Interoperability Overview 2025

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EUROPEAN UNION AGENCY FOR RAILWAYS

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Foreword

This summary report is one of the visible results of the Agency's activities in monitoring the progress of safety and interoperability. It is also part of the Agency's effort to provide to its stakeholders a more regular assessment of the development of railway interoperability and safety in the Single European Railway Area (SERA). This annual review focuses on some aspects of the progress in interoperability, whereas a first report for covering the progress in safety was published at the end of March 2025[1]. A larger analysis is performed by the Agency on a biennial basis with the statutory Report on Safety and Interoperability; the last biennial report was published in 2024 (and it is available on the Agency's website at this link), and the next edition will be published in 2026.

This overview draws on data available in the databases and registers hosted by the Agency, complemented by an annual data survey among National Safety Authorities and by official data available from the European Commission. The EU-27 countries, Norway and Switzerland are considered as members of the SERA for the purpose of this report.

The interpretation of the figures is the sole responsibility of the reader, who may wish to refer to the 2024 statutory Report on Safety and Interoperability for further guidance.

Additional statistics and insights (e.g. on rolling stock, infrastructure, etc.) from several sources in an accessible format per Member State are provided in the ERA Railway Factsheets on the Agency's website (at this link).

[1] It is available at: safety-overview-2025.pdf

Annual Overview on Interoperability in SERA (2025)

Executive summary

This annual overview confirms that, although interoperability of the Union railway system is improving, the progress has been slow so far and it appears to be unequal/uneven when looking at different areas.

Possibly and partially linked to the above, although not exclusively, railways have not increased their modal share in the past decade, despite being currently the most sustainable mode of transport. The modal share of freight rail transport in Europe is stagnating at a low level (around 12 %), and the share of people transported by railways has recovered the pre-COVID level (around 7 %). The international share of rail traffic is significant only for freight (over 50% of the total traffic) and very limited for passenger services. This picture is far away from the EU climate policy ambitions.

Greater use of rail is critical to satisfy the demand for more sustainable transport and would have substantial positive effects on pollution and energy consumption. In order to achieve the full potential of the Single European Railway Area, crossing internal EU borders should become a smoother process, enabling the increase of rail's modal share and international traffic; for this goal, the removal of interoperability barriers, the deployment of the ERTMS and the availability of appropriate rolling stock are key elements. Addressing cross-border operational challenges and eliminating persistent obstacles at borders will also be critical to advancing imminent key policy priorities on the horizon, such as the development of high-speed rail and the integration of dual-use mobility solutions.

Key findings:

- *The deployment of ERTMS remains still quite low and patchy across Europe and needs to be enhanced/accelerated in order to comply with the European Deployment Plan and increase interoperability of the EU rail network.*
- *Existing National Rules can still represent an obstacle to interoperability and effective cross border traffic, indicating the importance of removing NRs to strengthen railway competitiveness.*
- *The number of vehicle authorisations and vehicles authorised by ERA shows an increasing trend in recent years (especially for area of use in more Members States), with this positive momentum being sustained into 2024. In 2024 around 89% of those authorisations (for almost 19 600 vehicles) concerned an area of use in multiple countries.*
- *Single safety certificates (SSCs) are now gradually replacing the old scheme (i.e. safety certificates Part A and B). At the end of 2024, 20% of the total share of certificates were issued by ERA. The majority of the operations in the EU are domestic, while international operations are mostly related to freight.*
- *The degree of the implementation of single functions under TAP/TAF TSI by operators varies considerably among functions and it is progressing slowly, highlighting the need to keep on working on the implementation.*

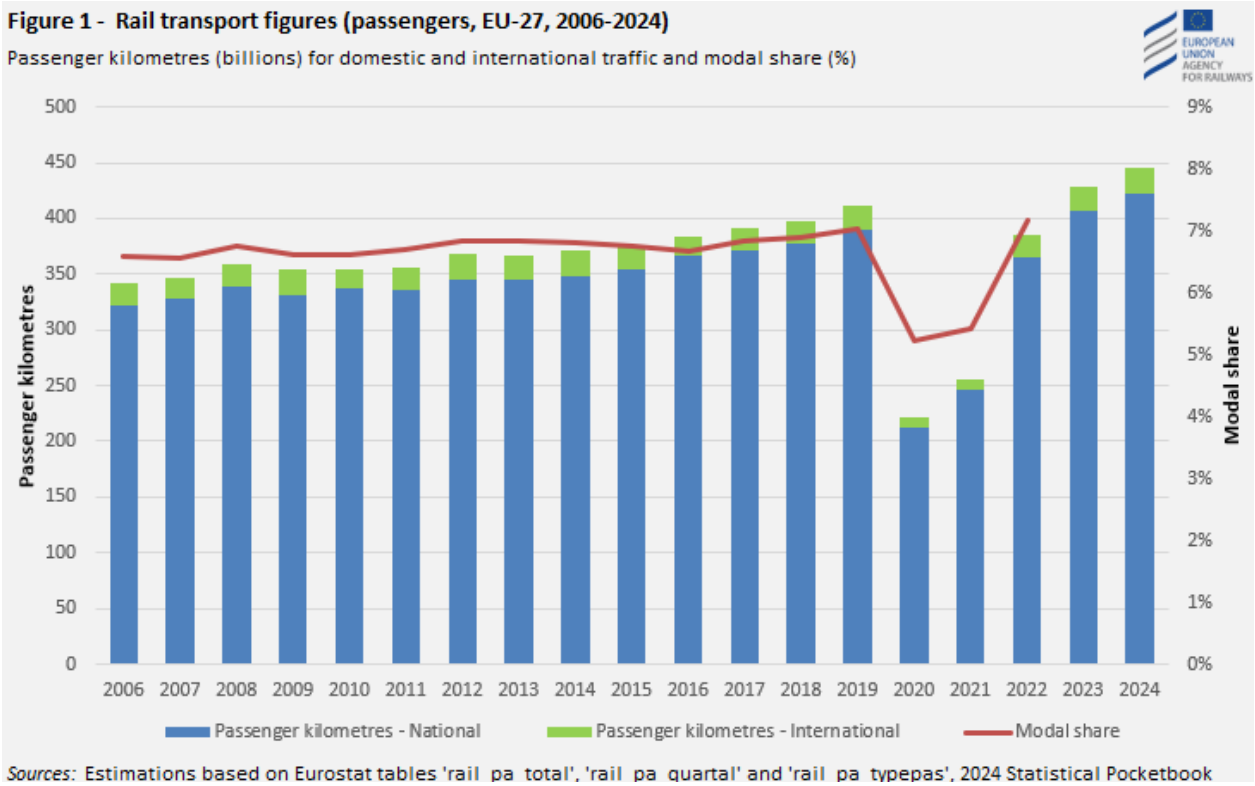
Rail transport figures (passenger kilometres and tonne kilometres by rail and relative modal share)

In this overview, the modal share[2] of rail transport and the percentage of rail international traffic across Europe are considered possible indirect measures of the impact of railway interoperability on actual transport performance. The modal split is calculated on the basis of transport performance (measured in passenger-kilometres and tonne-kilometres) of five transport modes: road, rail, inland waterways, air and maritime, and it is presented alongside absolute rail transport volumes (both domestic and international).

Figures 1 and 2 indicate that the European rail traffic has increased very little in the last decade; rail passenger volumes have slightly but constantly increased in the last years while freight volumes remained stable. The relative share of goods transported by railways, as compared to other modes, appears stagnant at rather low level (i.e. on average around 12 % in 2022), and the share of people transported by railways seems has recovered the pre-COVID level (i.e. on average around 7 % in 2022). Cross-border rail traffic is significant only for freight (over 50% of the total rail traffic) while it appears to be quite limited for rail passenger services.

Owing to the COVID-19 pandemic (and the related travel restrictions), in 2020 and 2021 the passenger-km in Europe (EU-27) recorded a significant decrease compared to 2019 (while clear signs of recovery are observable for the freight tonne-km in 2021). While passenger transport has shown a clear recovery in traffic volumes in the subsequent years, freight transport remains slightly below pre-COVID levels. It is worth noting, however, that freight proved more resilient during the pandemic, avoiding major declines - but it has yet to demonstrate any substantial growth since.

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

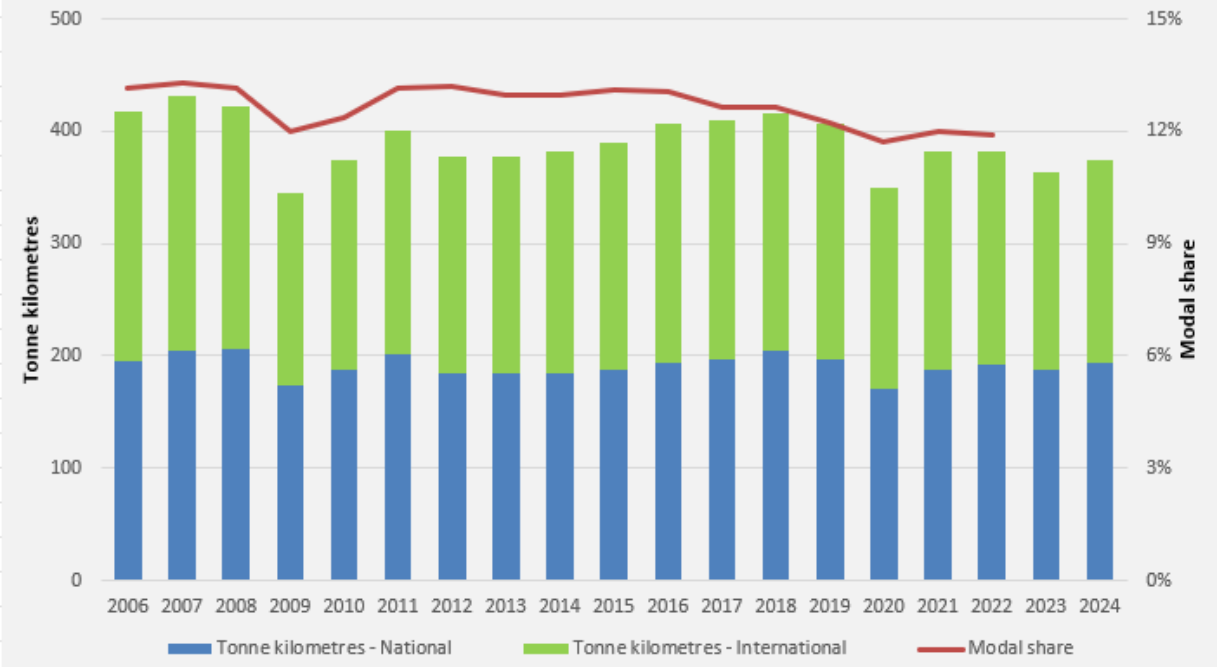


Sources: Estimations based on Eurostat tables 'rail_pa_total', 'rail_pa_quartal' and 'rail_pa_typepas', 2024 Statistical Pocketbook

[2] As reported in the Statistical pocketbook 2024 - European Commission.

Figure 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'. 2024 Statistical Pocketbook

Tracks equipped with train protection systems and lines with ETCS deployed

The ERTMS[3] is intended to replace legacy Train Protection 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. Although ideally all core/comprehensive networks[4] in the EU would be equipped with the system, emphasis has been put on nine Core Network Corridors (CNCs), with a view to maximising the return on investment. The long-term target adopted by the European Commission is to have the whole core trans-European transport network equipped with the ERTMS by 2030 and the whole comprehensive network equipped by 2050.

The deployment of the European Train Control System (ETCS) on the EU railway network has been slow so far. Figure 3 shows that the deployment of the ETCS has been limited whereas only a few SERA countries[5] have deployed the system on a significant length of lines and/or a significant share of their network. The data refer to the entire railway network of SERA countries as available in RINF. Deployment varies considerably among the Member States, reflecting national rail transport policy and investment priorities. According to

[3] ERTMS comprises of the European Train Control System (ETCS), i.e. a cab-signalling system that incorporates automatic train protection, the Global System for Mobile communications for Railways (GSM-R) and operating rules.

[4] See Regulation (EU) n. 1315/2013 (as amended)

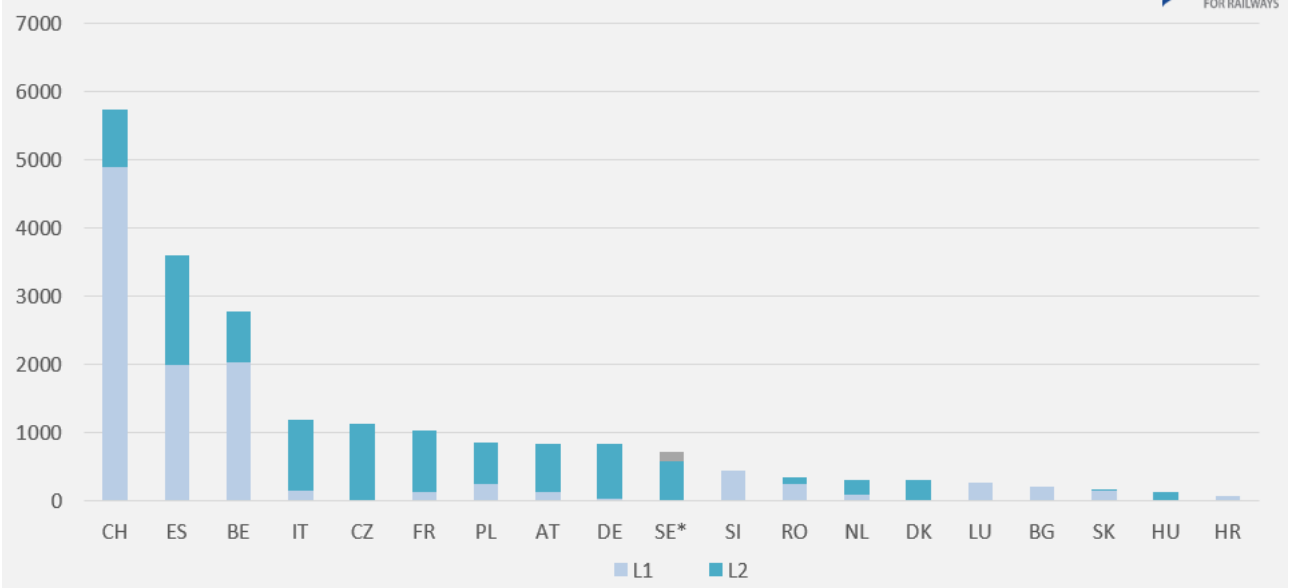
[5] SERA countries refer to those participating in the Single European Railway Area (EU-27 countries, Norway and Switzerland).

the records in the RINF, the leading implementers (in terms of kilometres of all lines equipped with the ETCS) are Switzerland, Spain, Belgium and Italy.

ERTMS deployment on the CNC network had reached 15 % (ETCS) and 61 % (GSM-R) at the end of February 2023[6]; a substantially greater effort is needed to meet the European deployment plan targets. Progress has been uneven among individual corridors; at the end of 2024, ETCS is operational on around 22 % of the Mediterranean and the North Sea-Rhine-Main-Danube Corridor corridors, compared with 6% – 18 % on other corridors (Figure 4).

Figure 3 - Length of railway lines equipped with ETCS (EU-27 + CH, end 2024)

Length in kilometers per ETCS level



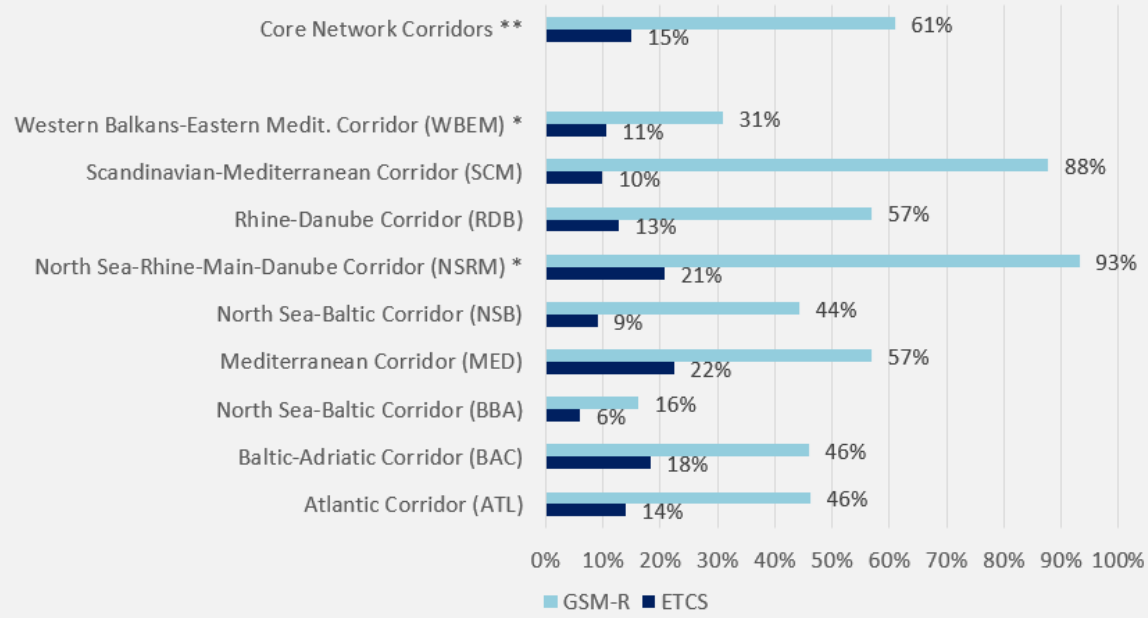
Note: (*) Grey bar refers to an ERTMS regional solution without a train Integrity function implemented on low traffic lines (https://www.ertms.net/wp-content/uploads/2021/06/19.ERTMS-in-Sweden.pdf)

Source: Register of Infrastructure (RINF), data extracted on 10 January 2025

[6] State of play - European Commission.

Figure 4 - Deployment of ERTMS on Core Network Corridors (end 2024)

ETCS and GSM-R equipped lines among core network corridor lines



Note: * - With the 2024 TEN-T Regulation update some corridors' names are different compared with the previous AIO Report.

** - Values at the end of 2023

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

Applicable national technical rules for vehicles authorisations[7]

Existing national rules can represent an obstacle to interoperability and effective cross border traffic. They can also be technical barriers to the vehicle authorisation process. In fact, the existence and use of national rules that are not notified and/or wrongfully applied leads to unnecessary uncertainty and costs, thus also affecting interoperability.

To avoid this, Member States shall notify their national rules to the European Commission and the Agency, the latter being in charge of the assessment of these national rules to check their compatibility with the EU legal framework. National technical rules are allowed only to cover open points in TSIs, aspects of vehicle compatibility with the network (e.g. class B signalling systems) and other very limited cases as set out in Directive (EU) 2016/797.

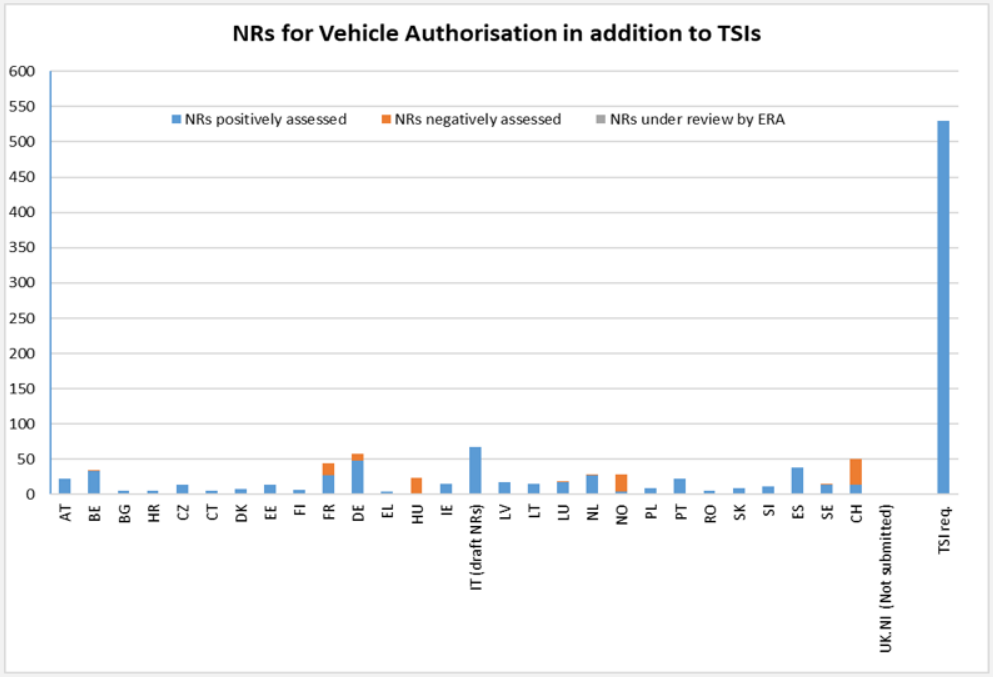
This process ensures that only the relevant rules are published in the publicly accessible Reference Document Database and gradually transferred to the Single Rules Database.

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 721 in September 2025, with some differences among the countries. Although there has been an impressive decrease in the number

[7] *'National rules' means all binding rules adopted in a Member State, irrespective of the body issuing them, which contain railway safety or technical requirements, other than those laid down by Union or international rules which are applicable within that Member State to railway undertakings, infrastructure managers or third parties* (Article 2 (30) of the Interoperability Directive EU 2016/797). Other existing national rules relate to safety (and operations) or to fixed installations.

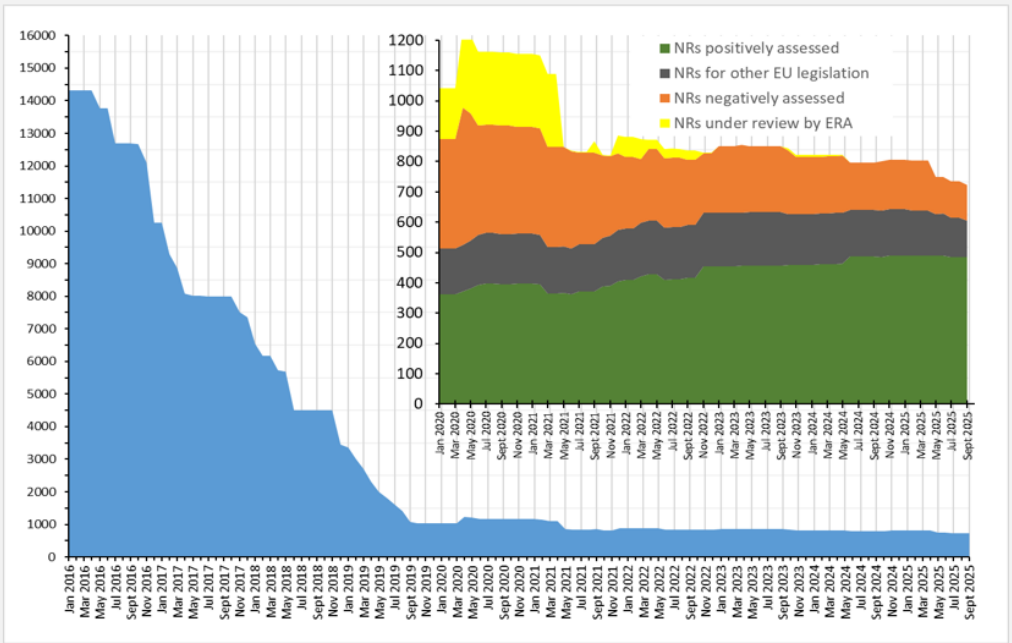
of published rules in the last years, this trend has flattened since 2019, as potentially removable rules are becoming scarce. Further reduction in the number of national rules is expected as Member States must revise their existing national rules and repeal redundant/contradictory ones.

Figure 5 - National rules for vehicle authorisation in addition to the latest TSIs
(EU-27 + CH + NO, September 2025)



Source: Reference Document Database (RDD) maintained by ERA

Figure 6 - National rules for vehicle authorisation
(EU-27 + CH + NO + UK, 2016–2025)



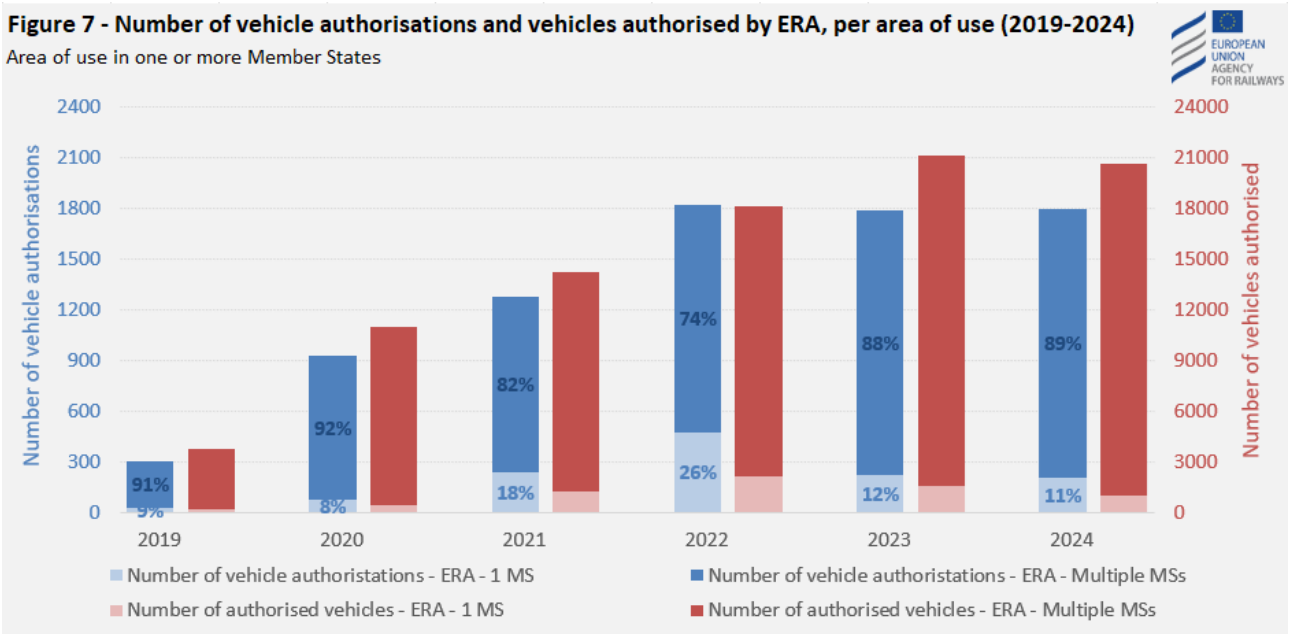
Note: NRs from UK are considered until 2021
Source: Reference Document Database (RDD) maintained by ERA

Vehicle authorisations

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 area of use, that is a network or networks within one or more Member States where the vehicle may be used. A further authorisation is required if changes are made to the area of use (e.g. extension of the area of use). According to Directive (EU) 2016/797 (Interoperability Directive), when the area of use is limited to a network or networks within one Member State, the applicant is able to choose whether it submits its application for vehicle authorisation to the NSA of that Member State or to ERA. However, in the case of vehicles intended for use in more than one Member State, the authorisation must be issued by ERA. The number of vehicle authorisations handled by the Agency with area of use in multiple countries provide an indication of the vehicles authorised for international use across Europe.

Figures 7 and 8 provide the number of vehicle authorisations and vehicles authorised by ERA per area of use and type of vehicle. Around 1 800 vehicle authorisations were submitted and handled by ERA in 2024, with more than 20 600 vehicles authorised. The number of authorisations of all types (e.g. conformity to type, first authorisation, renewal and extension of area of use) has exhibited an increasing trend in recent years (which can also be attributed to the progress in the transposition of the fourth railway package), with this positive momentum being sustained into 2024. Between 2019 and 2024, vehicle authorisations and authorised vehicles with an area of use in only one Member State increased steadily until 2022, but then declined and stabilised in 2024 at levels similar to the previous year. In addition, vehicle authorisations and authorised vehicles with an area of use in multiple Member States grew significantly throughout the same period, reflecting a strong trend toward cross-border interoperability. The majority of authorisations in 2024 were related to wagons, followed by locomotives and train sets, while almost 1 600 authorisations (for more than 19 600 vehicles) concerned an area of use in multiple countries (with almost all of the wagons authorised for the use in more than one Member State).

Figure 7 - Number of vehicle authorisations and vehicles authorised by ERA, per area of use (2019-2024)

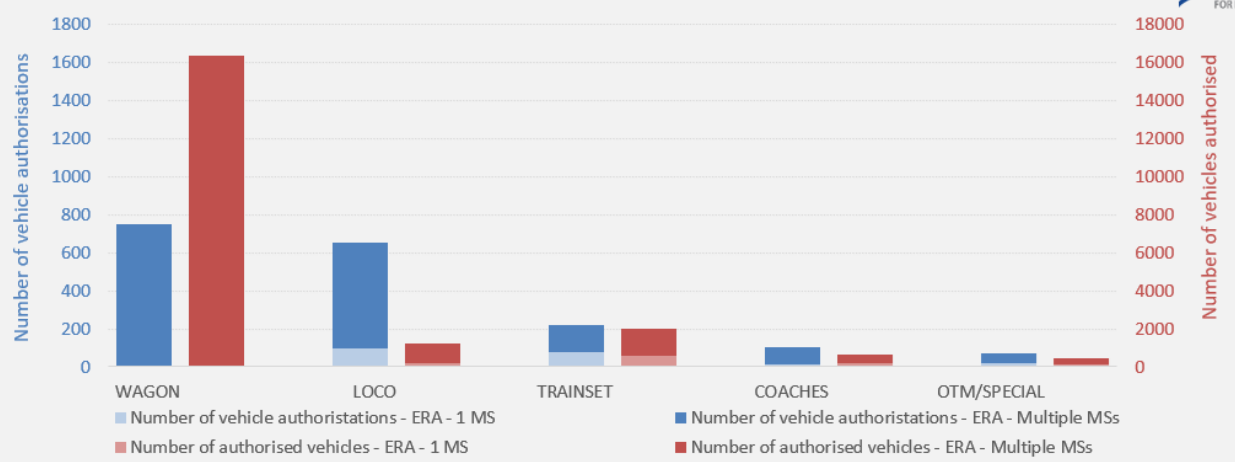


Note: Data for 2019 since July. In 2019 and 2020 full transposition did not occur in all Member States

Source: One-Stop Shop (OSS)

Figure 8 - Number of vehicle authorisations and vehicles authorised by ERA, per area of use and category of vehicle (2024)

Area of use in one or more Member States



Note: Each trainset is counted as single unit/vehicle

Source: One-Stop Shop (OSS)

Safety Certificates

The Railway Safety Directive requires the railway undertakings (RUs) to hold a safety certificate to access the railway infrastructure. Historically, until the entry into force of the fourth railway package, the safety certificate comprised a valid Part A safety certificate (certification confirming acceptance of the railway's undertaking safety management system) and at least one Part B safety certificate (certification confirming acceptance of the provisions adopted by the railway undertaking to meet specific requirements necessary for the safe supply of its services on a relevant network). A single safety certificate (SSC) is now gradually replacing the old scheme.

The number of RUs holding valid Part B Safety Certificates (SC) in more than one Member State and the number of SSCs with a multi-country area of operation may provide an indication of international rail services across Europe.

Figures 9 and 10 indicate the number of RUs per Member State (EU27 + NO) holding a Part B SC or an SSC with area of operation only in that country or in more Member States (including that country) valid during the period from the end of 2021 to the end of 2024. The figures show the general decrease (between the two considered years) of RUs holding Part B SCs, gradually replaced by the SSCs (which increase in number).

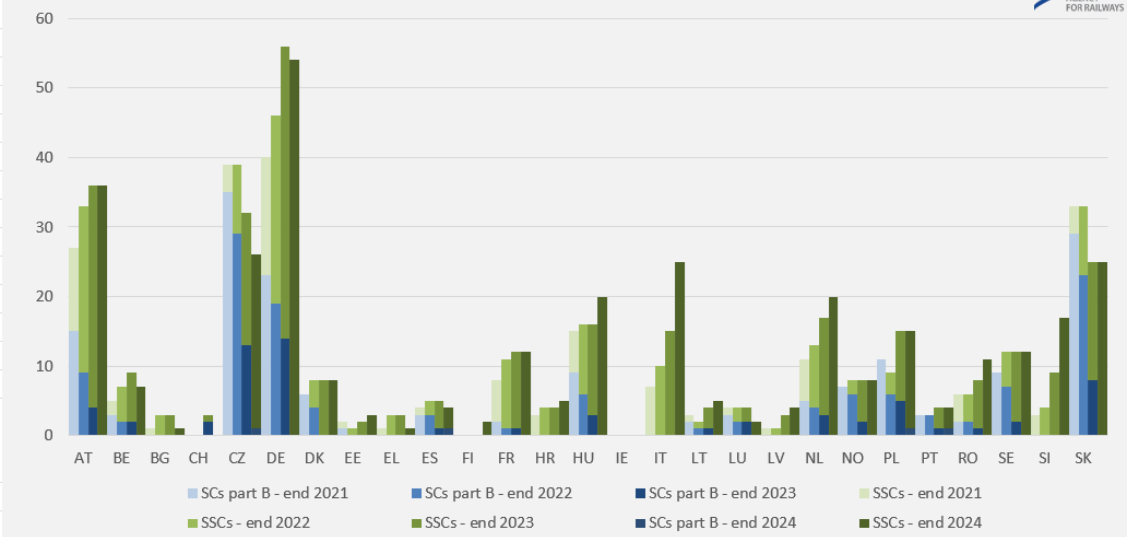
Figure 11, instead, shows the number of SCs Part B and SSCs issued by NSAs or ERA (valid at the end of 2024), per area of operation. SCs Part B and Part A for the same RU (operating in more MSs) are counted only once. 20% of the total share of certificates are managed by ERA which could increase at least to around 25% after the end of the transition period of the fourth railway package (i.e. when all Part B SCs will be replaced by SSCs).

Domestic operations represent most of the operations in the EU (87% share) with SCs that are mostly issued by NSAs and for which half of companies have already migrated to an SSC (and so to the new regulatory framework). Around one third of SSCs issued by NSAs originate from Germany, Czech Republic and Poland.

As evident also from Figure 12 (focusing only on the SSCs issued by ERA per type and area of operations), international operations are mostly freight operations.

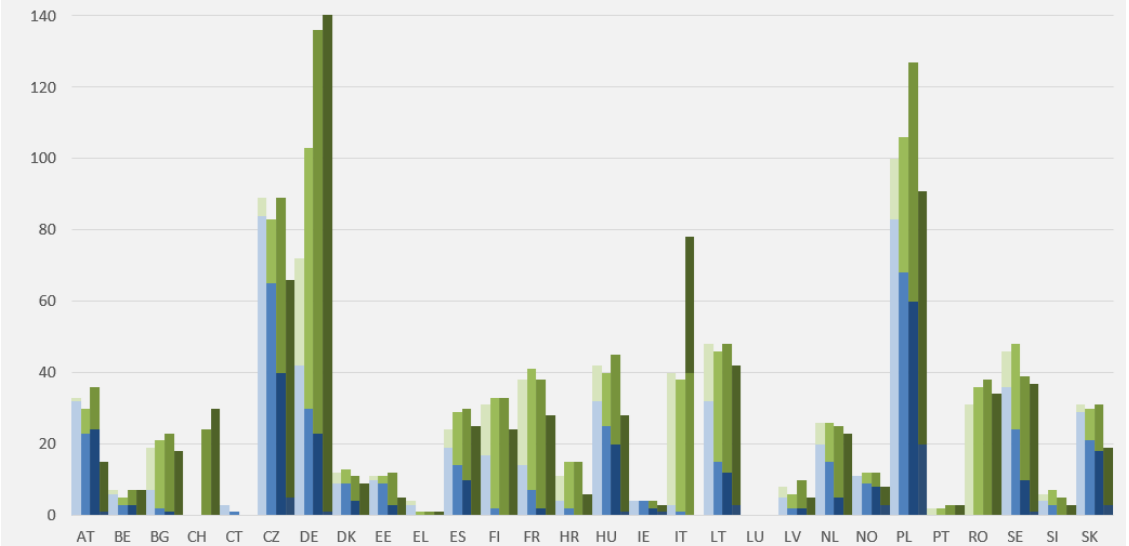
It should be noted that, granting a (single) safety certificate for an area of operation composed of 1 MS does not mean that the RU exclusively operates at national level. Many sister companies with their own (single) safety certificates still exist and manage their operations through partnership agreements or contractual relationships with other RUs either when crossing the State border or when operating to border stations. In addition, operations to border stations in neighbouring Member States, which represent around 6% of SSCs issued by NSAs, are not counted as international operations.

Figure 9 - Member States concerned with Part B SCs and SSCs for RUs operating in more than one Member State
(EU-27 + CH + NO, end of 2021, 2022, 2023, and 2024)



Source: ERADIS (ERA)

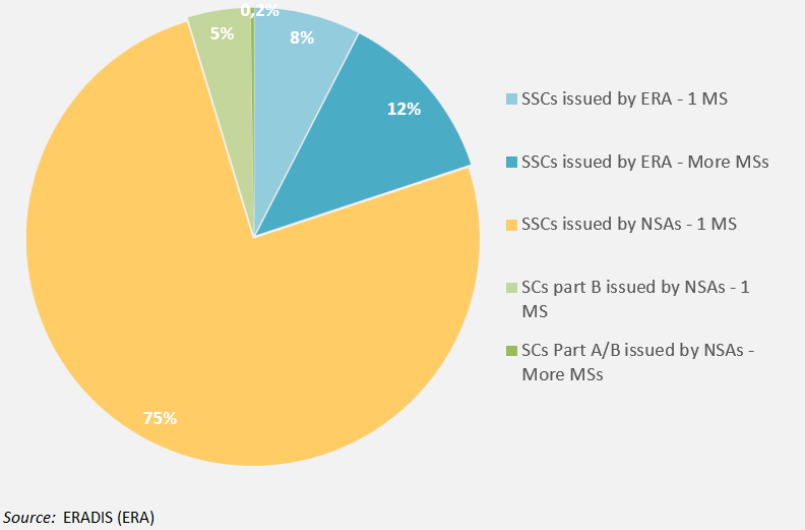
Figure 10 - Member States concerned with Part B SCs and SSCs for RUs operating in one Member State
(EU-27 + CH + NO, end of 2021, 2022, 2023 and 2024)



Source: ERADIS (ERA)

Figure 11 - SCs and SSCs issued by NSAs and ERA per area of operation

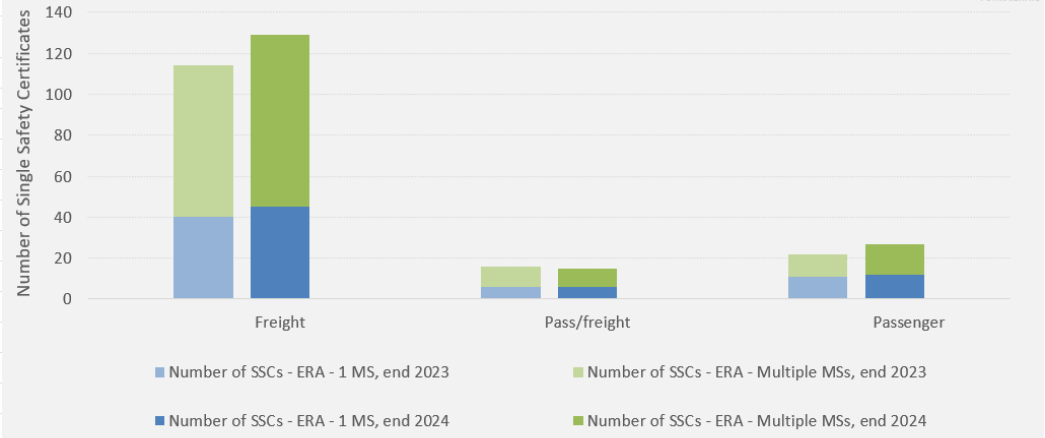
Percentage of SCs and SSCs (on the total), EU-27 +CH +NO, valid at the end of 2024



Source: ERADIS (ERA)

Figure 12 - Single Safety Certificates issued by ERA, per type and area of operation

(EU-27 + NO, end of 2023 and 2024)



Source: ERADIS (ERA)

TAF - TAP TSI implementation

The Technical Specifications for Interoperability relating to Telematics Applications for Freight services (TAF TSI) set the functional and technical standards for exchanging harmonised information between infrastructure managers, railway undertakings, combined transport operators and other wagon keepers to allow ultimately the sharing of up-to-date transport information to freight customers about the status of the wagon, train and the consignment.

The Technical Specifications for Interoperability relating to Telematics Applications for Passenger services (TAP TSI) were introduced to allow for the harmonisation/standardisation of procedures, data and messages to be exchanged between the computer systems of different railway undertakings and of the tickets vendors

to provide reliable information and services to passengers and also to issue tickets for journeys across the European Union railway network. Furthermore, the data exchange between the railway undertakings and infrastructure managers is standardised.

Following years of design and development, the implementation by the RUs and IMs is now underway. The railway operators have been gradually integrating TAF and TAP functions into their IT systems and exchange the TAF and TAP information among themselves.

The indicator used to monitor the progress on the implementation of TAF – TAP TSI specific functions by the railway sector is the share of operators that have implemented a certain TAP/TAF function in their IT systems, weighted by the tonne-kilometres for RUs and line-km for IMs performed on European scale. The target value for the indicator is to have 100% of the individual functions implemented as communicated in the Master Plan of the railway operators. A specific Implementation Monitoring Group led by the Agency and involving the sector's Joint Sector Group and the National Contact Points was set up for the purpose of collecting data on the TAF – TAP TSI implementation. This Group deploys a dedicated survey which allows the RUs, Ticket Vendors, Wagon Keepers and IMs to report once a year on the degree of implementation of specific TAF – TAP TSI functions. Data provided by the RUs and IMs have a good degree of reliability. The implementation rate is now reported with a higher level of detail, with separate breakdowns for IM and RU stakeholders, whereas previously the data were presented in a single, aggregated format. While analysing the trends in the deployment of the functions, attention should be paid to the fact that the population of respondents may not be identical across various reporting periods.

As reported in Figure 13 and 14, the degree of the implementation of single TAF and TAP[8] functions by type of operators varies considerably among functions, highlighting the need to keep on working on the implementation[9].

Regarding the degree of implementation of single TAP and TAF functions by RU and IM, Figure 13 shows the following takeaways.

- *Five TAF functions for RU have been fully implemented by more than 75 % of respondents (at end of 2024), while another five functions (wagon movement, consignment note data and train running forecast, path request and details) are on average 45 % of the market.*
- *Three TAP functions (company code, common interface, and train ready) for RUs have been fully implemented by more than 75 % of respondents (by the end of 2024), while four functions (path details, path request, train running information and interrupted message) are on average 39 % of the market.*
- *Five TAF and TAP functions for IM have been fully implemented by more than 75 % of respondents (at the end of 2024), while four functions (new identifiers) represent 58% of the market.*

[8] Both figures report the status of implementation for TAP and TAF at end 2024.

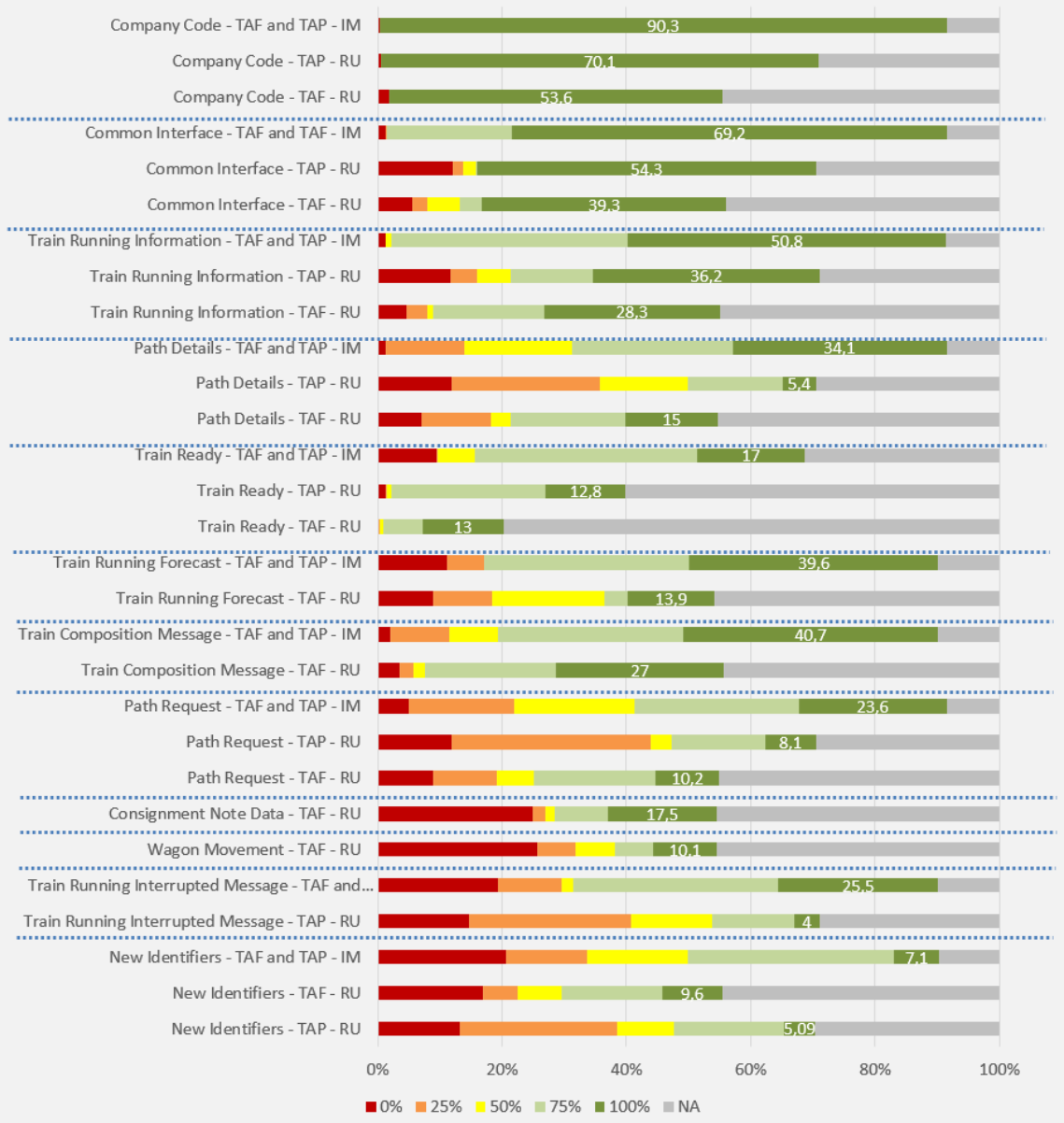
[9] Although not reported in Figures 13 and 14, wagon keepers, representing more than 60 % of the European freight wagon fleet, have achieved a high degree of implementation for the relevant mandatory TAF and TSI functions (ERA Report on Railway Safety and Interoperability in the EU - 2024).

The data suggests that IMs generally have higher implementation rates than RUs, with a more pronounced difference in functions such as company code, common interface, train running information, path details and path request.

Regarding the degree of implementation for the retail function for RUs (Figure 14), considering the varying response rate and that not all RUs are subject to implementing all of them, most of the functions shows a quite high degree of implementation, but for a few of them (e.g. exchange of special tariffs/fares and of IRT tariffs/fares) the implementation is much lower.

Figure 13 - Degree of implementation of TAP and TAF functions by RU and IM

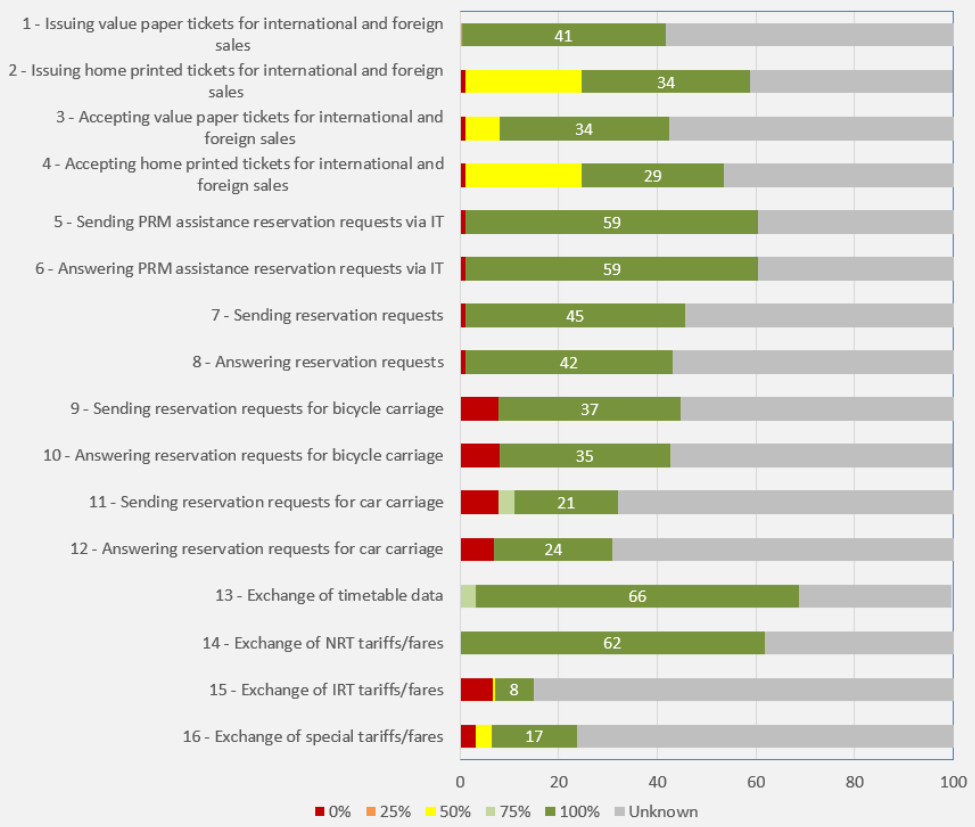
(% of European market share, 2024)



Sources: TAF and TAP surveys of RUs and IMs (IRG of the TAP JSG); EUROSTAT; SCIVerkehr publications, annual reports

Figure 14 - Degree of implementation for the retail functions by RU

(% of market share, end 2024)



Notes: NRT = Non-Reservation-Integrated Tickets; IRT = Integrated Reservation Tickets; PRM = Persons of Reduced Mobility

Sources: ERA TAP survey of RUs; EUROSTAT; SCIVerkehr publications, annual reports

Concluding remarks

The data collected for 2024 and reported in the figures above confirm a slow progress for railway interoperability of the Union railway system. Despite some positive developments, rail in Europe is not yet achieving its full potential; possibly and partially linked to this, although not exclusively, the European rail modal share remains low for freight (while for passenger there has been a slight increase), and international rail passenger services quite limited.

The deployment of the ETCS on the European rail network has been limited and uneven so far; similarly, the degree of the implementation of single functions under TAP - TAF TSI by rail operators varies considerably among functions, highlighting the need to keep on working on the implementation. In particular, IMs generally have higher implementation rates than RUs, with a more pronounced difference in functions such as company code, common interface, train running information, path details and path request.

Existing national rules can represent an obstacle to interoperability and effective cross border traffic and should be limited to the minimum necessary. Further reduction in the number of national rules is expected

as Member States should further revise their existing national rules and repeal redundant/contradictory ones.

Figures on vehicle authorisations and (single) safety certificates show clear progress in the transposition of the fourth railway package, also with the increasing role of ERA in issuing VAs (especially for multiple Member States) and SSCs. Areas of use/operations, though, remain mainly domestic, with international operations mostly related to freight.

These facts urge the Agency and the entire rail sector to continue to work relentlessly and tirelessly to improve railway interoperability in the SERA and make the railways fit for future growth and competition with other transport modes. Further indicators and analysis will be made available in the Agency's Biennial Report to be published in 2026.