2022 PRIME Benchmarking report

KPI & Benchmarking Subgroup PRIME

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Foreword by PRIME co-chairs

We are pleased to present the seventh PRIME KPI and Benchmarking Report, which marks a significant achievement in the ongoing effort to improve the performance and sustainability of the rail sector. An unprecedented 21 infrastructure managers participated in this year's report, underlining the commitment to data sharing, dialogue, and adoption of best practice across Europe.

This edition covers the period from 2018 to 2022 and provides a comprehensive view of the rail sector's challenges and achievements, particularly amidst the challenging backdrop of the COVID-19 pandemic. The onset of the pandemic and the subsequent implementation of travel restrictions had a profound impact, but with the 2022 data showcasing that rail is back on track and that it made a significant recovery for the industry.

The benchmarking is an essential pillar in the quest for a more efficient, reliable, and sustainable rail network. It not only helps infrastructure managers to measure their performance but also serves as a valuable resource for the European Commission to identify best practices and monitor progress towards EU policy objectives. Moreover, it provides all stakeholders with a lens through which to observe evolving trends, as well as the strengths and weaknesses within the sector.

Since the PRIME KPI & Benchmarking Subgroup was established in 2014, its contribution to developing a stable benchmarking framework at the EU level has been instrumental. Through diligent meetings, exchanges, and the continuous enhancement of the dataset, the Subgroup has significantly improved the report year after year. The harmonization of data definitions and KPIs, which is central to the Subgroup's efforts, results in the annual update of the KPI Catalogue, made available on the PRIME website.

We firmly believe that PRIME data and definitions can serve the needs of a large range of rail experts and policymakers. By measuring and sharing the results, we aim to demonstrate to the wider public that the rail sector is accountable toward the wider society and committed to improving services.

We would like to thank the PRIME KPI & Benchmarking Subgroup chairs Jude Carey from Irish Rail and Raymond Geurts van Kessel from ProRail together with the members of this group from 24 organisations, the Commission, and the European Union Agency for Railways, for this outstanding achievement. Your unwavering dedication has paved the way for this commendable accomplishment.

PRIME co-chairs

Kristian Schmidt
European Commission, DG MOVE
Director of Land Transport

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Executive summary

The Platform of Rail Infrastructure Managers in Europe (PRIME) was established to improve the cooperation between rail infrastructure managers across Europe and to assist in the knowledge transfer and benchmarking process of the participants. The following report is the seventh benchmarking report covering the years 2018-2022 and includes data of 21 infrastructure managers.

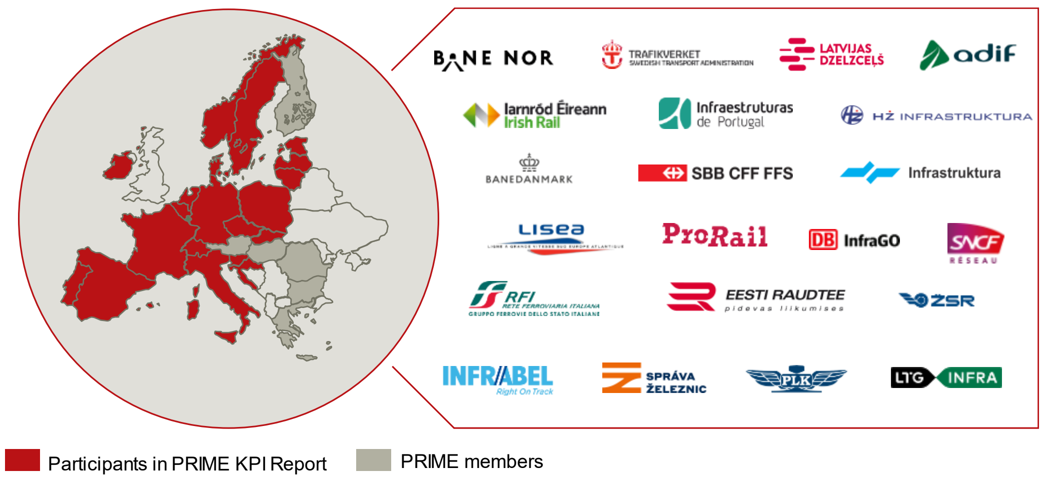

Figure 1: Participants of the PRIME KPI & Benchmarking Report and PRIME members

Recent years have been marked by significant challenges for the rail sector. The Covid-19 pandemic led to an unprecedented decline in passenger ridership, while Russia's war against Ukraine primarily affected the freight rail industry. Despite these obstacles the urgency to fight climate change has never been greater, and for this rail plays a key role in reducing emissions in the transport sector. The European Green Deal and the Sustainable and Smart Mobility Strategy, along with the related Action Plan, create the European framework for this effort.

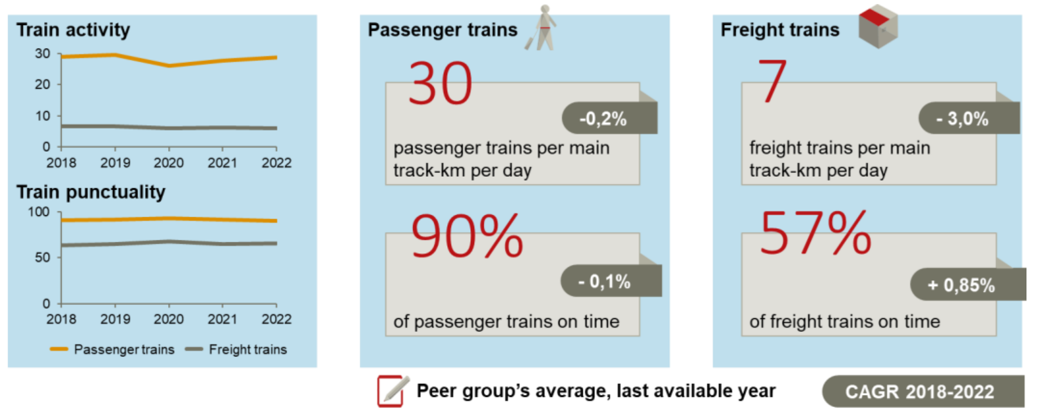

Figure 2: Summary of train activity and punctuality[1]

In 2022, although some pandemic-related regulatory measures were still partially in place, major mobility restrictions like lockdowns and international travel limitations were lifted. This had a significant impact on rail transportation: a marked recovery in train activity, already noticeable in 2021, continued through 2022, and almost completely returned to pre-pandemic levels. Some organisations were even able to surpass their 2019 values. However, it is important to note that rail has not fully recovered in terms of passenger numbers. While they increased in almost all countries compared to 2020, numbers remained below pre-pandemic levels. This suggests that, although train activity has resumed, passenger volumes have not fully recovered, which may be attributed to shifts in mobility patterns, such as the increase in remote work as well as ongoing health and safety concerns.

When examining freight train activity, the impact of the pandemic was less significant, with much smaller decreases in activity. However, over the five-year period from 2018 to 2022, the decline is more pronounced. This can partly be attributed to the drastic decline in rail freight in the Baltic states, an existing trend that was intensified following Russia's war against Ukraine. Additionally, this decrease in freight rail can also be attributed to the increased challenges and competition that it is currently facing from other transportation modes, especially road transport, which has increased in recent years.

The increase in train activity also affected the punctuality of the organisations. Compared to 2020, when train punctuality was higher due to reduced traffic, the data from 2022 shows punctuality levels returning to pre-pandemic levels. Freight

[1] The time series chart and the compound annual growth rate (CAGR) include only those infrastructure managers that provided data for the full period from 2018 to 2022. The peer group average, which is highlighted in red, includes data from all infrastructure managers who provided data for at least one year within the specified range.

train punctuality, however, has seen an improvement and is now averaging 57% in the peer group.

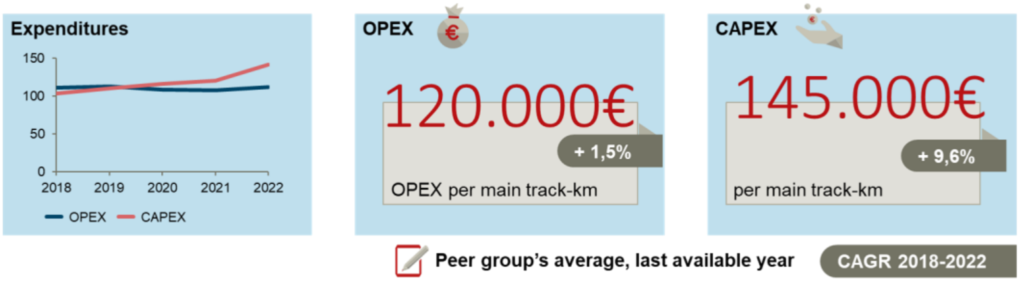

Figure 3: Summary of operational and capital expenditure[2]

Infrastructure managers participating in the report allocated, on average, EUR 120 000 per main track-km to operational tasks, whereas capital expenditure has an average of EUR 145 000 per main track-km. While PPP-adjusted operational expenditures only experienced a slight increase of 1,5% over the period between 2018 and 2022, PPP-adjusted capital expenditure for the peer group increased by almost 10%[3]. It is crucial to consider that these figures are nominal values. The real increase is estimated to be lower, as materials critical to the rail construction industry (e.g. steel) and relevant operational costs such as energy experienced significant inflation.

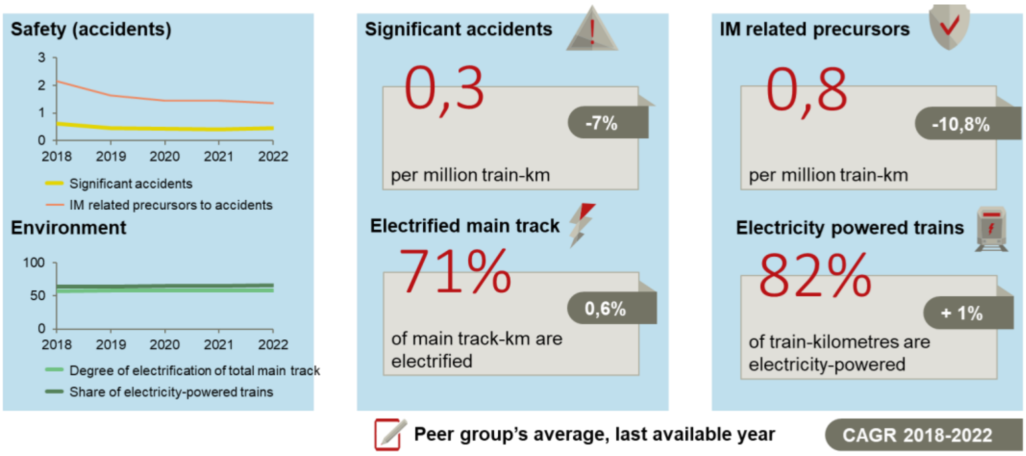

Figure 4: Summary of safety and environment[4]

[2] The time series chart and the compound annual growth rate (CAGR) include only those infrastructure managers that provided data for the full period from 2018 to 2022. The peer group average, which is highlighted in red, includes data from all infrastructure managers who provided data for at least one year within the specified range.

[3] Individually 9 out of 14 infrastructure manager reported positive average annual growth in operational expenditure between 2018 and 2022.

[4] The time series chart and the compound annual growth rate (CAGR) include only those infrastructure managers that provided data for the full period from 2018 to 2022. The peer group

Key objectives of the European Union include further increasing the safety and sustainability of rail. Safety is improving, showing a marked decrease in significant accidents and infrastructure manager related precursors between 2018 and 2022. The degree of electrification of main tracks has remained relatively stable at 72%. However, the share of electricity powered trains exhibits a positive trend with a +1% growth, particularly thanks to the electrification efforts by infrastructure managers who previously had a lower level of electrification.

average, which is highlighted in red, includes data from all infrastructure managers who provided data for at least one year within the specified range.

1. Introduction

Rail is the safest and greenest mode of land transport and plays an essential role in the green mobility transformation of Europe. Today, general transport emissions represent around 25% of the EU's total greenhouse gas emissions. It is the sole sector that has increased its emissions since 1990[5].

To counteract the threats of climate change, the European Commission committed itself to becoming the first climate neutral continent by 2050 through the introduction of the European Green Deal. One of the main aims of the plan is to reach a 55% reduction in net greenhouse gas emissions by 2030. An integral part of the European Green Deal is the Sustainable and Smart Mobility Strategy and the related Action Plan which includes 82 initiatives in 10 key areas for action, each with concrete measures. The strategy serves as a guideline for the next years, to achieve a 90% reduction in greenhouse gas emissions in transport by 2050 and is built around the objectives of creating a sustainable, smart, and resilient mobility sector[6]. Rail has an essential role in this transformation, which is why the Commission has set several ambitious rail transport-related milestones to be reached by 2050, such as to:

- **Double rail freight** traffic
- **Triple high-speed** rail traffic
- **Complete** a fully operational and multimodal **Trans-European Transport Network (TEN-T)** equipped for sustainable and smart transport.

To fulfil its role in the European Green Deal and meet the objectives of the Sustainable and Smart Mobility Strategy, rail must be sustainable, safe, resilient, reliable, smart, and affordable. Moreover, it needs to be able to adapt to the changing needs of passengers and industries. Therefore, the achievement depends on the performance of both, rail operators and infrastructure managers (IM). The latter are responsible for developing, maintaining, and managing all aspects of the rail infrastructure. The PRIME KPI & Benchmarking Subgroup collects data to monitor their performances in these categories.

- **Safety** is a top priority. Although safety risks cannot be eliminated safety levels can be significantly improved by good asset condition and the adoption of safety policies. Investing in state-of-the-art technology (e.g. ERTMS), rethinking networks, stations, level-crossings, and training of track workers and

[5] EEA: GHG emissions by sector in the EU-28, 1990-2016. https://www.eea.europa.eu/data-and-maps/daviz/ghg-emissions-by-sector-in#tab-chart_1

[6] European Commission. New transport proposals target greater efficiency and more sustainable travel. https://ec.europa.eu/commission/presscorner/detail/en/ip_21_6776

awareness-raising campaigns for the public, are available tools for infrastructure managers.

- **Ensuring the optimal use of rail infrastructure** based on the needs of customers is essential and can be promoted through adequate instruments such as economic incentives and/or charging and performance schemes, in line with EU law[7]. As capacity is limited, and new construction is very costly and time intensive, getting maximum capacity out of the existing infrastructure network is paramount. This depends on efficient capacity allocation and traffic management, as well as on systems like the European Rail Traffic Management System (ERTMS), which allows for shorter head times between trains.
- **Strong cooperation between all actors across borders** is vital to enabling smooth operation between countries, overcoming fragmented national structures, and creating a truly open and interoperable railway market. It paves the way for major international projects and services linking European cities and citizens with each other. The Platform for Rail Infrastructure Managers in Europe (PRIME) is a central element of this cooperation. In 2021 the European Commission published a proposal for the revision of the TEN-T Regulation which includes strengthened parameters for rail infrastructure and introduces an extended core network covering additional strategic rail links. At the same time, the Commission presented an Action Plan to boost long-distance and cross-border passenger rail services, in order to make rail more attractive as a travel option. In the view of Russia’s war of aggression against the Ukraine the European Commission presented its Solidarity Lanes Action Plan to help Ukraine export its products via rail, road and inland waterways.
- Efficient and far-sighted maintenance and renewals increase **reliability and availability**. Reducing the number of asset failures through proactive maintenance reduces delays and cancellations, thereby making rail more attractive to users. Conversely, tracks in bad condition, and therefore subject to permanent or temporary speed limitations or even closure, lead to longer travel times and in some cases lower utilisation, as the route becomes unattractive.
- Rail is already one of the most environmentally friendly and energy-efficient transport modes. But **environmental sustainability** is not only about more people using rail, but also about rail itself becoming greener. Looking at the trend in greenhouse gas emission by transport mode between 1990 and 2019 rail is the only mode that decreased its emissions by 60%[8]. Rail has the

[7] Directive 2012/34/EU of the European Parliament and of the Council of 21 November 2012 establishing a single European railway area http://data.europa.eu/eli/dir/2012/34/oj

[8] EEA Report: Transport and environment report 2021. https://www.eea.europa.eu//publications/transport-and-environment-report-2021 P. 17

potential to become completely carbon neutral well before the rest of the economy by 2050.

- **Providing good value for money** is important, as infrastructure managers are largely funded by the public and State budgets are constrained. Governments have a part to play here too. In accordance with EU law[9], Member States must ensure that the accounts of infrastructure managers are balanced. Low levels of investment over an extended period can negatively impact operational costs, safety, and overall performance.

The past few years have been challenging for the rail sector. Transport was one of the sectors most affected by the Covid-19 pandemic, with falling ridership and changing mobility behaviour. As this report covers the years between 2018 and 2022, it shows the beginning of the pandemic, but with 2022 also the year when the main restriction was lifted. As such, it provides interesting insights and a chance to understand the changes in the system a little better. While it is important to take external circumstances into account, it would be a limited view to attribute individual developments solely to the pandemic and, in the case of freight, to Russia's war against Ukraine. Rail transport is a complex system that depends on a variety of factors and actors.

[9] Directive 2012/34/EU of the European Parliament and of the Council of 21 November 2012 establishing a single European railway area. http://data.europa.eu/eli/dir/2012/34/oj

2. PRIME KPI & benchmarking

Platform of Rail Infrastructure Managers in Europe (PRIME)

The Platform of Rail Infrastructure Managers in Europe (PRIME) was established between the European Commission's transport and mobility directorate general (DG MOVE), and rail infrastructure managers in 2013. Its main objective is to improve the cooperation between rail infrastructure managers across Europe. Furthermore, the platform supports and facilitates the implementation of European rail policy and develops performance benchmarking for the exchange of best practices.

Alongside the European Commission and the European Union Agency for Railways (ERA), PRIME now has 37 industry members including all main infrastructure managers of EU Member States and of the EFTA members Switzerland and Norway. Four industry associations of European rail infrastructure managers participate as observers[10].

KPI & Benchmarking Subgroup

A central idea behind PRIME is to give infrastructure managers, who are natural monopolies, an opportunity to learn from each other. The performance benchmarking currently covers several dimensions of rail infrastructure management: costs, safety, sustainable development, punctuality, resilience, and digitalisation. The core of the benchmarking is the catalogue, which contains a clear and concise documentation of the PRIME key performance indicators (KPIs).

The number of infrastructure managers participating in the subgroup has steadily increased. The first pilot benchmarking started in 2015 with 9 infrastructure managers collecting data predating to 2012. In this year's benchmarking, based on 2022 data, 23 infrastructure managers have contributed to the report, of which 21 are involved in the external report presented in the table below. Estonia's infrastructure manager EVR is presented for the very first time in this year's report.

[10] PRIME members: https://wikis.ec.europa.eu/display/primeinfrastructure/About+PRIME

Infrastructure managers participating in the report

Infrastructure manager	Logo & abbreviation		Country	
Adif		Adif		Spain
Bane NOR		Bane NOR		Norway
Banedanmark		BDK		Denmark
DB InfraGO AG		DB		Germany
AS Eesti Raudtee		EVR		Estonia
HŽ Infrastruktura d.o.o.		HŽI		Croatia
Infraestruturas de Portugal S.A.		IP		Portugal
Infrabel		Infrabel		Belgium
Iarnród Éireann – Irish Rail		IÉ		Ireland
Latvijas dzelzceļš		LDZ		Latvia
AB LTG Infra		LTGI		Lithuania
LISEA[11]		LISEA		France
PKP PLK		PKP PLK		Poland
ProRail		ProRail		Netherlands
RFI		RFI		Italy
SBB CFF FFS		SBB		Switzerland
SNCF RÉSEAU		SNCF R.		France
Správa železnic, s.o.		SŽCZ		Czechia
SŽ-Infrastruktura d.o.o.		SŽ-I		Slovenia
Trafikverket		TRV		Sweden
Železnice Slovenskej republiky		ŽSR		Slovakia

Table 1: Infrastructure managers participating in the report

Purpose and empirical methodological approach of the report

The purpose of the public report is to illustrate the current performance of infrastructure managers, to identify areas for further analysis and to provide relevant data to the railway industry and related sectors, politicians, researchers, economists, and other interested stakeholders. Above all, the general objective of the

[11] LISEA (South Europe Atlantic High-Speed Rail Line) operates exclusively the high-speed line between Tours and Bordeaux.

report is to deliver insight and inspiration for more informed decisions in developing a sustainable and competitive infrastructure management which can provide high quality services.

In this report, the key indicators will each be shown in a benchmark graph and a time series graph, presenting a cross-comparison of infrastructure managers and key trends. As for previous reports, data for the last five years is included: this year's report covering 2018-2022. Basing the yearly reports on 5-year time series as opposed to the entirety of historical data since 2012 puts the focus on most recent developments as well as **allows for more companies to be presented in the graphs as it makes it easier for new members to reach the threshold for historical data.** To ensure clarity and comparability, only complete time series are shown, including the average development of the peer group. The time series charts are complemented with the compound annual growth rate (CAGR) to increase the visibility of the overall developments. The CAGR also only shows complete time series.

The benchmarking charts show 2022 data (or the latest available year) and the average of the years 2018-2022 for every individual infrastructure manager[12], plus the peer group's average weighted by the denominator. This weighting means that, if, for example, the KPI reflects cost per main track kilometre (denominator), organisations with large networks will have a correspondingly higher impact on the weighted average. Thus, the weighted average reflects the average of the combined total network of all participating infrastructure managers. The accuracy of the data is indicated and highlighted in a lighter colour in the charts for values that deviate from the standard. The reason for including deviating figures even if they are less comparable is to provide a more complete dataset and enable more infrastructure managers to contribute data. Fewer deviating figures are anticipated with each future report. The benchmarking charts always list the 21 infrastructure managers that took part in the report, regardless of whether they have delivered data for the specific KPI or not. This means that 0 can mean either 0 or no data, zero values are indicated in the footnote[13].

It is important to note that railway as a system consist of both railway undertakings (RUs) and infrastructure managers (IMs), which are together responsible for a smooth operation of rail traffic. This report however represents exclusively data from infrastructure managers, and not railway undertakings.

The quantitative results can only be interpreted meaningfully if the main influencing factors are considered. Without considering the different

[12] Infrastructure managers are abbreviated as "IM" in the charts.
[13] The weighted average includes zero values.

characteristics of the infrastructure managers and their structural peculiarities, meaningful comparisons cannot be achieved. LISEA for example exclusively operates one high-speed line and has a regional network, whereas the other infrastructure managers are active nationwide. To facilitate the interpretation of the figures and the quantitative results, background information on the specific contexts of the infrastructure managers and rail infrastructures is provided for each indicator. More general information on influencing factors can be found in the Annex 4.1, and some macro level data on the infrastructure managers and the countries they are operating in can be found in Annex 4.2.

Selected indicators and report structure

The indicators presented in this report are selected from the data pool of the PRIME KPI & Benchmarking Subgroup. They aim to display a status quo alongside the European objectives, covering the fields of finance, safety, environment, performance, and delivery. Figure 4 shows these groups as well as the selected indicators that are analysed in the report. The numbers next to the KPI point to the chapter in which they are treated.

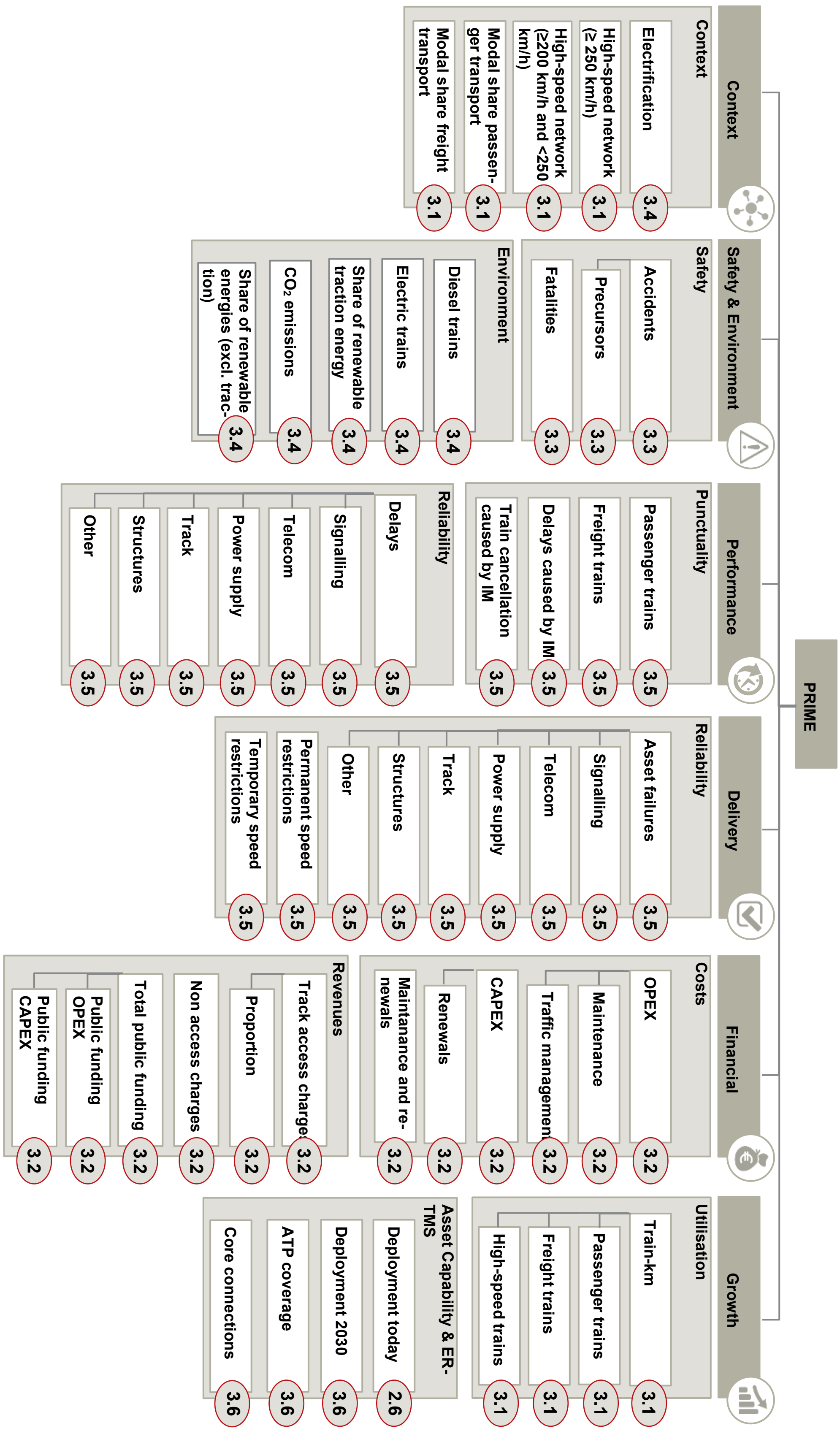

Figure 5: Selected indicators for the report and their chapters in the report

3. Main rail industry characteristics and trends

This core chapter aims to give an overview of the development and status quo of the infrastructure managers' performance, using finance, safety, environment, performance, and delivery, and ERTMS deployment as the selected indicators.

Before analysing the more specific indicators it is important to understand the major characteristics and trends of the rail industry in the states of participating members. For this reason, the development of the following will be outlined briefly: modal share, network, and utilisation in Chapter 3.1 and work through the different categories from Chapter 3.2 onwards.

3.1 Overview of main rail industry characteristics and trends

3.1.1 Summary of industry characteristics

EU-wide objectives
• Increasing the passenger volume in rail and shifting more freight transport from road to rail are key objectives of the European Green Deal and the Sustainable and Smart Mobility Strategy. • Rail needs to be an attractive alternative to more polluting modes of transport, both for passengers and freight. • The EU's Sustainable and Smart Mobility Strategy lays the foundation for making the EU transport system greener and supporting digital transformation. It sets out ambitious rail-related targets by 2050[14], such as to: – Double freight traffic – Triple high-speed traffic – Complete a fully operational, multimodal Trans-European Transport Network (TEN-T) for sustainable and smart transport with high-speed connectivity

[14] COM/2020/789 final: Sustainable and Smart Mobility Strategy – putting European transport on track for the future. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0789&from

Peer group's performance

- The modal share of rail passenger transport showed a significant increase from 2021 to 2022, reaching pre-pandemic levels in half of the participating countries.
- The impact of COVID-19 on freight rail transport was considerably less severe than on passenger traffic. However, there is a notable declining trend in freight rail transport, particularly in the Baltic countries.
- After the unprecedented decline in train activity due to the Covid-19 pandemic, passenger and freight train utilization have nearly returned to pre-pandemic levels. However, the number of passengers and the volume of goods transported remain lower.
- The impacts of the Russian war against Ukraine are most evident in the Baltic countries, where this trend had been emerging over the past few years but became significantly stronger since 2021.
- Ten infrastructure managers operate high-speed lines with a speed of equal or above 200 km/h.
- The network size ranges between 670 (LISEA) and 55.200 (DB) main track-kilometres.
- The average density of the peer group's network is 59 main track-kilometres per 1.000 km^2.
- The degree of utilisation ranges between 8 and 69 passenger trains and 0 and 19 freight trains per main track-kilometre per day.
- 4 infrastructure managers have a high-speed train activity of over 6 trains per main track-kilometre per day

3.1.2 Development and benchmark of industry characteristics

Rail infrastructure is developed over decades and determines the shape and the management of the network for long periods of time. This chapter aims to give an overview of the status quo on the rail sector of the country operated in and shows the infrastructure manager's main network characteristics on a macro level.

Rail characteristics indicators:

PRIME members are reporting twelve indicators on rail characteristics:

- National modal share of rail in passenger transport

- National modal share of rail in freight transport
- Total track-kilometres
- Total main track-kilometres
- Proportion of high-speed main track-kilometres (≥ 200 km/h and <250 km/h)
- Proportion of passenger high-speed main track-kilometres (≥ 250 km/h)
- Total main line-kilometres
- Total passenger high-speed main line-kilometres (≥ 200 km/h)
- Degree of network utilisation of passenger trains
- Degree of network utilisation of freight trains
- Degree of network utilisation of passenger high-speed trains (≥ 200 km/h)
- Degree of network utilisation of all trains
- Number of passengers transported by rail
- Goods transported by rail and road

To increase comparability of these values across infrastructure managers, utilisation is measured in train-kilometres per main track-kilometre.

Modal share of rail transport

Modal share is an important indicator for the European Union in developing sustainable transport. For passenger inland transport the modal share compares the share of passenger cars, buses/coaches, and railways. The modal share of rail in freight inland transport shows the national rail tonne-kilometres compared to total tonne-kilometres carried on road, inland waterways, and rail freight. Figures 6 and 9 present the benchmark of the modal share of rail in inland passenger and freight transport in the Participating states, based on data of the European Commission. Figures 7 and 10 show the national trends of rail in inland passenger and freight modal share development.

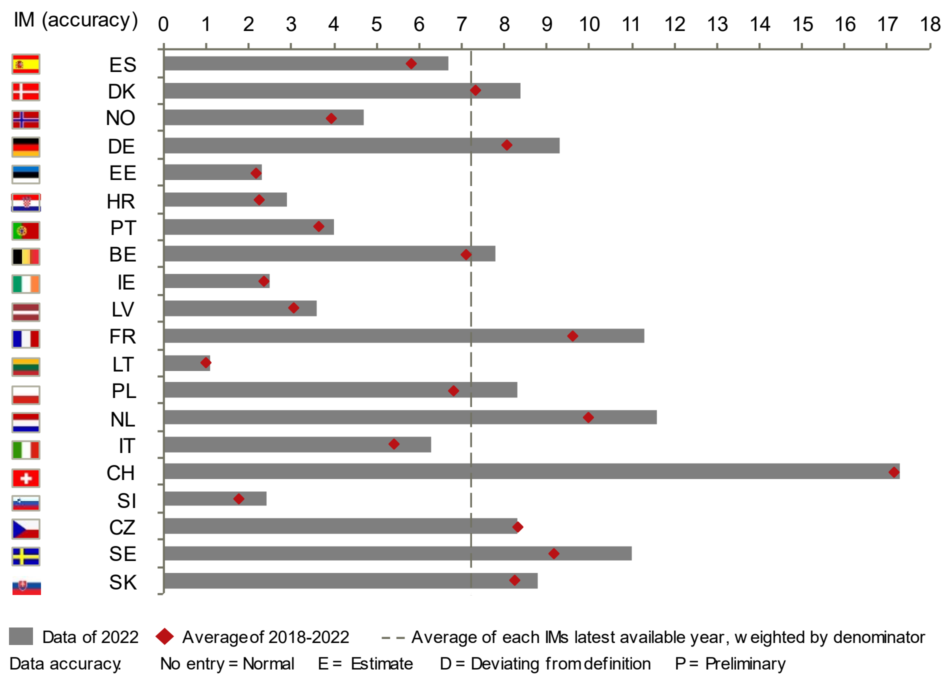

Figure 6: National modal share of rail in inland passenger transport (% of passenger-km)[15]

Figure 6 shows the cross-comparison of the states of participating members in 2022 for passenger rail transport. The peer group's average is 7.1%, while the spread across the peer group is 4%. The highest modal share can be found in Switzerland with a modal share of over 17% for rail, while the lowest value for passenger rail is in Lithuania with 1%.

The red rhombuses in the figure indicate the average value between 2018 and 2022. It is visible that most countries had a significantly higher value in 2022 compared to the average of these years, which was impacted by lower ridership during the pandemic years.

[15] Source: European Commission, Eurostat. MS = Participating state

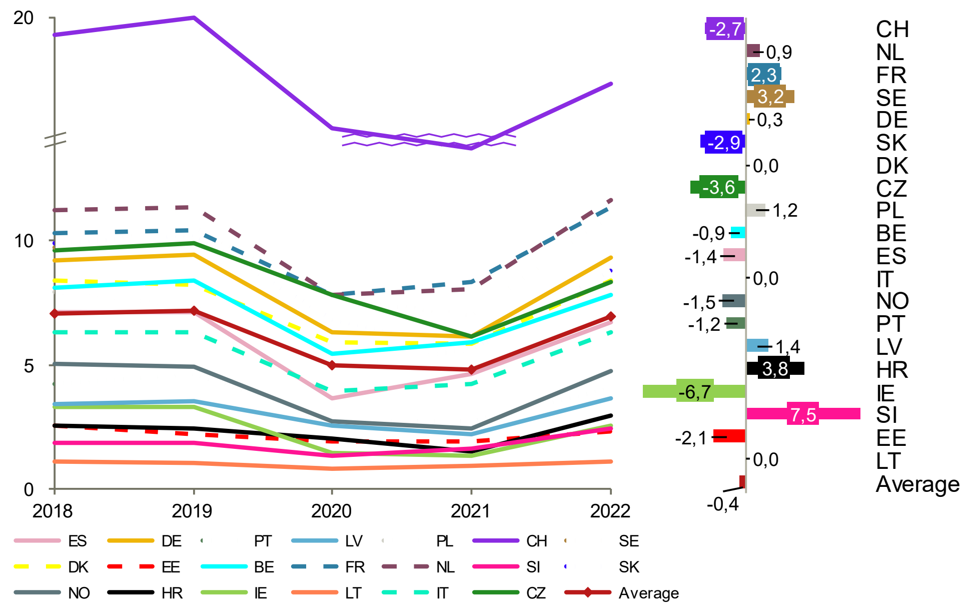

Figure 7: National modal share of rail in inland passenger transport (% of passenger-km) and CAGR (%) in 2018-2022[16]

Figure 7 visualizes the development of the modal share of passenger rail transport for the participating countries from 2018 to 2022. The data highlights the impact of the COVID-19 pandemic from its onset in early 2020 until 2022, when most travel restrictions had been lifted. From 2019 to 2020, the average decrease in the modal share of rail transport was 30%. In 2021 the modal share remained relatively low, as many travel restrictions were still in place, and people were cautious about using public transport modes like rail. In 2022, however, most countries reached pre-pandemic levels, with some even exceeding their 2019 values. Notable examples include Slovenia, France, Poland, and Sweden.

The modal share in passenger transport in a country highly depends on several geographic and socio-demographic factors as well as the network size, density, and utilisation. The main parameters affecting the mobility choice are travel time, availability and reliability, supply of alternative transportation means, comfort, and price factors. Switzerland is a good example for having relatively good conditions in most of these parameters. As the country has a relatively small territory, the travel distances are comparatively low. Due to the high rail network density and frequency, most of the cities can be reached in a relatively short time. Additionally, its performance in punctuality and reliability is high and the travel comfort and quality of rail services are among the best. Furthermore, it is important to

[16] Source: European Commission, Eurostat.

note that Switzerland also has a long-term vision in rail infrastructure development, accompanied by a substantial budget.

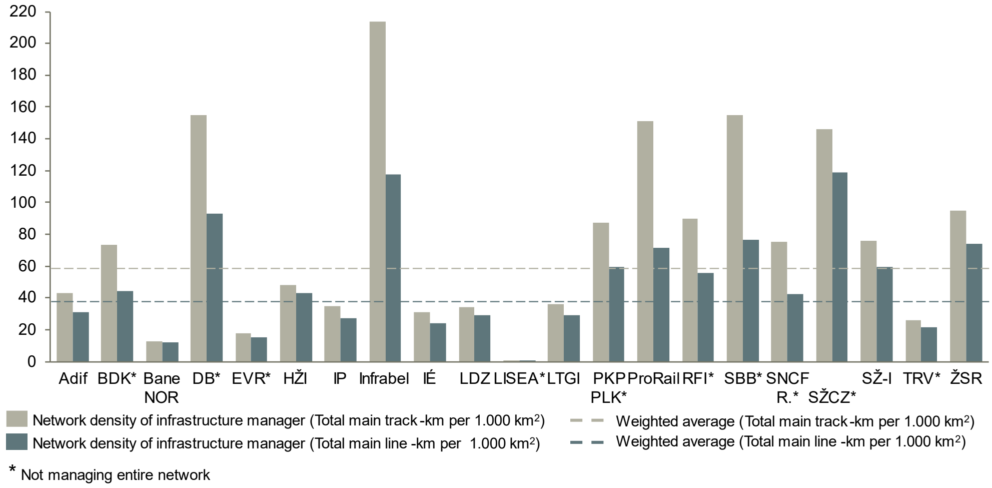

Figure 8: Network density of infrastructure manager (Total main track-km and total main line-km per 1.000 km²)

Network density of the infrastructure managers is illustrated in figure 8 both measured in main line-kilometres and main track-kilometres. It is important to note, that the graph does not reflect the national railway density of the country, but the network of the infrastructure managers represented in this report. Infrastructure managers that do not manage the entire national network are marked with an asterisk next to the company's name. Network density measured in main line-kilometres per square kilometre describes the coverage of the area from an operational perspective, in other words how well the area can be supplied with trains in the first place. Main track-kilometres per square kilometre describes the network density from the infrastructure manager's perspective, how many assets are managed in the respective area. Infrabel has the highest network density followed by ProRail, SBB and DB, while Bane NOR, EVR and TRV have the lowest. LISEA is a special case as it operates exclusively the high-speed line between Tours and Bordeaux.

Socio-demographic factors such as mobility demand, age structure, income level, household size, car ownership and environmental awareness might also play a role in determining the modal share. With a growing share of elderly people in all European countries, modal share of rail could increase more in countries where a higher percentage of elderly people are still active and mobile. With reference to income levels, the effect on rail usage can point in both directions: an increase in income level might have an impact on car ownership and consequently reduce the number of people traveling by train or higher income might increase the number of people who can afford to travel by train. In addition, the drastic change in work and travel patterns during the pandemic might have lasting effects on modal share and mobility. The effect of home office options seems to show in the passenger numbers, some infrastructure managers report that especially on Fridays the trains are emptier than before.

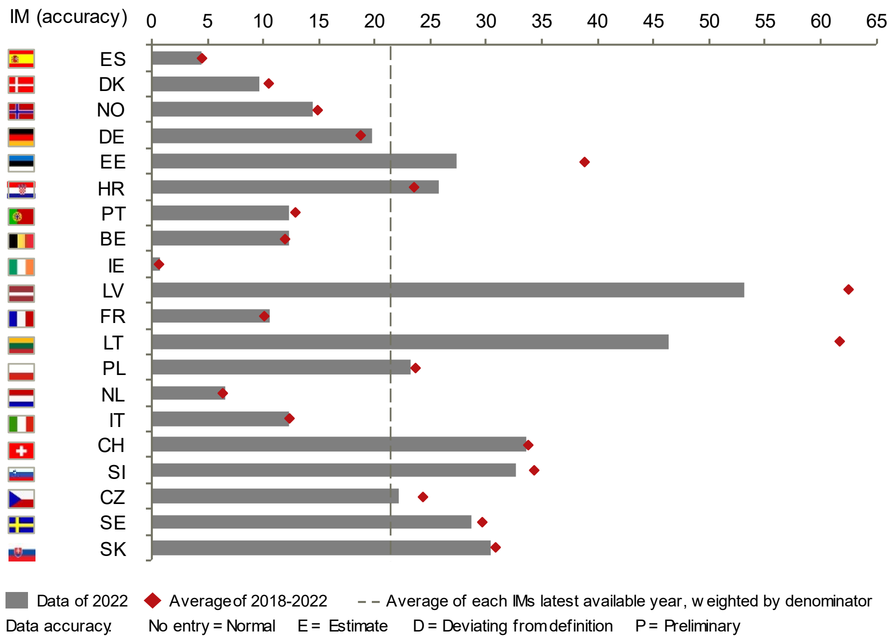

Figure 9: National modal share of rail in inland freight transport (% of tonne-km)[17]

The bandwidth of individual results for freight is more significant than the one of passenger transport which is also reflected by the standard deviation of 14%. It is noticeable that the share of rail freight in the Baltic countries is significantly higher than in the rest of the EU. In Latvia rail accounts for 53% and Lithuania for 46% of the total inland freight transport, followed by Switzerland with 34%, and Slovenia with 32%. The peer group's average is 21%, all figures rounded[18].

However, it is clearly visible from the red rhombuses that rail freight in 2022 significantly decreased in the Baltic countries compared to the average of previous years. This decline reflects the changed economic and political circumstances in the region.

[17] Source: European Commission, Eurostat, 2021 data. MS = Participating state

[18] Reporting freight modal share in tonne-km means that the distance travelled is considered. When considering only the volume of tonnes transported, modal share values can significantly differ from modal share values in tonne-km.

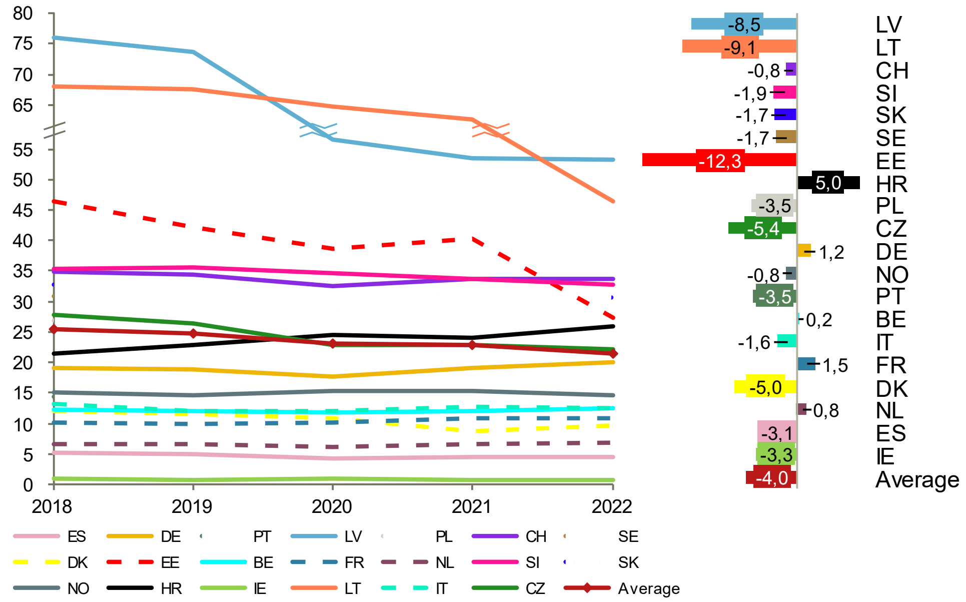

Figure 10: National modal share of rail in inland freight transport (% of tonne-km) and CAGR (%) in 2018-2022[19]

Figure 10 shows the development of the national modal share in rail freight transport between 2018 and 2022. The data from 2020 to 2022 indicates that the COVID-19 pandemic had a lower impact on freight traffic compared to passenger traffic. However, there was an ongoing significant decrease in the rail freight share in the Baltic countries: Estonia experienced a decrease of 12%, and both Lithuania and Latvia saw decreases of 9%. These reduced cargo volumes can be attributed to the current political relationship with Russia, limited cargo transportation through Latvia, improved Russian port infrastructure, and a decreased demand for coal in Europe.

Additionally, the rest of the countries showed a declining trend, averaging a 4% decrease. The only country with a significant increase in rail freight volume during this period was Croatia, which saw an average annual increase of 5% from 2018 to 2022.

As already highlighted, the Baltic countries show the highest share of rail in freight. These can be linked partly to the transit transport of Russian energy products but might also have its roots in the history of these countries[20]. In the post-war period the extension of freight rail transport became an important pillar of the industrialisation of Eastern European countries. Czechia and Poland also possess higher levels of freight activity. Switzerland, however, has almost no heavy

[19] Source: European Commission, Eurostat.
[20] DG MOVE (2015): Study on the Cost and Contribution of the Rail Sector.

industry but has a relatively high rail freight share. One explanation could be the Swiss ban on night-time trucking, its general rail-friendly transport policy, and its strategic position in Europe.

Macro-economic aspects, such as trade relations and the organisation of the logistics sector of a country, also have an impact on the freight sector and therefore also on rail freight traffic. Network density and transport corridors between economic centres, as well as transshipment points such as ports and airports, are equally important. The growth of e-commerce and the associated change in the logistics sector is not reflected in the data of rail freight development. An increase in interconnected multimodal transport solutions can support a shift to rail. However, this development must be initiated by the rail freight operators. Given the EU's policy objectives, it is important to continue to monitor this development. Rail freight needs serious boosting through increased capacity, strengthened cross-border coordination and cooperation between rail infrastructure managers, better overall management of the rail network, and the deployment of new technologies such as digital coupling and automation[21].

Network size

This subchapter aims to give a better overview of the network size operated by the infrastructure managers and presents its network measured in total track-kilometres, in total main track-kilometres, and total main line-kilometres. It furthermore illustrates the high-speed network of relevant infrastructure managers. Figures 11 and 13 show the benchmark and figures 12 and 14 show the development of the network in main track-kilometres and high-speed main line-kilometres for selected infrastructure managers.

[21] COM/2020/789 final: Sustainable and Smart Mobility Strategy – putting European transport on track for the future. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0789&from

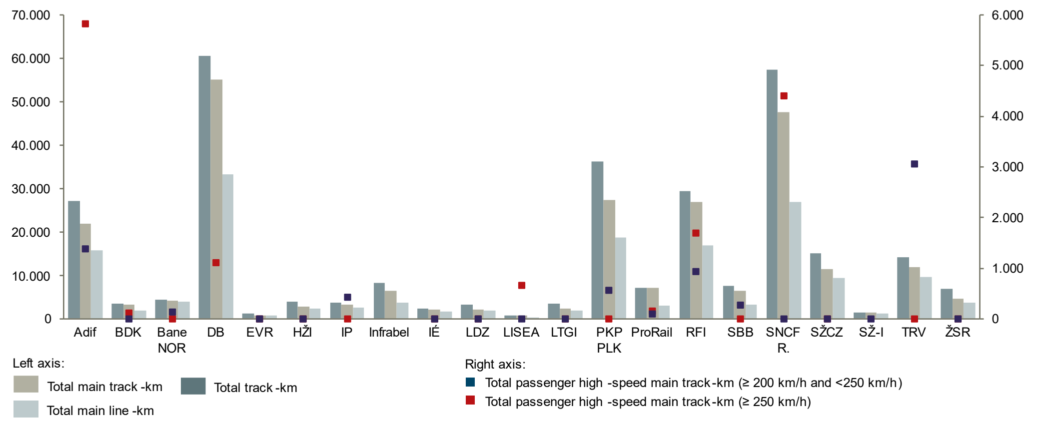

Figure 11: Total track-km, Total main track-km, Total main line-km, Total passenger high-speed main track-km (≥ 200 km/h), Total passenger high-speed main track-km (≥ 250 km/h)[22]

Figure 11 shows the benchmark of the network in the different units of measurement. The left axis shows the network distinguished between total track, total main track and total main line, the right axis and the square symbols indicate the high-speed tracks of the infrastructure managers differentiated based on their speed limits. While total track-kilometres show the cumulative length of all tracks maintained by the infrastructure manager, total main track-kilometres exclude tracks at service facilities[23] which are not used for running trains. Total main line-kilometres indicate the cumulative length of railway lines operated and used for running trains by the end of reporting year. Regarding total track-kilometres SNCF R. and DB are managing the largest networks with around 60.000 kilometres of track. The smallest networks considering track size are operated by LISEA, SŽ-I and EVR, however LISEA is not managing a countrywide network but operating a high-speed line alone (South Europe Atlantic High-Speed Rail Line).

It is important to recognise that these statistics do not cover the entire national railway network, but only the segments managed by the infrastructure managers within the peer group. In addition, the size of a network is closely related to the size of the country and its population density. Population distribution also plays an important role, potentially leading to network concentrations in urban centres or along specific corridors.

[22] LISEA has no countrywide network but is operating the South Europe Atlantic high-speed rail line.

[23] Service facilities are passenger stations, their buildings, and other facilities; freight terminals; marshalling yards and train formation facilities, including shunting facilities; storage sidings; maintenance facilities; other technical facilities, including cleaning and washing facilities; maritime and inland port facilities which are linked to rail activities; relief facilities; refuelling facilities and supply of fuel in these facilities.

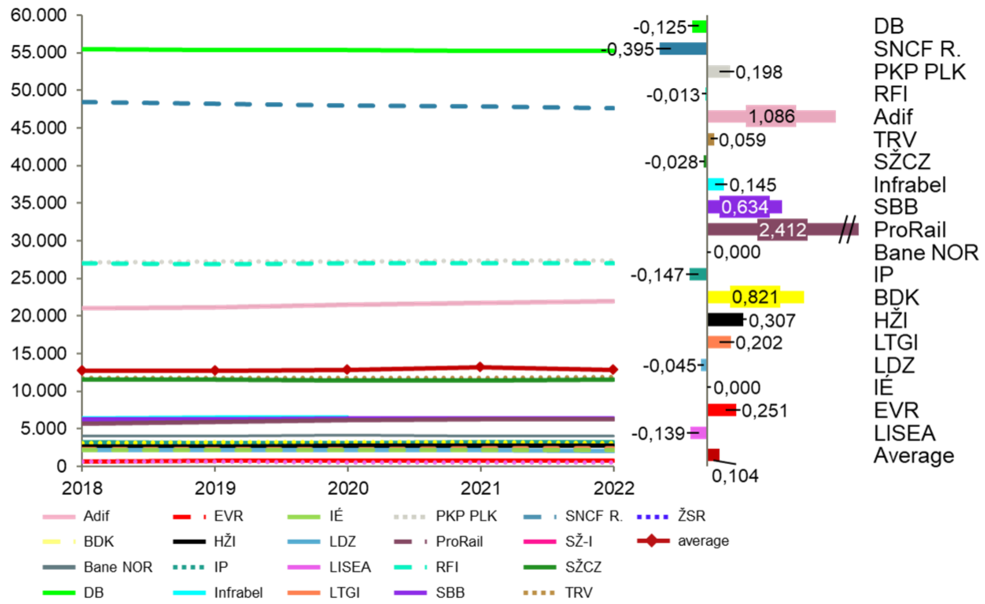

Figure 12: Total main track-km and CAGR (%) in 2018-2022

As illustrated in figure 12, rail networks mostly remained unchanged over the years, reflecting the long-term character of rail infrastructure. The more notable expansions in the networks of Adif and ProRail can be attributed to distinct factors. Adif's increase is primarily the result of an extensive development of its high-speed network. On the other hand, ProRail's more considerable growth is due to a change in the methodology used for calculating the main tracks.

Current network extension programs are highly dependent on the status of rail within the country, funding agreements and budgets available. These factors in turn are closely linked to a country's economic power. Eligibility for EU-funds is another important factor, especially with regards to the extension of high-speed lines, as EU cohesion policy-related financing is one of the major sources of rail funding. Most of the network extensions in Eastern and Central European countries, in Portugal and Spain were co-financed to a significant extent by the EU.

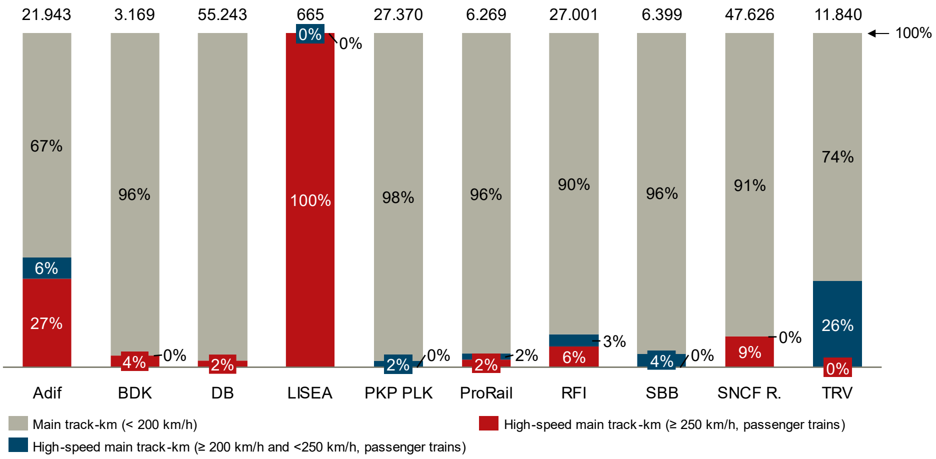

Figure 13: Share of high-speed main track-kilometres (in % of total main track-km)

Figure 13 shows selected infrastructure managers which also operate high-speed lines and their share of the network. The red colour indicates the share of total passenger high-speed main track-kilometres that allows a speed equal or above 250 km/h. Blue shows the lengths of high-speed tracks between a speed limit of equal or higher to 200 km/hm and lower than 250 km/h. The high-speed lines have furthermore following characteristics:

- specially built high-speed lines equipped for speeds generally equal to or greater than 250 km/h,
- specially upgraded high-speed lines equipped for speeds of the order of 200 km/h,
- specially upgraded high-speed lines which have special features because of topographical, relief or town-planning constraints, on which the speed must be adapted to each case.

The last category also includes interconnecting lines between the high-speed and conventional networks, lines through stations, accesses to terminals, depots, etc. travelled at conventional speed by 'high-speed' rolling stock.[24]

As shown in figure 13, there is a significant variation in the proportion of high-speed lines among the compared infrastructure managers. LISEA operates exclusively on high-speed lines, in contrast with Pro-Rail, where high-speed tracks constitute only 2% of its network. Adif holds the most extensive network of high-speed lines, enabling trains to travel at speeds of over 250 km/h along 5.834 kilometers of its main track. This accounts for a quarter of the total network managed by the infrastructure manager. In five countries that have high-speed rail

[24] Source: Glossary for Transport Statistics, A.I-04. Directive (EU) 2016/798 on the rail interoperability, Annex I, Article 1

lines, the maximum speed for these trains is restricted at 250 km/h. As of 2022, 26% of TRV's main track network supports speeds of up to 250 km/h.

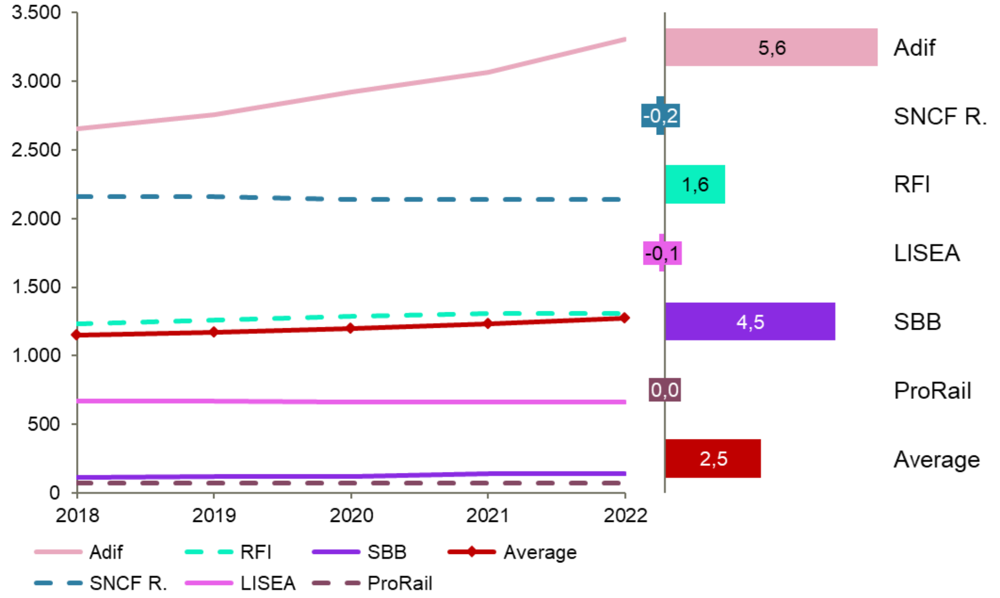

Figure 14: Total high-speed main line-kilometre (≥ 200 km/h) and CAGR (%) in 2018-2022[25]

Figure 14[26] shows the development of high-speed network of the relevant infrastructure managers. Three infrastructure managers increased the length of their high-speed lines (≥ 200 km/h) between 2018 and 2022. SBB increased its high-speed network mainly due to the opening of the Ceneri Base Tunnel in September 2020 through the Alps. Adif increased the absolute length of its high-speed main lines by over 600 kilometres between 2018 and 2022 due to the commissioning of new sections on the high-speed lines to Granada, Galicia, Asturias, Burgos, or Murcia.

In the context of developing high-speed rail networks, it is essential to consider the geographical layout of a country. For countries with large distances between major cities, the benefits of a high-speed network are much greater. Such a network can drastically reduce travel times, making long-distance train travel a competitive option compared to flying or driving.

Conversely, in countries where major urban areas are relatively close together, the impact of high-speed rail may be different. The strategic development of these networks requires a nuanced understanding of each country's specific

[25] Zero values are not included in the weighted average in this chart.

[26] Please note that this figure, unlike the charts above, shows high-speed lines and not high-speed tracks.

needs and geographical challenges to ensure that the benefits of high-speed rail can be fully realised.

Network utilisation

Utilisation is an essential measure of the performance of an infrastructure manager and especially crucial to be investigated regarding the Covid-19 pandemic. Figure 15 presents the aggregated benchmark of the degree of network utilisation by passenger and freight trains. Figures 16 to 17 show the development chart of these indicators.

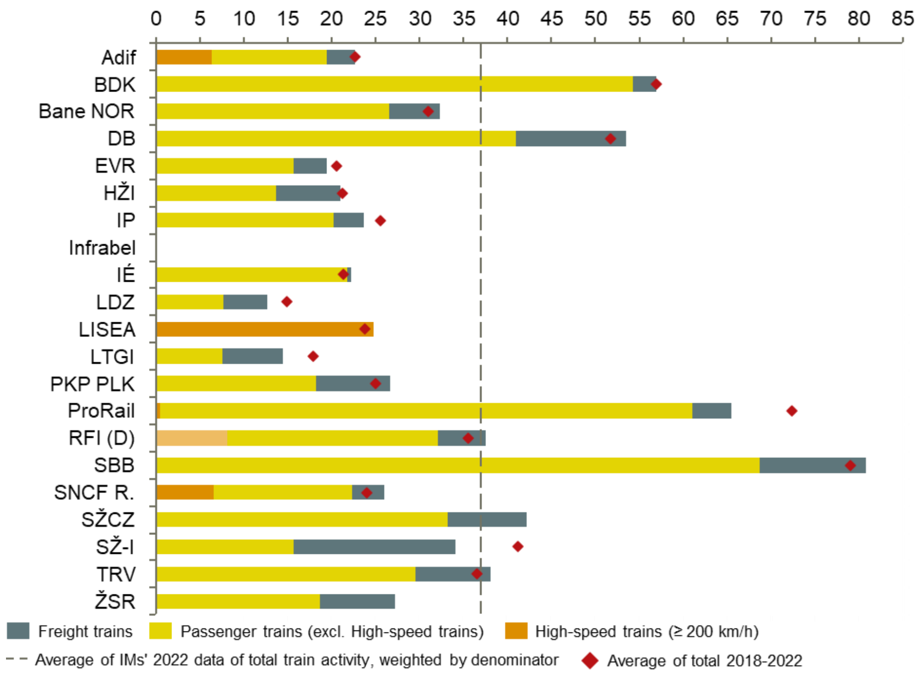

Figure 15: Degree of network utilisation – all trains (Daily train-km per main track-km)[27]

Figure 15 illustrates the network utilisation of passenger, freight, and passenger high-speed trains (≥ 200 km/h). The reason why there are less infrastructure manager showing their high-speed train activity than companies managing high-speed network, is because not all infrastructure managers distinguish high-speed trains from regular passenger trains. The intensity of network use of passenger trains is marked with yellow colour and ranges from 8 to 69 trains per day. SBB's ProRail's, BDK's and DB's networks are utilised notably more than the average. LTGI and LDZ are showing the lowest degrees of utilisation regarding passenger trains. The orange colour shows the train activity of passenger high-speed trains,

[27] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3. Zero value: LISEA (freight trains), EVR, LTGI, HŽI, IÉ, IP, LDZ, SBB, SŽCZ, SŽ-I, ŽSR, TRV (passenger high-speed trains)

with SNCF R., RFI and Adif showing similar levels and LISEA having only high-speed trains on its track. Utilisation of freight trains is provided in grey. SŽ-I, DB, and SBB have the highest intensity of use with more than 12 freight trains per day running on each kilometre of main track. LISEA is a special case, as its network is 100% high-speed, which does not allow freight trains.

Passenger train utilisation tends to be higher in smaller countries with high population density and a wider rail network, e.g. the Netherlands, Switzerland, and Denmark. Like the parameters influencing the share of passenger rail in a country's modal share, utilisation is driven by the prosperity of a country and its citizens, and the status of the rail sector in that country. It furthermore depends on public service obligations in rural areas with low population density and the existence of bottlenecks and congested nodes where all traffic must pass. Utilisation is particularly important for infrastructure managers when it comes to finance. It is decisive both for revenues and expenditures as public funding decisions are largely based on train activity. On the other hand, wear and tear is accelerated by more intensive use.

Like the modal share in freight transport, the degree of utilisation by freight trains highly depends on logistical circumstances, such as availability of suitable transshipments centres and smooth interconnections. The European Commission has set out in the Sustainable and Smart Mobility Strategy its intention to promote intermodal transport. Ultimately all transport modes for freight must come together via multimodal terminals and the European Commission will take initiatives to ensure that EU funding, and other policies, including R&I support, be geared better towards addressing these issues[28]. Punctuality and plannability are decisive factors for freight clients. Improving performance in freight train punctuality might also increase the willingness of companies to shift their goods to rail.

[28] COM/2020/789 final: Sustainable and Smart Mobility Strategy – putting European transport on track for the future. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0789&from

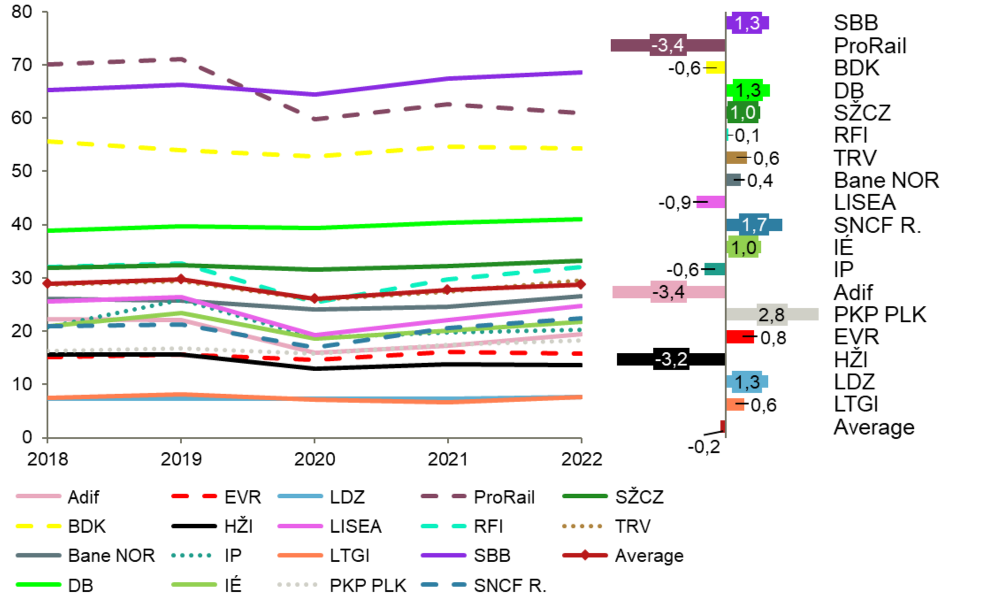

Figure 16: Degree of network utilisation – passenger trains (Daily passenger train-km per main track-km) and CAGR (%) in 2018-2022

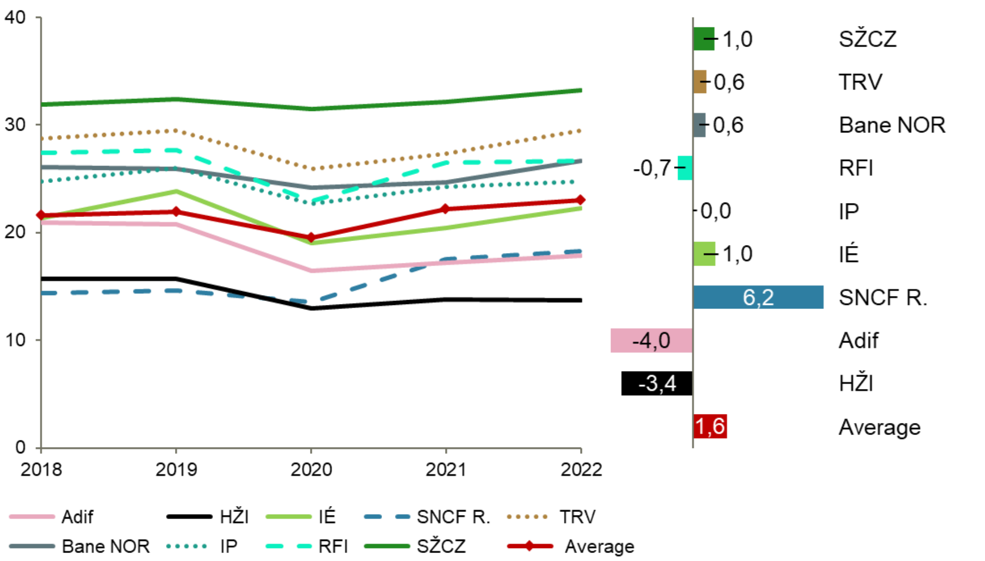

Figure 17: Degree of network utilisation – passenger trains - conventional (Daily passenger train-km per conventional main track-km) and CAGR (%) in 2018-2022

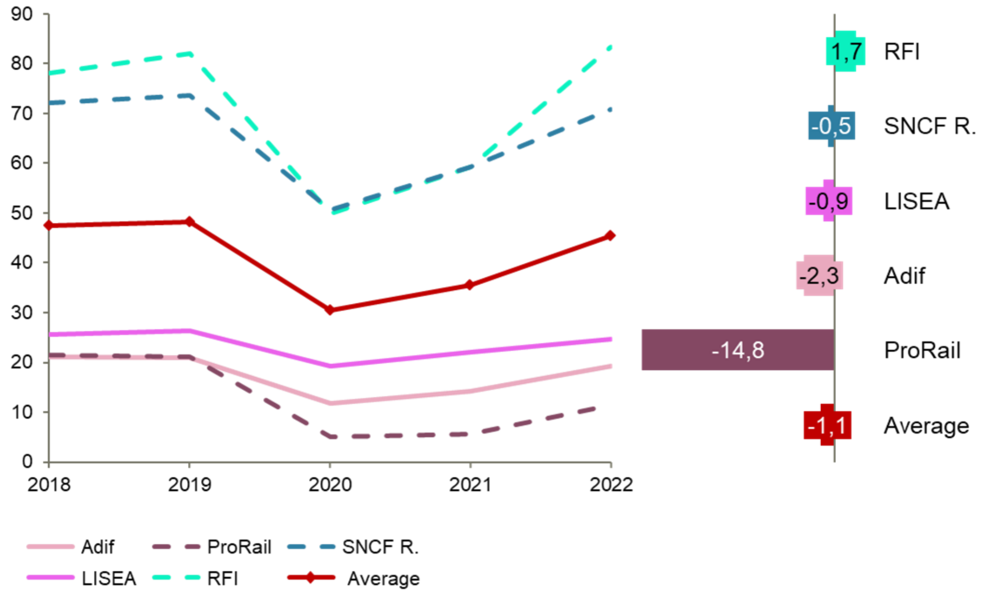

Figure 18: Degree of network utilisation – passenger trains – high-speed (Daily passenger train-km per high-speed main track-km (>200km/h)) and CAGR (%) in 2018-2022

Time series data on network utilization is particularly insightful when examining the impacts of the Covid-19 pandemic. The year 2022 marked a period when, despite many countries still preserving safety measures like mandatory mask-wearing on public transportation, major mobility restrictions, including international travel bans and lockdowns, were lifted. This shift is reflected in the data: after an unprecedented decline in passenger transport, especially in the high-speed trains, was observed in 2020, signs of recovery began to emerge in 2021. By 2022, most infrastructure managers had returned to pre-pandemic levels.

PKP PLK experienced the most significant growth, showcasing an average annual increase of 2.8%, even exceeding its performance levels from 2019 (by 10%). This growth can be attributed to more attractive rail services. The network has seen substantial investments in recent years, leading to improvements in punctuality and a general reduction in journey times. Higher passenger train utilization compared to 2018 was further reported by several operators, with SNCF R. experiencing an increase of 6%, DB by 5%, and SBB, SŽCZ, IÉ, LDZ each seeing a 4% rise.

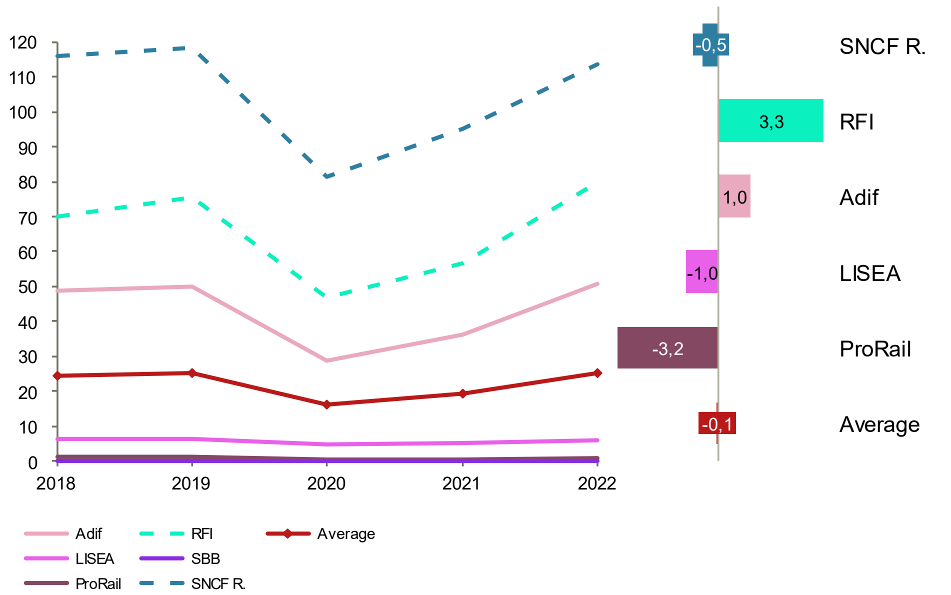

Figure 19: Total passenger high-speed train-km (≥ 200 km/h) (Million train-km) and CAGR (%) in 2018-2022

A similar trend is observed in passenger high-speed traffic, defined as services operating at speeds of 200 km/h or above. While SNCF R, ProRail, and LISEA's train activity in 2022 remained below their 2019 levels, RFI demonstrated a yearly growth of 3% and reported a 12% increase in train activity compared to 2021. Additionally, Adif surpassed pre-pandemic figures, particularly in 2022, marking a 4% increase in train activity compared to the previous year. This is mainly thanks to the liberalization process for high-speed traffic that started in 2020 and has resulted in more capacity, new train operators and more frequencies.

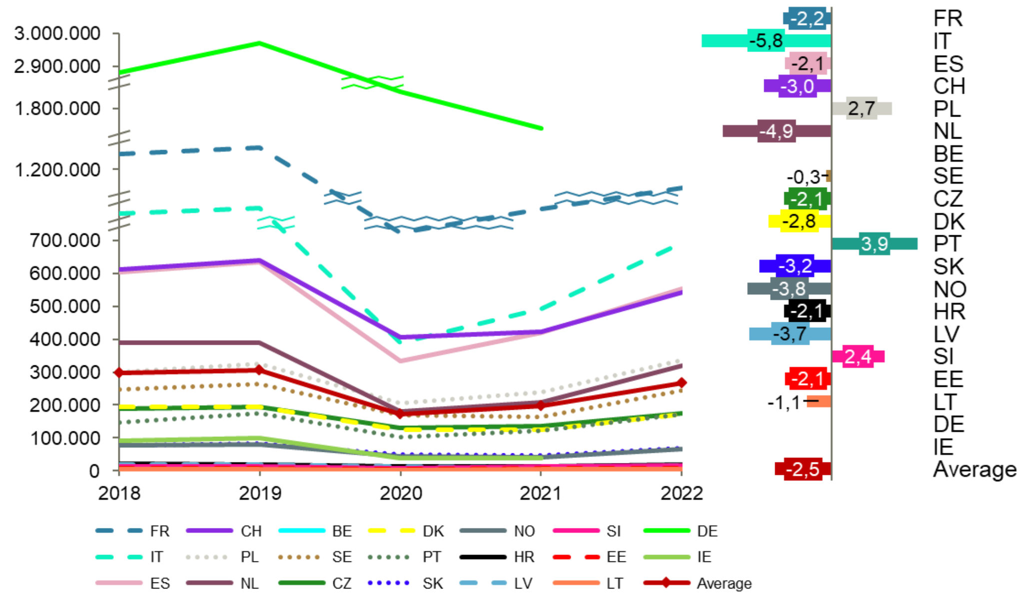

Figure 20: Passengers transported by rail (Number) and CAGR (%) in 2018-2022[29]

Despite the positive trends in train utilization, it represents only one aspect of the overall picture when assessing the railway sector's recovery. Passenger numbers and the rail's modal share are equally important indicators. Country data on passenger numbers from Eurostat reveal a less optimistic development. Although there has been a significant recovery in passenger figures from the lows of 2020, the numbers have yet to return to the pre-pandemic levels of 2019. The exceptions to this trend, showing growth, are Poland, Portugal, and Slovenia. Poland's positive development is likely to be related to the performance improvements of rail discussed above. In Portugal, growth can likely be attributed to the introduction of a new fare system in 2019, which significantly reduced the cost of travel and led to a significant increase in demand.

[29] Source: Eurostat.

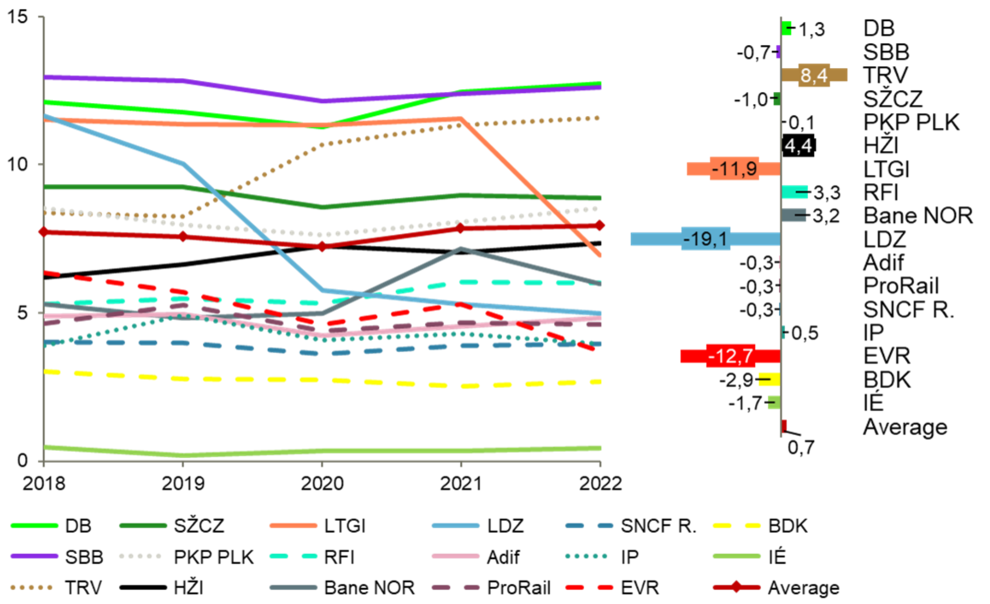

Figure 21: Degree of network utilisation – freight trains on non-high-speed network (Daily freight train-km per main track-km) and CAGR (%) in 2018-2022

When analysing the data on freight train activity, it clearly reflects the impact of the Russian war against Ukraine that started in February 2021. Particularly, the Baltic countries have experienced a significant reduction in freight train activity. Specifically, LTGI's train activity dropped by 66% compared to 2021, EVR's by 44%, and LDZ's along with Norway's by 6%. Although these developments are not new because of the political relations with Russia, they have significantly accelerated in 2022.

Between 2018 and 2022, many infrastructure managers reported a negative annual growth rate for freight train activity, with only five organizations noting an upward trend. However, besides train kilometers, load factor is also a key to understanding reduced freight train activity, as more trains are not necessarily needed to carry more goods, and slot optimization can also have a huge impact. To provide a more comprehensive view, figure 22 and figure 23 showcase the volume of goods transported by rail and road, respectively, within the jurisdictions of the infrastructure managers.

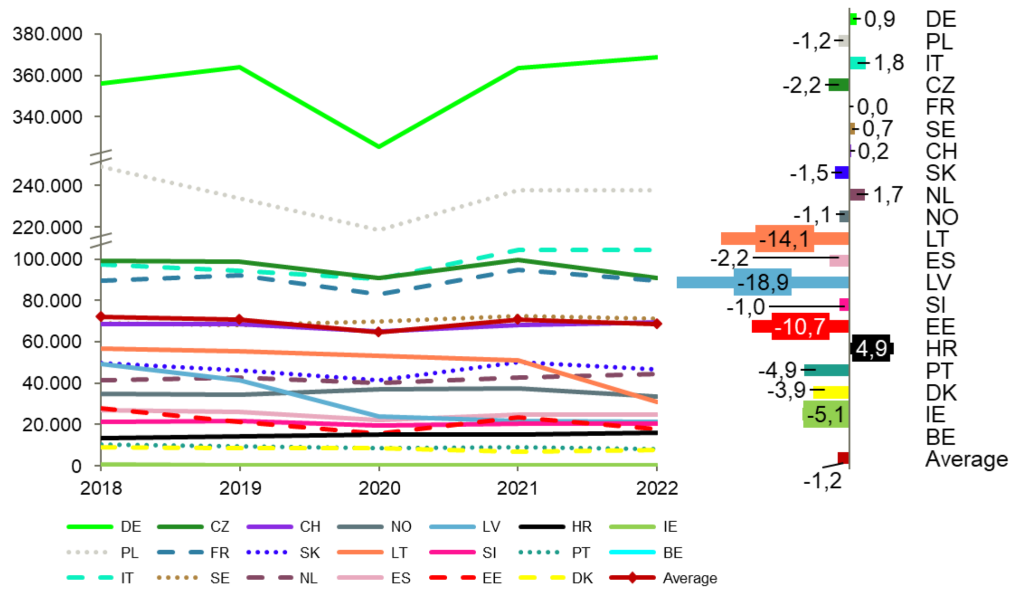

Figure 22: Goods transported by rail (Thousand tonnes) and CAGR (%) in 2018-2022[30]

When looking at the absolute amount of goods transported through the country (data of Eurostat), the countries of the peer group seem to be divided into two parts. While some countries kept the amount constant on average, other countries are facing a larger decline. Only three countries show a above 1% average growth of the transported goods by rail. The average growth rate is negative, with -1.2%.

[30] Source: Eurostat.

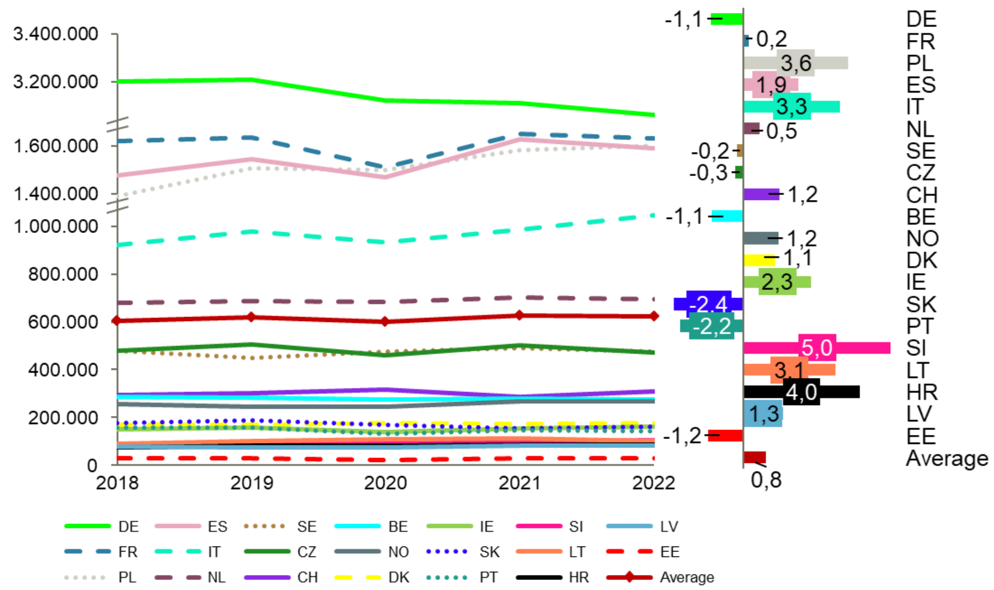

Figure 23: Goods transported on road (Thousand tonnes) and CAGR (%) in 2018-2022[31]

Figure 23 depicts the trends in the volume of goods transported by road. The data presents a mixed but generally upward trend in road freight volumes. A comparison with the weighted averages for rail, which show a decline (-1.2%), against an increase for road (+0.8%), suggests a possible shift of freight from rail to road. This trend may stem from significant industry shifts that rail has been challenged to keep pace with, including changes in goods transported and new customer service expectations, such as the growing demand for containerization and direct delivery options[32].

3.2 Financial

3.2.1 Summary of finance

EU-wide objectives
• Railway infrastructure requires substantial amounts of funding to cover capital and operating expenditures. Providing value for money is paramount as funding is constrained, and infrastructure managers are constantly improving their asset management activities to achieve this objective.

[31] Source: Eurostat.

[32] Islam, D.M.Z., Blinge, M. The future of European rail freight transport and logistics. *Eur. Transp. Res. Rev.* 9, 11 (2017).

EU-wide objectives

- The European infrastructure managers apply different financing and funding structures and rely on combinations of public funding, access charges and commercial revenues.
- EU legislation aims at increasing the transparency of funding arrangements and developing appropriate incentives to ensure the best available use of existing assets and capacity.
- Directive 2012/34/EU, establishing a single European railway area[33], requires:
  - rail undertakings and infrastructure managers to maintain separate accounts
  - the expenditure (under normal business conditions and over a period not exceeding five years) and the infrastructure managers' income from different sources (including access charges and state funding) to be balanced.
- It also sets out a framework for determining charges, establishing the principle that the charges paid to operate a train service must cover the direct cost incurred because of such operation while allowing for additional mark-ups and charges to recover fixed costs and address externalities.

Peer group's performance

- The level of operational expenditures varies between EUR 50 000 – 190 000 per main track-kilometre per year.
- The average capital expenditures is EUR 145 000 per main track-kilometre per year and varies between EUR 0 – 340 000 per main track-kilometre.
- Within the peer group, there's a wide range in the evolution of operational and capital expenditures.
- Operational expenditures have, on average, remained relatively constant, although there is a noticeable increasing trend among many infrastructure managers.
- Capital expenditures have risen, showing an average increase of about 10%.

[33] Directive 2012/34/EU of the European Parliament and of the Council of 21 November 2012 establishing a single European railway area Text with EEA relevance. http://data.europa.eu/eli/dir/2012/34/oj

- The proportion of TAC revenues decreased between 2018 and 2022 for most infrastructure managers.

3.2.2 Development and benchmark of finance

Rail infrastructure requires a significant amount of funding which is dedicated to building new infrastructure, replacing existing assets as well as maintaining and operating the asset base. The financial chapter covers important elements related to expenditure and revenues of infrastructure managers.

Rail financing indicators

PRIME members report four indicators measuring costs and six indicators measuring revenues:

- Costs:
  - Operational expenditures
  - Capital expenditures
  - Maintenance expenditures
  - Renewal expenditures
- Revenues:
  - Proportion of TAC in total revenue
  - Total track access charges
  - Non-access charges
  - Total public funding
  - Public funding for operational expenditure
  - Public funding for capital expenditure

To increase comparability of these values among infrastructure managers, the expenditure-figures are related to main track-kilometres. The revenues from track access charges are related to main track-kilometres, train-kilometres, and the monetary value. Non-access charges and public funding are related to main track-kilometres.

3.2.3 Costs

The costs category includes relevant costs incurred by the infrastructure manager, broken down into useful and comparable sub-categories. It includes all operating, capital and investment costs. For purposes of comparison, costs are adjusted to reflect local costs using purchasing power parities (PPPs). The costs incurred by an infrastructure manager are dependent on several factors: some lie within and some outside the responsibility of an infrastructure manager.

Figures 24 to 33 show the compositions of the operational and capital expenditures of the PRIME members in a latest benchmark and over the period of 2018-2022.

Operational expenditure

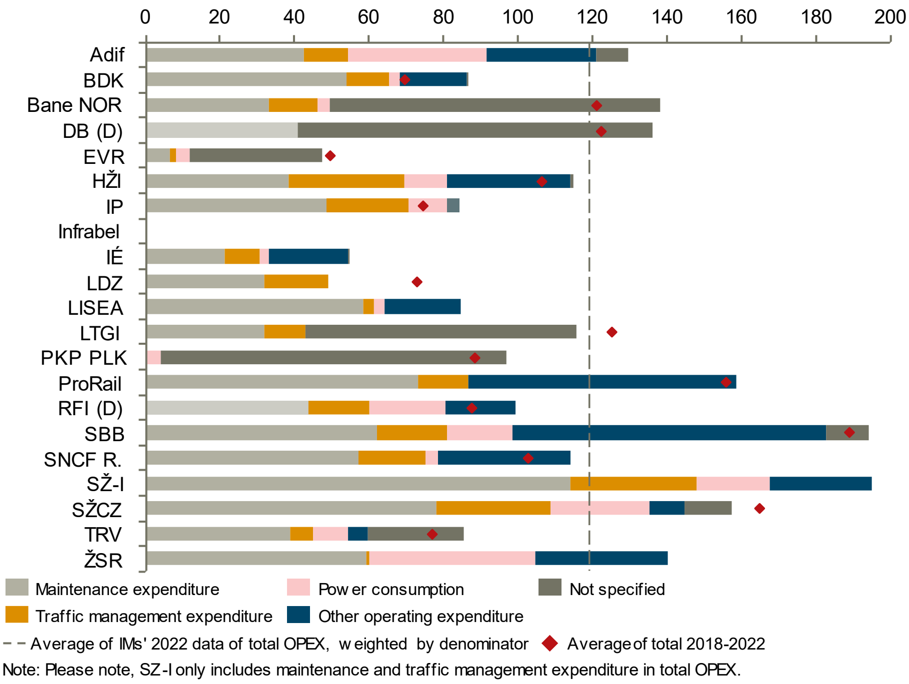

Figure 24: Detailed composition of operational expenditure in relation to network size (EUR 1 000 per main track-km)[34]

Figure 24 shows the composition and the level of operational expenditures in 2022. Accounting systems vary widely between countries, so not all infrastructure managers were able to allocate these costs to the individual categories. Maintenance costs refer to non-capital expenditures undertaken by the infrastructure manager to maintain the current condition and capacity of the existing infrastructure or to optimize asset longevity. Traffic management expenses compromise the oversight of signaling systems and traffic flow, including planning and track allocation. Financial expenditures, as recorded in the annual profit and

[34] Results are normalised for purchasing power parity. Lighter colours (DB, RFI) indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.

loss statement, encompass interest and related charges that are tied to the returns of specific financial assets such as deposits, bills, bonds, and loans. Power consumption costs arise from the energy used by the infrastructure manager. Other operating costs include operational expenditures that are included in total OPEX but cannot be attributed to the individual categories. The not specified category includes the costs that remain after deduction of the various sub-categories from the total operational expenditure[35].

Maintenance and traffic management expenditure are the largest categories, while costs related to finance and power consumption make up a smaller part. The level of total operational expenditures varies between EUR 50 000 – EUR 190 000 per main track-kilometre per year and shows an overall dispersion of values of EUR 40 000. On average, infrastructure managers' annual operational expenditures amount to EUR 120 000 per main track-kilometre. SBB's costs assigned to "other operating expenditure" are generated by activities related to other income, i.e. shunting yard operations and traction power supply, and by project-related, non-depreciable activities (see figure 38 as counterpart: total revenues from non-access charges). The lighter colour of DB and RFI indicate deviating data for individual components and are explained in the Annex 4.3.

Operational costs are driven by a range of different factors. The size and complexity of the networks are just as relevant as train utilisation. For example, a network with a relatively large number of switches and a high degree of electrification and level crossings is more prone to failures and requires more interventions. Tunnels and bridges must not only be checked more regularly, but also entail more costly and sophisticated replacements and repairs. Busy tracks are subject to higher wear and tear. Condition and age of the assets are also relevant: investments that have been made in the past pay off and reduce operational costs later. Besides maintenance, operational expenditures also include functions of traffic management. The services provided by the infrastructure manager vary significantly, too. Different technologies and the amount of human resources needed determine the level of expenditures.

[35] Other operating expenditures" is stated as such by the infrastructure managers, while the "not specified" category is calculated from total OPEX (not specified = total OPEX - all other indicated categories). This distinction is made to also allow infrastructure managers to be included in the graph which cannot attribute their expenses to the different categories.

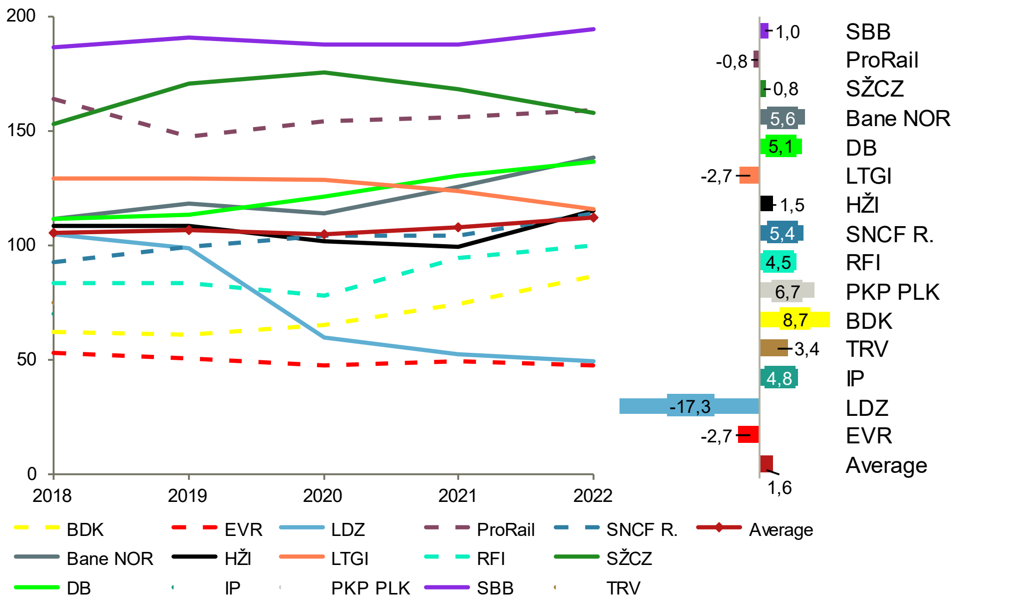

Figure 25: Operational expenditures in relation to network size (EUR 1 000 per main track-km) and CAGR (%) in 2018-2022[36]

As can be seen in figure 25, total operational expenditure shows mainly a positive annual growth from 2018 to 2022. The highest annual growth is reported by BDK, PKP PLK and Bane NOR. LDZ's operation costs on the other hand reduced more than half within 5 years.

For a comprehensive understanding of this growth (and the development of other financial indicators), one must consider the current global and European economic conditions, which are characterized by significant inflation. Looking at the EU's import prices for the total industry reveals a dynamic movement in the investigation period between 2018 and 2022. During the initial phase of the COVID-19 pandemic, import prices, particularly for goods coming from outside the eurozone, experienced a sharp decline (-9.2% from February to April 2020). However, prices began to rise again in the latter half of 2020. The years 2021 and 2022 saw a dramatic increase as a consequence of Russia's war against Ukraine, reaching a peak in summer 2022. Although there has been a notable downward trend in prices since that peak, they remain substantially higher than pre-pandemic levels[37]. A specific price index tailored for the rail sector captures

[36] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.
[37] Industrial import price index overview (2023). Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Industrial_import_price_index_overview

the extent of sector-relevant inflation, indicating a price increase of 22% between 2020 and 2024 for railway renewal costs[38].

Capital expenditures

According to the PRIME KPI & Benchmarking subgroup's definition, capital expenditures are funds used by a company to acquire or upgrade physical assets such as property, industrial buildings, or equipment. An expense is considered a capital expenditure when the asset is a newly purchased capital asset or an investment that improves the useful life of an existing capital asset. Hence, it comprises investments in new infrastructure as well as renewals and enhancements. As capital expenditures are often linked to major (re-)investment programs it is not surprising that expenditure levels fluctuate over time.

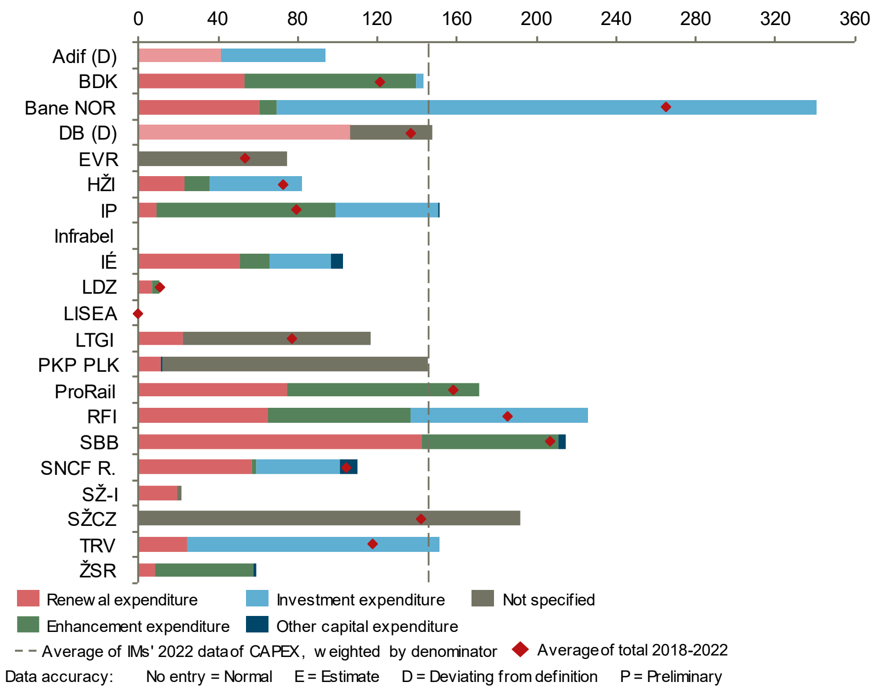

Figure 26: Composition of capital expenditures in relation to network size (EUR 1 000 per main track-km)[39]

Figure 26 shows different components of capital expenditure in 2022. Similarly, to the components of OPEX, infrastructure managers face challenges in clearly allocating expenditures, as the accounting systems are very different between the countries. Furthermore, it is difficult to always distinguish between enhancement and investment clearly, as enhancement often comes along with new

[38] Railways; Construction cost index (2024). StatLine. StatLine - Grond-, weg- en waterbouw (GWW); inputprijsindex 2015=100 (cbs.nl)

[39] Zero value: LISEA (total CAPEX), LISEA (investment expenditure), TRV (enhancement expenditure)

functionalities much like investments. For better understanding below a brief overview of the categories:

Investment in new infrastructure encompasses capital expenditures on constructing new installations for new lines, including the processes of planning, tendering, dismantling old equipment, construction, testing, and commissioning for full-speed operation. Renewals refer to capital expenditures for substantial replacement projects on existing infrastructure that maintain its original performance level, typically involving the systematic replacement of entire systems or components at their life's end. Enhancements, or upgrades, represent capital expenditures on significant modifications to existing infrastructure that boost its overall performance, often initiated by new functional requirements or regulatory mandates, rather than asset lifetimes. The category “not specified” include the costs that remain after deduction of the various sub-categories from the total capital expenditures.

The development and diversity of capital expenditure is expectedly more dynamic compared to the operational expenditure. In total, the annual capital expenditure varies between EUR 0 – 340 000 per main track-kilometre. On average EUR 145 000 per main track-kilometre per year is spent on capital expenditure, the standard deviation in the peer group is EUR 79 000. LISEA’s capital expenditure is zero as its infrastructure is fairly new.

The largest share, almost 35%, is accounted for by expenditure on renewals, where SBB’s expenditures (EUR 141 000) are the highest and more than double of the average. The highest investments are reported by Bane NOR with a value of almost EUR 270 000. Bane NOR’s high investments have been the result of strong political commitment to go greener and invest more into railways and include several projects concerning ERTMS development (e.g. preparatory works, installed systems at Nordlandsbanen and Gjøvikbanen, remodeling trains), capacity increasing (e.g. Bergensbanen with more double tracks, modernized freight terminal, new tunnel), and other projects.

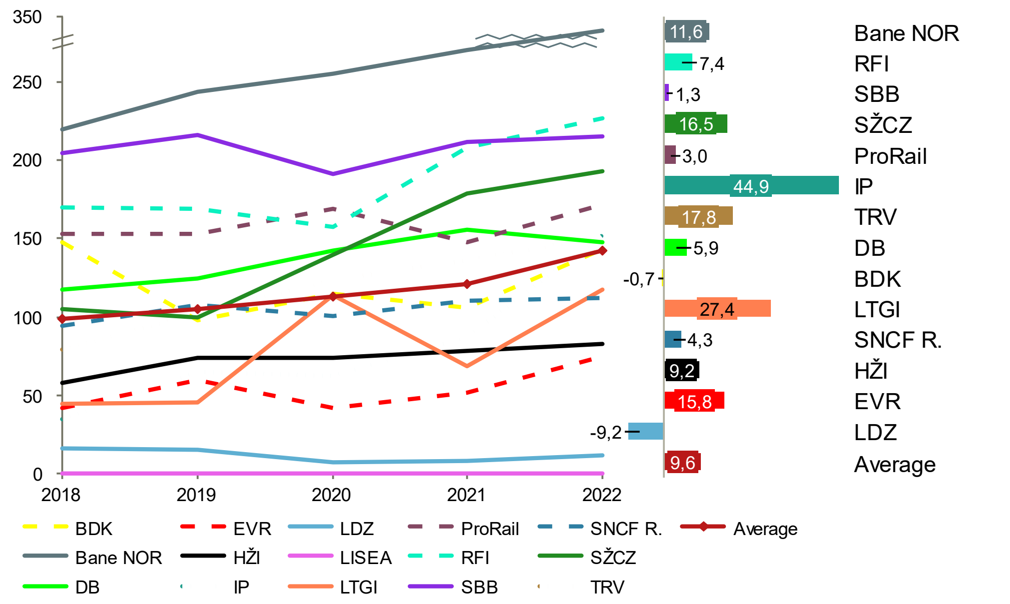

Figure 27: Capital expenditures in relation to network size (EUR 1 000 per main track-km) and CAGR (%) in 2018-2022[40]

As capital expenditures are often linked to major (re-)investment programs it is not surprising that expenditure levels fluctuate over time. The individual annual growth rates of the infrastructure managers range from -9% to 45%, with most infrastructure managers showing a positive growth resulting in an average of +10%. The highest increase in investment-related expenditure has been recorded at IP spending almost four times as much in 2022 as in 2018. IP is undertaking an important investment in the Portuguese railway network, building, enhancing and renewing infrastructure which will last until 2023.

Like operational costs, capital expenditures also increase with higher network complexity. High numbers of switches, signaling and telecommunication assets increase the cost of renewals. Network complexity, in turn, is in part determined by geographic conditions.

The level of capital expenditures is highly dependent on the budget and funding agreements between infrastructure managers and national governments. In particular renewals of rail infrastructure require long term planning, reflecting the long-lived nature of the assets and the need for a whole-life approach to asset management. Longer funding settlements provide more stability regarding finance issues and enable larger investments projects. In terms of public funding the eligibility for the EU Cohesion Fund is particularly important for Central and

[40] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.

Eastern European countries, as EU cohesion policy-related financing is one of the major sources of funding, especially modernisation projects such as ERTMS, railway electrification etc. The condition and age of the asset also influences the need for renewals and asset improvement. The supplier market, prices and resources determine the level of activities achievable with the budgets provided.

Maintenance and renewals

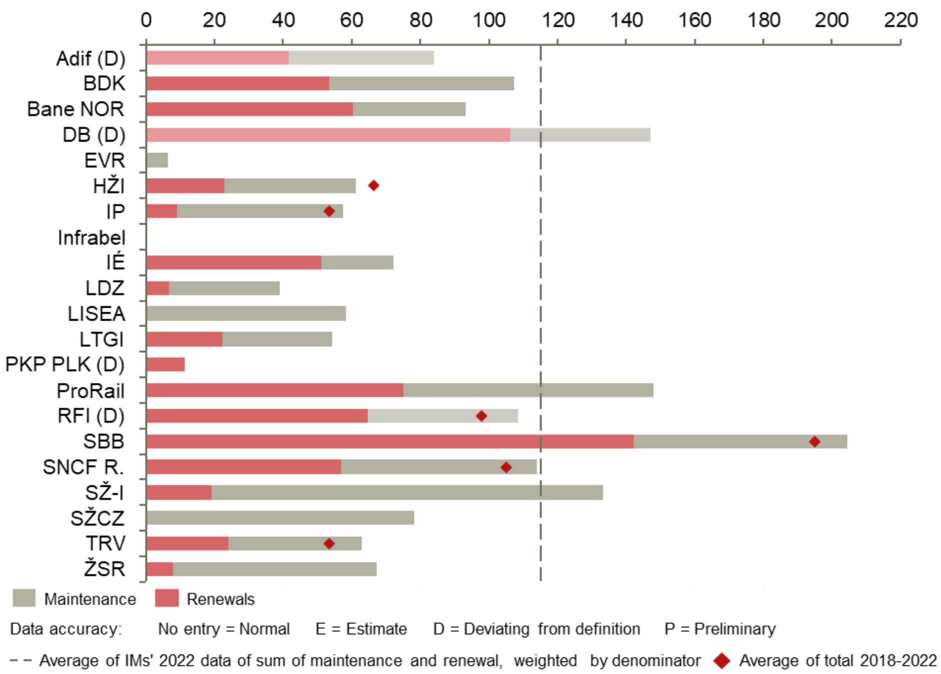

Figure 28: Maintenance (component of OPEX) and renewal expenditures (component of CAPEX) in relation to network size (EUR 1 000 per main track-km)[41]

Figure 28 aims to provide a snapshot of current maintenance and renewal expenditures. On average infrastructure managers spend EUR 113 000 per main track-kilometre per year on maintenance and renewal. SBB, ProRail and DB have highest expenditures on maintenance and renewals with above EUR 140 000 per main track-kilometre. The differential of spread of OPEX and CAPEX is also interesting to look at: while maintenance shows a standard deviation of EUR 26 000, renewals have a spread in data distribution of EUR 37 000.

[41] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.
Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3. Zero value: LISEA

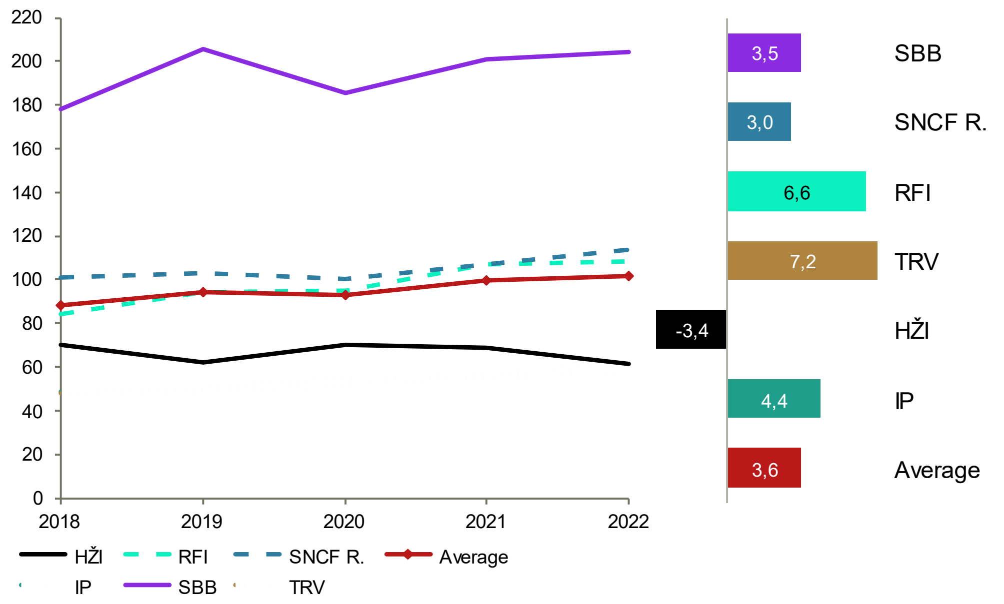

Figure 29: Maintenance (component of OPEX) and renewal expenditures (component of CAPEX) in relation to network size (EUR 1 000 per main track-km) and CAGR (%) in 2018-2022 [42]

The time series graph of maintenance and renewal is mirroring the development of the previous charts. Apart from HŽI all infrastructure managers increased their expenditure in the observed period. The highest average increase can be seen at TRV, with a balanced annual growth of 7%.

Like operational and capital expenditures, maintenance and renewal costs are driven by the following factors: network complexity/asset densities (e.g. switches, bridges, tunnels…), network utilisation and the condition of assets.

3.2.4 Revenues

This category provides an overview of track access charges (TAC) paid by railway undertakings using the railway network and its service facilities. TAC revenues are shown both in relation to network and to traffic volume, as operators are charged based on the usage of the network which is indicated by the traffic volume. The TAC relation to the network illustrates the TAC revenue in relation to a major cost driver. Furthermore, it measures and compares non-track access related revenues "earned" by an infrastructure manager, excluding subsidies and property development.

[42] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.

To achieve meaningful comparability, the indicators for charging have been simplified, and PRIME is using fundamental KPIs that all infrastructure managers find common and easy to collect. Together with cost related indicators, they provide an indication to what extent infrastructure managers can cover their costs, respectively to what extent they rely on subsidies.

Figures 30, 32 and 33 show the latest benchmark of the revenue indicators of the infrastructure manager. The development over the period 2018-2022 is presented in figures 31, 34, 35 and 36.

TAC - Track access charges

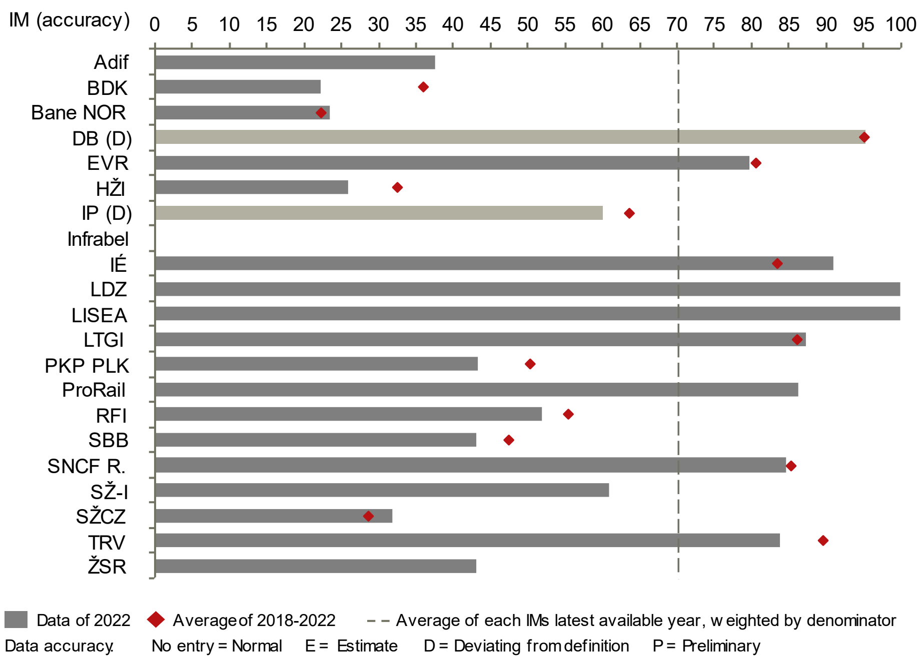

Figure 30: Proportion of TAC in revenue (grants excluded) (% of monetary value)[43]

Figure 30 shows the proportion of TAC revenues of total revenues which mainly divided in two parts: eight infrastructure managers generate less than 50% of their revenues from track access charges, while ten infrastructure managers generate a share of track access charges of total revenues of above 80%. LISEA and LDZ generate all their revenues from track access charges. The peer group's average is 70%, the standard deviation is 27%.

[43] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.

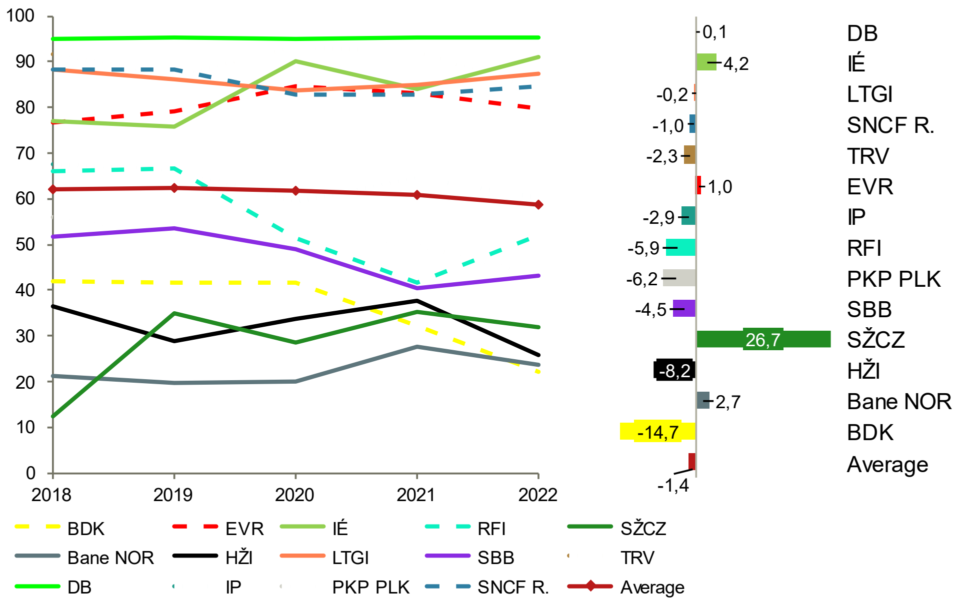

Figure 31: Proportion of TAC in revenue (% of monetary value) and CAGR (%) in 2018-2022

The proportion of revenues from track access charges slightly decreased between 2018 and 2022. Parts of this development can be explained as a consequence of the Covid-19 pandemic, which radically decreased train activity in 2020, which is linked to the earning from track access charges. The exceptions to the graph are SŽCZ, IE and Bane Nor, which increase their share over the period observed.

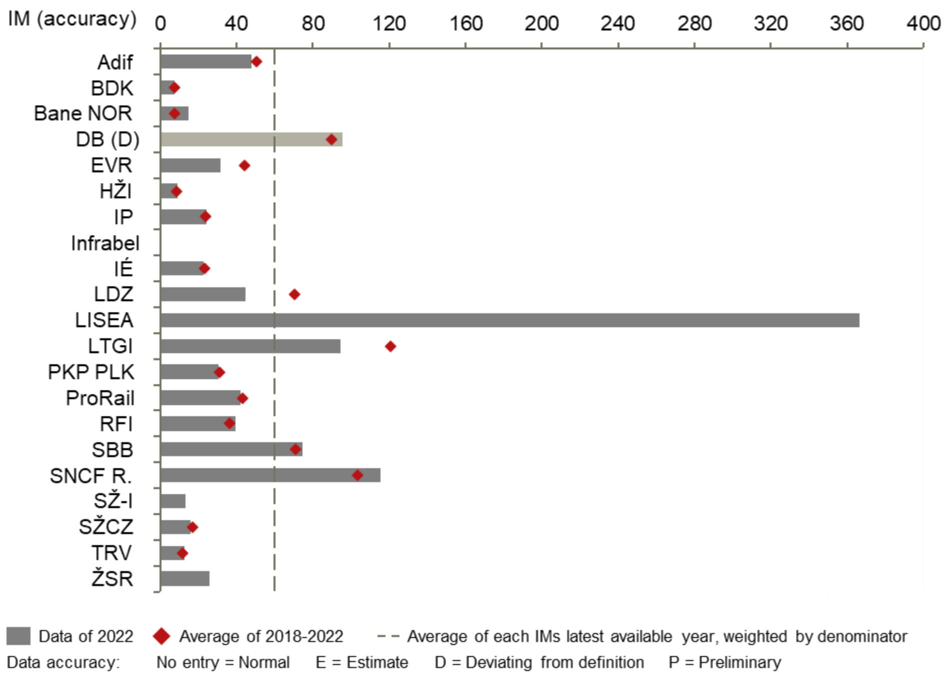

Figure 32: TAC revenue in relation to network size (EUR 1 000 per main track-km) [44]

[44] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.
Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.

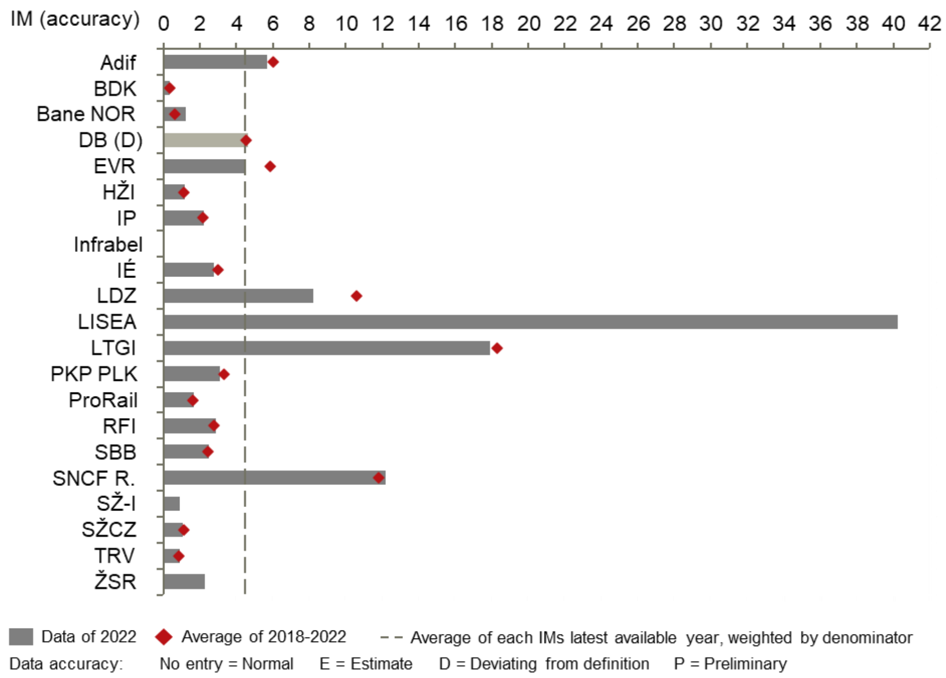

Figure 33: TAC revenue in relation to traffic volume (EUR per total train-km) [45]

Figure 32 illustrates the revenues per track-kilometre and figure 33 the revenues per train-kilometre as a benchmark. The comparison shows the differences in the extent to which infrastructure managers can generate TAC revenues per train-kilometre on the one hand, and how many TAC revenues per track they have available in relation to their network costs on the other. SBB's TAC revenues, for example, are above average in relation to network size, but remain below average when related to traffic volumes. When LTGI's revenues are analysed in relation to train activity, there is a notable increase, moving LTGI to the second-highest position within the range. TAC revenues in relation to network size varies between EUR 8 000 – EUR 360 000 per main track-kilometre per year however most of the infrastructure managers are below the average of EUR 64 000 per main track-kilometre. In relation to traffic volume TAC revenues varies between EUR 0.4 – 40, showing an average of EUR 4.5. LISEA's level of income is significantly higher than that of other infrastructure managers because it comes exclusively from the LGV line (high-speed line) while remaining comparable to the charge levels of other LGVs on the French national network. It covers both operation and maintenance costs as well as a large amount to the investments to build high-speed lines.

[45] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.
Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.

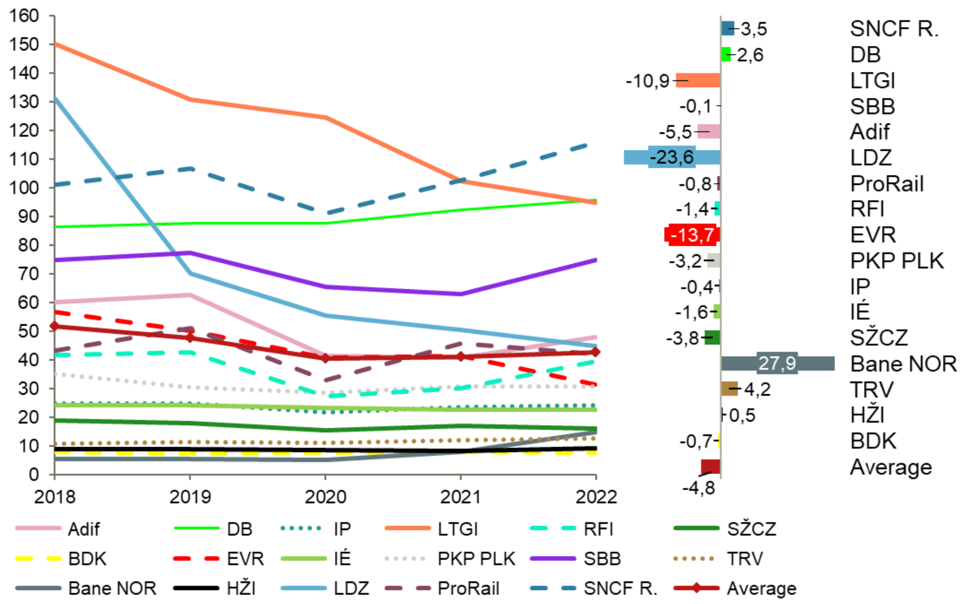

Figure 34: TAC revenue in relation to network size (EUR 1 000 per main track-km) and CAGR (%) in 2018-2022[46]

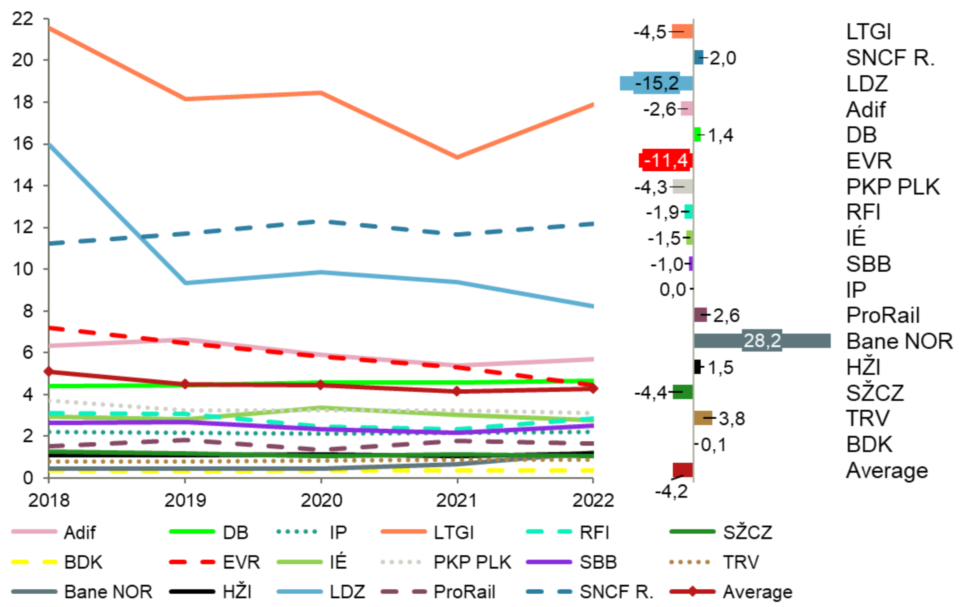

Figure 35: TAC revenue in relation to traffic volume (EUR total train-km) and CAGR (%) in 2018-2022[47]

[46] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.

[47] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.

Figures 34 and 35 illustrate the development of revenues per track-kilometre and train-kilometre generated by infrastructure managers to cover the cost of the network. By showing the potential impacts of the Covid-19 pandemic, it indicates why it is important to relate TAC revenues not only to the network but also to train activity. While TAC revenues in relation to network size decreased significantly for most of the infrastructure managers from 2019 to 2020, TAC revenues in relation to traffic volume remained on a similar level as train activity also decreased during the pandemic. As train activity returned to relatively normal in 2021 and 2022 also the track accesses reached closer to the pre-pandemic level. This development was mainly thanks to TAC revenues from passenger trains since the TAC revenues from freight trains have decreased since 2018 with a CAGR of 4.9% (to be seen in figures 36 and 37).

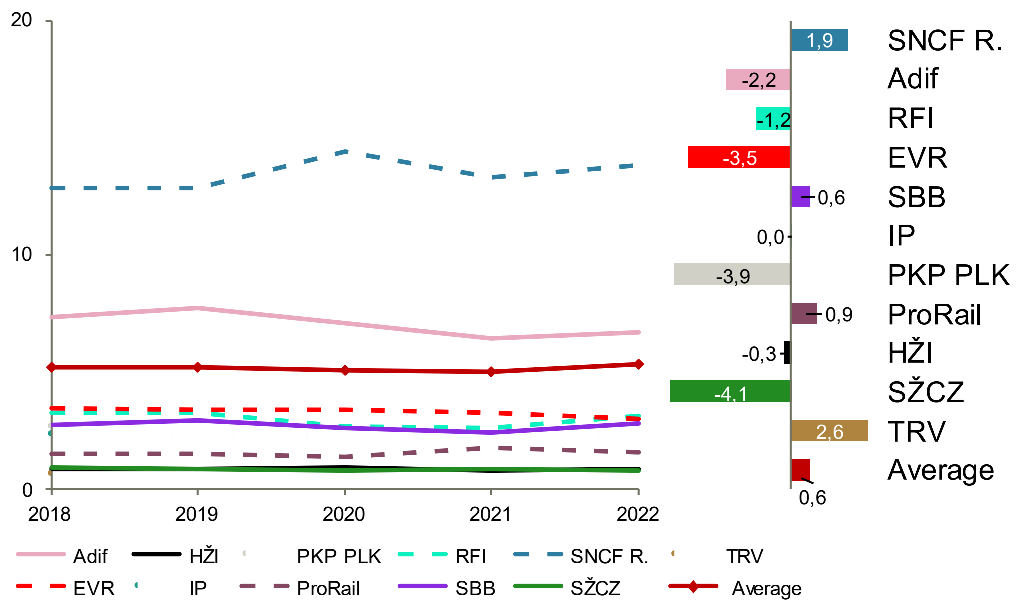

Figure 36: TAC revenue in relation to traffic volume – Passenger (Euro per passenger train-km) and CAGR (%) in 2018-2022[48]

[48] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.

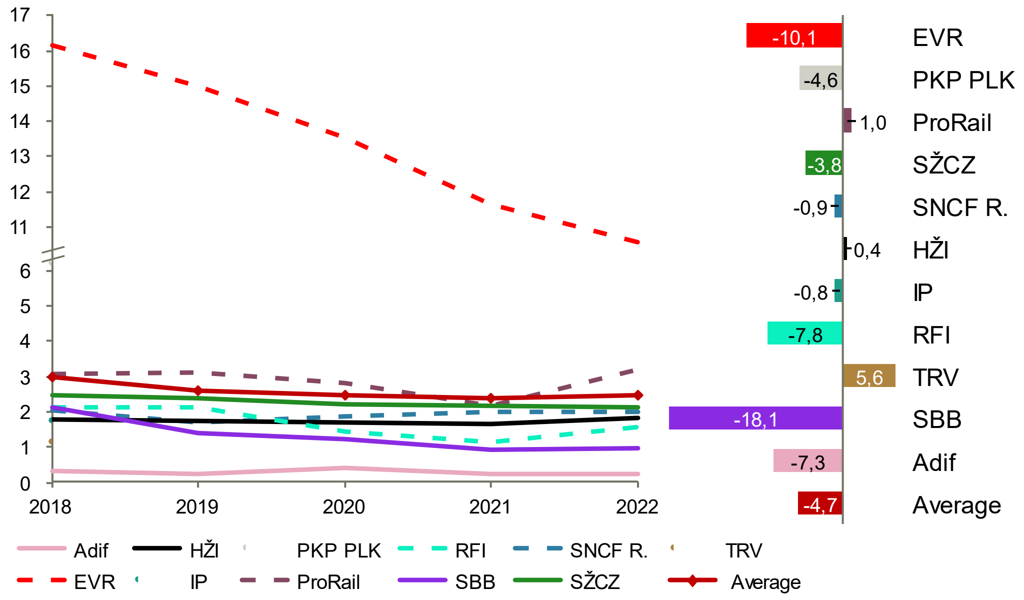

Figure 37: TAC revenue in relation to traffic volume – Freight (Euro per freight train-km) and CAGR (%) in 2018-2022[49]

Non-access charges

Revenues from non-access charges may include revenues from service facilities and other services for operators, commercial letting, advertising, and telecommunication services, but exclude grants and subsidies.

The annual peer group's average of revenues from non-access charges is EUR 24 000 per main track-kilometre. Adif and SBB have similarly high non-access charges of over EUR 70 000 per main track-kilometre, with SBB's high revenues coming from providing goods (e.g. traction current, switches) and services (e.g. use of IT tools, project management) to other infrastructure managers in Switzerland. Six infrastructure managers have revenues of less than EUR 10 000 per main track kilometre, among which LISEA has zero non-access charges revenues.

[49] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.

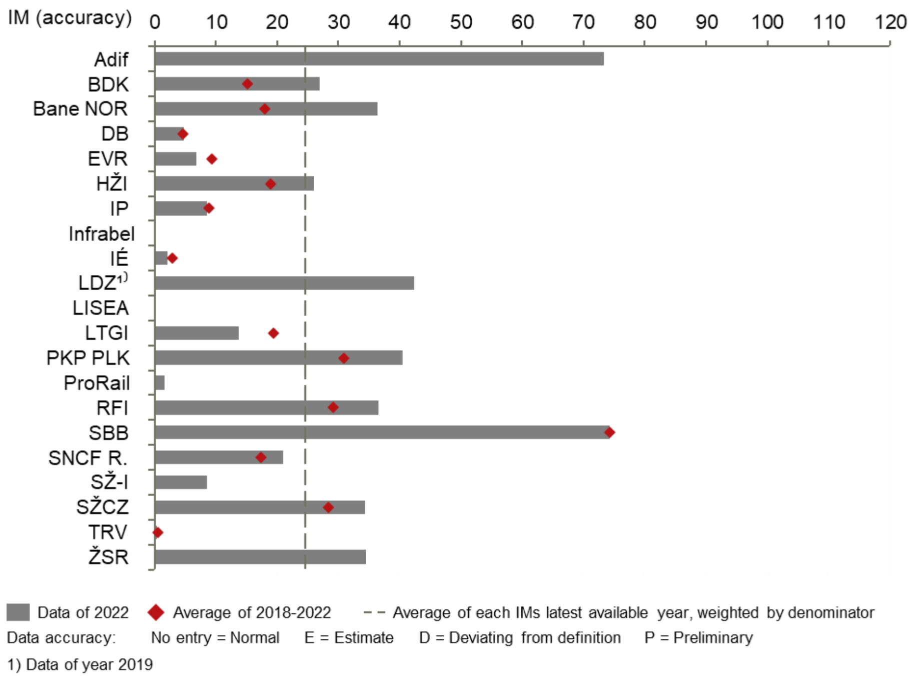

Figure 38: Total revenues from non-access charges in relation to network size (EUR 1 000 per main track-km) [50]

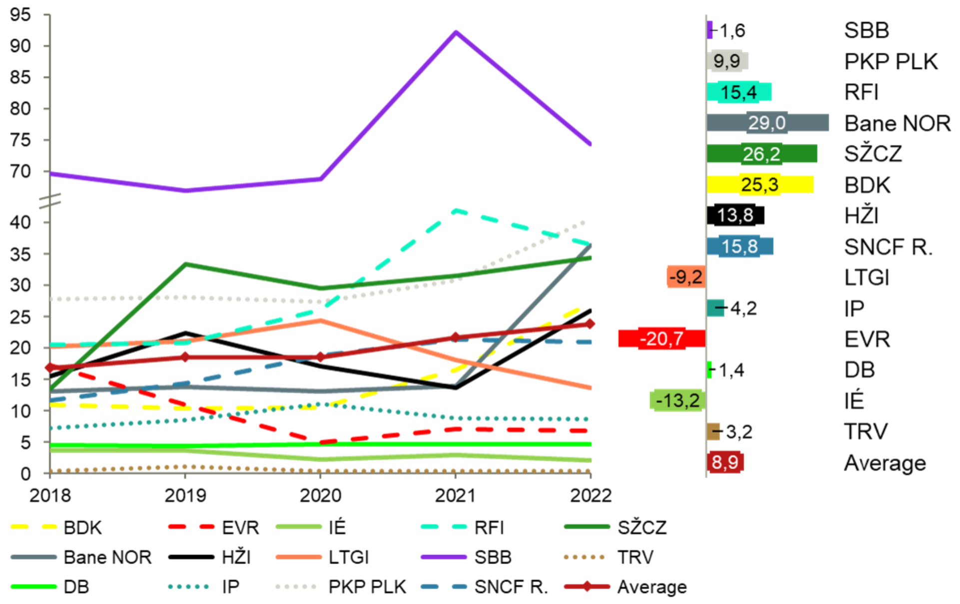

Figure 39: Total revenues from non-access charges in relation to network size (EUR 1 000 per main track-km) and CAGR (%) in 2018-2022 [51]

[50] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.
Zero value: LISEA

[51] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.

The growing importance of third-party financing in the transportation sector is also reflected by the development of the PRIME members. In the period of 2018 and 2022 the majority if infrastructure managers increased their revenues from non-access charges. Six companies have reached an annual growth of over 10%. The increase of RFI's value can be explained by the amount of public resources provided in 2020 and 2021 to compensate for the reduction of TAC due to the COVID-19 pandemic, as well as the increase in energy prices for traction.

The figures above demonstrate the different levels of revenues generated by infrastructure managers based on track access-related and non-track access-related sources. One of the main reasons for this variety is the range of possibilities ways of combining public funding, access charging and commercial funding. The precise combination in each country typically reflects historical precedent, the intensity with which the rail network is used, the legacy of asset management (which determines the extent to which maintenance and renewal costs can be forecast with confidence), the need for new capacity (which can prompt a search for alternative forms of funding) and the willingness of users to pay.

Public funding

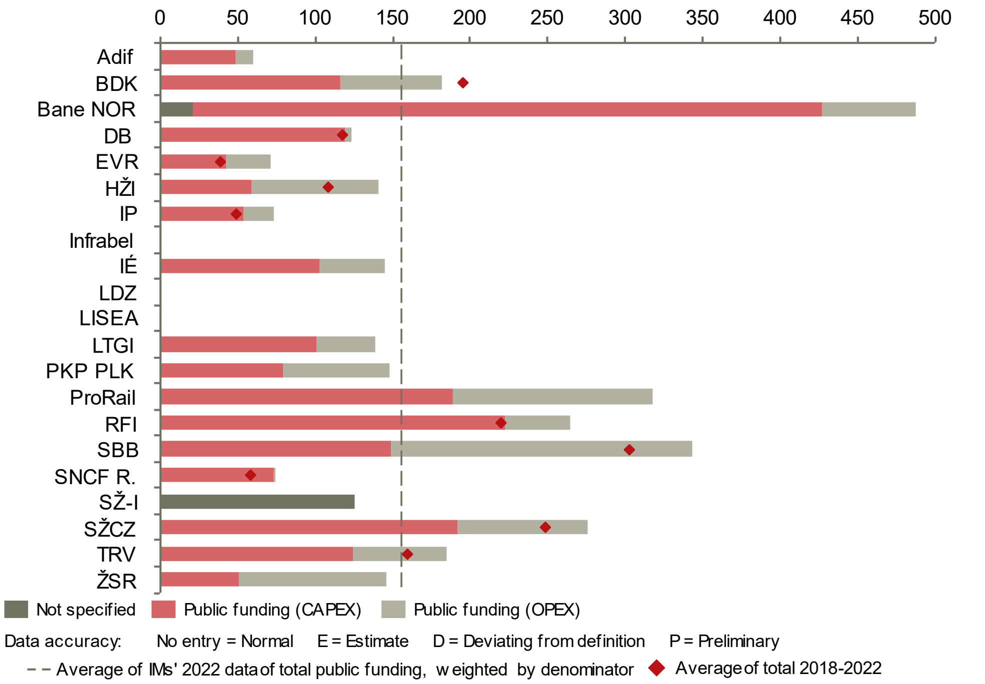

Figure 40: Public funding for OPEX and public funding for CAPEX in relation to network size (EUR 1 000 per main track-km) [52]

Figure 40 shows infrastructure managers' public funding dedicated to operational and capital expenditure. On average public funding dedicated to capital expenditures are higher for most organisations with a peer group's average of EUR 121 000, while the operational expenditure's average is EUR 36 000. SBB and ProRail have the highest public funding for OPEX. LISEA has no public funding at all due to its special case.

[52] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.
Zero values: LISEA (OPEX and CAPEX)

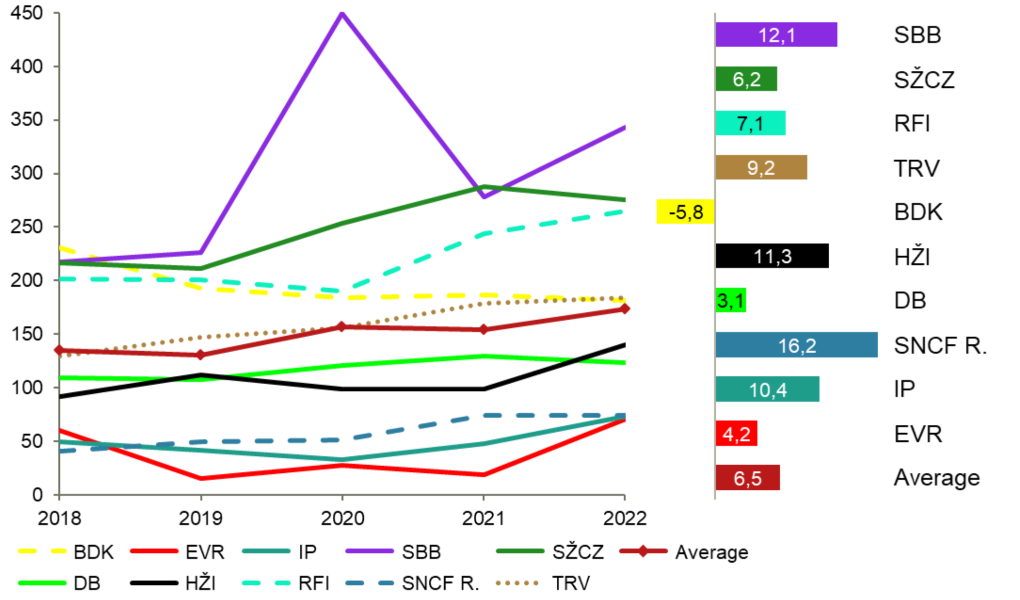

Figure 41: Total public funding in relation to network size (EUR 1 000 per main track-km) and CAGR (%) in 2018-2022[53]

Public funding, in line with other financial indicators, has predominantly seen growth across the board, with just one organization registering a negative annual growth rate. The most significant rise in public funding was reported by SNCF R. SBB's disproportionally high value in 2020 was due to the acquisition of the Ceneri Base Tunnel.

3.3 Safety

3.3.1 Summary of safety

EU-wide objectives

- All infrastructure managers aim at providing safe railway transport.
- To maintain and continuously improve railway safety EU-wide, the European Union has developed a legal framework for a harmonized approach to rail safety.
- The objective of the EU is to maintain and further develop the high standards of rail safety.

[53] Results are normalised for purchasing power parity. Calculated with preliminary PPP values for 2021 and 2022, which may be revised in the next data release periods of Eurostat.

- In accordance with the Sustainable and Smart Mobility Strategy, by 2050 the number of fatalities should be close to zero for all modes.

Peer group's performance

- Safety performance increased for most of the companies.
- Significant accidents decreased on average by 7%, while fatalities and weighted serious injuries declined by 3%.
- Infrastructure managers related precursors of safety incidents decreased on average by 11%.
- On average there have been 0.3 significant accidents and 0.2 people seriously injured and killed per million train-kilometres each year.

3.3.2 Development and benchmark of safety

For infrastructure managers safety is of outstanding importance and mandatory in any framework of key performance indicators. It is the most important element in the performance of an infrastructure manager, and affects customers, stakeholders, the reputation of the infrastructure manager, the railway and society at large. Infrastructure managers constantly invest in their assets and new technology to provide good safety levels, and they develop their safety policies to achieve maximum awareness. This chapter presents the safety performance of the infrastructure managers.

Rail safety indicators

PRIME members report three indicators measuring railway safety performance:

- Significant accidents
- Fatalities and weighted serious injuries
- Infrastructure manager related precursors to accidents

To increase comparability of these values among infrastructure managers, these values are related to million train-kilometres.

Development and benchmark

Figures 42 to 48 show the safety performance of the PRIME members as a benchmark, and over the time-period 2018-2022.

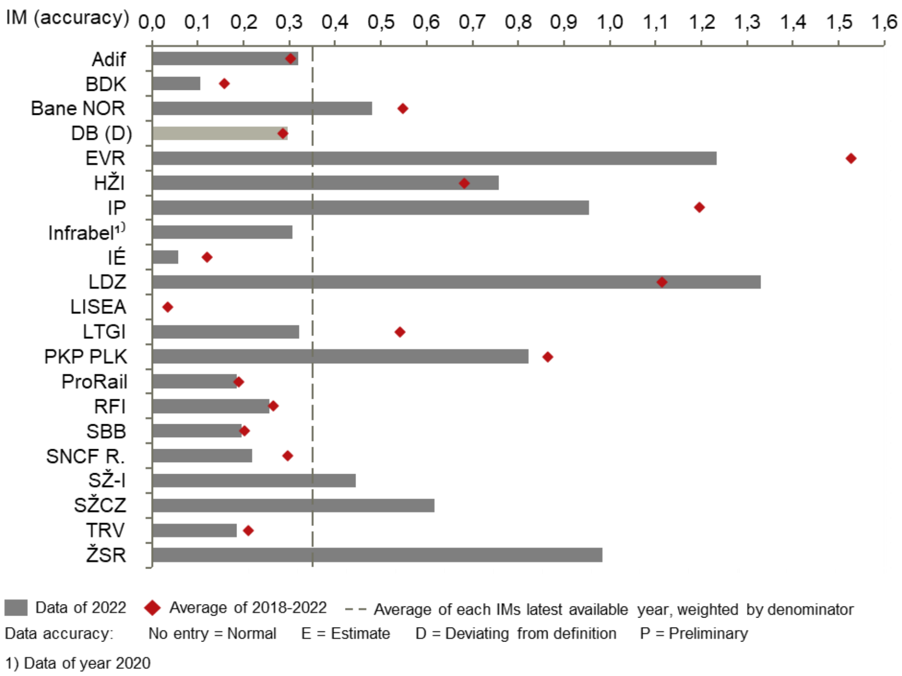

Figure 42: Significant accidents (Number per million train-km)[54]

Figure 42 presents the 2022 data on significant railway accidents. It provides the relative numbers of significant accidents that occurred on the main lines, excluding those in workshops, warehouses, and depots. The graph shows a wide range of values among the infrastructure managers, with LISEA recording zero accidents and LDZ reporting 1.3 accidents per million train-kilometers. On average, there were 0.35 significant accidents per million train-kilometers. Eleven infrastructure managers reported accident figures below this average. The lighter grey of DB indicates deviating data, which is explained in the Annex 4.3.

[54] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3. Zero value: LISEA

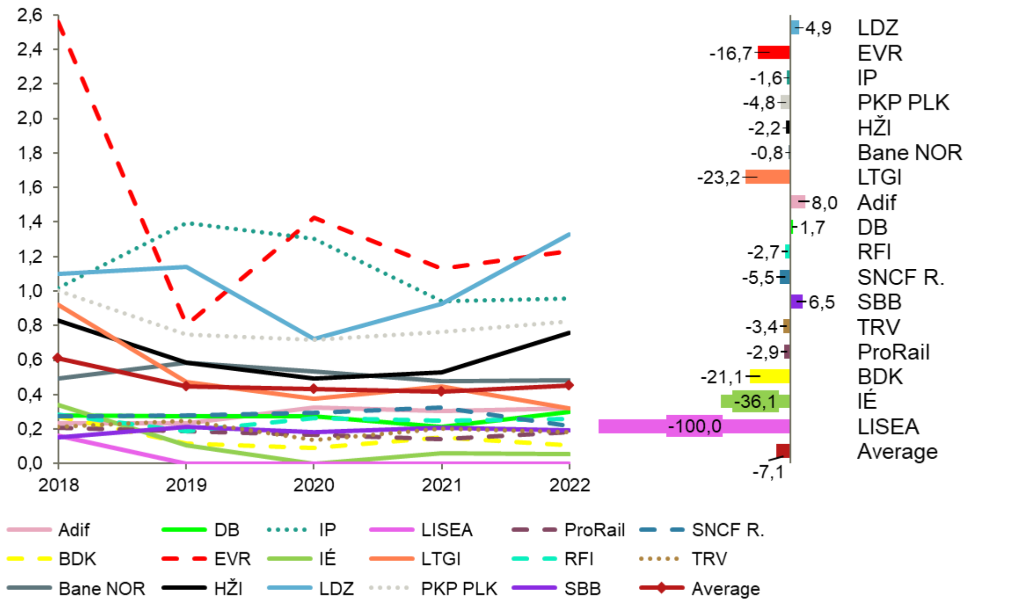

Figure 43: Significant accidents on infrastructure manager’s network (Number per million train-km) and CAGR (%) in 2018-2022

The development in safety performance between 2018 and 2022 is in line with EU ambitions. Almost all infrastructure managers improved their safety level from 2018 to 2022 with reducing their relative accident numbers. LISEA’s notable decrease is due to an accident in 2018 but zero accidents in the following year.

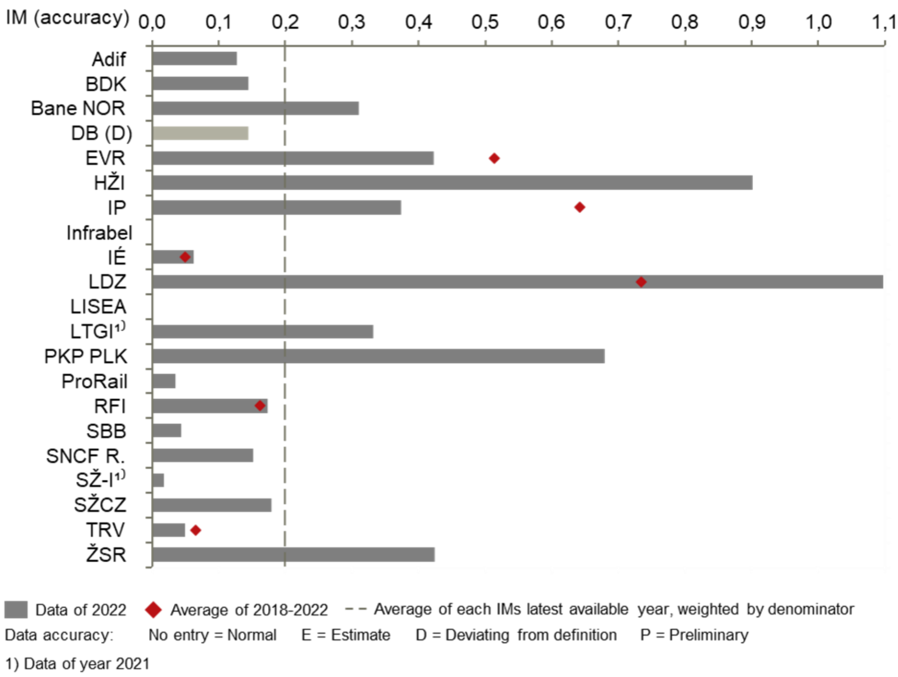

Figure 44: Fatalities and weighted serious injuries (Number per million train-km) [55]

The PRIME indicator for "Fatalities and weighted serious injuries" follows the definition and calculation method of the European Union Railway Agency (ERA) for the indicator of the same name. In this indicator, persons suffering serious injuries are given a statistical weight equal to 0.1 of a fatality. For all infrastructure managers, the average rate of serious injuries or fatalities is 0.2 per million train-kilometres. However, this figure varies considerably across the group, with a standard deviation of 0.18, indicating considerable variation in the data.

[55] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3. Zero value: LISEA, LTGI (Number of persons seriously injured and killed); LISEA (Number of persons killed)

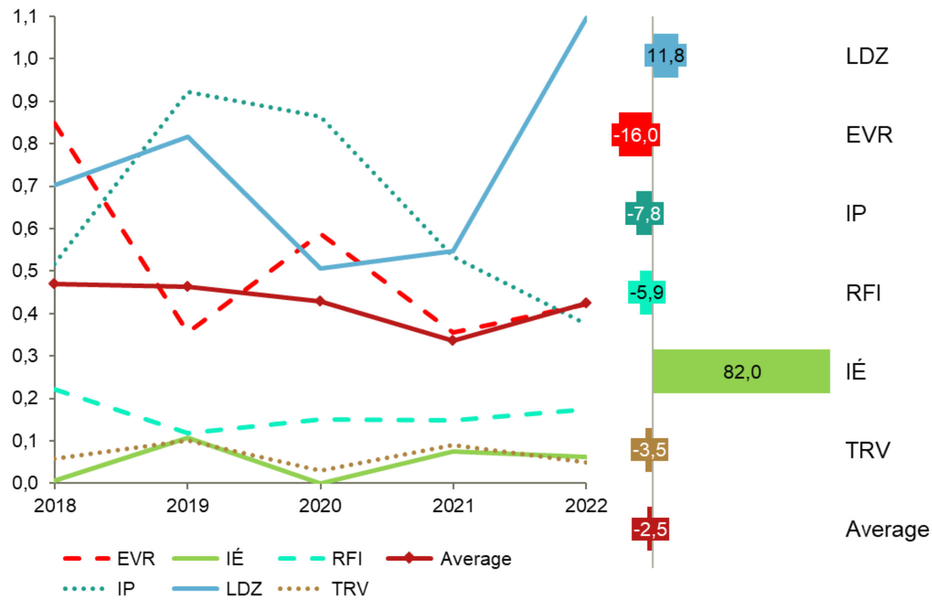

Figure 45: Fatalities and weighted serious injuries (Number per million train-km) and CAGR (%) in 2018-2022

Until last year there was no differentiation between fatalities and serious injuries in the data supplied by infrastructure managers, which has changed last year, to weigh the fatalities and injuries differently. Due to this change, the completeness of historical data is limited. As a result of this, only six infrastructure managers are shown in the time series graph. Nevertheless, the graph remains consistent with other safety indicators that show significant accidents.

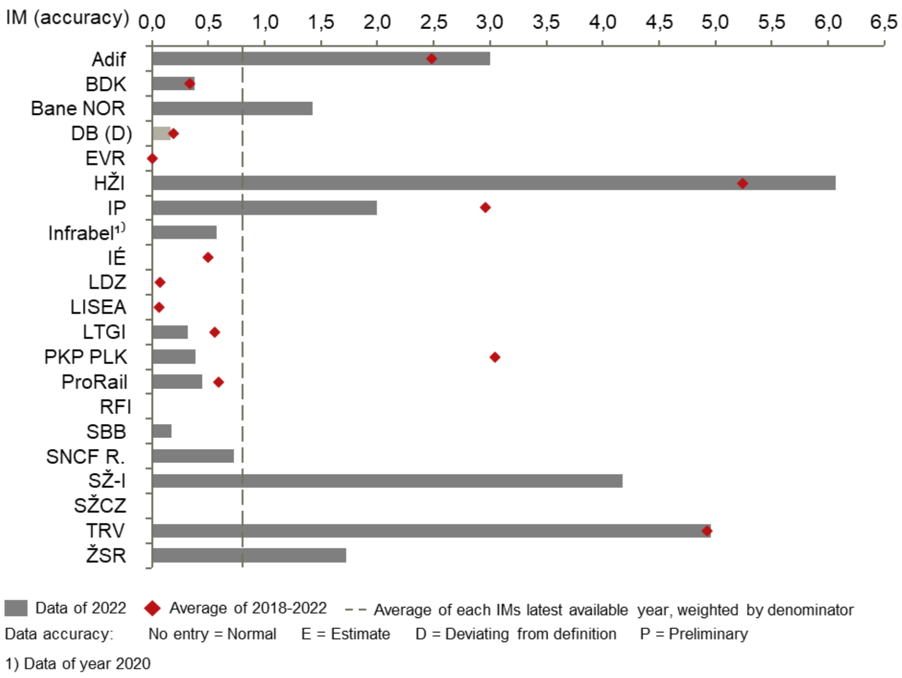

Figure 46: Infrastructure manager related precursors (Number per million train-km)[56]

Precursors are a good indicator to understand and mitigate root causes for significant accidents and include broken rails, track buckle and track misalignment, as well as wrong-side signaling failures.

Like the variation seen with other safety indicators, there's a notable disparity across the peer group when it comes to infrastructure manager-related precursors. The average stands at 0.8 precursors per million train-kilometers. In 2022, several organizations such as EVR, LISEA, IÉ, LDZ and SŽCZ reported zero precursors, whereas the highest numbers were documented by HŽI, TRV, and SŽ-I.

[56] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3. Zero value: EVR, LISEA, IÉ, LDZ, SBB, SŽCZ

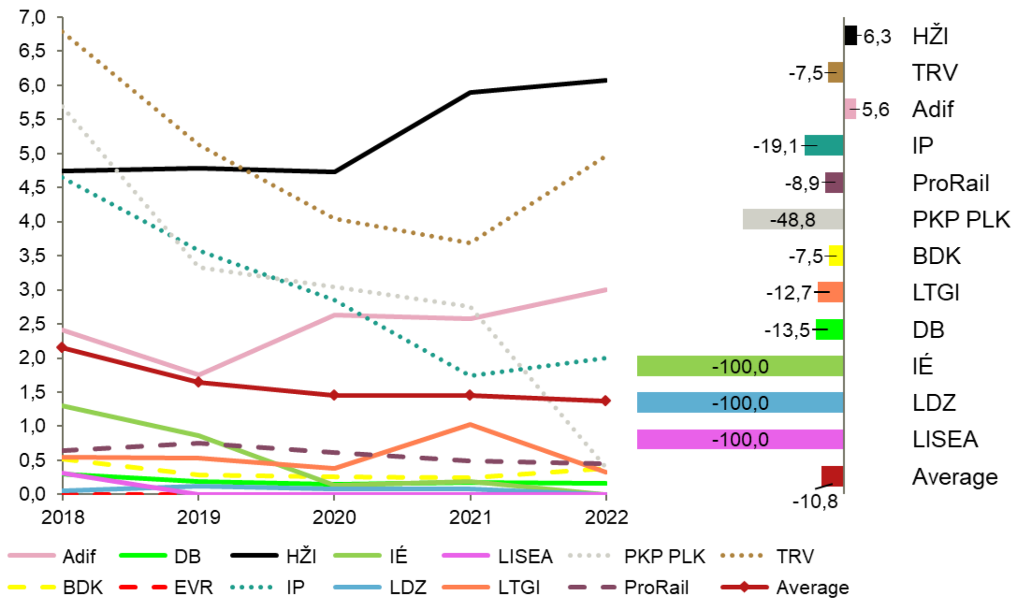

Figure 47: Infrastructure manager related precursors (Number per million train-km) and CAGR (%) in 2018-2022

Figure 47 is consistent with the data presented in the graphs on significant accidents and shows that infrastructure managers have significantly improved the level of safety over the years. The trend observed from 2018 to 2022 shows a reduction in the number of precursors related to infrastructure managers. The significant decreases reported by IÉ, LDZ and LISEA can be attributed to their reduction of incidents to zero in 2022.

Rail safety is influenced by a wide array of factors. Safety policies should be preventive and reactive at the same time. Providing assets in good condition by ensuring appropriate activity levels of maintenance and renewal is a precondition for reliable and safe operations. Safety figures are also influenced by unauthorised persons entering the rails, whereby these incidents can only be influenced by the infrastructure manager to a limited extent. Many infrastructure managers have launched campaigns to reduce the number of level crossings and to introduce modern signaling and communication systems. Increased awareness among employees and track workers, as well as the public, is another main pillar of rail safety. An organisation's safety culture is therefore essential, playing a major role by employing direct preventive measures, and through raising awareness of safety, which reduces the influence of the human factor. Regarding casualties, response time in emergency services and different reporting and hospital procedures in the Participating states might also have an impact on the statistics.

As infrastructure managers in the EU are working under different circumstances it is very important to put the data in context. The infrastructure managers from newer EU countries in Eastern Europe are still in a phase of modernizing and upgrading their railway networks. The initial conditions were different not only regarding asset conditions and technical safety equipment, but also safety policies. In addition, it is important to note that to identify infrastructure manager related precursors to accidents, an organisation must have sufficient capacity and implemented systems to capture them.

3.4 Environment

3.4.1 Summary of environment

EU-wide objectives

- The European Green Deal aims to make Europe climate-neutral by 2050.
- In accordance with the EU's Sustainable and Smart Mobility Strategy:
  - All transport modes need to become more sustainable.
  - Sustainable transport alternatives should be widely available.
  - Scheduled collective travel of under 500 km should be carbon-neutral by 2030 within the EU.
- Rail needs to continue with further electrification of the track or using greener alternatives to diesel where electrification is not possible. The TEN-T core network is to be electrified by 2030, the comprehensive network by 2050.

Peer group's performance

- The network of the peer group is mostly electrified with an average of 72%.
- The share of electricity-powered trains in relation to train-kilometres across the peer groups is around 82%.
- Network electrification shows a modestly positive trend from 2018 to 2022.
- The proportion of electricity-powered trains saw an average increase of 1%, largely due to the expansion of electrified train services in countries with relatively low levels of electrification previously.
- While the degree of electrification strongly correlates with the share of electricity-powered trains, the electrified networks are not 100% exploited.
- The peer group obtains approximately 52% of its energy from renewable sources.

3.4.2 Development and benchmark of environment

While rail is the most environmentally friendly transport mode it is still important that it continues to become greener. The biggest overall impact will come from electrification and the use of greener alternatives to diesel where electrification is not possible. Another possibility is to increase the share of renewable energies in traction energy, for which data is available since this year. The indicators related to the electrification process and energy consumption are presented in this chapter.

Rail environment indicators

PRIME members are reporting five indicators measuring railway environmental performance:

- Degree of electrification
- Share of electricity-powered trains
- Share of diesel-powered trains
- Share of renewable traction energy
- Share of renewable energies (excl. traction)
- CO_2 emission produced from maintenance rolling stock

To increase comparability of these values among infrastructure managers, these values are related to main track-kilometres and to train-kilometres.

Development and benchmark

Figures 48 to 55 show the relevant environmental indicators as a latest benchmark between the infrastructure managers and their development over the time-period 2018-2022.

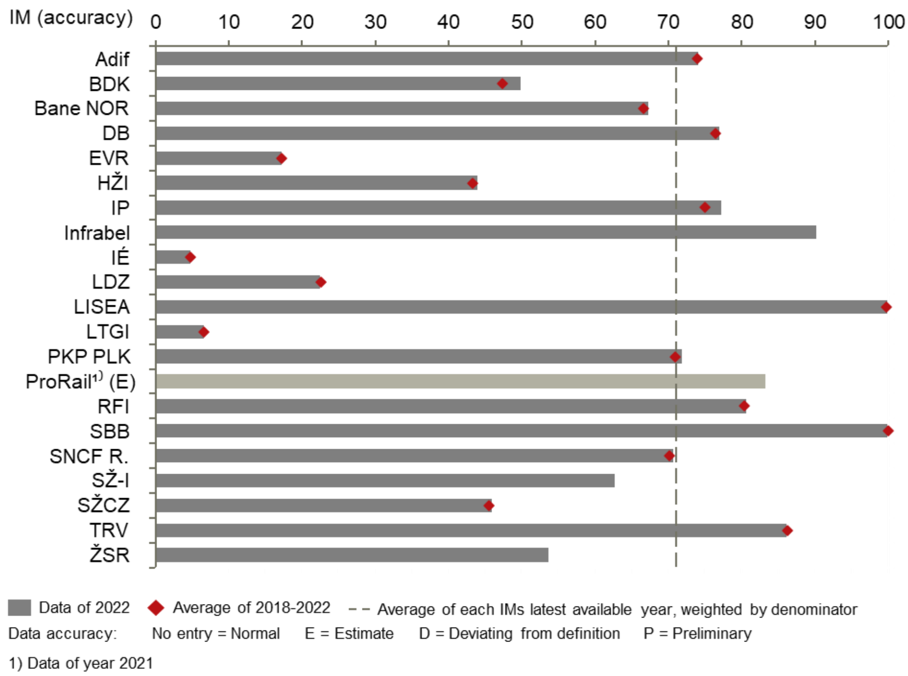

Figure 48: Degree of electrification of total main track (% of main track-km)

In the EU railway networks are mostly electrified. The peer group's average is 72%, however, the degree of electrification varies widely from 6% to 100%. While SBB and LISEA have electrified their entire network, IÉ and LTGI have an electrification degree of below 10%.

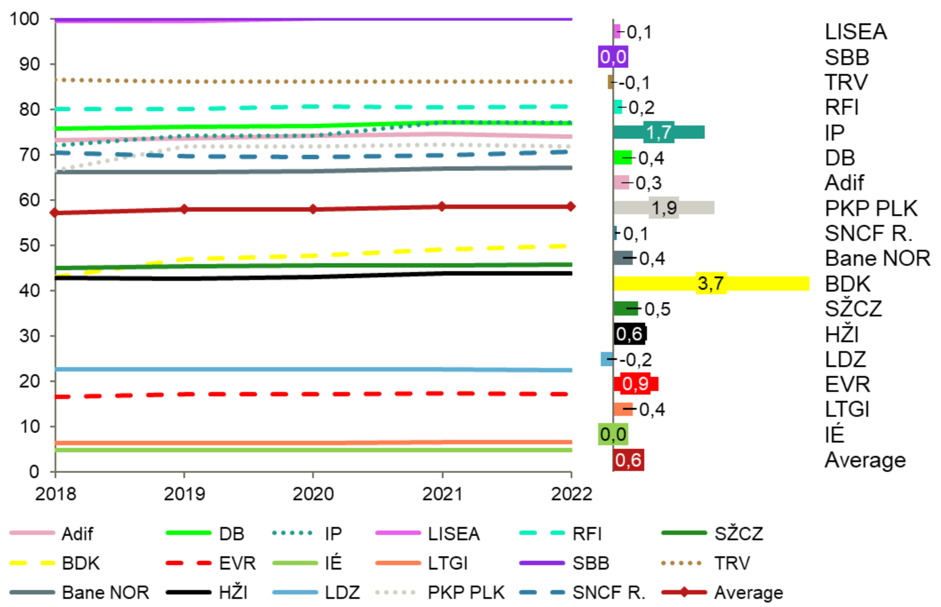

Figure 49: Degree of electrification of total main track (% of main track-km) and CAGR (%) in 2018-2022

Between 2018 and 2022, the level of electrification of main tracks showed relative stability. BDK stands out for having the most significant growth, expanding its electrified main tracks from 43% in 2018 to 49% in 2022. On average, there was a modest increase of 0.6% in the electrification rate among the peer group.

Network utilisation and density appear to be a driver for electrification in several cases. As the transfer to electrified lines requires high investments, electrification makes economically most sense on busy lines. On low-density lines the cost-efficiency is not proven, which is one reason why some infrastructure managers, such as IÉ, LDZ and LTGI, are showing rather low degrees of electrification. Economic conditions can also impact the ability of a rail member to invest. Infrastructure managers and operators managing and running on low-density networks are discussing other approaches to develop greener railways. Battery powered trains and hybrid-diesel electric locomotives are two possible approaches. Making rail transport more sustainable cannot only be achieved by a fully electrified network, but also by incentivising and investing in other alternative energy sources.

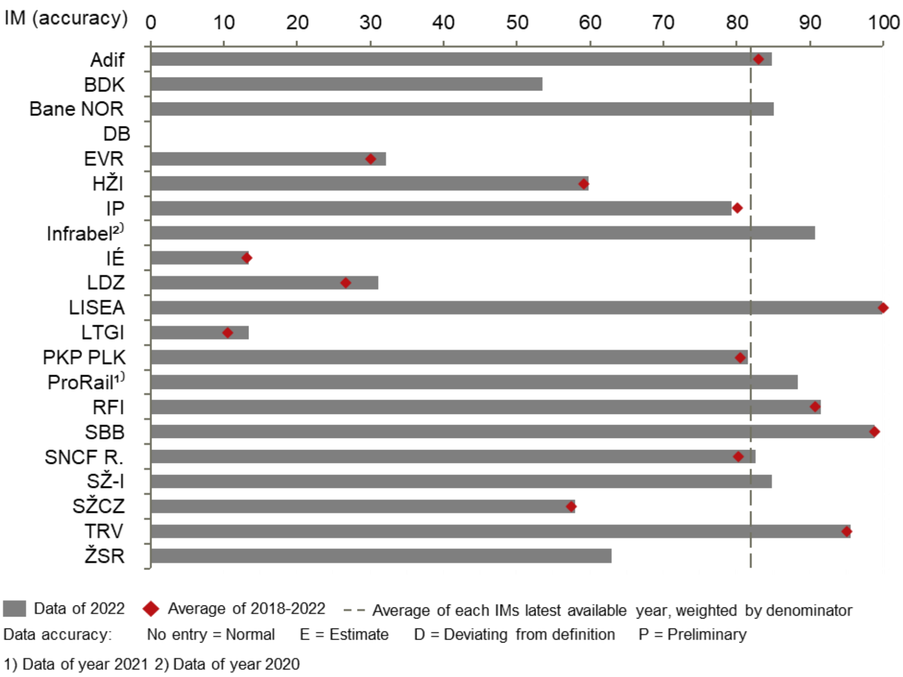

Figure 50: Share of electricity-powered trains (% of total train-km)

The share of electricity-powered trains corresponds to the electrification of the network. Over 82% of the peer group's traffic is powered by electricity. On LISEA’s network all trains run with electricity-power. SBB, TRV, RFI and Infrabel have above 90% of electricity-powered trains running on their network. The lowest share of electricity-powered trains can be seen for IÉ and LTGI.

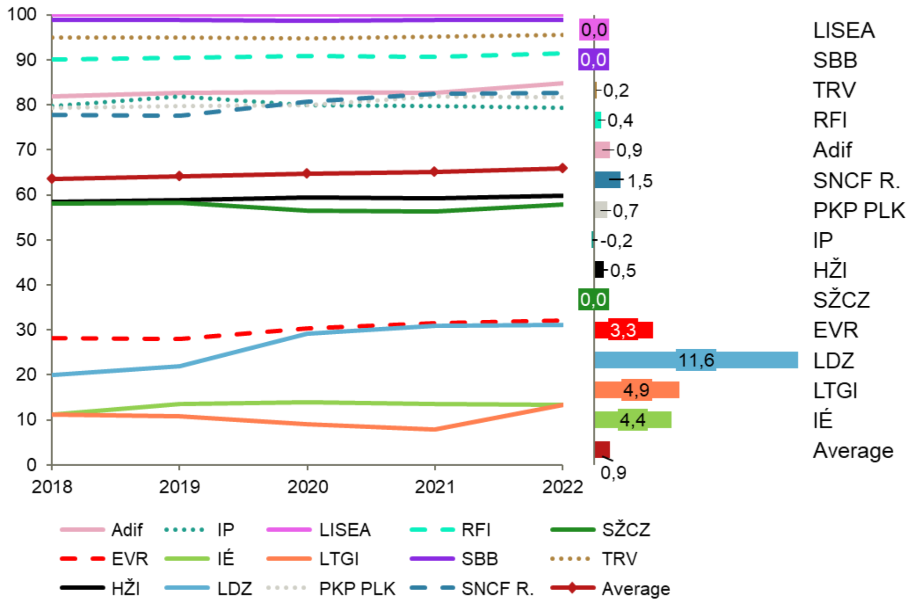

Figure 51: Share of electricity-powered trains (% of total train-km) and CAGR (%) in 2018-2022

Figure 51 illustrates the trend in the share of electricity-powered train from 2018 to 2022. Mirroring the stable yet slightly upward trend in main track electrification, there has been especially a noticeable increase among infrastructure managers with a previously low share of electricity-powered trains, particularly for LDZ, LTGI, IÉ, and EVR. LDZ recorded the most substantial annual growth, improving its percentage of electricity-powered trains from 20% in 2018 to 32% in 2022. LTGI and IÉ each raised their shares from approximately 11% to 13%, while EVR experienced an annual growth rate of 3%, translating to an increase in electricity-powered trains from 28% to 32%.

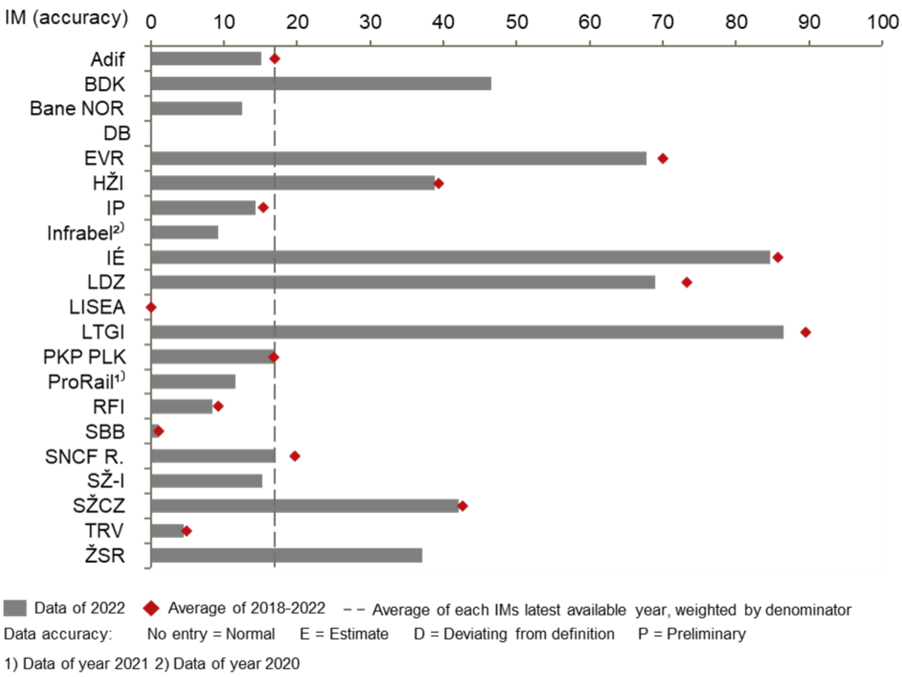

Figure 52: Share of diesel-powered trains (% of total train-km)

Figure 52 is the counterpart to figure 47 and shows the share of diesel-powered trains in relation to total traffic volume of the infrastructure managers. Corresponding to the low electrification level of their network, the Baltic countries and Ireland show higher rates of diesel-powered trains than the rest of the group. 89% of LTGI's, 86% of IÉ's, 69% of LDZ's and 68% of EVR's traffic volume is produced by diesel-powered trains while the peer group's average stays around 17%.

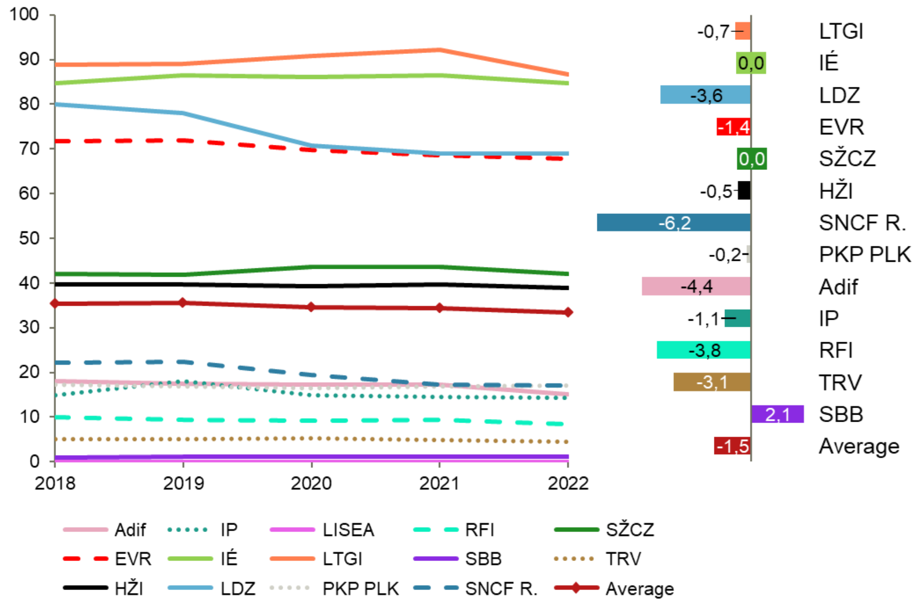

Figure 53: Share of diesel-powered trains (% of total train-km) and CAGR (%) in 2018-2022

Figure 53 shows the development of the share of diesel-powered trains between 2018 and 2022. Considering the European Commission's objective of reducing the share of diesel-powered trains, the declining trend (-1.5%) across the peer group is promising. Almost all infrastructure managers decreased their share of diesel-powered trains, six companies by over 1%. The highest decrease can be seen at SNCF R., which shows an annual reduction of 6.2%. The highest annual growth can be seen at SBB, as there has been a moderate increase in diesel powered freight and work trains.

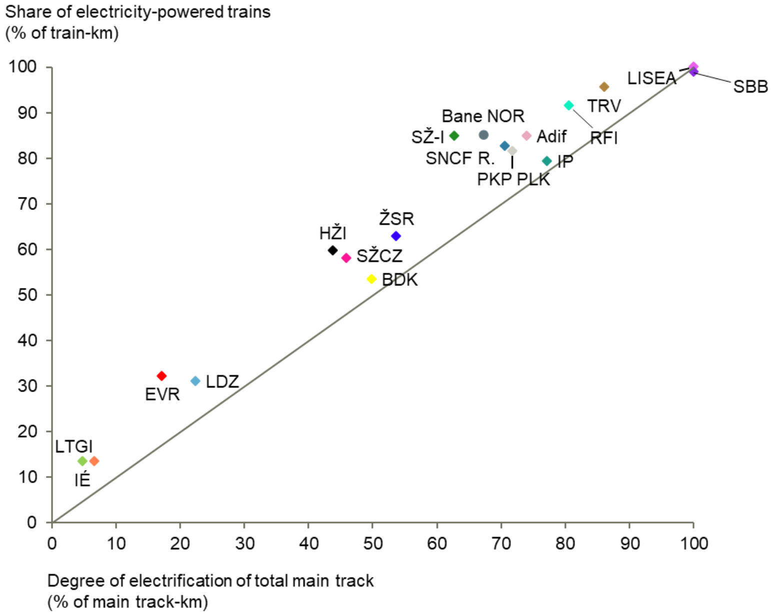

Figure 54: Share of electricity-powered trains (% of train-km) / Degree of electrification (% of main track-km)

Figure 54 shows an unsurprising correlation between the degree of electrification of the network and the share of electric trains. However, it is noticeable that similar degrees of electrification do not automatically lead to similar shares of electrically produced train services. The decision to operate electricity-powered trains lies mainly with the operator, which may decide to run diesel-powered trains or alternative engines on electrified lines. Historic trains or trains that also run on non-electrified lines are two examples.

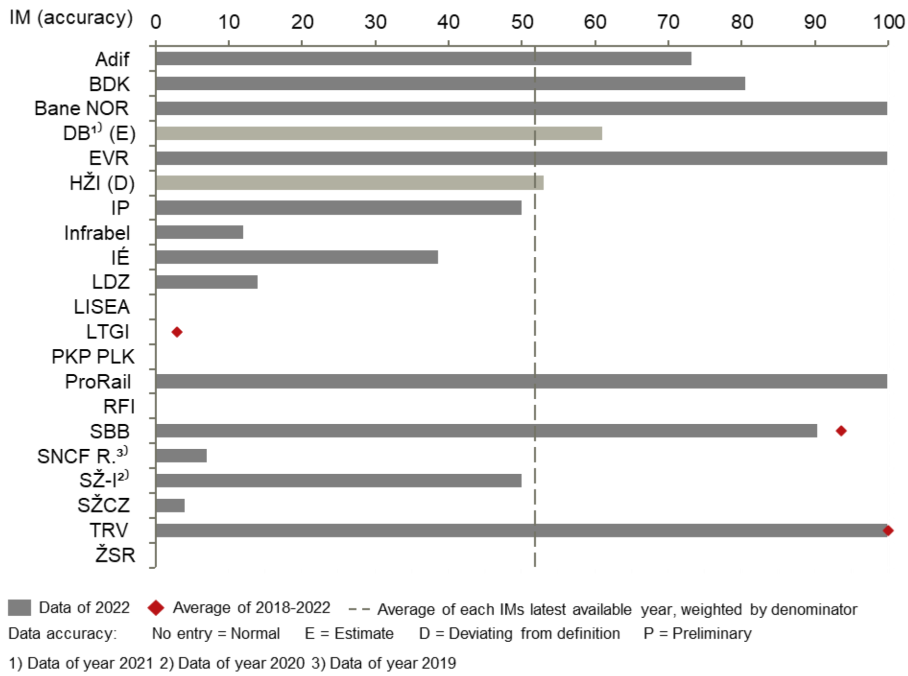

Figure 55: Share of renewable traction energy (% of kWh) [57]

Rails also aim to become greener in terms of energy consumption. Figure 55 shows the proportion of renewable traction energy in relation total traction energy in kWh. As we can see Bane NOR, EVR, TRV and ProRail obtain 100% of the energy needed to run electric trains from renewable energy sources, SBB has a share of over 90% mostly produced by its own hydropower plants. The peer group's average is 52%.

[57] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.
Zero value: LTGI, LISEA.

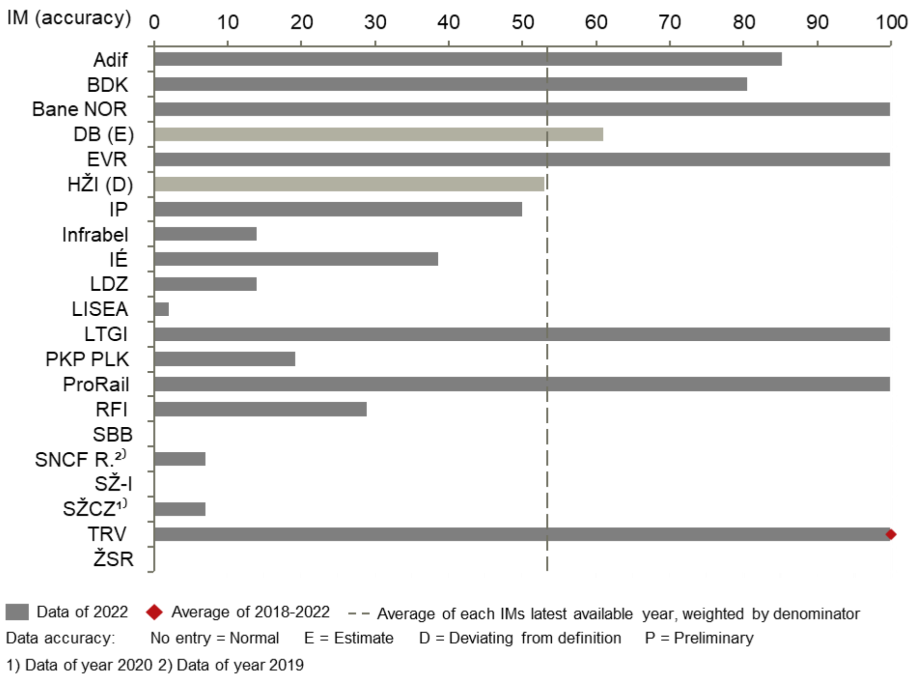

Figure 56: Share of renewable energy excluding traction (% of kWh) [58]

Figure 56 displays the proportion of renewable energy used, excluding traction energy. Consistent with the usage patterns for traction energy, the same infrastructure managers that sourced 100% of their traction energy from renewable sources also apply renewable energy for their other needs excluding traction. The average renewable energy usage for these purposes mirrors that of traction energy at 53%.

[58] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.

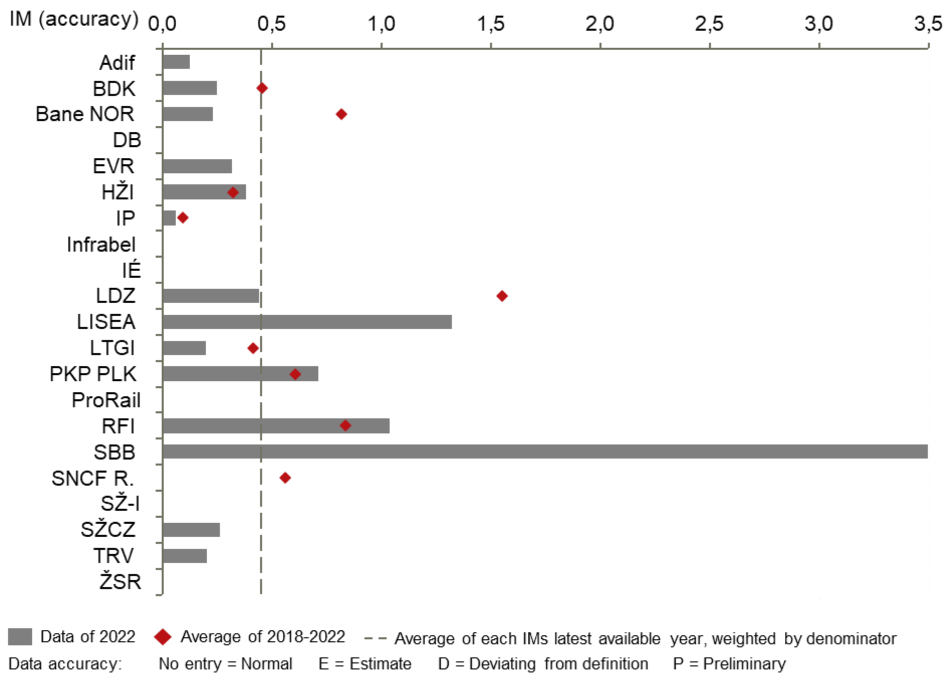

Figure 57: CO_2 emission produced from IM's own maintenance rolling stock (tCO_2 per main track-km) [59]

Figure 57 captures the environmental impact of an infrastructure managers own maintenance rolling stock regarding its CO_2 emission. Its contribution to the overall emissions is small, however it is relevant to collect and analyse the data. As we can see, the emissions produced by rolling stock vary across the peer group and have an average of 0.4. However, it is important to note that the extent to which infrastructure managers outsource maintenance and the usage of maintenance rolling stock has a major impact on their CO_2 emission in this respect. The collected data do not include the CO_2 emissions of such subcontracting. SBB's relatively high diesel consumption is due to the fact, that a large part of its maintenance work is done with its own rolling stock (values based on estimation).

[59] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.
Zero value: SNCF R.

3.5 Performance and delivery

3.5.1 Summary of performance and delivery

EU-wide objectives

- Improving performance and increasing punctuality of passenger and freight rail services is an objective of every infrastructure manager.
- Infrastructure managers establish targets and monitor them closely to develop appropriate activities and measure their effectiveness.
- EU legislation has established basic principles to minimise disruptions. Infrastructure charging schemes should encourage railway undertakings and the infrastructure manager to minimise disruption and improve the performance of the railway network through a performance scheme.

Peer group's performance

- PRIME has developed common definitions to increase the comparability of performance measures:
  - Passenger trains punctuality is measured with a threshold of 5:29 minutes.
  - Freight trains punctuality is measured with a threshold of 15:29 minutes.
- While compared to 2020 passenger train punctuality decreased as of higher train activity, when looking at the period of 2018-2022 it remained stable.
- Freight train punctuality increased on average by over 1% in the peer group.
- On average infrastructure managers caused 5 delay minutes per thousand train-kilometres.

3.5.2 Development and benchmark of performance and delivery

Performance and delivery is a category in which increased customer demands are particularly visible. More frequent and more complex journeys require coordinated schedules and punctual trains. The logistic sector calls for plannability, traceability, and speed in transportation. Infrastructure managers are constantly working on improving their performance by increasing their punctuality and minimising the effect of failures to provide a reliable and available network.

Rail performance and delivery indicators

PRIME members are reporting three indicators measuring railway punctuality, two indicators measuring reliability and two indicators measuring availability:

- Punctuality:
  - Passenger trains' punctuality
  - Freight trains' punctuality
  - Delay minutes caused by the infrastructure manager
- Reliability:
  - Asset failures in relation to network size
  - Average delay in minutes per asset failure
- Availability:
  - Tracks with permanent speed restrictions
  - Tracks with temporary speed restrictions

To increase comparability of these values among infrastructure managers, the train punctuality indicators are illustrated as a percentage of all trains scheduled, the delay minutes are related to train-kilometres and the number of asset failures as well as the speed restrictions are related to main track-kilometres.

3.5.3 Punctuality

Other than safety, train punctuality is the primary measure of overall railway performance and a key measure of quality of service, driven not only by the infrastructure manager but also operators, customers, and other external parties. It is a complex output that needs to be understood as the result of a system where many internal and external factors, different technologies, many actors and stakeholders come together and interact to produce a good service for passenger and freight customers.

Punctuality is measured and managed in very different ways, as performance schemes are not yet sufficiently coordinated between infrastructure managers. Different measurement concepts concern mainly the thresholds of punctuality and approaches regarding measurement points. Within the peer group the individual span of thresholds set to classify a train as delayed may differ by more than 10 minutes for passenger trains and more than 50 minutes for freight trains. The collection of the individual company standards that are used for national and company internal monitoring can be found in the Annex 4.5.

To promote good quality benchmarking, PRIME has established a common definition including an agreed threshold for each passenger and freight services. For passenger trains, punctuality indicators represent the percentage of operating national and international passenger trains which arrive at each strategic measuring point with a delay of less than or equal to 5:29 minutes. For freight trains the threshold has been set to 15:29 minutes. Several but not all infrastructure managers report their punctuality figures according to this definition. However, for some infrastructure managers this threshold is less favourable and difficult to align with internal company targets.

As already indicated, the other important component of measurement concepts is the approach regarding measuring points. The density of measurement points in networks can be as low as measuring at the final destination only, or as high as measuring at arrivals, destinations, and additional points. The following table shows the different concepts with regards to measurement points in each infrastructure manager's network. The counting method and definition of strategic measuring points lays in the responsibility of the infrastructure managers and is not further harmonised by PRIME.

Infrastructure manager	**Measurement points in the network**
Adif	For statistical purposes at final destination only. For traffic regulation and management also at every station, in blocks and at some other strategic points like switches.
BDK	Passenger trains (commuter): 86 strategic measurement points Passenger trains (regional and long distance): 48 strategic measurement points Freight trains: 14 strategic measurement points
Bane NOR	PRIME punctuality performance measures are measured at final destination and at Oslo Central Station for both passenger and freight trains.
DB	For statistical purposes: Punctuality of passenger trains is measured at all stations. Punctuality of freight trains is measured at the final station (arrival) within Germany.
EVR	Measured at final destination

Infrastructure manager	Measurement points in the network
HŽI	For all trains, time is measured only at the destination (final relation station, or transfer to neighbouring infrastructure managers)
IÉ	Measured at final destination
Infrabel	Passenger trains: Measured at final destination and if applicable, it is measured at arrival at the first station in Brussels. Freight trains: at arrival or at moment of leaving the country
IP	Exclusively at the destination (all systems are prepared for the measurement to be performed on more stations. To this end, the stations to be selected will be all those that enhance commercial service or have technical characteristics for services requested by the operator)
LDZ	Strategic measurement points
LISEA	Stations and strategic measurement points across the network
LTGI	Measured at strategic points.
PKP PLK	For statistical purposes, time measured at the destination (final relation station, or transfer to neighbouring infrastructure manager). The possibility of measurement exists at any point where the arrival / departure time of the train is described.
ProRail	Strategic measurement points
RFI	Final destination for punctuality purpose
SBB	Passenger trains: 53 strategic measurement points (large stations). Freight trains: 52 strategic measurement points (specific freight operating points).
SNCF R.	Measurements of punctuality are drawn from strategic and near-stations points.
SŽCZ	For statistical purposes:

Infrastructure manager	Measurement points in the network
	• Origin point of a train or arriving border station in case of cross-border train (transfer from other infrastructure manager) • Final destination point or departing border station in case of cross-border train (transfer to other infrastructure manager)
SŽ-I	Final destination for punctuality purpose.
TRV	Official performance measures measured at final destination only. Many more measuring points exist but are not calculated in the performance measures.
ŽSR	For passenger trains, the measurement points are at every station, but fulfilment of timetable is calculated based on measuring on arrival and sometimes departure, if needed. Same measurement points are applicable for freight trains, but the fulfilment of timetabling is not calculated unless demanded by an entity/authority.

Table 2: Infrastructure manager's measurement points in the network

Passenger total train punctuality (5:29 minutes)

Figures 58 and 59 show the punctuality of passenger trains for operators using the network of PRIME members as a benchmark and over the time-period 2018-2022. It is important to note that punctuality figures presented here are not solely the result of the infrastructure manager's performance but also include delays caused by operators and other parties as well as external causes, hence representing full system-punctuality.

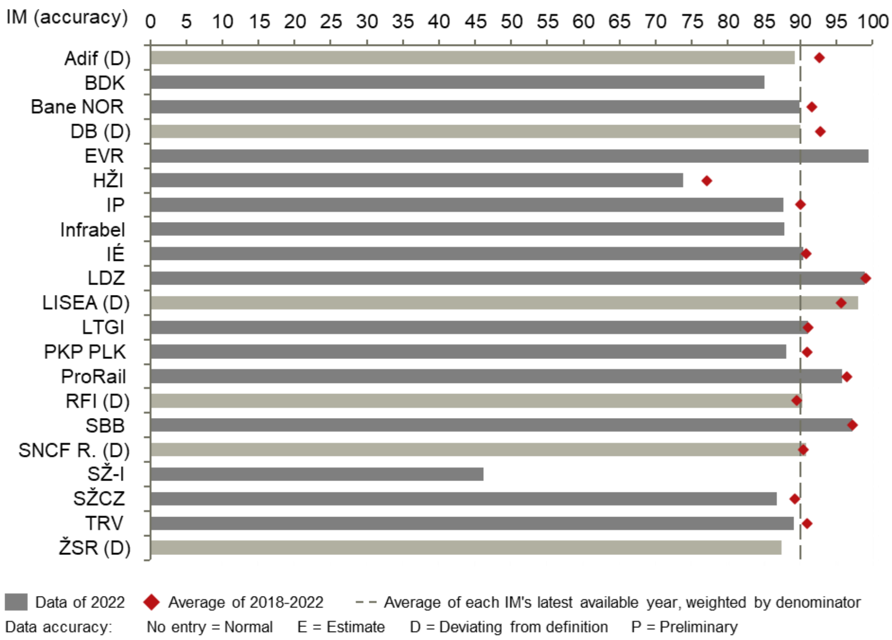

Figure 58: Passenger trains total punctuality (5:29 minutes) (% of operating trains)[60]

Figure 58 shows the passenger train punctuality data of the latest available year. The figures vary between 46% and 99%, which is again partly a result of different measuring methodologies. The punctuality of passenger trains has a weighted average of 90% and a standard deviation of 11%. SŽ-I has a lower value as a lot of tracks are closed due to intensive upgrading and maintenance works on the railway network. The lighter grey colour highlights the infrastructure managers which deviate from the PRIME definition. Infrastructure managers are constantly working on aligning their punctuality thresholds to the PRIME definition. In total, six infrastructure managers are deviating from definition. Comments explaining in what sense the individual data points are deviating are collected in the Annex 4.3.

60 Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.

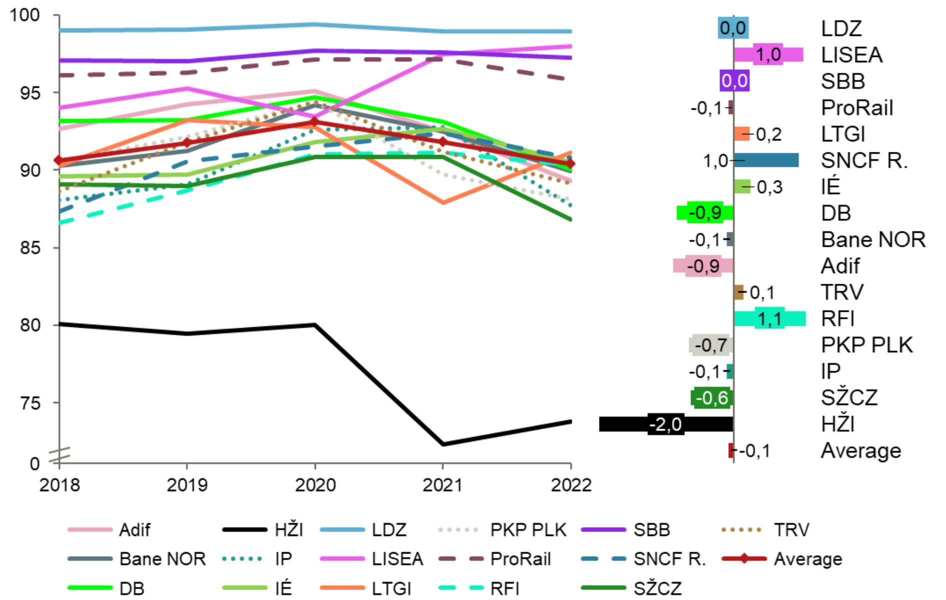

Figure 59: Passenger trains total punctuality (5:29 minutes) (% of operating trains) and CAGR (%) in 2018-2022

Figure 59 illustrates the evolution of passenger train punctuality from 2018 to 2022. Notably, almost all infrastructure managers experienced a decline in punctuality compared to 2020, which saw the highest rates within the period under review. This decrease was largely attributed to the Covid-19 pandemic, during which there was a significant reduction in train activity, which helped to improve on-time performance. The overall trend between 2018 and 2022 presents a varied picture: eight infrastructure managers saw a drop in their punctuality rates, whereas six managers improved their punctuality on an annual average, leading to a stable average punctuality rate across the board. SNCF R., RFI, and LISEA were among those that enhanced their punctuality throughout the period. HŽI faced a notable decrease in 2021, primarily due to extensive track maintenance and the imposition of temporary speed limits.

Besides different measuring concepts, there are other factors impacting punctuality. Some of them are outside the infrastructure manager's control. The complexity of a network and its utilisation are among the most important factors. Networks with a higher proportion of regional traffic tend to have better results than the networks with a higher proportion of long-distance traffic. The risk of delays due to failures increases with higher complexity. For example, a network with a high density of assets such as switches and level crossings is more prone to failures and requires more interventions, such as maintenance and renewal activities. Construction works can have an impact on punctuality as they can reduce the performance of the lines in the short term during the construction phase. The same principle applies with respect to the degree of utilisation. A network with a high degree of utilisation (expressed as train-kilometres per track-kilometre) experiences more wear and tear, operational conflicts, and train-affecting perturbations. Knock-on effects on punctuality increase with the level of utilisation. On the other side, higher utilisation implies that less error is accepted, and punctuality must be better. This means that the quality of the timetabling and of the infrastructure needs to be better. As shown in figures 24 and 25 this implies higher operational costs for infrastructure managers like SBB and ProRail. The need for more CAPEX is less clear as there are many other needs with high priority (e.g. renewal and safety requirements).

One should bear in mind that punctuality, however, results from a complex and long-term set of parameters; a meaningful analysis cannot be limited to one year.

Poor asset condition might also lead to a higher number of failures and increased repair time. Response times to failures and time needed to repair determine the infrastructure managers' capability to recover the assets availability and return to normal traffic operation. Condition of the rolling stock, which is a responsibility of the operator, as well as weather conditions, are factors that are perfectly independent from the infrastructure manager, but still do influence punctuality to a significant degree.

Freight total train punctuality (15:29 minutes)

Figures 60 and 61 show the punctuality of freight trains of PRIME members in a latest benchmark and over the period 2018-2022.

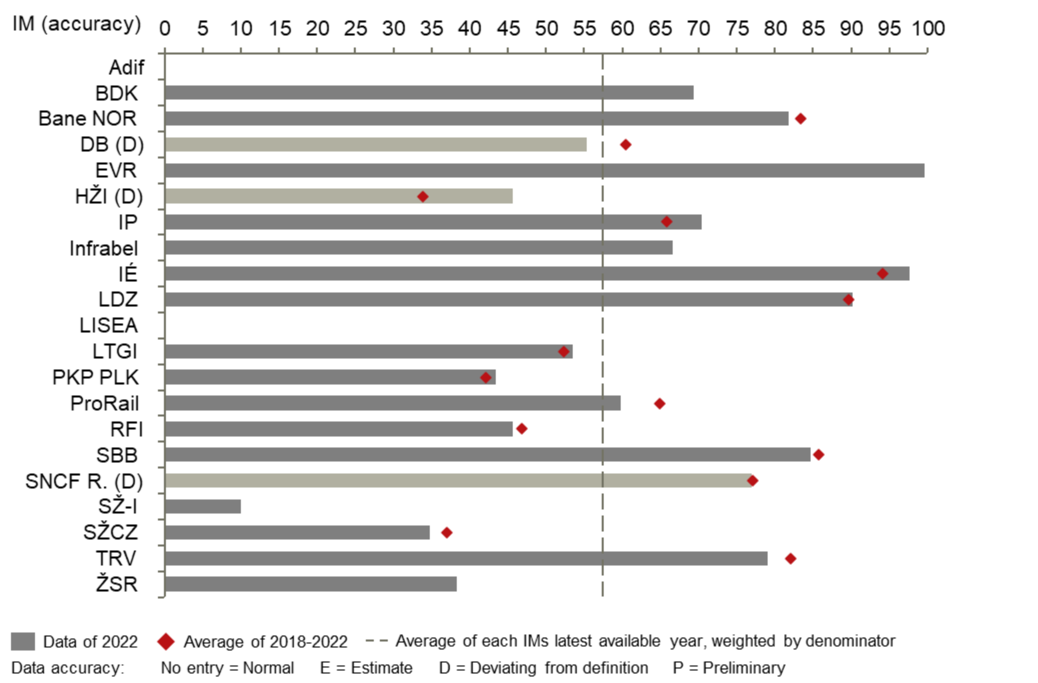

Figure 60: Freight trains total punctuality (15:29 minutes) (% of operating trains)[61]

Compared to passenger train services, the percentage of freight trains on time is lower and has an average of 58%. Also, the spread within the peer group is higher: the punctualities range between 10% and 97% and have a standard deviation of 27%. Three infrastructure managers deviate from the definition: these are marked in a lighter grey in the graph and the deviation are explained in the Annex 4.3.

[61] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.
Zero value: LISEA

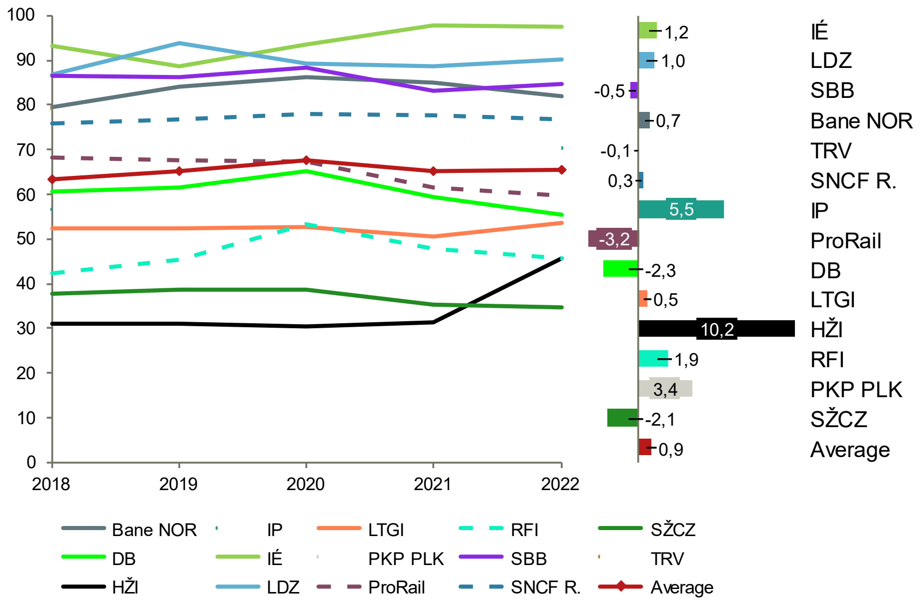

Figure 61: Freight trains total punctuality (15:29 minutes) (% of operating trains) and CAGR (%) in 2018-2022

In alignment with the European Union's goal to enhance freight transportation, the progress in freight train punctuality is encouraging. Out of thirteen infrastructure managers that submitted data for the entire timeframe, nine reported improvements in their punctuality rates, averaging an increase of 0.9%. Notably, HŽI experienced a significant rise in punctuality in 2022, attributed to a surge in ad hoc freight trains, which are excluded from the statistics. To become a true alternative for logistic companies, it is essential that rail further improves punctuality, reliability, and flexibility.

Factors influencing punctuality of freight trains are like the ones described for passenger train services. In addition, freight train services run for a large part on international routes and over long distances, which makes them more vulnerable to disturbances. Another impact on punctuality in freight transport is caused by the fact that freight trains run mainly at night. Maintenance and minor renewal works are mainly carried out at night to not, or only slightly, affect passenger traffic, which is often prioritized. Due to this, freight trains may be affected more frequently, especially by short-term repair and maintenance work, with a negative impact on punctuality.

Delays caused by infrastructure managers

As illustrated before, punctuality depends on a wide array of different factors and must be interpreted as a systemic result. Hence, the number of delay minutes accrued should be distinguished between those caused by the infrastructure managers and others. In general, only 20-30% of unpunctuality is caused by infrastructure managers.

Delay minutes caused by infrastructure managers

According to the PRIME KPI & Benchmarking subgroup delays caused by infrastructure managers can be allocated to one of these four categories: operational planning, infrastructure installations, civil engineering causes, causes of other infrastructure managers.

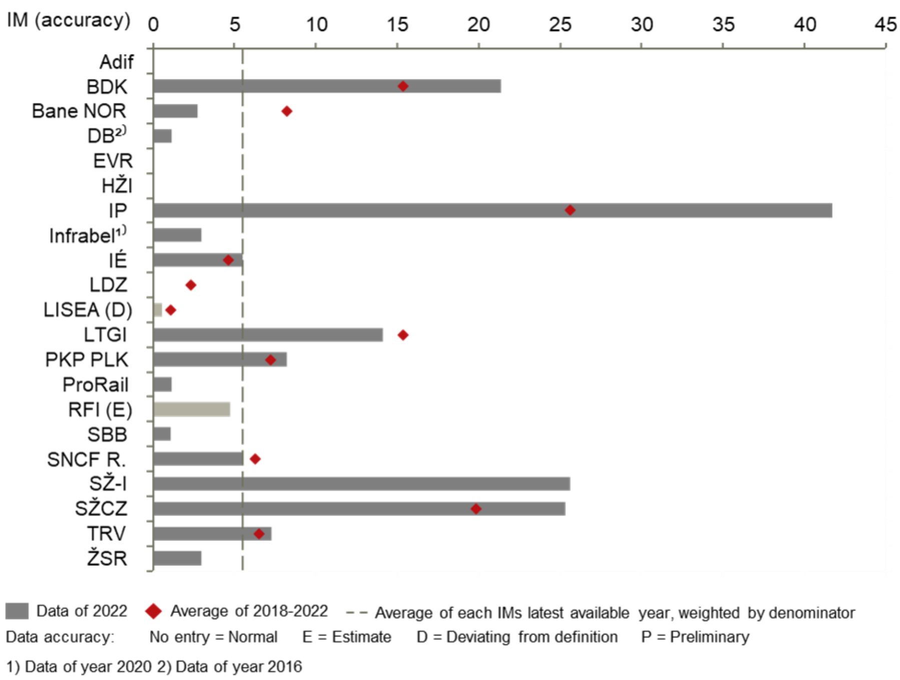

Figure 62: Delay minutes per train-km caused by the infrastructure manager (Minutes per thousand train-km) [62]

On average infrastructure managers caused 5 delay minutes per thousand train-kilometres, and their results vary between less than 1 and 41 minutes per thousand train-kilometres. Corresponding to their overall high passenger train punctuality shown in figure 58, SBB and LISEA have a significantly lower level of delay minutes caused by the infrastructure managers. IP's relatively high value can partly be explained by the restrictive cancellation policy of the Portuguese Rail system, and the way cancellations are treated in performance statistics according to which it is more acceptable to continue to delay a train rather than to cancel it. Furthermore, the current investment program in the Portuguese railway network in building, enhancing and renewing infrastructure will last until 2023.

[62] Lighter colours indicate accuracy level deviating from normal (here estimated). Comments concerning the deviations can be found in the Annex 4.3.

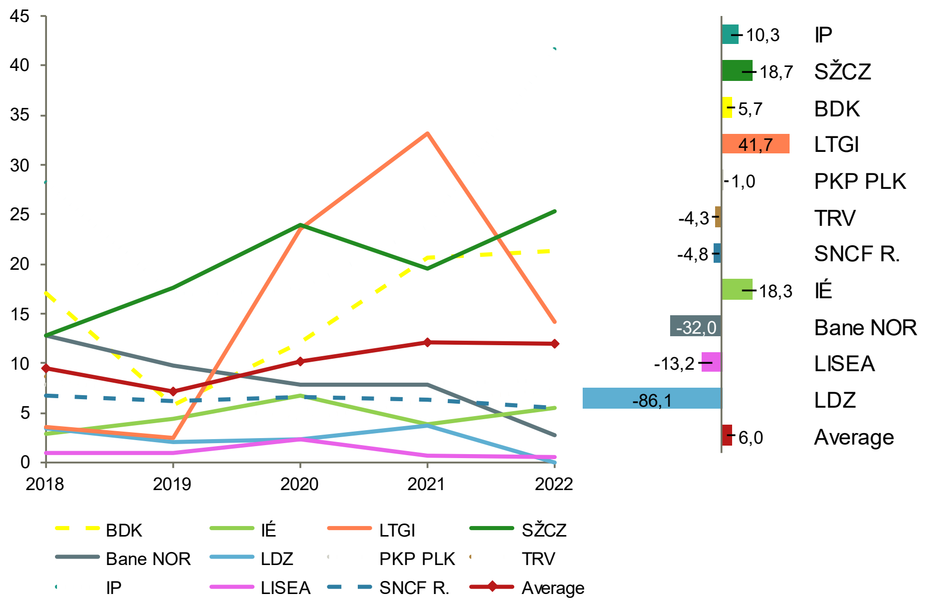

Figure 63: Delay minutes per train-km caused by the infrastructure manager (Minutes per thousand train-km) and CAGR (%) in 2018-2022

The number of delay minutes per train-kilometre caused by the infrastructure manager underwent a decrease in more than half of the companies. LTGI's significant increase from 2019 is mainly due to a change in methodology in data collection to get more accurate data.

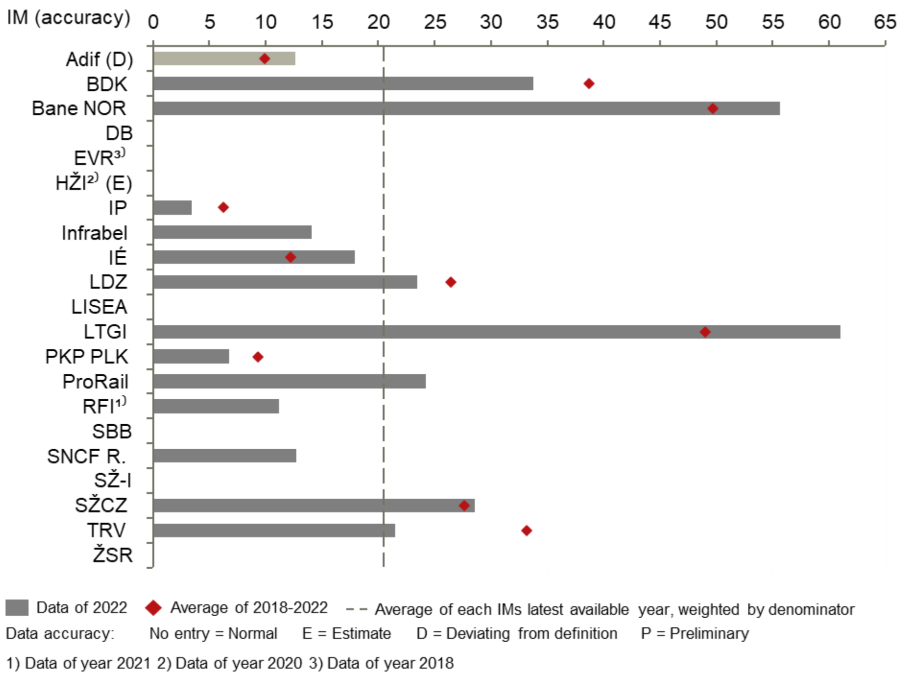

Figure 64: Passenger train cancellations caused by the infrastructure manager (% of scheduled and cancelled passenger trains) [63]

As illustrated in figure 64 the percentage of train cancellations caused by infrastructure managers varies widely, some showing levels well below the weighted average while others have significantly higher values. On average 21% of train cancellations were the infrastructure managers' responsibility; the standard deviation is 18%.

Besides different measuring concepts, cancellation policies vary between the infrastructure managers. Infrastructure managers apply different practices with regards to the number of trains cancelled and the way they are treated in performance statistics. Some infrastructure managers consider long delays above a fixed threshold as a cancellation while others do not have a fixed threshold and cancel trains according to the timetable reprogramming. Following a restrictive cancellation policy could make it more difficult to achieve punctuality goals.

[63] Lighter colours indicate accuracy level deviating from normal (here estimated). Comments concerning the deviations can be found in the Annex 4.3.
Zero value: LISEA

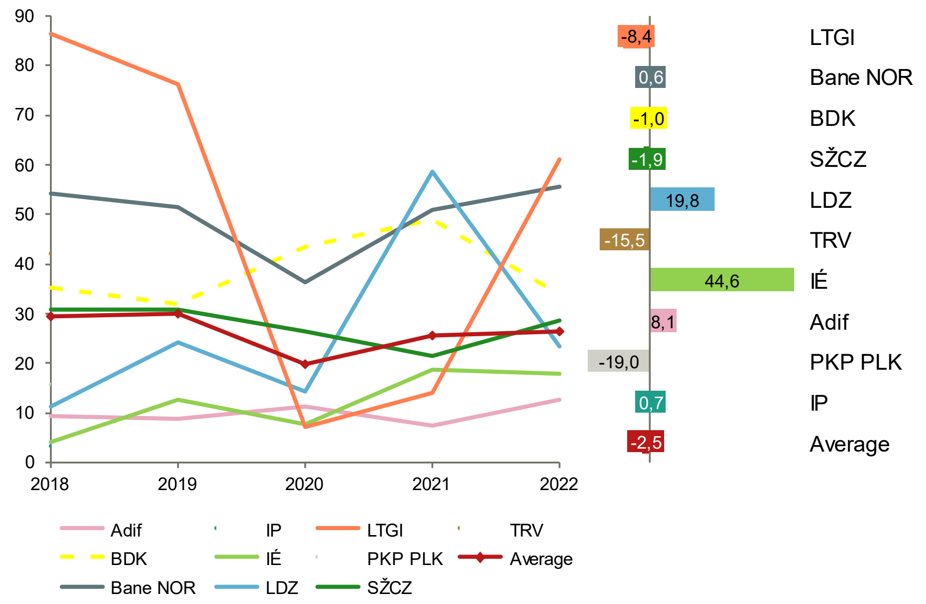

Figure 65: Passenger train cancellations caused by the infrastructure manager (% of scheduled and cancelled passenger trains) and CAGR (%) in 2018-2022

The development of train cancelations caused by infrastructure managers show a divided picture. Half of the companies have decreased their cancelations, while the other half recorded an increasing trend over the years. On average, however this meant a decrease of 2.5%. The significant fluctuation in LTGI's data can be attributed to the refinement of the data collection method to align more closely with PRIME standards, combined with issues related to data harmonization of the individual years.

3.5.4 Reliability

Reliability reflects the probability that railway systems or components will perform a required function for a given time when used under stated operating conditions. It is measured by counting failures which are affecting train operations. Many elements of the infrastructure manager's asset management system are geared to improve asset reliability, including regular condition monitoring of assets, renewal programmes, as well as predictive and preventive maintenance concepts.

Development and benchmark

Figures 66 to 69 show the latest benchmark of the number of train-affecting asset failures between the infrastructure managers and its development over the period of 2018-2022.

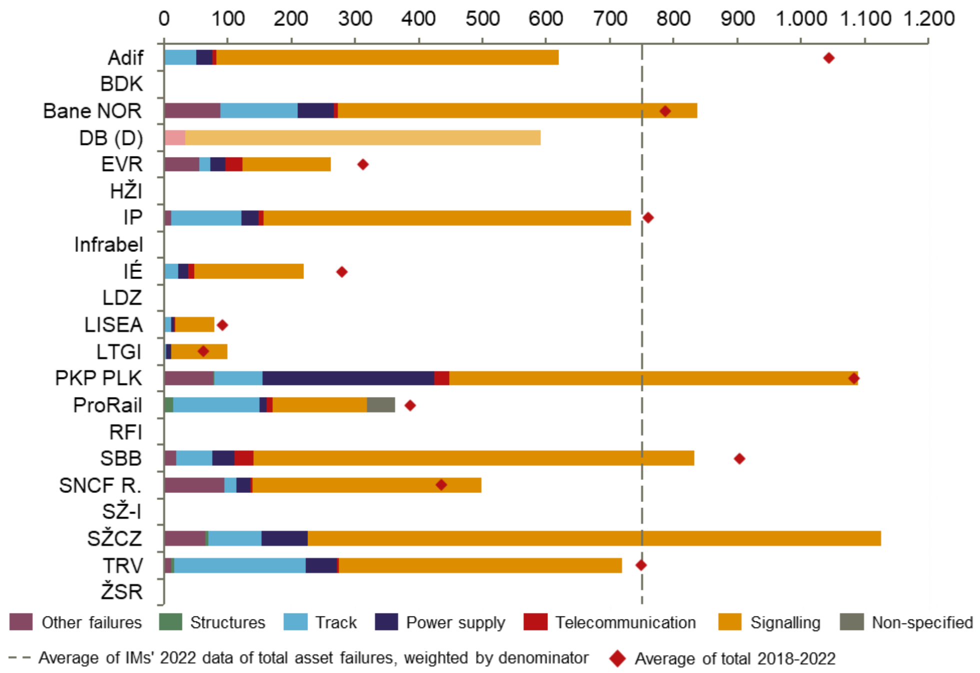

Figure 66: Asset failures in relation to network size (Number per thousand main track km)[64]

Figure 66 shows the level and the composition of asset failures that caused delays. On average around 770 assets fail per thousand main track-kilometres per year. The failure frequency in the peer group varies between 55 and 1.100 failures per thousand main track-kilometres. Signalling accounts for most of all asset failures. The track system is the second highest failing asset group. Failures of power supply and telecommunication assets are less common and, considering the overall number, the frequency of structural failures is negligible in most of the countries. The lighter orange colour of DB indicates deviating figures for signaling failures, the lighter red of DB for telecommunication failures. In what sense these data are deviating is explained in Annex 4.3.

[64] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.

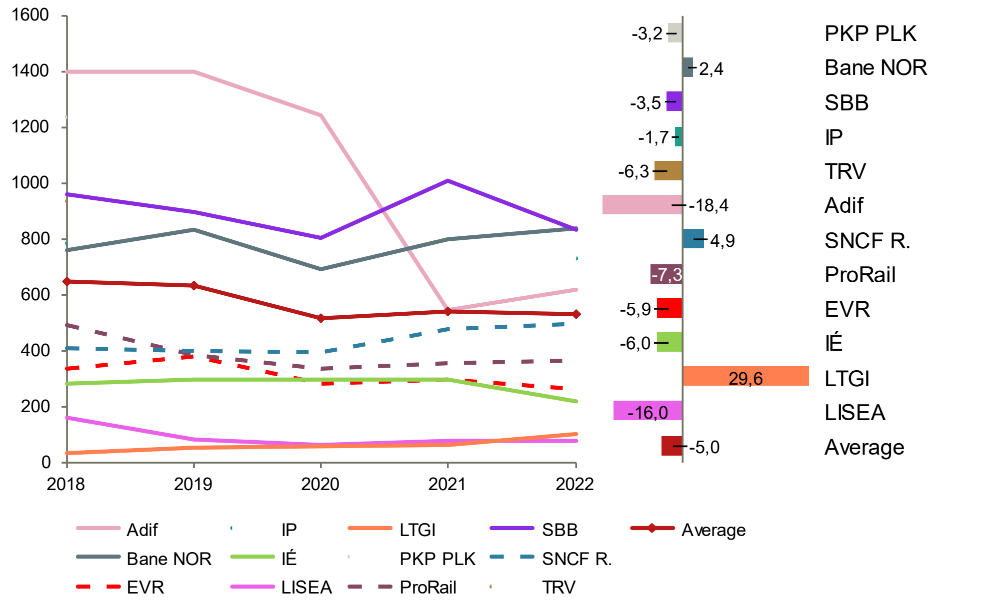

Figure 67: Asset failures in relation to network size (Number per thousand main track-km) and CAGR (%) in 2018-2022

The trend in the number of failures per main track-kilometre indicates a positive development, with an average reduction of 5%. Adif reported the most substantial decrease, a change that can be attributed to an alteration in the internal definition and method of data collection. The declining trend of SBB is partly a success of the implementation of a so-called network status report (Netzzustandsberichte) of the Federal Office of Transport in 2015, which aims to provide comprehensive overview of the condition of the railway infrastructure in Switzerland and to monitor its development[65].

Regarding the counting of asset failures, it is important to note that in the railway infrastructure there are several incidents affecting regular train operations. In this benchmarking an incident is counted as an asset failure, one time and one time only, if at least one passenger train is delayed by 5:29 minutes or one freight train by 15:29 minutes. Incidents that are handled with cancelation of trains, deferred lasting solution with limited slow zones, several affected trains each with less delay than thresholds, deteriorating failures that don't affect the timetables etc. do not count as asset failures in this context.

While asset failures have an impact on almost all performance indicators, such as finance, safety, punctuality and reliability, there are several factors which determine the frequency and dimension of asset failures. Complexity (electrification, switch density and signaling) naturally increases the chances of failures,

[65] Bundesamt für Verkehr BAV Netzzustandsberichte (admin.ch)

and high utilisation accelerates wear and tear. The condition, age and renewal rate of assets is also decisive. However, asset failure also depends on several factors such as stage of development, historic elements, and the budget of the infrastructure manager and the Participating state concerned. Prevention policies, good maintenance/renewal management, and failure recording technologies might help to identify failing assets at an early stage and allow effective measures to be taken before consequences grow.

Geographical risks such as earthquakes, floods and landslides might cause severe damage, and extreme weather conditions such as extreme heat can cause rail buckling and broken rails. Infrastructure managers must be prepared as extreme weather events, such as storms, rainfall and extreme temperature fluctuations are becoming increasingly common.

The magnitude of the impact of asset failures on delays and their development over the period is shown in figures 68 and 69.

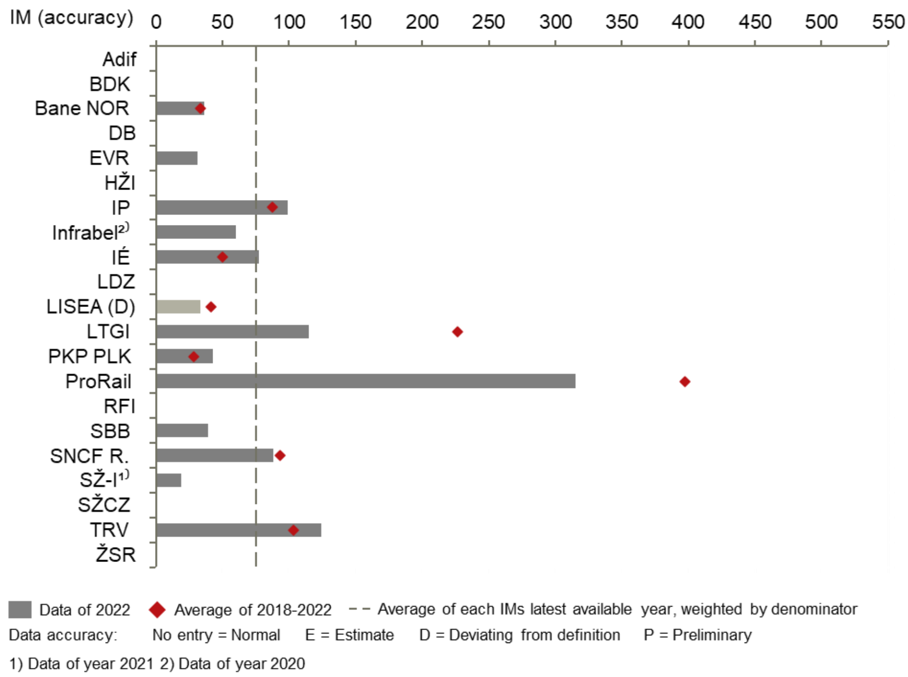

Figure 68: Average delay minutes per asset failure (Minutes per failure)[66]

On average asset failures cause a delay of 70 minutes. The lowest level of delay minutes caused by asset failures are found at SŽ-I, where one asset failure causes on average a delay of below 30 minutes.

[66] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.

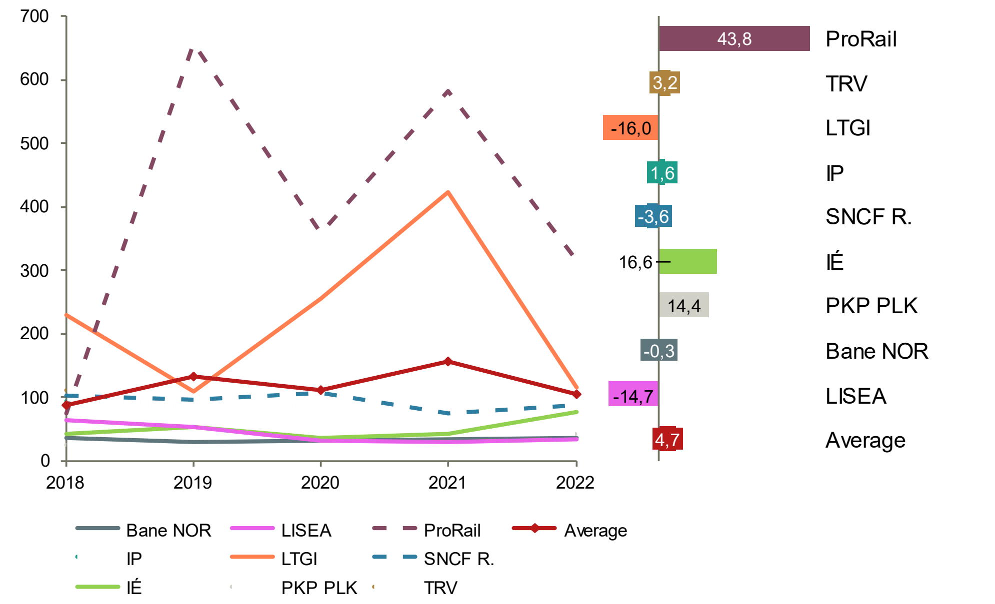

Figure 69: Average delay minutes per asset failure (Minutes per failure) and CAGR (%) in 2018-2022

Figure 69 shows the development of the average delays caused by an asset failure. What is visible, that apart of ProRail and LTGI the development is relatively stable. The highest decrease can be seen for LTGI and LISEA, and the most significant growth for ProRail.

The magnitude of delays caused by asset failures highly depends on the type of asset involved. By relating the frequency of individual asset failures to the delay minutes caused, the impact on punctuality becomes visible. Figure 70 shows this relationship.

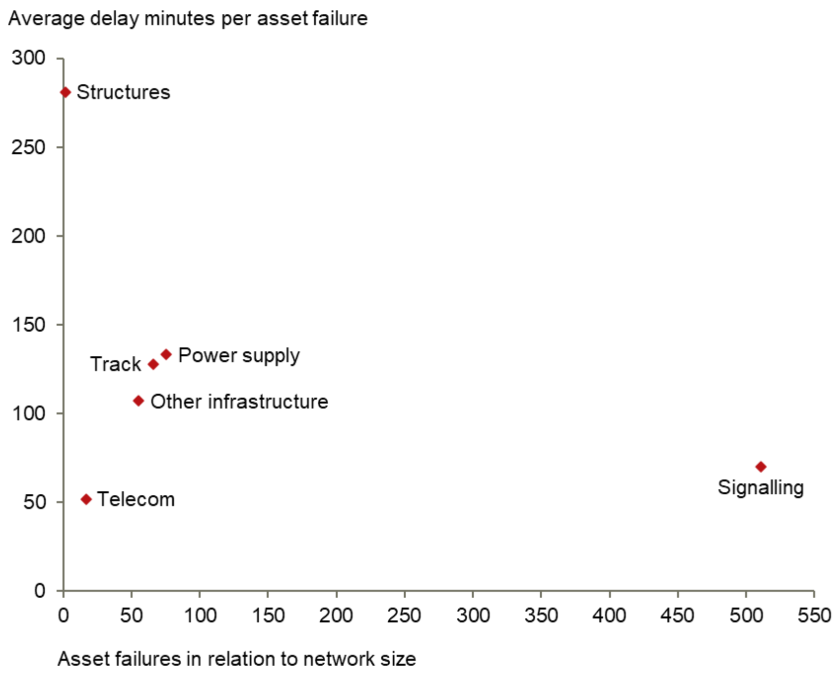

Figure 70: Delay per asset failure (Minutes per failure) / Asset failures (Number per thousand main track-km)[67]

Structure assets such as bridges and tunnels caused the second highest number of delay minutes with almost 300 minutes per failure. Power supply failures and track failures caused on average around 130 delay minutes. Telecommunication failures were responsible for an average delay of almost 52 minutes per failure. The most frequent type of asset failures was related to signaling, with an average of over 500 failures per thousand main track-kilometre, however they had a comparably low impact of 75 delay minutes per failure on average.

However, the type of asset failures is not the only driving factor. High utilisation increases knock-on effects. Particularly on very busy routes, one single disruption can cause several knock-on delays. The knock-on might affect the traffic on the route where the disruption happened, plus on any connecting tracks, resulting in secondary delays.

Having well-organised maintenance planning and good response times are important when it comes to managing failures. Efficient contingency plans, good communication with operators, and the ability to quickly alter timetables are essential for minimizing delays.

[67] Average indicates the weighted average within the peer group.

3.5.5 Availability

Availability of the infrastructure reflects the state of an asset and its usability for its intended purpose. As well as managing its assets in such a way as to minimise the effect of failures on the railway, availability indicators also measure the effectiveness and timeliness of the infrastructure manager in responding to these failures and returning the network to normal function.

Temporary and permanent speed restrictions have an overall impact on the availability of railway infrastructure, and can lead to delays, breakdowns and longer travel times. Speed restrictions are imposed on the railway to ensure safe use of the infrastructure and are applied when track renewals or regular maintenance work are carried out. However, it is often important to relieve the infrastructure by reducing speed limits even before maintenance work is started.

Development and benchmark

Figures 71 to 72 show to what degree a network was affected by permanent or temporary speed restrictions. Due to incomplete time series, no trend line is shown for these two indicators.

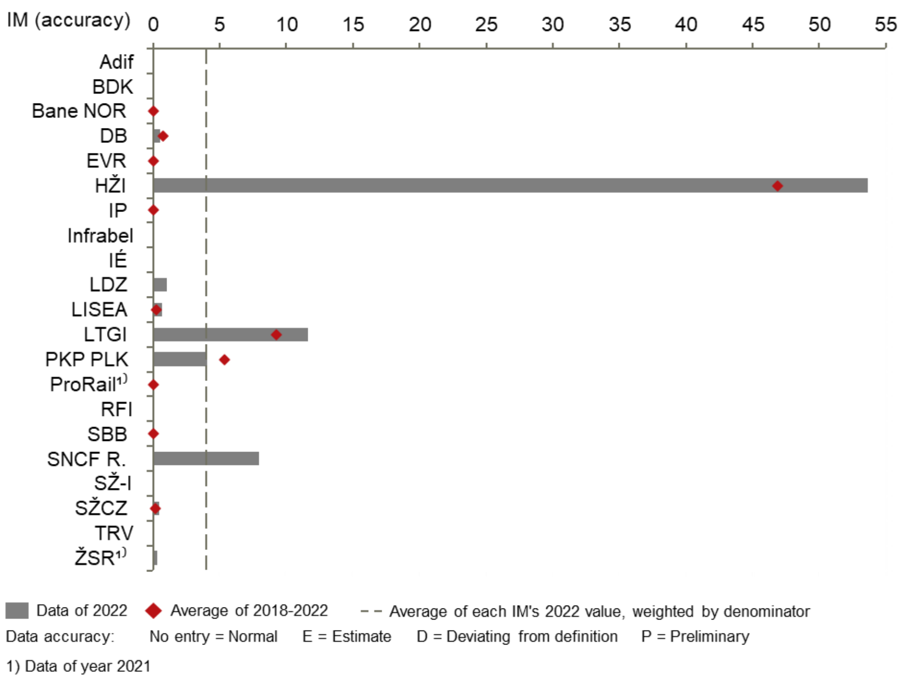

Figure 71: Tracks with permanent speed restrictions (% of main track-km)[68]

[68] Zero value: EVR, Bane NOR, IÉ, IP, ProRail, SBB

Permanent speed restrictions are classified as such when they are included into the annual timetable. Most infrastructure managers report that less than 1% of their tracks are subject to permanent speed restrictions. The overall average of 4% for main track is largely affected by HŽI, which stands out as an outlier. For HŽI, the permanent speed restrictions result from the deteriorating condition of its local and regional lines. It's important to note that some infrastructure managers do not separately account for permanent speed restrictions since they are factored into the operational timetable.

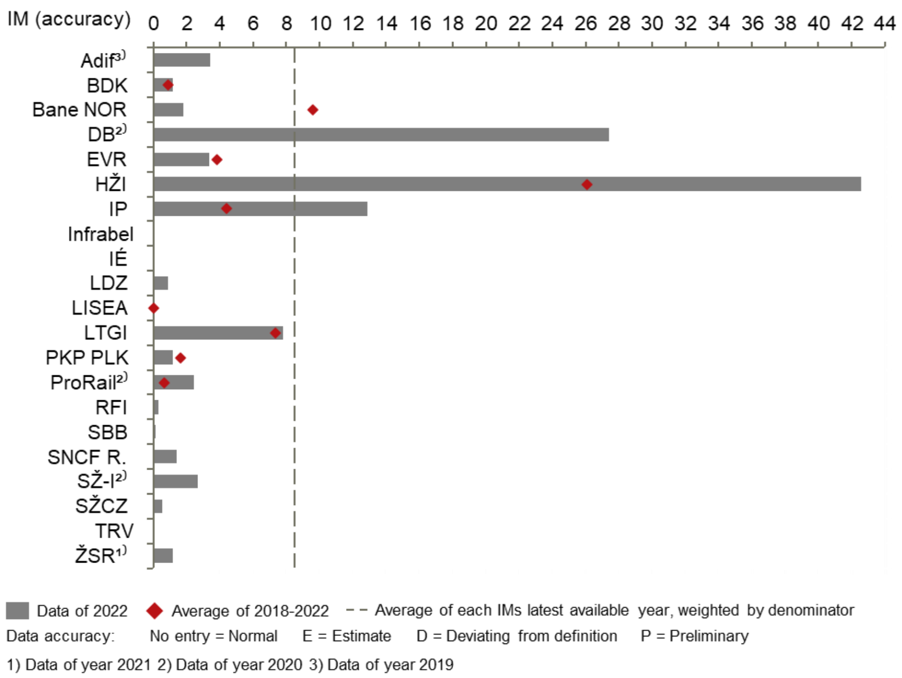

Figure 72: Tracks with temporary speed restrictions (% of main track-km)[69]

Other than permanent speed restrictions, restrictions that occur during the year and are not included in the annual timetable are considered temporary. On average, 8% of the main track is unavailable due to temporary speed restrictions, which are typically caused by deteriorating conditions or necessary track works. While nine infrastructure managers had less than 2% of main track-km submitted to a temporary speed restriction HŽI and DB restrict speed on more than 25% of their networks. HŽI indicated that, the temporary speed restriction in 2021 increased due to track overhaul works on international (TEN-T) lines, and on the other hand, due to bad track condition on local lines and poor visibility at level crossings on some regional lines. IP's temporary speed restrictions are mainly due to an investment program in the Portuguese railway network, building, enhancing, and renewing infrastructure, lasting until 2023. The increase for ProRail

[69] Zero value: LISEA

is caused by the fact that small temporary restrictions caused by trespassers are also included.

Speed restrictions are usually set by the infrastructure manager in consultation with train operators. For how long speed restrictions last and whether the temporary ones become permanent depends on the funding agreements and budget of the infrastructure managers for maintenance and investments. It is also relevant how utilised the effected routes are, and whether there are branch lines that can be used during the maintenance works. Reducing speed to extend service life is sometimes the better option than interrupting a very active route for a longer period.

3.6 Asset capability and ERTMS deployment

3.6.1 Summary of asset capability and ERTMS deployment

EU-wide objectives

- Digitalisation is one of the key pillars of the European Commission's Sustainable and Smart Mobility Strategy. It is an indispensable driver for the modernisation of the entire system, making it seamless and more efficient. In the rail sector ERTMS deployment plays a major role in this digital transformation.
- The main objectives of ERTMS are to increase safety, capacity as well as interoperability, harmonise automatic train control and communication systems throughout the European rail network, and act as the building block for the digitalisation of the rail network.
- The technical details of ERTMS are laid down in the CCS TSI (Control-Command and Signalling Technical Specification for Interoperability). The European Union Agency for Railways (ERA) is the ERTMS System Authority responsible for ensuring interoperable deployment as defined in the Fourth Railway Package.
- Based on the revised TEN-T Regulation from December 2021, the TEN-T network shall be gradually completed in three steps: 2030 for the core network, 2040 for the extended core network and 2050 for the comprehensive network. The core and extended core network together form the European Transport Corridors which are the most strategic part of the network with highest EU added value.
- Promotion of intermodality is a key goal of the European Commission and has the objective to develop a framework for an optimal integration of

different transport modes to enable an efficient and cost-effective use of the transport system through seamless, customer-oriented door-to-door services whilst favouring competitions between transport operators.

Peer group's performance

- ERTMS deployment is highly heterogonous in the peer group.
- ERTMS is deployed on about 10% of all tracks of the peer group's railway network.
- Across the peer group ERTMS is expected to be implemented in about 32% of the railway network by 2030.
- Four infrastructure managers plan to have above 90% ERTMS coverage by 2030.
- ATP coverage has an average of 58%.
- The highest on average connection can be seen for inland waterways, the lowest for airports.

3.6.2 Development and benchmark of ERTMS and ATP

In the rail sector ERTMS deployment plays a major role in this digital transformation. ERTMS deployment is a significant investment but is crucial for infrastructure managers, as expected benefits of ERTMS deployment are significant, including increased safety, capacity, availability, and interoperability. ATP aims to improve rail safety and harmonisation to other transport modes.

ERTMS and ATP indicators

PRIME members are reporting three indicators measuring ERTMS deployment:

- ERTMS track-side deployment
- Planned extent of ERTMS deployment by 2030
- ATP coverage

To increase comparability of these values among infrastructure managers, these values are related to main track-kilometres.

Development and benchmark

Figures 73 and 74 show the level of ERTMS track-side deployment and the planned extent of ERTMS deployment by 2030.

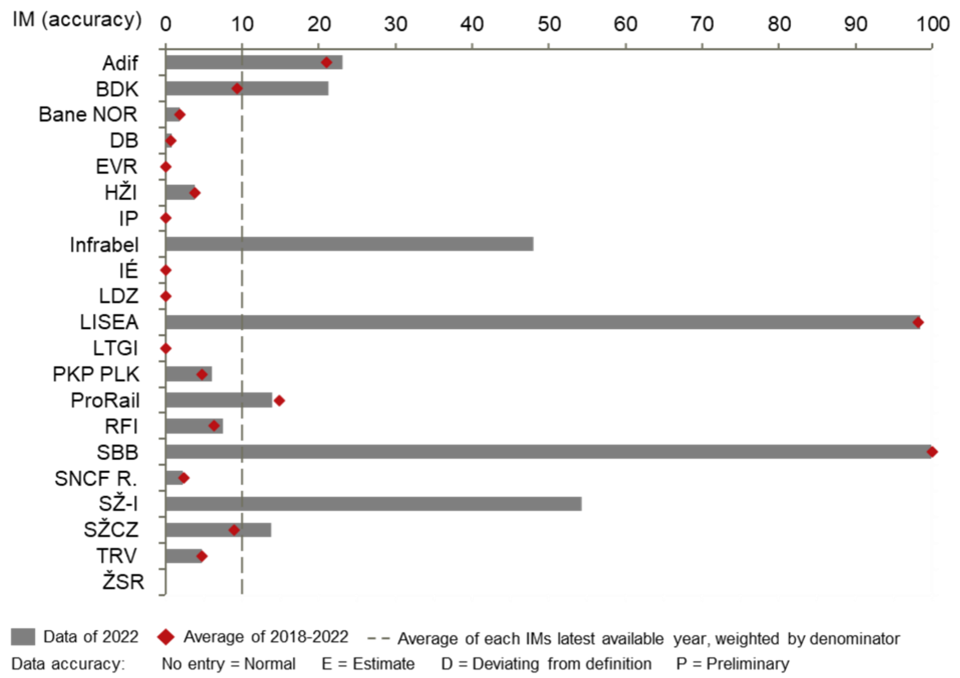

Figure 73: ERTMS track-side deployment (% of main track-km)[70]

ERTMS is deployed on about 10% of all tracks of the peer group's railway network. The infrastructure managers' implementation strategies are heterogeneous, which is reflected by there being no ERTMS deployment in some countries vs. a high share in others of more than 90% (LISEA and SBB). The standard deviation of ERTMS deployment is 32%. Some infrastructure managers have different traffic management systems, for example LTGI's isolated network which does not require ERTMS deployment. Ireland, too, does not have to implement ERTMS as it does not have a border with another EU-country, however it has started to deploy a new management control system which is a combination of other systems.

[70] Zero value: LTGI, EVR, IÉ, IP, LDZ

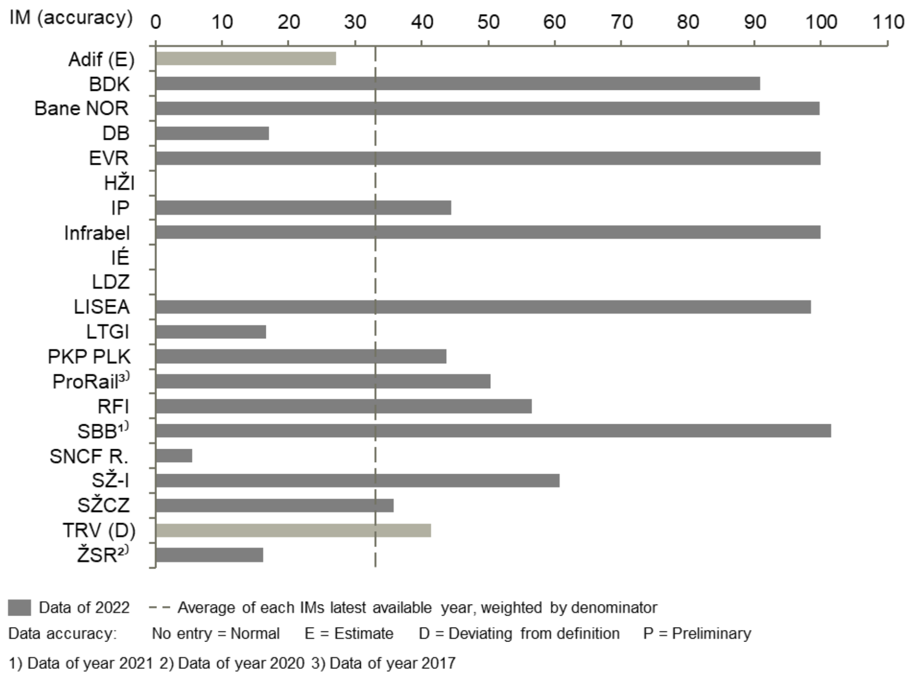

Figure 74: Planned extent of ERTMS deployment by 2030 (% of current main track-km)[71]

By 2030, ERTMS is expected to cover about 32% of the peer group's railway network. For SBB the value is higher than 100%, as the future network will be larger than the current network and both are and will be entirely equipped with ERTMS. For BDK the value is not quite 100% since the Copenhagen S-bane will be equipped with a similar system called CBTC instead of ERTMS. Other infrastructure managers which have above 90% deployment plans are BDK, Bane NOR, EVR (100%) and Infrabel (100%). It is important to note that considering the EU objective on ERTMS deployment, this indicator does not show the full picture, as it refers to the ERTMS deployment of the total main network and not only the TEN-T lines. It is also important to note that the numerator of this KPI (planned ERTMS deployment by 2030) refers to 2030 while the denominator (total main-track km) refers to 2020. If the whole network is planned to be equipped with ECTS by 2030, but will shrink between 2020 and 2030, the KPI is less than 100% even though ERTMS will be deployed on the whole network.

[71] Lighter colours indicate estimated and deviating data.
Zero values: IÉ, LDZ

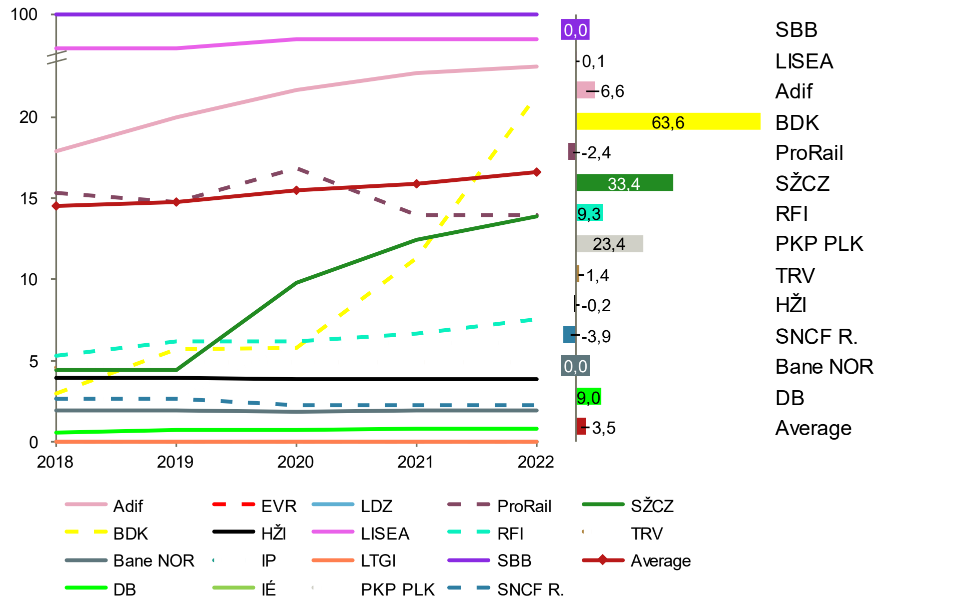

Figure 75: ERTMS track-side deployment (% of main track-km) and CAGR (%) in 2018-2022

Figure 75 shows the progress of ERTMS (European Rail Traffic Management System) deployment on the different networks. The most significant expansion is observed at BDK, which increased its ERTMS coverage from 3% in 2018 to 21% in 2022. SŽCZ also showed significant progress, expanding its ERTMS-equipped network from 4% in 2018 to 24% in 2022. PKP PLK's notable increase is largely due to the commissioning of ETCS Level 2 on the Warsaw-Gdynia section of the E65 in 2020. On average, the use of ERTMS in the peer group has increased by almost 4% per year.

ATP coverage is an important indicator describing the functionality of rail infrastructure. The train protection scheme aims to support infrastructure managers in achieving the vision zero approach to eliminating transport-related fatalities in the European Union and includes ETCS, ATB, LZB, CBTC and similar systems.

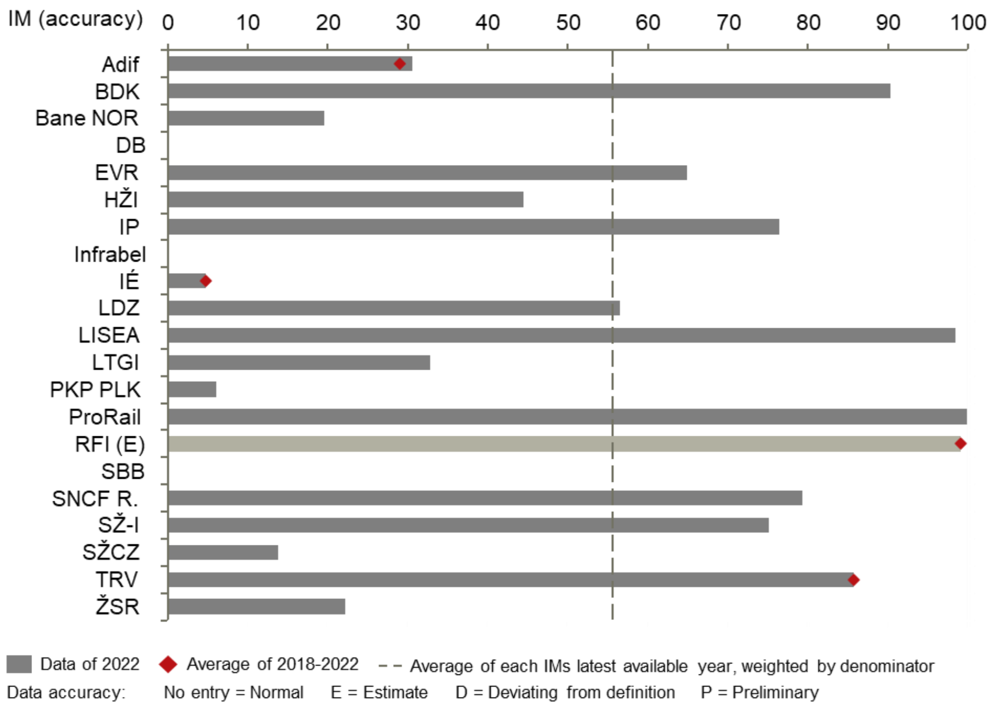

Figure 76: ATP coverage (% of main track-km)

ATP coverage is highly diverse within the peer group. ProRail and RFI have 100% of its network equipped with ATP, while coverage in IÉ and PKP PLK remains below 10%. The peer group average is 59% and has a standard deviation of 34%.

Even though the European vision of the deployment of ERTMS is clearly formulated, the speed and commitment of uptake depend on a variety of factors, including the stage of a railway's development, past and present priorities, funding agreements and the level of the budget for investment. Network size and complexity (number of stations and hubs), adaptability to the existing infrastructure, technical equipment and asset condition are other aspects that might influence the timeline for deployment of ERTMS. Difficulties in coordinating with operators, who must equip their fleet with ERTMS on-board systems, increase the burden of deployment.

3.6.3 Development and benchmark of intermodality

For the first time in this report the infrastructure managers are showing indicators describing intermodality with other transport modes. A highly functional intermodality between different transport modes can bring traffic and business to the rail network. Since trains rarely offer a door-to-door solution, and rather are a part of the mobility chain, connections between modes become essential for the customers. The indicators below show the connection of relevant ports to the TEN-T network. As the development of intermodal ports is mostly stable no development charts are shown for these indicators.

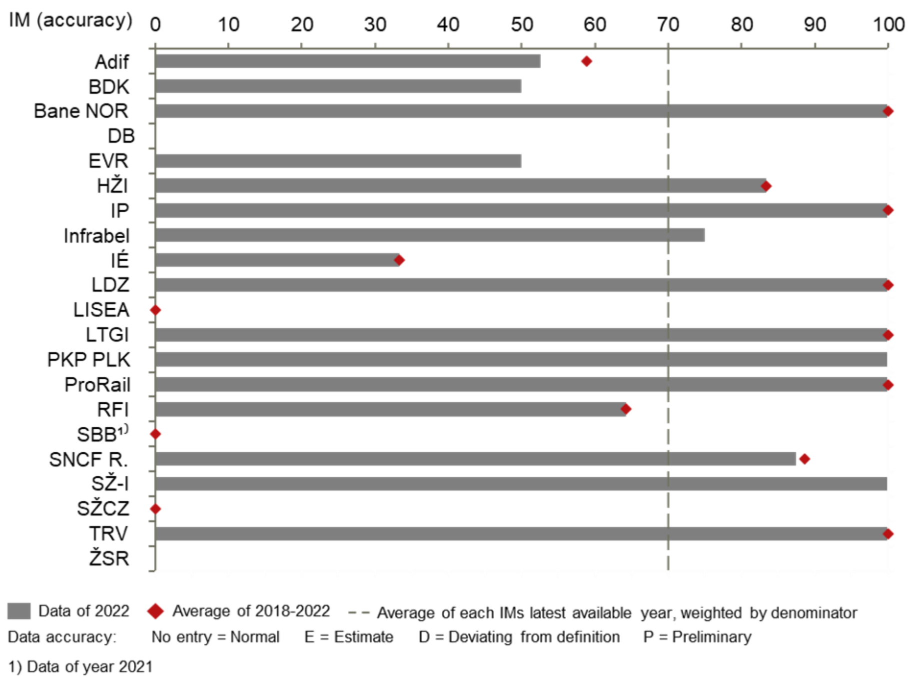

Figure 77: Core maritime ports connection (% of core maritime ports)[72]

Maritime connections points are important to make the transport of goods more efficient, especially from overseas. Of course, not all infrastructure managers are operating in a country with seaports, but of those that are, most core ports are connected to the TEN-T network. Eight infrastructure managers have even connected all core ports to rail.

[72] Zero value: LISEA, ŽSR, SŽCZ

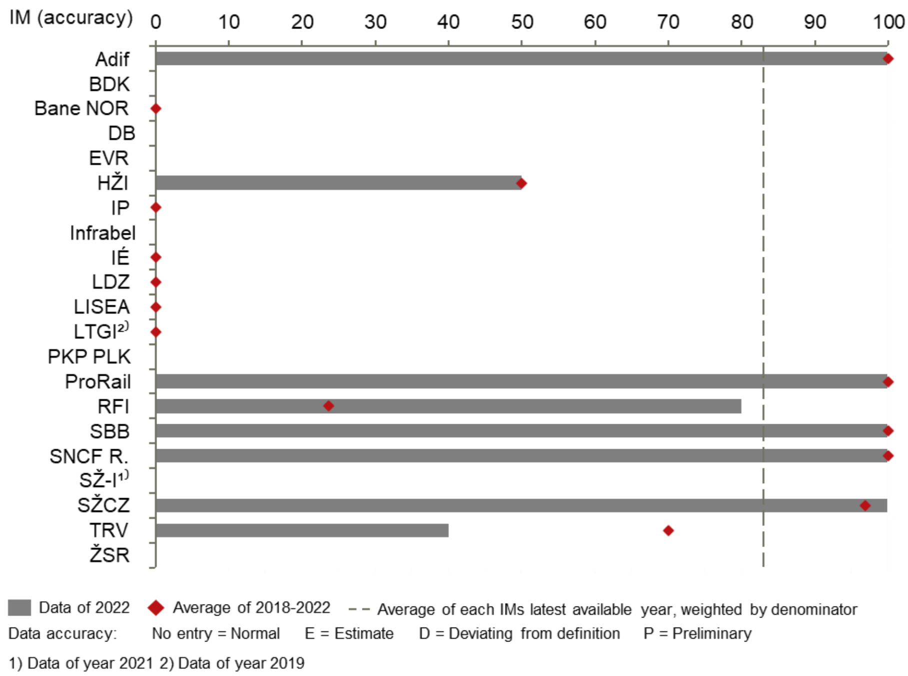

Figure 78: Core inland waterways connection (% of core inland waterways)[73]

The connection to inland waterways is similarly high. Five of the eight infrastructure managers providing data have all core inland waterways connected to the TEN-T network. The average of the peer group is 82%.

[73] Zero value: EVR, Bane NOR, BDK, IÉ, IP, LISEA, LDZ, PKP PLK, ŽSR

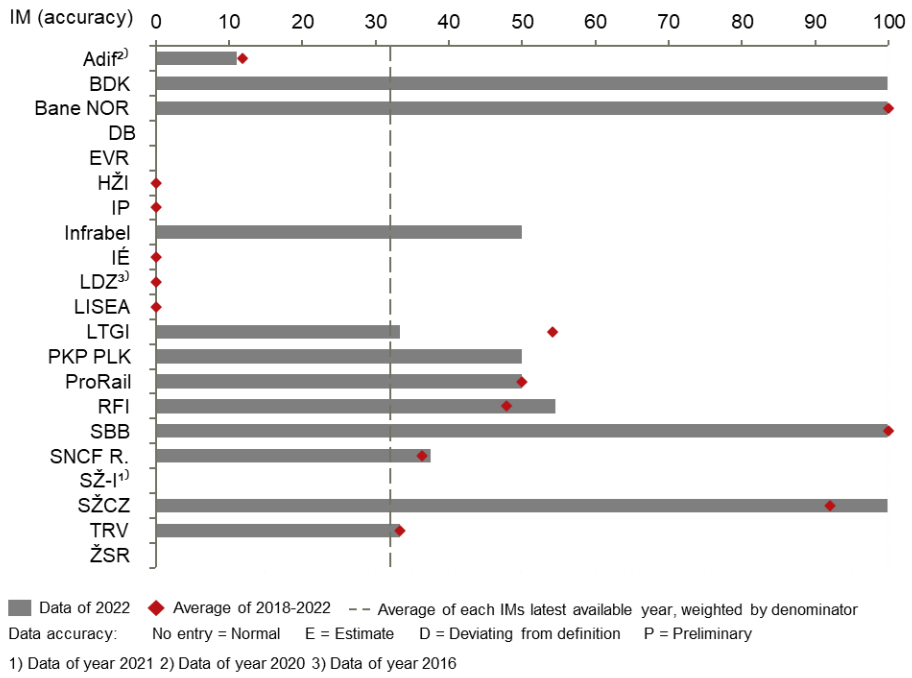

Figure 79: Core airports connection (% of core airports)[74]

Figure 79 shows the connection of TEN-T network to core airports. Five infrastructure managers have all the core airports connected to the rail network, while four to 50%. The average is lower than for the other modalities with 32%.

However, the above indicators give a good overview of the intermodal connection between rail and other transport modes, efficient intermodal transport flow is influenced by many other factors. Besides a coherent network of modes and interconnections, technical interoperability, harmonisation of regulations and standards for countries and means, data exchange and aligned procedures are essential. Different quality standards and liabilities make an intermodal chain less attractive and risky for contracting companies.

[74] Zero value: EVR, HŽI, IÉ, IP, LISEA, ŽSR

4. Annex

4.1 Key influencing factors of participating infrastructure managers

Operating context

Infrastructure managers are operating in different countries under different geographic and political circumstances. Understanding the influencing factors and contextualising the indicators with them is essential for the correct interpretation of the values.

Influencing factors can be grouped in the following seven categories, which are illustrated below. The impacts of these factors on the performance of infrastructure managers are very different: some lead to increasing costs, some have an impact on punctuality or safety.

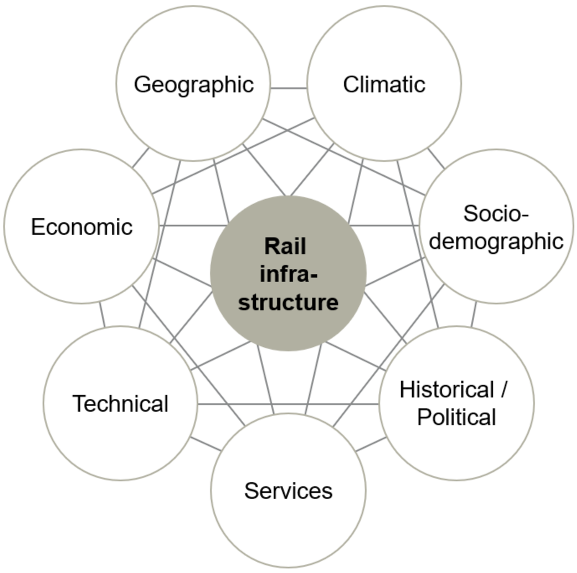

Figure 80: Factors influencing the outcome of rail infrastructure.

Geographic

The geography and topography of a country determines its rail network from the moment of its construction to its maintenance and renewals. The size of the country, its population density and distribution, and the locations of its economic and cultural centres are all influencing factors, above all for the length of the network. The range of sizes of the countries included in this report lies between 20,000 and 633,000 km² for Slovenia and France respectively (overseas territories included). The topography determines the shape and complexity of the network: mountainous regions hinder long, straight lines and generally require more sophisticated rail structures such as bridges and tunnels. The expansion of the network is technically more complex and therefore entails higher investment costs. Furthermore, maintenance costs are higher in mountainous regions as wear and tear is more frequent and repairs are carried out under more difficult conditions. Rail infrastructure in regions of seismic activity is highly exposed to damage caused by earthquakes and seismic waves. Countries with highly complex topographical conditions include Switzerland, Spain, Norway, and Italy.

Climatic

Conditions of climate are also important and have an impact on asset failures, reliability and punctuality that can increase maintenance and renewal costs. In countries with very hard winters such as Scandinavia and the Baltic, very low temperatures might cause broken rails, switch malfunctions, and snowdrifts. Besides normal latitude-related climate conditions, the increasing number of extreme weather events due to climate change has additional impacts. Heavy storms damage tall infrastructure (mileposts, signals), and overturned trees cause delays, failures, and speed restrictions[75]. Increased global temperature is leading to hotter and drier summers, which favour buckling in railway tracks and increase the risk of forest fires.

Socio-demographic

Population size, population density and population distribution within a country shape rail infrastructure. In small countries with a high population density, rail utilisation is higher, allowing for higher economies of scale than in sparsely populated areas. This is visible in the Netherlands with its highly utilised and polycentric urban network. In other countries, for example in Spain and the Scandinavian states, population density varies between densely populated metropolitan areas and the sparsely populated countryside. Age distribution, mobility patterns and environmental awareness of citizens are additional parameters that are influencing the share of rail in the modal split – with possible consequences on funding and extension plans. Beyond national circumstances, international links are also a decisive driver: In transit countries such as Belgium, the Netherlands, Germany, and Switzerland as well as Denmark for freight, transit also accounts for a considerable proportion of network usage. Six of the eleven Rail Freight

[75] UIC, 2017: Rail Adapt - Adapting the railway for the future.

Corridors run through Germany. In Switzerland, transit traffic has been a major support factor for a railway-friendly policy among the population and politicians.

Political and historical

Even though infrastructure managers are independent entities, output parameters of rail infrastructure, like rail transport volumes, are partly politically influenced and investment decisions heavily depend on the availability and regularity of state funding. The status of rail in a country and the commitment of politicians is therefore very relevant, and historically shaped.

Traditional heavy industry, with heavy and bulky transport goods such as coal, sand, steel, and wood partly explain the high share of rail freight in today's Eastern European EU Member States.

Services

The main services offered by railway undertakings on the infrastructure manager's networks are conventional passenger trains over different distances, freight trains and high-speed connections. The different rail services also have an impact on the infrastructure: a high share of freight transport causes higher wear and tear due to the weight of the freight and requires higher maintenance costs. The nature of high-speed train services is not uniform among infrastructure managers. In Germany, for example, high-speed connections mostly run on the same routes as lower speed passenger transport and even freight traffic. If a manager's network consists exclusively of high-speed lines between metropolitan areas, it naturally has other OPEX and CAPEX values and other punctuality and reliability values than a mixed transport network.

Technological

The technical and technological level and state of development of railway network infrastructures varies considerably throughout the EU. When comparing modernisation and roll-out of technological innovations, different starting points, and investment cycles must be considered. The new EU member states mainly started with technological modernisation from the 1990s, getting a bigger boost with the entitlement to EU-funding after their accession. Modern technology helps railways to achieve higher safety performance, minimize their impact on the environment and become more cost efficient. It is therefore in the interest of every infrastructure manager to be equipped with state-of-the-art rail technologies. EU rail policy promotes the incorporation of such technologies to contribute to the achievement of EU rail policy objectives, including facilitating cross-border transport. The introduction of ERTMS is a prominent example.

Economic

Economic circumstances within a country influence the operation of infrastructure managers both directly and indirectly. A country's GDP, its economic power and connectivity all have a positive impact on passenger and freight transport demand[76]. Market structure and the combination of public funding, track access charges and commercial infrastructure funding determines the financing pool available to infrastructure managers.

The amount and continuity of available revenues determines the infrastructure manager's investment possibilities and maintenance performance. In Switzerland for example rail projects are decided for several decades and are independent of politically influenced budgets of a current government. Furthermore, growing state funds and eligibility of European funds (e. g. cohesion fund) are important factors. Czechia for example receives an investment of over EUR 160 million for 2021 from the EU's Cohesion Fund to modernise its rail transport.[77]

[76] Passenger and freight transport demand in the EU: https://www.eea.europa.eu/data-and-maps/indicators/passenger-and-freight-transport-demand/assessment-1

[77] EC: EU Cohesion policy: €160 million to modernise the rail transport in Czechia. https://ec.europa.eu/regional_policy/en/newsroom/news/2021/01/01-11-2021-eu-cohesion-policy-eur160-million-to-modernise-the-rail-transport-in-czechia

4.2 Fact sheets of the infrastructure managers

adif

Other characteristics[3]

- Large areas are sparsely populated
- Complex orography (2nd most mountainous country in Europe)
- High quality road network

		Bandwidth of sample		
		Low	Medium	High
Area[0]	k km²			506
Border countries[0]	number		5	
Population[0]	millions		47	
GDP per capita[0]	%, EU 27=100	85		
Active licenses[1]	number	47		
National modal share passenger rail[0]	%		7	
National modal share rail freight[0]	%	4		
International passenger-km[1]	%	0,7		
International tonne-km[1]	%	17		
Length of national main lines[0]	km		15.847	
National passenger stations[1]	number	1.493		
Share of national network managed[2]	%			100
Length of high-speed lines	km			3.306
Length of main track	km		21.943	
Full time employees	fte	11.469		
Passenger train-kilometres	m train-km	156		
Freight train-kilometres	m train-km	26		
Total gross tonne-kilometres	bn gtkm		73	
Grants total	bn EUR	1,3		

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 81: Fact sheet Adif

BANE NOR

Other characteristics[3]

- Greatest length of any European country with many fjords
- Two-thirds of Norway is mountainous
- Warm summers and cold, snowy winters

		Bandwidth of sample		
		Low	Medium	High
Area[0]	k km²		324	
Border countries[0]	number	3		
Population[0]	millions	5		
GDP per capita[0]	%, EU 27=100			212
Active licenses[1]	number	10		
National modal share passenger rail[0]	%	5		
National modal share rail freight[0]	%	15		
International passenger-km[1]	%	0,3		
International tonne-km[1]	%		33	
Length of national main lines[0]	km	3.851		
National passenger stations[1]	number	334		
Share of national network managed[2]	%			100
Length of high-speed lines	km	97		
Length of main track	km	4.138		
Full time employees	fte	3.370		
Passenger train-kilometres	m train-km	40		
Freight train-kilometres	m train-km	9		
Total gross tonne-kilometres	bn gtkm	20		
Grants total	bn EUR	2		

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 82: Fact sheet: Bane NOR[78]

BANEDANMARK

Other characteristics[3]

- Area and population excludes: Faroe Islands & Greenland
- BDK as an IM is separated from RUs

		Bandwidth of sample		
		Low	Medium	High
Area[0]	k km²	43		
Border countries[0]	number	1		
Population[0]	millions	6		
GDP per capita[0]	%, EU 27=100		137	
Active licenses[1]	number	8		
National modal share passenger rail[0]	%		8	
National modal share rail freight[0]	%	10		
International passenger-km[1]	%	4		
International tonne-km[1]	%			94
Length of national main lines[0]	km	2.595		
National passenger stations[1]	number	454		
Share of national network managed[2]	%		80	
Length of high-speed lines	km	57		
Length of main track	km	3.169		
Full time employees	fte	2.367		
Passenger train-kilometres	m train-km	63		
Freight train-kilometres	m train-km	3		
Total gross tonne-kilometres	bn gtkm	17		
Grants total	bn EUR	0,6		

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 83: Fact sheet: Banedanmark[79]

78 Grants total are normalised for purchasing power parity
79 Grants total are normalised for purchasing power parity

DB InfraGO

Other characteristics[3)]

- Rail network large & No. of RUs very high
- Capacity has reached its limits
- Transit: six out of nine Rail Freight Corridors
- Rail noise – public issue

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

		Bandwidth of sample: Low	Medium	High
Area[0)]	k km²		357	
Border countries[0)]	number			9
Population[0)]	millions			83
GDP per capita[0)]	%, EU 27=100	117		
Active licenses[1)]	number			475
National modal share passenger rail[0)]	%		9	
National modal share rail freight[0)]	%		20	
International passenger-km[1)]	%	3		
International tonne-km[1)]	%		50	
Length of national main lines[0)]	km			39.379
National passenger stations[1)]	number			7.033
Share of national network managed[2)]	%		85	
Length of high-speed lines	km			2.663
Length of main track	km			55.243
Full time employees	fte			51.290
Passenger train-kilometres	m train-km			827
Freight train-kilometres	m train-km			252
Total gross tonne-kilometres	bn gtkm			
Grants total	bn EUR			7

Figure 84: Fact sheet: DB InfraGO AG[80]

EESTI RAUDTEE

Other characteristics[3)]

- The terrain is flat
- Relative short distances
- Often large amounts of snow in the winter

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

		Bandwidth of sample: Low	Medium	High
Area[0)]	k km²	45		
Border countries[0)]	number	2		
Population[0)]	millions	1,3		
GDP per capita[0)]	%, EU 27=100	87		
Active licenses[1)]	number	16		
National modal share passenger rail[0)]	%	2		
National modal share rail freight[0)]	%		27	
International passenger-km[1)]	%	0,6		
International tonne-km[1)]	%			92
Length of national main lines[0)]	km	1.167		
National passenger stations[1)]	number	106		
Share of national network managed[2)]	%		85	
Length of high-speed lines	km	0		
Length of main track	km	801		
Full time employees	fte	670		
Passenger train-kilometres	m train-km	5		
Freight train-kilometres	m train-km	1		
Total gross tonne-kilometres	bn gtkm	2		
Grants total	bn EUR	0,1		

Figure 85: Fact sheet: AS Eesti Raudtee[81]

HŽ INFRASTRUKTURA

Other characteristics[3)]

- Intersection of Mediterranean and Alpine-Western Balkan freight corridor
- High amount of single tracks
- 25 kV AC overhead line
- Normal track gauge

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

		Bandwidth of sample: Low	Medium	High
Area[0)]	k km²	57		
Border countries[0)]	number		5	
Population[0)]	millions	4		
GDP per capita[0)]	%, EU 27=100	73		
Active licenses[1)]	number	9		
National modal share passenger rail[0)]	%	3		
National modal share rail freight[0)]	%		26	
International passenger-km[1)]	%	1		
International tonne-km[1)]	%			74
Length of national main lines[0)]	km	2.617		
National passenger stations[1)]	number	537		
Share of national network managed[2)]	%			100
Length of high-speed lines	km	0		
Length of main track	km	2.709		
Full time employees	fte	4.773		
Passenger train-kilometres	m train-km	14		
Freight train-kilometres	m train-km	7		
Total gross tonne-kilometres	bn gtkm	8		
Grants total	bn EUR	0,4		

Figure 86: Fact sheet: HŽ Infrastruktura d.o.o. [82]

80 Grants total are normalised for purchasing power parity
81 Grants total are normalised for purchasing power parity
82 Grants total are normalised for purchasing power parity

Other characteristics[3]

- 1.600 mm broad gauge Railway
- Rail Freight market limited by the size of the country and the relatively short distances travelled

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

		Bandwidth of sample		
		Low	Medium	High
Area[0]	k km²	70		
Border countries[0]	number	1		
Population[0]	millions	5		
GDP per capita[0]	%, EU 27=100			233
Active licenses[1]	number	3		
National modal share passenger rail[0]	%	2,5		
National modal share rail freight[0]	%	0,7		
International passenger-km[1]	%	0		
International tonne-km[1]	%	0		
Length of national main lines[0]	km	1.888		
National passenger stations[1]	number	145		
Share of national network managed[2]	%			100
Length of high-speed lines	km	0		
Length of main track	km	2.165		
Full time employees	fte	1.738		
Passenger train-kilometres	m train-km	17		
Freight train-kilometres	m train-km	0,3		
Total gross tonne-kilometres	bn gtkm	5		
Grants total	bn EUR	0,3		

Figure 87: Fact sheet: Iarnród Éireann – Irish Rail[83]

Other characteristics[3]

- IP manages the Portuguese rail and road infrastructure
- Iberian gauge, 25kV AC overhead line
- Pop.(mainland) 9,7m
- Area (mainland) 89 k

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

		Bandwidth of sample		
		Low	Medium	High
Area[0]	k km²	92		
Border countries[0]	number	1		
Population[0]	millions	10		
GDP per capita[0]	%, EU 28=100	77		
Active licenses[1]	number	5		
National modal share passenger rail[0]	%	4		
National modal share rail freight[0]	%	12		
International passenger-km[1]	%	0,6		
International tonne-km[1]	%	24		
Length of national main lines[0]	km	2.526		
National passenger stations[1]	number	454		
Share of national network managed[2]	%			100
Length of high-speed lines	km	0		
Length of main track	km	3.225		
Full time employees	fte	3.647		
Passenger train-kilometres	m train-km	24		
Freight train-kilometres	m train-km	4		
Total gross tonne-kilometres	bn gtkm	6		
Grants total	bn EUR	0,2		

Figure 88: Fact sheet: Infraestruturas de Portugal S.A. [84]

Other characteristics[3]

- High population density
- High speed lines to surrounding European countries
- High degree of electrification

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

		Bandwidth of sample		
		Low	Medium	High
Area[0]	k km²	31		
Border countries[0]	number		4	
Population[0]	millions	12		
GDP per capita[0]	%, EU 27=100	120		
Active licenses[1]	number	9		
National modal share passenger rail[0]	%		8	
National modal share rail freight[0]	%	12		
International passenger-km[1]	%	7		
International tonne-km[1]	%		40	
Length of national main lines[0]	km	3.602		
National passenger stations[1]	number	554		
Share of national network managed[2]	%			100
Length of high-speed lines	km			
Length of main track	km	6.553		
Full time employees	fte	9.955		
Passenger train-kilometres	m train-km	77		
Freight train-kilometres	m train-km	-10		
Total gross tonne-kilometres	bn gtkm			
Grants total	bn EUR	1		

Figure 89: Fact sheet: Infrabel [85]

83 Grants total are normalised for purchasing power parity
84 Grants total are normalised for purchasing power parity
85 Grants total are normalised for purchasing power parity

LATVIJAS DZELZCEĻŠ

Other characteristics[3)]

- Connections with Baltic sea ports
- Transit between East and West

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

		Bandwidth of sample		
		Low	Medium	High
Area[0)]	k km²	65		
Border countries[0)]	number		4	
Population[0)]	millions	2		
GDP per capita[0)]	%, EU 27=100	74		
Active licenses[1)]	number	7		
National modal share passenger rail[0)]	%	4		
National modal share rail freight[0)]	%			53
International passenger-km[1)]	%	1,0		
International tonne-km[1)]	%			94
Length of national main lines[0)]	km	1.859		
National passenger stations[1)]	number	132		
Share of national network managed[2)]	%			100
Length of high-speed lines	km	0		
Length of main track	km	2.213		
Full time employees	fte	2.713		
Passenger train-kilometres	m train-km	6,2038		
Freight train-kilometres	m train-km	4		
Total gross tonne-kilometres	bn gtkm	14		
Grants total	bn EUR			

Figure 90: Fact sheet: Latvijas dzelzceļš[86]

LTG INFRA

Other characteristics[3)]

- Connection between 1435 and 1520 tracks
- Connection with Klaipėda seaport
- High amount of single tracks

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

		Bandwidth of sample		
		Low	Medium	High
Area[0)]	k km²	65		
Border countries[0)]	number		4	
Population[0)]	millions	3		
GDP per capita[0)]	%, EU 27=100	89		
Active licenses[1)]	number	9		
National modal share passenger rail[0)]	%	1,1		
National modal share rail freight[0)]	%			46
International passenger-km[1)]	%		10	
International tonne-km[1)]	%			76
Length of national main lines[0)]	km	1.911		
National passenger stations[1)]	number	131		
Share of national network managed[2)]	%			100
Length of high-speed lines	km	0		
Length of main track	km	2.354		
Full time employees	fte	2.453		
Passenger train-kilometres	m train-km	7		
Freight train-kilometres	m train-km	6		
Total gross tonne-kilometres	bn gtkm	30		
Grants total	bn EUR	0,3		

Figure 91: Fact sheet: AB LTG Infra[87]

LISEA

Other characteristics[3)]

- Only HSL
- PPP contract
- Touristic destination

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

		Bandwidth of sample		
		Low	Medium	High
Area[0)]	k km²			633
Border countries[0)]	number			8
Population[0)]	millions			68
GDP per capita[0)]	%, EU 27=100	102		
Active licenses[1)]	number	29		
National modal share passenger rail[0)]	%		11	
National modal share rail freight[0)]	%	11		
International passenger-km[1)]	%	5		
International tonne-km[1)]	%		41	
Length of national main lines[0)]	km			26.838
National passenger stations[1)]	number		2.967	
Share of national network managed[2)]	%			
Length of high-speed lines	km	665		
Length of main track	km	665		
Full time employees	fte	31		
Passenger train-kilometres	m train-km	6		
Freight train-kilometres	m train-km	0		
Total gross tonne-kilometres	bn gtkm	4		
Grants total	bn EUR	0		

Figure 92: Fact sheet: LISEA[88]

86 Grants total are normalised for purchasing power parity
87 Former Lietuvos geležinkeliai and grants are normalised for purchasing power parity
88 Grants total are normalised for purchasing power parity

PKP PLK

Other characteristics[3)]

- 3rd largest railway network in the EU
- Standard rail gauge
- 6th in the EU in terms of country coverage and population
- 3kV traction voltage

		Bandwidth of sample		
		Low	Medium	High
Area	k km²		313	
Border countries	number			7
Population	millions		38	
GDP per capita	%, EU 27=100	80		
Active licenses[1)]	number	141		
National modal share passenger rail	%		8	
National modal share rail freight	%		23	
International passenger-km[1)]	%	4		
International tonne-km[1)]	%		44	
Length of national main lines	km		18.611	
National passenger stations	number		2.711	
Share of national network managed[2)]	%			96
Length of high-speed lines	km	248		
Length of main track	km		27.370	
Full time employees	fte			37.705
Passenger train-kilometres	m train-km	182		
Freight train-kilometres	m train-km		84	
Total gross tonne-kilometres	bn gtkm			167
Grants total	bn EUR		4	

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 93: Fact sheet: PKP PLK [89]

ProRail

Other characteristics[3)]

- Large increase in passenger demand now and next 10 years to come
- Polycentric urban network with traffic evenly in both directions

		Bandwidth of sample		
		Low	Medium	High
Area[0)]	k km²	42		
Border countries[0)]	number	2		
Population[0)]	millions	18		
GDP per capita[0)]	%, EU 27=100	129		
Active licenses[1)]	number	41		
National modal share passenger rail[0)]	%		12	
National modal share rail freight[0)]	%	7		
International passenger-km[1)]	%	1		
International tonne-km[1)]	%			85
Length of national main lines[0)]	km	3.055		
National passenger stations[1)]	number	399		
Share of national network managed[2)]	%			100
Length of high-speed lines	km	72		
Length of main track	km	6.269		
Full time employees	fte	5.087		
Passenger train-kilometres	m train-km	140		
Freight train-kilometres	m train-km	10		
Total gross tonne-kilometres	bn gtkm	51		
Grants total	bn EUR	2		

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 94: Fact sheet: ProRail[90]

RFI

Other characteristics[3)]

- Complex orography (high number of tunnels and bridges); seismic territory (> 40%); hydrogeological risk
- Dichotomy North/South
- 100% ATP, 80% SCC
- Four out of nine Ten-T Corridors

		Bandwidth of sample		
		Low	Medium	High
Area[0)]	k km²		301	
Border countries[0)]	number		6	
Population[0)]	millions			59
GDP per capita[0)]	%, EU 27=100	96		
Active licenses[1)]	number	38		
National modal share passenger rail[0)]	%	6		
National modal share rail freight[0)]	%	12		
International passenger-km[1)]	%	1		
International tonne-km[1)]	%		49	
Length of national main lines[0)]	km		17.256	
National passenger stations[1)]	number	2.304		
Share of national network managed[2)]	%			92
Length of high-speed lines	km		1.311	
Length of main track	km		27.001	
Full time employees	fte		28.452	
Passenger train-kilometres	m train-km		317	
Freight train-kilometres	m train-km	54		
Total gross tonne-kilometres	bn gtkm			171
Grants total	bn EUR			7

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 95: Fact sheet: RFI[91]

89 Grants total are normalised for purchasing power parity
90 Grants total are normalised for purchasing power parity
91 Grants total are normalised for purchasing power parity

SBB CFF FFS

Other characteristics[3]

- Federal state, strong position of regions
- High purchasing power, almost no heavy industries
- Night driving ban for lorries, no national bus system

		Bandwidth of sample		
		Low	Medium	High
Area[0]	k km²	41		
Border countries[0]	number		5	
Population[0]	millions	9		
GDP per capita[0]	%, EU 27=100		154	
Active licenses[1]	number	54		
National modal share passenger rail[0]	%			17
National modal share rail freight[0]	%		34	
International passenger-km[1]	%		11	
International tonne-km[1]	%			76
Length of national main lines[0]	km	5.215		
National passenger stations[1]	number	1.672		
Share of national network managed[2]	%	61		
Length of high-speed lines	km	138		
Length of main track	km	6.399		
Full time employees	fte	9.835		
Passenger train-kilometres	m train-km	160		
Freight train-kilometres	m train-km	28		
Total gross tonne-kilometres	bn gtkm		78	
Grants total	bn EUR	2		

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 96: Fact sheet: SBB[92]

SNCF RÉSEAU

Other characteristics[3]

- Area (mainland): 543 k km²
- Population (mainland): 66 millions
- Heterogeneous climate
- Urban polarisation
- Highly regulated

		Bandwidth of sample		
		Low	Medium	High
Area[0]	k km²			633
Border countries[0]	number			8
Population[0]	millions			68
GDP per capita[0]	%, EU 27=100	102		
Active licenses[1]	number	29		
National modal share passenger rail[0]	%		11	
National modal share rail freight[0]	%	11		
International passenger-km[1]	%	5		
International tonne-km[1]	%		41	
Length of national main lines[0]	km			26.838
National passenger stations[1]	number		2.967	
Share of national network managed[2]	%			98
Length of high-speed lines	km		2.137	
Length of main track	km			47.626
Full time employees	fte			52.047
Passenger train-kilometres	m train-km		389	
Freight train-kilometres	m train-km	63		
Total gross tonne-kilometres	bn gtkm			
Grants total	bn EUR		4	

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 97: Fact sheet: SNCF Réseau[93]

SPRÁVA ŽELEZNIC

Other characteristics[3]

- Top density of lines per km² within the EU
- High density of stops, stations and level crossings
- Two gauges
- Four systems of electricity

		Bandwidth of sample		
		Low	Medium	High
Area[0]	k km²	79		
Border countries[0]	number		4	
Population[0]	millions	10		
GDP per capita[0]	%, EU 27=100	91		
Active licenses[1]	number	107		
National modal share passenger rail[0]	%		8	
National modal share rail freight[0]	%		22	
International passenger-km[1]	%	9		
International tonne-km[1]	%			70
Length of national main lines[0]	km	9.376		
National passenger stations[1]	number		2.617	
Share of national network managed[2]	%			98
Length of high-speed lines	km	0		
Length of main track	km	11.502		
Full time employees	fte		17.125	
Passenger train-kilometres	m train-km	140		
Freight train-kilometres	m train-km	37		
Total gross tonne-kilometres	bn gtkm		63	
Grants total	bn EUR		3	

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 98: Správa železnic, státní organizace[94]

92 Grants total are normalised for purchasing power parity
93 Grants total are normalised for purchasing power parity
94 Grants total are normalised for purchasing power parity

Slovenske železnice

Other characteristics[3)]

- Central network with only one company operating passenger services
- Intersection of Pan-European corridors V and X

		Bandwidth of sample		
		Low	Medium	High
Area[0)]	k km²	20		
Border countries[0)]	number		4	
Population[0)]	millions	2		
GDP per capita[0)]	%, EU 27=100	92		
Active licenses[1)]	number	8		
National modal share passenger rail[0)]	%	2		
National modal share rail freight[0)]	%		33	
International passenger-km[1)]	%		18	
International tonne-km[1)]	%			98
Length of national main lines[0)]	km	1.210		
National passenger stations[1)]	number	269		
Share of national network managed[2)]	%			100
Length of high-speed lines	km	0		
Length of main track	km	1.534		
Full time employees	fte			
Passenger train-kilometres	m train-km	9		
Freight train-kilometres	m train-km	10		
Total gross tonne-kilometres	bn gtkm	12		
Grants total	bn EUR	0,2		

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 99: Fact sheet: SŽ-Infrastruktura d.o.o.[95]

TRAFIKVERKET SWEDISH TRANSPORT ADMINISTRATION

Other characteristics[3)]

- Open market, many railway undertakings
- All tracks open for both passenger and freight traffic
- Large areas are sparsely populated

		Bandwidth of sample		
		Low	Medium	High
Area[0)]	k km²			450
Border countries[0)]	number	2		
Population[0)]	millions	10		
GDP per capita[0)]	%, EU 27=100	120		
Active licenses[1)]	number	59		
National modal share passenger rail[0)]	%		11	
National modal share rail freight[0)]	%		29	
International passenger-km[1)]	%	2		
International tonne-km[1)]	%		36	
Length of national main lines[0)]	km	10.909		
National passenger stations[1)]	number	675		
Share of national network managed[2)]	%			89
Length of high-speed lines	km	0		
Length of main track	km	11.840		
Full time employees	fte	9.167		
Passenger train-kilometres	m train-km	127		
Freight train-kilometres	m train-km	37		
Total gross tonne-kilometres	bn gtkm		74	
Grants total	bn EUR	2		

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 100: Fact sheet: Trafikverket[96]

ŽSR

Other characteristics[3)]

- Mostly standard, but also some broad gauge tracks
- Increasing number of private RUs

		Bandwidth of sample		
		Low	Medium	High
Area[0)]	k km²	49		
Border countries[0)]	number		5	
Population[0)]	millions	5		
GDP per capita[0)]	%, EU 27=100	68		
Active licenses[1)]	number	28		
National modal share passenger rail[0)]	%		9	
National modal share rail freight[0)]	%		30	
International passenger-km[1)]	%	4		
International tonne-km[1)]	%		49	
Length of national main lines[0)]	km	3.627		
National passenger stations[1)]	number	726		
Share of national network managed[2)]	%			100
Length of high-speed lines	km	0		
Length of main track	km	4.642		
Full time employees	fte	13.303		
Passenger train-kilometres	m train-km	32		
Freight train-kilometres	m train-km	15		
Total gross tonne-kilometres	bn gtkm	27		
Grants total	bn EUR	0,7		

0) Eurostat 2022
1) EC RMMS 2020 data
2) IRG Rail 2021 data
3) As characterised by the IM
— Under the line, IM specific data

Figure 101: Fact sheet: Železnice Slovenskej republiky[97]

95 Grants total are normalised for purchasing power parity
96 Grants total are normalised for purchasing power parity
97 Grants total are normalised for purchasing power parity

4.3 Comments on deviations

Page	Indicator name	Input data name[98]	IM[99]	Comment by the IM for 2022
30	Total passenger high-speed train-km	Total passenger high-speed train-km (≥ 200 km/h) (N)	RFI	The data include train km covered by high-speed trains. Some of these train-kms are operated on lines with speed <200 km/h
41	OPEX – operational expenditures in relation to network size	Total OPEX - operating expenditures (N)	DB	without stations
41	Maintenance expenditures in relation to network size	Total maintenance expenditures (N)	DB	without stations
41	Maintenance expenditures in relation to network size	Total maintenance expenditures (N)	RFI	The data refers only to minimum access package
44	CAPEX – capital expenditures in relation to network size	Total CAPEX - capital expenditures (N)	DB	without stations
44	Renewal expenditures in relation to network size	Total renewal expenditures (N)	Adif	Includes renewals and enhancements, this figure aggregates both
44	Renewal expenditures in relation to network size	Total renewal expenditures (N)	DB	without stations
47	Maintenance and renewal in relation to network size	Sum of total renewal and maintenance expenditures (N)	Adif	sum of renewals (and enhancements) plus maintenance
47	Maintenance and renewal in relation to network size	Sum of total renewal and maintenance expenditures (N)	DB	without stations
49	Proportion of TAC in total revenue	Revenues from TAC (N)	DB	without stations
49	Proportion of TAC in total revenue	Total Revenues (D)	IP	It also includes revenues from ID397+ID104
61	Significant accidents	Number of significant accidents (N)	DB	number refers to all IMs in Germany
63	Fatalities and weighted serious injuries	Fatalities and weighted serious injuries (N)	DB	number refers to all IMs in Germany
65	IM related precursors to accidents	Number of precursors to accidents (N)	DB	number refers to all IMs in Germany
75	Share of renewable traction energy	Share of renewable traction energy (N)	HŽI	Share of energy from renewable sources in Croatia in 2021
76	Share of renewable energies (excl. traction)	Share of renewable energies (excl. traction) (N)	HŽI	Share of energy from renewable sources in Croatia in 2021
83	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	Adif	Only HS and Medium range trains. Commuter and regional thresholds are 3' and 1' in Spain.
83	Passenger trains punctuality	Number of scheduled passenger trains that operated (D)	Adif	Only HS and Medium range trains. Commuter and regional thresholds are 3' and 1' in Spain.
83	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of	DB	"Definition: Passenger trains: 0:00 to max. 5:59 minutes"

[98] The letters “D” and “N” mark the denominator (D) and nominator (N) of the indicator.
[99] IM = Infrastructure manager

Page	Indicator name	Input data name[98]	IM[99]	Comment by the IM for 2022
		less than or equal to 5:29 minutes (N)		
83	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	LISEA	less than 05:59
83	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	RFI	For passenger transport, only regional trains are included.
83	Passenger trains punctuality	Number of all trains scheduled to be operated (D)	RFI	For passenger transport, only regional trains are included.
83	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	SNCF R.	Punctuality refers to an arrival with a delay of less or equal 5:59 minutes
83	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	ŽSR	Delay set to 5:00
86	Freight trains punctuality	Freight trains arrived at strategic measuring points with a delay of less than or equal to 15:29 minutes (N)	DB	"Definition: Passenger trains: 0:00 to max. 15:59 minutes"
86	Freight trains punctuality	Freight trains arrived at strategic measuring points with a delay of less than or equal to 15:29 minutes (N)	SNCF R.	Punctuality refers to an arrival with a delay of less or equal 15:59 minutes
86	Freight trains punctuality	Freight trains arrived at strategic measuring points with a delay of less than or equal to 15:29 minutes (N)	HŽI	ad hoc freight trains are not included in punctuality
88; 94	Average delay minutes per asset failure	Total delay minutes - Asset failures (N)	LISEA	less than 05:59
90	Percentage of train cancellations caused by the IM	Cancellations of scheduled passenger trains - IM's responsibility (N)	Adif	No comments
92	Signaling failures in relation to network size	Total number of signaling failures (N)	DB	KPI according to internal measurement system
92	Telecommunication failures in relation to network size	Total number of telecommunication failures (N)	DB	KPI according to internal measurement system
102	Planned extent of ERTMS deployment by 2030	In 2030 sum of main track-km planned deployed with ERTMS (N)	TRV	The national roll-out plan is currently under revision and the figures will probably be updated shortly. Reported figures are those before the revision started

4.4 PRIME KPI-definitions

More detailed explanation on the definitions of input data and the indicators can be found in the catalogue available on the PRIME website.

Overview of main rail industry characteristics and trends

KPI name	KPI Definition	KPI unit
National modal share of rail in passenger transport	Proportion of national rail passenger-km compared to total passenger-km of passenger cars, buses/coaches, and railways. (Source: European Commission, Eurostat)	% of passenger-km
National modal share of rail in freight transport	Proportion of national rail tonne-km compared to total tonne-km of road, inland waterways, and rail freight. (Source: European Commission, Eurostat)	% of tonne-km
Total track-km	Total track-km	km
Total main track-km	A track providing end-to-end line continuity designed for trains between stations or places indicated in tariffs as independent points of departure or arrival for the conveyance of passengers or goods, maintained and operated by the infrastructure manager. Tracks at service facilities not used for running trains are excluded. The boundary of the service facility is the point at which the railway vehicle leaving the service facility cannot pass without having an authorization to access the mainline or other similar line. This point is usually identified by a signal. Service facilities are passenger stations, their buildings, and other facilities; freight terminals; marshalling yards and train formation facilities, including shunting facilities; storage sidings; maintenance facilities; other technical facilities, including cleaning and washing facilities; maritime and inland port facilities which are linked to rail	km

KPI name	KPI Definition	KPI unit
	activities; relief facilities; refuelling facilities and supply of fuel in these facilities.	
Total main line-km	Cumulative length of railway lines operated and used for running trains by the end of reporting year Lines solely used for operating touristic trains and heritage trains are excluded, as are railways constructed solely to serve mines, forests or other industrial or agricultural installations and which are not open to public traffic. Metro, Tram, and Light rail urban lines (with non-standard – narrow - gauge) should be excluded. Private lines closed to public traffic and functionally separated (i.e. stand-alone) networks should be excluded. Private lines used for own freight transport activities or for non-commercial passenger services and light rail lines occasionally used by heavy rail vehicles for connectivity or transit purposes are excluded.	km
High-speed main line	High-speed main line-km	km
Proportion of high-speed main track-km ≥ 250 km/h)	Percentage of high-speed main track kilometres (≥ 250 km/h) of total main track kilometres	% of main track-km
Proportion of high-speed main track-km (≥ 200 km/h and <250 km/h)	Percentage of high-speed main track kilometres (≥ 200 km/h and <250 km/h) of total main track kilometres	% of main track-km

KPI name	KPI Definition	KPI unit
Degree of net-work utilisation – passenger trains	Average daily passenger train-km on main track (revenue service only, no shunting, no work trains) related to main track-km	Daily passen-ger train–km per main track-km
Degree of net-work utilisation – freight trains	Average daily freight train-km on main track (revenue service only, no shunting, no work trains) related to main track-km	Daily freight train–km per main track-km
Total passen-ger high-speed train-km	Total high-speed train-km (revenue service only, no shunting, no work trains), ≥ 200 km/h. The basis for consideration is the po-tential speed of the train, not the actual speed.	Train-km

Finance

KPI name	KPI Definition	KPI unit
OPEX – opera-tional expendi-tures in relation to network size	Total IM's annual operational expenditures (net values, excluding value added tax) per main track-km	Euro per main track-km
CAPEX – capi-tal expendi-tures in relation to net-work size	Total IM's annual operational expenditures (net values, excluding value added tax) per main track-km	Euro per main track-km
Maintenance expenditures in relation to net-work size	Total infrastructure managers annual maintenance expenditures (net values, ex-cluding value added tax) per main track-km	Euro per main track-km
Renewal ex-penditures in relation to net-work size	Total infrastructure managers annual re-newal expenditures (net values, excluding value added tax) per main track-km	Euro per main track-km
TAC revenue in relation to network size	Total infrastructure manager's annual TAC revenues (including freight, passenger, and touristic trains) per total main track-km	Euro per main track-km

KPI name	KPI Definition	KPI unit
TAC revenue in relation to traffic volume	Total infrastructure manager's annual TAC revenues (including freight, passenger, and touristic trains) per train-km	Euro per total train-km
Total revenues from non-access charges in relation to network size	Total infrastructure managers annual revenues from non-access charges (e.g. commercial letting, advertising, telecoms, but excluding grants or subsidies) related to total main track-km	Euro per main track-km
Proportion of TAC in total revenue	Percentage of infrastructure managers annual TAC revenues (including freight, passenger, and touristic trains) compared to total revenues	% of monetary value
Maintenance and renewal	Total IMs annual renewal and maintenance expenditures (sum of total IMs annual renewal expenditures and total IMs annual maintenance expenditures) in relation to network size	Euro per main track-km
Total public funding	Total public funding related to network size	Euro per main track-km
Public funding for OPEX	Total public funding for OPEX related to network size	Euro per main track-km
Public funding for CAPEX	Total public funding for CAPEX related to network size	Euro per main track-km

Safety

KPI name	KPI Definition	KPI unit
Significant accidents	Relative number of significant accidents including sidings, excluding accidents in workshops, warehouses, and depots, based on the following types of accidents (primary accidents): • Collision of train with rail vehicle, • Collision of train with obstacle within the clearance gauge,	Number per million train-km

KPI name	KPI Definition	KPI unit
	• Derailment of train, • Level crossing accident, including accident involving pedestrians at level crossing, • Accident to persons involving rolling stock in motion, except for suicides and attempted suicides, • Fire on rolling stock, • Other accidents The boundary is the point at which the railway vehicle leaving the workshop / warehouse / depot / sidings cannot pass without having an authorization to access the mainline or other similar line. This point is usually identified by a signal. For further guidance, please see ERA Implementation Guidance on CSIs.	
Fatalities and weighted serious injuries	Sum of the number of persons killed (i.e. killed immediately or dying within 30 days, excluding any suicide) and of the weighted number of persons seriously injured (i.e. hospitalised for more than 24 hours, excluding any attempted suicide) by accidents based upon following categories: • Passenger • Employee or contractor • Level crossing user • Trespasser • Other person at a platform • Other person not at a platform A person seriously injured is considered statistically equivalent to 0.1 person killed.	In number per million train-km

KPI name	KPI Definition	KPI unit
Infrastructure manager related precursor to accidents	Relative number of the following types of precursors: • broken rail, • track buckle and track misalignment, • wrong-side signaling failure	In number per million train-km

Environment

KPI name	KPI Definition	KPI unit
Degree of electrification of total main track	Percentage of main track-km which are electrified	% of main track-km
Share of electricity-powered trains	Train-kilometres of electricity-powered trains compared to total train-kilometres (both for passenger and freight trains)	% of train-km
Share of diesel-powered trains	Train-kilometres of diesel-powered trains compared to total train-kilometres (both for passenger and freight trains)	% of train-km
Share of renewable traction energy	Share of renewable electric traction energy of total traction energy in % of kWh. Renewable energy is an energy that is derived from natural processes that are replenished constantly, such as energy generated from solar, wind, biomass, geothermal, hydropower and ocean resources, solid biomass, biogas, and liquid biofuels. Only electric energy is included.	% of kWh
Share of renewable energies (excl. traction)	Share of renewable energies in total consumption excluding traction current. Renewable energy is an energy that is derived from natural processes that are replenished constantly, such as energy generated from solar, wind, biomass, geothermal, hydropower and ocean resources, solid biomass, biogas, and liquid biofuels. Does not only concern electric but also other energy such	% of kWh

KPI name	KPI Definition	KPI unit
	as heating of buildings, fuel, and oil for cars et. al.	
CO_2 emission produced from maintenance rolling stock	Tonnes of carbon dioxide emission produced from the activity of maintenance rolling stock compared to main track-km	tCO_2 per main track-km

Performance and delivery

KPI name	KPI Definition	KPI unit
Passenger trains punctuality	Percentage of operating (i.e. not cancelled) national and international passenger trains (excluding work trains) which arrive at each strategic measuring point with a delay of less than or equal to 5:29 minutes	% of operating trains
Freight trains punctuality	Percentage of operating (i.e. not cancelled) national and international freight trains (excluding work trains) which arrive at each strategic measuring point with a delay of less than or equal to 15:29 minutes	% of operating trains
Delay minutes per train-km caused by the infrastructure manager	Delay minutes caused by incidents that are regarded as infrastructure managers responsibility divided by total train-km operated (revenue service + shunting operations to and from depots + infrastructure manager's work traffic). Delay minutes according to UIC leaflet 450-2. Delay minutes will be measured at all available measuring points. Of those measured delay minutes that exceed a threshold of 5:29 minutes for passenger services and 15:29 minutes for freight services the maximum number is counted. No delay minutes are counted if these thresholds are not exceeded at any measuring point.	Minutes per operating train

KPI name	KPI Definition	KPI unit
Assets failures in relation to network size	Average number of all asset failures on main track according to UIC leaflet 450-2. An asset failure is counted one time and one time only if any train is affected by it. A train is affected if the asset failure causes the train to exceed a delay minutes threshold of 5:29 minutes for passenger services or 15:29 minutes for freight services at any available measuring point. An asset failure is not counted if these thresholds are not exceeded for any train at any available measuring point (i.e. if no train is affected).	Number per thousand main track-km
Average delay minutes per asset failure	Average delay minutes per asset failure caused by all asset failures on main track according to UIC leaflet 450-2. An asset failure is counted one time and one time only if any train is affected by it. A train is affected if the asset failure causes the train to exceed a delay minutes threshold of 5:29 minutes for passenger services or 15:29 minutes for freight services at any available measuring point. Delay minutes will be measured at all available measuring points. Of those measured delay minutes, the maximum number is counted. No delay minutes are counted if these thresholds are not exceeded at any measuring point. An asset failure is not counted if these thresholds are not exceeded for any train at any available measuring point (i.e. if no train is affected).	Minutes per failure

Availability

KPI name	KPI Definition	KPI unit
Tracks with permanent speed restrictions	Percentage of tracks with permanent speed restriction due to deteriorating asset condition weighted by the time the restrictions are in place (included in the yearly timetable)	% of main track-km

KPI name	KPI Definition	KPI unit
	related to total main track-km; restrictions are counted whenever criterion is met regardless of whether infrastructure manager reports permanent speed restrictions as such or if they are included in the timetable.	
Tracks with temporary speed restrictions	Percentage of tracks with temporary speed restriction due to deteriorating asset condition weighted by the time the restrictions are in place (not included in the yearly timetable) related to total main track-km.	% of main track-km

ERTMS deployment and intermodality

KPI name	KPI Definition	KPI unit
ERTMS trackside deployment	Main tracks with ERTMS in operation in proportion to total main tracks (measured in track-km).	% of main track-km
Planned extent of ERTMS deployment by 2030	In 2030, the percentage of main track-km planned to have been deployed with ERTMS, i.e. main tracks equipped with both - ETCS (European train control system; any baseline or level) and GSM-R (Global System for Mobile Communications); and where ETCS and GSM-R are used in service.	% of current main track-km
ATP coverage	Share of main track-km equipped with ATP. ATP is a train protection system providing warning and automatic stop, and continuous supervision of speed, protection of danger points and continuous supervision of the speed limits of the line, where "continuous supervision of speed" means continuous indication and enforcement of the maximal allowed target speed on all sections of the line. Including e.g. ETCS, ATB, LZB, CBTC and similar systems.	% of main track-km

KPI name	KPI Definition	KPI unit
Core maritime ports connection	Percentage of core maritime ports linked to the TEN-T network connected	% of core maritime ports
Core inland waterways connection	Percentage of core inland waterways linked to the TEN-T network	% of core inland waterways
Core airports connection	Percentage of core airports linked to the TEN-T network	% of core airports

4.5 Individual thresholds of punctuality for national measures

Passenger train categories	2:59	3:54	3:59	4:59	5:00	5:29	5:59	10:29
Long distance	SBB CFF FFS Banedanmark ProRail	Infrastruktura		adif Infraestruturas de Portugal	ZSR	PLK	LTG Infra SNCF Réseau DB InfraGO Latvijas Dzelzceļš Trafikverket Infrabel Bane Nor	RFI
Regional	SBB CFF FFS Banedanmark ProRail	Infrastruktura	Bane Nor Eesti Raudtee	adif Infraestruturas de Portugal	ZSR	RFI PLK	LTG Infra SNCF Réseau DB InfraGO Latvijas Dzelzceļš Trafikverket Infrabel	
Commuter	SBB CFF FFS Banedanmark adif ProRail	Infrastruktura	Bane Nor Eesti Raudtee	Infraestruturas de Portugal		RFI PLK	LTG Infra SNCF Réseau DB InfraGO Latvijas Dzelzceļš Trafikverket Infrabel	

Figure 102: National delay measurement thresholds (in minutes:seconds)[100]

	2:59	4:59	5:59	14:59	15:29	15:59	29:59	30:29	59:59	95:00
Freight trains	SBB CFF FFS ProRail	Banedanmark	Trafikverket Bane Nor	LTG Infra Eesti Raudtee	PLK	DB InfraGO Latvijas Dzelzceļš	SNCF Réseau Infraestruturas de Portugal Infrabel	RFI	adif	Infrastruktura

Figure 103: National delay measurement thresholds (in minutes:seconds)

[100] Some Long-distance trains have a threshold of 15:29

4.6 Financial data

	Purchasing power parity				
Country	**2018**	**2019**	**2020**	**2021**	**2022**
Belgium	1,17	1,17	1,16	1,16	1,18
Croatia	4,80	4,80	4,80	5,05	4,80
Czechia	17,43	17,79	18,33	18,19	19,25
Denmark	10,61	10,72	10,67	10,61	10,95
Estonia	0,80	0,82	0,82	0,86	0,93
France	1,11	1,10	1,09	1,09	1,07
Germany	1,06	1,08	1,08	1,09	1,10
Ireland	1,36	1,39	1,45	1,46	1,45
Italy	1,04	1,03	1,03	1,02	1,01
Latvia	0,72	0,74	0,74	0,76	0,81
Lithuania	0,63	0,66	0,66	0,68	0,74
Netherlands	1,18	1,21	1,21	1,21	1,21
Norway	14,81	15,27	15,65	15,62	15,46
Poland	2,41	2,45	2,48	2,57	2,72
Portugal	0,86	0,87	0,88	0,87	0,86
Slovenia	0,86	0,86	0,86	0,88	0,80
Slovakia	0,79	0,79	0,77	0,77	0,85
Spain	0,97	0,96	0,99	0,98	0,98
Sweden	13,74	13,89	14,04	13,80	13,74
Switzerland	1,68	1,95	1,95	1,91	1,85

Figure 104: Purchasing power parity (Index, EU-27=1)[101]

[101] Source: Eurostat, status 01.2024. Please note that the PPP values for 2021 and 2022 are preliminary and may be revised in the next data release periods of Eurostat.

5. Glossary

Name	Description	Source
Affected train (by an asset failure)	A train is affected if the asset failure causes the train to exceed a delay minutes threshold of 5:29 minutes for passenger services or 15:29 minutes for freight services at any available measuring point.	
Ancillary services	Ancillary services may comprise: (a) access to telecommunication networks; (b) provision of supplementary information; (c) technical inspection of rolling stock; (d) ticketing services in passenger stations; (e) heavy maintenance services supplied in maintenance facilities dedicated to high-speed trains or to other types of rolling stock requiring specific facilities.	Directive 2012/34/EU Annex II)
Asset Capability	Asset capability is a quality or function as a property or natural part of an asset. A capability is a characteristic of an asset enabling achievement of its desired function.	
Asset failure	An asset failure is counted one time and one time only if any train is affected by it. A train is affected if the asset failure causes the train to exceed a delay minutes threshold of 5:29 minutes for passenger services or 15:29 minutes for freight services at any available measuring point. An asset failure is not counted if these thresholds are not exceeded for any train at any available measuring point (i.e. if no train is affected).	
Asset Management	Coordinated activity of an organisation to realise value from assets.	ISO 55000:2014
Assets	LICB defines the Railway Infrastructures as consisting of the following items, assuming they form part the permanent way, including sidings, but excluding lines situated within railway repair workshops, depots or locomotive sheds and private branch lines or sidings: Ground area Track and track bed etc. Engineering structures: Bridges culverts and other overpasses, tunnels etc. Level crossings, including appliances to ensure safety of road traffic; Superstructure, in particular: rails, grooved rails; sleepers, small fittings for the permanent way, ballast, points, crossings. Access way for passengers and goods, including access by road; Safety, signaling and telecommunications installations on the open track, in stations and in marshalling yards etc. Lightning installations for traffic and safety purposes Plant for transforming and carrying electric power for train haulage: substations, Supply cables between sub-stations and contact wires, catenaries.	EC Directives, European Commission 5th Framework Programme Improve rail, Deliverable D3, “Benchmarking exercise in railway infrastructure management” as referred in the UIC Lasting Infrastructure Cost Benchmarking (LICB) project.
ATP (Automatic train protection)	ATP is a train protection system providing warning and automatic stop and continuous supervision of speed, protection of danger points and continuous supervision of the speed limits of the line, where "continuous supervision of speed" means continuous indication and enforcement of the maximal allowed target speed on all sections of the line.	
Bottleneck	A physical, technical, or functional barrier which leads to a system break affecting the continuity of long-distance or cross-border flows and which can be surmounted by creating new infrastructure or substantially upgrading existing infrastructure that could bring significant improvements which will solve the bottleneck constraints.	Regulation (EU) No 1315/2013 (TEN-T), Article (3)(q)
Broken rail	Any rail which is separated in two or more pieces, or any rail from which a piece of metal becomes detached, causing a gap of more than 50 mm in length and more than 10 mm in depth on the running surface.	Directive (EU) 2016/798 on railway safety, Annex I, Appendix 4.1
Cancelled train	If a planned service is not running (i.e. train cancelled in the operations phase). The codes described in UIC CODE, 450 – 2, OR, 5th edition, June 2009, Appendix A page 9 should be used to describe the cause of cancellation overall or just a part of the route. Cancelled trains can be split into four types. These are: •full cancellation (cancelled at origin) •part cancellation en route •part cancellation changed origin •part cancellation diverted (any train that diverts and does not stop at all of its scheduled locations will be classed as a part cancellation even if it reaches its end destination).	UIC CODE, 450 – 2, OR, 5th edition, June 2009, 6 – Cancelled services, combined with adopting the types of cancellations described by Network Rail.
Capacity (infrastructure)	Capacity means the potential to schedule train paths requested for an element of infrastructure for a certain period.	2012/34/EU (SERA), Article 3 (24)

Name	Description	Source
CAPEX, Capital expenditures	Capital expenditure are funds used by a company to acquire or upgrade physical assets such as property, industrial buildings, or equipment. An expense is a capital expenditure when the asset is a newly purchased capital asset or an investment that improves the useful life of an existing capital asset. Hence, it comprises investments in new infrastructure as well as renewals and enhancements.	PRIME KPI subgroup
Charges for service facilities	Revenues generated by providing access to service facilities. Services facilities include: (a) passenger stations, their buildings, and other facilities, including travel information display and suitable location for ticketing services (b) freight terminals (c) marshalling yards and train formation facilities, including shunting facilities (d) storage sidings (e) maintenance facilities, except for heavy maintenance facilities dedicated to high-speed trains or to other types of rolling stock requiring specific facilities (f) other technical facilities, including cleaning and washing facilities (g) maritime and inland port facilities which are linked to rail activities (h) relief facilities (i) refuelling facilities and supply of fuel in these facilities, charges for which shall be shown on the invoices separately	Directive 2012/32/EU, Annex II
Conventional train	Train, composed of vehicles designed to operate at speeds below 250 km/h.	Decision No. 1692/96/EC (TEN-T), Art.10(1)
Delay	The time difference between the time the train was scheduled to arrive in accordance with the published timetable and the time of its actual arrival.	Adapted from ERA, Glossary of railway terminology
Delay minutes	Delay minutes will be measured at all available measuring points. Of those measured delay minutes that exceed a threshold of 5:29 minutes for passenger services and 15:29 minutes for freight services the maximum number is counted. No delay minutes are counted if these thresholds are not exceeded at any measuring point.	
Deployment	The deployment of a mechanical device, electrical system, computer program, etc., is its assembly or transformation from a packaged form to an operational working state. Deployment implies moving a product from a temporary or development state to a permanent or desired state.	
Derailment of train	Any case in which at least one wheel of a train leaves the rails.	Glossary for Transport Statistics, A.VI-14 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.7
Direct Cost in the meaning of Regulation (EU)2015/909	Direct cost in this context means “the cost that is directly incurred as a result of operating the train service” and which is used for setting charges for the minimum access package and for access to infrastructure connecting service facilities. The modalities for the calculation of the cost that is directly incurred because of operating the train are set out in Commission Implementing Regulation (EU) 2015/909 and can in principle be established based on: (a) a network-wide approach as the difference between, on the one hand, the costs for providing the services of the minimum access package and for the access to the infrastructure connecting service facilities and, on the other hand, the non-eligible costs referred to in Article 4 of this regulation, or (b) econometric or engineering cost modelling.	PRIME KPI subgroup based on Implementing Regulation (EU) 2015/909

Name	Description	Source
Expenditure on enhancements of existing infrastructure	Enhancements (or 'upgrades') means capital expenditure on a major modification work of the existing infrastructure which improves its overall performance. Enhancements can be triggered by changed functional requirements (and not triggered by lifetime) or "forced" investments when acting on regulations. The purpose of enhancements is to change the functional requirements such as electrification of a non-electrified line, building a second track parallel to a single tracked line, increase of line speed or capacity. Enhancements include planning (incl. portfolio prioritization, i.e. which enhancements projects are realized when and where), tendering dismantling (disposal of old equipment), construction, testing and commissioning (when track is opened to full-speed operation). Enhancements are generally looked on at the level of annual spending from a cash-flow perspective, i.e. no depreciation or other imputed costs are considered. It includes its proportion of overhead (such as financials, controlling, IT, human resources, purchasing, legal and planning), labour (operative, personnel), material, (used/consumed goods), internal services (machinery, tools, equipment including transport and logistics) and contractors (entrepreneurial production) as well as investment subsidies.	PRIME KPI subgroup based on Regulation (EU) 2015/1100 (RMMS), Article 2
ERA	European Union Agency for Railways	Regulation (EU) 2016/796 (ERA)
ERTMS	'European Rail Traffic Management System' (ERTMS) means the system defined in Commission Decision 2006/679/EC and Commission Decision 2006/860/EC European Rail Traffic Management System (ERTMS) is the European signaling system consisting the European Train Control System (ETCS), a standard for in-cab train control, and GSM-R, the GSM mobile communications standard for railway operations. ERTMS in operations refers to main tracks equipped with both - ETCS (European train control system; any baseline or level) and GSM-R (Global System for Mobile Communications); and where ETCS and GSM-R are used in service.	Commission Decision 2006/679/EC Commission Decision 2006/860/EC
Failure	Termination of an item to perform a given service. Also see -> Asset failure	SIS-EN 13306:2010
Financial expenditures	Financial expenditures are the ones accounted for in the annual profit and loss statement. It includes interests and similar charges which correspond to the remuneration of certain financial assets (deposits, bills, bonds, and credits).	PRIME KPI subgroup based on Eurostat concepts and definitions on financial surplus
Freight train	Freight (good) train: train for the carriage of goods composed of one or more wagons and, possibly, vans moving either empty or under load.	Glossary for Transport Statistics, A.IV-06
Freight train-km	Unit of measurement representing the movement of all freight trains over one kilometre. From an infrastructure manager's point of view, it is important to include all freight train movements as they all influence the deterioration of the rail infrastructure assets. Empty freight train movements are therefore included in the number of freight train movements.	Glossary for Transport Statistics, A.IV-07 LICB Web Glossary, p.19
Funding	An amount of money used for a specific purpose, in our case to finance the infrastructure manager expenditures.	Longman, Dictionary of contemporary English
Grant	A direct financial contribution given by the federal, state, or local government or provided from EU funds to an eligible grantee. Grants are not expected to be repaid and do not include financial assistance, such as a loan or loan guarantee, an interest rate subsidy, direct appropriation, or revenue sharing.	PRIME KPI subgroup
Gross tonne km	Unit of measure representing the movement over one kilometre of one tonne of rail vehicle including the weight of tractive vehicle.	Glossary for Transport Statistics, A.IV-14
High-speed train	Train, composed of vehicles designed to operate: - either at speeds of at least 250 km/h on lines specially built for high speeds, while enabling operation at speeds exceeding 300 km/h in appropriate circumstances, - or at speeds of the order of 200 km/h on the lines, where compatible with the performance levels of these lines.	Glossary for Transport Statistics, A.I-02 Directive (EU) 2016/797 on the rail interoperability, Annex I, Article 1

Name	Description	Source
High-speed track	Track (line) whole or part of line, approved for V_{max} ≥ 250 km/h — specially built high-speed lines equipped for speeds generally equal to or greater than 250 km/h, *— specially upgraded high-speed lines equipped for speeds of the order of 200 km/h,* *— specially upgraded high-speed lines which have special features because of topographical, relief or town-planning constraints, on which the speed must be adapted to each case* *The last category also includes interconnecting lines between the high-speed and conventional networks, lines through stations, accesses to terminals, depots, etc. travelled at conventional speed by 'high-speed' rolling stock.* PRIME data collection is conducted separately for high-speed track ≥ 250 & high-speed track ≥ 200 and <250	Glossary for Transport Statistics, A.I-04 Directive (EU) 2016/797 on the rail interoperability, Annex I, Article 1
Infrastructure Manager (IM)	Any firm or body responsible for establishing, managing, and maintaining railway infrastructure, including traffic management and control-command and signaling. An infrastructure manager can delegate to another enterprise the following tasks: maintaining railway infrastructure and operating the control and safety system. 'Infrastructure manager' means any body or firm responsible for establishing, managing, and maintaining railway infrastructure, including traffic management and control-command and signaling; the functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or firms.	Glossary for Transport Statistics. A.III-03 Directive 2012/34/EU (SERA), Article 3(2)
Infrastructure Manager's responsibility for delay minutes	Table, column 1-, 2-, 3- (Operational and planning management, Infrastructure installations, Civil Engineering causes). Plus: Delay minutes caused by weather incidents that have affected the railway infrastructure. The relevant causes are described in Appendix 2.	UIC CODE, 450 – 2, OR, 5th edition, June 2009, Appendix A
Interoperability	The ability of a rail system to allow the safe and uninterrupted movement of trains which accomplish the required levels of performance.	Directive (EU) 2016/797 on the rail interoperability, Article 2(2)
Investments in new infrastructure	Investment in new infrastructure means capital expenditure on the projects for construction of new infrastructure installations for new lines. It includes planning (incl. portfolio prioritization, i.e. which investment projects are realized when and where), tendering dismantling (disposal of old equipment), construction, testing and commissioning (when track is opened to full-speed operation). Investments are generally looked on at the level of annual spending from a cash-flow perspective, i.e. no depreciation or other imputed costs are considered. It also includes its proportion of overheads (such as financials, controlling, IT, human resources, purchasing, legal and planning), labour (operative, personnel), material, (used/consumed goods), internal services (machinery, tools, equipment including transport and logistics) and contractors (entrepreneurial production) as well as investment subsidies.	PRIME KPI subgroup based on Regulation (EU) 2015/1100 (RMMS), Article 2
Killed (Death, killed person)	Any person killed immediately or dying within 30 days because of an accident, excluding any suicide.	Glossary for Transport Statistics, A.VI-09 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.18
Level crossing	Any level intersection between a road or passage and a railway, as recognised by the infrastructure manager and open to public or private users. Passages between platforms within stations are excluded, as well as passages over tracks for the sole use of employees.	Glossary for Transport Statistics, A. I-14 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 6.3
Level crossing accident	Any accident at level crossings involving at least one railway vehicle and one or more crossing vehicles, other crossing users such as pedestrians or other objects temporarily present on or near the track if lost by a crossing vehicle or user.	Glossary for Transport Statistics, A. I-15 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.8

Name	Description	Source
Line-km	A cumulative length of all lines maintained by infrastructure managers.	PRIME KPI sub-group based on Glossary for transport statistics
Main Lines (Principle railway lines)	Railway lines maintained and operated for running trains.	Glossary for transport statistics, A.I-02.1
Main lines (Principle railway lines), length of	Cumulative length of railway lines operated and used for running trains by the end of reporting year. Excluded are: - Lines solely used for operating touristic trains and heritage trains - Lines constructed solely to serve mines, forests or other industrial or agricultural installations and which are not open to public traffic - Private lines closed to public traffic and functionally separated (i.e. stand-alone) networks - Private lines used for own freight transport activities or for non-commercial passenger services and light rail tracks occasionally used by heavy rail vehicles for connectivity or transit purposes.	Glossary for transport statistics, A.I-02.1 and A.I-01
Maintenance cost	Costs of function: Maintenance means non-capital expenditure that the infrastructure manager carries out to maintain the condition and capability of the existing infrastructure or to optimise asset lifetimes. Preventive maintenance activities cover inspections, measuring or failure prevention. Corrective maintenance activities are repairs (but not replacement), routine over-hauls or small-scale replacement work excluded from the definitions of renewals. It forms part of annual operating costs. Maintenance expenditure relates to activities that counter the wear, degradation or ageing of the existing infrastructure so that the required standard of performance is achieved. Types of costs: Maintenance cost include planning, its proportion of overhead (such as financials, controlling, IT, human resources, purchasing, legal and planning), labour (operative, personnel), material, (used/consumed goods), internal services (machinery, tools, equipment including transport and logistics) and contractors (entrepreneurial production).	PRIME KPI sub-group based on LICB and Regulation (EU) 2015/1100 (RMMS), Article 2
Main track	A track providing end-to-end line continuity designed for running trains between stations or places indicated in timetables, network statements, rosters or other indications/publications as independent points of departure or arrival for the conveyance of passengers or goods.	Glossary for Transport Statistics, A.I-01.1
Main track (main track km), length of	A cumulative length of all running/main tracks Excluded are: - Lines solely used for operating touristic trains and heritage trains - Lines constructed solely to serve mines, forests or other industrial or agricultural installations and which are not open to public traffic - Private lines closed to public traffic and functionally separated (i.e. stand-alone) networks - Private lines used for own freight transport activities or for non-commercial passenger services and light rail tracks occasionally used by heavy rail vehicles for connectivity or transit purposes	Glossary for Transport Statistics, A.I-02.1 and A.I.01
Main track, electrified	Main running tracks provided with an overhead catenary or with conductor rail (3rd rail) to permit electric traction.	Glossary for transport statistics, A.I-01.1 and A.I.15 LICB Web Glossary, p.16
Minimum access package charges	Revenues generated by charging railway undertakings for enabling them to provide their services. The minimum access package comprises: (a) handling of requests for railway infrastructure capacity (b) the right to utilise capacity which is granted (c) use of the railway infrastructure, including track points and junctions (d) train control including signaling, regulation, dispatching and the communication and provision of information on train movement (e) use of electrical supply equipment for traction current, where available (f) all other information required to implement or operate the service for which capacity has been granted.	Directive 2012/32/EU, Annex II
Multimodal rail freight terminals	Multimodal Freight Terminals (IFT) or transfer points are places equipped for the transhipment and storage of Intermodal Transport Units (ITU). They connect at least two transport modes, where at least one of the modes of transport is rail. The other is usually road, although waterborne (sea and inland waterways) and air transport can also be integrated.	PRIME KPI sub-group based on Regulation (EU) 2015/1100 (RMMS), Article 2

Name	Description	Source
Multimodal transport	The carriage of passengers or freight, or both, using two or more modes of transport.	Regulation (EU) No 1315/2013 (TEN-T), Art.3(n)
Network	Principal railway lines managed by the infrastructure manager.	Glossary for Transport Statistics, A.I-02.1
Operations	Operations excluding maintenance. SS-EN 13306:2010 defines operation as: Combination of all technical, administrative, and managerial actions, other than maintenance actions that results in the item being in use. Total annual expenditures for the infrastructure manager on operations includes operations proportion of the infrastructure manager overhead (such as financials, controlling, IT, human resources, purchasing, legal and planning), labour (operative, personnel), material (used/consumed goods), internal services (machinery, tools, equipment including transport and logistics) and if some parts are handled by contractors, this is also included. (Central or holding overheads are to be allocated proportionally.)	
OPEX, operating expenditures	An operating expense is an expense a business incurs through its normal business operations. Operating expenses include inter alia maintenance cost, rent, equipment, inventory costs, payroll, insurance, and funds allocated toward research and development.	PRIME KPI subgroup
Other accident	Any accident other than a collision of train with rail vehicle, collision of train with obstacle within the clearance gauge, derailment of train, level crossing accident, an accident to person involving rolling stock in motion or a fire in rolling stock. Example: Accidents caused by rocks, landslides, trees, lost parts of railway vehicles, lost or displaced loads, vehicles and machines or equipment for track maintenance	Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.11
Other track	All other tracks than main/running ones: - tracks maintained, but not operated by the infrastructure manager - tracks at service facilities not used for running trains. Tracks at service facilities not used for running trains are excluded. The boundary of the service facility is the point at which the railway vehicle leaving the service facility cannot pass without having an authorization to access the mainline or other similar line. This point is usually identified by a signal. Service facilities are passenger stations, their buildings, and other facilities; freight terminals; marshalling yards and train formation facilities, including shunting facilities; storage sidings; maintenance facilities; other technical facilities, including cleaning and washing facilities; maritime and inland port facilities which are linked to rail activities; relief facilities; refuelling facilities and supply of fuel in these facilities.	Glossary for Transport Statistics A.I-01.2
Outsourcing	Outsourcing refers to any services provided by outside suppliers on a contractual basis	PRIME KPI subgroup
Passenger	Any person, excluding a member of the train crew, who makes a trip by rail, including a passenger trying to embark onto or disembark from a moving train for accident statistics only	Glossary for Transport Statistics, A.VI-18 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.12
Passenger-km	Unit of measurement representing the transport of one passenger by rail over one kilometre. The distance to be taken into consideration should be the distance travelled by the passenger on the network. To avoid double counting each country should count only the pkm performed on its territory. If this is not available, then the distance charged or estimated should be used.	Glossary for Transport Statistics, A.V-06
Passenger train-km	Unit of measurement representing the movement of all passenger trains over one kilometre. From an infrastructure manager's point of view, it is important to include all passenger train movements as they all influence the deterioration of the rail infrastructure assets. Empty passenger train movements are therefore included in the number of passenger train movements.	Glossary for Transport Statistics, A.IV-07 LICB Web Glossary, p.18
Passenger trains	Train for the carriage of passengers composed of one or more passenger railway vehicles and, possibly, vans moving either empty or under load.	Glossary for Transport Statistics, A.IV-06 and A.IV-05
Permanent restrictions	Restrictions are defined as permanent if they are incorporated within the yearly timetable.	PRIME KPI subgroup

Name	Description	Source
Punctuality	“Punctuality of a train is measured based on comparisons between the time planned in the timetable of a train identified by its train number and the actual running time at certain measuring point. A measuring point is a specific location on route where the trains running data are captured. One can choose to measure the departure, arrival or run through time”. “Punctuality is measured by setting up a threshold up to which trains are considered as punctual and building a percentage.” When measuring punctuality, the following are to be included all in service trains: freight and passenger but excluding Empty Coaching Stock movements and engineering trains.	UIC CODE, 450 – 2, OR, 5th edition, June 2009, 4, Measurement of punctuality
Railway line	Line of transportation made up by rail exclusively for the use of railway vehicles and maintained for running trains. A line is made up of one or more tracks and the corresponding exclusion criteria.	Glossary for Transport Statistics, A.I-02
Recycling	Reprocessing by means of a manufacturing process, of a used product material into a product, a component incorporated into a product, or a secondary (recycled) raw material, excluding energy recovery and the use of the product as a fuel. Recycling of waste is any activity that includes the collection and processing of used or unused items that would otherwise be considered waste. Recycling involves sorting and processing the recyclable products into raw material and then using the recycled raw materials to make new products.	ISO 18604:2013, 3.3
Renewable energy	Renewable energy is an energy that is derived from natural processes that are replenished constantly, such as energy generated from solar, wind, biomass, geothermal, hydropower and ocean resources, solid biomass, biogas, and liquid biofuels	PRIME KPI subgroup
Renewal expenditure	Renewals mean capital expenditure on a major substitution work on the existing infrastructure which does not change its overall original performance. Renewals are projects where existing infrastructure is replaced with new assets of the same or similar type. Usually, it is a replacement of complete systems or a systematic replacement of components at the end of their lifetimes. The borderline to maintenance differs among the railways. Usually, it depends on minimum cost levels or minimum scope (e.g. km). It is capitalised at the time it is carried out, and then depreciated. Renewals include planning (incl. portfolio prioritisation, i.e. which renewal projects are realised when and where), tendering, dismantling/disposal of old equipment, construction, testing and commissioning (when track is opened to full-speed operation). Renewals are generally looked at on the level of annual spending from a cash-flow perspective, i.e. no depreciation or other imputed costs are considered. Excluded from the definition are construction of new lines (new systems) or measures to raise the standard of existing infrastructure triggered by changed functional requirements (and not triggered by lifetime!) or "forced" investments when acting on regulations. It includes its proportion of overheads (such as financials, controlling, IT, human resources, purchasing, legal and planning), labour (operative, personnel), material, (used/consumed goods), internal services (machinery, tools, equipment including transport and logistics) and contractors (entrepreneurial production) as well as investment subsidies.	PRIME KPI subgroup based on Regulation (EU) 2015/1100 (RMMS), Article 2
Serious injury (seriously injured person)	Any person injured who was hospitalised for more than 24 hours because of an accident, excluding any attempted suicide.	Glossary for Transport Statistics, A. VII-10 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.19
Significant accident	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.	Glossary for Transport Statistics, A.VII-04 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.1
Significant damage	Damage that is equivalent to EUR 150 000 or more.	Glossary for Transport Statistics, A.VI-04 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.2

Name	Description	Source
TAC Total	Includes charges for minimum Track Access Charges for the passenger, freight, and service train path. Mark-ups. No other charging components are included.	
Temporary restrictions	Restrictions that occur during the year that are not included in the yearly timetable.	
TEN-T requirements	Infrastructure requirements as set in Article 39 of the Regulation (EU) No 1315/2013 on Union guidelines for the development of the trans-European transport network. http://publications.europa.eu/resource/cellar/f277232a-699e-11e3-8e4e-01aa75ed71a1.0006.01/DOC_1	Regulation (EU) No 1315/2013 (TEN-T)
Track	A pair of rails over which rail-borne vehicles can run maintained by an infrastructure manager. Metro, Tram, and Light rail urban lines are excluded. Excluded are: - Lines solely used for operating touristic trains and heritage trains - Lines constructed solely to serve mines, forests or other industrial or agricultural installations and which are not open to public traffic - Private lines closed to public traffic and functionally separated (i.e. stand-alone) networks - Private lines used for own freight transport activities or for non-commercial passenger services and light rail tracks occasionally used by heavy rail vehicles for connectivity or transit purposes.	Glossary for Transport Statistics, A.I-01
Track buckle or other track misalignment	Any fault related to the continuum and the geometry of track, requiring track to be placed out of service or have immediate restriction of permitted speed imposed.	Directive (EU) 2016/798 on railway safety, Annex I, Appendix 4.2
Track km	A cumulative length of all tracks maintained by the infrastructure manager; each track of a multiple-track railway line is to be counted.	PRIME subgroup, based on Glossary for Transport Statistics
Trackside	Area adjacent to a railway track such as embankments, level crossings, platforms, shunting yards. Workshops, warehouses, and depots are excluded.	PRIME KPI subgroup
Train	One or more railway vehicles hauled by one or more locomotives or railcars, or one railcar travelling alone, running under a given number or specific designation from an initial fixed point to a terminal fixed point, including a light engine, i.e. a locomotive travelling on its own. In this document we define trains as the sum of passenger trains and freight trains.	Glossary for Transport Statistics, A.IV-05 and A.IV-06
Train-km	The unit of measurement representing the movement of a train over one kilometre. The distance used is the distance run, if available, otherwise the standard network distance between the origin and destination shall be used. Only the distance on the national territory of the reporting country shall be considered.	Glossary for Transport Statistics, A.IV-05 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 7.1
Traffic Management Cost	Costs of functions: Traffic management comprises the control of signal installations and traffic, planning as well as path allocation. Types of costs: Traffic management includes planning, its proportion of overheads (such as financials, controlling, IT, human resources, purchasing, legal and planning), labour (operative, personnel), material, (used/consumed goods), internal services (machinery, tools, equipment including transport and logistics) and contractors (entrepreneurial production).	PRIME KPI subgroup based on UIC studies (CENOS and OMC)
Working timetable	The data defining all planned train and rolling-stock movements which will take place on the relevant infrastructure during the period for which it is in force	Directive 2012/34/EU (SERA), Article .3(28)