PRIME

Platform of Rail Infrastructure Managers in Europe

2019 PRIME Benchmarking report

KPI & Benchmarking Subgroup PRIME

European Commission

civity Management Consultants

Contents

Foreword by PRIME co-chairs

The European Green Deal sets out how to make Europe the first climate-neutral continent by 2050. The European Year of Rail 2021 highlights the important role of rail in reaching this goal. Rail will have to take up a bigger share of the transport system. Rail infrastructure managers work to provide safe, reliable and efficient railway infrastructure for the transport of people and goods. Their contribution will be key in meeting additional capacity needs and creating optimal operating conditions for the provision of attractive rail services. The recent COVID pandemic has had a very heavy economic impact on the sector, which will only become fully visible in the data in next year's report. But the ongoing recovery also offers an opportunity to transform our transport systems and it is good to see that many Member States are making use of funding from the EU Recovery and Resilience Facility to invest in rail.

The KPI subgroup was set up in 2014 with two main objectives: to monitor common trends at the EU level; and to benchmark performance and by so doing to strive for better results. We are pleased that we can share with you the fourth benchmarking report prepared by the PRIME KPI subgroup, covering the years 2012-2019. For the infrastructure managers, benchmarking helps to understand where each organisation stands and where there is potential for improvement. For the European Commission, there is an invaluable opportunity to identify best practice 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 three reports, this edition includes a more complete dataset and one new participant (in total 18). Six infrastructure managers are in the transitional phase to join. Similar to last year's report, this report offers more detailed explanations and contextual information to make the wealth of data more accessible.

We would like to thank the PRIME KPI subgroup chair Rui Coutinho from IP Portugal, as well as 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 that are relevant for their business. The progress on common data definitions and KPIs is documented in the catalogue, which is continuously refined and publicly available on the PRIME website. We will continue to work on making PRIME KPIs more robust, 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 committed to improving its service provision.

PRIME co-chairs

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Director of Land Transport

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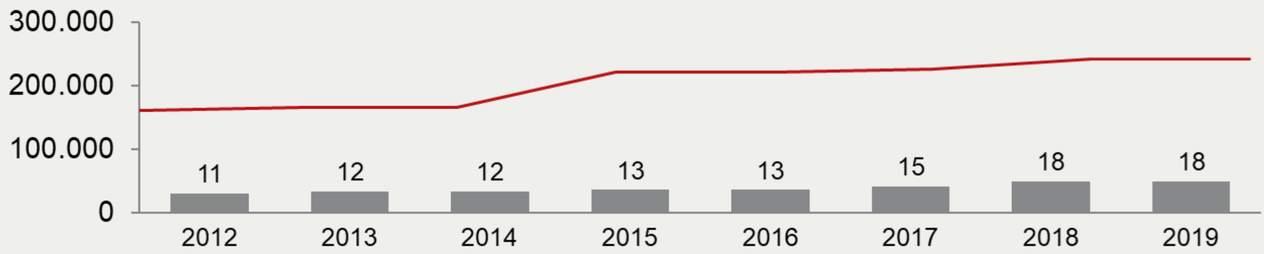
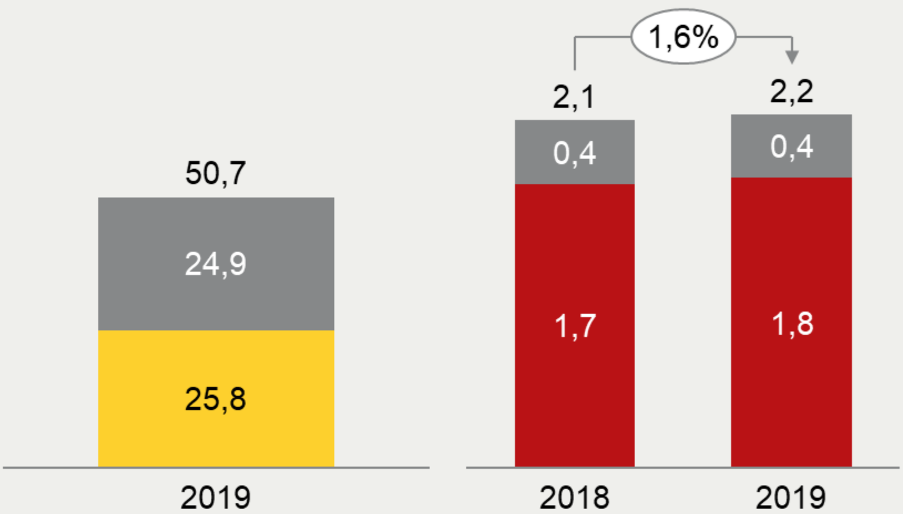
Participants in PRIME KPI Report · PRIME members



Total main track-km · Number of participating infrastructure managers



Total OPEX in billion EUR
Total CAPEX in billion EUR

Total freight in billion train-km
Total passenger in billion train-km

74%	Electrified network
81%	Electricity-powered trains
7%	ERTMS deployment
93%	Passenger trains on time
63%	Freight trains on time
6.665 km	High-speed lines

Introduction

Rail is the backbone of European transportation. It is the safest, greenest mode of land transport and has also proven efficiency in the current COVID-19 pandemic, as rail freight continued to run reliably throughout the pandemic, ensuring supply chains and being more resilient than other modes.

Today, transport accounts for a quarter of the EU's total greenhouse gas emissions, which have increased over recent years. One of the main objectives of the European Green Deal is to reach a 90% reduction in transport emissions by 2050. Rail has an essential role in this transformation, which is why the Commission has set a number of ambitious rail related milestones in the new Sustainable and Smart Mobility Strategy, to be reached by 2050, such as to:

- **Double rail freight** traffic
- **Triple high-speed** rail traffic
- **Complete** the 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 safe, reliable, green, smart, affordable and able to adapt to the changing needs of passengers and industries. This depends on the performance of both rail operators and infrastructure managers. The latter are responsible for developing, maintaining and managing 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, training of track 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[1]. As capacity is limited, and new construction is very costly

[1] 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

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.
- Efficient and foresighted maintenance and construction increases **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. Rail is mostly electrified, with 4 out of 5 trains running on electricity, and represents only 0,4% of CO_2 emissions from all transport modes[2]. Rail has the 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. This is done, for example, by developing high asset management standards and balancing costs, risk and performance as a tool for investment decisions. Governments have a part to play here too. In accordance with EU law[3], 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.

[2] Statistical Pocketbook 2020. https://ec.europa.eu/transport/facts-fundings/statistics/pocketbook-2020_en. and CER launches the Future is Rail campaign - UIC Communications

[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

2020 and most likely also 2021 are going to be difficult years for the rail sector. Transport is 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. Rail infrastructure managers are impacted due to the reduction in traffic and the revenues it generates[4].

As this report covers data up to 2019, it does not yet show the impacts of the pandemic, but is to be considered the last "regular" report in the sense that it shows the industry development before the various distortions of the COVID-19 pandemic. In this respect, this report can be a good data reference to compare developments before and after the pandemic.

More time will be 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.

[4] Opinion of the European Economic and Social Committee (TEN/716-EESC-2020) for the Proposal for a Regulation of the European Parliament and of the Council establishing measures for a sustainable rail market in view of the COVID-19 pandemic [COM(2020) 260 final - 2020/0127 (COD)], Rapporteur-general: Alberto MAZZOLA, Plenary session: 553 - Jul 16, 2020 https://www.eesc.europa.eu/fr/our-work/opinions-information-reports/opinions/proposal-regulation-european-parliament-and-council-establishing-measures-sustainable-rail-market-view-covid-19-pandemic

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[5].

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 2019 data, 23 infrastructure managers have contributed to the report, of which 18 are involved in the external report presented in the table below.

[5] PRIME members: https://webgate.ec.europa.eu/multisite/primeinfrastructure/about-prime/members_en

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
Finnish Transport Infrastructure Agency		FTIA		Finland
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[6]		LTGI		Lithuania
LISEA		LISEA		France
PKP PLK		PKP PLK		Poland
ProRail		ProRail		Netherlands
RFI		RFI		Italy
SBB		SBB		Switzerland
SNCF Réseau		SNCF R.		France
Správa železnic, s.o.		SŽCZ		Czechia
Trafikverket		TRV		Sweden

Table 1: Infrastructure managers participating in the report

[6] Former Lietuvos geležinkeliai

Purpose and empirical methodological approach of the report

The purpose of this 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 on developing a sustainable and competitive infrastructure management which provides high quality services.

In this report the key indicators will each be shown in a benchmark graph and a time series graph, presenting a cross-comparison of infrastructure managers and the key trends. Compared to last year's report, which showed data for 2012-2018, in this year's report the time series covers 2015-2019. **This allows more companies to be presented in the graphs and makes it in perspective 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 the latest available annual data and the average of the available years in 2012-2019 for every individual infrastructure manager, plus the peer group's average weighted by denominator. For example, 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 level 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 showing deviating figures even if they are less comparable is to show a more complete dataset and enable more infrastructure managers to provide data. Deviating figures will prospectively become less with every report.

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. In order to facilitate the interpretation of the figures and the quantitative results, background information on the specific contexts of the infrastructure managers and rail infrastructure is provided for each indicator. Additionally to this, more general information on influencing factors can be found in the Annex 4.1 as well as some macro level data of the infrastructure managers and the countries they are operating in, 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 1 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.

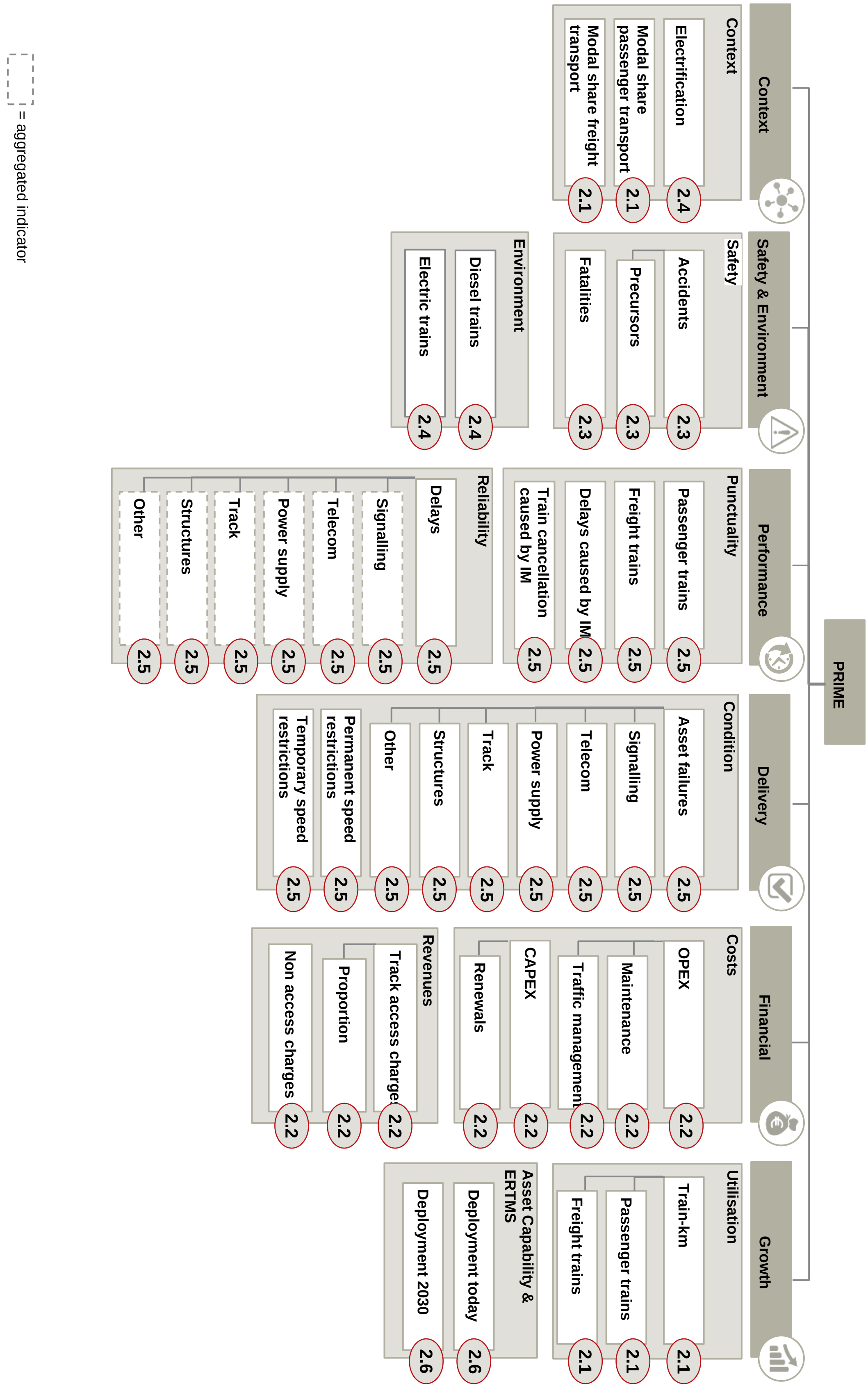


Figure 1: Selected indicators for the report and their chapters in the report

2 Trends and developments

In this core chapter of the report selected indicators regarding finance, safety, environment, performance and delivery, and ERTMS deployment are shown. It aims to give an overview of the development and status quo of the performance of the infrastructure managers.

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, such as to[7]: − Double freight traffic − Triple high-speed traffic − Complete the TEN-T network

[7] 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 network size ranges between 670 and 55.000 main track-kilometres.
- The average density of the peer group's network is 55 main track-kilometres per 1.000 km^2.
- Eight infrastructure managers operate high-speed lines.
- The individual modal share of rail of the peer group has a range between 1% and 19% in passengers and 0,8% and 76% in freight transport.
- In passenger transport the modal share of rail showed a positive development in more than half of the countries.
- In freight transport the modal share of rail decreased 0,2% on average in the peer group.
- The degree of utilisation ranges between 8 and 75 passenger trains and 0,2 and 10 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 nine 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
- Total passenger high-speed main line-kilometres
- Total main line-kilometres
- Degree of network utilisation of passenger trains
- Degree of network utilisation of freight trains

• 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 2 and 5 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 3 and 6 show the national trends of rail in inland passenger and freight modal share development.

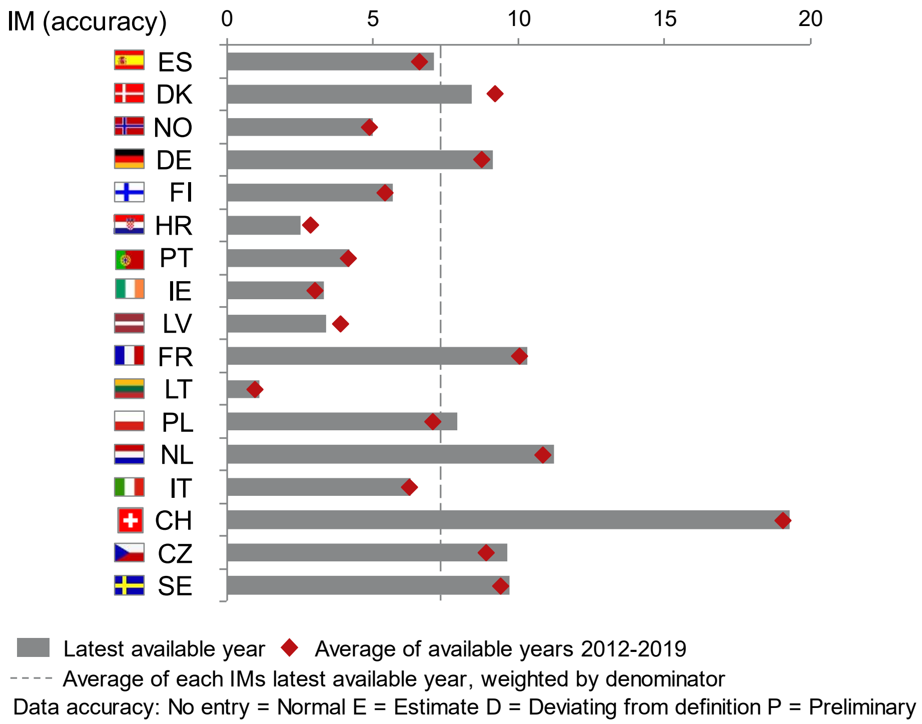


Figure 2: National modal share of rail in inland passenger transport (% of passenger-km)[8]

[8] Source: European Commission, Eurostat/Statistical Pocketbook. Estimated data for 2019 according to 2018 data

Figure 2 shows the cross-comparison of the participating Member States. The range of modal share of rail in inland passenger transport varies widely across the peer group. The highest modal share can be found in Switzerland (19%), while it varies between 1% and 11% in the other countries.

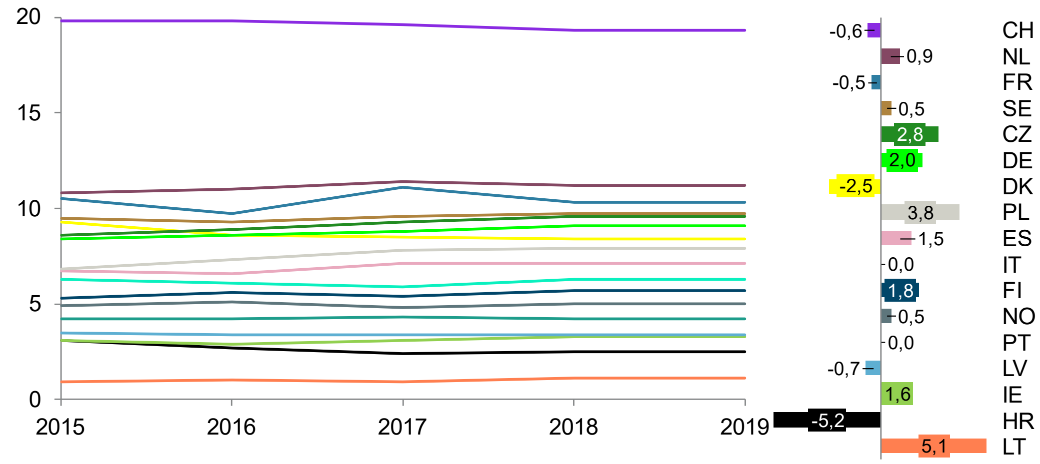


Figure 3: National modal share of rail in inland passenger transport (% of passenger-km) and CAGR (%) in 2015-2019[9]

Between 2015 and 2019 the peer group's modal share of passenger rail transport remained relatively stable, showing only a slight average increase of 0,6%. In two third of the countries the development was stagnating or positive. The highest annual increase in this period was in Lithuania, which however still has the lowest share of passenger rail in the peer group. Other countries with a growth above 2% were Poland, Czechia, and Germany. Frontrunner Switzerland showed a slight reduction of 0,6%.

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 utilisation, most of the cities can be reached in a relatively short time. Additionally, its performance in punctuality and reliability is

[9] Source: European Commission, Eurostat/Statistical Pocketbook. Estimated data for 2019 according to 2018 data

high and the travel comfort and quality of rail service are among the best. Furthermore, it is important to note that Switzerland also has a long-term vision in rail infrastructure development, accompanied with a substantial budget.

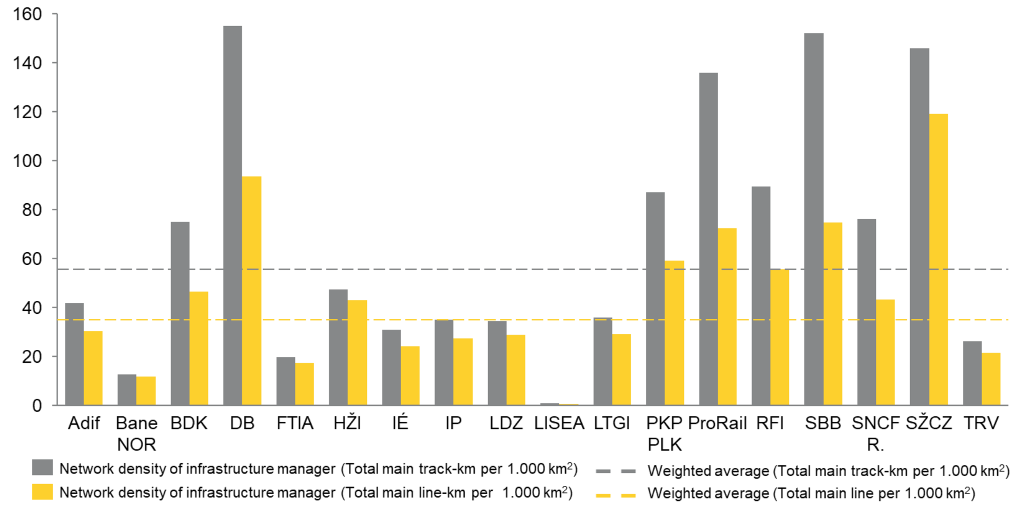


Figure 4: Network density of infrastructure manager (Total main track-km and total main line-km per 1.000 km^2)

Network density of the infrastructure managers is illustrated in figure 4 both measured in main line-kilometres and main track-kilometres. 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.

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.

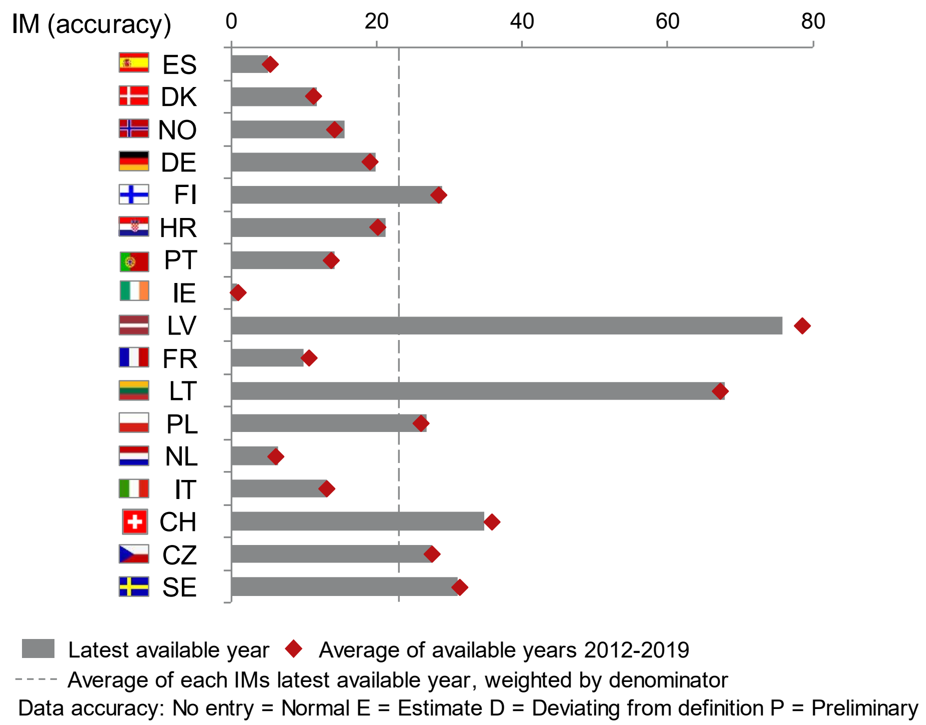


Figure 5: National modal share of rail in inland freight transport (% of tonne-km)[10]

The bandwidth of individual results for freight is more significant to those of passenger transport. However, the pattern is clearer: the share of rail freight in the Baltic countries is significantly higher than in the rest of the EU. In Latvia rail accounts for 76%, and in Lithuania for 68%, of the total inland freight transport. This is followed by Switzerland and Sweden with 35% and 31%. The peer group's average is 23%, all figures rounded.

[10] Source: European Commission, Eurostat/Statistical Pocketbook. Estimated data for 2019 according to 2018 data

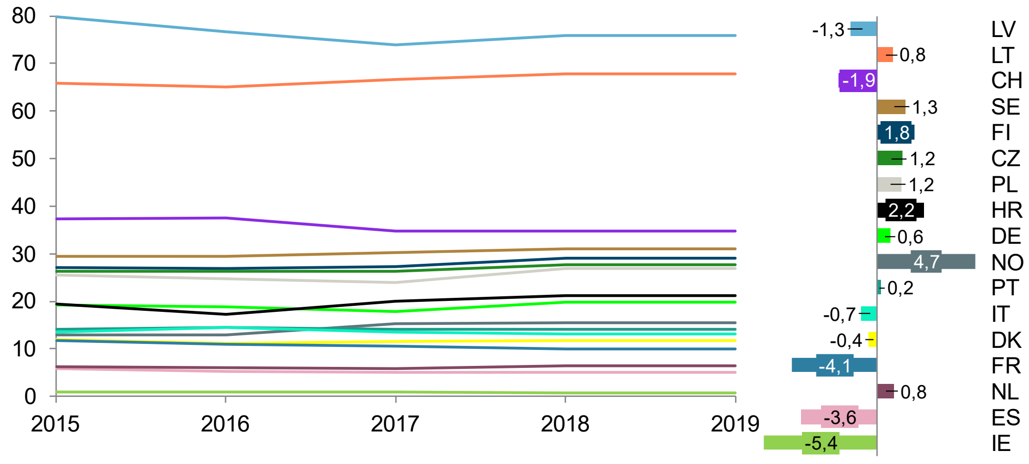


Figure 6: National modal share of rail in inland freight transport (% of tonne-km) and CAGR (%) in 2015-2019[11]

Figure 6 shows the national modal share development in rail freight transport. Compared to the slight increase in the modal share of passenger rail, freight transportation shows a slight reduction of 0,2% on average, with losses incurred in 7 countries. Considering the objective of doubling rail freight by 2050 set in the Sustainable and Smart Mobility Strategy, these trends are rather disappointing.

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[12]. 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 are also among the countries with higher levels of freight activity. Switzerland, however, has almost no heavy industry but shows a relatively high rail freight share. One explanation could be the Swiss ban on night-time trucking, its general rail-friendly transport policy and its strategic position in Europe.

Macro-economic aspects, such as trade relations and the organisation of the logistics sector of a country, 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 transhipment points such as ports and airports, are equally important. The growth of e-commerce and the associated change in the

[11] Source: European Commission, Eurostat/Statistical Pocketbook. Estimated data for 2019 according to 2018 data

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

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[13].

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. Figure 7 and 9 show the benchmark and figure 8 and 10 the development of the network in main track-km and high-speed main line for selected infrastructure managers.

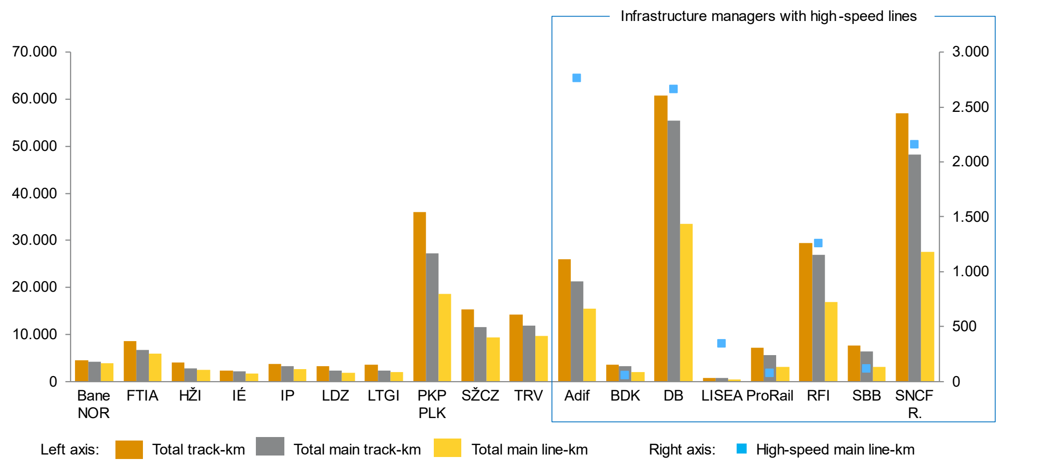


Figure 7: Total track-km, Total main track-km, Total main line-km and Total high-speed main line-km[14]

[13] 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

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

Figure 7 shows the benchmark of the network in the different units of measurement. Infrastructure managers with high-speed lines are circled on the right. 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[15] 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 more than 60.000 kilometres of track. The smallest networks considering track size are operated by LISEA, IÉ and LDZ, 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.

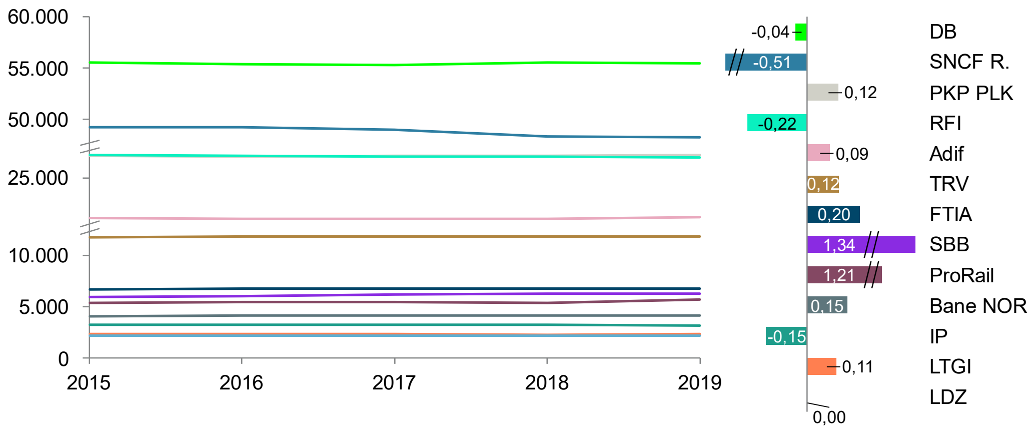


Figure 8: Total main track-km and CAGR (%) in 2015-2019

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. However, a more significant annual average increase in total main track kilometres can be observed at ProRail and SBB, both increasing their network size by almost 250 kilometres. In the case of ProRail, however, this can mainly be explained by its takeover of KeyRail.

[15] 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.

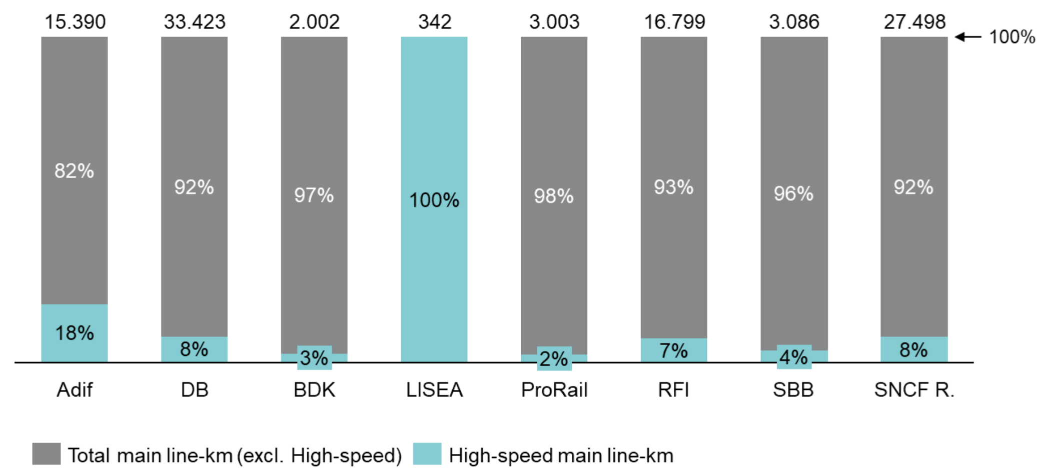


Figure 9: Share of total high-speed main line-kilometres (in % of total main line-km)

Figure 9 shows selected infrastructure managers which also operate a high-speed line and their share of the total main line. High-speed lines are defined as a whole or part of lines, approved for 250 km/h or more, which are:

- 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.[16]

Eight infrastructure managers have high-speed main lines ranging between 2760 kilometres for Adif and 57 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.

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

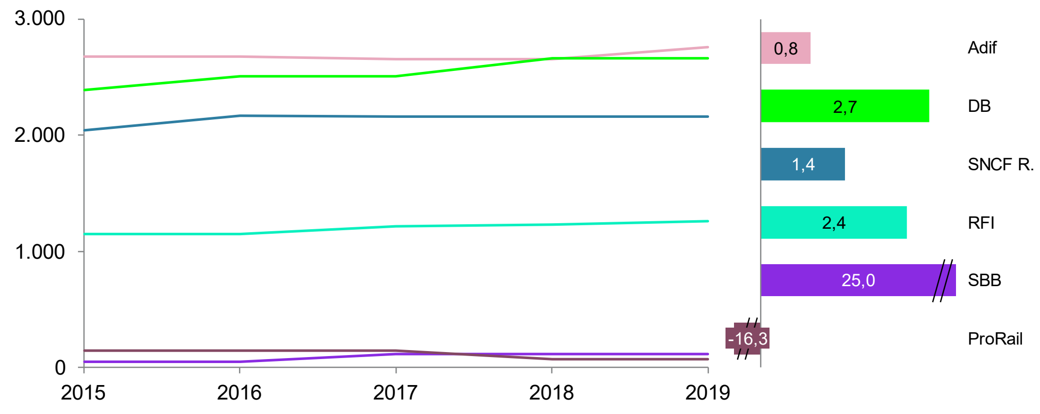


Figure 10: Total high-speed main line-kilometre and CAGR (%) in 2015-2019

Figure 10 shows the development of high-speed network of the relevant infrastructure managers. Five infrastructure managers increased the length of their high-speed lines between 2015 and 2019. SBB more than doubled its high-speed network compared to 2015 mainly with the opening of the Gotthard Base Tunnel in December 2016 through the Alps.

It is not surprising that the size of a network is strongly correlated 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. In particular where high-speed rail services can be linked to form an attractive alternative to long distance flights (e.g. Paris, Frankfurt, Amsterdam), this could not only reduce CO2 emissions compared to short-haul feeder flights, but also free up scarce airport capacity and avoid maintaining unprofitable air routes.

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

Network utilisation

Utilisation is an essential measure of the performance of an infrastructure manager. One of the most important objectives is to use its infrastructure as effectively as possible. Figure 10 presents the aggregated benchmark of the degree of network utilisation by passenger and freight trains. Figures 12 and 13 show the development chart of these indicators.

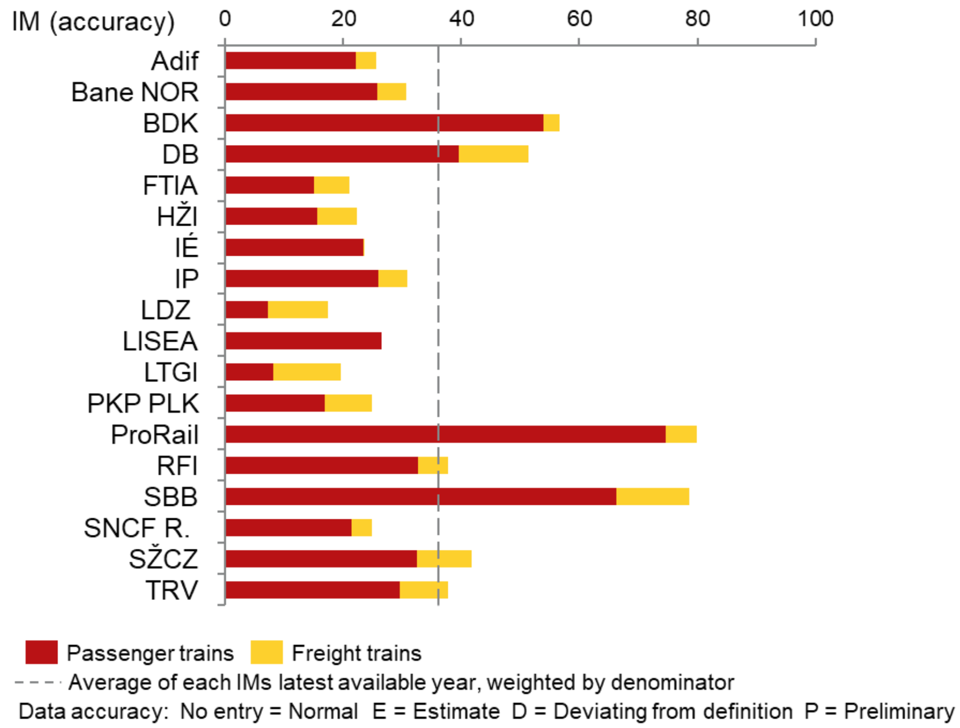


Figure 11: Degree of network utilisation –all trains (Daily train-km per main track-km)

Figure 11 illustrates the network utilisation of both passenger and freight trains. Marked with red colour the intensity of network use of passenger trains ranges from 7 to 75 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.

Utilisation of freight trains is marked with yellow colour and reflects the results seen in the modal share for freight transport in the Baltic countries. With more than 11 freight trains per day running on each kilometre of main track of LDZ's and LTGI's network, the intensity of use in the two Baltic networks is among the highest in the peer group. Only SBB and DB show higher utilisation, with 12 freight trains per day. With reference to non-freight train activity LISEA is a special case, as its network is 100% high-speed which does not allow freight trains.

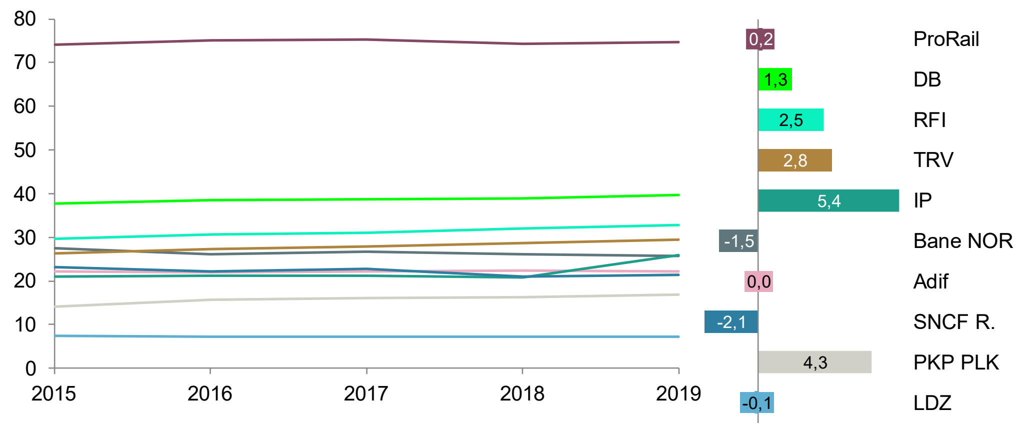


Figure 12: Degree of network utilisation – passenger trains (Daily passenger train-km per main track-km) and CAGR (%) in 2015-2019

As it can be seen in the figure above passenger train utilisation increased slightly over the years. The individual growth rates range between -2,1% and +5,4% per year, with IP showing the highest increase in passenger train activity on its network. Three infrastructure managers show a decrease in passenger train utilisation.

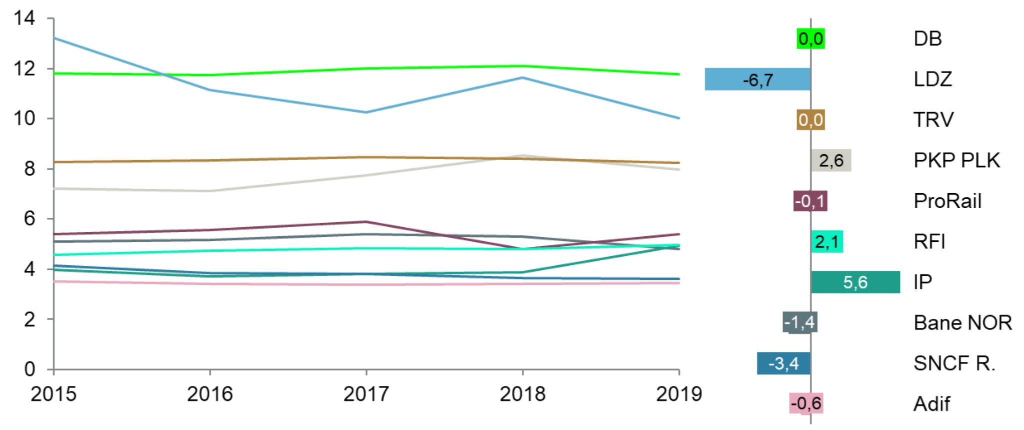


Figure 13: Degree of network utilisation – freight trains (Daily freight train-km per main track-km) and CAGR (%) in 2015-2019

The volatility of the degree of network utilisation with reference to freight trains is slightly higher than for passenger trains. Freight train activity decreased in five infrastructure managers, increased in three and remained stable in two infrastructure managers. Similarly, the highest annual growth of passenger train activity can be seen at IP, which increased the degree of utilisation by an annual average of 5,6%. LDZ shows a significant decline in freight train activity. The main 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. 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.

It is visible that – with the exception of DB – passenger train utilisation is 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, while 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 transhipments 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 so that EU funding and other policies, including R&I support, be geared better towards addressing these issues[17]. 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.

[17] 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[18], 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.

[18] 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 € 40.000 – 221.000 per main track-kilometre per year and remained relatively stable in 2015-2019.
- The range of capital expenditures varies between € 0 – 255.000 per main track-kilometre per year and show a higher fluctuation in 2015-2019.
- TAC revenues vary between €0,3 – €35, showing an average of €4,7 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 three indicators measuring revenues:

- Costs:
  - Operational expenditures
  - Capital expenditures
  - Maintenance expenditures
  - Renewal expenditures
- Revenues:
  - Proportion of TAC in total revenue
  - Track access charges
  - Non-access charges

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 are related to main track-kilometres.

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 14 to 18 show the operational and capital expenditures of the PRIME members in a latest benchmark and over the time period 2015-2019.

Operational expenditure

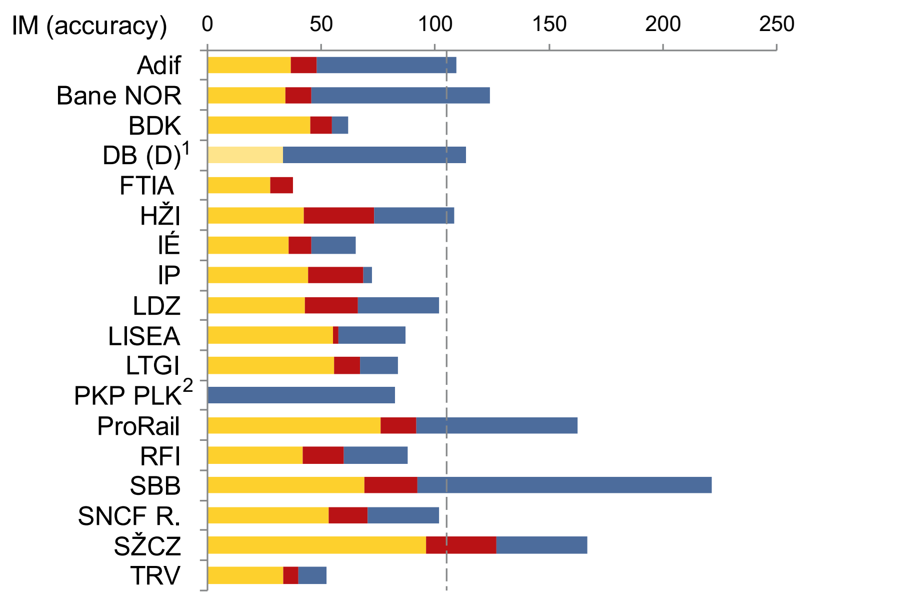


Figure 14: Composition of operational expenditure in relation to network size (1.000 Euro per main track-km)[19]

[19] 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 14 shows the composition and the level of operational expenditures in 2019. The level of operational expenditures varies between €40.000 – €221.000 per main track-kilometre per year and shows an overall dispersion of values of €45.000. SBB spent more than twice the amount compared to the peer group average, but this is due to the high residual OPEX which is 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 25 as counterpart: total revenues from non-access charges). On average, infrastructure managers' annual operational expenditures amount to €103.000 per main track-kilometre. The lighter colour of DB indicates deviating data for maintenance, which is explained in the Annex 4.3.

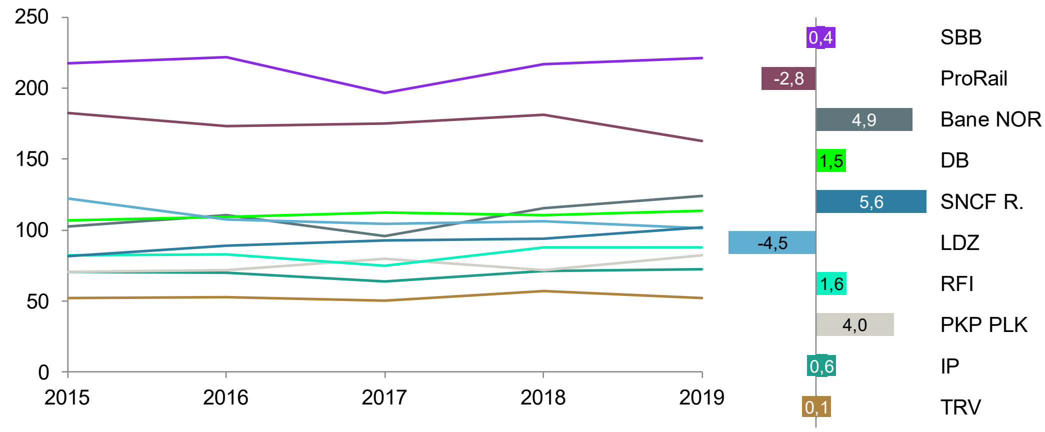


Figure 15: Operational expenditures in relation to network size (1.000 Euro per main track-km) and CAGR (%) in 2015-2019[20]

As can be seen in figure 15, the expenditure across the peer group remained relatively stable over the period. However, some infrastructure managers like SNCF R., Bane NOR, PKP PLK experienced more or less constant annual increases. In contrast, LDZ's and ProRail's operational expenditures decreased over the period.

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

[20] Results are normalised for purchasing power parity.

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.

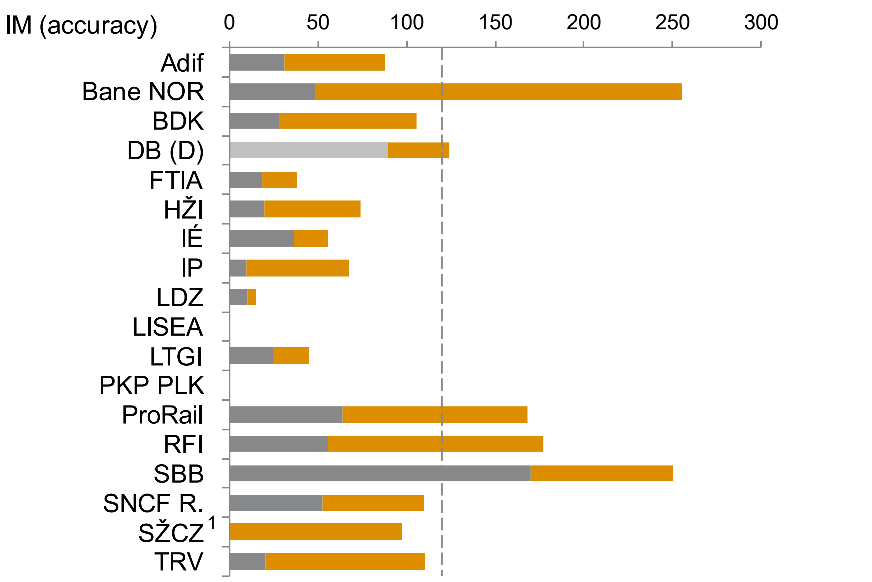


Figure 16: Composition of capital expenditures in relation to network size (1.000 Euro per main track-km)[21]

[21] Results are normalised for purchasing power parity.

As shown in figure 16 the range of annual capital expenditures varies between €0 – 255.000 per main track-kilometre. It also shows the composition of renewals and enhancements, investments & other capital expenditures. On average €121.000 per main track-kilometre and year are spent on capital expenditures. The standard deviation in the peer group is €73.000, expectedly higher than for OPEX. The highest value for renewals at SBB is mainly due to forced maintenance[22] as well as the intensive development of the railway by the federal government. LISEA's capital expenditure is zero as its infrastructure is fairly new. The lighter colour of DB indicates deviating data for renewals, which is explained in the Annex 4.3.

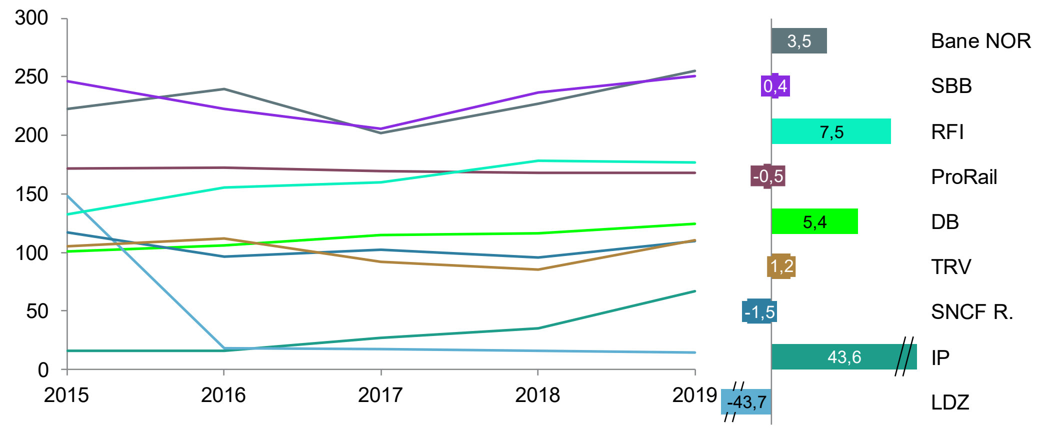


Figure 17: Capital expenditures in relation to network size (1.000 Euro per main track-km) and CAGR (%) in 2015-2019[23]

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 -43,7% to 43,6%. The highest increase in investment-related expenditure has been recorded at IP spending almost five times as much in 2019 as in 2015. IP is undertaking a relevant investment in 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

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

[22] "Forced maintanance" refers to maintenance acting on regulations.

[23] Results are normalised for purchasing power parity.

assets increase the cost of renewals. Network complexity, in turn, might partly be owed to 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 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

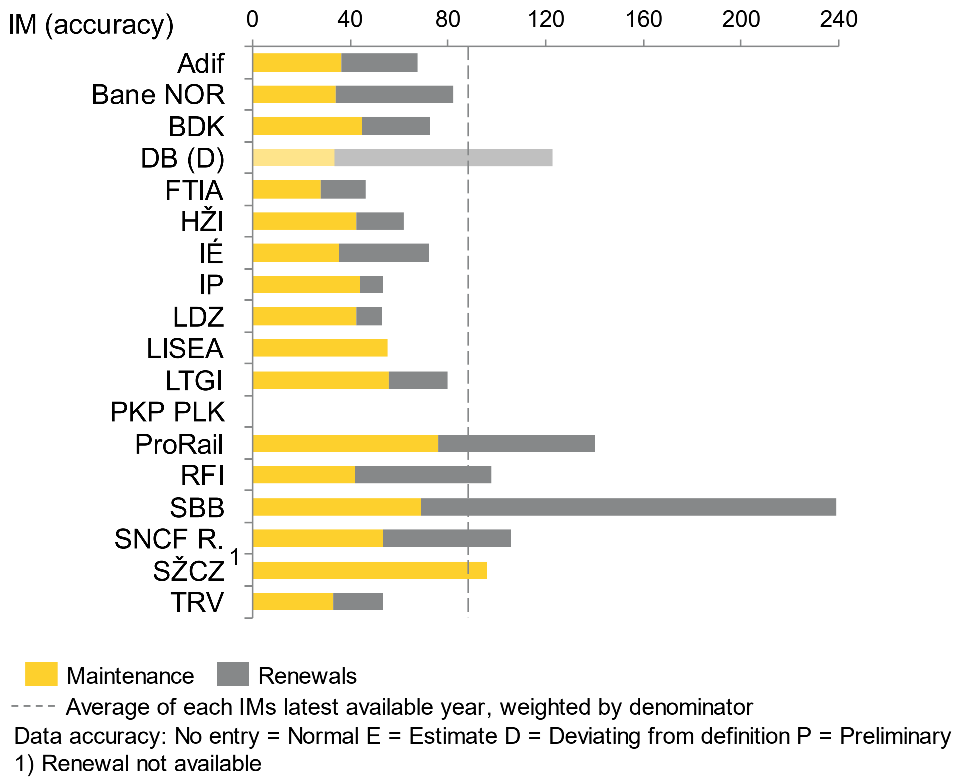


Figure 18: Maintenance (component of OPEX) and renewal expenditures (component of CAPEX) in relation to network size (1.000 Euro per main track-km)[24]

Figure 18 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 significantly spending more than average, namely SBB, ProRail and DB. The different spread of OPEX and CAPEX can also be seen here: while maintenance shows a standard deviation of €18.000, renewals have a spread in data distribution of €41.000.

[24] 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.

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.

Revenues

This category provides an overview of track access charges which are 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 provide an indication to what extent infrastructure managers are capable of covering their costs, respective to what extent they rely on subsides.

Figures 19, 21 and 22 show the latest benchmark of the revenue indicators of between the infrastructure managers. The development over the time period 2015-2019 is presented in figures 20, 23 and 24.

TAC - Track access charges

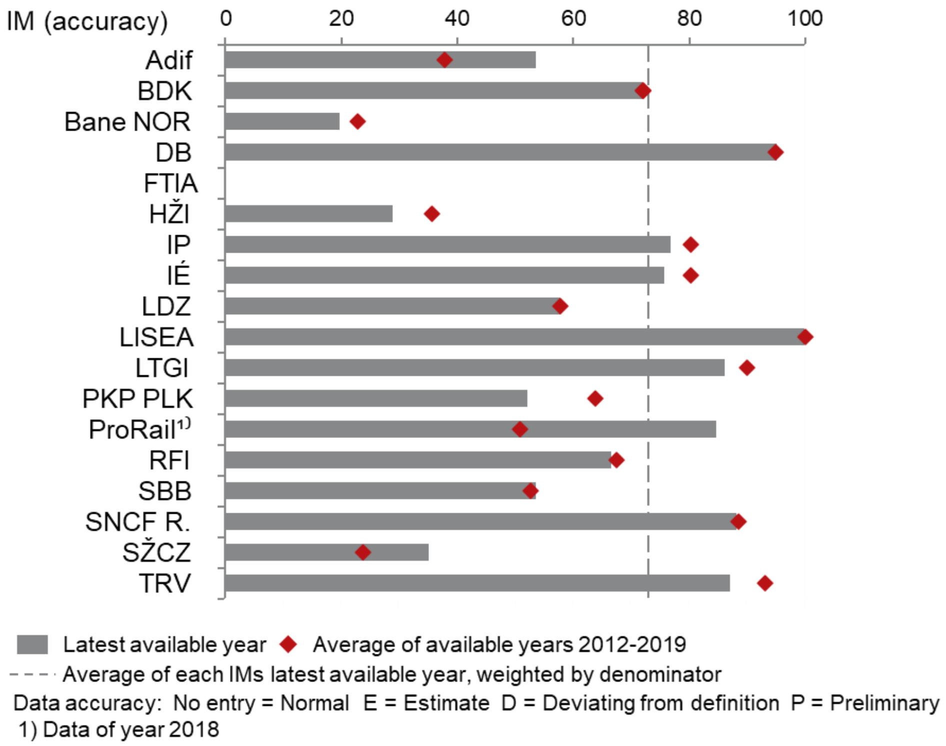


Figure 19: Proportion of TAC in revenue (% of monetary value)

For five infrastructure managers the share of track access charges of total revenues is above 80%. LISEA generates all its revenues from track access charges. The peer group's average is 74%, however for Bane NOR, HŽI and SŽCZ the relevant share is only 20%, 29% and 35%.

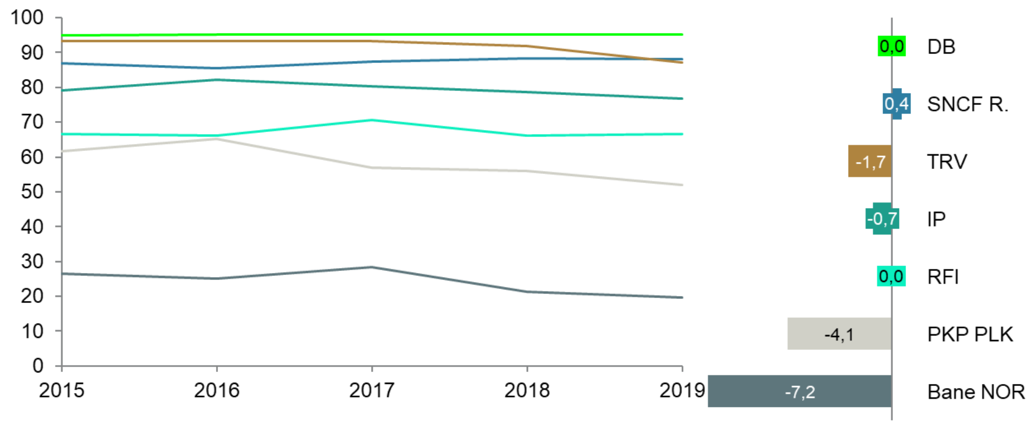


Figure 20: Proportion of TAC in revenue (% of monetary value) and CAGR (%) in 2015-2019

The proportion of revenues from track access charges remained relatively stable across the peer group. Only Bane NOR faced a more significant decline, where the proportion of TAC revenues decreased from 27% in 2015 to 20% in 2012.

Figure 21 and 22 illustrate the revenues per track-kilometre generated by infrastructure managers to cover the cost of the network in relation to its network and its traffic volume.

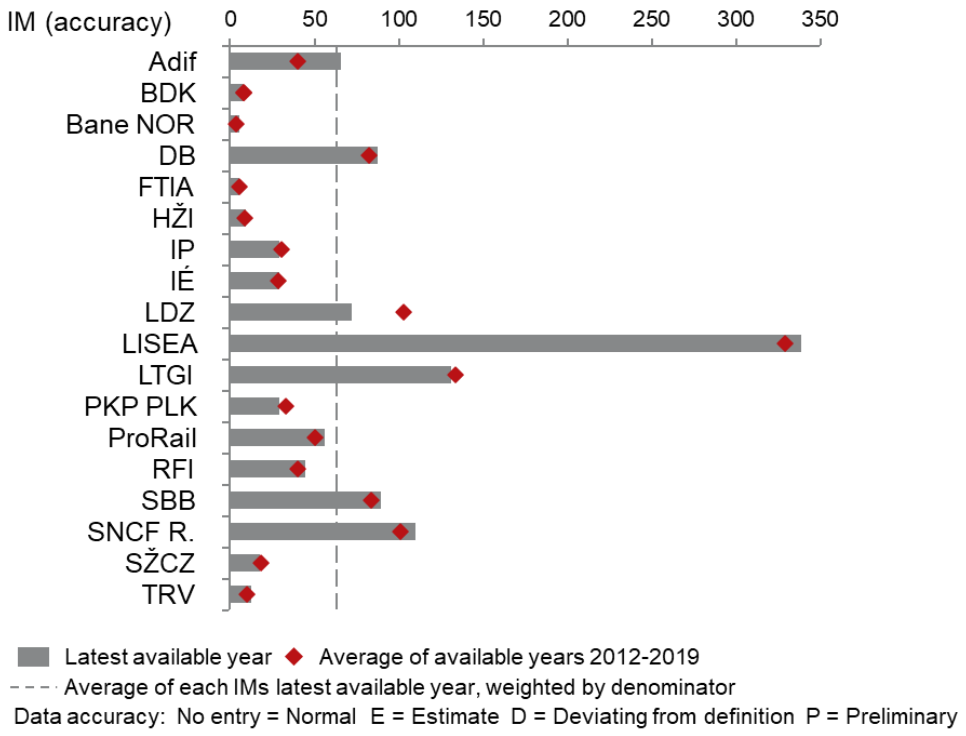


Figure 21: TAC revenue in relation to network size (1.000 Euro per main track-km) [25]

[25] Results are normalised for purchasing power parity.

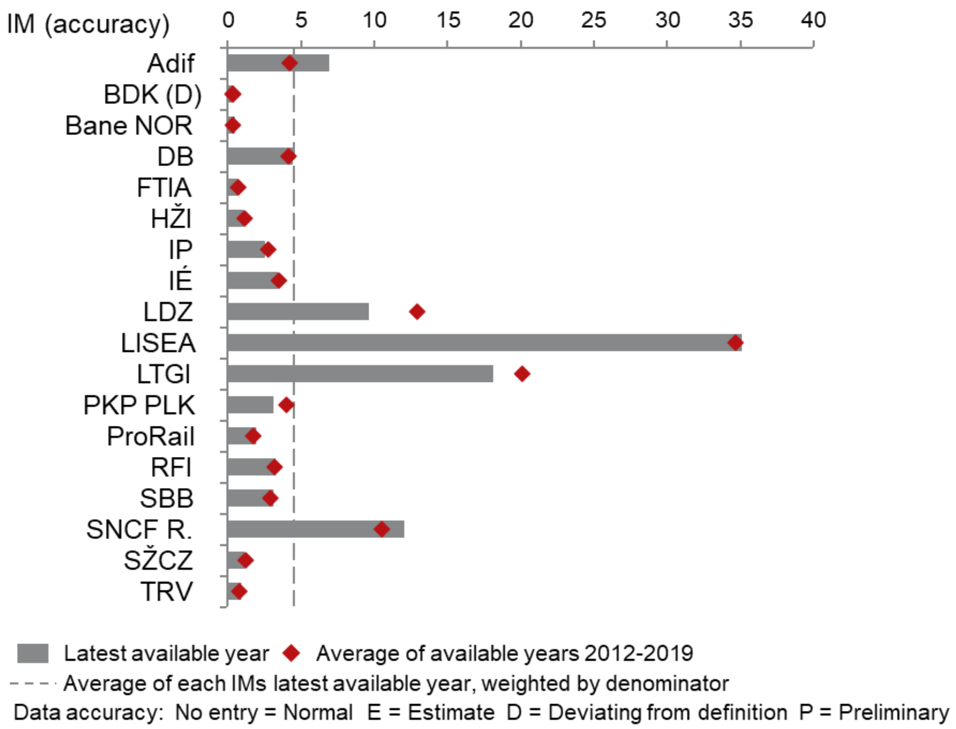


Figure 22: TAC revenue in relation to traffic volume (Euro per total train-km) [26]

Figure 22 illustrates the revenues per track-kilometre and figure 23 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. DB'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 – €338.000 per main track-kilometre per year and has a peer group average of €65.000 and a standard deviation of €78.000. In relation to traffic volume TAC revenues varies between €0,3 – €35, showing an average of €4,7. 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.

[26] 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.

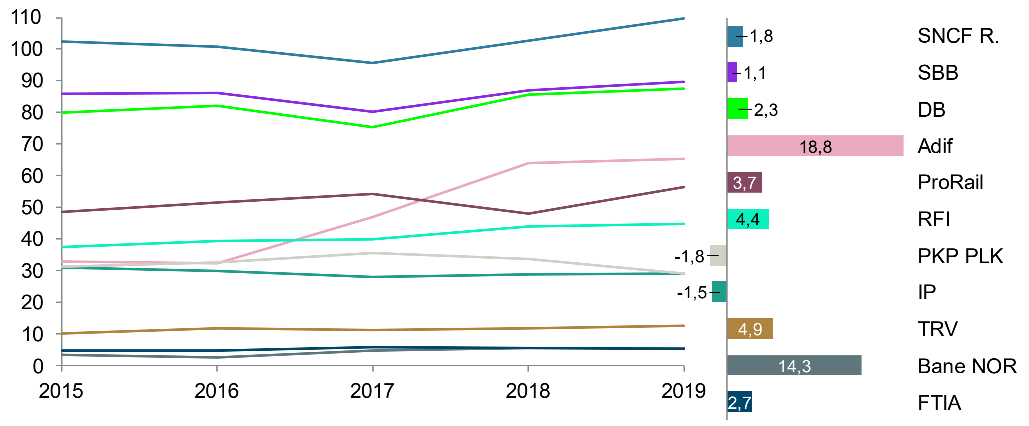


Figure 23: TAC revenue in relation to network size (1.000 Euro per main track-km) and CAGR (%) in 2015-2019[27]

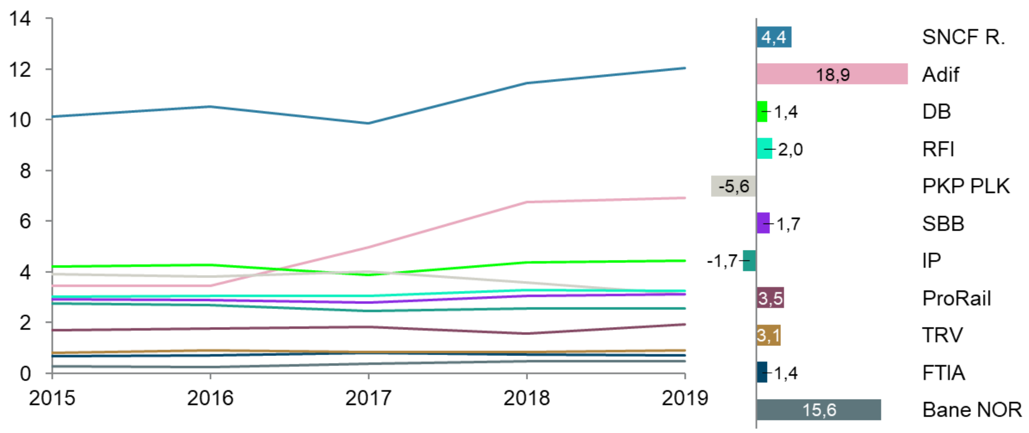


Figure 24: TAC revenue in relation to traffic volume (Euro total train-km) and CAGR (%) in 2015-2019[28]

Figure 23 and 24 illustrates the development of revenues per track-kilometre and train-kilometre generated by infrastructure managers to cover the cost of the network. Between 2015 and 2019 the majority of the peer group members increased their TAC revenues. The highest increase can be seen at Adif (18,9%), however this development is partly the result of a change of the TAC system in 2017[29].

[27] Results are normalised for purchasing power parity.
[28] Results are normalised for purchasing power parity.
[29] Data estimated from the official P&L and balance sheet of Adif and Adif AV (two different infra managers and legal entities).

Non-access charges

Revenues from non-access charges may include revenues from service facilities and other services for operators, commercial letting, advertising, and telecommunication services, but exclude grants and subsidies. The growing importance of third-party financing in the transportation sector is also reflected by the development of the PRIME members.

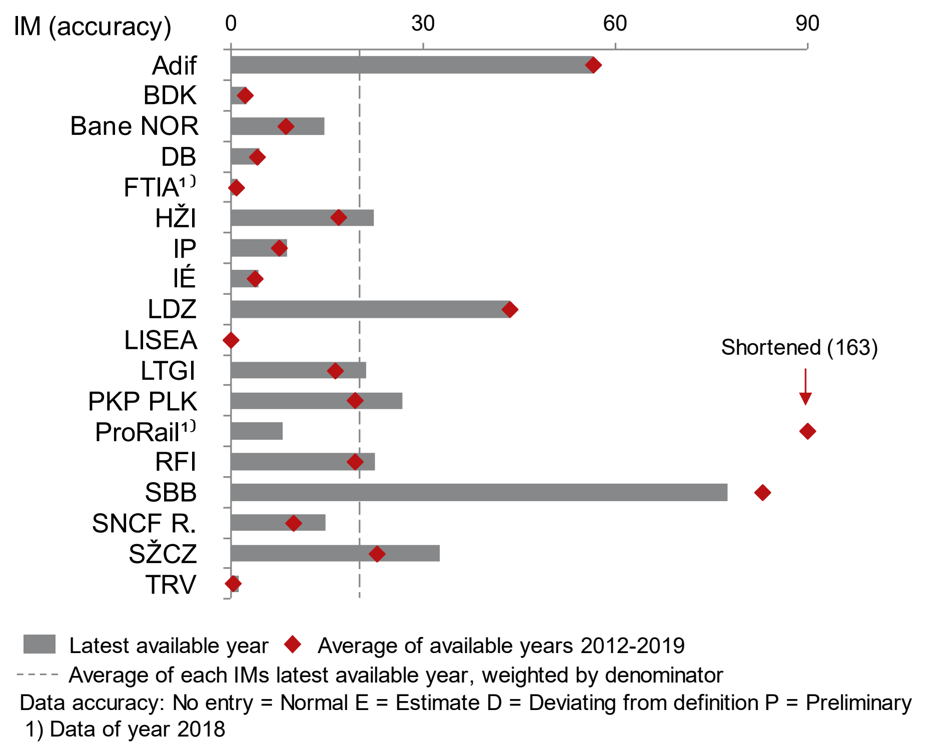


Figure 25: Total revenues from non-access charges in relation to network size (1.000 Euro per main track-km) [30]

The annual peer group's average is €20.000 per main track-kilometre. Six infrastructure managers have revenues from non-access charges of less than €10.000 per main track kilometre, among which LISEA has zero non-access charges revenues. The €80.000 generated by SBB are far above the average and stem from providing goods (e.g. traction current, switches) and services (e.g. use of IT tools, project management) to other infrastructure managers in Switzerland (See fig. 14 for the comparatively high financial importance of activities related to residual OPEX.).

[30] Results are normalised for purchasing power parity.
Axis is shortened due for readability. ProRails high value for the available years' average is due to a definition change in 2015.

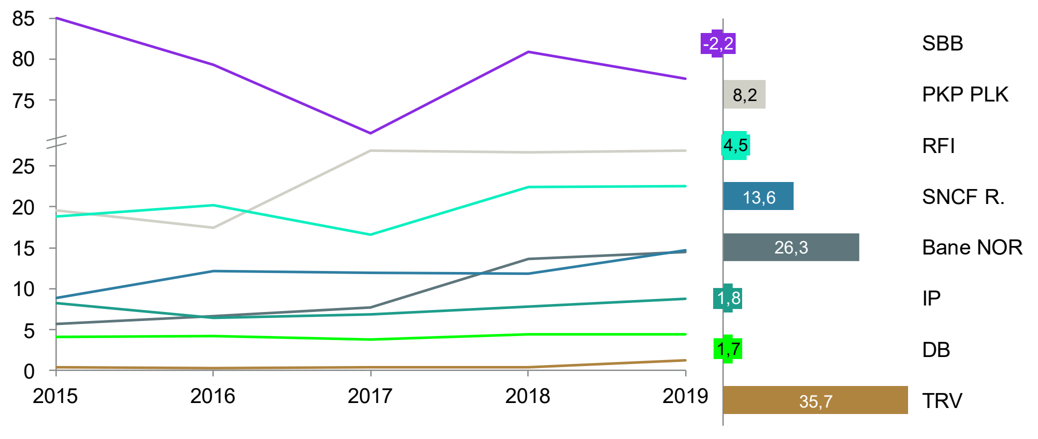


Figure 26: Total revenues from non-access charges in relation to network size (1.000 Euro per main track-km) and CAGR (%) in 2015-2019 [31]

Except for SBB all infrastructure managers exhibit an upwards trend: TRV, Bane NOR and SNCF R. realised annual growth rates of over 10%.

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 is the difference in 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.

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.

[31] Results are normalised for purchasing power parity.

EU-wide objectives
• The objective of the EU is to maintain and further develop the high standards of rail safety. • In accordance with the Sustainable and smart mobiltiy strategy, by 2050 the number of fatalities should be close to zero for all modes.
Peer group's performance
• On average there have been 0,3 significant accidents and 0,3 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 is 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 are reporting three indicators measuring railway safety performance:

- Significant accidents
- Persons seriously injured and killed
- 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 27 to 32 show the safety performance of the PRIME members as a benchmark and over the time-period 2015-2019.

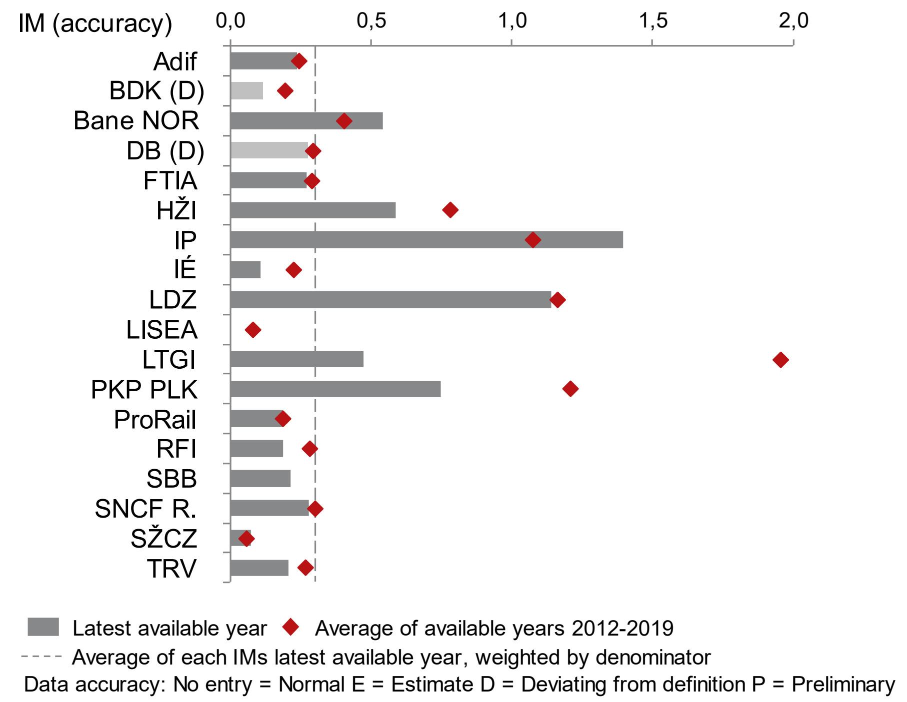


Figure 27: Significant accidents (Number per million train-km)[32]

The KPI values vary notably between the infrastructure managers, however they all remain below 1,5 significant accidents per million train-kilometres. LISEA and SŽCZ show the lowest values, LISEA counting zero accidents in 2019. A relative increase can be seen at IP. However, IP is aware of global safety KPI results and several perspectives that contribute to the current trend. On the one hand, IP's network has a relatively low traffic density which influences KPIs negatively, on the other hand, 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. The lighter grey of BDK and DB indicates deviating data, which is explained in the Annex 4.3.

[32] Lighter colours indicate accuracy level deviating from normal. Comments concerning the deviations can be found in the Annex 4.3.
SBB: No average of available years as some types of accidents were excluded before 2017.

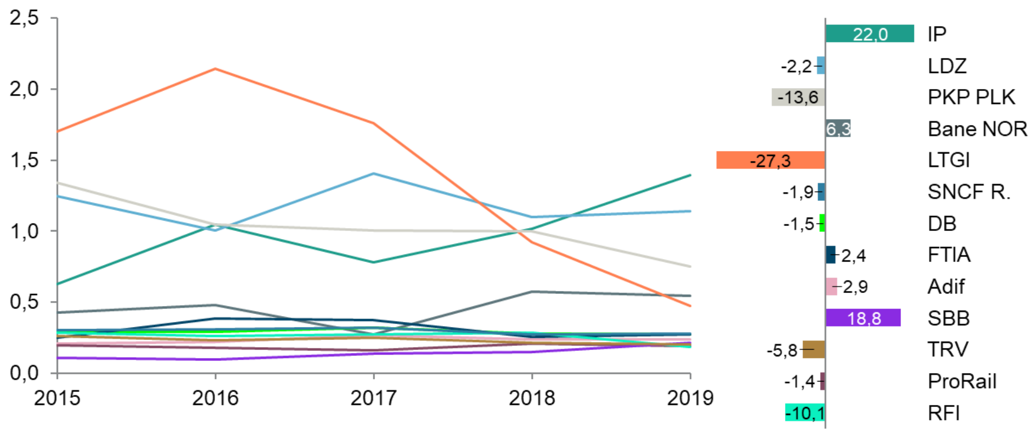


Figure 28: Significant accidents on infrastructure manager's network (Number per million train-km) and CAGR (%) in 2015-2019

The overall trend in safety performance is positive. Eight infrastructure managers improved their safety level from 2015 to 2019 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 PKP PLK with a reduction of 27% and 14%. This is also the result of direct safety measures and modernisation, and replacement of traffic control equipment. PKP PLK for example is running a social campaign called "Bezpieczny przejazd" (*safe crossing*), to raise awareness of risks resulting from failures to observe special precautions on railway grade crossings and railway areas, and offers targeted trainings for rail traffic controllers and people responsible for safety. SBB's increase is mainly due to different counting method according to the PRIME definition from 2017; its accidents rate is still among the lowest in the peer group.

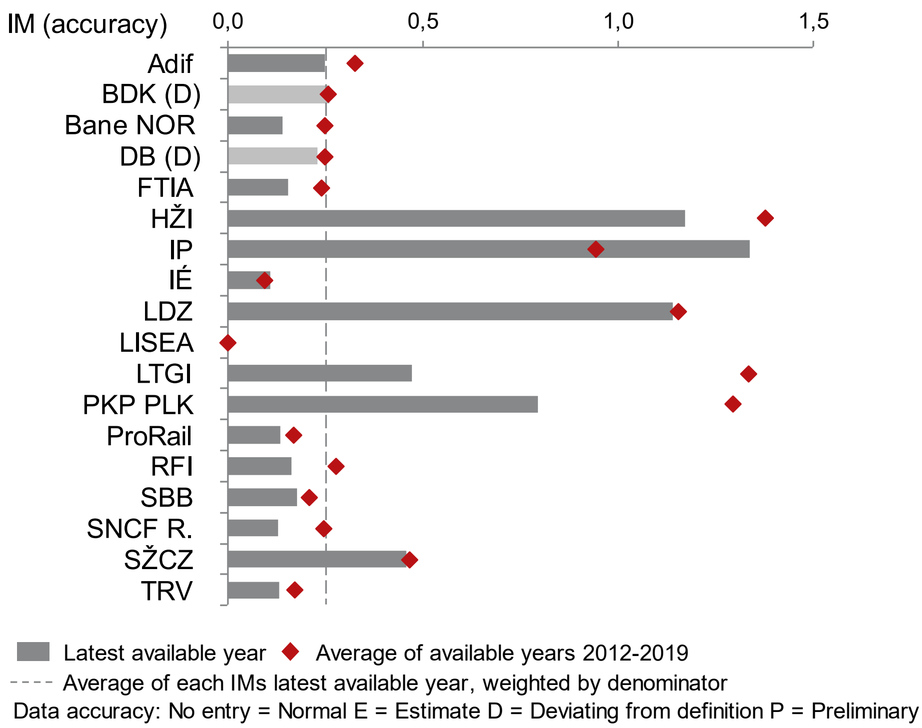


Figure 29: Persons seriously injured or killed (Number per million train-km) [33]

The number of persons seriously injured and killed strongly correlates to the lower number of significant accidents and has an average of 0,3 per million train-kilometres. However, while the majority of infrastructure managers have below average casualty rates, some networks are well above the weighted average. The standard deviation for this indicator is 0,4.

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

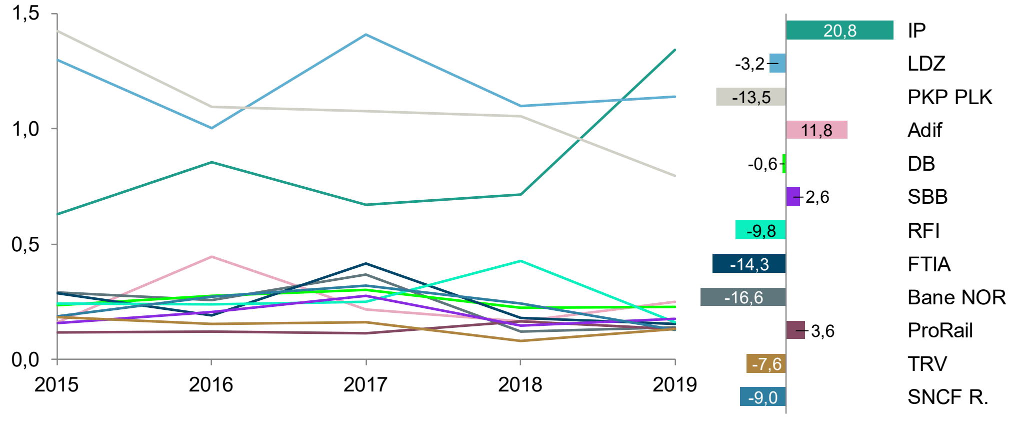


Figure 30: Persons seriously injured and killed (Number per million train-km) and CAGR (%) in 2015-2019

The number of persons seriously injured and killed corresponds to the number of significant accidents. Two thirds of the infrastructure managers have reduced the number of people seriously injured and killed relative to million train-km.

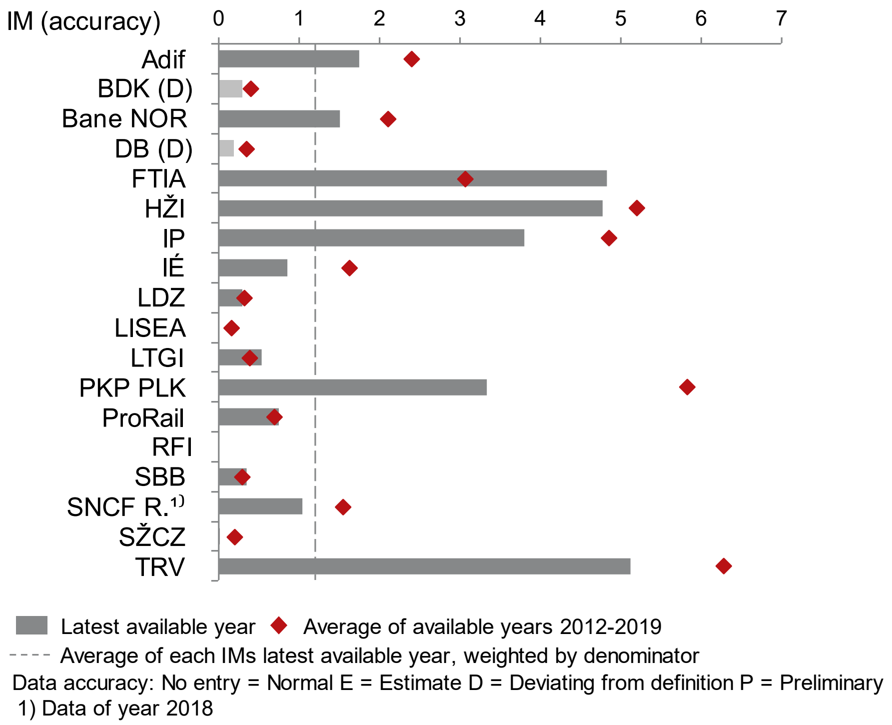


Figure 31: Infrastructure manager related precursors (Number per million train-km)[34]

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

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 1,2, while others have significantly higher values. However, it is interesting to see that the two infrastructure managers of the Baltic countries show a relatively high number of accidents, while the infrastructure related precursors to accidents are among the lowest in the peer group.

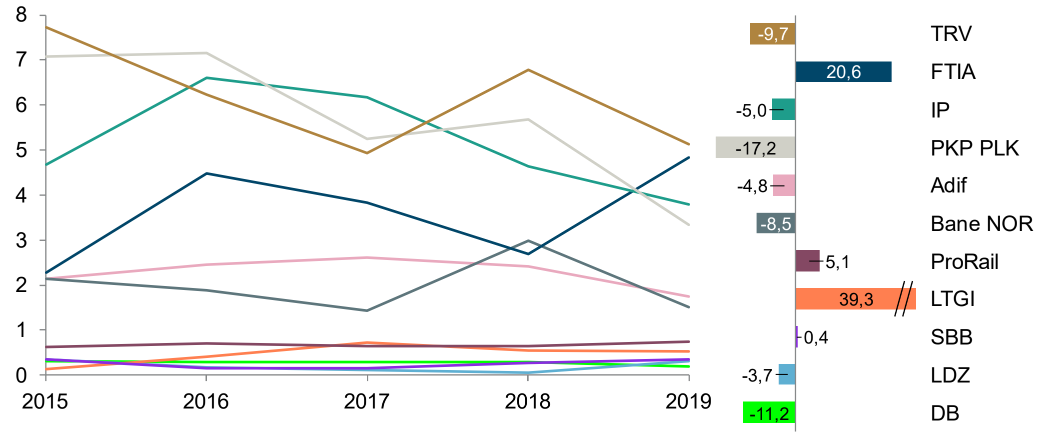


Figure 32: Infrastructure manager related precursors (Number per million train-km) and CAGR (%) in 2015-2019

Figure 32 depicts a higher fluctuation in infrastructure manager related precursors to accidents. However, there is also here a parallel to the positive development of the other indicators. Similarly to the other two indicators illustrated above (in figures 28 and 30), the most significant improvement can be seen at PKP PLK. On the other side LTGI and FTIA show an increase in infrastructure related precursors.

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 74%, and remained relatively stable in 2015-2019.
- The share of electricity-powered trains in relation to train-kilometres across the peer groups is around 81%.
- While the degree of electrification strongly correlates with the share of electricity-powered trains, the electrified networks are not 100% exploited by all infrastructure managers.
- The share of diesel-powered trains in relation to train-kilometres across the peer group is around 18%.

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. The indicators related to the electrification process are presented in this chapter.

Rail environment indicators

PRIME members are reporting three indicators measuring railway environmental performance:

- Degree of electrification
- Share of electricity-powered trains
- Share of diesel-powered trains

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 33 to 36 show the relevant environmental indicators as a latest benchmark between the infrastructure managers and their development over the time-period 2015-2019.

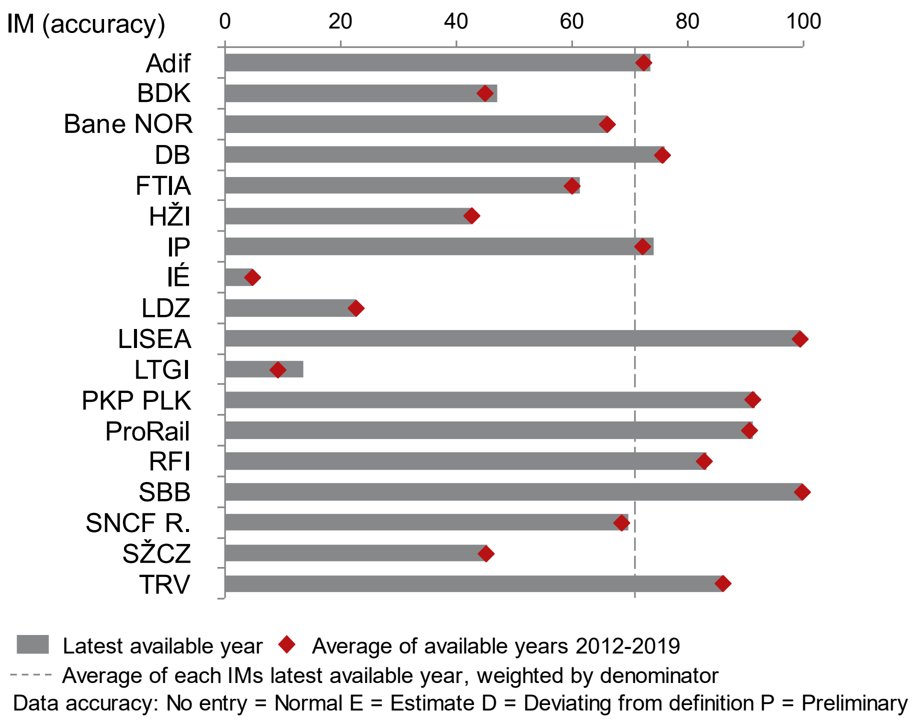


Figure 33: Degree of electrification of total main track (% of main track-km)

In the EU railway networks are mostly electrified. The peer group's average is 74%, however, the degree of electrification varies widely from 5% to 100%. While SBB, LISEA, and ProRail have the highest degree of electrification, reaching over 90%, IÉ, LTGI and LDZ have electrified below 25% of their network.

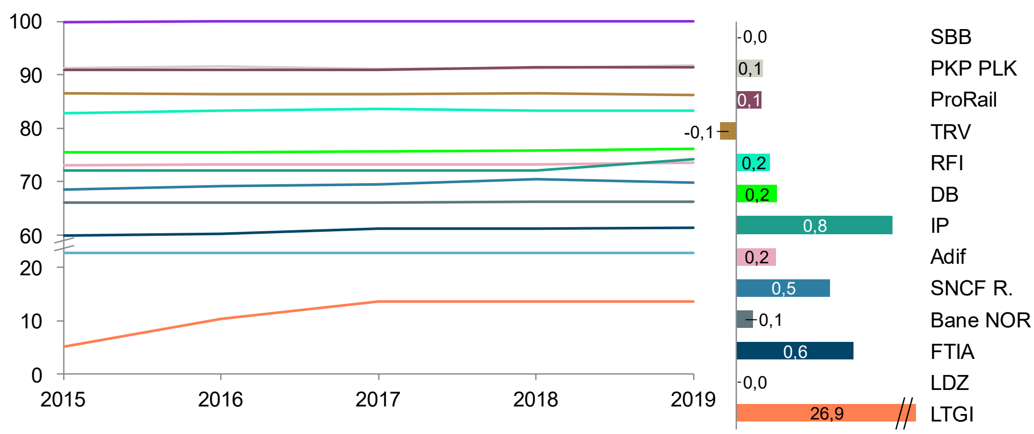


Figure 34: Degree of electrification of total main track (% of main track-km) and CAGR (%) in 2015-2019

The degree of electrification remained relatively constant over the period. Outstanding annual growth can be seen at LTGI, almost tripling its degree of electrified network between 2015 and 2019. In absolute terms this growth corresponds to an additional 195 kilometres of electrified main tracks in 2019 compared to 2015. The rest of the peer group increased its network by below 1%, with the exception of TRV, which showed a slight decrease in the share.

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 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.

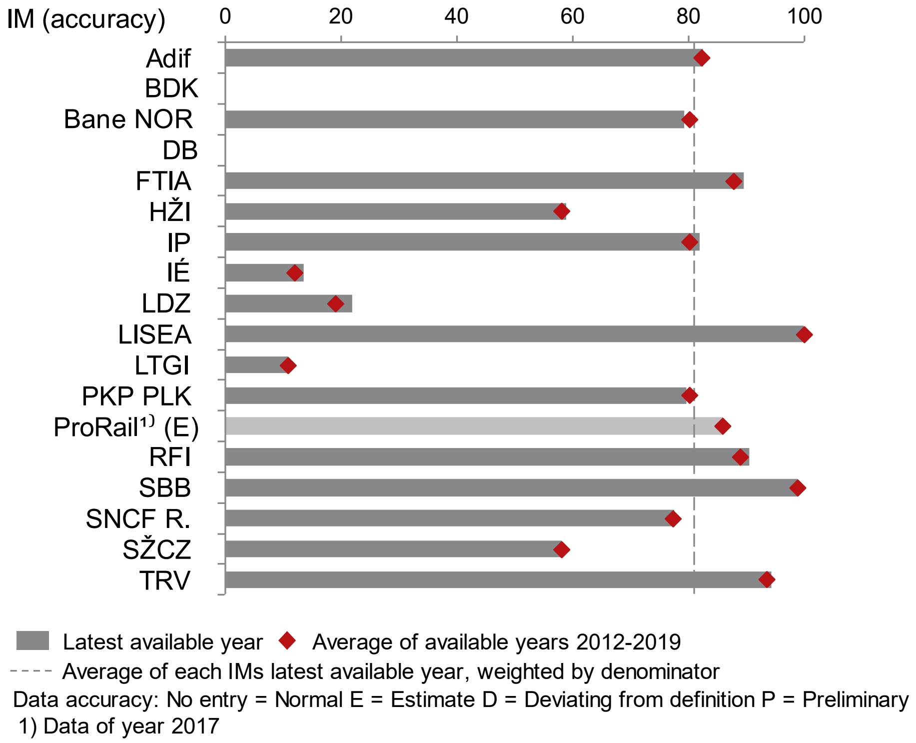


Figure 35: Share of electricity-powered trains (% of total train-km) [35]

The share of electricity-powered trains corresponds to the electrification of the network. Over 80% of the peer group's traffic is powered by electricity. On LISEA's network all trains run with electricity-power, also SBB, TRV and RFI have above 90% of electricity-powered trains running on their network. The lighter grey of ProRail indicates an estimated figure.

[35] Lighter colours indicate accuracy level deviating from normal.

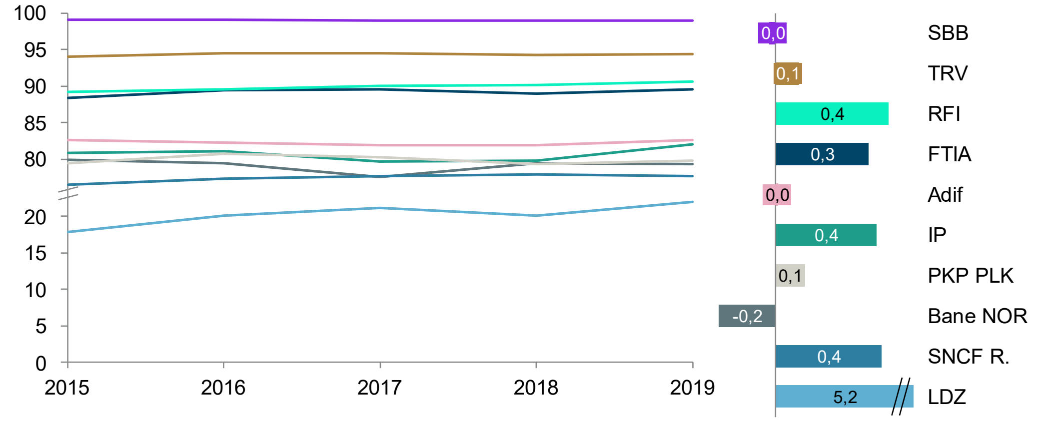


Figure 36: Share of electricity-powered trains (% of total train-km) and CAGR (%) in 2015-2019

Figure 36 shows the development of electricity-powered trains between 2015 and 2019. Parallel to the development of the electrification of the main tracks the trend is relatively stable, showing only a slight increase. Only LDZ shows an annual growth of above 5%, and increased its share of electricity-powered trains from 18% in 2015 to 22% in 2019.

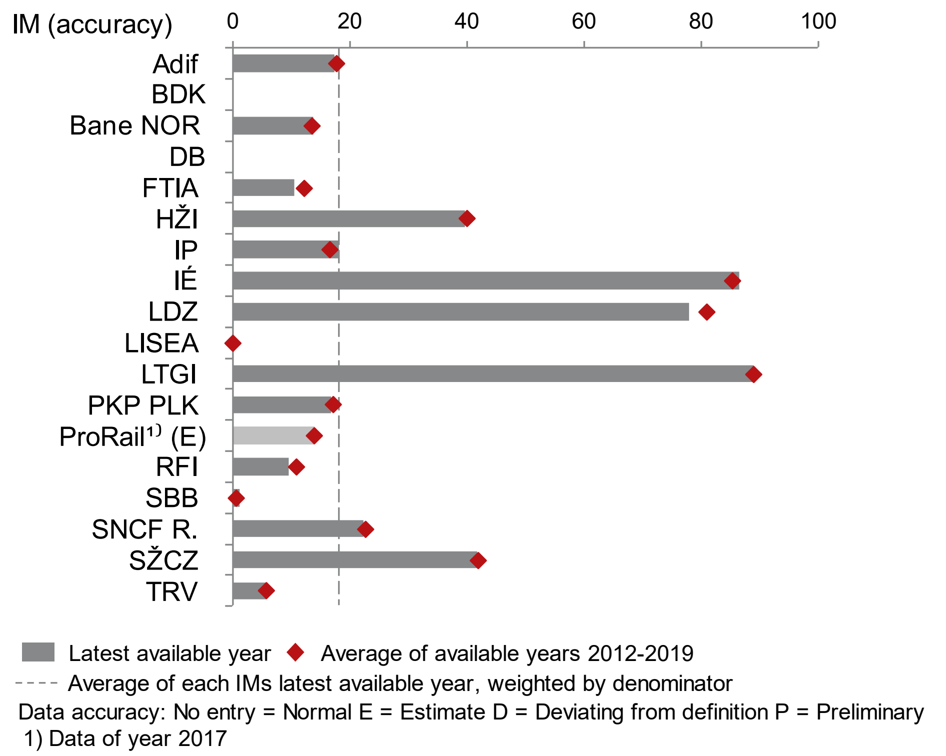


Figure 37: Share of diesel-powered trains (% of total train-km) [36]

Figure 37 is the counterpart to figure 35, and shows the share of diesel-powered trains in relation to traffic volume of the infrastructure managers. Corresponding to the low electrification level of their network, the Baltic countries and Ireland show higher rates of diesel-powered trains than the rest of the group. 89% of LTGI's, 87% of IÉ's and 78% of LDZ's traffic volume is produced by diesel-powered trains, however the peer group's average stays below 20%.

[36] Lighter colours indicate accuracy level deviating from normal.

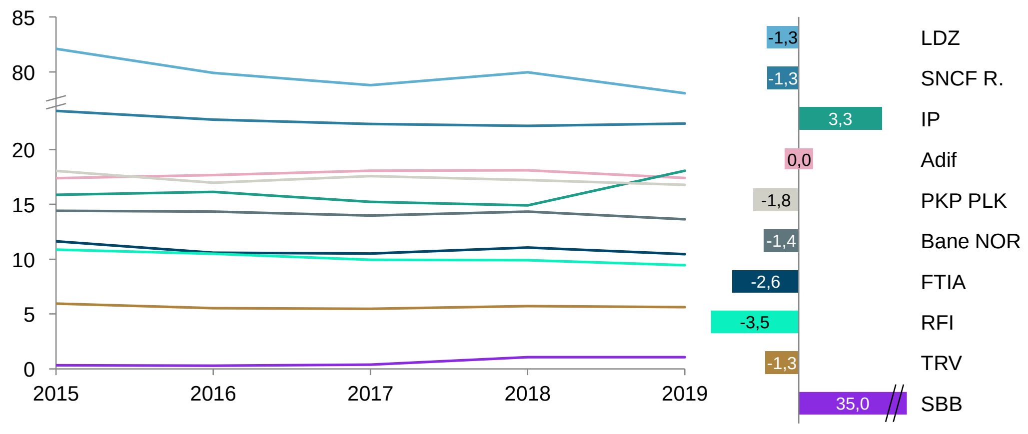


Figure 38: Share of diesel-powered trains (% of total train-km) and CAGR (%) in 2015-2019

Figure 38 shows the development of the share of diesel-powered trains between 2015 and 2019. Considering the European Commission's objective of reducing the share of diesel-powered trains, the declining trend across the peer group is promising. The highest annual growth can be seen at SBB, however it still remains far below the average with a share of diesel-powered trains of 0,3% in 2015 and 1% in 2019.

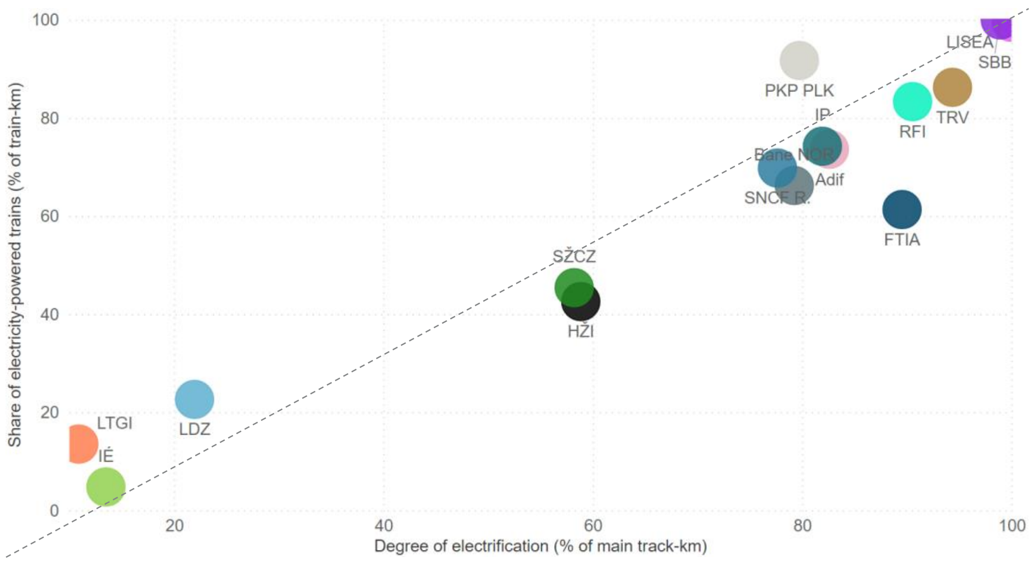


Figure 39: Share of electricity-powered trains (% of train-km) / Degree of electrification (% of main track-km)

Figure 39 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.

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
- Passenger train punctuality has remained relatively stable between 2015 and 2019.
- Freight train punctuality shows a slight decline between 2015 and 2019.
- On average infrastructure managers caused 5 delay minutes per thousand train-kilometres.
- On average 909 asset failures per thousand main track-kilometres per year causing an average delay of 51 minutes per failure.

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. Current trends in logistics, such as just-in-time manufacturing and customized deliveries, call for more plannability, traceability and speed in transportation. Infrastructure managers are constantly working on improving their performance by increasing their punctuality, minimising the effect of failures providing 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.

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.

Reaching good punctuality rates is a priority of all countries, although it is measured and managed in very different ways. In particular, measurement concepts are quite diverse, as performance schemes are not yet sufficiently coordinated between infrastructure managers. The different 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	For statistical purposes at final destination only. For traffic regulation and management also at every station, in blocks and at some other strategic points like switches.
BDK	Passenger trains (commuter): 85 strategic measurement

Infrastructure manager	Measurement points in the network
	points Passenger trains (regional and long distance): 47 strategic measurement points Freight trains: 16 strategic measurement points
Bane NOR	PRIME punctuality performance measures are measured at final destination and Oslo Central Station for both passenger and freight trains
DB	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.
FTIA	For local trains the measurement is done both at the first and at last station; for all other trains only at arrival. Delays are measured at block signals on line (but not used to calculate punctuality).
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

Infrastructure manager	Measurement points in the network
	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. Freight trains: 52 strategic measurement 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)
TRV	Official performance measures measured at final destination only. Many more measuring points exist, but are not calculated in the performance measures.

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

Passenger total train punctuality (5:29 minutes)

Figures 40 to 41 show the punctuality of passenger trains for operators using the network of PRIME members as a benchmark and over the time-period 2015-2019. 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.

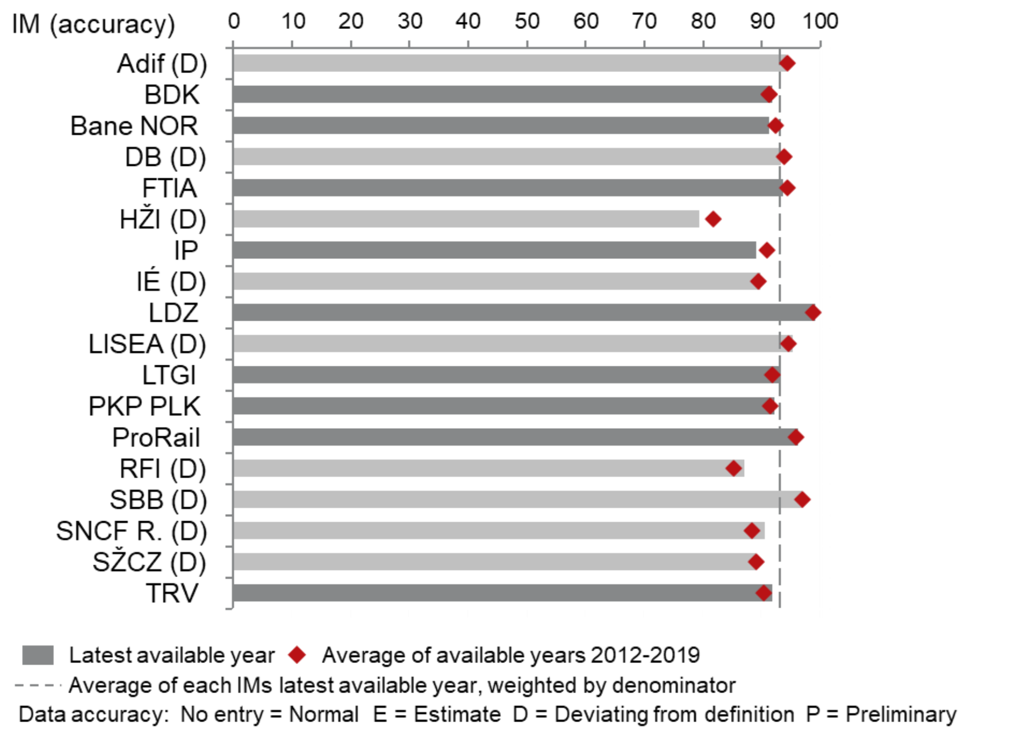


Figure 40: Passenger trains total punctuality (5:29 minutes) (% of trains) [37]

Figure 40 shows the passenger train punctuality data of the latest available year. The figures vary between 80% and 99%, which is again partly a result of different measuring methodologies. Passenger trains punctuality has a weighted average of 93% and a standard deviation of 4,3%. The lighter grey colour highlights the infrastructure managers which deviate from the PRIME definition. In total, nine infrastructure managers are deviating from definition. Comments explaining in what sense the individual data points are deviating are collected in the Annex 4.3.

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

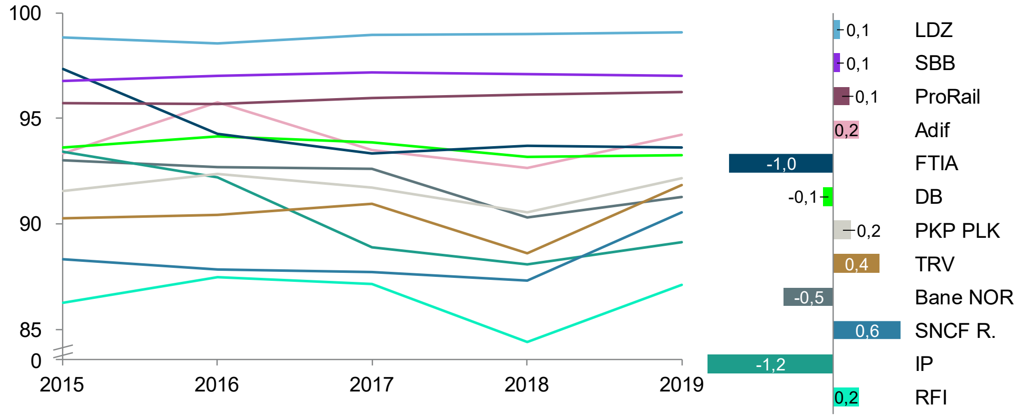


Figure 41: Passenger trains total punctuality (5:29 minutes) (% of trains) and CAGR (%) in 2015-2019

Overall, passenger train punctuality has remained relatively stable since 2015 in the peer group. Only two IMs show a decrease in punctuailty of over 1% during the period. Compared to 2015, 8 infrastructure managers improved their punctuality.

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, or a high degree of electrification, is more prone to failures and requires more interventions, such as maintenance and renewal activities. Construction works can have a relevant 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 a higher punctuality is needed. This means that the quality of the timetabling and of the infrastructure needs to be better. As shown in figure 14 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).

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 42 and 43 show the punctuality of freight trains of PRIME members in a latest benchmark and over the time period 2015-2019.

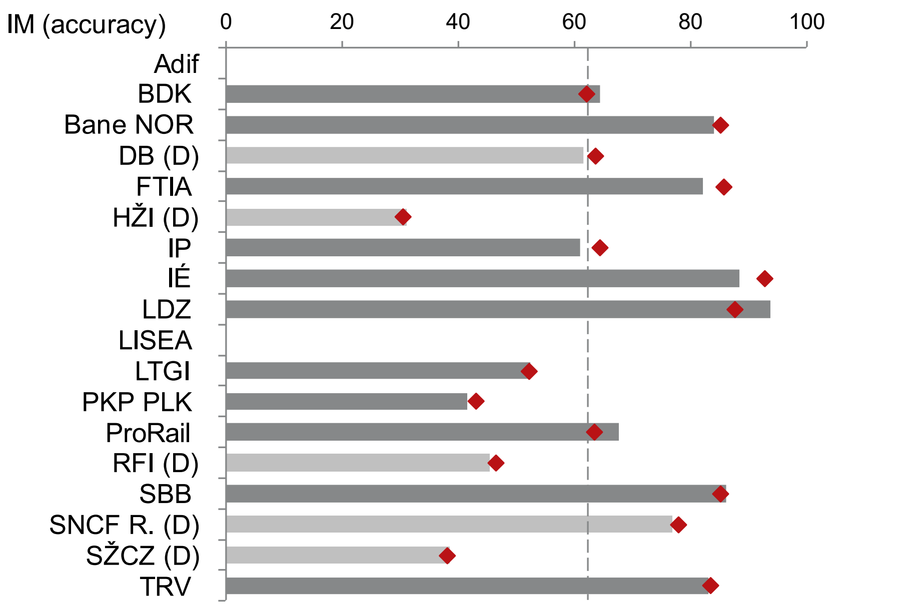


Figure 42: Freight trains total punctuality (15:29 minutes) (% of trains)[38]

In total 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. Compared to passenger train services, the percentage of freight trains on time is lower and ranges between 31% and 93%. The average punctuality for freight trains is 63% with a standard deviation of 25%. Especially, with regard to the European Union's objective to boost freight transportation, these

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

numbers are rather sobering. In order to become a true alternative for logistic companies, rail has to improve punctuality, reliability and flexibility.

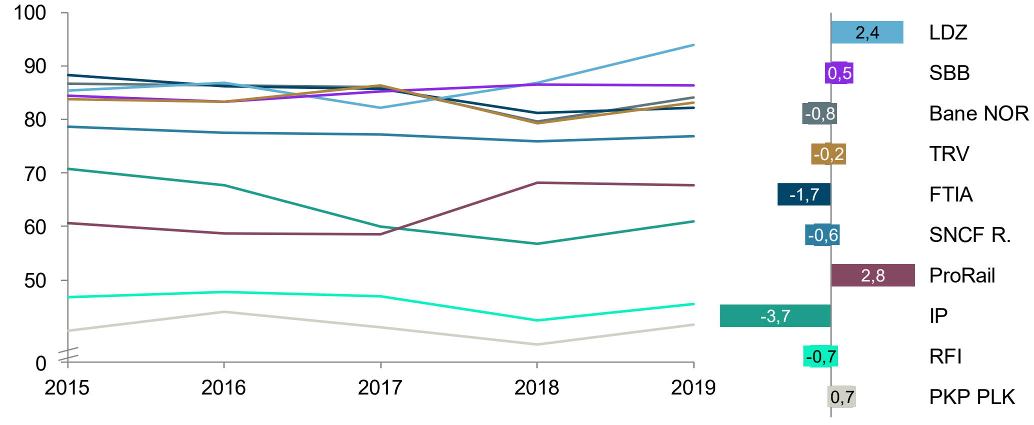


Figure 43: Freight trains total punctuality (15:29 minutes) (% of trains) and CAGR (%) in 2015-2019

As with the results for passenger train punctuality, the development of punctuality of freight trains in 2015 and 2019 is diverse. Four infrastructure managers improved their punctuality of freight trains up to 2,8% on an annual average. Six infrastructure managers on the other hand have faced punctuality losses in this period.

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, effect passenger traffic, which is often prioritized. Due to this, freight trains may be effected 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.

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.

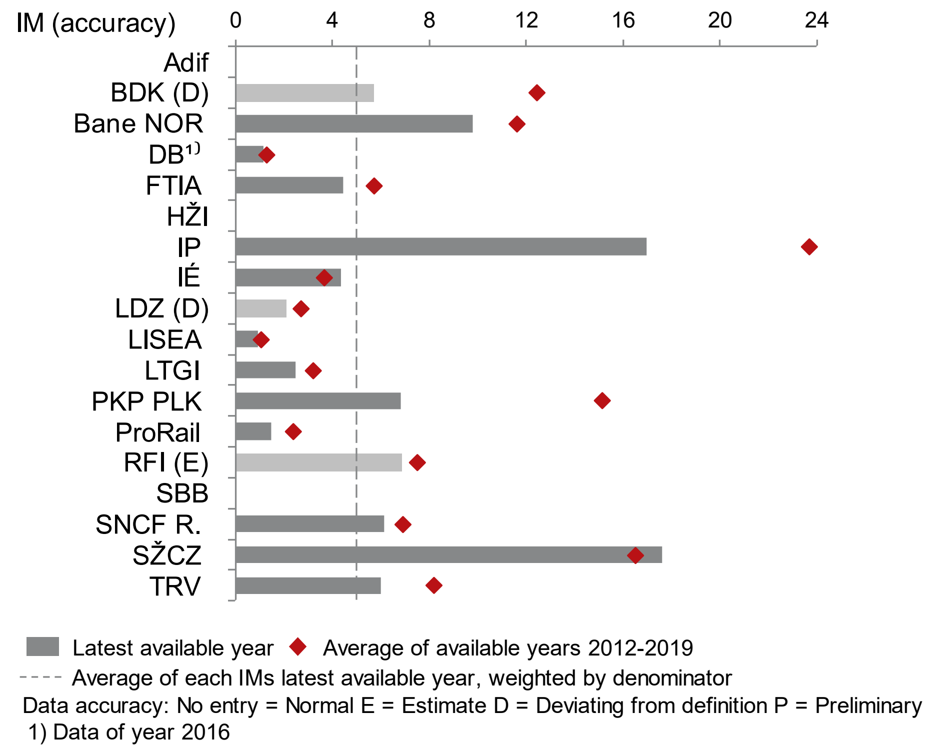


Figure 44: Delay minutes per train-km caused by the infrastructure manager (Minutes per thousand train-km) [39]

On average infrastructure managers caused 5 delay minutes per thousand train-kilometres, and their results vary between 1 and 18 minutes per thousand train-kilometres. Corresponding to their overall high passenger train punctuality shown in figure 40, LISEA, ProRail and DB 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

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

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

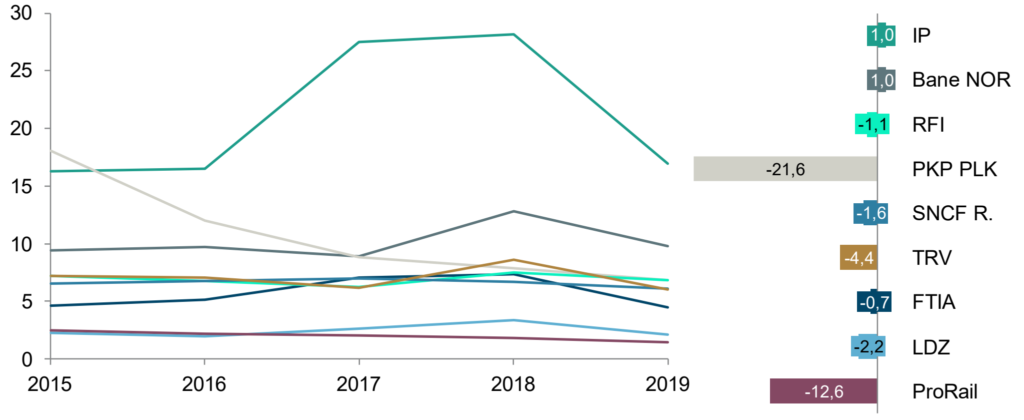


Figure 45: Delay minutes per train-km caused by the infrastructure manager (Minutes per thousand train-km) and CAGR (%) in 2015-2019

Regarding the delay minutes caused by infrastructure managers, the development is positive. The number of delay minutes per train-kilometre caused by the infrastructure manager shows a decrease in almost all companies. PKP PLK has seen an average annual decrease in delay minutes of 22% over the period 2015-2019, from 18 in 2015 to 7 in 2019. This significant 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.

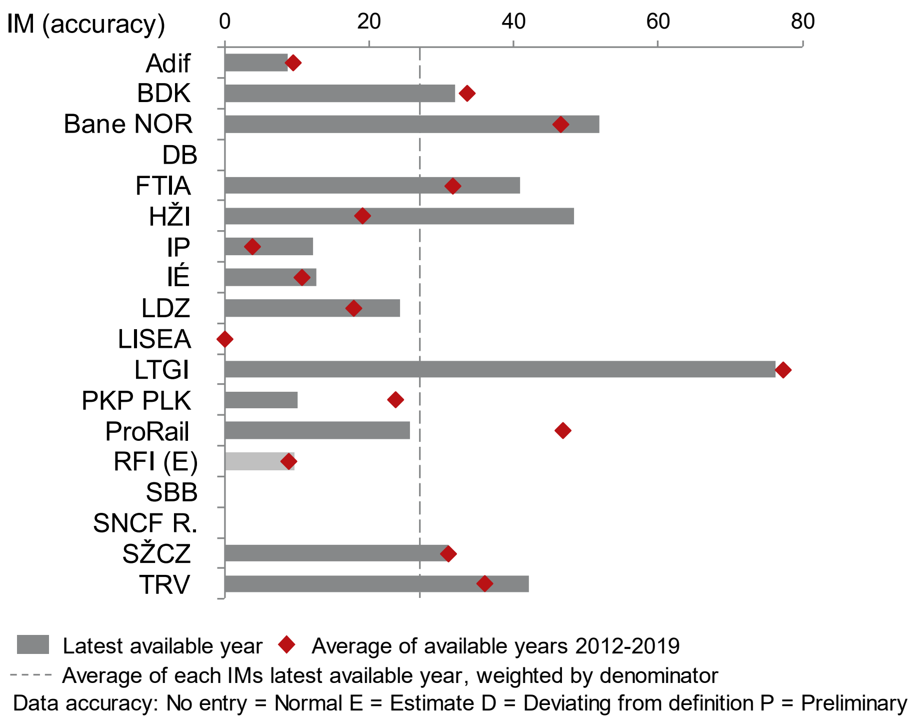


Figure 46: Passenger train cancellations caused by the infrastructure manager (% of scheduled and cancelled passenger trains) [40]

As illustrated in figure 46 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 21%.

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.

[40] Lighter colours indicate accuracy level deviating from normal.

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 47 to 50 show the latest benchmark of the number of train-affecting asset failures between the infrastructure managers and its development over the time period of 2015-2019.

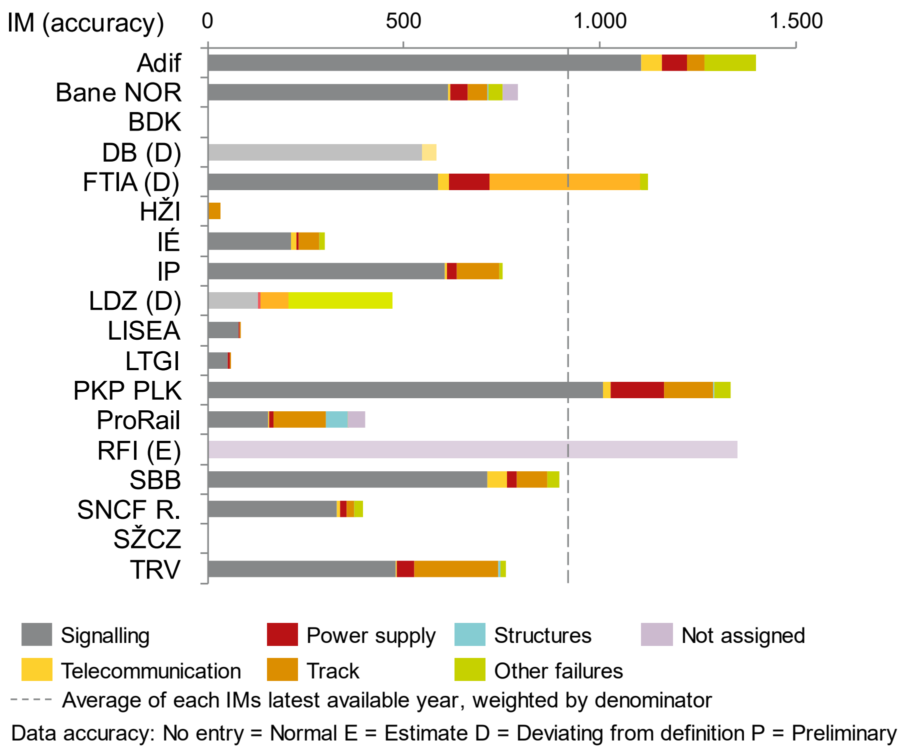


Figure 47: Asset failures in relation to network size (Number per thousand main track km)[41]

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

Figure 47 shows the level and the composition of asset failures that caused delays. On average 909 assets fail per thousand main track-kilometres per year. The failure frequency in the peer group varies between 55 and 1.400 failures per thousand main track-kilometres. Signalling accounts for the majority of all asset failures. SBB's high level of signalling errors stems at least partially from a high block and therefore signal density and the pioneering use of ETCS. 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 and LDZ indicates deviating figures for signalling failures, the lighter yellow of DB for telecommunication failures, the lighter orange of FTIA and LDZ for track failures and the lighter green colour and red colour of LDZ indicates deviating data for power supply failures and other failures. In what sense these data is deviating is explained in Annex 4.3.

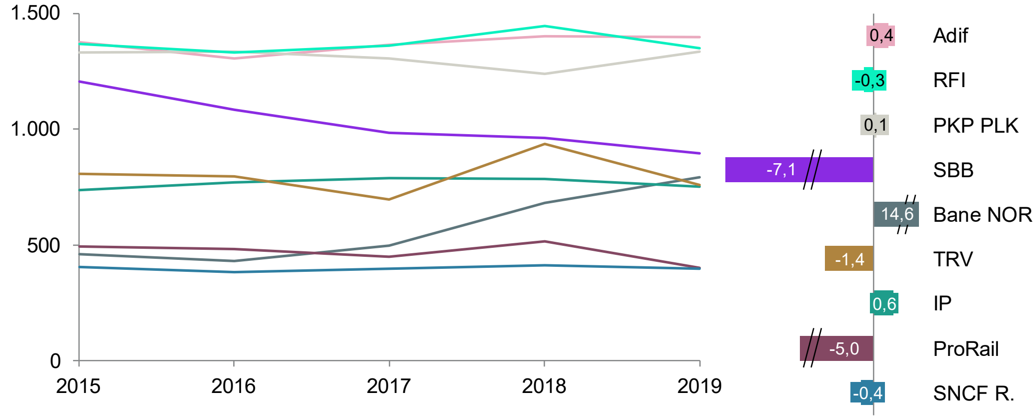


Figure 48: Asset failures in relation to network size (Number per thousand main track-km) and CAGR (%) in 2015-2019

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 460 in 2015 to 790 in 2019. This is mainly due to an increase registering of the number of signalling failures in 2017. However, as shown in figure 51, 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[42].

While asset failures have an impact on almost all performance indicators, such as finance, safety, punctuality and reliability, there are several factors which determine the frequency and dimension of asset failures. Complexity (electrification, switch density and 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, as well as 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 becoming increasingly common.

The magnitude of the impact of asset failures on delays and their development over the period is shown in figures 49 and 50.

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

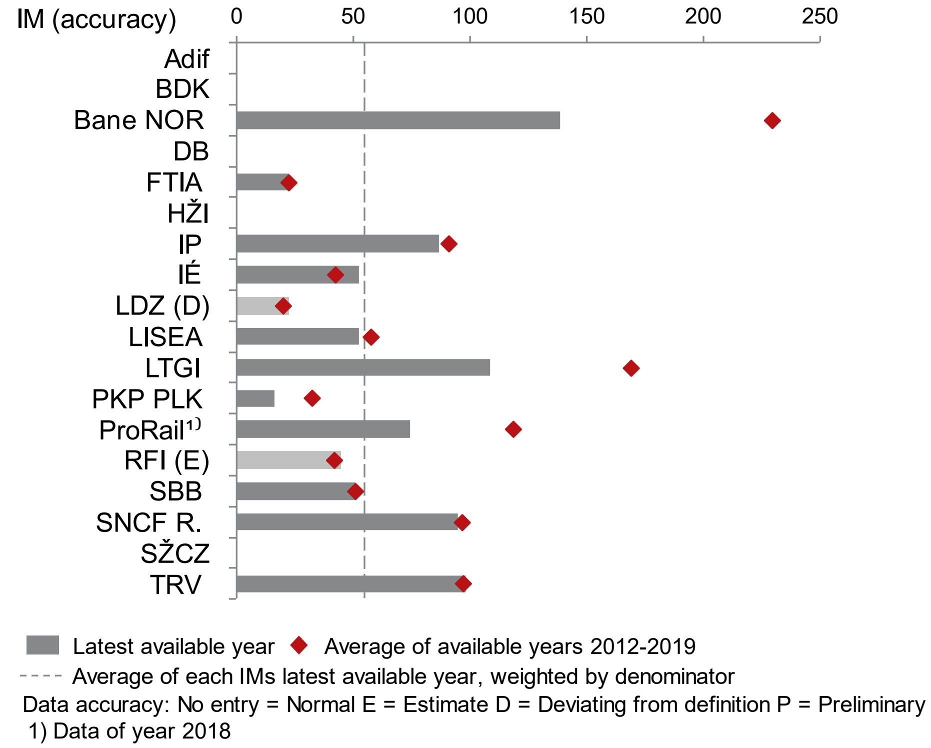


Figure 49: Average delay minutes per asset failure (Minutes per failure)[43]

On average asset failures cause a delay of 51 minutes and vary widely between 16 and 135 minutes per asset failure. The lowest level of delay minutes caused by asset failures are found at PKP PLK, LDZ and FTIA, where one asset failure causes on average a delay of below 25 minutes.

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

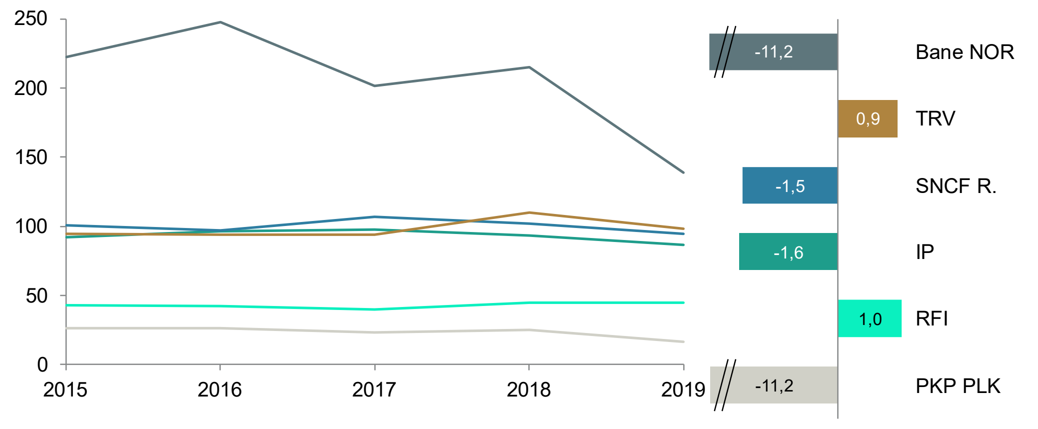


Figure 50: Average delay minutes per asset failure (Minutes per failure) and CAGR (%) in 2015-2019

Similar to the development of asset failures, the average train delay minutes per asset failure shows a high fluctuation in the peer group. While Bane NOR and PKP PLK show a decreasing trend of above 11%, the values for the rest of the group remained stable.

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 51 shows this relationship.

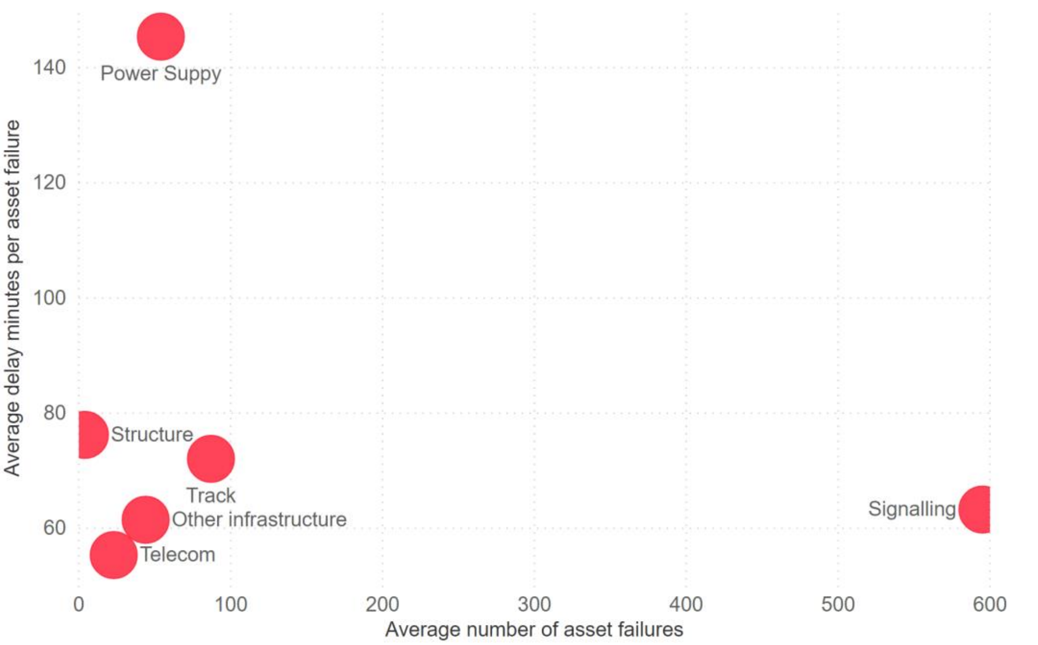


Figure 51: Delay per asset failure (Minutes per failure) / Asset failures (Number per thousand main track-km)

In 2019 power supply assets caused the highest number of delay minutes with 145 minutes per failure. Structural assets such as bridges and tunnels were responsible for an average delay of 76 minutes per failure. Track failures and telecommunication failures caused on average 72 and 55 delay minutes respectively. The most frequent type of asset failures was related to signalling, with an average of almost 600 failures per thousand main track-kilometre, however they had a comparably low impact of 63 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.

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 52 to 53 show to what degree a network was affected by permanent or temporary speed restrictions. Due to incomplete time series, no trend line can be shown for these two indicators.

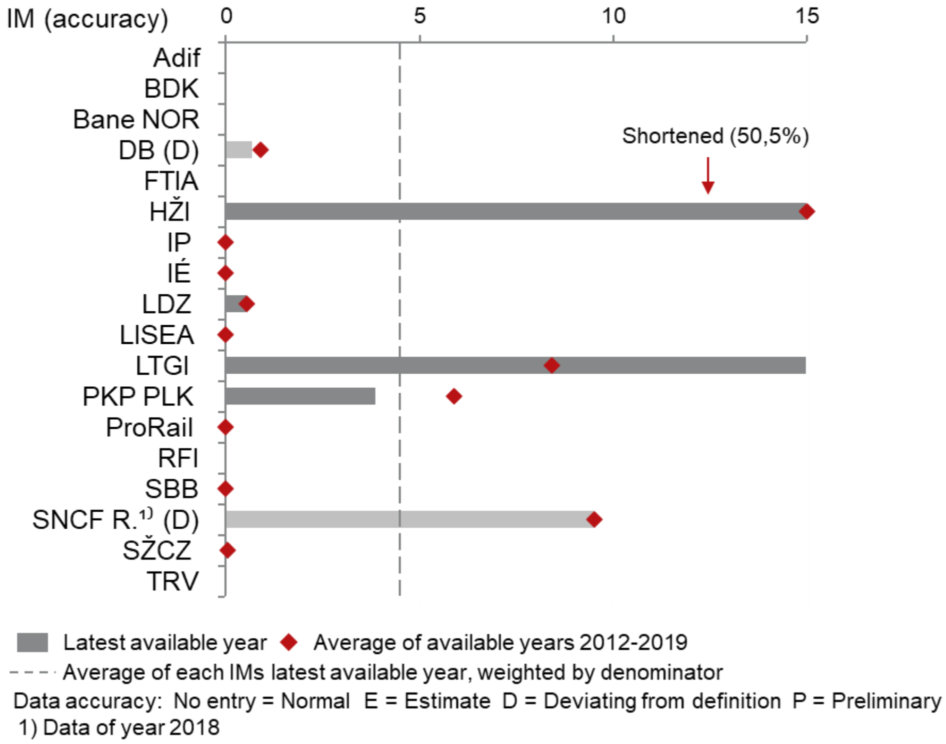


Figure 52: Tracks with permanent speed restrictions (% of main track-km)[44]

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 9%, 15% and 50% of their network under permanent speed restriction. On average 4,5% of the peer groups network faces a permanent speed restriction with a spread of 14%. 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.

[44] Axis for HŽI shortened for better readability. Lastest available year: 50,5%; average of available years: 50,6%

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

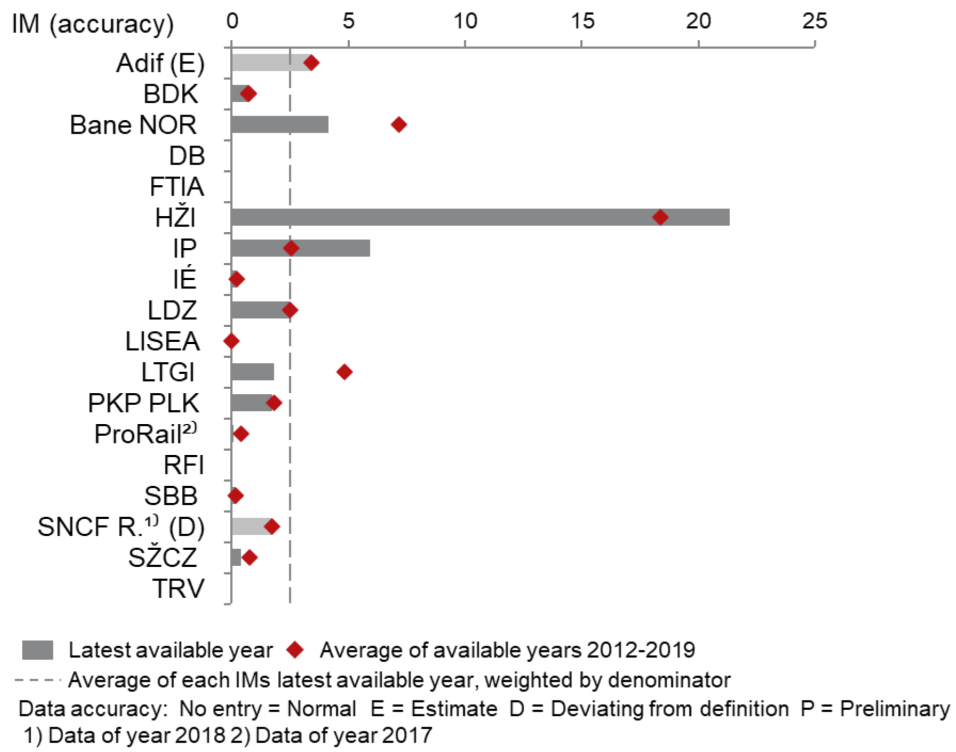


Figure 53: Tracks with temporary speed restrictions (% of main track-km)[45]

Other than permanent speed restrictions, restrictions that occur during the year and are not included in the annual timetable are considered temporary. On average, 2,2% 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, HŽI restricts speed on 21% of its network. IP's increase in temporary speed restrictions in 2019 is mainly due to an investment program in the Portuguese railway network, building, enhancing and renewing infrastructure, which will last until 2023. The standard deviation of the peer group is 5,5%.

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

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

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 ERTMS deployment

2.6.1 Summary of 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 digitalisation of the rail network. • 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. • According to the TEN-T Guidelines, the Core Network shall be equipped by 2030.
Peer group's performance
• ERTMS deployment is highly heterogonous in the peer group. • ERTMS is deployed on about 7% of all tracks of the peer group's railway network • Across the peer group ERTMS is expected to be implemented in about 35% of the railway network by 2030.

2.6.2 Development and benchmark of ERTMS

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.

ERTMS indicators

PRIME members are reporting two indicators measuring ERTMS deployment:

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

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

Development and benchmark

Figures 54 and 55 show the level of ERTMS track-side deployment and the planned extent of ERTMS deployment by 2030.

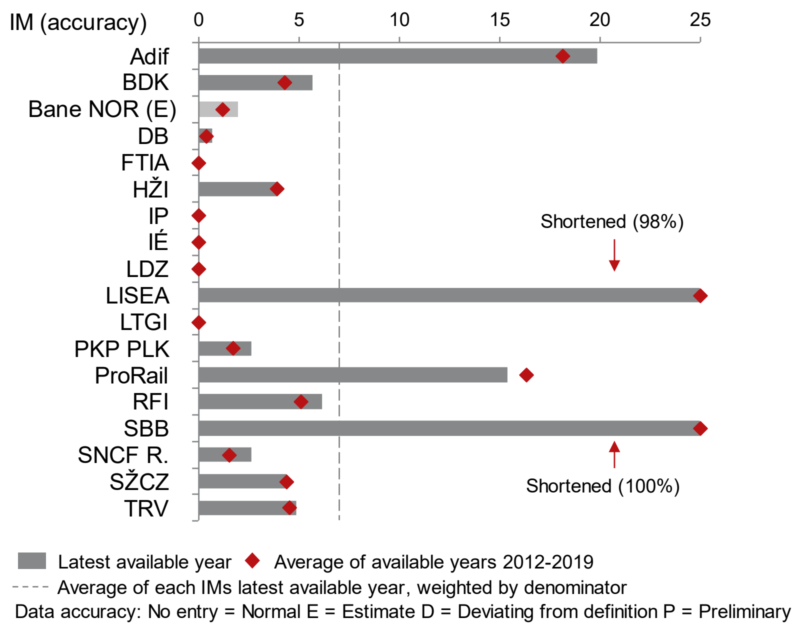


Figure 54: ERTMS track-side deployment (% of main track-km)[46]

ERTMS is deployed on about 7% of all tracks of the peer group's railway network. The infrastructure managers' implementation strategies are heterogene-

[46] Axis shortened for better readability. LISEA: Lastest available year: 98%; average of available years: 98%. SBB: : Lastest available year: 100%; average of available years: 99%.

ous, which is reflected by there being no ERTMS deployment in some countries vs. a high share in others of more than 90%. 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.

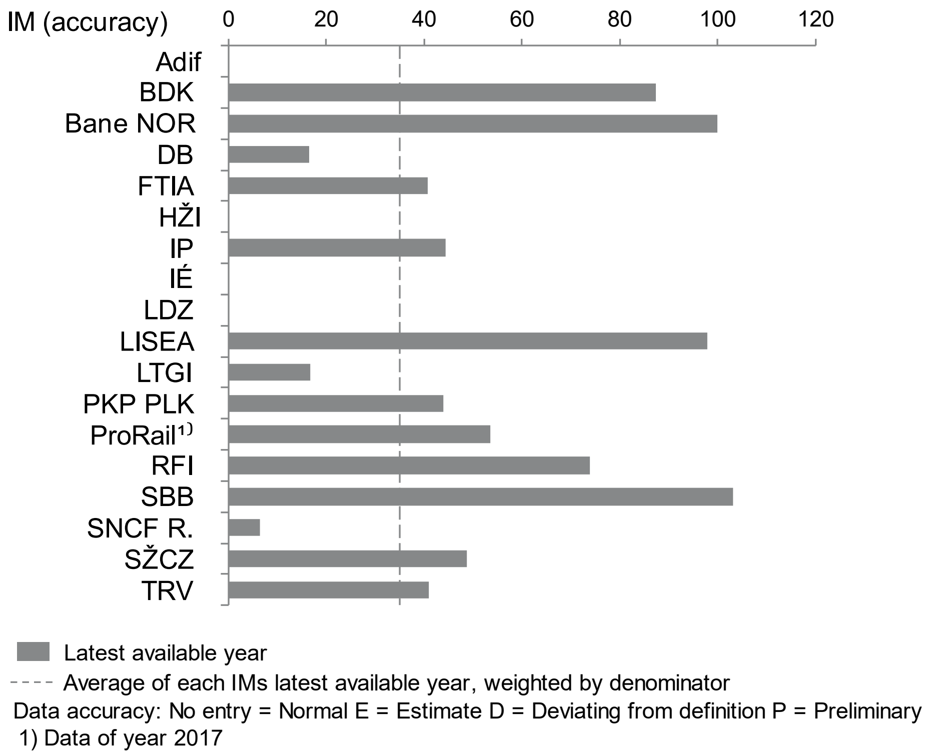


Figure 55: Planned extent of ERTMS deployment by 2030 (% of current main track-km)[47]

By 2030, ERTMS is expected to cover about 35% 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 or 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.

[47] The label "latest availabel year" indictates in this figure the latest approval of planned ERTMS deplyement. For ProRail the last available data is 2017.

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. The stage of a railway's development, past and present priorities, funding agreements and the level of the budget for investment are some of them. 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.

3 Outlook

This benchmarking report provides a status overview of the European rail industry at the end of 2019. Against the background of the policy objectives set at European level – through the European Green Deal and the Sustainable and Smart Mobility Strategy, it describes a successful development of the infrastructure managers cooperating in PRIME and their constant efforts to improve their network's performance. Important successes are visible, including positive developments in safety, a decreasing proportion of diesel-powered trains, growing passenger train activity, and a positive development in the modal share of passenger rail. On the other hand the conditions for freight trains need to be further developed as freight train activity and the modal share in rail freight both show a decreasing trend.

The PRIME KPI and benchmarking subgroup is still growing. ÖBB and CFL joined the working group in 2020 and are currently in transition. IE completed the transition phase and joined the public report for the first time this year. We hope that further members will complete the transition phase and become regular members to take part in this public benchmarking report next year.

This report is based on data up to 2019 and does not yet reflect the effects of the Covid-19 pandemic. As yet, the full extent and duration of the consequences for the infrastructure managers cannot be estimated.

It is to be expected however that significant effects will be seen in most of the PRIME dimensions measured, such as adverse effects on the financial situations and distorted favourable effects on punctuality.

The next benchmarking report 2020 will show the immediate first effects that the pandemic has left on the rail business and it will clearly not show a continuation of past development trends.

Which of these pandemic consequent effects will be of a temporary nature and which of the consequences may lead to permanent changes in transport behaviour in the rail sector is a crucial question for the next few years.

Against this background, the work of PRIME benchmarking seems more valuable than ever. Regular data collection and continuous improvement of the data base is important to make changes transparent and allow for meaningful comparisons on national and international level. The existing PRIME database will serve as a reference and a yardstick for targeted corporate and rail policy measures in response to the COVID-19 crisis.

4 Annex

4.1 Key influencing factors of participating infrastructure managers

Operating context

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

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

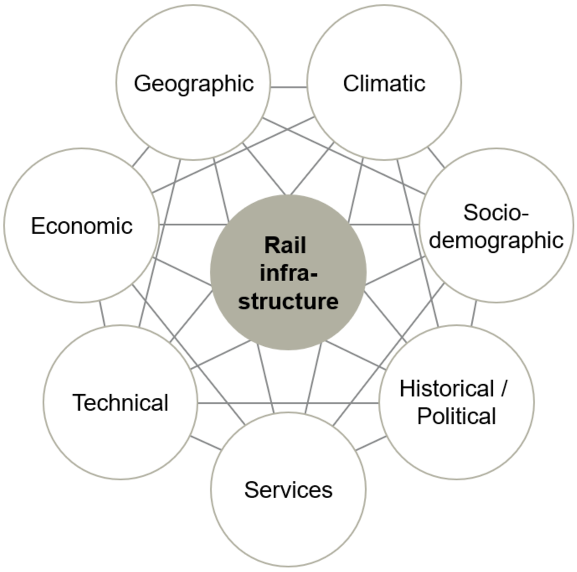


Figure 56: Factors influencing the outcome of rail infrastructure

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 as in Scandinavia and the Baltic, very low temperatures might cause broken rails, switch malfunction, 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[48]. 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 conse-

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

quences 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, transit also accounts for a considerable proportion of network usage. Six of the eleven Rail Freight 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 GDP, its economic power and connectivity all have a positive impact on passenger and freight transport demand[49]. 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 €160 million euros for 2021 from the EU's Cohesion Fund to modernise its rail transport.[50]

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

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

4.2 Fact sheets of the infrastructure managers

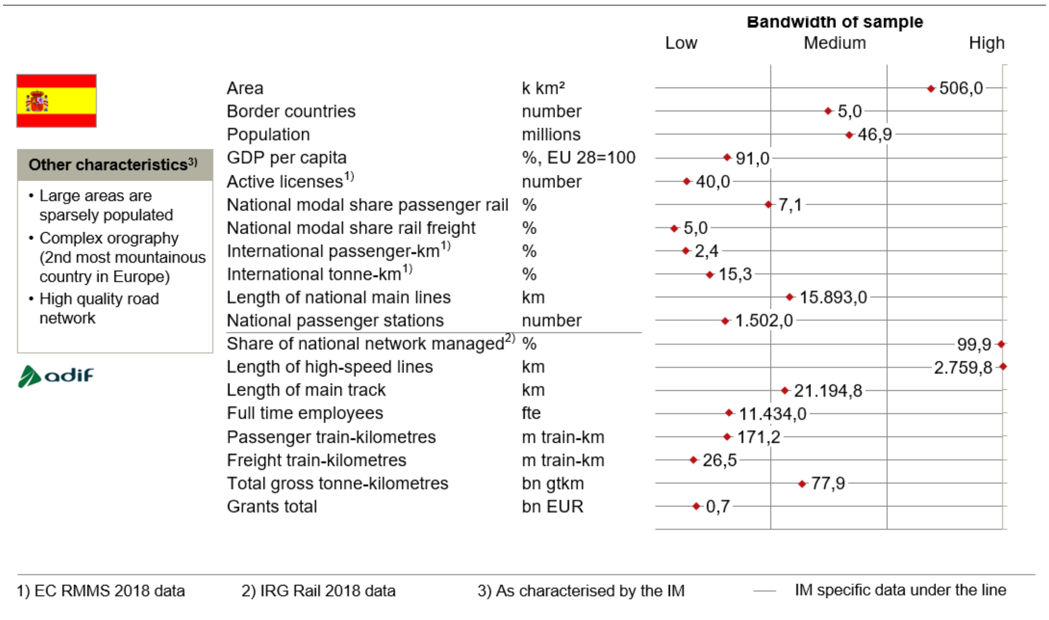


Figure 57: Fact sheet Adif

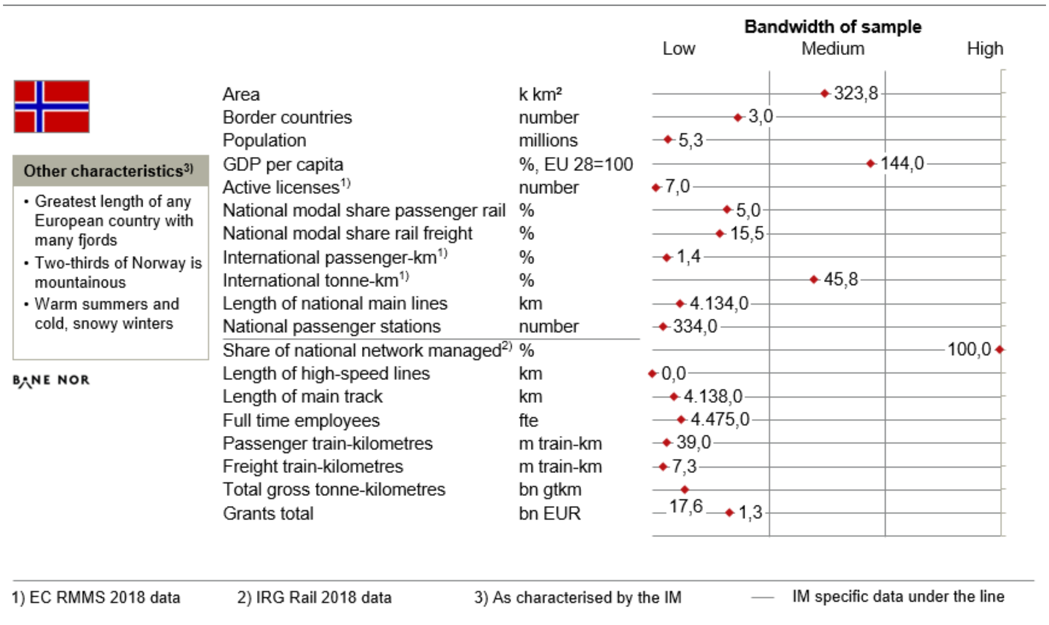


Figure 58: Fact sheet: Bane NOR[51]

[51] Grants total are normalised for purchasing power parity

Area	k km²	43,1
Border countries	number	1
Population	millions	5,8
GDP per capita	%, EU 28=100	129,0
Active licenses[1]	number	8,0
National modal share passenger rail	%	8,4
National modal share rail freight	%	11,8
International passenger-km[1]	%	6,8
International tonne-km[1]	%	93,6
Length of national main lines	km	2.519,0
National passenger stations	number	452,0
Share of national network managed[2]	%	79,2
Length of high-speed lines	km	
Length of main track	km	3.235,0
Full time employees	fte	2.367,0
Passenger train-kilometres	m train-km	63,7
Freight train-kilometres	m train-km	3,2
Total gross tonne-kilometres	bn gtkm	
Grants total	bn EUR	0,7

Bandwidth of sample: Low – Medium – High

Other characteristics[3]

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

banedanmark

1) EC RMMS 2018 data 2) IRG Rail 2018 data 3) As characterised by the IM — IM specific data under the line

Figure 59: Fact sheet: Banedanmark[52]

Area	k km²	357,1
Border countries	number	9,0
Population	millions	83,0
GDP per capita	%, EU 28=100	121,0
Active licenses[1]	number	434,0
National modal share passenger rail	%	9,1
National modal share rail freight	%	19,8
International passenger-km[1]	%	6,2
International tonne-km[1]	%	41,7
Length of national main lines	km	39.299,0
National passenger stations	number	6.987,0
Share of national network managed[2]	%	85,1
Length of high-speed lines	km	
Length of main track	km	55.408,0
Full time employees	fte	48.787,0
Passenger train-kilometres	m train-km	801,6
Freight train-kilometres	m train-km	238,2
Total gross tonne-kilometres	bn gtkm	
Grants total	bn EUR	0,0

Bandwidth of sample: Low – Medium – High

Other characteristics[3]

- Rail network large & No. of RUs very high
- Network on limit - little capacity
- Transit: six out of nine Rail Freight Corridors
- Rail noise - public issue

DB NETZE

1) EC RMMS 2018 data 2) IRG Rail 2018 data 3) As characterised by the IM — IM specific data under the line

Figure 60: Fact sheet: DB Netz AG[53]

[52] Grants total are normalised for purchasing power parity
[53] Grants total are normalised for purchasing power parity

		Bandwidth of sample (Low – Medium – High)
Area	k km²	338,4
Border countries	number	3,0
Population	millions	5,5
GDP per capita	%, EU 28=100	111,0
Active licenses[1)]	number	4,0
National modal share passenger rail	%	5,7
National modal share rail freight	%	29,0
International passenger-km[1)]	%	3,2
International tonne-km[1)]	%	36,5
Length of national main lines	km	5.925,0
National passenger stations	number	199,0
Share of national network managed[2)]	%	100,0
Length of high-speed lines	km	0,0
Length of main track	km	6.712,0
Full time employees	fte	398,0
Passenger train-kilometres	m train-km	36,8
Freight train-kilometres	m train-km	14,7
Total gross tonne-kilometres	bn gtkm	33,4
Grants total	bn EUR	0,0

Other characteristics[3)]

- Snow and ice on tracks during winters
- Falling trees due to storms breaking the electrified tracks
- Amount of single tracked lines is high

1) EC RMMS 2018 data 2) IRG Rail 2018 data 3) As characterised by the IM — IM specific data under the line

Figure 61: Fact sheet: Finnish Transport Infrastructure Agency[54]

		Bandwidth of sample (Low – Medium – High)
Area	k km²	56,6
Border countries	number	5,0
Population	millions	4,1
GDP per capita	%, EU 28=100	65,0
Active licenses[1)]	number	9,0
National modal share passenger rail	%	2,5
National modal share rail freight	%	21,2
International passenger-km[1)]	%	4,0
International tonne-km[1)]	%	67,7
Length of national main lines	km	2.605,0
National passenger stations	number	545,0
Share of national network managed[2)]	%	100,0
Length of high-speed lines	km	0,0
Length of main track	km	2.689,0
Full time employees	fte	5.044,0
Passenger train-kilometres	m train-km	15,3
Freight train-kilometres	m train-km	6,5
Total gross tonne-kilometres	bn gtkm	7,7
Grants total	bn EUR	0,3

Other characteristics[3)]

- High quality of motorway network
- High amount of single tracks
- 25 kV AC overhead line
- Normal track gauge

1) EC RMMS 2018 data 2) IRG Rail 2018 data 3) As characterised by the IM — IM specific data under the line

Figure 62: Fact sheet: HŽ Infrastruktura d.o.o. [55]

54 Grants total are normalised for purchasing power parity
55 Grants total are normalised for purchasing power parity

Other characteristics[3]	Indicator	Unit	Value (Bandwidth of sample: Low – Medium – High)
• 1.600 mm broad gauge Railway.	Area	k km²	70,3
• Rail Freight Market limited by the size of the country, by the relatively short distances travelled, and by the lack of international through traffic.	Border countries	number	1,0
	Population	millions	4,9
	GDP per capita	%, EU 28=100	191,0
	Active licenses[1]	number	2,0
	National modal share passenger rail	%	3,3
	National modal share rail freight	%	0,8
	International passenger-km[1]	%	4,3
	International tonne-km[1]	%	0,0
	Length of national main lines	km	2.045,0
	National passenger stations	number	145,0
	Share of national network managed[2]	%	100,0
	Length of high-speed lines	km	0,0
	Length of main track	km	2.165,1
	Full time employees	fte	1.738,0
	Passenger train-kilometres	m train-km	18,5
	Freight train-kilometres	m train-km	0,1
	Total gross tonne-kilometres	bn gtkm	4,8
	Grants total	bn EUR	0,2

Iarnród Éireann Irish Rail

1) EC RMMS 2018 data 2) IRG Rail 2018 data 3) As characterised by the IM — IM specific data under the line

Figure 63: Fact sheet: Iarnród Éireann – Irish Rail[56]

Other characteristics[3]	Indicator	Unit	Value (Bandwidth of sample: Low – Medium – High)
• IP manages the Portuguese rail and road infrastructure	Area	k km²	92,1
• Iberian gauge, 25kV AC overhead line	Border countries	number	1,0
• Pop.(mainland) 9,7m	Population	millions	10,3
• Area (mainland) 89 k	GDP per capita	%, EU 28=100	79,0
	Active licenses[1]	number	10,0
	National modal share passenger rail	%	4,2
	National modal share rail freight	%	14,2
	International passenger-km[1]	%	2,5
	International tonne-km[1]	%	24,5
	Length of national main lines	km	2.526,0
	National passenger stations	number	430,0
	Share of national network managed[2]	%	100,0
	Length of high-speed lines	km	0,0
	Length of main track	km	3.224,2
	Full time employees	fte	3.636,0
	Passenger train-kilometres	m train-km	30,6
	Freight train-kilometres	m train-km	5,8
	Total gross tonne-kilometres	bn gtkm	7,2
	Grants total	bn EUR	0,1

Infraestruturas de Portugal

1) EC RMMS 2018 data 2) IRG Rail 2018 data 3) As characterised by the IM — IM specific data under the line

Figure 64: Fact sheet: Infraestruturas de Portugal S.A.[57]

[56] Grants total are normalised for purchasing power parity
[57] Grants total are normalised for purchasing power parity

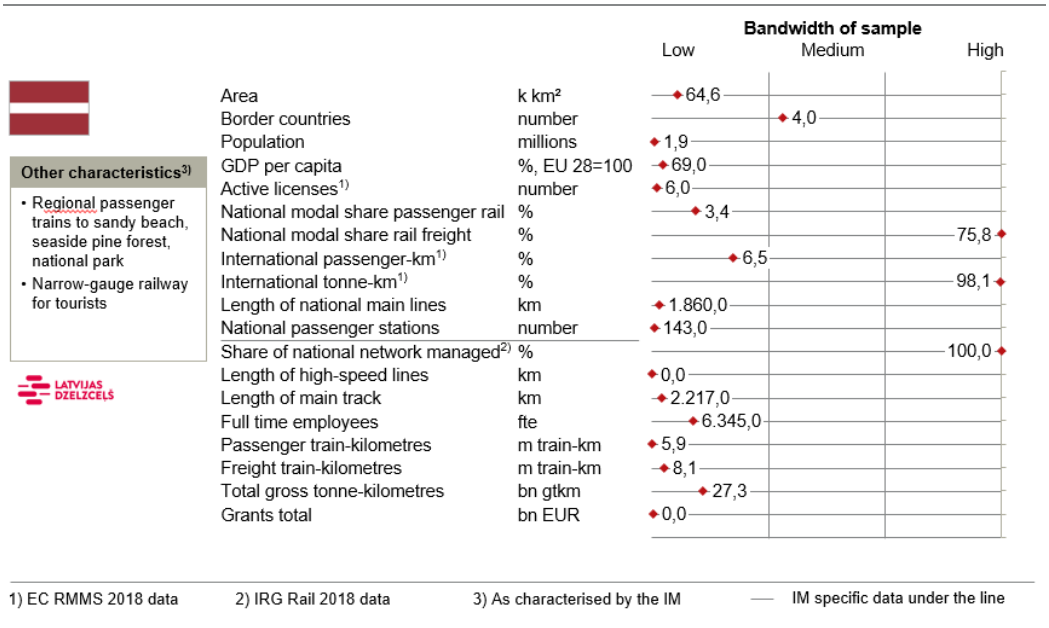


Figure 65: Fact sheet: Latvijas dzelzceļš[58]

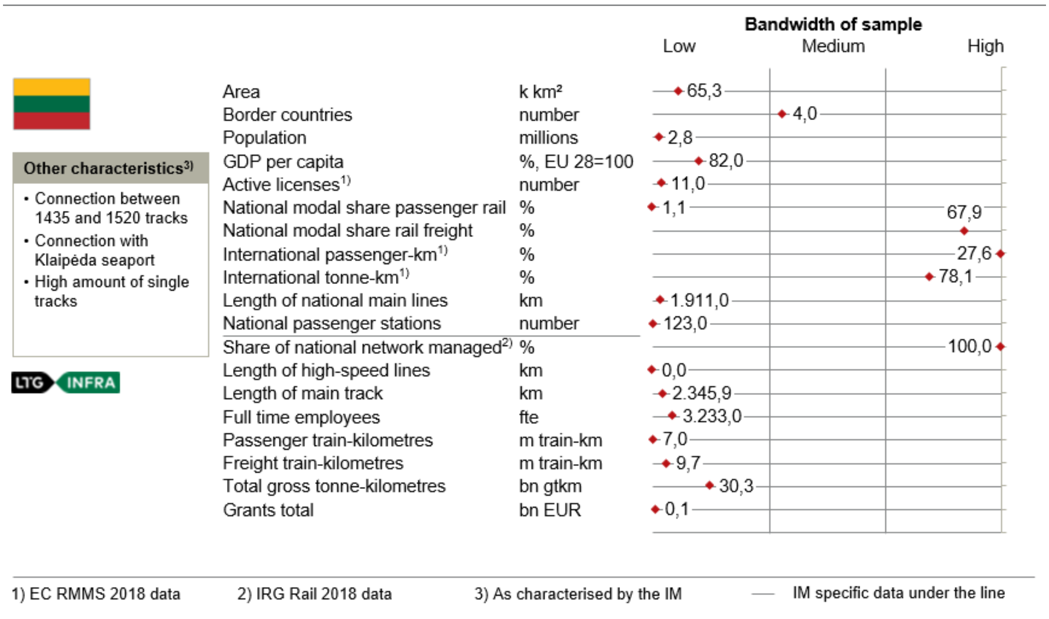


Figure 66: Fact sheet: AB LTG Infra[59]

[58] Grants total are normalised for purchasing power parity
[59] Former Lietuvos geležinkeliai and grants are normalised for purchasing power parity

		Bandwidth of sample (Low / Medium / High)
Area	k km²	633,1
Border countries	number	8,0
Population	millions	67,0
GDP per capita	%, EU 28=100	106,0
Active licenses[1)]	number	27,0
National modal share passenger rail	%	10,3
National modal share rail freight	%	9,9
International passenger-km[1)]	%	10,2
International tonne-km[1)]	%	37,0
Length of national main lines	km	27.594,0
National passenger stations	number	2.968,0
Share of national network managed[2)]	%	
Length of high-speed lines	km	669,0
Length of main track	km	669,0
Full time employees	fte	34,0
Passenger train-kilometres	m train-km	6,5
Freight train-kilometres	m train-km	0,0
Total gross tonne-kilometres	bn gtkm	3,8
Grants total	bn EUR	0,0

Other characteristics[3)]

- Only HSL
- PPP contract
- Touristic destination

LISEA

1) EC RMMS 2018 data 2) IRG Rail 2018 data 3) As characterised by the IM — IM specific data under the line

Figure 67: Fact sheet: LISEA[60]

		Bandwidth of sample (Low / Medium / High)
Area	k km²	312,7
Border countries	number	7,0
Population	millions	38,0
GDP per capita	%, EU 28=100	73,0
Active licenses[1)]	number	113,0
National modal share passenger rail	%	7,9
National modal share rail freight	%	26,8
International passenger-km[1)]	%	3,8
International tonne-km[1)]	%	39,0
Length of national main lines	km	18.536,0
National passenger stations	number	2.689,0
Share of national network managed[2)]	%	96,0
Length of high-speed lines	km	0,0
Length of main track	km	27.244,0
Full time employees	fte	39.107,1
Passenger train-kilometres	m train-km	167,2
Freight train-kilometres	m train-km	79,2
Total gross tonne-kilometres	bn gtkm	154,0
Grants total	bn EUR	

Other characteristics[3)]

- 4th largest railway network in the EU
- Standard rail gauge
- 6th in the EU in terms of country coverage and population
- 3kV traction voltage

POLSKIE LINIE KOLEJOWE

1) EC RMMS 2018 data 2) IRG Rail 2018 data 3) As characterised by the IM — IM specific data under the line

Figure 68: Fact sheet: PKP PLK [61]

[60] Grants total are normalised for purchasing power parity
[61] Grants total are normalised for purchasing power parity

Other characteristics[3]			
• Large increase in passenger demand now and next 10 years to come • Polycentric urban network with traffic evenly in both directions			

ProRail

Indicator	Unit	Value (Bandwidth of sample: Low – Medium – High)
Area	k km²	41,5
Border countries	number	2,0
Population	millions	17,3
GDP per capita	%, EU 28=100	128,0
Active licenses[1]	number	42,0
National modal share passenger rail	%	11,2
National modal share rail freight	%	6,4
International passenger-km[1]	%	1,9
International tonne-km[1]	%	83,6
Length of national main lines	km	3.220,0
National passenger stations	number	394,0
Share of national network managed[2]	%	100,0
Length of high-speed lines	km	72,0
Length of main track	km	5.645,0
Full time employees	fte	4.410,0
Passenger train-kilometres	m train-km	153,7
Freight train-kilometres	m train-km	11,1
Total gross tonne-kilometres	bn gtkm	57,4
Grants total	bn EUR	0,0

1) EC RMMS 2018 data 2) IRG Rail 2018 data 3) As characterised by the IM — IM specific data under the line

Figure 69: Fact sheet: ProRail[62]

Other characteristics[3]			
• Complex orography, seismic territory (40%); hydrogeological risk • Dichotomy North/South • HS Competition (capacity constraints) • 100% ATP; 79% SCC			

Indicator	Unit	Value (Bandwidth of sample: Low – Medium – High)
Area	k km²	301,3
Border countries	number	6,0
Population	millions	60,4
GDP per capita	%, EU 28=100	95,0
Active licenses[1]	number	26,0
National modal share passenger rail	%	6,3
National modal share rail freight	%	13,1
International passenger-km[1]	%	1,2
International tonne-km[1]	%	52,6
Length of national main lines	km	16.781,0
National passenger stations	number	2.393,0
Share of national network managed[2]	%	90,8
Length of high-speed lines	km	1.259,4
Length of main track	km	26.967,0
Full time employees	fte	26.488,0
Passenger train-kilometres	m train-km	322,0
Freight train-kilometres	m train-km	49,0
Total gross tonne-kilometres	bn gtkm	169,2
Grants total	bn EUR	5,7

1) EC RMMS 2018 data 2) IRG Rail 2018 data 3) As characterised by the IM — IM specific data under the line

Figure 70: Fact sheet: RFI[63]

[62] Grants total are normalised for purchasing power parity

[63] Grants total are normalised for purchasing power parity

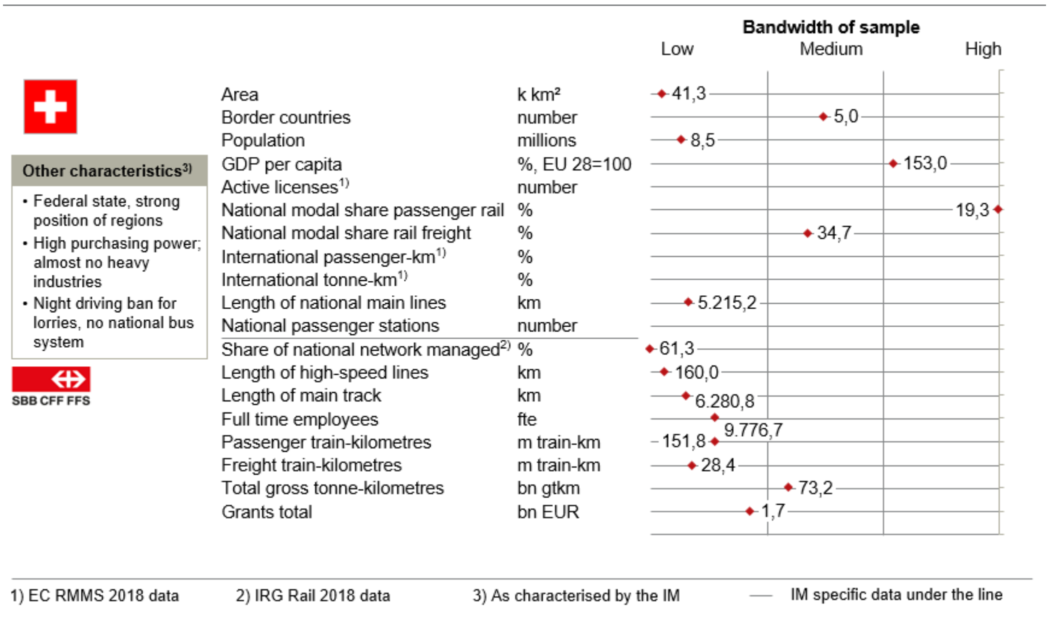


Figure 71: Fact sheet: SBB[64]

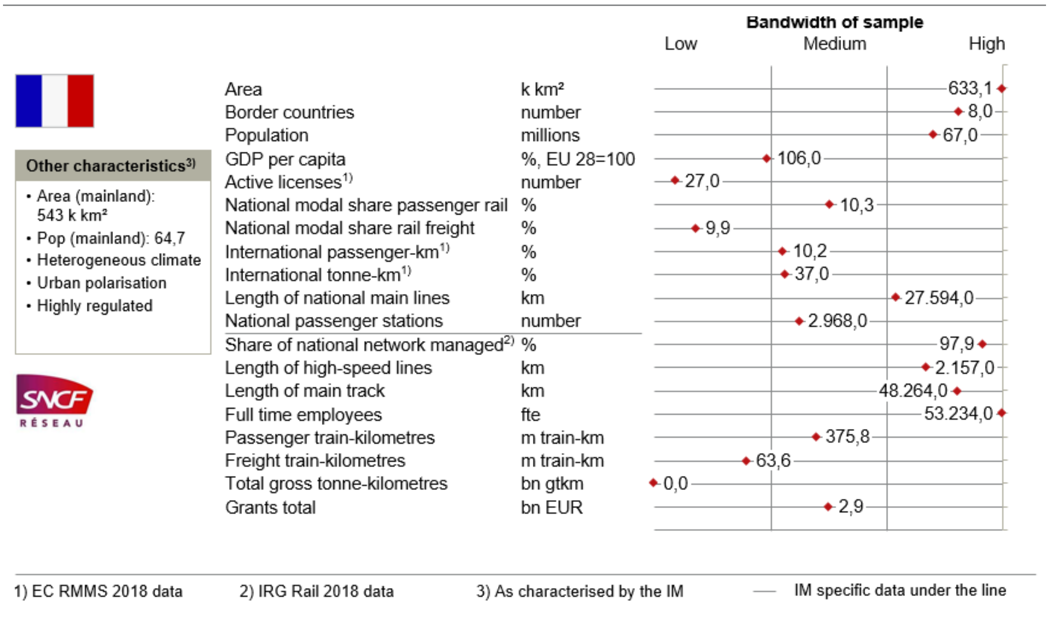


Figure 72: Fact sheet: SNCF Réseau[65]

[64] Grants total are normalised for purchasing power parity
[65] Grants total are normalised for purchasing power parity

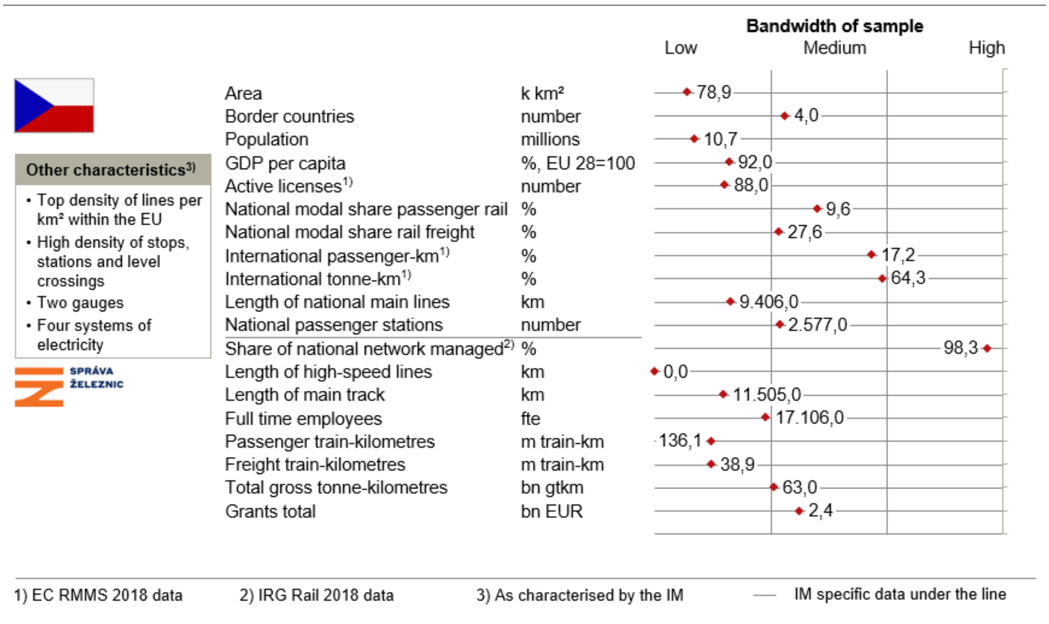


Figure 73: Správa železnic, státní organizace[66]

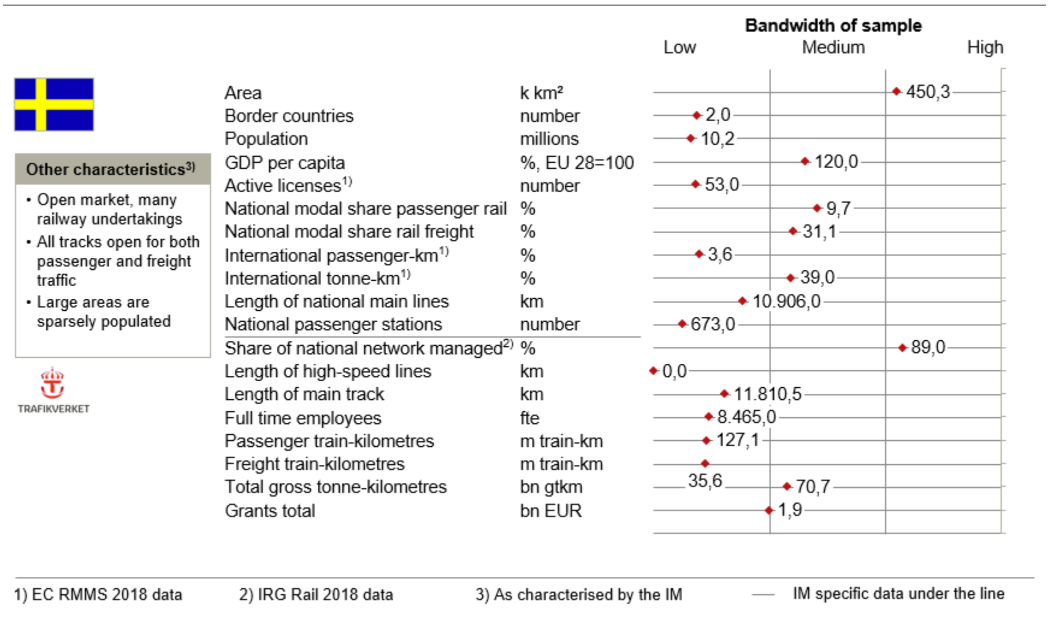


Figure 74: Fact sheet: Trafikverket[67]

[66] Grants total are normalised for purchasing power parity
[67] Grants total are normalised for purchasing power parity

4.3 Comments on deviations

Page	Indicator name	Input data name[68]	IM[69]	Comment by the IM for 2019 or the latest available year
30	OPEX – operational expenditures in relation to network size	Total OPEX - operating expenditures (N)	DB	According to the definition until data 2018: Total IMs annual operational expenditures
30	OPEX – operational expenditures in relation to network size	Total OPEX - operating expenditures (N)	FTIA	2015: Deviation from definition
32	CAPEX – capital expenditures in relation to network size	Total CAPEX - capital expenditures (N)	DB	According to the definition until data 2018: Total IMs annual operational expenditures
34	Maintenance expenditures in relation to network size	Total maintenance expenditures (N)	DB	According to the definition until data 2018: Total IMs annual operational expenditures
34	Renewal expenditures in relation to network size	Total renewal expenditures (N)	DB	According to the definition until data 2018: Total IMs annual operational expenditures
38	TAC revenue in relation to traffic volume	Total train-km (D)	BDK	The value does not include work traffic
43	Significant accidents	Total train-km (D)	BDK	The value does not include work traffic
43	Significant accidents	Number of significant accidents (N)	DB	The number refers to all IMs in Germany
45	Persons seriously injured or killed	Total train-km (D)	BDK	The value does not include work traffic
45	Persons seriously injured or killed	Number of persons seriously injured and killed (N)	DB	The number refers to all IMs in Germany
47	Infrastructure manager related precursors to accidents	Total train-km (D)	BDK	The value does not include work traffic
47	Infrastructure manager related precursors to accidents	Number of precursors to accidents (N)	DB	The number refers to all IMs in Germany
62	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 High Speed trains are included because only HS delays suit the definition
62	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 Strategic points are "stops" (Germ. "Halte")
62	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	HŽI	Delays are rounded to 5 minutes for passenger trains
62	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	LISEA	Measuring to less than 5mins 59sec.
62	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

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

Page	Indicator name	Input data name[68]	IM[69]	Comment by the IM for 2019 or the latest available year
62	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	SBB	Limit used is 4'59
62	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.	First, SNCF R. measures punctuality at the last observation point (which can be some kilometres away from the last stop of the train). Second, SNCF R. does not use UIC's rounding rule #2. Their system only allows the use of the following rule: 5'59 for passengers transport 15'59 for freight transport
62	Passenger trains punctuality	Passenger trains arrived at strategic measuring points with a delay of less than or equal to 5:29 minutes (N)	SŽCZ	UIC threshold for delay of less or equal to 5:00 minutes
64	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: Freight trains: 0,00 to max. 15,59 minutes
64	Freight trains punctuality	Freight trains arrived at strategic measuring points with a delay of less than or equal to 15:29 minutes (N)	HŽI	Delays are rounded to 60 minutes for freight trains.
64	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
64	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.	First, SNCF R. measures punctuality at the last observation point (which can be some kilometres away from the last stop of the train). Second, SNCF R. does not use UIC's rounding rule #2. Their system only allows the use of the following rule: 5'59 for passengers transport 15'59 for freight transport
64	Freight trains punctuality	Freight trains arrived at strategic measuring points with a delay of less than or equal to 15:29 minutes (N)	SŽCZ	UIC threshold for delay of less or equal to 5:00 minutes
66	Delay minutes per train-km caused by the infrastructure manager	Total train-km (D)	BDK	The value does not include work traffic
66	Delay minutes per train-km caused by the infrastructure manager	Delay minutes – infrastructure manager's responsibility (N)	LDZ	Threshold 1:00 minute
69	Signalling failures in relation to network size	Total number of signalling failures (N)	DB	KPI according to internal measurement system
69	Telecommunication failures in relation to network size	Total number of telecommunication failures (N)	DB	KPI according to internal measurement system
69	Track failures in relation to network size	Total number of track failures (N)	FTIA	Signalling related failures in switch functions are considered to be "track failures" as well
69	Assets failures in relation to network size	Total number of asset failures (N)	LDZ	Threshold 1:00 minute
69	Signalling failures in relation to network size	Total number of signalling failures (N)	LDZ	Threshold 1:00 minute
69	Telecommunication failures in relation to network size	Total number of telecommunication failures (N)	LDZ	Threshold 1:00 minute

Page	Indicator name	Input data name[68]	IM[69]	Comment by the IM for 2019 or the latest available year
69	Power supply failures in relation to network size	Total number of power supply failures (N)	LDZ	Threshold 1:00 minute
69	Track failures in relation to network size	Total number of track failures (N)	LDZ	Threshold 1:00 minute
69	Structure failures in relation to network size	Total number of structure failures (N)	LDZ	Threshold 1:00 minute
69	Other infrastructure failures in relation to network size	Total number of other failures (N)	LDZ	Threshold 1:00 minute
72	Average delay minutes per asset failure	Total delay minutes - Asset failures (N)	LDZ	Threshold 1:00 minute
75	Tracks with permanent speed restrictions	Track-km with permanent speed restriction (N)	DB	Base is a part of the network (according to the financing mechanism LuFV) and not the whole network
75	Tracks with permanent speed restrictions	Track-km with permanent speed restriction (N)	FTIA	2015: Deviation from definition
75	Tracks with permanent speed restrictions	Track-km with permanent speed restriction (N)	SNCF R.	Uncertainty to what extent PSR are included in the annual timetable
76	Tracks with temporary speed restrictions	Track-km with temporary speed restriction (N)	SNCF R.	2018: SNCF R accounts for all TSR planned, including short-term TSR, planned during the exploitation year.

4.4 PRIME KPI-definitions

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

Overview of main rail industry characteristics and trends

KPI name	KPI Definition	KPI unit
National modal share of rail in passenger transport	Proportion of national rail passenger-km compared to total passenger-km of passenger cars, buses/coaches and railways. (Source: European Commission, Statistical Pocketbook/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, Statistical Pocketbook/Eurostat)	% of tonne-km

KPI name	KPI Definition	KPI unit
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 convey-ance of passengers or goods, maintained and operated by the infrastructure manager. Tracks at service facilities not used for run-ning 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 for-mation facilities, including shunting facilities; storage sidings; maintenance facilities; oth-er 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.	km
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 agricul-tural installations and which are not open to public traffic. Metro, Tram and Light rail urban lines (with non-standard – narrow - gauge) should be	km

KPI name	KPI Definition	KPI unit
	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.	
High Speed main line	High Speed main line-km	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

Finance

KPI name	KPI Definition	KPI unit
OPEX – operational expenditures in relation to network size	Total infrastructure managers annual operational expenditures per main track-km	Euro per main track-km
CAPEX – capital expenditures in relation to net-work size	Total infrastructure managers annual capital expenditures per main track-km	Euro per main track-km
Maintenance expenditures in relation to net-	Total infrastructure managers annual maintenance expenditures per main track-km	Euro per main track-km

KPI name	KPI Definition	KPI unit
work size		
Renewal expenditures in relation to network size	Total infrastructure managers annual renewal expenditures 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-access charges in relation to network size	Total infrastructure managers annual revenues from non-access charges (e.g. commercial letting, advertising, telecoms, but excluding grants or subsidies) related to total main track-km	Euro per main track-km
Proportion of TAC in total revenue	Percentage of infrastructure managers annual TAC revenues (including freight, passenger and touristic trains) compared to total revenues	% of monetary value

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,	Number per mil-lion train-km

KPI name	KPI Definition	KPI unit
	• 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.	
Persons seriously injured and killed	Relative number of persons seriously injured (i.e. hospitalised for more than 24 hours, excluding any attempted suicide) and killed (i.e. killed immediately or dying within 30 days, excluding any 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	In number per million train-km
Infrastructure manager related precursor to accidents	Relative number of the following types of precursors: • broken rail, • track buckle and track misalignment,	In number per million train-km

KPI name	KPI Definition	KPI unit
	• wrong-side signalling failure	

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

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 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 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	Minutes per train-km

KPI name	KPI Definition	KPI unit
	to UIC leaflet 450-2. Delay minutes will be measured at all available measuring points. Of those measured delay minutes that exceed a threshold of 5:29 minutes for passenger services and 15:29 minutes for freight services the maximum number is counted. No delay minutes are counted if these thresholds are not exceeded at any measuring point	
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	Minutes per failure

KPI name	KPI Definition	KPI unit
	not exceeded for any train at any available measuring point (i.e. if no train is affected)	

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

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

4.5 Individual thresholds of punctuality for national measures

Passenger train categories	2:29	2:59	…	4:59	5:29	5:59	15:29
Long distance		SBB CFF FFS, banedanmark, ProRail		adif, Infraestruturas de Portugal	VÄYLÄ, Polskie Linie Kolejowe	LTG Infra, SNCF Réseau, DB Netze, Latvijas Dzelzceļš, Trafikverket	RFI
Regional		SBB CFF FFS, banedanmark, ProRail		adif, Infraestruturas de Portugal	RFI, Polskie Linie Kolejowe	LTG Infra, SNCF Réseau, DB Netze, Latvijas Dzelzceļš, Trafikverket	
Commuter	VÄYLÄ	SBB CFF FFS, banedanmark, adif		Infraestruturas de Portugal	RFI, Polskie Linie Kolejowe	LTG Infra, SNCF Réseau, DB Netze, Trafikverket	

Figure 75: National delay measurement thresholds (in minutes:seconds)[70]

	2:59	4:59	5:59	14:59	15:29	15:59	29:59	30:29	59:59
Freight trains	SBB CFF FFS, ProRail	banedanmark	Trafikverket	LTG Infra	Polskie Linie Kolejowe, VÄYLÄ	SNCF Réseau, DB Netze, Latvijas Dzelzceļš	Infraestruturas de Portugal	RFI	adif

Figure 76: National delay measurement thresholds (in minutes:seconds)

70 RFI: Some Long distance trains have a threshold of 10:29

4.6 Financial data

Country	2012	2013	2014	2015	2016	2017	2018	2019
Croatia	4,87	4,89	4,81	4,67	4,72	4,70	4,80	4,80
Czechia	17,70	17,49	17,44	17,21	17,61	16,43	17,82	18,19
Denmark	10,06	10,06	10,06	9,72	9,94	10,34	9,83	9,75
Finland	1,21	1,24	1,24	1,21	1,24	1,23	1,24	1,24
France	1,12	1,11	1,10	1,08	1,10	1,07	1,09	1,07
Germany	1,04	1,05	1,04	1,04	1,06	1,04	1,07	1,08
Ireland	1,09	1,11	1,11	1,08	1,11	1,29	1,13	1,16
Italy	1,00	1,01	1,01	0,98	0,99	1,02	0,99	0,98
Latvia	0,67	0,68	0,68	0,66	0,68	0,68	0,71	0,72
Lithuania	0,60	0,60	0,60	0,59	0,62	0,60	0,65	0,66
Netherlands	1,10	1,09	1,09	1,08	1,11	1,15	1,13	1,15
Norway	11,95	12,26	12,56	13,22	14,05	14,67	14,32	14,52
Poland	2,40	2,41	2,41	2,35	2,42	2,28	2,51	2,56
Portugal	0,78	0,79	0,78	0,78	0,80	0,84	0,84	0,83
Spain	0,91	0,91	0,90	0,88	0,90	0,94	0,91	0,92
Sweden	11,52	11,81	11,99	11,78	11,78	12,96	12,60	12,79
Switzerland	1,79	1,79	1,75	1,64	1,64	1,86	1,68	1,68

Figure 77: Purchasing power parity (**Index, EU-28=1**)

Country	2012	2013	2014	2015	2016	2017	2018	2019
Croatia	7,52	7,58	7,63	7,61	7,53	7,46	7,42	7,42
Czechia	24,15	25,98	27,54	27,28	27,03	26,33	25,65	25,67
Denmark	7,44	7,46	7,45	7,46	7,45	7,44	7,45	7,47
Finland	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
France	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Germany	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Ireland	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Italy	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Latvia	0,70	0,70	1,00	1,00	1,00	1,00	1,00	1,00
Lithuania	3,45	3,45	3,45	1,00	1,00	1,00	1,00	1,00
Netherlands	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Norway	7,48	7,81	8,35	8,95	9,29	9,33	9,60	9,85
Poland	4,18	4,20	4,18	4,18	4,36	4,26	4,26	4,30
Portugal	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Spain	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Sweden	8,70	8,65	9,10	9,35	9,47	9,64	10,26	10,59
Switzerland	1,21	1,23	1,21	1,07	1,09	1,11	1,16	1,11

Figure 78: Average annual exchange rate (**Local currency unit/Euro**)

5 Glossary

Name	Description	Source
Affected train (by an asset failure)	A train is affected if the asset failure causes the train to exceed a delay minutes threshold of 5:29 minutes for passenger services or 15:29 minutes for freight services at any available measuring point.	
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)	A system that enforces obedience to signals and speed restrictions by speed supervision, including automatic stop at signals.	Recommendations to revise Annex 1 to Directive 2004/49
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 LICB Web Glossary, p.19
Funding	An amount of money used for a specific purpose, in our case to finance the infrastructure manager expenditures.	Longman, Dictionary of contemporary English
Grant	A direct financial contribution given by the federal, state or local government or provided from EU funds to an eligible grantee. Grants are not expected to be repaid and do not include financial assistance, such as a loan or loan guarantee, an interest rate subsidy, direct appropriation, or revenue sharing.	PRIME KPI subgroup
Gross tonne km	Unit of measure representing the movement over 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} ≥ 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.*	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 responsible 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

Name	Description	Source
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 Statis-tics, A. I-15 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.8
Line km	A cumulative length of all lines maintained by infrastructure managers.	PRIME KPI sub-group based on Glossary for transport statistics
Main Lines (Principle railway lines)	Railway lines maintained and operated for running trains.	Glossary for transport statistics, A.I-02.1
Main lines (Principle railway lines), length of	Cumulative length of railway lines operated and used for running trains by the end of reporting year. Excluded are: - Lines solely used for operating touristic trains and heritage trains; - Lines constructed solely to serve mines, forests or other industrial or agricultural installations and which are not open to public traffic; - Private lines closed to public traffic and functionally separated (i.e. stand-alone) networks; - Private lines used for own freight transport activities or for non-commercial passenger services and light rail tracks occasionally used by heavy rail vehicles for connectivity or transit purposes.	Glossary for transport statistics, A.I-02.1 and A.I-01
Maintenance cost	Costs of function: Maintenance means non-capital expenditure that the infrastructure manager carries out 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 Regu-lation (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 Statis-tics, 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 Statis-tics, 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 Glossa-ry, p.16

Name	Description	Source
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 subgroup on the basis of Regulation (EU) 2015/1100 (RMMS), Article 2
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
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

Name	Description	Source
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 LICB Web Glossary, p.18
Passenger trains	Train for the carriage of passengers composed of one or more passenger railway vehicles and, possibly, vans moving either empty or under load.	Glossary for Transport Statistics, A.IV-06 and A.IV-05
Permanent restrictions	Restrictions are defined as permanent if they are incorporated within the yearly timetable.	PRIME KPI subgroup
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
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

Name	Description	Source
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
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

Name	Description	Source
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 report-ing country shall be taken into account.	Glossary for Transport Statis-tics, A.IV-05 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 7.1
Traffic Man-agement 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 sub-group 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 (SE-RA), Article .3(28)