2018 PRIME Benchmarking report

KPI & Benchmarking Subgroup PRIME

LEGAL NOTICE

Contents

Foreword by PRIME co-chairs

With the European Green Deal, the European Commission has set out to become carbon neutral by 2050. To meet this challenge, rail will have to take up a bigger share of the transport system. The recent COVID pandemic has shown that rail is an essential backbone for supply chains and very resilient, making it an even more attractive alternative to other modes. PRIME members work to provide safe, reliable and efficient railway infrastructure for the transport of people and goods.

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 doing so to strive for better results. We are pleased that we can share with you the third benchmarking report prepared by the PRIME KPI subgroup, covering the years 2012-2018. 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, to identify strengths and weaknesses of the system.

Compared to the first two reports, this edition includes a number of new indicators, a more complete dataset and four new participants (in total 18). Five infrastructure managers are in the transitional phase to join. Taking into account its wider reach, this year's report offers, for the first time, 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 23 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.

Finally, we invite remaining PRIME members to join the benchmarking framework so that our report can gradually offer a complete picture of infrastructure management in the EU!

PRIME co-chairs

Elisabeth Werner *European Commission, DG MOVE* *Director of Land Transport*	Alain Quinet *SNCF Réseau* *Deputy Director General*

1 Introduction

Rail is one of the greenest, safest and most energy efficient transport modes. Employing more than one million people in Europe[1] and generating turnover of over eight billion Euros[2] per year, it connects millions of citizens across Europe every day.

Transport is central to the European economy and daily life, and demand for it continues to rise. Estimates suggest increases in European passenger and freight transport by 42% and 60% by 2050 respectively. However, transport generates around a quarter of all EU greenhouse gas emissions[3] – which has serious health and environmental consequences. As public awareness about climate change increases, demand for sustainable forms of transport does too – be it for cross-border travel, or for everyday commutes. Transporting more freight by rail, instead of by road, is another essential element of making transport more sustainable. Having an attractive rail system with sufficient capacity and modernised infrastructure will be key to accelerating sustainable transport across Europe. The COVID-19 pandemic has even increased the urgency of achieving this goal. Under these circumstances, rail can ensure an adequate level of services to respond to the essential needs of mobility.

Promoting rail as a green choice for transport and mobility

With the European Green Deal, the European Commission has set out to cut CO_2 emissions by at least 50% by 2030, and to achieve net-zero CO_2 emissions by 2050, which requires reducing the carbon footprint of the transport system by 90%. To meet this challenge, rail will have to take up a bigger share of the transport system. Through its policies and legislation, the EU aims to make rail more efficient, affordable and innovative. EU policies focus on aspects that are crucial for developing a strong and competitive rail industry, and a green and sustainable transport system overall:

---

[1] European Commission (2019): Sixth report on monitoring development of the rail market. (https://ec.europa.eu/transport/sites/transport/files/staff_working_document_-_6th_rmms_report.pdf.)

[2] DG MOVE (2019): EU transport in figures. The values are estimated by DG MOVE including EU-28 countries: 24, 26

[3] European Environment Agency (2019): Greenhouse gas emissions from transport in Europe. https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases/transport-emissions-of-greenhouse-gases-12

- **Facilitating a strong and competitive rail sector.**
  Establishing a Single European Rail Area where railway companies can operate in a single and competitive EU-wide market – in which the same rail operator could offer services anywhere in Europe, without national borders – will bring down costs, and make rail more attractive for passengers.

- **Removing barriers to seamless rail transport.**
  EU legislation harmonises diverging safety, administrative and operational requirements across the EU. That way, the same train is able to run on networks all over Europe, following the same rules. The European Union Agency for Railways (ERA) has a mandate to issue single safety certificates and vehicle authorisations which are valid in multiple European countries.

- **Developing a modern rail infrastructure network.**
  Capacity constraints and ageing infrastructure are hampering rail traffic. That is why public and private investment in Europe's infrastructure is needed both in national operations and at cross-border links.

- **Stimulating innovation.**
  Tackling challenges and opportunities such as rising transport demand and digitalisation requires innovative solutions. The Shift2Rail Joint Undertaking is a public-private partnership in the rail sector, providing a platform for EU research and innovation.

Rail policy consequences for infrastructure managers

In order to fulfil its role in the European Green Deal as an attractive and performant alternative to more polluting modes of transport, rail has to be safe, punctual, reliable, affordable and inclusive 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.

- **Safety** is a top priority. Although safety risks cannot be completely eliminated, safety levels can be significantly improved by good asset condition and adopted 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.

- **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[4], 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.
- 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 0.5% of CO_2 emissions from all transport modes.[5] Rail has the potential to become completely carbon neutral well before the rest of the economy by 2050.
- Efficient and foresighted **maintenance and construction** increases reliability and availability. Reducing the number of asset failures through proactive maintenance reduces delays and cancellations. Conversely, tracks in bad condition, and therefore subject to permanent or temporary speed limitations, lead to longer travel times and in some cases lower utilisation, as the route becomes unattractive.
- **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[6]. As capacity is limited, and new construction is very costly and time intensive, getting maximum capacity out of the existing infrastructure network is paramount. This depends on efficient capacity allocation and traffic management, as well as on systems like the European Rail Traffic Management System ERTMS, which allows for shorter head times between trains.
- **Strong cooperation between all actors across borders** is vital to enabling smooth operation between countries, overcome fragmented national structures and create a truly open and interoperable railway market. It paves the

[4] 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

[5] European Environment Agency (2019): Greenhouse gas emissions from transport in Europe. https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases/transport-emissions-of-greenhouse-gases-12

[6] 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

way for major international projects and services linking European cities and citizens with each other. The Platform for Infrastructure Managers in Europe (PRIME) is a central element of this cooperation.

2 PRIME KPI & benchmarking

Platform of Rail Infrastructure Managers in Europe (PRIME)

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

The establishment of a network of rail infrastructure managers was one of the actions proposed by the Fourth Railway Package.[7] PRIME has grown significantly since its inception, both in terms of membership and the scope of activities. Alongside the European Commission and the European Union Agency for Railways (ERA), PRIME now has 39 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[8]. The participation of the main infrastructure managers per country in PRIME is mandatory. Working groups have been set up to address the major topics: safety, KPIs and benchmarking, digitalisation, charging and financing.

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: punctuality, costs, resilience, sustainable development, safety. The core of the benchmarking is the catalogue, which contains a clear and concise documentation of the PRIME key performance indicators (KPIs). The KPIs have been developed over a three-year period, in a consultative manner with all of the participant Infrastructure Managers and tested in 3 pilot exercises. The KPI & Benchmarking Subgroup is open to development and continues to expand the scope of the regular benchmarking study to adapt to the changing requirements and

[7] Article 7f of Directive 2012/34/EU of the European Parliament and of the Council of 21 November 2012. http://data.europa.eu/eli/dir/2012/34/2019-01-01

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

interests of the infrastructure managers. The number of infrastructure managers participating in the sub-group 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 2018 data, 23 infrastructure managers have contributed to the report, of which 18 are involved in this external report presented in the table below.

Infrastructure managers participating in the report

Infrastructure manager	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
Infraestruturas de Portugal S.A.	IP	Portugal
Latvijas dzelzceļš	LDZ	Latvia
Lietuvos geležinkeliai	LG	Lithuania
LISEA	LISEA	France
Network Rail	NR	Great Britain
PKP PLK	PKP PLK	Poland
ProRail	ProRail	Netherlands
RFI	RFI	Italy
SBB	SBB	Switzerland

Infrastructure manager	Abbreviation	Country
SNCF Réseau	SNCF R.	France
Správa železnic, státní organizace	SŽCZ	Czechia
Trafikverket	TRV	Sweden

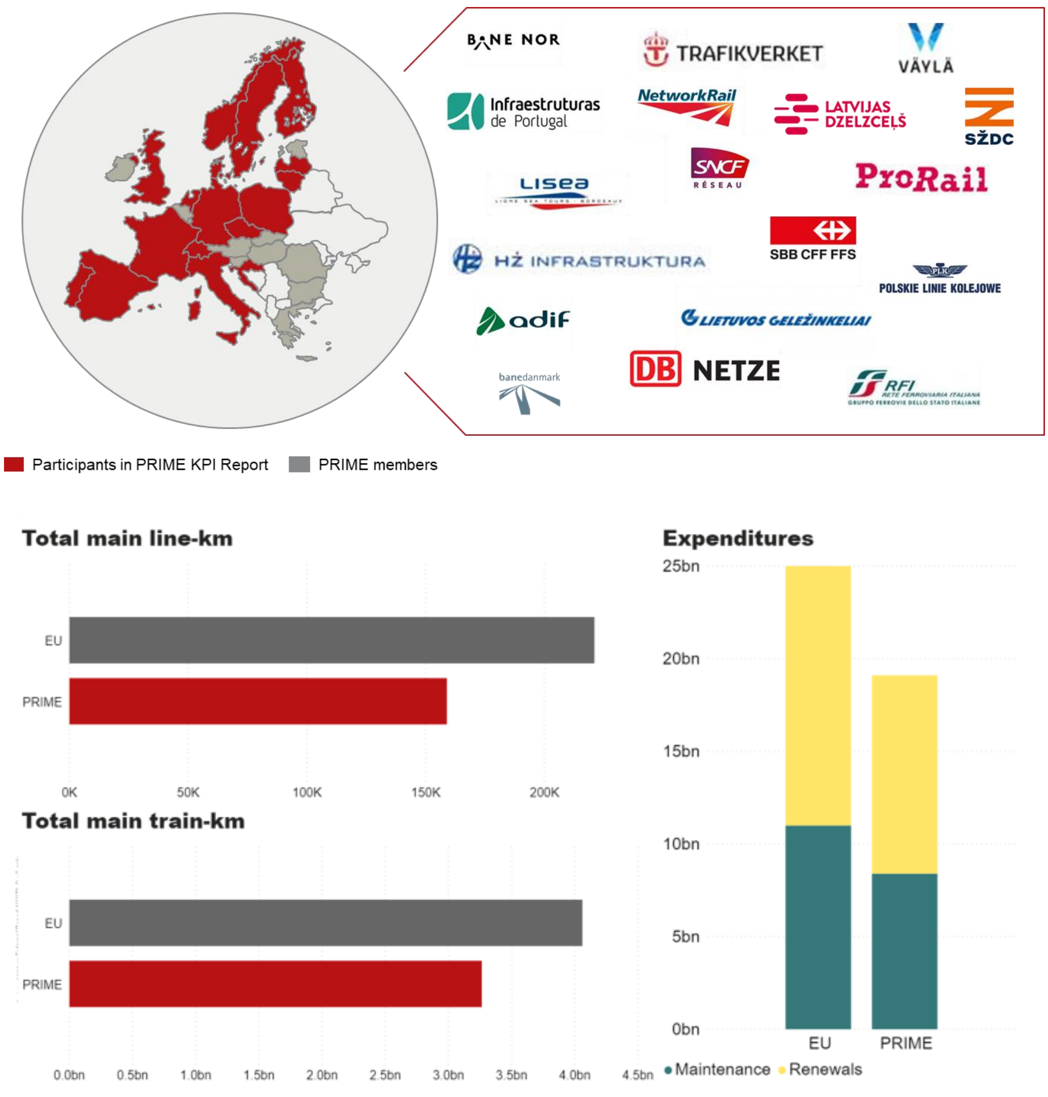


Figure 1: Dimensions of the infrastructure managers participating in the report[9]

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.

[9] EU-Data Source: RMMS Report 2018 (Data of 2016). PRIME-Data in the figure refers to all 18 participants of this report.

The current report has been produced based on 2012-2018 data accompanied by assessment of data completeness and robustness of 41 selected indicators. A significant improvement of the dataset has been achieved compared to the PRIME Benchmarking Report published last year with 2017 data, especially in terms of completeness.

The 18 infrastructure managers contributing their data to the present report represent over 70% of the European railway network. The data provided passed three quality checks including a check against data available from other sources, including representatives of the Commission and rail experts. Furthermore, the completeness of the indicators has improved over the years. At the beginning the completeness for the most relevant indicators was only 38%. Today it is nearly 75%.

In this report, the key indicators will each be shown in a time series and a benchmarking chart, presenting key trends and a cross-comparison of infrastructure managers. The time series chart is complemented with the compound annual growth rate (CAGR) to increase the visibility of the overall development. To ensure clarity and comparability only complete time series or time series with a maximum of one missing data point are shown. The same applies for the CAGR.

The benchmarking charts show the latest available annual data and the average of the available years for every individual infrastructure manager, plus the peer group's average weighted by denominator. The accuracy level of the data is indicated in each case. 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.

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 2 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. **When considering the following comparative presentations of the indicators it should be taken into account that the data and indicators reflect very different situations, both in terms of the infrastructure stock and in terms of use and investment.**

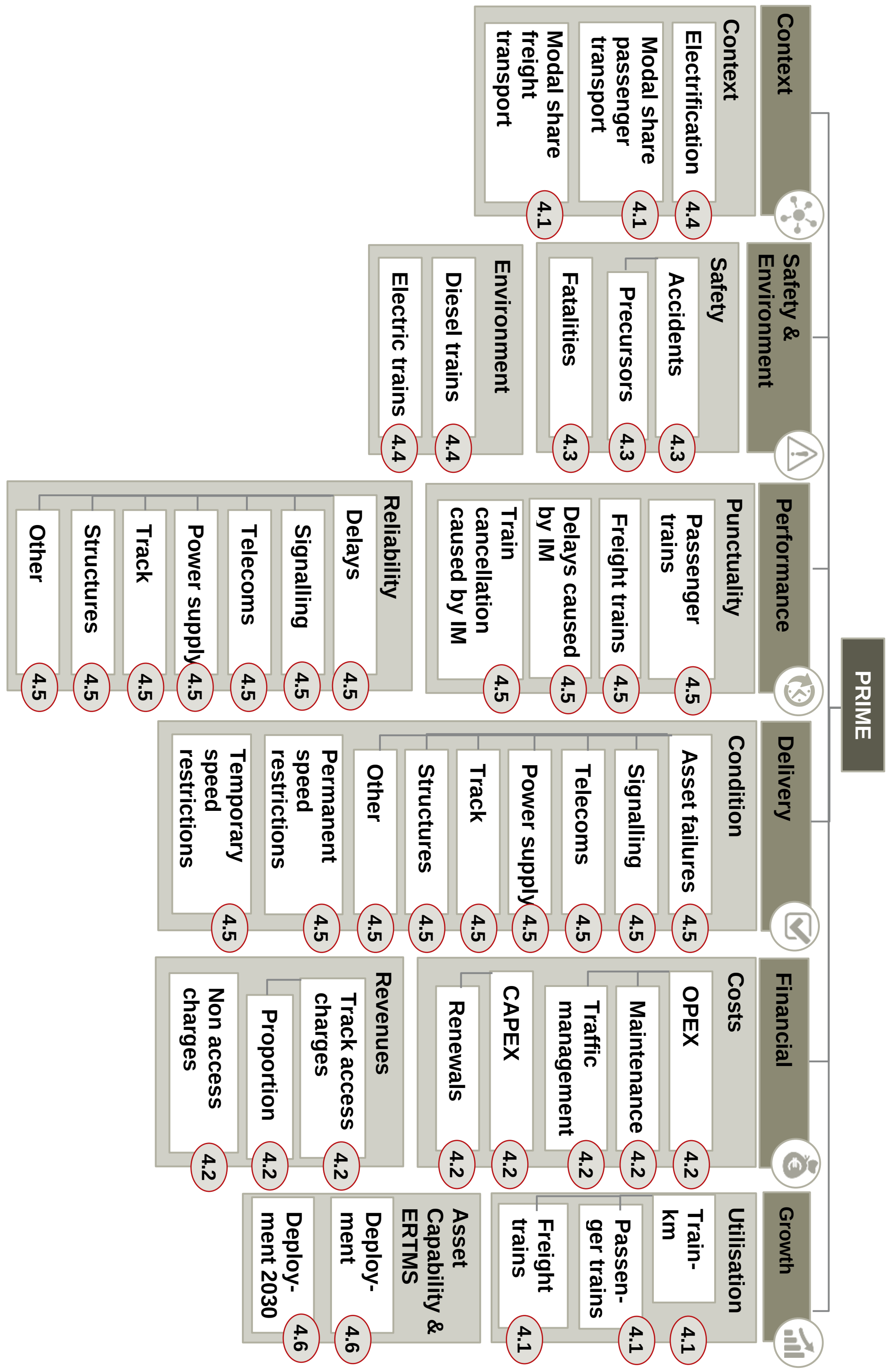


Figure 2: Selected indicators for the report and their chapters in the report

Chapter 3 provides a general overview of the main factors influencing the infrastructure managers' performance. **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.** Chapter 4 explains the indicators in detail and presents the infrastructure managers’ figures and results.

3 Key influencing factors of participating infrastructure managers

Operating context

Contextualising the indicators is essential for the correct interpretation of the values. Infrastructure managers are operating in different countries under different geographic and political circumstances. Rail infrastructure is developed over decades and such long-term infrastructure decisions determine the shape of the network over a very long time. The selected focus of railway infrastructure investments also has long-term consequences. For example, a focus on increasing capacity by expanding the network leads to different results than a focus on punctuality and reliability. Other relevant factors include rules and regulation in operational and technical areas. The list is long and the circumstances are not the same for two infrastructure managers.

Influencing factors can be grouped in the following seven categories, which are illustrated below. Geographic, climate, socio-demographic, historical and political, economic, technical factors and services provided by the infrastructure manager. 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.

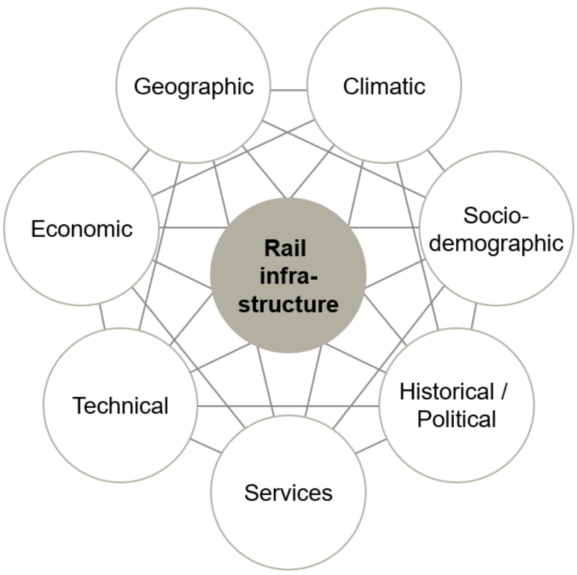


Figure 3: Factors influencing the outcome of rail infrastructure

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. Countries with highly complex topographical conditions include Switzerland, Spain, Norway and Italy.

That higher complexity requires more expensive network investments is itself compounded by the fact that higher complexity increases the possibility of asset failures (due to that complexity). However, complexity is only one factor driving asset failure rate: levels of operation and maintenance also have a significant influence.

Rail infrastructure in regions of seismic activity is highly exposed to damage caused by earthquakes and seismic waves. Landslides and floods have a similar impact, causing damage running into billions of euros. The topographic conditions are particularly challenging in Italy, where floods and landslides are relatively common, and approximately 40% of its territory is under seismic risk.

Coastal rail networks are affected by an acceleration of rusting and a reduction in electrical insulation performance caused by salty air. Accordingly, specific higher maintenance costs are a consequence in countries where a large number of tracks are built close to the coast.

Climatic

Conditions of climate are also important and influence specific results. In countries with very hard winters such as those in Scandinavian and the Baltic, very low temperatures might cause broken rails, switch malfunction, and snowdrifts. Besides normal latitude-related climate conditions, extreme weather events as a result of climate change also have an impact on rail infrastructure. Increased global temperature is leading to hotter and drier summers. High temperatures cause buckling in railway tracks and increase the risk of forest fires. Sweden and Norway especially were affected by extreme weather events in 2018.

In 2018 a number of very heavy storms damaged the rail infrastructure in several European countries. Strong winds damage tall infrastructure (mileposts, signals), and overturned trees cause delays, failures and speed restrictions[10]. In countries such as Latvia and in the northern European coniferous forest region (Finland, Sweden, Norway), such weather effects are naturally even more impactful.

Extreme weather events might also reduce safety performances: Accidents caused by fallen trees as well as by heat and cold damaged asset failures are likely consequences.

In addition to the effects of weather phenomena on reliability, asset failures and accidents in infrastructure operation, weather-induced damage to infrastructure naturally increases maintenance and renewal costs.

Socio-demographic

Population size, population density and population distribution within a country shape rail infrastructure. In small countries with a high population density the rail utilisation is consequently higher, allowing for higher economies of scale than in sparsely populated areas.

The population density of a country might also vary between regions. The network infrastructures of such countries then show parallels with both densely populated and with sparsely populated other countries but without being fully comparable. Spain, for example, has a mix of densely populated metropolitan centres and large areas that are sparsely populated. The same applies to the Scandinavian countries, with metropolitan centres in the south and sparsely populated northern regions, especially in Norway. The Netherlands on the other hand has a polycentric urban network.

Moreover, usage of rail infrastructure should not only be considered on a national level. In transit countries such as Germany and Switzerland, for example, 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

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

been a major support factor for a railway-friendly policy among the population and politicians.

Urban density, journey characteristics, car ownership, and environmental awareness of citizens are additional parameters that are influencing the share of rail in the modal split – with consequences on funding and extension plans. All these factors are very different among the infrastructure managers considered, which also makes direct comparison difficult.

Influencing factors such as the awareness and demand for safety in a younger or older society as well as the general social acceptance of (un)punctuality also influence the railway policy of a country via expectations and voting behavior. However different results of infrastructure managers cannot easily be explained by socio-demographic and political factors.

Historical and political

Historical factors, such as the onset of industrialisation in any given country, and the historical status and organisation of the railway also have an impact on today's infrastructure. A rail network might also reflect national characteristics: For example France's Paris-centric nature is projected on the spiderweb-like structure of the rail network in France, as it was designed during the mid-19th century.

The industrial structure of a country is another major factor influencing the share of freight transport. Heavy industry with heavy and bulky transport goods such as coal, sand, steel and wood also explains the high share of rail freight in today's Eastern European EU Member States. But again, there is no single influencing factor for all infrastructure managers. Switzerland, for example, has almost no heavy industry but shows a relatively high rail freight share. One explanation could be the Swiss ban on night-time trucking, and its general rail-friendly transport policy.

The historical, political and economic conditions of a country also contribute to explain the modal split between rail and road transport.

As a consequence of many years of environmentally conscious government policy, a railway-friendly financing policy is usually expected to increase funds for infrastructure managers. However, a dense and high-quality motorway network also has a significant impact on the split between these two modes of transport. E.g. Portugal, Spain, Croatia and also Germany have, inter alia, such road networks. Finally, the overall economic importance of a country's automotive industry might be another possible influencing factor.

National railway infrastructure is to a large part State funded. 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.

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. As explained, the service portfolio has grown historically and is politically and socio-politically determined.

The services offered on an infrastructure manager’s network can have different effects on performance. 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, differing significantly between countries. In Germany, for example, high speed connections mostly run on the same routes as lower speed passenger transport and even freight traffic. France, Spain and Italy have dedicated or partially dedicated infrastructures. A manager whose network consists exclusively of high-speed lines between metropolitan areas naturally has other OPEX and CAPEX values and also has other punctuality and reliability values than an operator of a mixed transport network.

Technological

The technical and technological level and state of development of railway network infrastructures varies considerably throughout the EU. For example, the networks in the newer EU Member States in Eastern Europe often still have a relatively high proportion of single tracked lines (Croatia, Lithuania). Also Finland shows a high portion of single tracked lines and due to its sparsely populated area outside the capital region, this infrastructure is also economically rational. Czechia for example has two gauges and four systems of electricity within one network - a circumstance of increased complexity and a driver of transaction cost.

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. Greater cost efficiency through investment in new technologies is achieved by eliminating specifically higher operating costs associated with the overuse of worn, error-prone assets. In addition, newer technologies are associated with specifically lower resource consumption especially in energy and personnel.

When comparing modernisation and roll-out of technological innovations, different starting points and investment cycles have to be considered. Furthermore, the effects that technological network investments might have on results in the areas of safety, reliability, punctuality and OPEX can only be observed afterwards. In the snapshot of the present report, such correlations of effects of technology investments and corresponding comparisons between managers are not apparent. One good example for how modern technology can help to improve the performance of rail are ATP systems. Automatic protection systems (ATP), such as ERTMS, are continually supervising the speed of the train and its compliance with the permitted speed, providing warning and automatic stop functions at certain signals or situations. High ATP-coverage across the network can make a positive contribution to the reduction of accidents and an improvement in overall safety. The EU aims to deploy ERTMS on the main corridors by 2030 to allow trains to seamlessly operate across different networks using the same system, and improve performance and safety (for example through wider coverage of ATP).

Economic

Economic circumstances within a country are influencing 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[11]. The market structure and the combination of public funding, track access charges and commercial funding of infrastructure determine the financing pool available to infrastructure managers.

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

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, the need for new capacity and the user's and the state's willingness to pay.

The amount of available revenues for an infrastructure manager determines its investment possibilities and maintenance performance. The status of the railway in a country is partly reflected by the budget allocated for that railway. Also, the time span for which funds are granted and approved is crucial. In Switzerland for example rail projects are decided for several decades and are independent of politically influenced budgets of a current government.

In the economic situation of an infrastructure manager, all other previously mentioned factors, namely geographic, climatic, socio-demographic, political, etc., ultimately merge together. The general economic situation of an infrastructure manager or his country on its own cannot meaningfully explain differences in individual performance indicators. A positive correlation between high GNP values, high revenues from track access charges and funding, with above-average performance in terms of network size and usage, safety, environment, and performance and delivery can of course be seen. However, such correlation is to be expected and should be self-evident.

4 Trends and developments

The chapter “Trends and Developments” is the core of the report showing selected indicators regarding finance, safety, environment, performance and delivery, and ERTMS deployment. 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 size and utilisation in Chapter 4.1 and work through the different categories from Chapter 4.2 onwards.

4.1 Overview of main rail industry characteristics and trends

Summary of industry characteristics

EU-wide objectives
• In order to fulfil its role in driving decarbonisation, rail needs to be an attractive alternative to more polluting modes of transport, both for passengers and freight. • The Fourth Railway Package aims to make cross-border traffic flows easier by harmonising operations and technologies and by reducing redundant national rules. • By 2030 the TEN-T core network should be completed.
Peer group’s performance
• The peer group’s network size remained almost unchanged between 2012 and 2018. • The average annual growth rate of the peer group for modal share is 0.3% for passenger rail and -1.2% in freight rail. • The individual modal share of rail of the peer group has a range between 0.9% and 17% in passengers and 5% and 74% in freight transport. • The peer group’s average annual growth rate of utilisation is 0.2% for passenger trains and -1% for freight trains. • The degree of utilisation ranges between 7 and 74 passenger trains and 3 and 11 freight trains per main track-kilometre a day.

4.1.1 Rail industry characteristics in the EU

The modal share is one of the most relevant indicators of a country's transportation and mobility. In order to increase the share of rail services in the transport market infrastructure managers are working to develop a more competitive and attractive rail service. Better utilisation of existing infrastructure as well as the expansion of capacity of the European rail network are essential elements of improvement.

Investing in rail network electrification is also in the forefront of future mobility sustainability, as part of European Green Deal, leading the world in transport carbon neutrality. Large infrastructure investments are mainly carried out on TEN-T corridors, allocating almost two thirds of the Connecting Europe Facility's funds to projects in rail transport. The ERTMS deployment plan has been established to replace legacy signalling systems on corridors, harmonizing the landscape of signalling and traffic management technology and generating additional positive effects with regards to capacity, safety and cost efficiency.

Rail characteristics indicators:

PRIME members are reporting seven 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
- 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 and tonne-kilometres per main track-kilometre.

4.1.2 Development and benchmark

Modal share of rail transport

Figures 4 and 6 show the national trends in the modal share of rail in passenger and freight transport on land in the Member States, based on data of the European Commission. Figures 5 and 7 present the benchmark between the infrastructure managers. For passenger transport the modal share compares the share of passenger cars, buses/coaches, aviation and railways. The modal share of rail in freight transport shows the national rail tonne-kilometres compared to total tonne-kilometres carried on road, inland waterways and rail freight.

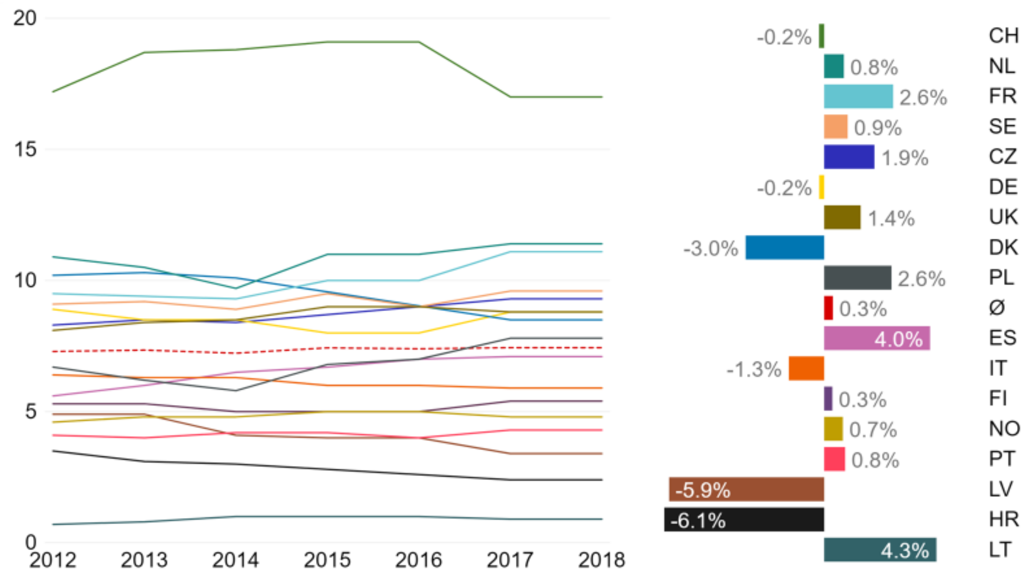


Figure 4: National modal share of rail in passenger transport in 2012-2018 (% of passenger-km)[12]

Between 2012 and 2018 the peer group's average in the modal share of passenger rail transport remained relatively stable, showing only a slight annual increase of 0.3%. Looking at the individual States the picture is more differentiated: in Lithuania, Spain, France and Poland the share of rail increased by over 2% on an annual average. In two thirds of the countries the development was positive.

[12] Source: European Commission, Statistical Pocket book. Data is estimated (except FI and LV). Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

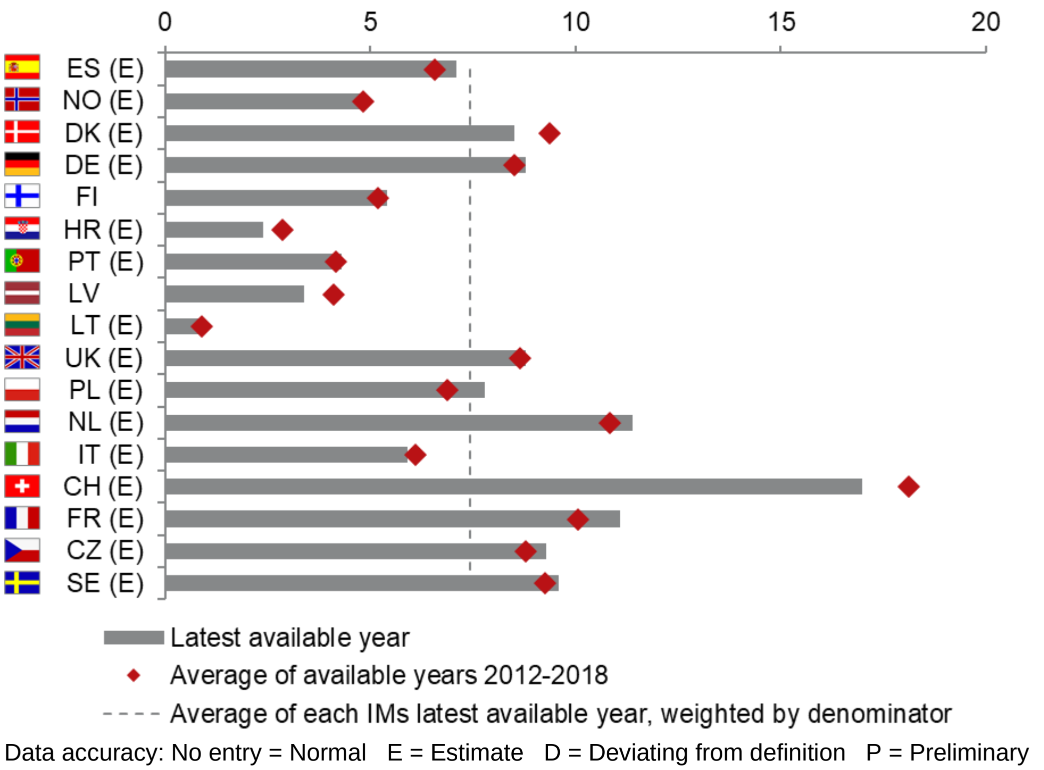


Figure 5: National modal share of rail in passenger transport (% of passenger-km)[13]

Figure 5 shows the cross-comparison of the Member States. The range of modal share of rail in passenger transport varies widely across the peer group. The highest modal share can be found in Switzerland (17%), while it varies between 0.9% and 11.4% in the other countries.

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 effecting the mobility choice are travel distances, availability and reliability, supply of alternative transportation means, comfort and cost factors. Switzerland is a good example for having relatively good conditions in most of them. As the country has a relatively small territory, the travel distances are comparatively low. Due to the high network density and utilisation, most of the cities can be reached in a relatively short time. Additionally, its performance in punctuality and reliability is high and the travel comfort and quality of service are among the best.

[13] Source: European Commission, Statistical Pocket book. Data for FI and LV have not been marked as “Estimate” in the data collection.

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. On the other hand, a higher number of people being able to afford to travel more could have a positive impact on long distance rail travel.

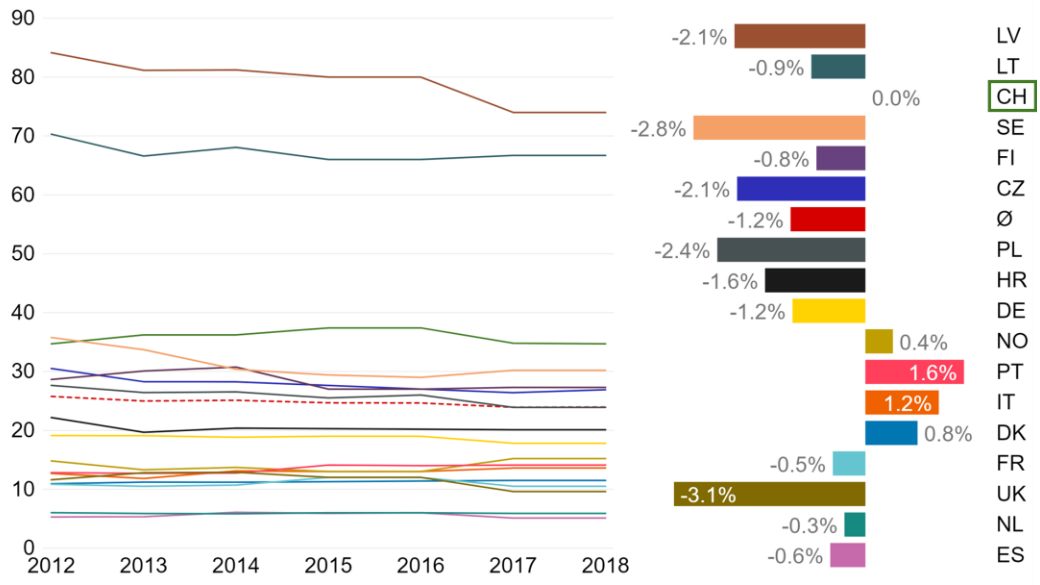


Figure 6: National modal share of rail in freight transport in 2012-2018 (% of tonne-km)[14]

In freight transport the development over the period is less positive: compared to the slight increase in the modal share of passenger rail, freight transportation decreased by 1.2% on average, with losses incurred in 12 countries. Only Portugal, Italy, Denmark and Norway showed a slightly positive development. This is especially disappointing when considering the objectives that have been set out in both the Transport White Paper in 2011 and the European Green Deal, which clearly emphasize the importance of increasing the share of rail in freight transport.

[14] Source: European Commission, Statistical Pocket book. Data is estimated (except FI and LV). Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

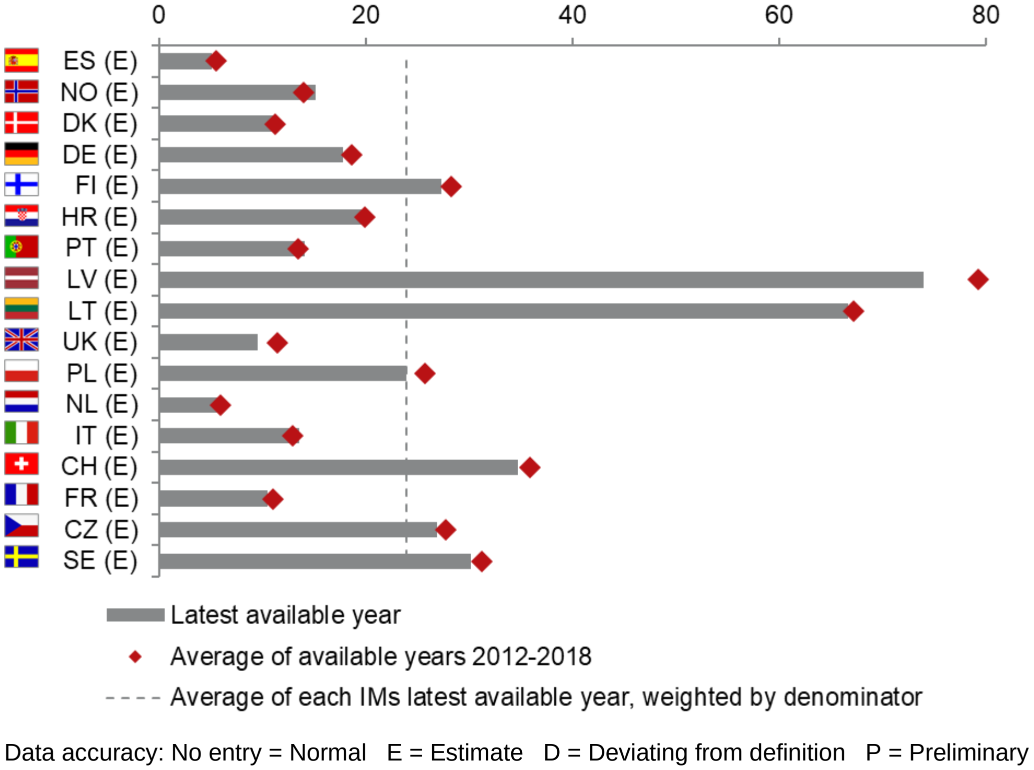


Figure 7: National modal share of rail in freight transport (% of tonne-km)[15]

The bandwidth of individual results for freight is similar to 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 74%, and in Lithuania for 66.7% of the total freight transport. In other countries it varies between 5% and 34.7%.

The high share of rail freight in the Baltic countries can be linked to the transport of Russian energy products but might also have its roots in the history of these countries.[16] In the post-war period the extension of freight rail transport became an important pillar of the industrialisation of Eastern European countries. Routes between important industrial centres were extended, but many side tracks were closed. Czechia and Poland are also among the countries with higher levels of freight activity.

[15] Source: European Commission, Statistical Pocket book.
Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.
[16] DG MOVE (2015): Study on the Cost and Contribution of the Rail Sector.

Macro-economic aspects, such as trade relations and the organisation of the logistics sector of a country, 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.

Network size

Figures 8 and 10 show the development of the rail network of the infrastructure managers measured in total track-kilometres and total main track-kilometres. Figure 10 presents the benchmark of these two indicators and the total main line kilometres to give a better overview of the network size operated.

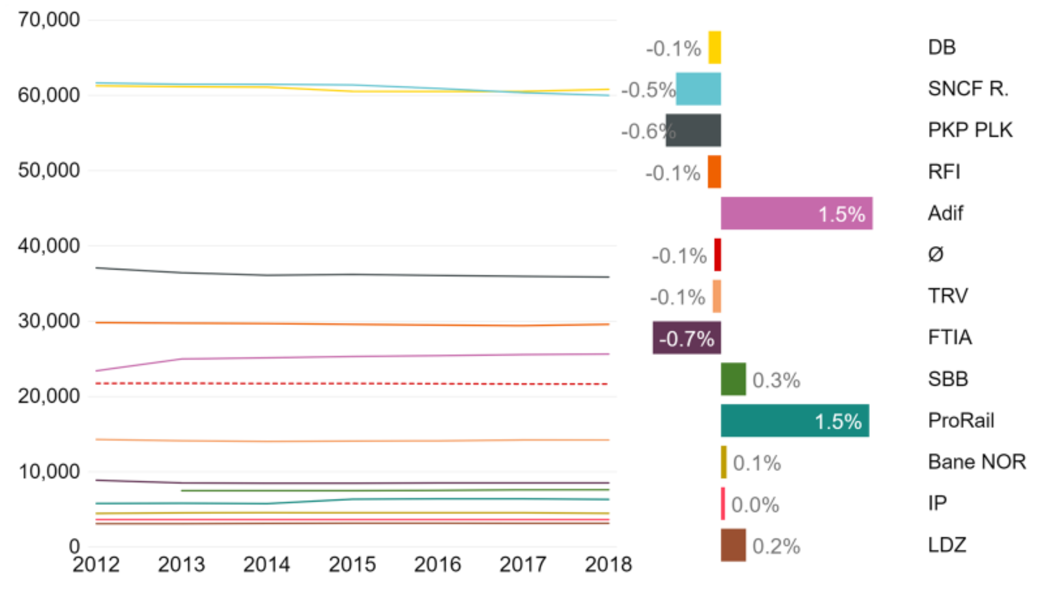


Figure 8: Total track km in 2012-2018 (Total track-km)[17]

[17] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

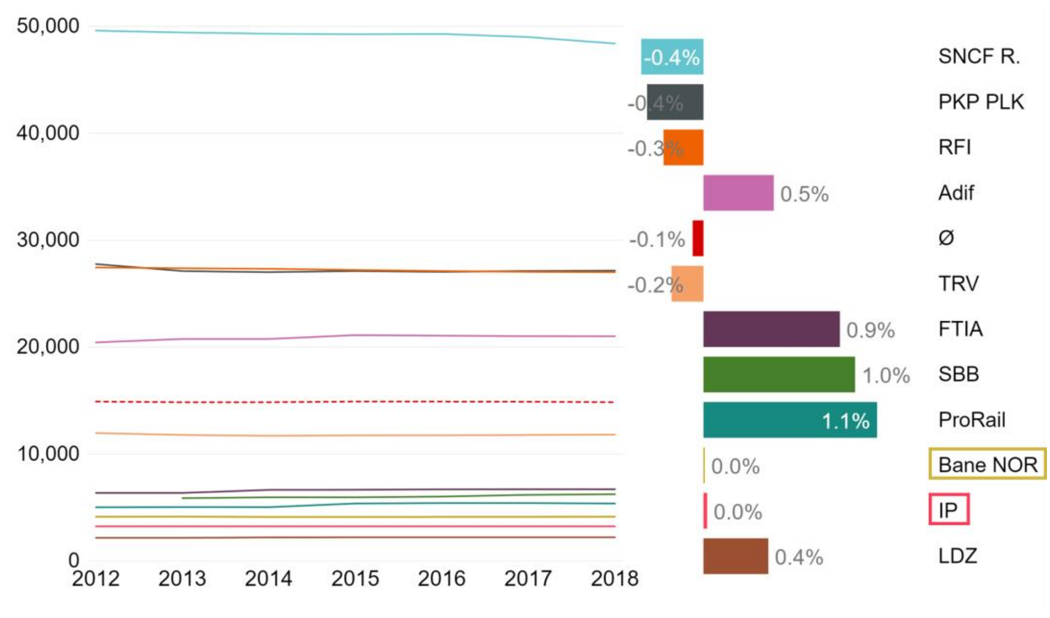


Figure 9: Total main track-km in 2012-2018 (Total main track-km)[18]

Rail infrastructure consists of long-lasting assets, with lifetimes often reaching several decades. Hence, the analysis over a period of seven years can only be of limited value. However, slight annual average increases in total main track kilometres can be observed at ProRail and SBB.

[18] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

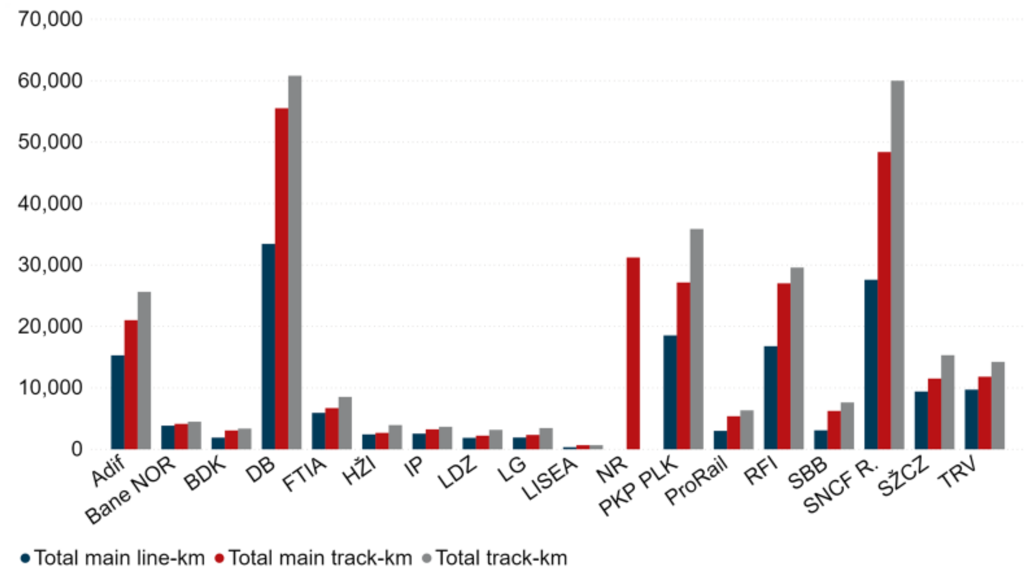


Figure 10: Total main line-km, Total main track-km and Total track-km[19]

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, LG, LDZ and HŽI. The length of railway lines operated and used for running trains is also the highest for DB and SNCF R. 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.

As illustrated, rail networks mostly remained unchanged over the years. They have slowly been extended over decades and were shaped by geographic conditions and the evolution of regions and cities. 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.

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.

[19] Data of 2016 (NR)

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. Nearly all network extensions were fully-financed or at least co-financed by the EU in Eastern and Central European countries and Portugal.

Network utilisation

Figures 11 and 13 show the development of the degree of network utilisation by passenger and freight trains. Figures 12 and 14 present the benchmark of these indicators between the infrastructure managers and are supplemented by figure 15, showing the utilisation of both passenger and freight trains.

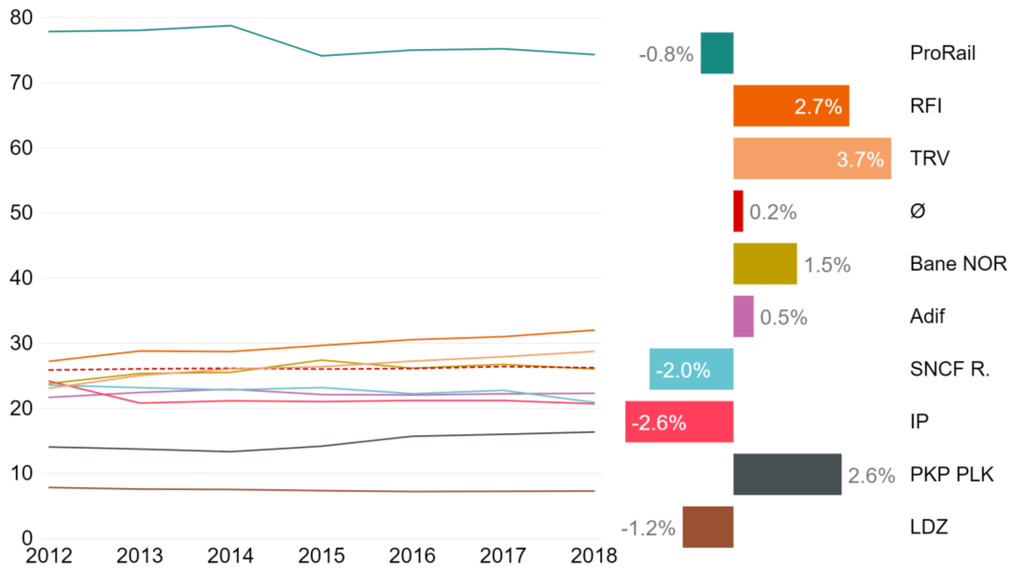
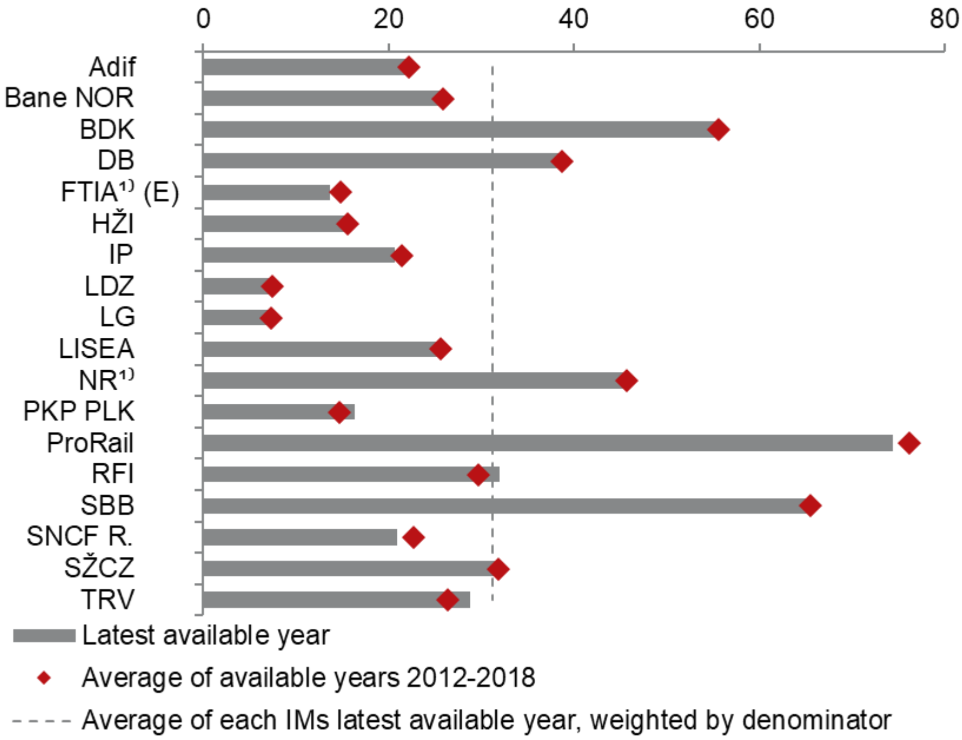


Figure 11: Degree of network utilisation – passenger trains in 2012-2018 (Daily passenger train-km per main track-km)[20]

Regarding passenger train utilisation, a marginal annual growth rate of 0.2% can be seen across all networks. The individual growth rates range between -2.6% and +3.7% per year, with TRV showing the highest increase in passenger train activity on its network.

[20] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2016

Figure 12: Degree of network utilisation – passenger trains (Daily passenger train-km per main track-km)

Figure 12 shows the individual degrees of network utilisation by passenger trains. The intensity of network use ranges from 7 to 74 trains a day. ProRail's and SBB's networks are utilised more than twice the average. LG and LDZ are showing the lowest degrees of utilisation regarding passenger trains.

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. Similarly 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 a country. 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.

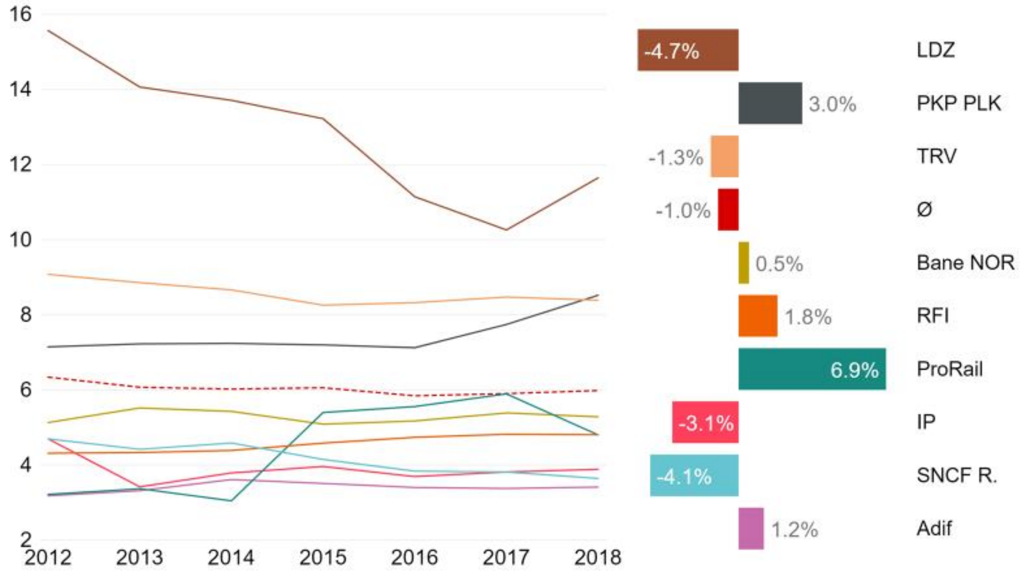
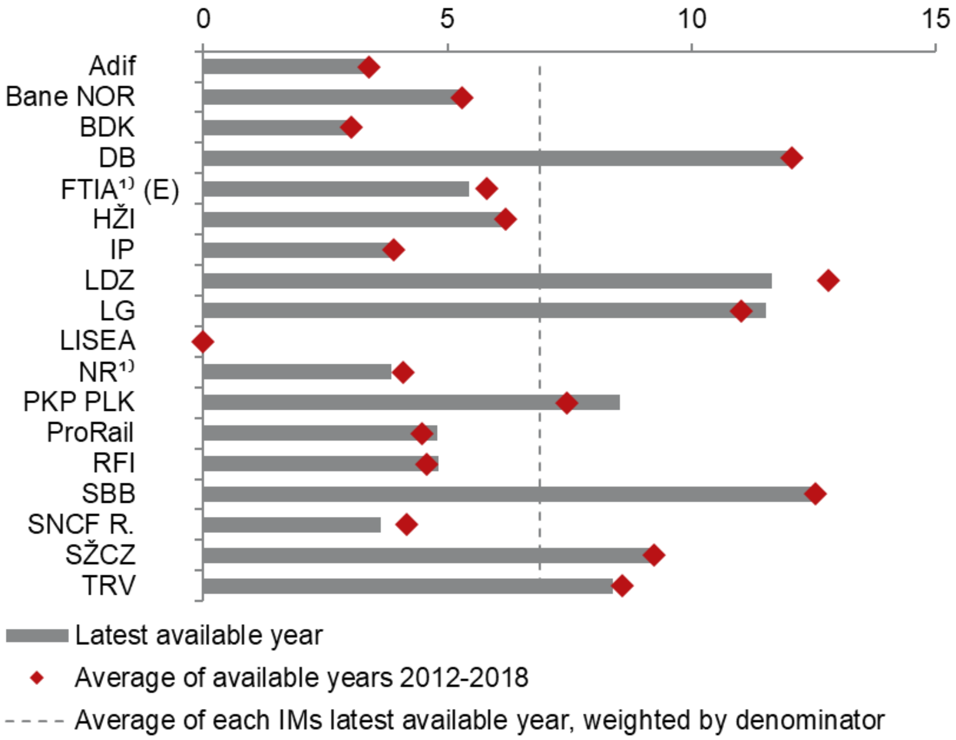


Figure 13: Degree of network utilisation – freight trains in 2012-2018 (Daily freight train-km per main track-km)[21]

The volatility of the degree of network utilisation with reference to freight trains is slightly higher than for passenger trains. The average annual growth rate across all networks is -1%. Almost half of the peer group faces a declining trend, which is most significant for LDZ and SNCF R. ProRail increased the degree of utilisation of freight trains by an annual average of 6.9%.

[21] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2016

Figure 14: Degree of network utilisation – freight trains (Daily freight train-km per main track-km)

The degree of freight train utilisation also 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 km of main track of LDZ's and LG's network, the intensity of use in the two Baltic networks is among the highest in the peer group. With reference to non-freight train activity LISEA is a special case, as its network is 100% high-speed.

Similarly to the modal share in freight transport, the degree of utilisation by freight trains highly depends on economic circumstances, more precisely the conditions for logistics within a country. Connectivity between trans-shipment centres such as airport and ports is just as decisive as smooth interconnections with other transport modes. 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.

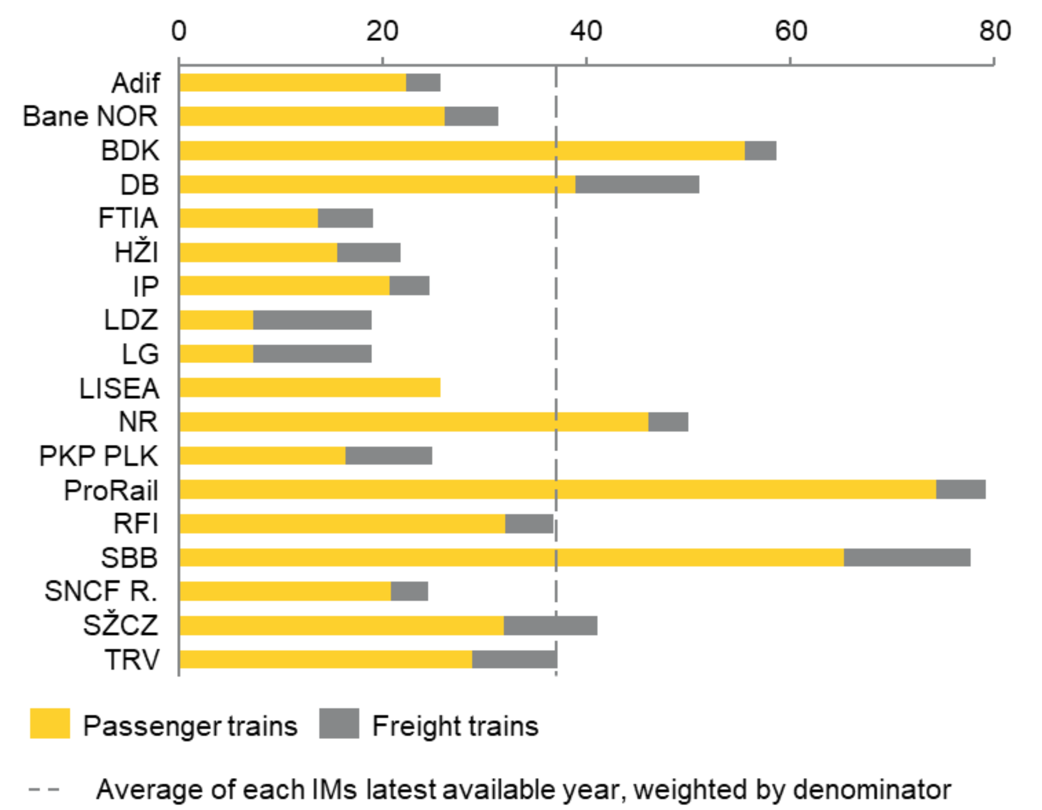


Figure 15: Degree of network utilisation –all trains (Daily train-km per main track-km)

Figure 15 illustrates the network utilisation of both passenger and freight trains. As utilisation itself has an impact on a range of other indicators it is important to analyse it as a whole: on average each of the peer group's railway tracks is frequented by 38 passenger and freight trains per day. The individual railway tracks are frequented between 19 to 83 times per day. When talking about the impact of utilisation in the following chapters, this concerns the utilisation of all trains.

4.2 Financial

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.

EU-wide objectives
• The European infrastructure managers apply different financing and funding structures and rely on combinations of public funding, access charges and commercial revenues. • EU legislation aims at increasing the transparency of funding arrangements and developing appropriate incentives to ensure the best available use of existing assets and capacity.
Peer group's performance
• Operational expenditures remain relatively stable over the years, showing a slight annual increase of 0.9%. • The level of operational expenditures varies between €40,000 - 217,000 per main track-kilometre per year. • Capital expenditures show higher fluctuation. The individual compound average growth rates of the infrastructure managers range from -24% to 13%. • The range of capital expenditures varies between €15,000 - 237,000 per main track-kilometre per year. • The share of track access charges in total revenues from charges is on a fairly constant level. The average annual share oscillates between 70% and 73% in 2012-2018.

4.2.1 Rail financing in the EU

Rail infrastructure requires a substantial amount of funding which is dedicated to building new infrastructure, replacing existing assets as well as maintaining and operating the asset base. Infrastructure managers are largely funded by public and state budgets which are constrained. Hence, providing good value for society is one of the most important objectives, requiring a constant balancing of costs, risks and performance. Infrastructure managers undertake a wide range of activities to ensure that funds available are spent in an appropriate way, including optimal decision making on where and when to spend budgets, state-of-the-art maintenance processes, digitalisation and the introduction of new technology.

In addition to funding provided by public sources, infrastructure managers generate revenues through track access charges and charges for other related services, paid by the railway undertakings. Apart from covering direct costs, infrastructure managers apply these charges to incentivise users to achieve the best utilisation of the network. As capacity is limited and investments into new infrastructure are costly, getting maximum capacity out of the existing infrastructure is paramount.

Successive packages of EU rail legislation have substantially increased the transparency of funding arrangements for European Rail infrastructure managers. Directive 2012/34/EU establishing a single European railway area[22] restates the need for rail undertakings and infrastructure managers to maintain separate accounts, and also requires that, under normal business conditions and over a period not exceeding five years, infrastructure manager income from different sources (including access charges and state funding) balances expenditure. 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.

However, the legal framework provides for considerable flexibility in the way in which the costs of infrastructure management are recovered. Subject to the requirement to set charges at least equal to the direct, or variable, costs of accommodating train services, infrastructure managers are free to defray the overall costs of the network through additional mark-ups, State funding, other commercial revenues or a combination of these.

Rail financing indicators

PRIME members report seven indicators measuring railway financing:

- Operational expenditures
- Capital expenditures
- Maintenance expenditures
- Renewal expenditures
- Track access charges

[22] 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

- Non-access charges
- Proportion of TAC in total revenue

In order to increase comparability of these values among infrastructure managers, the expenditure-figures are related to main track-kilometres, and the revenues from track access charges to the monetary value.

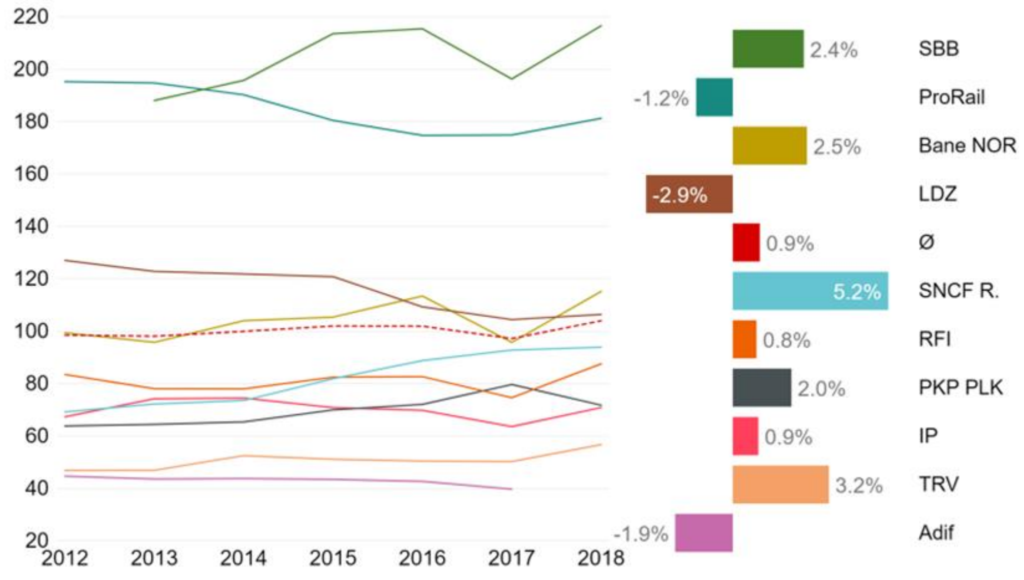
4.2.2 Costs

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.

4.2.3 Development and benchmark

Figures 16 to 20 show the operational and capital expenditures of the PRIME members over the time period 2012-2018 and the latest benchmark of these indicators between the infrastructure managers.

Operational expenditure

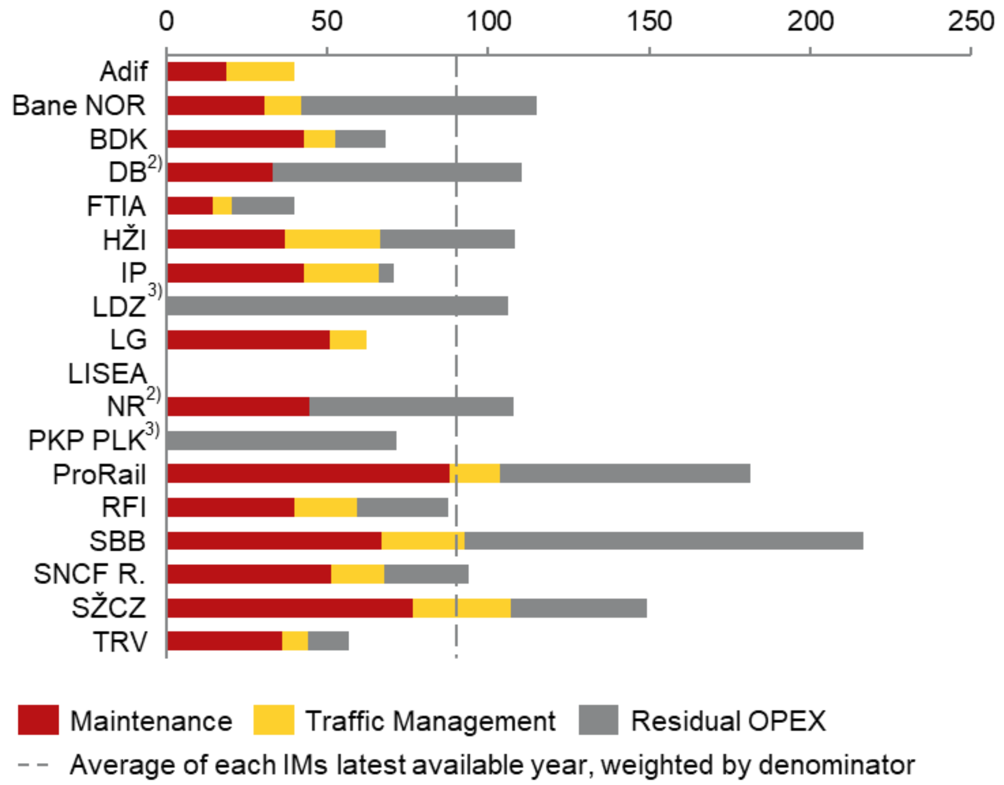


1) Results are normalised for purchasing power parity.

Figure 16: Operational expenditures in relation to network size in 2012-2018 (1,000 Euro per main track-km)[23]

According to the PRIME KPI & Benchmarking subgroup definition, operating expenditures are incurred through a business's normal operations. Operating expenditures include inter alia maintenance costs, traffic management, rent, equipment, inventory costs, payroll, insurance and funds allocated toward research and development. LDZ values for OPEX deviate from definition as they include expenditures in stations, signalling and industrial buildings as well. As can be seen in figure 16, the average expenditure across the peer group remained relatively stable over the period, showing only a slight increase in 2018. However, some infrastructure managers like SNCF R., Bane NOR, PKP PLK, and SBB experienced more or less constant annual increases. In contrast, Adif's and ProRail's operational expenditures decreased over the period.

[23] Results are normalised for purchasing power parity.
Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.



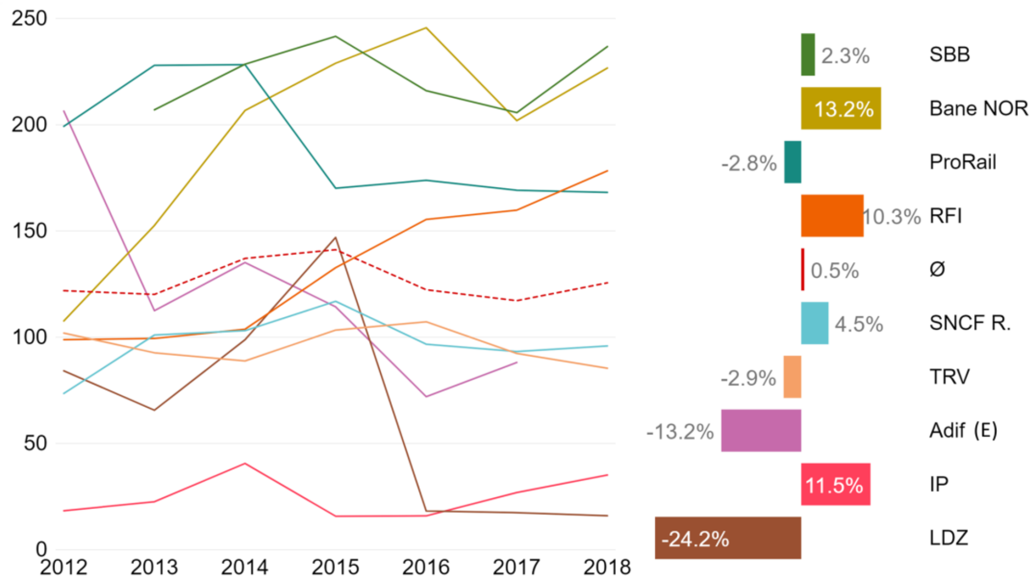
1) Results are normalised for purchasing power parity.
2) Traffic Management not available, therefore included in residual OPEX.
3) Disaggregation not available (LDZ, PKP PLK). Deviating from definition (LDZ).

Figure 17: Composition of operational expenditure in relation to network size (1,000 Euro per main track-km)

Figure 17 shows the composition and the level of operational expenditures in 2018. The level of operational expenditures varies between €40,000 – €217,000 per main track-kilometre per year. 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. providing goods and services to other infrastructure managers in Switzerland (See fig. 26 as counterpart: total revenues from non-access charges.). LDZ values for OPEX deviate from definition as they include expenditures in stations, signalling and industrial buildings as well. On average, infrastructure managers' annual operational expenditures amount to €91,000 per main track-kilometre.

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

Capital expenditures



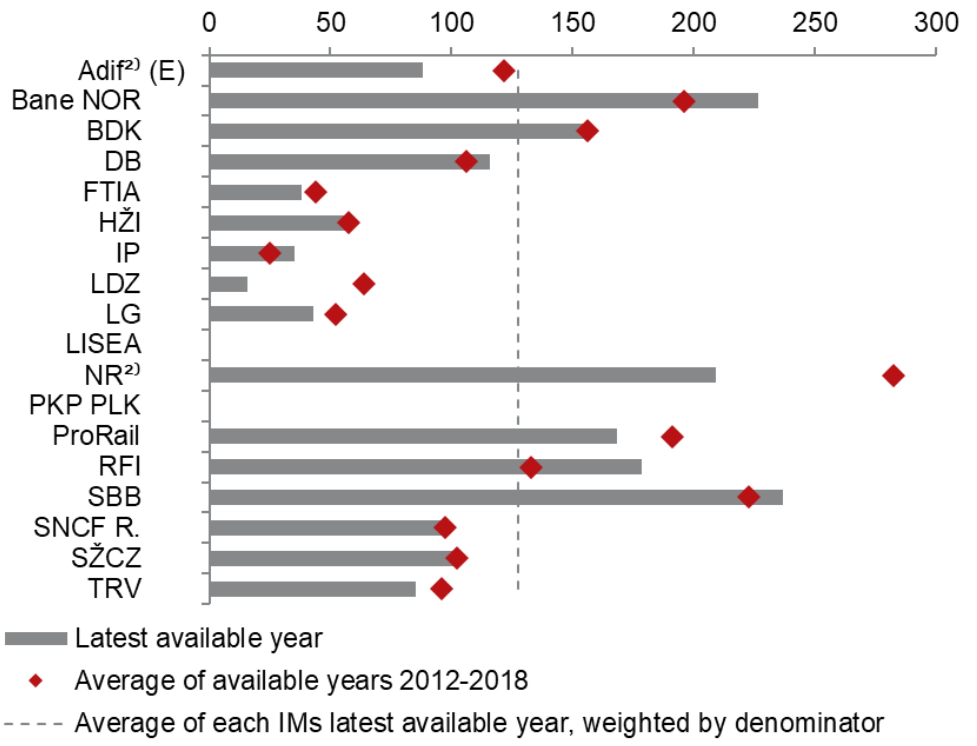
Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Results are normalised for purchasing power parity.

Figure 18: Capital expenditures in relation to network size in 2012-2018 (1,000 Euro per main track-km)[24]

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 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. As capital expenditures are often linked to major (re-)investment

[24] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

programs it is not surprising that expenditure levels fluctuate over time. The individual annual growth rates of the infrastructure managers range from -24.2% to 13.2%. The highest increase in investment related expenditure has been recorded at Bane NOR, IP and RFI, with Bane NOR spending almost twice as much in 2018 as in 2012. However, the peer group's annual average growth rate is rather low at 0.5%.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Results are normalised for purchasing power parity.
2) Data of 2017 (Adif) 2016 (NR).

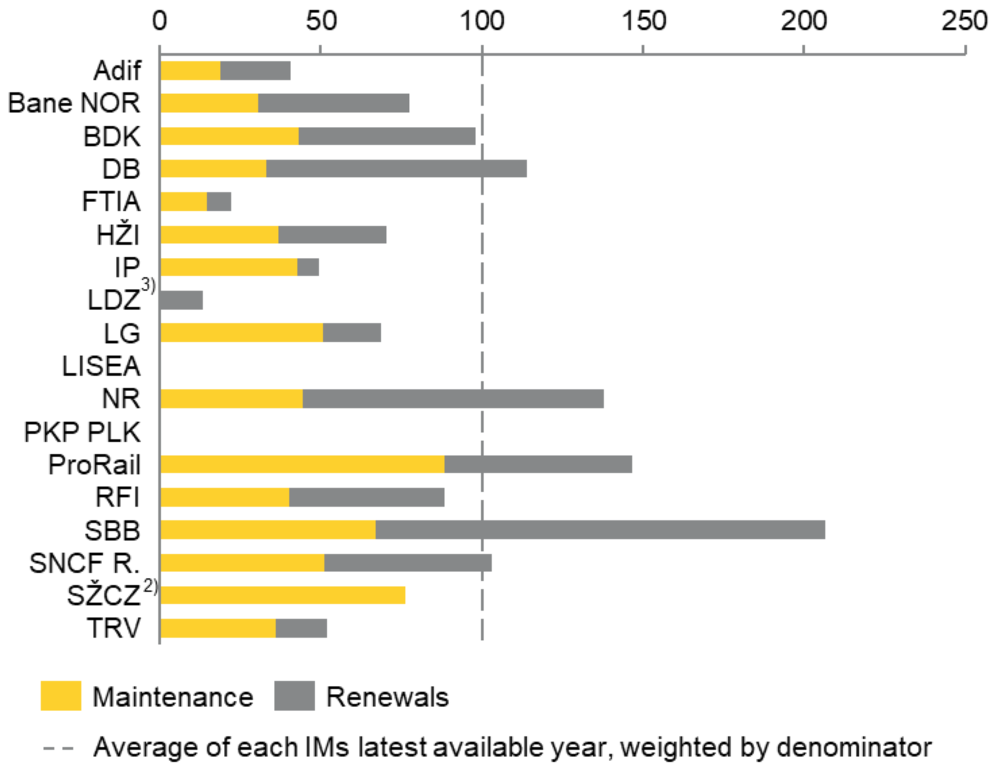
Figure 19: Capital expenditures in relation to network size (1,000 Euro per main track-km)

As can be seen in figure 19 the range of annual capital expenditures varies between €15,000 – 237,000 per main track-kilometre and year. On average €128,000 per main track-kilometre and year are spent on capital expenditures. The high value for SBB is due to forced maintenance as well as the intensive development of the railway by the federal government.

Similar to operational costs, capital expenditures also increase with higher network complexity. High numbers of switches, signalling and telecommunication assets increase the cost of renewals. Network complexity, in turn, 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



1) Results are normalised for purchasing power parity.
2) Renewal not available
3) Maintenance not available

Figure 20: Maintenance (component of OPEX) and renewal expenditures (component of CAPEX) in relation to network size (1,000 Euro per main track-km)

Figure 20 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 €100,000 per main track-kilometre per year. Only four infrastructure managers are significantly spending more than average, namely SBB, ProRail, NR and SNCF R.

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.

4.2.4 Revenues

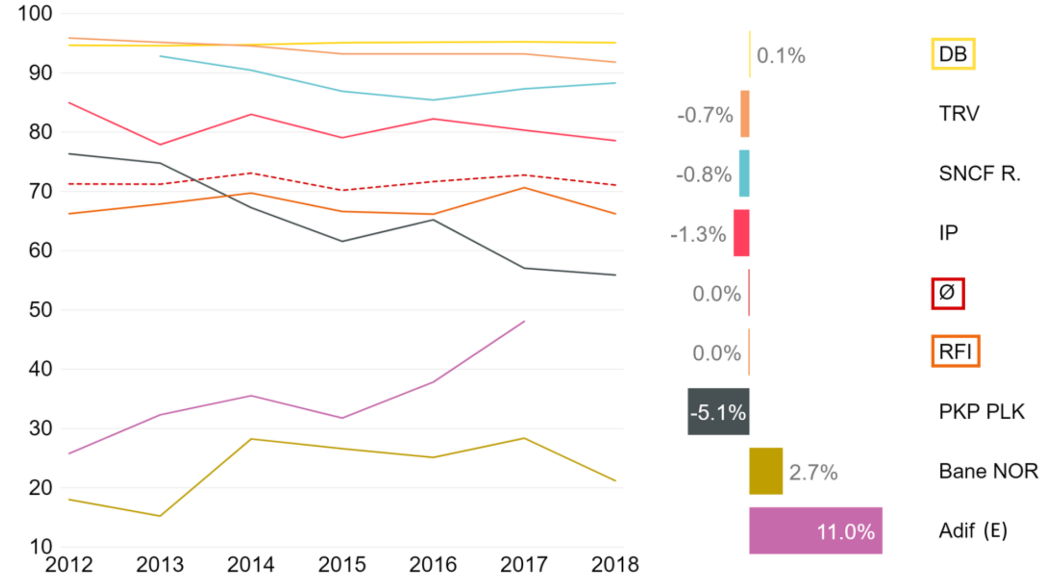
This category provides an overview of track access charges which are paid by railway undertakings using the railway network and its service facilities. Furthermore, it measures and compares non-track access related revenues 'earned' by an infrastructure manager, excluding subsidies and property development.

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.

4.2.5 Development and benchmark

Figures 21 and 23 show the development of the revenue indicators of the PRIME members over the time period 2012-2018, and the latest benchmark between the infrastructure managers is shown in figures 22 and 24.

TAC - Track access charges

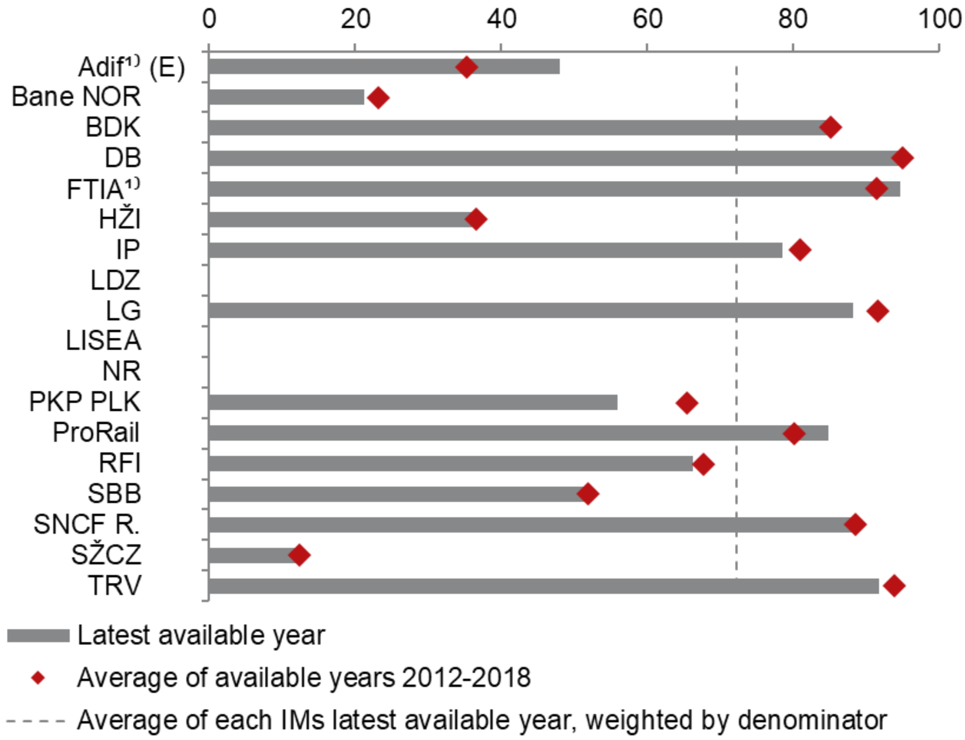


Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary

Figure 21: Proportion of TAC in total revenue in 2012-2018 (% of monetary value)[25]

The share of track access charges in total revenues from charges is on a fairly constant level. The average annual share oscillates between 70% and 73%. The individual proportion of TAC in total revenues changed annually between -5.1% and +11.0% in the period. Total revenues exclude grants and subsidies.

[25] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2017 (Adif) 2016 (FTIA)

Figure 22: Proportion of TAC in total revenue (% of monetary value)

At seven infrastructure managers the share of track access charges of total revenues is above 80%. The peer group's average is 73%, however for Bane NOR and SŽCZ the relevant share is only 21% and 12%.

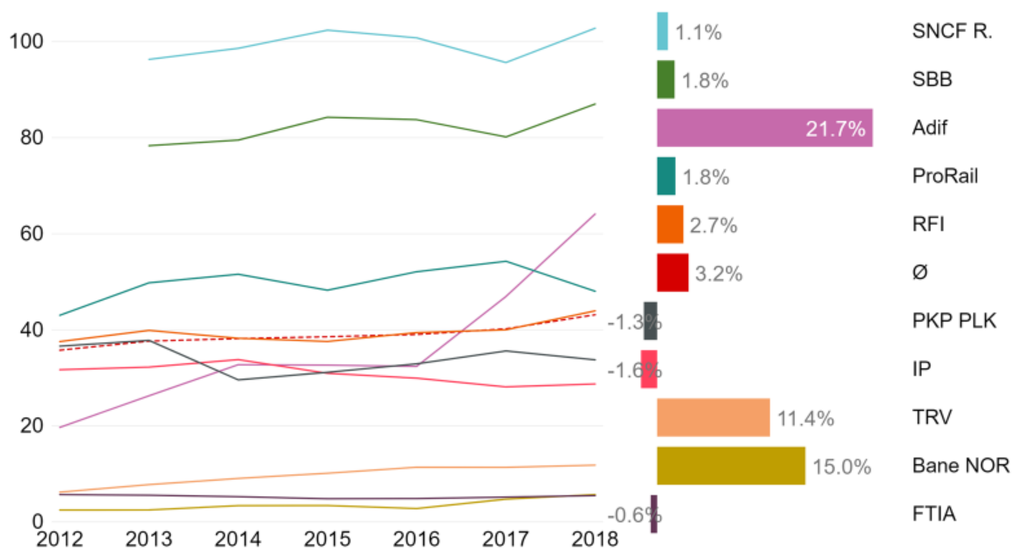
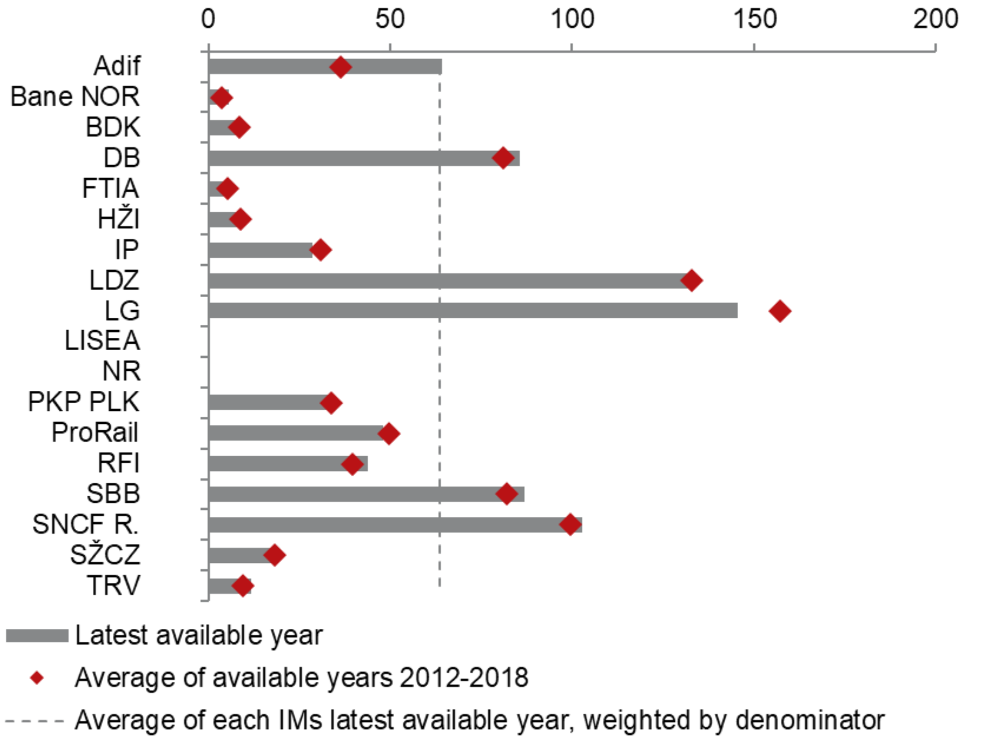


Figure 23: TAC revenue in relation to network size in 2012-2018 (1,000 Euro per main track-km)[26]

Figure 23 illustrates the revenues per track-kilometre generated by infrastructure managers to cover the cost of the network. Between 2012 and 2018 the majority of the peer group members increased their TAC revenues. The average income of the peer group from TAC was €35,800 per main track-kilometre in 2012 and €43,100 in 2018, representing an annual rise of 3.2%. The highest increase can be seen at Adif (21.7%), however this development is the result of a change of the TAC system in 2017.

[26] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

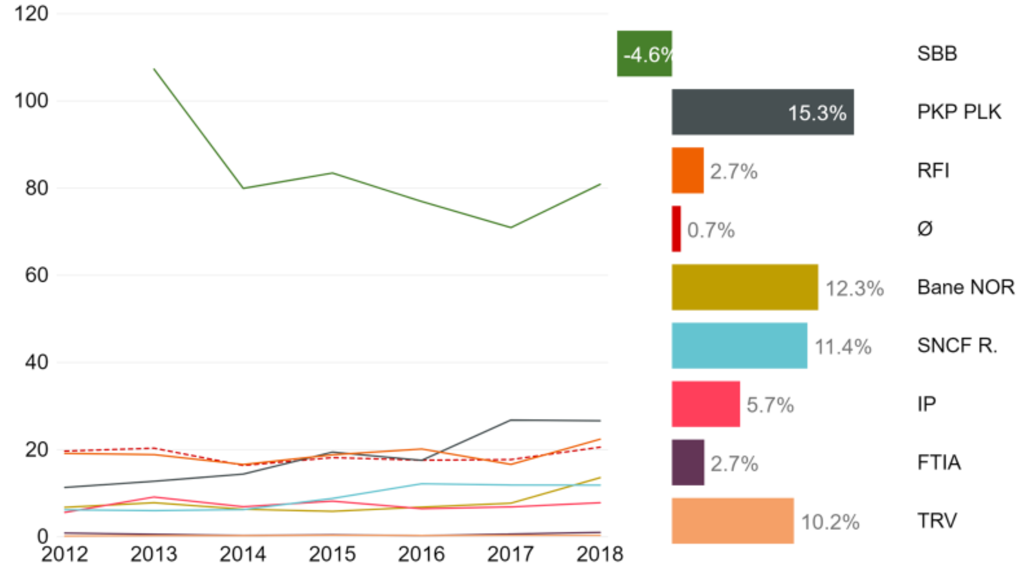


Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Results are normalised for purchasing power parity.

Figure 24: TAC revenue in relation to network size in 2012-2018 (1,000 Euro per main track-km)

The range of TAC revenues across the peer group varies between €5,000 – €320,000 per main track-kilometre per year. The average is €64,000 per main track-kilometre. LDZ and LG show the highest values, generating almost twice the amount of revenues compared to the group's average.

Non-access charges

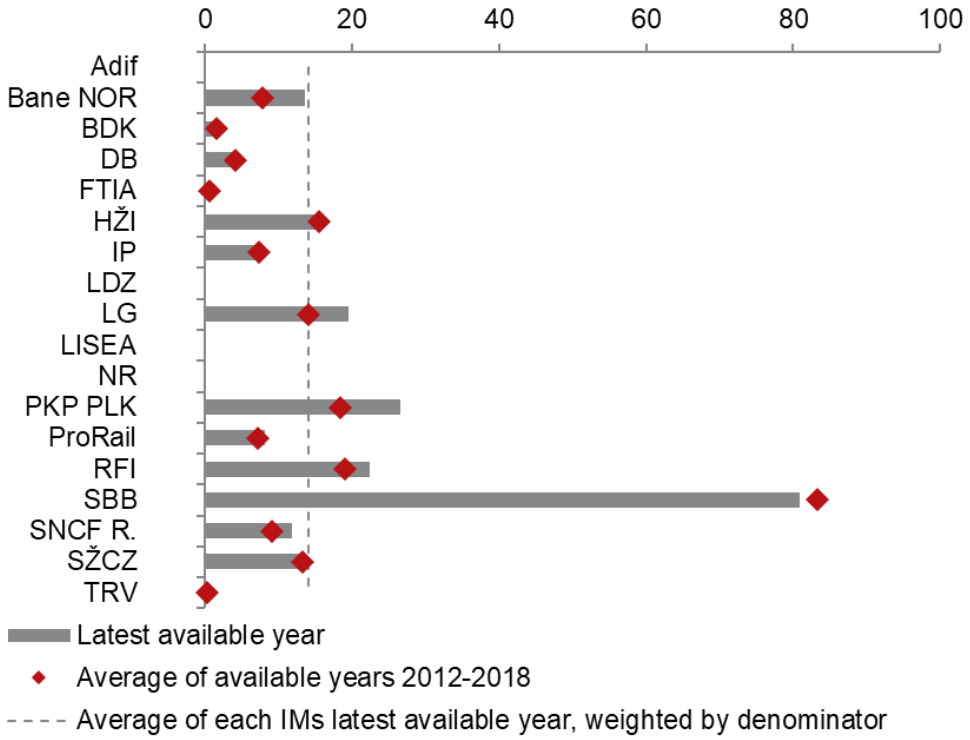


1) Results are normalised for purchasing power parity.

Figure 25: Total revenues from non-access charges in relation to network size in 2012-2018 (1,000 Euro per main track-km) [27]

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. Although the peer group's average remained relatively stable over the period, the individual growth rates were high. Except for SBB all the infrastructure managers exhibit a positive trend: PKP PLK, Bane NOR, SNCF R. and TRV realised annual growth rates of over 10%.

[27] Results are normalised for purchasing power parity.
Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Results are normalised for purchasing power parity.

Figure 26: Total revenues from non-access charges in relation to network size (1,000 Euro per main track-km)

As seen in figure 25, the trend of non-access charges is positive, however, the annual level of revenues is relatively low. The annual peer group's average is €14,000 per main track-kilometre. 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. 17 for the comparatively high financial importance of activities related to residual OPEX.).

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.

4.3 Safety

Summary on safety

EU-wide objectives
• Safety is a top priority for every infrastructure manager and all infrastructure managers aim at providing safe railway transport. • The objective of the EU is to maintain and further develop the high standards of rail safety and to harmonise safety requirements EU-wide.
Peer group's performance
• The peer group average of significant accidents and persons seriously injured and killed per train-kilometre remained stable between 2012 and 2018. • On average there have been 0.5 significant accidents and 0.5 people seriously injured and killed per million train-kilometres each year. • Infrastructure manager related precursors to accidents varied between 2.5 and 2.9 per million train-kilometres between 2012-2018 on the peer group's average.

4.3.1 Rail safety in the EU

In multi-modal comparison railway appears as the safest mode of land transportation and is particularly outstanding in the EU, being among the safest in the world.

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.

In order to maintain and continuously improve railway safety EU-wide, the European Union has developed a legal framework for a harmonized approach to rail safety. The European legislation lays down the requirements for placing rail products on the market and the conditions for a single safety certificate for railway undertakings operating on the Union network. Common Safety Methods (CSMs) and Common Safety Targets (CSTs) have been introduced to maintain rail safety at a high-level - and where reasonably practicable, improve rail safety. CSMs ensure common rules for managing and monitoring rail safety. Achievement of CSTs is monitored by Common Safety Indicators (CSIs). EU Member States are obliged to set up National Safety Authorities (NSAs) and independent accident investigation bodies. Since 16 June 2019, the EU Railway Agency has become the authorization and certification entity for vehicles and railway undertakings, working in cooperation with NSAs as regards the remaining national specificities.[28]

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.

4.3.2 Development and benchmark

Figures 27 to 32 show the safety performance of the PRIME members over the time period 2012-2018 and the benchmark of these indicators.

[28] EC (2004): Directive 2004/49/EC — Safety on the EU's railways

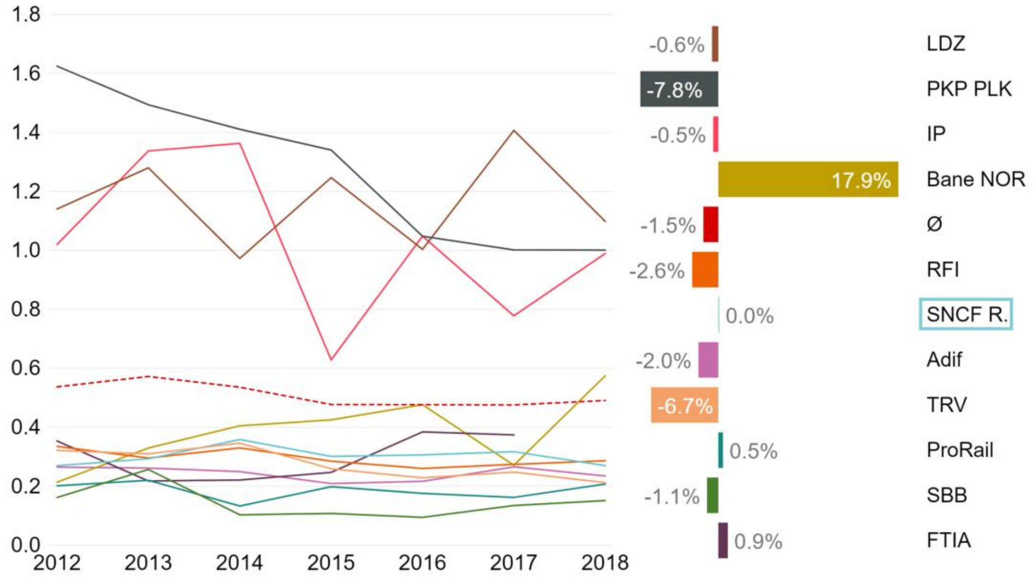
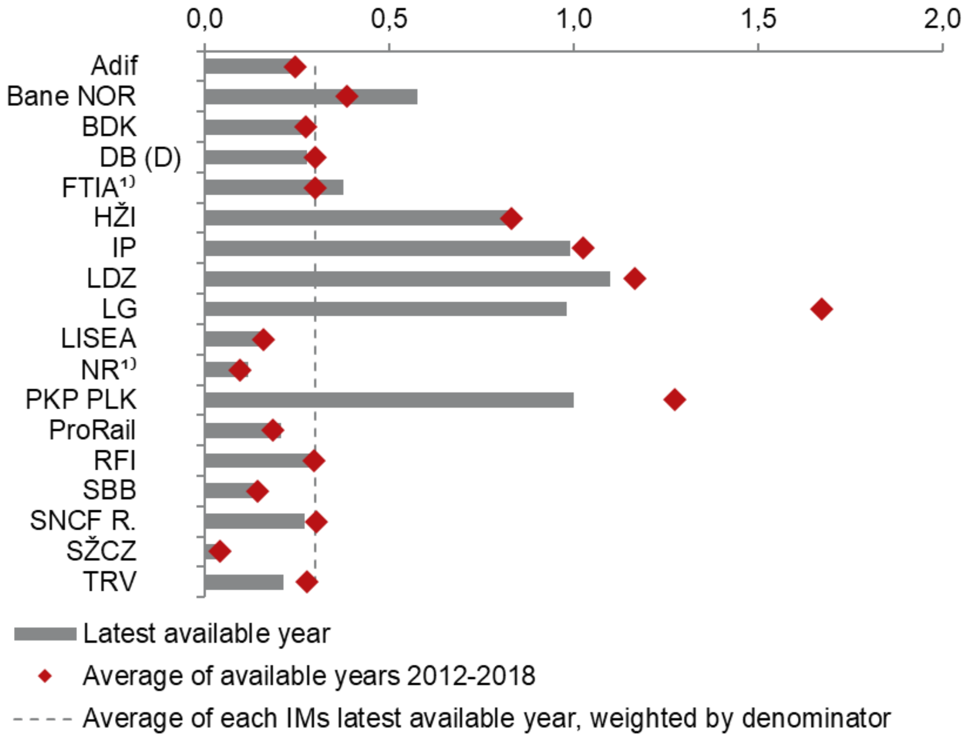


Figure 27: Significant accidents on infrastructure manager's network in 2012-2018 (Number per million train-km)[29]

As shown in figure 27 on average 0.5 significant accidents have been recorded per million train-kilometres each year. Both the overall trend and individual developments over time are very stable. Only a few infrastructure managers like IP, LDZ and PKP PLK have fluctuating values. PKP PLK shows a relatively positive trend, cutting the number of accidents from 1.6 to 1 accident per million train-kilometres. Bane NOR's CAGR was affected by extreme weather in 2018.

[29] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2017

Figure 28: Significant accidents in 2012-2018 (Number per million train-km)[30]

The KPI values vary notably between the infrastructure managers, some showing significant accident numbers of below 0.2 per million train-kilometres while others reach more than 2 per million train-kilometres. Both in recent years and on average over available years, NR and SBB operate their railways at the lowest accident levels.

[30] DB is deviating from the definition as the value refers to all infrastructure managers in Germany.

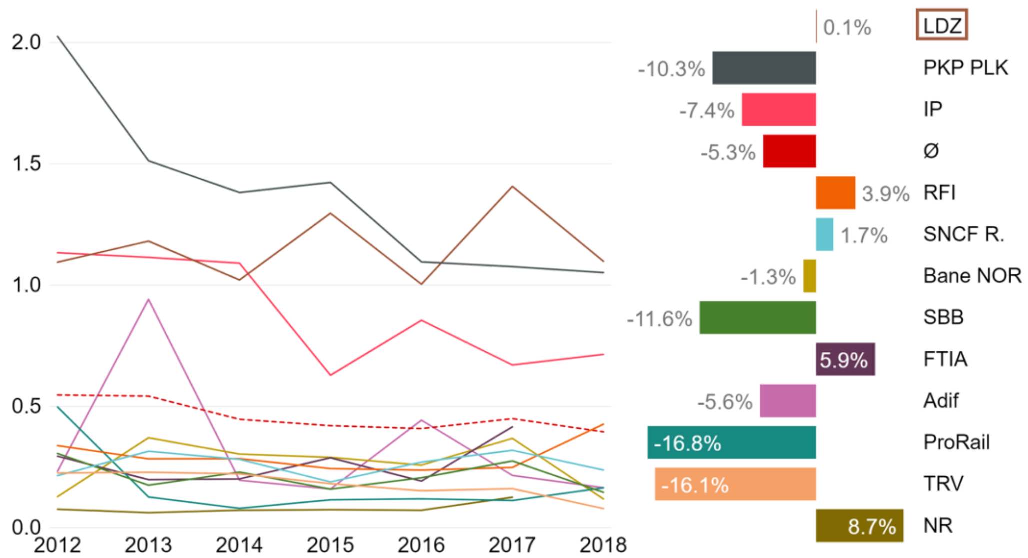
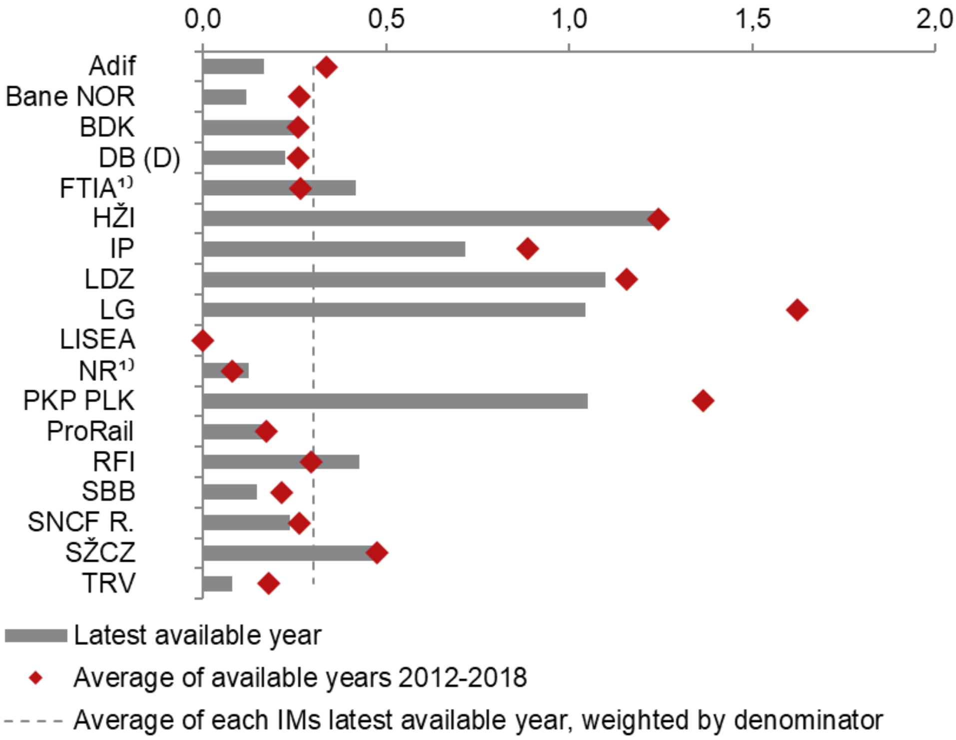


Figure 29: Persons seriously injured and killed in 2012-2018 (Number per million train-km)[31]

The number of persons seriously injured and killed was 0.6 per million train-kilometres among the infrastructure managers in 2012 and decreased to 0.4 in 2018 (figure 29). This positive development is mainly due to the reduction of accidents by IP and PKP PLK (annually 7.4% and 10.3%). The average includes a total of 12 infrastructure managers.

[31] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2017

Figure 30: Persons seriously injured or killed (Number per million train-km)[32]

The indicator for persons seriously injured and killed varies between 0 and 2.8 per million train-kilometres and strongly correlates with the number of significant accidents per million train-kilometres (figure 28). The weighted average of safety related injuries and fatalities in the peer group's railway network is 0.3 per million train-kilometres.

[32] DB is deviating from definition as the value refers to all infrastructure managers in Germany.

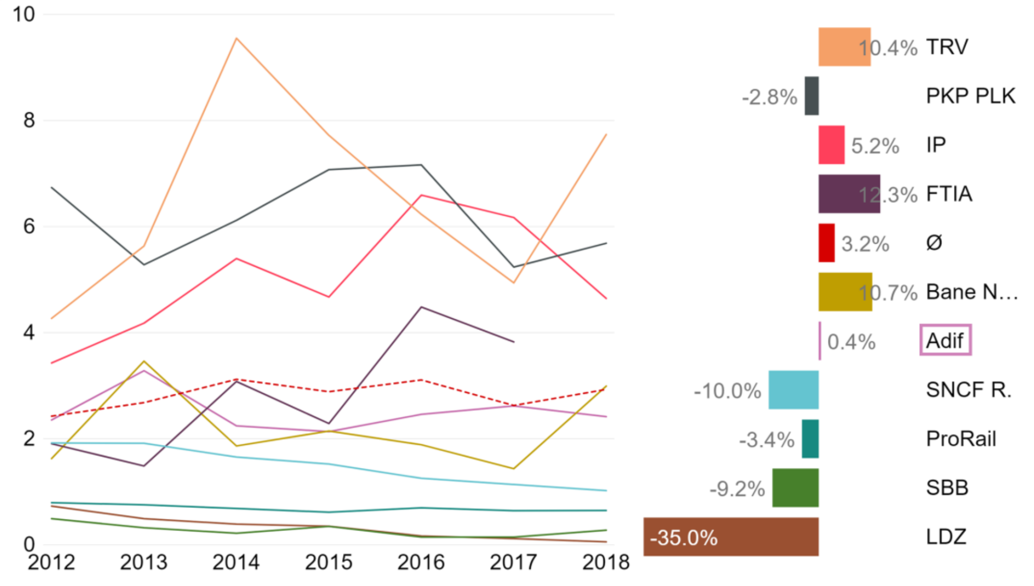
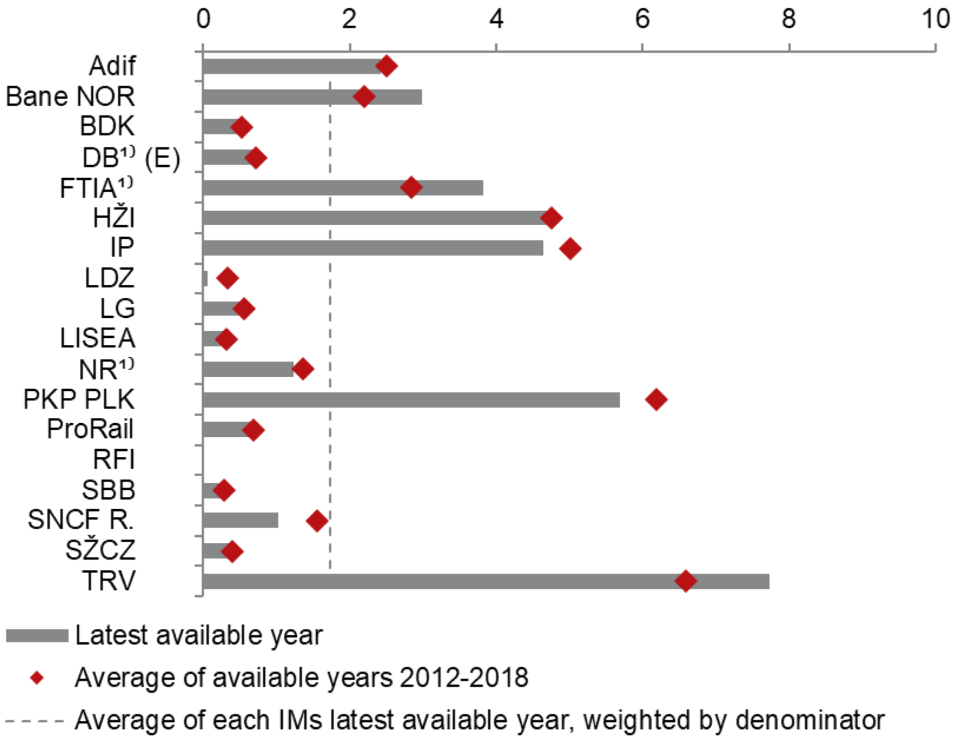


Figure 31: Infrastructure manager related precursors in 2012-2018 (Number per million train-km)[33]

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. Figure 31 depicts a high fluctuation in infrastructure manager related precursors to accidents. The peer group's average increases from 2.5 precursors per million train-kilometres in 2012 and to 2.9 precursors per million train-kilometres in 2018. The level of the infrastructure managers' fluctuation is similar. The extreme weather events in 2018 had a visible impact on Bane NOR's data, which is also reflected in its CAGR.

[33] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2017 (DB, FTIA) 2016 (NR)

Figure 32: Infrastructure manager related precursors in 2012-2018 (Number per million train-km)

The number of precursors of the peer group varies widely, some showing levels well below the peer group's weighted average of 1.9, 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.

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. Additionally, safety figures are also influenced by unauthorised persons entering the rails, which incidents are independent from the infrastructure manager. 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. Raising awareness for safety measures contributes to reducing the influence of the human factor.

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.

4.4 Environment

Summary on environment

EU-wide objectives
• The European Green Deal aims to make Europe the first climate-neutral continent by 2050. • Increasing the share of environmentally-friendly transport modes is a major goal of the deal. • It is important that rail itself continues to become greener, for example by further electrifying the track or using greener alternatives to Diesel where electrification is not possible.
Peer group's performance
• The network of the peer group is mostly electrified and the degree of electrification remained stable over the period. • The average rate is 74%. However, the individual degree of electrification varies strongly from 5% to 100%. • 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 electricity-powered trains across the peer groups is around 75% on average.

4.4.1 Ecological footprint in the EU

Decarbonising transport is a key challenge. Besides encouraging more people and companies to use rail, it is important that rail itself 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. Additionally, infrastructure managers can limit their impact on the environment in their operating business by using electric rolling stock for maintenance, boosting digitalization and automatization, wastewater, waste, sustainable use of materials, recycling, etc.

However, environmental aspects and the impact of railways require a whole system perspective and should include the performance of railway undertakings and other actors as well.

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 train-kilometres.

4.4.2 Development and benchmark

Figures 33 to 37 show the relevant environment indicators of the PRIME members over the time period 2012-2018 and the latest benchmark between the infrastructure managers.

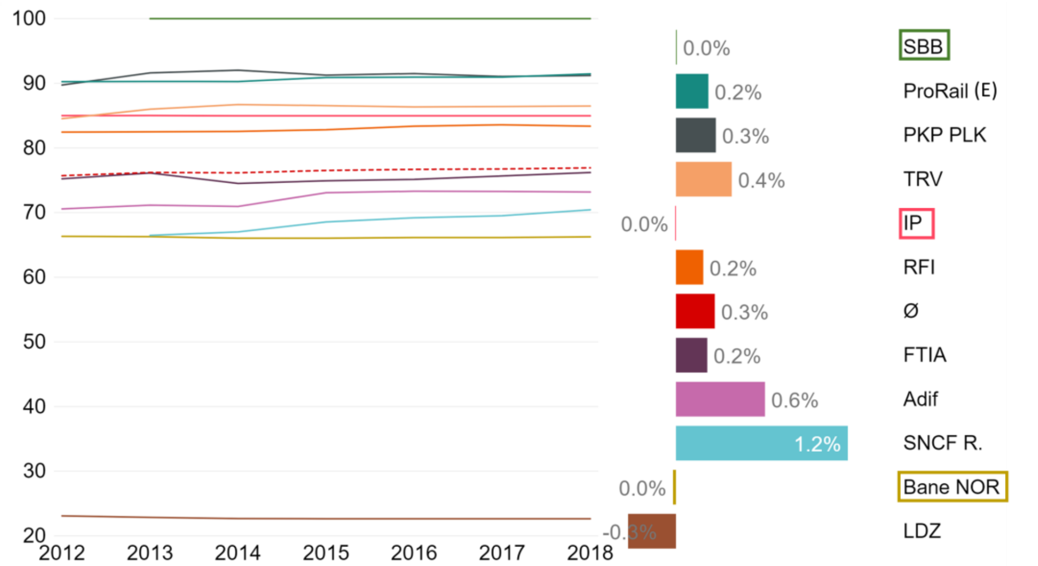


Figure 33: Degree of electrification of total main track in 2012-2018 (% of main track-km) [34]

As can be seen in the figure above, the degree of electrification remained relatively constant over the period. SNCF R. increased the share of electrified main tracks by 1.2% per year. In absolute terms this growth corresponds to an additional 1200 kilometres of electrified main tracks in 2018 as compared to 2012. The decrease at LDZ from 23.1% in 2012 to 22.6% in 2018 is due to network extensions without electrification.

[34] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

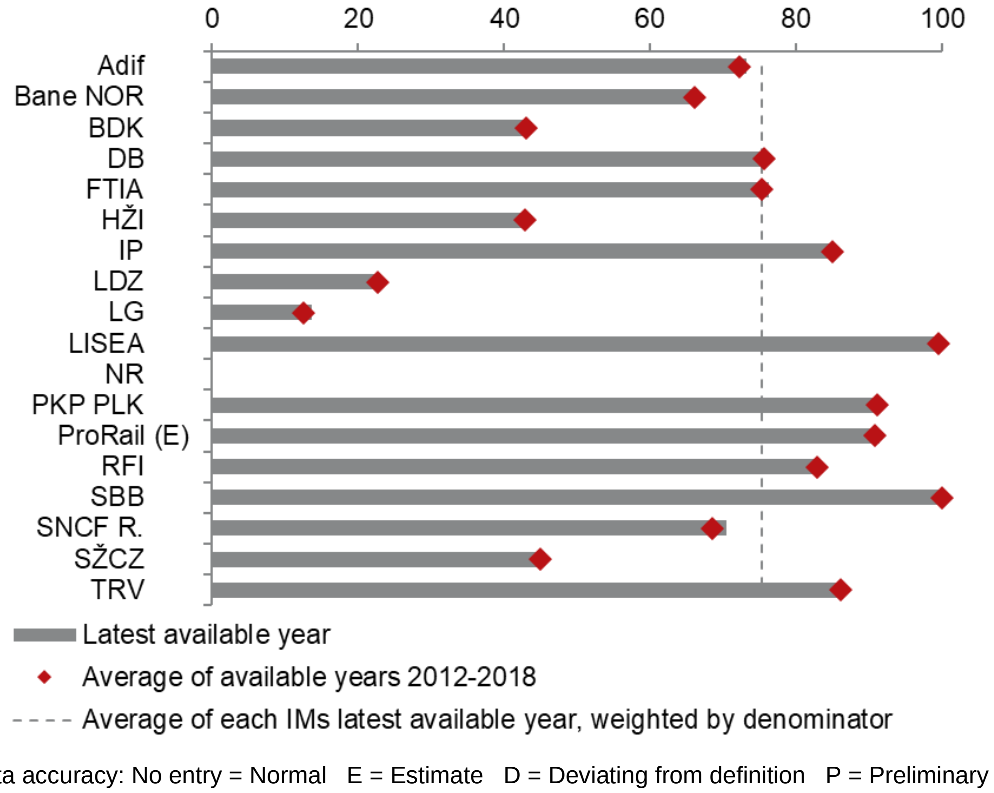


Figure 34: Degree of electrification of total main track (% of main track-km)

In the EU railway networks are mostly electrified. The peer group's average is 74%, however, the degree of electrification varies strongly from 5% to 100%. SBB, LISEA, ProRail are having the highest degree of electrification reaching over 90%.

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 LDZ and LG are showing rather low degrees of electrification. 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.

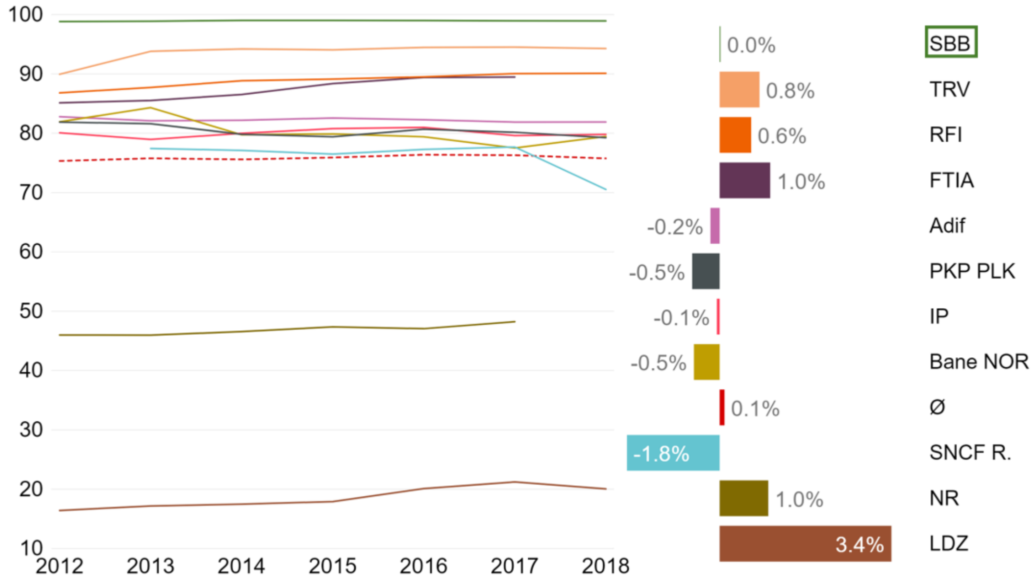


Figure 35: Share of electricity-powered trains in 2012-2018 (% of total train-km)[35]

Figure 35 shows the average and individual development of electricity-powered trains between 2012 and 2018. The aggregated value remains relatively stable at 75%-76% for electricity-powered trains.

[35] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

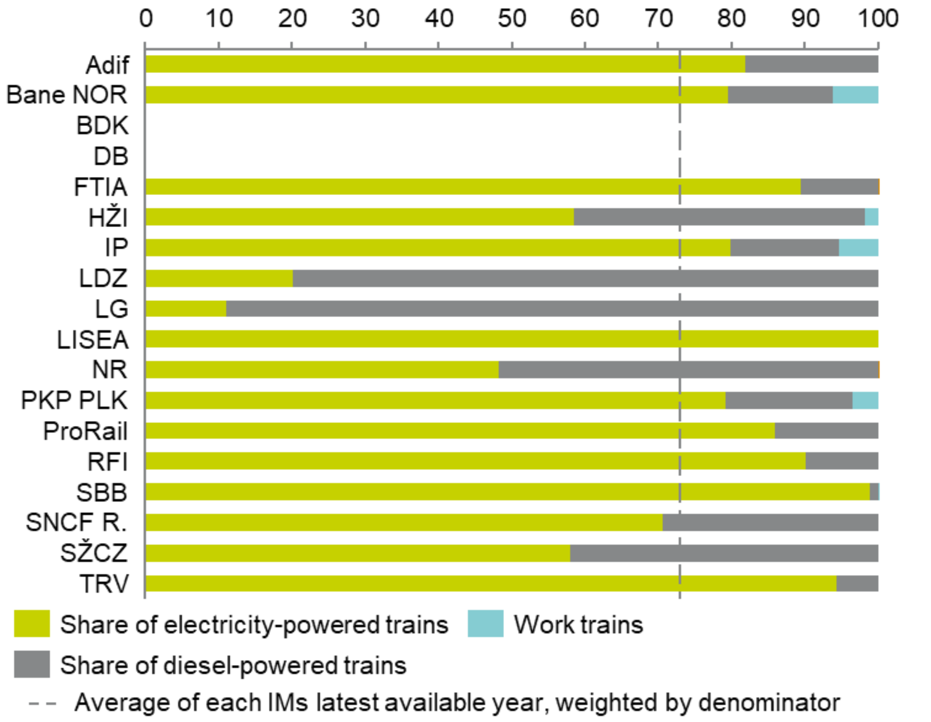


Figure 36: Share of train types (% of total train-km)

As shown in figure 36 most of the train-kilometres in the peer group are produced by electricity-powered trains. This reflects the degree of electrification of the network which for most organisations reaches 70% or more.

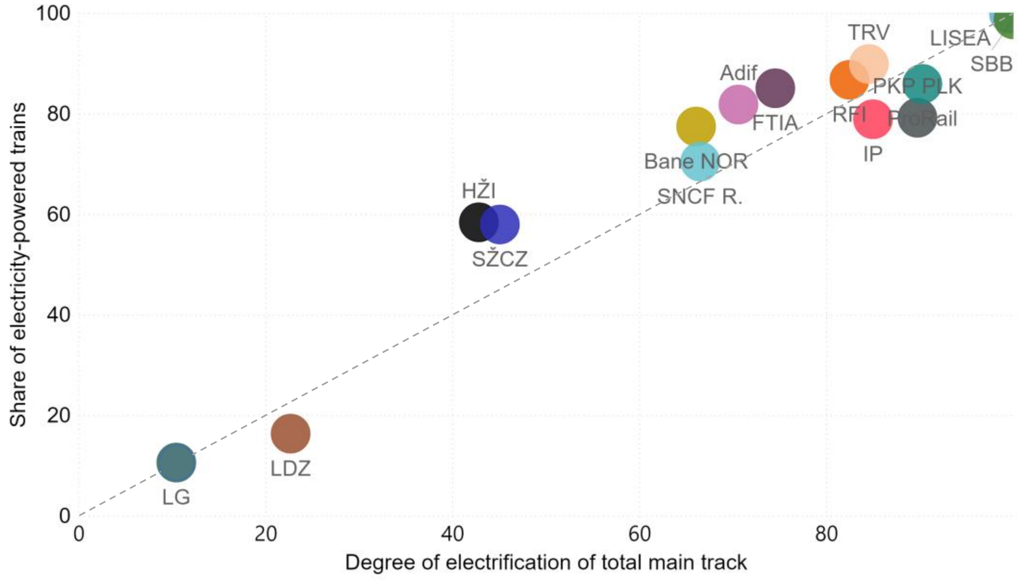


Figure 37: Share of electricity-powered trains (% of train-km) / Electrification (% of main track-km)

As expected, there is a strong correlation between the degree of network electrification and share of electric trains. However, it is noticeable that similar degrees of electrification do not 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.

4.5 Performance and delivery

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. • The EU's legislation has established basic principles to minimise disruptions and agree on performance schemes.
Peer group's performance
• PRIME has developed common definitions to increase the comparability of performance measures, which is limited due to different thresholds and measuring methods. • Delay measurement thresholds have a span between 2:29 and 5:59 minutes for passenger trains and 2:59 and almost 60 minutes for freight trains. • Punctuality performance shows a slightly negative development for almost all infrastructure managers. Nevertheless, some railway networks deliver high levels of punctuality, reaching up to 97% for passenger transport. • Punctuality of rail freight is significantly lower, showing a wide span of punctuality values between 40% and 86%.

4.5.1 Rail performance and delivery in the EU

The mobility demand of societies is constantly increasing. Not only has the number of rail passengers increased, but longer and more complex production chains have led to increased demands on freight transport. In addition, consumers are becoming more used to fast digital structures in other sectors. Purchasing goods 24 hours a day and getting them delivered the next day rises the expectation regarding all services, including rail.

Increased customer demands are particularly visible regarding punctuality and reliability. More frequent and 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.

In order to continuously improve their performance, infrastructure managers set punctuality targets as part of their strategy and monitor and steer them on the basis of their management systems. They aim at minimizing infrastructure related causes that lead to reduced reliability and availability of assets, which in turn have a negative impact on the performance of train operations.

EU legislation has established basic principles regarding performance and delivery. Under EU law, infrastructure charging schemes will encourage railway undertakings and the infrastructure manager to minimise disruption and improve the performance of the railway network through a performance scheme.

Rail punctuality and reliability indicators

PRIME members are reporting five indicators measuring railway punctuality and reliability:

- Passenger trains' punctuality
- Freight trains' punctuality
- Delay minutes caused by the infrastructure manager
- Asset failures in relation to network size
- Average delay in minutes per asset failure

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 is related to main track-kilometres.

4.5.2 Punctuality

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 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 measuring points in each infrastructure manager's network.

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): 84 strategic measurement points Passenger trains (regional and long distance): 47 strategic measurement points Freight trains: 16 strategic measurement points
DB	For statistical purposes: Punctuality of passenger trains is measured taking into account all stations.

Infrastructure manager	Measurement points in the network
	Punctuality of freight trains is measured at the final station (arrival) within Germany.
FTIA	For commuter 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).
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	Departure, subdivision border station and arrival.
LG	Measured at strategic points.
NR	Key stations, junctions or other critical points on the network such as terminus stations.
PKP PLK	For statistical purposes, time measured at the destination (final relation station, or transfer to neighbouring infrastructure manager). The possibility of measurement exists at any point where the arrival / departure time of the train is described.
ProRail	Strategic measurement points.
RFI	Final destination for punctuality purpose.
SBB	Passenger trains: 53 strategic measurement points. Freight trains: 52 strategic measurement points.
SNCF R.	Stations and strategic measurement points across the network.
TRV	Official performance measures measured at final destination only. Many more measuring points exist, but the data is not readily available to use.

The span of thresholds set to classify a passenger train as delayed can be as low as 2:29 or as high as 15:59 minutes[36]. In the majority of the sample the thresholds are between 2:59 and 5:59. Figure 38 depicts the different practices.

Passenger train categories	2:29	2:59	…	4:59	5:29	5:59	--->>>
Long distance		SBB CFF FFS Latvijas Dzelzceļš banedanmark ProRail		adif Infraestruturas de Portugal	Väylä Polskie Linie Kolejowe	Lietuvos Geležinkeliai SNCF Réseau DB Netze Trafikverket	NetworkRail RFI
Regional		SBB CFF FFS Latvijas Dzelzceļš banedanmark ProRail		NetworkRail adif Infraestruturas de Portugal	RFI Polskie Linie Kolejowe	Lietuvos Geležinkeliai SNCF Réseau DB Netze Trafikverket	
Commuter	Väylä	SBB CFF FFS banedanmark adif		NetworkRail Infraestruturas de Portugal	RFI Polskie Linie Kolejowe	Lietuvos Geležinkeliai SNCF Réseau DB Netze Trafikverket	

Figure 38: Delay measurement thresholds (in minutes:seconds)[37]

A greater heterogeneity can be found with measuring punctuality of freight trains. Here thresholds vary widely between 2:59 and almost 60 minutes. Figure 39 gives an overview of delay measurement thresholds for freight trains.

	2:59	4:59	5:59	14:59	15:29	15:59	29:59	30:29	59:59
Freight trains	SBB CFF FFS Latvijas Dzelzceļš ProRail	banedanmark	SNCF Réseau Trafikverket	NetworkRail Lietuvos Geležinkeliai	Polskie Linie Kolejowe Väylä	DB Netze	Infraestruturas de Portugal	RFI	adif

Figure 39: Delay measurement thresholds (in minutes:seconds)

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.

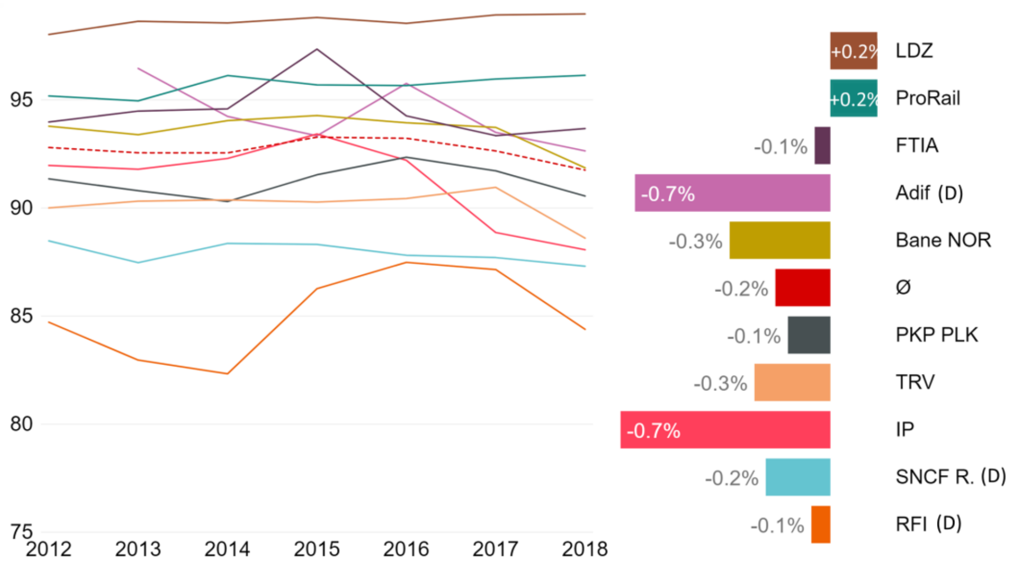
[36] Long distance thresholds: RFI 15:29

[37] Long distance thresholds: NR: 9:59, RFI: 15:29

Development and Benchmark

Passenger train punctuality

Figures 40 to 41 show the punctuality of passenger trains for operators using the network of PRIME members over the time period 2012-2018 and the latest benchmark of these indicators between the infrastructure managers. 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.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Bane NOR data for 2018 is preliminary.

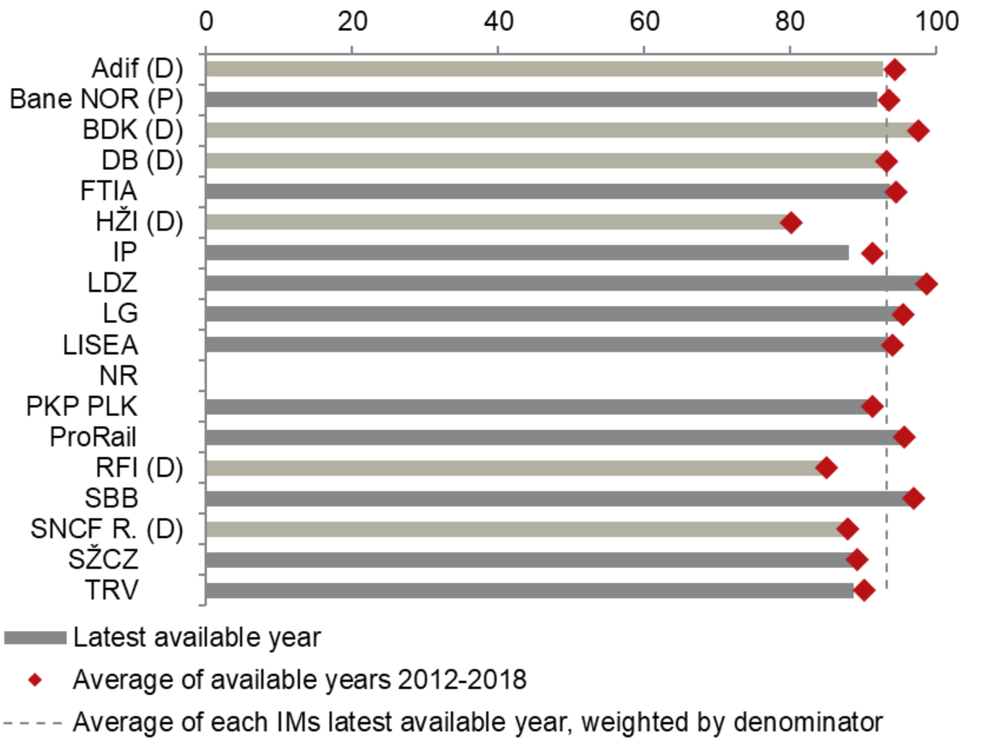
Figure 40: Passenger trains punctuality in 2012-2018 (% of trains)[38]

As mentioned before, a comparison between different railway systems is only possible to a limited extent. In figure 40 all infrastructure managers are comparable, except Adif, RFI and SNCF R. as they deviate from PRIME's definition. In these cases, the analysis of time series should be limited to identify individual developments over time.

Overall, the peer group's average of passenger train punctuality has slightly decreased since 2012, with the majority of the infrastructure managers showing a

[38] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

slightly negative trend. In terms of volatility some infrastructure managers show rather stable performance levels (ProRail, SNCF R.) while others have more volatile performance data.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary

Figure 41: Passenger trains punctuality (% of trains)

Figure 41 shows the passenger train punctuality data of the latest available year. The lighter grey colour highlights the infrastructure managers which deviate from the PRIME definition. The figures vary between 80% and 97%, which is again partly a result of different measuring methodologies.

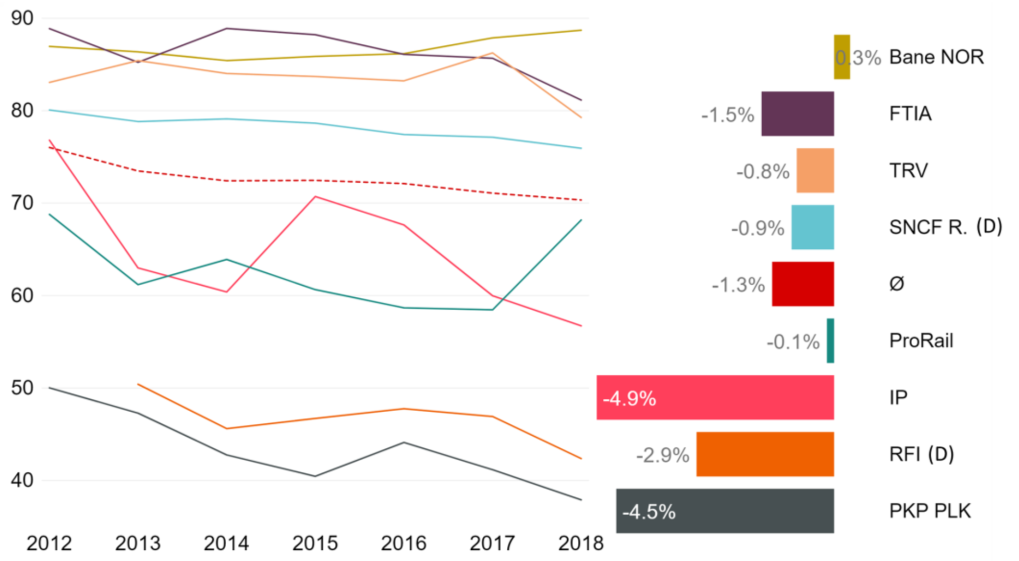
Besides different measuring concepts, there are other factors impacting punctuality. Some of them are outside the infrastructure manager's control. The complexity of a network and its utilisation are among the most important factors. For example, a network with a high density of assets such as switches and level crossings, or a high degree of electrification, is more prone to failures and requires more interventions, e.g. maintenance and renewal activities. Construction works can have a relevant impact on the punctuality as they can reduce the performance of the lines in the short term during the construction phase. The risk of delays due to failures increases with higher complexity.

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.

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 punctuality

Figures 42 to 43 show the punctuality of freight trains of PRIME members over the time period 2012-2018 and the latest benchmark of this indicator between the infrastructure managers.



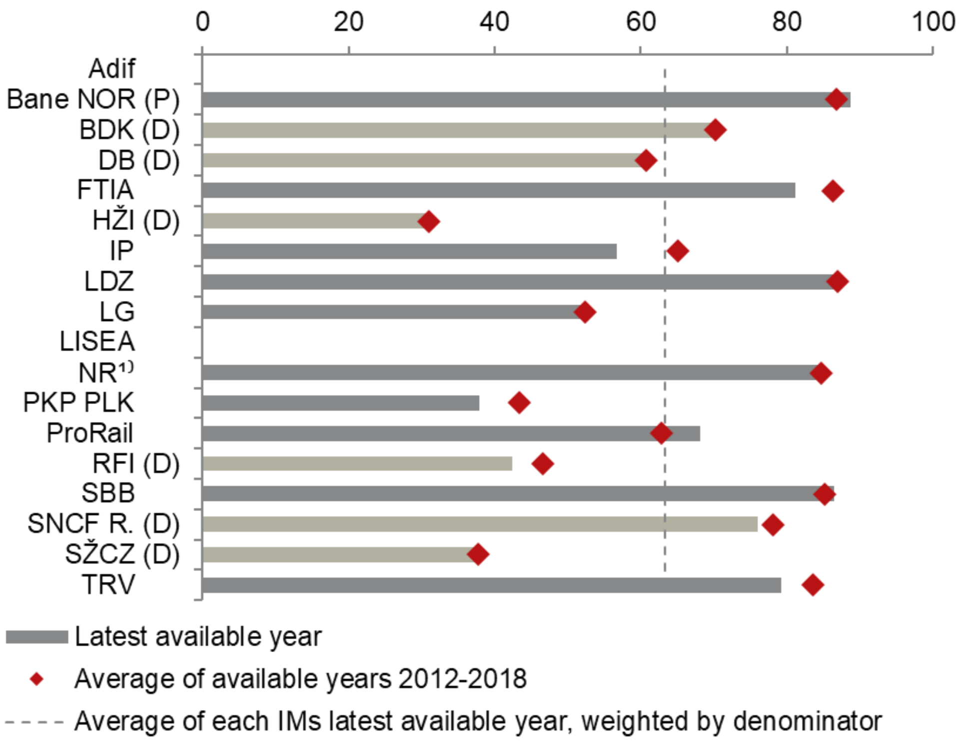
Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Bane NOR data for 2018 is preliminary.

Figure 42: Freight trains punctuality in 2012-2018 (% of trains)[39]

[39] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

As with the results for passenger train punctuality, most infrastructure managers face a decline in the punctuality of freight trains. At -1.3%, the average decline for freight trains is greater than for passenger trains. Except for Bane NOR, all the peer group members show a negative trend.

Here as well a comparison between different railway systems is only possible to a limited extent. In figure 42 all infrastructure managers are comparable, except RFI and SNCF R as they deviate from PRIME's definition. In these cases the analysis of time series should be limited to identify individual developments over time.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2017

Figure 43: Freight trains punctuality in 2012-2018 (% of trains)

Compared to passenger train services, the percentage of freight trains on time is lower and ranges between 40% and 86%. In total six infrastructure managers deviate from the definition: these are marked in a lighter grey in the graph. Especially with regard to the European Union's objective to boost freight transportation, these numbers are rather sobering.

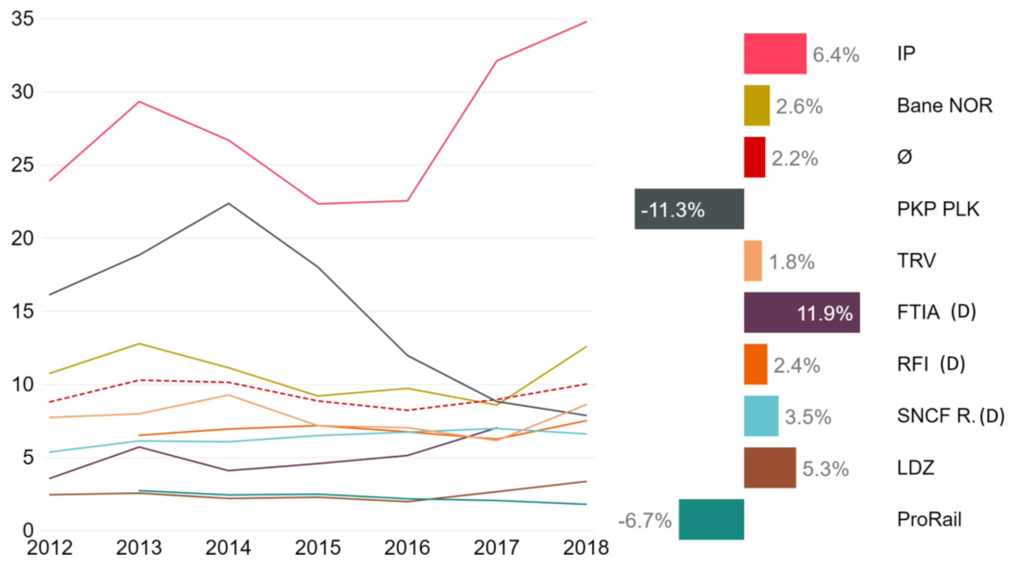
Factors influencing punctuality of freight trains are similar to the ones described for passenger train services.

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.



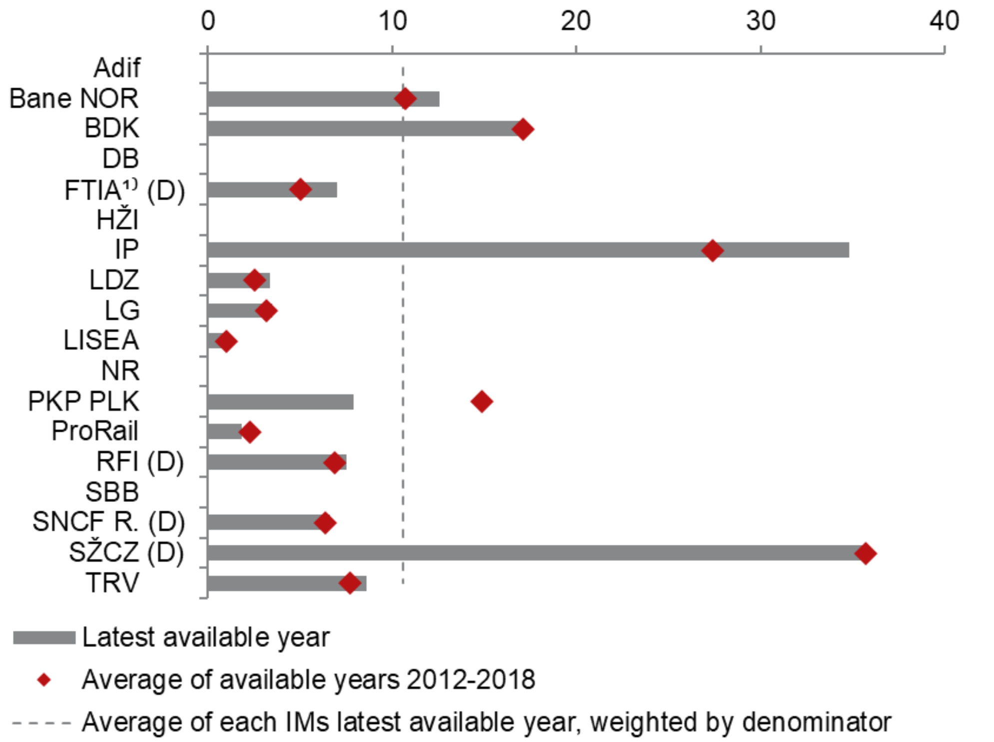
Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary

Figure 44: Delay minutes per train-km caused by the infrastructure manager in 2012-2018 (Minutes per thousand train-km)[40]

Regarding the delay minutes caused by infrastructure managers, the time series shows a similarly negative trend as for punctuality. The number of delay minutes

[40] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

per train-kilometre caused by the infrastructure manager increased for 7 out of 10 infrastructure managers. The average growth rate is 2.2% and the individual figures vary between -11.3% and +11.9%. PKP PLK, however, has considerably reduced delays in 2018.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2017

Figure 45: Delay minutes per train-km caused by the infrastructure manager (Minutes per thousand train-km)

On average infrastructure managers caused 11 delay minutes per thousand train-kilometres, and their results vary between 1 and 36 minutes per thousand train-kilometres.

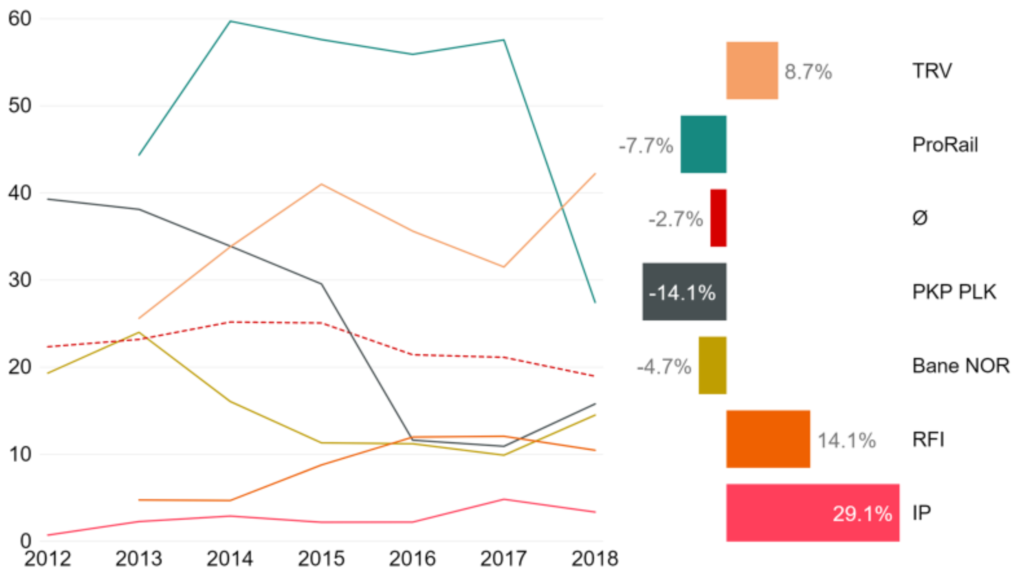
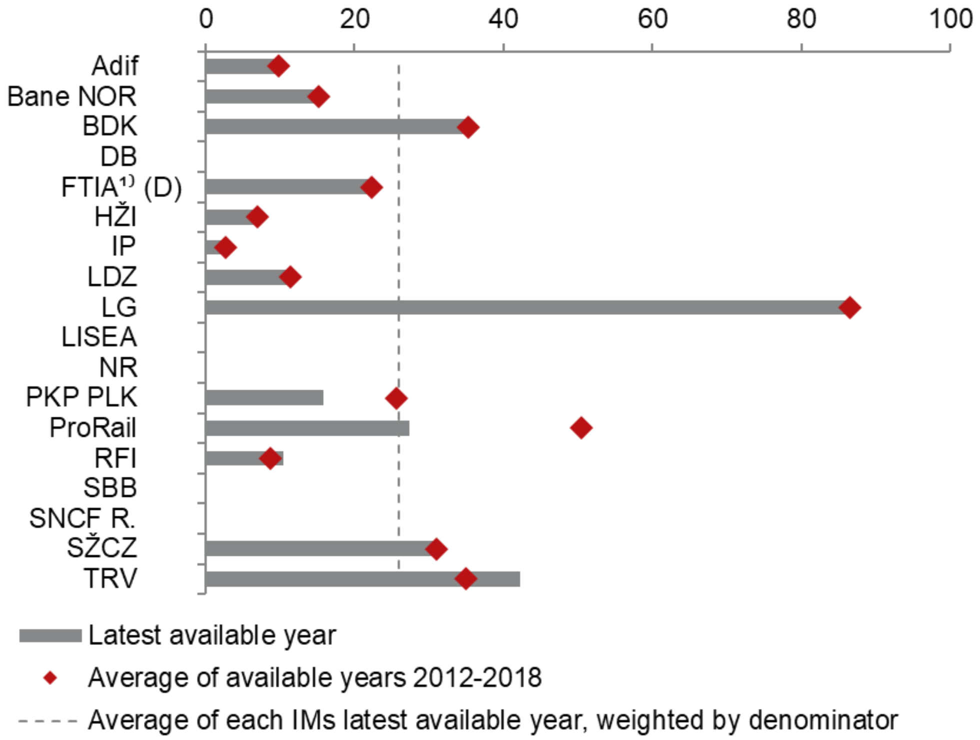


Figure 46: Passenger train cancellations caused by the infrastructure manager (Minutes per thousand train-km) [41]

The rate of cancellations related to infrastructure managers is calculated on the basis of trains cancelled versus the total number of trains planned to be operated. Over the years, PKP PLK, Bane NOR and ProRail developed a positive trend and reduced cancellations. However, IP is showing a rather high annual increase although the number of cancelations is still the lowest in the peer group.

[41] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2017

Figure 47: Passenger train cancellations caused by the infrastructure manager in 2012-2018 (% of scheduled and cancelled passenger trains)

As illustrated in figure 47 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.

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 (NR) while others do not have a fixed threshold and cancel trains according to the timetable reprogramming (RFI). Following a restrictive cancellation policy could make it more difficult to achieve punctuality goals.

4.5.3 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 48 to 49 show the number of train-affecting asset failures over the time period 2012-2018 and the latest benchmark between the infrastructure managers.

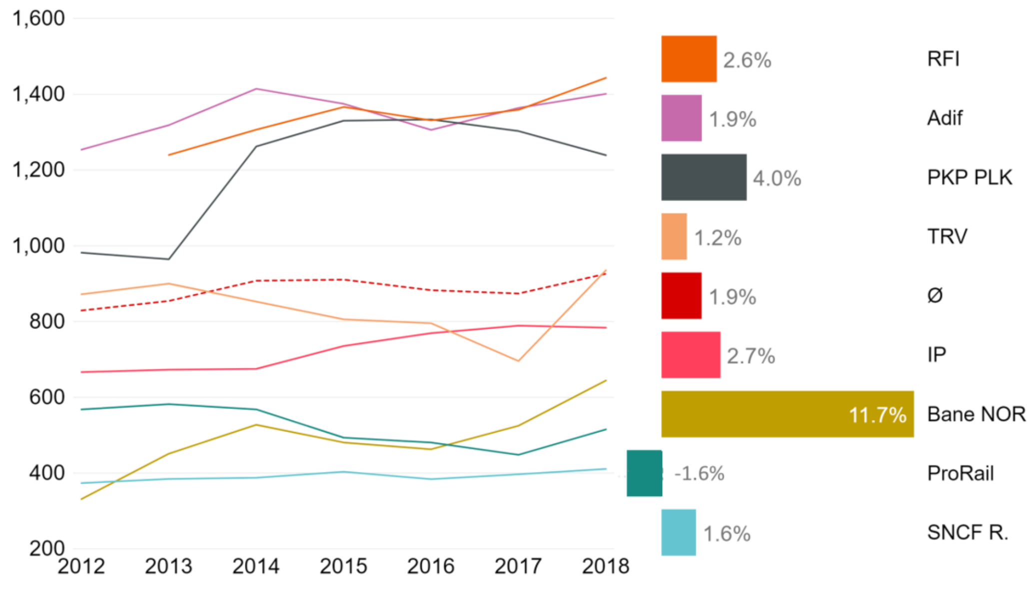


Figure 48: Asset failures in relation to network size in 2012-2018 (Number per thousand main track-km)[42]

As can be seen in figure 48 the overall average number of failures per main track-kilometre has slightly increased over the period. The individual development shows the same picture: only ProRail is showing an annual average reduction of 1.6%. Bane NOR's CAGR was affected by extreme weather in 2018.

[42] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

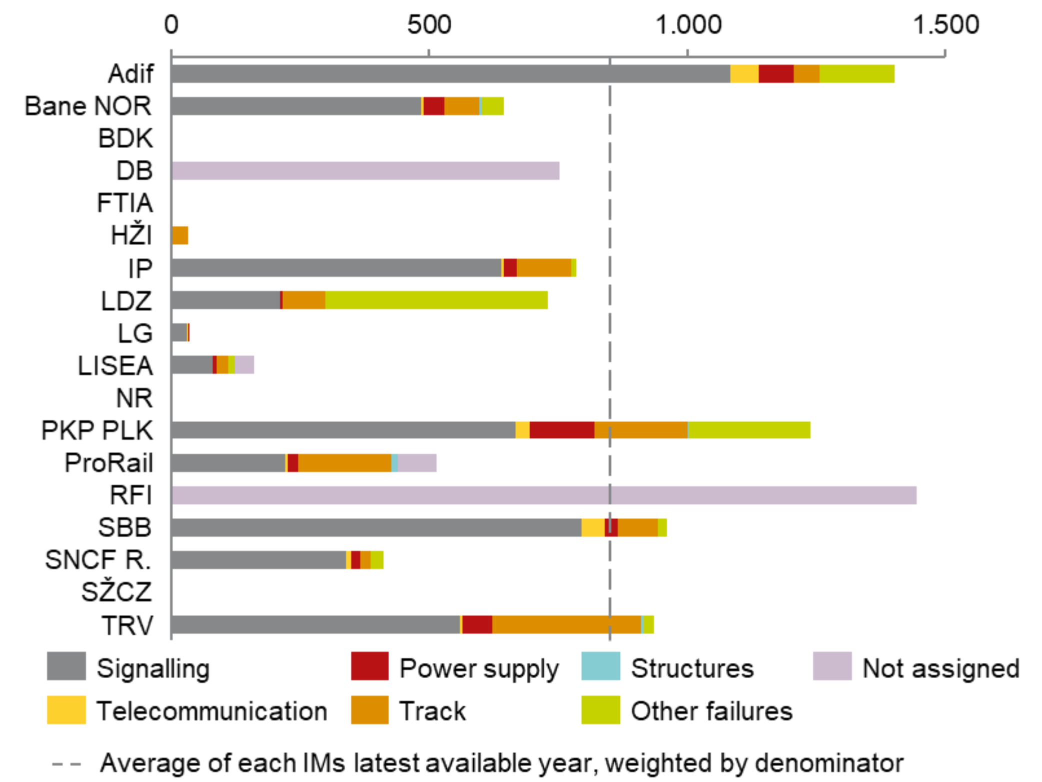


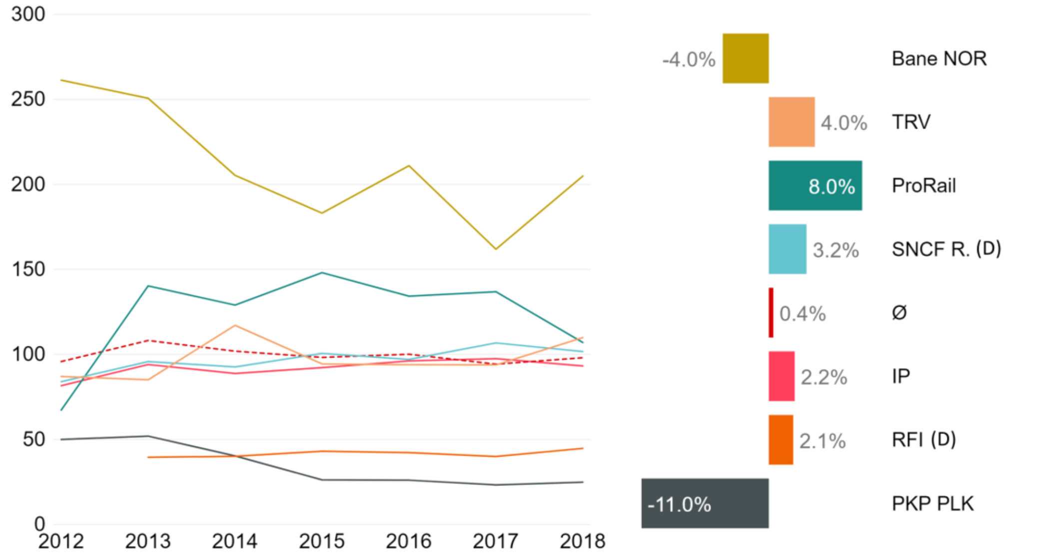
Figure 49: Asset failures in relation to network size (Number per thousand main track km)

Figure 49 shows the level and the composition of asset failures that caused delays. On average 885 assets fail per thousand main track-kilometres per year. The failure frequency in the peer group varies between 36 and 1,443 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.

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. While complexity (electrification, switch density and signalling) naturally increases the chances of failures, 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 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 become increasingly common.

The magnitude of the impact of asset failures on delays and their development over the period is shown in figures 50 and 52.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary

Figure 50: Average delay minutes per asset failure in 2012-2018 (Minutes per failure)[43]

The average train delay minutes per asset failure fluctuates between 94 and 108 minutes. While Bane NOR and PKP PLK show a decreasing trend, the other members of the peer group face increasing numbers.

[43] Only complete time series or time series with only one missing data point are shown. Missing data points were complemented by extrapolation. The CAGRs are then calculated on this basis for the period 2012-2018.

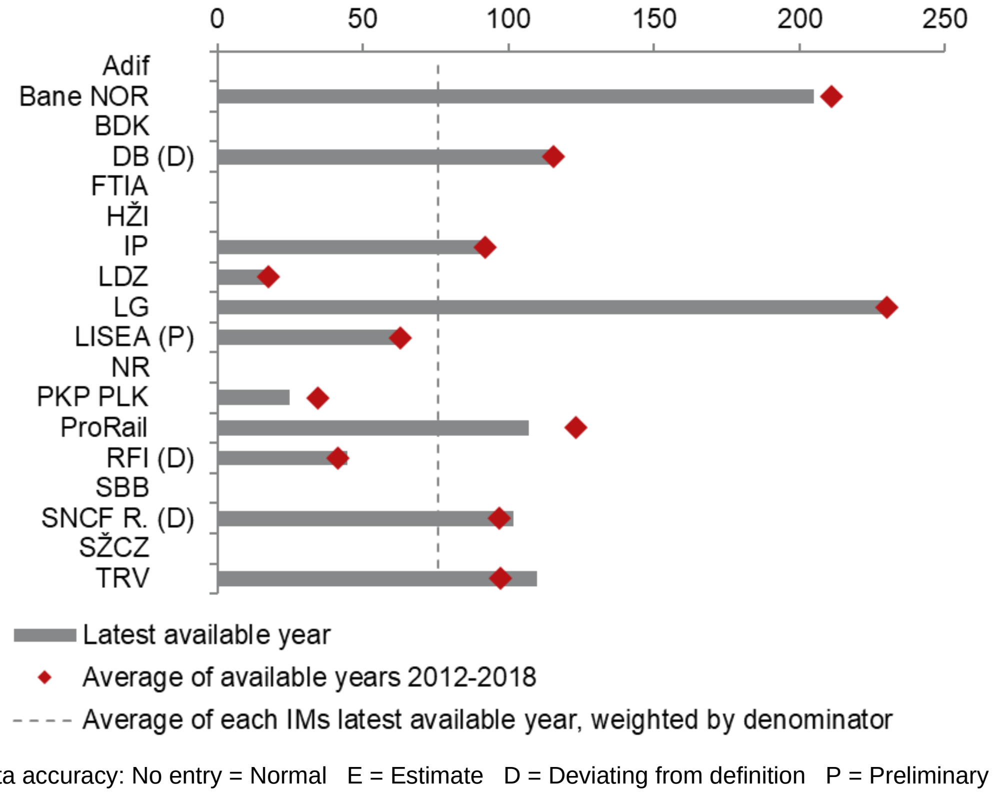


Figure 51: Average delay minutes per asset failure (Minutes per failure)

On average asset failures cause a delay of 76 minutes. Average delays vary widely between 18 and 230 minutes per asset failure.

The magnitude of delays caused by asset failures highly depends on the type of asset being involved. By relating the frequency of individual asset failures to the delay minutes caused, the impact on punctuality becomes visible. Figure 52 shows this relationship.

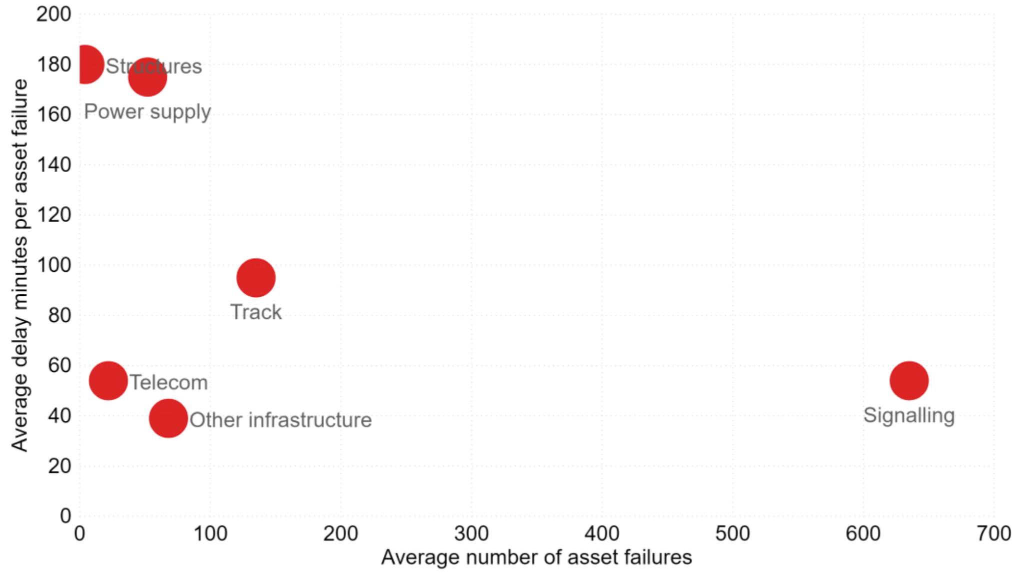


Figure 52: Delay per asset failure (Minutes per failure) / Asset failures (Number per thousand main track-km)

Structural assets such as bridges and tunnels cause the highest number of delay minutes, followed by power supply failures with 175 minutes per failure. However, failures of structures have the lowest occurrence. These are followed by average delay minutes per track failure (95 minutes), which is the second most common failure. The average impact of signalling failures, telecommunication failure and other failures is comparatively low, however signalling failures are the most frequent by far.

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.

4.5.4 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.

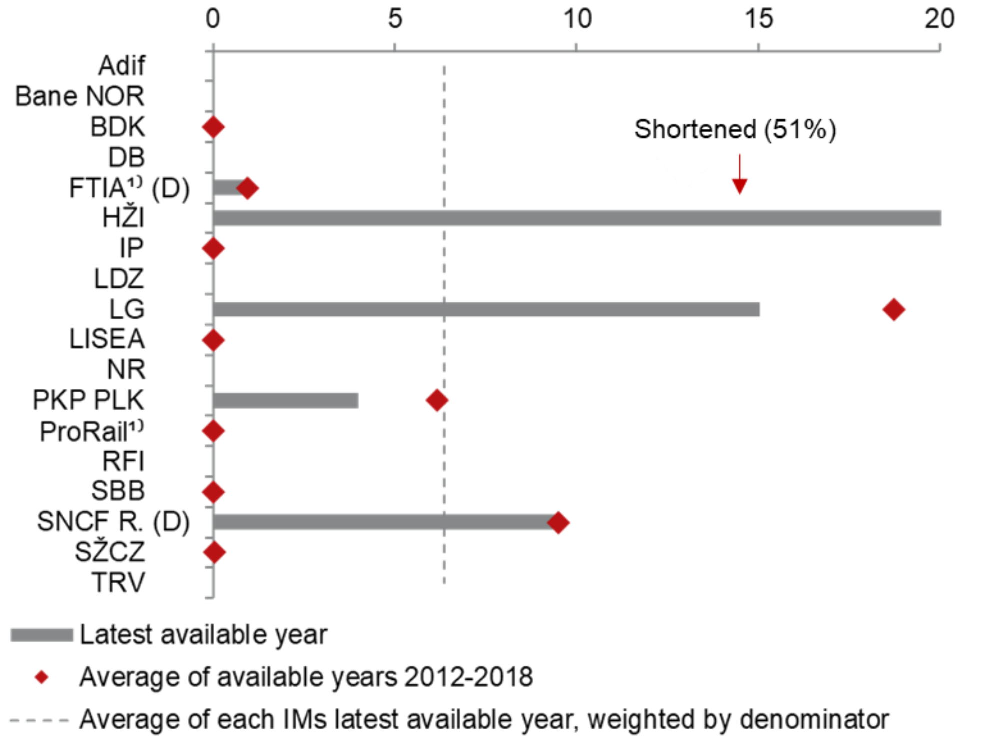
PRIME members are reporting two indicators for measuring railway delivery performance:

- Tracks with permanent speed restrictions
- Tracks with temporary speed restrictions

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

Development and benchmark

Figures 53 to 54 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.

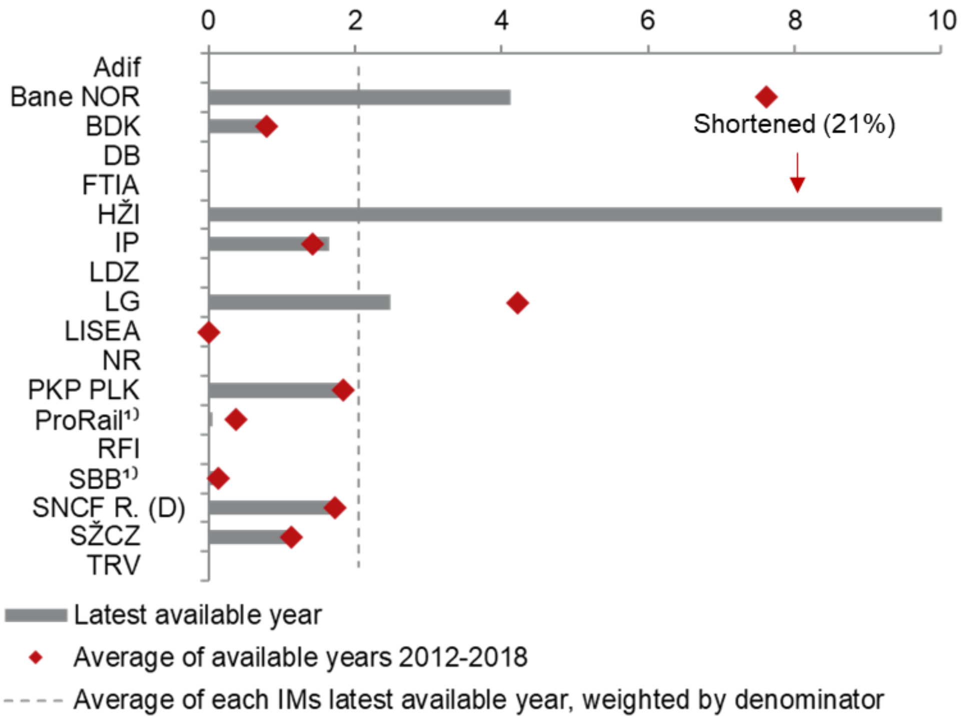


Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2017 (ProRail) 2015 (FTIA)

Figure 53: 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. 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.



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2017 (ProRail) 2016 (SBB)

Figure 54: 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, 2.1% 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 and Bane NOR restrict speed on more than 4% of their network.

Speed restrictions are usually set by the infrastructure manager in consultation with train operators. 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 affected routes are, and whether there are branch lines that can be used during the maintenance works. Reducing speed in order to extend the service life is sometimes the better option than interrupting a very active route for a longer period of time.

[45] Axis for HŽI shortened due to readability.

4.6 ERTMS deployment

Summary of ERTMS deployment

EU-wide objectives
• The main objectives of ERTMS are to increase 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 ERTMS European Deployment Plan (EDP) the Core Network Corridors shall be equipped by 2030.
Peer group's performance
• ERTMS deployment is highly heterogonous in the peer group. • Across the peer group ERTMS is expected to be implemented in about 29% of the railway network by 2030.

4.6.1 ERTMS deployment in the EU

ERTMS and the deployment of ERTMS is a complex but major topic for the rail sector. Increasing interoperability, harmonising the automatic train control and communication systems throughout the European rail network, and acting as the building block for digitalisation of the rail network are the major objectives of the industrial programme.

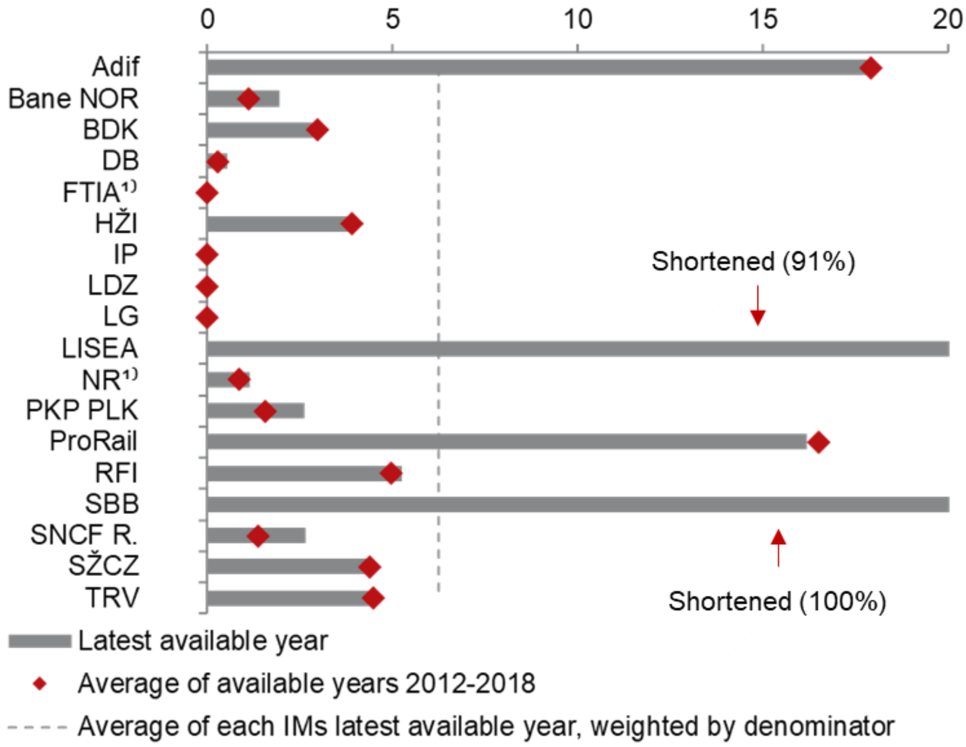
While deployment of ERTMS is costly, it is also often not solely the responsibility of infrastructure managers to choose rolling out ERTMS on their networks. However, ERTMS is crucial for infrastructure managers, as expected benefits of ERTMS deployment are significant, including increased safety, capacity, availability, and interoperability.

The technical details of the system are laid down in the CCS TSI (Control-Command and Signalling Technical Specification for Interoperability). The Fourth

Railway Package enhances the role of the European Union Agency for Railways (ERA) as the ERTMS system authority.

4.6.2 ERTMS indicators

Figures 55 and 56 show the level of ERTMS track-side deployment and the planned extent of ERTMS deployment by 2030.

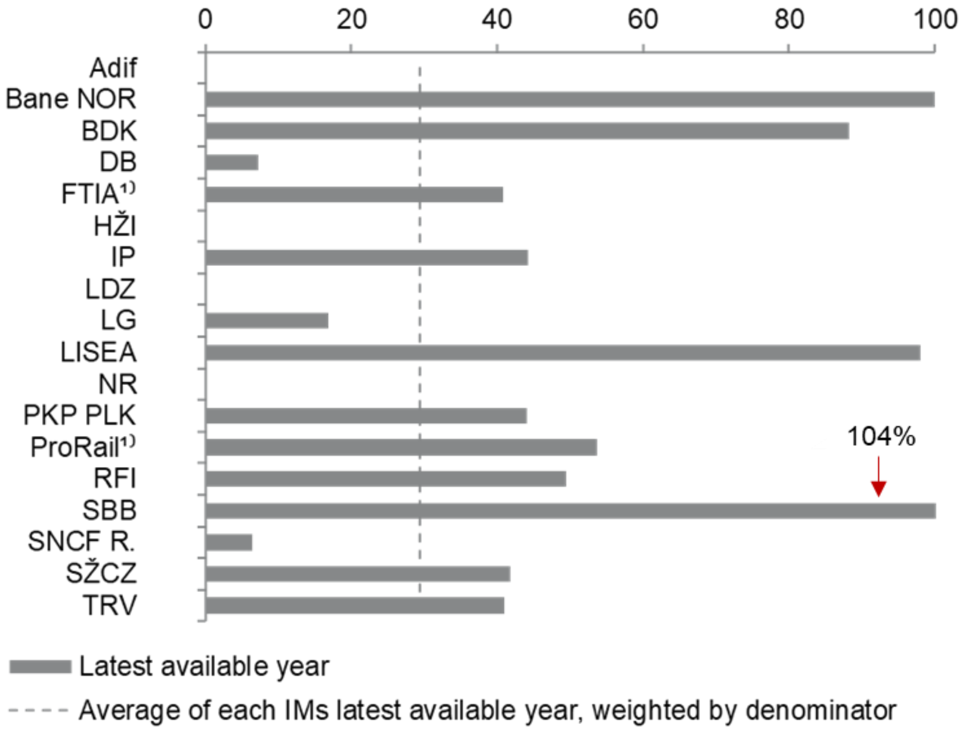


Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Data of 2016 (FTIA) 2015 (NR)

Figure 55: ERTMS track-side deployment (% of main track-km)[46]

ERTMS is deployed on about 6% of all tracks of the peer group's railway network. The infrastructure managers' implementation strategies are heterogeneous, which is reflected by there being no ERTMS deployment in some countries vs. a high share in others of more than 80%.

[46] Axis shortened due to readability (LISEA, SBB).



Data accuracy: No entry = Normal E = Estimate D = Deviating from definition P = Preliminary
1) Planning is based on 2018 for all infrastructure managers except ProRail (2017) and FTIA (2016).

Figure 56: Planned extent of ERTMS deployment by 2030 (% of current main track-km)

By 2030 ERTMS are expected to cover about 29% 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 ETRMS. 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.

Despite the fact that the European vison 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.

5 Outlook

Clearly a benchmarking report involving such a heterogeneous group of participants, operating in different environments and under diverse framework conditions cannot produce simple results or even a ranking of infrastructure managers. But it does provide a good starting point to raise questions and explore the differences. Furthermore, this report leads to the question of how benchmarking of European rail infrastructure can be developed and improved further.

While this benchmarking report does already cover over 70% of the European railway network, a steady increase of the number of infrastructure managers participating, in order to reflect the full European picture and to establish an even more solid basis for benchmarking, is the declared objective of this subgroup. In combination with longer time series, a larger number of participants will foster a more comprehensive dataset, allowing for better and more meaningful comparisons for the benefit of each individual infrastructure manager, the European Commission, national authorities and policy makers.

Eventually, annual PRIME reports can be supplemented with in-depth best practice descriptions of individual infrastructure manager, serving as a means to facilitate and enhance mutual inspiration and learning from each other. In this context, different and specific conditions the infrastructure managers are working in can be made more transparent. As a result, this can take benchmarking to the next level and contribute to deeper insights and, for example, more targeted rail policy measures.

Already today, the annual PRIME report is flanked by additional thematic reports, so called “deep dives” into certain focus areas, providing more detailed and concentrated investigation. Such a regular compilation of thematic reports supports the development of a better understanding of infrastructure managers’ characteristics, helps to identify fields of action as well as opportunities to achieve the entrepreneurial and socio-political goals set for the railways. Topics for future thematic reports can be suggested by both infrastructure managers and DG Move. Funding and charging of railway infrastructure will be the focus of the next report planned.

In addition to a growing peer group and deeper analysis, it remains an ongoing task of the subgroup to refine the existing indicators by further increasing their definitional accuracy and comparability, and by ensuring a higher level of completeness and robustness of all data. New indicators are being discussed to create more transparency related to the different aspects. And of course the dynamics of the technological, environmental and political conditions urge the collection of additional data and the development of more indicators. The recent development of the Green Deal is one of the most obvious drivers for new indicators.

6 Annex

6.1 Fact sheets of the infrastructure managers

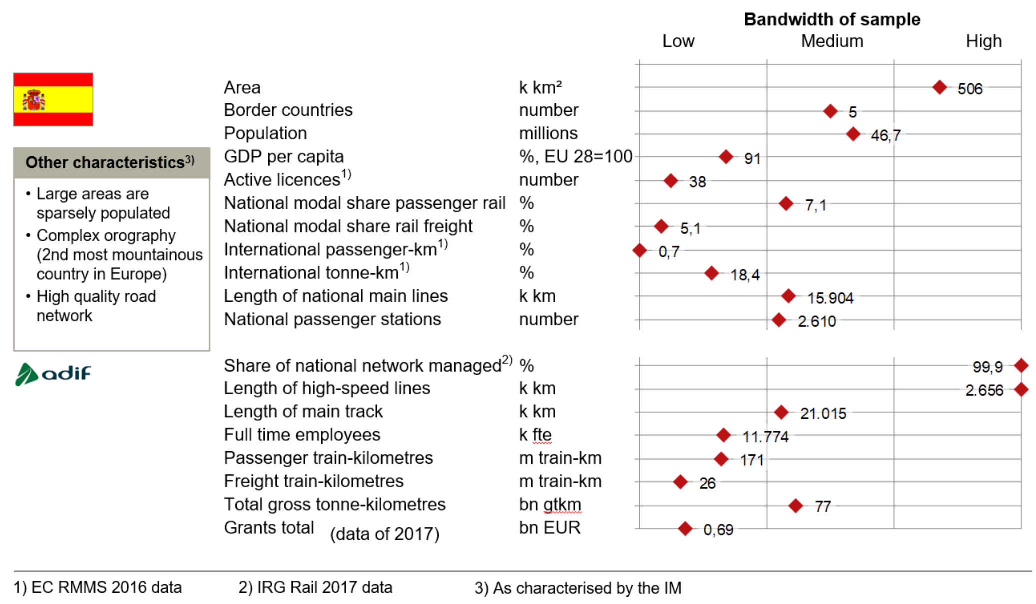


Figure 57: Fact sheet: Adif

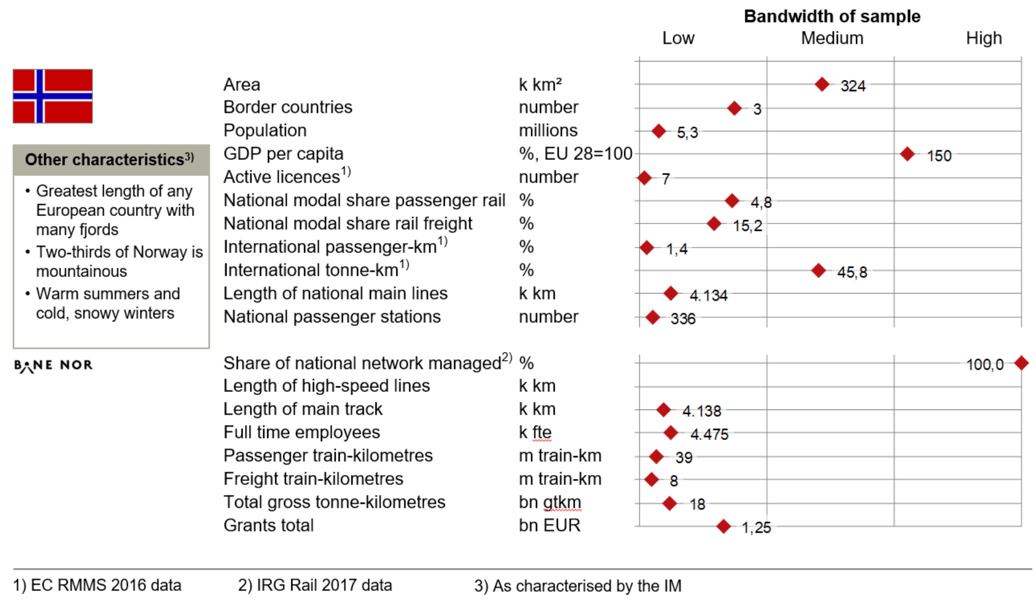


Figure 58: Fact sheet: Bane NOR

			Bandwidth of sample (Low / Medium / High)
	Area	k km²	43
	Border countries	number	1
	Population	millions	5,8
Other characteristics[3]	GDP per capita	%, EU 28=100	126
• Area and population excludes: Faroe Islands & Greenland	Active licences[1]	number	9
• BDK as an IM is separated from RUs	National modal share passenger rail	%	8,5
	National modal share rail freight	%	11,5
	International passenger-km[1]	%	5,6
	International tonne-km[1]	%	92,8
	Length of national main lines	k km	2.487
	National passenger stations	number	460
banedanmark	Share of national network managed[2]	%	79,9
	Length of high-speed lines	k km	
	Length of main track	k km	3.067
	Full time employees	k fte	2.367
	Passenger train-kilometres	m train-km	62
	Freight train-kilometres	m train-km	3
	Total gross tonne-kilometres	bn gtkm	
	Grants total	bn EUR	

1) EC RMMS 2016 data 2) IRG Rail 2017 data 3) As characterised by the IM

Figure 59: Fact sheet: Banedanmark

			Bandwidth of sample (Low / Medium / High)
	Area	k km²	357
	Border countries	number	9
	Population	millions	82,5
Other characteristics[3]	GDP per capita	%, EU 28=100	123
• Rail network large & No. of RUs very high	Active licences[1]	number	448
• Network on limit - little capacity	National modal share passenger rail	%	8,8
• Transit: six out of eleven Rail Freight Corridors	National modal share rail freight	%	17,8
• Rail noise - public issue	International passenger-km[1]	%	4,9
	International tonne-km[1]	%	48,3
	Length of national main lines	k km	39.219
	National passenger stations	number	6.981
DB NETZE	Share of national network managed[2]	%	85,0
	Length of high-speed lines	k km	
	Length of main track	k km	55.521
	Full time employees	k fte	46.969
	Passenger train-kilometres	m train-km	789
	Freight train-kilometres	m train-km	246
	Total gross tonne-kilometres	bn gtkm	
	Grants total	bn EUR	

1) EC RMMS 2016 data 2) IRG Rail 2017 data 3) As characterised by the IM

Figure 60: Fact sheet: DB Netz AG

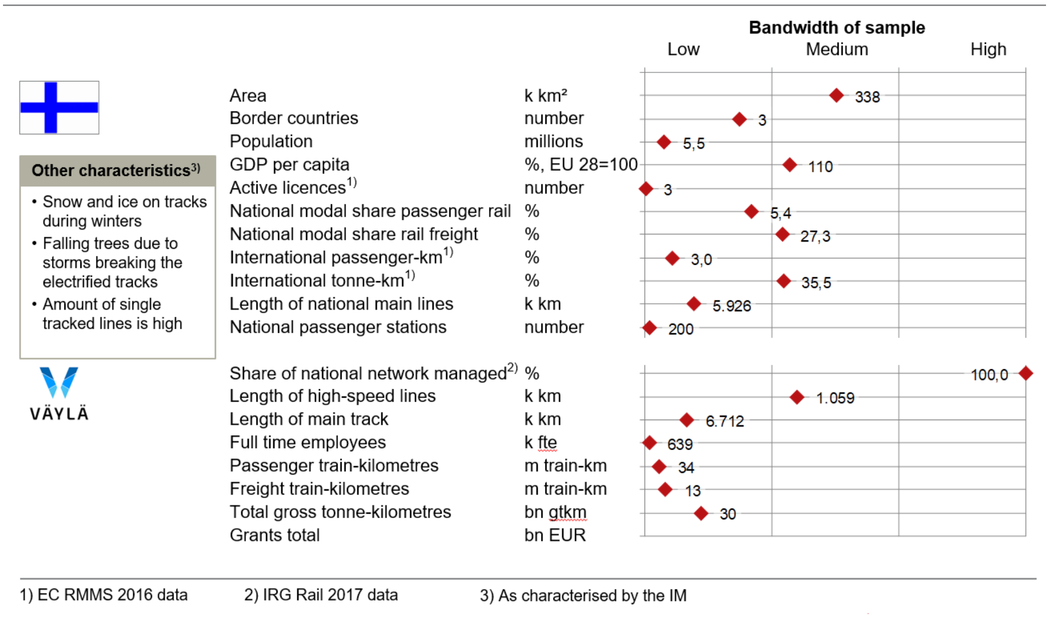


Figure 61: Fact sheet: Finnish Transport Infrastructure Agency

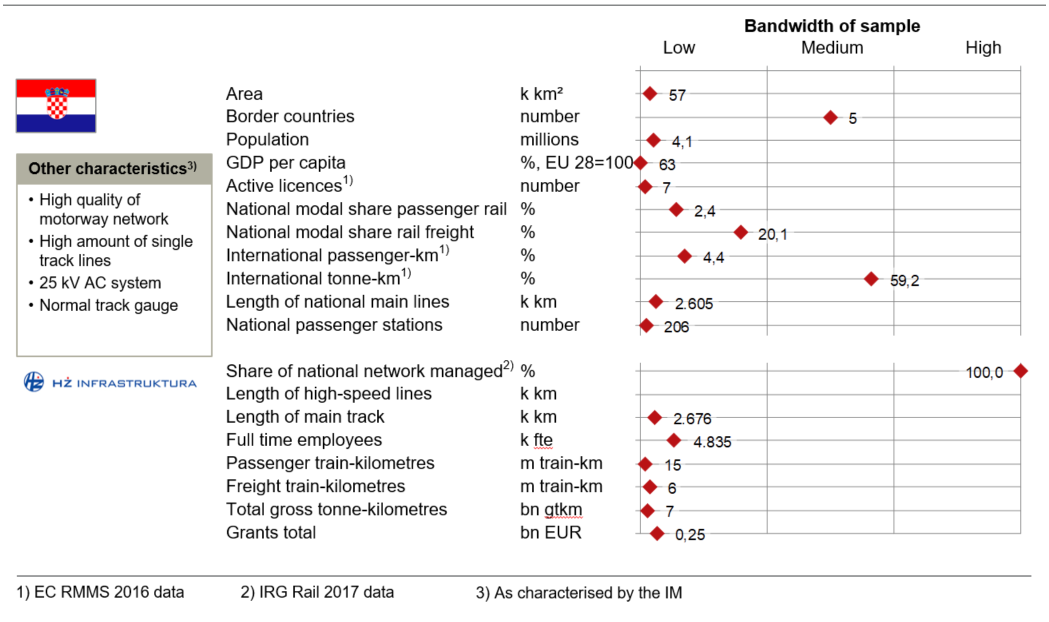


Figure 62: Fact sheet: HŽ Infrastruktura d.o.o.

Other characteristics[3]

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

Infraestruturas de Portugal

Bandwidth of sample: Low – Medium – High

Area	k km²	92
Border countries	number	1
Population	millions	10,3
GDP per capita	%, EU 28=100	76
Active licences[1]	number	10
National modal share passenger rail	%	4,3
National modal share rail freight	%	14,1
International passenger-km[1]	%	2,9
International tonne-km[1]	%	8,5
Length of national main lines	k km	2.546
National passenger stations	number	432
Share of national network managed[2]	%	100,0
Length of high-speed lines	k km	
Length of main track	k km	3.244
Full time employees	k fte	3.644
Passenger train-kilometres	m train-km	25
Freight train-kilometres	m train-km	5
Total gross tonne-kilometres	bn gtkm	7
Grants total	bn EUR	0,16

1) EC RMMS 2016 data 2) IRG Rail 2017 data 3) As characterised by the IM

Figure 63: Fact sheet: Infraestruturas de Portugal S.A.

Other characteristics[3]

- By regional passenger trains to sandy beach, seaside pine forest, national park
- Narrow-gauge railway for tourists

LATVIJAS DZELZCEĻŠ

Bandwidth of sample: Low – Medium – High

Area	k km²	65
Border countries	number	4
Population	millions	1,9
GDP per capita	%, EU 28=100	70
Active licences[1]	number	6
National modal share passenger rail	%	3,4
National modal share rail freight	%	74,0
International passenger-km[1]	%	6,6
International tonne-km[1]	%	97,5
Length of national main lines	k km	1.860
National passenger stations	number	143
Share of national network managed[2]	%	100,0
Length of high-speed lines	k km	
Length of main track	k km	2.217
Full time employees	k fte	6.439
Passenger train-kilometres	m train-km	6
Freight train-kilometres	m train-km	9
Total gross tonne-kilometres	bn gtkm	32
Grants total	bn EUR	

1) EC RMMS 2016 data 2) IRG Rail 2017 data 3) As characterised by the IM

Figure 64: Fact sheet: Latvijas dzelzceļš

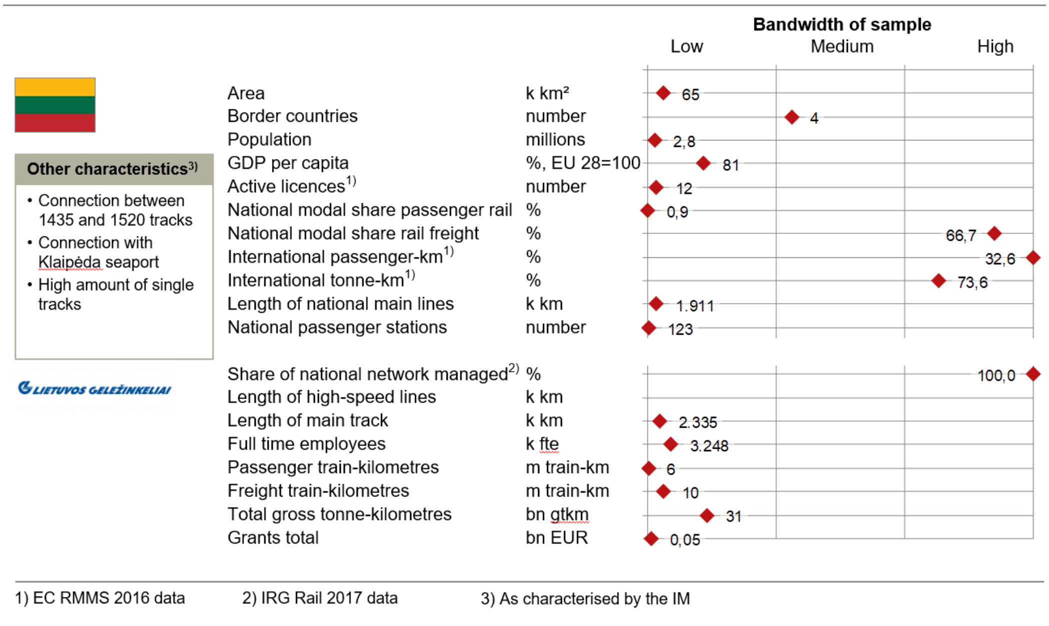


Figure 65: Fact sheet: Lietuvos geležinkeliai

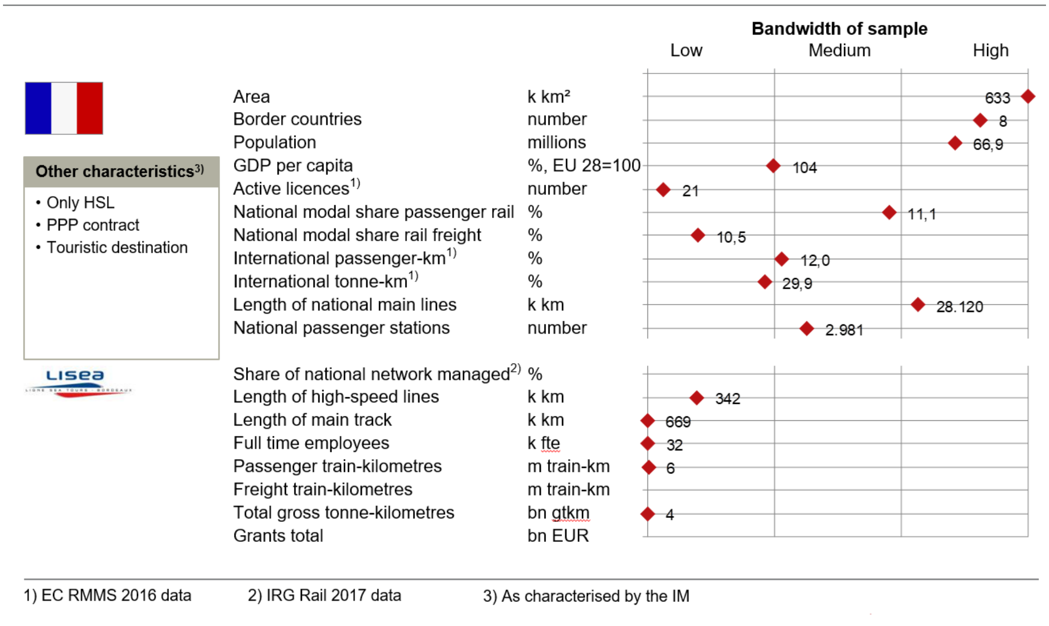


Figure 66: Fact sheet: LISEA

		Bandwidth of sample (Low / Medium / High)
Area	k km²	244
Border countries	number	1
Population	millions	66,3
GDP per capita	%, EU 28=100	104
Active licences[1]	number	51
National modal share passenger rail	%	8,8
National modal share rail freight	%	9,6
International passenger-km[1]	%	2,1
International tonne-km[1]	%	0,3
Length of national main lines	k km	16.320
National passenger stations	number	2.617
Share of national network managed[2]	%	
Length of high-speed lines	k km	
Length of main track	k km	31.221
Full time employees	k fte	38.594
Passenger train-kilometres	m train-km	530
Freight train-kilometres	m train-km	42
Total gross tonne-kilometres	bn gtkm	184
Grants total	bn EUR	4,35

Other characteristics[3]

- 20,000 miles of track, 30,000 bridges, tunnels & viaducts & thousands of signals & level crossings
- Relatively low level of electrification (~40%)

NetworkRail

1) EC RMMS 2016 data   2) IRG Rail 2017 data   3) As characterised by the IM

Figure 67: Fact sheet: Network Rail

		Bandwidth of sample (Low / Medium / High)
Area	k km²	313
Border countries	number	7
Population	millions	38,0
GDP per capita	%, EU 28=100	71
Active licences[1]	number	111
National modal share passenger rail	%	7,8
National modal share rail freight	%	23,9
International passenger-km[1]	%	3,2
International tonne-km[1]	%	42,7
Length of national main lines	k km	18.513
National passenger stations	number	2.628
Share of national network managed[2]	%	96,2
Length of high-speed lines	k km	
Length of main track	k km	27.154
Full time employees	k fte	38.740
Passenger train-kilometres	m train-km	162
Freight train-kilometres	m train-km	84
Total gross tonne-kilometres	bn gtkm	161
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 2016 data   2) IRG Rail 2017 data   3) As characterised by the IM

Figure 68: Fact sheet: PKP PLK

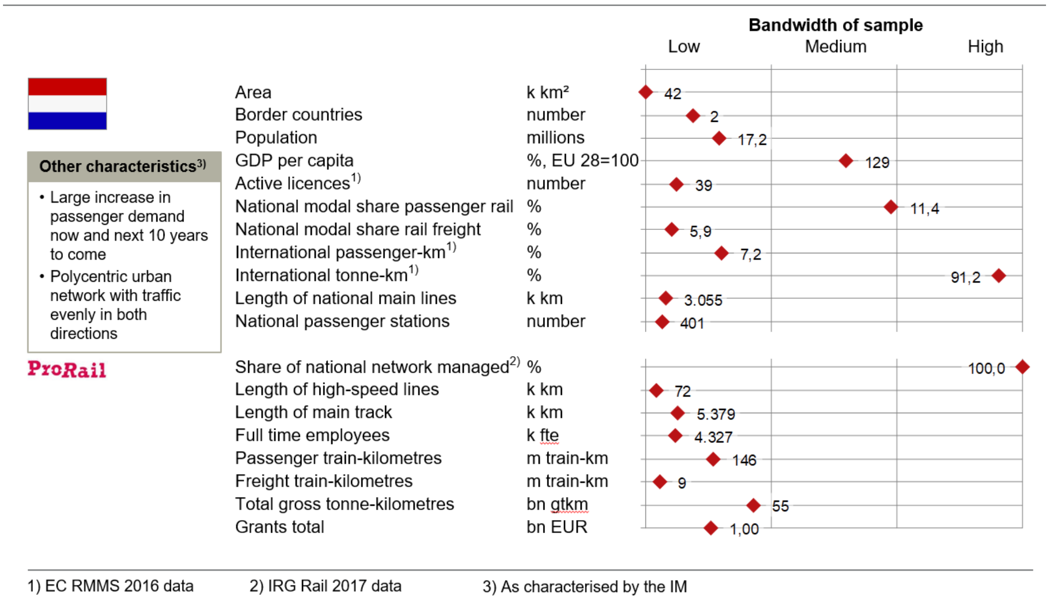


Figure 69: Fact sheet: ProRail

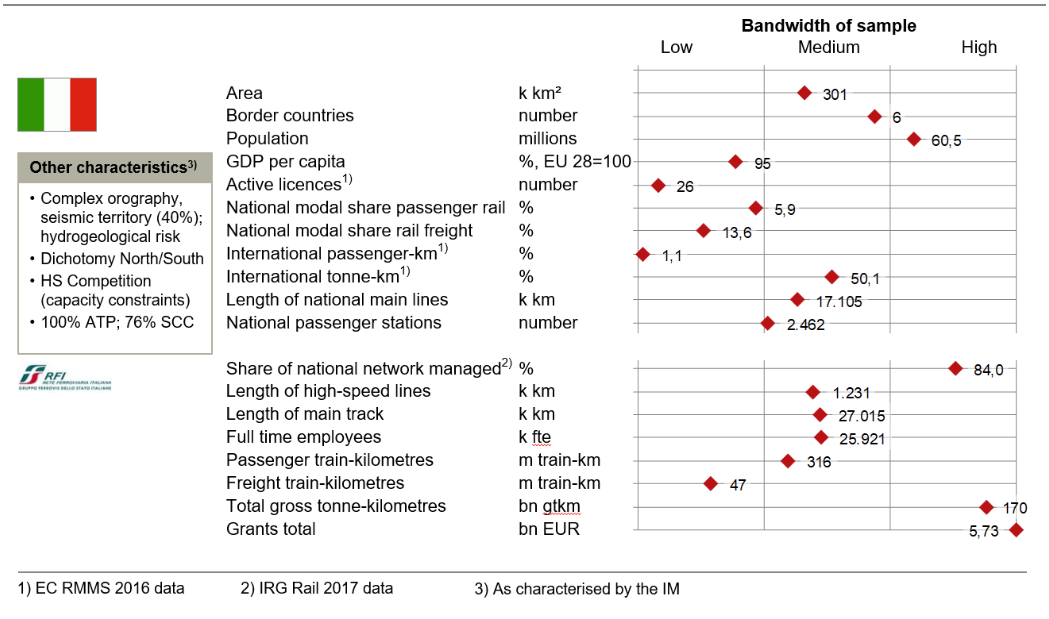


Figure 70: Fact sheet: RFI

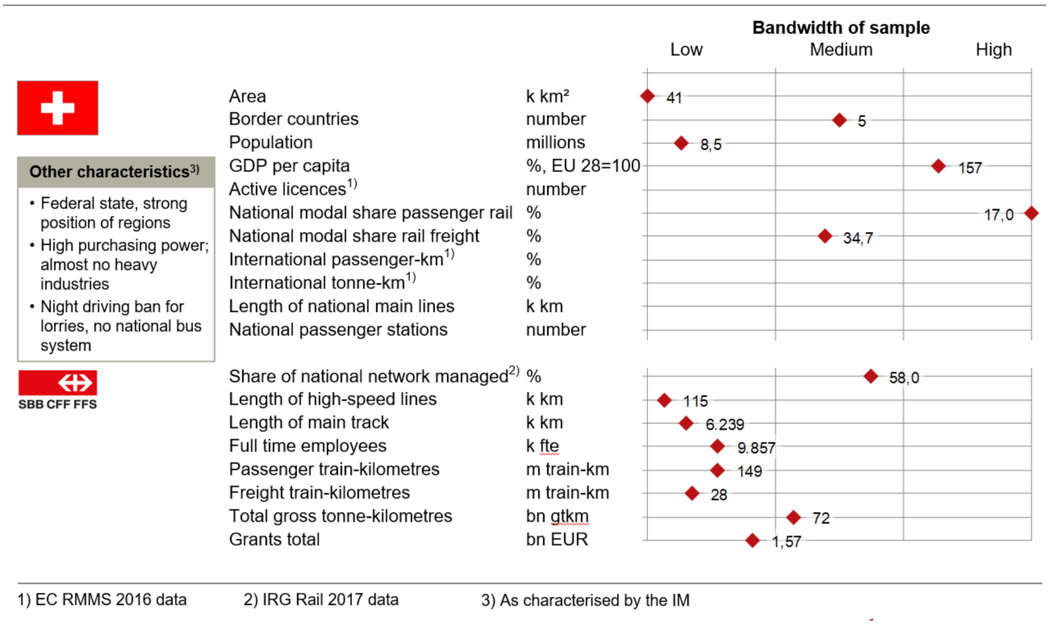


Figure 71: Fact sheet: SBB

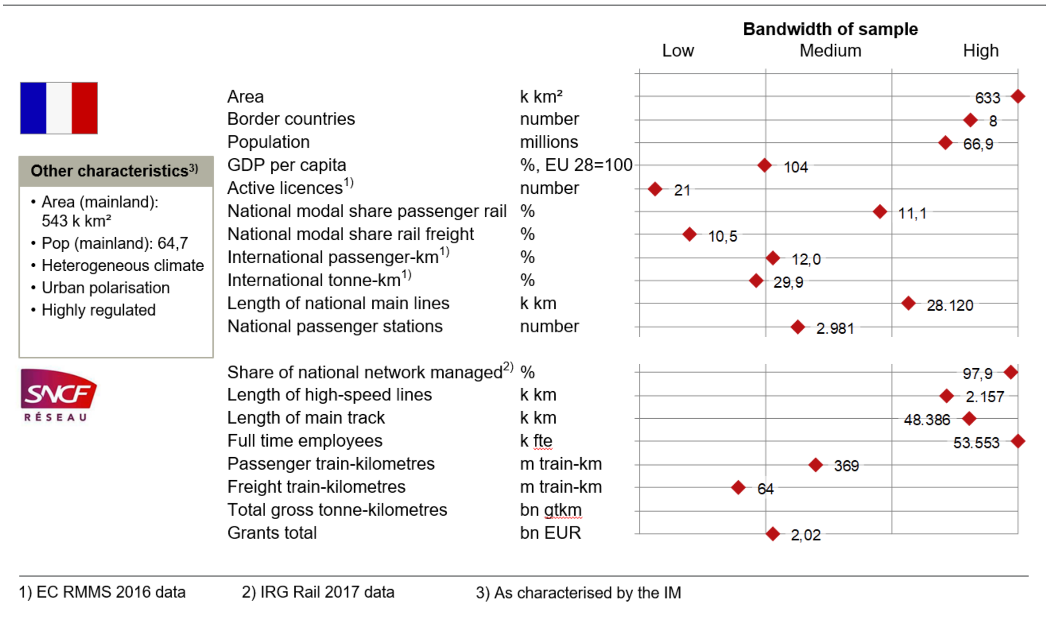


Figure 72: Fact sheet: SNCF Réseau

Other characteristics[3]

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

SŽDC

		Bandwidth of sample (Low – Medium – High)
Area	k km²	79
Border countries	number	4
Population	millions	10,6
GDP per capita	%, EU 28=100	90
Active licences[1]	number	110
National modal share passenger rail	%	9,3
National modal share rail freight	%	26,9
International passenger-km[1]	%	15,1
International tonne-km[1]	%	26,6
Length of national main lines	k km	9.408
National passenger stations	number	2.661
Share of national network managed[2]	%	98,3
Length of high-speed lines	k km	
Length of main track	k km	11.515
Full time employees	k fte	
Passenger train-kilometres	m train-km	134
Freight train-kilometres	m train-km	39
Total gross tonne-kilometres	bn gtkm	63
Grants total	bn EUR	

1) EC RMMS 2016 data 2) IRG Rail 2017 data 3) As characterised by the IM

Figure 73: Správa železnic, státní organizace

Other characteristics[3]

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

TRAFIKVERKET

		Bandwidth of sample (Low – Medium – High)
Area	k km²	450
Border countries	number	2
Population	millions	10,1
GDP per capita	%, EU 28=100	121
Active licences[1]	number	32
National modal share passenger rail	%	9,6
National modal share rail freight	%	30,2
International passenger-km[1]	%	3,6
International tonne-km[1]	%	36,2
Length of national main lines	k km	10.874
National passenger stations	number	675
Share of national network managed[2]	%	89,0
Length of high-speed lines	k km	
Length of main track	k km	11.812
Full time employees	k fte	7.845
Passenger train-kilometres	m train-km	124
Freight train-kilometres	m train-km	36
Total gross tonne-kilometres	bn gtkm	71
Grants total	bn EUR	1,67

1) EC RMMS 2016 data 2) IRG Rail 2017 data 3) As characterised by the IM

Figure 74: Fact sheet: Trafikverket

6.2 PRIME KPI-definitions

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, aviation and railways (Source: European Commission, Statistical Pocket book)	% 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 Pocket book)	% of tonne-km
Total track-km	Total track-km	Total track-km
Total main track-km	A track providing end-to-end line continuity de-signed for trains between stations or places indicated in tariffs as independent points of departure or arrival for the conveyance of passengers or goods, maintained and operated by the infrastructure manager. Tracks at service facilities not used for running trains are excluded. The boundary of the service facility is the point at which the railway vehicle leaving the service facility cannot pass without having an authorization to access the mainline or other similar line. This point is usually identified by a signal. Service facilities are passenger stations, their buildings and other facilities; freight terminals; marshal-ling 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	Total main track-km

KPI name	KPI Definition	KPI unit
	activities; relief facilities; refuelling facilities and supply of fuel in these facilities.	
Degree of net-work utilisation – passenger trains	Average daily passenger train-km on main track (revenue service only, no shunting, no work trains) related to main track-km	Daily passen-ger train–km per main track-km
Degree of net-work utilisation – freight trains	Average daily freight train-km on main track (revenue service only, no shunting, no work trains) related to main track-km	Daily freight train–km per main track-km

Finance

KPI name	KPI Definition	KPI unit
OPEX – opera-tional expendi-tures in relation to network size	Total infrastructure managers annual opera-tional expenditures per main track-km	Euro per main track-km
CAPEX – capi-tal expendi-tures 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-work size	Total infrastructure managers annual maintenance expenditures per main track-km	Euro per main track-km
Renewal ex-penditures in relation to net-work size	Total infrastructure managers annual re-newal expenditures per main track-km	Euro per main track-km
TAC revenue in relation to network size	Total infrastructure managers annual TAC revenues (including freight, passenger and touristic trains) compared to total main track-km	Euro per main track-km

KPI name	KPI Definition	KPI unit
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, • 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 accident 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	Number per mil-lion train-km

KPI name	KPI Definition	KPI unit
	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, • wrong-side signalling failure	In number per million train-km

Environment

KPI name	KPI Definition	KPI unit
Degree of electrification of total main track	Percentage of main track-km which are electrified	% of main track-km
Share of electricity-powered trains	Train-kilometres of electricity-powered trains compared to total train-kilometres (both for passenger and freight trains)	% of train-km

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

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

Availability

KPI name	KPI Definition	KPI unit
Tracks with permanent speed restrictions	Percentage of tracks with permanent speed restriction due to deteriorating asset condition weighted by the time the restrictions are in place (included in the yearly timetable) related to total main track-km; restrictions are counted whenever criterion is met regardless of whether infrastructure manager	% of main track-km

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

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

6.3 Financial data

	2012	2013	2014	2015	2016	2017	2018
Croatia	4.87	4.89	4.81	4.74	4.73	4.70	4.79
Czechia	17.70	17.49	17.44	17.29	17.61	16.43	17.82
Denmark	10.06	10.06	10.06	9.84	9.94	10.34	9.83
Finland	1.21	1.24	1.24	1.22	1.24	1.23	1.24
France	1.12	1.11	1.10	1.08	2.20	1.07	1.09
Germany	1.04	1.05	1.04	1.03	1.06	1.04	1.07
Great Britain	0.92	0.94	0.94	0.91	0.95	1.03	0.99
Italy	1.00	1.01	1.01	0.98	0.99	1.02	0.99
Latvia	0.67	0.68	0.68	0.67	0.67	0.68	0.71
Lithuania	0.60	0.60	0.60	0.60	0.62	0.60	0.65
Netherlands	1.10	1.09	1.09	1.09	1.10	1.15	1.13
Norway	11.95	12.26	12.56	12.86	13.71	14.67	14.32
Poland	2.40	2.41	2.41	2.36	2.40	2.28	2.51
Portugal	0.78	0.79	0.78	0.78	0.80	0.84	0.84
Spain	0.91	0.91	0.90	0.89	0.90	0.94	0.91
Sweden	11.52	11.81	11.99	11.99	12.28	12.96	12.60
Switzerland	1.79	1.79	1.75	1.67	1.69	1.86	1.68

Figure 75: Purchasing power parity (**Index, EU-28=1**)

	2012	2013	2014	2015	2016	2017	2018
Croatia	7.52	7.58	7.63	7.61	7.53	7.46	7.42
Czechia	24.15	25.98	27.54	27.28	27.03	26.33	25.65
Denmark	7.44	7.46	7.45	7.46	7.45	7.44	7.45
Finland	0.00	1.00	1.00	1.00	1.00	1.00	1.00
France	0.00	1.00	1.00	1.00	2.00	1.00	1.00
Germany	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Great Britain	0.81	0.85	0.81	0.73	0.82	0.85	0.81
Italy	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
Lithuania	3.45	3.45	3.45	1.00	1.00	1.00	1.00
Netherlands	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
Poland	4.18	4.20	4.18	4.18	4.36	4.26	4.26
Portugal	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Spain	0.00	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
Switzerland	1.21	1.23	1.21	1.07	1.09	1.11	1.16

Figure 76: Average annual exchange rate (**Local currency unit/Euro**)

7 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

Name	Description	Source
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)
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.	

Name	Description	Source
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
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

Name	Description	Source
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 measure representing the movement of all freight trains over one kilometre. From an IM'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 IM 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 of section 2.1, 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
High speed track	Track (line) whole or part of line, approved for $V_{max} \geq 250$ km/h — specially built high-speed lines equipped for speeds generally equal to or greater than 250 km/h, *— specially upgraded high-speed lines equipped for speeds of the order of 200 km/h,* *— specially upgraded high-speed lines which have special features as a result of topographical, relief or town-planning constraints, on which the speed must be adapted to each case* *The last category also includes interconnecting lines between the high-speed and conventional networks, lines through stations, accesses to terminals, depots, etc. travelled at conventional speed by 'high-speed' rolling stock.*	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)

Name	Description	Source
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 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
Killed (Death (killed person))	Any person killed immediately or dying within 30 days as a result of an accident, excluding any suicide.	Glossary for Transport Statistics, A.VI-09 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.18
Level crossing	Any level intersection between a road or passage and a railway, as recognised by the infrastructure manager and open to public or private users. Passages between platforms within stations are excluded, as well as passages over tracks for the sole use of employees.	Glossary for Transport Statistics, A. I-14 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 6.3
Level crossing accident	Any accident at level crossings involving at least one railway vehicle and one or more crossing vehicles, other crossing users such as pedestrians or other objects temporarily present on or near the track if lost by a crossing vehicle or user.	Glossary for Transport Statistics, A. I-15 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 1.8
Line km	A cumulative length of all lines maintained by infrastructure managers.	PRIME KPI subgroup 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

Name	Description	Source
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 overhauls 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 subgroup on the basis of LICB and Regulation (EU) 2015/1100 (RMMS), Article 2
Main track	A track providing end-to-end line continuity designed for running trains between stations or places indicated in timetables, network statements, rosters or other indications/publications as independent points of departure or arrival for the conveyance of passengers or goods.	Glossary for Transport Statistics, A.I-01.1
Main track (main track km), length of	A cumulative length of all running/main tracks Excluded are: - Lines solely used for operating touristic trains and heritage trains; - Lines constructed solely to serve mines, forests or other industrial or agricultural installations and which are not open to public traffic; - Private lines closed to public traffic and functionally separated (i.e. stand-alone) networks; - Private lines used for own freight transport activities or for non-commercial passenger services and light rail tracks occasionally used by heavy rail vehicles for connectivity or transit purposes	Glossary for Transport Statistics, A.I-02.1 and A.I.01
Main track, electrified	Main running tracks provided with an overhead catenary or with conductor rail (3rd rail) to permit electric traction.	Glossary for transport statistics, A.I-01.1 and A.I.15 LICB Web Glossary, p.16
Minimum access package charges	Revenues generated by charging railway undertakings for enabling them to provide their services. The minimum access package comprises: (a) handling of requests for railway infrastructure capacity; (b) the right to utilise capacity which is granted; (c) use of the railway infrastructure, including track points and junctions; (d) train control including signalling, regulation, dispatching and the communication and provision of information on train movement; (e) use of electrical supply equipment for traction current, where available; (f) all other information required to implement or operate the service for which capacity has been granted.	Directive 2012/32/EU, Annex II
Multimodal rail freight terminals	Multimodal Freight Terminals (IFT) or transfer points are places equipped for the transhipment and storage of Intermodal Transport Units (ITU). They connect at least two transport modes, where at least one of the modes of transport is rail. The other is usually road, although waterborne (sea and inland waterways) and air transport can also be integrated.	PRIME KPI subgroup on the basis of Regulation (EU) 2015/1100 (RMMS), Article 2

Name	Description	Source
Multimodal transport	The carriage of passengers or freight, or both, using two or more modes of transport;	Regulation (EU) No 1315/2013 (TEN-T), Art.3(n)
Network	Principal railway lines managed by the infrastructure manager.	Glossary for Transport Statistics, A.I-02.1
Operations	Operations excluding maintenance: SS-EN 13306:2010 defines operation as: Combination of all technical, administrative and managerial actions, other than maintenance actions that results in the item being in use. Total annual expenditures for the IM on operations. Includes operations proportion of the IM 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 it´s to be 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
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

Name	Description	Source
Passenger train-km	Unit of measure representing the movement of all passenger trains over a distance of one kilometre. From an IM'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 base 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 are measured by setting up a threshold up to which trains are considered as punctual and building a percentage." When measuring punctuality following are to be included all in service trains, i.e. 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

Name	Description	Source
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 are definitely 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 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
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 is included.	
Temporary restrictions	Restrictions that occur during the year, 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)

Name	Description	Source
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 immediate restriction of permitted speed.	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's trains and freight trains.	Glossary for Transport Statistics, A.IV-05 and A.IV-06
Train-km	The unit of measure representing the movement of a train over one kilometre. The distance used is the distance actually run, if available, otherwise the standard network distance between the origin and destination shall be used. Only the distance on the national territory of the reporting country shall be taken into account.	Glossary for Transport Statistics, A.IV-05 Directive (EU) 2016/798 on railway safety, Annex I, Appendix 7.1
Traffic Management Cost	Costs of functions: Traffic management comprises the control of signal installations and traffic, planning as well as path allocation. Types of costs: Traffic management includes planning, its proportion of 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 subgroup on the basis of UIC studies (CENOS and OMC)
Working timetable	The data defining all planned train and rolling-stock movements which will take place on the relevant infrastructure during the period for which it is in force	Directive 2012/34/EU (SERA), Article .3(28)