BY TRAIN INTO THE FUTURE

WHAT HIGH-SPEED RAIL WILL BRING
TO THE CZECH REPUBLIC

Ministerstvo dopravy

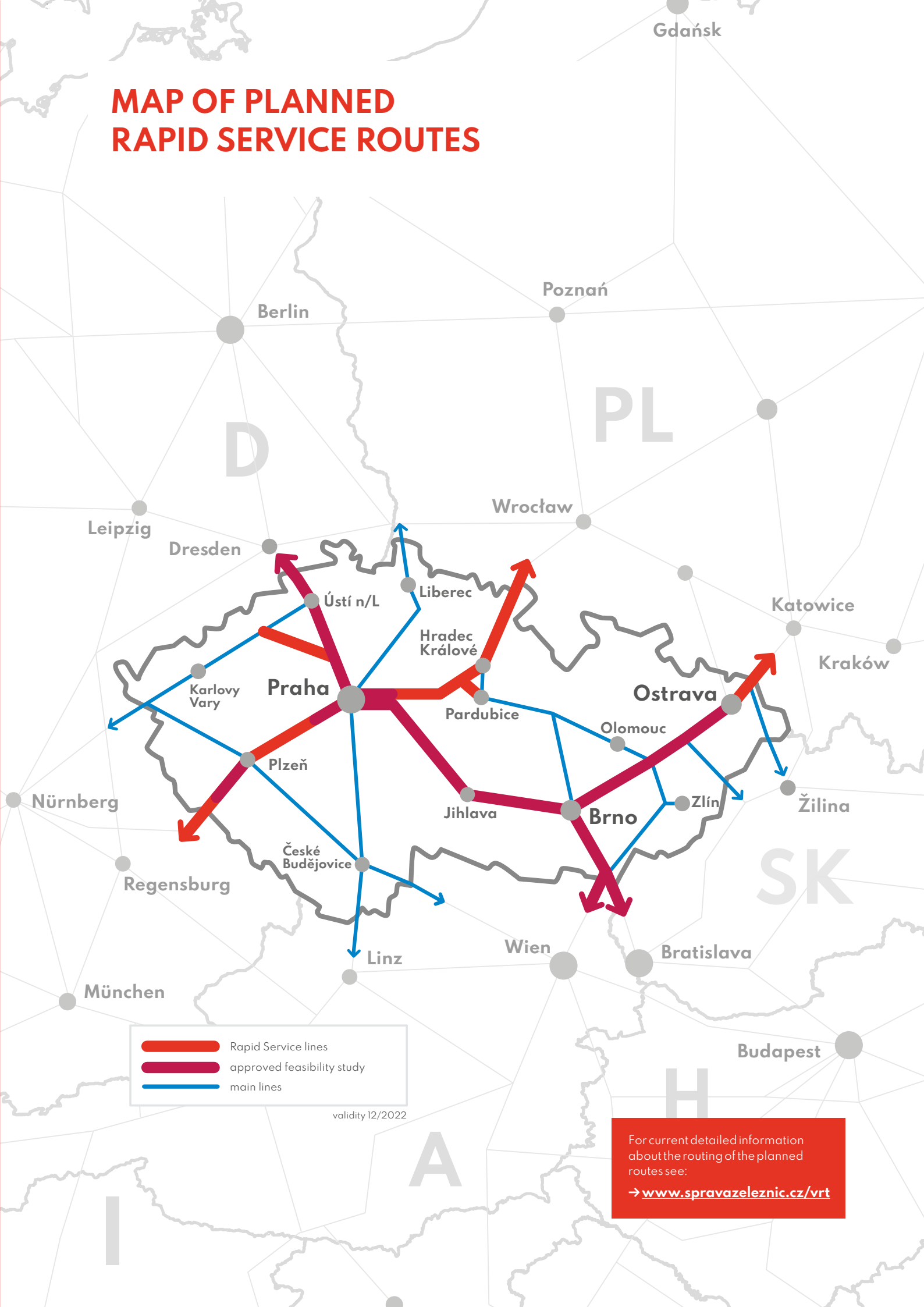
SPRÁVA ŽELEZNIC

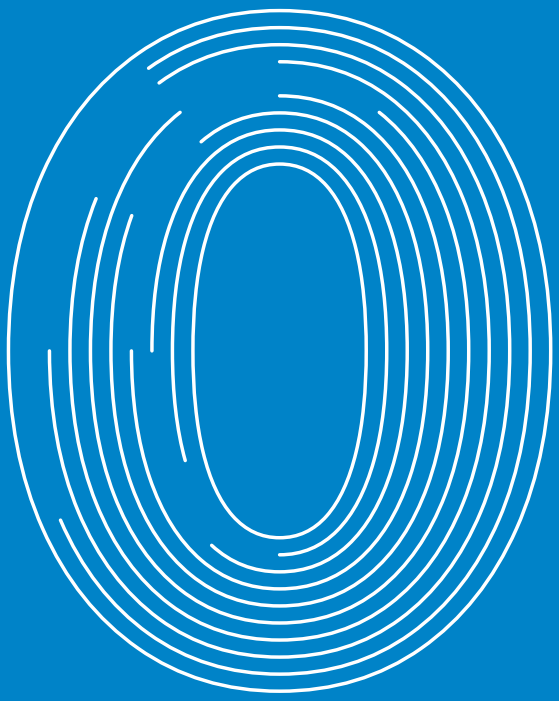
Discover intriguing possibilities with high-speed trains.

CONTENTS

CONTENTS

MAP OF PLANNED RAPID SERVICE ROUTES





BY TRAIN
TO THE FUTURE

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WHAT HIGH-SPEED RAIL WILL BRING TO THE CZECH REPUBLIC

SUMMARY

The acceleration, quality improvements, and increased frequency of services in the Czech railway system increase the demand for transport by rail. This results in greater utilisation on the main lines, which has become a limiting factor for further development. The Czech Republic also faces challenges in a number of areas, such as the need to improve the accessibility of our metropolises, engage remote or structurally disadvantaged regions in the economic life, and reduce the negative environmental impacts of transport. The answer to the need to address (not only) the problems listed above lies in high-quality, fast, and high-capacity rail transport, with high-speed rail as its backbone.

High-speed rail is one of the EU's main transport projects. The Czech Republic has subscribed to the project and is preparing it under the **Rapid Service (RS, Rychlá spojení)** brand. The main benefit will be a significant reduction in travel time at the domestic and international scales and improved accessibility of most of the territory of the country. Rapid Service will both serve the metropolitan areas and offer fast transport outside them – i.e. into the regions of Bohemia, Moravia, and Silesia. The new lines will also increase the capacity of the railway network, thus contributing to the further development of regional passenger and freight transport by rail. The speeds achieved on the high-speed lines will be up to 320 km/h. The new lines will also be sensitively integrated in the landscape and will not pollute the surrounding area with noise. The Rapid Service trains will offer comfortable, affordable, and reliable transport to the general public for commuter, business, leisure, or holiday travel.

All of these topic are covered in detail in the publication you have just opened.

MIT DER BAHN IN DIE ZUKUNFT
WAS BRINGT DIE HOCHGESCHWINDIGKEITSBAHN DER TSCHECHISCHEN REPUBLIK

ZUSAMMENFASSUNG

Die Beschleunigung der tschechischen Eisenbahn, die Erhöhung ihrer Qualität und die Intensivierung der Verbindungsfrequenz erhöhen die Nachfrage nach dem Schienenverkehr. Dies führt auch zu einer höheren Auslastung der Hauptstrecken, die eine Grenze für die weitere Entwicklung erreicht hat. Gleichzeitig steht die Tschechische Republik in vielen Bereichen vor Herausforderungen, wie etwa der Notwendigkeit, die Erreichbarkeit unserer Metropolen zu verbessern, abgelegene oder vom Strukturwandel betroffenen Regionen stärker in das Wirtschaftsleben einzubeziehen oder die negativen Umweltauswirkungen des Verkehrs zu verringern. Die Antwort auf die Notwendigkeit, (nicht nur) diese Probleme zu lösen, ist ein qualitativ hochwertiger, schneller und kapazitätsstarker Schienenverkehr mit der Hochgeschwindigkeitsbahn als Rückgrat.

Die Hochgeschwindigkeitsbahn ist eines der wichtigsten Verkehrsprojekte der EU. Die Tschechische Republik hat sich dem Projekt angeschlossen und bereitet es unter dem Markennamen **Schnellverbindungen** (tschechisch **Rychlá spojení (RS)**) vor. Der Hauptnutzen liegt in einer erheblichen Verkürzung der Reisezeiten auf nationaler und internationaler Ebene und einer besseren Erreichbarkeit des größten Teils der Tschechischen Republik. Die Schnellverbindungen werden nicht nur die Metropolen, sondern auch Gebiete außerhalb der Metropolen — die tschechischen, mährischen und schlesischen Regionen — bedienen. Die neuen Strecken werden auch die Kapazität des Schienennetzes erhöhen und so zur Weiterentwicklung des regionalen Personen- und Güterverkehrs auf der Schiene beitragen. Die Geschwindigkeit auf den Hochgeschwindigkeitsstrecken wird bis zu 320 km/h erreichen. Die neuen Strecken werden außerdem sensibel in die Landschaft eingefügt und sie werden ihre Umgebung nicht durch Lärm belästigen. Die Züge der Schnellverbindungen bieten komfortable, günstige und zuverlässige Verkehrsdienste für breite Bevölkerungsschichten, sei es für Pendler, Geschäftsreisende, AusflüglerInnen oder Urlaubsreisende.

All diese Themen finden Sie ausführlicher in der Publikation erläutert, die Sie gerade in Händen halten.

How to read this publication?

Dear readers,

We, the authors of this publication, are pleased by your interest in the benefits of high-speed rail for the Czech Republic, and we would like to make this trip by "train to the future" as enjoyable as possible and to introduce the future high-speed rail. The publication comprises **11 chapters**, grouped into four main parts. The individual parts answer the **four main questions**:

WHY DO WE NEED HIGH-SPEED RAIL?
WHAT WILL HIGH-SPEED RAIL BRING?
HOW DOES HIGH-SPEED RAIL WORK?
WHAT WILL BE THE DIRECTIONS OF FURTHER DEVELOPMENTS?

You can read the publication from the beginning to the end to get an overall picture of the high-speed rail. You can also opt to read only specific chapters if your interest is only in a certain aspect of the subject. Each chapter is designed to be a standalone feature that provides sufficient information on the given topic. That is also why some important general information is sometimes repeated across the chapters. At the beginning of each chapter, there is a **fold-out with a graphical summary** of the most important points of that chapter. Just glance over it and decide whether the topic interests you and requires a deeper focus.

The authors hope that you enjoy your reading and viewing experience.

WHY

DO WE NEED HIGH-SPEED RAIL?

AT THE DOORSTEP OF A GREAT PROJECT – TRAVEL IN THE 21ST CENTURY

In addition to motorways, Europe is gradually being covered by a network of high-speed railways. It is in the interest of the Czech Republic to join this network to improve the domestic and international accessibility.

1

Photo: © Siemens Mobility, 2022

1 AT THE DOORSTEP OF A GREAT PROJECT – TRAVEL IN THE 21ST CENTURY

DESPITE INCREASING CAR OWNERSHIP, PEOPLE TEND TO TRAVEL BY TRAIN MORE. THIS IS BECAUSE THE TRAIN CAN BE FAST.


1

SPEED IS THE BASIC MEASURE OF THE QUALITY OF TRANSPORT AND OF A TRANSPORT SYSTEM

Railways resolved the issue of speed decades ago:

→ speeds over **300 km/h** in routine operation

→ speeds over **500 km/h** in test runs

The way to achieving high transport speeds is high-speed rail, currently being prepared in the Czech Republic and known as "Rapid Service".

2

4


3

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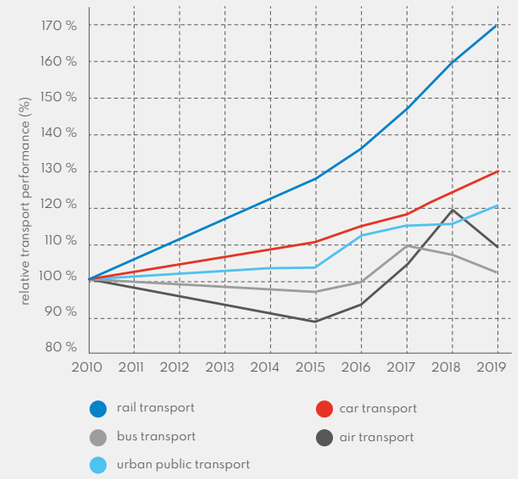
The previous decade has shown that the Czech railway becomes more attractive as its speed and quality increase.

DEVELOPMENT OF PASSENGER TRANSPORT IN THE CZECH REPUBLIC



Source: Transport Yearbooks, own calculation

2020 and 2021 data are not shown as they have little informative value due to the pandemic.

Rapid Service and HSL

The railway lines – rolling stock – services triangle forms the functional basis of the future high-speed rail system relies – the so-called **"Rapid Service"**.

The functional inseparability of this triangle is the reason why the term "Rapid Service" has been introduced in addition to the (infrastructural) term **"high-speed line" (HSL)**. **Rapid Service** is defined as the operational and infrastructural system of high-speed rail in the Czech Republic, which, in addition to newly built high-speed lines (HSL), also includes lines upgraded for speeds of up to 200 km/h as well as other modernised conventional lines for speeds of up to 160 km/h. A rolling stock of appropriate specifications and an operational concept forms a functional component of RS. The concept involving the proposed lines for high-speed trains will enable the use of both the HSL and the modernised conventional infrastructure, thanks to interconnections and exit points. People will gain access to high-speed rail even where there are no new lines as such. The principle is similar to that of motorways. The motorway reduces travel times for individuals and companies located both on or near the motorway and in places that cannot be directly accessed by motorway.

HSL = high-speed line
RS = Rapid Service

Rail benefits from speed

With the modernisation of the railway service from Prague to Olomouc, Ostrava, and Brno, completed in the first decade of this century and resulting in increasing the line speeds up to 160 km/h, the number of passengers increased considerably in the second decade:

→ by a factor of **almost three** between Prague, the Olomouc Region and the Moravian-Silesian Region

→ by a factor of **almost five** between Prague and the South Moravian Region

In connection to the ongoing modernisation of the railway service between Prague and Pilsen and České Budějovice, the second decade of this century also saw a significant increase in the number of passengers:

→ by **270**% between Prague and the Pilsen Region

→ by **240**% between Prague and the South Bohemian Region

In contrast, the volume of railway transport between Prague and the regions only connected by the original railway without major upgrades (e.g.: the Liberec Region), is stagnant. The regions concerned rightly see this as territorial discrimination and demand remedy.

Photo: **1** – NÖLB Mh / Wikipedia.org / CC, **2** – České dráhy, a.s. archives, **3** – České dráhy, a.s. archives, **4** – kmn-network / iStock images, **5** – Minwormed / Wikipedia.org / CC

AT THE DOORSTEP OF A GREAT PROJECT – TRAVEL IN THE 21ST CENTURY

Speed is both a physical quantity and a requirement of the modern times. This also applies at the beginning of the 21st century. It has become a measure of progress and maturity, whether we talk about data transfer, raw material processing, delivery of goods, or transport. Despite the emergence of activities in which the phenomenon of speed is being revaluated in contrast with the ever-growing dynamics of life (e.g. slow food), speed is likely to remain a staple in transport, with minor exceptions such as pleasure trains.

Gaining speed means getting ahead. That is also the reason why speed has surpassed its original physical content (being defined by the distance covered by an object per unit of time) and it is increasingly perceived in the pragmatic, economic and figurative sense as a means to increase efficiency of other activities in terms of the value of the time saved. In transport, speed has always been a main selling and competitive point.

The great advantage is that the railway technically resolved the issue of speed, specifically, that of high speeds, many decades ago. The Czech Republic can thus relatively easily follow in the footsteps of Japan, France, Germany, Italy, Spain, Turkey, South Korea, Belgium and many other countries where **speeds of 300 km/h** or more have **become a commonplace and standard part of everyday life**. The Czech Republic is preparing a high-speed rail project, and it is imperative for the country to do so. Failure to implement high-speed rail would be detrimental to both the Czech railways and, especially, the Czech Republic. This is because, in addition to motorways, Europe is gradually being covered by high-speed lines forming a network of priority trans-European routes.

It is in the interest of the Czech Republic to confirm its favourable geographical location and ensure not only better connections with the world, but also to create conditions for improved and more comfortable domestic travel. The know-how, technologies, and interest in their transfer are there.

High-speed rail is one of the EU's main transport policy instruments with a view to building a fast, high-capacity, reliable, and environmentally friendly network to connect the Member States. In May 2017, the high-speed rail project was supported by the Czech government. It is being prepared under the "**Rapid Service**" name, and it is designed to become an instrument for regional development with broader effects for the (national) economy, in addition to consolidating the country's position on international routes and improving the service between the main metropolitan areas of the Czech Republic.

Rapid Service and HSL

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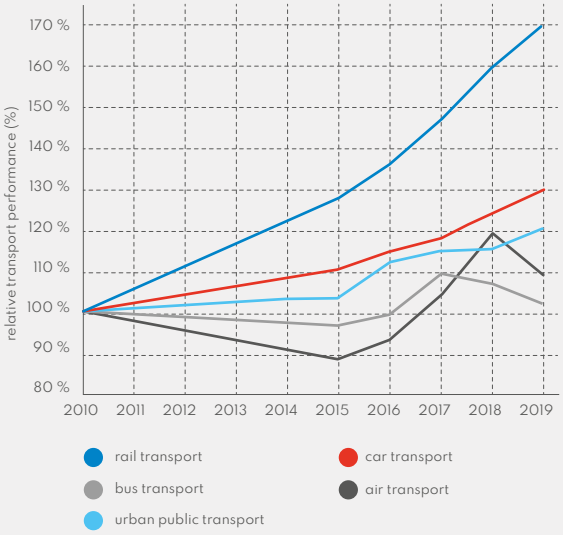
From the transport perspective, this plan provides an unprecedented opportunity to **redraw the domestic railway network** and thus the entire transport system. This is because, with few and rare exceptions, our railway network has seen only minor changes since the late 19th century. This is in stark contrast to the dynamic developments in road and aviation infrastructure. While, thanks to the foresight and generous planning of our ancestors, it has been possible to modernise the existing railway system to meet the demands of the modern society at least in some respects, it has reached its limits. If the railway is to meet the requirements of a globalised, highly urbanised and digitised society of the early 21st century, which reflects environmental and social issues related to sustainability as well as its economic needs and interests, the planning needs to show the corresponding perspective and, above all, undergo a generational (i.e. technological) transformation.

Experience from the modernisation of railway corridors confirms that the railway can regain customer trust and succeed where it offers fast and quality services. It is mainly because of increased popular interest in long-distance railway transport that passenger **railway traffic increased by 166%** in the Czech Republic between 2010 and 2019, **reaching the level forecast for 2050 as early as 2018 in some aspects**! This is despite the fact that the forecast is rather recent. Fore the pandemic, rail became the fastest growing transport modality in the Czech Republic.

The railway owes this growth not only to the modernisation of the infrastructure but also the significant improvements in the range of services by introducing cyclic timetables and improvements in the quality of the rolling stock and services.

DEVELOPMENT OF PASSENGER TRANSPORT IN THE CZECH REPUBLIC



Source: Transport Yearbooks, own calculation

2020 and 2021 data are not shown as they have little informative value due to the pandemic.

With the modernisation of the railway service from Prague to Olomouc, Ostrava, and Brno, completed in the first decade of this century and resulting in increasing the line speeds up to 160 km/h, the number of passengers increased considerably in the second decade:

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On the contrary, the volume of railway transport between Prague and the regions which are only connected by the original railway without major upgrades (e.g.: the Liberec Region), continues to stagnate. The regions concerned rightly see this as territorial discrimination and demand remedy.

More interesting information can be derived from the statistics. **The average passenger trip by train in the Czech Republic increased from 40 to 56.4 km**, i.e. to 141% of the baseline value, between 2010 and 2019.

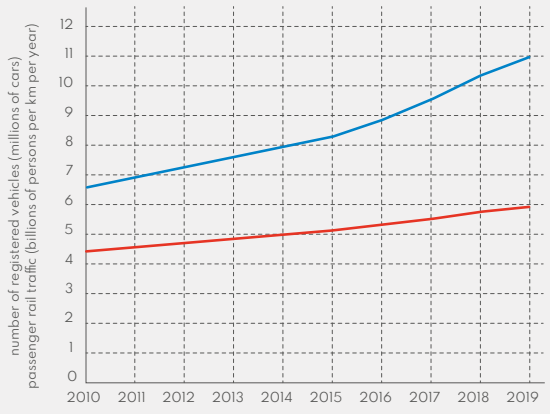
In the same period, the average trip by passenger car in the Czech Republic decreased to 96% of the initial value (from 32.3 to 31 km). The average daily trip of a vehicle in the Czech Republic is 29 km, i.e. 10,500 km per year, with the average vehicle occupancy being 1.3 passengers per car.

These figures somewhat contrast with the perception of the passenger car as the means of transport for long-distance and family travel. It is paradoxical that **despite increasing car ownership, people tend to travel by train more**. To an increasing degree they combine individual and public transport. This is because they drive to take a train.

The importance and intensity of contacts between larger yet more distant settlement have been growing in recent decades.

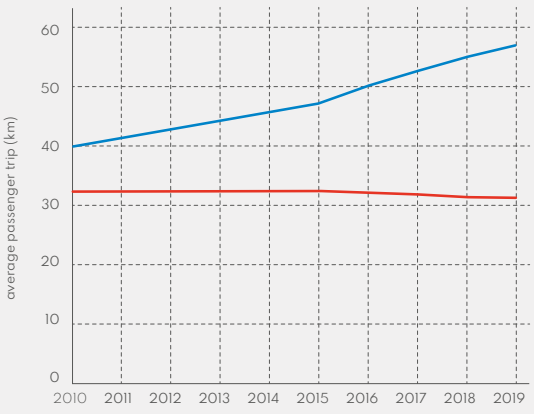
It is these cities that the country's economic power concentrates in and that naturally generate the demand that can be covered by rail transport. This trend is also confirmed by the experience from the corridor modernisation projects. Most of today's railway traffic is carried out via this modernised infrastructure between the domestic and international main settlements, complemented by suburban transport. In other words, if we are able to speed up rail transport to a point where it is significantly faster to travel between the major settlements by rail than by car and where European travel is not much slower than air travel, the attractiveness of rail travel will skyrocket.

DEVELOPMENT OF PASSENGER TRANSPORT IN THE CZECH REPUBLIC



Source: Transport Yearbooks, own calculation

DEVELOPMENT OF AVERAGE PASSENGER TRIP IN THE CZECH REPUBLIC



Source: Transport Yearbooks, own calculation

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Photo: České dráhy, a.s. archives

HARMONIOUS TERRITORIAL DEVELOPMENT

Long-term functioning of neighbouring rich and impoverished regions is without conflict impossible. Among other benefits, high-speed rail can help poorer regions become engaged in the country's life.

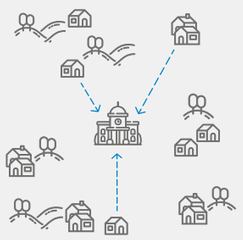
2

2 HARMONIOUS TERRITORIAL DEVELOPMENT

THE HARMONIOUS DEVELOPMENT OF THE ENTIRE TERRITORY OF OUR COUNTRY IS A TASK FOR BOTH SPATIAL PLANNING AND, THROUGH IMPROVED ACCESSIBILITY, FOR TRANSPORT.

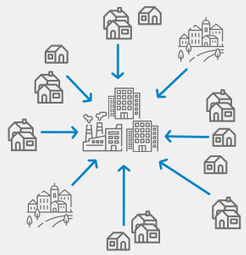
HOW DOES THE STRUCTURE OF TERRITORIAL RELATIONS CHANGE OVER TIME AND HOW DOES IT TRANSLATE INTO THE SOCIETY'S TRANSPORT NEEDS?

1 AGRICULTURAL (until about 1850)



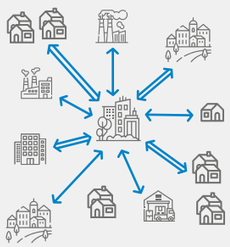
Most people live in **rural areas** – close ties between people and the land and place. The reasons for the low mobility of the population included local livelihoods, statute labour, and only **animal-powered transport possibilities**. Trans-regional mobility only occurs among a small group of people and is usually associated with territorial administration and trade. Very limited inter-regional relations.

2 INDUSTRIAL (about 1850—1990)



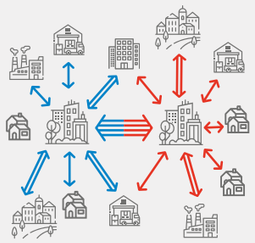
Industrial developments changed the social structure, causing **massive migration of the rural population to cities**. A new settlement structure emerged. The concentration of jobs in cities gradually resulted in a new social demand – that for commute, leading to the rise of public transport. The interconnection between the city and its hinterland is reinforced significantly.

3 POSTINDUSTRIAL (since about 1990)



The urban hinterland is no longer used for housing only but also becomes the setting for work. **Commuting to work** becomes bi-directional. Especially around large metropolises, the size of the service area increases, as does **the intensity of contacts** (economic, scientific, tourist) **between similarly sized settlements**. The most important ones form a global metropolitan structure.

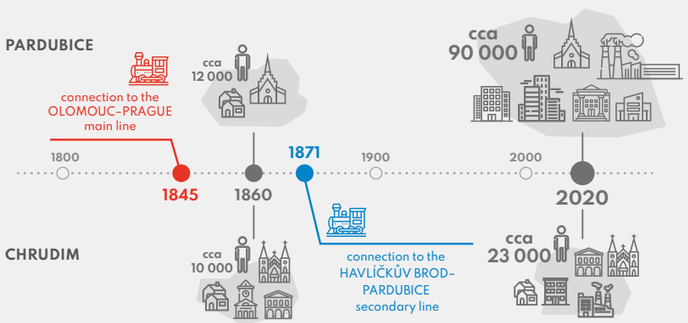
4 POLYCENTRIC (21st century)



Large metropolises remain important. However, a part of the activities continues to "spill over" **from the metropolises into smaller settlements**. Those that are easy to access and located on major routes have an advantage. They are attractive for investors, work, and living alike. A **polycentric settlement structure** emerges, involving territorial division of labour. With few exceptions, the entire national territory participates in creating and consuming value.

FAST AND HIGH-CAPACITY RAIL IS A DEVELOPMENT OPPORTUNITY

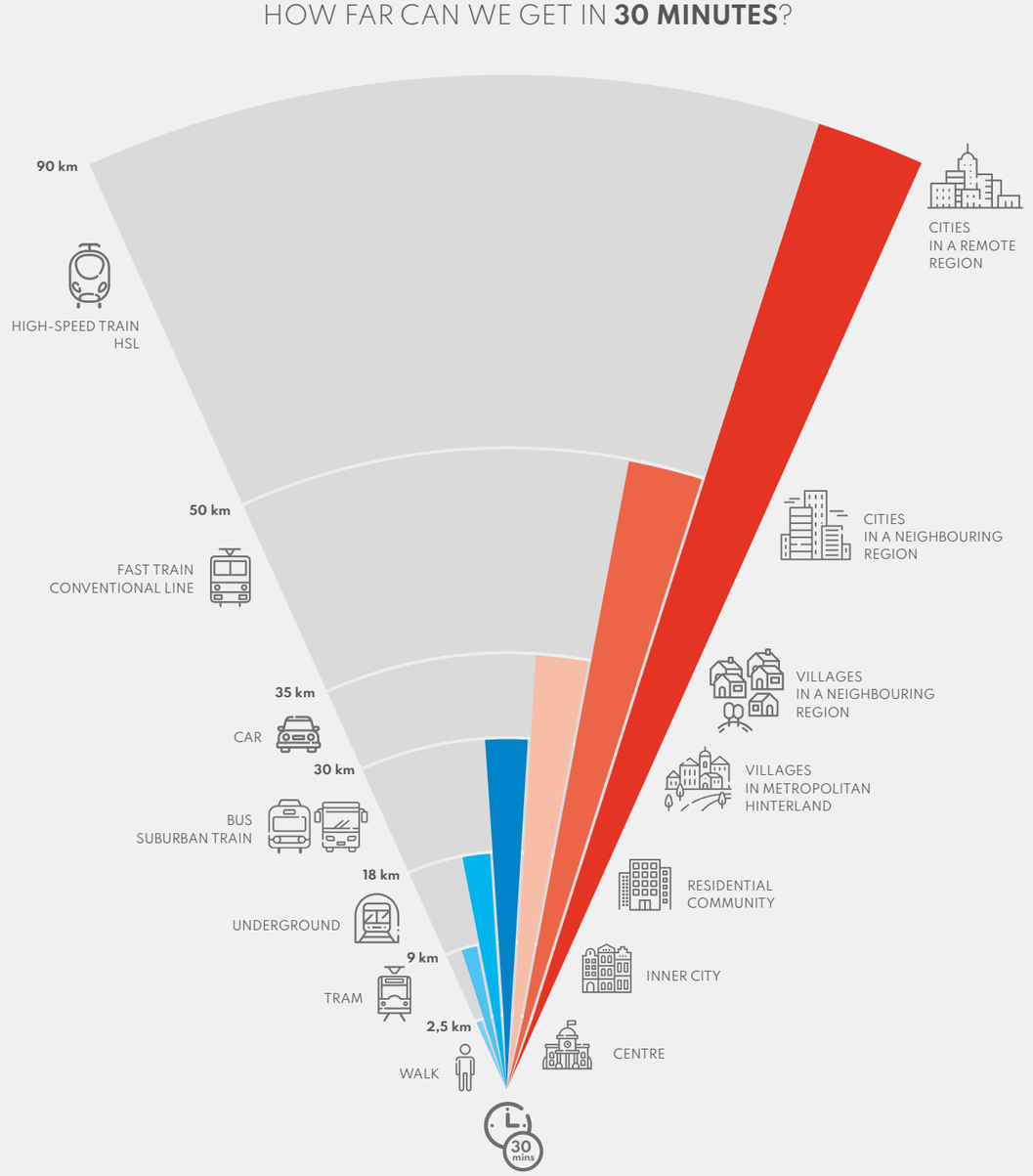
How the rail influenced the development of Pardubice and Chrudim



High-quality rail service creates the conditions for:

- → more jobs in the industrial and service sectors
- → the development of culture and education
- → easy commute to other cities and regions
- → improved quality of life

HOW FAR CAN WE GET IN **30 MINUTES**?



HARMONIOUS TERRITORIAL DEVELOPMENT

THE CHANGING WORLD

Ensuring that jobs are accessible from the place of residence is a basic feature of a functional society. Before the Industrial Revolution, people were closely tied to their rural homes and the land that provided them with their basic livelihood. This was one of the reasons for the very low mobility. People were unable to travel, and had no reason to do so on a large scale. Their livelihood was right where they lived. Transport was done by animals at corresponding speeds. The Industrial Revolution changed everything, with the development of industry being linked to the development of urban areas. The uneven distribution of natural resources became the impetus fo **widening the gaps between regions**, giving rise to a new structure of the pattern of settlement with a strong role of cities, a new social structure, and new needs. **Commuting became one of them**. As the population became more affluent, the new phenomenon of leisure travel also occurred.

Illustration: Ludwig Förster, Amédée Demarteau: Pardubice viewed from the new railway line in 1845 / Wikipedie.cz / public domain

The traditional settlement structure, characterised by the dominant role of small villages evenly distributed across the entire territory of the state, corresponded to most of the population being engaged in agriculture. Technical progress relieved agriculture of the need for a numerous labour force. It concentrated jobs in the cities, where people began to move to find work in industry. The cities naturally grew and prospered and social activities began to **concentrate in the agglomerations**. In addition to the traditional concentration of public administrative and the industry, sectors such as finance, research, education, health care, culture, sports and a number of other activities began to concentrate in these selected urban areas. The introduction of the railway unexpectedly shuffled the cards in some instances. Thanks to their favourable connection to the main railway lines, some of the previously less important urban areas overtook their formerly more important neighbours and rocked their legacy position that had dated back to the middle ages. They often surpassed their rivals in terms of size and economic advances as well as in culture and education and proceeded to gradually take over the role of the main administrative centre of the region. Examples can include the cities of Pardubic and Chrudim, Ostrava and Opava, Kolín and Kouřim, and many others.

The continued concentration of population in large cities was also significantly affected by advances in education: young people would go to study in a metropolis, where they remained after graduation because they often could not find adequate employment for their qualifications in the places they came from. Regions thus continued to lose the biggest assets of civilisation – educated young families. The **gradual drain and aging of the population**, reflecting the low availability of jobs, lower wages and thus generally lower attractiveness, became the main features of the peripheral areas. On the other hand, the urban metropolitan areas began to face other challenges related to strong and concentrated demand. History has shown countless times that the **long-term functioning of neighbouring rich and impoverished regions without conflict is impossible**. This is also why the problem of regional development, social and regional balance is a fundamental policy issue and why it is the task of the country's management to create the conditions to enable the entire country to participate in the shared system of creating and consuming value. No country can afford extreme internal polarisation without endangering its own existence.

INSPIRED BY RAIL SYSTEMS IN METROPOLISES

A modern fast train can do what cars cannot.

High-speed rail transport is one of the instruments to help tackle this type of task. The creation of **more favourable conditions of a daily commute** to the places of job concentration enable the wealth generated in the metropolitan areas to be distributed into their hinterland, thus improving the living conditions even in the more remote areas. The mechanism of this process is the same as that of suburbanisation, wherein the **original rural areas within a good commuting range** from the metropolis assume a new function – that of housing – and their wealth grows thanks to the new residents. Most jobs continue to be concentrated in cities. This territorial specialisation is conditional on an efficient transport system that can make these more remote areas more accessible and attractive. However, the territorial reach and operation of this mechanism are limited in the case of traditional suburbanisation. Commuting from the more remote areas by car simply does not work – in timing, environmental and/or economic terms. However, a modern fast train can do what cars cannot. In addition, unlike the satellite communities, often built as a greenfield project in metropolitan hinterland with insufficient services and dependent on road transport, the more important centres of more remote regions that are accessible by a (high-speed) train are not burdened by these disadvantages. Even today, these centres offer amenities and traditional urban features and are therefore well-positioned for continued sustainable growth and development.

With the new infrastructure, it will be possible to reduce the travel times and offer more frequent services. This will expand the perimeter of the daily commute, which will become an option even where it is virtually unthinkable today because of time constraints. In principle, this new railway system will operate in a manner **similar to that of the underground**, which made the original peripheries more attractive for development and construction by bringing them closer to the metropolitan centres by providing fast and frequent transport services. By analogy, a fast railway leveraging high-speed line sections can deliver the same effect, yet on a scale that is larger by an order of magnitude.

Similarly, like in the case of the ground, the Rapid Service project cannot be expected to deliver only the "tunnel" effect that is concentrated around its stops. In the medium to long term, this new infrastructure is expected to affect a broader area. This is mainly due to the ties to other transport – both mass and individual. If this assumption is correct, this will reduce the pressure on migration and permanent relocation to metropolitan areas, which process can be replaced by regular commute, which, in the Czech Republic, is achievable from a substantial part of the country's territory.

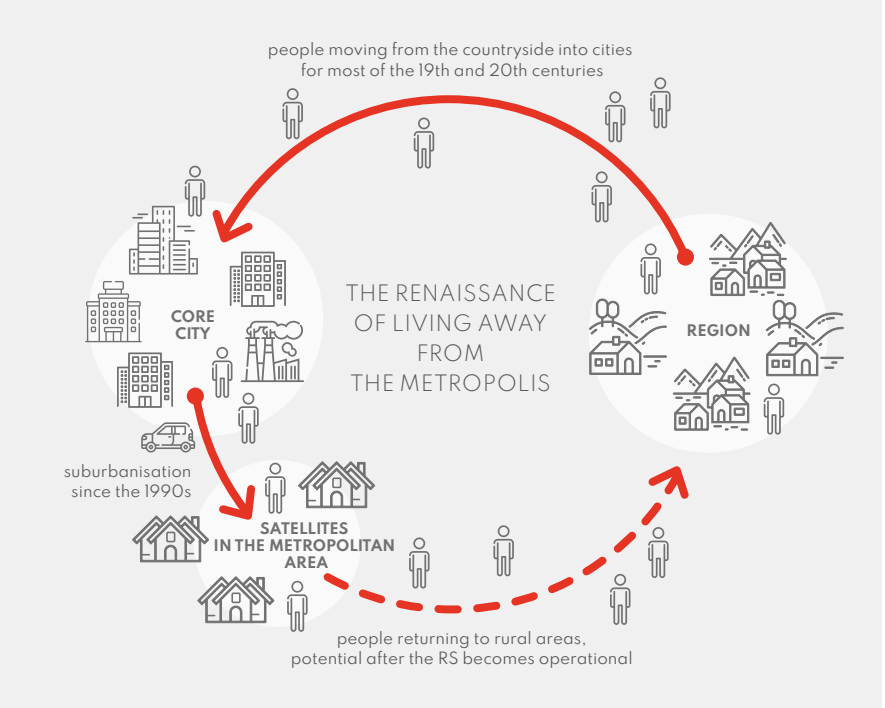
How did the underground change Prague?

As long as the role of Prague's main transport system was performed by the rather unreliable and slow trams travelling at about 18 km/h, i.e. at a time when the half-hour travel isochrone map covered a circle with a radius of 9 km from the city centre, the **continuous settlement reached as far as the tram line terminal stops** in the Kobylisy, Hostivař, Zlíchov or Liboc urban districts. Even the districts of Vysočany, Strašnice, Krč and Smíchov were considered unattractive suburbs. After several decades of construction of the underground (started in 1974), which assumed to role of Prague's main transport system and continues to perform it to a significantly higher quality standard (with a reliability of 99.99% and a double travel speed of 36 km/h), the radius of the isochrone circle for half-hour travel **doubled for the accessibility of the city centre (to 18 km)**. Because of the algebraic square effect, **Prague now covers a quadruple area** that is basically **defined by the terminal stations of the underground lines**. This has brought relief to the historical centre and turned the former **peripheries into thriving urban districts**. The urbanisation of the former fields beyond the original city limits provided new, high-quality housing as well as space for the development of businesses. The society has seen a return on its investment in the quality of transport, in the form of building a network of underground lines, within a short time in the form of the significantly increased values of land, real estate, and businesses. Thanks to its good accessibility, the improved area continues to support economic growth by creating added value.

POLYCENTRIC SETTLEMENT STRUCTURE

The construction of the new lines will make it possible to integrate railway transport much deeper into servicing the entire country, including in the common value creation and consumption system. This is because, in addition to expanding the metropolitan hinterland, the new high-speed lines will also form a new transport backbone that **connects the most important cities**. This is of great significance because the high-speed transport service will enable greater activation of these settlements and reinforce their role in the division of labour. It is wise leverage their potential in terms of the national and international competitiveness of our country because these cities hold the key international contacts and ties.

The **polycentric settlement structure** is a concept that builds on the mutual cooperation of larger town and cities where the key share of employment is concentrated and which are responsible for a substantial share of GDP, innovation, education, etc. At the same time, however, this requires a good connection, including transport. If this condition is met, the growing attractiveness of the main settlement can be expected to increase the attractiveness and size of their hinterland. In the ideal scenario, the majority of the state's territory can thus become covered by interconnected areas that form the hinterland of prosperous cities.



The modern times bring about new opportunities for remedying the territorial discrimination of remote areas, as shown by the recent rapid development of e-shops and e-culture, for example. New technologies and business platforms have made many products and services available from virtually anywhere. With e-commerce and the development of shipping services, goods that used to be available for purchase only in metropolitan areas are now available even in remote areas. That is why it is imperative that the state ensure such conditions as will **eliminate peripherality** – whether in terms of the availability of skilled jobs, housing, or in other areas of civic life.

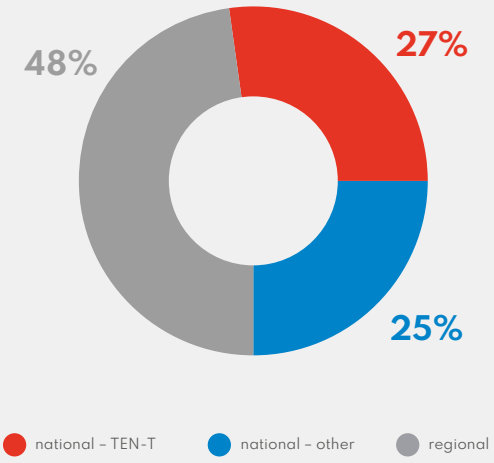
NOT WITHOUT HIGH-SPEED RAIL

The development of transport has reached a point where the legacy network needs to be expanded by adding new elements in order to better integrate transport in the implementation of national, European, and global policies to address decarbonisation, territorial development, and other important topics. Transport is a very important instrument of this effort. However, the existing transport system, dominated by road transport, is unable to provide a satisfactory response and solution to many of these challenges because of the nature of its organisation (capacity, speed). On the contrary, road transport tends to exacerbate some of the problems we are facing. A modern environmentally friendly railway is an effective tool for promoting healthy polycentric territorial development. With technical innovation, rail transport is turning into a transport system that creates the conditions for the natural cooperation of transport modalities, acting as the backbone of the system.

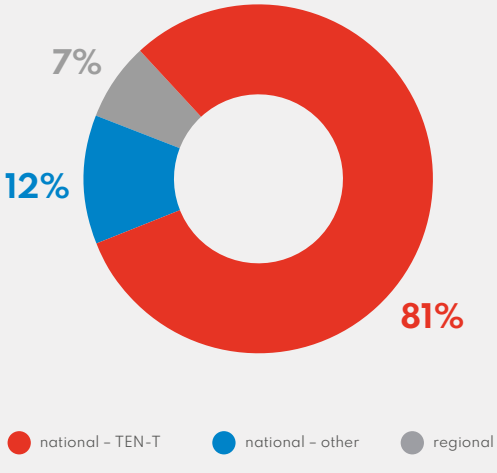
In the developed world, the backbone network tends to be chronically congested and struggles with limited functionality in many places, constricting the efficient functioning of the economy as a whole. In the Czech Republic, for example, **81% of the passenger traffic and 92% of cargo traffic takes place on the main lines of the trans-European network**, which, however, account for only **28% of the length of the Czech rail network**. It is this part of the network that faces a **critical lack of free capacity** due to congesting, thus inhibiting further development.

The addition of high-speed rail to the conventional rail network can **extraordinarily accelerate transport between the key economic and cultural centres**. This will not only serve the railway itself, but also contribute to achieving objectives of general societal importance, including a **more balanced regional development**. Moreover, it can be noted with a certain degree of exaggeration that adding new high-speed lines to the existing railway network is not unlike building new motorways, which we consider absolutely normal.

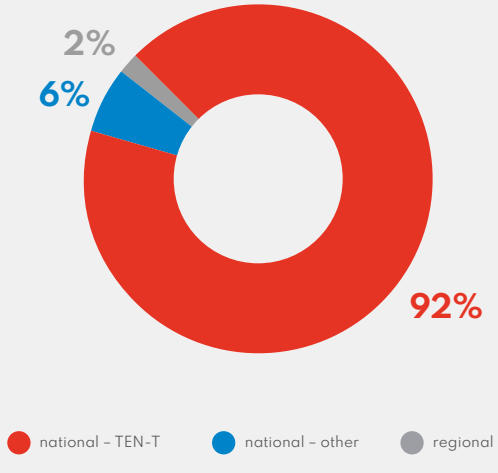
SHARE OF LINE CATEGORIES
IN THE CZECH RAILWAY NETWORK (2019)



PASSENGER TRANSPORT PERFORMANCE
BY LINE CATEGORY (2019)



CARGO TRANSPORT PERFORMANCE
BY LINE CATEGORY (2019)



source: Správa železnic

WHAT

WILL HIGH-SPEED RAIL BRING?

BENEFITS OF HIGH-SPEED LINES FOR THE POPULATION

After the depopulation of rural areas in the 20th century and the move from cities into suburbs in the early 21st century, the Rapid Service project will enable people to return to the regions without losing the benefits of city life.

3

Photo: anouchka / iStock images

3 BENEFITS OF HIGH-SPEED LINES FOR THE POPULATION

FASTER TRAVEL
ACCESSIBLE TRAVEL
EASIER TRAVEL
BETTER TRAVEL FOR ALL


1

FASTER TRAVEL

Maximum speed of up to 320 km/h

Fast connection to regions by interconnection of HSL and existing rail

ACCESSIBLE TRAVEL

Most of the territory can be accessed within 1 hour of travel from the main metropolises of PRAGUE, BRNO, or OSTRAVA

Nearly 65% of the population within 20 mins of high-speed rail

EASIER TRAVEL thanks to more frequent service and new capacity

MORE TRAINS

On new lines: new capacity and speed for existing long-distance trains, and further capacity boost

On existing lines: long-distance trains moved to the new lines → new capacity for regional and freight trains

MORE TRAINS → BETTER OFFER FOR PASSENGERS → ATTRACTIVE RAIL

FEWER DELAYS

New rail capacity → fewer delayed trains

Much like on congested roads with traffic collapses and jams, a similar effect can also be observed on the railway, making it unreliable.

BETTER TRAVEL FOR ALL

NEW QUALITY

New high-speed trains will **improve the quality of the rolling stock** for both long-distance and regional transport. Today's **elite long-distance trains can be moved into the fast-train segment**, or they can improve the quality of other lines.


2

EMPTIER ROADS

Better rail has the potential of attracting car users, thus relieving the congested road sections. The new **PRAGUE–BRNO** line alone can take as many as **3.500 cars** off the D1 motorway! If these cars were to line up in two lanes on the motorway, the line would be over **11 kilometres** long.

WHO WILL BENEFIT FROM THE NEW LINES?


3

COMMUTERS TO WORK FROM A REMOTE REGION:
The significantly higher travel speed of long-distance and fast regional trains on the high-speed lines will **open up the possibility of commuting across greater distances**. This will increase the number of jobs offered, giving the population greater choice of jobs without the need to move.


4

COMMUTERS FOR WORK FROM METROPOLITAN HINTERLAND:
The segregation of long-distance services on the new lines will free up capacity on existing lines. Regions will thus be able to order more suburban trains to address the issue of overcrowded suburban rail services. This will improve and **extend the capacity of today's daily commuting in metropolitan areas**.


5

RESIDENTS TRAVELLING WITHIN LARGE CITIES:
Even if the population may not directly use high-speed lines to travel across cities, they can also benefit from them through the **improved offer of suburban and inner city train service**. At the same time, they will not be so troubled by road traffic as there will be **fewer cars coming into the city from the region** because of the improved rail service.

TRAVELLERS WITHIN THE REGION:
The HSL network will be connected to the conventional network. Additional connecting train and bus services will be introduced for the high-speed trains to better serve the region. Passengers will thus be able to use an **extended offer of regional transport** when travelling around the reason even without using the HSL directly.

ENTREPRENEURS AND EMPLOYEES ON BUSINESS TRIPS:
The high speed of travel will enable the railway to be used for **business travel in the Czech Republic and to European destinations** which are now commonly reached by air or by car. The improved accessibility of Czech companies within Europe will increase their growth potential, with a positive **impact on the national economy and employment**.

LEISURE TRAVELLERS:
The higher travel speeds on long-distance services and the greater offer of connecting regional services will make the railway **more attractive for tourists**. The **reduced burden of road traffic** will also benefit tourist regions. Moreover, travelling tourists will conveniently fill the railway capacity on days off.

CAR DRIVERS:
The part of the population seemingly untouched by high-speed line construction. The new lines have the potential of changing the transport system of the Czech Republic – significantly strengthening the position of the railway in passenger and freight transport. With this, the new lines will **relieve road traffic and make it smoother**. In addition, the new P+R car parks will also enable some drivers to take a part of the trip by train instead of a strenuous car drive.

CUSTOMERS OF COURIER SERVICES:
The **online shopping boom** places demands on shipping speed. With the HSL, it will be possible to create a network of **high-speed trains carrying post** and consignments that will reach the addressees in a reliable and environmentally friendly way and sooner than they do today. This will **remove a part of the trucks and vans from motorways**. Those will mainly support the so-called "last-mile" distribution.

Photo: **1** — olrat / iStock images, **2** — České dráhy, a.s. archives, **3** — České dráhy, a.s. archives, **4** — České dráhy, a.s. archives, **5** — České dráhy, a.s. archives

BENEFITS OF HIGH-SPEED LINES FOR THE POPULATION

The new high-speed lines to form the backbone of the new system are not the end, but the means. They are the way to an extraordinary acceleration of passenger transport, higher network capacity for passenger and freight trains, which is a prerequisite for shifting long-distance transport from road to rail, and to further development of suburban transport. Everywhere round the world, suburban transport is becoming an alternative to the congested road network in metropolitan areas. This is particularly significant when we consider that cities are where most of the population but even more jobs are concentrated. Ensuring their accessibility without unnecessary time (and energy) lost in congested traffic is now therefore one of the crucial tasks and challenges and a way to meet the economic, environmental, and social needs of the modern society.

With the new lines, the time required to travel within the Czech Republic and between its regions and around Europe will be reduced significantly. The country's capital, being the seat of the central institutions, will become accessible from all the regional capitals by a train ride taking no more than two hours. With the connecting terminals on the new HSLs, this opportunity will also be opened to a number of other medium-sized settlements. Improvements on the international scale will also be important.

The reduced travel times can therefore be expected to create conditions for shifting a proportion of long-distance passengers from road and air transport to rail. In case of strong relations, this may **bring new passengers to the rail system** and the lower number of car journeys and reduced number short and medium-haul flights can also deliver **significant environmental effects**. Another considerable effect of this activity will be **freeing up airport capacity for long-distance flights**, for which, by definition, there is no alternative.

→ travel around the Czech Republic and Europe → CHAPTERS 4 and 5

A FASTER JOURNEY

The new lines' speeds of up to **320 km/h** will bring the individual settlements closer. Just like today's daily travellers between neighbouring cities or regions, people will be able to travel seamlessly over much longer distances, between multiple regions, between Bohemia, Moravia, Silesia and abroad on the new high-speed rail.

The significant reduction in travel times may **potentially change the behaviour of the population** and of an entire region as the previously remote areas may become the hinterlands for major metropolitan areas. After the depopulation of rural areas in favour of cities in the 20th century and the move from cities into suburbs in the early 21st century, the Rapid Service project will enable people to return to the regions without losing the benefits of city life.

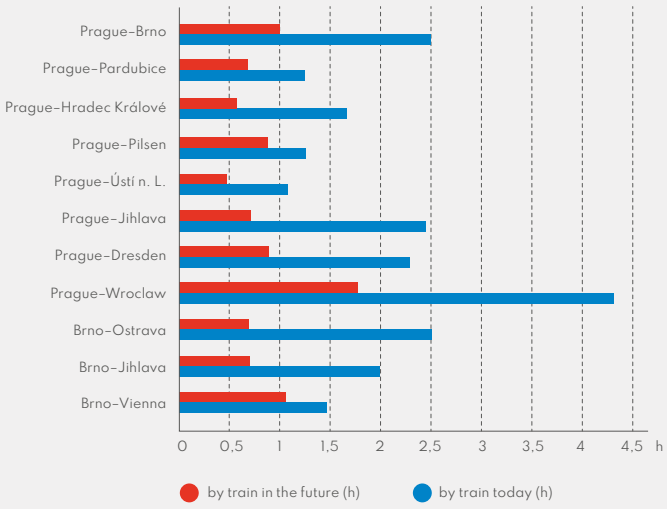
For example, Jihlava is now **1:20–1:50 hours away from Prague** and **1:00–1:20 hours away from Brno** when travelling by the fastest mode of transport – the car, depending on the traffic.

After the RS 1 high-speed line between Prague and Brno is built, Jihlava residents will reach **Prague and Brno in about 50 and less than 40 minutes**, respectively.

After the new lines are completed, rail will become the fastest mode of land transport on domestic and international routes. **Train speeds of over 300 km/h are high enough to compete with air travel on shorter continental flights**. In the long term, the rail network should ideally be completed in such a way that travel between regional capitals is always faster by rail than by road. This fully complies with the current objectives of the European transport policy.

→ examples of reduced travel times → CHAPTER 4

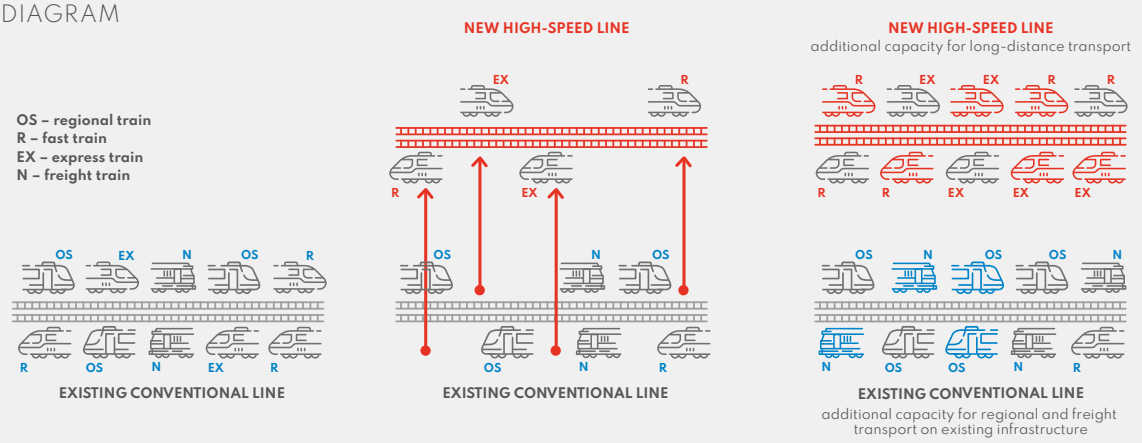
GRAPH OF REDUCED TRAVEL TIMES BETWEEN CITIES



CAPACITY FOR MORE TRAINS

High-speed lines will provide an additional rail network capacity for the development of passenger and freight transport. The segregation of long-distance transport, i.e. moving the high-speed trains to the new lines, will free up capacity on the existing conventional lines. While the high-speed long-distance and interregional trains will mainly use the new capacity of the high-speed lines, **suburban and regional passenger transport along with freight will benefit from the freed-up capacity of the existing conventional lines**. The new capacity will allow for an **expanded offer of rail services in segments**. New express trains will connect the centres of the Czech Republic at regular intervals, not unlike urban public transport in large cities.

CAPACITY REALLOCATION DIAGRAM



Examples:

PRAGUE and **BRNO** will be connected by **6 pairs** of high-speed trains per hour.

PRAGUE and **OSTRAVA** → **3 pairs** of high-speed trains per on a new high-speed line.

PRAGUE and **HRADEC KRÁLOVÉ** → **2 pairs** of express trains per hour.

PRAGUE and **ÚSTÍ NAD LABEM** → up to **4 pairs** of trains per hour on a new high-speed line.

The freed-up capacity of the conventional network will become available to support the currently congested suburban rail service. Passengers who currently use suburban rail services will benefit from the high-speed rail every day without having to take a high-speed train directly. Thanks to the increased capacity on suburban rail services, there will **always be a seat available on their train**.

FEWER DELAYS

The additional capacity will bring about the potential for the further strengthening of rail transport as well as operational stability. Much like there are no traffic jams on roads that are not congested while traffic collapses on very busy roads, a similar effect can also be observed on rail. Today's congested lines are susceptible to operational disruptions because their capacity is fully utilised and there is no room to mitigate the impact of emergencies and to reduce delays. In addition, these delays carry forwards from the main lines onto other services, decreasing the reliability of the railway as a whole and its attractiveness to passengers. Operational reliability must be one of the basic features of the future Czech railway system.

NEW QUALITY

The additional capacity will bring about the potential for the further strengthening of rail transport as well as operational stability. Much like there are no traffic jams on roads that are not congested while traffic collapses on very busy roads, a similar effect can also be observed on rail. Today's congested lines are susceptible to operational disruptions because their capacity is fully utilised and there is no room to mitigate the impact of emergencies and to reduce delays. In addition, these delays carry forwards from the main lines onto other services, decreasing the reliability of the railway as a whole and its attractiveness to passengers. Operational reliability must be one of the basic features of the future Czech railway system.

LESS CONGESTION ON ROADS

The new capacity of the railway is a prerequisite for shifting passengers and goods from the road network to rail. The traffic of the Czech railways has continued to grow in recent years without any significant increase in the capacity of the network. The capacity of the backbone rail lines has thus been nearly exhausted, and further development possibilities are very limited. Without spare railway capacity, the national and European strategies concerning the shift of passenger and freight transport to rail cannot be met. Among other things, the facilitation of the shift of a proportion of passenger and freight transport from road to rail makes the high-speed line project beneficial for the whole society. That is, not only for that part of the public that will use rail transport, but for anybody who travels anywhere, regardless of whether travelling by rail, or public or individual road transport.

Example:

As an example, let us mention again the **PRAGUE–BRNO** route, i.e. the **D1 motorway**, where up to **3,500 cars** per day are forecast to be **"switched" from road to rail** (for illustration, if these 3,500 were to line up in **two lanes on the motorway**, the line would be over **11 km** long).

WHO WILL BENEFIT FROM THE NEW LINES?

Photo: České dráhy, a.s. archives

Commuters to work from a remote region

The significantly higher travel speed of long-distance and fast regional trains on the high-speed lines will open up the **possibility of commuting across greater distances**. This will increase the number of jobs offered, giving the population greater choice of jobs **without the need to move**. It will also reduce employment disparities. The new capacity and higher efficiency of the long-distance trains will increase their frequency, further boosting the quality of long-distance rail travel, attracting more passengers, and creating the potential for increasing the number of trains and improving the quality of travel in the Czech Republic.

Example:

A resident of the Vysočina Region will be able to commute for work to Prague or Brno on a daily basis.

Commuters for work from metropolitan hinterland

The segregation of long-distance services on the new lines will free up capacity on existing lines. Regions will thus be able to order **more suburban trains** and thus to address the issue of overcrowded suburban rail services. Thanks to the Rapid Service system, daily commuters to the metropolitan areas will **always be able to find a seat on a suburban train**. And next time, their **neighbour will also be able to leave the car at home to travel to the metropolis faster by train**.

Example:

A resident of Blansko will be able to commute to Brno in greater comfort than today.

Photo: České dráhy, a.s. archives

Photo: České dráhy, a.s. archives

Residents of large metropolitan areas

Even if residents of metropolitan may not use high-speed lines to travel, they will also be able to benefit from them through the **improved offer of suburban and inner city train services**. They are the fast mode of transport around the city; in the case of Prague, they are even faster than the underground. At the same time, there will be a lower burden imposed by road transport externalities because the higher number of trains will **reduce the number of cars coming in from the region**.

Example:

A resident of the Prague-Kyje urban district will be able to commute to the centre of Prague comfortable and often by taking a suburban train.

Travellers within the region

The Rapid Service system will link the high-speed rail network with the conventional network. **Additional train and bus services** to major railway nodes and high-speed line terminals will be introduced to connect passengers to the high-speed trains. In addition to providing connection to long-distance trains, these regional services will also ensure better servicing of the region. Passengers could thus be able to use an **extended offer of regional transport** when travelling around the reason even without using the high-speed line directly. This will improve the transport services in the regions and, consequently, the quality of life therein.

Example: Residents of the Vysočina Region will be able to benefit from more frequent services running between Havlíčkův Brod and Žďár nad Sázavou.

Car drivers

The part of the population seemingly untouched by high-speed line construction. The new lines have the potential of changing the transport system of the Czech Republic — significantly strengthening the position of the railway in passenger and freight transport. With this, the new lines will **relieve road traffic and make it smoother**. In addition, **drivers will no longer have to undertake the long and demanding drive** if they leave their car at the P+R car park and continue by a high-speed train.

Example: Anywhere around the country, for example, on the D1

Entrepreneurs and employees on business trips

With Rapid Service, **rail transport will also be available for business travel**. The high speed of travel will enable the railway to be used for business travel in the **Czech Republic** and to **European destinations** which are now commonly reached by air or by car. The rail will save time – and time is money. The accessibility of a business or a branch of a larger company by high-speed transport within Europe increases the **growth potential of these companies**, with effects on the national economy and employment.

Example: A business trip to Frankfurt

Leisure travellers

The railway will be more useful for leisure travel than today thanks to the higher travel speeds across longer distances and the increased offer of connecting regional trains and other modes of regional transport. The higher utilisation of the rail by tourists will also benefit the **tourist regions because tourist destinations will not be congested with road traffic** (e.g. Adršpach). This applies to both the actual transport to these locations and the issue of **insufficient parking capacity**. In addition, leisure travel will conveniently complement the utilisation of the railway, which is less used on weekends or holidays than on weekdays.

Example: Prague–Trutnov–the Krkonoše

BY HIGH-SPEED TRAIN ACROSS THE CZECH REPUBLIC

The vast majority of the country will be within an hour's ride from Prague, Brno, or Ostrava. High-speed trains will provide a frequent and affordable service for the residents of metropolitan areas and smaller settlements.

4

Photo: Olrat / Dreamstime.com

4 BY HIGH-SPEED TRAIN ACROSS THE CZECH REPUBLIC

FASTER AND MORE FREQUENT SERVICES

PRAGUE — BRNO
1 hour

PRAGUE — OSTRAVA
in less than
1 ¾ hrs

All regional capitals no more than
2 hours' ride from Prague

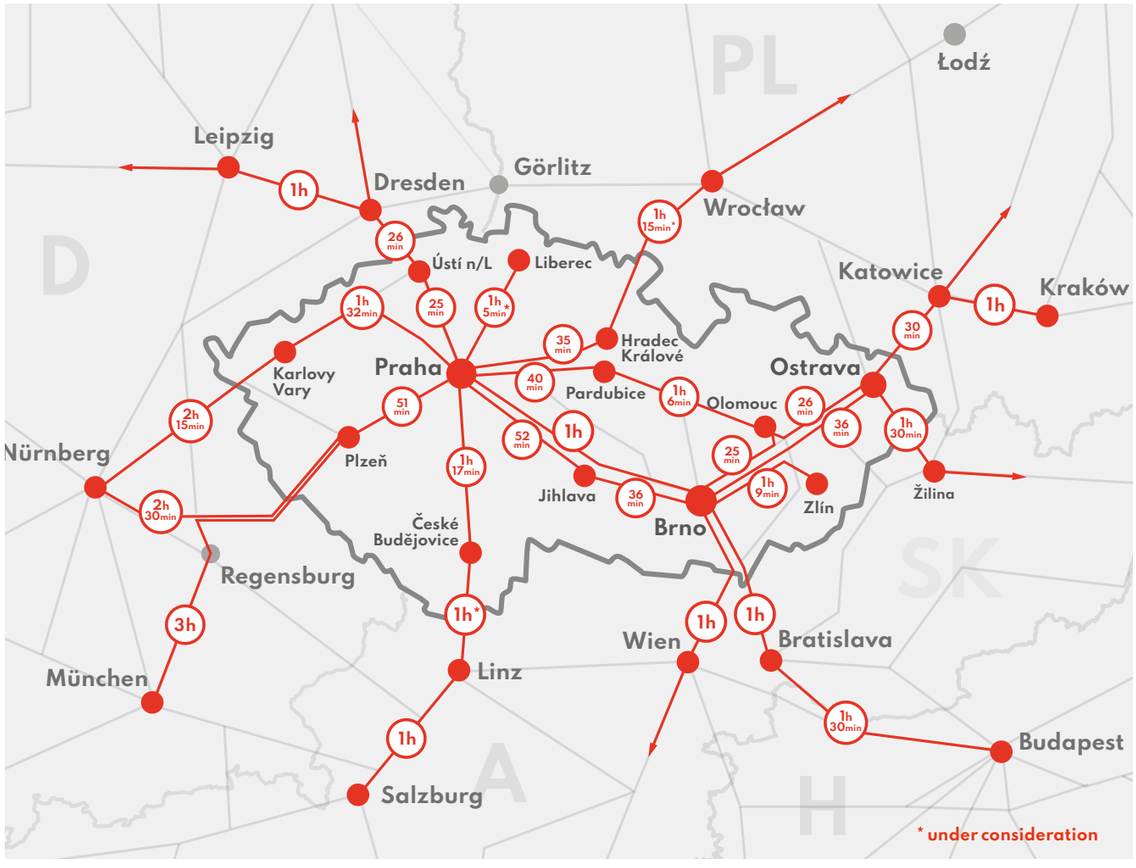
A half of them even less than
1 hour away

RAPID SERVICE – A FUNDAMENTAL CHANGE IN DOMESTIC TRAVEL

- → faster travel to work, school, or for leisure
- → regular commute across longer distances without having to move
- → regional development through improved accessibility
- → new opportunities for tourism

- → service between **Prague** and **Brno** up to **6 times** per hour
- → travel time between **Prague** and the **Ostrava** region reduced by nearly a half
- → faster travel to Central Moravia via **Brno**
- → faster travel to metropolises from the **Vysočina** region
- → closer to Prague and Germany from **North** and **West Bohemia**

EXPECTED TRAVEL TIMES USING HIGH-SPEED AND OTHER FAST LINES
(STAGE TO BE COMPLETED 2030–2050)

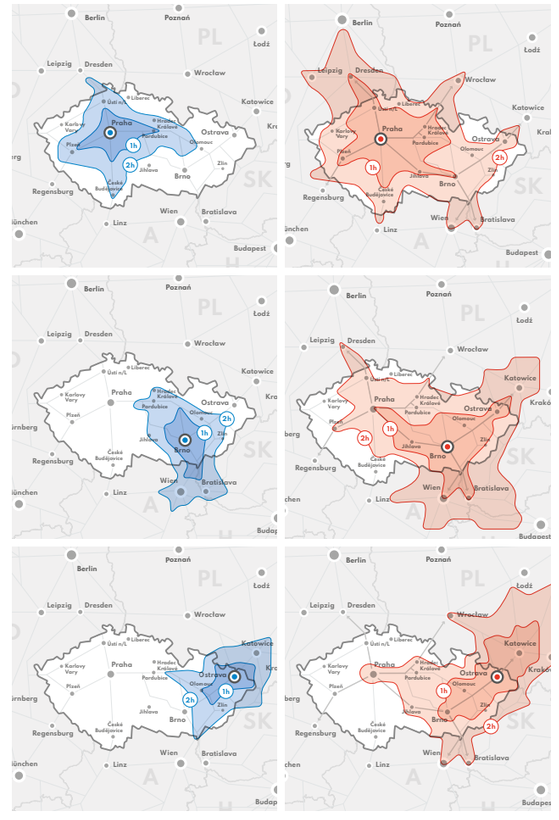


The travel times to foreign destinations are approximate

IMPROVED ACCESS THROUGH RAPID SERVICE FROM PRAGUE, BRNO, AND OSTRAVA

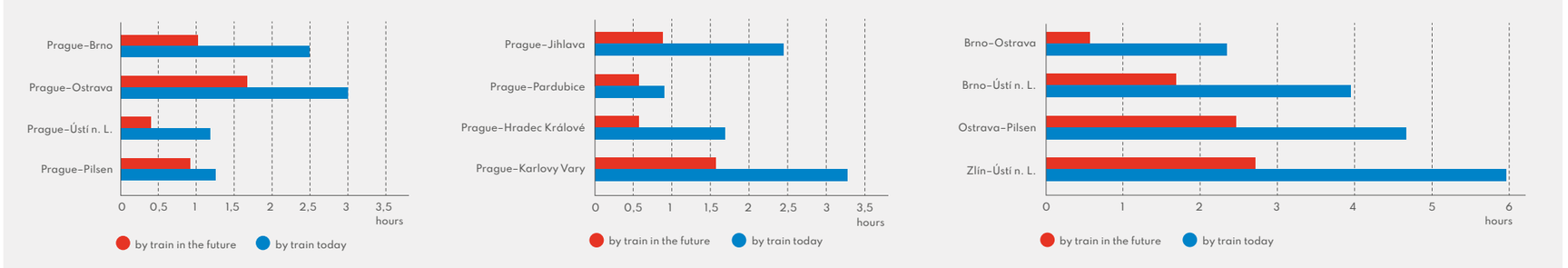
TODAY

IN THE FUTURE WITH HIGH-SPEED RAIL



This is a simplified representation of accessibility based on travel times to the main regional centres. The travel time may be longer for certain areas which are more remote from the main railway lines.

SELECTED EXAMPLES OF REDUCED TRAVEL TIMES BETWEEN CZECH CITIES



FUTURE FREQUENCY OF LONG-DISTANCE TRAIN SERVICES FROM PRAGUE

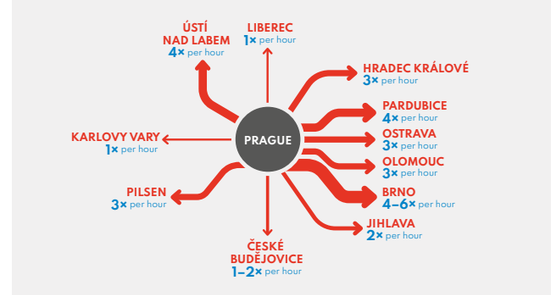


Photo: **1** – Meinzahn / Dreamstime.com

BY HIGH-SPEED TRAIN ACROSS THE CZECH REPUBLIC

The launch of the Rapid Service network will mean a fundamental change in travel all over the Czech Republic. Rapid Service will form a new transport backbone across the country and, if combined with other high-speed conventional lines, it will be possible to take a quick trip to all regions by train. People will thus benefit from a wide range of very fast and frequent express services to all regional capitals, complemented by fast trains to a number of smaller settlements. Instead of a demanding drive, they will be able to enjoy the fast and comfortable railway of the future.

FROM PRAGUE TO BRNO IN AN HOUR

The construction of a high-speed line between Prague and Brno will truly **revolutionise travel between the eastern and western** parts of the country. While the train ride between our two largest cities takes 2.5 hours and the drive on the motorway takes 2 to 2.5 hours, depending on traffic, the **journey by a high-speed train will take only 1 hour**. This will literally "shrink" the country by 1.5 hours in the east-west direction. These 90 minutes are a gift to the thousands of people travelling from east to west or vice versa. Instead of spending them by travelling, they can stay with the family longer, come back from work earlier, get more done at work, extend their trip or a stay with friends, or travel from Prague to Brno to attend a cultural event and come back the same evening.

Speed will not be the only asset. As this section will be the core of the Czech and Central European long-distance rail network, the Rapid Service trains travelling to different destinations will run between the two cities up to 9 times per hour. The frequency of services between Prague and Brno will be similar to the offer of services in urban public transport.

PRAGUE
—
BRNO
1 hour

TRAVEL TIME BETWEEN PRAGUE AND OSTRAVA REDUCED BY NEARLY A HALF

The line between Prague and Ostrava is among the busiest routes served by the railway; the quality, frequency and speed of that line offers the maximum of what can be achieved on a conventional rail.

The construction of a high-speed line between Prague, Brno, and Ostrava **will connect the previously isolated Prague–Brno and Brno–Ostrava backbone routes and into a single line to form the basic long-distance transport axis connecting our three largest cities**. Traffic models predict a very high transport utilisation of this backbone line, and high-capacity trains will therefore need to be deployed here.

The traffic between Prague and the Ostrava region is traditionally very heavy. It will therefore be possible to also introduce the **very fast Sprinter category trains**, which can cover the distance between the two cities **in 100 minutes**, in addition to high-speed express trains. Indeed, the Prague–Ostrava line is already the only one in the country where the Sprinter category of trains is operated in the form of the SC Pendolino services.

PRAGUE
—
OSTRAVA
in less than
1 ¾ hours

The north-south connection from Poland across Moravia and into Austria, Slovakia and Hungary is a major axis that will run through Ostrava and will also see significant acceleration.

→ see CHAPTER 5

Fare rates

The attractiveness of high-speed rail transport is also affected by fare prices. With the right operational model of the high-speed rail, there is no reason why the prices would need to be too high.

On the contrary, the **price of the high-speed train service should be close to what we know today**.

The fare rates are mainly influenced by the carrier's cost and the cost of the vehicles. Even though a high-speed train set is slightly more expensive than the conventional one of a similar capacity, its high speed makes it much more productive. It means that the set can do more kilometres per day and thus manages to serve the line in question more times than a conventional train. Because of that, **it can carry more passengers**, **thus earning higher revenues**. Similarly, the efficiency of the staff increases as they manage to serve more services per shift and their wages can be covered from the revenue from a much higher number of passengers than on conventional trains. With the new technologies, design aerodynamics, and constant speeds make, it is possible to keep other costs (e.g. the consumption of traction energy) at economically acceptable levels, despite the high speeds. The fact that the length of the high-speed lines is shorter than the current lines (e.g. by 60 kilometres between Ústí nad Labem and Brno) also plays a role on some routes.

Knowing the prices of high-speed train sets and the other costs (payroll, energy, etc.), the fares could be as follows, based on today's price levels.

TYPICAL 2ND CLASS FARE RATES

Route	High-speed line estimate	Conventional line today
PRAGUE–BRNO	CZK 300–400	CZK 260–360
PRAGUE–ÚSTÍ N/L	CZK 140–180	CZK 130–170
PRAGUE–OSTRAVA	CZK 480–700	CZK 380–650
BRNO–OSTRAVA	CZK 260–330	CZK 250–280
BRNO–ÚSTÍ N/L	CZK 440–550	CZK 480–530
BRNO–PILSEN	CZK 470–590	CZK 480–540
JIHLAVA–PRAGUE	CZK 200–250	CZK 210–250

The prices above are indicative and based on the December 2022 price level.

FASTER TRAVEL TO METROPOLISES FROM THE VYSOČINA REGION

Vysočina is a region that a long way from everywhere by train. The only fast connection between the region and the world is provided by the congested and rather unreliable D1 motorway. The opening of the high-speed line between Prague and Brno will significantly improve the accessibility of Jihlava as the regional capital and of other parts of the region. In the future, passengers will be able to **reach Prague in 50 minutes and Brno in less than 40 minutes from the centre of Jihlava**. In addition, the northern part of the Vysočina Region will be connected in a similar vein to the fast-train line from Prague to Světlá nad Sázavou via a high-speed line, then over the existing line to Havlíčkův Brod and Žďár nad Sázavou and from there to Brno on a high-speed line. This will give provide these settlements an unprecedented connection to Prague and Brno.

In addition, the **HSL terminal near Jihlava** will also make it possible to travel **to Ústí nad Labem**, **Dresden**, **Berlin**, **Vienna** or **Bratislava**.

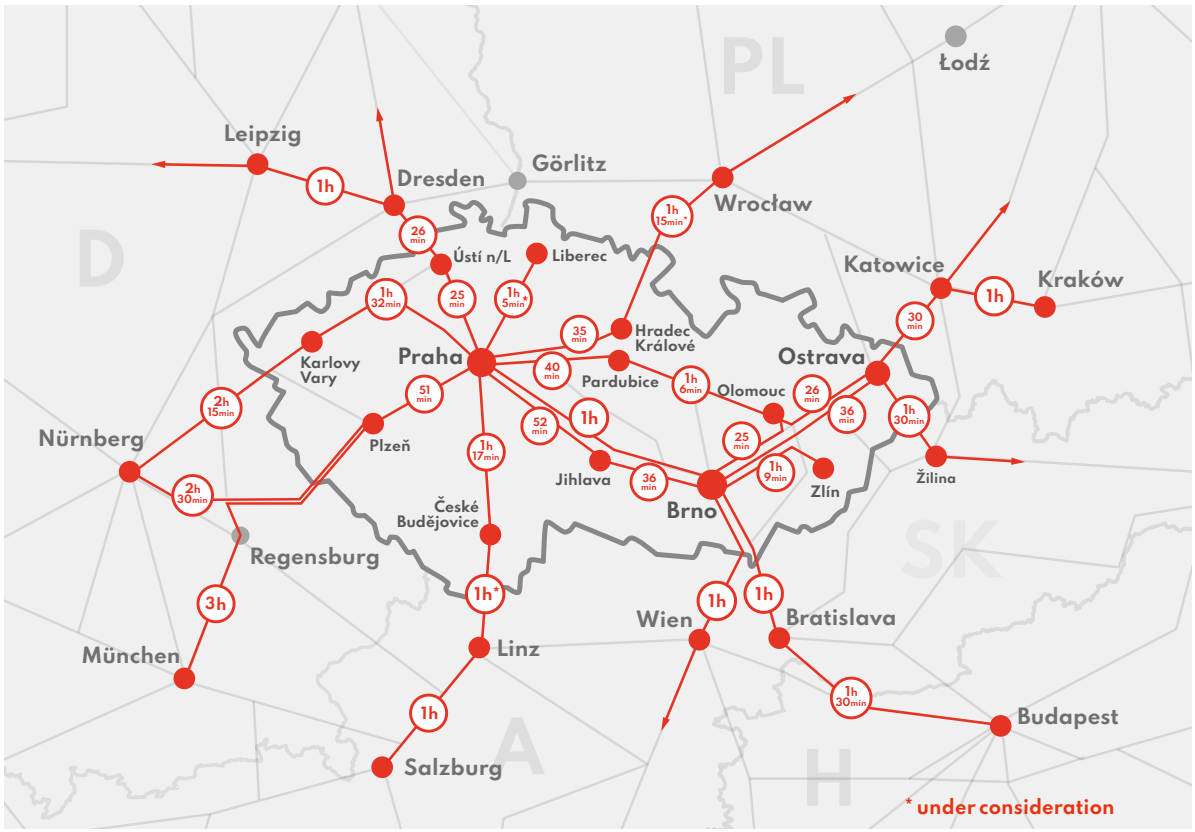
JIHLAVA
—
PRAGUE
52 mins

JIHLAVA
—
BRNO
in less than
40 mins

CZECH REGIONS – CLOSER TO PRAGUE AND TO METROPOLISES ABROAD

The **Ústí nad Labem regions** are now among the structurally disadvantaged regions where the ongoing changes in the economic structure had a long-term impact on the offer of jobs. As a result, there is a drain of the young and educated population into

EXPECTED TRAVEL TIMES USING HIGH-SPEED AND OTHER FAST LINES (STAGE TO BE COMPLETED 2030–2050)



The travel times to foreign destinations are approximate.

other regions. People also increasingly **commute to Prague or Dresden for work**. **With the Prague–Dresden high-speed line**, each passenger who travels from Ústí nad Labem to Prague or Dresden will **save half an hour** and will be able to choose from **twice the number of services** compared to today.

The **southern part of the Ústí nad Labem Region and Karlovy Vary Region** will get an even better connection with Prague after the Rapid Service project from Most via Louny to the Nová Ves branch on the main path from Dresden to Prague. The area comprising Most, Litvínov, Chomutov, Jirkov and other towns, with a total population almost as that of two average regional capitals, will be **more than an hour closer to Prague** when travelling by train, compared to travelling by the conventional line with the detour via Ústí nad Labem.

Photo: České dráhy, a.s. archives

The high-speed line leading **from Prague to eastern Bohemia can not only bring Hradec Králové and Pardubice closer to Prague**, but its continuation will also reopen the route into the Silesian metropolis **Wroclaw**. At the same time, the trip into our highest mountains will also be faster as it will be possible to take a **less-than-ninety-minute ride from Prague to Svoboda nad Úpou**, i.e. literally within sight of Pec pod Sněžkou.

PLZEŇ
—
PRAGUE
in less than
1 hour

ČESKÉ BUDĚJOVICE
—
PRAGUE
in about
1 ¼ hours

The new tunnel between Prague and Beroun, along with other implemented investments in the conventional infrastructure, **will bring Pilsen to less than an one-hour trip from Prague**. The modernised line leading further into Bavaria will, among other things, establish the conditions for the return of the trains running in this direction into the family of long-distance European connections. This path has also been included in the Rapid Service network, although it will only have conventional parameters in currently planned development stage. Looking forward, it will be appropriate to further increase the capacity and speed on both sides of the border as demand and the European high-speed rail network continue to develop.

In the **direction of České Budějovice**, a new high-speed line from Prague will be added to the modernised line that is currently being completed. With that, the South Bohemian metropolis will be only one and quarter hours away from Prague. A major modernisation and acceleration project is also being prepared for Prague in the **direction of Liberec** because that regional capital also deserves a fast and frequent service to connect to the long-distance railway.

→ **further development potential** → **CHAPTER 11**

A NEW DIMENSION OF ACCESSIBILITY

The construction of the Rapid Service network will revolutionise accessibility in the Czech Republic. **The vast majority of the country will be within an hour's ride away from Prague**, **Brno**, or **Ostrava**. All the regional capitals will be accessible from Prague within a two-hour ride, with six regional capitals being less than an hour's ride away.

This will open up a **wide range of possibilities**, **for commuting to work**, **housing**, and **travel to cultural events or exploring our country**.

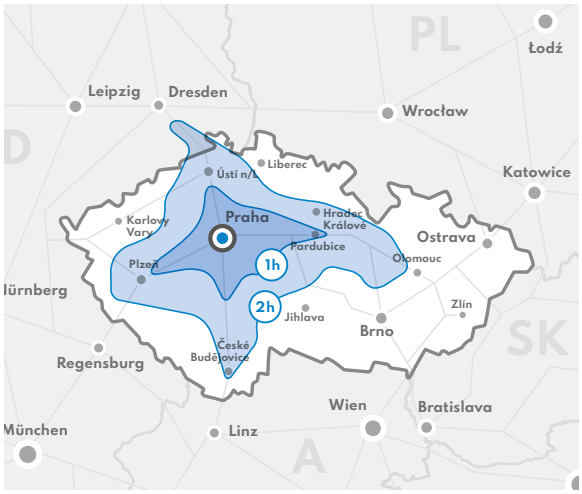
→ **connecting the system to the regions** → **CHAPTER 6**

The transport models show that the backbone high-speed rail on the **Dresden–Prague–Brno–Ostrava/Břeclav** alone will be used by over

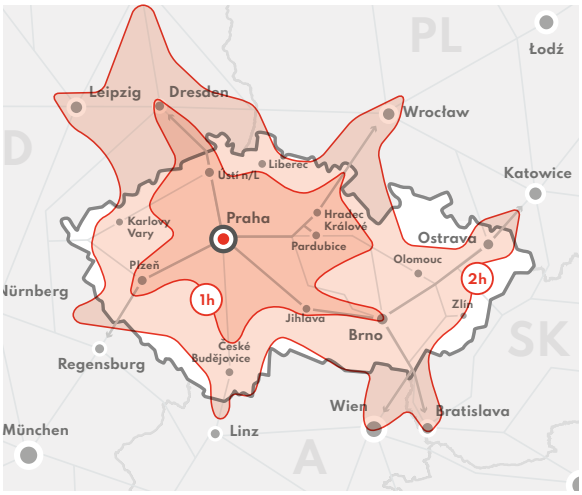
125,000 passengers per day.

IMPROVED ACCESS THROUGH RAPID SERVICE FROM PRAGUE

today

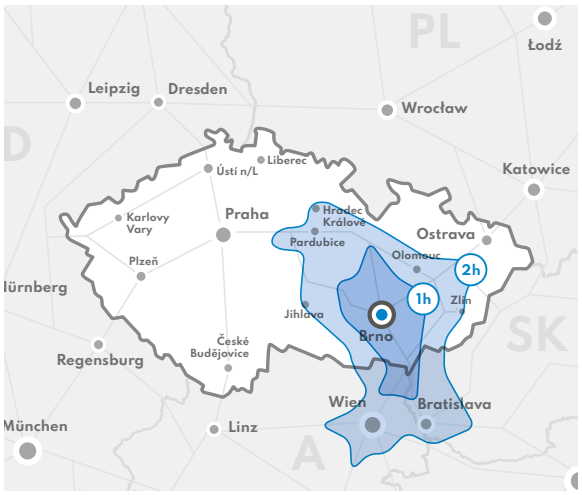


in the future with high-speed rail

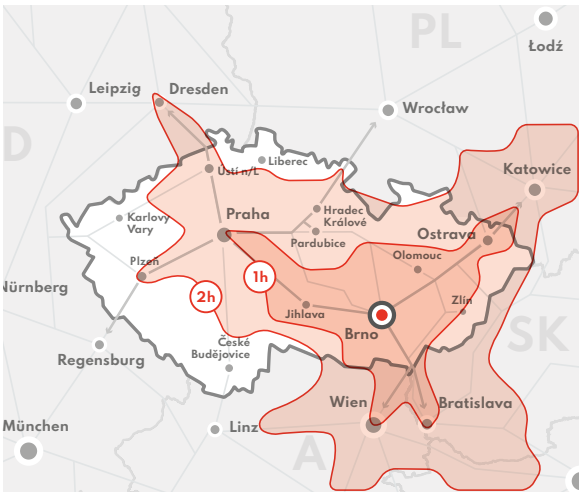


IMPROVED ACCESS THROUGH RAPID SERVICE FROM BRNO

today

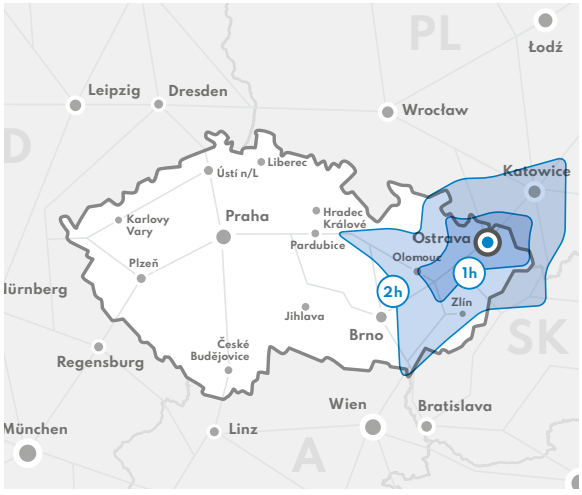


in the future with high-speed rail

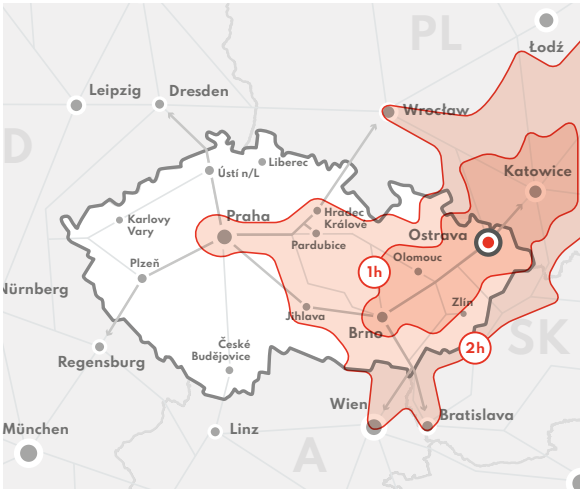


IMPROVED ACCESS THROUGH RAPID SERVICE FROM OSTRAVA

today

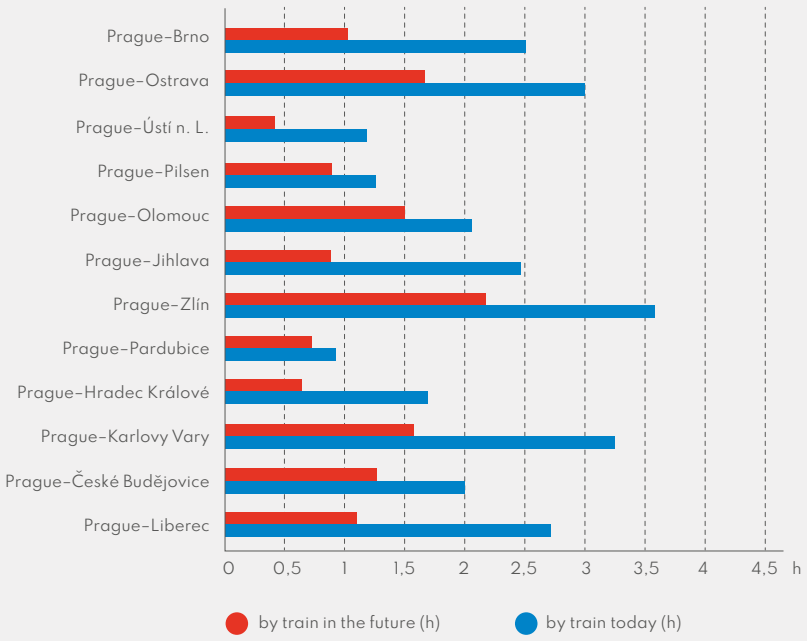


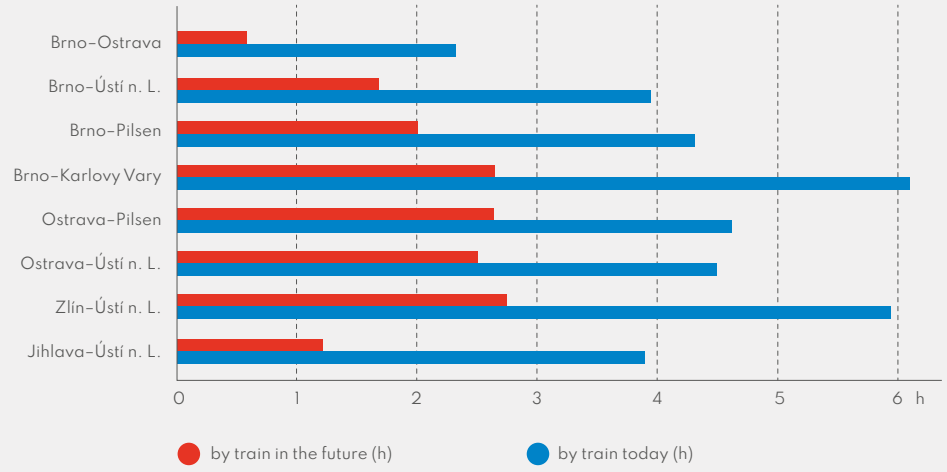
in the future with high-speed rail



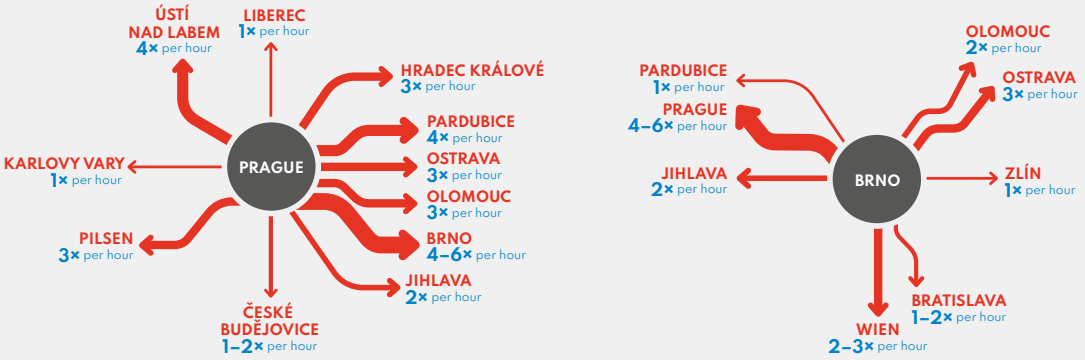
This is a simplified representation of accessibility based on travel times to the main regional centres.
The travel time may be longer for certain areas which are more remote from the main railway lines.

EXAMPLES OF REDUCED TRAVEL TIMES





FUTURE FREQUENCY OF LONG-DISTANCE TRAIN SERVICES FROM PRAGUE AND BRNO



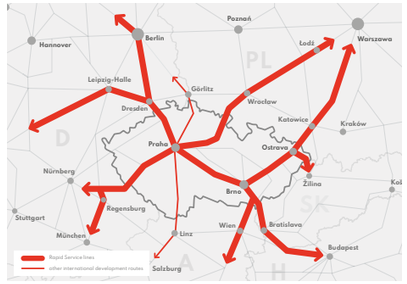
BY HIGH-SPEED TRAIN INTO EUROPE

Compared to travel by air or by car, the train will provide passengers much more time to work or relax, also saving them a great deal of inconvenience associated with air travel or demanding drives on motorways.

5

5 BY HIGH-SPEED TRAIN INTO EUROPE

FASTER AND MORE FREQUENT SERVICES



THE CZECH REPUBLIC AS THE RAILWAY HUB OF CENTRAL EUROPE

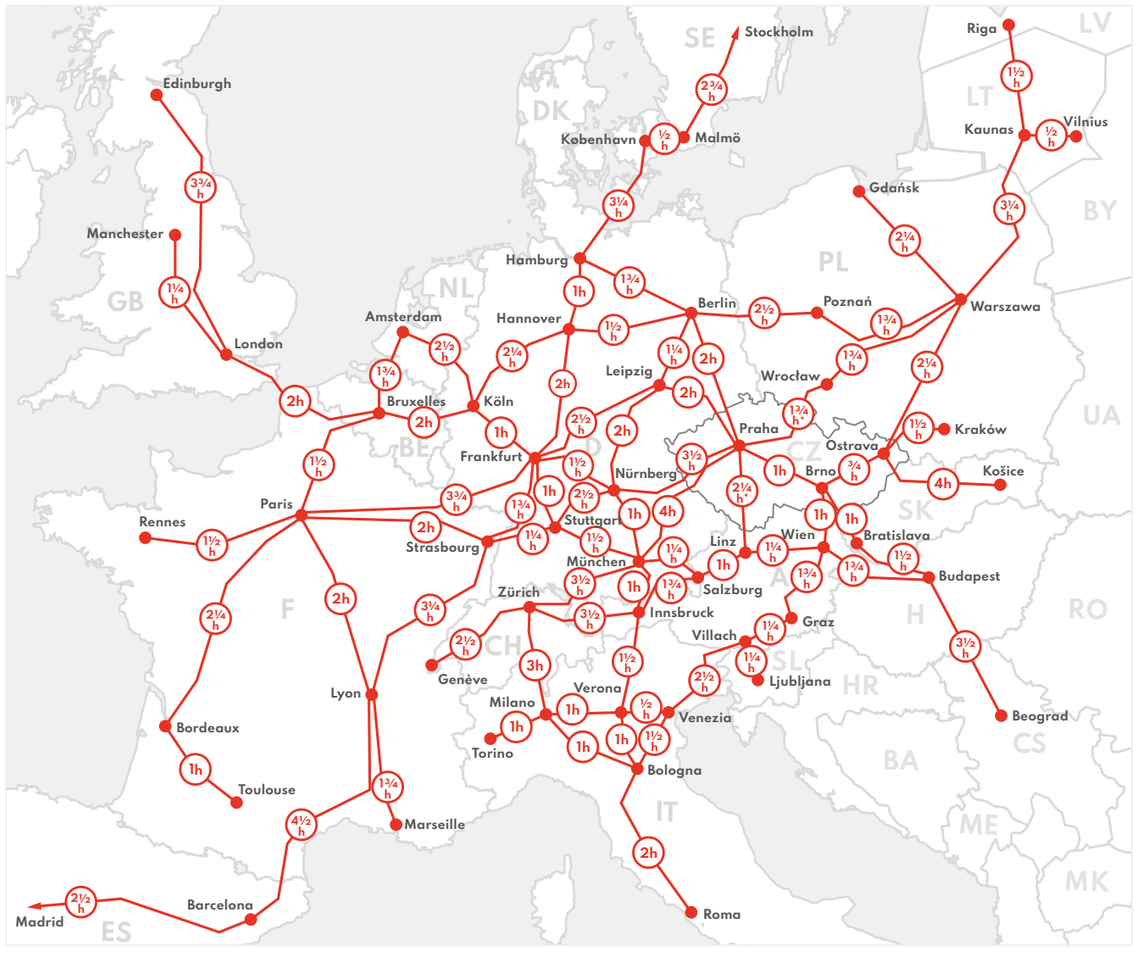
RAPID SERVICE – A FUNDAMENTAL CHANGE IN TRAVELLING ABROAD

- → faster business, leisure, or holiday travel
- → possibility to work abroad but live at home
- → improved access to border regions
- → new opportunities for tourism and leisure

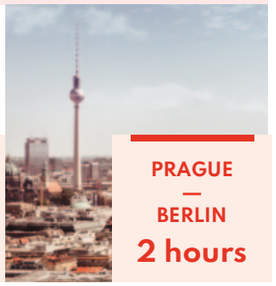
1

2

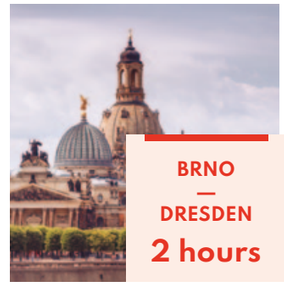
EXPECTED TRAVEL TIMES USING HIGH-SPEED AND OTHER FAST LINES (STAGE TO BE COMPLETED 2030–2050)



PRAGUE — VIENNA 2 hours



PRAGUE — BERLIN 2 hours



BRNO — DRESDEN 2 hours

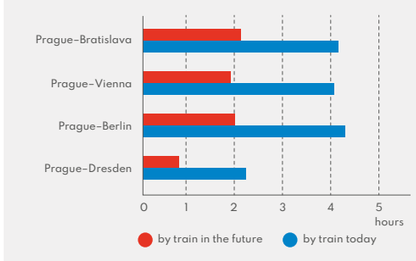
OSTRAVA — VIENNA 2 hours

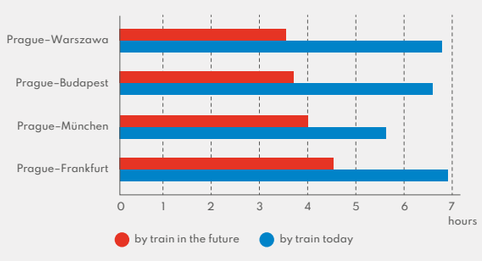
PRAGUE — FRANKFURT in more than **2 hours** less time

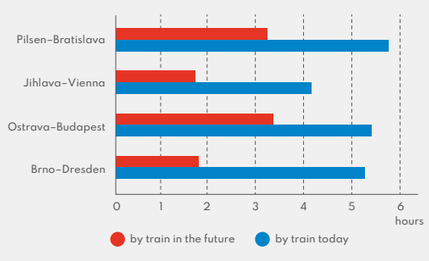
PRAGUE — BUDAPEST in more than **2 hours** less time

2 All persons travelling to neighbouring countries will gain an approximate **2 hours,** to make better use of rather than spend on the way.

SELECTED EXAMPLES OF REDUCED TRAVEL TIMES BETWEEN CZECH AND INTERNATIONAL DESTINATIONS







- → travel to Western Europe or worldwide via **Frankfurt**
- → frequency of services to **Berlin** and **Vienna more than doubled** compared to today
- → fast travel to **Poland** via Ostrava and Hradec Králové
- → travel to **Dresden**, **Vienna** or **Bratislava** for work, to school or for leisure

Photo: **1** – olrat / iStock images, **2** – © Siemens Mobility, 2022

BY HIGH-SPEED TRAIN INTO EUROPE

The launch of the Rapid Service network will mean a fundamental change in the accessibility of foreign destinations. Czech citizens and foreign visitors will be able to take advantage of the wide range of high-speed and frequent services into the neighbouring and other European countries instead of today's less flexible air travel, lengthy journeys by today's trains or demanding drives on motorways.

CZECH REPUBLIC ON THE EUROPEAN RAIL MAP

Building a high-speed rail and connecting it to our neighbours **will strengthen the position of the Czech Republic on the railway map of Europe**. Because of their slow conventional infrastructure, our railways are not attractive and competitive enough on a number of international railway stretches. High-speed lines will help us join the elite rail club. Although the Czech Republic is positioned practically in the centre of Europe, its size does not make it impossible to ride around the country in many directions. That would decrease the accessibility of our country with all the consequences such as reduced competitiveness in comparison with the neighbouring states. From the very onset, **Rapid Service has been prepared as a project with a strong international dimension**. Close coordination with neighbouring countries seeks to achieve **three main objectives**:

- → **Connect** our high-speed lines **to the Western European network** to create conditions for **full integration in the already-functioning European high-speed rail system**
- → **Extend** the future branches of the European high-speed rail **further to the east** so that we do not remain the terminal country for high-speed trains but instead benefit from the wide range of transit services
- → **Improve** the quality of connections **in the directions which have not been adequately addressed in the past**

THE CZECH REPUBLIC AS THE RAILWAY HUB OF CENTRAL EUROPE

Naturally, it is an integral part of these efforts to anchor our future high-speed lines **in the EU transport policy**, which is mainly represented by the main development directions of the **trans-European transport network (TEN-T)**. The inclusion of high-speed line projects in the TEN-T network is not only symbolic in terms of a clear declaration of the significance and the European added value of our projects, but it also has an important financial dimension. Projects included in the TEN-T core network have a significantly better chance of receiving co-financing from European funds in both the preparation and implementation stages.

The high-speed rail project will make our country (as well as our two largest cities, Prague and Brno) the **railway hub of Central Europe**. The crossing of multiple major trans-European routes will enable the high-speed rail to offer fast and attractive connections in almost any direction. That is also important for the Czech economy, which largely depends on good international accessibility.

VIA VINDOBONA

Via Vindobona is one of the most important international paths in Central Europe, connecting Berlin, Prague, and Vienna. It takes its name from a traditional express train, the reinstatement of which, in the form of modern **Railjet** trains in 2020, foreshadows the return of the Czech Republic to the long-distance rail map of Europe.

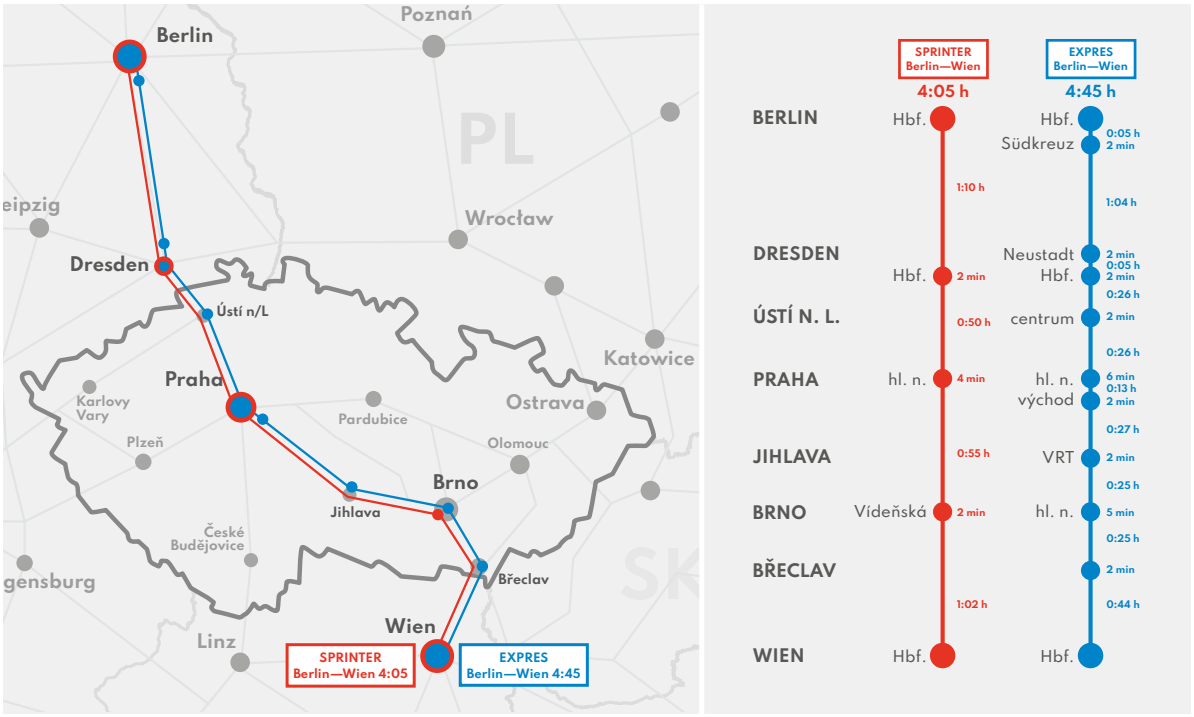
After the completion of the high-speed lines, the **Berlin–Prague–Vienna axis** will become the backbone of the Rapid Service network in the Czech Republic and Central Europe. The new or upgraded infrastructure will enable a fundamental change in the range of services offered. The existing express trains will cut their travel times to Dresden, Berlin or Vienna by about a half, and their number will double. The residents of Prague, Brno, Ústí nad Labem, and Jihlava will be able to travel directly at least **two times more** often and, in most cases, **more than twice as fast**. Like the existing **EuroCity** or **Railjet** trains, these express trains will be fully integrated in the Czech long-distance transport system. Through connecting services at the railway nodes, this will enable people in virtually the entire Czech Republic to take advantage of the new high-speed international routes. By changing trains at the major nodes, they will also be able to reach other international destinations.

The new infrastructure will enable us to speed up the existing express trains, but also to go even further by offering new superfast services to cover a demand that is not there on the rail today – that for a **very fast service between the largest cities**. In addition to the basic system of express trains travelling **between Berlin**, **Prague**, and **Vienna**, the new **Sprinter** train category will be introduce, managing to cover the distance between Berlin and Prague in 2 hours and between Prague and Vienna in the same time with a minimum of stops. These services will be able to offer a **connection from Berlin to Vienna taking about 4 hours**, making them an attractive alternative for air travellers. With that, we can convert the transport between these cities into a more environmentally friendly mode as well as free up the relatively congested airspace over Central Europe.

PRAGUE
—
VIENNA
2 hours

PRAGUE
—
BERLIN
2 hours

DIAGRAM OF FUTURE SERVICE ALONG THE BERLIN–VIENNA AXIS

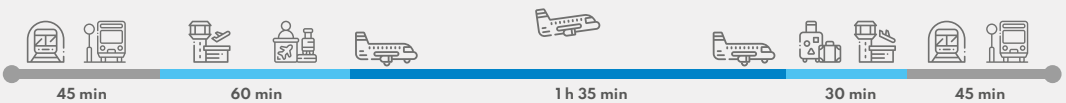


By airplane or high-speed train from Vienna to Berlin

Air travel is currently the only practical way of travelling from Vienna to Berlin quickly. After the **Via Vindobona** high-speed rail is built and **Sprinter** trains are introduced, it will be possible to travel by high-speed train in a comparable timeframe. The train settings will offer more time to work or relax and a much wider range of catering services, and spare passengers many of the inconveniences associated with air travel, such as security checks, inability to use mobile phones, turbulence, and luggage trouble.

High-speed trains between Vienna and Berlin will bring benefits for international travellers as well as the citizens of and visitors to the Czech Republic because, unlike airplanes, they will also serve other cities along the route. The transfer of passengers from short-haul flights to rail will also be beneficial for air transport. The move will free up the airport capacity and airspace for flights across distances over 800 km, where air transport will remain irreplaceable.

TRAVEL BY AIR



Total travel time: 4 h 35 min
Time to work/relax while travelling: 1 h 35 min

TRAVEL BY HIGH-SPEED TRAIN

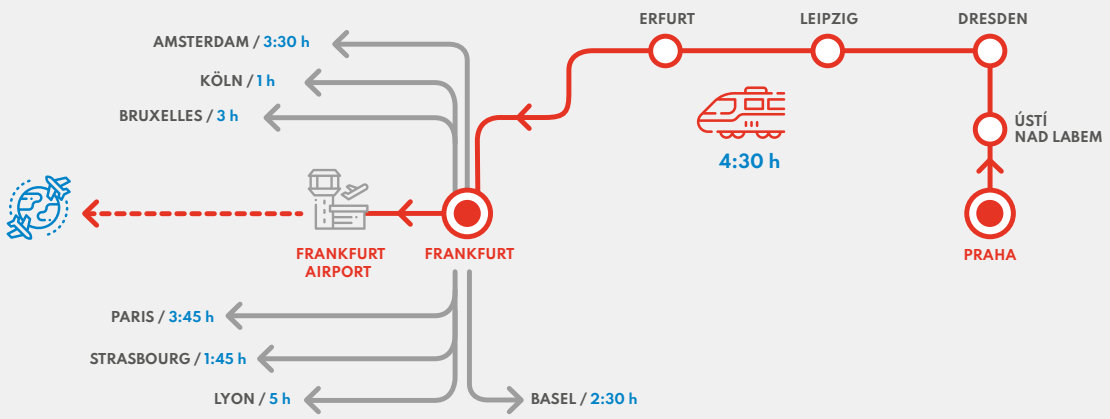
Total travel time: 4 h 45 min
Time to work/relax while travelling: 4 h 05 min

FRANKFURT—THE GATEWAY FOR WESTBOUND TRAVEL

The launch of the high-speed line **from Prague to Dresden** will be a major improvement in travel not only to northern Germany but also westwards to **Frankfurt am Main**, one of Europe's most important rail and air hubs. It is in Dresden that the Czech Republic will be connected to the Western European high-speed rail network. **Every hour throughout the day**, passengers travelling from Prague will be able to reach Frankfurt – the city centre and the airport – in 4.5 hours either directly or with a quick change in Dresden. This will open up **further services from Frankfurt into France, Belgium, the Netherlands or Switzerland**. Also passengers from many places in Czechia, especially from the stations en route, such as Ústí nad Labem, can travel overseas by taking a speed-train directly to the Frankfurt Airport and changing to their long-distance flight there.

PRAGUE
—
FRANKFURT
4.5 hours
every day, every hour

PRAGUE–FRANKFURT AM MAIN BY HIGH-SPEED TRAIN



EASTBOUND HIGH-SPEED TRAVEL

The idea of high-speed rail has also been embraced by other Central European countries such as **Poland**, **Slovakia**, and **Hungary**. Thanks to the connecting high-speed lines, the trip **between Prague and Bratislava** will be reduced to just **over two hours**, and even under two hours after the cross-border section is eventually straightened. As the HSL continues into Hungary, the trip **from Prague to Budapest** will take only **3.5 hours**.

Major high-speed line developments are in the pipeline going into Poland. The basis will be the high-speed service **from Brno to Katowice and Warsaw via Ostrava**. This will make it possible **to reach Warsaw in 4 hours** and **Krakow in just over 3 hours from Prague**. This path will help speed up the service from Warsaw to Prague as well as Vienna, Bratislava, and Budapest. There is another high-speed line being prepared in the direction of Poland – that from Prague, running through eastern Bohemia to Wroclaw and then **to Warsaw**. Once this line is completed, the journey **between Prague and Warsaw** will be even shorter, taking only about **3.5 hours**.

PRAGUE
—
BUDAPEST
3.5 hours

PRAGUE
—
BRATISLAVA
2 hours

PRAGUE
—
WROCLAW
in less than
2 hours

PRAGUE
—
WARSAW
3.5 hours

Photo: ewg3D / iStock images

FASTER TRAVEL ALSO TO THE SOUTH-WEST OF EUROPE

The Rapid Service project will also improve the connection **between Prague**, **Pilsen**, and **Bavaria**. Combined with the upgraded lines in Germany, the projects planned in the Czech territory will shorten the journey between Prague and **Munich** to **4 hours** and between Prague and **Nuremberg** to **3.5 hours**. While the speed increase will not be a major as it will be in other directions because of the smaller proportion of truly high-speed lines, there will still be a significant improvement compared to the situation today. Further acceleration through the construction of high-speed lines will be required in the future, depending on the development of the Czech and European railways.

→ **further development potential** → **CHAPTER 11**

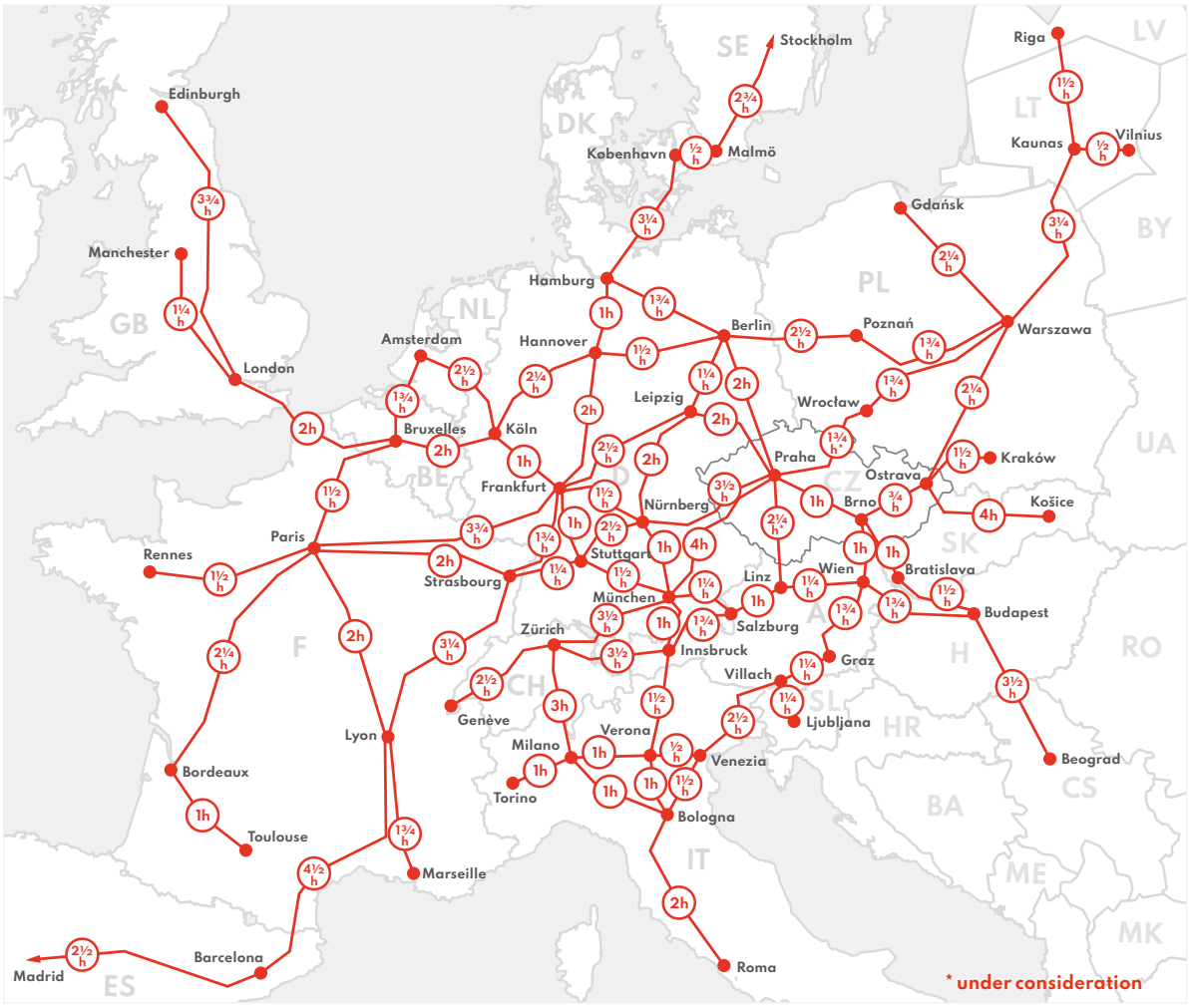
While the **Prague–České Budějovice–Linz** connection is not yet directly incorporated in the Rapid Service system, it should be noted in this context that the high-speed line between Prague and České Budějovice will provide a foundation for the south-west-bound services using the connecting Austrian high-speed lines. The key to further development will be increasing the speed and capacity of the cross-border rail section to Linz.

Only through cooperation and interconnection of high-speed and fast conventional lines can we bring a truly dense network of fast trains into almost every corner of Europe.

PRAGUE
—
MUNICH
4 hours

PRAGUE
—
NUREMBERG
3.5 hours

EXPECTED TRAVEL TIMES USING HIGH-SPEED AND OTHER FAST LINES
(STAGE TO BE COMPLETED 2030–2050)



Trans-Europe-Express 2.0 (TEE)

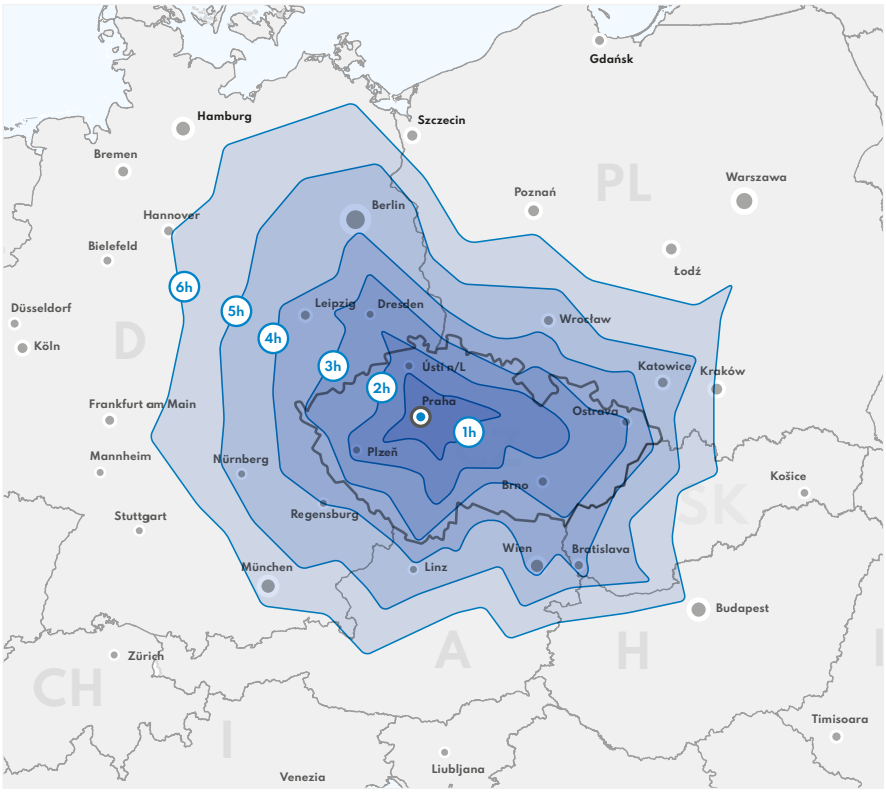
In times long past, the train used to be the main transport modality for long-distance travel and Europe was criss-crossed by a large number of express trains. As aviation developed, however, the rail became limited to serving shorter distances between neighbouring countries, and long-distance express trains disappeared from the timetables, with rare exceptions.

Thanks to the development of high-speed lines, however, the rail has again become an attractive option for long-haul travel. Carriers have begun to reintroduce or even launch new long-distance trains. Attempts are even being made to systemise European long-distance transport. An example of this can be seen in the initiative launched by the German EU Presidency, entitled "Trans-Europe-Express 2.0", which builds on the once famous network of long-distance express trains, yet in the form and at speeds meeting the demands of the 21st century. Once the Rapid Service network is completed, the Czech Republic will be able to fully join this network to offer its citizens the opportunity of fast, comfortable, and direct travel over long distances. The plan is to first integrate the existing **"Vindobona"** and **"Hungaria"** services running **from Berlin to Prague** and **Vienna or Budapest**, respectively, in the system. Another step will be to extend the existing long-distance services from Czechia, e.g. **from Hamburg to Copenhagen**, **from Graz to Venice or Ljubljana**, or **from Warsaw to Gdansk**. After the completion of the high-speed lines, the third phase may mainly introduce the **Prague–Frankfurt–Paris** service as well as integrate the **Berlin–Prague–Vienna** sprinter trains in the TEE.

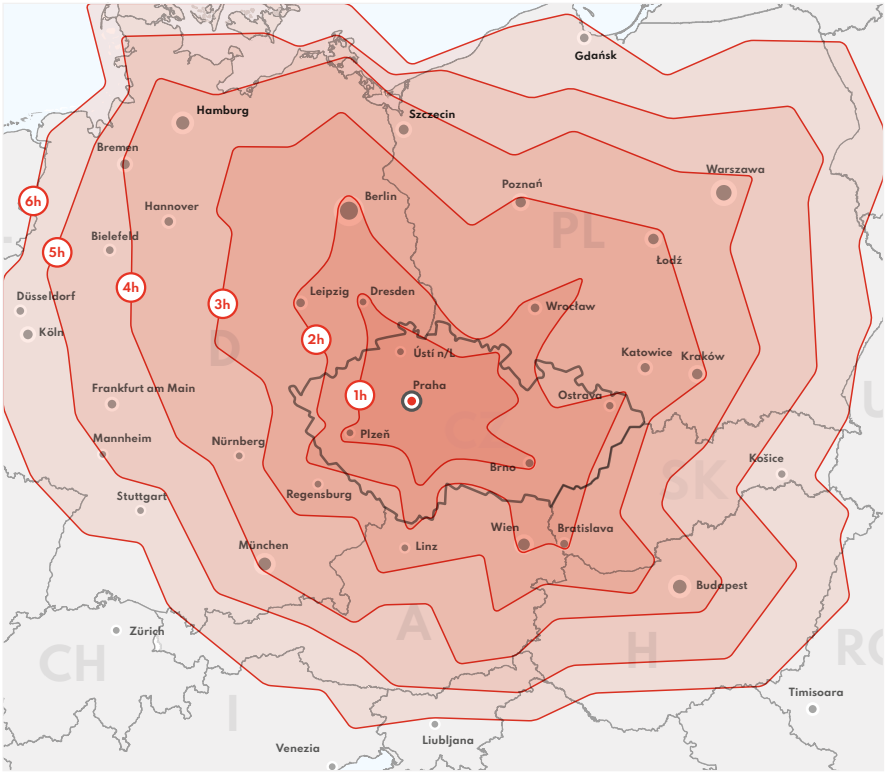
Photo: Stéphane Gottraux, CH-2350 Saignelégier, Switzerland / Wikipedia.org / CC

IMPROVED ACCESSIBILITY OF CENTRAL EUROPE BY TRAIN FROM PRAGUE WITH RAPID SERVICE AND RELATED INTERNATIONAL PROJECTS

today

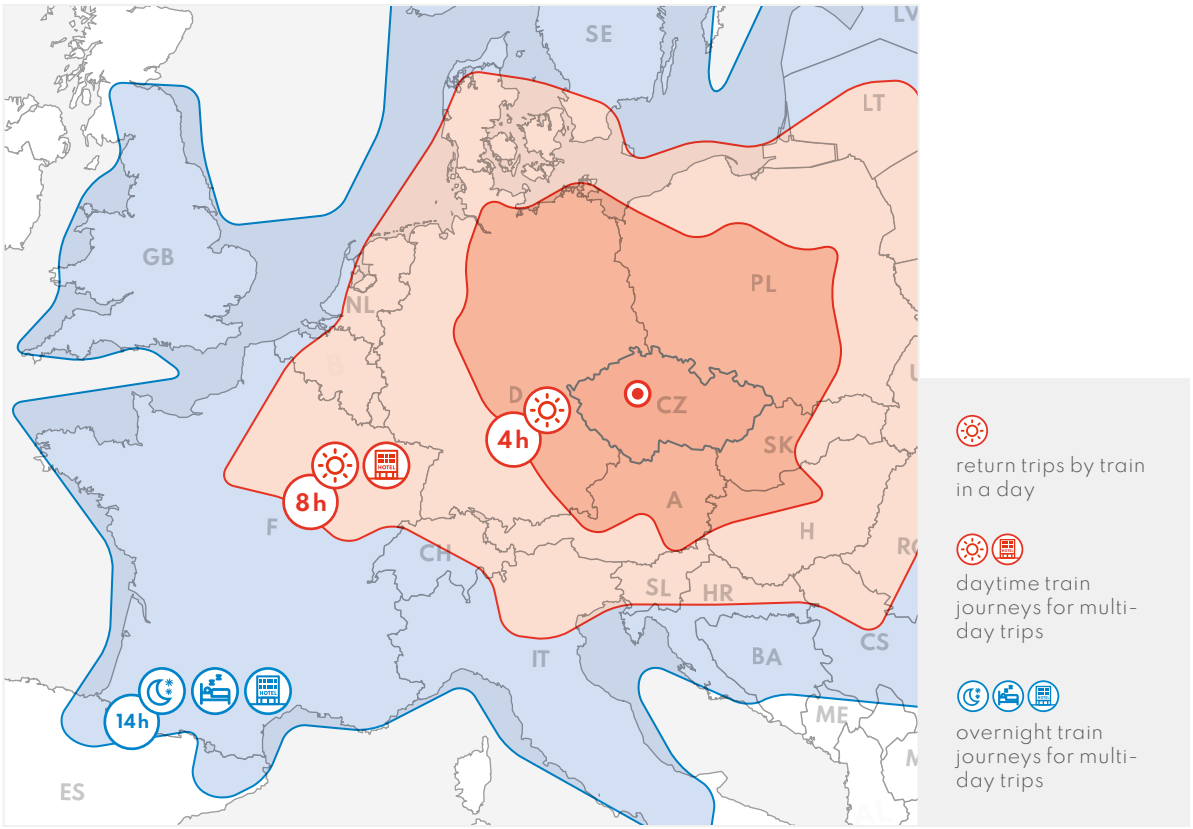


in the future with high-speed rail

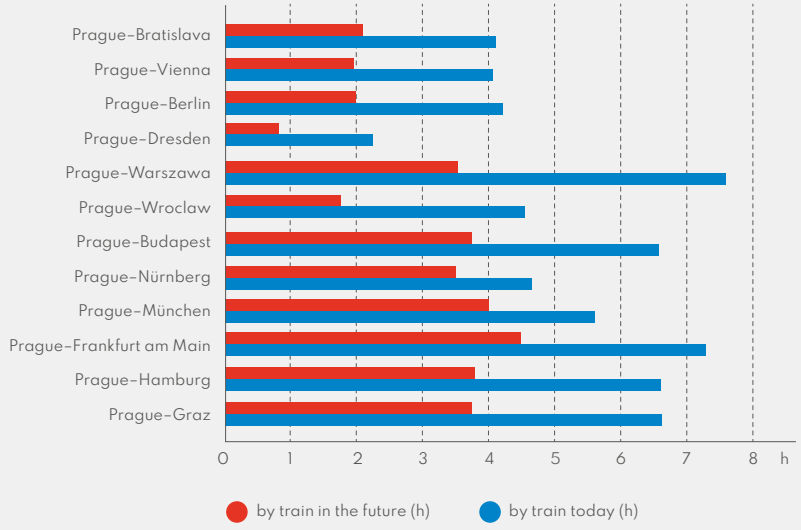


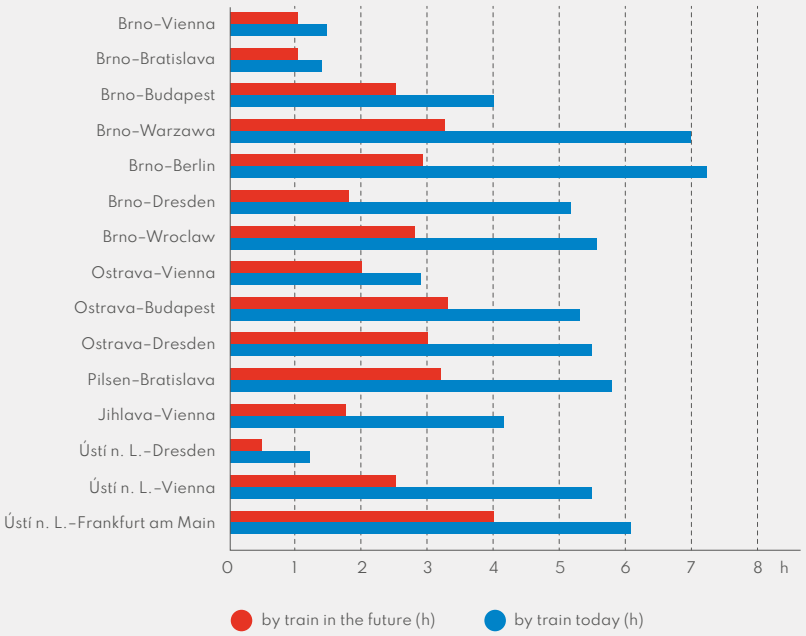
This is a simplified representation of accessibility based on the travel times to the main centres.
The travel time may be longer for certain areas which are more remote from the main railway lines.

TRAVELLING ACROSS EUROPE BY FUTURE ECO-FRIENDLY DAYTIME
OR OVERNIGHT HIGH-SPEED TRAINS FOR ONE- OR MULTI-DAY TRIPS



REDUCED TRAVEL TIMES ON SELECTED ROUTES





BY HIGH-SPEED TRAIN INTO THE REGIONS

High-speed trains will be compatible with the conventional railway network. It is this principle that will ensure that the regions are well-serviced.

6

Photo: © Siemens Mobility, 2022

6 BY HIGH-SPEED TRAIN INTO THE REGIONS

The Rapid Service project is not only about high-speed lines but also about servicing the regions. The linchpin of the Rapid Service is connecting regions directly to the main centres and to economic life.

ECONOMIC PROSPERITY OF REGIONS

The potential of regions is a function of their accessibility

The Rapid Service project will create a closely interconnected system to serve both agglomerations and the regions, including those that are not directly intersected by the high-speed railway. The project aims at improving the general accessibility of the regions through better (railway) transport.

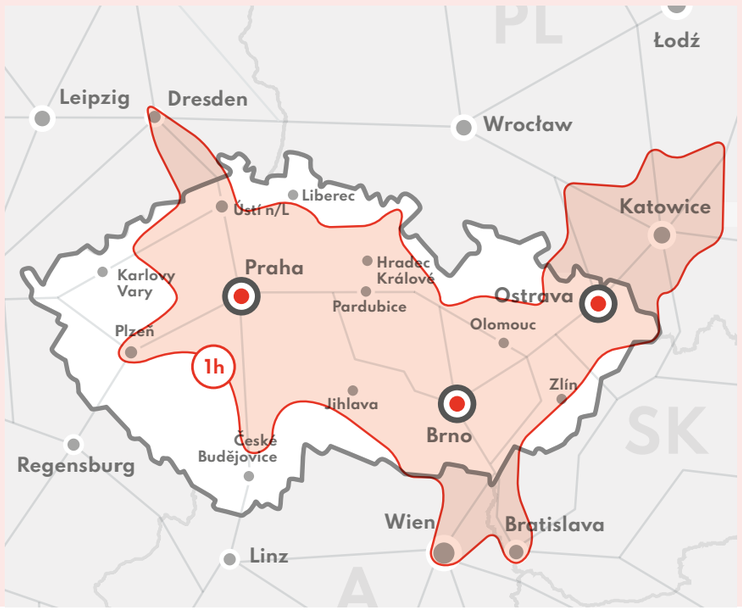
Connecting the metropolises with the regions will benefit all.

→ The labour market will increase for metropolises.

→ The residents of the regions will stay in their municipalities and their income earned in the metropolis will be spent at their place of residence.

→ This will create more services and jobs directly in the regions, thus improving the quality of life for all.

ACCESSIBILITY OF THE LARGEST CITIES OF PRAGUE, BRNO, AND OSTRAVA FROM THE REGIONS WITHIN 1 HOUR USING HIGH-SPEED AND OTHER FAST LINES



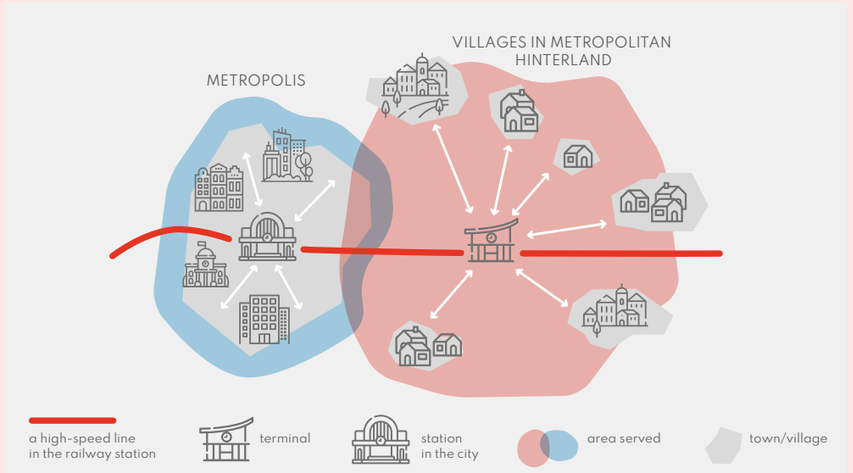
1-hour journey

Regions within an hour's journey from a metropolis become its hinterland and economic ties are built. This is also a great opportunity for many remote areas.

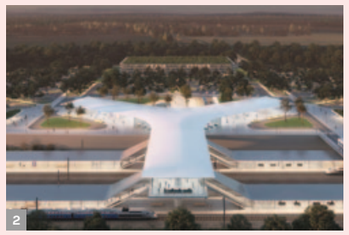
This is a simplified representation of accessibility based on travel times to the main regional centres. The travel time may be longer for certain areas which are more remote from the main railway lines.

SERVING THE METROPOLIS AND ITS HINTERLAND VIA A STATION IN THE CENTRE AND A TERMINAL

STATION IN THE CENTRE



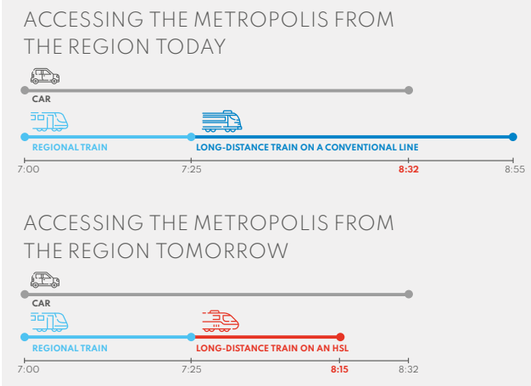
TERMINAL



* local conditions-dependent

RAPID SERVICE – A BOOST ALSO FOR REGIONAL LINES

Regional lines that are hardly competitive with road transport may see a renaissance in the future. Connection to the RS will bring them new passengers.



Examples of such regional lines may include:

→ Lovosice–Louny, Lovosice–Most, Lovosice–Česká Lípa, Roudnice nad Labem–Straškov

→ Nymburk–Jičín, Trutnov–Svoboda nad Úpou

→ Světlá nad Sázavou–Ledeč nad Sázavou, (Jihlava)–Kostelec u Jihlavy–Slavonice

RAPID SERVICE WILL COOPERATE WITH ROAD TRANSPORT

Railway transport alone cannot serve every settlement in the Czech Republic. Its interconnectedness with road transport via P+R (and B+R for micromobility) is therefore important to combine the two transport modalities into a single journey.

Photo: **1** – Gregory_DUBUS / iStock images, **2** – visualisation of the Prague-East – Nehvizdy terminal, Railway Administration, **3** – visualisation of the Prague-East – Nehvizdy terminal, Railway Administration

BY HIGH-SPEED TRAIN INTO THE REGIONS

On the surface, the high-speed line projects may appear to be merely a tool for improving long-distance rail transport between the country's largest cities. The Rapid Service project, which will connect the high-speed lines to the existing conventional network, will create a cohesive system for the benefit of both large metropolitan areas and the regions intersected by the high-speed railways as well as other regions linked by connecting lines.

The project thus aims to not only connect the Czech Republic's most important cities to the new high-speed railway, but to also **improve the general quality and accessibility of railway transport**. This will also make high-speed lines **instrumental in closing the economic gap between the "poor" and the "rich" regions**. They will become a new development impetus for the structurally disadvantaged region. International examples show that the positive impact on the economic development of regions can be economically as significant as the advantages derived only from the transport benefits and travel time savings.

→ more on territorial development → CHAPTER 2

Photo: České dráhy, a.s. archives

The planned high-speed rail in the Czech Republic will be an integral part of the railway system. Unlike other systems, especially those developed in Asia, the Czech high-speed train will be compatible with the conventional rail network. Trains will freely switch between high-speed and conventional lines. This principle will ensure the general servicing of the regions because a high-speed train can use the high-speed line to cover longer distances but then it switches to an existing line to serve the regional centres.

→ Rapid Service → CHAPTER 1

The regions can also be served by **terminals located directly on the high-speed line**, for example, with connections to conventional rail, connecting bus services, or individual transport with P+R facilities. This solution is seen as a complementary one and the primary objective is to serve the regional centres directly. The terminals are mainly suitable for areas where it is impossible to serve the regional centre directly or where it is difficult to determine what the actual centre is.

→ more about travel in the Czech Republic → CHAPTER 4

ECONOMIC PROSPERITY

A region's development potential is a function of its accessibility. One of the basic missions of Czech railway transport will be to **promote equal regional prosperity**. An economically strong region needs an economically strong hinterland because significant disparities between the country's regions reduce the development of the regions and of the country as a whole. A **functioning high-speed rail transport has the potential to curb rural depopulation and relieve the pressure for suburbanisation in the ring around large cities**, which causes serious transport issues in their general hinterland. The comparison of the economic prosperity of the regions with their accessibility by transport services suggests a correlation between these variables.

Visualisation of the terminal in Roudnice n. L., Správa železnic

The high speeds of the trains on the new high-speed lines can bring even remote regions to the core areas of Czechia. Provided that these regions get to within an acceptable daily commute distance (about 1 hour from the metropolitan area), the inhabitants of these regions no longer need to move to the "richer" centres for work. They can live in their regions and spend their income, earned at the rates of the "richer" metropolis, in the place of their current residence. **This will support the development of new services and the entire tertiary sector, further promoting the quality of life and the economic standard of the region, including the emergence of new jobs for other residents**.

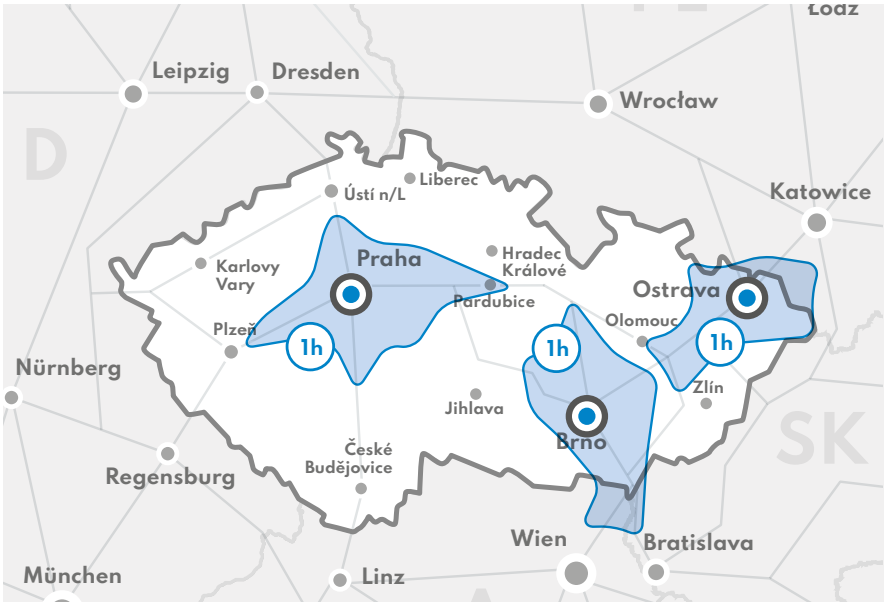
An example of servicing a region (Vysočina Region):

Today by car as the fastest mode of transport:
SVĚTLÁ N. S.–PRAGUE → 1:10–1:40 hours

In the future by train from **SVĚTLÁ N. S.** to **PRAGUE**:
about **40 minutes**

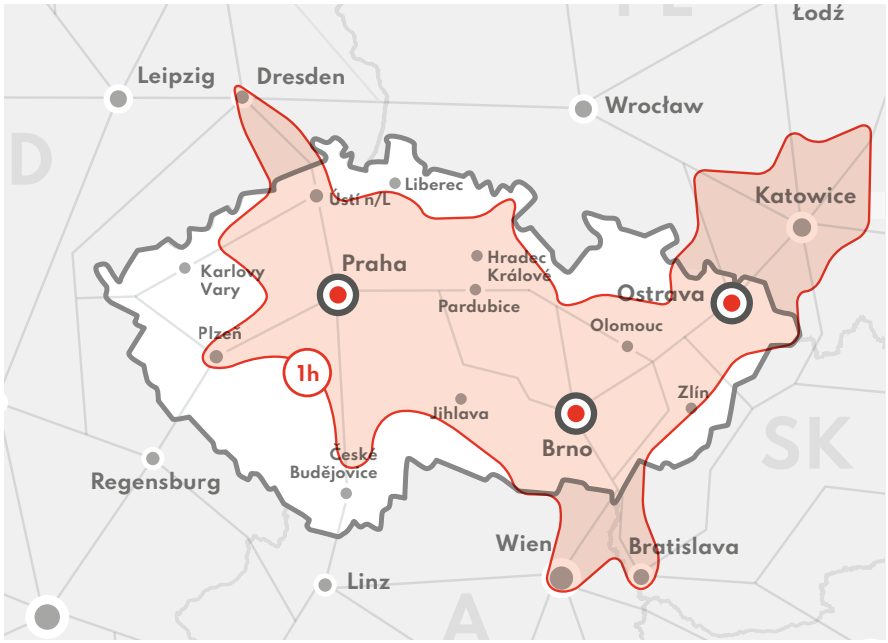
COMPARISON OF REGION ACCESSIBILITY WITHIN 1 HOUR BY TRAIN FROM PRAGUE, BRNO OR OSTRAVA

today



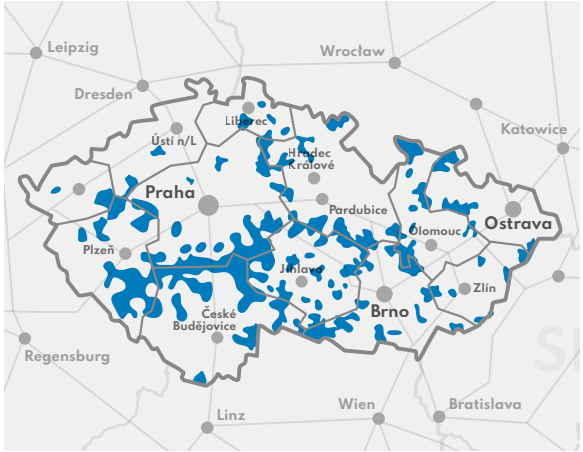
1 hour
regular commute to metropolises

in the future with high-speed rail



This is a simplified representation of accessibility based on travel times to the main regional centres. The travel time may be longer for certain areas which are more remote from the main railway lines.

DEFINITION OF REMOTE REGIONS OF THE CZECH REPUBLIC



With Rapid Service, most remote regions will be able to reach PRAGUE, BRNO or OSTRAVA by a ride of no more than

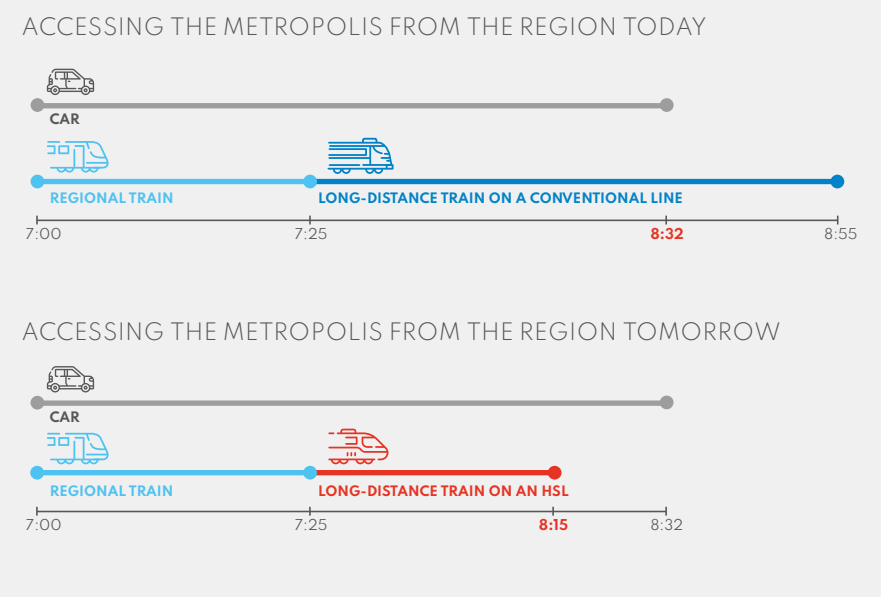
1 hour.

TAKING THE HIGH-SPEED TRAIN TO THE CITY CENTRE

The ability of high-speed trains to serve city centres directly is another advantage of linking the high-speed network with conventional rail. In many cases, this will eliminate the need to change from a high-speed train to a regional service that connects high-speed rail with the regional centre. This change would reduce convenience and increase travel times. The advantage of this solution lies in the fact that the existing infrastructure that connects cities to the rail will be utilised without the need for building new connecting infrastructure at a high cost. The public sector can thus already invest in improving rail interchanges, which investment will prove even more valuable after the Rapid Service project is implemented. Even though high-speed rail transport is sometimes compared to air travel, it can take passengers to the centre of smaller towns and cities, unlike aircraft which usually land at airports far from our destination.

RAPID SERVICE IS ALSO A BOOST FOR REGIONAL LINES

Today's railway is slow in many ways. The railway has managed to strengthen its position in long-distance transport after the modernisation efforts which were undertaken on the transit railway corridors in the past decades and which are still underway, as well as in suburban transport, where passenger numbers continue to grow, driven by the ever-increasing interest in travel to large metropolitan areas. However, it is not so successful on regional lines. Nevertheless, the state spends considerable resources on maintaining and upgrading these lines. Is this money being spent effectively? The rail is already a sustainable alternative mode of travel in long-distance as well as in regional terms. In connection with the building of the Rapid Service lines, some of the regional lines harbour the potential for converting what is now a slow regional line that connects minor settlements into a line feeding the new high-speed line. Services running between the regions and the metropolitan area utilising slow local lines and connecting conventional rail often cannot compete with individual car transport. After the launch of the high-speed line, the same trip may be much faster than a passenger car if the same regional slow line is used but the interchange is made to the high-speed line. This may revitalise some regional lines. The Czech Republic can thus benefit from the dense railway network to make the new high-speed rail service truly available on a truly wide scale rather than at certain points represented by terminals and metropolitan areas. Even if we admit that the "last mile" role will always be played by the automobile in sparsely populated areas, regional lines help shorten this "last mile" to a minimum. Selected regional lines may thus contribute significantly to the new rail network in the future.



CONNECTIONS TO THE CONVENTIONAL NETWORK PLANNED AND UNDER CONSIDERATION

CONNECTIONS TO OTHER MODES OF TRANSPORT

High-speed rail will become the backbone of multimodal mobility. Connectivity with other transport modalities will be required to ensure proper general service. Therefore, multimodal terminals have been proposed to ensure connectivity to other means of transport, including public transport and individual car transport. With these new terminals with high-capacity P+R facilities, it will not be necessary to drive to the station in the city centre and pay expensive parking fees. **Czechia's transport system will rely on cooperation between road and trail transport**. Connection to the downstream modes of transport must not be limited to terminals on the high-speed lines. Instead, it must also be provided on other railway lines where it is efficient with a view to the competitiveness of public transport. The success of the Rapid Service project depends on successful connectivity to other modes of transport in the region and in the city.

High-speed transport stations and terminals to serve a wide variety of passengers

Traditional large railway stations in city centres (as well as other stations within the city) and the connecting urban public transport services (underground, trams, trolleybuses, buses) provide interchange to conventional trains and, finally within walking distance of the administrative and historical centre, directly serving the city. These railway stations mainly rely on being served by public transport because the resulting additional car traffic is not desirable on the already-congested city centre streets.

Newly built suburban or regional multimodal terminals used mainly to serve the adjacent metropolitan areas and the region, accessed by public transport or individual cars (P+R) without the need to enter the city centre. In this case, it is advisable to build high-capacity parking facilities because car transport can efficiently serve the entire surrounding region to complement the services of the high-speed rail.

High-speed trains will serve stations in city centres. For example:

Prague Main Station

Brno Main Station

Ostrava Main Station

Olomouc Main Station

Hradec Králové Main Station

Pardubice Main Station

Ústí nad Labem Central Station

Plzeň Main Station

Jihlava Central

Zlín Central

Havlíčkův Brod

Litoměřice Central

Most

etc.

The new terminals will make high-speed trains more accessible for those that drive to catch their train. The following terminals can be used as an example:

Prague-East HSL

Jihlava HSL

Brno-Vídeňská HSL

Roudnice nad Labem HSL

etc.

Visualisation of the Prague-East – Nehvizdy terminal, Správa železnic

BENEFITS FOR FREIGHT TRANSPORT

High-speed rail is also the solution for freight transport. It will increase network capacity and open new possibilities of high-speed freight transport.

7

Photo: METRANS, a.s. archives

7 BENEFITS FOR FREIGHT TRANSPORT

MORE FREIGHT TRANSPORT ON RAIL

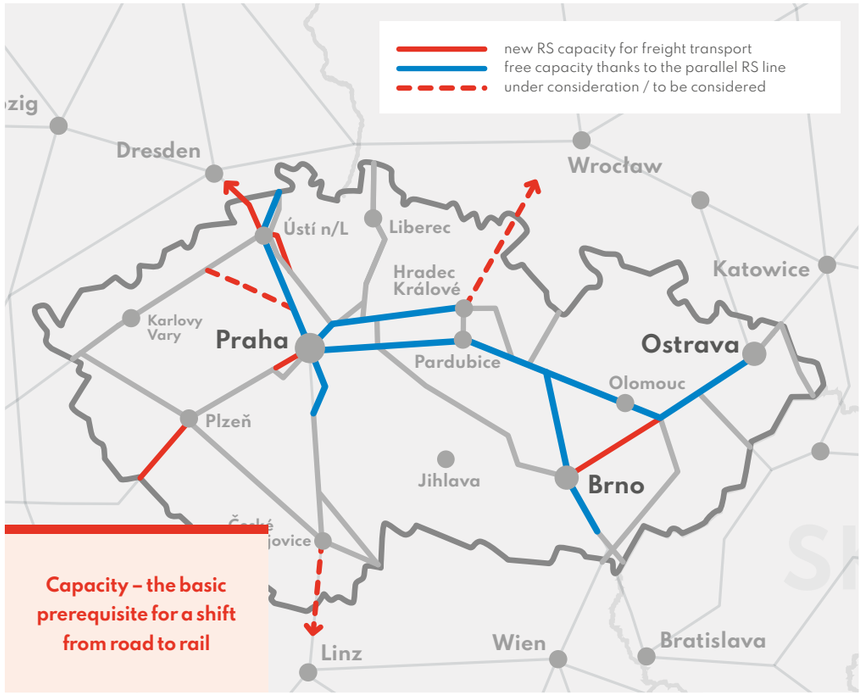
HSLs are also the prerequisite for converting freight transport by road to rail, **environmental improvements**, **energy savings**, and **improved road safety**.

RAPID SERVICE WILL ALSO HELP FREIGHT TRANSPORT

- → They will deliver higher capacity and new opportunities for freight transport.
- → They will free up capacity of the existing lines for further development of freight transport.
- → Selected new Rapid Service lines will also be usable for regular freight transport.
- → All the new Rapid Service lines will support the operation of Cargo Sprinter trains for carrying post and express consignments, not unlike air cargo.

1

RS/HSL: HIGHER CAPACITY FOR FREIGHT TRANSPORT



Capacity – the basic prerequisite for a shift from road to rail

THREE MAIN BENEFITS OF HSL FOR FREIGHT TRANSPORT

1 Higher capacity on existing main lines → faster and smoother operation of existing and added freight trains

3

2 New capacity on busy routes → Krušnohorský, Středohorský, and "Berounský" tunnels also for freight trains

4

3 New opportunities for involving railways in express shipping and post using HSLs → Cargo Sprinter express trains

5

CARGO SPRINTER – a new dimension of freight transport

- → promising for the fast-growing segment of express shipping and post
- → vehicles based on passenger trains for speeds of **230–320 km/h**
- → the interconnection of the high-speed and conventional networks will enable the operation of the existing terminals and sorting centres and other links in the logistics chain
- → significant spatial reach and unprecedented transport times

NO NEED FOR WINDOWS OR SEATS – THE HIGH-SPEED TRAIN IS ADAPTED FOR EXPRESS SHIPPING

2

ESTIMATED CARGO SPRINTER TRAVEL TIMES BETWEEN MAIN SHIPMENT SORTING CENTRES

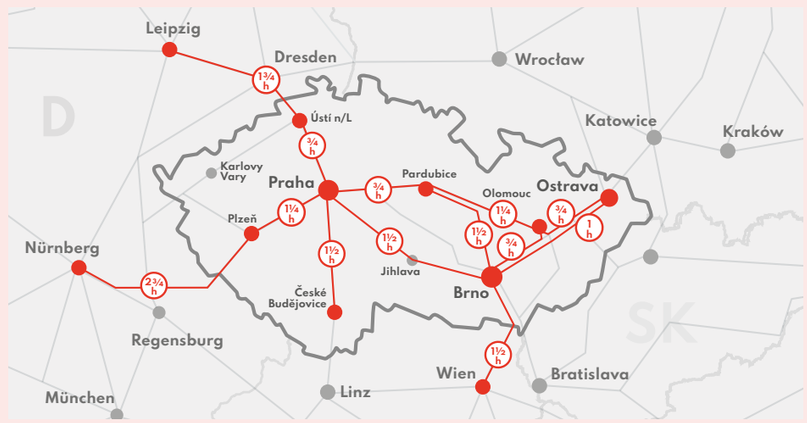


Photo: **1** – ČD Cargo, a.s. archives, author: Lukáš Růžička, **2** – Clipper98 / Wikipedia.org / CC, **3** – Matijak / Wikipedia.org / CC, **4** – Hannes Ortlieb / Wikipedia.org / CC, **5** – Clipper98 / Wikipedia.org / CC

BENEFITS FOR FREIGHT TRANSPORT

The importance of energy and emission savings associated with shifting cargo traffic from road to rail is so important for climate protection that the European Commission set a target in its 2019 strategic plan to shift 75% of cargo traffic from road to rail by 2050. In the Czech Republic, this implies an increase in rail freight traffic by more than three times over the next 30 years.

Photo: ČD Cargo, a.s. archives, author: Michal Roh Jr.

PARAMETERS REQUIRED FOR FREIGHT TRANSPORT

High-speed rail is an impetus for the development of freight transport in that it will boost the capacity of the network on the most congested routes. The transport flows in passenger and freight transport are becoming increasingly concentrated on the main lines. Freight operators have been acquiring new high-performance electric locomotives with higher capabilities but also higher costs, and they therefore seek to maximise their daily mileage. In order to achieve a return on this investment, the vehicles need to be efficiently. For that reason, it is important for the infrastructure to achieve the required parameters and capacity to ensure the smooth operation of freight trains.

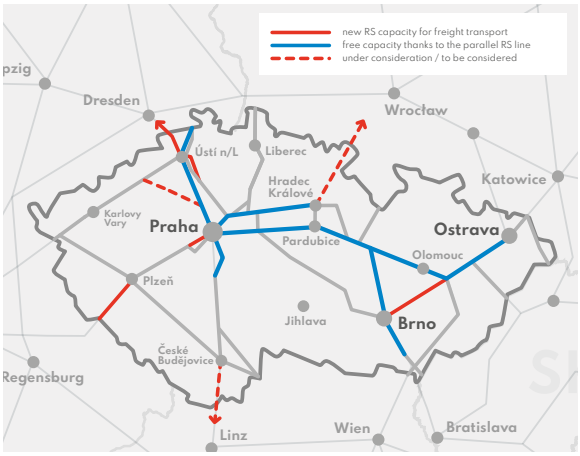
In terms of its infrastructural requirements, freight transport is relatively modest. In essence, it needs a traction line, favourable gradients, stable speeds of 100–120 km/h, and a guarantee of an assigned path with a minimum of stops. Simply speaking, it is **the ideal transport segment to efficiently use the parameters of the modernised corridors**. They usually offer favourable gradients because they were originally designed for low-power steam engines, and their speed characteristics of many sections are more suitable for freight trains than for high-speed long-distance passenger trains.

WE ARE PREPARING A MAJOR CAPACITY BOOST FOR THE EXISTING NETWORK

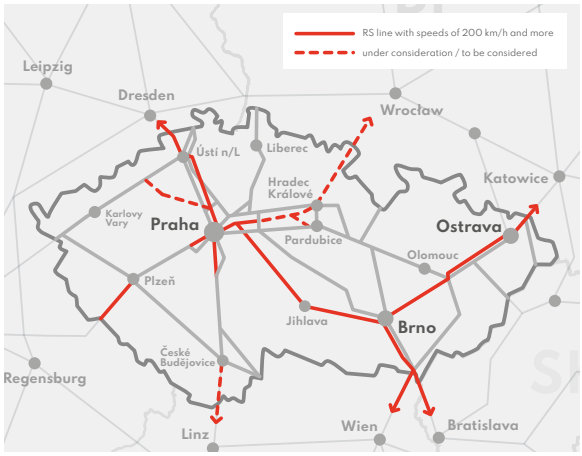
By building the high-speed lines, we will contribute to the capacity of the existing corridors becoming available for freight transport after a part of long-distance passenger transport is transferred to the new lines. This effect will be even multiplied in combination with the modernisation and capacity increase of additional lines for freight transport, with the most important ones including the "right-bank" **Děčín–Nymburk–Kolín line** and the connected **Velký Osek–Hradec Králové–Choceň line** and, for example, the **Pilsen–Domažlice–German border line**.

Photo: ČD Cargo, a.s. archives, author: Lukáš Růžička

RS/HSL: HIGHER CAPACITY FOR FREIGHT TRANSPORT



NEW INFRASTRUCTURE FOR CARGO SPRINTERS



Freight corridors

Within the framework of the forthcoming revision of the European Regulation No. 913/2010/EU on rail freight corridors, the Czech Republic aims to gradually change the operation of the rail freight corridors, in particular, towards a stable offer of freight train paths throughout the day, including spare capacity and guaranteed throughput for corridor trains (a ready path in the given state, its purchase from one one-stop shop to another regardless of the number of countries along the freight train path). In general terms, the aim is to improve the overall quality for customers (operators and carriers), consisting mainly in high-quality infrastructure, interoperability, and removal of any bottlenecks. Overall, however, the most important thing is that any steps taken in rail freight transport, wherein infrastructure and management must go hand in hand, need to deliver an improvement in the performance of rail fright.

Photo: České dráhy, a.s. archives

HIGH-SPEED LINES (ALSO) FOR FREIGHT

Certain selected sections of the Rapid Service system will also be intended for conventional freight transport. This mainly concerns high-speed line sections which must be made accessible for freight trains because of the capacity of the existing network and/or the need to address noise pollution. It is important find a reliable route along the key sections that is independent of, for example, the danger of flooding. Specifically, this concerns the **Litoměřice–Ústí nad Labem–German border section**, including the **Středohorský and Krušnohorský Tunnels**, and the **Prague–Beroun tunnel section**.

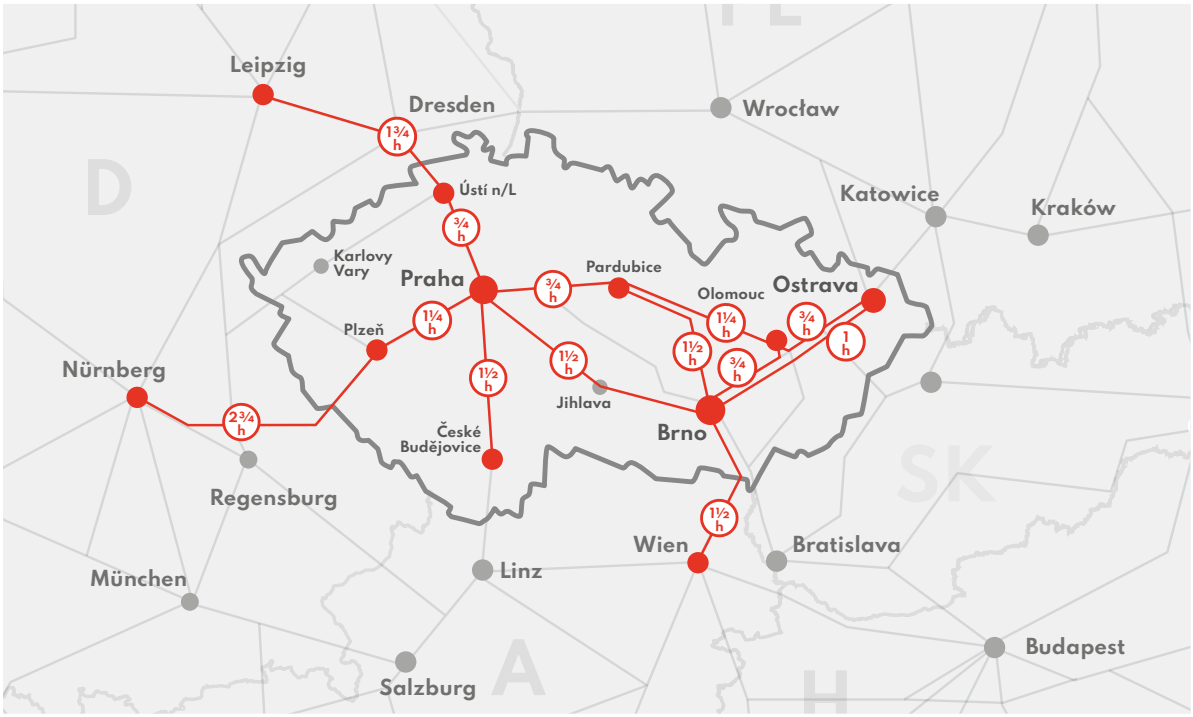
Photo: Clipper98 / Wikipedia.org / CC, **3** – Matijak / Wikipedia.org / CC

Other high-speed lines will not be made available to conventional freight trains because of their capacity and higher **maximum speeds of up to 320 km/h**, and they will be primarily dedicated for high-speed passenger transport. Regardless of the perception of high-speed rail as being primarily intended for passenger transport, it may also offer a significant potential in the **express shipping of individual consignments**. This is the freight segment that continues to grow steadily, especially in connection with online shopping. All the high-speed lines will be open to the **Cargo Sprinter** freight trains that carry lightweight cargo placed on Euro pallets, post, and parcels. This type of train is made up of vehicles derived from high-speed passenger trains. Thanks to their speed, such trains can be incorporated in the itinerary of high-speed passenger trains, and their parameters also meet the stringent requirements for axle load and dynamic effects on the track.

The question that arises is to what extent this type of transport can establish itself in real life in Europe and in the Czech Republic, as it is still in its infancy (the Eurocarex and Mercitalia projects). It can be **strongly boosted by the surge in online shopping** and the associated volumes of light consignments as a result of the covid-19 pandemic. In fact, an initiative has emerged in the Czech Republic to first introduce this type of trains on the corridor network and then expand it to the future high-speed lines.

The Rapid Service network should therefore be prepared with a certain justifiable spare capacity so as to allow for the future operation of these trains and for the introduction of this modality in the Czech Republic. As the high-speed lines are foreseen to be connected to the conventional network, it will be possible for the trains in this segment to be served by the existing cargo terminals or sorting centres connected to the railway.

CARGO SPRINTER – ACHIEVABLE TRAVEL TIMES BETWEEN TERMINALS / SORTING CENTRES AT 230 km/h



Instruments to improve rail freight performance:

- → **improved performance** of transit corridors by using ETCS optimised to allow for trains running in close intervals, including ETML-based operational efficiency improvements, increased performance of the electric traction line by switching to the unified 25kV AC 50Hz system to enable the wide use of high-performance electric locomotives and allow for the running of freight trains up to 740 m in length
- → **improving the capacity of diversionary or alternate routes**
- → **involvement of other, previously unused rail lines** in freight operations by electrifying and upgrading such lines, including the application of the ETCS
- → **promoting the development of combined transport terminals** and the construction/revitalisation of sidings
- → **relieving the conventional rail network** by transferring long-distance passenger trains to the newly built high-speed rail
- → **integration of high-speed** (and fast conventional) **lines into parcel and post transport**
- → **improving the efficiency of capacity management** and guaranteed routes by implementing the **"Timetable Redesign" (TTR)** project at the European level

SUSTAINABLE TRANSPORT

High-speed rail is one of the tools to achieve climate neutrality of Czech economy and reduce the emissions produced by transport by up to 90% against the current situation.

8

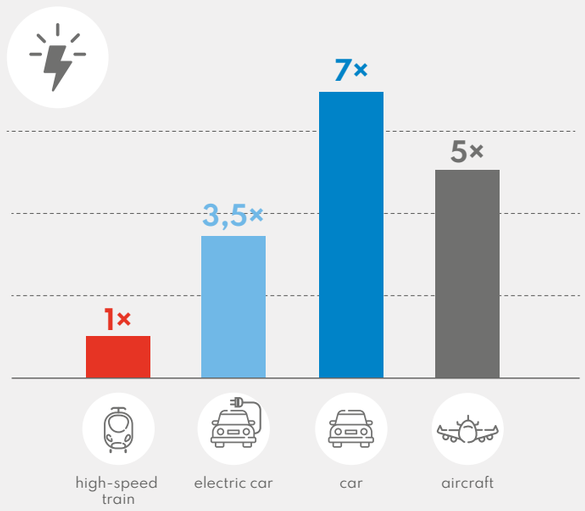
8 SUSTAINABLE TRANSPORT

A PROVEN SOLUTION FOR OVER 100 YEARS

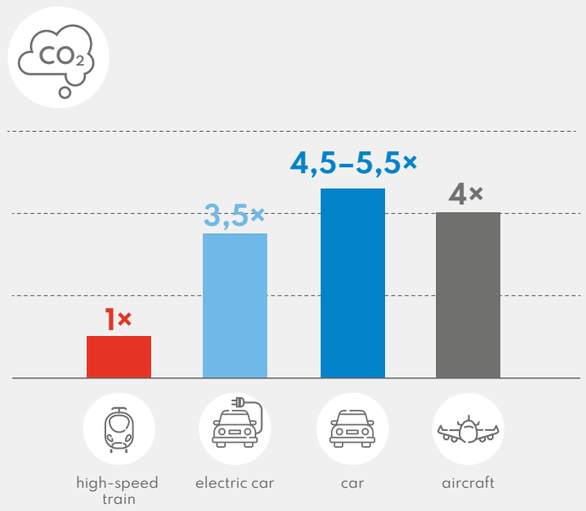
THE TRANSFER OF TRANSPORT TO ELECTRIFIED RAIL OR PUBLIC TRANSPORT IS THE MOST EFFECTIVE TOOL FOR ELECTROMOBILITY

HIGH-SPEED RAIL IS THE MOST ENERGY EFFICIENT AND ENVIRONMENTALLY FRIENDLY MODE OF TRANSPORT

GENERAL COMPARISON OF THE ENERGY CONSUMPTION PER PASSENGER PER KM

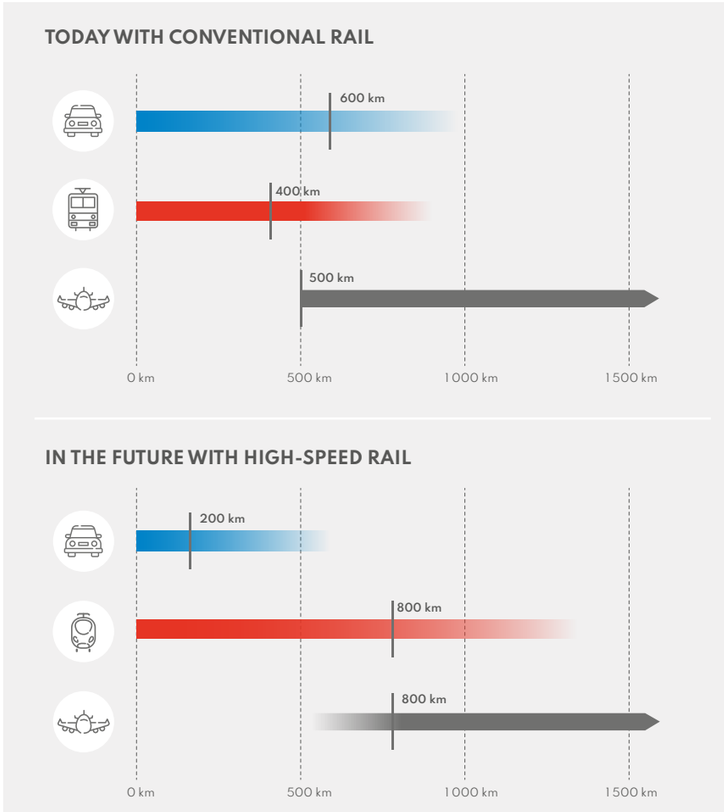


GENERAL COMPARISON OF CARBON DIOXIDE PRODUCTION PER PASSENGER PER KM

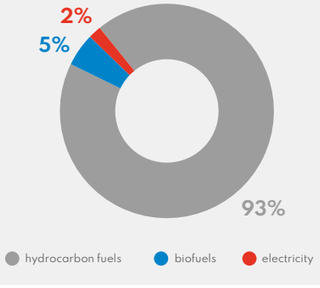


The calculation takes into account the following typical average vehicle occupancy rates (2019): car/electric car: 1.3 person, high-speed train: 60%, aircraft: 80%.

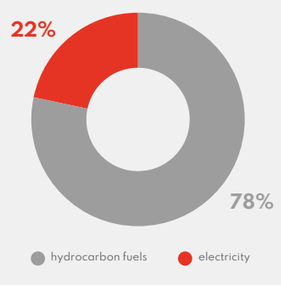
MODES OF TRANSPORT OVER DIFFERENT DISTANCES (PASSENGER TRANSPORT)



ENERGY CONSUMPTION STRUCTURE IN CZECH TRANSPORT



TRANSPORT PERFORMANCE STRUCTURE IN THE CZECH REPUBLIC



Source: National energy balance of the Czech Republic, Transport Yearbook

Mobility is an essential part of modern life and economy. With a view to the development and sustainability of mobility, it is therefore necessary to mitigate the negative impact of transport through well-considered cooperation between different modes of transport. The so-called **multimodality** combines the different modes of transport, leveraging their strengths where they can be best applied in terms of consumption, speed, and capacity.

High-speed rail is the part still missing in the Czech transport system, and it is the key precondition for ensuring better division of labour between the individual transport modalities.

SUSTAINABLE TRANSPORT

In addition to creating the conditions for changes in the transport-related behaviour of the population, Rapid Service will also lay the foundations for the pursuit of other policies and objectives – for example, those related to cohesion which focus on reducing economic or environmental disparities and which are increasingly coming to the forefront in recent years.

INTERMODALITY – A PRINCIPLE FOR FUTURE MOBILITY OF PEOPLE AND GOODS

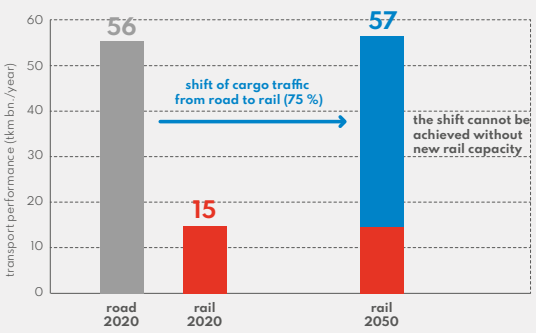
High-quality, generally accessible, safe, fast, and reliable passenger and freight transport has become an integral part of our daily lives. It is also a fundamental precondition for the functioning of the state. However, the current shape of transporting people and goods, provided largely by cars powered by combustion engines, is **unsustainable in the long run for a number of reasons**.

Replacing competition between the modes of transport with cooperative relations is the underlying principle of **multimodality**, which is to become the main form of organising transport going into the future. Today, public transport is organised in the form of integrated transport systems, within which passengers are served by different means of transport (usually with a single travel ticket). In freight transport, containers are globally transported by sea, real, and road. The future objective is to **strengthen the principle of cooperation between transport disciplines**, even on a much larger scale. The purpose is to take advantage of the benefits and transport capacities of the individual modes of transport while optimising energy intensity, improving continuity and accuracy, and reducing the negative impacts of transport on the environment, and ensuring its sustainability in the long term. Unlike today, the "optimal" use of the individual transport modes will be increasingly dependent on environmental and energy considerations, which will also be reflected in the costs. The **"polluter pays" principle**, known from aviation and the automotive industry in the form emission allowances, will be applied to a much greater extent.

Driven by environmental and long-term economic sustainability considerations, the European Commission introduced in 2019* its **plan to shift up to 75% of the cargo traffic from road to rail by 2050**. In the Czech Republic, this implies an **increase in rail freight traffic by more than three times**. Similar development are expected to take place in passenger transport, especially in relation to the **completion of the European high-speed rail network around 2050**. A partial objective is to **triple the length of high-speed lines by 2030**. By 2050, most transport over medium distances should be carried out by rail, including in passenger transport.

While these changes appear very ambitious, they need to be understood as a part of a broader socio-economic transformation. It includes as its elementary component also a structural change in energy, which will be reflected in the transport sector in the form of a completely different energy mix to support our transport needs. In order for these objectives to be met, a fundamental condition must be fulfilled – the infrastructure of the individual modes must be completed to reach an appropriate level to enable this transformation.

WHAT THE PLANNED SHIFT OF 75% OF TODAY'S FREIGHT TRAFFIC FROM ROAD TO RAIL ENTAILS



Source: Transport Yearbook, own calculation

* A European Green Deal, complemented in 2021 by measures under the "Fit for 55" package

SUSTAINABLE TRANSPORT

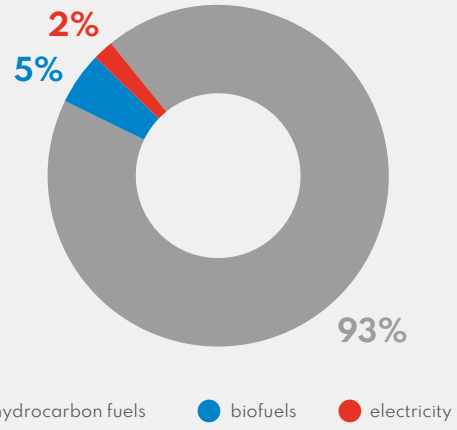
In the Czech Republic, **transport accounts for over a quarter of energy consumption**. **93% of the energy consumed comes from fossil fuels**, about **5% from biofuels**, and **only 2% from electricity**. On the output side, this information can be interpreted to mean that transport produces a considerable amount of harmful substances and pollutants – in the EU, transport accounts for producing over a quarter of the greenhouse gases.

Although fossil fuel-dominated energy sources made the modern civilisation possible and underpin our current lifestyle, this course can non longer be sustained without damaging Earth's climate and the health of its inhabitants. It is not just about the climate as such, but about the consequences of climate change for the entire society as a whole and for social and economic sustainability. With this in mind, the Paris Climate Change Conference, held in December 2015, made the global decision to halt the rise in the planet's temperature by phasing out the use of fossil fuels.

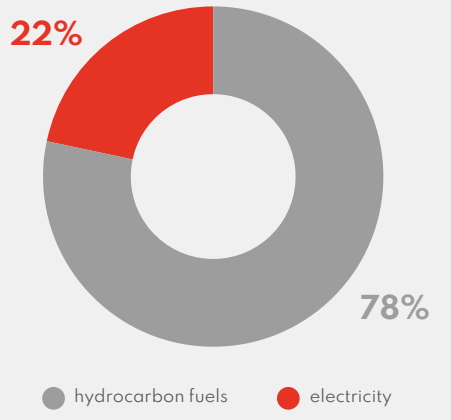
The energy mix in transport

Energy consumption in the transport sector has overtaken industry in the Czech Republic and it continues to grow steadily at the rate of about **3.5% per year**. In cities, transport is the largest source of air pollution. **Fossil fuels account for over 90% of energy consumption** in transport in Czechia, and their combustion produces **19 million tonnes of CO_2** annually. That is more than double the amount of CO_2 released by Czech industry (8 million tonnes per year). **Electricity** is the alternative to fossil fuels. It is worth noting that electricity, which accounts for **about 2%** of the energy consumed in transport, powers as much as **22% of the total traffic**. This is caused by two objective facts. Firstly, the electric traction motor is about 2.5 times more efficient than the internal combustion engine. Secondly, electricity is now used in the Czech Republic almost exclusively in rail transport, i.e. on the railways (85% of the traffic on Czech railways is powered by electricity) and in urban public transport (underground, trams). Rail transport is also characterised by low energy consumption because of the low rolling resistance of the steel wheel on the steel rail and the low aerodynamic drag of the long, slender vehicles moving in a line (and forming a train).

ENERGY CONSUMPTION STRUCTURE IN CZECH TRANSPORT



TRANSPORT PERFORMANCE STRUCTURE IN THE CZECH REPUBLIC



Source: National energy balance of the Czech Republic, Transport Yearbook

The European Commission then set the goal for the European economy **to achieve climate neutrality by 2050**. Among other things, **it means that transport emissions must be reduced by 90%**. This is what brings about the fundamental structural change in the entire sector.

The Czech Republic is among the countries getting ready to face this challenge. **The Czech National Energy Policy** therefore has a vision for the transport sector according to which it will be necessary to reduce the energy intensity and environmental impacts through a greater representation of alternative fuels to replace the current dependence on oil and, specifically, on the fuels produced from oil. **The consumption of oil-based fuels in transport is to decrease between 2015 and 2030 from 59 billion kWh per year to 50 billion kWh per year**, while the **use of electricity is to increase from 2.4 billion kWh per year to 4.3 billion kWh per year**.

Energy security

Increased **use of electric traction on rail**, which is the most efficient electromobility tool, will not only achieve energy savings and reduce the negative environmental impacts of transport, but also **increase the energy safety and self-sufficiency** of our country. While **we can generate electricity ourselves**, we mostly depend on oil imports from high-risk countries. Electricity can also be generated by a combination of different sources, which further enhances the security aspect.

However, this vision remains to be in stark contrast with the current form of transport, which is dominated by cars with internal combustion engines. Moreover, energy consumption in transport tends to increase steadily in the Czech Republic. Particularly problematic is the amount of energy lost, i.e. the energy lost due to the low efficiency of the combustion engine. Only about **1/3 of the fuel energy is used to power internal combustion engine vehicles**. The **remaining 2/3 is converted into heat**, the energy of which is roughly double the amount of heat supplied by Czech heating plants to heat buildings. It is also this context that the ongoing emergence of electromobility in road transport and the potential harboured by an electrified rail on busy paths need to be put into.

Photo: BeyondImages / iStock images

Electricity currently accounts for only 2% of energy consumption in transport in the Czech Republic, but it powers nearly 22% of the total traffic in passenger and freight transport. This significant disproportion is due to the combination of the high efficiency of electric traction motors compared to internal combustion engines and the very low energy intensity of rail transport. A certain part is also played by the uneven distribution of traffic load, with most of the traffic taking place over the electrified backbone network. It is a clear advantage of rail in this respect that – unlike other modes of transport – it sorted out the issue of power supply by introducing linear electrification more than 100 years ago. Because of this, it can make extensive use of renewable energy as well as recover energy – return into the mains the electricity generated while the vehicles are braking when going downhill or stopping. It is also much easier to introduce battery-powered vehicles which can be recharged from the trolley while stationery as well as on the move.

There is more that favours the rail, especially when compared to road transport. This includes the area of land required, landscape fragmentation, and noise pollution, which is a parameter for which great progress has been made in the area of high-speed rail. It has been shown that it is not necessary to build massive noise screens in some cases and that other, more landscape-friendly solutions can be preferably employed. Significant improvements have also been achieved in terms of the transmission of vibrations into the subsoil or the so-called tunnel boom that is sometimes generated by high-speed trains entering tunnels at speeds of over 200 km/h, which is often pointed to as one of the negative effects of this new infrastructure. Tunnel portal modifications and other measures have managed to virtually suppress the audible effect of the shock waves. Contributions to rail's positive environmental balance also come from the life cycle of the railway vehicles, which is 30–40 years – a significant difference compared to automobiles in terms of waste management.

Two paths to energy savings in transport

Intramodal savings mainly result from increasing the energy efficiency of the same mode of transport. An example is the **replacement of the less energy-efficient drives** – such as a combustion engine (with a mean efficiency of about 32%) – with electric traction drives with a mean efficiency of about 80% and the effect of energy recovery while braking. This change is accompanies by an energy consumption **decrease to about 40% of the original value** and by reduced emissions. This is the context that the ongoing emergency of electromobility in road transport should be seen in.

Extramodal savings mainly result from increasing the energy efficiency by shifting transport from a highly energy-intensive mode of transport to one with a **lower energy intensity**. A typical example can be seen in shift of road transport to rail transport, the energy intensity of which is about **three times lower**. Reducing the energy intensity of transport is conditional on achieving multimodality, in which the individual modes of transport cooperate towards the most efficient way moving passengers or goods from the initial station to the destination.

All this explains why rail has received such interest at the European level since the mid-1990s. The goal is to increase the proportion of traffic supported by electric traction. That is also why steps are being taken towards its modernisation and development as they are necessary for its involvement in transport operations and thus for achieving higher social objectives. The Rapid Service system in the Czech Republic, which will create a high-capacity and **high-speed transport backbone powered exclusively by electricity fully complies with these objectives**.

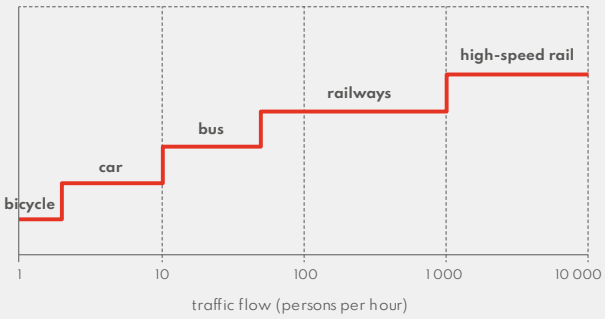
HOW IT WILL WORK

In addition to the above, the role of rail in the transport system can be expected to be strengthened. However, it would be misleading to claim that this will necessarily take place at the expense of other transport modalities. What will happen is merely a redistribution of the roles and functions to be performed by the each transport sector to form a single functional transport system. The key part in the composition of the individual field of transport will be derived from their energy intensity or, specifically, from their price, time intensity, and the size of the transport stream, i.e. demand. Nobody can be forced to use rail. Quite on the contrary. Massive use of rail will be the natural outcome of the free choice of customers, to whom rail will offer attractive, fast, and reliable services.

Long distances will continue to be covered by air transport, for which there will be no alternative. On the other hand, rail should assume the dominant role in transport over medium distances for both passenger and freight transport. Displaying a significantly lower energy intensity, **high-speed rail will manage to replace air transport at distances of up to about 800 km**, which will become inefficient for air transport both in terms of energy, time, and comfort. This will free up airspace and airport capacity for long-distance flights to destinations where air transport will remain irreplaceable.

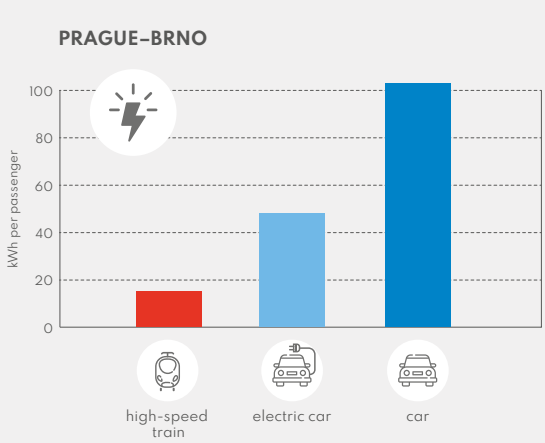
Road transport will continue to play a dominant part in transport over shorter distances and in serving the general area. Rather than being used for long journeys, the automobile should "feed" the terminals, which will play an important role as connections to the more remote locations or in the daily commute to major cities. There is indeed still a great potential harboured in transport combining the car and the train. There is no guarantee that the scenarios outlined above will become reality. On the other hand, it is reasonable to believe that at least the basic features of this development will materialise, given the facts presented above. The ever-growing and always-occupied P+R car parks at railway stations and stops strongly suggest that multimodality is a natural behaviour of the population provided that appropriate conditions are created for it in the form of a fast and comfortable rail and high-capacity and secure parking options.

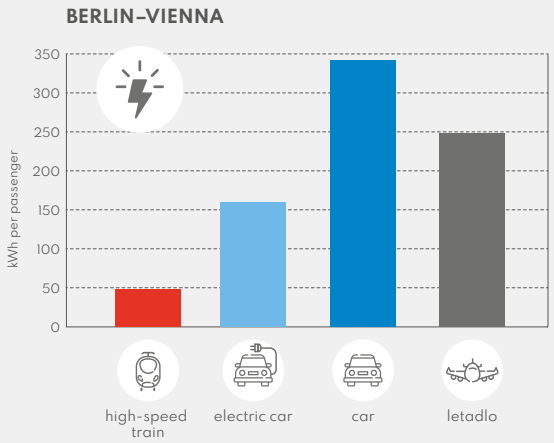
CHOOSING THE OPTIMAL TRANSPORT SYSTEM



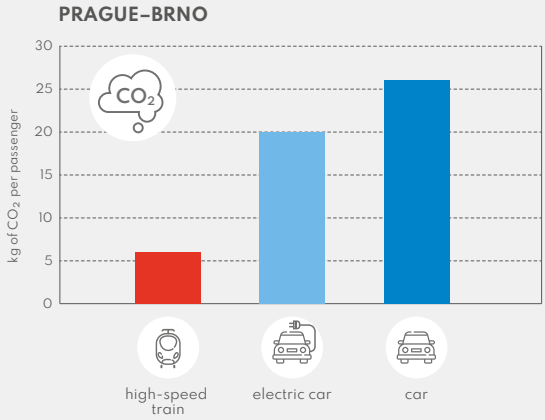
High-speed rail is a highly efficient transport system. With the limit train length of 400 metres, as set by the standards, and an interval of several minutes in between the trains, this system is capable of transporting **more than 10,000 persons per hour in one direction**.

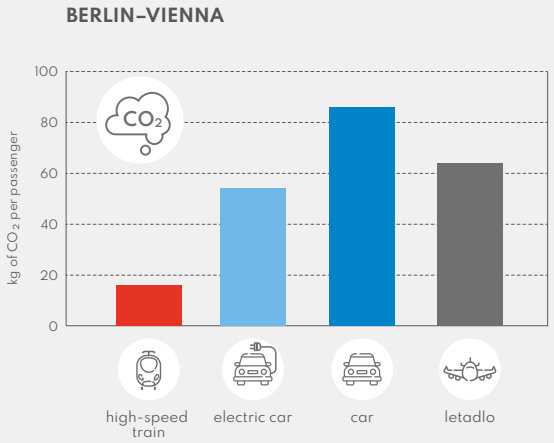
ENERGY CONSUMPTION PER PASSENGER





CO_2 PRODUCTION PER PASSENGER





The calculation takes into account the following typical average vehicle occupancy rates (2019): car/electric car: 1.3 person, high-speed train: 60%, aircraft: 80%.

Sources: Summary energy balance, Power Grid Operation Annual Report, Thales: Decarbonising Transport, EGÚ: Rail Energy Saving Opportunities, own calculation

HOW

DOES HIGH-SPEED RAIL WORK?

HIGH-SPEED RAIL INFRASTRUCTURE

The existing railways are reaching the limits of their capacity. Adding new high-speed lines to the railway network will increase the capacity, speed, and reliability.

9

9 HIGH-SPEED RAIL INFRASTRUCTURE

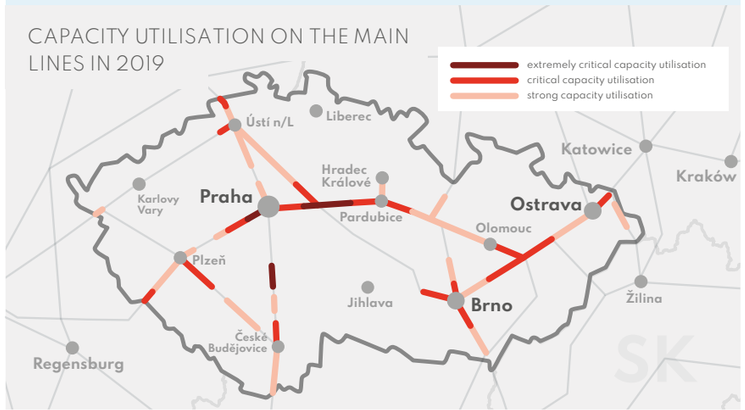
The Rapid Service will rely on high-speed lines that enable trains to travel at speeds of up to 320 km/h.

Is it worth it?

Absolutely. **Feasibility studies** have been prepared for the key sections of the Rapid Service to perform, among other tasks, an economic analysis to determine whether the project is beneficial for the society.

The existing rail corridors are congested. Each single delay impacts more and more trains by a domino effect. The railway is becoming unreliable and has no capacity for further development. The key problem lies in the concentration of fast and slow passenger and freight trains on the same shared infrastructure.

CAPACITY UTILISATION ON THE MAIN LINES IN 2019



Why we need new high-speed lines

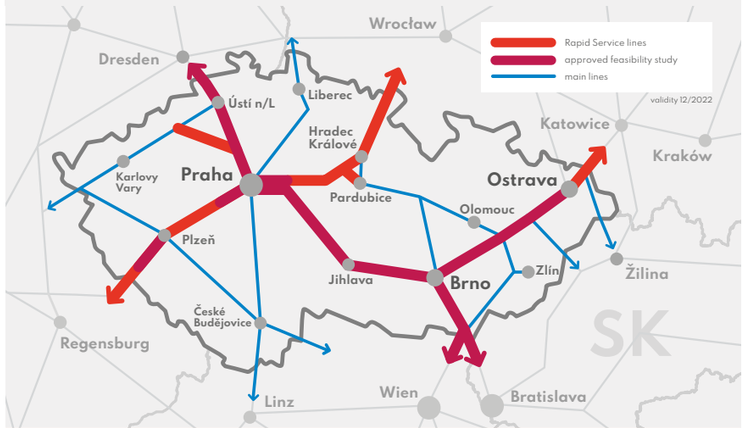
- In addition to higher speed, they will also bring about new capacity, enabling the separation of fast and slow trains and ensuring smoother operation compared to the situation today.
- Smoother operations will mean higher reliability as well as an improved energy balance.
- Alternatives on the main transport routes will emerge and the conditions for dealing with emergencies will be improved.

The effects of high-speed lines can be leveraged during the implementation phase – new lines will be put into operation in stages.

HSL/RS implementation sequence

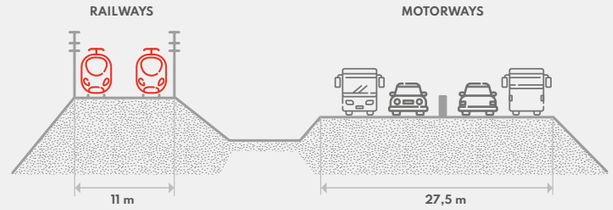
1. Radial lines around metropolises to relieve the most congested routes
2. Interconnecting the lines in metropolitan hinterland into comprehensive connections between metropolises to create a new transport backbone
3. Building additional lines in other directions to expand the offer of high-speed rail

RAPID SERVICE ROUTES CURRENTLY PLANNED



For current detailed information about the routing of the planned routes see:
→ www.spravazeleznic.cz/vrt

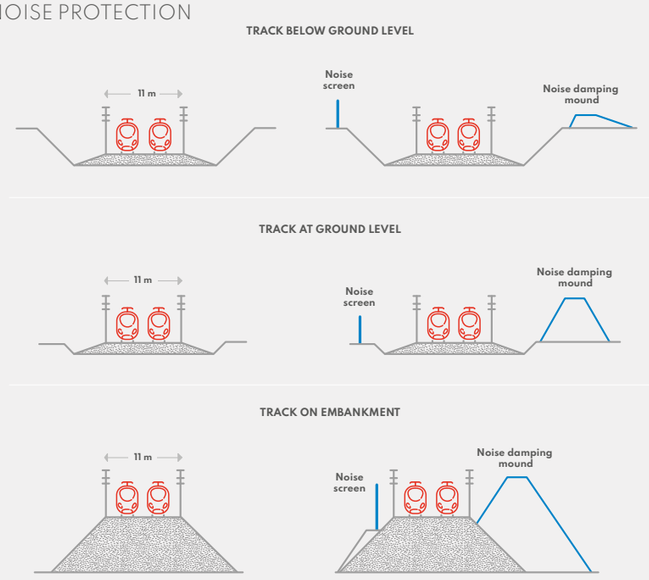
The demands placed by high-speed rail on the area are lower than those of motorways.



HSLs MEET NOISE EXPOSURE LIMITS

- For the speed of 300 km/h (at the assumed 100 trains per day), the **noise exposure limit** for daytime **is met at less than 160 metres from the line**.
- If other measures – **recessed**, **noise barriers** – are implemented, this **limit can be met** as close as **20–50 metres from the line**.
- **The clear advantage of HSLs lies in their being routed away from developed areas**. There will be **much less noise impact** compared to the traditional lines that historically run directly through cities and villages.

NOISE PROTECTION



BASIC PRINCIPLES OF HIGH-SPEED RAIL IN THE CZECH REPUBLIC

- Separation of fast and slow trains by building new HSLs – **"speed segregation"** → high transport performance and reliability of railways
- High-speed trains using HSLs and conventional lines – **"internal connectivity" of the railway system** → opportunity to directly serve city centres and regions by high-speed trains

1

RAILWAY NODES

Railway nodes must offer sufficient capacity and robustness with alternative route options to prevent them from becoming infrastructure bottlenecks.

STATIONS

The new and existing stations of the RS system will be an important gateway. That is why they have to:

- meet high technical and aesthetic standards,
- meet high standards of services,
- tie to the urban pattern of their general surroundings or create conditions for the development of new areas.

Photo: **1** — visualisation of the Prague-East — Nehvizdy terminal, Railway Administration

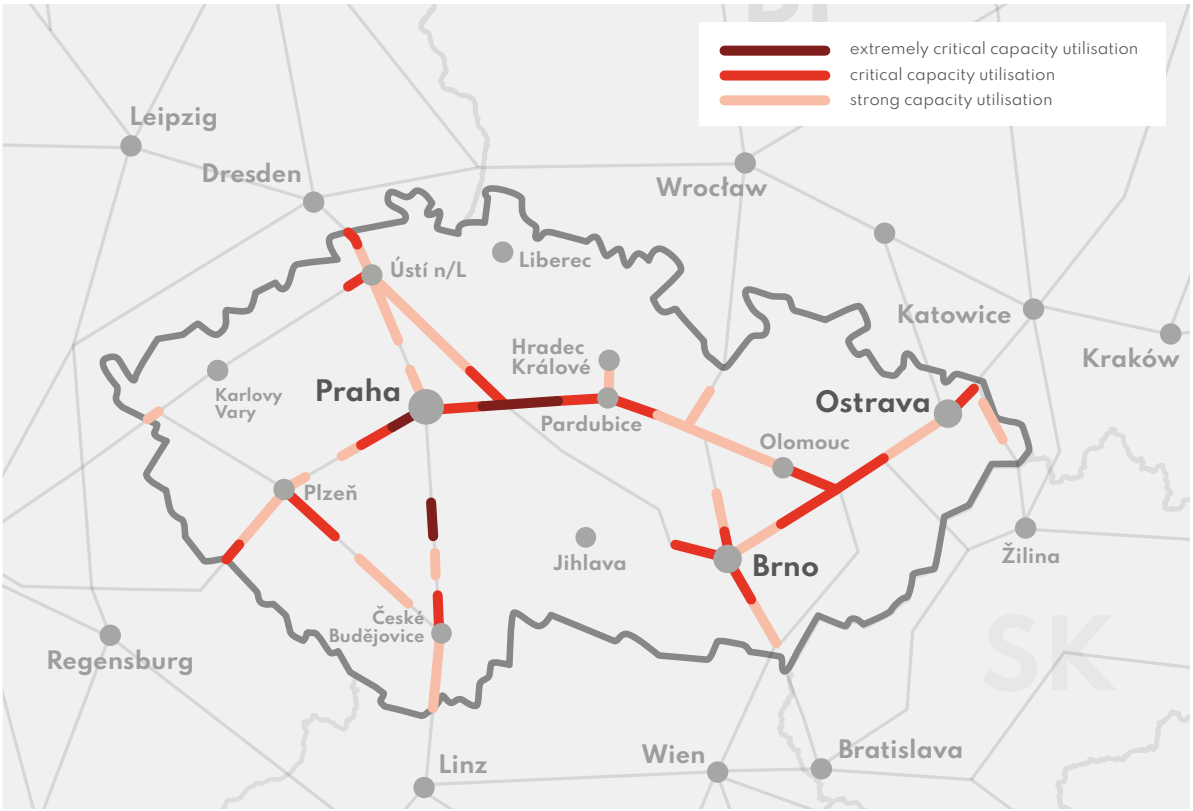
HIGH-SPEED RAIL INFRASTRUCTURE

The basic framework of the Rapid Service project will be formed by the new high-speed lines (HSLs) built along the main traffic routes. They will be connected to modernised conventional lines to ensure that they are linked to the most important railway nodes and/or lines running further into the regions.

THERE IS A NEED FOR NEW LINES

The number of long-distance passenger, regional passenger, and freight trains is so enormous, especially in suburban areas, that the **railway is already reaching its capacity limits at peak times**. Almost everyone agrees on the need for action. Measures such as train priority changes and similar arrangements generally deliver no major improvements. Simply speaking, there is no way to get two litres of water into a one-litre bottle. What we need is a bigger bottle. In our case, we need to **enlarge the railway infrastructure along the main traffic routes**.

CAPACITY UTILISATION ON THE MAIN LINES IN 2019



Data: Správa železnic

At first glance, it might appear sufficient to simply modernise and increase the capacity of the backbone lines. However, this seemingly "simple" solution has some major pitfalls. Adding two more tracks to the existing two tracks on the corridors where the lines are tightly enclosed by urban development or natural barriers would only be possible at the cost negotiations, demolishing a number of houses, and complicated noise protection measures. While this time-consuming, costly, and organisationally complex efforts would eventually result a capacity increase, it would deliver no acceleration compared to today. In addition, decades of delays and irregular service would certainly lead to a significant loss of customers in passenger and freight transport.

A more appropriate solution will be to build brand new lines to which a substantial part of mainly the long-distance trains will be transferred. The existing transit corridors will be freed to accommodate smoother regional and freight traffic, potentially giving rise to the emergence of new services related to the passengers and the goods. The principal benefit of this solution is the fact that, in addition to increasing the capacity, the railway will be able to offer significantly faster transport along the key routes.

BASIC PRINCIPLES OF HIGH-SPEED RAIL IN THE CZECH REPUBLIC

Moreover, adding new high-speed sections to the railway network while **respecting the principle of increasing the capacity of the railway nodes** will achieve not only **higher speeds** but also significantly higher **operational reliability**. The new railway system will rely on two principles:

→ **speed segregation**

→ **internal connectivity of the railway system, the so-called network interconnectedness**

Speed segregation is a term that denotes the separation of high-speed trains from the slow ones. As the trains running on a line all travel at similar speeds, more of them can be fit on the same line. The underground is an example of a line with 100% speed segregation, as the underground does not need to share its infrastructure with trams, which are slower, for example. All the underground trains travel at the same speed and can therefore run at 1.5 to 2 minutes apart.

Speed segregation is also the way to **achieving high traffic at a low energy intensity**, among other things by minimising the need to overtake other trains, which is very expensive in terms of both investment (as more operating control points, switching and passing tracks need to be built) and operation (higher energy consumption due to trains starting and braking for traffic reasons). In addition, the slower trains waiting to be overtaken become even slower, less productive, and less attractive. Overtaking also makes the timetable less stable and the delays are carried forward to other services.

The **internal connectivity of the railway system** refers to the infrastructure having such design parameters as will ensure the transition of the high-speed trains between high-speed lines and conventional lines. That is the basic principle of European high-speed rail, distinguishing it from other systems (such as those in Asia or the Hyperloop theoretical concept) which form a standalone operational system that is isolated from the conventional rail network. **The principle of harmonising the parameters between high-speed and conventional networks** will deliver the following positive effects:

- Using the existing conventional rail lines, high-speed trains will **easily enter city centres** through dense urban development to enable their passenger to board and detrain at traditional stations. These stations offer very good connection to urban public transport as well as enable fast and easy interchange to long-distance and regional services running on conventional railways.

- Using the connection to the conventional rail network, high-speed trains offer more than a mere link between the terminal points of the high-speed rail. In this way, they will allow for routing options to establish a **fast and direct connection to (and between) cities located outside the high-speed rail network**.

- While the high-speed rail is being constructed, the existing sections (pilot projects) of high-speed lines can be used to partially accelerate and **increase the capacity of conventional rail**. The high-speed lines will thus contribute to increasing the performance of the railway system even before they are fully completed.

CONSTRUCTION IN STAGES

The new high-speed lines are a cost-intensive and time-consuming task that will be **implemented gradually**. It is important to set the appropriate strategy of the individual implementation stages so that the benefits of the completed sections can be maximised. The foreseen development of the high-speed rail can be divided into the following stages:

1 **In the first stage**, **radial high-speed lines will be built around the metropolises** to relieve the conventional railway network along the sections which are most congested by long-distance passenger, regional passenger, and freight transport. This category includes all the pilot sections **around Prague**, **Brno**, and **Ostrava**, which are to be **completed by 2030**.

2 **In the second stage**, the continued construction will **interconnect the suburban radial lines to create coherent intercity services**, including those to other countries. The priority of this stage will be creating a **coherent axis along the Dresden–Prague–Brno–Vienna/Ostrava route**.

3 **In the third stage**, high-speed rail may also be **built along other paths**, which are not currently being considered. International experience shows that, following the general success of high-speed rail, developments in demand as well as the traffic on the existing network often highlight the need for new lines even on routes for which they were not originally considered.

The Rapid Service project represents a series of sub-projects. At the core of the project are **new high-speed lines over 650 kilometres long**. The way to using at least a part of the new lines as soon as possible is through well-thought-out phasing to reap the maximum benefits of each completed section.

Risks involved in HSL preparation and construction

HSL preparation and construction involves certain risks that need to be mitigated by thorough preparation of the project.

Main risk groups:

→ **Risks related to routing** – danger difficulties in reaching a consensus on a specific route in terms of impacts on the territory, the population, and the environment, and danger of lengthy approval processes

→ **Risks related to land ownership and settlement** – danger of lengthy acquisition of the necessary land

→ **Funding-related risks** – danger of underprioritised funding

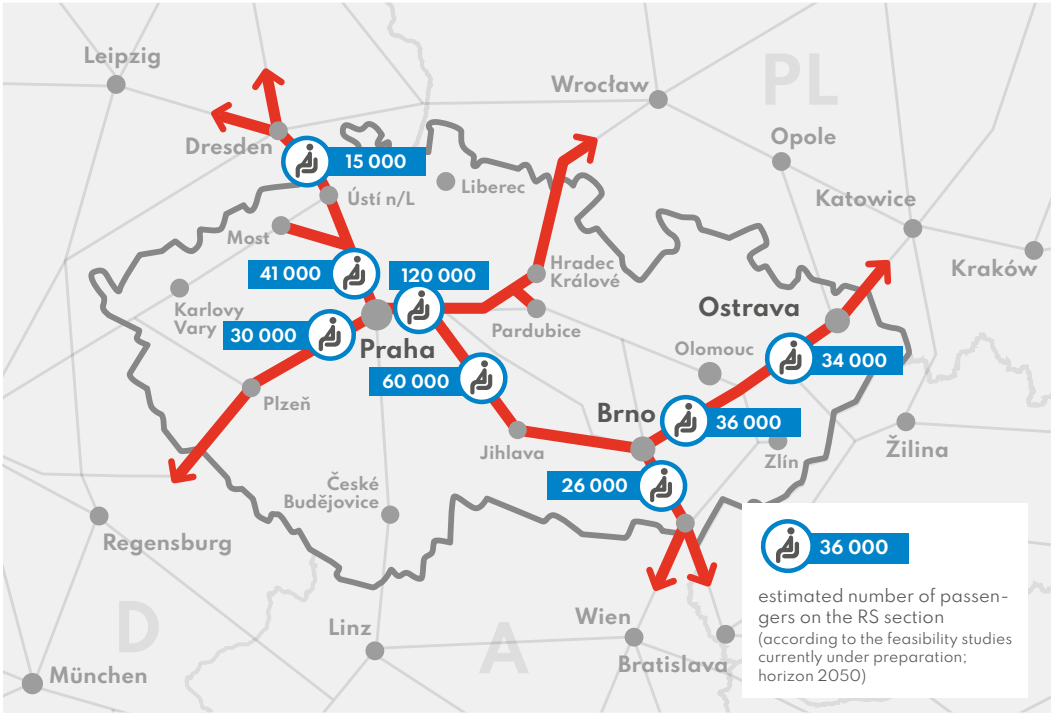
→ **Construction-related risks** – danger of insufficient building capacity and unforeseen factors in the course of construction (e.g. geological conditions for tunnelling).

These risks are carefully analysed and taken into account during the preparation of the HSLs, and appropriate risk mitigation measures are taken.

For current detailed information about the routing of the planned routes see:
→ **www.spravazeleznic.cz/vrt**

The state plans to invest over
€34 billion
in the new high-speed lines by 2050.

EXPECTED NUMBER OF DAILY PASSENGERS
ON SELECTED RS SECTIONS (HORIZON 2050)



IT IS WORTH IT

Feasibility studies have been prepared for the key sections of the Rapid Service to perform, among other tasks, an economic analysis to determine whether the project is beneficial for the society. The studies carried out confirm that the Rapid Service projects do indeed deliver socio-economic benefits and evaluation results exceed the pre-set economic efficiency threshold. The investment will be far outweighed by the benefits delivered by the projects.

The economic analysis carried out under the above-mentioned studies tends to rely on a rather conservative estimate of transport demand to ensure that the projects are still economically efficient in case of a less favourable development. However, experience from high-speed lines abroad as well as from the modernisation of the corridors in the Czech Republic shows that the demand usually exceeds the forecast values by a considerable margin in backbone infrastructure projects of this nature.

Economic analysis of the RS projects

Like any other infrastructure plans, all the Rapid Service projects are evaluated by feasibility studies. Their objective is to verify the projects under consideration and their variants through an economic analysis to determine whether the investment in building and operating the lines will be outweighed by sufficient benefits.

The largest item on the expenditure side is the **investment in building** the new line. The evaluation also makes an allowance for unforeseen circumstances and risks of around **25–30% of the estimated capital costs**. The project thus remains efficient, up to the rate of this allowance, even if the construction work and material prices increase or in case of complications in the further preparation or implementation of the project.

In terms of the benefits, the highest figure is that of **time savings achieved by the passengers**, who include those that currently use the railway but also those that switch to high-speed rail from road. The transfer of passengers from road (or air) transport is also associated with another important benefit component – that of **reduced emissions and noise**, which will have a **positive environmental impact**. Equally important are also the benefits for freight and regional transport on the conventional lines after their capacity has been freed up by segregating the long-distance trains. The high-speed lines will bring about a number of other benefits which are currently difficult to quantify accurately, such as **higher attractiveness for housing and the development of services** in the communities and regions served by the high-speed trains.

For example, the project the **Prague–Brno–Břeclav high-speed line** in its 320km/h variant (including the new line between Prague and Benešov) shows the **benefit-to-cost ratio of 1.4**. It means that **the benefits of the project exceed the costs by 40%**. The project is thus significantly economically efficient in terms of society as a whole.

SPEED OF 320 km/h

The analysis conducted under the feasibility studies has shown that the design of the new line with high-speed parameters does not vary much in terms of capital expenditure based on whether the line is designed for speeds of 250 km/h, 300 km/h or 320 km/h. **Higher running speeds lead to shorter journey times, higher competitiveness, and greater time savings for a much wider group of passengers**. Because of that, the 320km/h variants achieve better economic results despite the slightly higher operating costs. Building the new lines for the highest speeds possible is therefore beneficial by being more advantageous economically and strategically.

The line speed of **320 km/h is also currently the top speed** that has been tested in routine operation in European conditions, including the existence of the applicable regulations and standards. Thanks to this, the lines designed for this speed can be prepared and proceed with implementation rather quickly. In terms of their routing, the new high-speed lines have even been designed for speeds of up to 350 km/h, which creates a margin for further development based on advances in demand and technology.

DRAWING INSPIRATION FROM EXPERIENCE

The Czech Republic has had experience in the preparation and construction of lines designed for speeds of **up to 200 km/h**. It would be an arduous and lengthy process to prepare all the technical regulations and standards for high-speed lines. For that reason, the decision was made to work closely with **France** to adopt their experience in building high-speed line and implement it in the Czech settings. In the preparation, construction, and operation stages, we will therefore be able to draw on decades of experience of our French colleagues to avoid many mistakes and dead ends that would otherwise lead to unnecessary complications and delays.

Following the French model, the new high-speed lines will be built for the speed of 320 km/h and they will be designed for high-speed passenger trains as well as special freight trains that transport post and parcels and whose technical specifications will be derived from high-speed passenger trains. For example, this is how the **Litoměřice–Prague–Brno backbone rail section**, the **southbound section from Brno**, and the **section from Přerov to Ostrava** will be built.

Photo: olrat / iStock images

A specific role will be played in the high-speed rail system by the **section between Litoměřice**, **Ústí nad Labem**, and **Dresden**, which will also be used by conventional freight transport to increase the transport capacity and eliminate noise pollution in the valley of the Elbe. This section will consist of two long tunnels – the Středohorský and the Krušnohorský Tunnels. The Krušnohorský Tunnel will be designed and built according to **the German model for high-speed lines to allow the operation of conventional freight transport**. Close cooperation with **Germany** has been underway to prepare the tunnel and the experience gained will be used for other projects in the future. This applies, for example, to the **tunnel between Prague and Beroun**, which will also be designed to accommodate conventional freight trains.

The new lines will meet all the technical specifications for interoperability, which ensure the full mutual compatibility of rail infrastructure throughout Europe.

INFRASTRUCTURE FOR RELIABLE OPERATION

In terms of the number of passengers, the Rapid Service system will perform a role that is completely different from that of today's conventional rail. In some aspects, it will literally be the **backbone of the transport system in the country and in Central Europe**. Its position will be comparable to that of the underground in large cities. This also implies the required level of reliability of the entire system, which must be much higher than that of conventional rail as we know it. Infrastructure parameters and properly set traffic control principles are crucial for railway reliability. For that reason, maximum attention must be paid to these criteria in the design of each line – in particular, to the critical points where they interface with conventional rail, which generally tends to be a more common source of unreliability than high-speed rail. From this perspective, the most problematic points include railway nodes and the connecting conventional lines on which services that transition to/from high-speed lines will run.

The connection of lines intended for high-speed trains to railway nodes must be designed with the highest possible degree of segregation from other railway segments in mind. The ability to take high-speed trains all the way to city centres on conventional lines is a great advantage of European high-speed train systems. This is how the relevant infrastructure has been designed in the Czech Republic, in accordance with the underlying principles of the Rapid Service project. However, it is also necessary to eliminate the possibility of conventional trains becoming the source of unreliability for high-speed rail. At the largest nodes, it is also necessary to keep in mind alternative routes in case of emergencies so that the majority stream of high-speed trains can be rerouted to diversionary routes to prevent the backbone system from being blocked for several hours. **The railway nodes need to be designed and executed with sufficient capacity and robustness** to ensure that they do not become a infrastructural bottleneck. **The node must remain operational even if the operation of one of the elements is restricted**. Similar rules also apply to the connected conventional lines, the operation of which is interconnected with the high-speed system. They should be upgraded and their capacity should be increased to

Photo: © Siemens Mobility, 2022

Similar rules also apply to the connected conventional lines, the operation of which is interconnected with the high-speed system. They should be upgraded and their capacity should be increased to ensure that trains can enter the high-speed line within their time slot even if there is a delay on the conventional network. At the high-speed line speeds of up to 320 km/h, a delay of five or ten minutes can have adversely affect service by trains tens of kilometres away from the critical point.

TECHNOLOGICAL PROGRESS ON RAIL

The high-speed rail project will also **contribute to a technological leap on Czech railways**. Firstly, the preparation and construction of high-speed lines implies the application of state-of-the-art technologies of the 21st century. Secondly, it also contributes to the spill-over of these solutions onto the conventional network. With this, the conventional rail will free itself of outdated and obsolete solutions which, until recently, were thought "sufficient" for operating a conventional rail, which tended to be a complementary component rather than one of the backbones of the national transport system.

As high-speed rail develops in Europe, we can already begin to **install the advanced ETCS**, which was originally intended to be mandatory on new high-speed lines but its implementation has been extended to conventional rail over time. The plans to build high-speed lines* into the northern parts of the Czech Republic were also an impetus for the ongoing **project of converting the existing electric traction system from 3 kV DC to 25 kV AC 50 Hz**, which will have the significant effect of improving conventional line performance, enabling easier and cheaper electrification of previously unelectrified sections, and easier deployment of emission-free battery-powered vehicles on services that use these lines to charge the batteries from the overhead line. A number of examples of infrastructure improvements derived from high-speed lines could follow.

High-speed rail has already brought about a number of **improvements in the area of the rolling stock**. We now take for granted that the new conventional vehicles are equipped with air conditioning, automatic doors, closed-loop toilet systems, and many other improvements that trickled down to conventional rail from high-speed rail and that were far from commonplace even in the vehicles of the 1990s.

However, the technological development of rail is far from done because Czech and European railways continue to face many challenges that need to be overcome to make the whole system more efficient and user-friendly. High-speed rail, being the flagship in the field, will also be a valuable opportunity for R&D institutions and the academic sector.

*According to European technical specifications, high-speed lines may only be electrified using AC power (25 kV 50 Hz in the Czech conditions).

STATIONS FOR THE 21ST CENTURY

The new concept of rail in the national transport system will place **high demands on the standard and equipment of the railway stations** on the high-speed lines as well as of the stations and stops on the conventional network which will be connected to the high-speed line network directly or with a transfer. **The direct service of city centres** by high-speed trains using existing stations will place **higher demands on the capacity and facilities of the stations**, the design of which often meets the needs of the late 19th century railways. As the stations are the gateway to the rail and often create the first impression, they must be gradually modified to meet the requirements of the 21st-century passenger. Stations must be **designed or reconstructed with the passenger** at the centre of attention.

Photo: georgeclerk / iStock images

New railway stations **must be clearly organised**, **comfortable**, and **safe for passengers**. Naturally, their facilities and services must be adequately match the importance of the station. Today's passengers' expectations are not only to travel from A to B but also to use auxiliary services that make travel more attractive and save time. The portfolio of the services offered at railway stations and terminals must also prepare for new groups of customers who do not rail transport today but will start to after the high-speed lines are completed. This applies, for example, to **"lounges"** – premium waiting rooms with catering and other services, not unlike airport lounges.

Adequate facilities to serve the passengers are also an important part of the railway station design. Railway transport should include as a quality standard the **high quality of the architectural solution** of the newly designed or modernised passenger areas, as it was the case when the railway was built in the 19th and early 20th centuries. High architectural standard should be achieved by **architectural competitions**, which should be used as the tool to select the appropriate design proposal for the reconstruction/construction of the passenger and service buildings of the railway station. If terminals are built away from developed areas, the **surrounding urban structure must also be designed as part of the terminal design**

because these terminals will become the nucleus of development, with new projects springing up around them. This, too, offers the opportunity to select a quality design of the urban structure through architectural competitions.

If the new rail is to become synonymous with a system of high quality and functional standards, every detail of the station design should reflect this. **The information and navigation system** is one of the important elements as it is used by virtually 100% of passengers. It must be simple, intuitive and easily visible while having a high aesthetic value because it influences how passengers perceive the atmosphere of the station. The information and navigation system must rely on the same principles across the entire rail network. The information system will provide passengers in real time all the information needed for their travel. An important feature of the information system is interconnection with information from the transport operator so that passengers waiting for their train always get up-to-date information about train arrival and departure times, train position on the platform, marshalling, and any incidents.

NO LONG AIRPORT-LIKE WAITS

While high-speed rail transport may resemble air transport in many respects, including the station facilities and services, there is a **major difference in terms of passenger check-in and handling procedures because**, **like on today's conventional rail and unlike at airports**, **there is no need for long waits and checks**. Any obstacles and complications in passenger handling are undesirable in terms of the competitiveness of the system. On the contrary, the trend of electronic check-in is gaining momentum, and paper tickets and the related queues at the ticket counter will gradually become a thing of the past.

COMMUNICATION WITH ALL STAKEHOLDERS

With a view to the smooth implementation of the Rapid Service project, it **is necessary to continue to coordinate the plans with the Czech regions and municipalities** and introduce the concept to the general public. The preparation of the high-speed lines must therefore include as its integral part a strategy for communication between the state on the one hand and local government bodies, citizens and interest associations on the other. The aim of this cooperation should be mainly a high-quality project and involvement in the design to integrate the stations in the urban landscape or the railway line in the natural landscape.

THE NEW LINES ARE LANDSCAPE-FRIENDLY

High-speed rail lines, conventional lines, motorways and roads have an impact on the territory that they intersect. Firstly, it should be emphasised that even a high-speed line is basically still an "ordinary" electrified double-track line that only includes a slightly higher share of artificial structures to overcome natural obstacles. **In comparison with motorways**, for example, which have been routinely placed in the Czech landscape for decades, **the land requirement of a high-speed line formation is roughly half the size**.

COMPARISON OF THE WIDTH OF A MOTORWAY AND HIGH-SPEED LINE STRUCTURE

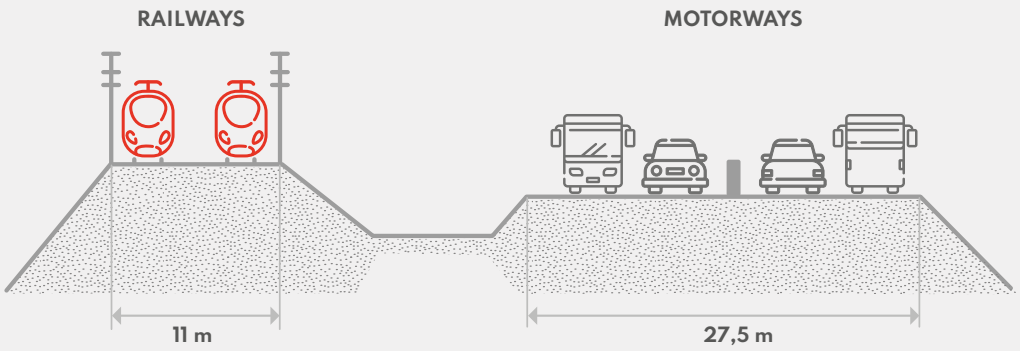
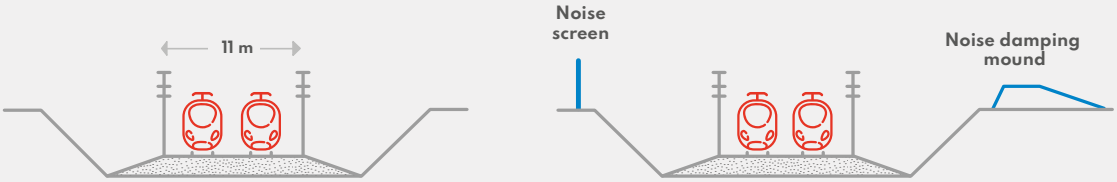


Photo: © Siemens Mobility, 2022

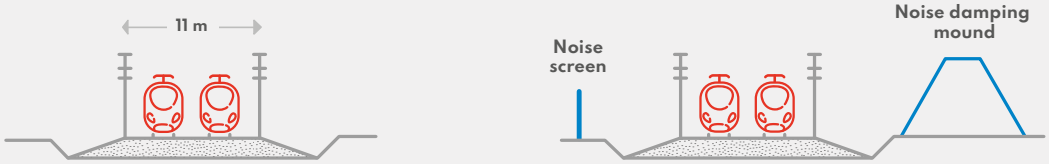
The aim is to limit the impacts on the surrounding area. The high-speed lines will be prepared so that the design is **sensitively integrated in the landscape** while **minimising the barrier effect** of the linear construction. The undesirable fragmentation of the landscape can be eliminated using artificial recesses at certain points or, conversely, **using bridge structures**. In addition, there are many ways of sensitively **protecting the surrounding area from noise**. The new line must meet all the noise protection requirements. Otherwise it would never be issued the required permits.

NOISE PROTECTION OPTIONS (data: Správa železnic)

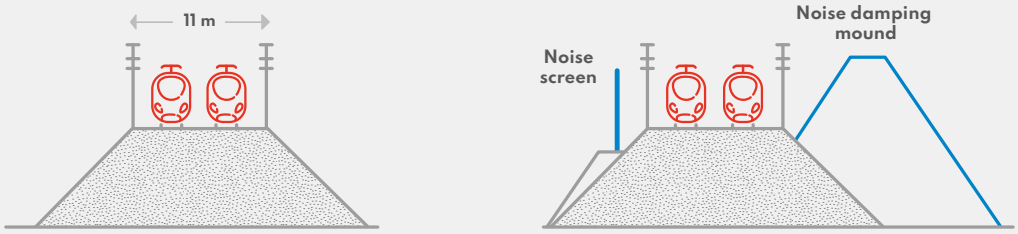
TRACK BELOW GROUND LEVEL



TRACK AT GROUND LEVEL



TRACK ON EMBANKMENT



High-speed lines and agriculture

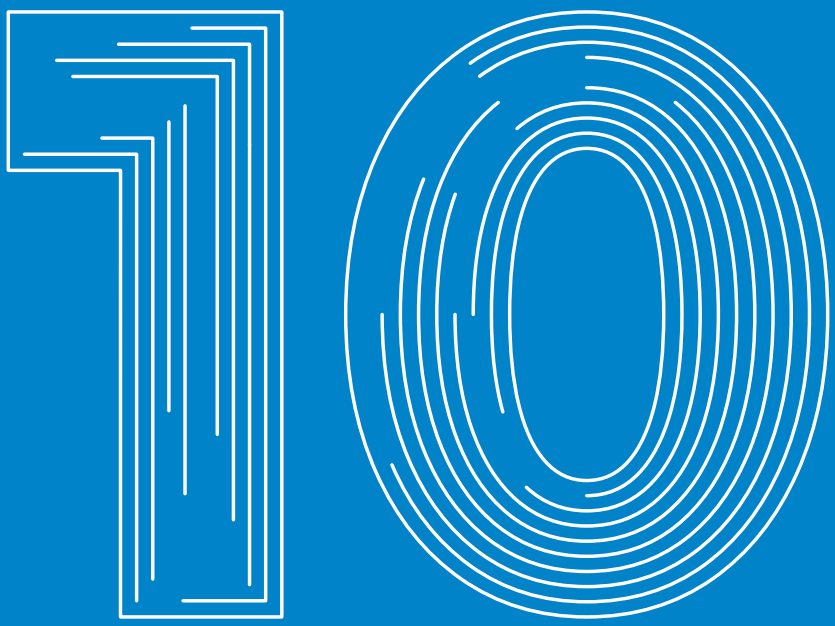
The reality of climate change impacts all areas of human activity.
Legislators tackle it in two ways:

- → **mitigation measures** seeking to stop climate change by moving away from fossil fuels
- → **adaptation measures** seeking to adapt to climate change

93% of the energy for transport in the Czech Republic is generated from fossil fuels (oil products and natural gas). By producing about 20 million tonnes of carbon dioxide per year, transport exceeds both industry and heat production. **Replacing car transport with rail**, **which is roughly eight times less energy-intensive**, **not to mention the environmentally friendly electric rolling stock**, **is a major mitigation measure**.

Climate change has had, and will have, a severe impact on agriculture. One of the **essential adaptation measures is land-use change**. The DZES 7d (GAEC) standard has recently become applicable in the Czech Republic. Its primary objective is to **improve landscape structure**, **biodiversity**, and overall **water retention in the landscape** as well as to reduce the loss of arable land by erosion. The function of the required **visible division of land blocks of over 30 hectares with a buffer strip at least 22 metres wide** according to GAEC 7d can also be rationally performed by a landscape feature having the form of a high-speed rail. When routed across land block larger than 30 hectares, it may partially substitute the mandatory division by buffer strips that are put in place to retain water, support plant and animal biodiversity, and limit erosion.

There is another agriculture-related effect of high-speed rail that cannot be overlooked. At present, arable land intended for growing food crops is being depleted of areas allocated to technical crops for producing biofuels for automobile internal combustion engines. The **high-speed rail between Prague and Brno can replace car transport with an annual fuel consumption of about 267 million liquid fuels**. Considering that the share of biofuel additives was 5% until recently, this **will save about 13 million litres of liquid biofuels**, whereby the high-speed line between Prague and Brno will free up about **12,000 hectares of fertile land for growing food crops**, i.e. for the primary function of agriculture.



HIGH-SPEED RAIL OPERATION

In some directions, trains will run nearly as often as urban public transport vehicles. Different categories of high-speed trains will transport passengers at speed and in comfort to remote and nearby destinations.

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Photo: Boarding1now / Dreamstime.com

10 HIGH-SPEED RAIL OPERATION

4 HIGH-SPEED TRAIN CATEGORIES

SPRINTERS as planes on tracks for the fastest connection between the most important Czech and Central European cities

EXPRESS TRAINS to all regional capitals and international metropolises at speeds of up to 320 km/h

FAST TRAINS to all major regional centres

SUBURBAN FAST TRAINS for even better service within metropolitan areas

New high-speed trains will be purchased for the Rapid Service system.

The standard will be **1st and 2nd class** with **modern equipment**, **high-quality catering**, and detailed attractive, sophisticated design.


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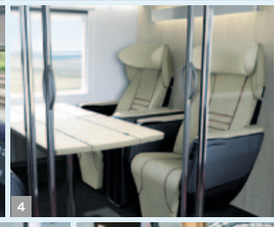
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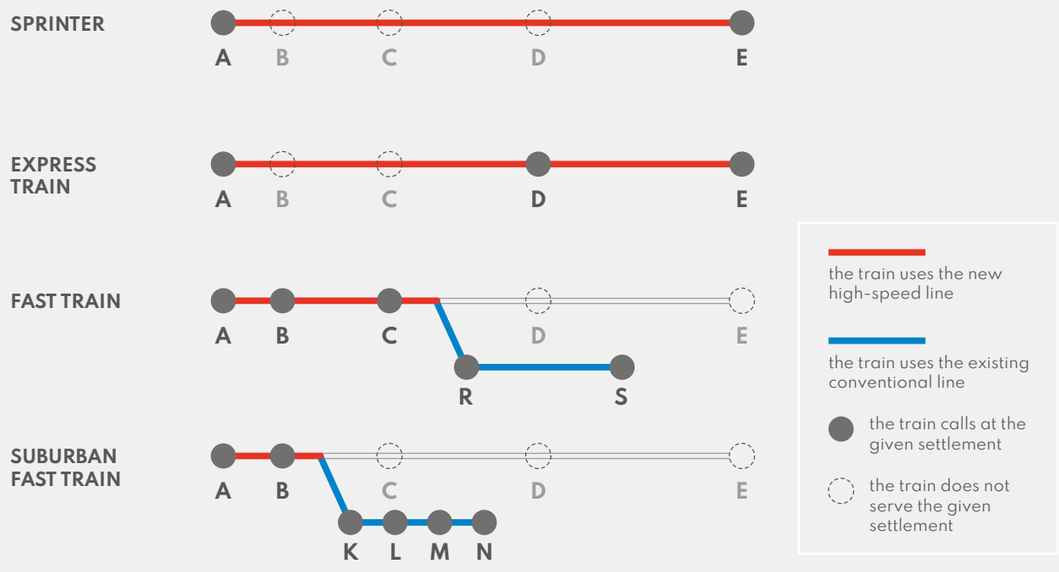
4 HIGH-SPEED TRAIN CATEGORIES WILL ENSURE GENERAL AVAILABILITY OF FAST TRAVEL ACROSS A WIDE AREA



The high-speed trains will be fully integrated in the Czech public transport system and, as such, they will be accessible to most of the population.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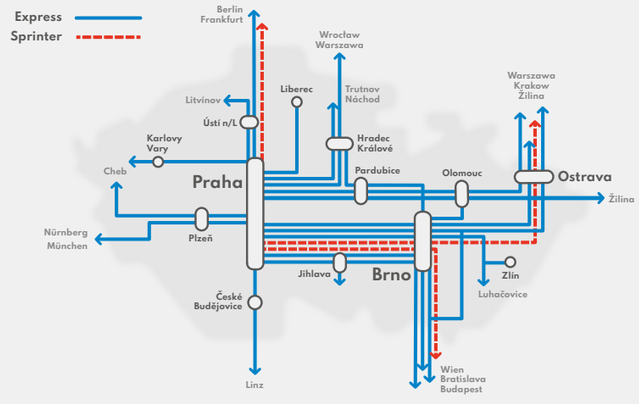
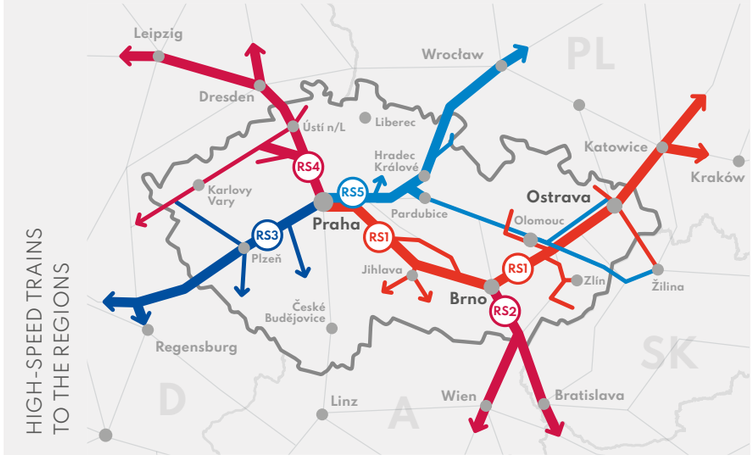
EXPRESS TRAINS INTO ALL REGIONAL CAPITALS



HIGH-SPEED TRAINS TO THE REGIONS



Integration in the public transport system

- The RS trains will be a part of the national long-distance transport system.
- For the RS trains running every 60 or 30 minutes or even more frequently, there will be connecting services into cities and regions from the railway nodes.
- There will be regular service all day long.
- The trains will be integrated into the **"OneTicket"** single tariff.

one ticket
jedna jízdenka

Photo: **1–6:** © Siemens Mobility, 2022, **7** – Teka77 / iStock images, **8** – Boarding1Now / iStock images, **9** – © Siemens Mobility, 2022, **10** – Vividaphoto / Dreamstime.com, **11** – České dráhy, a.s. archives, **12** – PeterSkuce, Wikipedia.org, CC

HIGH-SPEED RAIL OPERATION

The Rapid Service trains will truly revolutionise the accessibility of places in the Czech Republic and abroad by public transport. In order to make benefits, in the form of reduced travel times and more frequent services, available to the broadest population groups, the Rapid Service trains will be fully integrated in the long-distance and regional rail transport system. By connecting the new lines to the major hubs and to other existing railway lines, high-speed trains will also be able to serve more regions.

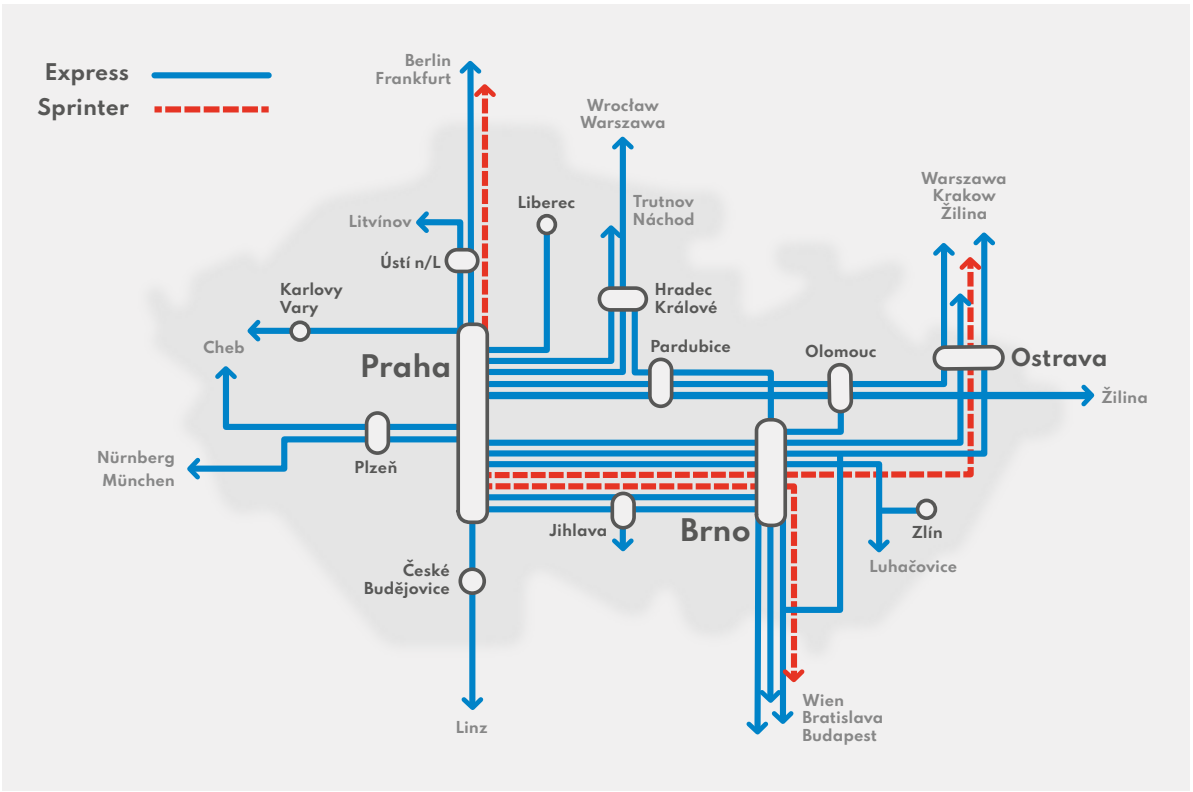
EXPRESS TRAINS – RAPID SERVICE BETWEEN REGIONAL CAPITALS

Much like today's conventional rail, the Rapid Service system as a whole will rely on express trains that connect regional capitals and important cities abroad, now, however, at speeds of up to 320 km/h. The services will be much more frequent than they are today. **Each express service will generally run on an hourly timetable**, with frequency of service being even higher on the busier sections as multiple services stack up.

Together with express trains running on other important lines, the express trains running on the Rapid Service lines will form a **comprehensive and interconnected backbone network to link all the regional capitals together**.

For example, the target is to run **4 express trains (plus 2 Sprinter trains)** per hour **between Prague and Brno** and **2 express trains** per hour **between Prague and Ústí nad Labem**. In some directions, trains will run nearly as often as urban public transport vehicles.

EXPRESS SERVICE BETWEEN REGIONAL CAPITALS



SPRINTERS – AIRPLANES ON RAIL

The construction of high-speed lines will make it possible to **offer a very fast and attractive service on certain routes for distances of up to 800 km**, for which air travel is currently used as the primary mode of transport. For example, it will be possible to cover the distance **between Berlin and Vienna in about 4 hours** after the introduction of the super-fast Sprinter trains. In addition, these trains will also benefit Prague and Brno by gaining an even faster connection option to Germany and Austria.

Another example of a route that is suitable for the introduction of such trains is the line **connecting the Ostrava region with Prague**, which is already served by several types of high-speed trains. Not only will the Sprinter trains speed up the service between the Moravian-Silesian Region and Prague, but they will also separate passengers travelling directly between Ostrava and Prague, thus freeing up the very busy backbone express trains on the Ostrava–Brno–Prague route for intermediate traffic. Selected Sprinter trains are also foreseen to run all the way to/from Warsaw, thus establishing a **very fast service connecting Warsaw**, **Katowice**, **Ostrava**, **Brno**, and **Prague** with a journey time of about **4 hours** before the route via Wroclaw is completed to reduce the travel time from Prague to Warsaw even further.

The Sprinter train network can be expanded even further by introducing additional high-speed international services under the Trans-Europe-Express 2.0 concept. It is important that we have the infrastructure in place for these services in the form of high-speed lines as well as sufficient hub capacity so that the trains crossing Europe over long distances do not lose time and competitiveness because of delays to other trains on the network.

→ for more → CHAPTER 5

Sprinter tradition on our railways

Photo: National Technical Museum archives

Sprinter trains might appear to be an untried novelty in Czech conditions. In fact, quite the reverse is true. Historically speaking, the first sprinter on our rail was the **Slovenská Strela** (**"Slovak Arrow"**) service, which began to run **between Prague**, **Brno**, and **Bratislava in the 1930s** with journey times much shorter than other long-distance trains of the time. The service was aimed primarily at business travel, and the services offered on the train, such as refreshments delivered to the passengers' seat, were also innovative for the time.

As the time of WWII and then the Communist era did not favour the development of fast, business travel-oriented trains, new developments in this segment did not occur until the 1990s. The SuperCity Manažer train was the harbinger for the new railway era, laying the foundations for what is now a systematic offer of sprinter trains between Prague and Ostrava, the SuperCity Pendolino service. High-speed lines will enable the sprinter train segment to develop on many other routes.

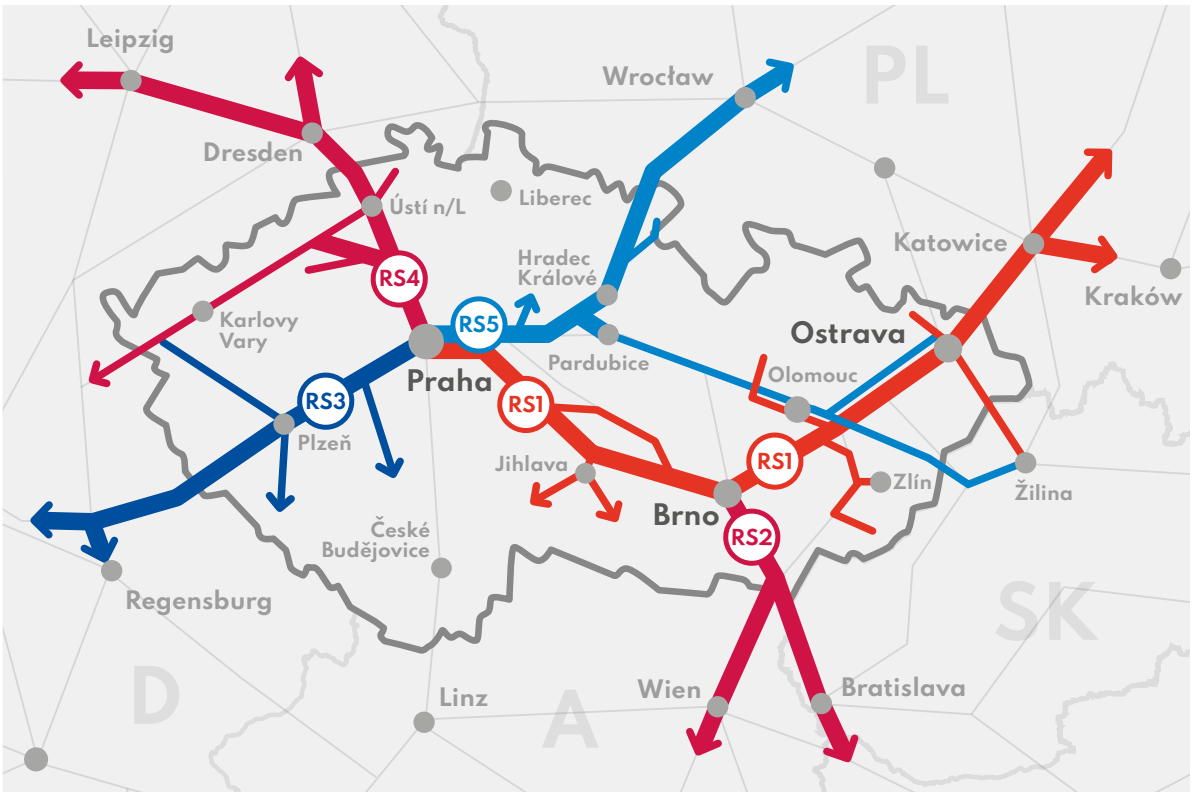
Photo: České dráhy, a.s. archives

HIGH-SPEED TRAINS TO THE REGIONS

The Rapid Service trains will also **connect the regions with large metropolitan areas and with each other**. This service will rely on the use of fast trains which will partially use the high-speed line along the way, enabling very fast service to the regions by connections to other lines. These trains will achieve speeds of **200–230 km/h** (and more on some services) and they will run **every hour**. This will give the regions an unrivalled connection to the long-distance network to open up new possibilities of commuting for work, school, and cultural events. These regions will also become more accessible to visitors from other parts of the country.

→ for more → CHAPTER 6

HIGH-SPEED TRAINS TO THE REGIONS



HIGH-SPEED SUBURBAN TRAINS

In the hinterland of large cities, especially Prague and Brno, the new high-speed lines can also be used for **high-speed suburban transport at a speed of 200 km/h**. This will expand the metropolitan hinterland to cover a wider area to help tackle the rising housing prices in these cities and rural depopulation, for example. These trains will enable daily commute to the cities across much greater distances. In addition, many people who drive on the motorway today will be able to change to these high-speed, reliable trains to avoid traffic jams, with the benefit of improving the environment in large cities.

For example, the new lines will make it possible **to reach Roudnice nad Labem in 20 minutes**, **Benešov in 23 minutes**, and **Nymburk in 30 minutes** from the main railway station in Prague. **Beroun will be only 13 minutes away from the Prague-Smíchov station**, which will open up new possibilities of a fast service to **Příbram**, for example.

High-speed suburban trains can also be introduced around Brno, where fast services can be offered to locations which now only depend on the D1 motorway, such as **Velká Bíteš**, **Velké Meziříčí**, and **Vyškov**.

It will become possible to offer high-speed service to locations with a high potential for regular commute.

PRAGUE — ROUDNICE n/L
20 mins

PRAGUE — BENEŠOV
23 mins

BRNO — VELKÁ BÍTEŠ
20 mins

BRNO — VYŠKOV
17 mins

DEVELOPMENT OF INDIVIDUAL RAIL TRANSPORT SEGMENTS WITH RAPID SERVICE

Transport segment	Today	In the future
SPRINTER	only one route: Prague–Ostrava	new routes (Berlin–Prague–Vienna, Prague–Ostrava–Warsaw)
EXPRESS TRAIN	selected cities on corridor lines, interval of 1–2 hours	connection to all regional capitals at intervals of 1 hour or less
FAST TRAIN	connection between major settlements, interval of about 2 hours	acceleration of backbone lines over HSL, new routes, 1-hour intervals
SUBURBAN FAST TRAIN	limited offer, often peak-time trains only	new high-speed offer on selected HSLs and freed-up conventional lines in metropolitan areas
SLOW SUBURBAN/ REGIONAL TRAIN	the backbone of suburban transport, often facing insufficient capacity	more frequent and faster service by moving a part of long-distance trains away from conventional lines
CARGO SPRINTER	only one postal route Prague–Ostrava, outdated vehicles	more routes for post and parcel transport using HSLs and other fast lines and new vehicles
FREIGHT	freight trains slowed down by lack of capacity	faster and smoother operation thanks to new network capacity

ORGANISATION OF THE NEW TRANSPORT

The parameters of the high-speed lines will make them a huge opportunity for transport operators and customers. They will be attractive enough for commercially successful services on long-distance routes while offering transport operators brand new opportunities to order long-distance and high-speed regional transport services. **The basic principle of the Rapid Service system is that the high-speed express**, **fast**, **and suburban trains will be part of the transport service system of the Czech Republic**. These trains will be mainly operated on the basis of concessions or orders issued by the state or the region. The objective is for these trains to run on a regular timetable all day, offer sufficient capacity to manage peak times, and remain available without mandatory reservation to achieve maximum flexibility in their use. These trains will also be fully integrated in the single tariff system and will allow the use of season or line-specific commuter tickets. The timetable of these trains, much like that of today's express and fast trains, will be optimised for interchanges at railway nodes so that passengers can easily and quickly change to the connecting rail and other public transport services. This is a crucial aspect, as the Rapid Service trains will form the new backbone of high-speed transport, thus becoming the core of the entire public transport network in the Czech Republic.

Visualisation of the terminal in Roudnice n. L., Správa železnic

The **Sprinter trains** are expected to be operated both at the commercial risk of the operators and, theoretically, on the basis of a concession. The final operation model will depend on the specific route and the market situation. The two models may also be combined on certain sections on the same line or on (a) specific service(s). The basic parameter of the Sprinter trains is to achieve the shortest possible journey times between the defined major centres, similar to air services. On some routes, the trains will run on a regular timetable throughout the day; on other routes, there will be additional services at peak time or, on the contrary, long-distance trans-European services that run only once or several times per day. The only connections considered to these trains will be those that do not lead to extending their journey times or that only relate to changing to trains of the same segment.

Whatever of final ratio of commercial and concession or ordered trains, it will be crucial to set up the high-speed line capacity management system correctly by defining the speed and performance requirements for the paths allocated in the timetable. This is the only way to guarantee the optimal utilisation of the parameters and capacity of the lines. It is also one of the main ideas behind the **Timetable Redesign (TTR)** project, which is expected to be implemented in the EU in the future.

RAPID SERVICE VEHICLES

The specifications, quality, and equipment of the vehicles are a very important component of the success of the Rapid Service project. The vehicle is both the tool that allows the full utilisation of the infrastructure parameters and the main element through which the whole system is viewed by the passenger. It is therefore necessary to prevent the huge infrastructure investments from being devalued by the failure to address what seems like petty details on the vehicle side. On the contrary, a **timeless and high-quality design of the vehicles** will underscore the attractiveness of the Rapid Service system, and the principles can then trickle down to the whole rail system. Speed and convenience is what motivates people to switch to rail for their travel. Finally, it should be noted that the acquisition cost of the vehicles is lower by an order of magnitude compared to the cost of the infrastructure.

EQUIPMENT OF TRAINS FOR HIGH-SPEED TRANSPORT

	EXPRESS/SPRINTER	FAST TRAIN	SUBURBAN
Sufficient performance and speed to fully utilise the infrastructure parameters	X	X	X
Pressure-tight cars with quiet running characteristics, good soundproofing	X	X	X
Effective HVAC	X	X	X
Transport of persons with reduced mobility	X	X	X
High seats with armrests	X	X	X
Adjustable seats, footrests, table for each seat	X	X	
230 V socket / USB socket / induction charging for each seat	X	X	X
Understandable information system (visual + audible), stable WiFi	X	X	X
Optional seat reservation	X	X	
1st and 2nd class compartments	X	X	X
Interior variations depending on the requirements of different groups of passengers (individual, larger groups, families, business travellers, ...)	X	X	
Transport of bicycles	X	X	X
Minibar	X	X	
Bistro or restaurant section	X		

An important role will also be played a **clear and intuitive information system** to provide passengers with the necessary information about the train journey, services, and emergencies and to facilitate smooth boarding. It should be mentioned in this context that a regular high-speed train travelling at peak times may **carry up to 900 passengers**, which will also place high demands on the organisation of boarding, detrainment, movement around the train, catering, and so on.

HIGH PRODUCTIVITY OF HIGH-SPEED VEHICLES

In order to support the extensive operations foreseen for Rapid Service, it will be necessary to procure dozens of new sets of various parameters and equipment standards. At the same time, however, the number of new vehicles to be procured will not be as high as it might appear. This is because high-speed vehicles can be used on many more services each day than conventional rail vehicles, ultimately becoming more efficient even if only a part of the train's route runs on a high-speed line.

Photo: scaliger / iStock Photo

As an example, let us look at a service running only between **PRAGUE** and **VIENNA**. It would take 5 train sets (without backup) to serve the route on a corridor line at an interval of two hours. Using a high-speed line, the same number of high-speed trains can fully support one-hour intervals, **doubling the number of services per day**. The same would apply to a domestic route, for example, between **PRAGUE and BRNO**. In this case, achieving one-hour running intervals would take 6 trainsets on the corridor line, while the same number of trains would manage to run **every 30 minutes** on a high-speed line.

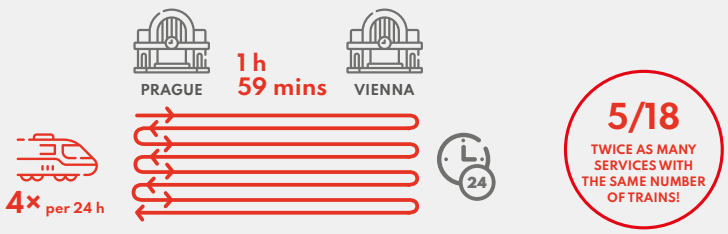
While a high-speed train may be slightly more expensive to purchase and maintain, it is also **much more productive** than a conventional train even if a high-speed line is only used along a part of the route. A high-speed train can therefore **generate much higher daily revenues** while keeping the fare rate at a similar level. It is much more efficient to operate than trains using only the conventional network. The staff payroll and many other costs are covered by the higher revenue from the passengers.

MODEL COMPARISON OF VEHICLE PRODUCTIVITY ON CONVENTIONAL AND HIGH-SPEED RAIL

CURRENT PRAGUE–VIENNA CONVENTIONAL TRAIN:

JOURNEY TIME: 4 h 05 mins **VEHICLE PRODUCTIVITY:** 1 620 km per day
1 TRAINSET DOES **2 PRAGUE–VIENNA ROUNDTRIPS** ON AVERAGE
5 SETS NEEDED TO COVER THE CURRENTLY OFFERED **8 PAIRS OF SERVICES** PER DAY, RUNNING EVERY **2 HOURS**

PRAGUE–VIENNA HIGH-SPEED TRAIN (SPRINTER):



JOURNEY TIME: 1 h 59 mins **VEHICLE PRODUCTIVITY:** 2 880 km per day
1 TRAINSET DOES **4 PRAGUE–VIENNA ROUNDTRIPS** ON AVERAGE
5 SETS NEEDED TO COVER **18 PAIRS OF SERVICES** PER DAY, RUNNING **EVERY HOUR**

DIFFERENT TYPES OF VEHICLES FOR DIFFERENT SEGMENTS

While different types of vehicles are suited to each segment of high-speed transport, certain larger groups of services should be as standardised as possible in order to ensure efficient vehicle maintenance as well as interchangeability.

The goal is for the **vehicles for the express segment** (including the Sprinter trains) to be **complete traction units for speeds of up to 320 km/h**. The basic technical and commercial specifications of the units should be coordinated with international partners so that the trains can be deployed on international routes and, if necessary, combined with foreign trainsets of the same type. These trains should be equipped to be operated in the Czech Republic as well as in Slovakia, Germany, Austria, Poland, Hungary, Slovenia, Italy, and Denmark. In case of the ambition to operate TEE services between Prague and Paris, the relevant units should also be approved for France. In terms of the variability of use, it seems to be most advantageous to procure the so-called **"half-trains"** with a length of 200 metres and a **capacity of about 450 seats**, which can be combined into long trainsets at peak times or on busy sections. The added advantage of this concept on some routes is that splitting the trainset at the end of a line section to offer direct service to more destinations. Trainsets designed for lower speeds, typically those of 230—250 km/h, will be deployed as express trains that only use high-speed lines along a smaller proportion of their route.

The same will apply to the **vehicles intended for the fast-train segment** because they will usually use the high-speed line on a part of the journey. Vehicle designed for a speed of 230 km/h appear to be the optimum choice for these lines. Their higher speed (e.g. more than "only" 200 km/h) will promote better utilisation of the high-speed line capacity and, at the same time, this speed is still the upper limit for the concept of locomotive-drawn non-traction trainsets, which may offer a more flexible solution on some routes. On the contrary, it may be more appropriate to procure even faster vehicles for other fast-train services (250—320 km/h). These trains will be traction units similar to the trainsets intended for the express train segment so that they can follow the express trains as close as possible in order to utilise the line capacity efficiently.

→ for more information about TEE → CHAPTER 5

EXAMPLES OF TRAIN ARRANGEMENTS FOR DIFFERENT TRAIN CATEGORIES

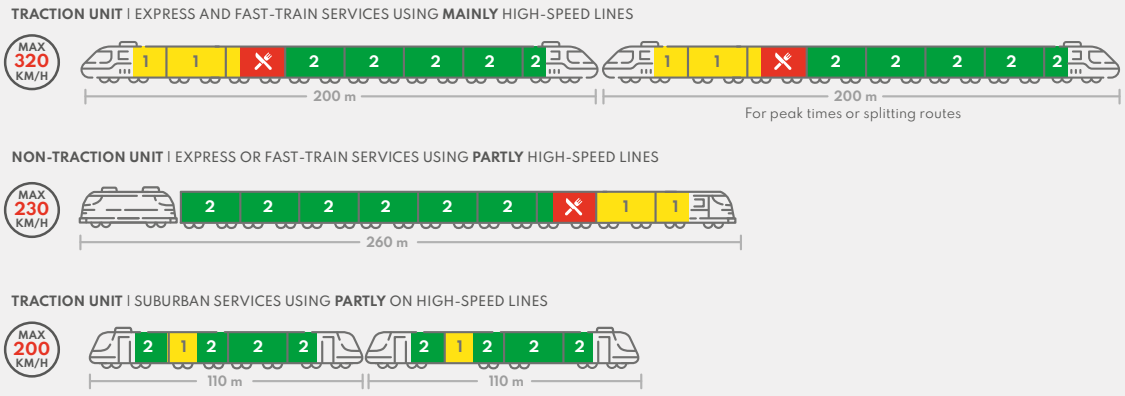


Photo: © Siemens Mobility, 2022

VEHICLE PROCUREMENT MUST START TODAY

It is important to begin the acquisition of vehicle capable of serving the future Rapid Service routes today. This is because a fundamental renewal of the rolling stock will take place on many long-distance and regional services in **2020–2030**, mostly by **replacing it with new vehicles**. Moreover, the forthcoming contract with carriers are often planned for up to 15 years with the prospect of operating the purchased vehicles under a follow-up contract for another 15 years. Hence, **these newly procured vehicles will also have been operated on high-speed lines for at least 25 to 30 years by the time their lifetime ends in about 2055–2060**. They must therefore technically qualify for operation on high-speed lines.

Photo: © Siemens Mobility, 2022

It would be a mistake to repeat the situation concerning the railway corridors, where not only were the suitable vehicles designed for speeds of up to 160 km/h unavailable when the first modernised corridor sections were put into operation 20 years ago, but this unfortunate situation persists to this day on some corridors. The Czech Republic cannot afford to take a similar approach to the acquisition of the vehicles for the future high-speed lines.

Therefore, if there are contracts being prepared for fast trains, involving the requirement for new vehicles for the services that will partly run on high-speed lines, the vehicles purchased should be **designed for speeds of at least 200 km/h**, given the foreseen period of the contracts. This applies in particular to the services that will soon be running on at least a part of the RS 4 and RS 1 high-speed line along the Ústí nad Labem–Prague–Brno–Ostrava route.

Still, it might now be premature to immediately purchase vehicles **for the target speed of 320 km/h** as trains in the express segment. It seems to be the right strategy to purchase trainsets for speeds of up to 230 km/h for these services, as this speed will already be well-usable on certain sections abroad now and on the first pilot sections of the high-speed line in the Czech Republic in the near future. Only after the completion of longer, continuous sections for speeds of up to 320 km/h in the late 2020s and early 2030s, there will be an opportunity to deploy vehicles designed for this top speed on the relevant services. The trainsets used on these services until that time will be slightly modified and reassigned to other (usually fast-train) duty on the expanding high-speed network, or they may replace the older express-train units that utilise the high-speed lines to a smaller degree.

RELIABILITY

Among other considerations, the Rapid Service system must be designed with high reliability in mind. This applies to both the infrastructure, in particular, the nodes, and the vehicles and operational organisation. The trainsets as such should be designed for high reliability, and their technical design should be robust enough to support the heavy operational duty. With a view to early diagnostics of any potential faults and failures, a brand new system of automated information transfer to the depot will have to be created to enable a flexible response to the situation and remedy most defects on the trains during night-time maintenance.

The operation concept as such must be proposed and organised **with enough reserve vehicles** to enable a flexible response to any vehicle unavailability. It would be extremely unfortunate to operate the country's backbone network with few or no spare vehicles, with subsequent forced cancellations and long delays. This principle can be guaranteed under the concession or terms and conditions, where a sufficient number of reserve vehicles should be required by the contracting authority.

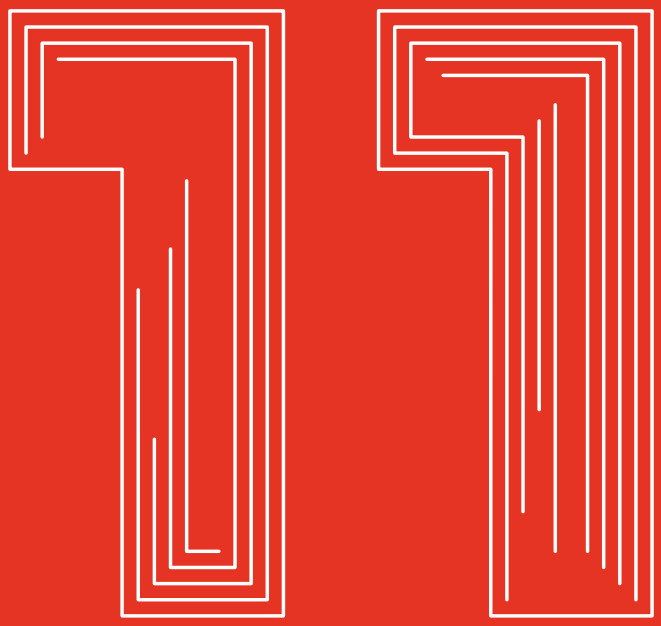
Photo: © Siemens Mobility, 2022

As the Rapid Service trains will form the backbone of transport in Czechia and Central Europe, no major cancellations or delays can be afforded as they would seriously disrupt the smooth mobility of a large number of passengers.

WHAT

WILL BE THE DIRECTIONS OF FURTHER DEVELOPMENTS?

Photo: olrat / iStock images



FURTHER DEVELOPMENT PREREQUISITES AND POSSIBILITIES

European experience shows that the construction of the core high-speed network as presented in this document will subsequently create demand for the extension of high-speed rail to cover additional destinations.

11

11 FURTHER DEVELOPMENT PREREQUISITES AND POSSIBILITIES

A balanced approach to individual and public transport is one of the hallmarks of developed countries. For that reasons, their railway systems tend to be advanced.

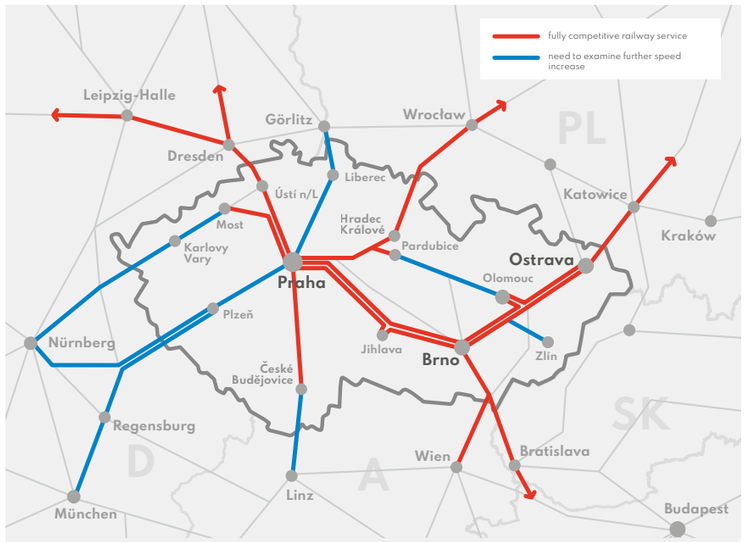
THE HIGH-SPEED RAIL WILL HAVE TO BE DEVELOPED ON OTHER ROUTES.

AN ADVANCED RAILWAY REPRESENTS:

- → high-capacity and high-quality **INFRASTRUCTURE**, modern and reliable **TECHNOLOGIES**, and comfortable and safe **ROLLING STOCK**
- → a mutually coordinated development of these components with a view to the efficient utilisation of investments on the infrastructure and rolling stock side
- → a comprehensive product centred around the passenger as the customer
- → the ability to learn from the past, find inspiration in good international practices, follow new trends and innovations


1

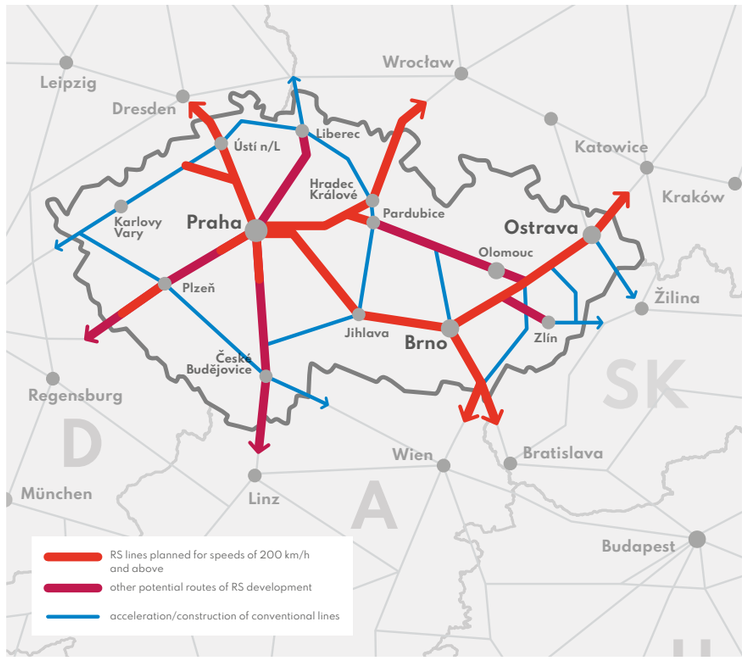
WHEN WILL THE RAIL BE FULLY COMPETITIVE?



COMPETITIVENESS OF THE RAILWAY AFTER THE COMPLETION OF THE MOTORWAY NETWORK AND OF THE CURRENTLY PLANNED HSL AND CONVENTIONAL LINE PROJECTS

It turns out that the construction of HSLs leads to the rail being fully competitive, while additional improvements will be required on the routes with predominant conventional lines.

FURTHER DIRECTIONS OF RAPID SERVICE DEVELOPMENT



It will be advisable to verify the possibility of further developments beyond the current Rapid Service plans.


2


3


PILSEN


LIBEREC


ZLÍN


ČESKÉ BUDĚJOVICE


5 NÜRNBERG


6 LINZ


7 GÖRLITZ


8 ŽILINA

Photo: **1** — visualisation of the terminal in Roudnice n. L., **2** — © Alstom SA_Speedinnov SAS 2020.D&S / Avelia Horizon™, **3** — © Siemens Mobility, 2022, **4** — Norbert Aepli, Wikipedia.org. CC. **5** — DALIBRI, Wikipedia.org. CC. **6** — DALIBRI, Wikipedia.org. CC. **7** — Manecke, Wikipedia.org. CC. **8** — Vojtasekd, Wikipedia.org. CC

IN PLACE OF A CONCLUSION – A FOUNDATION FOR FURTHER DEVELOPMENT

One of the characteristics of the transport systems of developed European countries is that they provide the option of using a high-quality, fast and interconnected public transport network in addition to individual transport. This supports the mobility of wide groups of the population, including those who cannot own or drive a car for any reason. The quality and speed of high-speed rail can make public transport attractive not only for those who have to travel by public transport but, on a larger scale, also for those for whom using public transport services is a matter of free choice.

In doing so, high-speed rail contributes to meeting a number of societal goals aimed at **improving the quality of life of individuals and regional communities, environmental improvement**, **reducing CO_2 emissions in transport**, **expanding the range of opportunities for work and leisure**, **access to education**, etc. Each mode of transport plays an indispensable part in this respect.

High-speed rail helps develop the generally accepted advantage of rail transport being efficient in its ability to transport large concentrated streams of persons and goods fast. By increasing capacity, the Rapid Service project will promote the development of all three backbone segments – **long-distance passenger transport**, **suburban passenger transport**, **and long-distance freight transport**. The improved accessibility of many regions by rail will also contribute to revitalising regional transport in rural areas by ensuring interconnectedness with other means of public transport.

The high-speed rail project is a logical product and a continuation of the ongoing revitalisation of the Czech railway system. During the previous decade, the Czech railway literally caught its "second wind". The improved infrastructure and services provided by the operators on selected backbone routes have increased the traffic to a point where the railway took only several years to **reach its capacity and technological limits**. It is certainly important in this regard to continue to disseminate modern technologies, in particular, in the areas of security and power supply, in order to improve the level of security, performance, and reliability. However, it is a precondition for further development to boost the capacity of the system along its critical sections and increase the speed along the main routes. That is the only way for the Czech railway to effectively fulfil its role as a fast and reliable backbone of Czech and Central European transport. It can be said, with a bit of overstatement, that the railway system needs to be completed by adding "rail highways" to completely reorganise transport relations.

LEARNING FROM PREVIOUS MISTAKES AND MONITORING NEW TRENDS

The development of all the basic components of the rail system – i.e. infrastructure, technology, and vehicles – must proceed in a coordinated fashion. The experience of the transit corridor modernisation project highlights the issue of the infrastructure development not being accompanied by sufficient developments in the other two components – technology and vehicles. That is why today we have what looks like modern corridor lines, but they are secured by a system that is more suited to the slow-moving coal-trains of the past than the express passenger and freight trains of the present, and they are powered by a 3kV system designed for outdated low-power locomotives rather than the modern 6-megawatt machines. The imbalance can also be seen on the vehicle side, as the maximum line speed of 160 km/h cannot be achieved by all the trains, including those running as long-distance services on the corridors.

This lack of coordination must not be repeated with the high-speed rail project. In terms of technology, the situation is much "easier" today, **thanks to the common European technical specifications**, which only allow the most advanced technologies for high-speed

rail. In the area of vehicles, the preparations must start now. Most of the rolling stock operated today, dating from various eras of the 20th century, will reach the end of its service life within the next decade. It would be a grave mistake not to replace these vehicles with new ones that will be capable of taking advantage of the parameters and possibilities offered by the future high-speed rail. While a high-speed vehicle, procured with a certain degree of generosity, can also be temporarily used on conventional infrastructure, a conventional vehicle of inadequate specifications can hardly be used to operate on the future high-speed infrastructure.

Generally speaking, high-speed rail is the flagship of progress and an impetus for the development and modernisation of the entire railway sector. It is therefore important to monitor the infrastructural and vehicle innovation and new technologies and to be ready to implement them on an ongoing basis. This will allow us to continuously improve the performance and effectiveness of the foreseen system. For example, the new generation of vehicles, currently in its advanced stages of development, will be up to tens of percent more efficient than the current vehicles. This is a considerable benefit, especially given the circumstances of ever-increasing energy prices.

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Visualisation of the Prague-East – Nehvizdy terminal, Správa železnic

THE HIGH-SPEED RAIL WILL HAVE TO BE DEVELOPED FOR OTHER ROUTES

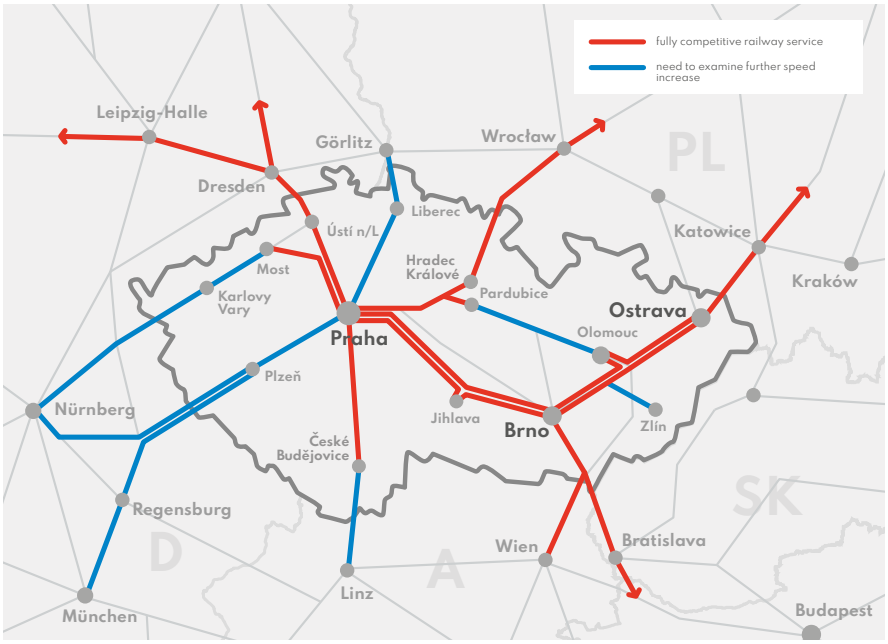
In terms of the timeframe, this document describes what can be seen as the first stage of high-speed rail development in the Czech Republic. It covers the traditional and **very busy routes bound southeast**, **northeast**, **and northwest from Prague** and onwards into neighbouring countries. This is a logical step in that, in addition to the desirable speed increase, it will provide the much-needed capacity boost for these heavily used routes. This approach also demonstrates that the availability of historically relatively good infrastructure attracts demand. And **where there is demand**, **there is also the need for further improvements in the form of high-speed lines**.

The situation is different on other routes, especially going southwest or south from Prague. Because of the relatively less-developed infrastructure and a less dense population, rail plays a much smaller part, specially on an international scale. This is also reflected in the fact that even the development plans are far less generous for these routes. The high-speed railway for these routes will only have conventional specifications, albeit with speeds of **up to 200 km/h**. This change, too, will bring about significant improvements compared to the current status.

It can be assumed that it will become reasonable to extend the high-speed railway onto other routes in addition to those for which it is planned today. Indeed, European experience shows that the construction of a core network of a certain scale will subsequently create demand for the extension of high-speed rail to cover additional destinations. While the **Sprinters travelling between Vienna and Berlin take 4 hours to cover 750 km**, **the trains between Prague and Munich will take the same 4 hours to cover half that distance**. This situation may certainly create new challenges to be addressed internationally, not least so because **Bavaria** is one of our country's leading economic partners.

Similarly, domestic efforts can be expected to equalise the differences in regional accessibility as **Pilsen** or **Liberec**, found at roughly the same distance from Prague as Ústí nad Labem, Pardubice, or Hradec Králové, will hardly settle for the longer journey times. Looking ahead, it also seems necessary to increase the speed and capacity of the route to **České Budějovice** and **Linz** beyond the current modernisation of Corridor IV. **Comparison with the motorway** network is another important impetus for the further development of high-speed rail. For some important destinations, the travel times by train will not be favourable for rail compared to road even after the completion of the upgrade projects in the pipeline. In contrast, the routes served by lines of high-speed specifications will be competitive even with the completed motorway network. It is therefore wise to develop high-speed rail along additional routes.

COMPETITIVENESS OF THE RAILWAY AFTER THE COMPLETION OF THE MOTORWAY NETWORK AND OF THE CURRENTLY PLANNED HSL AND CONVENTIONAL LINE PROJECTS

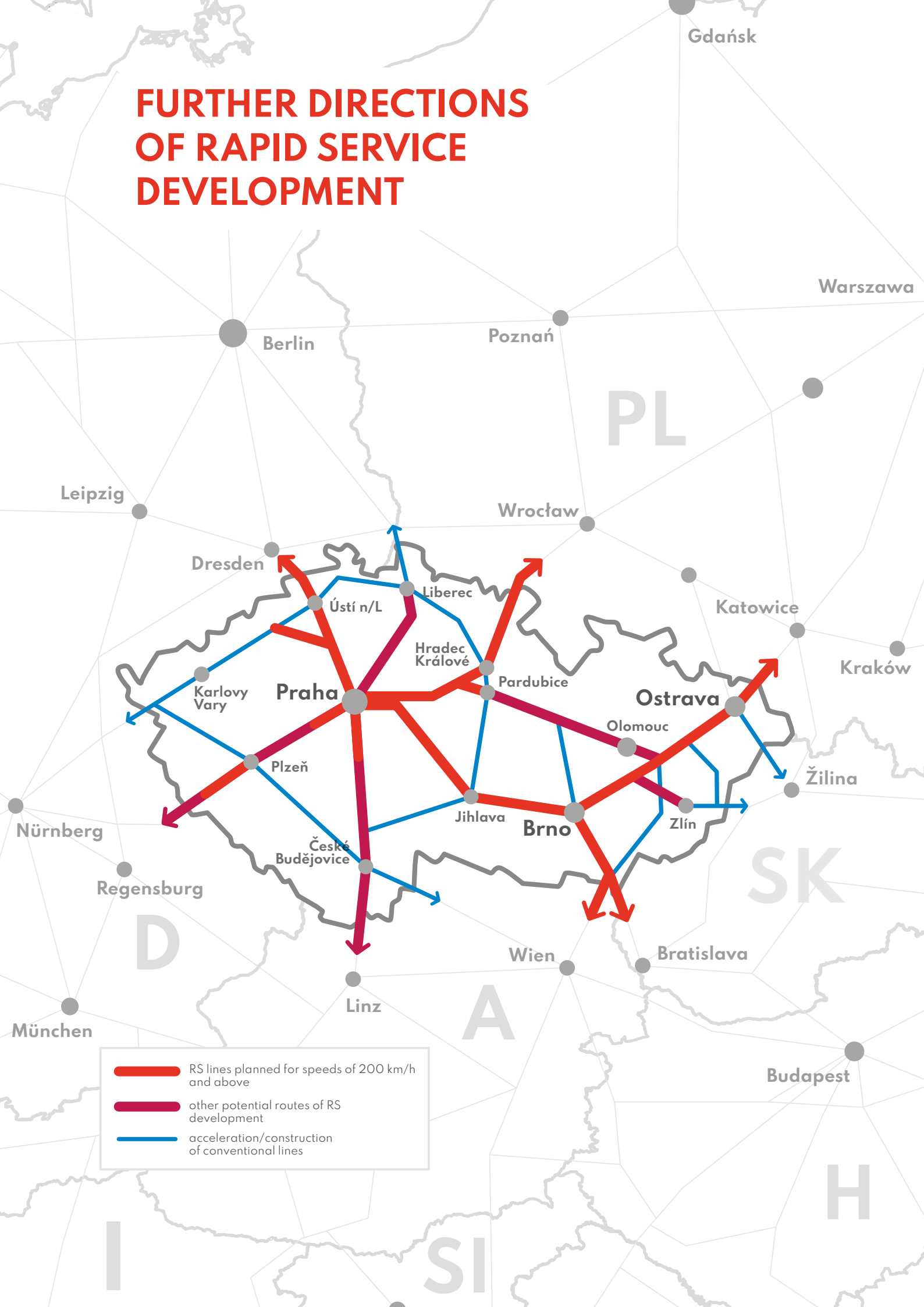


In addition to the much-needed acceleration of the backbone connecting lines, work will also need to be done on addressing the **tangential interconnections of regional capitals**. In some cases, it will be possible to use the foreseen radial high-speed lines, including the possibility of travelling fast between the cities by changing in Prague. In terms of balanced regional development, it is desirable to also modernise and accelerate the **conventional connecting lines for regional capitals**. With this, we will be able to **connect most of the area of our country to the high-speed backbone network**.

In conclusion, it needs to be said that the scope and specifications of the high-speed rail as described in this document are by no means final. Instead, they describe the first major stage, which will be followed by other new high-speed rail projects and which will be complemented by the gradual development of conventional lines.

Visualisation of the terminal in Roudnice n. L., Správa železnic

FURTHER DIRECTIONS OF RAPID SERVICE DEVELOPMENT



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Have a safe journey!

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