2021 PRIME Benchmarking report

KPI & Benchmarking Subgroup PRIME

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Foreword by PRIME co-chairs

In In 2020 and 2021, the European rail sector faced many challenges. Shortly after launching the European Green Deal, the world was hit by the Covid-19 pandemic, which had unprecedented impacts on the European rail sector. The sharp decline of rail passengers left lingering fears that the pandemic will be a long-term setback for our mobility targets. Fortunately, the rail sector has shown resilience and while scaled down, it continued to run reliably throughout the pandemic, adapting to the new situation. In 2021, passenger and freight traffic recovered to a large extent despite the need to stay cautious in the face of returning COVID waves.

Moreover, the urgency of the climate crisis and the need to reduce energy dependency on Russia and fossil fuel further underlined the need to have a safe, reliable, and efficient rail system. Demand is growing, and rail infrastructure managers have a key role in meeting additional capacity needs and creating optimal operating conditions for the provision of attractive and affordable rail services.

Sharing information and knowledge is essential to achieving better results. Monitoring common trends at EU level and to benchmark performance is essential and were the two main objectives of establishing the PRIME KPI subgroup in 2014. We are pleased that we can share with you the sixth benchmarking report prepared by the PRIME KPI subgroup, covering the years 2017-2021. For the infrastructure managers, benchmarking helps to understand where each organisation stands and where there is potential for improvement. For the European Commission, it is an invaluable opportunity to identify best practices and to monitor the progress with respect to EU policy priorities. For all stakeholders, it is an opportunity to observe trends as they evolve, and to identify strengths and weaknesses of the system.

Compared to the first five reports, this edition includes a more complete dataset, less deviating figures, four new performance indicators and one new participant (in total 19). Three additional infrastructure managers are preparing to join. As in last year's report, detailed explanations and contextual information is making the wealth of data more accessible.

We would like to thank the PRIME KPI 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.

PRIME members have jointly agreed on the key performance indicators (KPIs) that are relevant for their business. The progress on common data definitions and KPIs is documented in this catalogue and is continuously being refined and made publicly available on the PRIME website. We will continue to work on making PRIME KPIs more robust, increasingly comparable for benchmarking purposes and more complete by covering additional aspects. We believe that PRIME data and definitions can serve the needs of a large range of rail experts and policy makers. 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.

PRIME co-chairs

Kristian Schmidt
European Commission, DG MOVE Director of Land Transport

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SNCF Réseau Deputy Director General

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 sixth benchmarking report covering the years 2017-2021 and includes data of 19 infrastructure managers.

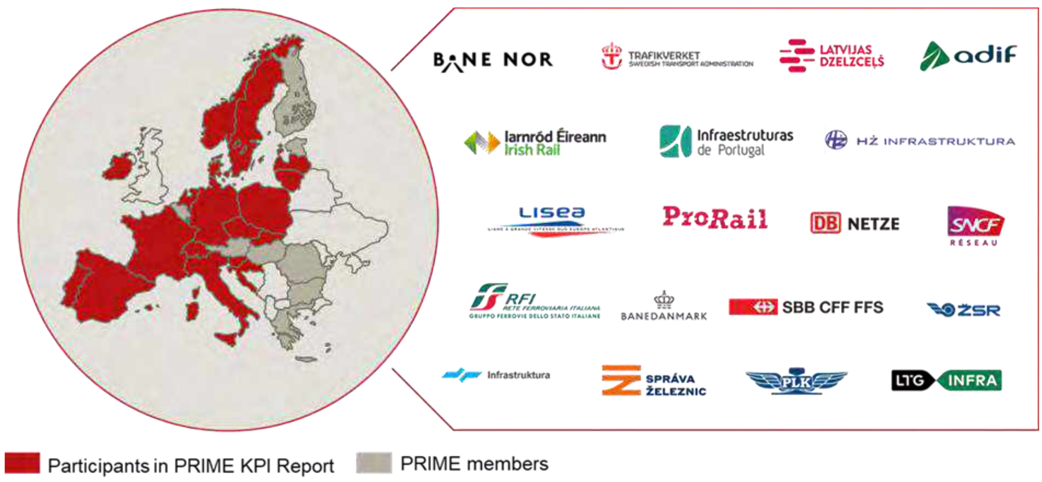

Figure 1: Participants of the PRIME KPI & Benchmarking Report and PRIME members

2021 is the second year that has been marked by the global Covid -19 pandemic. After the severe impact on the transport sector with an unprecedented drop in ridership in 2020, many feared that this would set back rail transport by years. Unsurprisingly, the previous PRIME Benchmarking report presented several unfavourable developments, most notably the sharp decline in train utilisation. With this year's report, we are now able to take a step further and show how rail transport has adapted to the situation in the second year of the pandemic: Despite many policy measures such as lockdowns and international travel restrictions still being in place, rail traffic recovered significantly in 2021.

In comparison to 2020, almost all infrastructure managers increased their passenger train activity, with three companies even surpassing their respective 2019 values. Regarding freight trains the development is similarly positive: half of the infrastructure managers recorded higher freight train utilisation in 2021 than before the pandemic. Increased utilisation, however, had also an impact on train punctuality: Due to declining passenger numbers and generally less mobility, train punctuality increased in 2020, however, decreasing again in 2021, when train activity was back to normal levels.

Now taking a closer look at the development of the expenditure we are positively able to observe an increase in spending: While OPEX figures recorded an increase of 4%, CAPEX was 9% higher compared to the 2020 figures across the peer group. Moreover, it is positive to note that rail is increasingly becoming greener: Compared to 2020, the participants in the PRIME KPI and Benchmarking report increased their share of their electrified main track-km by 0,6%, in addition +1% electricity-powered trains are running on the network.

Figure 2: Summary of development of industry characteristics

This overall development is especially promising regarding the ambitions set by the European Green Deal and the EU Smart and Sustainable Mobility Strategy. 2022 once again proved that the climate crisis and the current geopolitical developments call for an efficient, reliable and green transformation. Investing in rail infrastructure is inevitable in order to maintain and further develop a connected, modern and competitive European transport system capable of coping with the current challenges. Therefore, it is also encouraging that the expenditures of infrastructure managers have steadily increased in recent years.

With a view to the war of aggression in Ukraine, the current 2021 report is once again a report before a Europe-wide crisis year. Especially the Eastern European countries are strongly affected by the situation, which will predictably be reflected in the data of 2022.

Analysing data and exchanging increasing information on the management of other European companies is an important basis for constantly improving the rail transport system. Having clear definitions and harmonizing data collection is essential for ensuring comparability between the infrastructure managers. The PRIME KPI and Benchmarking Subgroup is constantly working on a more accurate dataset and the number of deviating figures is decreasing with every report.

This year, 19 infrastructure managers took part in the report, in which SŽ-I (Slovenia) participated for the first time. In addition, EVR (Estonia), ÖBB (Austria) and CFL (Luxemburg) are currently in transition and will hopefully become regular members taking part in this public benchmarking report in the upcoming year.

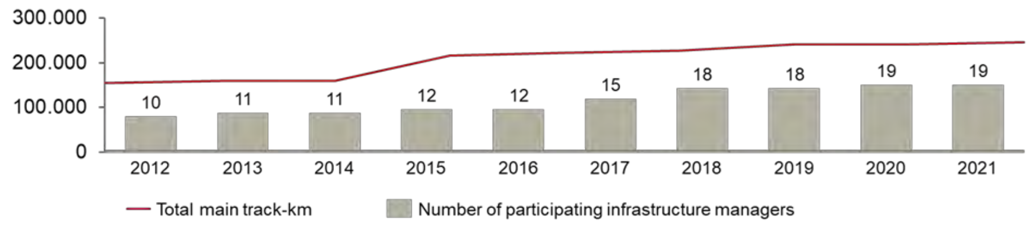

Figure 3: Development of participating infrastructure managers

In the ongoing transformation in becoming the first climate neutral continent by 2050, the European Commission has significantly highlighted in 2021 the importance of rail transport. Under the European Year of Rail 2021 and the improved transport proposal encompassed in the Sustainable and Smart Mobility Strategy, new parameters and objectives were introduced in creating an environmentally friendly and efficient trans-European transport network. The tracks for a more sustainable future are set and the European infrastructure managers are indispensable in reaping the full potential of this transformation. In the following years, we will continue monitoring the progress being made and ensuring access to information, following this new governance structure. The rail infrastructure will continue being a main enabler in reaching climate neutrality within the European Union by 2050.

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[1].

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, in order 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[2]. Rail has an essential role in this transformation, which is why the Commission has set a number of ambitious rail 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.

In order to fulfil its role in the European Green Deal and meet the objectives of the Sustainable and Smart Mobility Strategy, rail has to 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 completely 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

[1] 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

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

workers and 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[3]. 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%[4]. Rail has the

[3] 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

[4] 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[5], Member States have to ensure that the accounts of infrastructure managers are balanced. Low levels of investment over an extended period of time can negatively impact operational costs, safety and overall performance.

2020 and 2021 were difficult years for the rail sector. Transport was one of the sectors most severely affected by the Covid-19 pandemic. While freight transport has shown a certain resilience in the crisis, there has been a huge drop in passenger mobility. During the peak of the crisis, ridership went down by more than 90% in several countries and many international connections were stopped. In 2021 it recovered significantly but did not reach the pre pandemic level. Rail infrastructure managers were impacted due to the reduction in traffic and the revenues it generates.

At the same time the year 2021, categorized as the European Year of Rail 2021[6], emphasized the importance of rail transport and infrastructure in achieving cross-border holistic sustainable transport. This was showcased by the Connecting Europe Express, travelling through 26 countries in 36 days.

As this report **covers data up to 2021**, **it reflects the impacts of the pandemic in 2020 and 2021**. Nevertheless, it would be a limited view to attribute individual developments exclusively to the pandemic. Rail transport is a complex system that depends on a variety of factors and actors. Furthermore, more time is needed to gather and analyse data in order to grasp the full impact of the current pandemic on the behaviour of passengers and transport users. But there are certainly lessons to be learnt, such as the resilience and increased punctuality of rail during the crisis and the growing appetite of customers for sustainability.

[5] 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

[6] European Commission. End of the European Year of Rail – beginning of a new journey. https://transport.ec.europa.eu/news/end-european-year-rail-beginning-new-journey-2022-02-21_en

1. 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[7].

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 2021 data, 23 infrastructure managers have contributed to the report, of which 19 are involved in the external report presented in the table below.

[7] 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 Netz AG		DB		Germany
HŽ Infrastruktura d.o.o.		HŽI		Croatia
Iarnród Éireann – Irish Rail		IÉ		Ireland
Infraestruturas de Portugal S.A.		IP		Portugal
Latvijas dzelzceļš		LDZ		Latvia
AB LTG Infra		LTGI		Lithuania
LISEA[8]		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 for the report is to deliver insight and inspiration for better decisions in developing a sustainable and competitive infrastructure management which can provide high quality services.

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

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. Similarly to last year's report it includes data for the last five years: this year's report covering 2017-2021. **This allows more companies to be presented in the graphs and makes it easier for new members to reach the threshold for historical data.** To ensure clarity and comparability only complete time series are shown. The time series chart is complemented with the compound annual growth rate (CAGR) to increase the visibility of the overall development. The CAGR also shows only complete time series.

The benchmarking charts show 2021 data (or the latest available year) and the average of the years 2017-2021 for every individual infrastructure manager[9], plus the peer group's average weighted by denominator[10]. The peer group's average weighted by denominator means for example that, if 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 in each case 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 19 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.

It is important to note that railway as a system includes both railway undertakings (RU) and infrastructure managers (IMs). This report however represents only data from infrastructure managers, and not railway undertakings.

The quantitative results can only be interpreted meaningfully if the main influencing factors are taken into account. Without considering the different characteristics of the infrastructure managers and their structural peculiarities, meaningful comparisons cannot be achieved. LISEA for example operates exclusively one high-speed line and has a regional network, whereas the other infrastructure managers are active nationwide. In order to facilitate the interpretation of the figures and the quantitative results, background information on the specific contexts of the infrastructure managers and

[9] Infrastructure managers are abbreviated as "IM" in the charts.

[10] In last year's report, data were exceptionally not supplemented with the latest available values when data for 2020 were not available, due to the specificity of 2020 and the potential impact of the Covid 19 pandemic. The weighted average includes zero values.

rail infrastructure 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 beside the KPI point to the chapter in which they are treated.

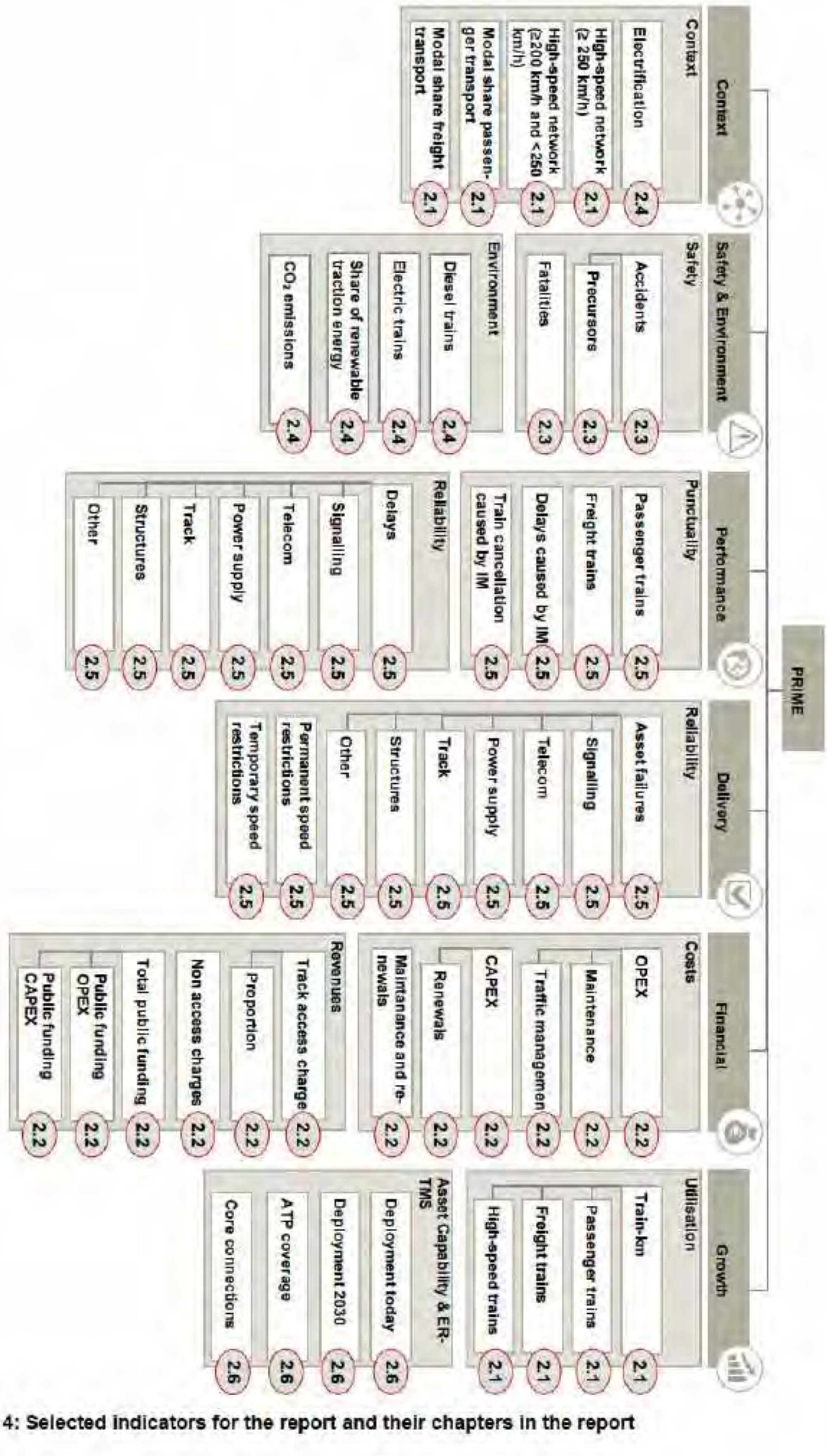

Figure 4: Selected indicators for the report and their chapters in the report

2. Main rail industry characteristics and trends

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

Before analysing the more specific indicators, however, it is important to understand the major characteristics and trends of the rail industry in the participating Member States. For this reason, we will briefly outline the development of the modal share, network and utilisation in Chapter 2.1 and work through the different categories from Chapter 2.2 onwards.

2.1 Overview of main rail industry characteristics and trends

2.1.1 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[11], 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

[11] 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 impact of the pandemic is reflected by the modal share data of 2020: passenger rail transport dropped by 11% and freight transport by 2%.
- The network size ranges between 670 (LISEA) and 55.200 (DB) main track-kilometres.
- The average density of the peer group's network is 58 main track-kilometres per 1.000 km^2.
- Ten infrastructure managers operate high-speed lines with a speed of equal or above 200 km/h.
- The degree of utilisation ranges between 7 and 67 passenger trains and 0 and 11 freight trains per main track-kilometre per day.

2.1.2 Development and benchmark of industry characteristics

Rail infrastructure is developed over decades and determines the shape and the management of the network for a very long time. This chapter aims to give an overview of the status quo on the rail sector of the operating country 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

In order 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 5 and 8 present the benchmark of the modal share of rail in inland passenger and freight transport in the Member States, based on data of the European Commission. Figures 6 and 9 show the national trends of rail in inland passenger and freight modal share development.

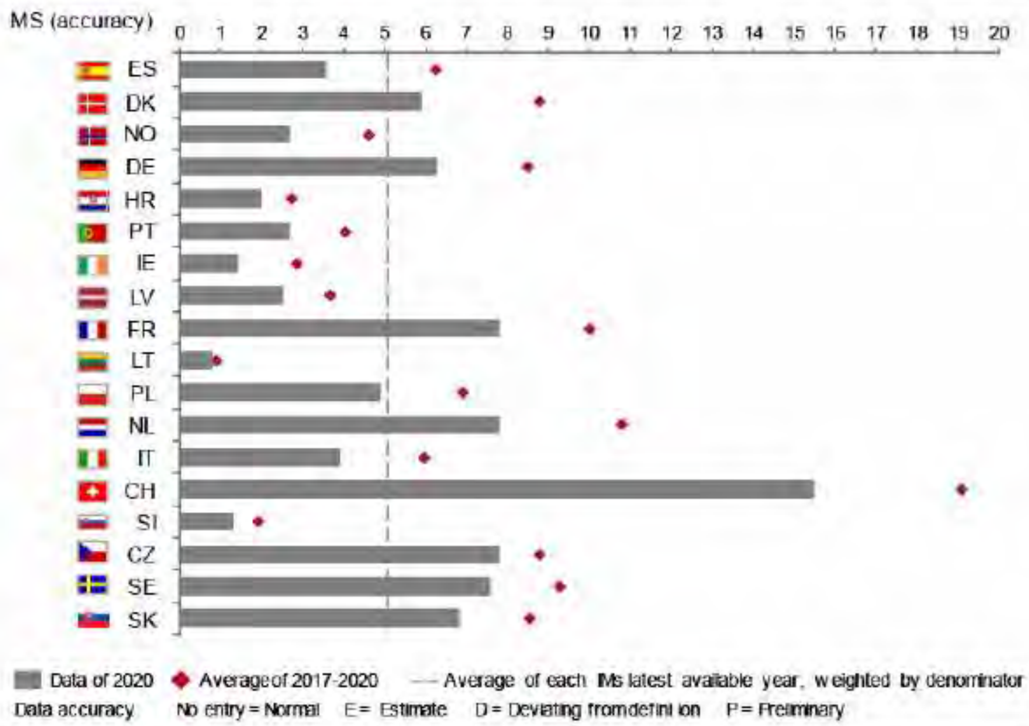

Figure 5: National modal share of rail in inland passenger transport (% of passenger-km)[12]

Figure 5 shows the cross-comparison of the participating Member States in 2020 for passenger rail transport. The peer group's average is around 5% and the standard deviation is 3.6%. The highest modal share can be found in Switzerland (15%), while the lowest value for passenger rail is in Lithuania with under 1%.

[12] Source: European Commission, Eurostat, 2020 data. MS = Member State

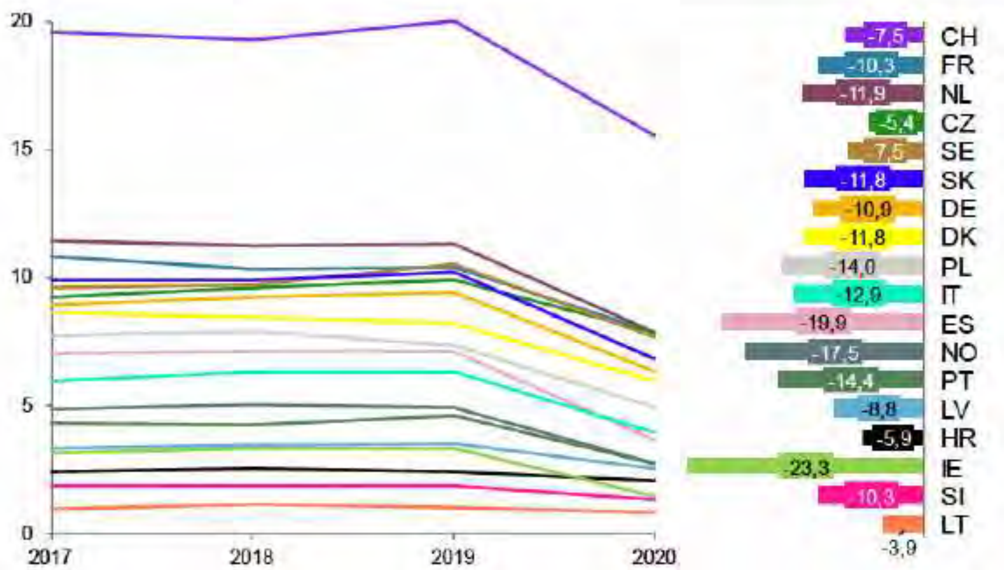

Figure 6: National modal share of rail in inland passenger transport (% of passenger-km) and CAGR (%) in 2017-2020[13]

Between 2017 and 2019 the peer group's modal share of passenger rail transport was relatively stable. In 2020 all countries experienced a significant drop in passenger transportation, which was mainly the result of travel restrictions and other measurements due to the Covid-19 pandemic. The most significant relative decrease can be seen in Ireland, Spain and Norway with a reduction of over 15%. It will be interesting to investigate next year's data (data 2021) and compare it with the utilisation development.

The modal share in passenger transport in a country highly depends on a number of 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 note that Switzerland also has a long-term vision in rail infrastructure development, accompanied by a substantial budget.

[13] Source: European Commission, Eurostat.

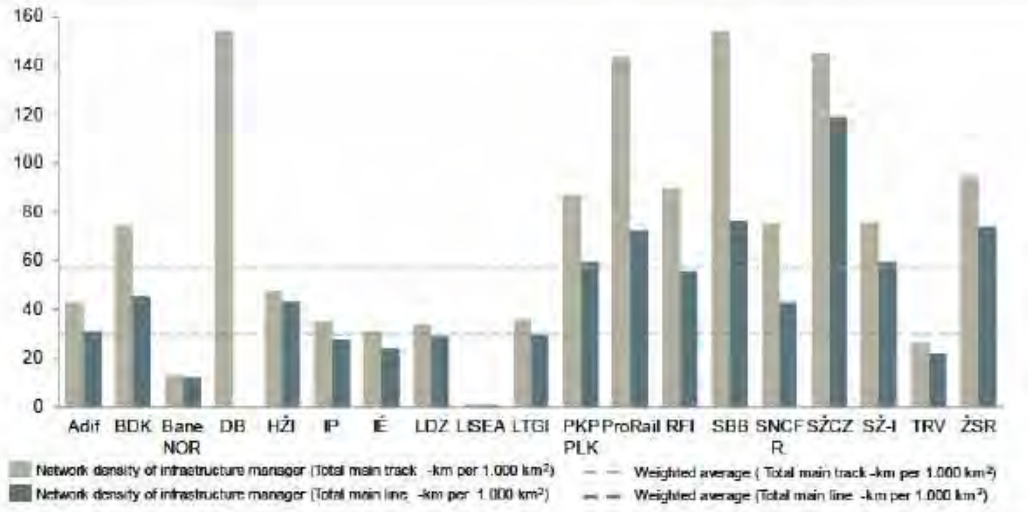

Figure 7: Network density of infrastructure manager (Total main track-km and total main line-km per 1.000 km^2)

Network density of the infrastructure managers is illustrated in figure 7 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. 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. SBB and DB have the highest network density, while Bane NOR and TRV 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.

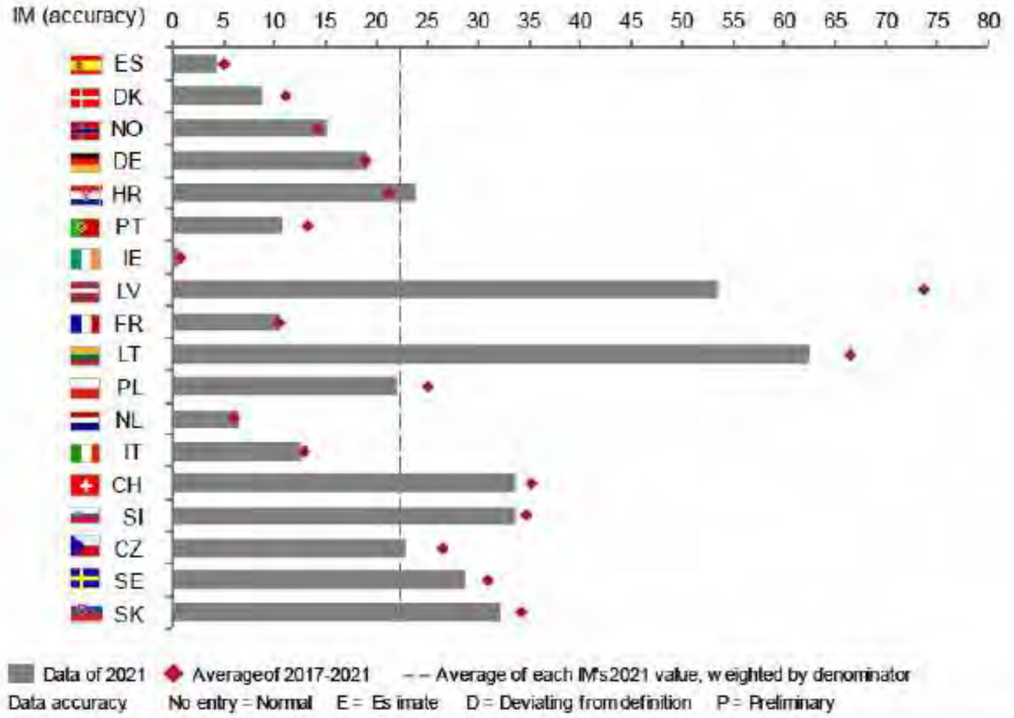

Figure 8: National modal share of rail in inland freight transport (% of tonne-km)[14]

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 17%. It is noticeable that the share of rail freight in the Baltic countries is significantly higher than in the rest of the EU. In Lithuania rail accounts for 63% and Latvia for 54% of the total inland freight transport. This is followed by Slovenia and Switzerland with 34%, and Sweden with 29%. The peer group's average is 22%, all figures rounded.[15]

[14] Source: European Commission, Eurostat, 2021 data. MS = Member State

[15] Reporting freight modal share in tonne-km means that the distance travelled is taken into account. When taking into account only the volume of tonnes transported, modal share values can significantly differ from modal share values in tonne-km.

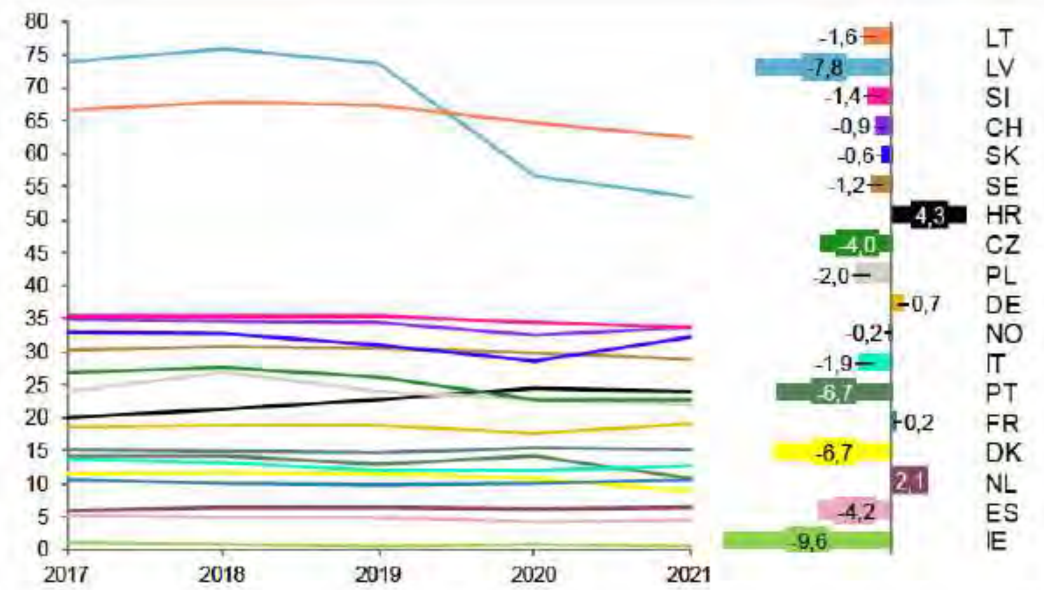

Figure 9: National modal share of rail in inland freight transport (% of tonne-km) and CAGR (%) in 2017-2021[16]

Figure 9 shows the development of the national modal share in rail freight transport between 2017 and 2021. Compared to passenger transport, there was only a small decrease in most countries in 2020 and in 2021 in some countries it even overtook pre pandemic level (Slovakia, Italy). This difference is mainly due to the fact that freight transport was not as strictly regulated during the Covid 19 pandemic as passenger transport; on the contrary, rail freight transport continued to run reliably throughout the pandemic and secured the supply chains. Only Latvia recorded a drop from 74% in 2017 to 54% in 2021. One of the reasons for these reduced cargo volumes can be related to the current political relationship with Russia and a limited cargo transportation through Latvia, improved Russian port infrastructure, and a lack of demand for coal in Europe.

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[17]. 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 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.

[16] Source: European Commission, Eurostat.

[17] DG MOVE (2015): Study on the Cost and Contribution of the Rail Sector.

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[18].

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 10 and 12 show the benchmark and figures 11 and 13 show the development of the network in main track-kilometres and high-speed main line-kilometres for selected infrastructure managers.

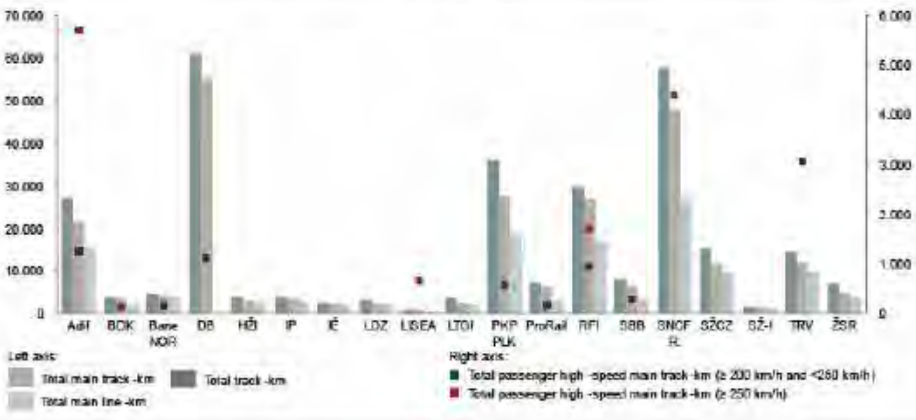

Figure 10: Total track-km, Total main track-km, Total main line-km, Total passenger high-speed main track-km (≥ 200 km/h), Total passenger high-speed main track-km (≥ 250 km/h)[19]

[18] 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

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

Figure 10 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[20] 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 IÉ, however LISEA is not managing a countrywide network but operating a high-speed line alone (South Europe Atlantic High-Speed Rail Line). Furthermore, it is important to note that these figures do not represent the entire national railway network but only the part that is managed by the peer group's infrastructure manager.

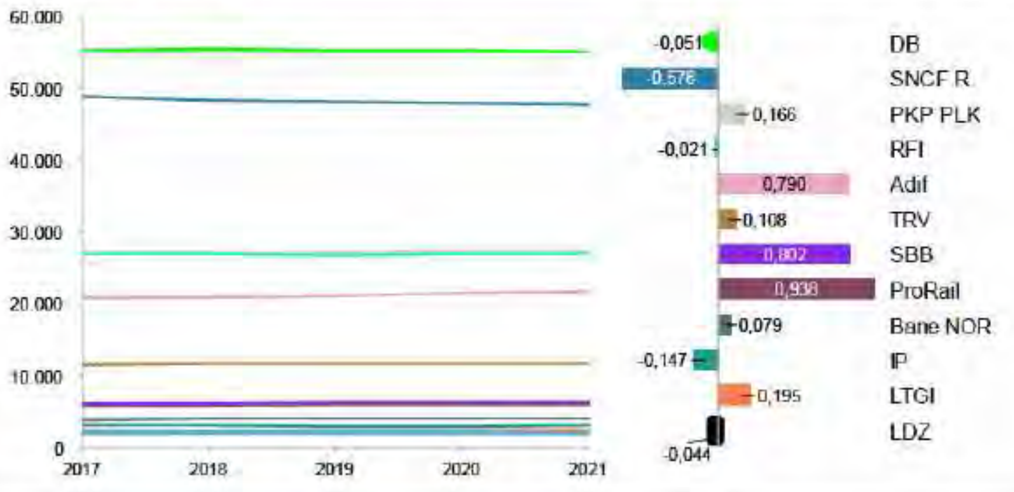

Figure 11: Total main track-km and CAGR (%) in 2017-2021

Rail infrastructure consists of long-lasting assets, with lifetimes often reaching several decades. Hence, the analysis over a period of five years can only be of limited value. The largest absolute growth was realized by Adif with additional 670 kilometres of main track. Furthermore, the development was positive for PKP PLK, TRV, Bane NOR and LTGI.

[20] 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.

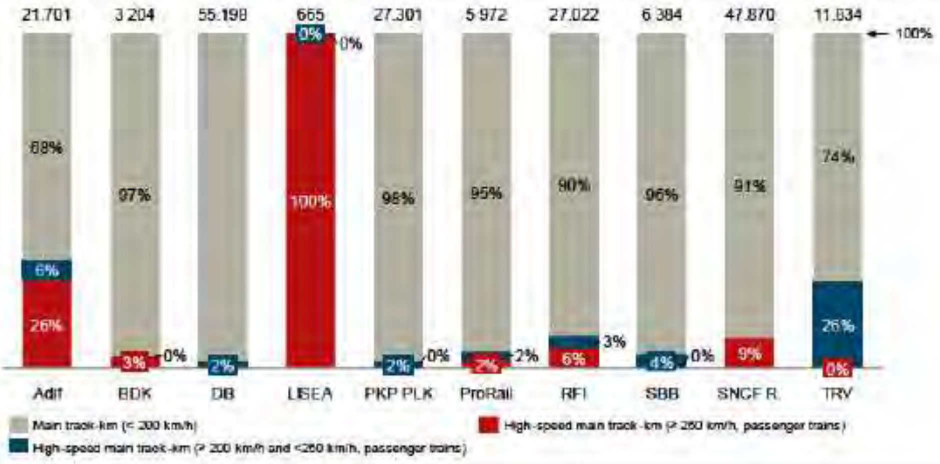

Figure 12: Share of high-speed main track-kilometres (in % of total main track-km)

Figure 12 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 as a result 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.[21]

As shown in figure 12 six infrastructure managers have high-speed main tracks equipped for speed above 250 km/h, ranging between 5714 kilometres for Adif and 112 kilometres for BDK. There is large variation in the proportion of high-speed tracks. While LISEA is a 100% high-speed line, only 2% of ProRail's network is high-speed. In Sweden 26% of TRV's network is allowing passengers trains with a speed of between 200 and 250 km/h.

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

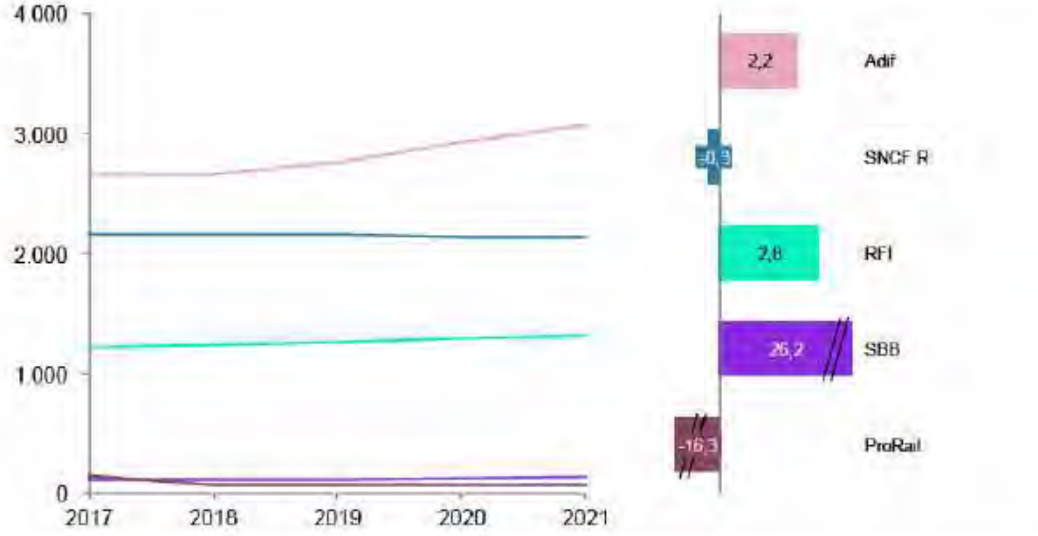

Figure 13: Total high-speed main line-kilometre (≥ 200 km/h) and CAGR (%) in 2017-2021

Figure 13[22] 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 2017 and 2021. 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 400 kilometres.

It is not surprising that the size of a network strongly correlates with the size of the country and its population. However, the distribution of the population is an important aspect too, as it might lead to a concentration of significant parts of the network in a few urban areas or along corridors.

As illustrated, rail networks mostly remained unchanged over the years, however more infrastructure managers focus now on extending their high-speed infrastructure. Increasing high speed traffic is among the transport priorities of the European Commission. Improving the offer of high-speed rail services would provide passengers with a true alternative to short-haul flights and cars.

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

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

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.

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 14 presents the aggregated benchmark of the degree of network utilisation by passenger and freight trains. Figures 15 to 16 show the development chart of these indicators.

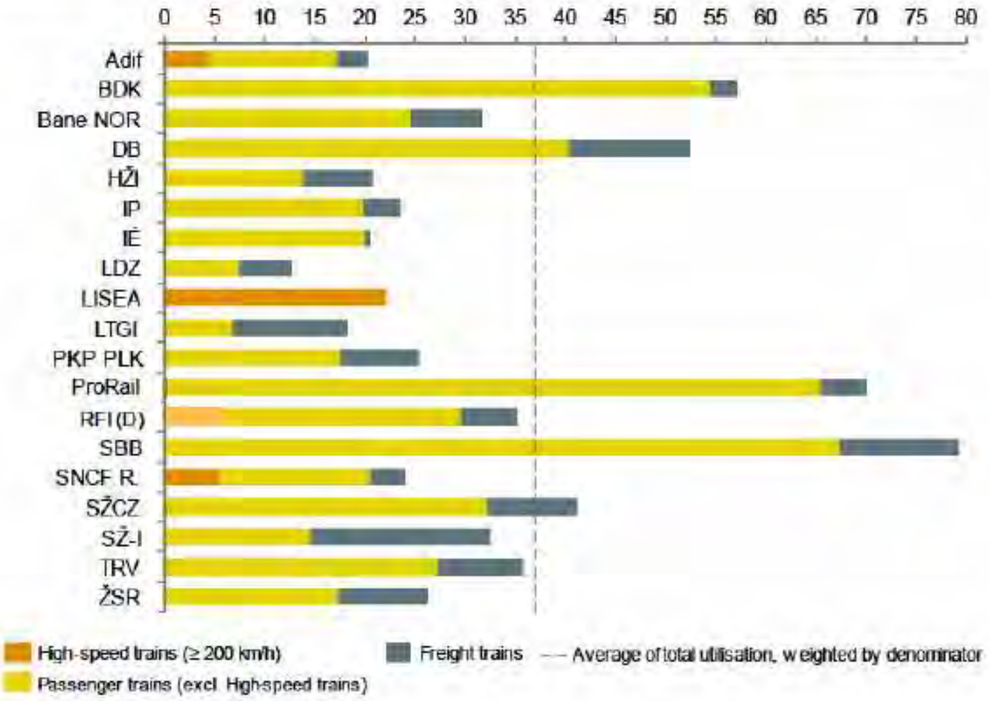

Figure 14: Degree of network utilisation – all trains (Daily train-km per main track-km)[23]

Figure 14 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 7 to 67 trains per day. ProRail's and SBB's networks are utilised more than twice the average. LTGI and LDZ are showing the lowest degrees of utilisation regarding passenger trains.

[23] 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), LTGI, HŽI, IÉ, IP, LDZ, SBB, SŽCZ, SŽ-I, ZSR passenger high speed trains)

The orange colour shows the train activity of 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, LTGI and SBB have the highest intensity of use with more than 11 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.

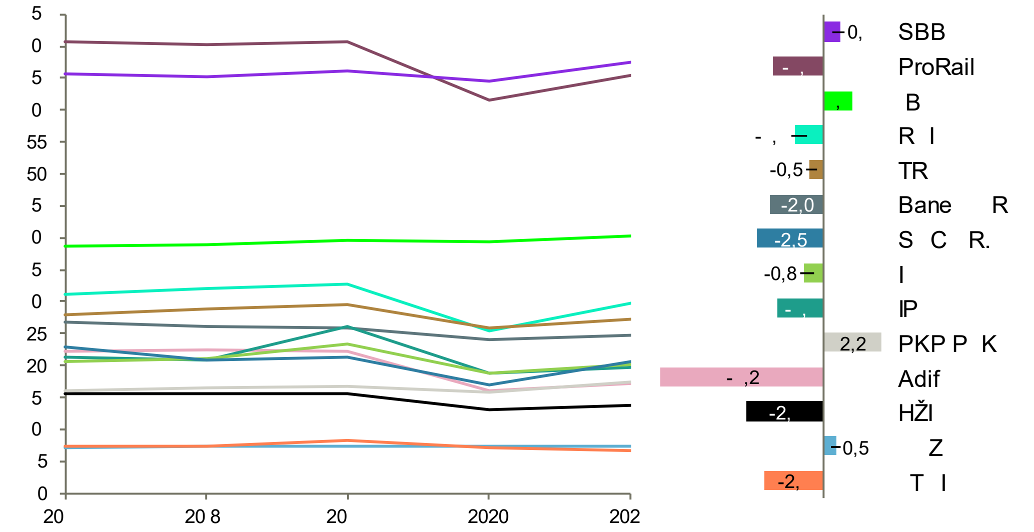

Figure 15: Degree of network utilisation – passenger trains (Daily passenger train-km per main track-km) and CAGR (%) in 2017-2021

Data on network utilisation is particularly interesting regarding the impacts of the Covid-19 pandemic. While a large decline in passenger transport was recorded in 2020, the numbers showed a recovery in 2021 in almost all countries. SNCF R. registered a growth of 21% compared to 2020 showing an increase from 17 passenger train kilometre per main-track in 2020 to 21 in 2021. Three infrastructure managers even surpassed the 2019 values, namely PKP PLK (+4%), SBB (+2%) and DB (+1%). This is encouraging, as many experts feared that the pandemic would a have long-term impact on the use of trains and public transportation.

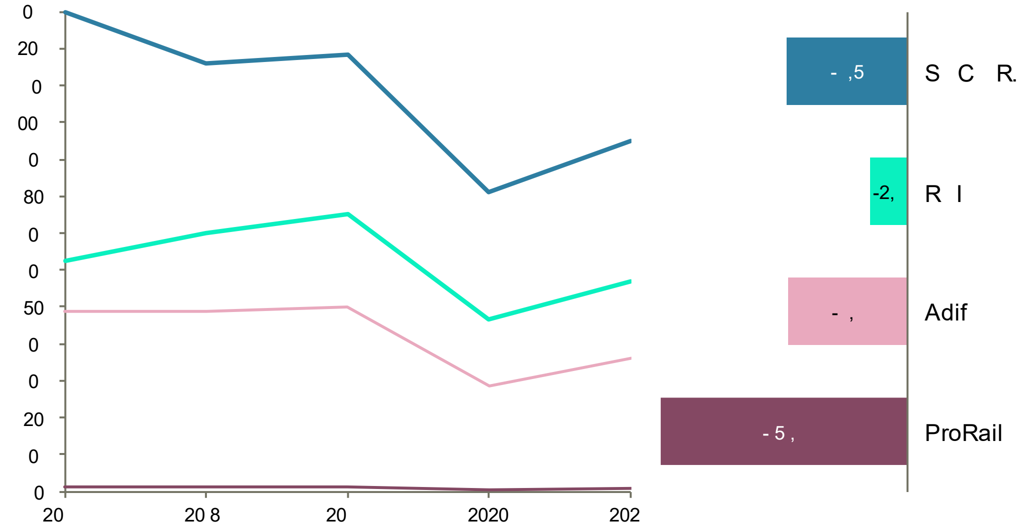

Figure 16: Total passenger high speed train-km (≥ 200 km/h) (Million train-km) and CAGR (%) in 2017-2021

A similar development can be seen for passenger high-speed traffic with a speed of equal or above 200km/h. However, there is a visible increase in train activity compared to 2020, none of the companies reached the pre pandemic level. Compared to 2017 SNCF R. recorded over 30 million train-kilometres less, RFI saw a sharp decline in 2020 after a constant growth and Adif also remained under the pre-pandemic level.

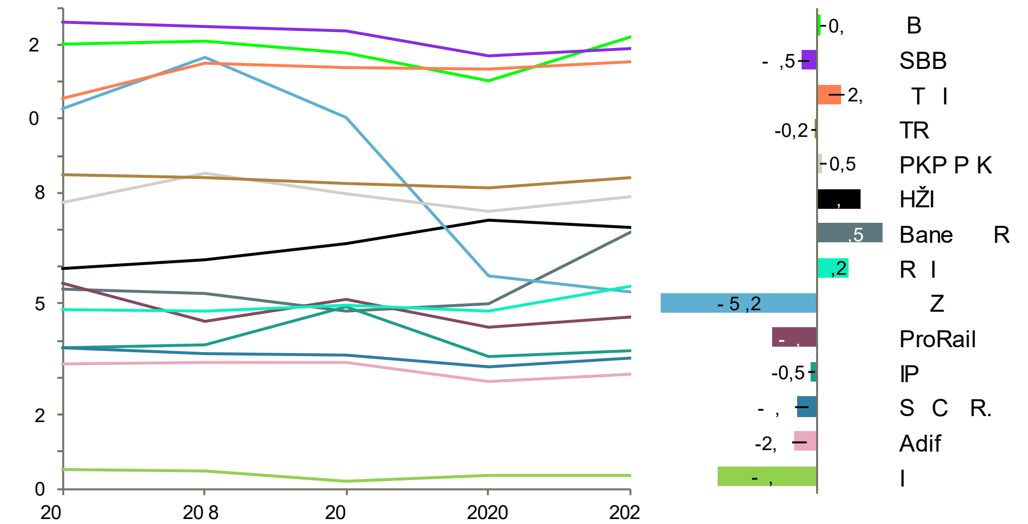

Figure 17: Degree of network utilisation – freight trains (Daily freight train-km per main track-km) and CAGR (%) in 2017-2021

As we can see in figure 17 the impact of the pandemic was smaller in freight transport than in passenger transport: on average the peer group recorded a decrease of 2% in 2020 compared to 2019. Apart from LDZ and HŽI all infrastructure managers increased their freight train activity in 2021. Seven companies even surpassed the level of 2019. Z’s decrease of freight train activity started before the pandemic and was connected with improved Russian port infrastructure. Nevertheless, the pandemic dramatically impacted cargo volumes, as did the political relationship with Russia.

However, besides train kilometres, 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. 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. Similar to 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 has to 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.

Similar to 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[24]. 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.

[24] 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

2.2 Financial

2.2.1 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.
- 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[25], 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 as a result of such operation while allowing for additional mark-ups and charges to recover fixed costs and address externalities.

[25] 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

Peer group's performance

- The level of operational expenditures varies between € 53.000 – 180.000 per main track-kilometre per year and remained for most infrastructure managers relatively stable in 2017-2021.
- The average capital expenditures is € 141.000 per main track-kilometre per year with a standard deviation of € 71.000.
- TAC revenues vary between €0,4 - €44, showing an average of €4,5 per train-kilometre.

2.2.2 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

In order 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.

2.2.3 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 a number of factors: some lie within and some outside the responsibility of an infrastructure manager.

Figures 18 to 27 show the compositions of the operational and capital expenditures of the PRIME members in a latest benchmark and over the time period 2017-2021.

Operational expenditure

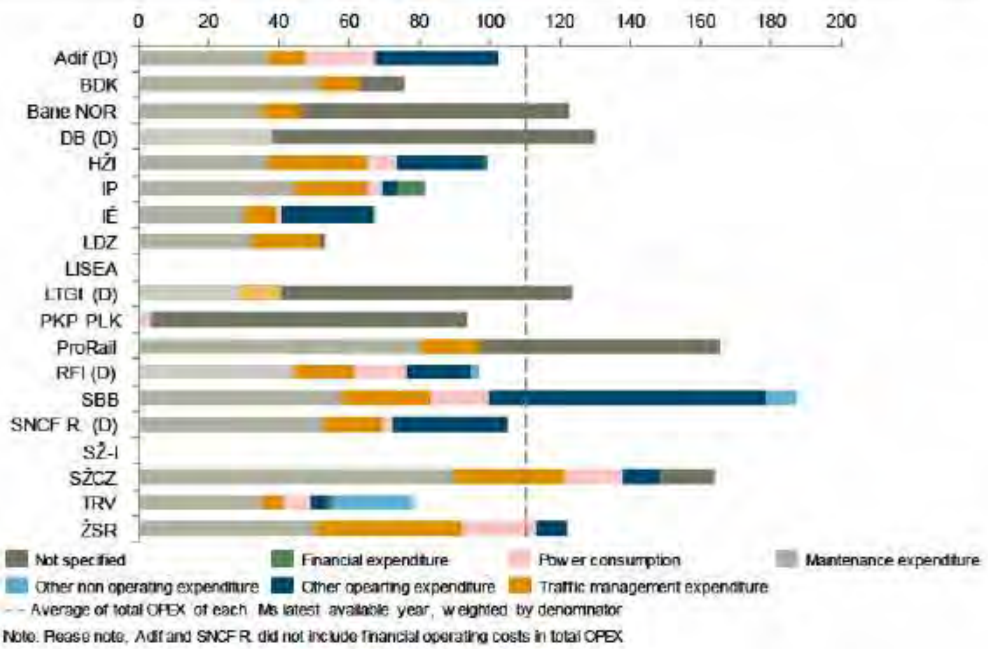

Figure 18: Detailed composition of operational expenditure in relation to network size (€1.000 per main track-km)[26]

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

Figure 18 shows the composition and the level of operational expenditures in 2021. Accounting systems vary widely between countries, so not all infrastructure managers were able to allocate these costs to the individual categories. Maintenance and traffic management expenditure are the largest categories, while costs related to finance and power consumption make up a smaller part. The residuals include the costs that remain after deduction of the various subcategories from the total operational expenditure. The level of total operational expenditures varies between €53.000 – €180.000 per main track-kilometre per year and shows an overall dispersion of values of €36.000. On average, infrastructure managers' annual operational expenditures amount to €112.000 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 34 as counterpart: total revenues from non-access charges). The lighter colour of DB, LTGI and RFI indicate deviating data for individual components and are explained in the Annex 4.3.

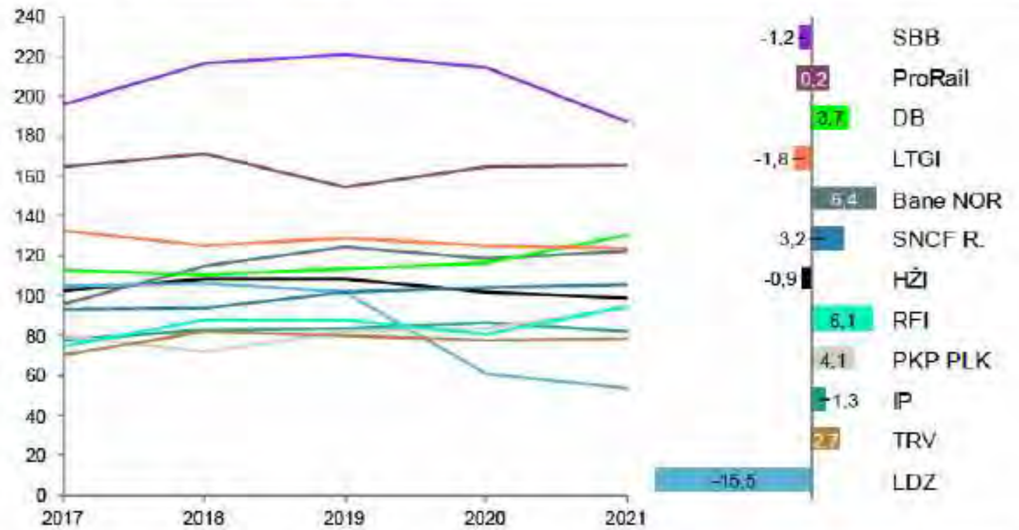

Figure 19: Operational expenditures in relation to network size (€1.000 per main track-km) and CAGR (%) in 2017-2021[27]

As can be seen in figure 19, total operational expenditure has remained relatively homogenous across the group, however a slight increase is visible compared to 2020. The highest annual growth is reported by Bane NOR, RFI and PKP PLK. LDZ's operation costs on the other hand almost decreased to half within 5 years.

"Other operating expenditures" were stated as such by the infrastructure managers, residuals were calculated from total Opex (residuals = total Opex - all other indicated categories).

[27] Results are normalised for purchasing power parity.

Trend of SBB's relative operational expenditures is dominated by the development of Switzerland's purchasing power parity.

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.

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.

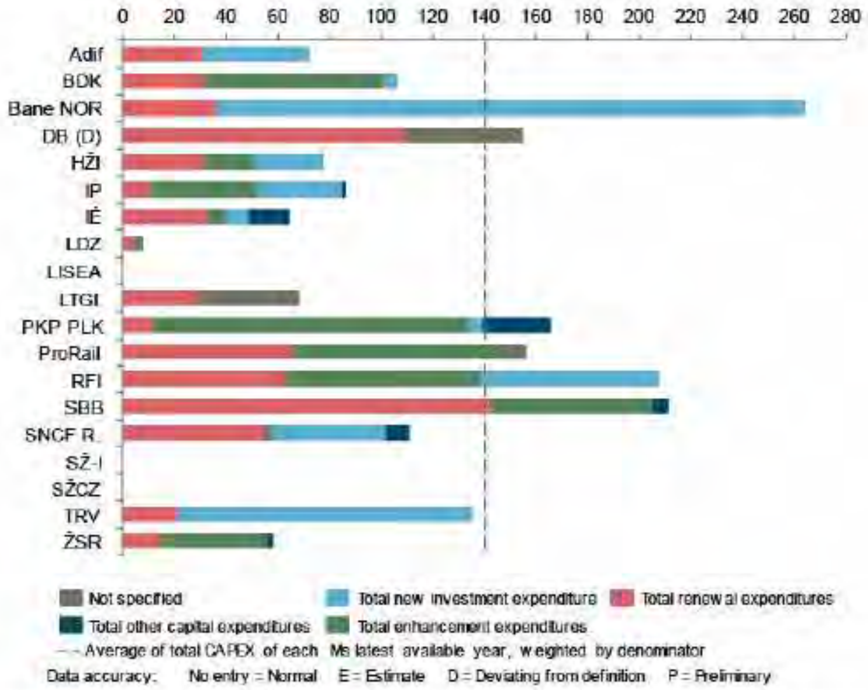

Figure 20: Composition of capital expenditures in relation to network size (€1.000 per main track-km)[28]

Figure 20 shows different components of capital expenditure in 2021. 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 functionalities much like investments. The largest share, almost 35%, is accounted for by expenditure on renewals, where SBB's expenditures (€140.000) are the highest. The highest investments are reported by Bane NOR, followed by TRV and RFI. 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 ERMTS 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. In total, the annual capital expenditure varies between €0-265.000 per main track-kilometre. On average €141.000 per main track-kilometre per year is spent on capital expenditure. The standard deviation in the peer group is €71.000, significantly higher than for OPEX, as would be expected. LISEA's capital expenditure is zero as its infrastructure is fairly new. The category "not specified" include the costs that remain after deduction of the various sub-categories from the total capital expenditures.

[28] Zero value: LISEA (total CAPEX), LISEA, ZSR (investment expenditure)

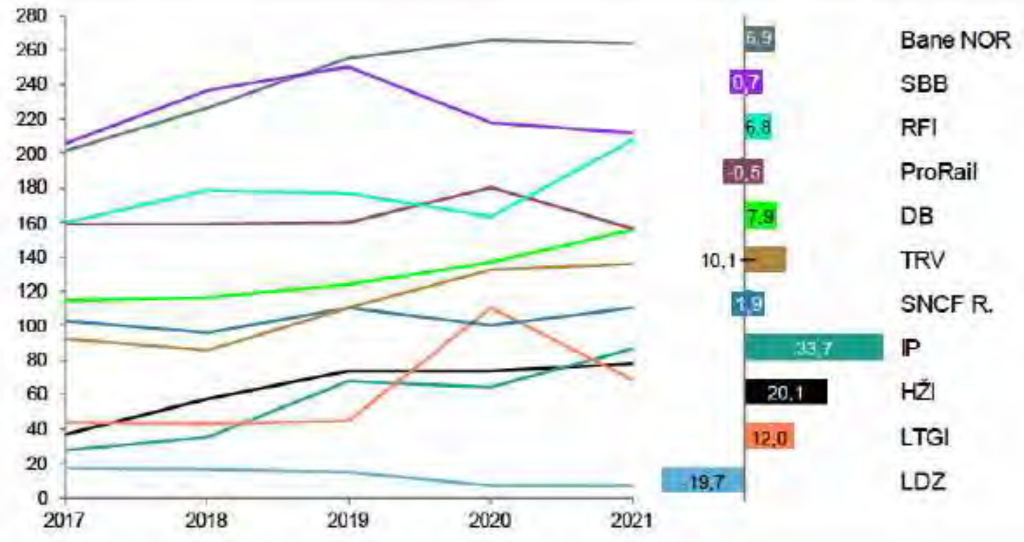

Figure 21: Capital expenditures in relation to network size (€1,000 per main track-km) and CAGR (%) in 2017-2021[29]

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 -19,7% to 33,7%. The highest increase in investment-related expenditure has been recorded at IP spending four times as much in 2021 as in 2017. IP is undertaking an important investment in the Portuguese railway network, building, enhancing and renewing infrastructure which will last until 2023.

Similar to operational costs, capital expenditures also increase with higher network complexity. High numbers of switches, signalling 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 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

[29] Results are normalised for purchasing power parity.

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

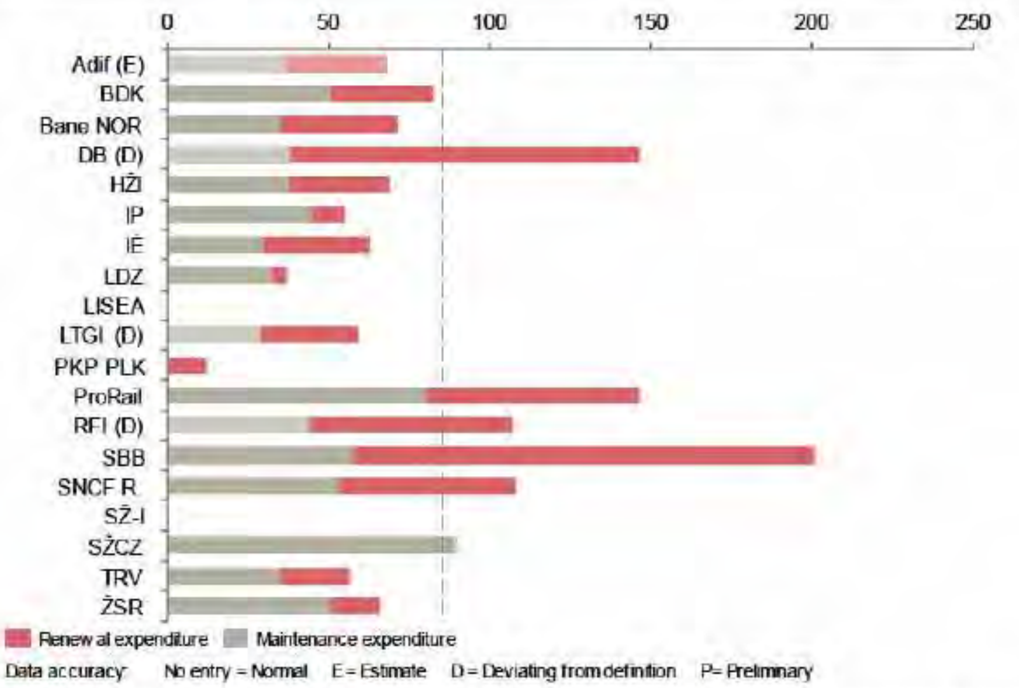

Figure 22: Maintenance (component of OPEX) and renewal expenditures (component of CAPEX) in relation to network size (€1.000 per main track-km)[30]

Figure 22 aims to provide a snapshot of current maintenance and renewal expenditures. Maintenance expenditures are dedicated to the infrastructure manager's activities needed to maintain the condition and capability of the existing infrastructure or to optimise asset lifetimes. Renewals represent capital expenditures needed to replace existing infrastructure with new assets of the same or similar type. On average infrastructure managers spend €88.000 per main track-kilometre per year on maintenance and renewal. Only three infrastructure managers are spending significantly more than average, namely SBB, ProRail and DB. The differential of spread of OPEX and CAPEX can also be seen here: while maintenance shows a standard deviation of €17.000, renewals have a spread in data distribution of €38.000.

[30] Results are normalised for purchasing power parity. Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3. Zero value: LISEA

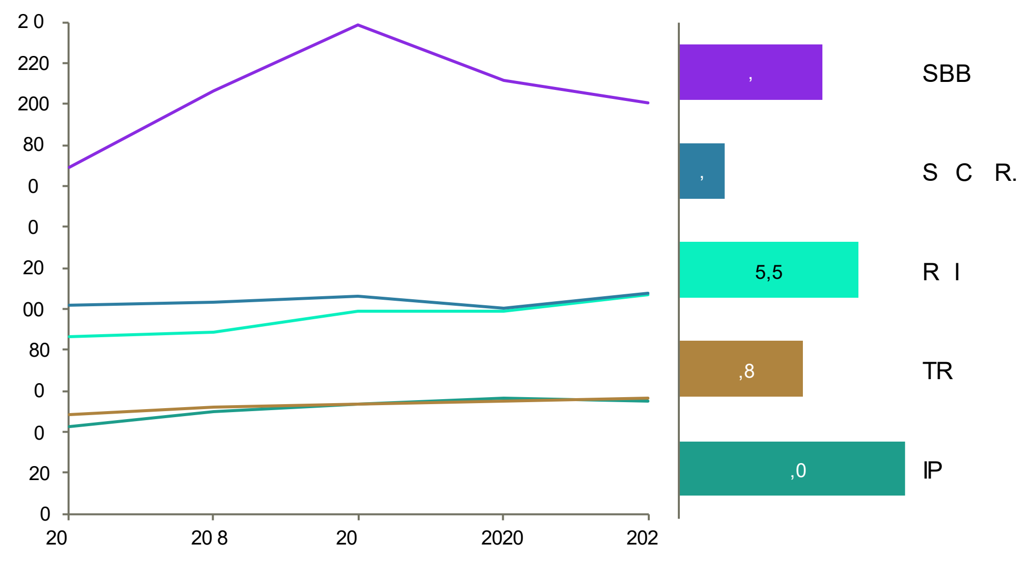

Figure 23: Maintenance (component of OPEX) and renewal expenditures (component of CAPEX) in relation to network size (1.000 Euro per main track-km) and CAGR (%) in 2017-2021 [31]

Out of the five infrastructure mangers which provided a complete dataset for 2017-2021 all companies recorded a positive annual growth rate. The highest average increase can be seen at IP, however it remained mostly stable for the companies.

Similar to 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.

2.2.4 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.

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

[31] Results are normalised for purchasing power parity.

provide an indication to what extent infrastructure managers are capable of covering their costs, respectively to what extent they rely on subsidies.

Figures 24, 26 and 27 show the latest benchmark of the revenue indicators of the infrastructure manager. The development over the time period 2017-2021 is presented in figures 25, 28 and 29.

TAC - Track access charges

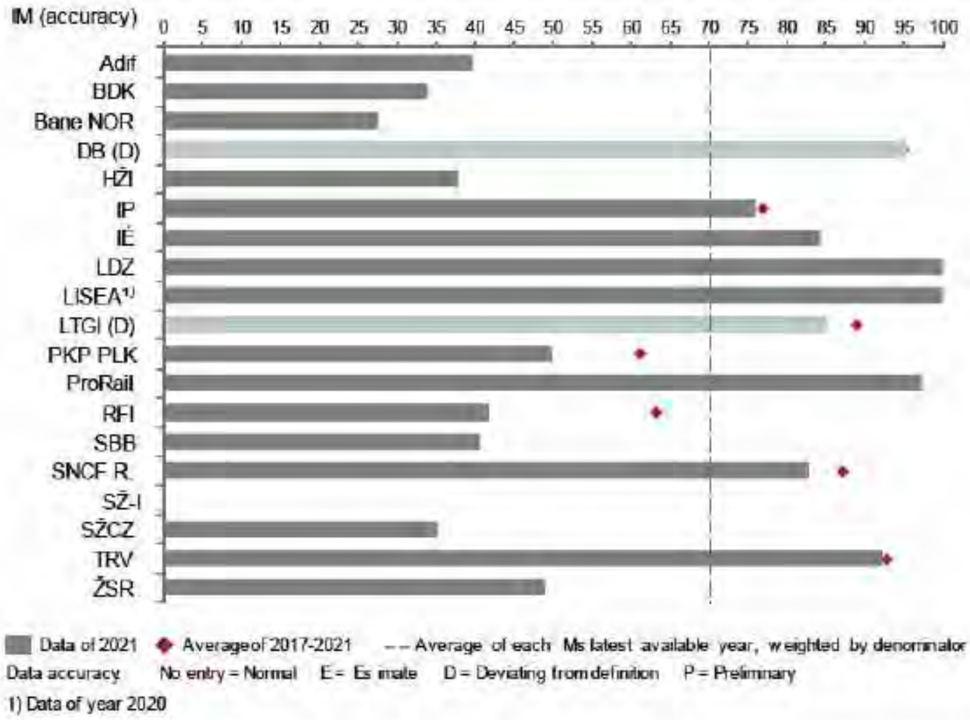

Figure 24: Proportion of TAC in revenue (grants excluded) (% of monetary value)[32]

Figure 24 shows the proportion of TAC revenues of total revenues which mainly divided in two parts: Nine infrastructure mangers generate less than 50% of their revenues from track access charges, while eight 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 71%, the standard deviation is 27%.

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

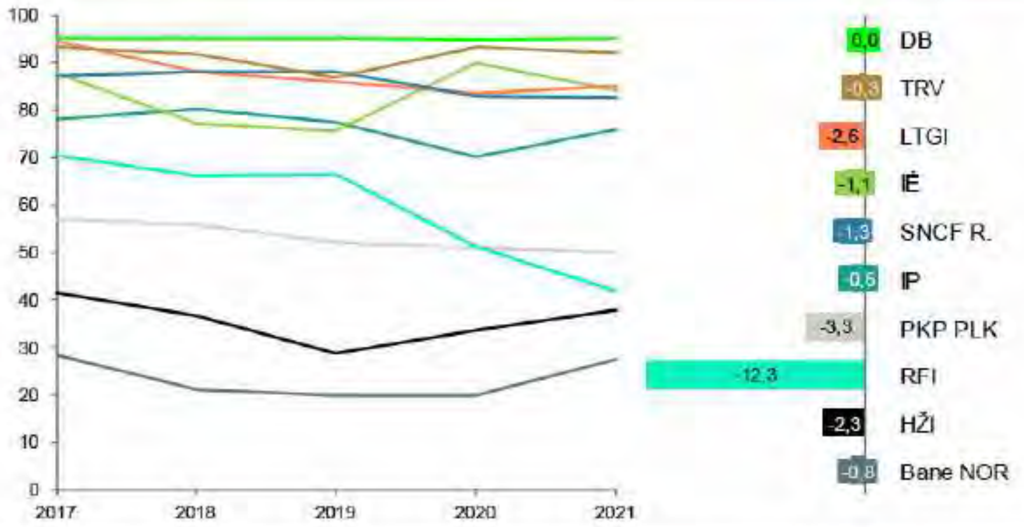

Figure 25: Proportion of TAC in revenue (% of monetary value) and CAGR (%) in 2017-2021

The proportion of revenues from track access charges slightly decreased between 2017 and 2021. The highest decrease of the proportion of track-access charges can be seen for RFI, which can be explained by the COVID-19 impacts.

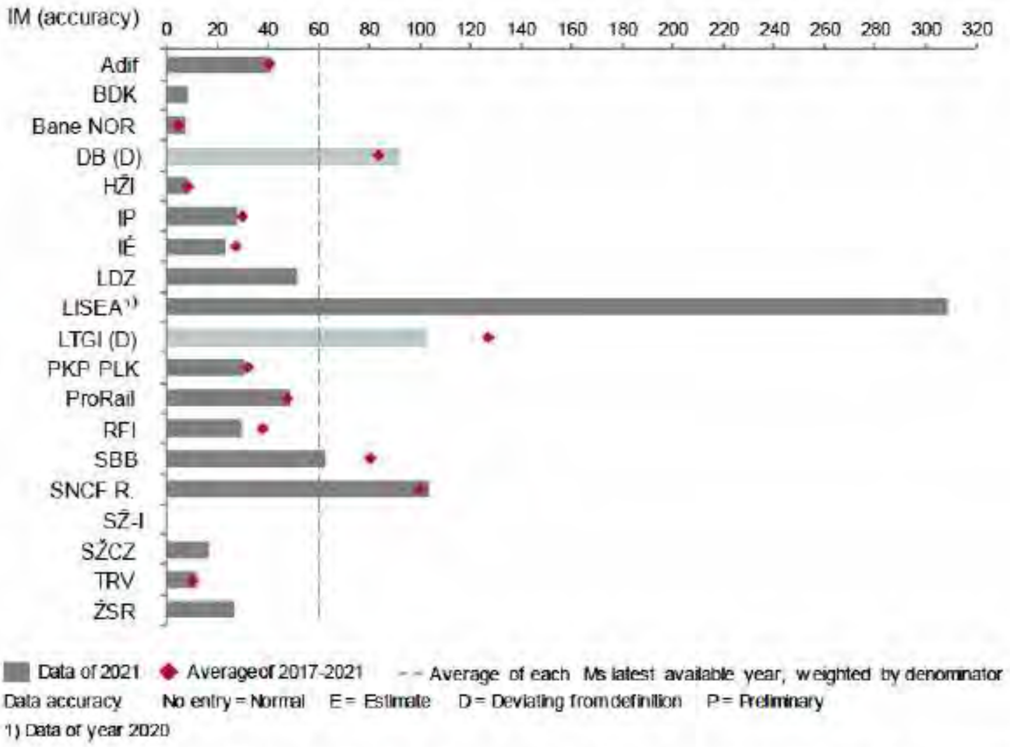

Figure 26: TAC revenue in relation to network size (€1.000 per main track-km) [33]

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

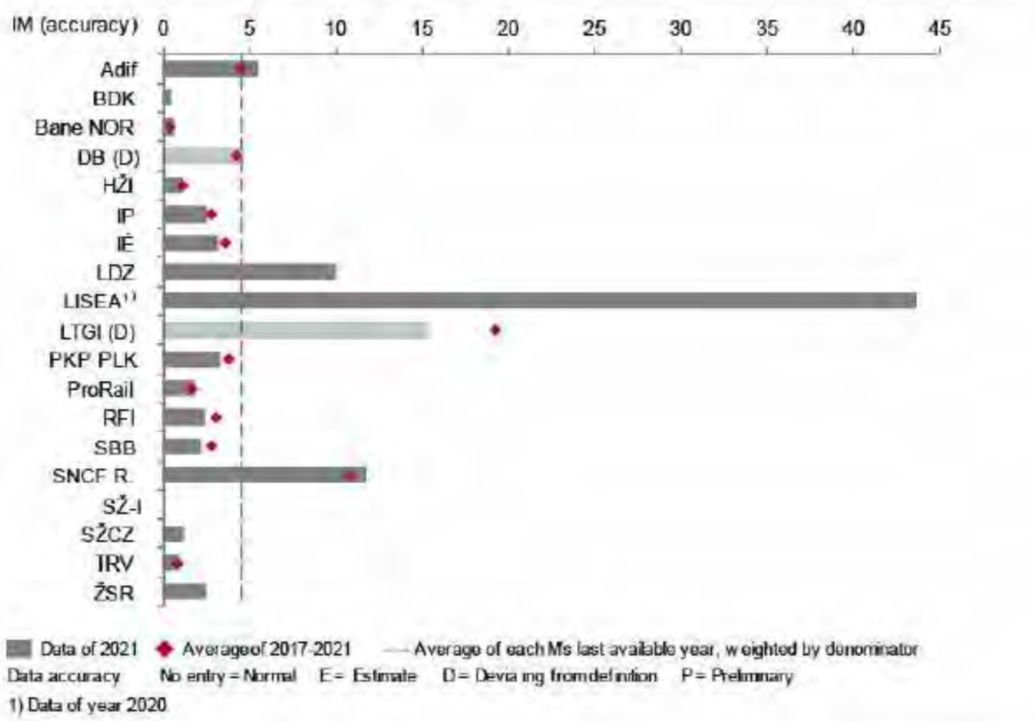

Figure 27: TAC revenue in relation to traffic volume (€ per total train-km) [34]

Figure 26 illustrates the revenues per track-kilometre and figure 27 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. The range of TAC revenues in relation to network size varies between €5.000 - €307.000 per main track-kilometre per year however the majority of the infrastructure managers are below the average of €60.000 per main track-kilometre. In relation to traffic volume TAC revenues varies between €0,4 - €44, showing an average of €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 charges 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.

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

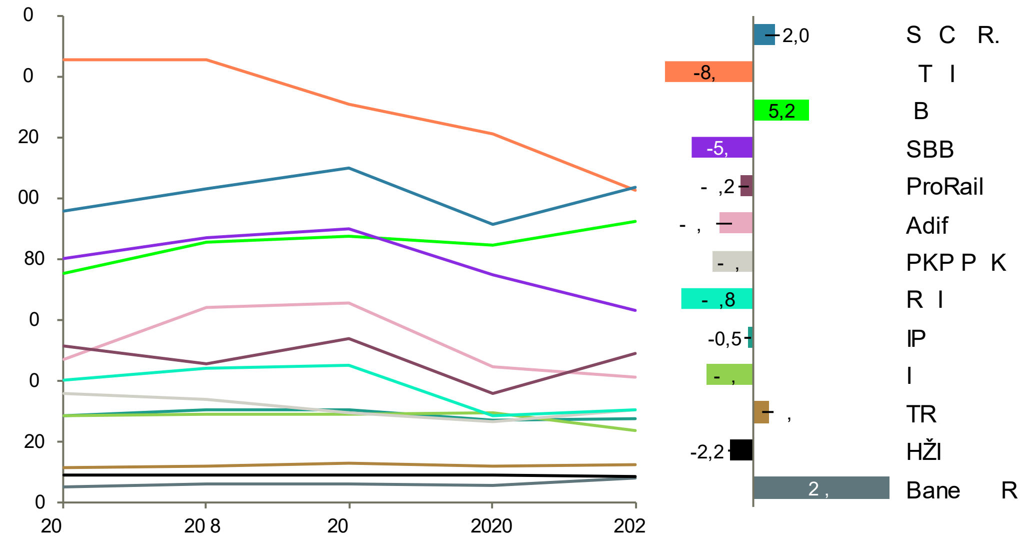

Figure 28: TAC revenue in relation to network size (€1.000 per main track-km) and CAGR (%) in 2017-2021[35]

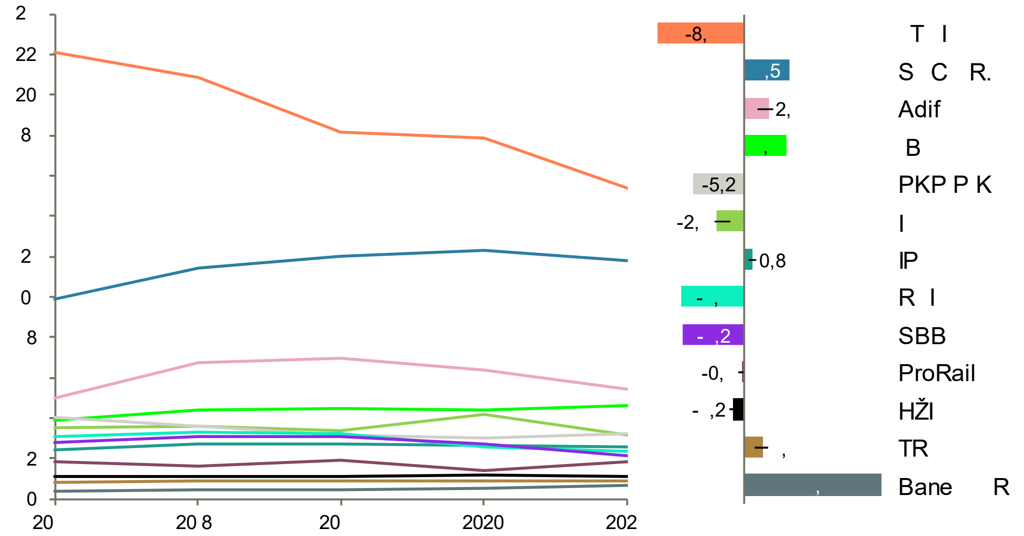

Figure 29: TAC revenue in relation to traffic volume (Euro total train-km) and CAGR (%) in 2017-2021[36]

Figures 28 and 29 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

[35] Results are normalised for purchasing power parity.
[36] Results are normalised for purchasing power parity.

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 also the track access charges went back to the pre-pandemic level.

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.

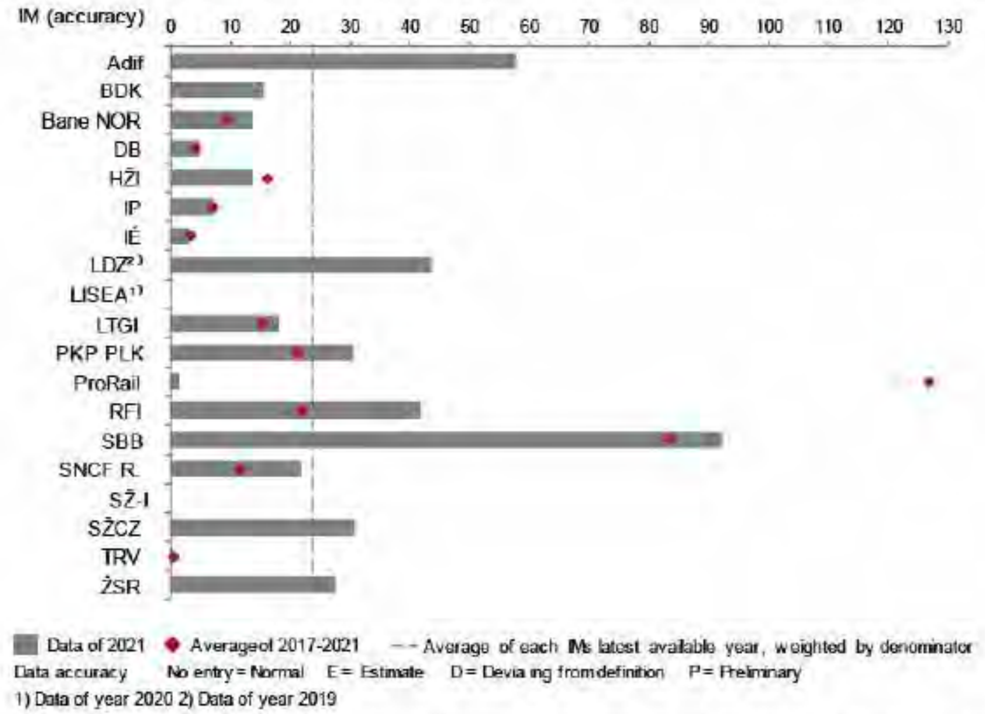

Figure 30: Total revenues from non-access charges in relation to network size (€1.000 per main track-km) [37]

The annual peer group's average of revenues from non-access charges is €25.000 per main track-kilometre. SBB records the highest values with more than €80.000 per main track-kilometre and stems from providing goods (e.g. traction current, switches) and services (e.g. use of IT tools, project management) to other infrastructure managers in Switzerland. Five infrastructure managers have revenues of less than €10.000 per main track kilometre, among which LISEA has zero non-access charges revenues.

[37] Results are normalised for purchasing power parity.

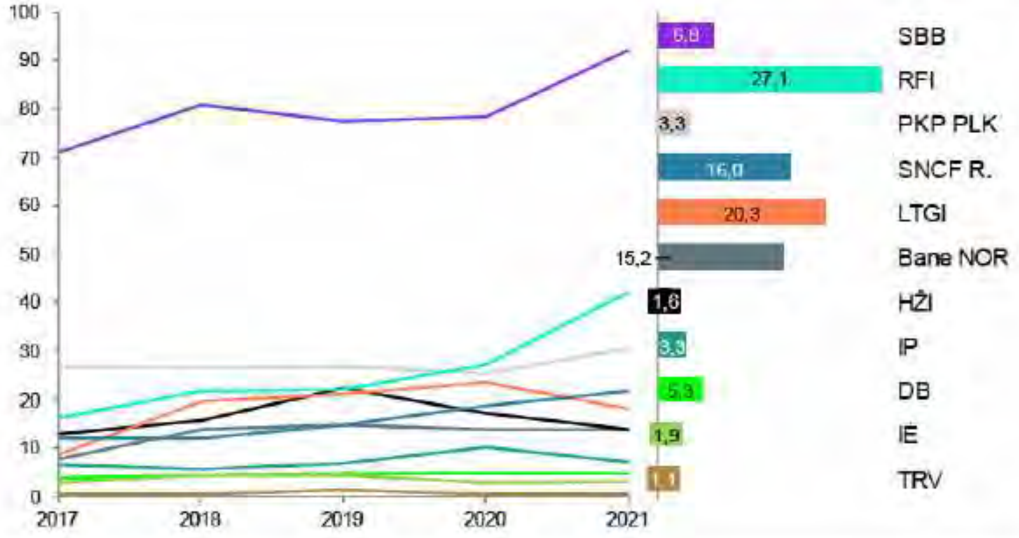

Figure 31: Total revenues from non-access charges in relation to network size (€1.000 per main track-km) and CAGR (%) in 2017-2021 [38]

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 2017 and 2021 all infrastructure managers increased their revenues from non-access charges. Four companies have reached an annual growth of over 15%. 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 a given 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.

[38] Results are normalised for purchasing power parity.

Public funding

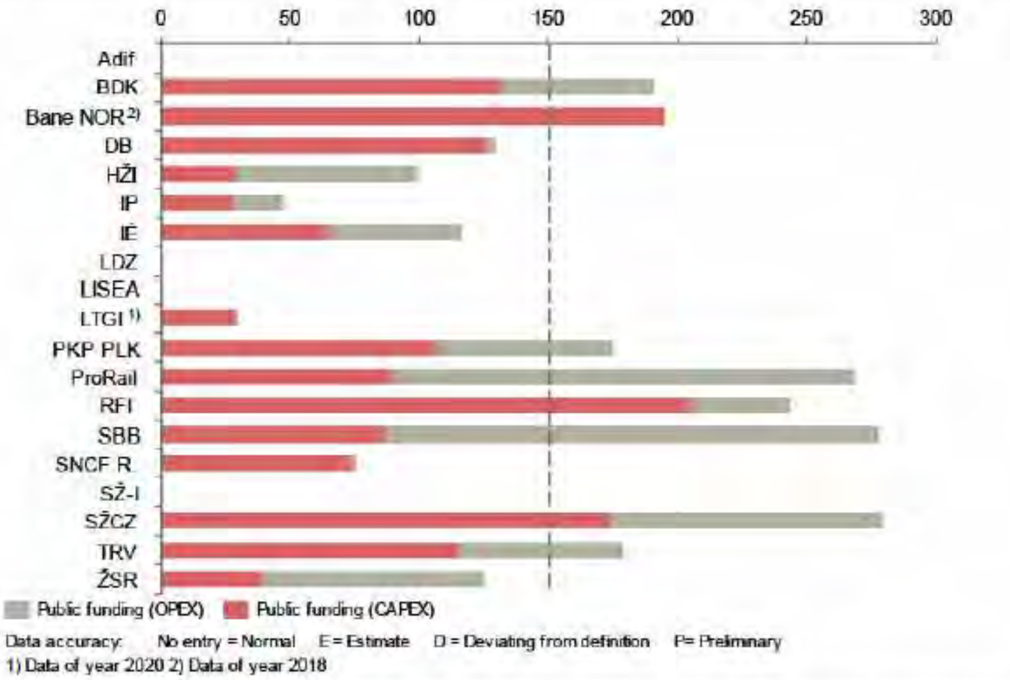

Figure 32: Public funding for OPEX and public funding for CAPEX in relation to network size (€1.000 per main track-km)

Figure 32 shows infrastructure managers' public funding dedicated to operational and capital expenditure. As can be seen, the proportions in terms of the categories for which the funds are used are highly diverse. Total public funding has a weighted average of €150.000 and a standard deviation of €98.000. SBB, SŽCZ, ProRail and RFI receive the highest public funding with more than €200.000 related to their network size. LISEA has no public funding at all due to its special case.

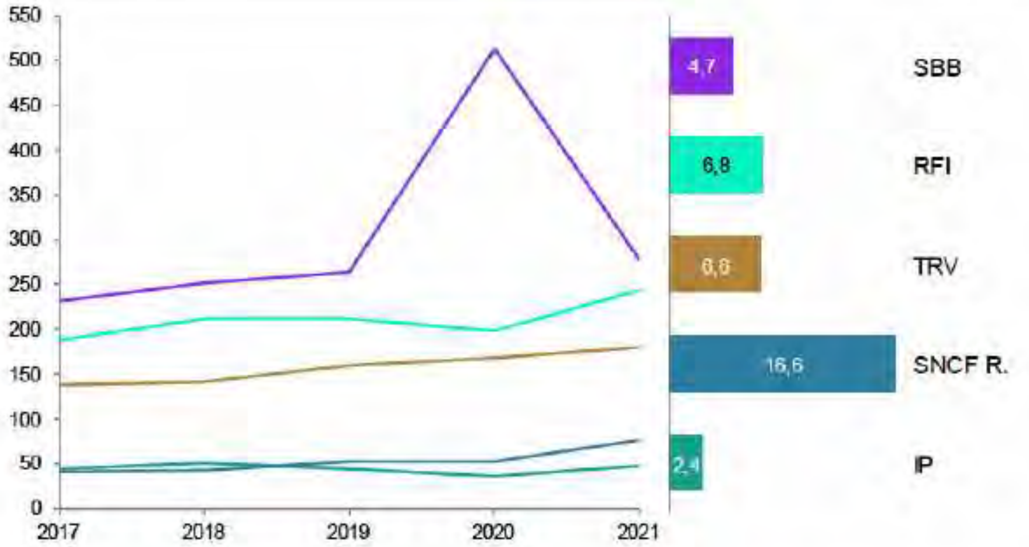

Figure 33: Total public funding in relation to network size (€1.000 per main track-km) and CAGR (%) in 2017-2021 [39]

Public funding shows a stable development for four of the five companies which provided complete data for 2017-2021. SBB's disproportionally high value in 2020 was due to the acquisition of the Ceneri Base Tunnel. The highest relative growth in public funding shows SNCF R. with an annual growth rate of 16,6%.

2.3 Safety

2.3.1 Summary of safety

EU-wide objectives

- All infrastructure managers aim at providing safe railway transport.
- In order 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.
- In accordance with the Sustainable and Smart Mobility Strategy, by 2050 the number of fatalities should be close to zero for all modes.

[39] Results are normalised for purchasing power parity.

Peer group's performance

- The definition and calculation method of the PRIME indicator "Persons seriously injured and killed" was changed compared to the previous report and aligned with ERA's "Fatalities and weighted serious injuries" indicator.
- On average there have been 0,3 significant accidents and 0,2 people seriously injured and killed per million train-kilometres each year.
- Safety performance increased in two third of the companies.
- Infrastructure manager related precursors also show a declining trend.

2.3.2 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 [40]
- Infrastructure manager related precursors to accidents

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

Development and benchmark

Figures 34 to 40 show the safety performance of the PRIME members as a benchmark, and over the time-period 2017-2021.

[40] Change in the definition compared to the last report: Now the weighted serious injured are considered rather than the absolute number; the historic data was updated by the IMs accordingly (see also Annex)

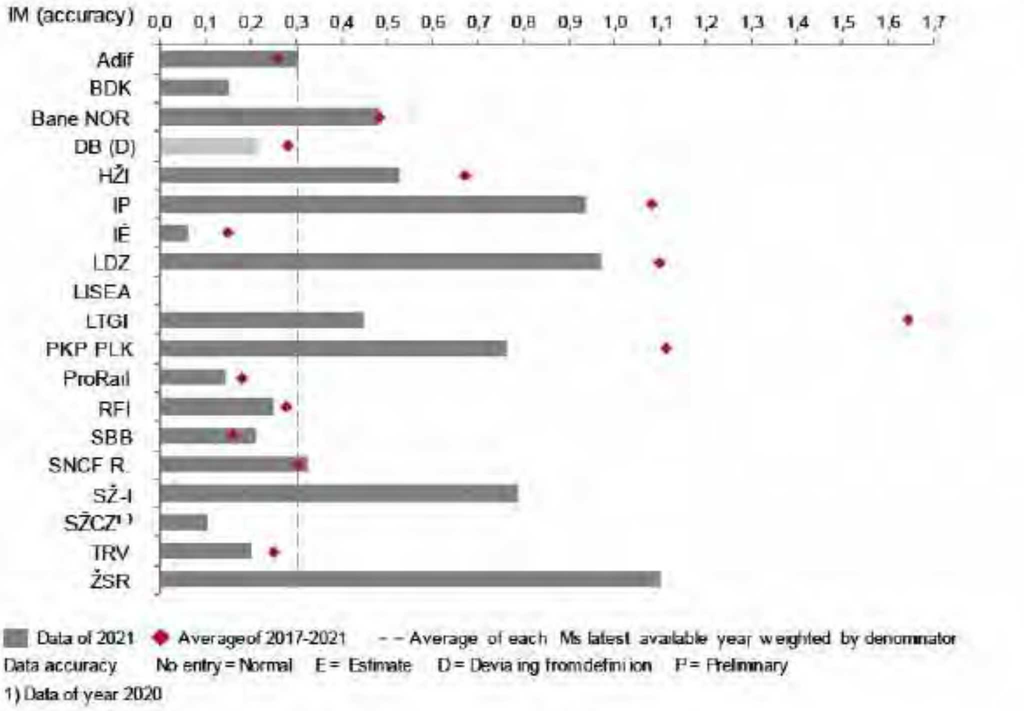

Figure 34: Significant accidents (Number per million train-km)[41]

The KPI values vary notably between the infrastructure managers, however in 2021 they all remain below 1,1 significant accidents per million train-kilometres. The lowest relative number of significant accidents was recorded at LISEA, IÉ and SŽCZ. As was the case in 2020 LISEA counted zero significant accidents also in this year. The highest number of accidents occurred on the network of ZSR, LDZ and IP. The lighter grey of DB indicates deviating data, which is explained in the Annex 4.3.

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

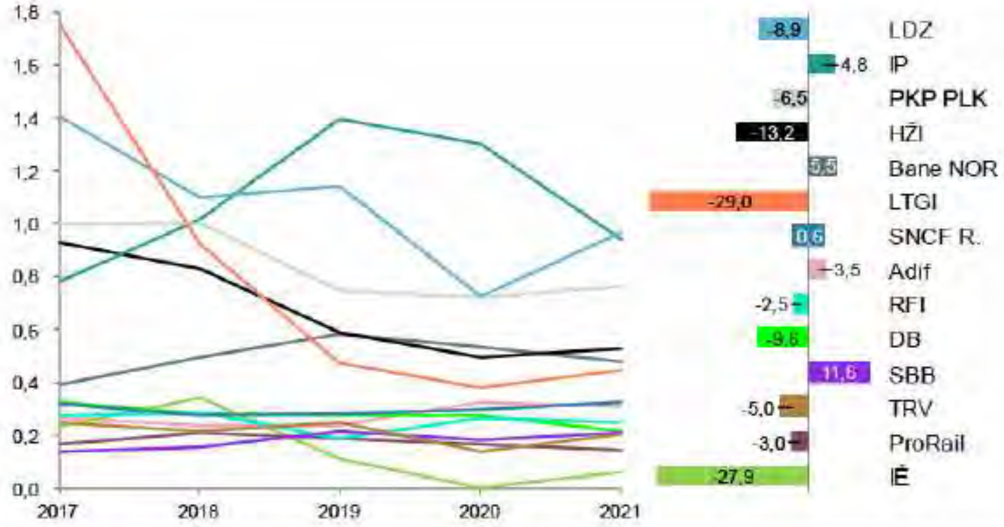

Figure 35: Significant accidents on infrastructure manager's network (Number per million train-km) and CAGR (%) in 2017-2021

The overall development in safety performance between 2017 and 2021 is in line with EU ambitions. Nine out of fourteen infrastructure managers improved their safety level from 2017 to 2021 with reducing their relative accident numbers. The highest decrease in the number of significant accidents related to train activity can be seen at LTGI and IÉ with a reduction of 29% and 28%. Noticeable is also the decrease in IP's figures from 1,4 significant accidents per train kilometre in 2019 to almost 1 in 2021. While the Covid-19 pandemic and the resulting reduction in passengers in 2020 certainly contributed to this positive development, better safety numbers are also the result of investments in modernisation and safety measures and the replacement of traffic control equipment, which have been implemented.

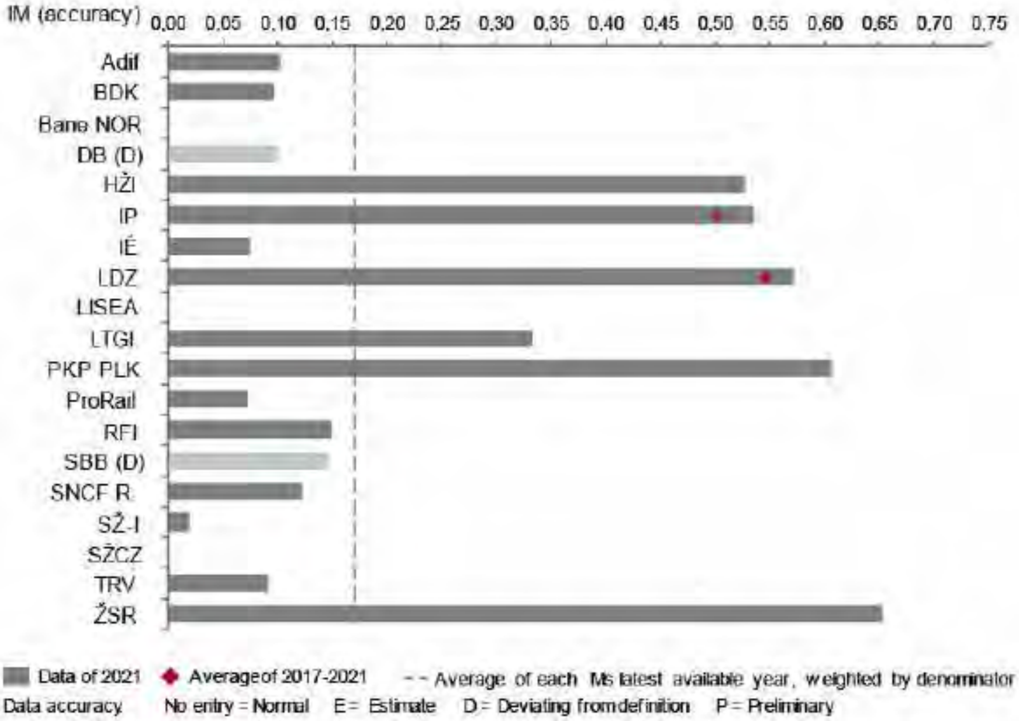

Figure 36: Fatalities and weighted serious injuries (Number per million train-km) [42]

The definition and calculation method of the PRIME indicator "Fatalities and weighted serious injuries" was changed compared to the previous report and aligned with ERA's indicator with the same name. Persons seriously injured are now weighted and are statistically equivalent to 0,1 person killed. The average of the infrastructure managers is 0,17 persons seriously injured or killed per million train-kilometres, however it varies strongly across the group and has a standard deviation of 0.24.

As the definition and calculation of the indicator changed, the completeness of previous years is limited. Therefore, there is no graph on the development between 2017 and 2021.

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

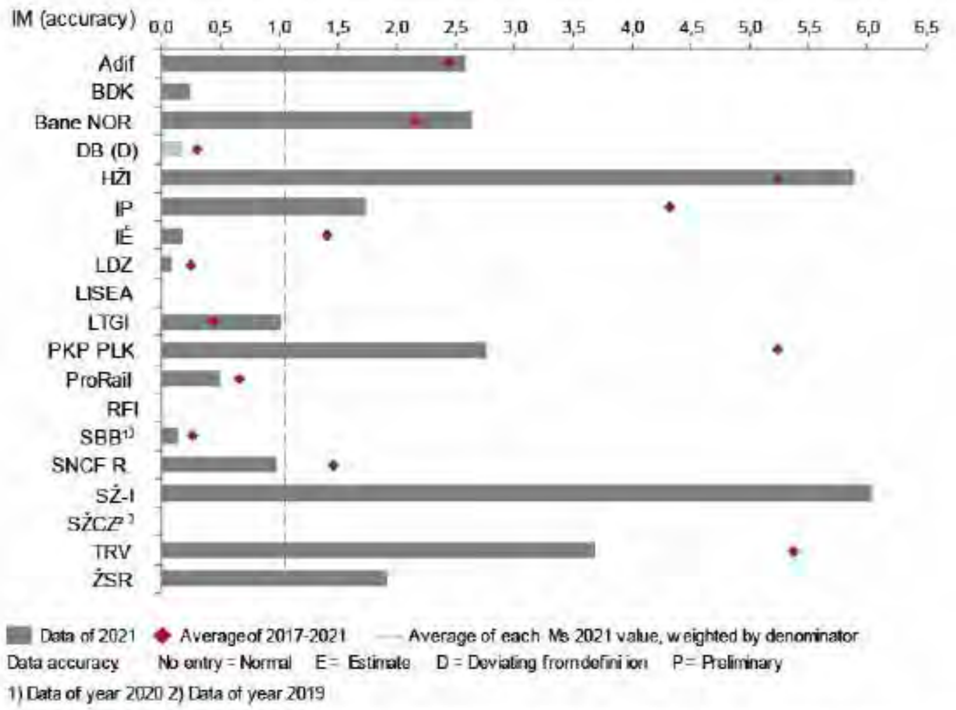

Figure 37: Infrastructure manager related precursors (Number per million train-km)[43]

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 signalling failures.

The number of precursors of the peer group varies widely, some showing levels well below the peer group's weighted average of 1,1, while others have significantly higher values. The lowest values have LDZ, SBB and DB, while the highest record SŽ-I and HŽI. IP's value might look a bit in contradiction to the relatively high number of significant accidents, but the explanation for this can be found in the cause of accidents: 90% of significant accidents and its consequences result from infringement of rules by people external to railway system, intrusion into the rail premises and failure to comply signalling at level crossings.

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

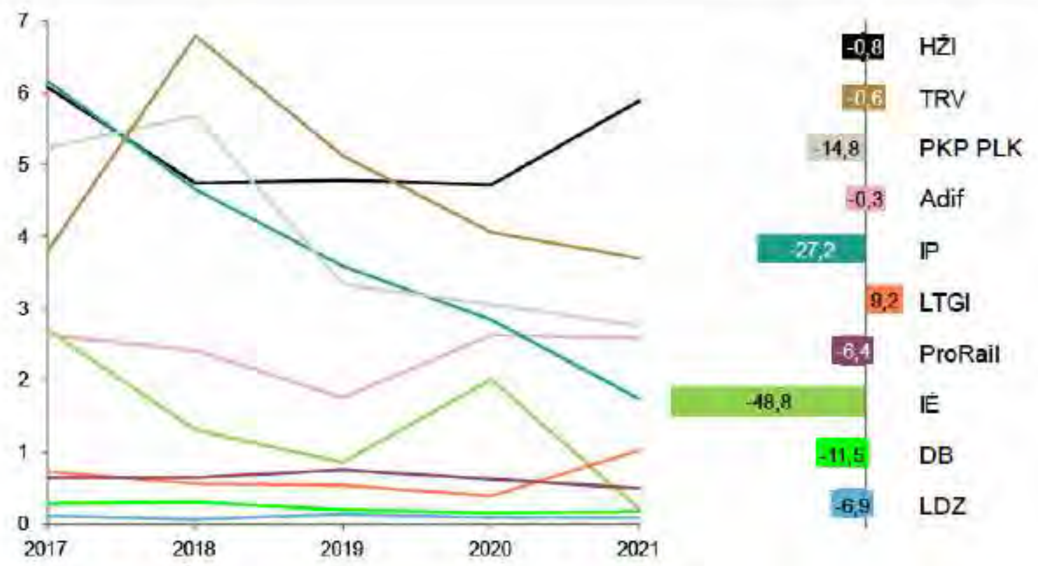

Figure 38: Infrastructure manager related precursors (Number per million train-km) and CAGR (%) in 2017-2021

Figure 38 corresponds to the diagrams on significant accidents. Here, too, the trend between 2017 and 2021 shows a decline in infrastructure manager related precursors. The highest decrease can be seen at IÉ and IP. IP reduced the infrastructure related precursors from 6 per million train-kilometre in 2017 to almost 1,7.

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 signalling 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 Member 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 in order to identify infrastructure manager related precursors to accidents, an organisation must have sufficient capacity and implemented systems to capture them.

2.4 Environment

2.4.1 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% and remained relatively stable in 2017-2021.
- The share of electricity-powered trains in relation to train-kilometres across the peer groups is around 82%.
- While the degree of electrification strongly correlates with the share of electricity-powered trains, the electrified networks are not 100% exploited
- The share of diesel-powered trains in relation to train-kilometres across the peer group is around 17%.

2.4.2 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
- CO2 emission produced from maintenance rolling stock

In order 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 39 to 47 show the relevant environmental indicators as a latest benchmark between the infrastructure managers and their development over the time-period 2017-2021.

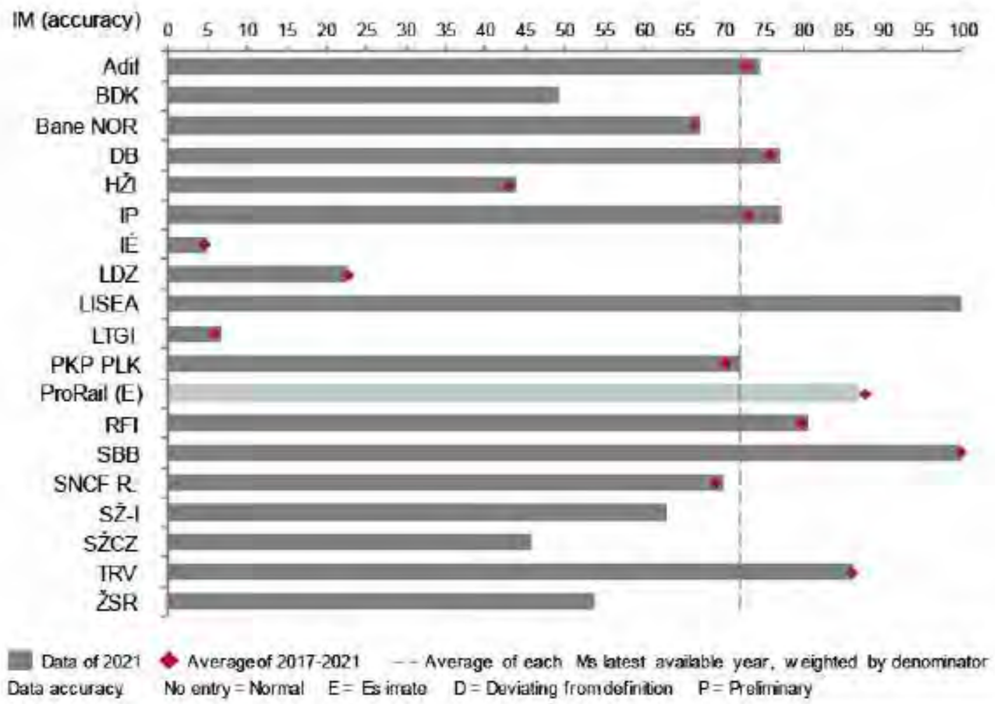

Figure 39: Degree of electrification of total main track (% of main track-km)

In the EU railway networks are mostly electrified. The peer group's average is 72%, however, the degree of electrification varies widely from 5% to 100%. While SBB and LISEA have electrified their entire network, IÉ and LTGI have an electrification degree of below 10%.

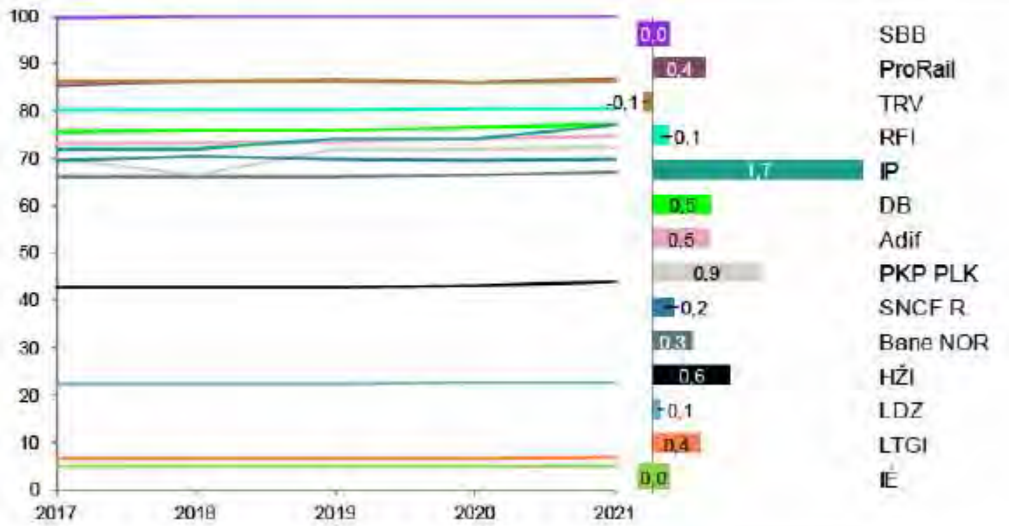

Figure 40: Degree of electrification of total main track (% of main track-km) and CAGR (%) in 2017-2021

The degree of electrification remained relatively constant over the period. Only IP shows a relatively high annual increase of 1,7% with 72% of electrified main tracks in 2017 and 77% in 2021.

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.

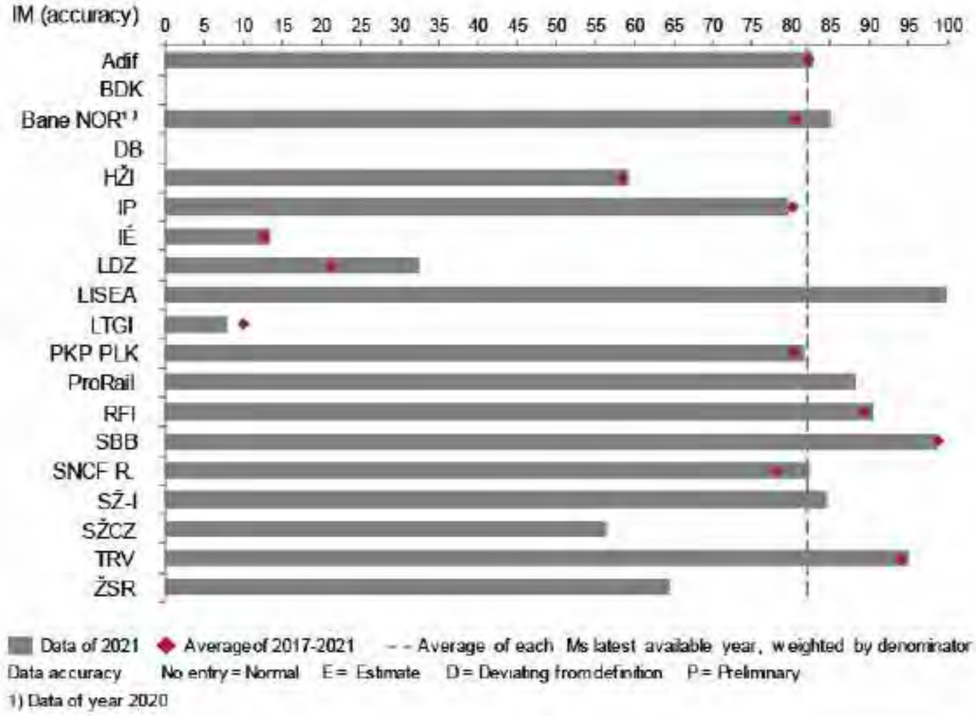

Figure 41: Share of electricity-powered trains (% of total train-km)

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 and RFI have above 90% of electricity-powered trains running on their network.

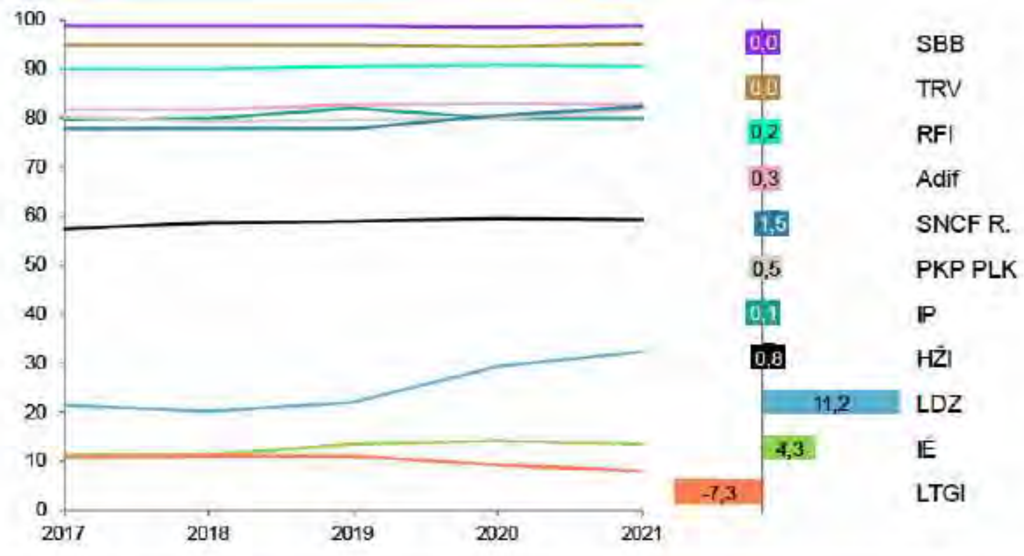

Figure 42: Share of electricity-powered trains (% of total train-km) and CAGR (%) in 2017-2021

Figure 42 shows the development of electricity-powered trains between 2017 and 2021. Parallel to the development of the electrification of the main tracks the trend is relatively stable, showing only a slight increase for LDZ and IÉ. LDZ had the most significant annual growth and increased its share of electricity-powered trains from 21% in 2017 to 32% in 2021. IÉ's annual growth rate is 4,3 and means an increase from 11% in 2017 to 14% in 2021. Starting from 2019 LTGI shows a decrease in the share of electricity-powered trains.

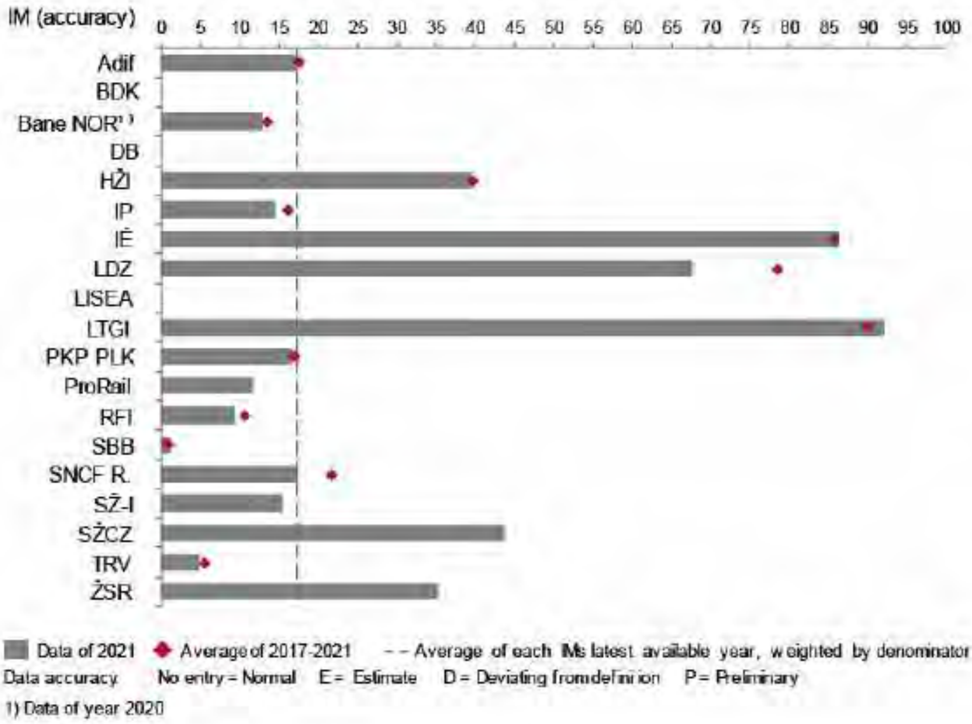

Figure 43: Share of diesel-powered trains (% of total train-km)[44]

Figure 43 is the counterpart to figure 46 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. 91% of LTGI's, 86% of IÉ's and 67% of LDZ's traffic volume is produced by diesel-powered trains while the peer group's average stays around 17%.

[44] Zero value: LISEA

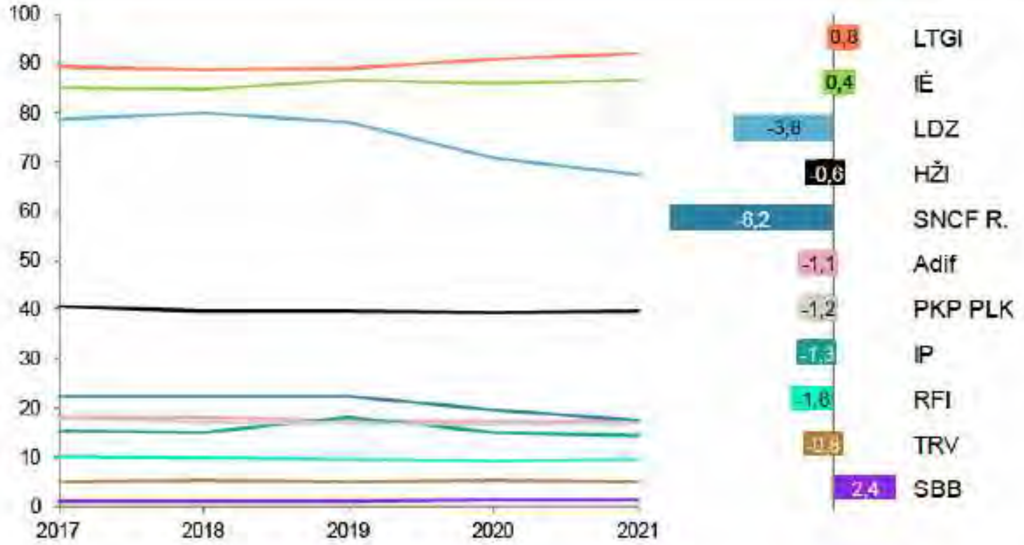

Figure 44: Share of diesel-powered trains (% of total train-km) and CAGR (%) in 2017-2021

Figure 44 shows the development of the share of diesel-powered trains between 2017 and 2021. Considering the European Commission's objective of reducing the share of diesel-powered trains, the declining trend 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%. The highest annual growth can be seen at SBB, as there has been an increase in diesel powered work trains. However, it still remains far below the average with a share of diesel-powered trains of 0,3% in 2017 and 1,2% in 2021.

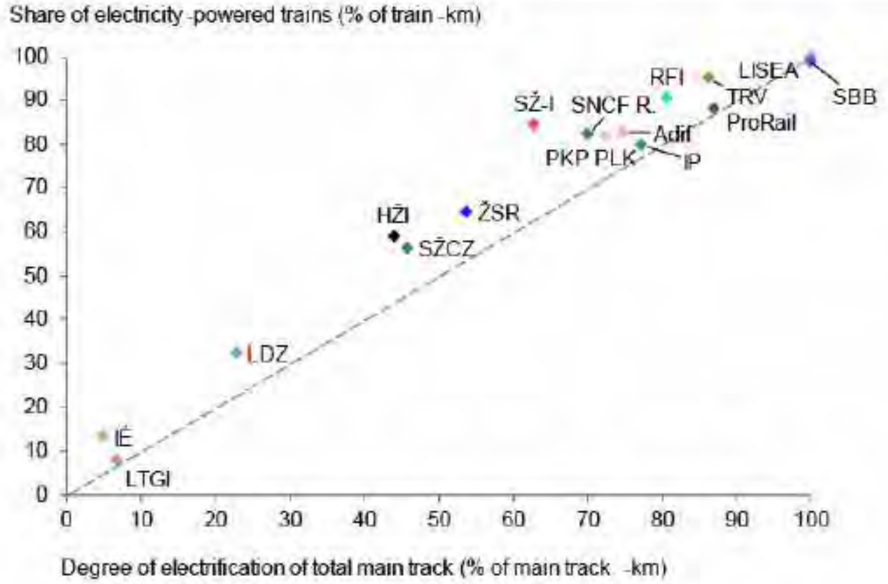

Figure 45: Share of electricity-powered trains (% of train-km) / Degree of electrification (% of main track-km)

Figure 45 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.

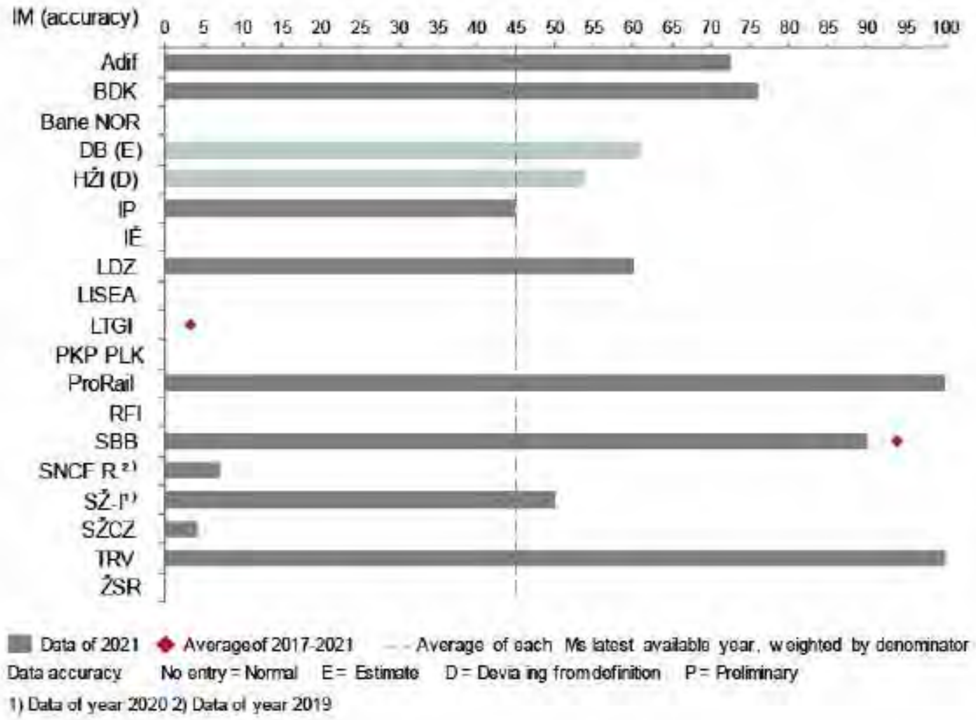

Figure 46: Share of renewable traction energy (% of kWh) [45]

Rails also aim to become greener in terms of energy consumption. Figure 46 shows the proportion of renewable traction energy in relation total traction energy in kWh. As we can see 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 45% with a standard deviation of 38%.

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

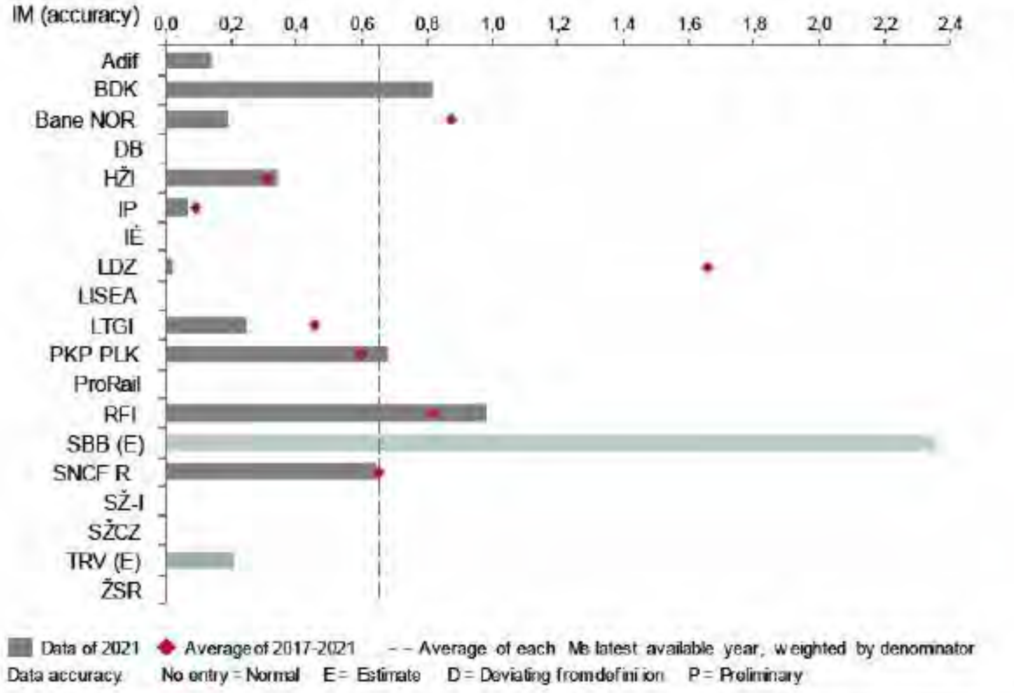

Figure 47: CO_2 emission produced from IM's own maintenance rolling stock (tCO_2 per main track-km) [46]

A new indicator, which captures the environmental impact of an infrastructure managers own maintenance rolling stock regarding its CO_2 emission is shown in figure 47. 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 0,6. 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 CO2 emission in this respect. The collected data do not include the CO2 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).

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

2.5 Performance and delivery

2.5.1 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
- Compared to 2020 punctuality rates decreased both for passenger and freight trains in 2021
- The average passenger train punctuality is 93%, the average freight train punctuality is 59%
- On average infrastructure managers caused 5 delay minutes per thousand train-kilometres.

2.5.2 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 in order 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

In order 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 and the speed restrictions are related to main track-kilometres.

2.5.3 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, a large number of 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.

In order 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 actually 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 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 BANEDANMARK	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 BANE NOR	PRIME punctuality performance measures are measured at final destination and at Oslo Central Station for both passenger and freight trains.
DB DB NETZE	For statistical purposes: Punctuality of passenger trains is measured taking into account all stations. Punctuality of freight trains is measured at the final station (arrival) within Germany.

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
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: • 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)

Infrastructure manager	Measurement points in the network
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 48 and 49 show the punctuality of passenger trains for operators using the network of PRIME members as a benchmark and over the time-period 2017-2021. 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.

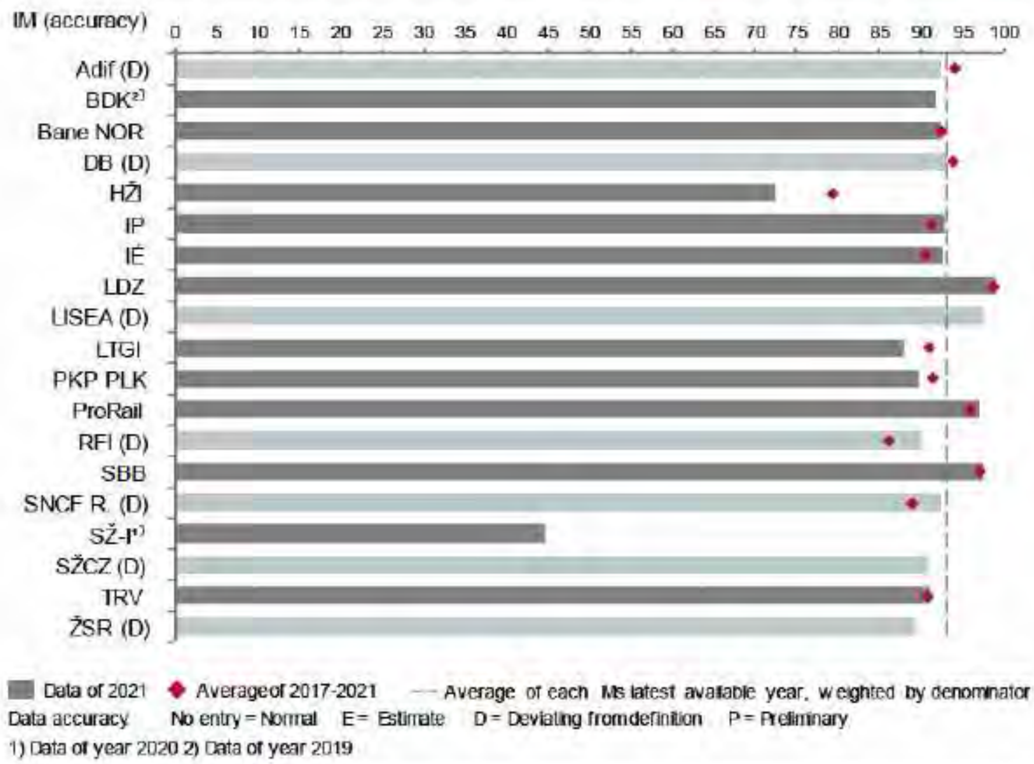

Figure 48: Passenger trains total punctuality (5:29 minutes) (% of actually operating trains) [47]

Figure 48 shows the passenger train punctuality data of the latest available year. The figures vary between 45% and 99%, which is again partly a result of different measuring methodologies. The punctuality of passenger trains has a weighted average of 93% and a standard deviation of 12%. 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, seven infrastructure managers are deviating from definition. Comments explaining in what sense the individual data points are deviating are collected in the Annex 4.3.

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

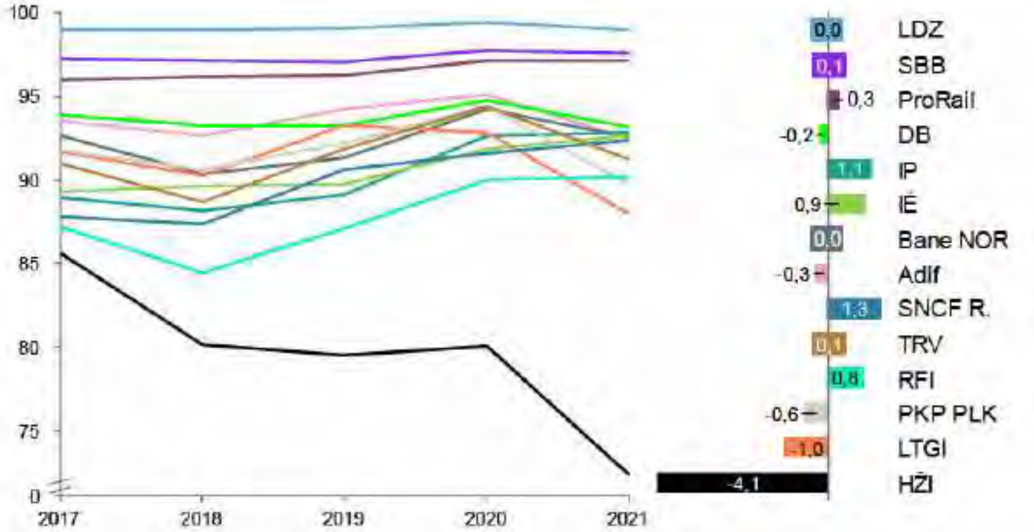

Figure 49: Passenger trains total punctuality (5:29 minutes) (% of actually operating trains) and CAGR (%) in 2017-2021

Figure 49 shows the development of passenger train punctuality between 2017 and 2021. The development of punctuality rates is relatively divers across the peer group. Some infrastructure managers recorded a higher fluctuation in their punctuality, while for others it remained stable. SNCF R., IP and RFI increased their punctuality over the period. HŽI had a significant drop in 2021 which was mainly the result of track overhaul works and temporary speed restrictions.

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. 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 figure 15 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 50 and 51 show the punctuality of freight trains of PRIME members in a latest benchmark and over the time period 2017-2021.

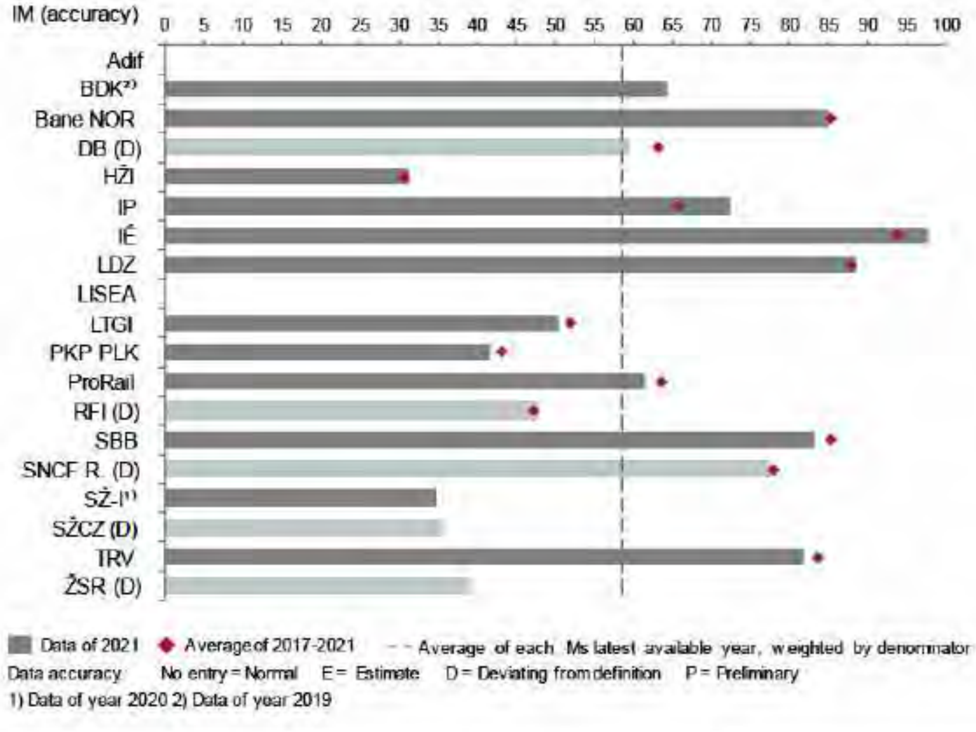

Figure 50: Freight trains total punctuality (15:29 minutes) (% of actually operating trains)[48]

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 30% and 97% and have a standard

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

deviation of 25%. Five 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.

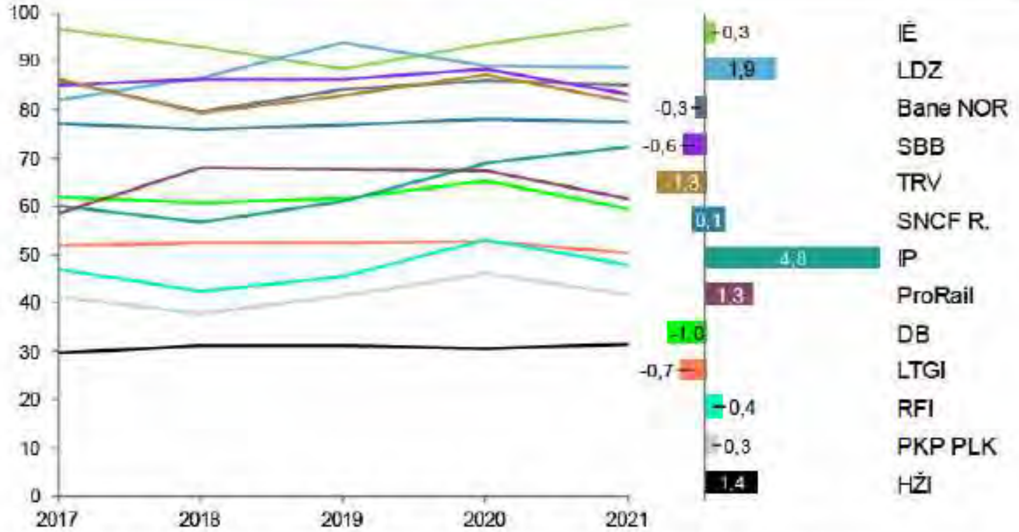

Figure 51: Freight trains total punctuality (15:29 minutes) (% of actually operating trains) and CAGR (%) in 2017-2021

Especially with regard to the European Union's objective to boost freight transportation, the development of freight train punctuality is promising. Eight out of thirteen infrastructure managers which provided data for the complete time series increased their punctuality rates. IP increased its freight punctuality with an annual growth of 4,8 from around 60% in 2017 to over 70% in 2021. In order 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 similar to 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 so as 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 has to 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 manager

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.

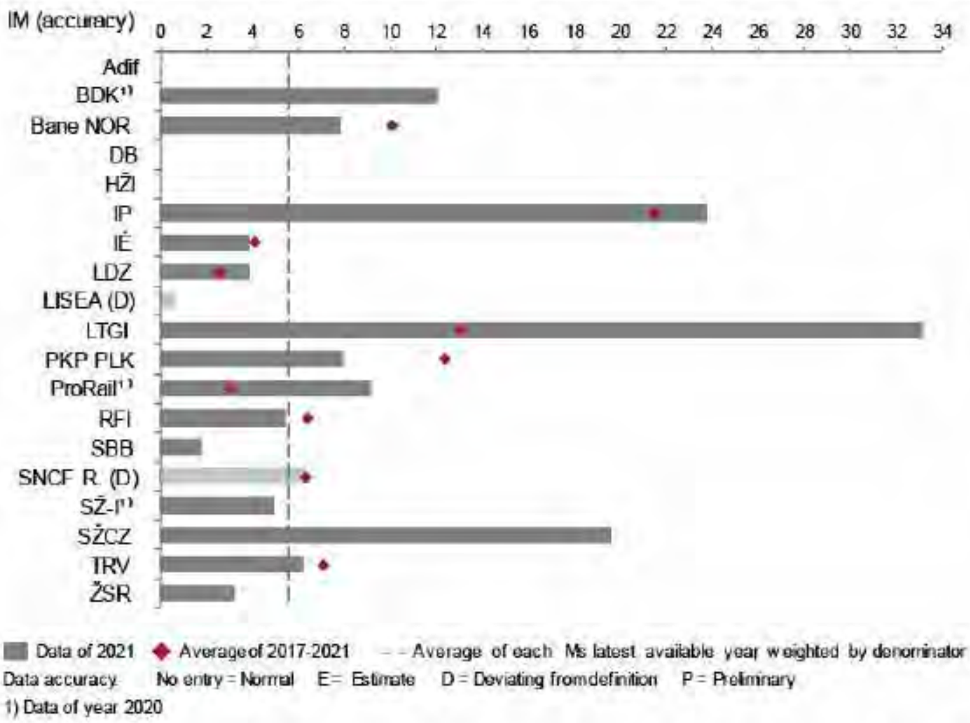

Figure 52: Delay minutes per train-km caused by the infrastructure manager (Minutes per thousand train-km) [49]

On average infrastructure managers caused 5 delay minutes per thousand train-kilometres, and their results vary between less than 1 and 33 minutes per thousand train-kilometres. Corresponding to their overall high passenger train punctuality shown in figure 51, 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

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

network in building, enhancing and renewing infrastructure will last until 2023, leading to further delays.

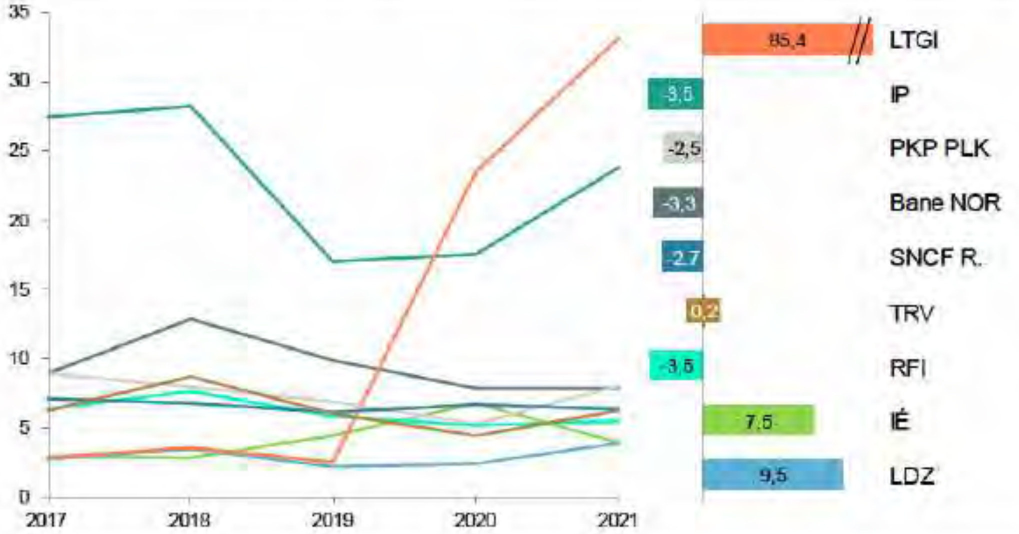

Figure 53: Delay minutes per train-km caused by the infrastructure manager (Minutes per thousand train-km) and CAGR (%) in 2017-2021

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 is mainly due to a change in methodology in data collection in order to get more accurate data. PKP PLK constant reduction is mainly the result of multi-billion euro investments in modernising railway infrastructure, for example replacing old CCS (Control-Command and Signalling) devices with new and more reliable ones, implementing and completing programs of replacement of turnouts like collision-free rail-road crossings, and construction of viaducts.

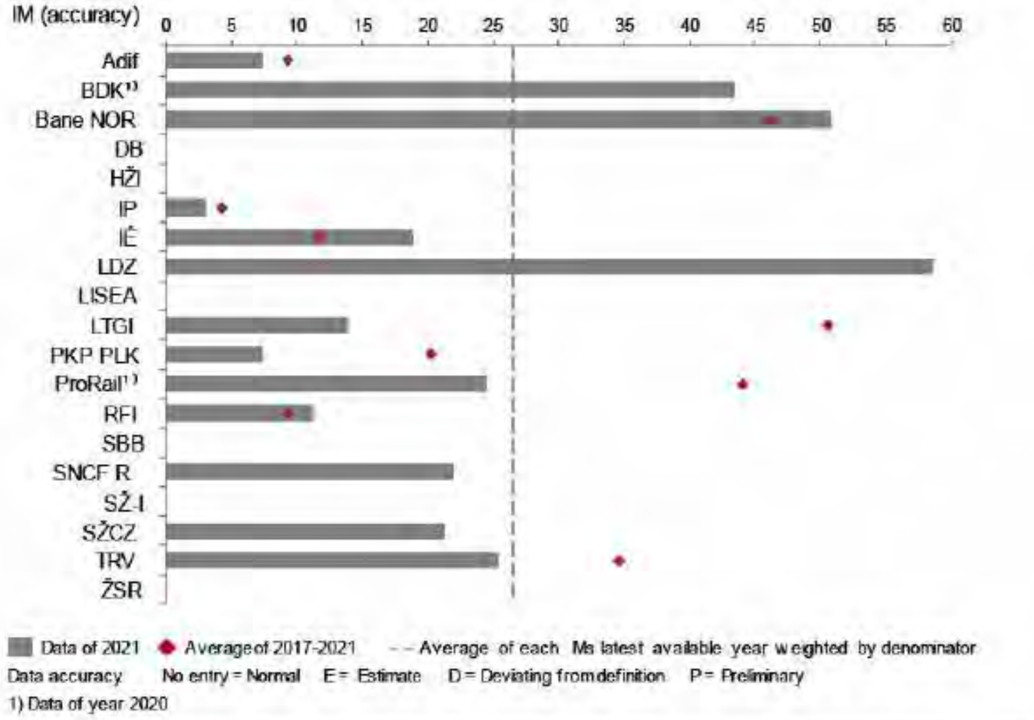

Figure 54: Passenger train cancellations caused by the infrastructure manager (% of scheduled and cancelled passenger trains) [50]

As illustrated in figure 54 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 27% 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.

[50] 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

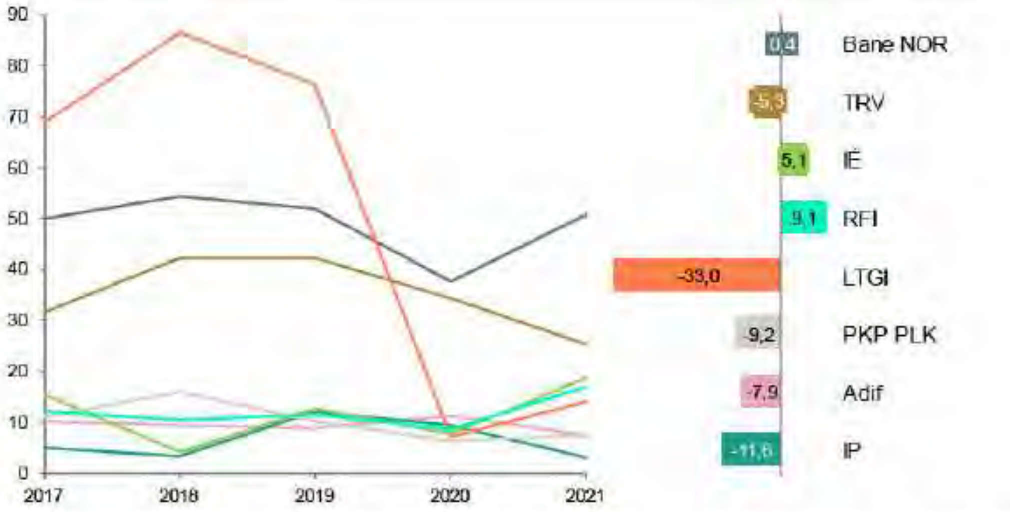

Figure 55: Passenger train cancellations caused by the infrastructure manager (% of scheduled and cancelled passenger trains) and CAGR (%) in 2017-2021

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. The most significant decrease is visible for LTGI, which reduced its share from almost 90% in 2018 to less than 20% in 2021.

2.5.4 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 actually 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 56 to 59 show the latest benchmark of the number of train-affecting asset failures between the infrastructure managers and its development over the time period of 2017-2021.

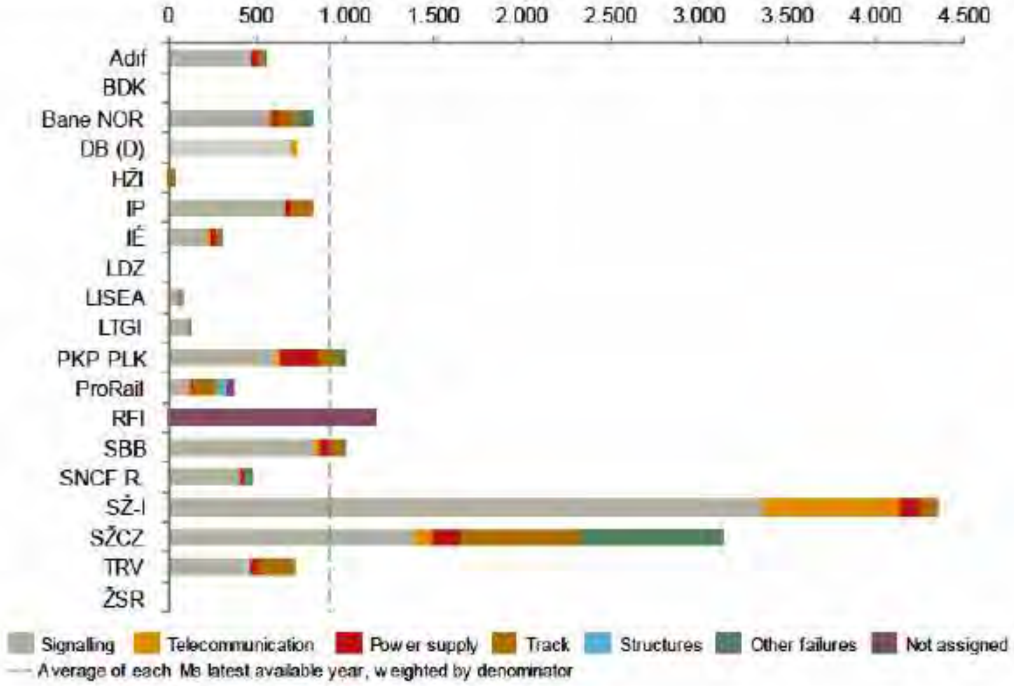

Figure 56: Asset failures in relation to network size (Number per thousand main track km)[51]

Figure 56 shows the level and the composition of asset failures that caused delays. On average almost 900 assets fail per thousand main track-kilometres per year. The failure frequency in the peer group varies between 55 and 3.300 failures per thousand main track-kilometres. Signalling accounts for the majority 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 grey colour of DB indicates deviating figures for signalling failures, the lighter yellow of DB for telecommunication failures. In what sense these data are deviating is explained in Annex 4.3.

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

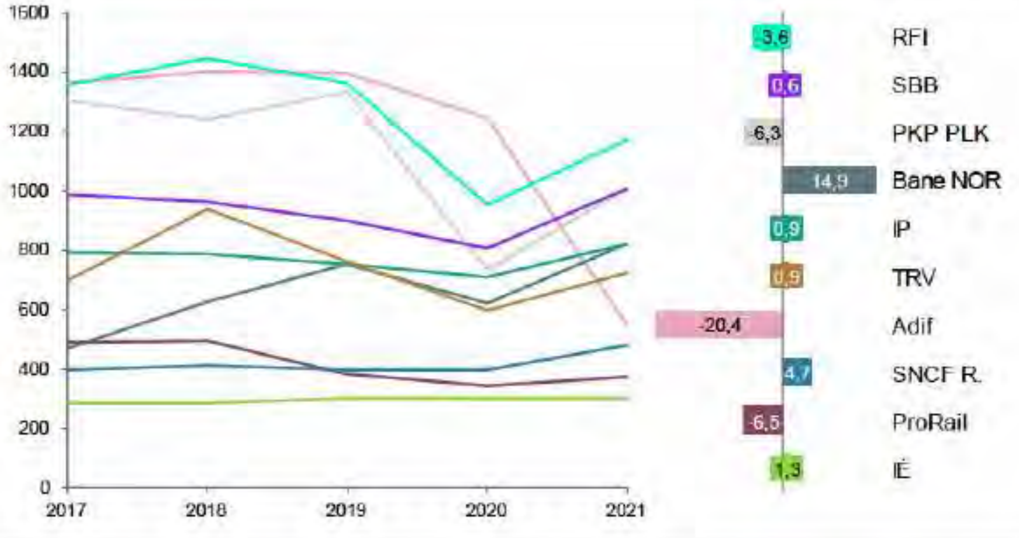

Figure 57: Asset failures in relation to network size (Number per thousand main track-km) and CAGR (%) in 2017-2021

The development of the number of failures per main track-kilometre is rather different in the peer group. Some infrastructure managers show a stable performance, while others are facing a higher fluctuation. In Bane NOR the relative number of asset failures increased from 470 in 2017 to 820 in 2021. This is mainly due to an increased registering of the number of signalling failures in 2018. However, as shown in figure 57, the impact of signalling failures on delays is comparatively low, which can party be the reason for the declining trend of Bane NOR's average delay minutes caused by asset failures shown in the next two figures. 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[52]. The sharp decrease of Adif's asset failures is mainly due to a change in calculation method in 2021. 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 time tables 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

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

determine the frequency and dimension of asset failures. Complexity (electrification, switch density and signalling) naturally increases the chances of failures, and high utilisation accelerates wear and tear. The condition, age and renewal rate of assets is also decisive. However, asset failure also depends on a number of factors such as stage of development, historic elements and the budget of the infrastructure manager and the Member 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 have to 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 57 and 58.

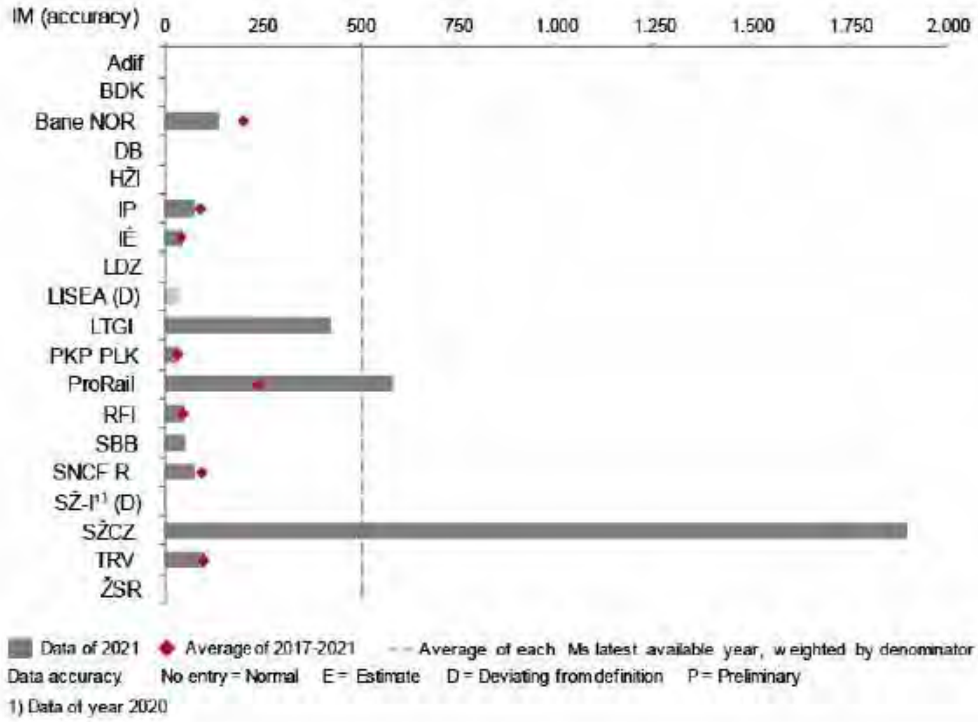

Figure 58: Average delay minutes per asset failure (Minutes per failure)[53]

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

On average asset failures cause a delay of 500 minutes, however this average is mainly the results of SŽCZ's high value. The majority of companies have an average delay caused by failures of below 80. The lowest level of delay minutes caused by asset failures are found at PKP PLK, LISEA and IÉ, where one asset failure causes on average a delay of below 40 minutes.

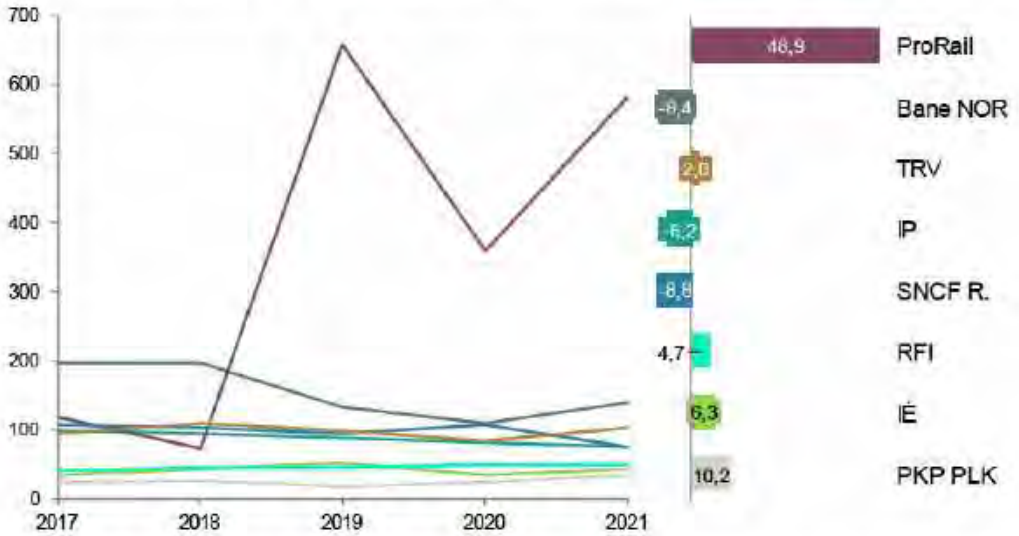

Figure 59: Average delay minutes per asset failure (Minutes per failure) and CAGR (%) in 2017-2021

Apart from ProRail's outliers and Bane NOR's constant decrease, the impact of asset failures on delay minutes remained relatively stable over the year. It is interesting to see that Bane NOR had the most significant decrease in delay minutes within the group, however it showed the highest increase in the frequency of asset failures (figure 57). This underlines the fact that the type of equipment failure plays a role, as well as the frequency of the failures and the infrastructure manager's response time to the problem.

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 60 shows this relationship.

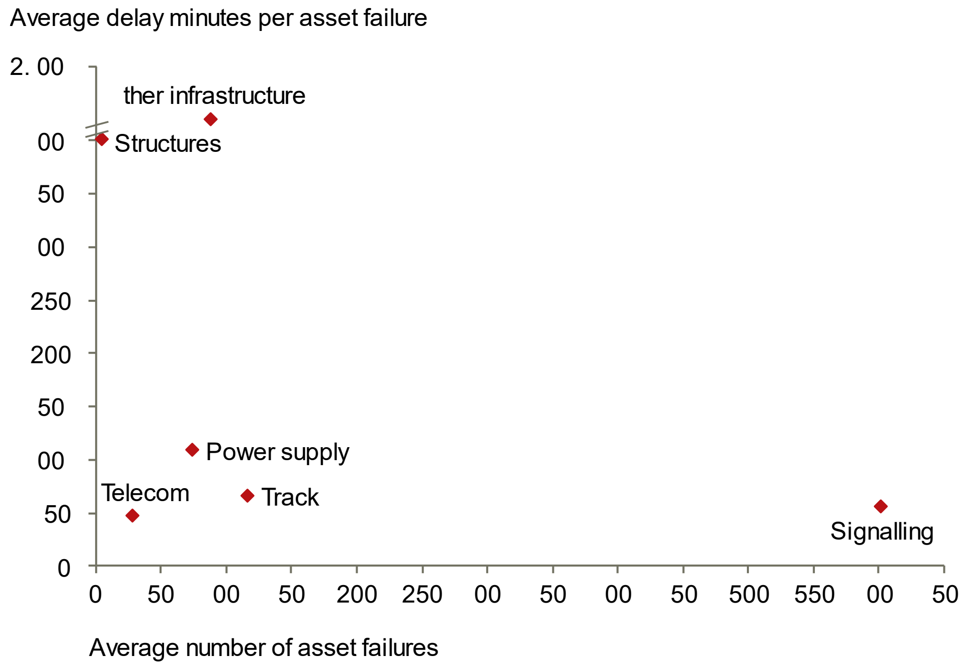

Figure 60: Delay per asset failure (Minutes per failure) / Asset failures (Number per thousand main track-km)[54]

In 2021 the other failures category was the largest due to SŽCZ's values which could not been assigned to the specific categories. Structure assets such as bridges and tunnels caused the second highest number of delay minutes with more than 400 minutes per failure. Power supply failures were responsible for an average delay of 110 minutes per failure. Track failures and telecommunication failures caused on average 66 and 47 delay minutes respectively. The most frequent type of asset failures was related to signalling, with an average of almost 500 failures per thousand main track-kilometre, however they had a comparably low impact of 56 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.

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

2.5.5 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 61 to 62 show to what degree a network was affected by permanent or temporary speed restrictions. Due to incomplete time series, no trend line are shown for these two indicators.

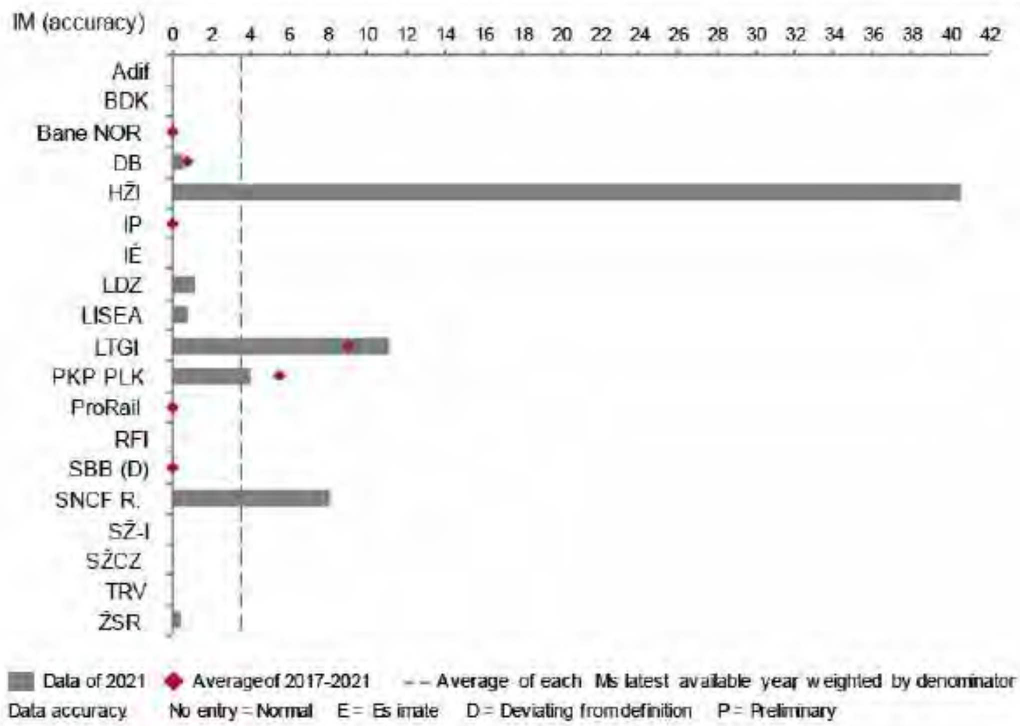

Figure 61: Tracks with permanent speed restrictions (% of main track-km)[55]

[55] Zero value: Bane NOR, IÉ, IP, ProRail, SBB, LISEA

Based on the definition, restrictions are defined as permanent if they are incorporated within the yearly timetable. The majority of infrastructure managers show a share of track with permanent speed restrictions below 1%, while others have 3% to 40% of their network under permanent speed restriction. On average 4% of the peer groups network faces a permanent speed restriction with a spread of 11%. For HŽI permanent speed restrictions are a consequence of the poor condition of local and regional lines. Some infrastructure managers do not count permanent speed restrictions at all, as they are included in the working timetable.

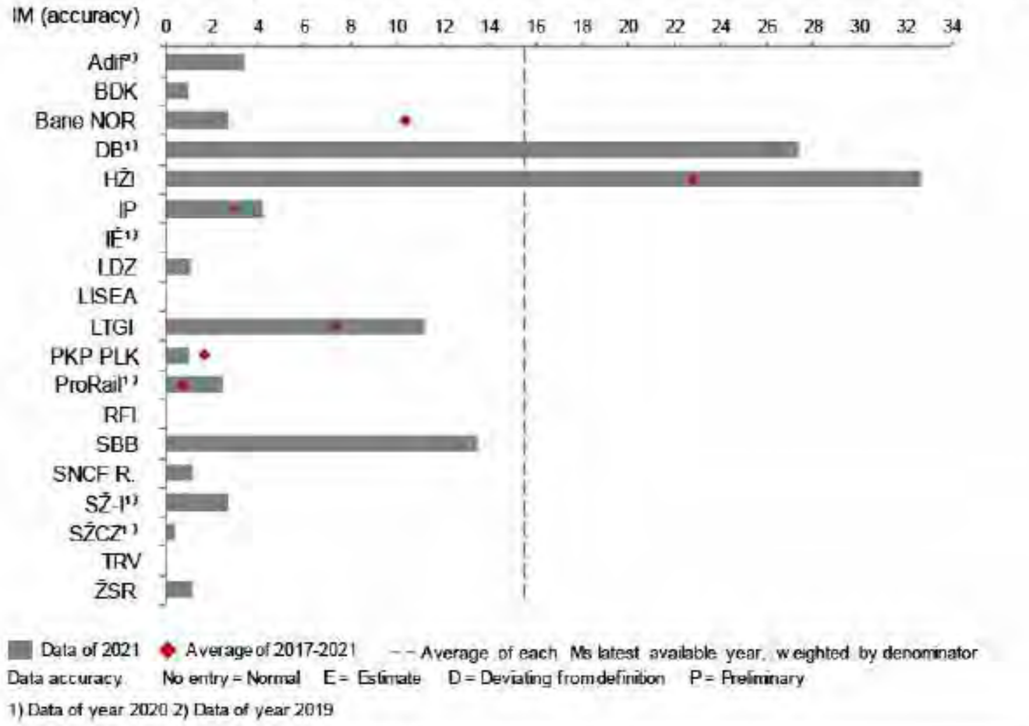

Figure 62: Tracks with temporary speed restrictions (% of main track-km)[56]

Other than permanent speed restrictions, restrictions that occur during the year and are not included in the annual timetable are considered temporary. On average, 10% of the main track is unavailable due to temporary speed restrictions, which are typically caused by deteriorating conditions or necessary track works. While some infrastructure managers have hardly any temporary speed restrictions, DB and HŽI restrict speed on more than 25% of their networks. This causes a standard deviation of 9%. IP's temporary speed restrictions are mainly due to an investment program in the Portuguese railway network, building, enhancing and renewing infrastructure, which will last until 2023. The increase for ProRail is caused by the fact that small temporary restrictions caused by trespassers are also included.

[56] Zero value: LISEA

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 in order to extend service life is sometimes the better option than interrupting a very active route for a longer period of time.

2.6 Asset capability and ERTMS deployment

2.6.1 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 and 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 TENT-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 so as 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 9% of all tracks of the peer group's railway network
- Across the peer group ERTMS is expected to be implemented in about 31% of the railway network by 2030.
- ATP coverage is included as a new indicator for the first time and has an average of 58%
- The majority of core connections ports are connected to the TEN-T corridor of the peer group

2.6.2 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 two indicators measuring ERTMS deployment:

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

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

Development and benchmark

Figures 63 and 64 show the level of ERTMS track-side deployment and the planned extent of ERTMS deployment by 2030.

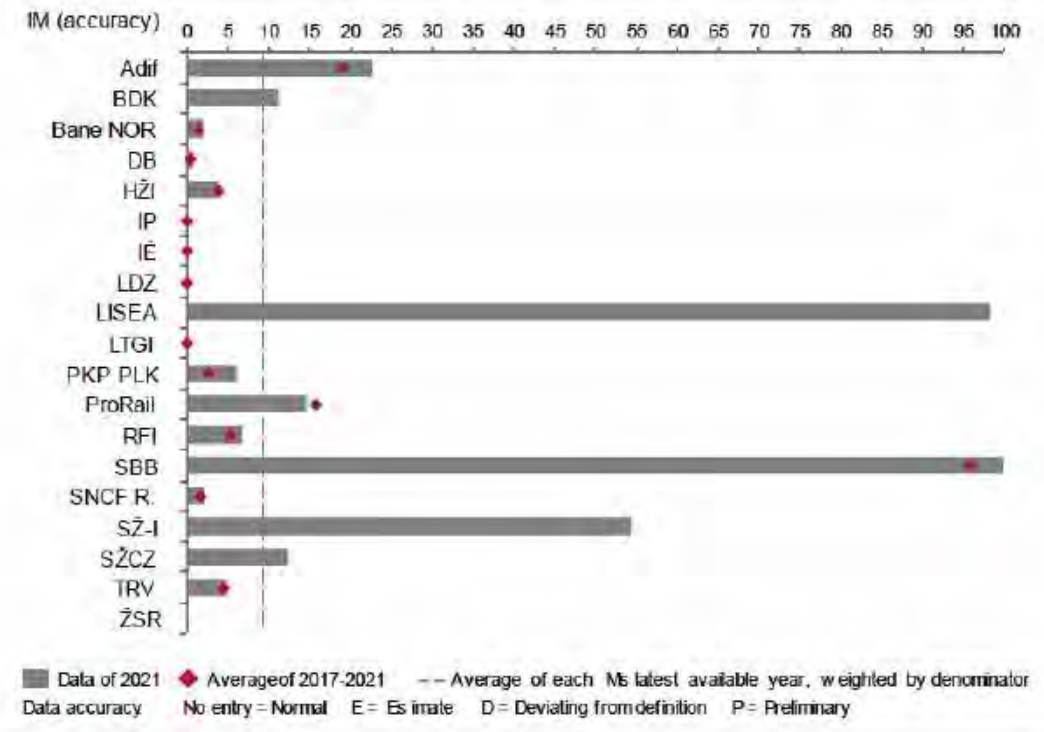

Figure 63: ERTMS track-side deployment (% of main track-km)[57]

ERTMS is deployed on about 9% 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.

[57] Zero value: LTGI, IÉ, IP, LDZ

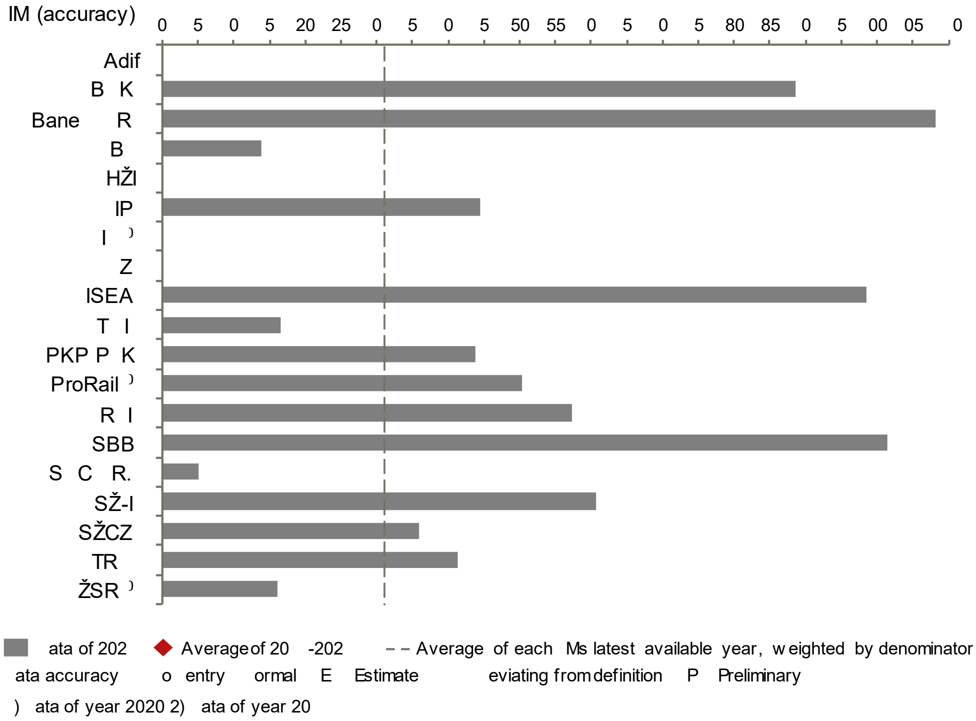

Figure 64: Planned extent of ERTMS deployment by 2030 (% of current main track-km)[58]

By 2030, ERTMS is expected to cover about 31% 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. 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.

[58] Lighter colours indicate estimated data.

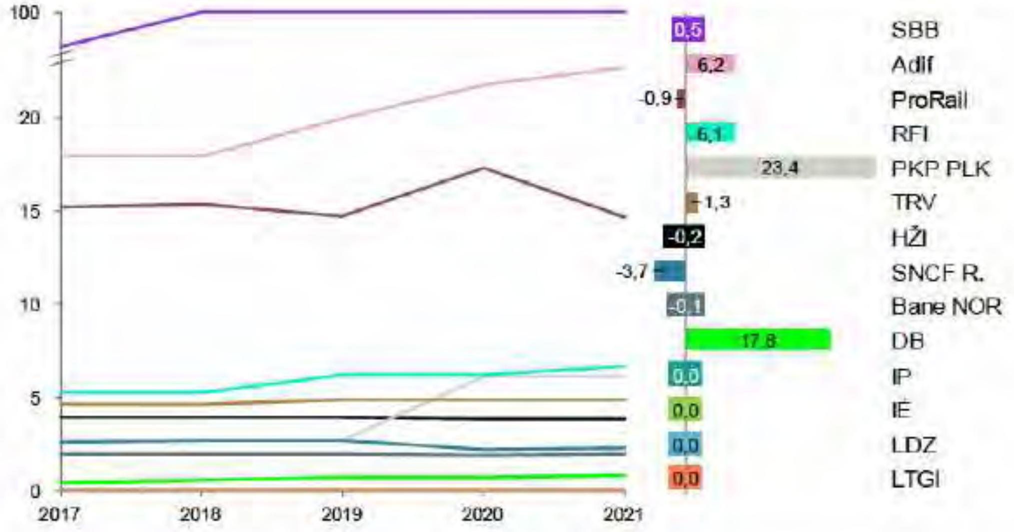

Figure 65: ERTMS track-side deployment (% of main track-km) and CAGR (%) in 2017-2021

The development of ERTMS deployment is visualised in figure 65. The most significant increase can be seen in DB and PKP PLK, which almost doubled their ERTMS-equipped main lines between 2017 and 2021. Adif increased the level of ERTMS equipped lines from 18% in 2017 to almost 23% in 2021. PKP PLK's increase was mainly due to the ETCS Level 2 system on the Warszawa - Gdynia section of the E 65 route being put into operation in 2020.

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.

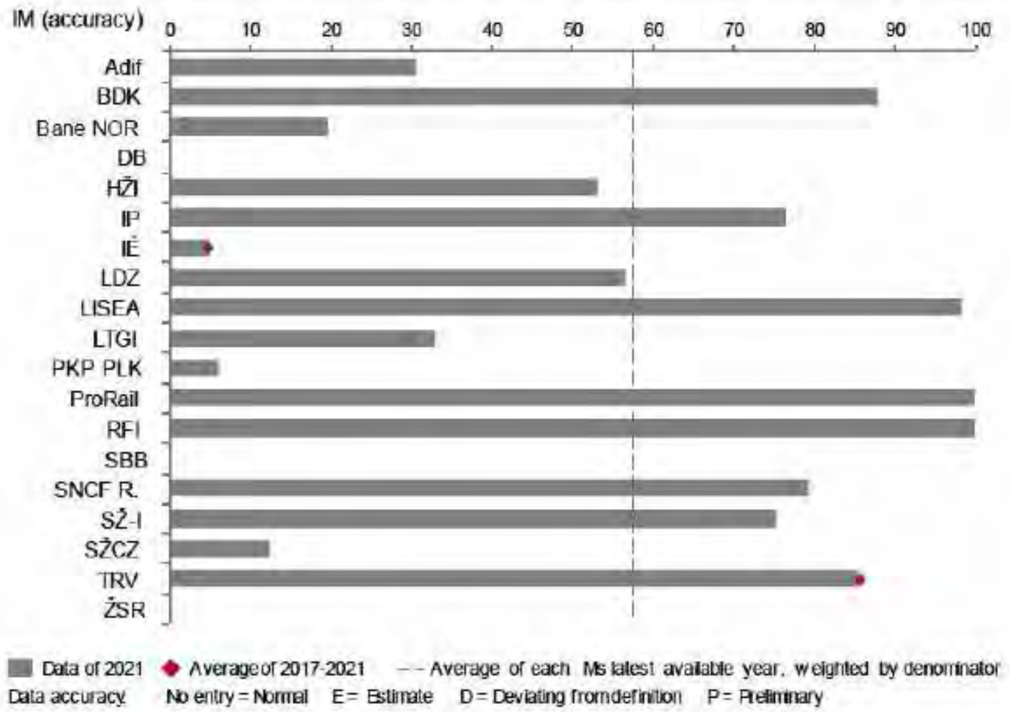

Figure 66: ATP coverage (% of main track-km)

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%.

Despite the fact that 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 have to equip their fleet with ERTMS on-board systems, increase the burden of deployment.

2.6.3 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 area 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.

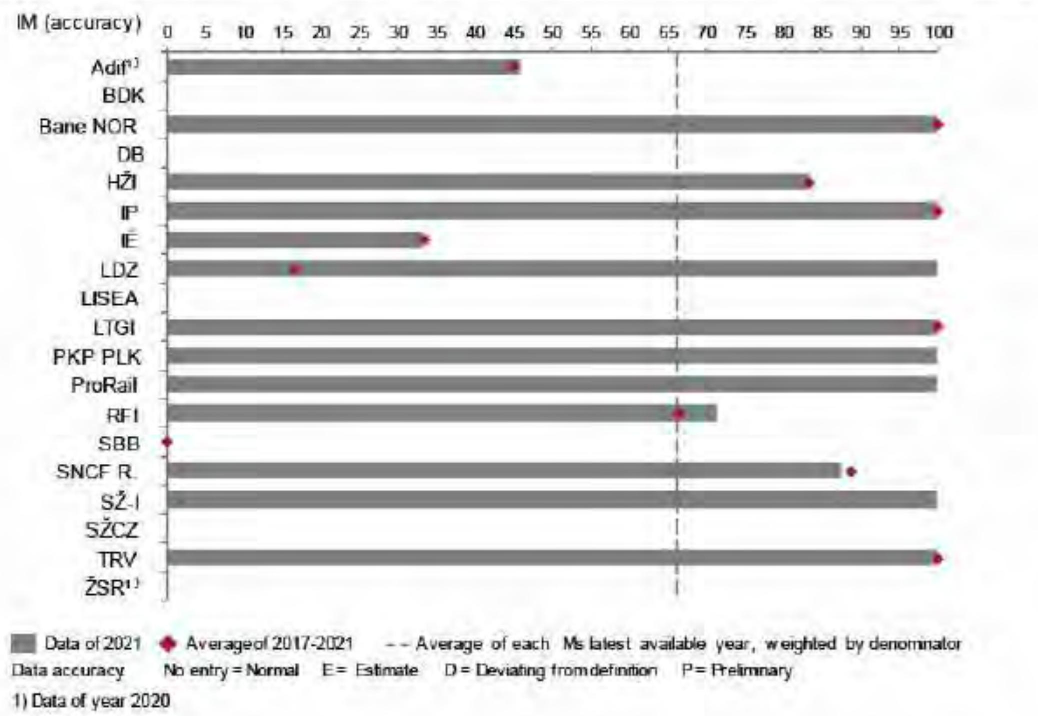

Figure 67: Core maritime ports connection (% of core maritime ports)[59]

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, the majority of core ports are connected to the TEN-T network. Seven infrastructure managers have even connected all core ports to rail.

[59] Zero value: LISEA, SBB, SŽCZ

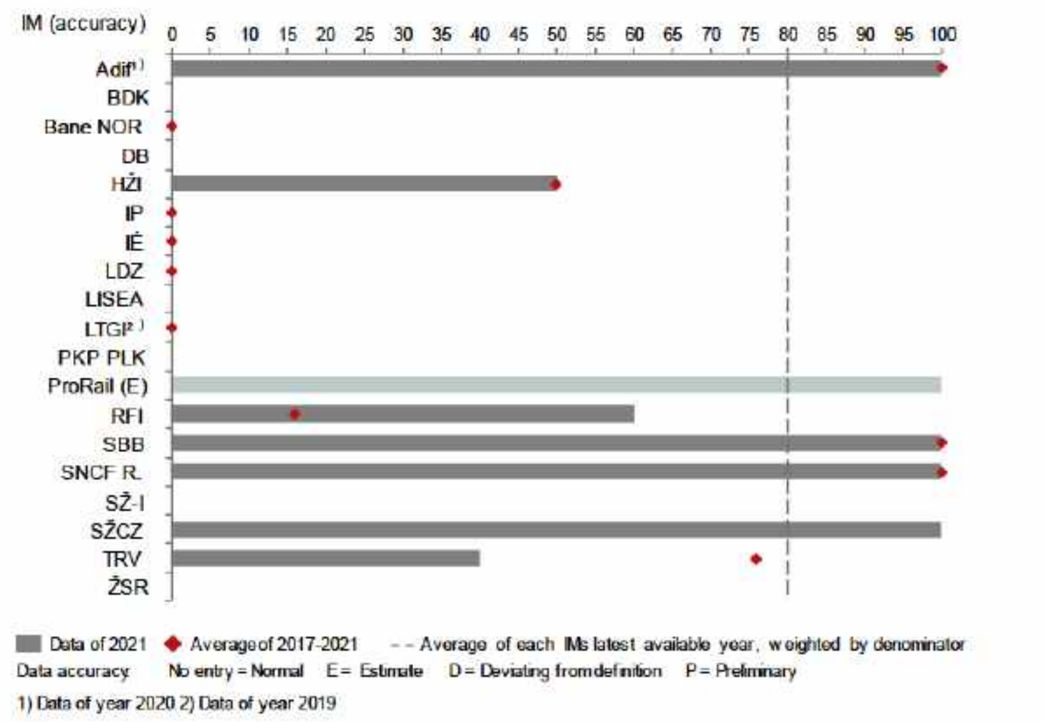

Figure 68: Core inland waterways connection (% of core inland waterways)[60]

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 80%.

[60] Zero value: Bane NOR, IĖ, IP, LISEA, LDZ, PKP PLK, SŽ-I

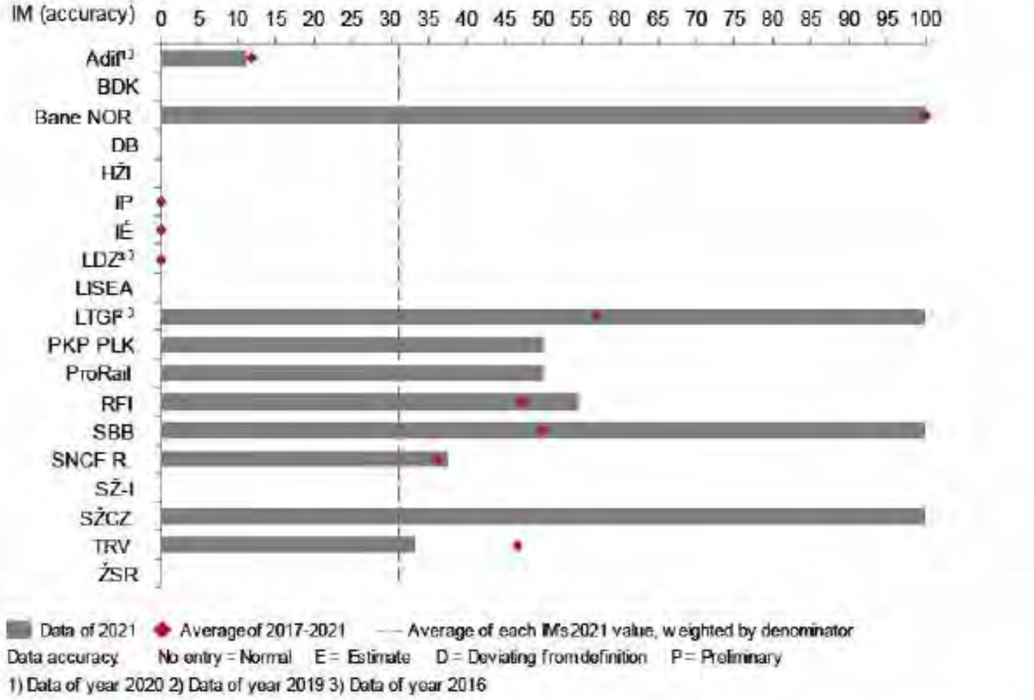

Figure 69: Core airports connection (% of core airports)[61]

Figure 69 shows the connection of TEN-T network to core airports. As it can be seen in the graph the peer group is divided in two parts. Five infrastructure managers have all the core airports connected to the rail network, while four to 50%.

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.

[61] Zero value: HŽI, IÉ, IP, LISEA, SŽ-I

3. Annex

3.1 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.

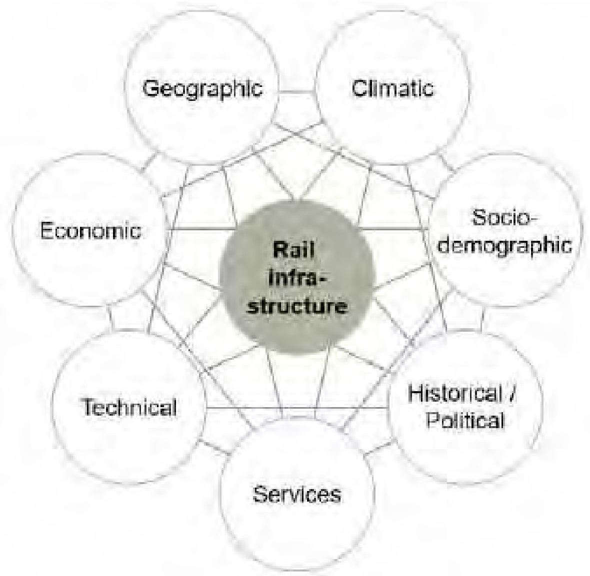

Figure 70: Factors influencing the outcome of rail infrastructure

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 41,000 and 633,000 km² for Switzerland 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[62]. 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

[62] 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 also 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 have to 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 also 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 P, its economic power and connectivity all have a positive impact on passenger and freight transport demand[63]. 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 € 0 million for 202 from the EU’s Cohesion Fund to modernise its rail transport.[64]

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

[64] EC: EU Cohesion policy € 0 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

3.2 Fact sheets of the infrastructure managers

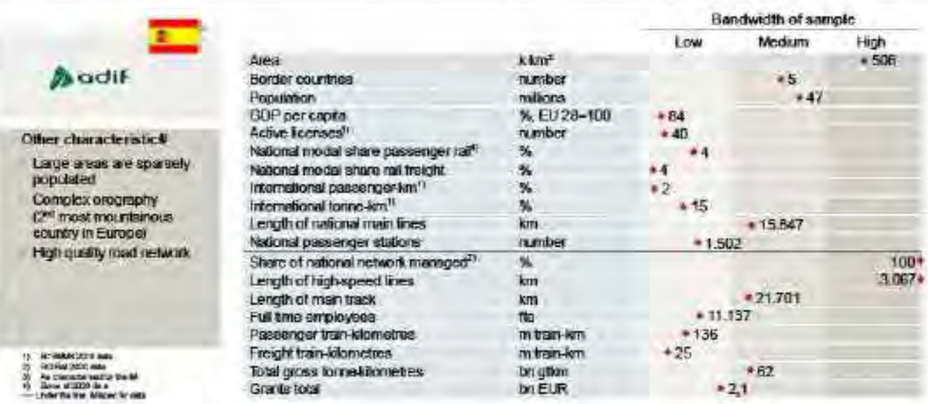

Figure 71: Fact sheet Adif

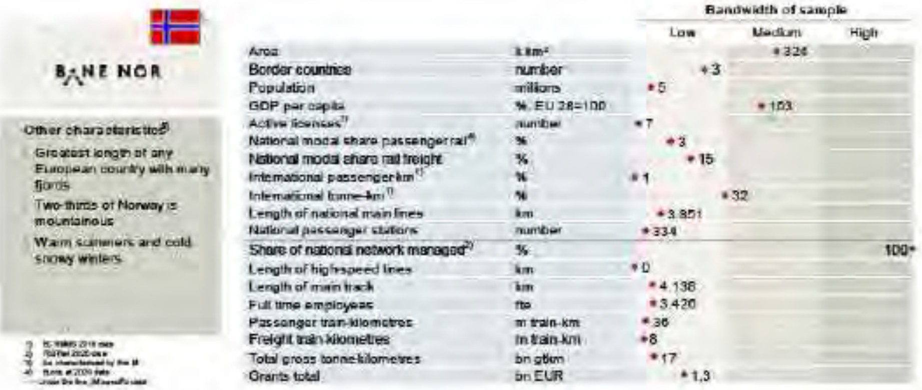

Figure 72: Fact sheet: Bane NOR[65]

Figure 73: Fact sheet: Banedanmark[66]

65 Grants total are normalised for purchasing power parity
66 Grants total are normalised for purchasing power parity

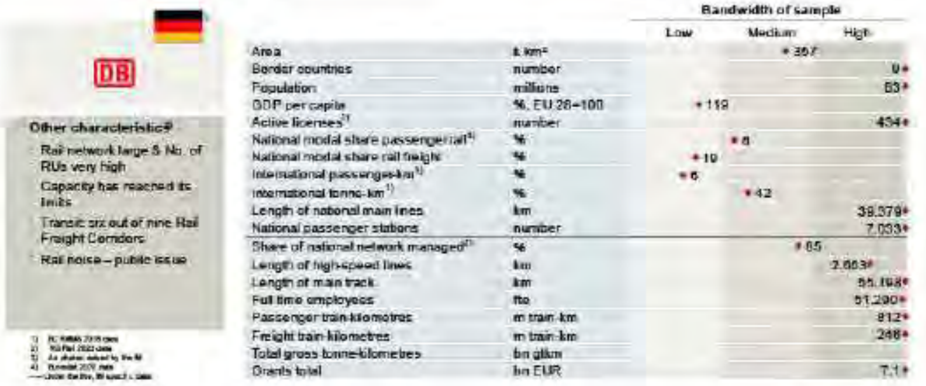

Figure 74: Fact sheet: DB Netz AG[67]

Figure 75: Fact sheet: HŽ Infrastruktura d.o.o. [68]

Figure 76: Fact sheet: Iarnród Éireann – Irish Rail[69]

[67] Grants total are normalised for purchasing power parity
[68] Grants total are normalised for purchasing power parity
[69] Grants total are normalised for purchasing power parity

Other characteristics[4]
- IP manages the Portuguese rail and road infrastructure
- Iberian gauge, 25kV AC overhead line
- Pop (mainland) 9,7m
- Area (mainland) 89 k

		Bandwidth of sample		
		Low	Medium	High
Area	k km²	92		
Border countries	number	1		
Population	millions	10		
GDP per capita	%, EU28=100	74		
Active licenses[1]	number	10		
National modal share passenger rail[4]	%	3		
National modal share rail freight	%	11		
International passenger-km[1]	%	3		
International tonne-km[1]	%	24		
Length of national main lines	km	2.526		
National passenger stations	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	3.687		
Passenger train-kilometres	m train-km	23		
Freight train-kilometres	m train-km	4		
Total gross tonne-kilometres	bn gtkm	7		
Grants total	bn EUR	0,2		

Figure 77: Fact sheet: Infraestruturas de Portugal S.A.[70]

Other characteristics[4]
- Connections with Baltic sea ports
- Transit between East and West

		Bandwidth of sample		
		Low	Medium	High
Area	k km²	65		
Border countries	number		4	
Population	millions	2		
GDP per capita	%, EU28=100	71		
Active licenses[1]	number	8		
National modal share passenger rail[4]	%	3		
National modal share rail freight	%			53
International passenger-km[1]	%	6		
International tonne-km[1]	%			98
Length of national main lines	km	1.859		
National passenger stations	number	143		
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	3.131		
Passenger train-kilometres	m train-km	6		
Freight train-kilometres	m train-km	4		
Total gross tonne-kilometres	bn gtkm	15		
Grants total	bn EUR	0,0		

Figure 78: Fact sheet: Latvijas dzelzceļš[71]

Other characteristics[4]
- Connection between 1435 and 1520 tracks
- Connection with Klaipėda seaport
- High amount of single tracks

		Bandwidth of sample		
		Low	Medium	High
Area	k km²	65		
Border countries	number		4	
Population	millions	3		
GDP per capita	%, EU28=100	88		
Active licenses[1]	number	11		
National modal share passenger rail[4]	%	1		
National modal share rail freight	%			63
International passenger-km[1]	%			
International tonne-km[1]	%			78 28
Length of national main lines	km	1.911		
National passenger stations	number	136		
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	2.982		
Passenger train-kilometres	m train-km	6		
Freight train-kilometres	m train-km	10		
Total gross tonne-kilometres	bn gtkm	30		
Grants total	bn EUR	0,1		

Figure 79: Fact sheet: AB LTG Infra[72]

70 Grants total are normalised for purchasing power parity

71 Grants total are normalised for purchasing power parity

72 Former Lietuvos geležinkeliai and grants are normalised for purchasing power parity

Figure 80: Fact sheet: LISEA[73]

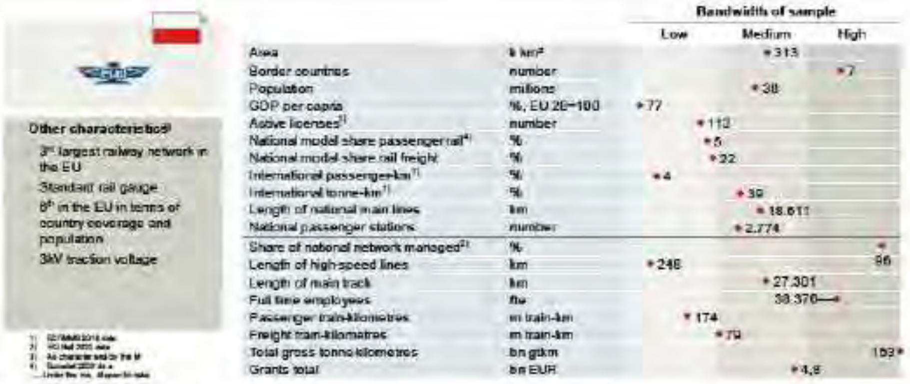

Figure 81: Fact sheet: PKP PLK [74]

Figure 82: Fact sheet: ProRail[75]

73 Grants total are normalised for purchasing power parity

74 Grants total are normalised for purchasing power parity

75 Grants total are normalised for purchasing power parity

Figure 83: Fact sheet: RFI[76]

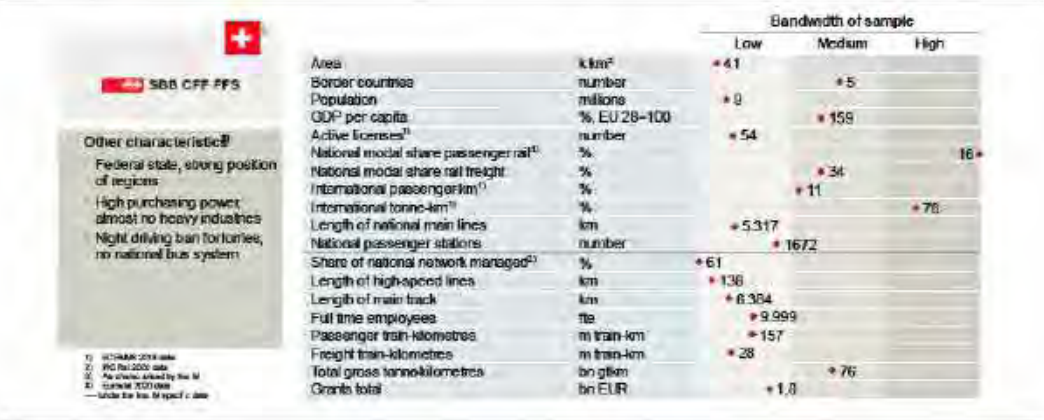

Figure 84: Fact sheet: SBB[77]

Figure 85: Fact sheet: SNCF Réseau[78]

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76 Grants total are normalised for purchasing power parity

77 Grants total are normalised for purchasing power parity

78 Grants total are normalised for purchasing power parity

Figure 86: Správa železnic, státní organizace[79]

Figure 87: Fact sheet: SŽ-Infrastruktura d.o.o.[80]

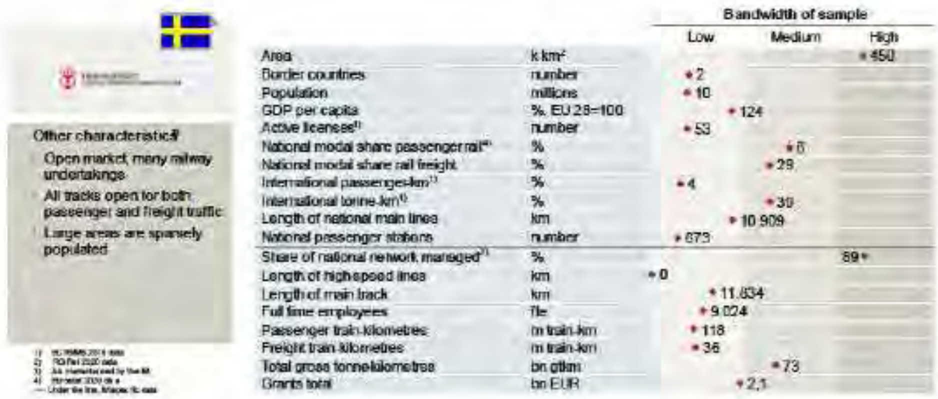

Figure 88: Fact sheet: Trafikverket[81]

[79] Grants total are normalised for purchasing power parity
[80] Grants total are normalised for purchasing power parity
[81] Grants total are normalised for purchasing power parity

Figure 89: Fact sheet: Železnice Slovenskej republiky[82]

[82] Grants total are normalised for purchasing power parity

3.3 Comments on deviations

Page	Indicator name	Input data name[83]	IM[84]	Comment by the IM for 2021
28	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 km are operated on lines with speed <200 km/h
34	OPEX – operational expenditures in relation to network size	Total OPEX - operating expenditures (N)	Adif	Our data does not include financial expenditures as part of OPEX
34	OPEX – operational expenditures in relation to network size	Total OPEX - operating expenditures (N)	DB	without stations
34	OPEX – operational expenditures in relation to network size	Total OPEX - operating expenditures (N)	SNCF R.	According to SNCF R. financial statement under the IFRS standard, financial expenditure is excluded from Operational expenditures.
34	Maintenance expenditures in relation to network size	Total maintenance expenditures (N)	DB	without stations
34	Maintenance expenditures in relation to network size	Total maintenance expenditures (N)	RFI	The data refers only to minimum access package
34	Maintenance expenditures in relation to network size	Total maintenance expenditures (N)	LTGI	Depreciation, traffic management, electricity costs are not included
34	Traffic management expenditures in relation to network size	Total traffic management expenditures (N)	LTGI	Traffic management without depreciation and electricity cost
34	Traffic management expenditures in relation to network size	Total traffic management expenditures (N)	DB	without stations
36	CAPEX – capital expenditures in relation to network size	Total CAPEX - capital expenditures (N)	DB	without stations
36	CAPEX – capital expenditures in relation to network size	Total CAPEX - capital expenditures (N)	SNCF R.	without stations
41	Proportion of TAC in total revenue	Revenues from TAC (N)	LTGI	1) MAP
41	Proportion of TAC in total revenue	Revenues from TAC (N)	DB	without stations
50	Significant accidents	Number of significant accidents (N)	DB	number refers to all IMs in Germany
52	Fatalities and weighted serious injuries	Number of persons seriously injured (N)	DB	number refers to all IMs in Germany
52	Fatalities and weighted serious injuries	Number of persons killed (N)	SBB	Only total of IM employees killed and seriously injured. The 30-day period is not implemented in the system. It is simply determined at the end of the year (key date) how many deaths there were. At the moment, no one keeps a total of all four "categories": travellers, other persons, internal staff and third party staff.

[83] The letters "D" and "N" mark the denominator (D) and nominator (N) of the indicator.

[84] IM = Infrastructure manager

Page	Indicator name	Input data name[63]	IM[64]	Comment by the IM for 2021
53	IM related precursors to accidents	Number of precursors to accidents (N)	DB	number refers to all IMs in Germany
62	Share of renewable traction energy	Share of renewable traction energy (N)	HŽI	Share of energy from renewable sources in Croatia in 2020
69	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 trains threshold is 3' and 10' in Spain.
69	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	DB	Definition: Passenger trains: 0,00 to max. 5,59 minutes
69	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
69	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	SŽCZ	delay of less than or equal to 5:00 minutes (all trains) UIC definition
69	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	RFI	The measuring point is the arrival time of the train
69	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.	Two reasons: 1)we measure punctuality at the last observation point (which can be some kilometres away from the last stop of the train) 2) We do not use UIC's rounding rule #2, our system only allows the use of following rule: 5'59 for passengers transport 15'59 for freight transport
69	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 threshold 5:00
69	Passenger trains punctuality	Number of scheduled passenger trains that operated (D)	Adif	The measuring point is the arrival time of the train
71	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
71	Freight trains punctuality	Freight trains arrived at strategic measuring points with a delay of less than or equal to 15:29 minutes (N)	RFI	The measuring point is the arrival time of the train
71	Freight trains punctuality	Freight trains arrived at strategic measuring points with a delay of less than or equal to 15:29 minutes (N)	SŽCZ	Delay of less than or equal to 5:00 minutes (all trains) UIC definition
71	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.	Two reasons: 1)we measure punctuality at the last observation point (which can be some kilometres away from the last stop of the train)

Page	Indicator name	Input data name[83]	IM[84]	Comment by the IM for 2021
				2) We do not use UIC's rounding rule #2, our system only allows the use of following rule: 5'59 for passengers transport 15'59 for freight transport
71	Freight trains punctuality	Freight trains arrived at strategic measuring points with a delay of less than or equal to 15:29 minutes (N)	ŽSR	Delay threshold 15:00
73	Delay minutes per train caused by the IM	Delay minutes - IM's responsibility (N)	LISEA	less than 05:59
73	Delay minutes per train caused by the IM	Delay minutes - IM's responsibility (N)	SNCF R.	5'59 for passengers transport & 15'59 for freight transport
77	Signalling failures in relation to network size	Total number of signalling failures (N)	DB	KPI according internal measurement system
77	Telecommunication failures in relation to network size	Total number of telecommunication failures (N)	DB	KPI according internal measurement system
82	Tracks with permanent speed restrictions	Track-km with permanent speed restriction (N)	SBB	SBB has no permanent speed restrictions according the definition. "Permanent speed restrictions" are integrated in the annual timetable..

3.4 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.	km

KPI name	KPI Definition	KPI unit
	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.	
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

KPI name	KPI Definition	KPI unit
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
Degree of network 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 passenger train–km per main track-km
Degree of network 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 passenger 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 potential speed of the train, not the actual speed.	Train-km

Finance

KPI name	KPI Definition	KPI unit
OPEX – operational expenditures 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 – capital expenditures in relation	Total IM's annual operational expenditures (net values, excluding value added tax) per main track-km.	Euro per main track-km

KPI name	KPI Definition	KPI unit
to net-work size		
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
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-ac-cess charges in relation to network size	Total infrastructure managers annual reve-nues from non-access charges (e.g. com-mercial letting, advertising, telecoms, but excluding grants or subsidies) related to to-tal main track-km.	Euro per main track-km
Proportion of TAC in total revenue	Percentage of infrastructure managers an-nual TAC revenues (including freight, pas-senger and touristic trains) compared to to-tal revenues.	% of mone-tary value
Maintenance and renewal	Total IMs annual renewal and maintenance expenditures (sum of total IMs annual re-newal 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 net-work size.	Euro per main track-km

KPI name	KPI Definition	KPI unit
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, • Derailment of train, • Level crossing accident, including accident involving pedestrians at level crossing, • Accident to persons involving rolling stock in motion, with the exception of 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.	Number per mil-lion train-km
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.	In number per million train-km

KPI name	KPI Definition	KPI unit
	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.	
Infrastructure manager related precursor to accidents	Relative number of the following types of precursors: • broken rail, • track buckle and track misalignment, • wrong-side signalling 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	% of kWh

KPI name	KPI Definition	KPI unit
	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.	
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 actually 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 actually operating trains
Freight trains punctuality	Percentage of actually 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 actually 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	Minutes per actually operating train

KPI name	KPI Definition	KPI unit
	these thresholds are not exceeded at any measuring point.	
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) 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.	% of main track-km
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

ERMTS 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	% of main track-km

KPI name	KPI Definition	KPI unit
	allowed target speed on all sections of the line. Including e.g. ETCS, ATB, LZB, CBTC and similar systems.	
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

3.5 Individual thresholds of punctuality for national measures

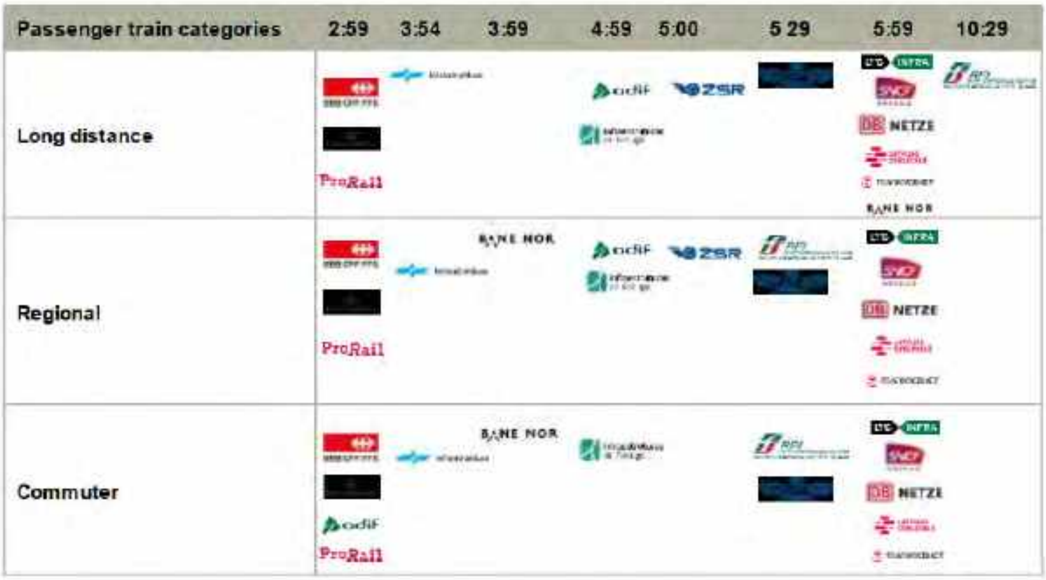

Figure 90: National delay measurement thresholds (in minutes:seconds)[85]

Figure 91: National delay measurement thresholds (in minutes:seconds)

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

3.6 Financial data

	Purchasing power parity (LCU/EUR)				
Country	2017	2018	2019	2020	2021
Croatia	4.7	4.8	4.8	4.8	5.05
Czechia	16.43	17.82	18.19	18.95	18.68
Denmark	10.34	9.83	9.75	9.88	10.58
France	1.07	1.09	1.07	1.09	1.08
Germany	1.04	1.07	1.08	1.12	1.09
Ireland	1.29	1.13	1.16	1.17	1.41
Italy	1.02	0.99	0.98	0.99	1.02
Latvia	0.68	0.71	0.72	0.72	0.75
Lithuania	0.6	0.65	0.66	0.68	0.68
Netherlands	1.15	1.13	1.15	1.16	1.19
Norway	14.67	14.32	14.52	15.01	15.98
Poland	2.28	2.51	2.56	2.67	2.59
Portugal	0.84	0.84	0.83	0.85	0.88
Slovenia	0.83	0.82	0.83	0.83	0.88
Slovakia	0.65	0.69	0.74	0.79	0.82
Spain	0.94	0.91	0.92	0.92	0.97
Sweden	12.96	12.6	12.79	13.12	13.8
Switzerland	1.86	1.68	1.68	1.71	1.91

Figure 92: Purchasing power parity (Index, EU-28=1)

	Average annual exchange rate				
Country	2017	2018	2019	2020	2021
Croatia	7.46	7.42	7.42	7.54	7.53
Czechia	26.33	25.65	25.67	26.46	25.64
Denmark	7.44	7.45	7.47	7.45	7.44
France	1.00	1.00	1.00	1.00	1.00
Germany	1.00	1.00	1.00	1.00	1.00
Ireland	1.00	1.00	1.00	1.00	1.00
Italy	1.00	1.00	1.00	1.00	1.00
Latvia	1.00	1.00	1.00	1.00	1.00
Lithuania	1.00	1.00	1.00	1.00	1.00
Netherlands	1.00	1.00	1.00	1.00	1.00
Norway	9.33	9.60	9.85	10.72	10.16
Poland	4.26	4.26	4.30	4.44	4.57
Portugal	1.00	1.00	1.00	1.00	1.00
Slovenia	1.00	1.00	1.00	1.00	1.00
Slovakia	1.00	1.00	1.00	1.00	1.00
Spain	1.00	1.00	1.00	1.00	1.00
Sweden	9.64	10.26	10.59	10.48	10.15
Switzerland	1.11	1.16	1.11	1.07	1.08

Figure 93: Average annual exchange rate (Local currency unit/Euro)

4. 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, signalling 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 on the whole 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 considered to be 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, with the exception of 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 as a result of operating the train are set out in Commission Implementing Regulation (EU) 2015/909 and can in principle be established on the basis of: (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 on the basis of 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 taken into account. 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 on the basis of 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 signalling 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 on the basis of 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 UICB 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 a distance of 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 $V_{max} \geq 250$ 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 as a result 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, in particular, for establishing, managing and maintaining railway infrastructure, including traffic management and control-command and signalling. 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 respons ble in particular for establishing, managing and maintaining railway infrastructure, including traffic management and control-command and signalling; 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 taken into account. 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 on the basis of Regulation (EU) 2015/1100 (RMMS), Article 2
Killed (Death (killed person))	Any person killed immediately or dying within 30 days as a result 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 rail-way lines)	Railway lines maintained and operated for running trains.	Glossary for transport statistics, A.I-02.1
Main lines (Principle rail-way 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 in order 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 on the basis of 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 signalling, 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 on the basis of 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 a distance of one kilometre. The distance to be taken into consideration should be the distance actually 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 a distance of 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 UCB 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 on the basis of 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 taken into account. 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 on the basis of Regulation (EU) 2015/1100 (RMMS), Article 2
Serious injury (seriously injured person)	Any person injured who was hospitalised for more than 24 hours as a result 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 actually 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 taken into account.	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 on the basis of 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)