Report on **Railway Safety and Interoperability in the EU**

2026

EUROPEAN UNION AGENCY FOR RAILWAYS

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Abbreviations

ADR	agreement concerning the international carriage of dangerous goods by road
AoU	area of use
CCS	control command and signalling
CRA	Cyber Resilience Act
CSI	common safety indicator
CSM ASLP	common safety methods for assessing safety level and safety performance
CST	common safety target
CTT	conformity to type
ECM	entity in charge of maintenance
EMU	electric multiple unit
ENE	energy
ERA	European Union Agency for Railways
Eradis	European Railway Agency Database of Interoperability and Safety
ERAIL	European Railway Accident Information Links
ERATV	European Register of Authorised Types of Vehicles
ERTMS	European rail traffic management system
ETC	European transport corridor
ETCS	European train control system
EU	European Union
EVR	European Vehicle Register
FRMCS	future railway mobile communication system
FWSI	fatalities and weighted serious injuries
GSM-R	global system for mobile communications – railway
HS	high-speed
IM	infrastructure manager
INF	infrastructure
LOC & PAS	locomotives and passenger rolling stock
NIB	national investigation body
NIS-2 Directive	revised Network and Information Systems Directive
NoBo	notified body
NOI	noise
NSA	national safety authority
OPE	operation and traffic management
OSS	One-Stop Shop
PRM	people with reduced mobility
RID	regulation concerning the international carriage of dangerous goods by rail
RINF	Register of Railway Infrastructure
RNE	RailNetEurope
RSD	Railway Safety Directive
RU	railway undertaking
SC	safety certificate
SERA	single European railway area
SPAD	signal passed at danger
SPD	single programming document
SRD	Single Rules Database
SRT	safety in railway tunnels
SSC	single safety certificate
TAF	telematics applications for freight services
TAP	telematics applications for passenger services
TDD	Train Drivers Directive
TDG	transport of dangerous goods
TEN-T	trans-European transport network
TIS	train information system
TPS	train protection system
TSI	technical specification for interoperability
WAG	wagons

Country codes

AT	Austria
BE	Belgium
BG	Bulgaria
CH	Switzerland
CY	Cyprus
CT	Channel Tunnel
CZ	Czechia
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
FI	Finland
FR	France
HR	Croatia
HU	Hungary
IE	Ireland
IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
NO	Norway
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia
UK	United Kingdom

Welcome message by the Director-General for Mobility and Transport

Magda Kopczyńska

I warmly welcome the publication of the 2026 Biennial Report on Railway Safety and Interoperability, prepared by the European Union Agency for Railways aimed at monitoring progress on safety and interoperability of the Union rail system.

The Commission has set ambitious goals for the 2024–2029 mandate, focused on sustainable competitiveness, resilience and strategic autonomy. DG MOVE is working to turn these priorities into concrete regulatory and operational measures that speed up ERTMS deployment, simplify cross-border operations and strengthen safety oversight. The progress achieved so far is encouraging, but it is also clear that we need to accelerate our efforts on standardisation and simplification which will accelerate further ERTMS deployment.

Offering a clear snapshot of the Single European Railway Area, this report is an essential monitoring tool. It turns raw data into clear indicators, reveal where progress is real and where it stalls, and help us track delivery against the safety and interoperability goals we have set at EU level. By combining accident statistics, cross-border traffic indicators, ERTMS deployment metrics and TSI implementation data, among others, the report gives policymakers, and stakeholders a shared evidence base to prioritise actions, target investments and measure the impact of reforms over time. This is how we move from good intentions to measurable results.

Safety depends on a balanced approach: technical upgrades and resilient infrastructure must be matched by better sharing of safety information, common assessment methods and a stronger safety culture across organisations. Progress on the Common Safety Methods, including the Common Safety Methods on Assessment of Safety Level and Safety Performance, will support harmonised performance assessment, systematic learning from accidents and occurrences and a reduction of differences between Member States.

On interoperability, the report highlights real advances alongside structural bottlenecks. It is essential to accelerate ERTMS rollout, reduce remaining national technical rules, simplify vehicle authorisation processes and complete the implementation of the new Telematics TSI. These steps are necessary to unlock cross-border capacity and to support modal shift, particularly for freight in order to fulfil our ambitions for decarbonisation of the EU transport system.

The report also identifies new areas where the Agency can add value: military mobility, climate resilience of infrastructure, cybersecurity and digital safety.

Delivering on these ambitions requires shared responsibility and close cooperation: Member States, National Safety Authorities, infrastructure managers, railway undertakings, industry and the Agency must coordinate investments, exchange data and align priorities. The Commission will continue to support ERA's operational and strategic role under the Fourth Railway Package and to promote the regulatory clarity needed for long-term investment decisions.

I thank the Agency for this thorough and forward-looking report. The evidence it contains will inform the Commission's work and guide our joint efforts to make European rail safer, more interoperable and more resilient for the benefit of citizens, businesses and the climate.

Magda Kopczyńska
Director-General for Mobility and Transport, European Commission

Foreword by the Executive Director of the European Union Agency for Railways

Dear reader,

Oana Gherghinescu

I am pleased to introduce the 2026 edition of the Report on Railway Safety and Interoperability in the EU. This tenth biennial edition combines technical rigour with a clear recognition of the human dimension behind every statistic: the workers, passengers, citizens and communities affected by our decisions. We present evidence, draw lessons and set priorities that must translate into concrete improvements on the ground.

We can be proud of the overall safety performance, yet the data remind us that there is no room for complacency. The report records nearly 30 railway worker fatalities per year – each one a human tragedy that calls for renewed commitment. In a controlled environment such as rail, the expectation should be that people go to work and come home safely; this report underlines the need to translate that expectation into measurable ambition and action. We explicitly acknowledge the Adamuz (Spain) accident and the grief it has caused: even when an event falls close to or outside the strict reporting window for this report, its human impact and the lessons it offers must inform our immediate and longer-term responses.

Interoperability remains central to a competitive and sustainable rail system. Passenger traffic is recovering while freight continues to face structural challenges. ERTMS deployment and vehicle authorisations show technical progress, but full seamless cross border operation is still a work in progress. The implementation of telematics shows gradual improvement: TAP deployment by infrastructure managers covers a large share of the network, while uptake among railway undertakings is uneven; TAF has progressed more consistently. The newly adopted Telematics TSI, which merges TAP and TAF and strengthens reporting and compliance, should accelerate convergence and support more consistent deployment across all actors.

This edition introduces Part C, a forward-looking chapter that maps emerging challenges and proposes how the report should evolve. We also present new cross border operational indicators and deeper analyses of ERTMS, telematics deployment, clean-up of national rules and safety trends. Where EU wide data are not yet available, Part C identifies priorities for future measurement and the visualisation needed to make them actionable.

Technical tools, regulatory clarity and improved data are necessary but not sufficient. We must pair them with clear objectives, measurable targets and a culture that values every life and every user of the network. This report aims to be both evidence based, and purpose driven: to inform decisions, to support harmonised action across Member States and stakeholders, and to keep the human consequences of our choices clearly in view.

I invite all stakeholders to engage with the data and analysis in this report, to share their experience, and to join us in shaping a railway system that is safer, more interoperable, more resilient and more effective for people across Europe.

Enjoy reading!

Oana Gherghinescu
Executive Director, European Union Agency for Railways

Introduction

This report is one of the visible results of the activities of the European Union Agency for Railways (ERA) in monitoring safety levels and performance. It is also part of the Agency's effort to provide to its stakeholders with a comprehensive overview of the development of railway safety and interoperability in the European Union (EU). In accordance with EU legislation ([1]), the report has been published biennially since 2006.

Specifically, this publication is the fifth edition of the report on progress on safety and interoperability in the Single European Railway Area (SERA), a joint statutory report mandated by the recast ERA Regulation. It follows the two thematic reports that have been produced by ERA since 2006.

Monitoring the safety and interoperability of the EU railway system is one of the key tasks of ERA. The Agency collects, processes and analyses different sets of data to support its recommendations on actions to be taken. In this way, ERA facilitates evidence-based policymaking at the EU level. By continuously monitoring and analysing the safety and interoperability performance of the EU railway system, the Agency provides assurance that the common goals are achieved.

Report scope

For Part A (safety) of the report, figures based on Common Safety Indicators (CSI) refer to 2024, while other safety-related figures (e.g. Figures A-5, A-6, A-31 to A-33, A-36, A-39 to A-42) use data up to 2025 ([2]). For Part B (interoperability), the general reference year is 2025; however, when figures rely on data extracted from the National Safety Authorities' (NSAs') annual safety reports, the reference year is 2024. The reference year of 2024 also applies to other figures (e.g. Sections B-6 and B-7), except for Section B-12, for which 2026 data are used. As Cyprus and Malta do not have railway systems that are covered by EU legislation, the EU railway system comprises the networks of the railway systems of 25 EU Member States. Data are also provided for Norway and Switzerland; data for the United Kingdom are included until 2020. The Channel Tunnel is a separate reporting entity for safety purposes, bringing the total to 28 reporting entities for Part A. For Part B, figures are generally labelled 'EU-27' plus 'CH + NO' (where applicable). Readers should therefore interpret 'EU-27' (and its variants) as referring to Member States with an operational railway network.

Information sources

This report is based on data available in various EU databases and registers, as provided by national authorities, such as NSAs and national investigation bodies (NIBs), operators and other actors (e.g. RailNetEurope (RNE)).

In the area of safety, the national bodies have a legal obligation to report to ERA a set of defined information that can be used to assess the development of railway safety in the EU. Notably, the NSAs gather CSIs, defined in legislation, from the railway undertakings (RUs) and infrastructure managers (IMs), which show safety performance in Member States and the EU.

In the area of interoperability, the report draws on data available in the databases and registers hosted by ERA, complemented by additional annual data included in the annual

([1]) This report is published in accordance with Article 35(4) of Regulation (EU) 2016/796.
([2]) For specific sections (e.g. A-6 and A-13), 2022 and 2023 data are used, respectively, as they are from the most up-to-date datasets available.

safety reports of NSAs. Furthermore, official data available from the European Commission are also used. Finally, data from industry associations add to the picture.

Report and chapter overview

This report consists of three main parts: progress with safety (Part A), progress with interoperability (Part B) and emerging challenges and the development of the report (Part C). To monitor the progress in these two aspects of the EU railway system, a series of standard indicators are used. A comprehensive methodological framework, outlined in Annex II, governs their selection. Indicators are based on the logical framework for evaluation, assessing three main areas: inputs, outputs and outcomes. For each indicator, further details are provided in the following sections:

- the **purpose** section describes the reason for the indicator, its importance in the pursuit for safety and interoperability, its goal, or official target if available, and its expected use;
- the **indicators** section describes the measures of quantitative assessments used to track and compare performance;
- the **findings** section provides the main observations along with the results of the data analysis;
- the **sources and limitations** section provides additional information on the data source, data production and other aspects influencing the metric and its quality.

Metrics for each indicator are shown with the help of figures. Where available, two figures are presented: the first provides an overview, while the second provides further insight.

Single Programming Document(s)

This biennial report is built around a set of indicators designed to monitor key developments in the European railway sector and to provide an evidence-based overview of its state and development. Each indicator feeds into the Single Programming Document (SPD), ensuring that strategic priorities are grounded in measurable trends, performance outcomes and challenges identified across the sector.

By structuring the indicators in line with the three strategic pillars of the SPD – interoperable and cost-efficient, safe, and future-proof – the report creates a clear and transparent link between monitoring, strategic planning, and implementation. Indicators grouped under the safe pillar, for example, directly inform the agency's safety agenda within the SPD; those linked to interoperability and cost-efficiency, and future-oriented challenges contribute to their related strategic objectives.

Together, these indicators form a coherent analytical framework that supports the Agency in translating observed developments and emerging needs into concrete programmes and outputs. They provide the basis for preparing the multiannual and annual work programmes, guiding actions aiming to strengthen the performance, safety, interoperability and resilience of the European railway system.

A. Progress with safety

Summary

The safety level of the EU railway system remains high; it is one of the safest railway systems in the world. In a multimodal comparison, rail appears the safest mode of land transport in the EU, with its fatality rate for passengers very similar to that for aircraft passengers.

The numbers of significant accidents and resulting casualties have decreased steadily since 2010; however, in 2021 and 2022, an increase was recorded. In the following years, the numbers declined again; in 2024, they reached values lower than those observed before the COVID-19 pandemic.

Major accidents resulting in five or more fatalities are rare: no such accidents occurred in 2018, 2020 and 2021, but six such accidents occurred in 2022 and 2023 (including the tragic accident in Tempi, Greece, in 2023). In 2025, the number dropped to zero again (while the report covers data up to 2025 – with CSI data referring to 2024 – it is worth noting that a major accident occurred in Adamuz, Spain, in early 2026). The number of fatal train collisions and derailments has decreased continuously since 1990. However, a slight increase was observed between 2020 and 2022, with 22 such accidents recorded. In contrast, in 2023 and 2024, numbers reached an all-time low, comparable to the low number seen in 2019.

The rates of significant accidents, fatalities and passenger fatalities have decreased substantially since 2010. Although there was an increase in 2022–2023, they reached their lowest values in 2024 (with the exception of passenger fatalities, whose lowest value was recorded in 2021). Despite the drop observed in 2021, the passenger fatality rate has shown a stagnating trend since 2017.

The results of the latest assessment of the achievement of safety targets (carried out annually by the Agency) indicate that safety performance remains acceptable at the EU level, although probable or possible deteriorations in safety performance were identified in six Member States ([3]).

In 2024, Member States reported a total of 1 507 significant railway accidents – more than 4 every day on average – continuing the gradual decline seen since 2022. Over the past decade, this overall improvement has been largely driven by the steady reduction in 'external' accidents involving third parties such as trespassers and level crossing users up to 2020. By contrast, 'internal' accidents have remained relatively stable and even showed a slight increase between 2022 and 2024. Looking at recent developments, derailments of trains, level-crossing accidents, accidents to persons, and fires in rolling stock recorded decreases in 2024 compared with 2022. All other accident categories exceeded their pre-COVID-19 levels, highlighting the need for continued attention to be paid to safety performance across the network. The overall toll of railway accidents remains high: the economic cost of significant accidents alone was estimated at about EUR 3.4 billion in 2024. Progress in improving safety has also been very uneven across the Member States, with the variation in safety levels remaining high.

Significant fluctuations in the number of accidents involving the transport of dangerous goods (TDG) were observed between 2018 and 2022, followed by a steady decline through 2024. However, it is not yet possible to determine with certainty whether this reflects an actual degradation of safety performance or differences in the interpretation of the applicable legislation.

Good results achieved in reducing third-party fatalities (trespassers and suicides) came with a similar reduction in overall suicide mortality rates and cannot therefore be fully

([3]) The *ex post* evaluation carried out by the Agency offers a more detailed explanation of the methodology, including worked examples and simulation exercises, and it also transparently discusses the known weaknesses (e.g. outdated national reference values) and limitations of the current methodological approach underpinning the common safety target (CST) results. Including this reference ensures that the CST results are interpreted within the appropriate methodological context and supports full transparency for stakeholders.

attributed to the work done by the railway IMs. The only exception is 2022, when a marginal increase in the overall suicide mortality rate was observed while railway suicides continued to decline.

No clear progress has been seen in reducing railway worker fatalities in the last few years. With the exception of 2019, around 30 railway workers have lost their lives each year, and more than 40 employees have suffered from serious injuries annually. In particular, the centred moving averages show that incidents caused by rolling stock in motion follow a distinct trend compared with those resulting from collisions or derailments, underlining the need for differentiated safety measures. Since 2006, there has been a significant decrease in the fatality rate among railway staff; however, in the past few years, a slight upward trend has emerged, underscoring the need for continued attention to be paid to worker safety.

Safety at level crossings improved across the EU-27 over 2010–2016, and the number of significant accidents fell steadily between 2010 and 2024. After a period of stagnation between 2017 and 2022 – despite a temporary drop in 2020, probably linked to the COVID-19 pandemic – the downward trend resumed, reaching its lowest level in 2024. However, level crossing accident rates still vary considerably across Member States, highlighting the need for sustained efforts and targeted interventions at the national level.

One of the key factors behind disparities in safety levels across Europe appears to be the safety measures of the railway infrastructure: the deployment of advanced train protection systems (TPSs) (including the European train control system (ETCS)) and rail-side protected level crossing devices. The deployment of advanced TPSs – such as the ETCS – and rail-side safety devices at level crossings varies significantly among Member States. Luxembourg, Belgium and Switzerland are currently the countries with the highest levels of ETCS deployment, reaching 100 %, 98 % and 96 % of their networks, respectively.

The accident investigation reports and a high number of reported precursors highlight the potential for further safety improvements through learning from experience. This potential can be fully exploited only if the information and knowledge are shared across the EU.

The trend observed over the last four years confirms the gradual transition from the old certification system (i.e. safety certificates (SCs), Parts A and B) to the new single safety certificate (SSC) scheme, reflecting the full transposition of the fourth railway package in all Member States. A gradual decrease in the number of valid Part A SCs, which is accompanied by a steady increase in SSCs, can be observed in all Member States.

All entities in charge of maintenance (ECMs) for vehicles must comply with Commission Implementing Regulation (EU) 2019/779. At the end of 2025, in the European Railway Agency Database of Interoperability and Safety (Eradis) (for the EU-27 + CH + NO), 340 ECM certificates for vehicles other than freight wagons, 91 ECM certificates for freight wagons and 518 ECM certificates for wagons and other vehicles were reported.

Overview of indicators and figures

Part A: Progress with safety

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Indicator	Figure	Indicator/Figure(s)	Category	Area
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A-1 Costs of railway accidents

Purpose

An unsafe railway system has both direct and indirect consequences on society. Economic theory makes it possible to express those consequences in monetary terms, offering a clearer picture of the costs that unsafe railway operations impose on the sector and the wider public. While the monetisation of business-related costs is relatively straightforward, the assessment of socioeconomic costs relies on per-unit values derived from economic studies. These estimates develop over time as new empirical evidence becomes available and methodologies in cost valuation research continue to advance.

Indicators

In the application of the Railway Safety Directive (RSD) (Directive (EU) 2016/798), the economic impact of accidents is measured by the economic impact of fatalities and serious injuries, the costs of delays, the costs of material damage to rolling stock or infrastructure and the costs to the environment. Other types of costs ([4]) have been recognised, but they represent a minor addition to the statutory costs.

Findings

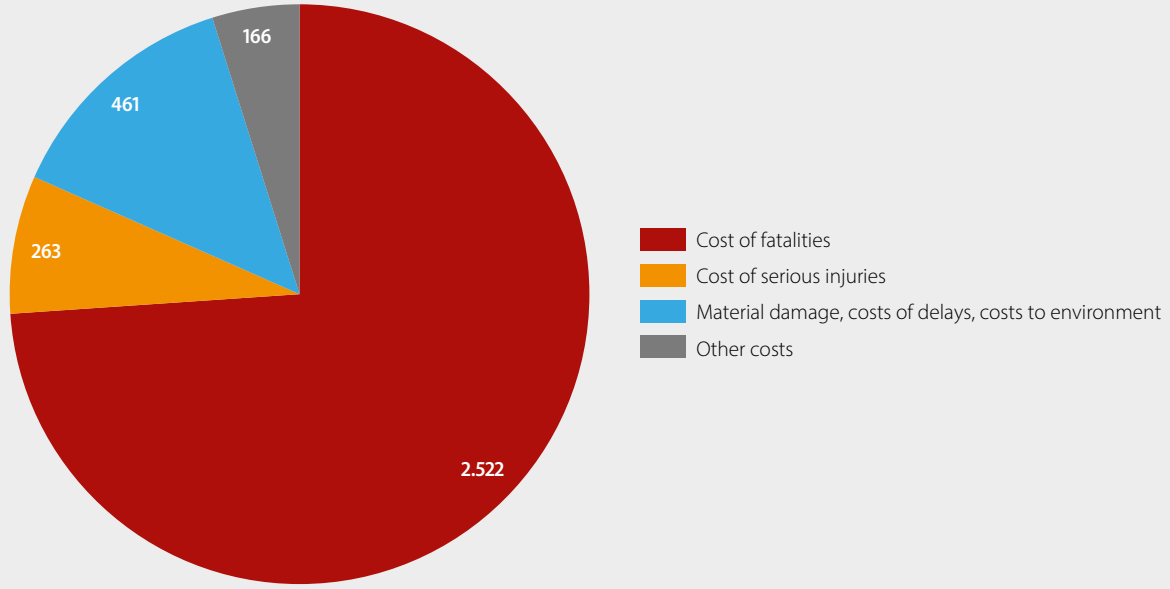
The total cost of significant railway accidents ([5]) was estimated at about EUR 3.4 billion in the EU-27 in 2024. In recent years, an update to the casualty unit costs has resulted in a significant increase in these costs. Fatalities account for around 74 % of total costs. The costs reported and estimated for individual Member States reflect both the accident outcomes and the economic situation, as per-unit cost estimates for casualties.

Sources and limitations

While the economic impact of casualties can be estimated for all Member States thanks to EU-wide studies on the unit costs, the costs of delays are available for only 23 (out of 25) Member States. A few Member States were not able to monetise the total material damage of significant accidents in 2024, and only five countries recorded environmental damage related to those accidents. Data have been reported by NSAs for 20 years under Annex I to the RSD (i.e. CSIs), and detailed guidance material, including fallback values, is available. In addition, some countries fail to report certain cost categories, and so the reliability of cost data should be considered on a case-by-case basis. Given these limitations, it is likely that the total cost figures presented here are underestimated.

([4]) Other costs are those associated with modal shift, air pollution, administration, rerouting, reputational damage and productivity losses and are estimated from unit costs developed by a consultant for the Agency.
([5]) The RSD (Directive (EU) 2016/798) defines a 'significant accident' as 'any accident involving at least one rail vehicle in motion, resulting in at least one killed or seriously injured person, or in significant damage to stock, track, other installations or environment, or extensive disruptions to traffic, excluding accidents in workshops, warehouses and depots'. The directive explains that "'significant damage to stock, track, other installations or environment" means damage that is equivalent to EUR 150 000 or more', and that "'extensive disruptions to traffic" means that train services on a main railway line are suspended for six hours or more'.

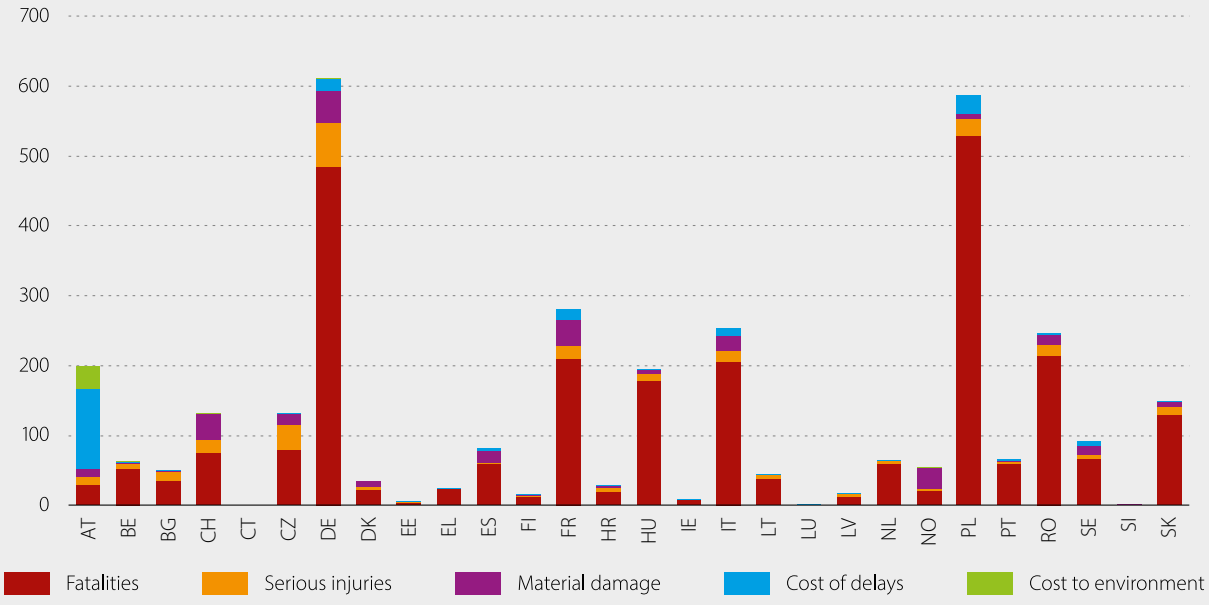
Figure A-1: Estimated costs of railway accidents, million EUR (EU-27, 2024)



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

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

Figure A-2: Estimated costs of railway accidents per country, million EUR (EU-27 + CH + NO, 2024)



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

A-2 Accidents and their main outcomes

Purpose

Significant accidents and the resulting casualties provide the ultimate insight into the safety level of railway systems. European legislation sets the goal to maintain or, where possible, improve railway safety in the SERA.

Indicators

The absolute numbers of significant accidents and resulting serious and fatal injuries are recorded.

Findings

Both the number of significant rail accidents and the number of resulting casualties in the EU recorded a slight decrease in 2024, reversing the upward trend observed in 2023. This change follows the overall positive progress of the previous decade (2010–2019). The 2024 figures also remain below pre-COVID-19 levels. In total, 1 507 significant accidents, 750 fatalities and 548 serious injuries were reported in the EU-27 in 2024.

The number of significant accidents decreased by 4 % in 2024 compared with 2023 and increased by 3 % relative to the average of the four preceding years. These variations were generally observed across most accident categories, with only a few exceptions: the decrease was mainly driven by level crossing accidents and derailments of trains, while the increase was primarily linked to other accidents and fires in rolling stock.

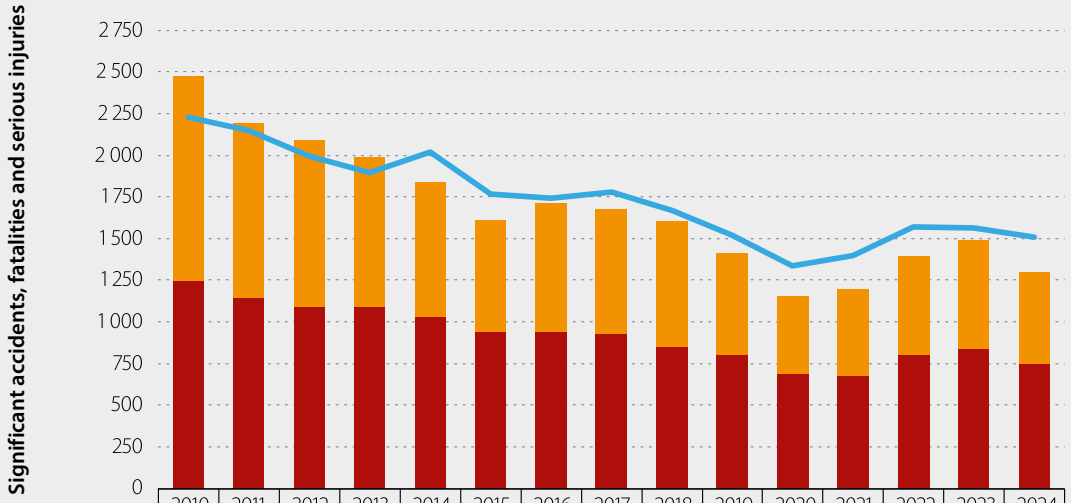
Sources and limitations

Data used to monitor progress with safety outcomes are part of the CSIs supplied by the NSAs to ERA. Twenty years of continuous work on data quality in Member States and at the Agency provides assurance on the accuracy of the data ([6]).

([6]) ERA, 'Common safety indicators (CSIs)', ERA website.

Figure A-3: Main safety outcomes (EU-27, 2010–2024)

Significant accidents, fatalities and serious injuries



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Serious injuries	1 226	1 041	996	899	810	672	766	747	750	613	469	512	594	650	548
Fatalities	1 245	1 151	1 093	1 095	1 029	939	942	933	855	802	687	683	803	841	750
Significant accidents	2 230	2 146	1 994	1 896	2 022	1 764	1 742	1 778	1 671	1 518	1 336	1 395	1 567	1 565	1 507

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

Figure A-4: Significance of changes in annual counts of significant accidents (EU-27, 2020–2024)

Significance of change in outcomes	2024/2023	2024/(2020-2023)
Collisions of trains	6%	25%
Derailments of trains	-7%	-11%
Level-crossing accidents	-14%	-13%
Accidents to persons	-3%	7%
Fires in rolling stock	10%	16%
Other accidents	19%	15%
All significant accidents	-4%	3%
Fatalities	-11%	-0,5%
Serious injuries	-16%	-1%
Suicides	-1%	2%

Note: A poisson statistical significance test was performed at a significance level of 95%. Statistically significant changes are highlighted in orange.

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

A-3 Major accidents and fatal train collisions and derailments

Purpose

As past accident records may not always be complete across all Member States, focusing on railway accidents with severe consequences offers a more reliable basis for confirming the identified trends. This approach also brings greater visibility to the most serious events that occurred and their impact on overall accident statistics. Accidents with multiple fatalities rarely escape the attention of the media and the public, so data on events are generally assumed to be complete. Historical information on serious accidents causing five or more fatalities in the EU-27, Norway, Switzerland, referred to here as 'major accidents', is collected by ERA, in addition to the regulatory data collection.

Indicators

Indicators are the number of major accidents (i.e. those resulting in five or more fatalities) and the number of fatal train collisions and derailments (the latter includes train collisions, train derailments and train fires following collisions or derailments in which one or more people are killed, thus covering the most serious operational accidents).

Findings

An overall downward trend in major accidents (and in the number of corresponding fatalities) has been observed since 1980, despite the increase in the last few years. Although no accidents resulting in five or more fatalities were registered in 2018, 2020, 2021 and 2025, six such accidents occurred in 2022, 2023 and 2024 (including the recent tragic accident in Tempi, Greece) ([7]).

Fatal train collisions and derailments constitute a subset of the most significant accidents. Despite the long-term downward trend, with 22 (fatal collisions and derailments) were registered between 2020 and 2022. The five-year moving average and the accident rates (adjusted for changes in traffic volume) show a similar pattern, with an increase in a few of the later years (i.e. 2020–2022) despite the overall positive trend (i.e. decrease) observed since 1990. The figures reported for 2023 and 2024 are the lowest ever recorded, comparable to the low number seen in 2019.

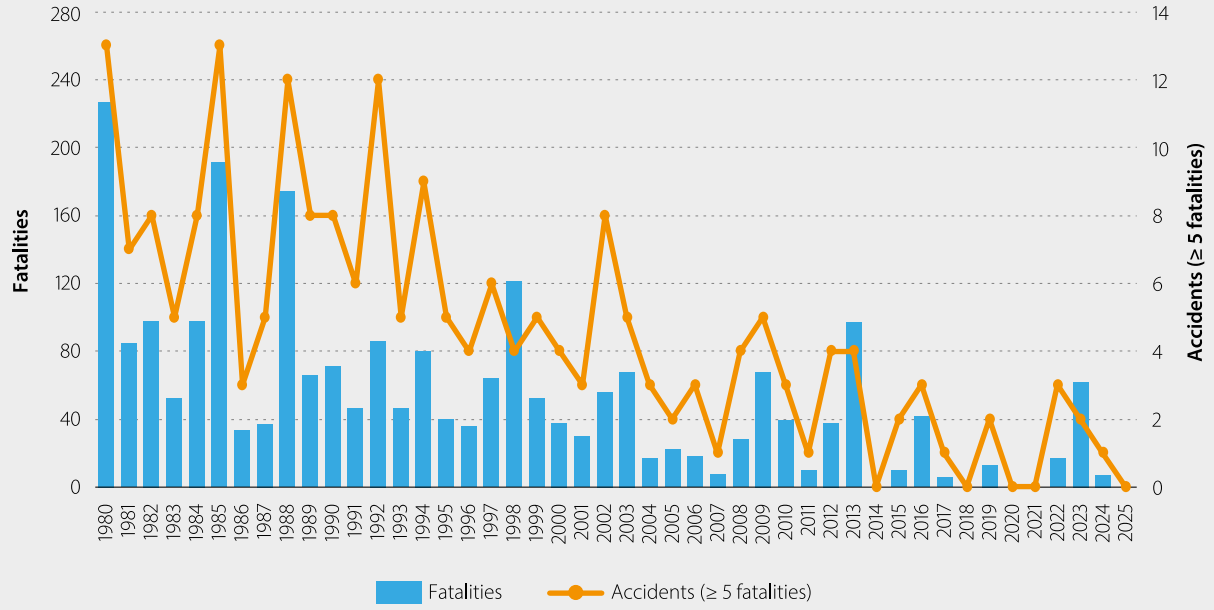
Sources and limitations

Both major accidents and fatal train collisions and derailments rarely escape the attention of the media and the authorities, and several sources were used to compile the archive of historical accidents in Europe, originally developed by Professor Andrew Evans (Imperial College London) for ERA. The Agency continues to rely on that database for historical accident data.

([7]) The railway accident that occurred in Adamuz (Spain) in 2026 is not included in the statistics presented here, as the CSI data used in this analysis refer to the reference year of 2024.

Figure A-5: Major accidents in Europe (EU-27 + CH + NO, 1980–2025)

Railway accidents resulting in five or more fatalities

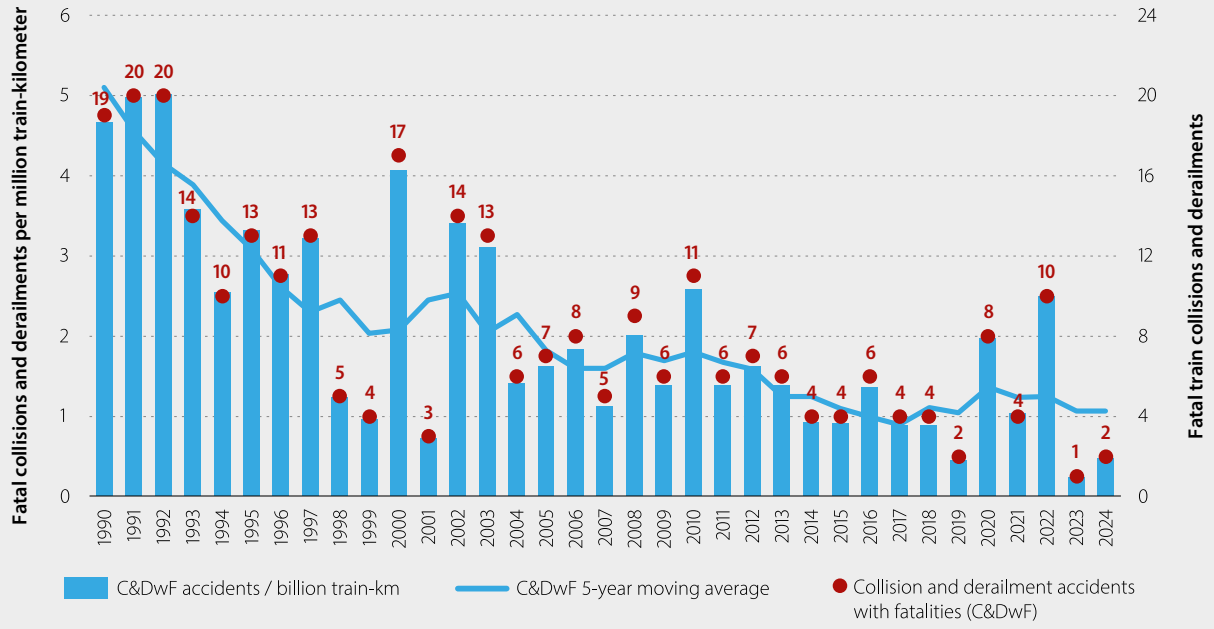


Note: Data updated at 17/11/2025; data for UK available until end 2020 .

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

Figure A-6: Fatal train collisions and derailments in Europe (EU-27 + CH + NO, 1990–2024)

Accidents and accidents rates per million train kilometer



Note: Data for UK available until end 2020.

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

A-4 Trends in accident and casualty rates and their variations

Purpose

Accident and casualty trends are assessed in relation to traffic volume, which remains the main explanatory factor for variations in accident occurrence. For this reason, the statistics are normalised against traffic data.

Indicators

The indicators used are significant accident and fatality rates, expressed as significant accidents per million train-km and railway fatalities per million train-km, which reflect the overall risk of railway operation. Passenger fatalities per billion passenger-km are also considered, capturing the risk for people using trains. In addition, the trend over years in the fatalities and weighted serious injuries (FWSI) ([8]) rate is analysed.

Findings

The overall fatality rate in 2024 was around 0.19 fatalities per million train-km (almost 1 fatality for every 5 million train-km on average), whereas the overall passenger fatality rate was 0.034 passenger fatalities per billion passenger-km (around 1 fatality for every 29 billion passenger-km).

All the rates analysed have decreased substantially over the last decade despite an increase in 2022–2023, with the lowest values registered in 2024, except for passenger fatalities, for which the lowest value was recorded in 2021.

The variation in the FWSI rate among Member States (measured through the standard deviation) decreased over 2010–2021, rose again in 2022 and peaked in 2023, before falling in 2024 to a level consistent with that observed before 2021. The average FWSI rate followed a similar trend, with the coefficient of variation ([9]) remaining close to 1 (except in 2023, when it reached 2.7) due to the variability of the values around the mean. Achieving a single safety area requires achieving comparable safety levels across Member States.

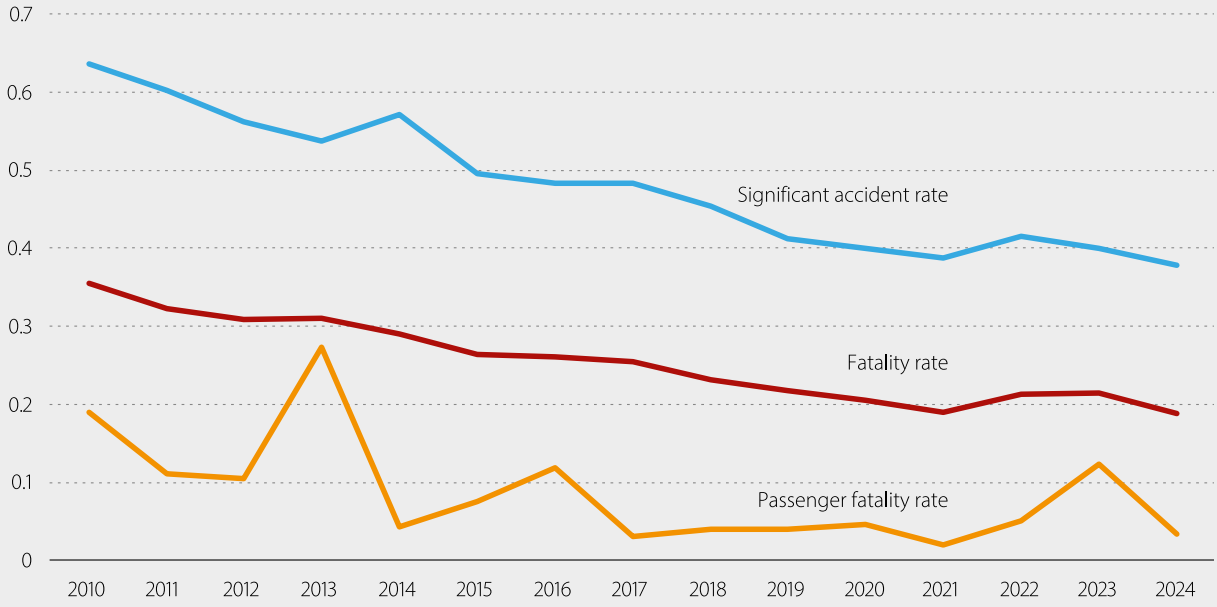
Sources and limitations

Data used to monitor progress with safety outcomes are part of the CSIs supplied by the NSAs to ERA ([10]). Twenty years of continuous work on data quality in Member States and at the Agency provides assurance on the accuracy of the data.

([8]) FWSIs are a measurement of the consequences of significant accidents combining fatalities and serious injuries, where one serious injury is considered statistically equivalent to 0.1 fatalities.
([9]) The coefficient of variation is the ratio of the standard deviation to the mean.
([10]) ERA, 'Common safety indicators (CSIs)', ERA website.

Figure A-7: Trends in accident and fatality rates (EU-27, 2010–2024)

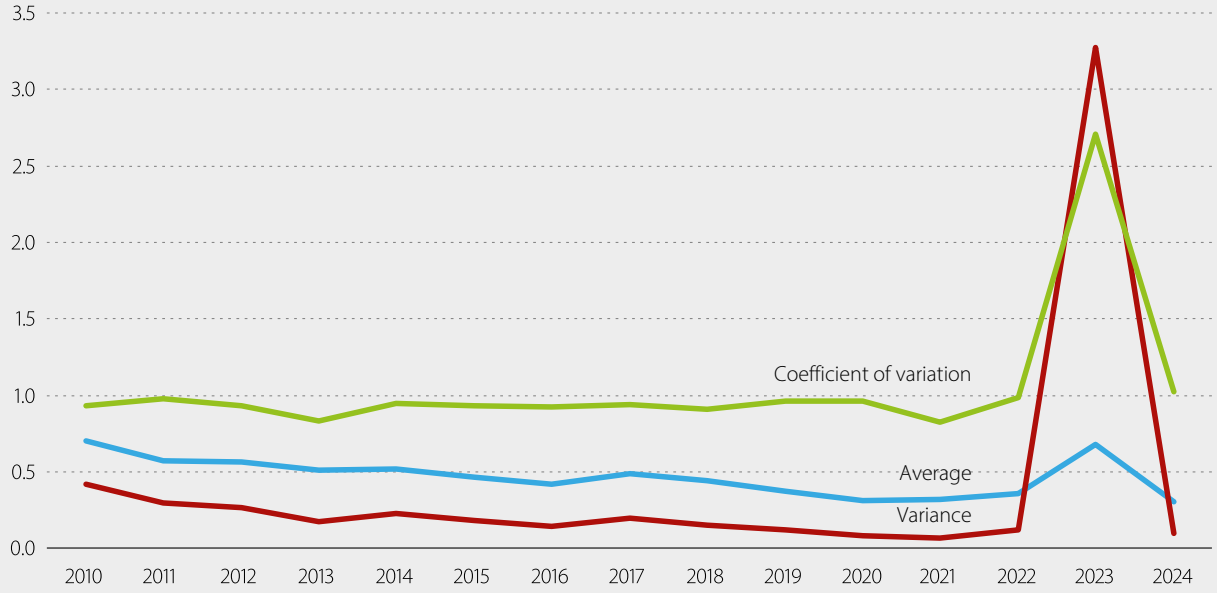
Significant accidents and fatalities per million train-km. Passenger fatalities per billion passenger-km



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

Figure A-8: Fatalities and weighted serious injuries rates (EU-27, 2010–2024)

FWSI per million train-km: average, variance and coefficient of variation



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

A-5 Railway and passenger fatality rates

Purpose

Behind the general EU picture, a much more diverse reality exists, with notably large differences in casualty rates among Member States. Plotting the fatality rates for individual Member States unveils the extent of the existing disparities in safety levels. Sorting the countries provides further insight into these differences.

Indicators

Two main indicators are used here: fatality rate (railway fatalities normalised by train-km, expressed as a 3-year average to smoothen annual fluctuations and capture the manifested overall risk of railway operation) and passenger fatality rate (passenger fatalities per passenger-km, expressed as an 11-year average to reflect the personal manifested risk for people using trains).

Findings

The data reveal at least a 15-fold difference in fatality rates between the countries with the lowest rates and those with the highest rates. In both cases, the median values are much lower than the mean values, as the rates for Member States with relatively high rates are much higher than the rates for other countries. For railway fatality rate, excluding one country with an exceptionally high value due to a major accident ([11]), a cluster of nine countries emerges with rates that stand in stark contrast to those of the remaining Member States. Similarly, the passenger fatality rate is significantly higher than the European average in almost half of the Member States.

Sources and limitations

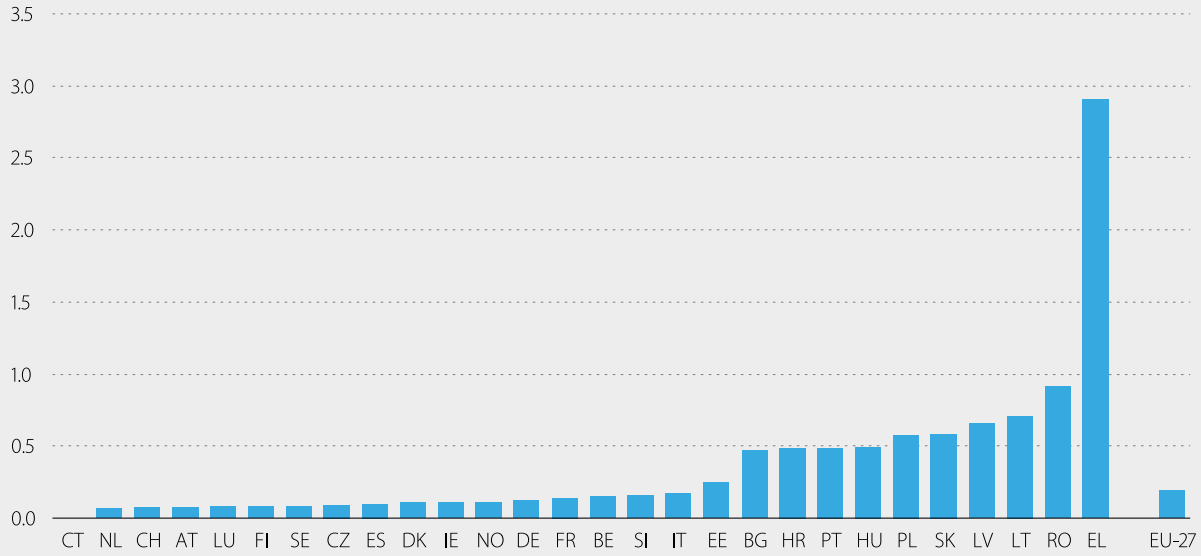
Although the rates are estimated over a period of 3 years for the fatality rate and over a period of 11 years for the passenger fatality rate, major accidents with large numbers of passenger casualties still weigh heavily on the estimates. An extreme case is the collision of trains in Tempi, Greece, which occurred in 2023 and has resulted in the two fatality rates for Greece being the highest in Europe.

Data used to monitor progress with safety outcomes are part of the CSIs supplied by the NSAs to ERA ([12]). Twenty years of continuous work on data quality in Member States and at the Agency provides assurance on the accuracy of the data.

([11]) This refers to the accident in Tempi, Greece, in 2023.
([12]) ERA, 'Common safety indicators (CSIs)', ERA website.

Figure A-9: Railway fatality rates (EU-27 + CH + NO, 2022–2024)

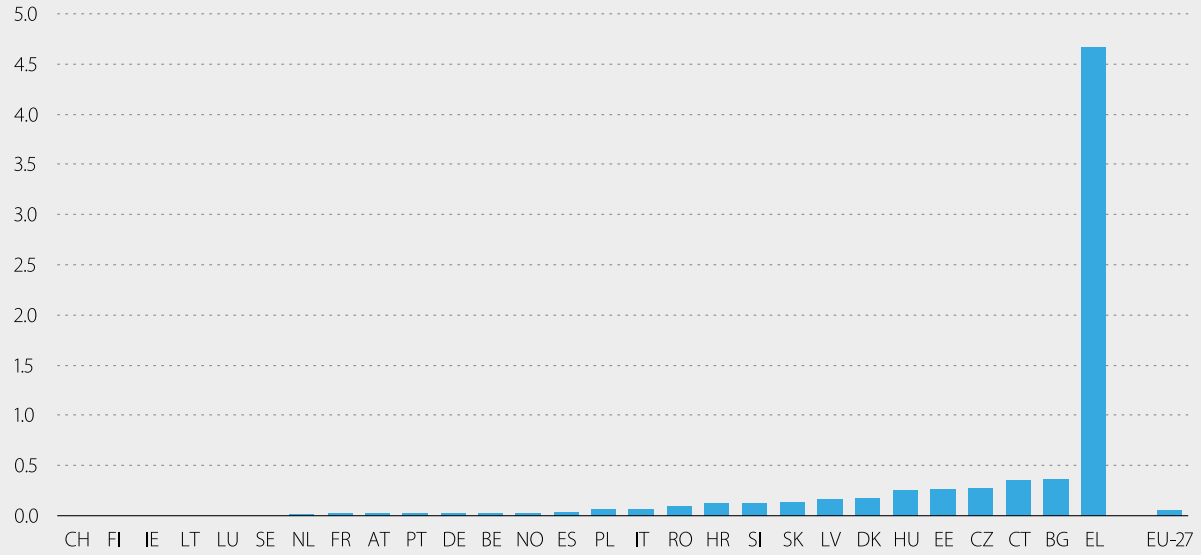
All fatalities per million train kilometers (average over 2022-2024)



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

Figure A-10: Railway passenger fatality rates (EU-27 + CH + NO, 2014–2024)

Passenger fatalities per billion passenger kilometers (average over 2014-2024)



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

A-6 Safety of different transport modes

Purpose

Different means of transport have different levels of risk for travellers. In this section, the user fatality risk is estimated for the four main transport modes for which comparable data are available.

Indicators

The indicator measures the risk of passenger fatality by the distance travelled across different transport modes. It is based on a 10-year block of data (2014–2023). Although transport modes vary significantly in usage and characteristics, safety levels can be directly compared by applying specific travel scenario assumptions.

Findings

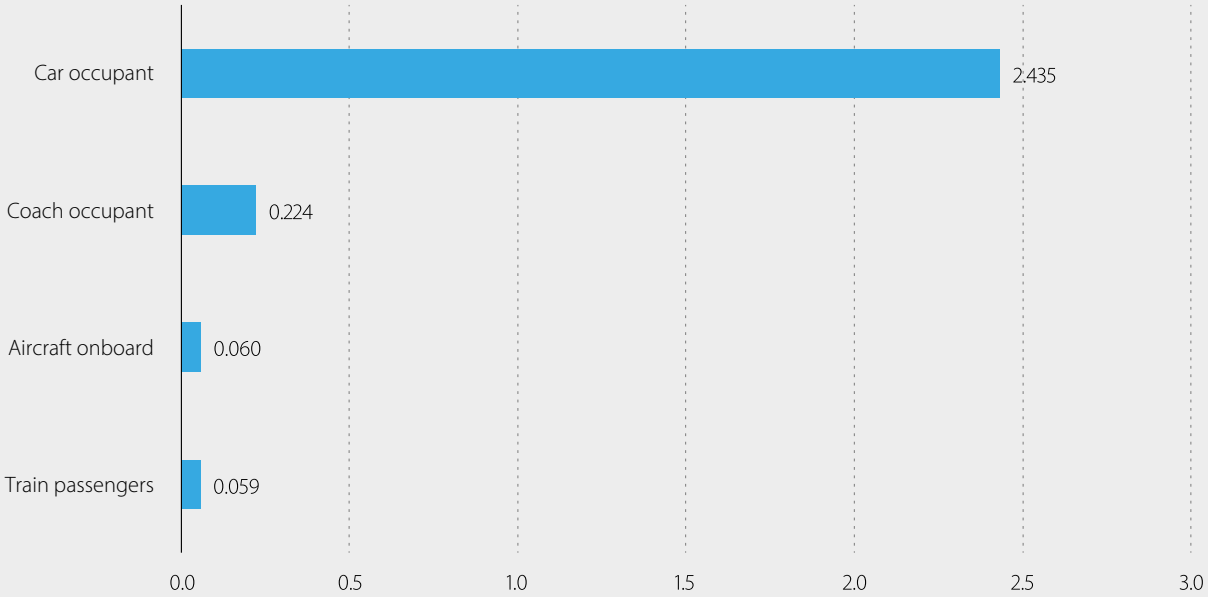
The fatality risk for a train passenger is around one third of the risk for a bus/coach passenger, and very similar to that for a commercial aircraft passenger. The use of individual means of transport, such as a passenger car, carries a substantially higher fatality risk: car occupants have a 40 times higher likelihood of dying than a train passenger travelling over the same distance. The fatality risk for an average train passenger (calculated over 10 years) is now about 0.059 fatalities per billion passenger-km, making it, comparatively, the safest mode of land transport in the EU and also comparable to the highest safety standards in commercial aviation.

Sources and limitations

The risk estimated for commercial air travel, and also for bus and train travel, is subject to greater variation, as a single accident may result in dozens of fatalities. As the annual numbers of aircraft, train and coach accidents resulting in fatalities are relatively small, the risk estimated for a relatively short period should be interpreted with caution; this is why in this edition of the report we focus on the fatality risk over 10 years. In addition, the results of such a comparative exercise strongly depend on the type of exposure data considered. It is also worth noting that differences in typical journey length across transport modes – much longer for aviation than for land transport – can influence the resulting safety rates. This effect is partly balanced by the substantially higher number of passengers transported by land-based modes, which affects how exposure is measured and compared.

Figure A-11: Passenger and driver (i.e. on-board) fatality rates for different transport modes (EU-27, 2014–2023)

Onboard fatalities per billion passenger kilometers



Notes: Fatalities are for all people occupying the vehicle, except for rail (includes passengers only). Passenger-kms for air include only domestic and intra-EU-27 transport.

Sources: CARE (DG MOVE), EASA, 2025 Statistical Pocketbook (DG MOVE), CSIs reported to ERA.

A-7 Worldwide railway safety

Purpose

Despite structural differences, the overall safety performance of the EU railway system can be meaningfully benchmarked against that of other countries worldwide. From ERA's perspective, the sector as a whole should strive to ensure that the EU railway system becomes and remains the safest in the world.

Indicators

The indicators used are the railway fatality rate and the passenger fatality rate, estimated for a five-year period. This longer period is used to account for fluctuations between individual years and for randomness in the data. A more accurate comparison is available as a result.

Findings

Based on railway fatality rates estimated in six jurisdictions, the EU railway system is among the safest, after South Korea and Australia ([13]).

A passenger on board a train in the EU railway system also enjoys the lowest risk after passengers in South Korea and Japan. No passenger fatalities were registered in Japan between 2020 and 2024. The gap in passenger fatality rates between Europe and Japan may be challenging to close in the medium term.

Sources and limitations

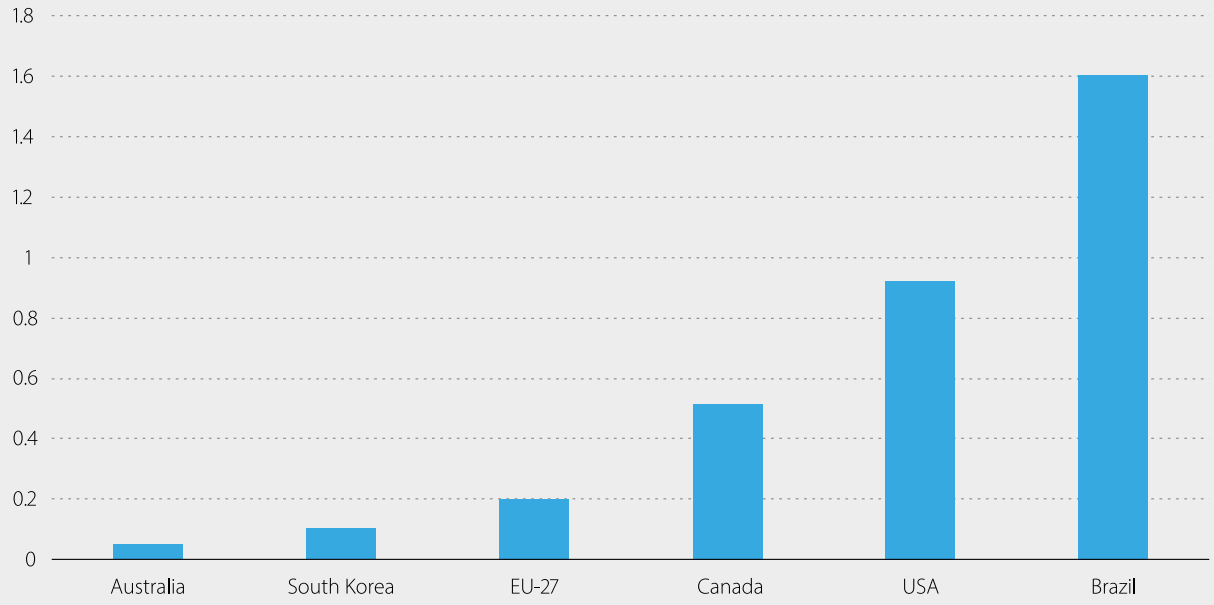
Data used for this indicator are taken from statutory reports and/or public databases from national railway safety administrations or safety administrations of the jurisdictions concerned. Data for South Korea are for high-speed (HS) railway lines and conventional lines and were provided by the railway safety division of the Korea Transportation Safety Authority for the previous biennial report.

There is no guarantee that all the countries use the same, internationally agreed, definition of a railway fatality – that is, a fatality occurring 'within 30 days of [the] accident' – or that train-km are recorded in the same fashion for all RUs. The possible exclusion of trespasser fatalities (to exclude possible suicide fatalities) is also likely to be an issue. Nevertheless, the comparability of the data may be satisfactory for the given purpose of an international benchmark. Last, the selection of countries used in the two benchmark figures is driven by the comparability of the railway systems in terms of size and volume and the availability of comparable data.

([13]) The definitions and recording of trespassers and suspected suicides may differ across countries.

Figure A-12: Railway fatality rates for different countries worldwide (2020–2024)

All railway fatalities (excluding suicides) per million train-km

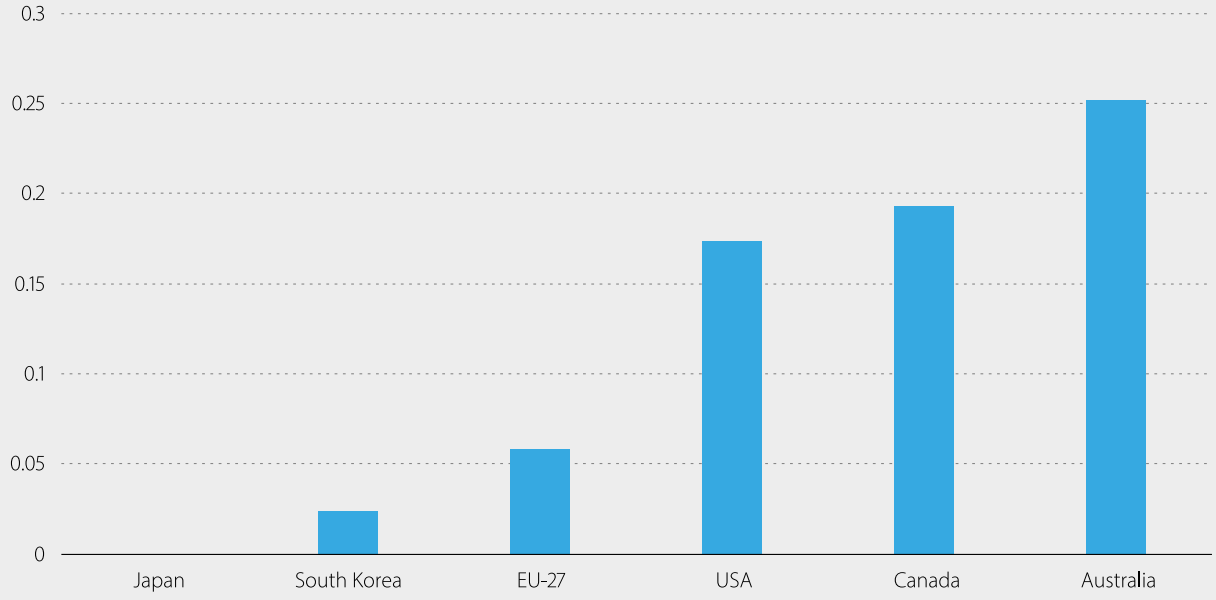


Notes: Data (referring to high-speed rail and conventional lines) for South Korea were provided by Korean Transport Safety Authority`s railway safety division for 2018-2022. Data for Australia exclude suspected suicides and were extracted from the 2025 rail safety report of the Office of the National Rail Safety Regulator.

Source: Statutory reports produced by national administrations of the jurisdictions concerned.

Figure A-13: Passenger fatality rates for different countries worldwide (2020–2024)

Railway passenger fatalities (excluding suicides) per billion passenger kilometers



Notes: Data (referring to high-speed rail and conventional lines) for South Korea were provided by Korean Transport Safety Authority`s railway safety division for 2018-2022. Data for Japan refer to the period 2019-2023.

Source: Statutory reports produced by national administrations of the jurisdictions concerned.

A-8 Achievement of safety targets

Purpose

Common safety targets (CSTs) ([14]) are the lowest acceptable safety levels prescribed for the railway systems of the EU and Member States. They are used as a reference when assessing if the current safety levels are at least maintained. In the long term, they could also help drive efforts to reduce the current variation in safety levels across the EU. Rail is the only mode of transport for which targets have been prescribed by European legislation. The achievement of CSTs is assessed by ERA annually by applying the common safety method on common safety targets ([15]). The latest assessment available is the 2026 assessment, which compares the 2019–2024 safety levels with the set reference values ([16]).

Indicators

The safety level is measured in terms of the number of Fatalities and Weighted Serious Injuries (FWSIs per train-km and is assessed for the following categories: passengers, employees, level crossing users, unauthorised persons on railway premises and society as a whole.

Findings

The results of this latest assessment indicate that safety performance remains acceptable at the EU level, whereas a possible or probable deterioration in safety performance was identified in six Member States. Such a result is in line with the previous assessments, which typically identified possible deteriorations in a few countries and categories.

Member States are more likely to achieve acceptable safety performance in the category of passengers than in any other category. A possible or probable deterioration in safety performance is most frequently recorded for employees and unauthorised persons on railway premises, and in recent years this has also been observed for the category 'others'. Although possible or probable deterioration has been identified in 17 countries, in only one Member State was this the finding in the large majority of assessments. In four other countries, nine or more instances have been identified since 2008.

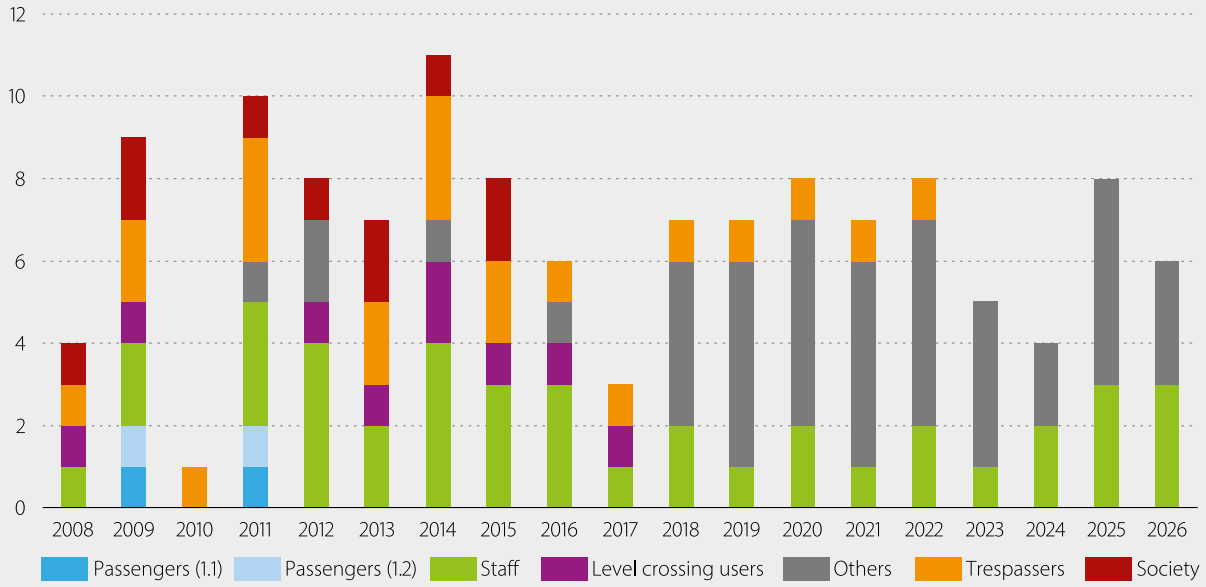
Sources and limitations

Risk categories as defined in the RSD are used. For the passenger category, two measures are applied: FWSI per passenger train-km (1.1) and FWSI per passenger-km (1.2). FWSIs are a measurement of the consequences of significant accidents combining fatalities and serious injuries, where one serious injury is considered statistically equivalent to 0.1 fatalities. For more information on the weaknesses and strengths of the method, see the *ex post* evaluation of the common safety method for assessment of achievement of safety targets carried out by the Agency ([17]).

([14]) ERA, 'Common safety method on common safety targets', ERA website.
([15]) Commission Decision 2009/460/EC also contains detailed information on the method and definitions of the categories. Commission decision of 5 June 2009 on the adoption of a common safety method for assessment of achievement of safety targets, as referred to in Article 6 of Directive 2004/49/EC of the European Parliament and of the Council (notified under document number C(2009) 4246) (2009/460/EU) (OJ L 150, 13.6.2009, p. 11, ELI: http://data.europa.eu/eli/dec/2009/460/oj).
([16]) Commission decision of 23 April 2012 on the second set of common safety targets as regards the rail system (notified under document C(2012) 2084) (2012/226/EU) (OJ L 115, 27.4.2012, p. 27, ELI: http://data.europa.eu/eli/dec/2012/226(1)/oj).
([17]) https://www.era.europa.eu/system/files/2022-11/report_ex-post_csm_cst_final_public_en.pdf?t=1768481711.

Figure A-14: Instances of possible/probable deterioration in safety performance by risk category (EU-27 + NO, 2008–2026)

Probable or possible deterioration of safety performance as per annual CST assessment



Source: Annual common safety target assessment reports published by ERA.

Figure A-15: Instances of possible/probable deterioration in safety performance by country (EU-27 + NO, 2008–2026)

Instances across all risk categories

	SK	RO	SE	BG	NO	DE	PT	CZ	FR	HU	BE	IT	NL	ES	HR	LT	LV	Total
2008	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
2009	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	9
2010	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2011	4	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10
2012	1	2	1	2	1	0	0	0	0	0	0	0	0	0	1	0	0	8
2013	2	1	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	7
2014	2	1	1	1	2	0	0	0	1	2	0	1	0	0	0	0	0	11
2015	2	0	1	1	3	0	0	0	0	0	0	1	0	0	0	0	0	8
2016	1	0	0	2	0	0	0	0	0	2	0	1	0	0	0	0	0	6
2017	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	3
2018	1	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	1	7
2019	0	0	1	0	0	1	1	1	1	0	1	0	1	0	0	0	0	7
2020	1	0	1	0	0	1	1	1	1	0	0	0	1	1	0	0	0	8
2021	0	0	1	0	0	1	1	1	1	0	1	0	1	0	0	0	0	7
2022	1	0	1	0	0	1	1	1	1	0	0	0	1	1	0	0	0	8
2023	2	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	5
2024	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	4
2025	2	0	1	1	0	1	1	1	0	0	1	0	0	0	0	0	0	8
2026	1	0	1	1	0	1	1	0	0	0	1	0	0	0	0	0	0	6
Total	26	16	12	11	9	8	8	7	7	5	4	4	4	3	1	1	1	

Notes: Colours correspond to the number of occurrences.

Source: Annual common safety target assessment reports published by ERA.

A-9 Significant accidents

Purpose

Significant accidents ([18]) represent the basis for the harmonised monitoring of safety occurrences across the EU and beyond. Their scope is limited to accidents resulting in significant harm, such as fatal or serious injuries, significant damage or major traffic disruption. Their further subcategorisation allows for the identification of the parts of the railway systems with a relatively high prevalence of accidents and those relatively underperforming over time.

Indicators

The indicators used are the absolute number of significant accidents disaggregated in two ways: by type of railway accident, as prescribed by the RSD, and by categories reflecting the involvement of a third party.

Findings

A total of 1 507 significant accidents were reported by Member States for 2024 alone – that is, more than 4 significant accidents per day on average – continuing the decreasing trend observed since 2022. The overall decrease in the last decade has been mainly driven by the reduction in 'external' accidents involving a third party (trespasser or level crossing user) until 2020, while 'internal' accidents have remained relatively stable but with a slight increase in recent years (2022–2024). Between 2022 and 2024, derailments of trains, level-crossing accidents, accidents to persons, and fires in rolling stock all showed a reduction. However, when compared to pre-COVID-19 levels, only derailments and level-crossing accidents remained lower, while the other accident types recorded higher values.

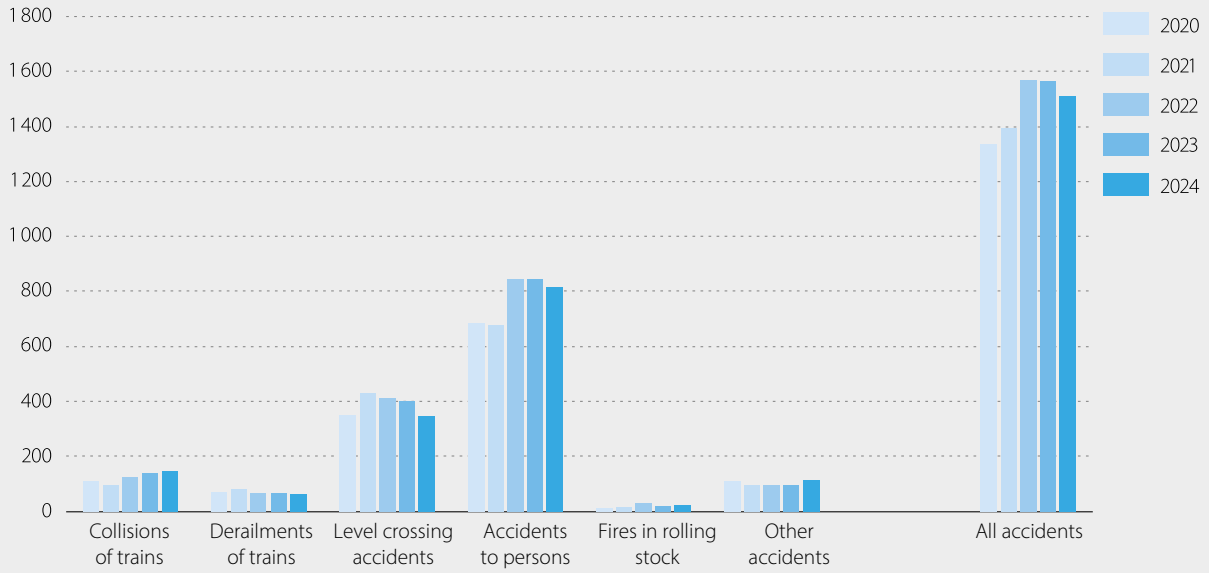
A wide range of accidents, not included in the specific types mentioned previously, are included in the category 'other accidents'. The 114 cases reported in 2024 include collisions and derailments of shunting rolling stock / maintenance machines, objects projected by trains (e.g. ballast) and electrocution in connection with rolling stock in motion.

Sources and limitations

Data used to monitor progress with safety outcomes are part of the CSIs supplied by the NSAs to ERA. Twenty years of continuous work on data quality in Member States and at the Agency provides assurance on the accuracy of the data.

([18]) '"Significant accident" means any accident involving at least one rail vehicle in motion, resulting in at least one killed or seriously injured person, or in significant damage to stock, track, other installations or environment, or extensive disruptions to traffic, excluding accidents in workshops, warehouses and depots' (Directive (EU) 2016/798, Appendix to Annex I).

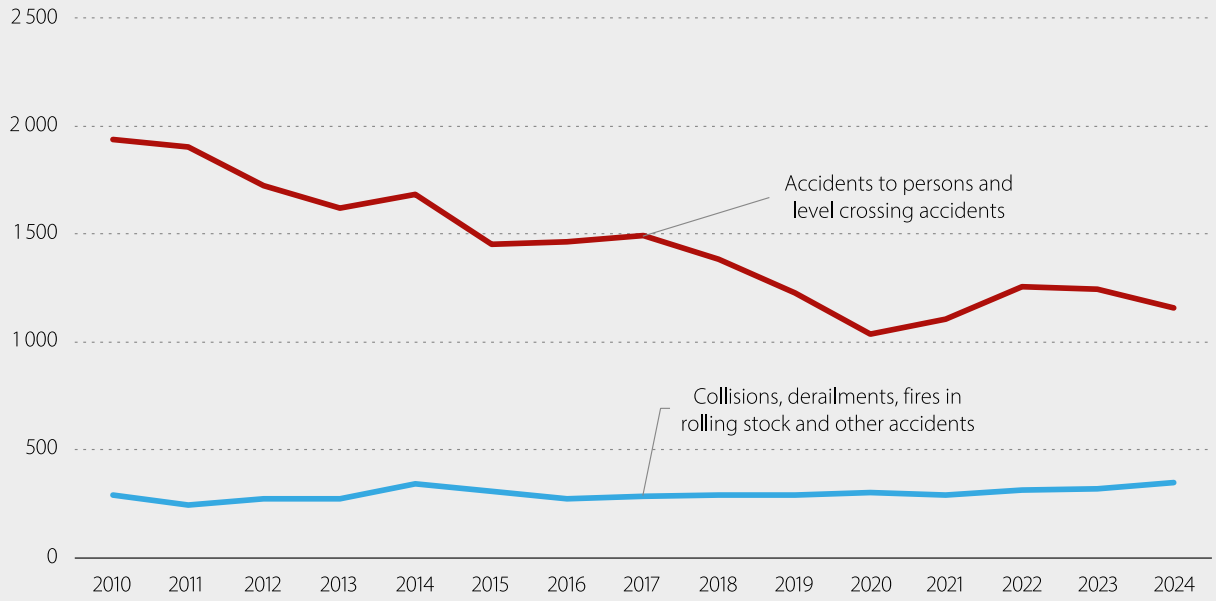
Figure A-16: Significant accidents per type (EU-27, 2020–2024)



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

Figure A-17: Railway 'internal' and 'external' significant accidents (EU-27, 2010–2024)

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.

A-10 Accidents and incidents involving the transport of dangerous goods

Purpose

Owing to its potential for severe consequences, the TDG is subject to additional regulatory provisions and supervision by NSAs and TDG-competent authorities. Nevertheless, accidents involving the TDG continue to occur and, in addition to being reported among the CSIs, are subject to a dedicated reporting regime under the regulation concerning the international carriage of dangerous goods by rail (RID) and its Annex.

Indicators

The indicator used is the number of accidents involving the TDG, as indicated in the RSD. This includes any accident or incident that must be reported in accordance with Section 1.8.5 of the RID / agreement concerning the international carriage of dangerous goods by road (ADR), whether or not a release of those goods occurs.

Findings

The current reporting scheme for accidents involving the TDG can be difficult to understand and implement, because the current RID definition of 'release' also includes situations where no actual release occurs (i.e. near miss releases), which may lead to non-homogeneous reporting across Member States.

In this context, a relatively large number of accidents involving the TDG was recorded between 2018 and 2022, although it is not yet possible to determine whether this reflects an actual degradation of safety performance or differences in the interpretation of the applicable legislation. After the peak observed in 2018 and 2019 ([19]), the number of accidents involving dangerous goods progressively decreased up until 2024 (except for in 2022). In 2024, Member States reported a total of 24 accidents, 9 of which involved a release of the dangerous goods being transported. These figures were largely driven by the numbers of accidents reported in two Member States.

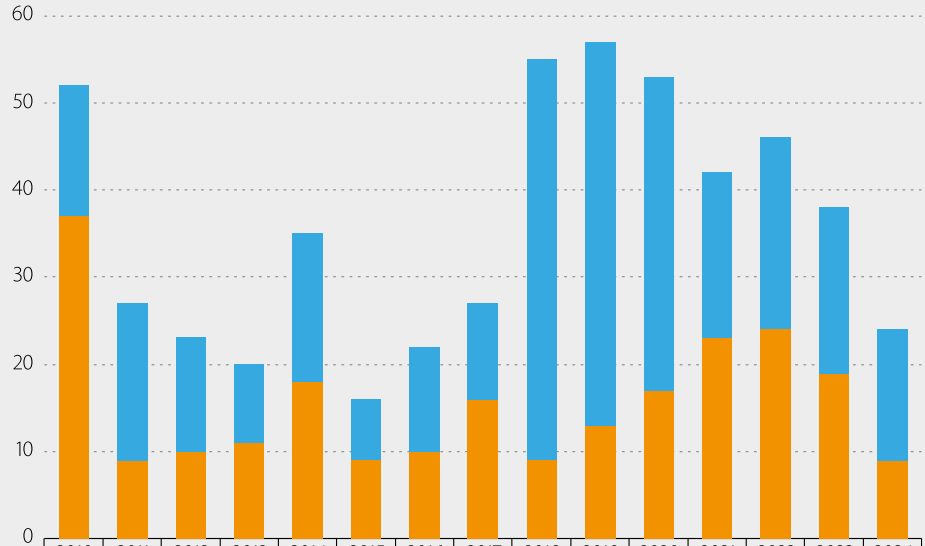
Sources and limitations

A number of activities related to the development and publication of the inland TDG risk management framework have taken place since 2018 ([20]), including a proposal for the clarification of the categories of releases to be reported, as recommended in the risk estimation guide. In parallel with the publication of the framework, a proposal for the improvement of Section 1.8.5 of the RID / ADR / European agreement concerning the international carriage of dangerous goods by inland waterways is currently examined by an informal working group of the United Nations Economic Commission for Europe / Intergovernmental Organisation for International Carriage by Rail joint meeting. Moreover, the regulation on common safety methods for assessing safety level and safety performance (CSM ASLP) will establish a more consistent and comprehensive reporting regime for TDG occurrences, combining information from the reports under the RSD and RID without duplication. Following the adoption of the CSM ASLP Regulation, and once the multimodal improvement of Section 1.8.5 of the RID/ADR/AND is adopted by the United Nations Economic Commission for Europe / Intergovernmental Organisation for International Carriage by Rail joint meeting, the 2029 RID may integrate an improvement of reporting requirements and be fully consistent with the CSM ASLP. This would enable the production of more reliable safety indicators for the TDG by rail.

([19]) The peak was mainly due to a single country reporting 34 accidents involving at least one railway vehicle transporting dangerous goods in those years.
([20]) See also ERA, *Guide for Risk Estimation – Risk management framework for inland transport of dangerous goods*, Publications Office of the European Union, Luxembourg, 2018.

Figure A-18: Accidents involving the transport of dangerous goods (EU-27, 2010–2024)

Railway accidents with and without release of dangerous goods



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Without dangerous goods release	15	18	13	9	17	7	12	11	46	44	36	19	22	19	15
With dangerous goods release	37	9	10	11	18	9	10	16	9	13	17	23	24	19	9

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

A-11 Casualties from significant accidents

Purpose

The severity of accidents, as reflected in the number of fatalities, varies across accident types. Monitoring the fatalities by accident type thus enables the identification and prioritisation of categories associated with relatively high impacts.

Indicators

The indicator used is the number of fatalities from significant accidents by type of accident, as set out in Annex I to the RSD.

Findings

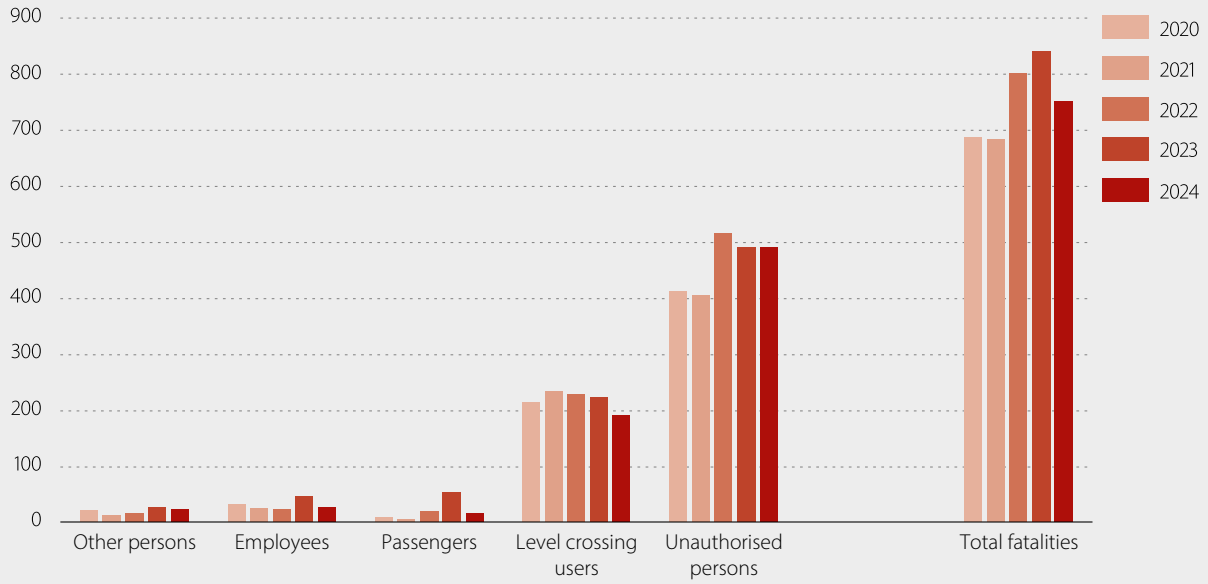
In parallel with the trend in railway accidents, the total number of fatalities excluding suicides, after the drop observed in 2020 and 2021, returned to pre-COVID-19 levels in 2022 and 2023, before decreasing again in 2024. Member States reported 750 fatalities for 2024, an 11 % decrease compared with the previous year (841 fatalities in 2023). This reduction was mainly driven by the decrease in fatalities among passengers and employees. When suicides are excluded, most fatalities on railway premises result from accidents to people (67 %). Fatalities from level crossing accidents account for around 29 % of the total, while those due to collisions and derailments represent about 3 % of all railway fatalities. Around 9 % of people killed (passengers, employees and other persons) on EU railways in 2024 were strictly internal to railway operations.

Sources and limitations

Data on fatalities from railway accidents have been collected for several decades and are therefore considered one of the most accurate metrics of railway safety in the EU.

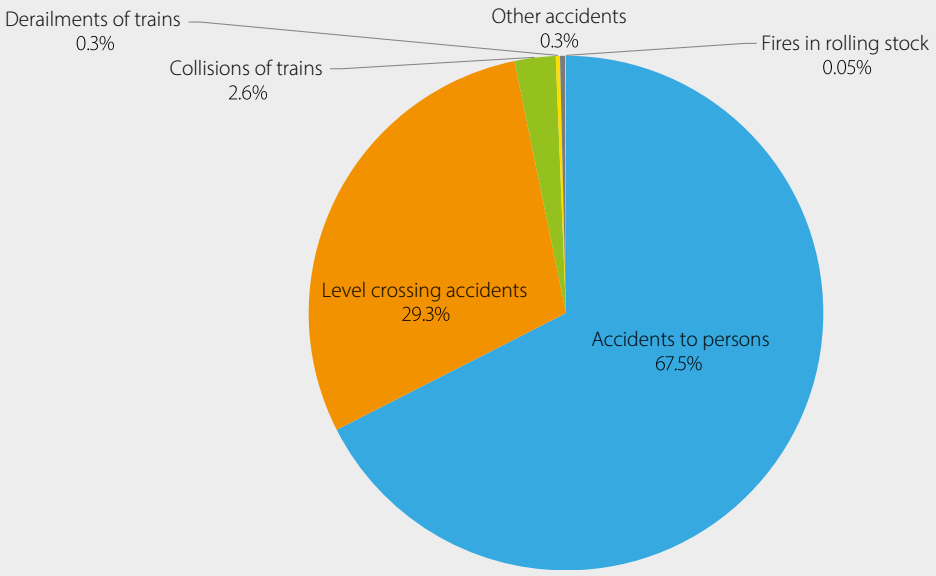
Data on seriously injured persons are slightly less reliable than statistics on fatalities, as reporting practices and hospital procedures may vary across Member States and may change over time. This has only a limited impact on the CST framework, in which the weight attributed to a seriously injured person is relatively low.

Figure A-19: Fatalities per victim category, excluding suicides (EU-27, 2020–2024)



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

Figure A-20: Fatalities per type of significant accident (EU-27, 2020–2024)



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

A-12 Suicides and trespasser fatalities

Purpose

'Death by railway' is a specific category of railway system safety reporting, focusing on 'external' fatalities among those not intending to use or maintain the railway system. As these fatalities have serious consequences in terms of the safety and quality of railway system operation, their monitoring is essential in proactive safety management.

Indicators

The indicators used are the numbers of suicide (intentional) and trespasser (unintentional) fatalities occurring on railway premises. Two indicators are used to reflect potential exposure to train movements: third-party fatalities per train-km and third-party fatalities per line-km.

Findings

Suicides are reported separately from accident fatalities. They represent around 76 % of all fatalities on railways and, together with fatalities of unauthorised persons on railway premises, constitute an overwhelming 90 % of all fatalities occurring within the railway system. In 2024, on average, almost 7 suicides were recorded every day on railways in the EU-27, totalling 2 357 over the year.

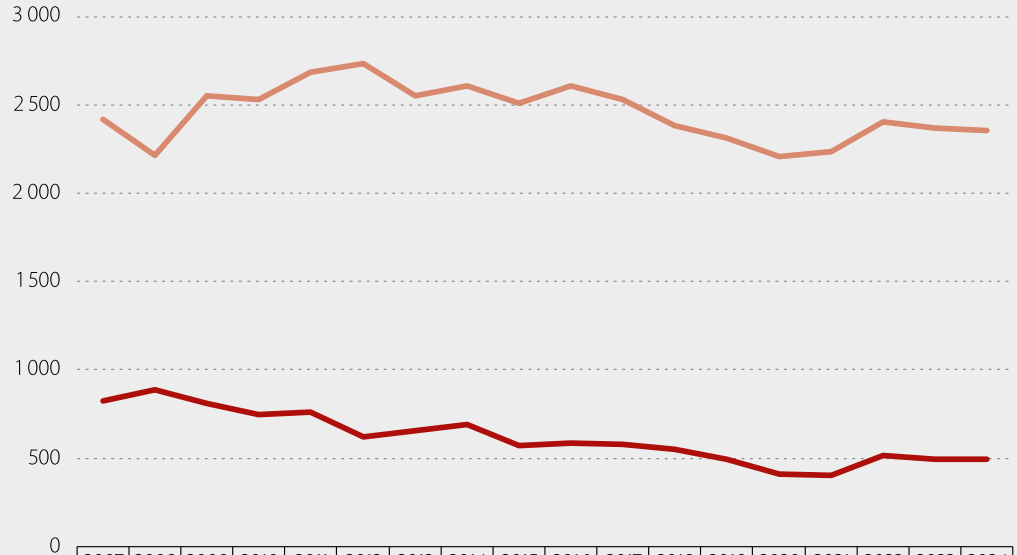
Trespasser fatalities have been decreasing since 2007, with a temporary increase in 2022 after a period of stability. Suicides followed a different pattern: they rose after the 2008 financial crisis, peaked for the first time in 2012, declined until an increase was recorded in 2022, and then continued to decrease in 2023 and 2024.

Countries located in the lower-right quadrant of Figure A-22 show relatively high third-party fatality rates despite low exposure to train movements (i.e. low train frequency). In many of those countries, trespassing is relatively frequent and railway lines are often poorly fenced. However, other factors also play a role. Notably, neither of the two indicators sufficiently accounts for population density along railway lines, which is a known risk factor for third-party fatalities.

Sources and limitations

Due to the inherent difficulties in classifying certain third-party fatalities on railways and because of the diverging national practices in their classification and reporting, suicides and trespasser fatalities are considered jointly when comparing countries.

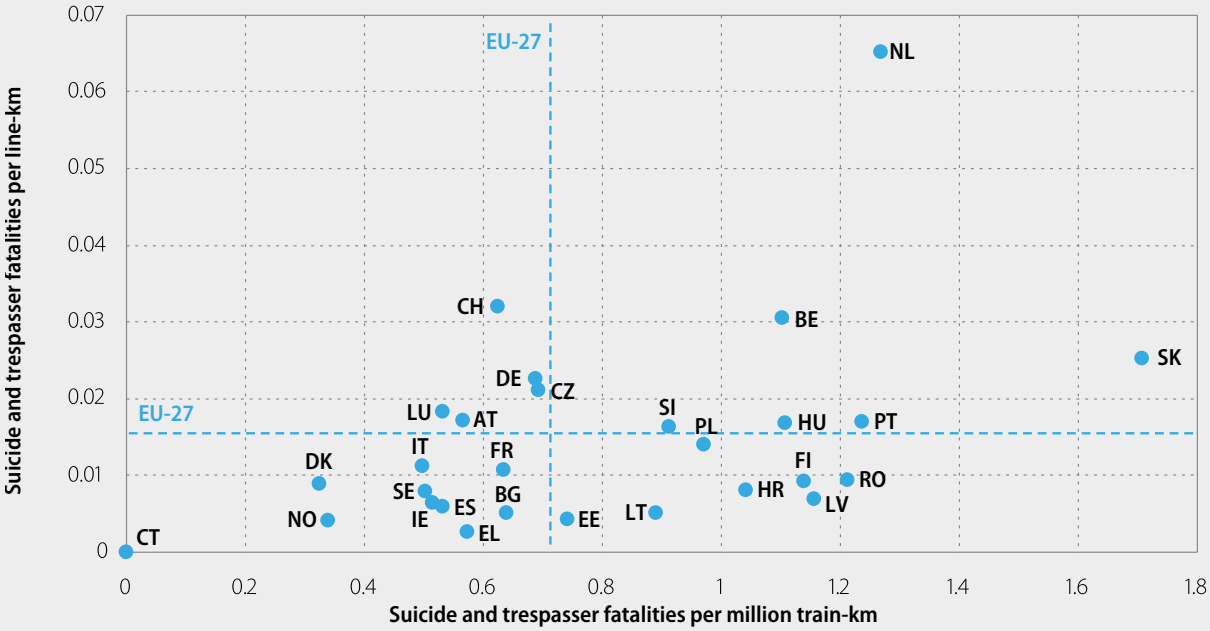
Figure A-21: Railway suicides and trespasser fatalities (EU-27, 2007–2024)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Suicides	2 417	2 211	2 552	2 532	2 687	2 734	2 552	2 608	2 511	2 608	2 532	2 379	2 313	2 204	2 234	2 401	2 371	2 357
Trespasser fatalities	822	887	813	750	759	622	659	692	572	585	579	549	491	411	405	516	491	492

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

Figure A-22: Suicide and trespasser fatality rates (EU-27 + CH + NO, 2022–2024)



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

A-13 Railway suicides versus overall suicides

Purpose

Plotting the railway suicide rate against suicide mortality in individual countries provides an indication of how effectively railway system managers have succeeded in reducing suicides on the network.

Indicators

The railway suicide rate (suicides per million train-km) and suicide mortality rate (suicides per 100 000 population) are used as indicators.

Findings

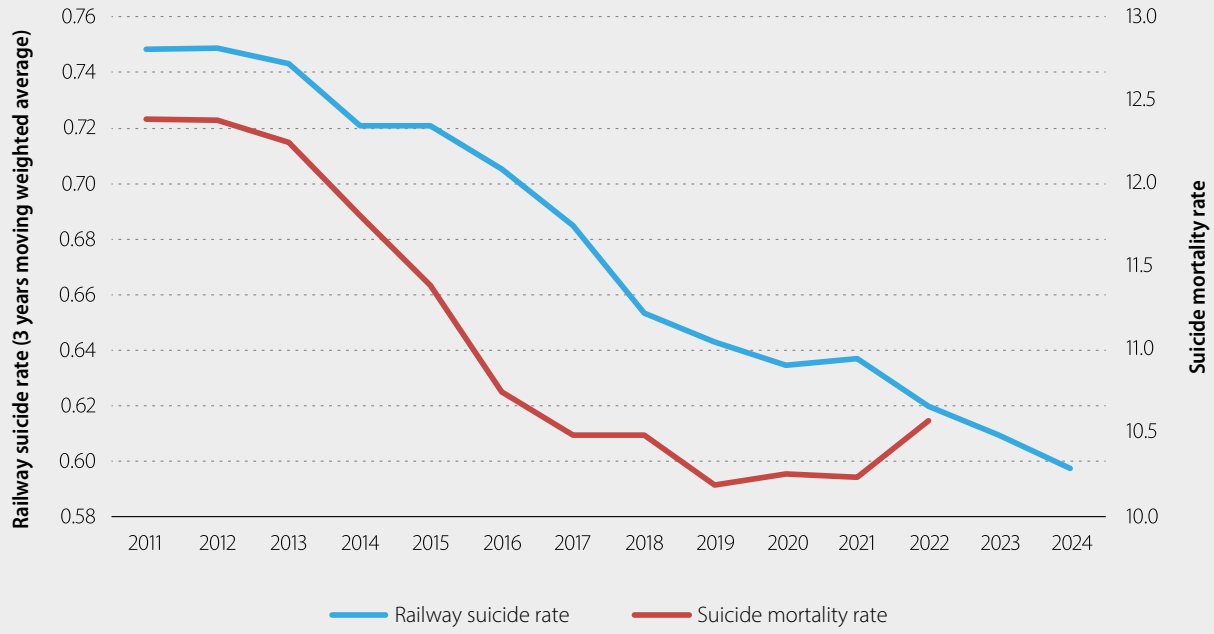
Suicides on railway premises have decreased in recent years. However, the total number of suicides in society has also decreased. Plotting the trend in the railway suicide rate (suicides per million train-km) alongside that of the suicide mortality rate (suicides per 100 000 population) shows a strong correlation between the two indicators. This suggests that the recent decrease in railway suicides is unlikely to be attributable solely to measures implemented within the railway system, with the only exception being the marginal increase in the overall mortality rate observed in 2022.

However, the countries with a high train frequency and a high population density along railway lines remain heavily disadvantaged in this comparison. In general, in countries below the trend line, suicide fatalities occurring on railways account for a relatively large proportion of all suicides.

Sources and limitations

Railway suicide data are the result of the classification of fatalities on railways by coroners' courts, the police or other judicial bodies. This judicial classification, for example suicide or trespasser, is supplied by the NSAs to ERA. Data on suicide mortality are collected by the health authorities of Member States and provided by their statistical offices to Eurostat. There is a significant delay in data becoming available at the EU level, which means that data relating to more recent years are not yet included..

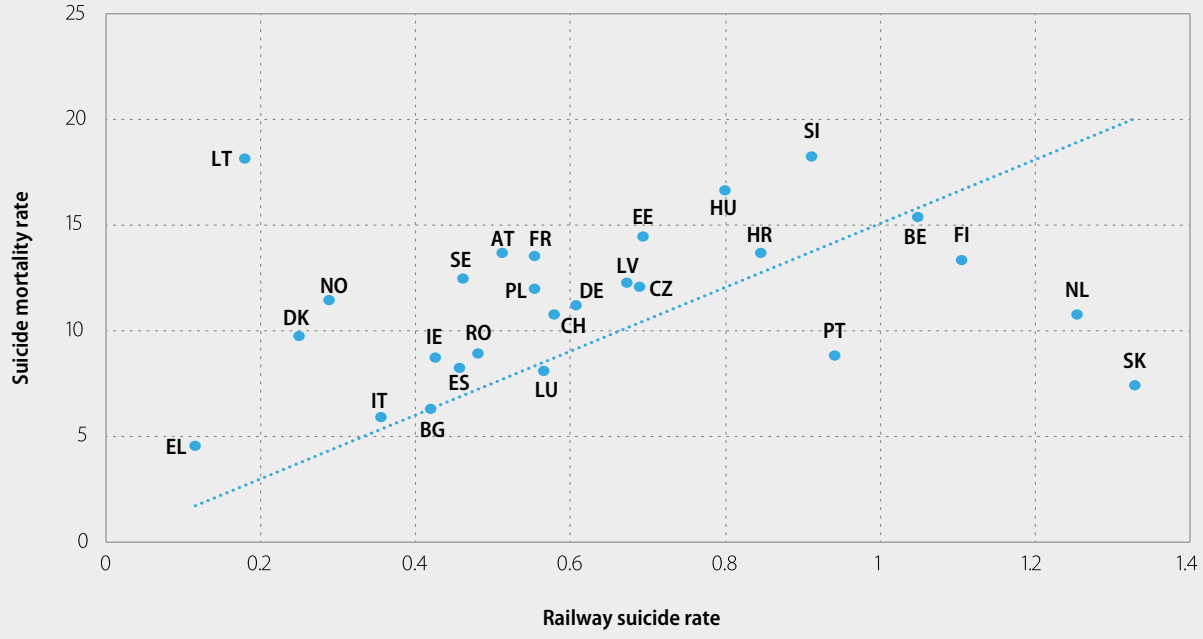
Figure A-23: Figure A-23: Railway suicide rate (EU-27, 2011–2024) and suicide mortality rate (EU-27, 2011–2022)



Sources: Railway suicide rate – CSIs as reported by NSAs to ERA; suicide mortality rate – Eurostat (dataset 'Death due to suicide, by sex' (TPS00122)).

Figure A-24: Suicide mortality rate compared with railway suicide rate (EU-27 + CH + NO)

Fatalities per 100 000 population in 2022, fatalities per million train-km 2022-2024



Source: Suicide mortality rate – Eurostat (dataset 'Death due to suicide, by sex' (TPS00122)).

A-14 Railway workers' safety

Purpose

A century ago, most victims of railway accidents were railway workers. However, thanks to a sustained focus on staff safety, railway operators have succeeded in significantly reducing the number of these casualties. Many operators have adopted a zero-tolerance policy towards fatal injuries in the workplace and have implemented a range of policies and measures to support this objective. Safety statistics for workers therefore provide an indication of how effectively railway operators are limiting safety risks for their staff and contractors. In this context, it is also important to distinguish between accidents involving collisions or derailments and those caused by rolling stock in motion, as they reflect fundamentally different operational situations and require different preventive measures.

Indicators

The indicators used here are railway worker (employee and contractor) fatalities and, for comparison, railway passenger and employee fatality rates (three-year moving averages). Worker fatalities are also differentiated by accident type, distinguishing events linked to train operations (collisions and derailments) from those linked to trackside exposure and movements of rolling stock.

Findings

No clear progress in reducing railway worker fatalities in absolute terms has been seen in the last few years, with a peak in 2023 to decrease in 2024. In 2024, 28 fatalities and 46 serious injuries were reported among railway employees in the EU-27.

The centred moving averages show that incidents caused by rolling stock in motion follow a distinct trend compared with those resulting from collisions or derailments, underlining the need for differentiated safety measures.

After a significant decrease up to 2018, both passenger and worker fatality rates remained relatively stable for several years, before rising again until 2024.

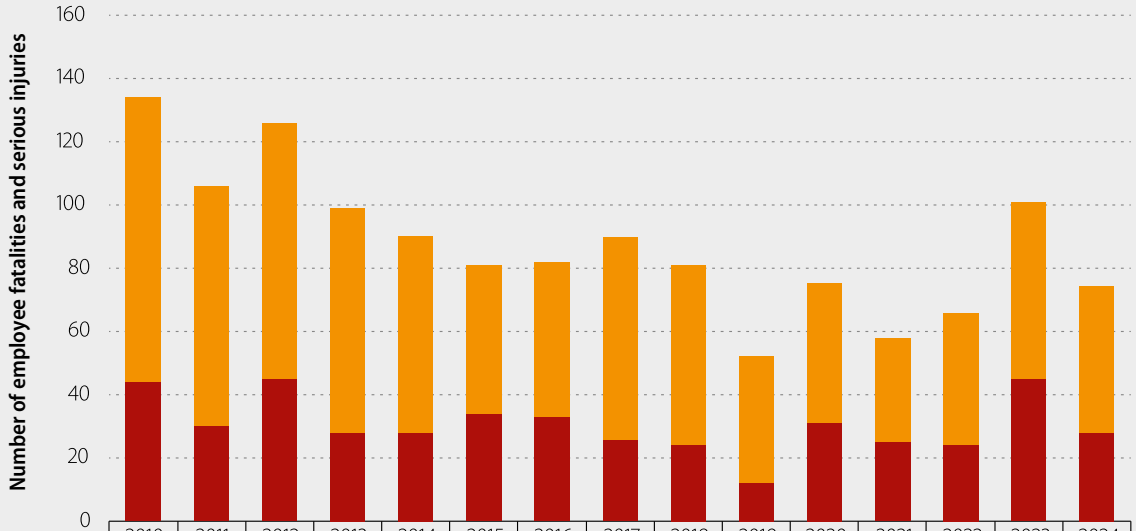
Sources and limitations

Data used to monitor progress in safety outcomes and the distinction between accident types are included in the CSIs supplied by the NSAs to ERA ([21]). Twenty years of continuous work on data quality in Member States and at the Agency provides assurance on the accuracy of the data.

([21]) ERA, 'Common safety indicators (CSIs)', ERA website.

Figure A-25: Railway worker casualties (EU-27, 2010–2024)

Fatalities, serious injuries

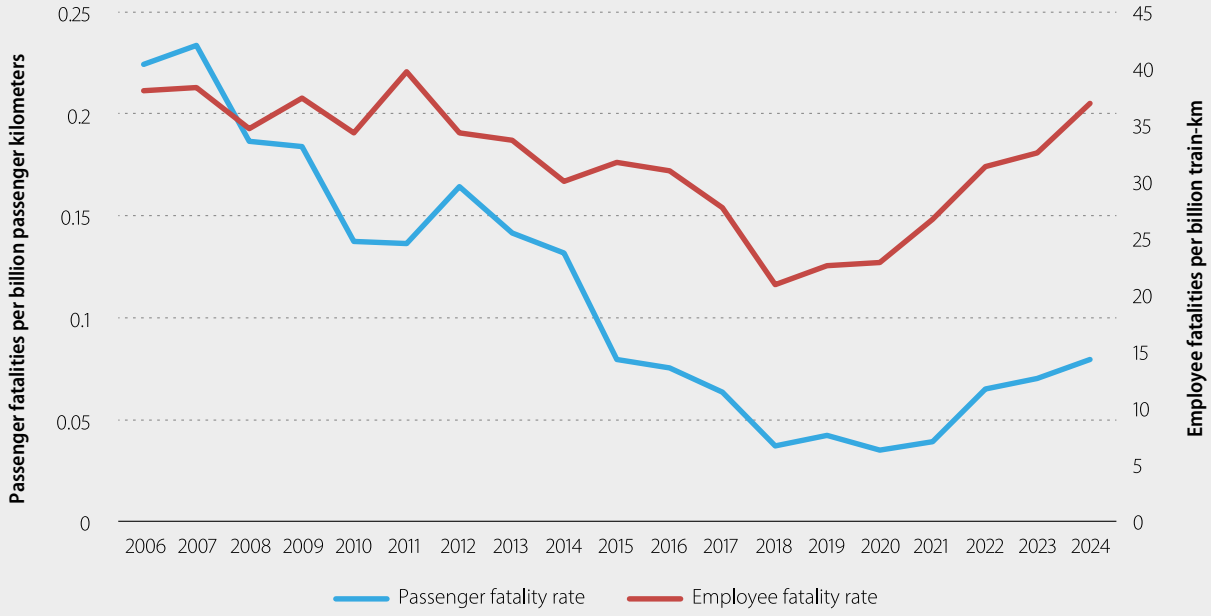


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Seriously injured	90	76	81	71	62	47	49	64	57	40	44	33	42	56	46
Fatalities	44	30	45	28	28	34	33	26	24	12	31	25	24	45	28

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

Figure A-26: Railway passenger and worker fatality rates (EU-27, 2006–2024)

Passenger fatalities per billion passenger kilometers, Employee fatalities per billion train kilometers, 3-years moving average



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

A-15 Level crossing safety

Purpose

Level crossing accidents represent almost one quarter of all significant accidents on EU railways. Level crossings represent not only the physical intersection of a railway track and a road but also an intersection of responsibilities and interests. The high-level monitoring of outcomes therefore provides objective evidence for efficient safety improvements.

Indicators

The indicators used are the absolute numbers of significant level crossing accidents, resulting fatalities and serious injuries, and the accident rate (significant accidents per train-km).

Findings

After an improvement in the number of level crossing accidents and related fatalities over 2010–2016, in the following years (2017–2022) a more stagnant trend was observed (despite a drop in 2020, probably linked to the COVID-19 pandemic). This was followed by a renewed decrease, culminating in 2024 with the lowest figures ever recorded.

Level crossing accident rates vary considerably among Member States. The figure reveals at least a 39-fold difference in the level crossing accident rates between the countries with the lowest rates and those with the highest rates (excluding the outlying high value). The countries with the lowest accident rates have typically developed comprehensive strategies to improve the safety of level crossings, and this has translated into a small number of level crossings with poor or no protection. Common features of the countries with the highest accident rates are a low population density and low railway traffic volumes. These conditions perhaps provide less incentive for the comprehensive management of level crossing safety.

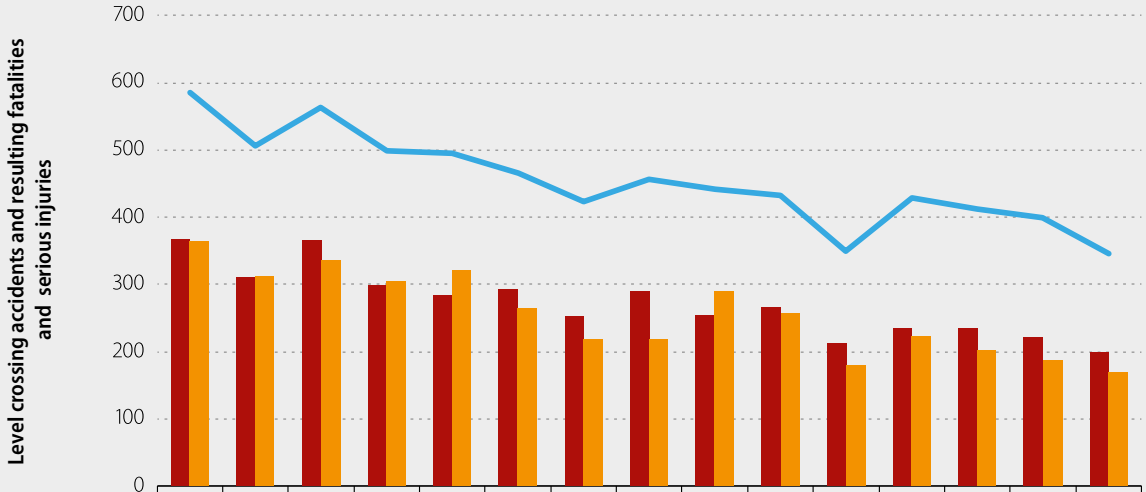
Sources and limitations

Data used to monitor progress with safety outcomes are part of the CSIs supplied by the NSAs to ERA ([22]). Twenty years of continuous work on data quality in Member States and at the agency provides assurance on the accuracy of the data.

([22]) ERA, 'Common safety indicators (CSIs)', ERA website.

Figure A-27: Level crossing accidents and resulting casualties (EU-27, 2010–2024)

Significant accidents, fatalities and serious injuries

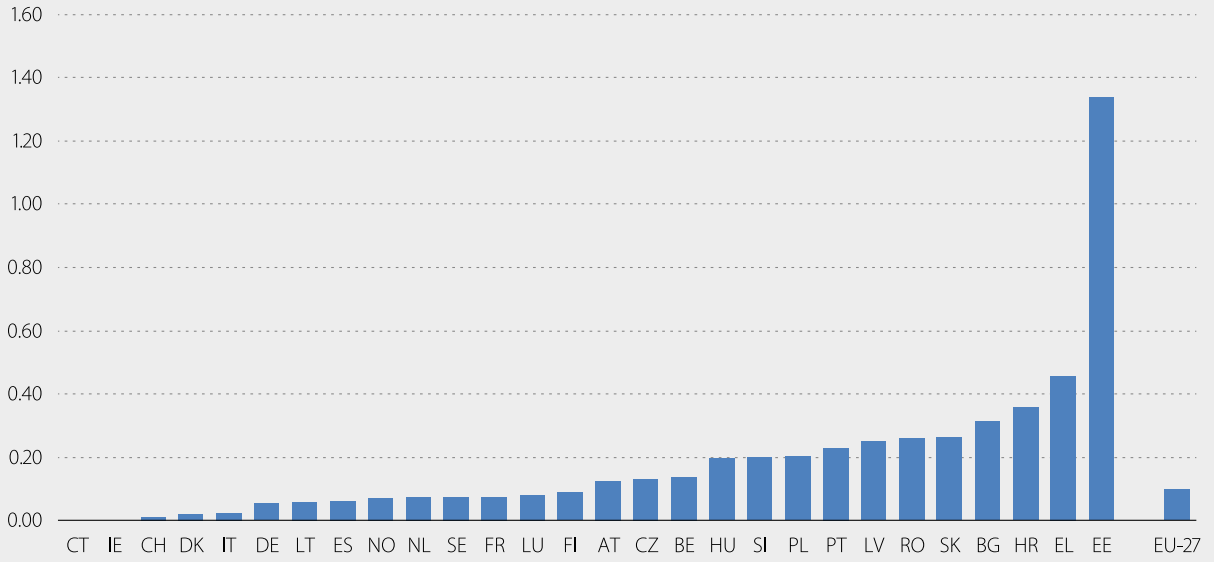


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Fatalities	367	309	365	298	284	294	252	289	254	265	213	234	234	222	199
Serious injuries	363	311	335	305	321	263	217	217	290	257	179	224	201	186	169
Accidents	585	506	563	498	495	465	424	456	442	432	350	428	412	399	345

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

Figure A-28: Level crossing accident rates (EU-27 + CH + NO, 2020–2024)

Significant accidents at level crossings per million train-km



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

A-16 Precursors to accidents

Purpose

As accidents on railways are rare, a proactive safety management system relies heavily on monitoring events that occur on railways, even when they have no harmful consequences. Such events act as precursors to accidents, representing incidents that, under different circumstances, could have resulted in an accident.

Indicators

The indicators available at the EU level are broken rails, track buckles, signals passed at danger (SPADs), wrong-side signalling failures, broken wheels and broken axles. Their absolute numbers provide an initial indication of their relevance and trends.

Findings

Between 2020 and 2024, Member States reported almost 10 500 precursors to accidents as defined under the CSIs on average each year. This works out as a ratio of precursors to significant accidents of 7:1 per year. However, if we disregard accidents caused by rolling stock in motion, the ratio of precursors to accidents rises to 14:1. This highlights the learning potential offered by precursors to accidents. Among the SPAD incidents, those in which a danger point was passed represent a particularly high risk of collision. Of the 2 314 SPAD incidents on EU railways recorded on average each year during 2020–2024, fewer than one quarter were of this type.

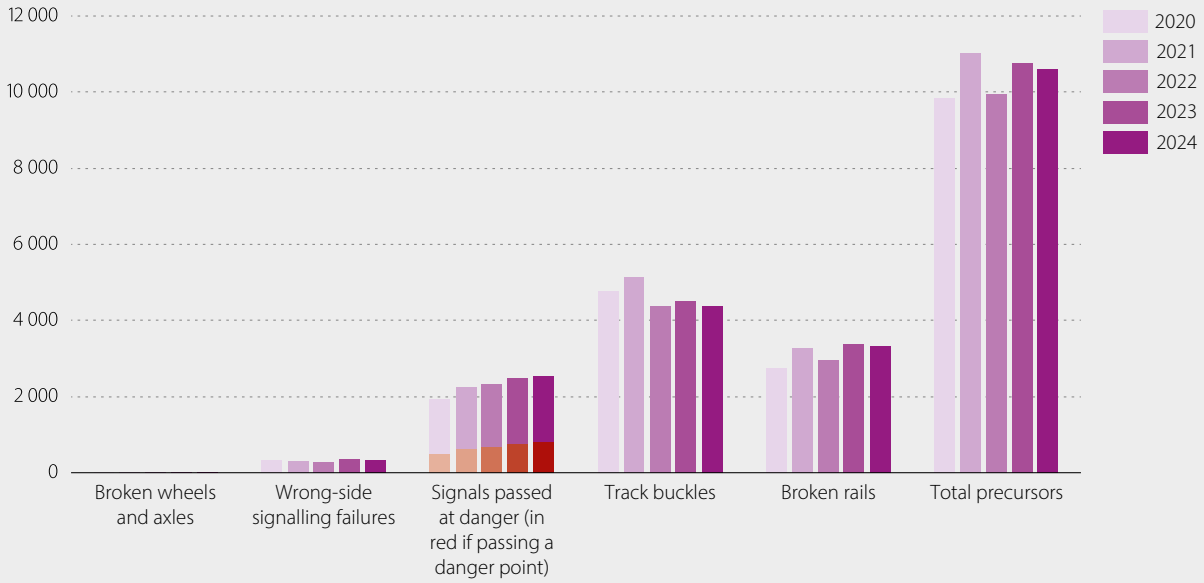
The year-to-year variation in the occurrence of track buckles and broken rails does not offer a fully reliable picture of the situation, as it is affected by differences in the data collection practices for and reporting approaches of these occurrences across Member States. This limitation becomes evident when examining the ratio of accident precursors to accidents at the country level. Given the importance of consistent and high-quality data, further analysis and discussions are planned to identify potential discrepancies and explore ways to harmonise data collection and reporting among countries. A swift implementation of the CSM ASLP, together with the associated systematic and comprehensive EU-wide safety incidents reporting scheme, would provide an additional perspective for assessing and enhancing safety management across Europe.

Sources and limitations

Data used to monitor progress with safety outcomes are part of the CSIs supplied by the NSAs to ERA ([23]). Despite gradual improvements in the quality of precursor data, the data may not yet be fully comparable between Member States, so a degree of caution should be exercised when interpreting the results. Under-reporting is not uncommon in relation to incidents in general and for certain accident precursors in particular.

([23]) ERA, 'Common safety indicators (CSIs)', ERA website.

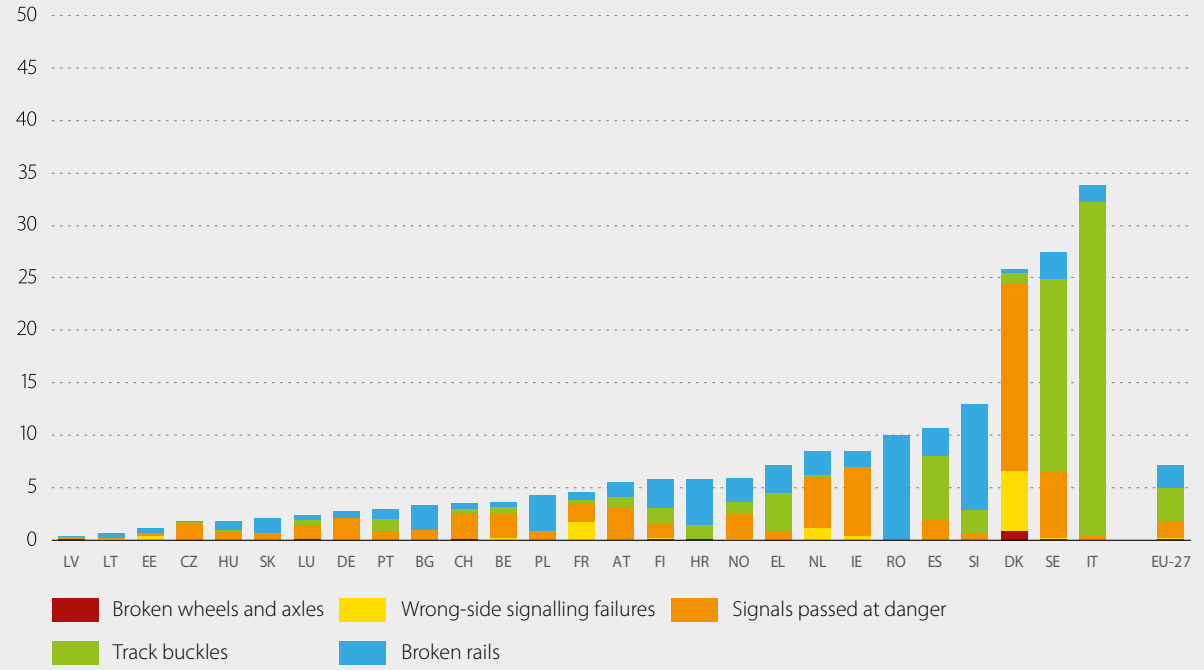
Figure A-29: Precursors to accidents (EU-27, 2020–2024)



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

Figure A-30: Accident precursor to accident ratio per country (EU-27 + CH + NO, 2020–2024)

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.

A-17 Accident investigations

Purpose

Independent investigations into the causes of accidents are invaluable to society as a whole, particularly for the learning potential they offer. They ensure that lessons are drawn from past events and that appropriate measures can be taken to prevent similar accidents in the future. Responsibility for conducting independent accident investigations lies with each Member State, while ERA's role is limited to supporting the NIBs in carrying out their tasks. The RSD requires that serious accidents be investigated by an independent NIB.

Indicators

The indicators used are the number of accidents and incidents investigated by NIBs and their further subclassification in accordance with investigation compulsoriness, accident type and availability of the final report.

Findings

Since 2006, the NIBs have opened investigations into 201 accidents and incidents per year on average, with final reports available in the European Railway Accident Information Links (ERAIL) database ([24]) for some 96 % of these. Occurrences for which a mandatory independent investigation is legally required (by the RSD) represent 18 % of all investigated occurrences. As this proportion has been stable, it could indicate stability in NIBs' overall priorities and available budget.

NIBs have the discretion to investigate certain occurrences on top of those they must investigate. Regarding the distribution of accident types investigated and accompanied by a final report published since 2006, it appears that the NIBs are more inclined to investigate derailments and level crossing accidents (even when this is not mandatory). Non-mandatory investigations (under the RSD) are carried out for all accident types and also for incidents (especially for SPADs). It should be noted that in some Member States, in accordance with national legislation, the investigation of derailments, SPADs and/or level crossing accidents is mandatory, regardless of the consequences of the accident.

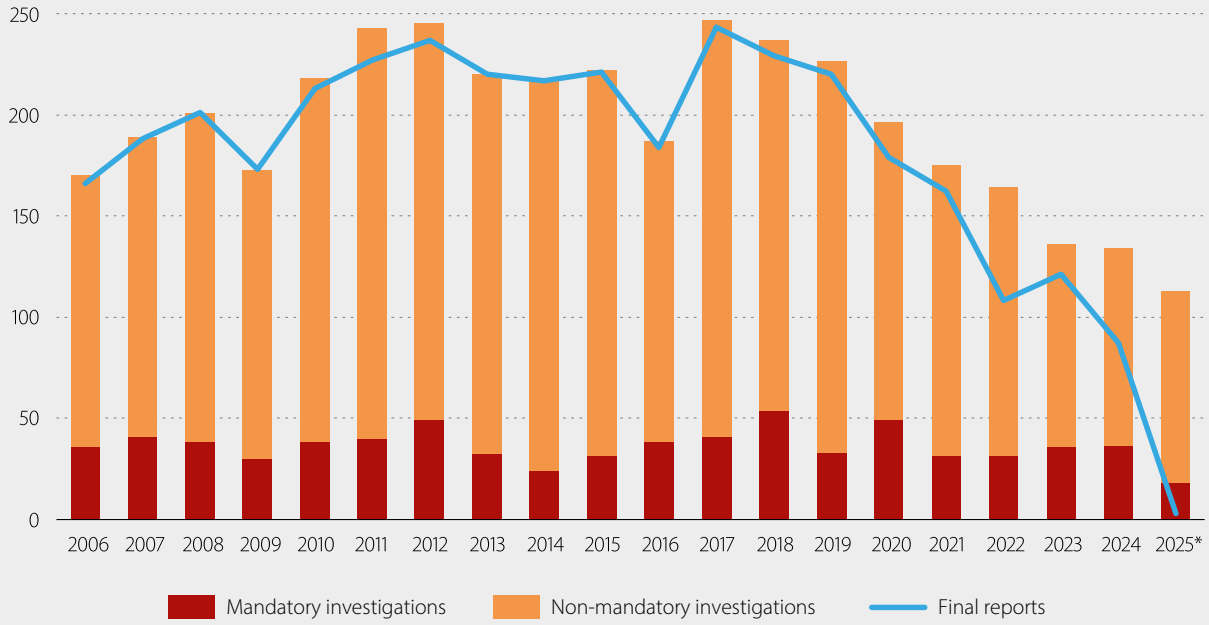
Sources and limitations

Investigations by NIBs were recorded in the ERAIL database until its disconnection at the end of 2020. Since then, an Excel database (based on the information retrieved from the ERAIL database) has been updated with information on the new investigations reported to ERA. The completeness of the data depends on the inputs provided by the NIBs.

([24]) ERA, 'Rail accident investigation', ERA website.

Figure A-31: Accidents and incidents subject to independent investigation (EU-27 + CH + NO, 2006–2025)

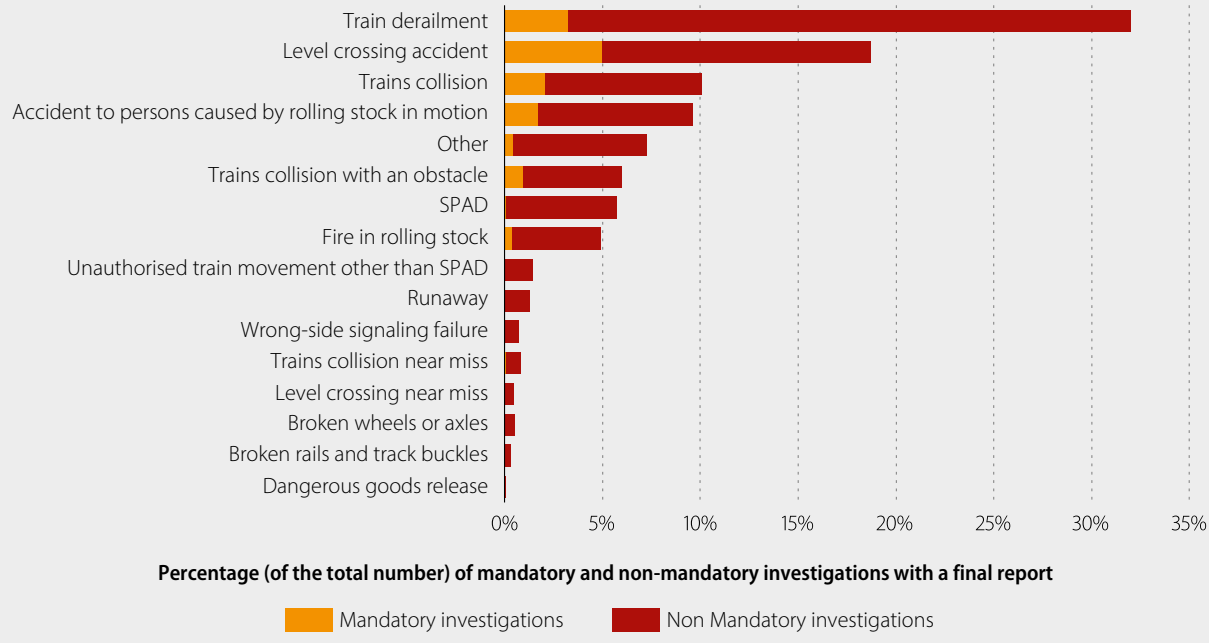
Mandatory and voluntary investigations by National Investigation Bodies per year of occurrence



Note: Data for UK available until end 2020; (*) Final reports are presented by year of the occurrence (not by year of publication); for example for accidents occurred in 2021 final reports are expected to be issued within 1 year from the date of occurrence.

Source: Investigations by NIBs notified to ERA (ERAIL database), as of end of November 2025.

Figure A-32: Accident types of NIB-investigated accidents (EU-27 + CH + NO, 2006–2025)



Note: Data for UK available until end 2020; 'Mandatory' refer to the obligations under the Safety Directive, excluding national rules which can impose more restrictive investigations rules.

Source: ERAIL database; this includes the data been provided by NIBs as of the end of November 2025.

A-18 Weather-related occurrences investigated by NIBs

Purpose

In recent years, the number of extreme-weather-related events has increased, with several of these events having significant consequences for the railway system and transport services. Natural disasters driven by climate change (e.g. extreme heatwaves and fires, heavy rainfall and flooding, or severe snowfall and thunderstorms) pose safety risks and challenge the resilience of the European transport system ([25]).

Indicators

Using information retrieved from final accident investigation reports sent to the Agency by the NIBs, it is possible to provide an overview of weather-related rail accidents/incidents investigated by the NIBs, classified by cause / contributing factor or by occurrence type.

Findings

From 2007 through November 2025, the Agency received 102 final accident investigation reports for occurrences caused, in whole or in part, by weather. Weather conditions were identified as direct causes in 28 cases, while they were considered contributing factors for the remaining 74 occurrences.

The weather conditions most frequently directly causing investigated rail occurrences are snow and ice (reported in nine occurrences) and flooding (five occurrences), followed by landslips, wind and storms. Snow and ice also appear among the most common contributing factors (14 occurrences), together with fog (14 occurrences), wind (14 occurrences) and rain (13 occurrences). According to the accident investigations, train derailments and train collisions with obstacles are the types of occurrences most often caused, in whole or in part, by severe weather conditions or weather-related events.

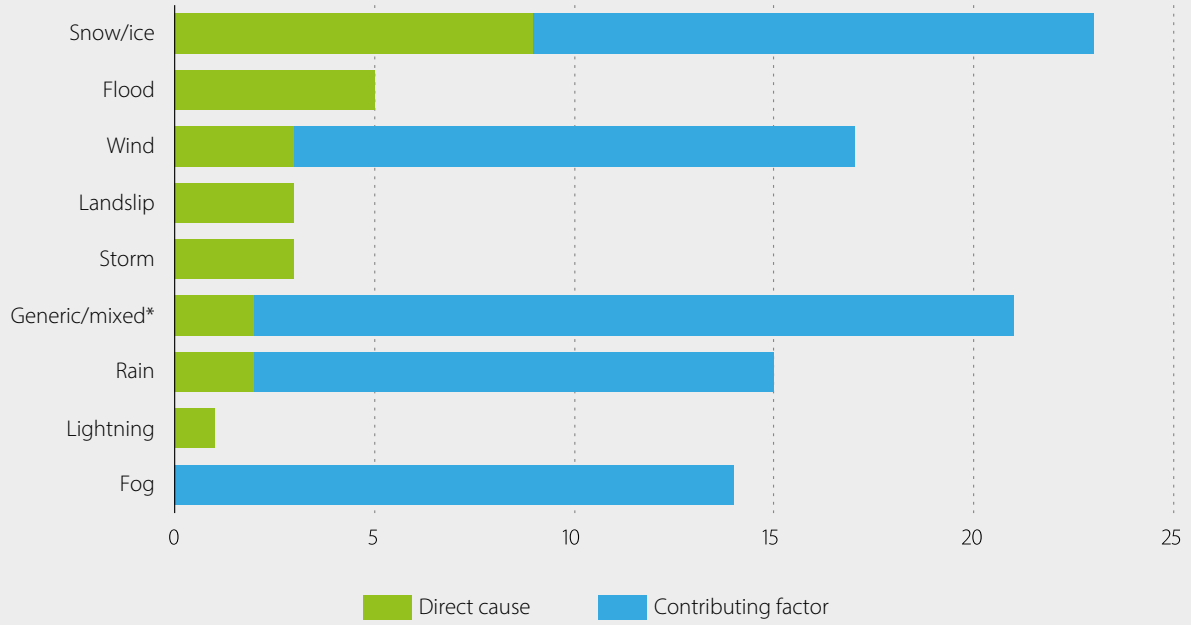
Sources and limitations

Investigations carried out by NIBs were recorded in the ERAIL database until its disconnection at the end of 2020. Since then, an Excel database (based on the information retrieved from the ERAIL database) ([26]) has been updated with information on the new investigations reported to ERA.

The analysis focuses exclusively on weather-related accidents and incidents investigated by the NIBs, and therefore covers only a subset of all occurrences linked to severe weather conditions. A swift implementation of the CSM ASLP, together with the associated systematic and comprehensive EU-wide safety incidents reporting scheme, would support further analysis of emerging patterns in weather-related accidents and incidents across Europe.

([25]) For further information on environmental aspects, climate resilience and related ERA work, see the agency's web page 'Rail & environment', which provides access to the first *Rail Environmental Report* (2024) and to the recent study report *Rail Resilience to Climate Change – Impact of extreme weather events on the European railway system* (2026).
([26]) ERA, 'Rail accident investigation', ERA website.

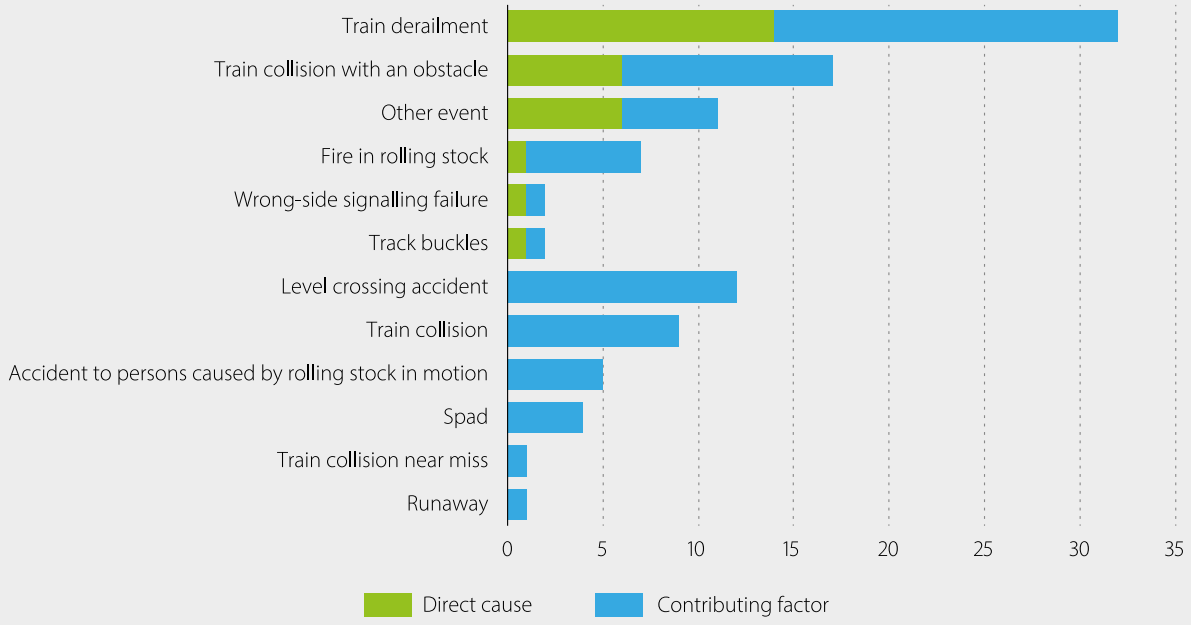
Figure A-33: Number of investigations of weather-related occurrences by cause / contributing factor (EU-27 + CH + NO, 2007–2025)



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 A-34: Number of investigations of weather-related occurrences by occurrence type (EU-27 + CH + NO, 2007–2025)



Note: Data for UK available until end 2020.

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

A-19 Deployment of train protection systems on railway lines

Purpose

The installation of TPSs is widely recognised as one of the most effective railway safety measures for reducing the risk of train-to-train collisions. Given the wide variety of TPS types and versions in use across the EU, a classification based on three levels of assistance provided to the train driver offers a solid basis for reporting comparable statistical data.

While TPSs are non-interoperable legacy systems, also known as class B systems, their functions, reliability and accuracy vary significantly depending on their age and technical characteristics. In contrast, the European rail traffic management system (ERTMS) is the most advanced class A system, and its installation across all core, extended core and comprehensive networks of the EU is mandated ([27]). The ETCS is the EU's standard system for automatic train protection. It ensures high levels of safety, interoperability, reliability and performance. Several Member States have chosen to deploy the ETCS on their entire rail network, thereby going beyond EU legal requirements. This is particularly relevant because many legacy TPSs are now obsolete and are characterised by low reliability, low safety performance and reduced operational capability.

Indicators

The shares of railway lines equipped with TPSs (by level of assistance) and with the ETCS are used as indicators.

Findings

Some Member States reported advanced TPSs functional levels (including, in some cases, the ERTMS), while a few others did not report the share of tracks equipped with TPSs (or reported that no tracks were equipped with TPSs). Among those providing TPS data, Germany, Spain, Italy, Luxembourg, the Netherlands and Romania reported that more than 90 % of their networks are equipped with TPSs that provide the highest level of train protection – that is, warning, automatic stop and (discrete or continuous) supervision of train speed. However, a significant proportion of railway lines in other Member States are still not protected by TPSs.

The deployment of the ETCS has been limited so far; only a few countries have equipped a significant share of their network with the system. The percentage of the national network equipped with the ETCS is highest in Luxembourg, which had already reached full (100 %) deployment before 2025; in Belgium and Switzerland, which achieved 98 % and 96 % deployment, respectively, by the end of 2025; and in Denmark and Slovenia, where more than 35 % of the network is equipped with the system.

Sources and limitations

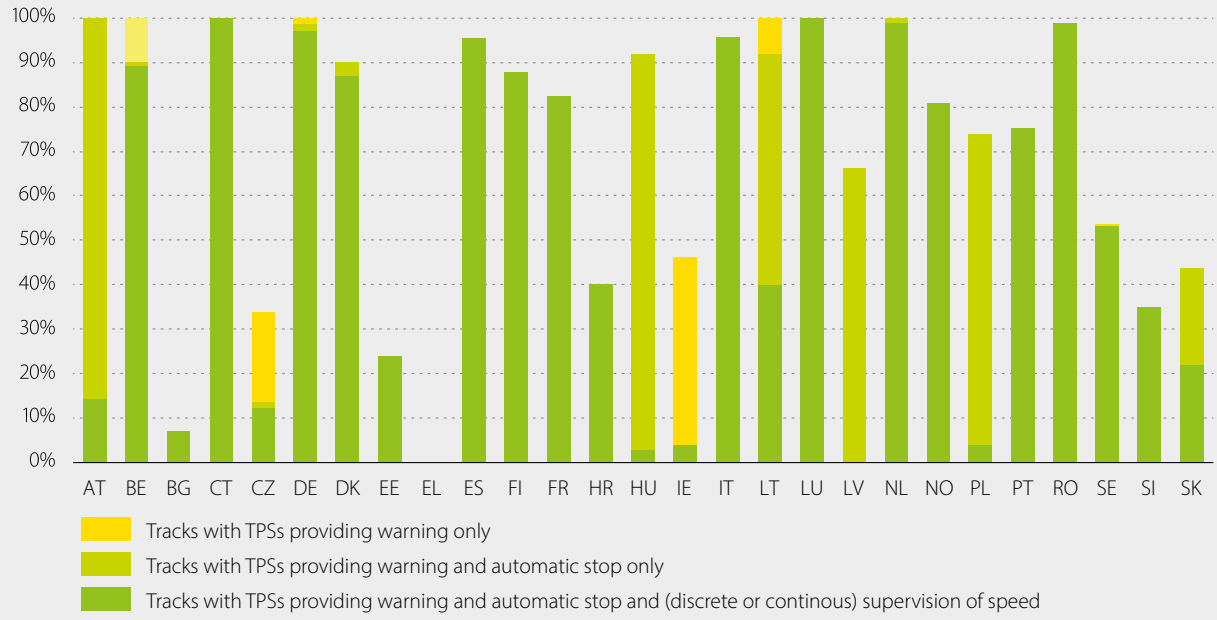
Although the three TPS levels have long been part of CSI data collection, they have recently been redefined to ensure more harmonised reporting. However, not all IMs provide these data, and some submissions may still contain inaccuracies. Moreover, for the 2024 values, some countries reported a change from previous years due to variation in indicator definition and reporting procedures. Regarding the Register of Railway Infrastructure (RINF), the reliability of the information depends on how up to date and complete the data entered into the database by IMs and Member States are, as the data are retrieved directly from it. As stated in the RINF terms of use, ERA bears no responsibility or liability for the

([27]) See Regulation (EU) 2024/1679 of the European Parliament and of the Council of 13 June 2024 on Union guidelines for the development of the trans-European transport network, amending Regulations (EU) 2021/1153 and (EU) No 913/2010 and repealing Regulation (EU) No 1315/2013 (OJ L, 2024/1679, 28.6.2024, ELI: http://data.europa.eu/eli/reg/2024/1679/oj).

information submitted to and published in the database. In several cases, it was necessary to contact IMs to obtain data quality clarifications. Double counting is possible for some Member States where the same track is equipped with ETCS levels 1 and 2; this will be reflected in a higher share of railway lines equipped with the ETCS. Moreover, the overall data quality also depends on the provisions and implementation of the RINF Revision Regulation ([28]).

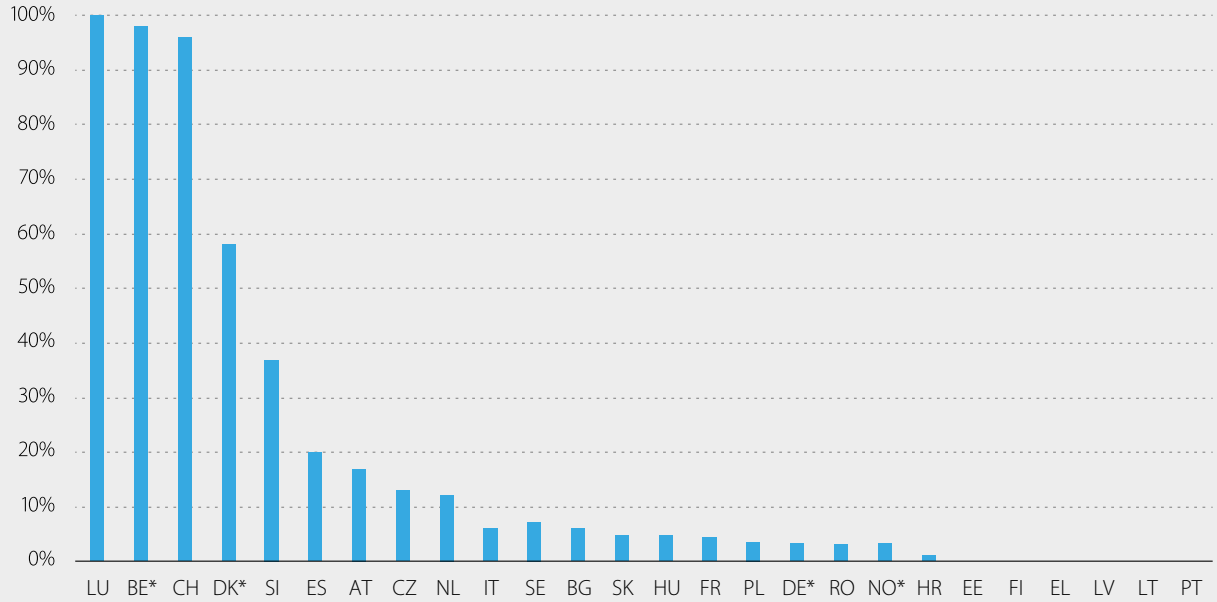
([28]) Implementing regulation–2023/1694–EN–EUR-Lex.

Figure A-35: Share of tracks equipped with train protection systems, % (EU-27 + NO, end of 2024)



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

Figure A-36: Share of railway lines equipped with ETCS, % (EU-27 + CH + NO, end of 2025)



Note: * Value and addifional info from IM; for BE, the HS railway line from Halle to the cross-border BE/FR is not currently equipped with ETCS.
Sources: ETCS data and total line data – RINF (end of 2025).

A-20 Deployment of level crossing protection systems

Purpose

Level crossings are high-risk spots on the railway network, as they pose an inherent danger to both road and railway users. The installation of various protection systems has historically been a cheaper, although less efficient, alternative to replacing level crossings with overpasses, underpasses or bridges. Nevertheless, these systems remain costly to deploy across the entire railway network. Empirical data show that, although any form of protection is preferable to none, only manual and rail-side-protected level crossings reduce the risk of an accident to nearly zero.

Indicators

The indicators used are the absolute number of level crossings by type of protection, as defined in the RSD (Annex I), and the relationship between the number of accidents on passive level crossings and the number of passive level crossings per country.

Findings

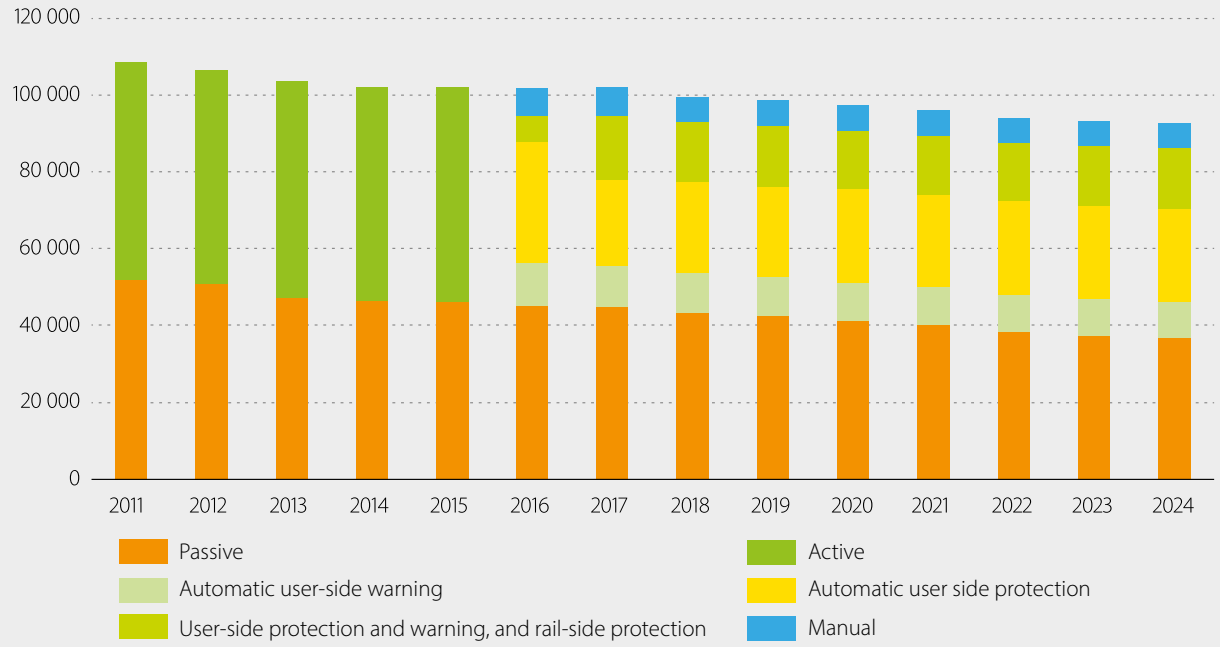
In 2024, the EU-27 reported more than 92 000 level crossings. Passive level crossings account for 40 % of the total; these level crossings are typically equipped with a St Andrew's cross traffic sign but do not provide an active warning to road users. Level crossings with user-side protection (arm barriers and flashing lights) are the most common type of active level crossings (44 %). Around 17 % of all level crossings combine full road-side protection with rail-side protection.

Passive level crossings and level crossings in general are being removed only slowly. Preliminary observations suggest a possible relationship between the total number of level crossings and passive level crossings (2022–2024 averages) among European countries and the average number of accidents at these level crossings. In most countries, a higher number of passive level crossings is associated with a higher number of accidents on these level crossings, with a few exceptions (e.g. France, Norway and Hungary). The possible correlation patterns, including those involving active and total level crossings, could be explored in more depth. The greater granularity offered by CSM ASLP reporting may support more robust analyses in the future.

Sources and limitations

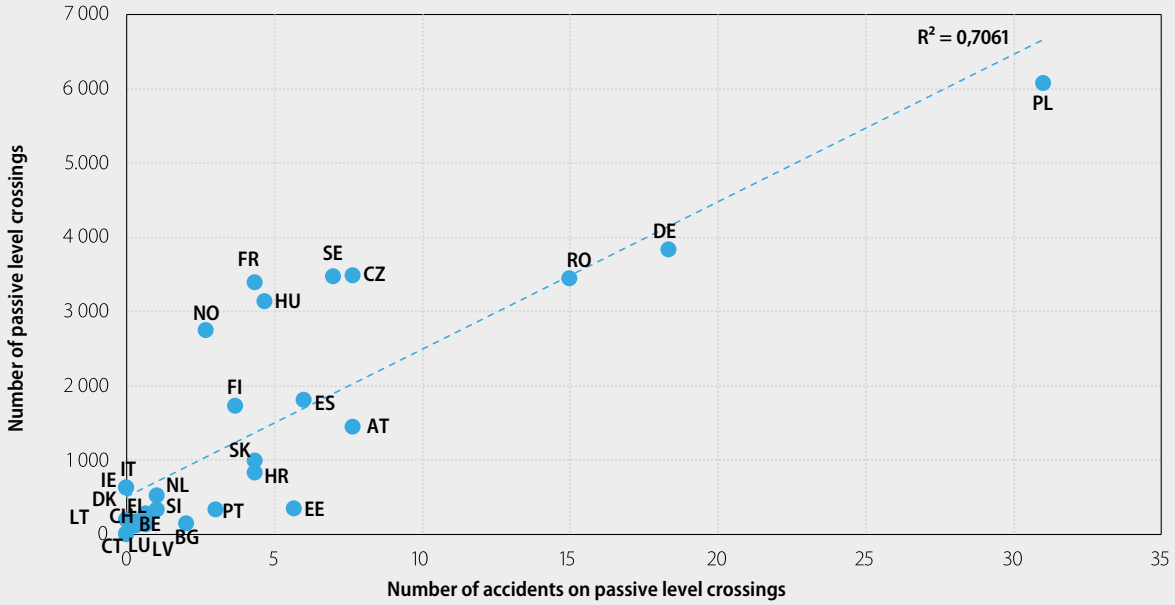
As there is no standard for level crossing protective equipment, dozens of types with various combinations of features exist in Europe. Nevertheless, a basic classification has been agreed, comprising five main types, characterised by their core functional capacities and their potential to reduce risk.

Figure A-37: Level crossings per type of protection (EU-27, 2011–2024)



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

Figure A-38: Number of accidents on passive LCs and number of passive LCs per country (EU-27 + CH + NO, 2022–2024)



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

A-21 Safety certification

Purpose

The RSD requires the RU to hold an SC issued by the NSAs in order to access the railway infrastructure. Historically, and until the entry into force of the fourth railway package, the certification framework was based on a two-part system: a Part A SC (confirming acceptance of the RU's safety management system) and at least one Part B SC (confirming that the RU met the specific requirements needed to operate safely on a given network). This two-part scheme is now being gradually replaced by an SSC, following the full application of the technical pillar of the fourth railway package across the EU since the end of 2020.

Indicators

The indicators used are the number of valid Part A SCs and the number of SSCs per country (valid at the end of the last four years) and the breakdown of SSCs by type of service (valid at the end of 2025).

Findings

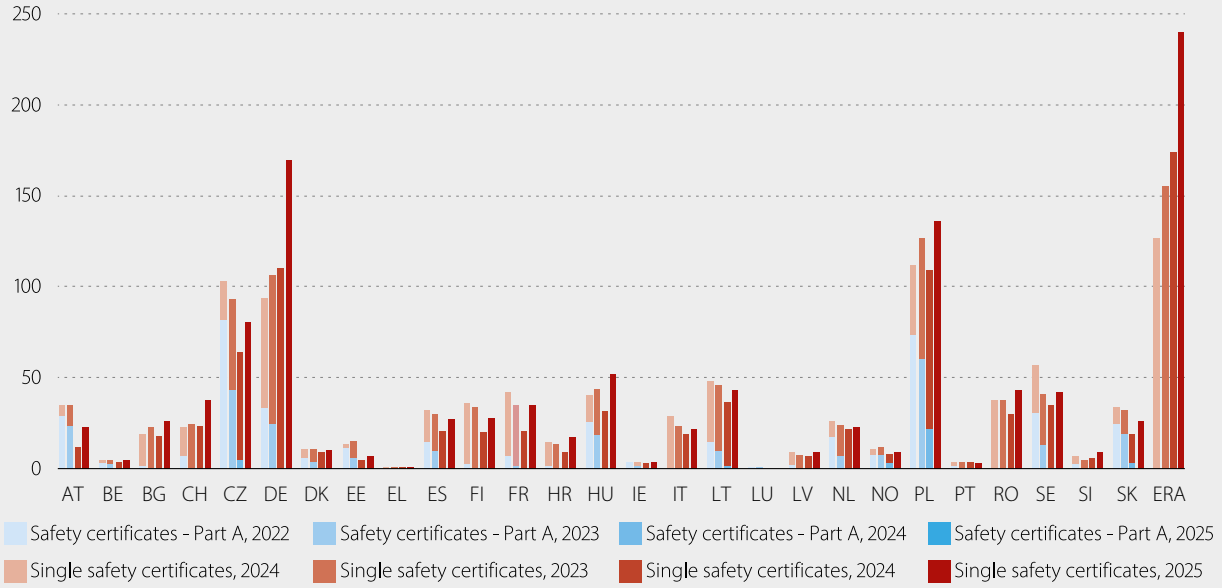
The trend over the last four years confirms the gradual shift from the old certification system (i.e. SCs, Parts A and B) to the new scheme (i.e. SSCs). In all countries, a gradual decrease in the number of valid Part A SCs can be observed, accompanied by a steady increase in SSCs.

The figures (for the EU-27 + CH + NO) at the end of 2025 show only two Part A SCs (expiring in mid-February 2026), compared with around 1 127 SSCs, with the vast majority of all certificates linked to freight services.

Sources and limitations

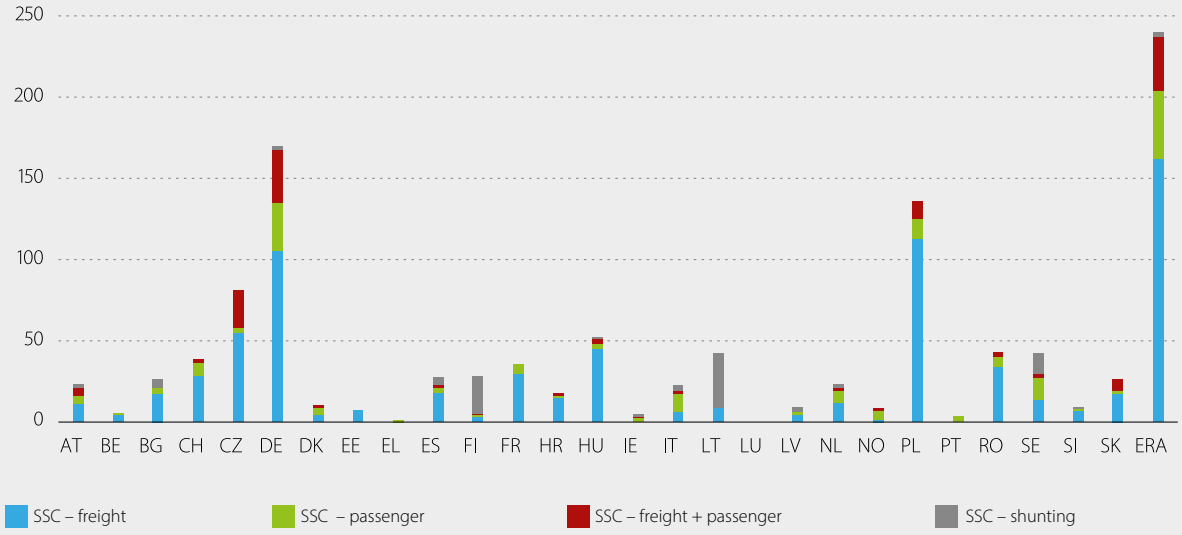
Eradis still contains data on Part A and Part B SCs granted by NSAs and data on SSCs issued by NSAs or ERA. The reliability of these data depends on how up to date and complete the information provided is. As specified in the Eradis terms of use, ERA assumes no responsibility or liability with regard to the data submitted by NSAs and published in the database.

Figure A-39: Number of SCs (Part A) and SSCs valid at the end of 2022, 2023, 2024 and 2025 by issuing country / ERA (EU-27 + CH + NO)



Source: ERADIS (ERA).

Figure A-40: Number of SSCs valid at the end of 2025 by type of service (EU-27 + CH + NO)



Source: ERADIS (ERA).

A-22 Entity in charge of maintenance certificates

Purpose

Commission Implementing Regulation (EU) 2019/779, as amended by Commission Implementing Regulation (EU) 2020/780, sets out detailed provisions on the certification system for the ECMs of vehicles, pursuant to the RSD (Directive (EU) 2016/798) and in line with Annex A to the uniform rules concerning the technical admission of railway material used in international traffic (Appendix G to the Convention Concerning International Carriage by Rail). Data on ECM certificates and maintenance function certificates are reported in Eradis.

Indicators

The indicators proposed are the number of ECM certificates and maintenance function certificates (including maintenance workshop certificates) by the country of the certified entity, and the number of ECM certificates issued for wagons and for vehicles other than freight wagons.

Findings

Eradis reports 949 ECM certificates and 1 211 maintenance function certificates (of which 646 were for maintenance workshops) valid at the end of 2025 (in the EU-27 + CH + NO). There is a significant variation across Member States, with the highest values reported in Germany.

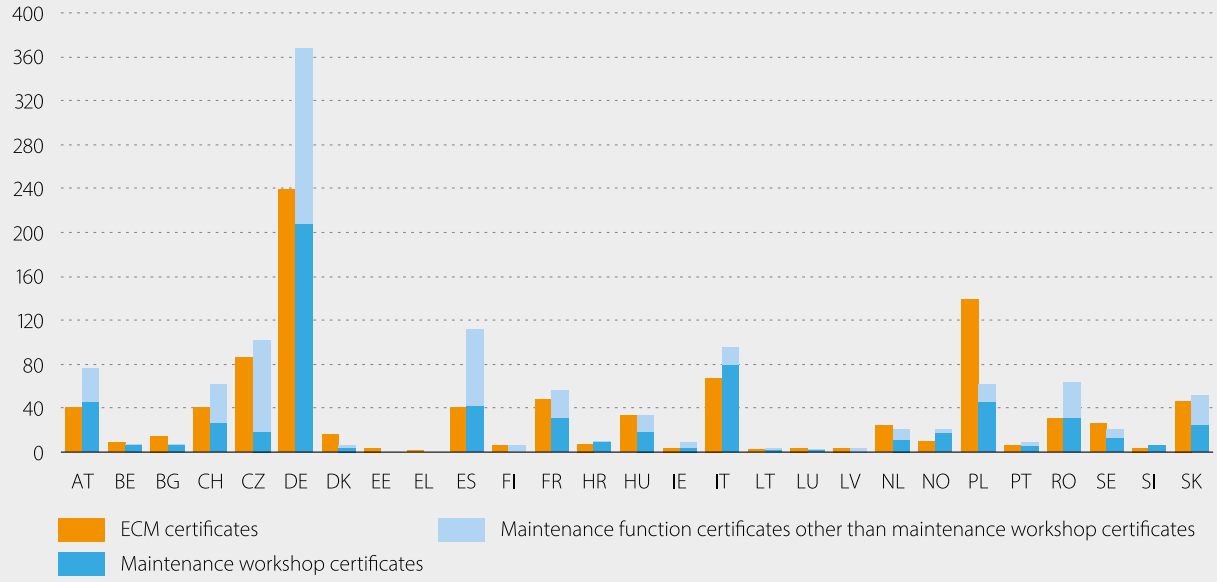
All ECMs for vehicles must comply with Commission Implementing Regulation (EU) 2019/779. At the end of 2025, in Eradis (for the EU-27 + CH + NO), 340 ECM certificates for vehicles other than freight wagons, 91 ECM certificates only for freight wagons and 518 ECM certificates for wagons and other vehicles were reported.

In addition, as of the end of 2025, Eradis reported 15 NSAs acting as certification bodies in their Member States. There were also 18 accredited or recognised certification bodies (in nine countries) able to certify any ECM in the whole territory of the EU.

Sources and limitations

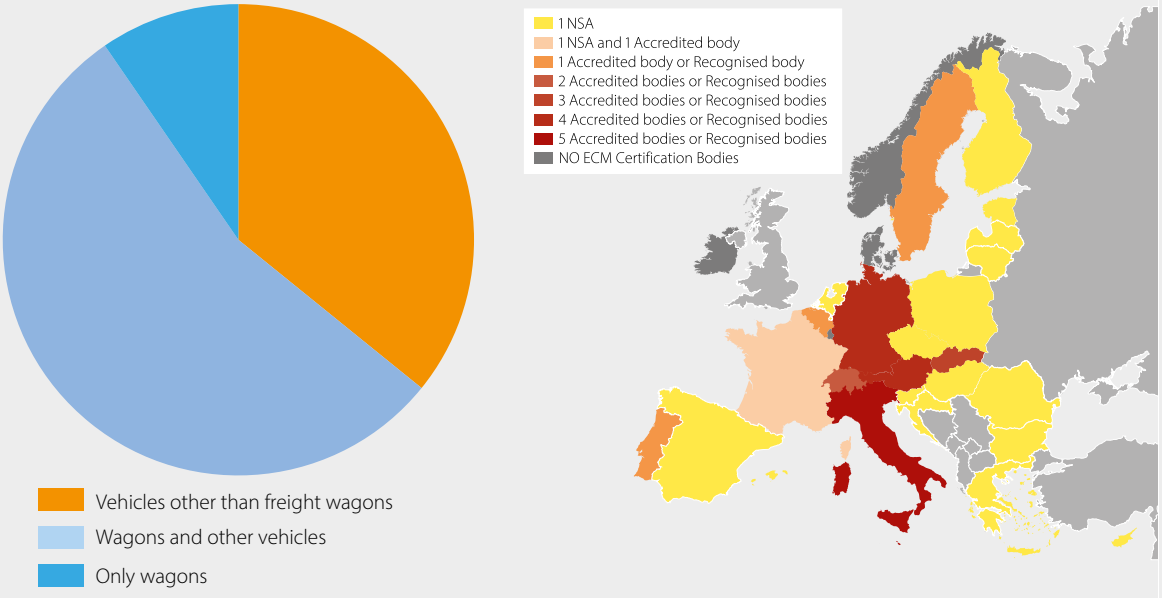
Data on ECM certificates and maintenance function certificates are available in Eradis, and their reliability depends on how up to date and complete the information provided is. As specified in the Eradis terms of use, ERA has no responsibility or liability for the data on ECM certificates and maintenance function certificates submitted by NSAs and published in the database.

Figure A-41: Number of ECM certificates active at the end of 2023 by country of the certified entity (EU-27 + CH + NO)



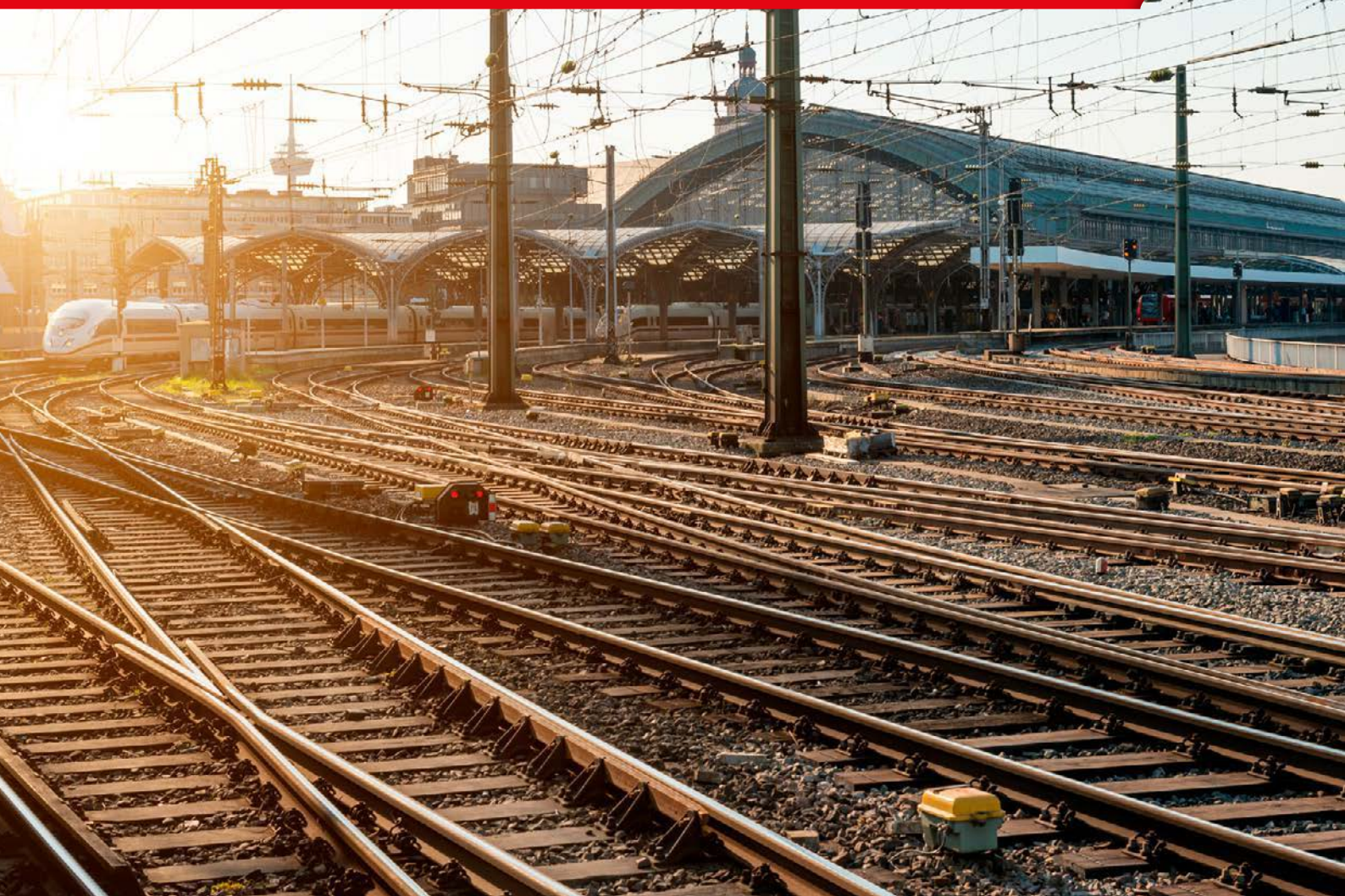
Source: ERADIS.

Figure A-42: Number of ECM certificates for wagons and/or other vehicles valid at the end of 2025 in EU-27 + CH+ NO (left), and number of certification bodies by type and EU countries at end of 2025 (right)



Source: ERADIS.

B. Progress with interoperability



Summary

Although the interoperability of the EU railway system is improving, progress has been slow so far, and it appears to be unequal/uneven across different areas. Solid progress has been achieved in aligning rules and procedures, whereas improvements have been slow in the area of rolling stock and infrastructure, partly because they have long lives. Progress in the widespread adoption of technical standards supporting information availability and data exchange has also been delayed across the EU, often resulting in parallel developments, which in turn reduces the effectiveness of investments and slow system-wide benefits.

Rail passenger transport in the EU-27 has entered a phase of sustained growth after the collapse caused by the pandemic. Passenger-km rose sharply in 2022 and continued to increase in 2023 and 2024, surpassing pre-COVID-19 levels. The modal share of passenger rail has also followed a slightly positive trend. Rail freight, by contrast, shows long-term stagnation: tonne-km have remained close to a stable average since 2006, and the modal share has continued to decline, reaching around 12 % in 2023. International passenger activity remains a small component of total rail passenger volumes, while cross-border freight continues to represent a substantial share of overall freight movements. Taken together, these trends highlight a widening gap between a dynamic passenger segment and a freight sector struggling to expand its market position, with implications for the EU's modal-shift and climate objectives. However, the modal share of rail passenger traffic is still at a relatively low level.

The regular monitoring of rail traffic volumes, transfer time and punctuality at border sections may provide an indication of the development of rail interoperability across Europe year by year. In this report, for the third time, indicators are presented based on data provided by RNE, drawing on information from the RNE train information system (TIS). On the majority of the border sections analysed, traffic volumes slightly increased over 2023–2025. Rail traffic is quite significant for some cross-border sections but quite low in other areas. The average real transfer time for freight in 2023–2025 differed from the planned transfer on for most of the border sections analysed, either shorter or longer, showing some difficulty in planning the timetable precisely and in keeping to it. Data for passenger trains show more expected/normal trends, with differences between real and planned transfer times of a few minutes. Entry and exit delays at the selected border sections seem to confirm those trends. On average, transfer times were longer, and punctuality was poorer, for freight trains than for passenger trains. The current dataset does not cover all European border crossing points and therefore the results cannot yet be considered representative of the overall situation in Europe; data coverage is expected to increase over time.

ERTMS deployment is expanding across the EU network, but progress remains uneven and still far from trans-European transport network (TEN-T) targets. By the end of 2025, around 22 000 km of lines were equipped with the ETCS. Switzerland, Belgium and Spain account for the largest equipped networks, together totalling approximately 11 500 km of lines. While several Member States have accelerated roll-out in recent years, overall deployment at the EU level is still slow, with substantial differences in both the scale and the pace of implementation. On the European transport corridors (ETCs), deployment reached 15 % for the ETCS and 57 % for the global system for mobile communications – railway (GSM-R) by late 2024, with considerable differences between corridors, and several Member States where the ETCS is not yet installed. As a result, a much stronger and more coordinated effort will be needed to ensure timely compliance with the key milestones and to unlock the full interoperability, capacity and safety benefits expected from the ERTMS across the European rail system.

This infrastructure picture is mirrored by ERTMS trackside approvals and progress in onboard deployment of the ERTMS. Trackside approvals increased markedly by the end of 2025, with 158 applications submitted and 44 approvals delivered by the Agency, reflecting growing uptake of the new harmonised process. The ETCS remains the dominant component, the GSM-R still accounts for a substantial share and future railway mobile communication system (FRMCS) applications are beginning to emerge. Application vol-

umes vary widely across Member States and do not necessarily reflect the scale of national deployment, but the overall trend confirms a expansion of ERTMS implementation under the fourth railway package.

Based on estimates, ERTMS on-board deployment continues to grow, with a sharp rise in contracted vehicles – projected to reach around 17 600 in the EU (24 000 for the EU-27 + CH + NO) by the end of 2024. Only about a quarter of tractive vehicles in operation are currently equipped, and significant acceleration is still required to meet the 2030 core network targets.

The implementation of the telematics specifications for interoperability shows a mixed but gradually improving picture across the European rail system. For the telematics applications for passenger services (TAP) technical specification for interoperability (TSI), by 2023–2024 most functions had been deployed – at varying maturity levels – by IMs covering more than 80 % of the EU network, while progress among RUs remains uneven. Only a limited number of functions reach high implementation levels among operators representing over half of the passenger market, with a clear gap between incumbent RUs, where deployment is more advanced, and new entrants, where progress is still limited. For the telematics applications for freight services (TAF) TSI, implementation followed a more consistent upward trajectory over 2019–2024, with a marked acceleration in the latest reporting cycle. Most functions now reach medium to high maturity, and, although differences between IMs and RUs persist, they have narrowed over time, indicating a gradual convergence in deployment patterns. Overall, while TAF implementation shows steady consolidation, TAP progress is beginning to accelerate, although it is still fragmented, underscoring the need for continued coordinated efforts to achieve full telematics interoperability across the sector. In the coming years, further acceleration is expected as a result of the newly adopted Telematics TSI ([29]), which introduces updated requirements, a new implementation-reporting procedure and content, compliance assessment and a strengthened framework aimed at supporting more consistent and comprehensive deployment across all actors. The new Telematics TSI also merges TAP and TAF into a single legal act.

Requests for non-application of TSIs remain at a persistently high number. Since 2022, requests concerning the fixed-installation TSI have increased year on year up to 2025. Control command and signalling (CCS)-related non-application requests have been consistently high, while infrastructure (INF) (and to a lesser extent energy (ENE) and people with reduced mobility (PRM)) TSI requests rose sharply in 2024–2025. By contrast, rolling-stock non-application requests have declined gradually.

Meanwhile, the total number of national rules for vehicle authorisation (in addition to the latest TSIs in force) has decreased significantly since 2016, with some differences among countries. Although there has been an impressive decrease in the number of published rules in the past eight years, this trend has flattened since the end of 2019.

The EU train driver licensing scheme is fully implemented: nearly 209 000 train drivers held valid EU licences across the EU-27, Norway and Switzerland at the end of 2024, reflecting both the maturity of the scheme and the differing sizes of national railway sectors.

Safety certification has also consolidated: the shift from Part A/B certificates to SSCs is well advanced. By the end of 2025, only two Part A certificates remained in force (expiring in early 2026), compared with around 1 127 SSCs, most of which relate to freight operations. ERA has issued more SSCs in the past five years than any individual NSA, and by the end of 2025 it managed 24 % of all valid SCs – a share expected to rise slightly once the last Part B certificates are fully replaced. Around 22 % of all valid certificates concerned international operators, and approximately 64 % of these were SSCs issued by ERA, reflecting the central role of the agency in cross-border operations. Domestic services continue to represent the majority of railway activity in the EU, with most companies already migrated to SSCs. International freight operators remain more numerous than international passenger operators, partly because passenger RUs often rely on partnership arrangements that allow them to operate under a partner's certificate without applying for an SSC directly.

Vehicle authorisations handled by ERA rose in 2025 (with around 2 000 applications; and nearly 21 000 vehicles authorised), with most authorisations for wagons and for multi-country areas of use (AoUs), reflecting both the increasing maturity of the Fourth Railway Package framework and the predominantly cross-border nature of vehicle authorisation requests.

The average AoU of newly manufactured traction vehicles is expanding (especially for electric locomotives and HS train sets) and increasingly authorised for operation in multiple countries, reflecting TSI-driven interoperability, the reduction in national technical barriers and increasing market demand for cross-border operations across the EU.

At the same time, ERA processed about 60 % of conformity to type (CTT) requests in the EU and has reduced delivery time on average to 2.5 working days, well below the 5-day target, demonstrating improved administrative efficiency even under higher workloads.

([29]) Commission Implementing Regulation (EU) 2026/253 of 6 February 2026 on a technical specification relating to the telematics subsystem of the rail system in the European Union for interoperability of data sharing in rail transport (TEL TSI) and repealing Regulations (EU) No 454/2011 (TAP TSI) and (EU) No 1305/2014 (TAF TSI) (OJ L, 2026/253, 10.2.2026, ELI: http://data.europa.eu/eli/reg_impl/2026/253/oj).

Part B: Progress with interoperability

Indicator	Figure	Indicator/Figure(s)	Category	Area
B-1		**Rail transport figures**	Final outcomes	Rail transport figures
	B-1	Rail transport figures (passengers, EU-27, 2026-2024)		
	B-2	Rail transport figures (freight, EU-27, 2026-2024)		
B-2		**Number of international passenger/freight trains at selected border stations**	Outcomes	Cross-border train services
	B-3	Border crossing points included in the analysed dataset (location and border ID)		
	B-4	Number of (freight and passenger) trains crossing the selected border sections (2023-2025)		
B-3		**Transfer time of international trains at selected border sections**		Seamless cross-border train operations
	B-5	Planned and real transfer times at selected border sections (international freight trains, 2023-2025)		
	B-6	Difference between real and planned transfer times at selected border sections (international freight trains, 2023–2025)		
	B-7	Planned and real transfer times at selected border sections (international passenger trains, 2023-2025)		
B-4		**Punctuality of international trains at selected border crossing points**		Punctuality of international train services
	B-8	Entry and exit delay at selected border sections (international freight trains, 2023-2025)		
	B-9	Difference between exit and entry delay at selected border sections (international freight trains, 2023–2025)		
	B-10	Entry and exit punctuality at selected border sections (international passenger trains, 2023-2025)		
B-5		**Implementation of TSI concerning telematics applications for passenger services**	Outputs	Operating procedures
	B-11	Degree of implementation of TAP functions (% of the European market share , 2019-2024)		
B-6		**Implementation of TSI concerning telematics applications for freghit services**		
	B-12	Degree of implementation of TAF functions (% of European market share, 2019-2024)		
B-7		**Train drivers with a European Union licence**		Humans
	B-13	Number of valid train driver licences per country (EU-27 + NO + CH, end 2024)		
B-8		**Railway stations accessible to Persons with Reduced Mobility**		
	B-14	Railway stations per type of PRM accessibility (19 MSs, end of 2024)		
	B-15	Railway stations accessible to PRMs by Member State (18 MSs, end of 2024)		
B-9		**Request for non-application of fixed installation-related technical specifications for interoperability**		Fixed installations
	B-16	Non-applications of fixed installation-related TSIs (EU-27 + NO, end of 2025)		
	B-17	Non-applications of fixed installation-related TSIs per year (EU-27 + NO, 2011–2025)		
B-10		**ERTMS trackside deployment**		
	B-18	Length of railway lines (whole network) equipped with ETCS (EU MSs + CH + NO, end 2025)		
	B-19	Deployment of ERTMS on European Transport Corridors (EU-27, end 2024)		

Indicator	Figure	Indicator/Figure(s)	Category	Area
B-11		**Request for non-application of technical specifications for interoperability related to rolling stock**	Outputs	Rolling stock
	B-20	Non-applications of rolling stock-related TSIs (EU-27 + NO, 2008-2025)		
	B-21	Non-applications of rolling stock-related TSIs per country (EU-27 + NO, end of 2025)		
B-12		**Applicable national technical rules for vehicles**		
	B-22	National rules for vehicle authorisation in addition to the latest TSIs (EU-27 + CH + NO, January 2026)		
	B-23	National Rules for vehicle authorisation (EU-27 + CH + NO, 2016–January 2026)		
B-13		**ERTMS on-board deployment**		
	B-24	Estimates of vehicles in operation equipped with ERTMS OBUs (EU MSs + CH, end of 2024)		
	B-25	Contracted ERTMS vehicles (EU-27 + CH + NO, 2010–2022, 2024)		
B-14		**Safety certificates or single safety certificates for railway undertakings with an international area of operation (Part 1)**		Area of operations in more than one Member State
	B-26	MSs and ERA concerned with Part B SCs and SCCs for RUs operating in one MS (EU-27 + CH + NO, end of 2023, 2024 and 2025)		
	B-27	MSs concerned with Part B SCs and SCCs for RUs operating in more than one MS (EU-27 + CH + NO, end of 2023, 2024 and 2025)		
B-15		**Safety certificates or single safety certificates for railway undertakings with an international area of operation (Part 2)**		
	B-28	SCs and SSCs issued by NSAs and ERA per area of operation (EU-27 + CH + NO, end 2025)		
	B-29	SSCs issued by ERA, per type and area of operation (EU-27 + CH + NO, end of 2023, 2024 and 2025)		
B-16		**Vehicle authorisations handled by the European Union Agency for Railways per area of use and type of vehicle**		Area of use in more than one Member State
	B-30	Number of vehicle authorisations and vehicles authorised by ERA, per area of use (EU-27 + NO, 2021–2025)		
	B-31	Number of vehicle authorisations and vehicles authorised by ERA, per area of use and category of vehicle (EU-27 + NO, 2025)		
B-17		**Area of use of traction vehicles**		Licences
	B-32	Evolution of the average area of use of different categories of traction vehicles (EU-27, 1960-2025)		
B-18		**Licence documents**	Inputs	Enablers
	B-33	Number of valid licence documents active at the end of 2025, by country (EU-27 + CH + NO, end of 2025)		
	B-34	Time to obtain vehicle authorisation		
B-19		**Trends in processed and received Conformity To Types vehicle authorisation (2019–2025)**		
	B-35	ERTMS trackside approvals		
	B-36	Number of ERTMS trackside approval applications, by application scope (EU-27, end of 2025)		
B-20		**Number of ERTMS trackside approval applications, by country (EU-27, end of 2025)**		
	B-37	Average capital expenditure per ETCS level 1-equipped vehicle (EU-27, 2014–2017)		
	B-38	Average capital expenditure per ETCS level 2-equipped vehicle (EU-27, 2014–2017)		
B-21		**Time to obtain vehicle authorisation**		
	B-39	Time frame to obtain a vehicle authorisation in conformity to type (2019–2023)		
B-22		**European Rail Traffic Management System trackside approvals**		

B-1 Rail transport figures

Purpose

Rail transport is increasingly considered a cornerstone of a sustainable European mobility strategy, due to its strategic importance, high level of safety, capacity to move large volumes and comparatively low negative externalities. EU transport policy has set explicit objectives to increase the share of rail in mobility and provides public support to achieve these goals. Continuous monitoring of rail transport developments is therefore essential.

The relative share of passengers and goods moved by rail, compared with other transport modes, reflects rail's competitive position in terms of efficiency and performance. Seamless operation and resilience are inherent strengths of rail transport and are further enhanced by an interoperable railway system that facilitate cross-border and international traffic. For this reason, modal share and the proportion of international traffic are used as indirect measures of the impact of interoperability on overall transport performance.

Indicators

The modal split is calculated on the basis of transport performance, measured in passenger-km and tonne-km, across five transport modes: road, rail, inland waterways, air and maritime. These figures are presented together with absolute rail transport volumes (both domestic and international) to provide background context on underlying trends.

Findings

Rail passenger transport in the EU-27 shows a clear recovery following the sharp decline caused by the COVID-19 pandemic. After the historic drop in 2020 and the continued depression of volumes in 2021, passenger-km increased substantially in 2022 and continued to rise in 2023 and 2024. The 2024 values are the highest in the entire time series, indicating that rail passenger demand has not only rebounded but surpassed pre-pandemic levels. The modal share of rail passenger transport follows the same upward trajectory.

Rail freight transport in the EU-27 has shown limited overall growth since 2006, with t-km fluctuating around a broadly stable long-term average. The modal share of rail freight displays a gradual downward trend over the period, reaching around 12 % in 2023.

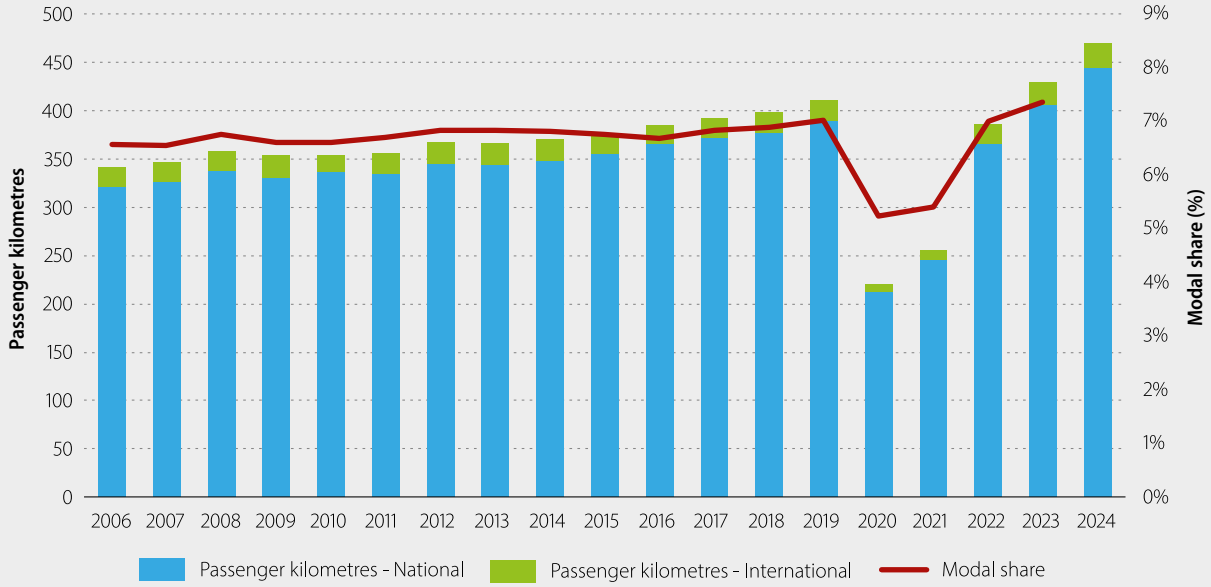
International passenger-km remain a relatively small component of total rail activity, whereas, for freight, international movement represents a significantly larger share of total volumes.

Sources and limitations

Rail traffic data are primarily compiled by Eurostat, based on submissions from national statistical offices. Eurostat applied established methodologies to territorialise transport flows at the Member State level and to avoid double-counting, particularly for road transport. The quality of these administrative data is generally high due to long-standing data collection practices. Modal share figures are sourced from the 2025 Statistical Pocketbook published by the Directorate-General for Mobility and Transport.

Figure B-1: Rail transport figures (passengers, EU-27, 2006–2024)

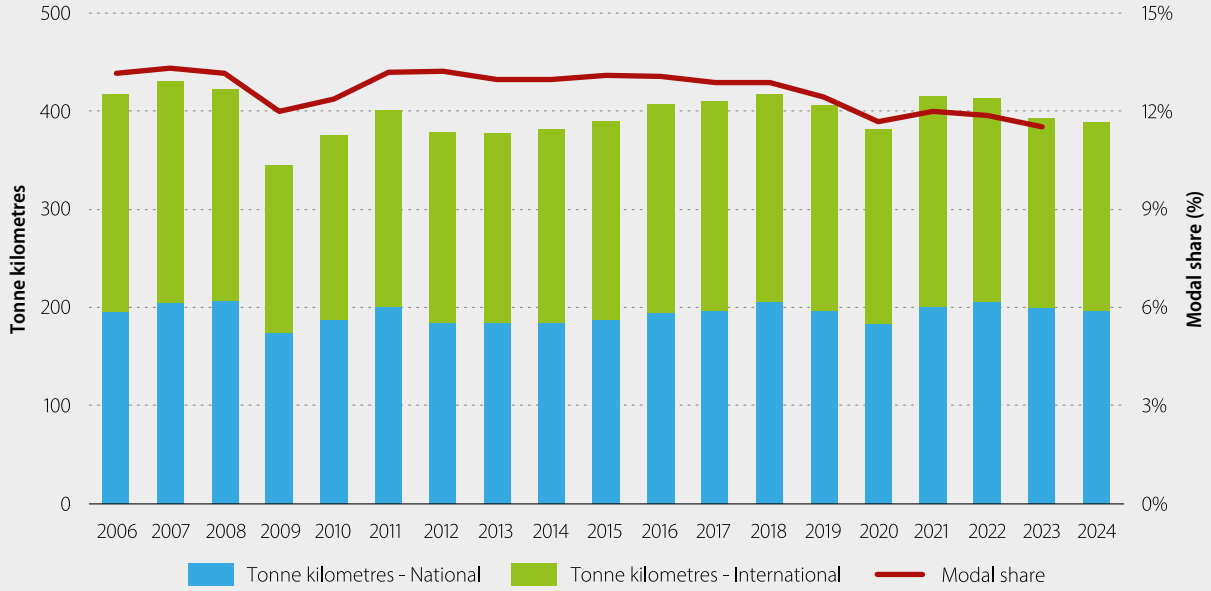
Passenger kilometres (billions) for domestic and international traffic and modal share (%)



Source: Estimations based on Eurostat tables 'rail_pa_total', 'rail_pa_quartal' and 'rail_pa_typepas', 2025 Statistical Pocketbook (Directorate-General for Mobility and Transport).

Figure B-2: Rail transport figures (freight, EU-27, 2006–2024)

Tonne kilometres (billions) for domestic and international traffic and modal share (%)



Sources: Estimations based on Eurostat tables 'rail_go_total', 'rail_go_quartal' and 'rail_go_typepas', 2025 Statistical Pocketbook (Directorate-General for Mobility and Transport).

B-2 Number of international passenger/freight trains at selected border stations

Purpose

As mentioned in the section on transport figures, the volume of international rail traffic across Europe can be considered an indirect measure of the impact of railway interoperability on actual transport performance. Therefore, the purpose of this indicator is to monitor traffic volumes in terms of international passenger/freight trains at selected border stations, as an outcome of the interoperability of the European railway system.

Indicators

The metric used is the number of passenger and freight trains crossing selected sections of borders, collected by RNE automatically from the TIS. The figures refer to the total annual number of trains over 2023–2025. For some borders, only freight data or only passenger data are provided; this does not necessarily mean that the related line is dedicated to one type of traffic (i.e. data for the other type of traffic could be incomplete owing to operational restrictions or data quality problems).

Findings

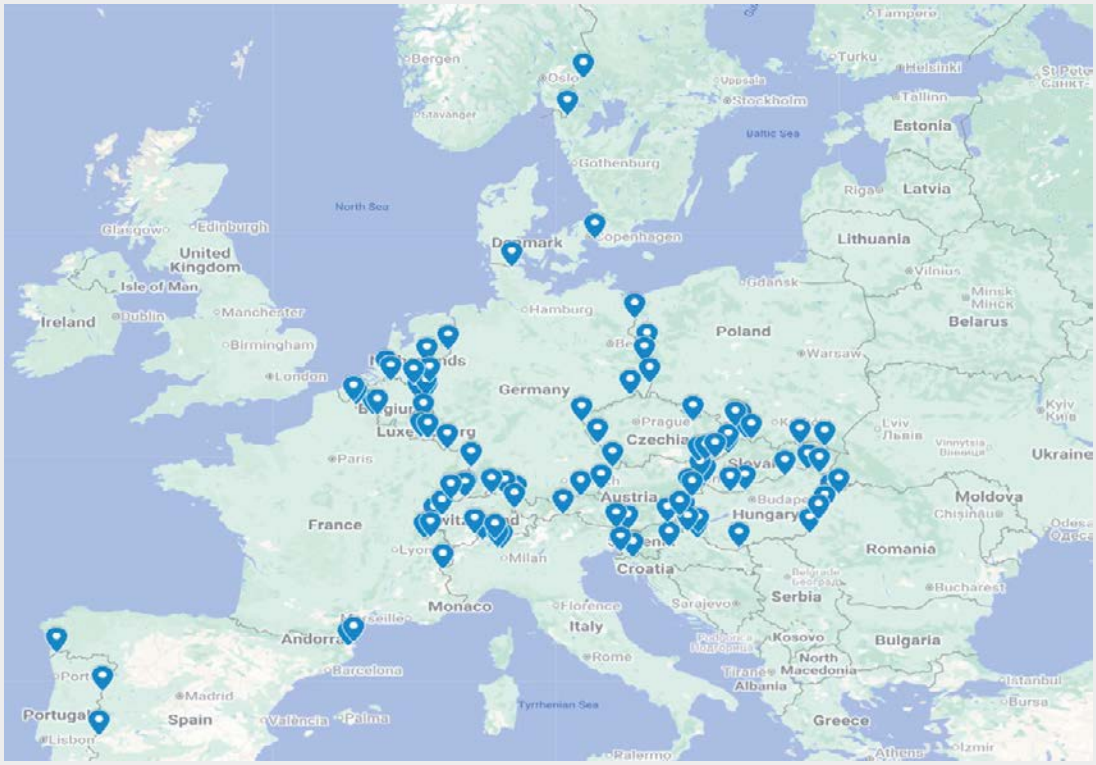
Although an improvement is noticeable compared with the 2024 map, the current one, Figure B-3, still leaves overall geographical coverage of border sections uneven among Member States. Data availability is higher for major central and south-eastern corridors and lower for northern and Baltic Member States. For this reason, the results presented in this section and in the following sections should not be considered representative of the overall picture in Europe.

Traffic across the selected border sections in 2023–2025 varied from less than 1 freight train per day to 56 and from 1 passenger train per day to almost 200. Crossing volumes are significant for some sections but quite limited in other areas. As shown in Figure B-4, the volumes of traffic for the majority of cross-border sections remained relatively stable over the three years, even with significant increases or decreases at some points or in some areas. The total number of freight trains for all the analysed sections increased almost 2 % from 2023 to 2025, while passenger trains increased almost 12 % in the same period (mainly as a result of significant increases at some border crossing points). The variance in traffic volumes across the selected border sections may reflect not only possible limitations to interoperability but also different demand levels, capacity and/or operational planning.

Sources and limitations

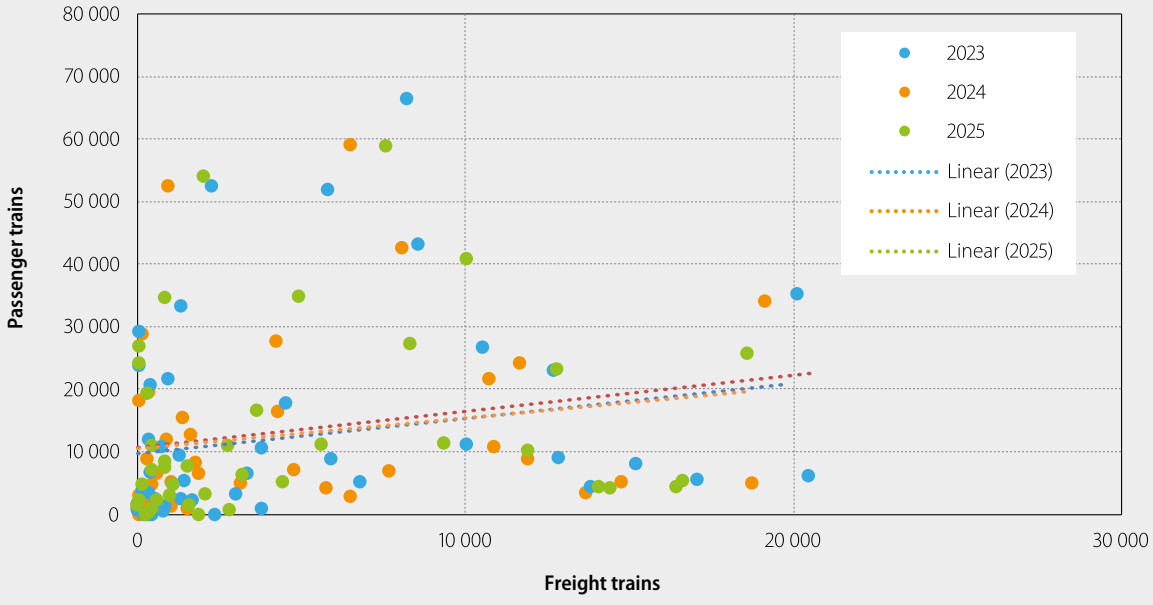
Data are collected by RNE automatically from the TIS. Only a sample of the 105 border crossing points analysed for the SERA network (i.e. around 60 border-crossing points with the best data quality) was used to obtain the figures provided. Detailed reliability checks were carried out by RNE with experts from its member IMs to provide the best sample of data. The number of borders considered is expected to increase in the coming years (thanks partly to ongoing initiatives by RNE to improve data quality). The current dataset does not cover all European border-crossing points, so the results should not be considered a picture of the overall Europe; however, data coverage is expected to increase in the coming years. International trains may have two unlinked train numbers (i.e. an international train may have a different national train number on each IM network section). If the two numbers are unlinked, both are counted in this indicator (i.e. there is potential error due to double counting). In the future, improvements in linking train numbers (e.g. through the full implementation of the Telematics TSI train ID concept and/or based on the train composition message) could lead to a decrease in the number of international passenger/freight trains at selected border stations (such a reduction in traffic volumes may be driven by improved data quality, eliminating double counting, and not by an actual decrease in rail traffic).

Figure B-3: Border crossing points included in the analysed dataset (location and border ID)



Source: RNE TIS (Train Information System).

Figure B-4: Number of (freight and passenger) trains crossing the selected border sections (2023–2025)



Source: RNE TIS (Train Information System).

B-3 Transfer time of international trains at selected border sections

Purpose

Seamless train operation across national borders is one of the main goals of an interoperable railway system. The regular monitoring of transfer time at border sections provides an indication of how rail interoperability across Europe develops year on year. Section transfer time (related to dwell time) is therefore considered a relevant indicator for policy advice. Long transfer times can result from multiple causes, including locomotive and crew changes, operational choices by RUs, lack of immediately available train paths on onward infrastructure, capacity constraints, engineering works, commercial aspects and administrative or technical procedures at borders.

Indicators

The metrics proposed focus on the variance of planned and real transfer times (measured in minutes, including running and dwell times) at selected border sections, calculated based on data from the RNE TIS. The figures presented are calculated as averages weighted by the yearly number of trains at each location. The section transfer time represents a compatible measurement for all borders with a focus on the total time that a train spends in the border section area. The main focus of the analysis is on the difference between planned and real transfer times, to identify the operational obstacles causing transfer times that are longer than planned.

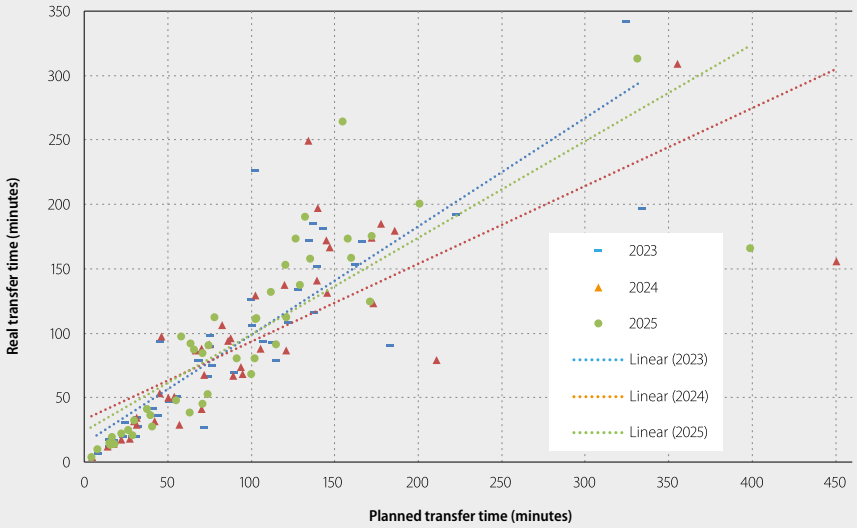
Findings

As shown in Figure B-5, the comparison of planned and actual transfer times at the selected border sections for international freight trains reveals substantial variability; during the period analysed, the average real transfer time of freight border sections in 2023–2025 differed from the planned transfer time, either shorter or longer, showing some difficulty in planning the timetable precisely and in keeping to it. In many border areas the planned transfer time (on average in 2025) was around 90 minutes (and sometimes more than 200 minutes) longer than the real transfer time. Data for passenger trains show more expected/normal trends; the difference between real and planned transfer times (calculated over 2025) is within the range from – 2 to + 6 minutes. For almost the totality of border sections crossed by both freight and passenger trains, the transfer time for freight is (significantly) longer than the transfer time for passengers. Benchmarking the difference in transfer time across the border points should not be the focus of the analysis, as the underlying causes of extended running and dwell times are not directly available, and may not reflect the limitations to interoperability stemming from the physical or regulatory constraints. Anyway, it should be noted that for freight trains the average real transfer time for more than half of the analysed cross-border sections in 2025 was higher than 1 hour, while for passenger trains sections' transfer times vary from 30 minutes to more than 1 hour. The different border sections may have long/short transfer times depending on the sections' length, type of traffic, geography and infrastructure design, among other things, such as possible necessary changes of technical systems.

Sources and limitations

Data are provided by the RNE TIS. The border sections vary in length from 10 to 30 km, covering both sides of the geographical border and all major points where procedures related to border crossing normally occur. Only a sample of the 105 border crossing points analysed for the SERA network (i.e. around 50 border crossings with the best data quality) was used to obtain the figures provided. Detailed reliability checks were carried out by RNE with experts from its member IMs to provide the best sample of data for as many borders as possible. The current dataset does not cover all EU border crossing points and therefore the results should not be considered a picture of the overall EU situation. Data coverage is expected to increase over time. To evaluate the planned and real times, only cross-border trains with the same train number on both sides of the border or trains with linked numbers were considered; given the possible cases of unlinked trains, the actual traffic volumes at the borders may be slightly higher than the volumes considered.

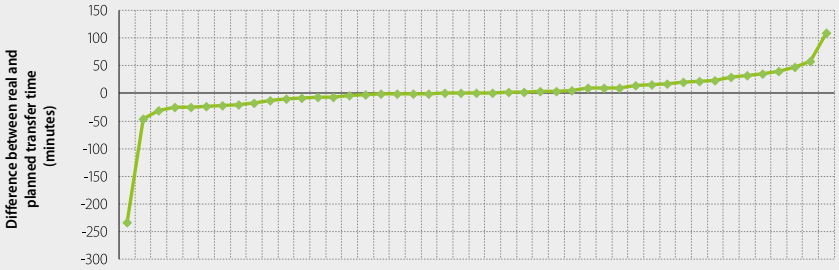
Figure B-5: Planned and real transfer times at selected border sections (international freight trains, 2023–2025)



Notes: For some borders the incorrect or missing data may influence the figures; only a limited sample of trains (compared to all trains crossing the border) was considered for calculations.

Source: RNE TIS (Train Information System).

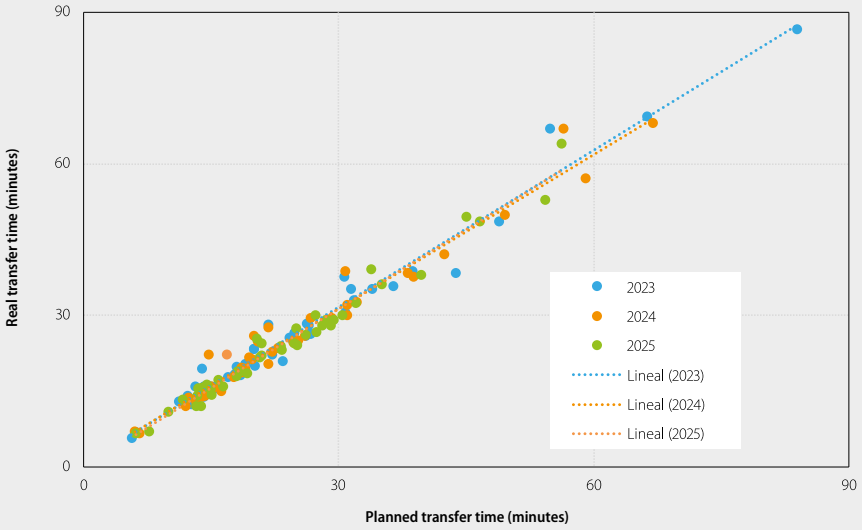
Figure B-6: Difference between real and planned transfer times at selected border sections (international freight trains, 2023–2025)



Notes: For some borders the incorrect or missing data may influence the figures; only a limited sample of trains (compared to all trains crossing the border) was considered for calculations.

Source: RNE TIS (Train Information System).

Figure B-7: Planned and real transfer times at selected border sections (international passenger trains, 2023–2025)



Notes: For some borders the incorrect or missing data may influence the figures; only a limited sample of trains (compared to all trains crossing the border) was considered for calculations.

Source: RNE TIS (Train Information System).

B-4 Punctuality of international trains at selected border crossing points

Purpose

Monitoring cross-border train punctuality provides insight into the operational quality and the constraints affecting international rail services. Comparing entry and exit delays at borders helps identify where delays are accumulated or recovered within the border area and thus informs assessments of cross-border operational performance.

Indicators

The primary metric is the difference between the coded delay on entry and on exit ([30]) at selected border crossings, calculated based on data provided by the RNE TIS. Figures are calculated as averages for 2023–2025 and are weighted by the annual number of trains at each location.

Findings

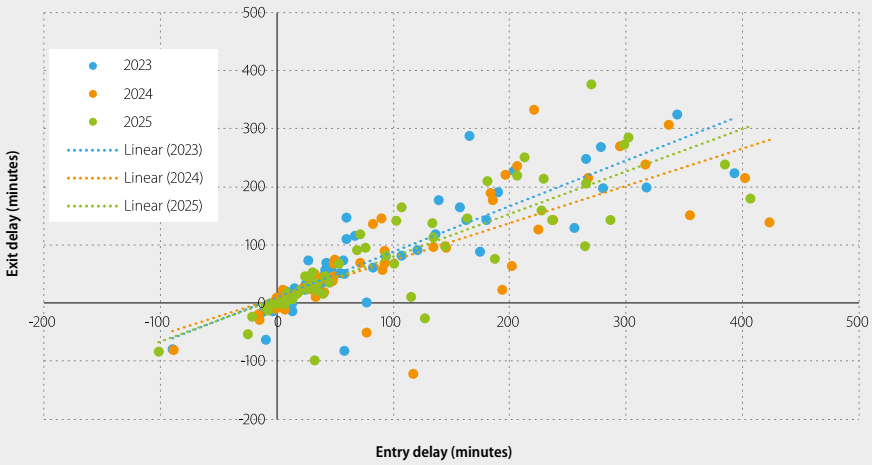
Data for freight seem to confirm that, crossing some border sections, trains may face on average either an additional delay or a recovery of the initial entry delay. The difference between exit delay and entry delay can vary from quite low to quite high values; in various border areas (on average over 2025) a recovery of more than 60 minutes (and sometimes more than 200 minutes) was registered, while in other cross-border sections delays of more than 20 minutes (up to 1 hour) were registered. In more than half of the sections analysed, the average exit delay for freight trains (over 2025) appears to be quite significant (> 90 minutes) and in general longer than the delays for passengers. The differences between exit and entry delays (on average over 2025) for passenger trains are in the range of between – 2 and + 8 minutes, even if there are many border sections with final exit delays of more than 10 minutes.

Sources and limitations

Data are calculated by RNE based on data in the RNE TIS. The border sections vary in length from 10 to 30 km, covering both sides of the border and all major points where procedures related to border crossing normally occur. Only a sample of the 105 border-crossing points analysed for the SERA network (i.e. almost 60 border-crossing points with the best data quality) was used to obtain the figures provided. Detailed reliability checks were carried out by RNE with experts from its member IMs in order to provide the best sample of data for as many borders as possible. The current dataset does not cover all European border-crossing points and therefore the results should not be considered a picture of the overall situation in Europe. The number of borders considered and the data coverage are expected to increase over time (partly thanks to ongoing initiatives by RNE to improve data quality). Because some trains are not linked in the TIS (e.g. international services not detected as border crossing) the dataset may underestimate actual volumes at certain crossings.

([30]) Coded delays are delays for which the TIS has a 'train delay cause message'.

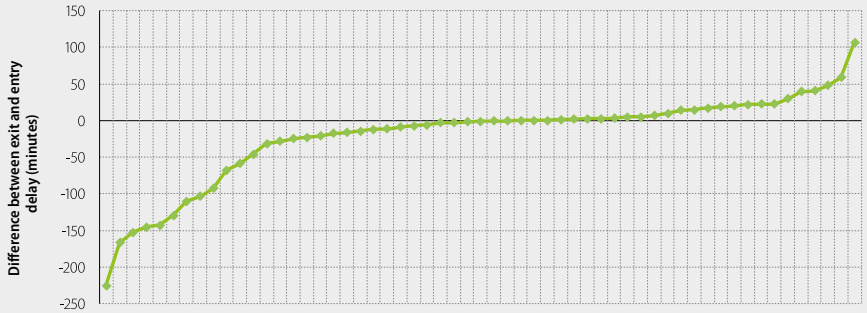
Figure B-8: Entry and exit delays at selected border sections (international freight trains, 2023–2025)



Notes: For some borders the incorrect or missing data may influence the figures; only a limited sample of trains (compared to all trains crossing the border) was considered for calculations.

Source: RNE TIS (Train Information System).

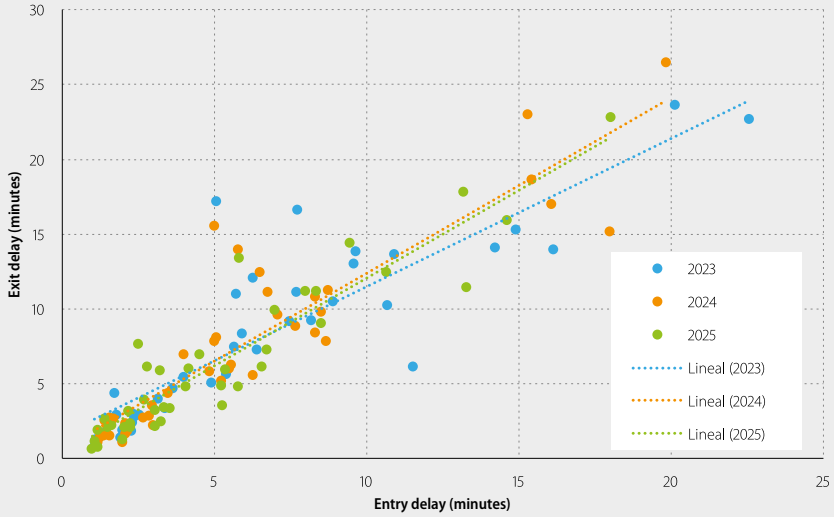
Figure B-9: Difference between exit and entry delay at selected border sections (international freight trains, 2023–2025)



Notes: For some borders the incorrect or missing data may influence the figures; only a limited sample of trains (compared to all trains crossing the border) was considered for calculations.

Source: RNE TIS (Train Information System).

Figure B-10: Entry and exit delays at selected border sections (international passenger trains, 2023–2025)



Notes: For some borders the incorrect or missing data may influence the figures; only a limited sample of trains (compared to all trains crossing the border) was considered for calculations.

Source: RNE TIS (Train Information System).

B-5 Implementation of TSI concerning telematics applications for passenger services

Purpose

The TAP TSI were introduced to allow for the harmonisation/standardisation of procedures, data and messages to be exchanged between the computer systems of multiple railway companies and of independent ticket vendors to provide reliable information to passengers and to issue tickets for journeys across the EU railway network. Furthermore, the data exchange between the RUs and IMs is standardised to make information to passengers on connections, delays, transport of passengers with reduced mobility, disruptions, etc. more accurate, supporting the requirements concerning the passenger information of the Rail Passenger Rights Regulation (Regulation (EU) 2021/782). In the coming years, a further acceleration is expected as a result of the newly adopted Telematics TSI ([31]), which introduces updated requirements, a new implementation-reporting procedure and content, compliance assessment and a strengthened framework aimed at supporting more consistent and comprehensive deployment across all actors.

Indicators

The indicator used to track the progress on the implementation of TAP TSI-specific functions across the railway sector measures the market share of IMs (weighted by line-km at the European level) and RUs (weighted by the estimated passenger-km) that have integrated each TAP function into their IT systems. For every two-year cycle, only the most recent response from each operator is considered. The resulting figure shows both the degree of implementation and the share of the market represented by the respondents, highlighting the remaining knowledge gap. The target for the indicator is to have 100 % of the individual functions implemented (including existing, updated or new IT systems, as this TSI is a functional one), as set out in the TAP TSI master plan.

Findings

The degree of implementation of single functions by operators varies considerably among functions, and it is progressing very slowly. However, it is starting to take off. In 2023–2024, most of the functions (i.e. all except one) had been implemented (to different degrees) by IMs representing around 80 % of the European rail network, and some by IMs representing more than 80 %. The figures for RUs, however, are less positive, with only two functions implemented to a high degree by operators representing more than 50 % of the market share (in terms of passenger-km). Regarding the retail functions for RUs, considering the varying response rate and that not all RUs are required to implement all of them, the majority of the functions show quite a high degree of implementation, but for a few of them (e.g. exchange of special tariffs/fares) the implementation is much lower and the deadlines have passed. Overall, it has to be considered that the implementation of TAP TSI functions is mainly in place for the incumbent RUs, whereas new entrant RUs have achieved less progress so far.

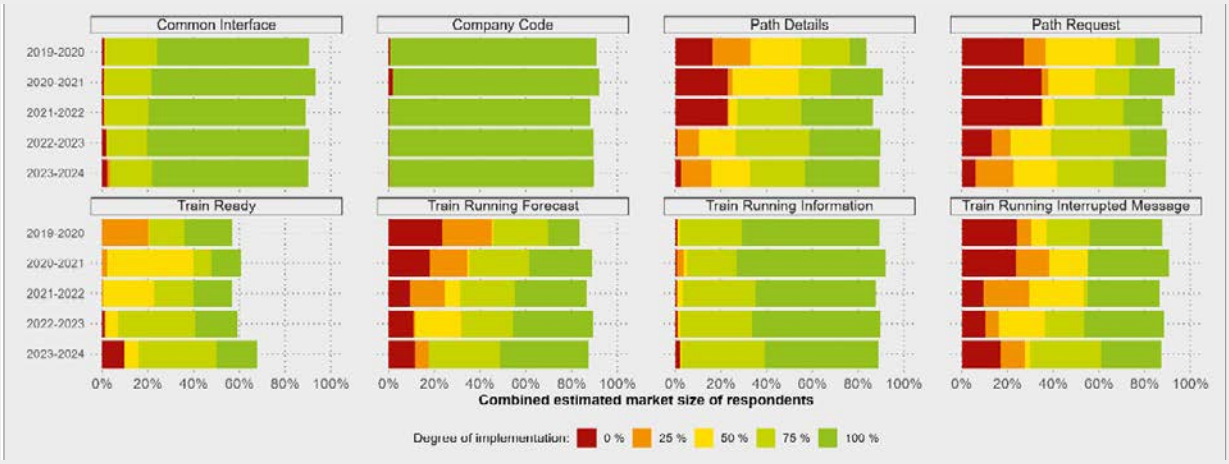
Sources and limitations

A dedicated Implementation Cooperation Group – led by the Agency and involving sector representatives and national contact points – was established to collect data on the TAP TSI implementation. The group developed an annual survey enabling RUs, IMs and ticket vendors to report the implementation level of specific TAP TSI functions. The data provided by RUs and IMs are generally deemed to be reliable. However, as with any survey, the quality of statistical estimates depends on the response rate. When analysing the trends, it is important to note that the set of respondents may vary between reporting periods. For this reason, Figure B-11 covers several reporting years. The estimated market shares are based on market studies, annual reports and desk research.

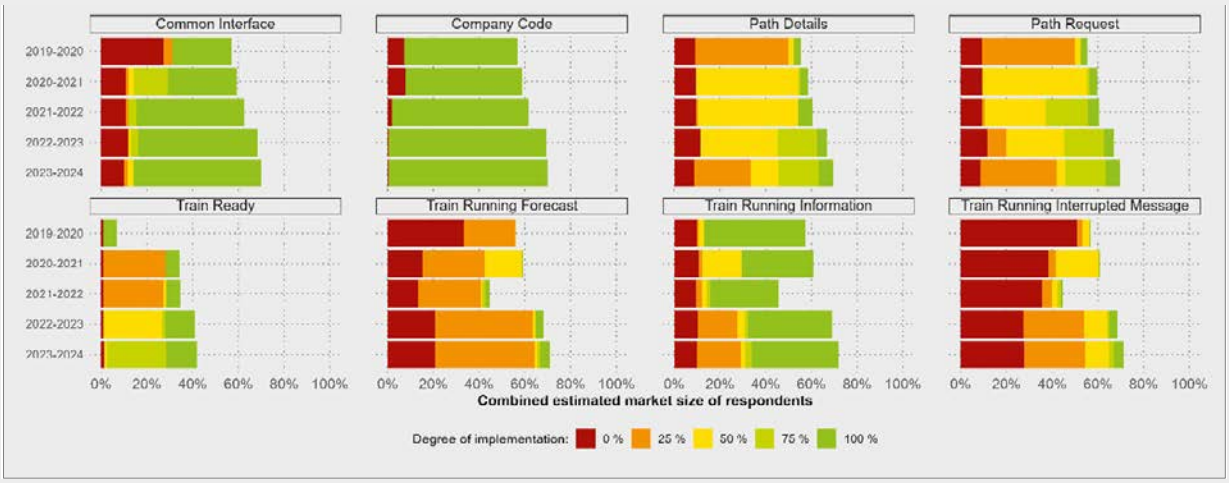
([31]) Commission Implementing Regulation (EU) 2026/253 of 6 February 2026 on a technical specification relating to the telematics subsystem of the rail system in the European Union for interoperability of data sharing in rail transport (TEL TSI) and repealing Regulations (EU) No 454/2011 (TAP TSI) and (EU) No 1305/2014 (TAF TSI) (OJ L, 2026/253, 10.2.2026, ELI: http://data.europa.eu/eli/reg_impl/2026/253/oj).

Figure B-11: Degree of implementation of TAP functions (% of European market share, 2019–2024)

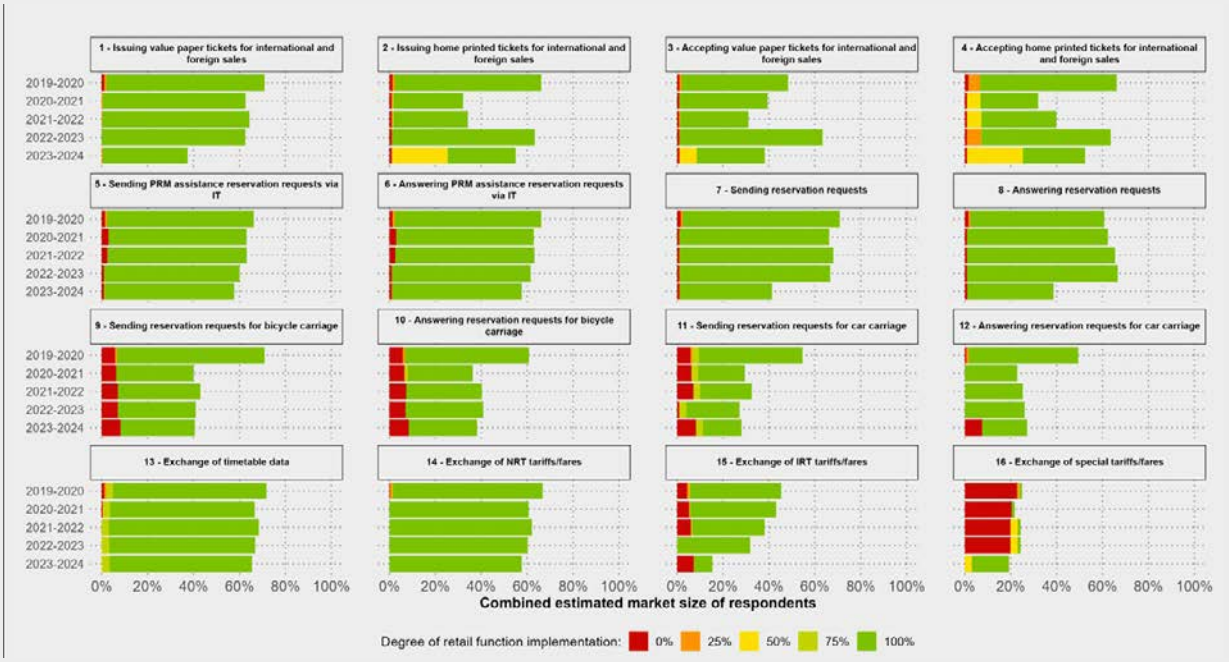
TAP implementation status for IMs



TAP implementation status for RUs



Degree of implementation for the retail functions for RUs



Sources: TAP surveys of RUs and IMs, TAP retail function surveys, SCI Verkehr data and ERA analysis.

B-6 Implementation of TSI concerning telematics applications for freight services

Purpose

The TAF TSI sets the functional and technical standards for exchanging harmonised information between IMs, RUs, terminal operators, wagon keepers and other identifiable stakeholders involved in the freight service.

After years of design and development, implementation by the RUs and IMs has been under way in the EU, with railway operators progressively integrating TAF standards into their IT systems in line with the European TAF master plan. In the coming years, a further acceleration is expected as a result of the newly adopted telematics TSI ([32]), which introduces updated requirements, a new implementation-reporting procedure and content, compliance assessment and a strengthened framework aimed at supporting more consistent and comprehensive deployment across all actors.

Indicators

The indicator used to monitor the progress with the implementation of TAF TSI-specific functions by the railway sector is the market share of IMs (weighted by line-km on a European scale) and RUs (weighted by the estimated t-km on a European scale) that have implemented the TAF functions in their IT systems, weighted by the t-km for RUs and line-km for IMs performed on a European scale. For each two-year period, the more recent response of an operator is used if two responses were given. The figure gives insights into the degree of implementation and the market share that the responses represent, and thus the knowledge gap that remains. The target for the indicator is to have 100 % of the individual functions implemented (including existing, updated or new IT systems, as this TSI is a functional one), as set out in the TAF TSI master plan.

Findings

The implementation of TAF functions shows a steady and progressive improvement during 2019–2024, with a clear acceleration in the most recent reporting cycle. By 2023–2024, most functions reached medium to high levels of implementation, indicating a more mature and consistent uptake across the sector. Differences between IMs and RUs remain, although they have narrowed over time: IMs generally display a more homogeneous and advanced level of implementation, while RUs show greater variability across functions and slower progress in reaching the highest maturity levels, with deadlines that have passed. Overall, the data point to a gradual convergence in implementation patterns and a strengthening of TAF deployment across the European rail freight ecosystem.

Sources and limitations

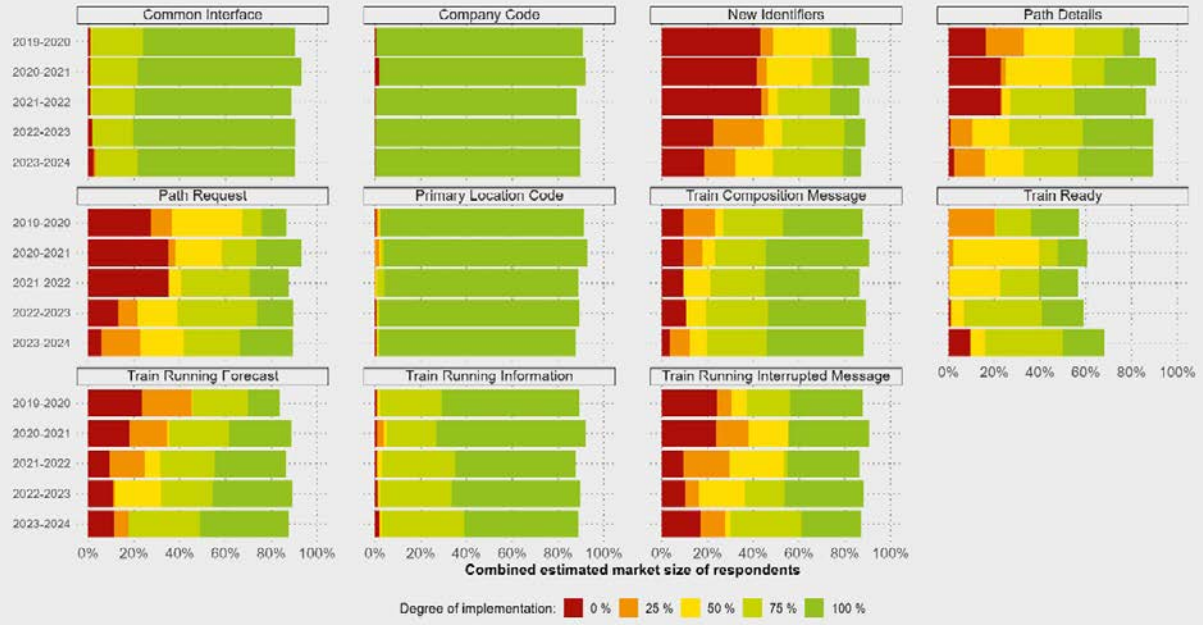
A specific Implementation Cooperation Group, led by the agency, collects annual data on the deployment of TAF TSI functions through a dedicated survey addressed to RUs, IMs and wagon keepers. Although not all organisations respond, the number of respondents increases steadily each year and the sample is highly representative, as it includes the main actors in the European rail freight market. As the respondent population may vary across reporting cycles, Figure B-12 covers multiple years. ERA is now exploring a transition from self-reported implementation levels to reporting based on key performance indicators and derived from TAF/TAP-compliant tools ([33]), to obtain a more accurate view of actual usage and quality.

([32]) Commission Implementing Regulation (EU) 2026/253 of 6 February 2026 on a technical specification relating to the telematics subsystem of the rail system in the European Union for interoperability of data sharing in rail transport (TEL TSI) and repealing Regulations (EU) No 454/2011 (TAP TSI) and (EU) No 1305/2014 (TAF TSI) (OJ L, 2026/253, 10.2.2026, ELI: http://data.europa.eu/eli/reg_impl/2026/253/oj).
([33]) https://www.era.europa.eu/sites/default/files/2025-12/agencys 2024 report era-rep-114-impl-2024 on taf tsi implementation–kpi.pdf.

Figure B-12: Degree of implementation of TAF functions (% of European market share, 2019–2024)

TAF implementation status for IMs

TAF implementation status for RUs



Sources: TAF surveys of RUs , SCI Verkehr data and ERA analysis.

B-7 Train drivers with a European Union licence

Purpose

The EU train driver licence is a means of facilitating cross-border operations and labour mobility. It is obtained and maintained based on the common requirements valid in all Member States for all train drivers involved in train operation covered by the RSD. It was introduced by the Train Drivers Directive (TDD), which envisages its gradual implementation in the Member States. Since October 2018, all train drivers operating trains on the network of the EU have been required to hold a licence, in conformity with the TDD. In addition to the licence, the train driver certification scheme includes a complementary certificate documenting the rolling stock and the infrastructure the driver is authorised to use. This certificate is issued by the RU employing or contracting the driver. It is provided in accordance with the RU's safety management system.

Indicators

The indicator used is the number of valid train driver licences in the EU.

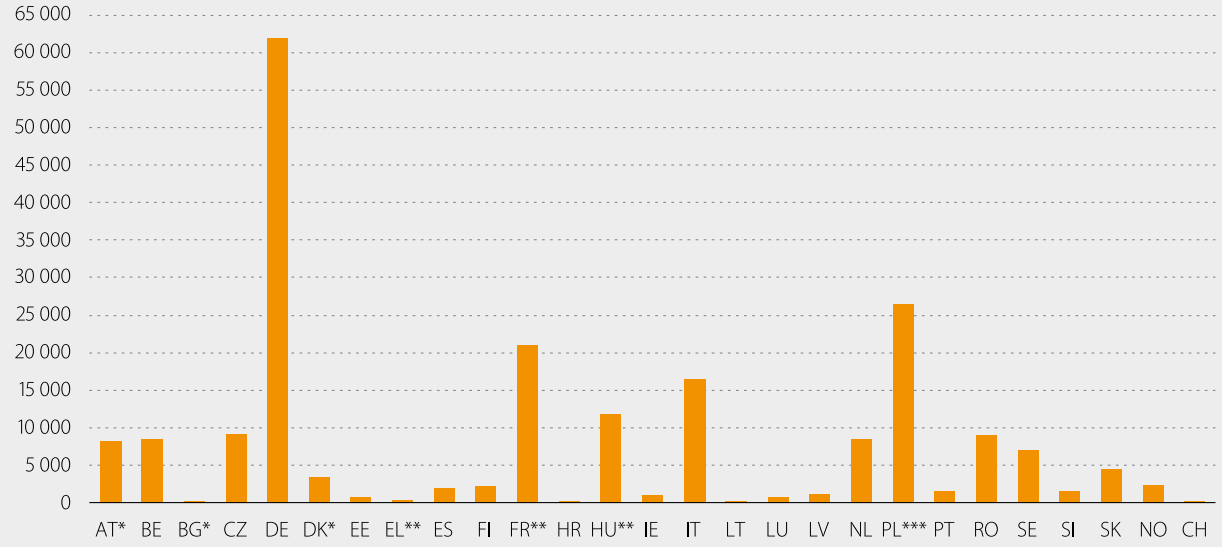
Findings

At the end of 2024, the implementation of the EU certification scheme appeared to be complete in all Member States. According to the data provided by the NSAs, almost 209 000 train drivers held valid EU licences in the EU-27, Norway and Switzerland at the end of 2024. Numbers vary significantly between countries due to difference in the sizes of their railway sectors.

Sources and limitations

The data on the total number of train drivers licensed in accordance with the TDD are provided by the NSAs in each Member State, which act as the licensing authority (data are included in each NSA's annual safety report). Some quality issues may arise, as not all NSAs provide updated figures every year and, in six Member States, only data from previous NSA surveys (2019 or 2021) were available. In addition, for certain countries the reported values fluctuate significantly from one year to another, which may reflect differences in data collection or reporting practices. In some cases, additional checks were carried out with the NSAs to clarify data quality issues, and the figure was updated where possible.

Figure B-13: Train drivers with an EU licence per country (EU-27 + CH + NO, end of 2024)



Note: (*) Data as of end 2021 (from the survey of NSAs in 2022); (**) Data as end of 2019 (no updates available); (***) Data provided by NSA..
Source: Annual Safety Reports (survey) of NSAs 2024.

B-8 Railway stations accessible to Persons with Reduced Mobility

Purpose

There are over 100 million people with disabilities living in the EU ([34]) and an additional 50 million Europeans experienced reduced mobility due to temporary impairments, age or pregnancy ([35]). Many of them refrain from using rail transport because of physical barriers still present in stations and on trains. The PRM TSI requires all Member States to work towards improving the accessibility of their rail systems for people with disabilities and people with reduced mobility. In particular, each Member State is required to develop and seek to implement a national plan outlining how it will progressively remove all identified accessibility barriers across the rail network. The European Commission, in cooperation with the advisory body referred to in Article 9 of the PRM TSI, is currently working to identify common priorities and criteria to further support the implementation of the PRM TSI.

Indicators

Stations may have various degrees of accessibility to PRM. The indicators used to measure the degree of accessibility are the share of stations compliant with the PRM TSI requirements and the share of stations considered accessible under national legislation. Full TSI compliance means full conformity with the PRM TSI requirements, as demonstrated by a notified body (NoBo) certificate. Partial TSI compliance means conformity with some, but not all, PRM TSI requirements, also evidenced by a NoBo certificate. An accessible station, by contrast, is a station deemed accessible according to national legislation, in cases where no NoBo certificate is available.

Findings

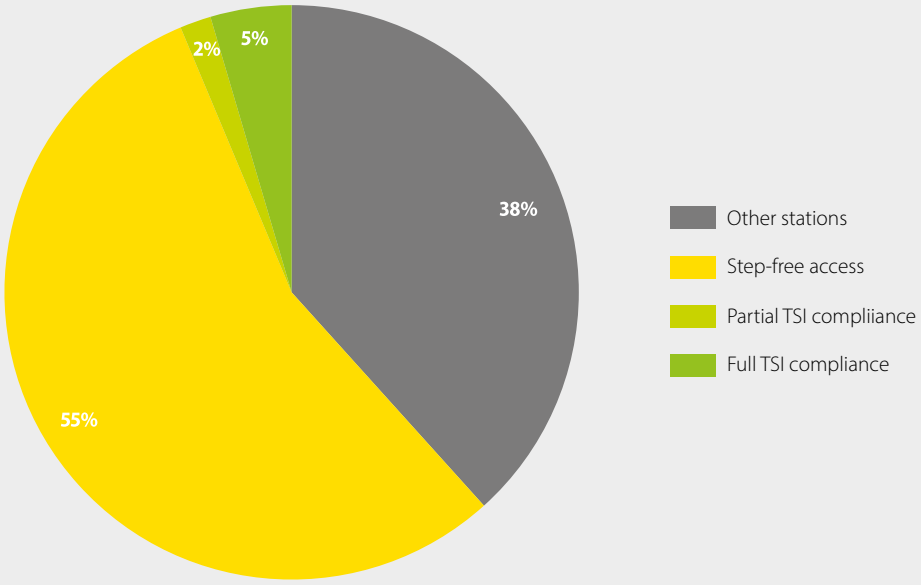
According to the data supplied by the NSAs, by the end of 2024 there were at least 590 stations with full TSI compliance and 227 stations with partial TSI compliance. At the EU level, around 5 % of all reported stations are fully TSI compliant, and around 2 % are estimated to be partially TSI compliant. An additional 55 % of all stations offer step-free access to platforms and are considered accessible under national legislation.

Sources and limitations

Data quality remains a constraint on these estimates. In some cases, inconsistencies persist between different national sources on railway stations, and the classification of stations according to the categories used here is still a relatively new concept that has not yet been fully implemented across all national datasets. Significant differences are observed among Member States, with some of the most advanced progress recorded in smaller countries, often in eastern Europe. The available information highlights the need for continued and closer monitoring of progress towards accessible mobility for all. For this report, reliable data were available only for 19 and 18 Member States for Figures B-14 and B-15, respectively. For some Member States, 2021 data had to be used.

([34]) European Disability Forum.
([35]) Study: Railway costs and benefits data collection (ERA 2017 38 RS) by INECO-Ecorys.

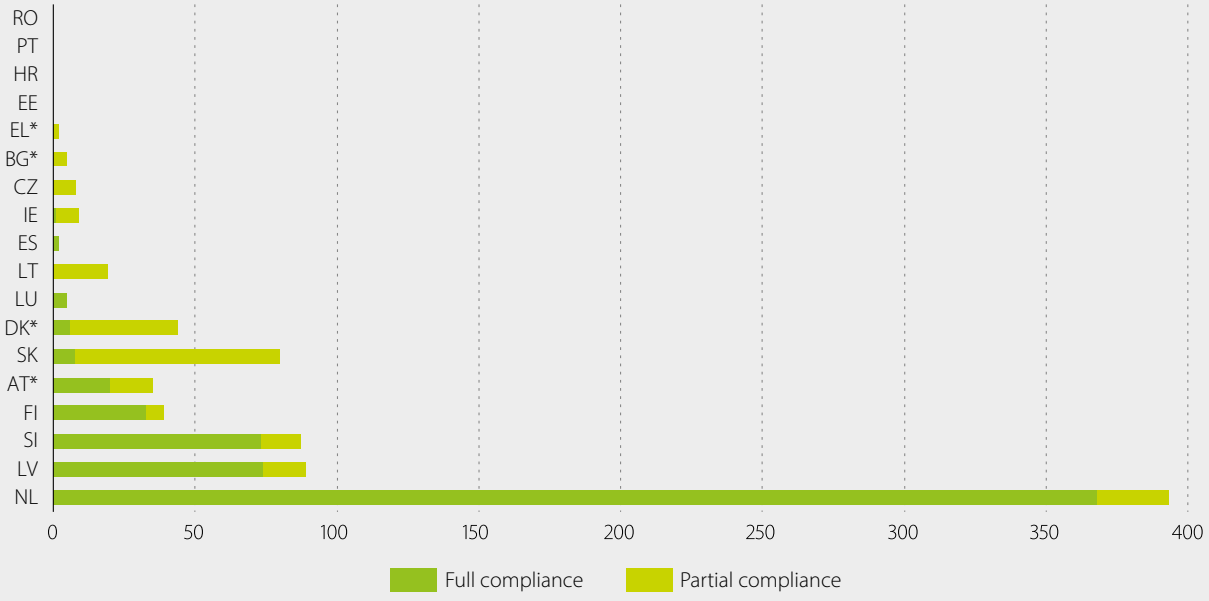
Figure B-14: Railway stations per type of PRM accessibility (19 Member States, end of 2024)



Note: ERA estimates based on data from 19 EU MSs; for 4 MSs, 2021 data were used.
Source: Annual Safety Reports (survey) of NSAs 2024.

Figure B-15: Railway stations accessible to PRMs by Member State (18 Member States, end of 2024)

PRM – TSI-compliant stations



Note: (*) Data as of end 2021 (from NSA Annual Safety Reports 2022).
Source: Annual Safety Reports (survey) of NSAs 2024.

B-9 Requests for non-application of fixed installation-related technical specifications for interoperability

Purpose

Article 7(1) of the Railway Interoperability Directive (Directive (EU) 2016/797) sets out several legal grounds under which the requirements for the TSIs may be waived when a subsystem cannot fully comply with them. This situation often arises for projects that are already at an advanced stage of development when a new TSI enters into force. Since each TSI includes its own transitional provisions – most recently the 2023 amendment of the CCS TSIs – many ongoing projects may continue applying the previous requirements for a defined period without submitting a request for non-application.

Under Article 7(1)(a), Member States may grant a request for non-application. Other grounds require a positive assessment by the Commission (e.g. Article 7(1)(e) concerning isolated networks) or formal endorsement by the Railway Interoperability and Safety Committee (e.g. Article 7(1)(c) concerning economic viability).

Non-applications related to fixed installations may constitute technical barriers to interoperability. As a general principle, a lower number of non-application requests should correspond to a higher level of interoperability across the EU railway system. At the same time, the procedure established in Article 7 aims to strike a balance: it allows exceptional and duly justified non-applications to ensure the feasibility of the projects, while safeguarding the highest possible degree of interoperability at the system level.

Indicators

The indicator here is the number of non-application requests submitted by Member States under the current Railway Interoperability Directive concerning fixed-installation TSIs. Specifically, it includes all cases concerning the INF and ENE TSIs, and those concerning fixed installations in the safety in railway tunnels (SRT), PRM and CCS TSIs. These requests concern general infrastructure projects and may apply either to a single railway line or to a wider network area, depending on the geographical scope defined by the Member State.

Findings

Requests for non-application of fixed-installation-related TSIs concern predominantly the CCS TSIs, while requests for the non-application of the INF, ENE and PRM TSIs have spiked in the past two years. From July 2020 onwards, all non-application requests have been submitted under the current Railway Interoperability Directive (Directive (EU) 2016/797).

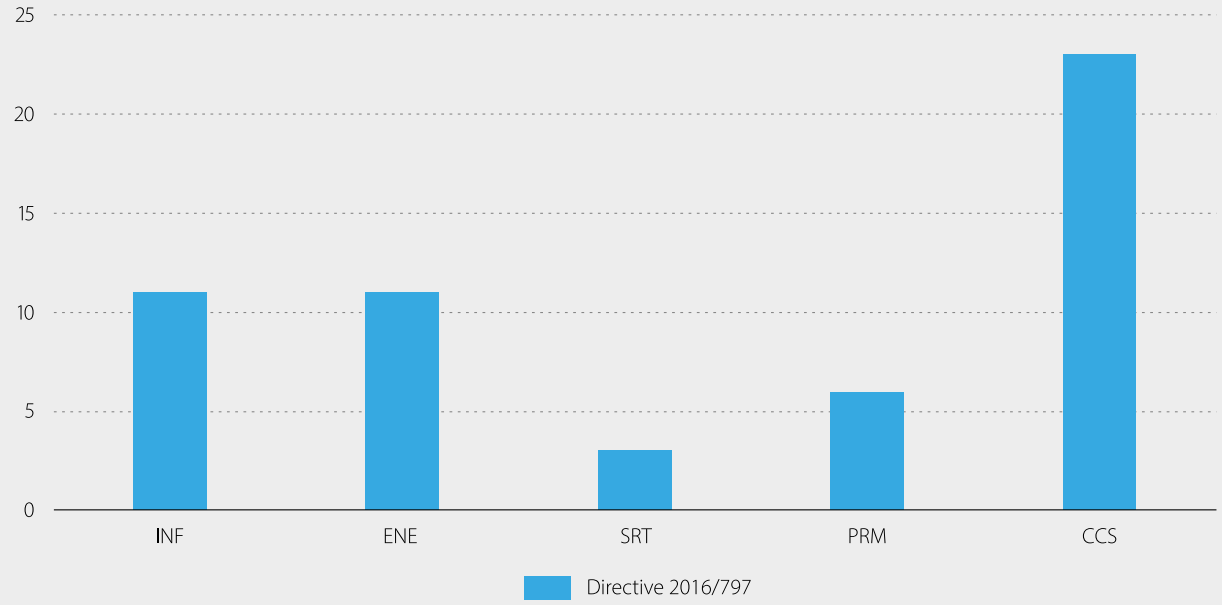
On average, 13 non-application requests have been received each year since 2008. The number of requests rose sharply in 2017 and then declined steadily until 2021. From 2022 onwards, however, the trend reversed, with a continuous year-on-year increase. By 2025, the number of requests had doubled compared with 2017.

Sources and limitations

While an analysis by Member State is not shown in this report, the data show that non-application requests are submitted by many Member States. Interestingly, in a few cases, requests for non-application have been made for some countries but not others, in relation to the same project, although the Railway Interoperability Directive (Article 7) requires applications to be made by each Member State individually. A limited number of individual cases submitted by the Member States in one year are counted in the following year. The data are directly retrieved from an internal database of the European Commission (Directorate-General for Mobility and Transport), where all submitted non-applications requests are recorded. Their quality is considered satisfactory for the given purpose. A significant number of cases in both 2024 and 2025 were either withdrawn by the Member State or found to be not necessary. Of these, 11 cases in 2024 and 6 in 2025 concerned fixed installations..

Figure B-16: Non-application of fixed installation-related TSIs (EU-27 + NO, end of 2025)

TSI INF, ENE, SRT, PRM, CCS

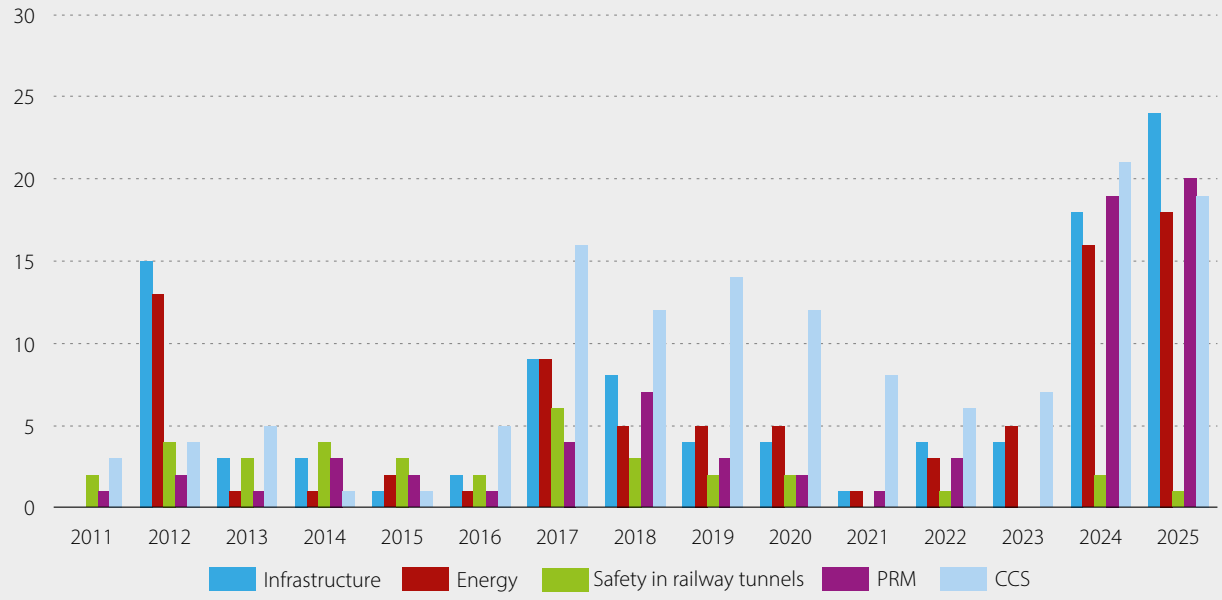


Note: From July 2020 all non-applications are based on Directive 2016/797; Data for UK until 2021.

Source: Directorate-General for Mobility and Transport internal database.

Figure B-17: Non-application of fixed installation-related TSIs per year (EU-27 + NO, 2011–2025)

TSI infrastructure, energy, safety in railway tunnels, PRM and CCS



Note: Data for UK until 2021.

Source: Directorate-General for Mobility and Transport internal database.

B-10 ERTMS trackside deployment

The ERTMS is intended to replace legacy class B signalling systems and is designed to replace the many incompatible safety systems currently used by European railways. It will allow an interoperable railway network in Europe, while providing additional benefits in terms of increased operational efficiency, capacity and safety. While the core/comprehensive networks ([36]) in the EU are to be equipped with the ERTMS, emphasis has been put on nine ETCs as a priority. The long-term target adopted by the European Commission is to have the whole core TEN-T network equipped with the ERTMS by 2030, the extended core network by 2040 and the whole comprehensive network by 2050.

Indicators

The indicators used are the length of lines of the whole EU network equipped with the ERTMS (per Member State and per level) and the share of lines equipped with the ETCS and the GSM-R on the ETCs.

Findings

While the previous section of this report presented the percentages of national networks equipped with the ETCS (Figure A-36), Figure B-18 reports the total length of ETCS-equipped railways lines by country with reference to the entire national network reaching the aggregated length of about 22 000 km at end of 2025. Of these, about 12 400 km are part of the TEN-T network (EU-27), based on the latest available data as of the end of 2024 ([37]).

According to RINF records, Switzerland, Belgium and Spain show the longest lengths of their networks equipped with the ETCS. For Member States listed with zero values, the ETCS has either not yet been deployed or not yet been put into operation.

By the end of 2024, ERTMS deployment on the ETC network (EU-27) had reached 15 % for the ETCS and 57 % for the GSM-R. Progress remains uneven across corridors. For the ETCS, the Mediterranean and North Sea–Rhine–Mediterranean corridors show the highest shares (around 23 % and 19 %, respectively), compared with 6–11 % elsewhere.

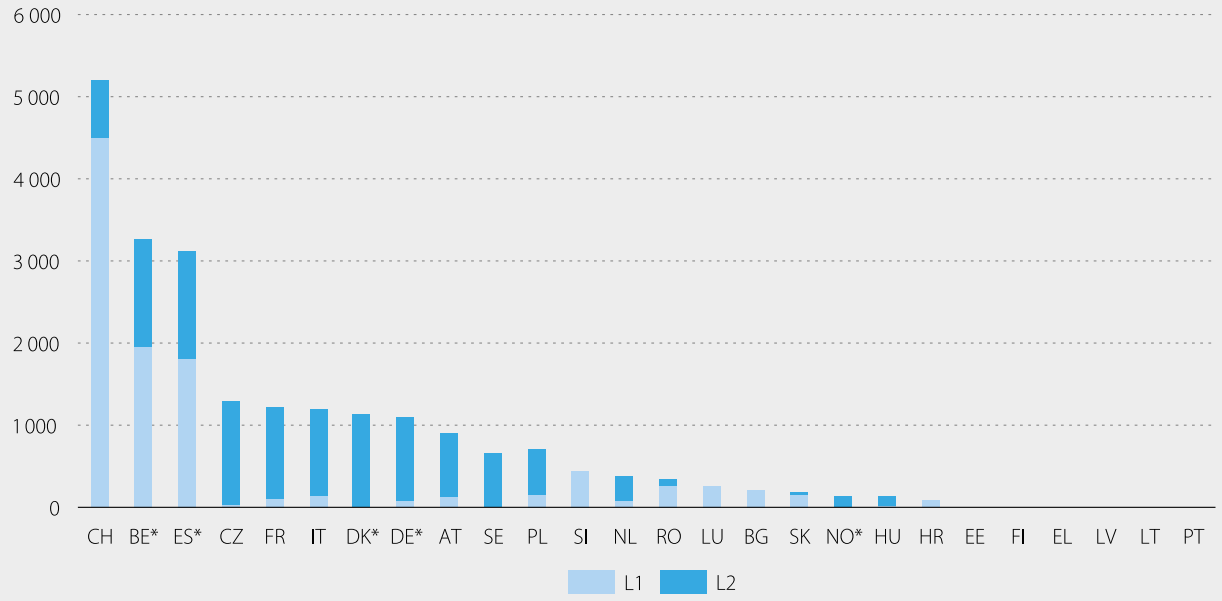
Sources and limitations

The underlying data relating to the entire national rail networks are reported by IMs to the RINF, maintained by ERA, while data relating to the ETCs are provided by the ERTMS Deployment Management Team contracted by European Commission to coordinate and support the TEN-T policy database under the European deployment plan ([38]). The quality of the available ETCs data is deemed satisfactory. In the case of the RINF, data reliability depends on the extent to which the information provided is up to date and complete; as specified in the terms of use, ERA has no responsibility or liability with regard to the information submitted and published in the RINF. Double counting for some Member States is possible when the same track is equipped with ETCS levels 1 and 2. This should also be considered in light of the recent RINF Regulation revision and the fact that, for a few Member States (only 25 %), a data quality assessment was necessary. Following a data quality review, the figure was updated wherever additional or revised information was made available.

([36]) The revised TEN-T Regulation (Regulation (EU) 2024/1679) introduces an additional intermediary layer, the 'extended core network', which must be equipped with the ERTMS by 2040. It also restructures and expands the former core network corridors into nine ETCs, strengthening connections with neighbouring non-EU countries by integrating Moldova, Ukraine and the six Western Balkan partners.
([37]) https://transport.ec.europa.eu/news-events/news/third-ertms-work-plan-ertms-deployment-progressing-more-must-be-done-2026-02-23_en.
([38]) Commission Implementing Regulation (EU) 2017/6 of 5 January 2017 on the European rail traffic management system European deployment plan.

Figure B-18: Length of railway lines (whole network) equipped with the ETCS (EU MS + CH + NO, end of 2025)

Length in kilometers per ETCS level

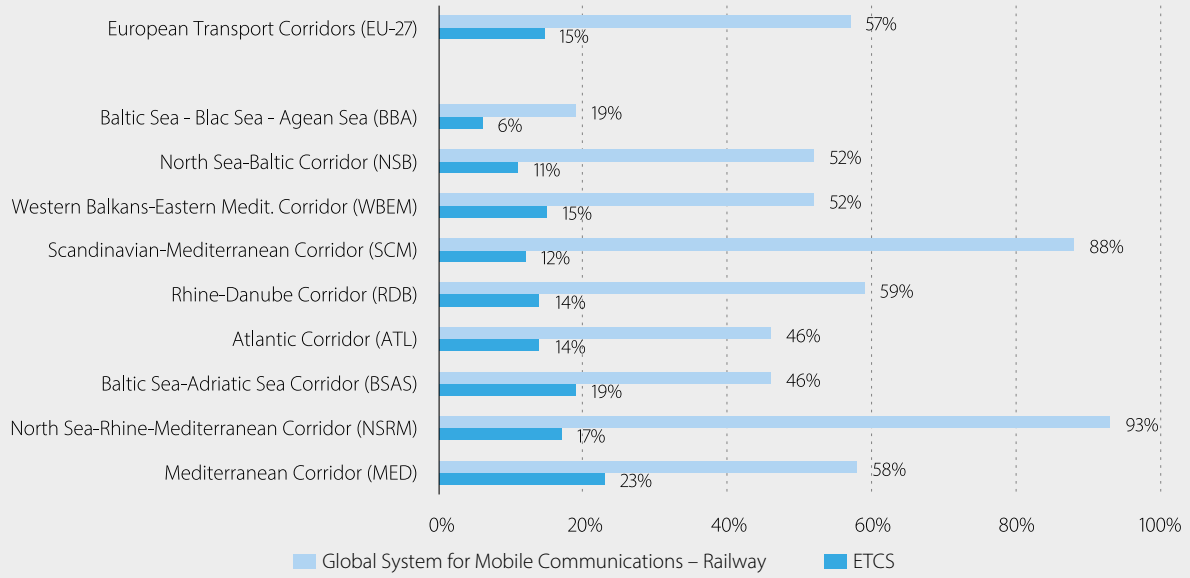


Note: * - Value/info received from IM.

Source: Register of Infrastructure (RINF), data extracted on 6 January 2026.

Figure B-19: Deployment of the ERTMS on European Transport Corridors (EU-27, end of 2024)

ETCS and GSM-R equipped lines among ETCs



Source: DMT / TENtec (Directorate-General for Mobility and Transport).

B-11 Requests for non-application of technical specifications for interoperability related to rolling stock

Purpose

Requests for non-applications of current TSIs for vehicles may indicate technical barriers that hinder progress towards an interoperable target system.

In general, a lower number of non-application requests should correspond to a higher level of interoperability of the EU railway system.

Indicators

The indicator used is the number of requests for non-application requests submitted by Member States for rolling-stock-related TSI. Specifically, it includes all cases concerning the locomotives and passenger rolling stock (LOC & PAS), wagons (WAG) and noise (NOI) TSIs, and those concerning rolling-stock provisions in the SRT, PRM and CCS TSIs.

The indicators represent the non-application of TSIs under Directive 2008/57/EC and Directive (EU) 2016/796.

Findings

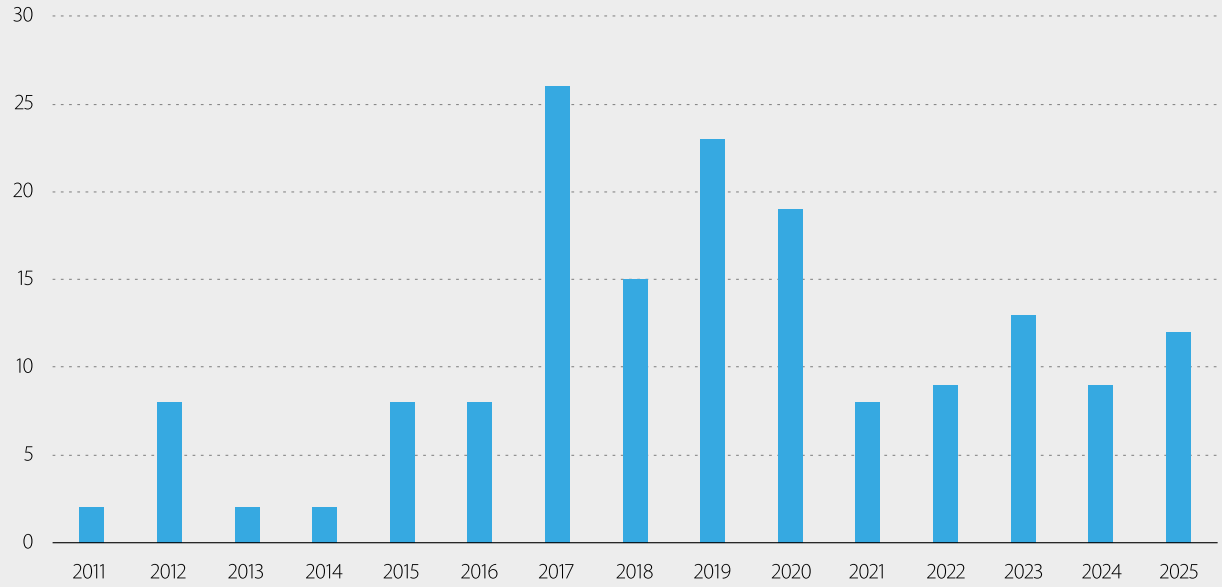
On average, there have been 10 non-application requests per year since 2008; altogether, 182 requests for non-application of TSIs were submitted to the European Commission under Directive 2008/57/EC and Directive (EU) 2016/796. The number of requests varies from year to year, with peaks in 2017–2020; there is also quite significant variation across Member States.

Sources and limitations

Non-application requests are received and processed by the European Commission (Directorate-General for Mobility and Transport), which also keeps track of them through an internal database. The data quality is considered satisfactory for the given purpose. A significant number of cases in both 2024 and 2025 were either withdrawn by the Member State or found to be not necessary. Of these, two cases in 2024 concerned rolling stock.

Figure B-20: Non-applications of rolling stock-related TSIs (EU-27 + NO, 2011–2025)

TSI WAG & NOI, LOC & PAS, RST, CCS

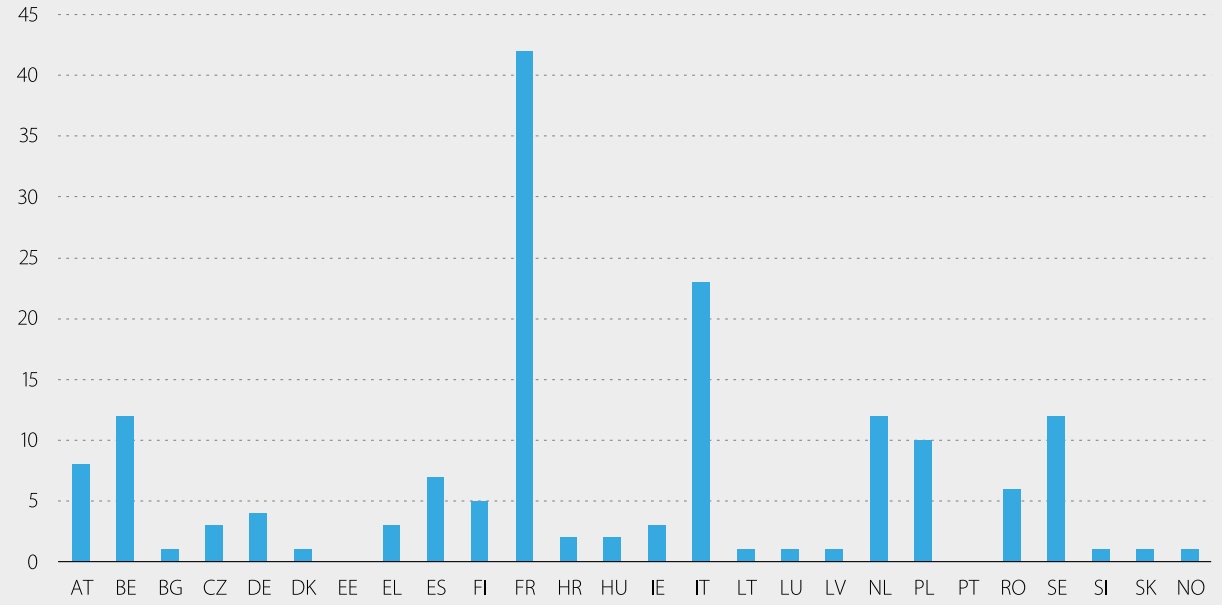


Note: Data for UK until 2021.

Source: Directorate-General for Mobility and Transport internal database.

Figure B-21: Non-applications of rolling stock-related TSIs per country (EU-27 + NO, end of 2025)

TSI WAG & NOI, LOC & PAS, RST, CCS



Source: Directorate-General for Mobility and Transport internal database.

B-12 Applicable national technical rules for vehicles

Purpose

National technical rules for vehicle authorisation can be technical barriers to the vehicle authorisation process because vehicles also have to be compliant with these rules to be authorised. This is especially the case when the national rules negatively assessed against the harmonised TSIs and other applicable EU legal frameworks are not repealed by the Member States or in case the national rules are not notified.

Member States have to notify their national rules according to Directive (EU) 2016/797. ERA has to examine the notified national rules. The enforcement of national rules that are not notified contravenes the directive, leads to unnecessary uncertainty and costs, and can affect interoperability. A process of cleaning up the national rules is ongoing. The remaining national technical rules should cover only open points in TSIs (including specific cases), aspects of vehicle compatibility with the network (e.g. class B signalling systems) and other limited cases as set out in Directive (EU) 2016/797. The cleaning-up process ensures that the rules are notified/published along with the ERA assessment results in the publicly accessible Reference Document Database and will be transferred in the future to the Single Rules Database (SRD) ([39]).

Indicators

The indicator used is the number of national rules for vehicle authorisation published/notified in the EU-27, Norway and Switzerland since January 2016.

Findings

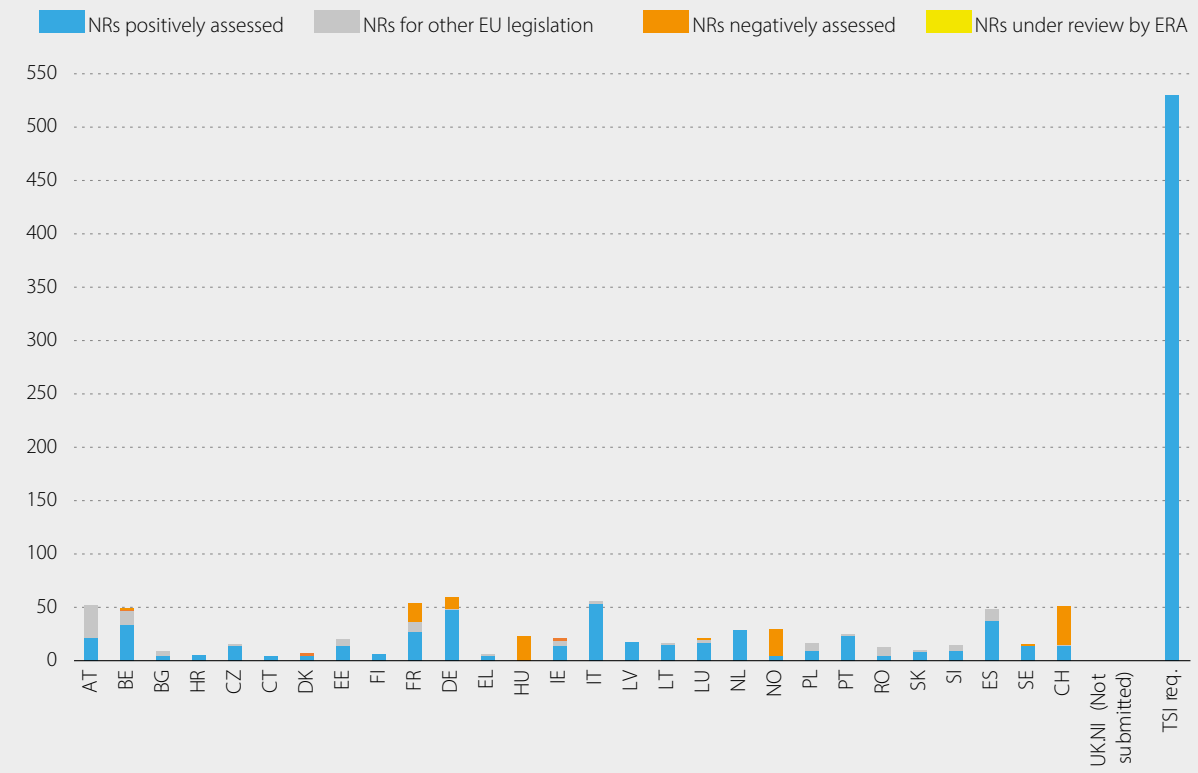
At the level of the EU-27, Norway and Switzerland, the total number of national rules for vehicle authorisation (in addition to the latest TSIs in force) dropped from about 13 450 in January 2016 to 695 in January 2026, with some differences among the countries. Although there has been an impressive decrease in the number of published rules in the past eight years, this trend has flattened since the end of 2019. After cleaning up, a further reduction in the number of national rules is envisaged in the next revision of the TSIs.

Sources and limitations

As the data are retrieved directly from ERA's Reference Document Database after being published by the Member States, the reliability of the data depends on the extent to which the information from the Member States is up to date and complete.

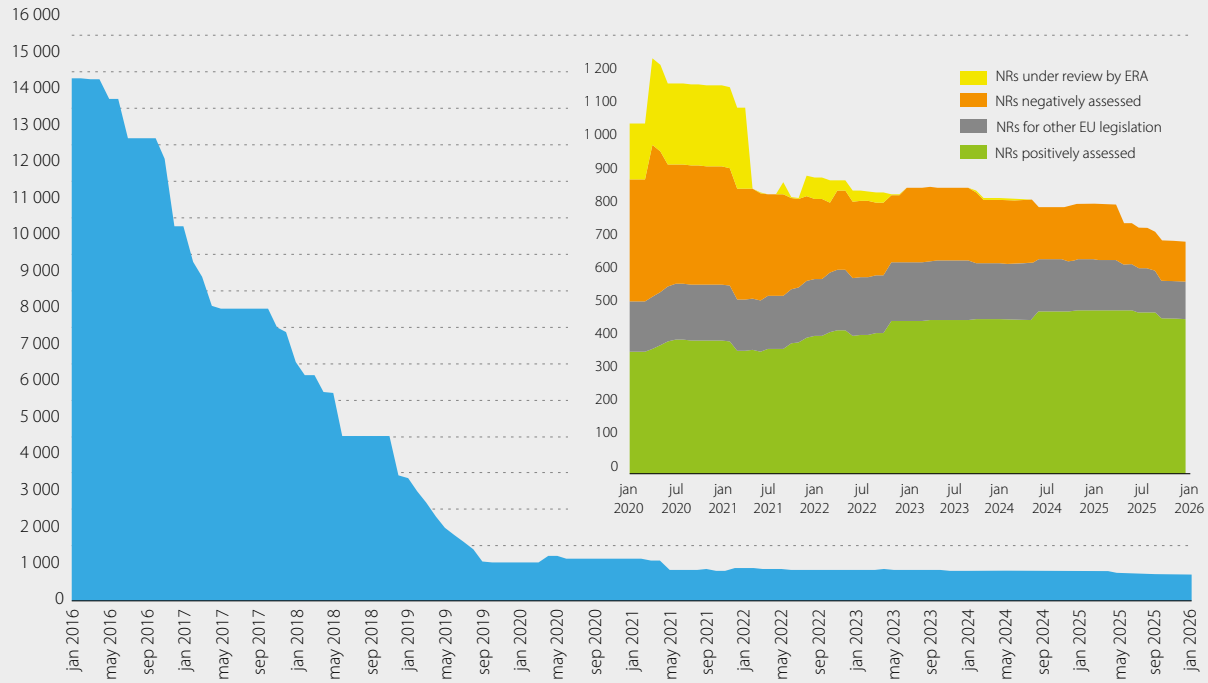
([39]) In addition, the number of adopted/in-force 'safety' and 'fixed installation' national rules are 752 and 109, respectively, based on the rules notified by the Member States, Norway, Switzerland and the Channel Tunnel in the SRD as of 25 March 2026. These numbers do not refer to the abovementioned national rules concerning vehicle authorisation.

Figure B-22: National rules for vehicle authorisation in addition to the latest TSIs (EU-27 + CH + NO, January 2026)



Source: Reference Document Database (RDD) maintained by ERA.

Figure B-23: National rules for vehicle authorisation (EU-27 + CH + NO, 2016–January 2026)



Note: NRs from UK are considered until 2021.

Source: Reference Document Database (RDD) maintained by ERA.

B-13 ERTMS on-board deployment

Purpose

The deployment of ERTMS equipment on board tractive vehicles is a prerequisite for ERTMS-compatible train operation. It is achieved either through purchasing new vehicles or by retrofitting the existing fleet.

Indicators

The indicators used to measure the extent of on-board deployment of the ERTMS are the total number of tractive rolling stock vehicles in operation equipped with the ERTMS authorised by Member States (+ CH + NO) for operations on the EU railway network and the number of ERTMS-equipped vehicles contracted (delivered or to be delivered) in the Member States (+ CH + NO).

Findings

The countries reporting the highest number of vehicles equipped with the ERTMS in operation in 2024 were Belgium, Switzerland and Germany. The data extracted from the annual safety reports of NSAs indicated that on average (in the countries that provided data) around 25 % of the operating tractive vehicles (including train sets) were equipped with the ERTMS at the end of 2024.

The number of contracted vehicles with the ERTMS has increased steadily since 2010, with a sharp projected rise to around 17 600 vehicles contracted in Member States ([40]) (and about 24 000 in the Member States + CH + NO) by the end of 2024. However, the time lag between the contracting of vehicles with the ERTMS and their actual entry into operation should be taken in account.

To achieve successful implementation of the ERTMS in the core network by the target date of 2030, greater effort is needed to accelerate the on-board deployment of the ERTMS.

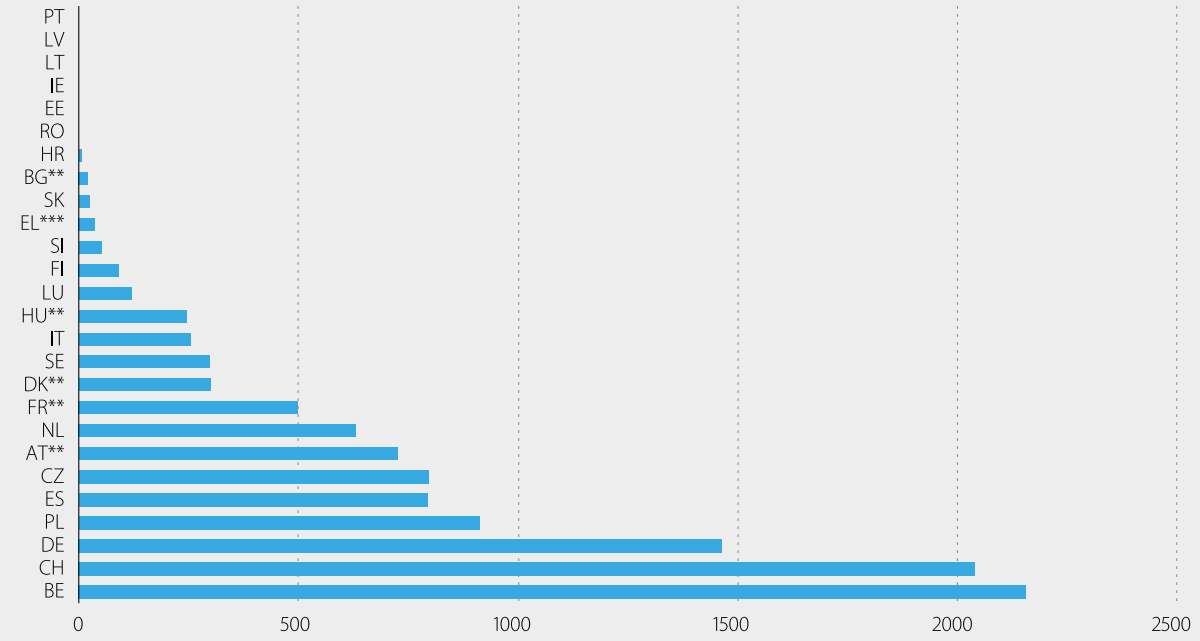
Sources and limitations

The underlying data are estimates, as they are not readily available and have to be compiled from various sources. Regrettably, current data quality issues in the European Vehicle Register (EVR) and the European Register of Authorised Types of Vehicles (ERATV) do not allow the production of statistics based on primary data. One source is a survey on vehicles in service, conducted among NSAs and included in their annual safety reports, which provides the number of vehicles registered in a country. An additional source is the Deployment Management Team (data included in the work plan of the ERTMS European Coordinator), which reports the vehicles registered in each Member State. A third source is a survey by the rolling-stock manufacturers' association, the European Rail Supply Industry Association, of its members about vehicles contracted; these data cover all types of contracts, including those that were later cancelled. In the case of national data provided by NSAs, the data are not available for five countries (Austria, Bulgaria, France, Hungary and Norway). In the case of the European Rail Supply Industry Association, the data are deemed accurate enough. NSA survey data are provided by the NSAs in their annual safety reports, and some discrepancies between these data and data from other sources are possible. The number of tractive vehicles operated comprises the numbers owned, leased and rented minus the number of rented-out vehicles equipped with the ETCS. Vehicles without power units are excluded. Multiple units and train sets are counted as one equipped vehicle. Data include vehicles that are operated to transport freight or passengers. Vehicles under pilot yellow fleet operations, vehicles for track maintenance and other IM vehicles are not included. As mentioned, data refer only to vehicles that are registered in the country in which the RUs conduct their main business activities; for some Member States there could be double counting of vehicles.

([40]) European Rail Supply Industry Association, 'Deployment Statistics'.

Figure B-24: Vehicles in operation equipped with ERTMS OBUs (EU-27 + CH, end of 2024)

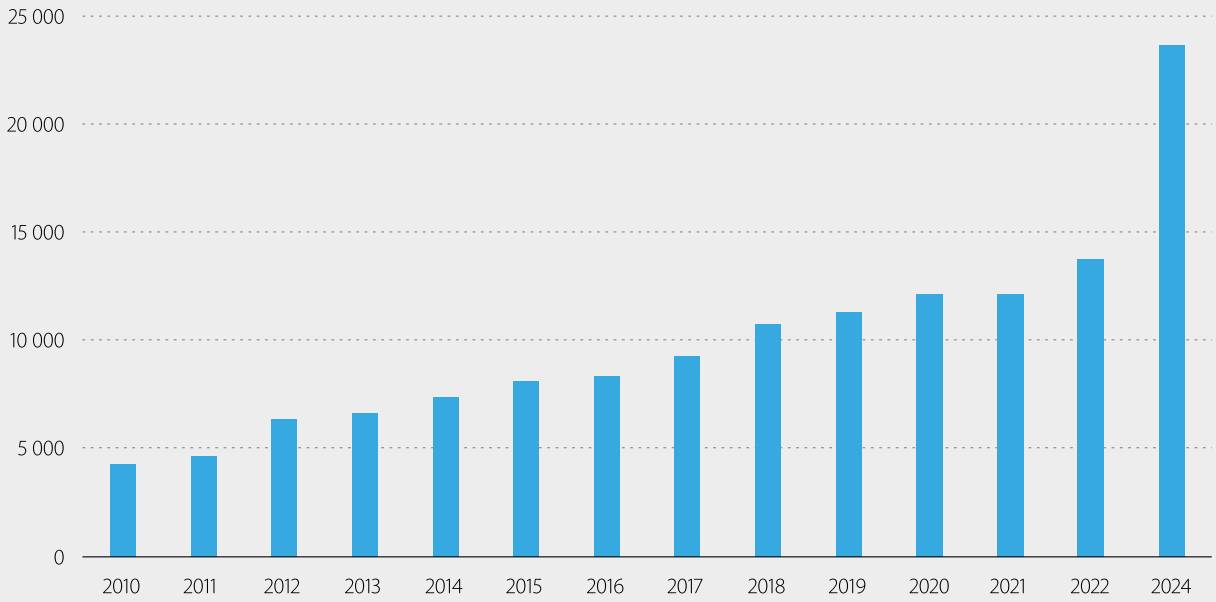
New and retrofitted vehicles



Note: * NSA 2023 value; ** Data from DMT for 2024;* NSA 2022 value.

Sources: Annual Safety Reports of NSAs.

Figure B-25: Contracted ERTMS vehicles (EU-27 + CH + NO, 2010–2022, 2024)



Source: European Rail Supply Industry Association (UNIFE).

B-14 Safety certificates or single safety certificates for railway undertakings with an international area of operation (part 1)

Purpose

The number of RUs with Part B SCs in more than one Member State and the number of SSCs with multi-country areas of operation may provide an indication of the international rail services across Europe. A multi-country area of operation includes operations at border stations.

Indicators

Member States and ERA concerned with national or international operation of RUs (i.e. area of operation in one or more Member States) holding valid Part B SCs and/or SSCs.

Findings

Records in Eradis indicate only two Part B SCs and 1 127 SSCs valid at the end of 2025 with an area of operation in one Member State; the trend since 2021 confirms the gradual transition to the new scheme in all countries, a process that was completed at the beginning of 2026.

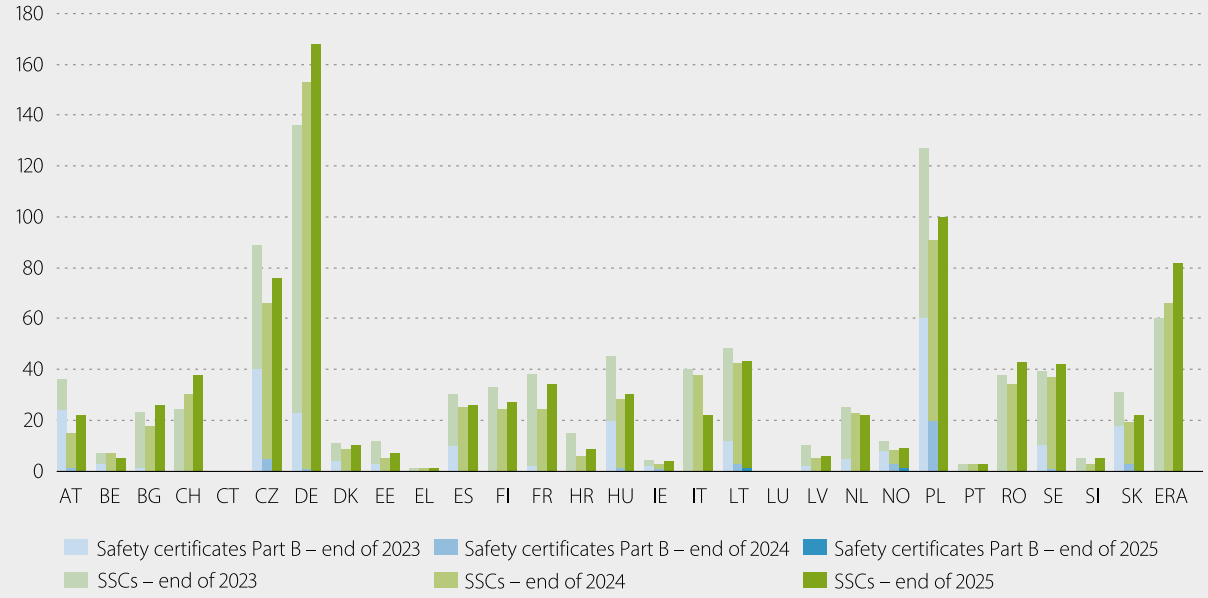
ERA has issued more SSCs under the new scheme in the last five years than any individual NSA.

Sources and limitations

Part B SCs are submitted by NSAs in Eradis. Data reliability depends on the extent to which information provided is up to date and complete. As specified in the terms of use, ERA has no responsibility or liability with regard to the data submitted by NSAs and published in Eradis. Data for SSCs issued by ERA, instead, are available in Eradis and were retrieved from the One-Stop Shop (OSS).

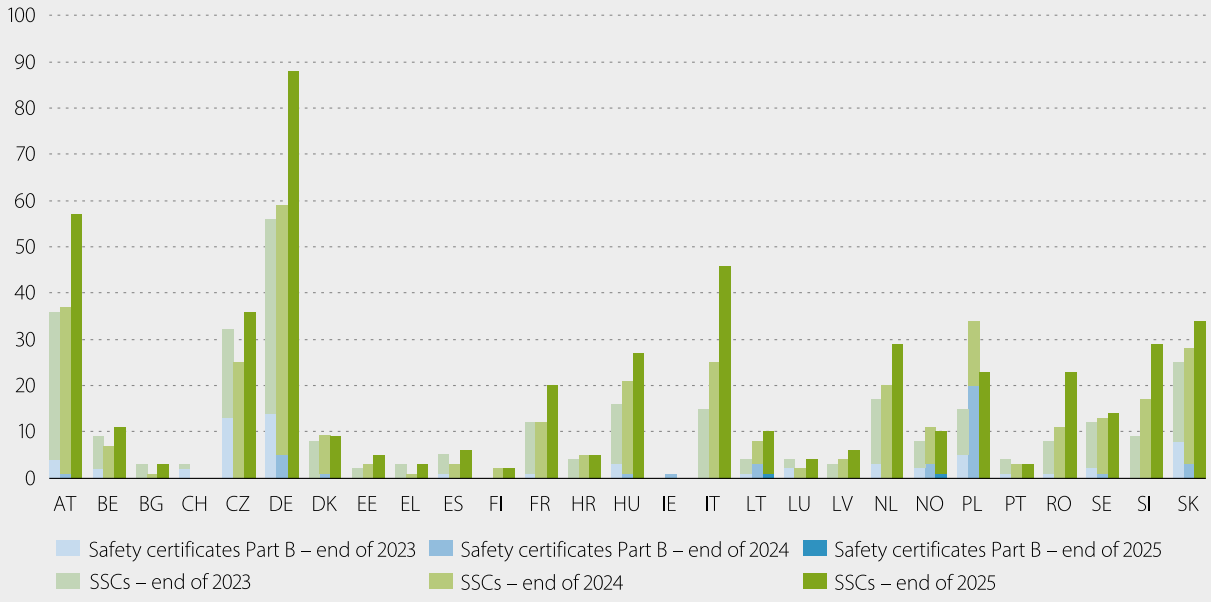
It should be noted that granting an (S)SC for an area of operation composed of one Member State does not mean that the RU exclusively operates at the national level. Many sister companies with their own (S)SCs still exist and manage their operations through partnership agreements or contractual relationships with other RUs either when crossing the national border or when operating to border stations. In addition, operations to border stations in neighbouring Member States are not counted as international operations.

Figure B-26: Member States and ERA concerned with part B safety certificates and single safety certificates for RUs operating in one Member State (EU-27 + CH + NO, end of 2023, 2024 and 2025)



Source: ERADIS (ERA).

Figure B-27: Member States concerned with part B safety certificates and single safety certificates for RUs operating in more than one Member State (EU-27 + CH + NO, end of 2023, 2024 and 2025)



Source: ERADIS (ERA).

B-15 Safety certificates or single safety certificates for railway undertakings with an international area of operation (part 2)

Purpose

The Part B SCs for RUs operating in more than one Member State are being gradually replaced by SSCs with multi-country areas of operation issued by ERA, which may provide an indication of the international rail services across Europe. A multi-country area of operation includes operations at border stations.

Indicators

Percentages (on the total) of valid SCs and SSCs issues by NSAs and ERA per area of operation, and number of SSCs issued by ERA per type and area of operation.

Findings

Records in Eradis indicate that 24 % of all SCs valid at the end of 2025 are managed by ERA, a percentage that could slightly rise after the end of the transition period of the fourth railway package (i.e. when the last few Part B SCs will also be replaced by SSCs). In 2019–2025 ERA delivered 329 SSCs, of which around 240 were valid at the end of 2025. Each RU can apply several times for SSCs (renewals, amendments, etc.) but it has only one SSC valid at any specific moment/time.

Around 22 % of all the SCs (recorded in Eradis and valid at the end of 2025) concerned international operators (i.e. with an area of operation in more than one Member State). Around 64 % of these certificates are SSCs issued by ERA, confirming the gradual transition to the new regulatory framework.

Domestic operations represent most operations in the EU, for which the vast majority of companies have already migrated to SSCs. As is also evident from the number of SSCs issued by ERA for each type and area of operations, more freight services are registered or operated internationally, while the international rail passenger services appear relatively limited. This can be partially explained by the fact that, for passenger transport, RUs rely on partnership agreements among themselves (i.e. they can operate under the SC of the partner RU without applying to ERA for an SSC).

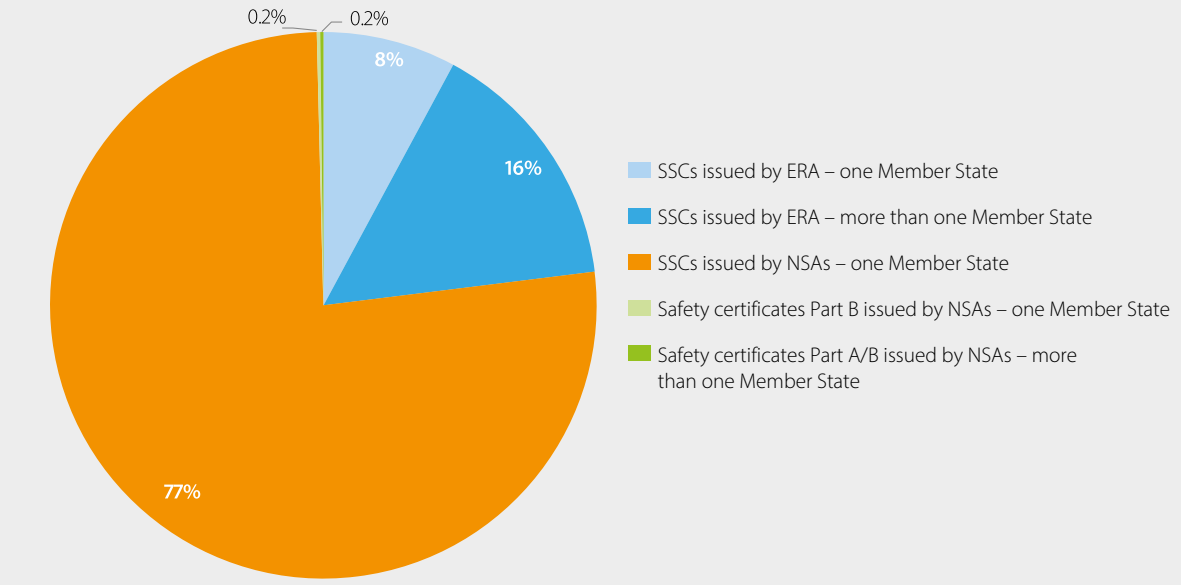
Sources and limitations

Part B SCs are submitted by NSAs in Eradis. Data reliability depends on the extent to which information provided is up to date and complete; as specified in the terms of use, ERA has no responsibility or liability with regard to the data submitted by NSAs and published in Eradis. Data for SSCs issued by ERA, instead, are available in Eradis and were retrieved from the OSS; they also include border stations rather than the whole Member State.

It should be noted that granting an (S)SC for an area of operation composed of one Member State does not mean that the RU exclusively operates at the national level. Many sister companies with their own (S)SCs still exist and manage their operations through partnership agreements or contractual relationships with other RUs either when crossing the national border or when operating to border stations.

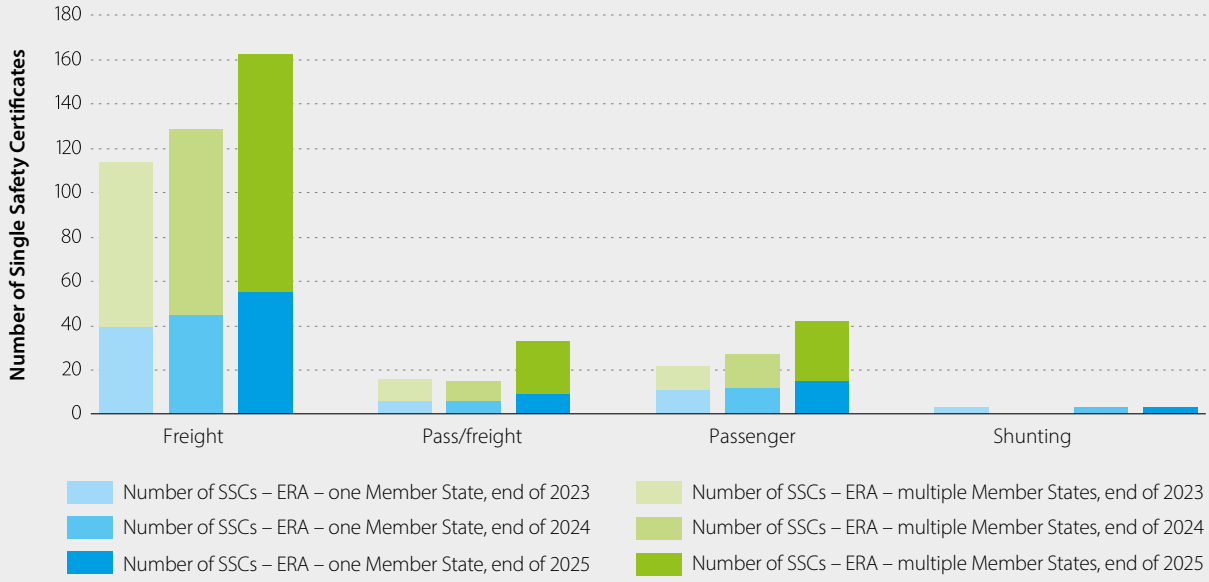
Figure B-28: SCs and SSCs issued by NSAs and ERA per area of operation (EU-27 + CH + NO, end of 2025)

Percentage of SCs and SSCs (on the total)



Sources: ERADIS (ERA).

Figure B-29: SSCs issued by ERA, per type and area of operation (EU-27 + CH + NO, end of 2023, 2024 and 2025)



Sources: ERADIS and OSS (ERA).

B-16 Vehicle authorisations handled by the European Union Agency for Railways per area of use and type of vehicle

Purpose

Before a new or modified railway vehicle is permitted to operate on the EU railway network it must be authorised. A vehicle and/or vehicle type authorisation is valid for a defined AoU, that is, a network or networks within one or more Member States where the vehicle may be used; a further authorisation is required if the AoU is extended to another Member State (extension of the AoU). According to Directive (EU) 2016/797 (Railway Interoperability Directive), when the AoU is limited to a network or networks within one Member State, the applicant can choose whether it submits its application for vehicle authorisation to the Member State or to the agency. If the AoU in more than one Member State, the Agency is to issue the authorisation.

The number of vehicles authorised by the Agency with AoU in multiple countries provides an indication of the international traffic across Europe.

Indicators

Number of vehicle authorisations and vehicles authorised by ERA, per AoU and category of vehicle.

Findings

Around 2 000 vehicle authorisations were submitted and handled by ERA in 2025, with more than 21 000 vehicles authorised. The figures show an upward trend over the past years (partly as a result of progress with the transposition of the Fourth Railway Package) and they relate to all types of authorisations (CTT, first authorisation, renewal, extension of AoU, etc.).

Around 20 % of all vehicle authorisations handled by ERA since 2021 concern AoUs in one Member State, and 80 % AoUs in multiple countries.

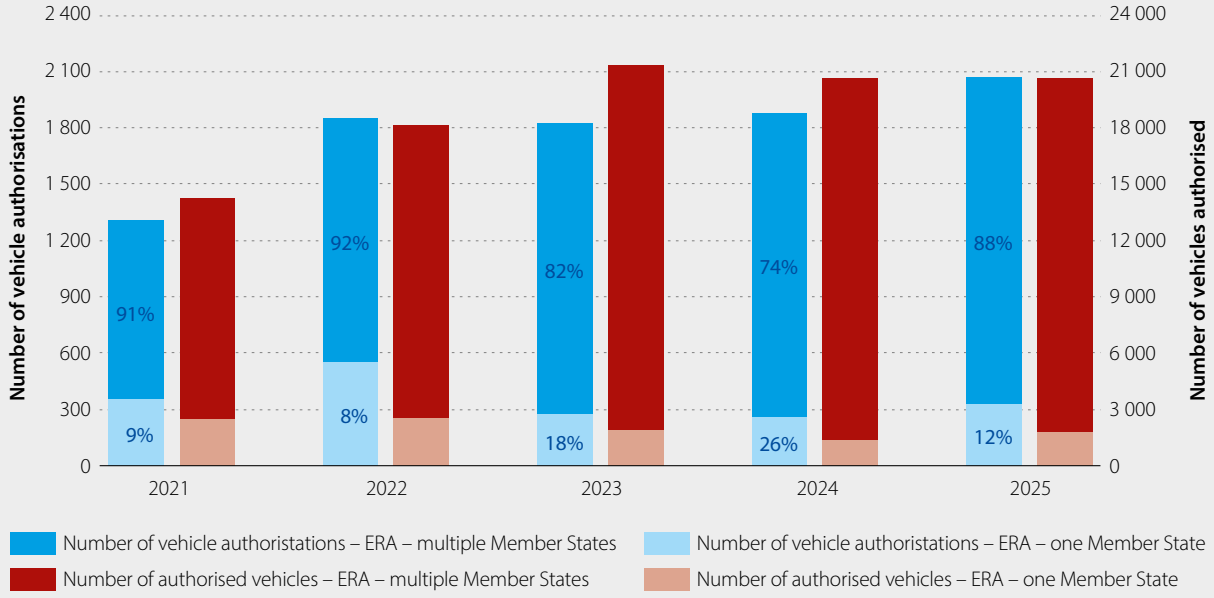
Most authorisations in 2025 were related to wagons, followed by locomotives and train sets, while more than 1 700 authorisations (for more than 18 800 vehicles) concerned AoUs in multiple countries.

Sources and limitations

Data on vehicle authorisations and vehicles authorised by ERA are retrieved from the OSS and can be considered fully reliable.

Figure B-30: Number of vehicle authorisations and vehicles authorised by ERA, per area of use (EU-27 + NO, 2021–2025)

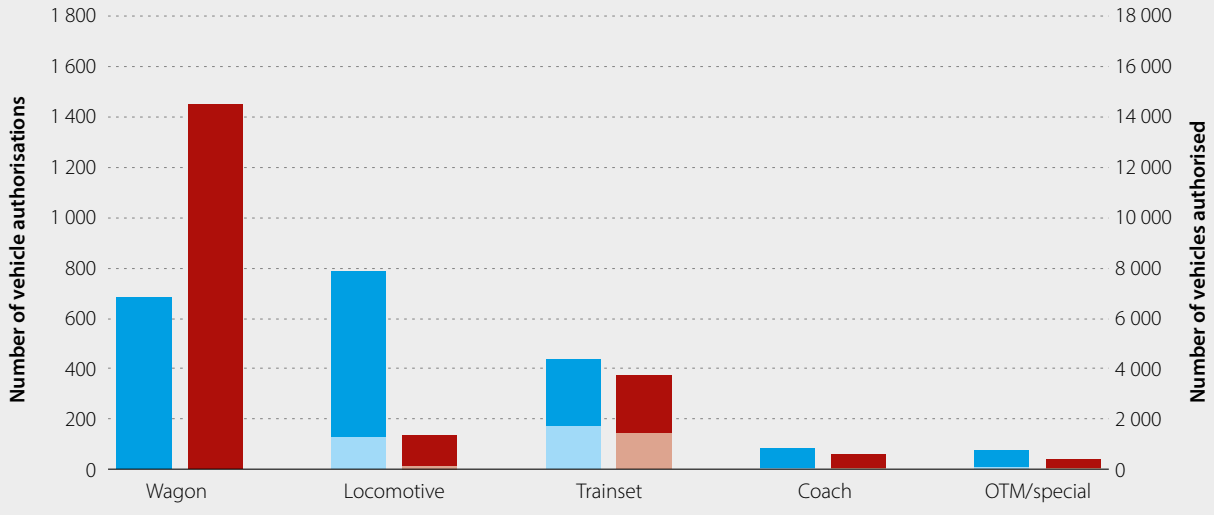
Area of use in one or more Member States



Source: One-Stop Shop (OSS).

Figure B-31: Number of vehicle authorisations and vehicles authorised by ERA, by AoU and category of vehicle (EU-27 + NO, 2025)

Area of use in one or more Member States



Note: Each trainset is counted as single unit/vehicle.

Source: One-Stop Shop (OSS).

B-17 Area of use of traction vehicles

Purpose

This section examines changes in the average AoU of traction vehicles placed on the EU market. Monitoring AoU trends supports the assessment of interoperability progress under the technical pillar of the fourth railway package, particularly regarding cross-border operability, harmonised authorisation conditions and the practical impact of TSIs on rolling-stock deployment ([41]). In addition, it gives an indication of the operational flexibility of rolling stock.

Indicators

The main indicator is the average AoU, expressed as the average number of countries in which a vehicle with a valid registration is authorised to operate, split by manufacturer and year. The indicator is disaggregated into electric locomotives, train sets (electric multiple units (EMUs)) and HS EMUs.

Findings

The data show a progressive increase in the average AoU for more recently manufactured electric locomotives and HS EMUs with valid registrations, suggesting that newer traction vehicles are designed and authorised for border operation. This trend coincides with the consolidation of TSI-based requirements, the reduction of national technical barriers, the liberalisation of the railway market and the growing use of harmonised authorisation procedures. Differences between categories remain, reflecting distinct operational roles and legacy constraints, but the overall pattern indicates a steady strengthening of interoperability and a more integrated market for EU rolling stock.

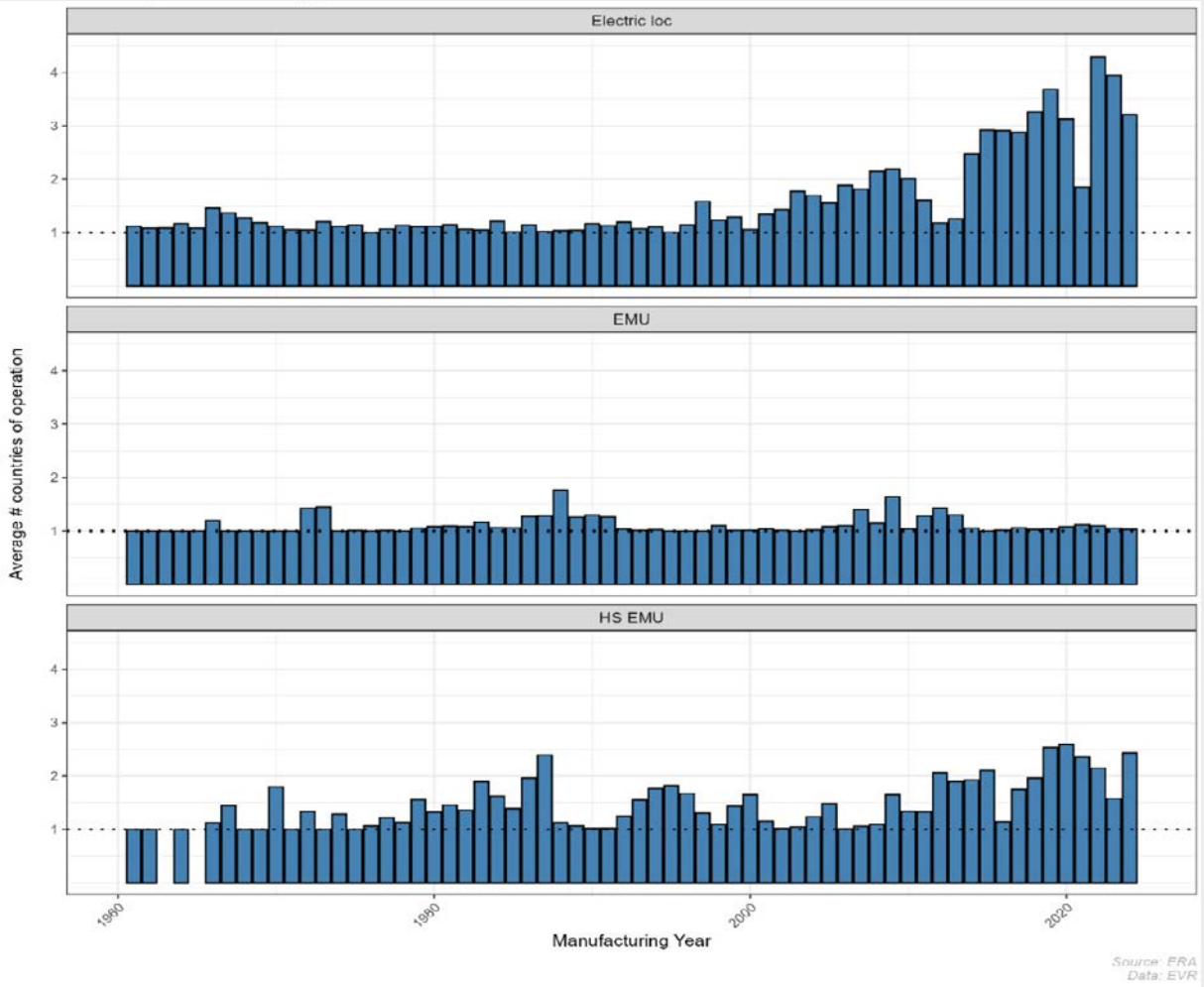
Sources and limitations

The analysis relies on data extracted from the EVR in December 2025 and aimed to include countries only if the vehicle could access the entire main network of that country. A data quality review was carried out to resolve inconsistencies in the EVR data entries. The accuracy of the data, however, could not be assessed for most vehicles; hence, the analyses rely on the correctness of the information as provided by the keeper and the registration entity. Despite its constraints, the validated EVR dataset provides a good initial basis for interpreting the trends in AoU and understanding the development of cross-border operability and harmonisation in the EU rolling-stock fleet. For future analyses, a consistency analysis with ERATV will be performed.

([41]) Additional findings on the EU rolling-stock fleet are available in the *ERA Rolling Stick Fleet Study – Final report – December 2024*.

Figure B-32: Evolution of the average area of use of different categories of traction vehicles (EU-27, 1960–2025)

Trend by manufacturing year



Source: EVR.

B-18 Licence documents

Purpose

Directive 2012/34/EU, as amended, sets out the criteria applicable to the issuing, renewing or amending of licences by a Member State for RUs established or intending to be established in the Union. Data on licences for the performance of rail transport services within the Union and the European Economic Area are submitted by the national licensing authorities, monitored by the Commission and available in Eradis ([42]).

Indicators

The number of licence documents valid at the end of 2025, per country and type of service.

Findings

Eradis reports around 1 266 licence documents ([43]) valid on 31 December 2025 (in the EU-27 + CH + NO) for freight, passenger and combined freight/passenger services.

Most licences relate to freight services, and there are significant differences across Member States, with the highest numbers reported in Germany, Poland and Czechia.

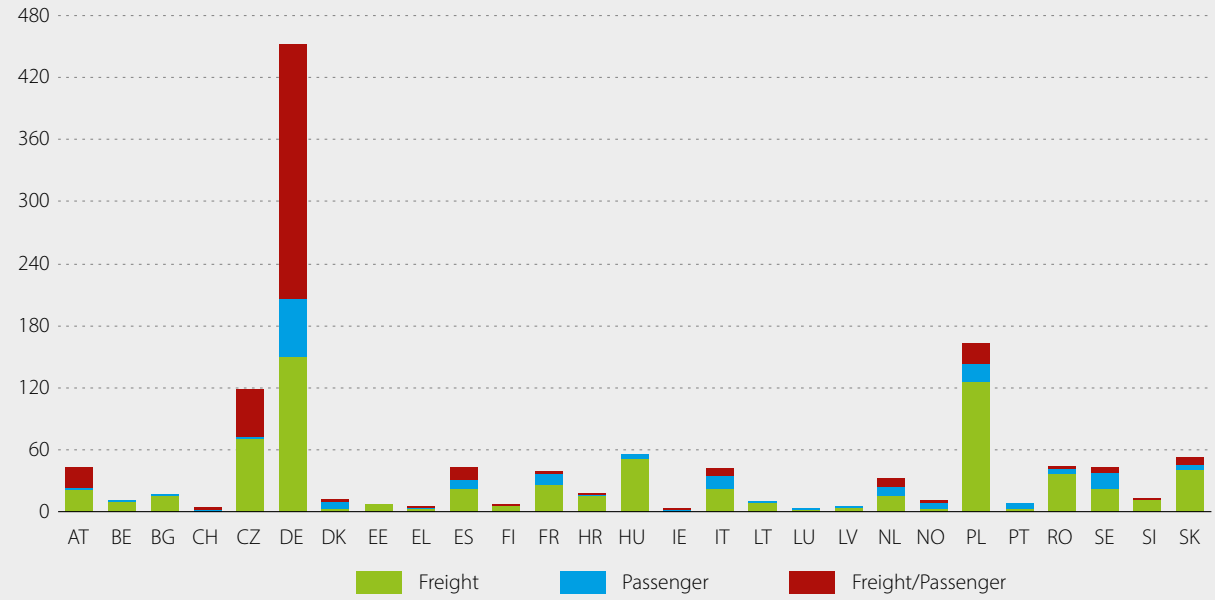
Sources and limitations

Data on the licence documents are submitted by the national licensing authorities, monitored by the Commission and published in Eradis. Data reliability depends on the extent to which information provided is up to date and complete. As specified in the terms of use, ERA has no responsibility or liability with regard to the information submitted and published in Eradis.

([42]) https://eradis.era.europa.eu/.
([43]) Note: an RU with a licence may not necessarily be operational.

Figure B-33: Number of valid licence documents active at the end of 2025, by country (EU-27 + CH + NO)

Documents valid on 31 December 2025, for passenger, freight and freight/passenger services



Note: a railway undertaking with a licence may not necessarily be operational.

Source: ERADIS.

B-19 Time to obtain vehicle authorisation

Purpose

The Fourth Railway Package introduced a scheme for a single EU vehicle authorisation, for single safety certification of RUs and for ERTMS trackside approval as a means to enhance interoperability and improve the efficiency of the railway sector. A key promise of its technical pillar was the reduction of the time required to obtain formal regulatory documents necessary for train operation – an aspect directly linked to cost savings for the sector. To fully assess this performance, it is also important to consider the number of CTT requests received, as this indicator reflects the workload the Agency must manage while ensuring timely delivery.

Indicators

The indicator for the number of CTTs corresponds to the total count of CTT requests received by the Agency within the reference period. The duration of the vehicle authorisation process for CTTs is measured by the time spent – in working days – to deliver the authorisations for placing vehicles on the market (i.e. time elapsed between the submission of the application through the OSS and the issuance of the authorisation).

Findings

The Agency receives approximately 60 % of all CTTs in the EU. Peaks in CTT requests received, particularly in 2023 and 2024, have not resulted in proportional increases in processing time.

The average time to obtain a CTT authorisation has decreased significantly over time, remaining since August 2022 well below the target threshold of 5 working days, and now shows a stable value of 2.5 working days.

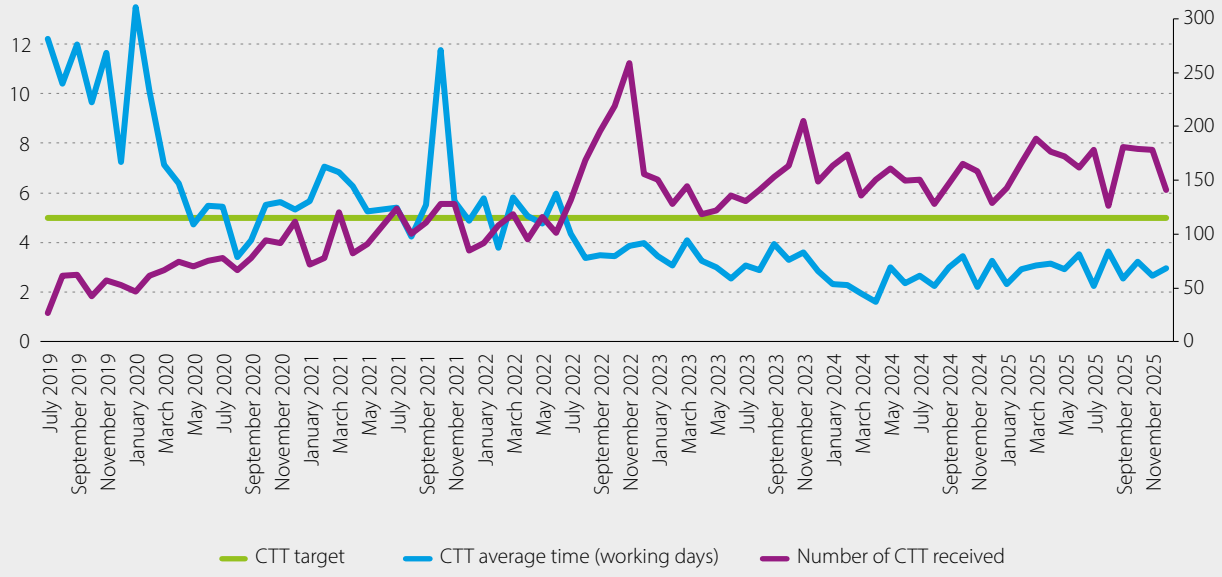
Overall, a higher number of CTTs corresponds to a progressive reduction in the time spent to deliver CTT-related vehicle authorisations.

Sources and limitations

Data on vehicle authorisations and vehicles authorised by ERA are retrieved from the OSS and can be considered fully reliable. The figures presented refer to all types of authorisations.

Figure B-34: Trend in processes and received Conformity To Types vehicle authorisations (2019–2025)

Average duration (over the month) in working days and average monthly number of CTTs, July 2019 - December 2025



Sources: One-Stop Shop (OSS).

B-20 ERTMS trackside approvals

Purpose

The ERTMS is a cornerstone of railway interoperability in the EU, enabling seamless cross-border operations and supporting the gradual replacement of national legacy systems. Under the fourth railway package, ERA is responsible for issuing ERTMS trackside approvals, ensuring harmonised implementation of ERTMS and supporting cross-border interoperability and consistent application of the CCS TSI across Member States. Trackside approvals by ERA are a prerequisite for the authorisation of NSAs to place in service new or upgraded rail infrastructure where the ERTMS has been deployed or upgraded.

Indicators

The indicators represent the number of ERTMS trackside applications submitted, broken down by application scope (ETCS, GSM-R, FRMCS, automatic train operation or any combination of these ERTMS components) and by application status (ongoing or decision delivered), along with a country-level breakdown.

Findings

By the end of 2025, ERA had received 158 ERTMS trackside applications, of which 44 had been approved, while the ongoing applications were pending the completion of their application files. This represents a substantial increase compared with the situation at the end of 2023, when only 14 approvals had been issued and around 100 applications were ongoing.

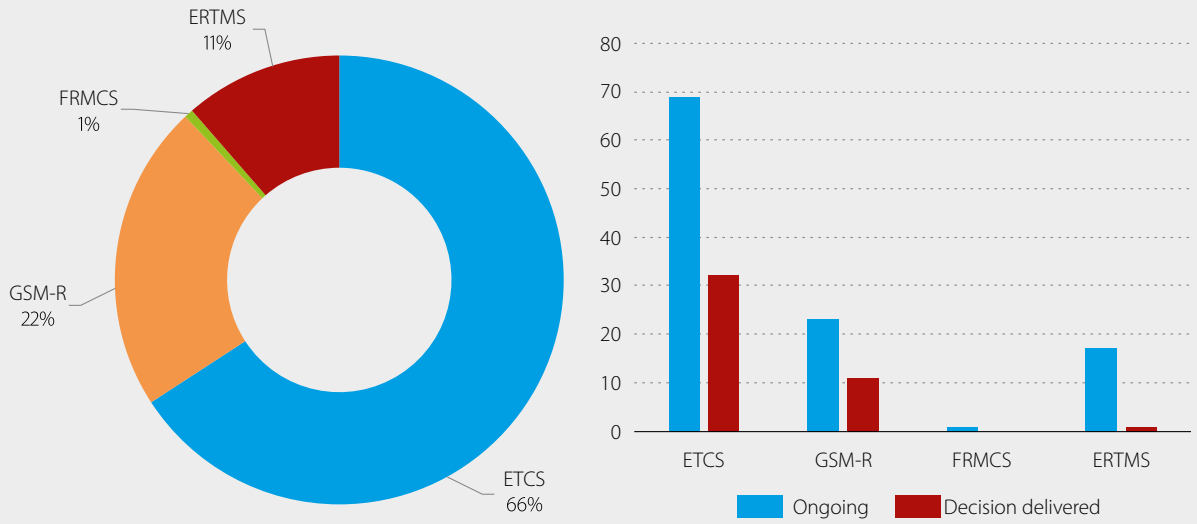
The distribution of applications by scope shows that the ETCS remains the dominant component, representing roughly two thirds of all requests. The GSM-R still accounts for a significant share, while FRMCS applications are emerging. In addition, only two applications involve more than one Member State.

The distribution of ERTMS trackside applications across Member States shows wide variation, with some countries submitting many applications while others submit only a few, and in several cases none at all. The length of track covered by an application can vary significantly, ranging from a few km to several thousand km. It is important to note that the number of applications does not indicate the scale or ambition of national deployment. Therefore, a higher number of applications does not necessarily mean that a Member State is more advanced in ERTMS deployment.

Sources and limitations

The analysis is based on the ERTMS trackside approval applications submitted in the OSS. The dataset reflects the status of applications at the end of 2025.

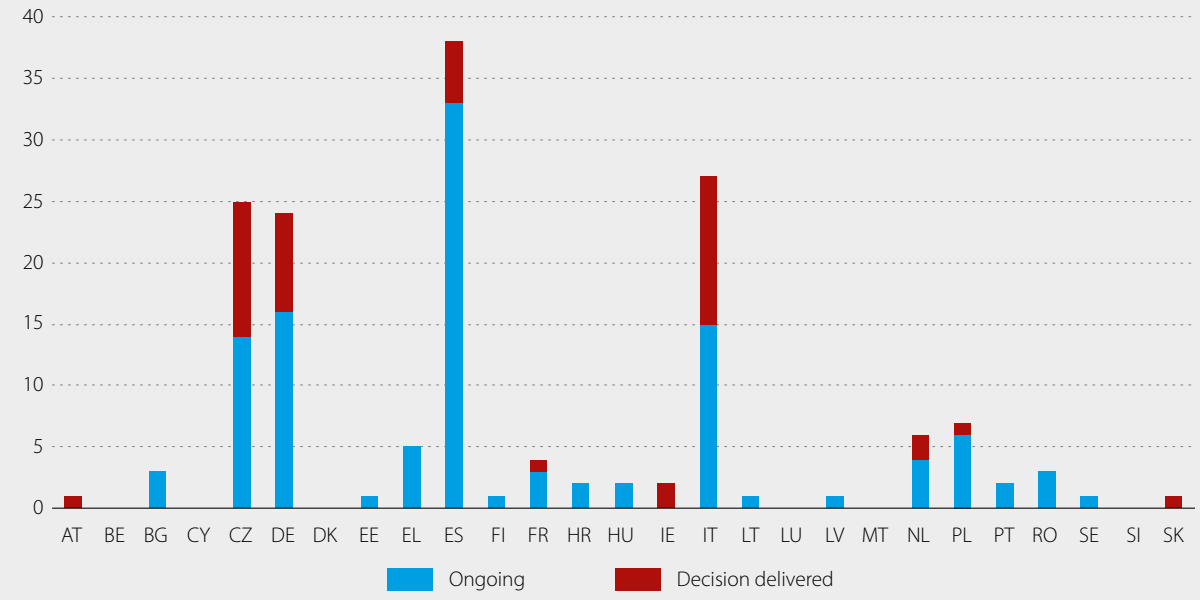
Figure B-35: Number of ERTMS trackside approval applications, by application scope (EU-27, end of 2025)



ERTMS = ETCS + GSM-R or FRMCS.

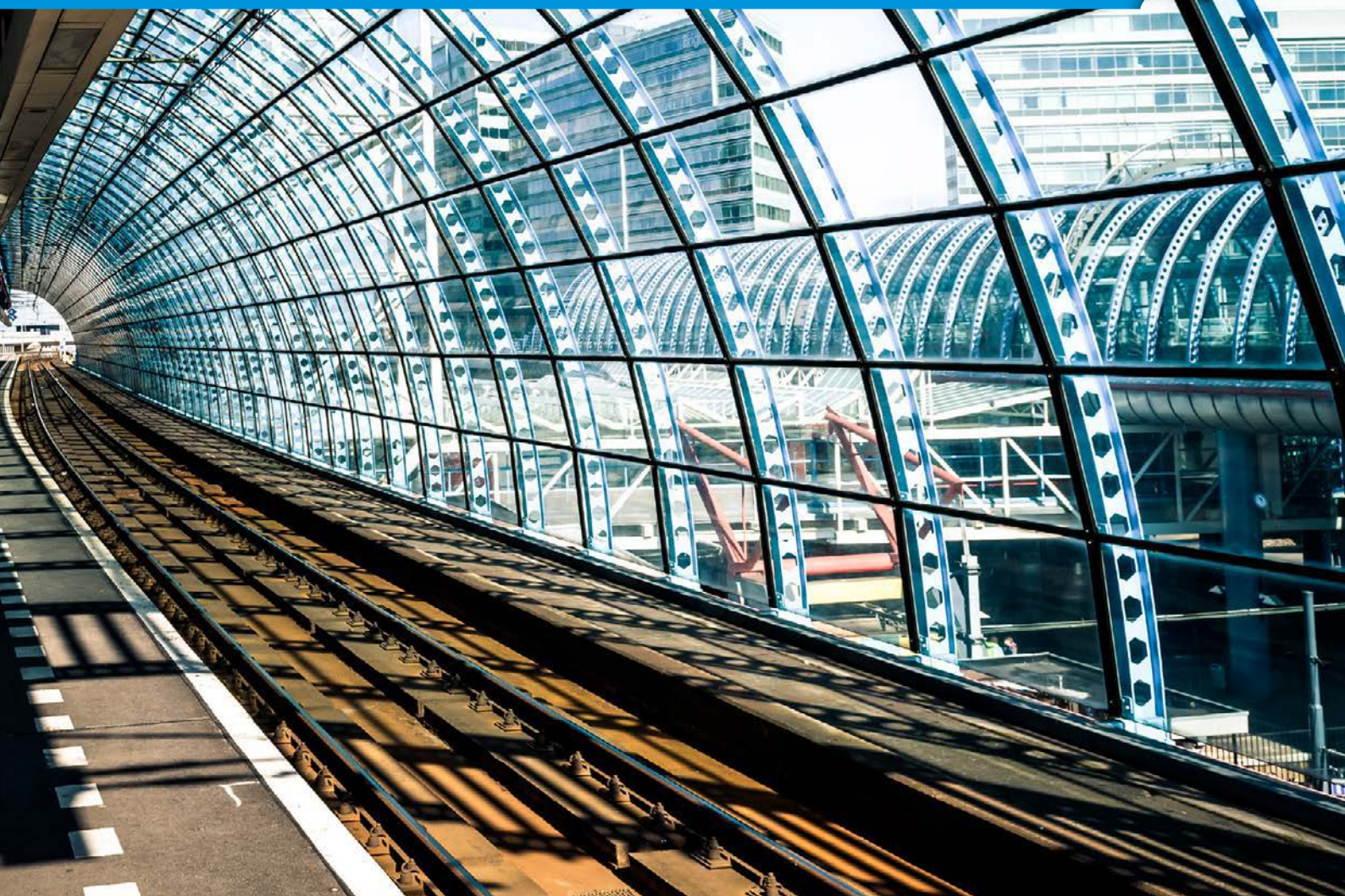
Source: One-Stop Shop (OSS).

Figure B-36: Number of ERTMS trackside approval applications, by country (EU-27, end of 2025)



Source: One-Stop Shop (OSS).

C. Looking ahead: emerging challenges and the evolution of the report



Introduction

Since 2008, the biennial *Report on progress on safety and interoperability in the EU* has served as the Agency's flagship statutory publication ([44]). Over nearly two decades, it has matured in analytical depth and coverage of topics, progressively incorporating cross-border traffic monitoring, ERTMS deployment metrics, safety assessments, TSI implementation indicators and other data related to the fourth railway package.

However, the context has changed considerably, not only due to political developments but also because of wider strategic, technological and operational shifts within the EU. The agency's SPD for 2026–2028 aligns ERA's work with the Commission's 2024–2029 priorities, including sustainable competitiveness, resilience, strategic autonomy and the implementation of a true SERA. Within this framework, several areas emerge where the Agency's role is expected to grow, such as climate resilience, military mobility, EU-wide safety information sharing, digital and telematics solutions, capacity optimisation and multimodal cooperation. The forthcoming revision of the ERA Regulation is anticipated to address a number of these expanded responsibilities.

This section proposes thematic and structural improvements to the report's content for the next editions and the updated Part A and Part B data.

([44]) This report is a part of a series of statutory publications by the agency on monitoring the safety and interoperability of the EU railway system. The series originated in 2008 with the first biennial report on railway performance, published under the original ERA Regulation (Regulation (EC) No 881/2004) and covering CSI data for 2006–2007. Five editions of the safety report were published between 2008 and 2016, alongside separate biennial reports on interoperability. Following the entry into force of the recast ERA Regulation (Regulation (EU) 2016/796), these two thematic strands were merged into a single joint report on progress on safety and interoperability in the SERA. The present edition is the 5th of this joint series (following those published in 2018, 2020, 2022 and 2024) and the 10th biennial report overall. Since 2021, the biennial cycle has been complemented by annual overviews on safety and interoperability, providing stakeholders with more regular monitoring between full editions.

Enhancing existing themes

The following proposals deepen and enrich topics already covered, reflecting growing data availability and the Agency's expanded operational activities.

- **ERTMS deployment.** This topic is already extensively covered in the report, and in this edition the section on trackside approvals has been significantly expanded, together with a quality analysis of data on the ETCS-equipped network length. Looking ahead, further enhancements may include the introduction of dedicated maps and the integration of additional elements, such as insights on ERTMS on-board costs. The introduction of a reporting obligation for beneficiaries in the Commission's next revision of the unit cost decision ([45]) for Connecting Europe Facility support will be essential to restore comprehensive data collection.
- **Safety analysis – from aggregated indicators to a systemic understanding and more granular safety data.** Absolute safety is unattainable in any complex socio-technical system. The goal is instead to manage risk as effectively as possible and drive continuous improvement. The current report provides a solid quantitative picture through CSIs, but a more holistic approach is needed to capture the full breadth of safety performance, encompassing not only accident outcomes but also the quality of safety management by RUs and IMs, the maturity of the safety culture across organisations, the effectiveness of national safety supervision and railway safety policy development, the condition and resilience of infrastructure and the socioeconomic context of each country. Future editions may therefore enrich the CSI-based analysis with indicators of the mentioned themes and with composite metrics enabling a fairer comparison of safety management capability across Member States, moving towards an assessment that reflects each national system's ability to anticipate, prevent and learn from safety occurrences rather than only counting the negative outcomes. One of the key enablers of this transition will be the adoption and implementation of the CSM ASLP, which will introduce a systematic and comprehensive EU-wide occurrence reporting framework and provide the structured data foundation necessary to support this deeper analysis.
- **Cross-border traffic, capacity and bottleneck reduction.** Additional statistics, developed in cooperation with RNE in its new role as the network coordinator, should go beyond monitoring transfer times and punctuality by addressing the reduction of cross-border bottlenecks and the increase of overall railway efficiency and effectiveness. This means covering, for example, the identification and systematic tracking of cross-border operational, technical and administrative barriers ([46]); progress in capacity allocation under the new European framework for infrastructure capacity management; monitoring of HS rail deployment against TEN-T corridor targets, in line with the Commission's HS rail plan (November 2025); and the contribution of these measures to the competitiveness and modal share of rail, particularly for international freight, where stagnation persists.
- **Vehicle authorisation and disaggregated reporting.** Part B of the report currently shows aggregate vehicle authorisation figures. Future editions may provide a disaggregated analysis by type of authorisation (first authorisation, renewed authorisation, extended AoU, new authorisation, CTT) and by vehicle category (wagons, locomotives, EMUs / diesel multiple units, HS train sets, special vehicles, coaches). The data may also track the expanding average AoU of newly manufactured or existing traction vehicles, possibly disaggregating by Member State and clusters of them. Monitoring the proportion of TSI-compliant vehicles in operation, broken down by subsystem and by Member State, would provide a direct interoperability indicator that is currently missing.

([45]) European Commission: Directorate-General for Mobility and Transport, 'Decision authorising the use of unit contributions to support the deployment of ERTMS, electric vehicles recharging infrastructure and the retrofitting of noisy wagons under the Connecting Europe Facility (CEF) – Transport sector', Ares(2021)4721320, 22 July 2021.

([46]) It should not be limited to ERTMS gaps but should include differing operational procedures, language requirements, crew change arrangements, incompatible infrastructure parameters and possible gaps in the framework of cross-border agreements between neighbouring Member States or NSAs that may hinder facilitated access to stations located close to borders.

- **TSI implementation, stability and life cycle.** Part B of the report monitors non-application requests and national rules but does not systematically measure the degree of TSI implementation in each Member State across all relevant subsystems. Future editions may develop indicators tracking the actual application of TSIs by Member States for subsystems and specific TSIs (INF, ENE, CCS, LOC & PAS, WAG, NOI, operation and traffic management (OPE), SRT, PRM, TAP/TAF), including the TSI national implementation plans (where present), and an assessment of compliance gaps and their impact on cross-border operations. The recent increase in non-application requests for fixed-installation TSIs (rising year-on-year since 2022, with sharp increases for INF, ENE and PRM in 2024–2025) and the persistently high CCS-related derogations deserve a dedicated analysis. Moreover, it is equally important to address TSI stability and the predictability of the TSI life cycle. Frequent revisions create uncertainty for manufacturers, operators and IMs who invest over long-time scales in terms of asset life. Future editions may, for example, track TSI revision cycles, provide aggregated data on the number of change requests for TSIs received by the Agency from the rail sector, and record the nature and scope of amendments (substantive versus editorial/clarification). Reporting on the sector's perception of regulatory predictability – drawing, for example, on structured feedback from NB-Rail, applicants and representative bodies – would provide a valuable complement to the quantitative implementation data.

- **Monitoring and cleaning up of national rules.** The scope of the monitoring and cleaning up of national rules in the report may be expanded beyond the current focus on national technical rules for vehicle authorisation. The SRD is being developed to accommodate not only vehicle-authorisation-related national technical rules but also safety rules and national-level fixed-installation rules. Once the SRD is ready to host all three categories, the report should monitor the development, reduction, clean-up and convergence of the full set of national rules across Member States. This strengthened monitoring function is not merely a technical exercise: it is a key driver of regulatory simplification and a prerequisite for achieving a genuinely harmonised SERA. National safety rules and fixed-installation rules can constitute barriers to cross-border operations and to a level playing field just as much as national technical rules for vehicles can. A systematic and more assertive monitoring of all categories would significantly enhance transparency, accelerate the clean-up of obsolete or redundant rules and provide a clearer picture of the remaining regulatory fragmentation that the sector must overcome.

- **Completeness and data quality of ERA registers.** The Agency maintains an ontology and suite of registers (the RINF, ERATV, Eradis, the ERAIL database, the EVR, the European Centralised Virtual Vehicle Register, the Vehicle Keeper Marking Register, the SRD, the Reference Document Database, Organisation Code Register and future systems like the information sharing system) that underpin the operational functioning of SERA. The ERA Knowledge Graph and the programme for the biennial Rail Data Forum, along with additional agency initiatives, are indicative of a maturing data ecosystem. The latest RINF Regulation (2023) re-establishes RINF as the reference basis for infrastructure data, including a more detailed topology and data for route book compilation as described in the OPE TSI (Appendix D2). Future editions of the report may include dedicated metrics on register completeness (for each Member State and data field), data quality indicators (timeliness, accuracy, consistency) and the uptake of data interoperability across the Agency's data ecosystem. These metrics would provide transparency on progress towards the Agency's objective of becoming a data-centric organisation and support informed policymaking based on high-quality railway data.

- **Environment, climate and sustainability.** The 2024 rail environmental report established a baseline covering noise, greenhouse gas emissions, air pollutants, land use, and climate adaptation and resilience. Rather than duplicating that stand-alone report, this report could incorporate a targeted section cross-referencing key findings, tracking progress and making use of additional insights identified in other ERA studies (e.g. *Rail Resilience to Climate Change – Impact of extreme weather events on the European railway system* and *Study on the implementation of on-ground energy data collecting systems in the EU railway system*).

New themes: emerging challenges

The following topics are not currently covered in the biennial report but have emerged as strategic priorities for the stakeholders and for the sector's operational reality.

- **Military mobility and dual-use.** The EU Military Mobility Package (November 2025) positions rail as a critical defence logistics enabler. Future editions of this report may track dual-use authorisation activity, military-mobility-related TSIs and register amendments, interoperability requirements for strategic corridors, and the Agency's contribution to the military Schengen concept.
- **HS rail development.** The European Commission's plan to accelerate HS rail (November 2025) sets ambitious connectivity targets. The updated Part B data show strong and sustained passenger growth and expanding AoUs for HS train sets authorised in multiple countries. Future editions of this report may, for example, monitor HS rail line deployment against TEN-T targets, HS train set authorisation activity and the Agency's technical support on interoperability specifications for HS corridors.
- **TEN-T implementation and EU enlargement.** The revised TEN-T Regulation sets binding milestones for 2030, 2040 and 2050, including milestones for ERTMS deployment, the decommissioning of class B systems, interoperability standards and infrastructure quality. While avoiding the duplication of existing reporting obligations stemming from the TEN-T policy and the Commission's information system to coordinate and support the trans-European transport network policy, future editions of this report may track progress against TEN-T milestones and report on Member States' requests for derogations regarding rail-related technical and interoperability parameters, advisory and assistance activities with candidate and neighbouring countries, and the elimination of cross-border bottlenecks.
- **Cross-border agreements and national rules.** The current report monitors national technical rules for vehicle authorisation, noting a significant decrease in published rules since 2016. However, it does not cover cross-border operational agreements between Member States, IMs and/or RUs, nor does it address the broader landscape of national safety rules (as distinct from national technical rules). Cross-border agreements on matters such as traffic management at border sections, communication protocols, incident handling and degraded mode operation are essential enablers of seamless cross-border traffic, yet their number, scope and development are not systematically monitored. Similarly, national operational rules – including company rules permitted under the OPE TSI, language requirements and locally applicable safety and operational procedures – can constitute significant barriers to cross-border operations that are not captured by tracking only the reduction in technical rules. Future editions of this report may introduce indicators on the number and coverage of cross-border agreements, their standardisation level, and the inventory and convergence of national safety rules. Together with the expansion of the monitoring of national rules proposed in the item regarding TSI implementation and stability – extending the scope from vehicle authorisation technical rules to also include national safety and additional fixed-installation rules through the SRD – this would provide a comprehensive view of all regulatory layers that affect cross-border operations.
- **Insights from NSA monitoring.** NSA monitoring activities – even when aggregated or anonymised – provide valuable evidence on how safety management is implemented across Member States. Future editions of this report may integrate high-level trends emerging from these supervisory findings and the levels of staffing, budget and competence of NSAs, offering a more comprehensive picture of safety performance and supporting a more harmonised approach to oversight in cooperation with NSAs.
- **Simplification of authorisation processes and support for massive retrofitting.** As the Fourth Railway Package matures (ERA processed around 2 000 vehicle authorisation

applications in 2025, with more than 21 000 vehicles authorised), the sector increasingly calls for the evidence-based simplification of authorisation processes, especially in cases of massive retrofitting. Future editions of this report may introduce a dedicated section tracking the efficiency of the Agency's processes and identifying bottlenecks.

- **Cybersecurity in railways.** The two main items of EU legislation related to railway are the revised Network and Information Systems Directive (NIS-2 Directive) ([47]) and the Cyber Resilience Act (CRA); both are applicable to the rail sector (operators, suppliers, NoBos). The NIS-2 Directive introduces mandatory risk management, incident-reporting and supply chain requirements for essential services operators and digital service providers. The CRA defines mandatory 'essential cybersecurity requirements' for products with digital elements in railway systems. The European Union Agency for Cybersecurity and ERA joint conference series has drawn the attention of railway stakeholders to both the CRA and the NIS-2 Directive, contributing to fostering cooperation in the railway cybersecurity community. The ERTMS 2026 Conference, with the support of EU-Rail, featured workshops on designing a cybersecure ERTMS transition regime and on economic cost drivers. The newly adopted telematics TSI (in force since 2 March 2026) sets requirements for data quality and cybersecurity; the CCS and ENE TSIs are also scheduled to incorporate further requirements for security interoperability. Future editions of this report may include a section mapping cybersecurity framework maturity across Member States, explore and engage with stakeholders on the topic of compliance costs (particularly in the ETCS/FRMCS transition context) and explore how authority tasks related to cybersecurity may develop in the future.

- **Innovation, automation and emerging technologies.** Railway innovation is increasingly central to the sector's long-term competitiveness, sustainability and safety performance. Topics such as automatic train operation (up to grade of automation 4), satellite-based train positioning, AI-based predictive maintenance and digital twins are progressively moving from research towards early operational deployment. While these technologies are not yet mature enough to allow for comprehensive, EU-wide monitoring through harmonised indicators or systematic statistical reporting across all Member States, their potential impact on safety, interoperability and the regulatory framework is significant. Future editions of the report may therefore seek to begin tracking these developments in a qualitative and forward-looking manner, mapping the state of play of key technology streams, identifying regulatory implications (e.g. for vehicle authorisation, safety assessment methods and conformity evaluation) and flagging areas where the existing framework may need to adapt. As these technologies mature and deployment scales up, the report should progressively introduce structured indicators and quantitative monitoring, following the same evidence-based approach applied to other sections.

- **Streamlined reporting obligations at the EU level.** Currently, separate statutory publications cover different monitoring reports, statistics and activities due to slight differences in legal bases and scope. These publications include this report, the rail market monitoring report, the Platform of Rail Infrastructure Managers in Europe benchmarking key performance indicator reports, Eurostat statistics, TEN-T policy monitoring and other monitoring reports and statistics produced by regulatory bodies or rail sector bodies such as RNE and the International Union of Railways. Future editions of this report may look at the potential for streamlining reporting obligations to avoid overlaps at least across EU-level official monitoring reports.

The themes and elements outlined above constitute a non-exhaustive list and will be fine-tuned and enriched over time based on the Agency's developing activities, stakeholders input and the availability of EU-level data. They will be gradually integrated into future editions of the Agency's reports and Factsheets.

([47]) Directive (EU) 2022/2555 of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union, amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972, and repealing Directive (EU) 2016/1148 (NIS 2 Directive) (OJ L 333, 27.12.2022, p. 80, ELI: http://data.europa.eu/eli/dir/2022/2555/oj).

Annexes

Annex I. Methodological information

Progress with safety

This report is mainly based on CSI data as of the end of December 2024 reported to ERA by NSAs ([48]). Any changes after that date have not been taken into account. Information on serious accidents and their investigations is based on reports available to ERA on 17 November 2025. Any event occurring after that date is not covered by this report.

European legislation requires Member States to report to ERA on significant accidents and serious accidents occurring in their territory. The NSAs must report all significant accidents. The NIBs must investigate all serious accidents, notify ERA of these investigations and, when closed, send the investigation reports to ERA. The term 'significant accident' covers a wider range of events than serious accidents. The RSD (Directive (EU) 2016/798) provides the following definitions and ways of reporting for these two groups of accidents.

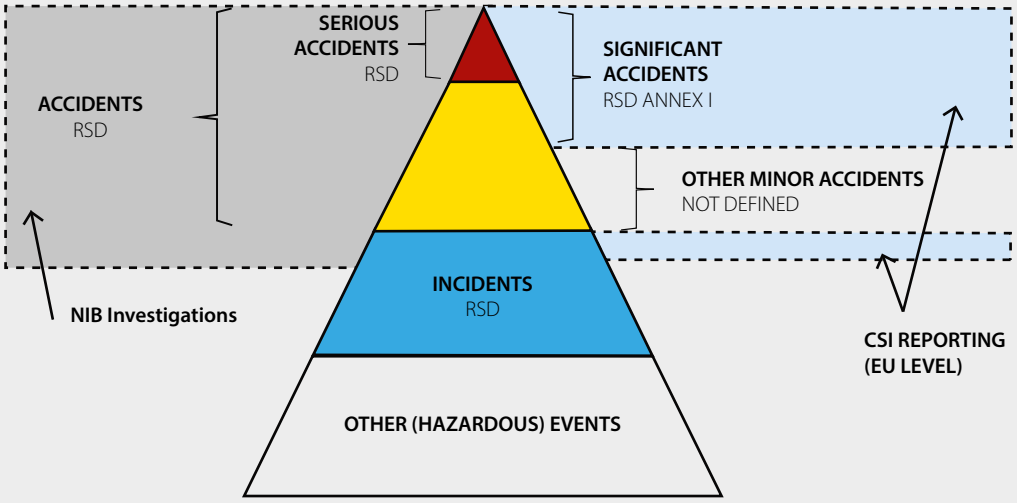
Significant accident (point 1.1 of the Appendix to Annex I to the RSD)	Serious accident (Article 3(12) of the RSD)
'[A]ny accident involving at least one rail vehicle in motion, resulting in at least one killed or seriously injured person, or in significant damage to stock, track, other installations or environment, or extensive disruptions to traffic'. Accidents in workshops, warehouses and depots are excluded. Significant damage is damage that is equivalent to EUR 150 000 or more.	'[A]ny 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. '"[E]xtensive damage" means damage that can immediately be assessed by the investigating body to cost at least EUR 2 million in total.'
Annual safety reports by NSAs	Accident investigation reports by NIBs

Source: ERA Implementation Guidance for CSIs ([49]).

The current legislative framework does not require Member States to collect information on all railway accidents. Reporting is often limited to significant accidents and a selection of incidents (precursors to accidents). At the Member State level, the information on incidents is not necessarily collected by RUs/IMs, and the NSAs usually rely on accident data when planning their supervisory activities. This absence may represent an obstacle to efficient learning and the early identification of recurring safety issues in the EU railway system.

To facilitate the long-term monitoring of railway safety, this report also uses the accident category 'major accidents' (which includes accidents resulting in five or more fatalities) and the category 'fatal train collisions and derailments' (which includes train collisions, train derailments and train fires following collisions or derailments in which one or more persons are killed).

([48]) ERA, 'Common safety indicators (CSIs)', ERA website.
([49]) ERA, *Implementation Guidance for CSIs*, Valenciennes, 2023, p. 6.



Progress with interoperability

Unlike the EU regulatory framework for railway safety, the interoperability regulatory framework does not contain common indicators for monitoring interoperability. A set of indicators has therefore been developed by ERA, in consultation with stakeholders, for assessing the extent to which trains are able to operate safely without interruption while achieving the required level of performance. However, data availability remains an issue; for example, directly measuring the dwell times on national borders in a harmonised way is still a developing area, and data cannot always be made available centrally for relevant indicators.

This report makes use of various sources of data: databases and registers hosted by ERA, databases of the Commission and other agencies, and databases of representative bodies and international organisations. Each year, additional data are extracted from the NSAs' annual safety reports, for which several NSAs (81%) provide interoperability data on a voluntary basis.

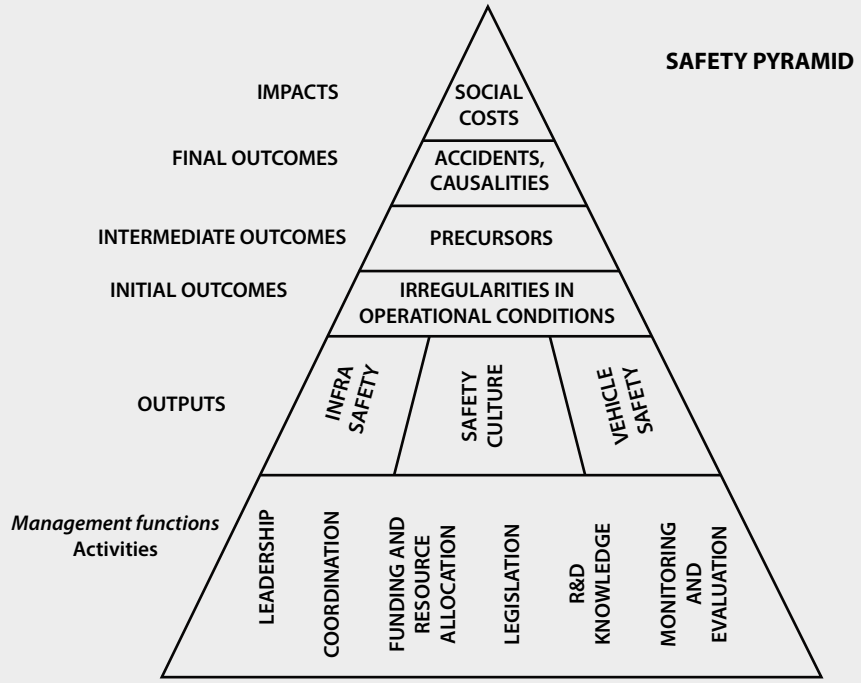
The standard reference date for this report is the end of 2024 or the end of 2025, depending on the data source (e.g. NSA survey or database/register). The data available for the Member States, Norway, Switzerland, the United Kingdom (until the end of 2020) and the Channel Tunnel are included. The EU aggregate is representative of the EU-27 (as of the end of 2020, therefore excluding the United Kingdom).

Annex II. Methodological framework for monitoring safety and interoperability

The methodological framework used in this report builds on the universal results framework. Outcomes and impacts are the main focus of a results framework; inputs and implementation processes are generally not emphasised, although outputs are often noted. This conceptual presentation of a results chain (outputs, outcomes and impacts) is often accompanied by a more detailed plan for monitoring progress towards the ultimate objectives through measuring the achievement of outputs, outcomes and impacts at different time intervals. Results are typically defined through indicators, which are often, but not always, quantifiable and measurable or observable. Some indicators are qualitative. The monitoring plan typically includes baseline values and targets expected for outputs and outcomes, and it specifies the measures that will be used to gather data to ensure that the results framework is actually populated with data, updated with information at key points during programme/project implementation and used in decision-making.

Methodological framework for safety monitoring

In the framework for safety monitoring, the **impacts** refer to evidence on whether outcomes are actually changing beneficiary long-term factors that are important from a societal perspective and resulting from a safer railway system – such as reduced social costs of accidents, a healthier population or a more efficient transport system. **Final outcomes** consist of long-lasting desirable and measurable results of safety improvements, in terms of a reduction in accidents, resulting casualties and fatalities. **Intermediate outcomes** are indicators of unsafe operational conditions that may lead to accidents if not addressed; accident precursors constitute one of the most direct and available measurements at this level. **Initial outcomes** reflect specific irregularities in operational conditions and represent the earliest observable signs of emerging safety issues. At the level of **outputs**, the focus is on the conditions and performance of the system's components (infrastructure, rolling stock, human performance and organisational processes). They reflect how well the system is functioning on a day-to-day basis and provide the basis for understanding overall safety performance. **Activities** encompass the operational, maintenance, training, regulatory and organisational actions carried out by all stakeholders (the European Commission, ERA, Member States, NSAs, NIBs, assessment bodies and the wider sector). These activities can be grouped into six areas, which can also be viewed as system management functions.



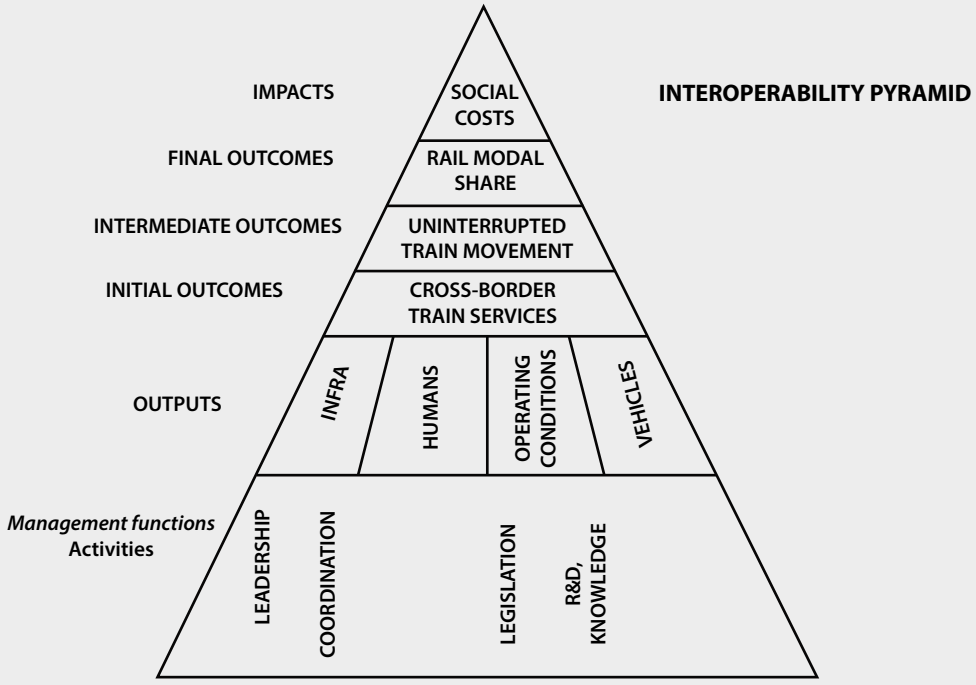
The CSIs include indicators at the levels of impacts, final outcomes and intermediate outcomes, and also a few at the level of outputs. Safety culture is a complex concept, and no common indicators exist at the EU level; however, the Agency has developed a safety culture model ([50]) to allow for a shared understanding and assist stakeholders in assessing and improving their organisational culture. Measurements at the level of activities are crucial for a complete understanding of the full chain and notably of the contribution of organisational, regulatory and contextual factors. They should be examined thoroughly in evaluation exercises. For routine safety performance monitoring, however, they remain a secondary focus, partly because the underlying cause–effect relationships are not yet fully understood.

Methodological framework for interoperability monitoring

In the proposed framework for interoperability performance monitoring, the **impacts** refer to evidence on whether outcomes are improving for long-term conditions of interest as a result of enhanced interoperability. The **final outcomes** consist of long-lasting desirable results, most notably an increase in the rail modal share and a more competitive and efficient rail system. **Intermediate outcomes** are indications of seamless train operation, particularly the reduction of unnecessary stops at national borders and the removal of technical or operational barriers. **Initial outcomes** are represented by the availability and quality of services operating across borders, which act as early signs of interoperability performance. At the level of **outputs**, the focus is on the condition and performance of infrastructure, vehicles, human resources and overall operating conditions. These outputs describe how well the system supports interoperable operations on a day-to-day basis. **Activities** can be grouped in several ways; four areas are proposed, which can also be interpreted as system management functions.

The European regulatory framework does not introduce any interoperability indicators, and so far the Agency has been looking mainly at the output level. Impacts have not yet been assessed systematically. However, this report explores and presents additional indicators at the level of outcomes (final, intermediate and initial), thereby expanding the analytical basis for monitoring interoperability performance.

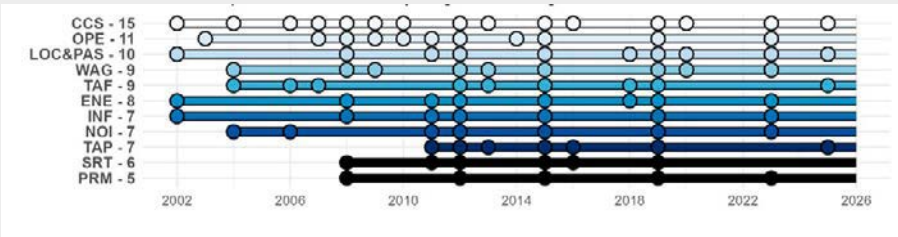
([50]) More information is available on ERA's website (https://www.era.europa.eu/activities/safety-culture_en#meeting2).


INTEROPERABILITY PYRAMID
IMPACTS
FINAL OUTCOMES
INTERMEDIATE OUTCOMES
INITIAL OUTCOMES
OUTPUTS
Management functions
Activities
SOCIAL COSTS
RAIL MODAL SHARE
UNINTERRUPTED TRAIN MOVEMENT
CROSS-BORDER TRAIN SERVICES
INFRA
HUMANS
OPERATING CONDITIONS
VEHICLES
LEADERSHIP
COORDINATION
LEGISLATION
R&D, KNOWLEDGE

Annex III. Overview of technical specifications for interoperability

A historical overview of TSIs' progressive development and stability across key technical domains within the European railway system over a 25-year period is reported in the following figure.

Each row represents a distinct TSI ([51]), with circles indicating years when it was adopted or revised.



This figure above reflects the progressive extension of the TSIs' scope and highlights the major milestones along the way (with 2019 marking the adaptation to the 4th Railway Package. It highlights how different TSIs – such as CCS, OPE and LOC & PAS – have evolved in terms of regulatory engagement. The intensity and continuity of activity vary across domains, reflecting the European Commission's strategic priorities, technological maturity and interoperability challenges. CCS, OPE and LOC & PAS show sustained engagement, while newer or more specialised areas like PRM and SRT exhibit more targeted bursts of activity ([52]).

The tables below offer overviews of structural and functional TSIs and their amendments from 1999 to 2026.

([51]) These elements need to be considered carefully, as some TSI names have changed over time – for example, LOC & PAS was previously referred to as high-speed and rolling stock – meaning that the scope of the TSIs has not always been the same.
([52]) It is also due to the nature of the subsystems.

Table IIIa: Structural TSIs and their amendments by year

Year	INF		ENE				RST				CCS	
	HS TSI INF	CR TSI INF	HS TSI ENE	CR TSI ENE	TSI SRT	TSI PRM	HS TSI RST	CR TSI LOC & PAS	CR TSI WAG	TSI NOI	HS TSI CCS	CR TSI CCS
1999											Decision 1999/569 on basic parameters EiF: 29.7.1999	
2000												
2001											Decision 2001/260 on basic parameters	
2002	Decision 2002/732 **(1st HS INF TS)** EiF: 30.11.2002		Decision 2002/733 **(1st HS ENE TSI)** EiF: 30.11.2002				Decision 2002/735 **(1st HS RST TSI)** EiF: 30.11.2002				Decision 2002/731 **(1st HS CCS TSI)**	
2003												
2004									Decision 2004/446 (on basic parameters)	Decision 2004/446 (on basic parameters) (CR only)	Decision 2004/447 (amendment)	Decision 2004/447 (on basic parameters)
2005												
2006										Decision 2006/66 **(1st NOI TSI)** (CR only) DoA: 8.8.2006	Decision 2006/860 **(2nd HS CCS TSI)** DoA: 7.11.2006	Decision 2006/679 **(1st CR CCS TSI)** DoA: 28.9.2006
2007											Decision 2007/153 (amendment) DoA: 6.3.2007	Decision 2007/153 (amendment) DoA: 7.3.2007
2008	Decision 2008/217 **(2nd HS INF TS)** EiF: 21.12.2007 DoA: 1.7.2008		Decision 2008/284 **(2nd HS ENE TSI)** EiF: 6.3.2008 DoA: 1.10.2008		Decision 2008/163 **(1st SRT TSI)** EiF: 21.12.2007 DoA: 1.7.2008	Decision 2008/164 **(1st PRM TSI)** EiF: 27.12.2007 DoA: 1.7.2008	Decision 2008/232 **(2nd HS RST TSI)** EiF: 21.2.2008 DoA: 1.9.2008		Decision 2006/861 **(1st CR WAG TSI)** DoA 31.1.2008		Decision 2008/386 (amendment) DoA: 1.6.2008	Decision 2008/386 (amendment) DoA: 1.6.2008
2009									Decision 2009/107 (amendment) DoA: 1.7.2009			Decision 2009/561 (amendment) DoA: 1.9.2009
2010											Decision 2010/79 (amendment) DoA: 1.4.2010	Decision 2010/79 (amendment) DoA: 1.4.2010
2011		Decision 2011/275 **(1st CR INF TSI)** DoA: 1.6.2011		Decision 2011/274 **(1st CR ENE TSI)** DoA: 1.6.2011	Decision 2011/291 (amendment) DoA: 1.6.2011			Decision 2011/291 **(1st CR LOC & PAS TSI)** DoA: 1.6.2011		Decision 2011/229 **(2nd NOI TSI)**		
2012	Decision 2012/462 (amendment) DoA: 24.1.2013		Decision 2012/462 (amendment) DoA: 24.1.2013				Decision 2012/462 (amendment) DoA: 24.1.2013			Decision 2012/462 (amendment) DoA: 4.1.2013	Decision 2012/463 (amendment) DoA: 24.1.2013	Decision 2012/463 (amendment) DoA: 24.1.2013
	Decision 2012/464/EU amending Decisions 2006/861/EC, 2008/163/EC, 2008/164/EC, 2008/217/EC, 2008/232/EC, 2008/284/EC, 2011/229/EU, 2011/274/EU, 2011/275/EU, 2011/291/EU etc. DoA: 24.1.2013										Decision 2012/88 **(1st merged CCS TSI)** DoA: 26.7.2012	

Year	INF		ENE		TSI SRT	TSI PRM	RST			TSI NOI	CCS	
	HS TSI INF	CR TSI INF	HS TSI ENE	CR TSI ENE			HS TSI RST	CR TSI LOC & PAS	CR TSI WAG		HS TSI CCS	CR TSI CCS
2013									Regulation 321/2013 **(2nd WAG TSI)** EiF: 13.4.2013 DoA: 1.1.2014		Decision 2012/696 (amendment) DoA: 1.1.2013	
2014									Regulation 1236/2013 (amendment) EiF: 4.12.2013 DoA: 1.1.2014			
2015	Regulation 1299/2014 **(1st merged INF TSI)** EiF/DoA: 1.1.2015		Regulation 1301/2014 **(1st merged ENE TSI)** EiF/DoA: 1.1.2015 Corrigendum L 13/13 (2015) (editorial corrections)		Regulation 1303/2014 **(2nd SRT TSI)** EiF/DoA: 1.1.2015	Regulation 1300/2014 **(2nd PRM TSI)** EiF/DoA: 1.1.2015	Regulation 1302/2014 **(2nd LOC & PAS TSI)** EiF/DoA: 1.1.2015 Corrigendum L 10/45 (2015) (editorial corrections)		Regulation 2015/924 (amendment) DoA: 1.7.2015	Regulation 1304/2014 **(3rd NOI TSI)** EiF/DoA: 1.1.2015	Decision 2015/14 (amendment) DoA: 1.7.2015	
2016					Regulation 2016/912 (correction) EiF: 30.6.2016						Regulation 2016/919 (recast) EiF: 5.7.2016 Corrigendum L 279/94 (2016) (editorial corrections)	
2017												
2018			Regulation 2018/868 (amendment) EiF: 4.7.2019				Regulation (EU) 2018/868 (amendment) EiF: 4.7.2019					
2019	Regulation 2019/776 (amendment) EiF: 16.6.2019		Regulation 2019/776 (amendment) EiF: 16.6.2019		Regulation 2019/776 (amendment) EiF: 16.6.2019	Regulation 2019/772 (amendment) EiF: 16.5.2019	Regulation 2019/776 (amendment) EiF: 16.6.2019		Regulation 2019/776 (amendment) EiF: 16.6.2019	Regulation 2019/774 (amendment) EiF: 16.6.2019	Regulation 2019/776 (amendment) EiF: 16.6.2019	
2020							Regulation 2020/387 (amendment) EiF: 9.3.2020		Regulation 2020/387 (amendment) EiF: 9.3.2020		Regulation 2020/387 (amendment) EiF: 9.3.2020 Regulation 2020/420 (amendment only DE language) EiF: 21.3.2020	
2021												
2022												
2023	Regulation 2023/1694 (amendment) EiF: 28.9.2023		Regulation 2023/1694 (amendment) EiF: 28.9.2023			Regulation 2023/1694 (amendment) EiF: 28.9.2023	Regulation 2023/1694 (amendment) EiF: 28.9.2023		Regulation 2023/1694 (amendment) EiF: 28.9.2023	Regulation 2023/1694 (amendment) EiF: 28.9.2023	Regulation 2023/1695 (repealing 2016/919) EiF: 28.9.2023	
2024												
2025							Regulation 2025/675 (amendment) EiF: 4.4.2025		Regulation 2025/2064 (amendment) EiF: 14.10.2025			
2026												

NB: CR, conventional; DoA, date of application; EiF, entry into force.

Table IIIb: Functional TSIs and their amendments by year

Year	TSI OPE		TA	
	HS TSI OPE	CR TSI OPE	CR TSI TAF	TSI TAP
2002	Decision 2002/734 (**1st HS OPE TSI**) DoA: 12.3.2003			
2003				
2004			Decision 2004/446 (on basic parameters)	
2005				
2006		Decision 2006/920 (**1st CR OPE TSI**) DoA: 18.5.2007	Regulation 62/2006 (**1st TAF TSI**) EiF: 19.1.2006	
2007				
2008	Decision 2008/231 **(2nd HS OPE TSI)** DoA: 1.9.2008			
2009		Decision 2009/107 (amendment) DoA: 1.7.2009		
2010	Decision 2010/640 (amendment) DoA: 25.10.2010 and 1.1.2014 (*)	Decision 2010/640 (amendment) DoA: 25.10.2010 and 1.1.2014 (*)		
2011		Decision 2011/314 (**2nd CR OPE TSI**) DoA: 1.1.2012 (**)		Regulation 454/2011 (**1st TAP TSI**) EiF: 13.5.2011
2012	Decision 2012/464 (amendment) DoA: 24.1.2013		Regulation 328/2012 (amendment) EiF: 8.5.2012	Regulation 665/2012 (amendment) EiF: 22.7.2012
2013				
2014	Decision 2012/757 OPE:2012 (**1st merged OPE TSI**) DoA: 1.1.2014		Regulation 280/2013 (amendment) EiF: 24.3.2013	Regulation 1273/2013 (amendment) EiF: 8.12.2013
2015	Regulation 2015/995 (amendment) EIF/DoA: 20.7.2015		Regulation 1305/2014 (**2nd TAF TSI**) EiF/DoA: 1.1.2015	Regulation 2015/302 (amendment) EIF: 18.3.2015
2016				Regulation 2016/527 (amendment) EIF: 25.4.2016
2017				
2018			Regulation 2018/278 (amendment) EIF: 16.3.2018	
2019	Regulation 2019/773 (**2nd OPE TSI**) EIF: 16.6.2021 (***)		Regulation 2019/778 (amendment) EIF: 16.6.2019	Regulation 2019/775 (amendment) EIF: 16.6.2019
2020				
2021				
2022				
2023	Regulation 2023/1693 (amendment) EiF: 28.9.2023			
2024				
2025				
2026			Regulation 2026/253 (**1st TEL TSI**) EiF: some articles by 2.9.2026; others by 2.3.2027	

(*) DoA of 1 January 2014 is only for point 6 of Annex I and point 5 of Annex II.

(**) Appendices P and Pa have different dates of application: Appendix P applies from 1 January 2012 until 31 December 2013, and Appendix Pa applies from 1 January 2014.

(***) Sections 4.2.2.1.3.2 and 4.4 of the Annex to this regulation apply from 16 June 2019. Section 4.2.2.5 and Appendix D1 of the Annex apply from 16 June 2019 in the Member States that have not notified ERA and the Commission in accordance with Article 57(2) of Directive (EU) 2016/797. Section 4.2.2.5 and Appendix D1 of the Annex apply from 16 June 2020 in the Member States that have notified ERA and the Commission in accordance with Article 57(2) of Directive (EU) 2016/797. Appendices A and C of the Annex apply from 16 June 2024 at the latest.

NB: DoA, date of application; EiF, entry into force; OPE, operation and traffic management.

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