REGIONÁLNY PLÁN UDRŽATEĽNEJ MOBILITY

Bratislavský samosprávny kraj

Strategy delivery

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List of abbreviations:

A	Austria - Austria
ASD	automated traffic counter
B + R	Bike and Ride
BEV	battery electric vehicle
BID	Bratislavská integrovaná doprava, as
BSK	Bratislava self-governing region
BUS	bus, trolleybus
C	cyclists
CMO	central urban area
CNG	compressed natural gas
CSS	road traffic lights
CR	Czech Republic
ČSAD	Czechoslovak automobile transport
CTU	Czech Technical University
dB	decibel
DN	car accident
DPB	Transport company Bratislava, as
ECV	vehicle registration number
EU	European Union
EUR	Euro
FCEV	fuel cell electric vehicles
GPS	global location system
H, HU	Hungary - Hungary
GDP	gross domestic product
HR	border
HŠ	material damage
CHVO	protected water management area
IAD	individual car transport
IDS	Integrated transport system
IDS BK	Integrated transport system in the Bratislava region
ICT	information and communication technologies
IMR	informative speedometer
IT	information technologies
JCL	one-time travel ticket
K + R	Kiss and Ride
KR PZ	Regional Directorate of the Police Force
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LTE	high speed internet via wireless networks
LZ	slight injury
MA	Malacky
MDRR	Ministry of Transport, Construction and Regional Development
MDV	Ministry of Transport and Construction
MH	Ministry of Economy
MHD	city transport
mod.	modernization

MFA	Ministry of Health
MoE	Ministry of Environment
NDS	National Highway Company
NPR	National Reform Program
NR SR	National Council of the Slovak Republic
OA	personal vehicle
OC	shopping center
P	pedestrian traffic
P + R	Park and Ride
THE FALL	suburban bus transport
PCL	subscription travel ticket
PHEV	plug-in hybrid electric vehicle
PK	Pezinok
PŠO	afternoon peak period
PŽD	suburban rail transport
osobokm	transported person per km
QSV	degree of quality of the traffic flow
R-BSK	BSK region
RPUM	regional sustainable mobility plan
RŠH	morning rush hour
RŠO	early peak period
SC	Senec
SR	Slovak republic
SSC	Slovak Road Administration
NNW	light signaling device
STN	Slovak technical standard
SZ	fatal injury
TEN-T	Trans - European transport network
TIOP	integrated passenger transport terminal
TK	rail top
TP	technical conditions
TTSK	Trnava self-governing region
TZ	severe injury
ÚPD	land use planning documentation
VOD	public passenger transport
BEFORE	Verkehrsverbund Ost-Region GmbH
vozokm	vehicle kilometer
VPS	hydrogen filling station
VUT	Technical University
VW	Volkswagen
WC	flushing toilet
wi-fi	wireless data transmission technology
ZaD	amendments
ZAP SR	Association of the Automotive Industry of the Slovak Republic
ZSSK	Railway company Slovensko, as
ŽSR	Railways of Slovak Republic
ŽST	train station

Introduction

1.1 Strategy delivery

After the analytical part of the project "Regional Plan for Sustainable Mobility BOD (RPUM BSK)", which focused on the analysis of collected, available data and data, comes the last phase, which will focus on the vision of mobility, goals and measures on the transport network of the Bratislava region.
The main benefit of this part is mainly the recommendation of further direction of the Bratislava region in the field of transport, transport processes and transport infrastructure.
The main output of this design part of the project of the Regional Plan of Sustainable Mobility of the Bratislava self-governing region as well as the whole project is based on the previous parts (Surveys and data collection and Analytical part) design of the transport network in 2025, 2030, 2040 and 2050, together with the recommended schedule .

The design part therefore focuses on the following areas:

- The vision of mobility in the Bratislava region
- Definition of the main goals in the field of regional mobility
- Proposal of measures leading to the improvement of the traffic situation of the Bratislava region
- Solution of the transport system in individual modes of transport in the Bratislava region
- Transport model of prospective periods
- Evaluation of a summary of the proposed measures using indicators
- General overview of RPUM BSK measures

1.2 Basic summary of the analytical part

Strategy:
Sustainable mobility planning in urban agglomerations has a strong support not only in European and national strategies and directives, but also at the level of the Bratislava self-governing region. The downside is the generally low respect for the priorities of the city's strategy and policy, which is reflected both in the level of the city budget and in the budget of the BOD.

Objectives:
A number of binding documents have strictly set goals that can only be met through the coordinated development of mobility in the BOD. These are, in particular, objectives linked to reducing dependence on fossil fuels, reducing road accidents or removing barriers for public transport users, as well as changing the division of transport work.

Comparison:
Bratislava as the core city of the BSK region in the context of comparable cities has a low share of public transport with an average price level, lags behind in the share of cycling, parking regulation and modern forms of mobility (sharing, alternative drives, parking lots on the public transport network). The situation in the area of congestion or promotion of mobility services is above average.

Roads in VOD:
The integrated transport system of the Bratislava Region transports approx. 309 mil. passengers. Within BSK, inner-city roads significantly predominate with a share of up to 78%, the share of external roads is 22%. The number of trips made per inhabitant of BSK currently averages 2.59 trips per day. In public transport, the Integrated Transport System (IDS BK), which allows travel on a single ticket, has a key role to play. The number of passengers is still growing.

Processes:
Traffic planning in the Bratislava self-governing region is procedurally complex. The complication is considerable decentralization of self-government (17 city districts + 72 municipalities), unfinished property settlement (at the level of state administration and in external relations) or competence overlaps of some institutions (for example in traffic management or public space). It is also a problem in this regard to order each mode of transport by another institution

Budget:
Transport contributes to the expenditures of the budget of the capital city of Bratislava resp. BOD regularly 45-50%. At the same time, however, the funds invested in the reconstruction of roads, bridges and the modernization of railways are insufficient. Significant costs represent the annual coverage of losses from the operation of transport in the public interest.

IDS BK Network:
The basic problems of the IDS BK network include the insufficiently developed railway infrastructure in the territory of the Bratislava self-governing region and congestion on the road network, which affects the reliability of bus transport. The public transport network is also plagued by unsatisfactory transfer points and their poorer pedestrian accessibility.

Public transport network:
In recent years, the technical level of some tram lines has slightly improved and the technical level of vehicles has significantly improved, but rail transport has not been extended to high-demand areas where it is being replaced by buses.

P + R
P + R car parks in the BSK area have a capacity of only 527 places, some of which are regularly filled in the early morning hours. The accompanying phenomenon of "natural parking" in the vicinity of train stations is largely widespread in the BOD.

Active mobility
In the area of active mobility, a growing trend can be traced to the use of bicycles for city transport. The network of walking and cycling routes is missing throughout the BSK, but especially in the outskirts of Bratislava and also in connection with the existing cycling routes in the Bratislava self-governing region. The built-up area of the compact city suffers from the discontinuity of cycling measures on the main routes.

Cars
BSK and especially the capital of the Slovak Republic Bratislava with its high degree of automation (almost 500 vehicles per 1000 inhabitants), ranks among the leading places in Europe. The car is occupied by an average of 1.3 people, the dimensions of the vehicles are increasing.

Communication network
A fundamental problem of the Bratislava region is the slow construction of a superior communication network. Infrastructure development is generally unable to respond at the same pace to the development of buildings around the city. The use of the network (including newly built sections of circuits) is often at the edge of capacity without maintaining a reserve, which causes increased sensitivity to emergencies (accidents, closures).

Air and water transport
Air transport and especially its part of passenger transport is currently not connected to rail transport. The port of Bratislava will have a direct connection to the implemented R7 expressway, as such a connection is currently absent.

Supply
In the area of goods transport, it is necessary to solve the organization of parking on reserved parking unloading / loading lanes, resp. stands for supply vehicles. In the territory of BSK and Bratislava, there is currently insufficient regulation of entry and movement of trucks (as well as supply trucks) and also thanks to this, the movement of trucks around Bratislava is higher than necessary.

2 Vision of mobility

Defining the vision of mobility is one of the pillars of creating a strategy for an optimally functioning transport system in the Bratislava region. Other pillars are strategic objectives, specific objectives, measures and specific measures.

- **Vision of mobility** - the overall state of transport mobility and the idea of the future development and evolution of the transport system of the Bratislava region
- **Strategic goals** - description of changes (higher goals) to fulfill the defined vision
- **Specific objectives** - specific tools to achieve the strategic objectives
- **Measures** - general activities (interventions or interventions) contributing to the fulfillment of specific objectives. The measures have the nature of infrastructural intentions, or the nature of administrative, resp. security, technical and organizational system processes / changes.

2.1 Overall vision of mobility

The main question we need to answer is: In what region do we want to live? The answer to this question can be provided by the overall vision of the mobility of the Bratislava self-governing region, which is the result of considerations of all stakeholders, provides a qualitative description of the required future of the region and serves as a guide for developing appropriate planning measures.

In line with the European Commission's long-term strategic vision for a prosperous, modern, competitive and climate-neutral economy until 2050, called a Clean Planet for All and in the BOD, all modes of transport should contribute to the decarbonisation of our mobility system. This requires a systems approach that includes low- and zero-emission vehicles, a significant increase in the capacity of the rail network, priority for public passenger transport, strengthening non-motorized modes of transport and a much more efficient organization of the transport system using new information and communication technologies to achieve sustainable mobility.
Experience from many cities documents that GDP growth in the past has always led to increased momentum / mobility. As a result, we encounter traffic jams every day. Sustainable mobility therefore means giving priority to alternative modes of transport, developing intelligent information and communication technology (ICT) services for people living in the region (R-BSK) and developing new transport policy strategies, especially in the area of accessibility to sensitive R-BSK areas.

Basic visions emerge as a basic strategic framework for finding beneficial projects in proposals. Visions are the result of professional discussion and arise not only as professional recommendations, but should also be a social consensus with the citizens of BSK.

Public transport is paramount

The future of the Bratislava self-governing region is in a fast, high-quality, interconnected and accessible network of integrated public transport, based on the advantages of rail transport and electric traction, which will not only be a competitive alternative to individual car transport in sensitive areas of the region. traffic inadequate areas. The well-thought-out strengthening and development of rail transport, suburban bus and urban public transport lines will offer public transport users fast and easy travel throughout the BOD with low environmental impact and high economic, energy and spatial efficiency.

By car only if necessary

R-BSK will support car transport only as a supplement to public transport travel in less congested transport relations, where public transport would not be efficient enough and also where it provides the necessary supply of the city with goods and services. The P + R system connected to attractive public transport railway lines in the BOD area will be expanded. In areas with good access to public transport and a high concentration of activities, road transport will be regulated by a combination of reassurance measures, parking policy, regulation and paid entry into the territory of sensitive R-BSK areas. The city's supply of goods and services will have a lower impact on the city and the environment.

Promoting active travel

BSK will develop walking and cycling on "door-to-door" routes, as well as in connection with public transport transfer points in the "first and last kilometer" of the route. The B + R system and shared bicycles, connected to the hubs of VOD routes in the region, will also undergo great development.

A land for life

R-BSK and other municipalities in the region will increase the quality of public space and calm traffic throughout the area in connection with the gradual elimination of deficiencies in the transport infrastructure network. It will also systematically develop and favor integrated public transport, together with the benefits of walking and cycling. It will gradually make it possible to reduce the demands on the size of traffic areas, improve local living conditions and return more life to streets and public spaces. This will make BSK a more pleasant place to live and do business.

Planning for the future

The Bratislava self-governing region will consistently coordinate spatial and transport planning, including the use of the city-forming function of rail transport, especially as a response to suburbanization in the area. The Bratislava self-governing region will use new knowledge in science and technology for the development of its transport system in accordance with the global concept of the so-called "Smart cities". New knowledge in science and technology means, above all, greater use of the segment of information and communication technologies for planning, mobility management or the use of transport and transport infrastructure. Thanks to information and communication technologies, the Bratislava self-governing region will move towards the concept of "mobility as a service".

Build less, drive better

The Bratislava self-governing region will give priority to the local improvement of the existing road infrastructure, including the introduction of advanced traffic management systems for the efficient

use of the road network, before the construction of new capacity roads. In the connection of Bratislava to the surrounding region, measures will be applied for the diversion of transit road traffic outside densely built-up areas. BSK will also support the implementation of appropriate management systems that optimize the operation of public transport or enable an increase in capacity, especially rail transport. In order to better manage transport demand, the management centers of urban and regional passenger and freight mobility will be systematically interconnected, which will enable the indication and relocation of demands for relocation, transport and transportation of passengers and freight,

Cleaner supply
The BOD will focus on expanding the supply database. It will support alternative, in particular low-emission and non-emission transport of goods, including rail, water and bicycle transport and their interconnection. It will also support the consolidation of consignments, whether during transport or at distribution points, including automated methods of issuing consignments. Emphasis will also be placed on reducing the impact of the transport of substrates and building materials or waste, through the use of rail and water transport infrastructure, as well as the implementation of the circular economy and the targeted prevention of excessive traffic volumes.

Cooperation of individual organizations
BSK will create conditions for strong mutual coordination between organizations belonging to BSK and hl. m. Bratislava, its city districts and organizations, organizations belonging to the BSK, cities and municipalities in its territory and other partners at the state level, which is a necessary precondition for fulfilling the policy of sustainable mobility. Only a close interconnection of entities on the side of the organization, investments and operations will make it possible to implement both a number of small measures in a short time and major investments in rail transport in the coming decades.

The Bratislava self-governing region will apply the principles of sustainable mobility and orientation towards more environmentally friendly modes of transport. The negative effects of individual road transport, including the effects on the use of public space, will be significantly reduced by achieving a better distribution of individual modes of transport and by increasing its safety as well as energy intensity and operational efficiency.

The vision adopted by the Regional Sustainable Mobility Plan can be characterized as follows:

- BSK will aim at sustainable mobility - to ensure the movement of people and goods, which will be acceptable in the long run in terms of social, economic and environmental impacts ▶ more reliable, faster, greener and more enjoyable travel
- The transport accessibility of the targets will be significantly oriented towards more environmentally friendly modes of transport - public transport (especially rail) and also walking and using bicycles ▶ increasing the share of public, pedestrian and bicycle transport
- In the territory of R-BSK and also in the surrounding region, a better compliance of transport with the quality of the environment and public spaces will be gradually achieved. ▶ an attractive city for its inhabitants.
- In road transport, combinations of regulatory and investment measures will be used to reduce the negative impacts of road transport ▶ a better environment in a densely populated area of cities and the desired speed of transit traffic on the roads at municipalities.
- The safety and energy efficiency of transport will be increased ▶ positive economic impact and reduction of dependence on oil and natural gas

2.2 The concept of transport infrastructure development

The development of transport infrastructure must be conditioned by conceptual solutions and conceptual materials starting at the international level and ending at the level of cities and municipalities. The development of infrastructure must in no case be an accidental and chaotic phenomenon, as in such a case follow-up links would not be ensured either within the same type of transport infrastructure between individual territorial units or within individual transport modes and their infrastructure with each other.

In the conceptual development of transport infrastructure, it is important to observe in particular:

- Logical continuity of the communication network and transport infrastructure
- Conditions for creating a synergistic effect of sustainable mobility
- Fulfillment of obligations (international, national, etc.) in the field of transport infrastructure
- Compliance of mobility requirements with spatial planning documentation

In the process of transport infrastructure development, it is necessary to ensure the following:

- Creating the conditions for sustainable mobility
- Ensuring a proportional solution of transport infrastructure and communication networks in accordance with mobility requirements and the offer of a hierarchical system of transport services in the region
- Reduction of environmental burdens due to transport
- Ensuring the interconnection of transport networks and unification of technical standards
- Increasing operational safety
- Creating preconditions for balanced development of regions
- Improving the accessibility of territorial units and settlements
- Improving the condition and quality of transport infrastructure
- Covering investments with funds

The solution of transport infrastructure is a requirement above all for economic prosperity and the demands of other areas of social life, tourism and the sustainable development of the region itself.

The overall intention of the transport infrastructure solution can be defined on the basis of approved or prepared strategic development documents on the basis of the application of the principles of sustainable mobility. The basis for the development of transport infrastructure is a strategy to apply solutions that simultaneously bring improvements in the economy, the environment and social aspects. Sustainable development of transport is thus a process that respects environmental, economic and social impacts, creates a circle of links between the three poles and conditions economic efficiency without losing sight of social needs for the general public.

2.3 Principles of traffic regulation of territorial development

Territorial development is conditioned by several areas of life and individual activities are reflected in the territory in various forms. In the territory of BSK, especially in the hinterland of Bratislava, the largest increase of small municipalities is recorded, which is conditioned by suburbanization but also concentration trends. This growth is spontaneous, uncontrolled, resulting in increased demands on land use, operation and management, especially in terms of transport relations (high growth of individual passenger transport, low level of regional public transport), lack of civic amenities (availability of schools, medical facilities and other basic and advanced civic amenities), increasing operational demands on technical equipment and increasing negative consequences for the environment and the natural landscape.

The development of the BOD transport system is directly linked to national and supra-regional transport relations, and the Bratislava metropolitan region also has a fundamental impact on the shape and density of transport networks in BOD. The main international transport corridors are also routed

through the territory of BSK, which are more or less concentrated in the territory of the capital of the Slovak Republic, Bratislava. The highest traffic intensities of road traffic are already achieved on all crucial BSK roads today, especially in comparison with the rest of Slovakia.

The transport system is designed from the networks of individual transport subsystems, where the emphasis is mainly on the development of public transport and its preference over road transport, while the following principles are applied for their creation:

Motorways and expressways - have been prepared for a long time in terms of national needs and the main intention is to significantly increase transport capacity in the relationship Bratislava - Trnava - Nitra, which is reflected in the preparation of the D1 motorway extension and the implementation of new R1 and R7 expressways. The route of the new D4 motorway is of fundamental importance for the distribution of all transit and source road transport in front of Bratislava and its execution outside the central part of the city.

For roads, the main emphasis is on the reconstruction of the road I / 61, the capacity of the road II / 502, the completion of bypasses of towns and villages and the creation of the county circuit.

Rail transport has two basic goals - the construction of sufficient capacity railway corridors at the Bratislava railway junction and the strengthening of regional suburban rail transport, as part of an integrated transport system, within which new sections of regional railway lines are also proposed.

Public passenger transport is based on the preference of all types of public passenger transport over car transport. Here, the basic condition is the overall integration of all participating passenger transport operators, to such an extent that driving in suburban public transport is faster, more comfortable and cheaper in all its directions than driving a car.

Water transport represents the completion of the port in Bratislava in terms of its long-term intentions, ie the relocation of all loading operations from the main flow of the Danube to the port pools. Part of water transport is also the targeted development of recreational water transport and its relevant coastal facilities.

Air transport on the territory of BSK is primarily represented by MR Štefánik Airport. The airport is oversized to 5 mil. passengers per year and currently its capacity is not used to 50%. In the future, a significant share of the international airspace division can be expected and it will provide services as a diversion airport for Vienna, Budapest and Brno, thanks to its better climatic and weather conditions.

For bicycle transport, the development of a comprehensive network of cycle paths on the territory of the entire BSK is proposed, also with direct links to neighboring regions.

The systematically developed system of integrated public passenger transport in the region is competitive with individual car transport. The basic aspect is the level of services provided, where the most required parameter is the cruising speed. Well-organized and especially used integrated suburban public transport, with a significant share of rail transport, has a significant impact on reducing traffic intensities and thus on the need for capacity roads.

The integrated public transport system is intended to offer faster and more convenient travel. Its main advantages include a uniform tariff, a single travel ticket for all modes of transport, continuity of lines and clock intervals. The main goal of the integration is to make public transport more attractive compared to the conditions for the use of individual car transport, especially on the way to work, not only in the territory of Bratislava, but in the entire Bratislava region. These measures may lead to a change in the division of transport work in favor of public transport, which will ultimately have the effect of gradually reducing the pressure to widen roads and car parks for IADs.

At present, IDS BK already covers the entire territory of the region and also extends to some municipalities in TTSK. With regard to the needs of the traveling public, it is necessary to expand the scope of IDS beyond the region to the entire Trnava self-governing region and prospectively to the Trenčín and Nitra self-governing regions and the border regions of Austria and Hungary.

The arrangement of IDS lines and their interconnections is an operational aspect of the establishment of IDS and these intentions do not have a significant impact on territorial development. From the point of view of the territory, TIOPs are important, which represent a transfer node between the railway and public transport, resp. PAD, while new stops will be created on railway lines. Then there are P + R and B + R car parks, which require a certain limited space. The principles of line arrangement and the division of the BSK territory into operational and tariff zones are the subject of separate chapters of this document.

The process of suburbanization has an important influence on the change of transport behavior of the BSK region, which results in the stagnation of the population growth rate in Bratislava and the increase of the population density in the suburbs and its hinterland. Residents are moving to these areas usually due to lower prices than in the center of Bratislava. Their demand for public and cultural services is high, as they were used to in the city, but the supply lags far behind the requirements. This generates a phenomenon called single-driver cars and commuting to work, services and entertainment that are not available in the suburban area.

The most significant suburbanization zone in BSK is the transition between the compact settlement of Bratislava and the typically rural settlement of the region. It is created by a group of several original rural villages (Devínska Nová Ves, Záhorská Bystrica, Rusovce, Čunovo and Vajnory), which were administratively annexed to Bratislava in the 50s and 70s, as well as rural villages (Chorvátsky Grob, Ivanka pri Dunaji, Most pri Bratislave , Rovinka, Dunajská Lužná, Kalinkovo, Miloslavov, Hamuliakovo, Malinovo, Zálesie, Marianka and Borinka) and two cities with strong functional functions (Stupava and Svätý Jur). This area has become the site for the construction of numerous new residential zones, as well as logistics centers and production facilities. At a greater distance, changes in land use are concentrated along transport corridors, especially around the town of Senec (highway D1), along the road I / 63 (E575) to Šamorín,

Suburban growth around Bratislava causes significant social, transport and environmental impacts and is one of the priorities for the management of this area. in the coming decades.

The processing of individual stages of spatial planning documentation (ÚPD) must be based on the following general principles:

- when dividing transport work, take into account the aspect of the division of public space, which is used by all modes of transport and in which the principles of sustainable construction of non-motorized infrastructure, public passenger transport must be taken into account and which must also ensure efficient maintenance processes
- to support non-motorized and public transport, which should currently take into account the requirements of available built-up area, given the density and organization of housing, job opportunities, commercial and recreational facilities, on existing but also on new development areas, given the trend of sustainable development
- when planning and implementing transport infrastructure and public spaces, to prefer public transport in order to reduce congestion by changing the division of transport work and reducing the share of individual transport, to support pedestrian and bicycle transport as an ecological, economic and healthy mode of transport
- when proposing the implementation of better regional mobility, the local culture and the "spirit" of the region must be respected. This means that the communication network, public transport infrastructure and means of transport, the solution of public space for pedestrians and cyclists must be designed with regard to the natural, social, architectural and urban characteristics of the region, municipalities and cities as well as the way of life of citizens. they felt good in the region and their community cohesion was promoted. From abroad, the positive effects of improving the accessibility of the territory are known by introducing a hierarchical system of public transport, where accessibility has improved, transport time has been reduced, employment has increased and crime has decreased.

The long-term priorities in the field of territorial development relevant for spatial planning and

regulation from the point of view of sustainable mobility are the following:

- balanced territorial development - application of comprehensive spatial and spatial planning, priority development of lagging and peripheral areas of the region, application of the institute of interregional solidarity, integrated development of settlements, restoration and maintenance of historical structures, settlement identity and forms of settlement
- high quality of the environment, protection and rational use of natural resources - effective environmental protection, careful use of natural resources, removal of environmental burdens and environmental damage, limiting economic development in accordance with natural conditions and potentials, achieving and maintaining a quality environment with emphasis on endangered areas

2.4 Trends of traffic characteristics of the area

In terms of the transport system and its function in the logistics system of the region, transport should ensure the optimal division of labor between modes of transport, optimal quality of transport and minimization of costs for the transport process. At present, the individual transport systems are not systematically linked, many transport processes are carried out autonomously. The current integration of public passenger transport has brought a systemic change in passenger transport, but it does not include the whole complex of transport modes of the region. For the following time periods, the transport as a whole must have the following characteristics:

- Ability of area service, ie the ability to provide transport services anywhere in the region
- Speed of transport in the whole range from house to house.
- Time certainty of transport performance
- The degree of comfortable achievement and use of the means of transport resp. transport system
- Transport safety

In road transport, the vision rather presupposes a solution to transport safety and environmental protection of cities and municipalities. Therefore, the vision deals with the solution of tangential relations through the county circuit along the road II / 503 as well as the relocation of the road I / 61 outside the village. The extension of the D1 motorway and the construction of the D4 / R7 motorway can already be considered a reality.

In individual car transport, there is a trend of gradually reducing its share in total transport work. This will be achieved through a preference for public passenger transport and non-motorized transport, while restricting car traffic. These include limiting and reducing the capacity of roads by creating reserved lanes for VOD in the existing road profile, disadvantage of IAD in favor of VOD at light-controlled intersections, limitation, resp. banning the entry of some, especially non-ecological vehicles, into sensitive zones and restricting monetary, such as extending tolls to lower-class roads, introducing tolls at the entrance to the city center, progressive parking systems and others.

To ensure the decarbonisation of road transport, both passenger cars and buses for alternative fuels will be introduced, in particular electric cars for hybrid and gaseous fuels. This is especially true for public passenger buses.

In public passenger transport, the vision presupposes its intensive support and development at the expense of road transport. The main emphasis is placed on the development of rail, whether train or tram transport. The preference for public passenger transport will be supported by a number of measures that give it priority over road transport directly. This includes the preference of VOD at traffic lights and the allocation and reservation of lanes on roads for VOD. This also includes support measures, such as Park and Ride car parks, progressive parking systems, restrictions on certain modes of transport in selected zones, the introduction of tolls on selected roads and city centers. An important

place in the vision of passenger transport is occupied by the expansion and improvement of the integrated transport system throughout the region.

In bicycle transport, the vision assumes a significant increase in its share in the total division of transport work. This will be achieved in particular to the maximum extent possible, in particular by building a system of segregated cycle paths, but also by supporting cyclists in public transport, building Bike and Ride car parks, and expanding bikesharing. In case of insufficient spatial arrangement, these sections will be solved separately at the local level.

2.5 Real possibilities for further development of transport policy

Transport policy is a set of principles, goals and priorities in transport, which will guide all bodies and organizations from the state level to the level of municipalities and transport service providers in creating, implementing and adhering to measures designed to achieve strategic and specific objectives set out in this policy.

The transport-policy principles that pursue the achievement of the set goals are

- understanding transport as a complete transport system with the integration of subsystems of individual modes of transport
- sustainable transport development
- optimal balance of the use of the potential of individual modes of transport
- orientation of transport to its users
- reducing the dependence of the increase in transport demand on the increase in gross domestic product

The main intentions of the state in the field of transport policy are the following:

- transport solutions as an integrated transport system and the resulting infrastructure needs
- promoting sustainable mobility by prioritizing public transport over individual transport and more environmentally friendly and safer modes of transport
- adequate transport service of the territory andensuring the right of citizens to quality and affordable transport services
- fundamental changes in the field of public interest performance; andreimbursement of losses by their provider
- the share of public resources in security functioning and development of the transport system
- support for environmentally friendly, safer and society-wide more efficient transport systems
- environmental protection, reflected in the choice of transport routes and means of transport on the basis set environmental criteria
- increasing transport safety and reliability

3 Defining strategic goals RPUM

RPUM BSK defines the basic strategic goals for the field of transport. These objectives consist of priority axes, while only by adhering to them according to the proposed measures can the fulfillment of specific values of indicators be achieved, so that the development and degree of fulfillment can be monitored in comparison with the current situation.

3.1 The main problems of mobility in the Bratislava region

Capacity problems on railway lines - not enough infrastructure is built on the railway lines in the territory of BSK, especially in the morning and afternoon peak hours, to ensure the demand of passengers

Deterioration of conditions for rail freight - inter alia in relation to the capacity of lines and the absence or obsolescence of combined transport terminals and set-up stations

Low travel speed PAD and public transport- cruising speed is significantly influenced, inter alia, by the way passengers are checked in, the insufficient number of priority (express) lines in the PAD and the associated large number of serviced stops for each line, insufficient preference at intersections

The problem of tram transport - insufficient network length, missing additional radials and tangential connections and incomplete segregation, as well as low cruising speed and insufficient preference

Heavy load on bus routes - missing reserved lanes for bus transport, especially at the entrances to the territory of Bratislava

Incomplete integration between TTSK and BSK - the high number of passengers arriving in the BOD area from the TTSK cannot take advantage of the integrated system

Failure to involve all carriers in BSK in the integrated system - in the territory of BSK there are carriers in PAD, which are not involved in IDS BK

Inconsistency of information and check-in system in modes connected in IDS BK - in each VOD mode there is a different information and check-in system

Poor public awareness of the possibilities offered by IDS BK - absence of intelligent stops and other information systems, unattractive waiting areas, low range of additional services.

Technical obsolescence of VOD stations and stops - newly built stations and stops are built in accordance with IDS BK standards, but the reconstruction of the original stations and stops to the current standards is carried out to a minimum extent

Increase in the number of external ties to Bratislava (suburbanization) - there is an increase in traffic, especially in connection with the socio-economic factor

Weak development of the P + R and B + R program- only in 2019 (in the period of processing the design part) the first P + R and B + R car parks were built

Communication network congestion and sensitivity - insufficient number of tangential connections in the suburban area of Bratislava, which in the near future will be partially solved by the operation of the D4 ring road in relation to Bratislava

Neglect of maintenance of existing infrastructure - even though regular inspections of infrastructures on the territory of BSK are performed by individual administrators in accordance with legislation and internal regulations, in several cases unconceptual maintenance of all modes of communication follows, which depends on the availability of financial resources. It is also related to the increase in traffic intensities and the low ratio between this and available funds

Absence of road bypasses on important roads in the vicinity of important municipalities - the construction of important transport connections is being postponed, which would also protect the interior of these municipalities from the excessive impact of transiting car traffic.

Untapped potential of advanced traffic management tools - even in the busiest parts of the communication network, elements of advanced traffic management are not deployed for optimal use of communication capacity

Missing pedestrian and bicycle connections in the territory of BSK - largely missing sidewalks / cycle paths in connection with terminals and significant stops

Insufficient cycling measures - insufficiently built continuous sidewalks for cyclists, absence of parking places for bicycles near terminals and VOD stops

Absence of a system modernization and maintenance of bicycle paths

Insufficient support for physical activity of the population - insufficient motivation of the public to use pedestrian and bicycle traffic

Increase in intensities, especially in road freight transport - due to socio-economic factors in particular, there is an increase in road traffic

Insufficient number of supply states - poorly addressed concept of building supply states, permission to build new companies / shops / services without conditional supply solution
Lack of concept and knowledge base on logistics and supply process - basic information on this issue is missing in the territory of BSK
Population aging - nationwide trend
Insufficient alternative energy distribution network - Lack of concept in building a distribution network of alternative energies, which are currently being built "randomly"
Negative impact of IAD on air quality and public health - Insufficient support for zero-emission and low-emission fuel
Obsolescence of the vehicle fleet in terms of emissions produced - negative impact on the environment
IAD inefficiency - stagnation or declining occupancy of cars
Incorrect development of public opinion -In the last 20 years, the view of public transport has been strongly strengthened in society only as an alternative for those who cannot own or use a car for economic, age, health or legislative reasons.
Security - accidents in the BOD area do not have a decreasing tendency
Failure to take into account operating costs in the implementation of investments and their steady increase - no compensation is required for the increase in the cost of VOD due to the restriction during the construction and reconstruction of investment units.
Non - existent project prioritization - non-existent prioritization of investment measures (projects) that are insufficiently directed to public transport
Property management and administration - often complex property relationships
Irregularity, incompleteness and inconsistency in the collection, scope and format of road network and road traffic data - data is incomplete and data formats are inconsistent

3.2 Strategic goals for improving the mobility of the Bratislava region

The strategic goals for the area of transport in BSK, which respond to the analyzed problem areas of the R-BSK transport system, are as follows.

3.2.1 Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport

The strategic goal is to reduce the space requirements for the occupation of the territory by the transport infrastructure, resp. public space by means of transport. The transport of one person requires the least space in the case of electric rail transport and the most in the case of a passenger car with low occupancy. At the same time, the strategic goal is to reduce the carbon footprint and thus improve the environment.

The specific objectives to achieve this strategic objective are the following:

- preference for public transport and the development of rail transport
- support for walking and cycling
- optimization of city supply
- improving the quality of public spaces
- reduction of air pollution by mobile sources and reduction of noise pollution and carbon footprint
- improving human health

Indicators that measure the success of this goal:

- Increasing the share of public, pedestrian and bicycle transport in the division of transport

work
- Increasing the share of rail public transport in the number of transported passengers
- Increasing the average occupancy of vehicles
- Reduction of specific greenhouse gas (CO_2) emissions from transport
- Reducing emissions from road transport
- Reduction of the area and population permanently living in areas where night noise
- exceeds 50 dB
- Increasing the number of registered vehicles with electric motor (including hybrid)
- Expansion of the tram and trolleybus transport network
- Increasing the number of buses with alternative propulsion in public transport
- Increasing the capacity of the P + R system (B + R)

3.2.2 Increasing the efficiency, reliability and accessibility of public transport

The strategic objective aims to increase the overall efficiency of the transport system, in particular by using a multimodal chain (synergy), optimizing the current system by using available capacities and reducing the effects of traffic excesses such as accidents or temporary reductions in capacity on the transport system and its user.

The specific objectives to achieve this strategic objective are the following:

- increasing the interconnection of public transport with other modes of transport, as well as between different modes in VOD
- reducing sensitivity and alleviating capacity problems in the transport network
- improving the accessibility of transport, transport infrastructure and public spaces for different groups of the population
- improving the collection of statistical data and their registration
- increase passenger comfort

Indicators that measure the success of this goal:

- Increasing the average cruising speed VOD
- Reduction of the length of communications with QSV level D - F
- Increasing the number of transported VOD passengers
- Increasing the share of public, pedestrian and bicycle transport in the division of transport work
- Increasing the share of low-floor connections in VOD
- Increasing the share of barrier-free stations and PŽD train stops

3.2.3 Increased security

The strategic goal is to increase the safety and resilience of the entire transport system, in particular by reducing the impact on the health and lives of people in the event of accidents or incidents, such as natural disasters or safety incidents.

The specific objectives to achieve this strategic objective are the following:

- modernization of obsolete transport infrastructure
- reduction of traffic accidents
- raising transport literacy awareness

Indicators that measure the success of this goal:

- Reduction of the total number of traffic accidents registered by the Police
- Reducing the number of people killed and seriously injured in road accidents

- Reducing the number of people injured in traffic accidents
- Reducing the number of most vulnerable participants (pedestrians and cyclists) injured and killed
- Length of new or modernized roads in the region

3.2.4 Increasing financial sustainability

The strategic goal is to increase the sustainability of investment and operating financing and to improve the balance of income and expenditure, including ensuring the stability of income and expenditure.

The specific objectives to achieve this strategic objective are the following:

- ensuring the financial sustainability of the transport system
- support for sustainable development of the region
- ensuring procedural support for mobility

Indicators that measure the success of this goal:

- Increasing the share of transport revenues in the total budget
- Non - increase of the share of compensation for the loss from the operation of public transport to its total costs
- Increase in GDP per capita
- Increasing the number of inhabitants with permanent residence in the Bratislava region
- Length of new or modernized roads in the region
- Increasing the share of capital expenditures for the development of public, pedestrian and bicycle transport

3.3 Proposal of measures in the field of public passenger transport

Below are described measures that respond to the identified problems in the field of public passenger transport in the Bratislava region and meet individual specific objectives.
Measures responding to specific objectives:

- Preference for public transport and development of rail transport
- Interconnection of public transport with other modes of transport, as well as between different modes in VOD
- Improving the accessibility of transport, transport infrastructure and public spaces for different groups of the population

Table 3-1 Measures for the specific objective "Preference for public transport and development of rail transport"

Preference for public transport and development of rail transport

Measures	
Infrastructure	Process / organizational / system
VOD preference	Promotion of public transport
Construction of P + R and B + R car parks	Equipping PAD vehicles with propulsion that will lead to emission reductions
Development of railway transport in BSK	Quality solution of transfer points

Table 3-2 Measures for the specific objective "Improving the accessibility of transport, transport infrastructure and public spaces for different population groups"

Improving the accessibility of transport, transport infrastructure and public spaces for disadvantaged groups

Measures	
Infrastructure	Process / organizational / system

Construction of barrier-free connections, means of transport and buildings	Purchase of low-floor buses

Table 3-3 Measures for the specific objective "Increasing the interconnection of public transport with other modes of transport as well as between different modes in VOD"

Increasing the interconnection of public transport with other modes of transport, as well as between different modes in VOD

Measures	
Infrastructure	Process / organizational / system
Construction of transfer terminals (TIOP)	Streamlining IDS BK
Construction of P + R and B + R car parks	Strengthening the transport authority, which will manage and coordinate all types of public transport in the region (currently performed by BID)
	Introduction of a uniform tariff and a single travel document for all types of public transport in the region

Table 3-4 Measures for the specific objective "Increasing passenger comfort"

Increasing passenger comfort

Measures	
Infrastructure	Process / organizational / system
Construction of transfer terminals (TIOP)	Streamlining IDS BK
Construction of barrier-free connections, means of transport and buildings	

3.4 Proposal of measures in the field of road transport

As described above, the following text describes the measures that respond to the identified problems in the transport sector in the Bratislava region and meet the individual specific objectives.
Measures responding to specific objectives:

- Reducing sensitivity and alleviating capacity problems in the transport network
- New connections for different modes of transport
- Reduction of traffic accidents
- Improving the collection of statistical data and their registration

Measures related to road transport are listed in the following tables:

Table 3-5 Measures for the specific objective "Reduction and mitigation of capacity problems in the transport network"

Reducing sensitivity and alleviating capacity problems in the transport network

Measures	
Infrastructure	Process / organizational / system
Construction of capacity and safe transport infrastructure (bypasses, relocations, delays, etc.)	Acceleration of the preparation and construction of priority buildings (compliance with the minimum legal deadlines, thorough procedural, factual and legal preparation)

Table 3-6 Measures for the specific objective "Reduction of traffic accidents"

Reduction of traffic accidents

Measures	
Infrastructure	Process / organizational / system

Construction / modernization of safe transport infrastructure with the involvement of road safety auditors	Traffic campaigns
Adaptation of existing infrastructure to standards that will lead to increased security	Carrying out security checks with proposals for specific measures Safety modifications / removal of accident sites

Table 3-7 Measures for the specific objective "Improving the collection and recording of statistical data"

Improving the collection of statistical data and their registration

Measures	
Infrastructure	Process / organizational / system
Decentralized infrastructure for interconnecting cross-border, state, city, municipal and regional passenger sensor data buses in VOD and IAD (Informative Speed Meters -IMR) for processing and providing BigData mobility files.	Improving procedural requirements in the collection and registration of data on transport and mobility - uniform structure, scope and registration from national entities, through regional entities to local entities.

Table 3-8 Measures for the specific objective "Modernization of obsolete transport infrastructure"

Modernization of obsolete transport infrastructure

Measures	
Infrastructure	Process / organizational / system
Regular maintenance and repairs of transport infrastructure	Acceleration of preparation and construction of priority buildings (compliance with minimum legal deadlines, thorough procedural, factual and legal preparation)
Construction of modernized / homogenized sections of transport infrastructure	

3.5 Support for cycling and walking

Below are described measures that respond to the identified problems in the field of support for walking and cycling in the Bratislava region and fulfill a specific goal:

- Support for walking and cycling

Table 3-9 Measures for the specific objective "Promoting pedestrian movement and cycling"

Support for walking and cycling

Measures	
Infrastructure	Process / organizational / system
Construction of cycle paths and cycle connections	Bikesharing support

Construction of additional equipment for cyclists (service centers, bicycle rest areas, info panels, etc.)	Support for bicycle transport in VOD
Construction of sidewalks and pedestrian infrastructure on VOD access routes	

3.6 Further proposals for action

Below are described measures that respond to other identified problems in other areas in the Bratislava region and meet individual specific objectives.

Measures responding to specific objectives:

- City supply optimization
- Improving the quality of public spaces
- Reduction of air pollution, noise pollution and carbon footprint
- Sustainable territorial development of BSK
- Process support for sustainable mobility and effective regional governance
- Financial sustainability of the transport system
- Economic development of the region

Table 3-10 Measures for the specific objective "Ensuring the financial sustainability of the transport system"

Ensuring the financial sustainability of the transport system

Measures	
Infrastructure	Process / organizational / system
	Securing financing - change of legislation for the distribution of state, regional and city budgets with emphasis on ensuring sustainable financing of all types of transport IDS BK

Table 3-11 Measures for the specific objective "Ensuring procedural support for mobility"

Providing procedural support for mobility

Measures	
Infrastructure	Process / organizational / system
	Determining conditions and creating a market environment

Table 3-12 Measures for the specific objective "Support for the sustainable development of the region"

Support for sustainable development of the region

Measures	
Infrastructure	Process / organizational / system
	Effective spatial planning and balanced spatial development - effective and comprehensive spatial plans

Table 3-13 Measures for the specific objective "Ensuring the financial sustainability of the transport system"

Ensuring the financial sustainability of the transport system

Measures	
Infrastructure	Process / organizational / system
	Increasing the share of revenues from transport

	Detours
	Increase of capital expenditures for the development of public, pedestrian and bicycle transport and projects to increase the safety and fluidity of transport

Table 3-14 Measures for the specific objective "Improving the quality of public spaces"

Improving the quality of public spaces

Measures	
Infrastructure	Process / organizational / system
Quality transfer points	Elaboration of architectural / urban studies
Removal of visual smog	

Table 3-15 Measures for the specific objective "Reduction of air pollution by mobile sources and reduction of noise pollution and carbon footprint"

Reduction of air pollution by mobile sources and reduction of noise pollution and carbon footprint

Measures	
Infrastructure	Process / organizational / system
	Promoting the use of low-emission and environmentally friendly fuels and modes of transport without the need for any fuels (electric traction)
	Green infrastructure

Table 3-16 Measures for the specific objective "Optimization of city supply"

City supply optimization

Measures	
Infrastructure	Process / organizational / system
Construction of distribution centers	Elaboration of a city-wide strategy for the development of urban supply for district cities of BSK

Table 3-17 Measures for the specific objective "Improving human health"

Improving human health

Measures	
Infrastructure	Process / organizational / system
Construction / modernization of road infrastructure with the involvement of road safety auditors.	Support for low-emission and environmentally friendly drives.

Table 3-18 Measures for the specific objective "Raising awareness of transport literacy"

Raising awareness of traffic literacy

Measures	
Infrastructure	Process / organizational / system
	Traffic lessons / traffic campaigns

4 Creation of the BSK transport system by 2050

After defining the overall vision in the field of transport of the Bratislava region, setting goals eliminating the unfavorable situation in this sector, specific measures come up that will eliminate the analyzed problems and at the same time fulfill the vision of mobility in terms of set goals.
The measures are further broken down by mode of transport, despite the fact that there is a close link between modes of transport in the context of integrated mobility. However, for a given measure, a certain dominant mode of transport predominates, on which the given measure focuses primarily. Furthermore, we divide the measures according to their nature into "infrastructure" measures, which consist in the physical construction or modernization of new / existing infrastructure, and "process / organizational" measures, which consist in setting / optimizing / improving administrative and operational processes and requirements.

4.1 Rail transport

4.1.1 Main constructions in rail transport

According to the prepared feasibility study of ŽSR transport node Bratislava, the following actions in the development of railway transport were specified:
The first time level (approx. until 2025) represents:

- preparation and subsequent implementation of selected projects that were confirmed by the study regardless of the final alternative (so-called "no regret" projects):
    - increasing the efficiency of the section Bratislava-Nové Mesto - Podunajské Biskupice by implementing the Ružinov branch (as a necessary precondition for the implementation of the Ružinov TIOP), other measures to increase the permeable performance of the section such as 2nd line track, electrification and its continuation min. after Kvetoslavov will be adjusted according to the results of the currently processed feasibility study of the line Bratislava - Dunajská Streda - Komárno
    - reconstruction of the Bratislava Vinohrady / Suburbs interchange
    - increasing the efficiency of the section Bratislava-Nové Mesto - Bratislava hl. st. (2nd track)
    - modernization of the section Devínska Nová Ves - Bratislava-Lamač (inclusive)
    - ERTMS (priority sections that are part of international corridors within the node in which the modernization or reconstruction of railway infrastructure will be carried out)
    - electrification of the section Devínska Nová Ves - state border SR / Austria (Marchegg) (according to the Twin City Rail project)
    - preparation of other modernization projects, resp. reconstruction of selected sections within the Bratislava node in accordance with the implementation schedule
- pre-preparation (urban-technical studies and EIA) of projects requiring more time-consuming preparation, resp. which are important for the next decision-making process:

- pre-preparation of the project modernization of the railway station Bratislava hl. st.
- pre - preparation of the project revitalization of the section Bratislava Predmestie - Bratislava Branch

The outputs of the processed documentation (studies, intentions, EIA) of these key structures, together with the conclusions of the comprehensive SEA process and other strategic documents will be the basis for further study of broader socio-economic and urban contexts, to confirm their readiness for implementation, identification of additional in the CBA unconsidered) benefits that can support the effectiveness of any of the alternatives and examine the possibilities for possible innovative forms of financing, in cooperation with the city, region, state or private sources.

The second time level (approx. until 2030) represents:

- project preparation and subsequent implementation of projects confirmed by the study:
  - modernization resp. reconstruction of sections in the junction (Bratislava hl. st. - Bratislava-Rača / Bratislava-Vajnory, Bratislava-Nové Mesto - Bratislava-Petržalka, and others)
  - ERTMS (crucial part of the node, modernized and reconstructed sections) and the Traffic Management Center in the node
- project preparation and subsequent implementation of focus projects, the implementation of which depends on transport policy decisions based on the results of the above-mentioned urban study (s) and EIA and SEA assessment
  - revitalization of the section Bratislava suburbs - Bratislava-Filiálka (if a development alternative with Filiálka is adopted). The technical solution must allow for a possible future continuation of the line to the south - it is not expedient to choose a dead-end solution, as demographic conditions may change in the future, which would justify further continuation of the line. PUM BSK recommends considering a possible extension of this line to Bratislava-Niva in contact with the bus station (joint HUB), with a possible further rail connection of the final station of this line Filiálka / Nivy with Petržalka (see "Feasibility study - Rail infrastructure of Bratislava integrated transport from 2012 ")
  - capacity of the section Bratislava Predmestie - odb. Močiar (for the needs of running a higher number of trains in the direction of Bratislava-Filiálka)
  - modernization of the railway station Bratislava hl. st. (realization)

At the same time, it is recommended (also in cooperation with neighboring countries) to monitor and analyze the development and forecast of rail freight performance and optimize or re-evaluate the time schedule for implementing infrastructure measures to increase performance at critical sections of the node (see below for a non-exhaustive list of project examples).

Third time level (after 2030) represents:

- projects confirmed by the study
  - modernization and reconstruction of sections in the Bratislava junction (ŽST Bratislava-Vajnory, Bratislava-Nové Mesto - Podunajské Biskupice, Bratislava-Petržalka - Rusovce and others)
- projects whose potential and economic efficiency can be re-evaluated on the basis of the above-mentioned study of the development of freight transport, such as (but not exclusively):

- increase of efficiency and modernization of the section Bratislava hl. st. - Bratislava-Lamač (3rd track track)
- increase in the performance of the section Bratislava-Lamač - Devínska Nová Ves (3rd line track in connection with the development of freight transport)
- increasing the efficiency of the Devínska Nová Ves section - no. SR / RR border - Marchegg (2nd line track in connection with the development of freight transport)
- increase in the performance of the Bratislava-Petržalka section - no. SR / RR border - Kittsee (2nd line track in connection with the development of freight transport)

• projects that have not been confirmed by the study, but their potential and economic efficiency may be re-evaluated in the future by other studies on the basis of significant changes in the urban development of the city background, such as (but not exclusively):

- involvement of MR Štefánik Airport (following the connection of Vienna - Bratislava airports)
- new regional line Bratislava - Stupava (- Lozorno)
- new regional line Bratislava - Chorvátsky Grob - Pezinok

<u>Projects not reviewed by the study:</u>

- new regional line Pezinok - Modra - Smolenice
- connection Plavecký Mikuláš - Jablonica
- renewal of the Kvetoslavov - Šamorín line (currently being examined in the feasibility study of the BA - DS - KN line)
- extension of the Bratislava suburb - Bratislava-Filiálka line to Bratislava-Nivy in contact with the bus station (joint HUB), with possible further rail connection of the final station of this line Filiálka / Nivy with Petržalka (see "Feasibility study - Railway infrastructure of Bratislava integrated transport from 2012 ")

  Note: Based on the above study, the following investments were recommended: introduction of IDS BK, construction of TIOP MA, PK, SC (built), construction of 5 P + R Pezinok (built), Ivanka (construction in progress), Nové Košariská (planned 2022-2023), Zohor (in the plan 2022-2023), Lamačská brána, construction of 7 TIOP in the territory of Bratislava (the study of the node re-checked them and recommended the construction of 4 of them, the VO process is underway), construction of el. lines Janíkov dvor - Šafárikovo nám. with the reconstruction of the Old Bridge (1 stage completed, the second stage in preparation) and the purchase of trams (implemented), extension of el. lines Vajnory, Ružinov, Bory (their extension is planned in connection with the construction of TIOP), reconstruction of el. lines to the Main Station (implemented) and to Dúbravka (modernization is being completed). The study examined several possibilities of the suburban - Filiálka - Nivy - Petržalka track connection and at that time did not recommend implementation (it is stated that it is not excluded that the input parameters may change in the future) so that they can be rechecked and subsequently implemented in the future. "Feasibility study - ŽSR, transport hub Bratislava" has already recommended the implementation of the line to the Suburbs - Branch, as unfortunately. lines for regional railways. transport, so the subject of research of another possible / suitable rail connection will be only the section Filiálka - Šafárikovo nám. / Petržalka. The Affiliates project must be conceived in such a way as to enable the line to continue in the future (avoidance of a dead-end solution). so that in the future they can be re-examined and subsequently implemented. "Feasibility study - ŽSR, transport hub Bratislava" has already recommended the implementation of the line to the Suburbs - Branch, as unfortunately. lines for regional railways. transport, so the subject of research of another possible /

suitable rail connection will be only the section Filiálka - Šafárikovo nám. / Petržalka. The Affiliates project must be conceived in such a way as to enable the line to continue in the future (avoidance of a dead-end solution). so that in the future they can be re-examined and subsequently implemented. "Feasibility study - ŽSR, transport hub Bratislava" has already recommended the implementation of the line to the Suburbs - Branch, as unfortunately. lines for regional railways. transport, so the subject of research of another possible / suitable rail connection will be only the section Filiálka - Šafárikovo nám. / Petržalka. The Affiliates project must be conceived in such a way as to enable the line to continue in the future (avoidance of dead-end solutions).

- investment measures on existing lines from the region leading to the railway junction:
  - reconstruction and increase of permeable performance of line D. Streda - Bratislava (feasibility study of line BA - DS - KN is currently underway)
  - increase in throughput performance of the Trnava - Bratislava line
  - modernization and increase of throughput performance of the Kúty - Bratislava line (modernization is being prepared, but there will be no increase in throughput performance of the line, which we perceive as a shortcoming)
  - modernization and increase of permeable performance of the Štúrovo - N. Zámky - Bratislava line

4.1.1.1 Description of measures in the document ŽSR, transport node Bratislava (2019)

Specific conditions for the implementation of individual projects:

- Modernization of the railway station Bratislava hl. st. - coordination with the implementation of the 3rd line in the section Bratislava hl. st. - Bratislava-Lamač (including tunnel)
- Revitalization of the section Bratislava Predmestie - Bratislava Filiálka - fulfillment of the principles and number of trains of the operating concept 4 and demonstration of economic efficiency (especially against alternative 2)
- Increasing the efficiency of the Bratislava hl. st. - Bratislava-Lamač (3rd line track + tunnel) - coordination with the modernization of ŽST Bratislava hl. st. and fulfillment of assumptions (demand will exceed the available capacity of the line)
- Increasing the performance of the section Bratislava-Lamač - Devínska Nová Ves (3rd line track) - exceeding the assumptions of transport performance (demand will exceed the available capacity of the line)
- Increasing the performance of the section Devínska Nová Ves - no. border SR / RR - Marchegg (2nd track)- Exceeding the assumptions of transport performance (demand will exceed the available capacity of the line)
- FROMperformance improvement of the Bratislava-Petržalka section - no. SR / RR - Kittsee border (2nd track)- Exceeding the assumptions of transport performance (demand will exceed the available capacity of the line)
- Connection of MR Štefánik Airport to the railway network - objectively proven sufficient demand for transport by rail and demonstration of economic efficiency of the operating concept
- Regional line Bratislava - Stupava - objectively proven sufficient demand for transport by rail and demonstration of economic efficiency of the operating concept
- Regional line Vajnory - Chorvátsky Grob - Pezinok - objectively proven sufficient demand for transport by rail and demonstration of economic efficiency of the operating concept

- Increasing the supply of suburban / urban railway transport (PDO BSK) - coordination with investment measures on lines leading to the railway junction (reconstruction and increase of permeable performance of line D. Streda - Bratislava, increase of permeable performance of line Trnava - Bratislava and modernization and increase of permeable performance of Kúty lines - Bratislava and Štúrovo - N. Zámky - Bratislava, possibly also capacity building on the section Marchegg - Devínska Nová Ves, as well as possible other necessary measures to increase the permissible performance of line sections and traffic within the Bratislava junction), implementation of ERTMS on lines in the junction, resp. its surroundings and demonstration of economic efficiency and ensuring budgetary coverage of the increased scope of the railway offer.

4.1.1.2 Proposed lines in UPN R BSK

Within the ÚPN R BSK (as amended), railways were designed in the territory of BSK in order to create suitable conditions for the support of public passenger transport, especially its rail part, so as to create a competitive competitive environment for the use of HD against the use of passenger cars. .

- Bratislava-Filiálka is a renewed station on the Bratislava Predmestie - Bratislava-Petržalka line, with a considered connection in UPN R BSK with the Bratislava-Petržalka station with crossing the Danube, as a connection of corridor lines and with an increased share of urban and suburban passenger transport. Even in the construction phase without a connection across the Danube, ŽST Bratislava-Filiálka will serve as an important terminal for suburban railway passenger transport for trains from the directions of railway lines 120,130 and possibly 131.

When revitalizing the Bratislava Predmestie - Bratislava-Filiálka section, PUM BSK recommends considering a possible extension of this line to the Bratislava-Niva railway station (Bratislava-Filiálka only stop) in contact with the bus station and a possible connection to Petržalka,

A picture 4-1 Bratislava Suburbs - Bratislava Branch - Bratislava - Petržalka (Source: UPN R BSK as amended)

- Bratislava-MR Štefánik Airport with the function of an international stop of express and fast trains, especially for connecting Bratislava - Vienna airports and all main routes via Bratislava-Nové Mesto or Bratislava-Petržalka station, underground stop connected to the direct airport service system and Bratislava public transport system. The airport is expected to be involved in routes 130, 131 and 132.

A picture 4-2 Connection of MR Štefánik Airport to railway lines (Source UPN R BSK as amended)

Route 1 / Vienna - Marchegg - Devínska Nová Ves - Bratislava hl.st. - Airport

It is the northern branch of the connection between Vienna and Bratislava. Due to its technical parameters, the line has the character of a regional track.

The Marchegg - Devínska Nová Ves line is single-track and not electrified. The line speed of this line is up to V = 80 km / h on the section Marchegg - DNV. In both nodes, the line is suitably connected to the technological and technical equipment on which the establishment of freight trains is performed.

In passenger transport, the line is important for regional connections from the Gänserndorf, Marchegg area to the industrial zone in Devínská Nová Ves and also to Bratislava.

An increase in the capacity of this route can be achieved by partial, resp. complete doubling of the line in the section Marchegg - Devínska Nová Ves and electrification of this section along its entire length.

The section Bratislava main station - Devínska Nová Ves is the most congested section on the ŽSR network and when increasing performance it is necessary to look for a solution to increase throughput performance either by widening the section (3rd line track according to BŽU) or by diverting freight traffic to other lines.

In the section Bratislava main station - Bratislava-Nové Mesto, the line is single-track and is on the verge of permeable performance. In the next period, it is necessary to increase the capacity of this line section.

The section of the Bratislava-Nové Mesto line to the Podunajské Biskupice station is single-track, non-electrified and up to the level of turning to the airport it is in parallel with a double-track, electrified line in the direction of the Central Freight Station and the port, continuing to the Bratislava-Petržalka station and continuing to border crossings Rajka (with Hungary) and Kittsee (with Austria).

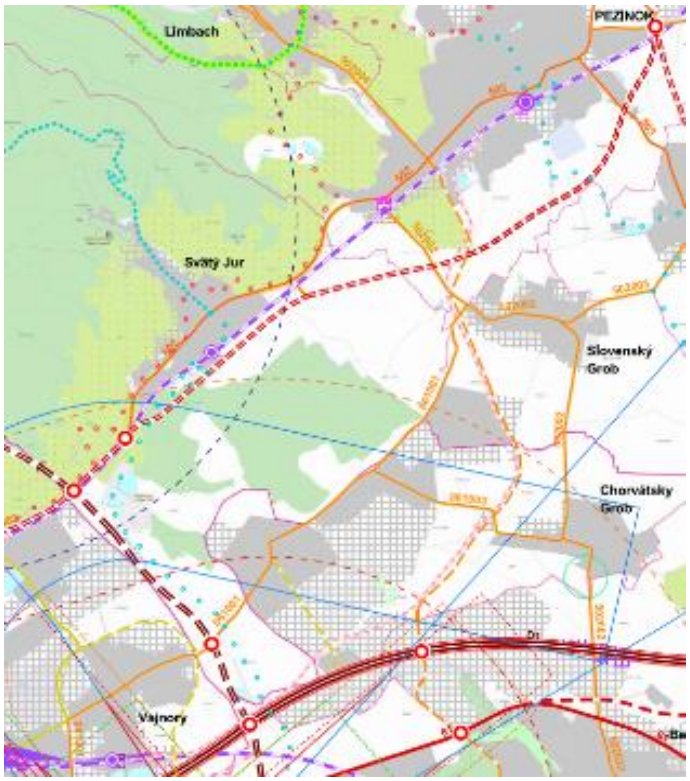
Railway lines in the city of BA are routed in dense urban development, so their expansion will be technically and investment-intensive. Within the Bratislava Railway Junction - Feasibility Study, it is assumed that projects that have not been confirmed by the study, but their potential and economic efficiency may be re-evaluated in the future by other studies will be included in the project stack for capacity of line sections and construction of a new station at MR Štefánik Airport, including its track connections on lines 132, 131 and 130.
The proposed railway connection from the Bratislava-Nové Mesto station to the Airport by a single-track line in parallel with the line to Podunajské Biskupice passes through the built-up area of Bratislava. The connection to the airport crosses the D1 motorway and the route in the direction of Podunajské Biskupice and Dunajská Streda, which plays an important role in regional transport.

Route 2 / Kittsee - Bratislava Petržalka - Harbor Bridge - Airport

This line in the section Bratislava-Petržalka - Bratislava-Central Freight Station was established as a replacement line after the abolition of the railway through the city. The track for the most part passes over the double-track Harbor Bridge. The line through the sparsely populated part of Bratislava and to the Bratislava Nové mesto station does not fulfill the function of a city railway. From the station Bratislava-Ústredná nákladná stanica it is connected by a rail connection - a siding in-house system for the company Slovnaft and for the area of the port of Bratislava, where several companies provide logistics. The line in the section Bratislava-Central Freight Station - Bratislava-Nové Mesto is double-track, electrified with a direct turn to the Airport, above the railway line to Podunajské Biskupice. The line passes through a less populated part of Bratislava and therefore has less environmental impact on the surroundings.
The route is advantageous for transit transport, both passenger and freight. The route can serve as a fast connection to Bratislava and Vienna airports. The track parameters are up to speed V = 80 km / h.

- Construction of a new regional line from ŽST Bratislava-Vajnory to ŽST Pezinok with service of the area Chorvátsky Grob - Slovensky Grob - Pezinok. Creation will require a new route and level crossings with existing and proposed roads. The mouth is at the head of ŽST Vajnory and ŽST Pezinok. The routing of this regional railway line and stops on it will be specified according to the state of development of the whole area, especially to the extent and type of development in the affected area. The location of this line will also be affected by future noise conditions from railway traffic.

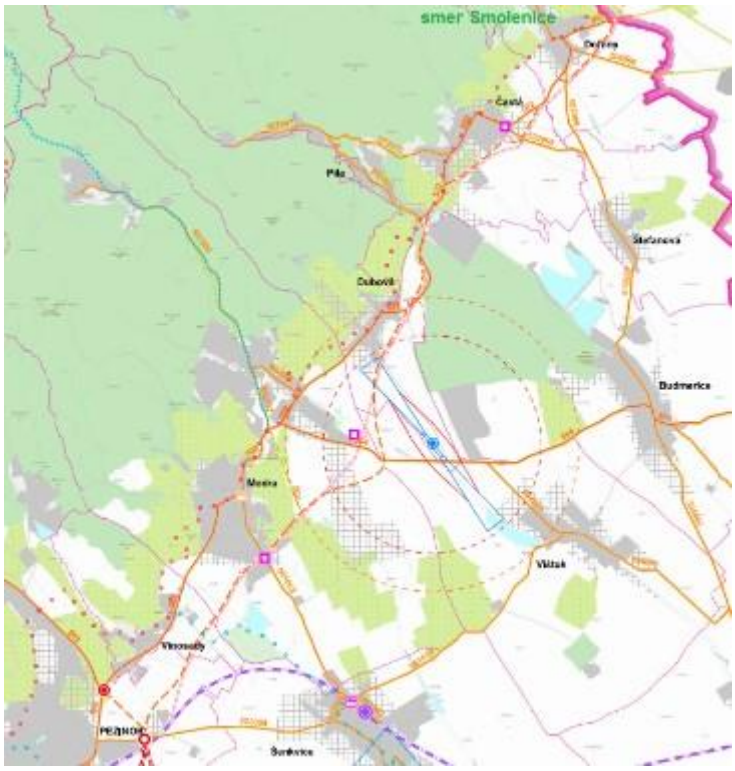
As part of the PUM BSK, we propose to check in the first stage the implementation of the Bratislava-Vajnory - Triblavina railway station, where the Triblavina station will include a capacity P + R car park serving the IAD-VLAK crossing from the D1 motorway using the Triblavina junction before entering Bratislava. Then the second stage continues to Pezinok.



A picture 4-3 Design of a new railway line - Bratislava-Vajnory - Chorvátsky Grob - Pezinok (Source: UPN R BSK as amended)

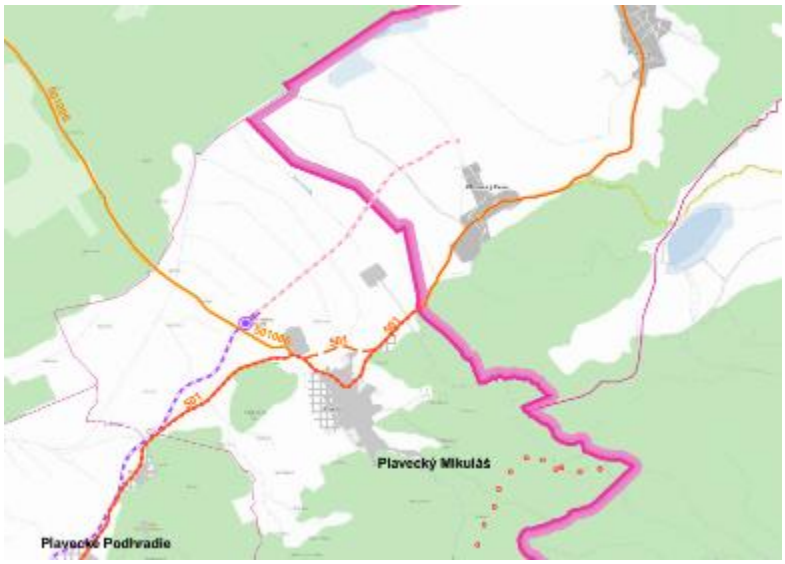
- As part of increasing the attractiveness of the rail part of integrated suburban transport, it is proposed to strengthen and interconnect existing lines within the BOD, while the connection of two regional lines will achieve a complete transport interconnection of the railway circuit around the Little Carpathians, which can be very advantageously used in suburban rail transport.

ŽSR 120-116 construction of a new regional line from Pezinok to Smolenice. The new line will be single-track, electrified, will serve mountain villages and will create a circuit by connecting lines 120 - 116 - 112 - 110.

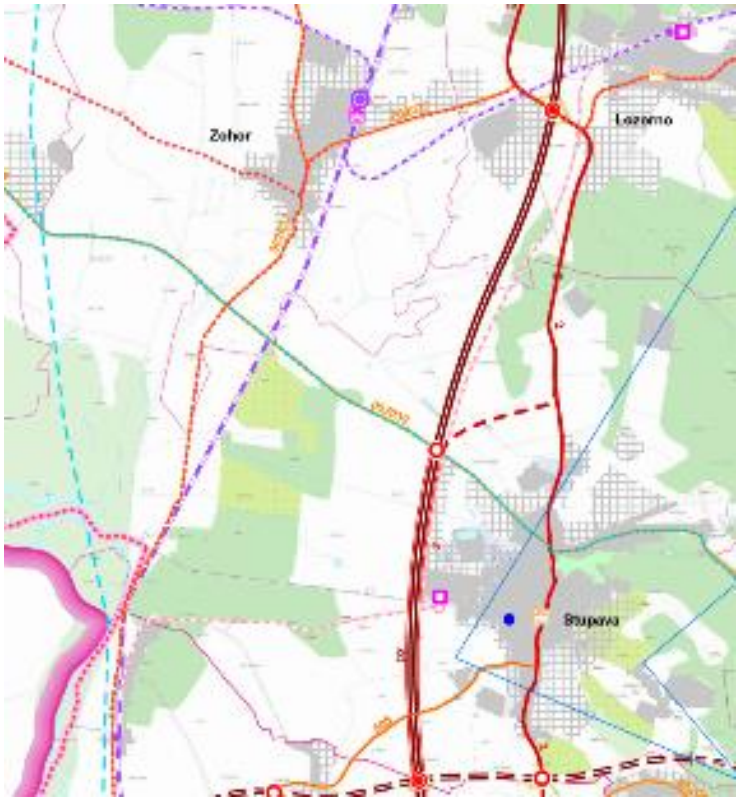


A picture 4-4 Design of a new railway line Pezinok - Modra - Smolenice
(Source: UPN R BSK as amended)

- ŽSR 112Zohor - Plavecký Mikuláš - new extension of line 112 from Plavecký Mikuláš to Jablonice, which will enable connection with line no. 116



A picture 4-5 Design of a new railway line - Plavecký Mikuláš - Jablonica
(Source: UPN R BSK as amended)

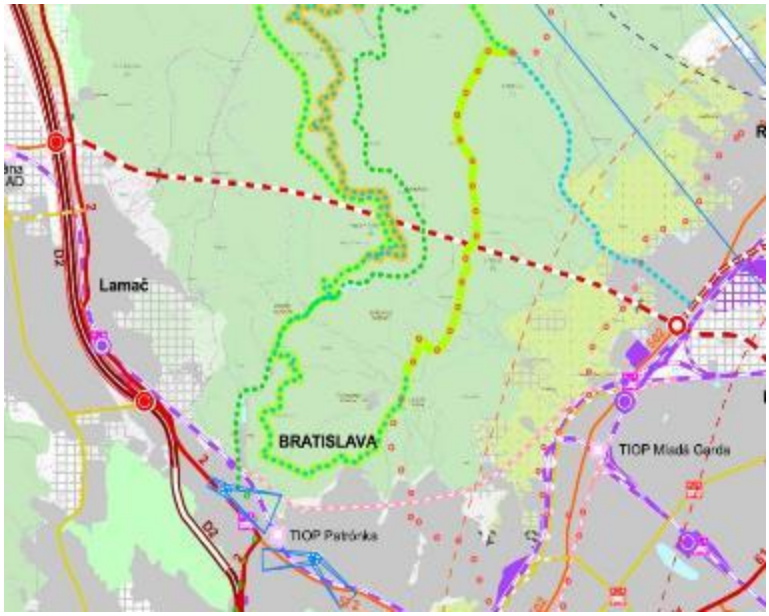


A picture 4-6 Design of a new railway line - Devínske Jazero - Stupava - Lozorno (Source: UPN R BSK as amended)

New route of line 112 from Lozorno through the cadastre of Stupava, use of the former body of the line Stupava - Devínske Jazero av odb. Devínske Jazero connection to line 110. Within this line, the solution will be the connection of the Stupava station in the direction of Lozorno and line no. 112. Zohor station and heads remain unchanged. Use in increasing the share of rail transport in the integrated system of suburban public transport. This direction is important, especially for the creation of conditions for the suburban railway VOD from the western part of BSK to Bratislava.

Within the PUM BSK, we recommend checking the alternative route Stupava - Bratislava outside odb. Devínske Jazero, directly in the direction of the I / 2 road and the D1 motorway to the Bory locality. We also recommend checking several options for capacity transport - railway line, tram line, respectively. another track.

- The segregation of traffic (passenger and freight rail transport) in the Bratislava railway junction (BŽU) is the reason for the design of a relief tunnel for freight transport in the Lamač-Briežky corridor with a continuation to the Bratislava-Východ station.



A picture 4-7 Tunnel for freight transport Lamač - Bratislava - East (Source: UPN R BSK as amended)

4.1.2 Rail and combined transport

The radial-circular network of the existing main lines of European and national importance and the basic railway lines significantly supports the development of the region's territory.

Space for the location of combined transport terminals (parking lots and connecting roads to the superior roads of the 1st and 2nd class) must be reserved at the touch of the railway stations Malacky, Devínska Nová Ves, ÚNS, Vlčie hrdlo - Čierny les, port Bratislava, Bratislava - East, Pezinok and Senec.

In the organization of rail freight transport, it is necessary to increase the use of the railway line No. 116 Trnava - Jablonica - Senica - Kúty, due to the relief of the Bratislava railway junction, especially from transit freight transport.

Modernization of lines at speeds of 160-200 km in the flat area of western Slovakia and electrification will provide a European standard for passenger and freight transport. In the area of the Bratislava Region, the line Vienna - Schwechat Airport - Bratislava Airport will be connected to this system, whereby Bratislava and the railway highways in Slovakia (corridors No. IV and V) will be indirectly connected to the trans-European express train system.

Evaluation of the measure

The measure seeks to strengthen rail public passenger transport by creating improved conditions for its use by the traveling public. It enables users to travel better by rail and more comfortably by rail. The measure creates personal benefits for the user in his financial and time savings as well as social benefits in positive impacts on the environment.
Users: passenger train

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport
- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- Ministry of Transport and Construction of the Slovak Republic
- Carriers on the territory of BSK
- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- Municipalities

Dates of implementation and investment costs:

Table 4-1 Dates of implementation and estimated investment costs for the implementation of modernization and new construction of railways

Marking Measures	Name of the project	Date of implementation	Investment costs (EUR)	Variant
K1	Partial increase in the permissible performance of the Bratislava-Nové Mesto - Dunajské Streda railway line, specifically construction of the Ružinov branch, reconstruction of the transport track in the Nové Košariská railway station for freight transport	Until 2025	22,000,000	Zero
K2	Electrification and reconstruction of the railway line on the section Devínska Nová Ves - Marchegg	Until 2025	14,000,000	Zero
K3 (K3A)	Modernization and capacity building of the railway line 110 Devínska Nová Ves (outside) - Kúty in two stages, while the first stage will be after Malacky	Until 2030	305,000,000	Zero
K4	Modernization of ŽST Bratislava hl. st. (railway infrastructure)	Until 2030	140,000,000	Maximalist

K5	2nd dormitory Bratislava hl. station (outside) - Bratislava-Nové Mesto	Until 2025	62 000 000	Maximalist
Marking Measures	Name of the project	Date of implementation	Investment costs (EUR)	Variant
K6	Modernization of the section Devínska Nová Ves - Bratislava Lamač	Until 2025	90,000,000	Maximalist
K7	Partial increase in throughput on line 120 Bratislava-Rača - Trnava	Until 2025	40,000,000	Maximalist
K7A	Capacity building of line 120 Bratislava-Rača - Trnava	Until 2030	280,000,000	Maximalist
K8	Partial measures to increase the throughput performance on the Bratislava-Vajnory - Senec line resp. Galanta	Until 2025	50,000,000	Maximalist
K9	Reconstruction of the Vinohrady / Suburbs interchange	Until 2025	20,000,000	Maximalist
K10	Reconstruction of ŽST Bratislava ÚNS	Until 2030	22,000,000	Maximalist
K11	Modernization and capacity building of the railway line 130 BA - Senec - Galanta - Nové Zámky - Štúrovo	Until 2030	200,000,000	Maximalist
K12	Capacity BA Nové Mesto (outside) - Podunajské Biskupice	Until 2030	66,000,000	Maximalist
K13	Capacity building Podunajské Biskupice - Kvetoslavov - Dunajská Streda (also with line to Šamorín)	Until 2030	55 000 000	Maximalist
K15	Connection of MR Štefánik Airport with a new line section	Until 2035	415 000 000	Maximalist
K14	Capacity Petržalka (outside) - border SK / AT	Until 2030	15,000,000	Maximalist
K16	Bratislava hl. station (outside) - Bratislava-Rača / Bratislava-Vajnory - mod.	Until 2030	67 000 000	Maximalist
K17	Bratislava odb. Vinohrady - Bratislava-Vajnory - mod.	Until 2030	38,000,000	Maximalist
K30	Modernization of the Bratislava-Vajnory railway station	Until 2030	20,000,000	Maximalist

K31	Capacity Bratislava Predmestie - odb. Swamp	Until 2030	18,000,000	Maximalist
K18	Bratislava-Nové Mesto (outside) - Bratislava-Petržalka - mod.	Until 2030	80,000,000	Maximalist
K19	Bratislava suburb – Bratislava-Filiálka / Bratislava-Nivy	Until 2030	190 000 000 / 250,000,000	Maximalist
Marking Measures	Name of the project	Date of implementation	Investment costs (EUR)	Variant
K20	Bratislava-Vajnory (outside) - Chorvátsky Grob - Pezinok	Until 2035	89,000,000	Maximalist
K21	Bratislava-Petržalka - Rusovce - state border SK / HU - mod.	Until 2035	30,000,000	Maximalist
K22	Capacity building and modernization of the Bratislava hl. st. (outside) - Lamač (outside)	Until 2035	57 000 000	Maximalist
K23	Capacity building of the section Bratislava - Lamač - Devínska Nová Ves	Until 2035	18,000,000	Maximalist
K24	Capacity building of the section Devínska Nová Ves (outside) - state border SK / AT	Until 2035	11,000,000	Maximalist
K25	Devín Lake - Stupava, resp. variant route between Bormi and Stupava	Until 2035	35,000,000	Maximalist
K26	Pezinok - Modra - Smolenice	Until 2040	95 000 000	Maximalist
K27	Swimming Mikulas - Jablonica	Until 2040	55 000 000	Maximalist
K28	Lozorno (outside) - Stupava (outside)	Until 2040	67 000 000	Maximalist
K29 / E29	Rail / tram connection Bratislava-Filiálka / Bratislava-Nivy with Petržalka (following K19)	Until 2050	100,000,000 / 60,000,000	Maximalist
K32	Rail connection of ŽST ÚNS with EUROVEA	Until 2030	10,000,000	Maximalist
Variant solution (K7A + K11)	New line from Bratislava for long-distance passenger and freight transport routed in the area between lines 120 and 130 with subsequent branching to Galanta and Trnava.	Address in case of impossibility of sufficient proposed capacity building of lines 120 and 130. RPUM BSK proposes in this case that the original lines serve as a priority for the needs of regional railway transport.		

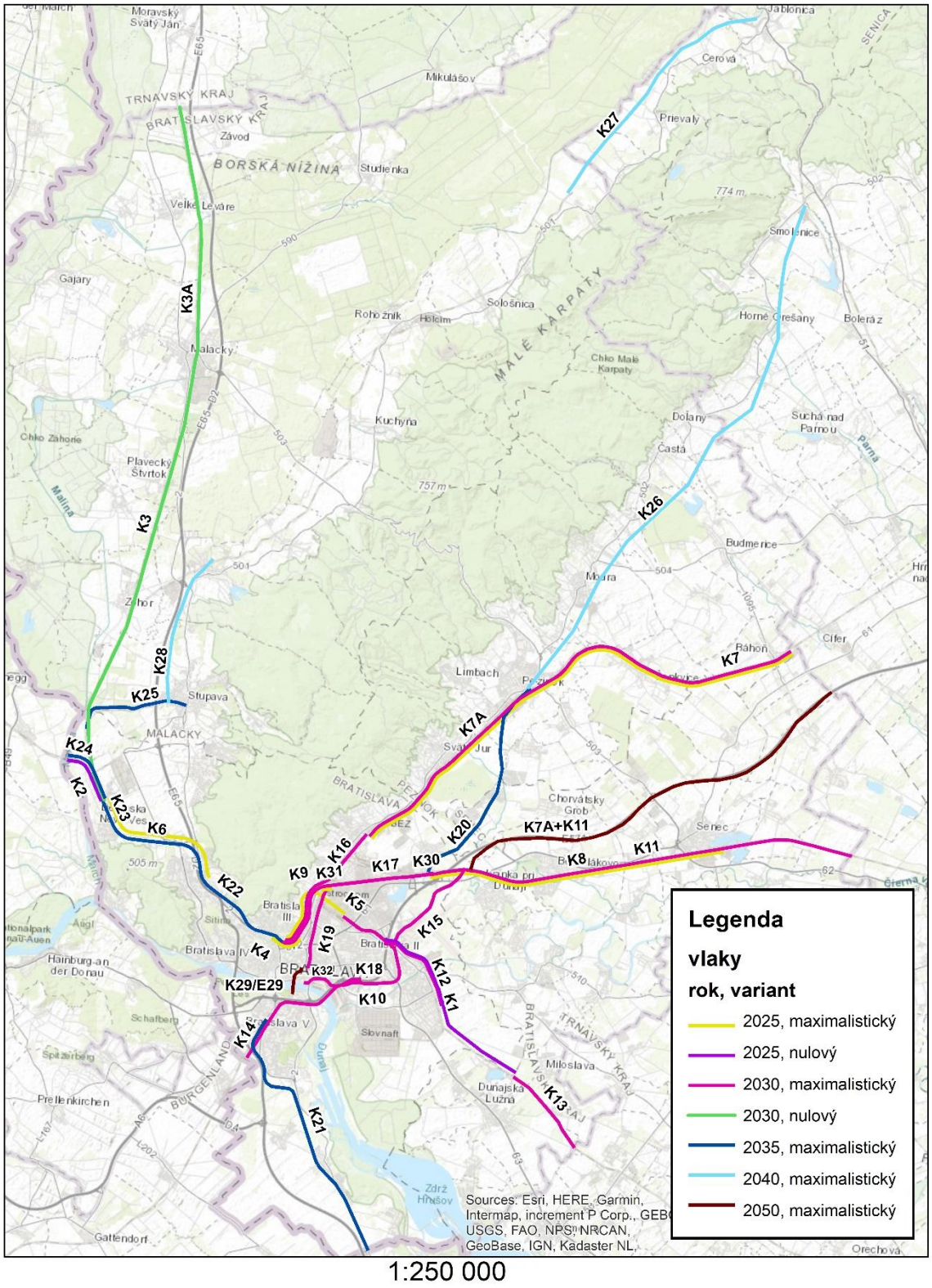
Note: Implementation dates are informative. The end dates are in the Implementation section.

As part of railway modernization projects, all level crossings are being abolished in principle and replaced by level crossings of roads of all kinds (roads, cycle paths and pedestrians). All these measures are taken into account and incorporated in the project of modernization of the railway line.

Impact on the Spatial Plan

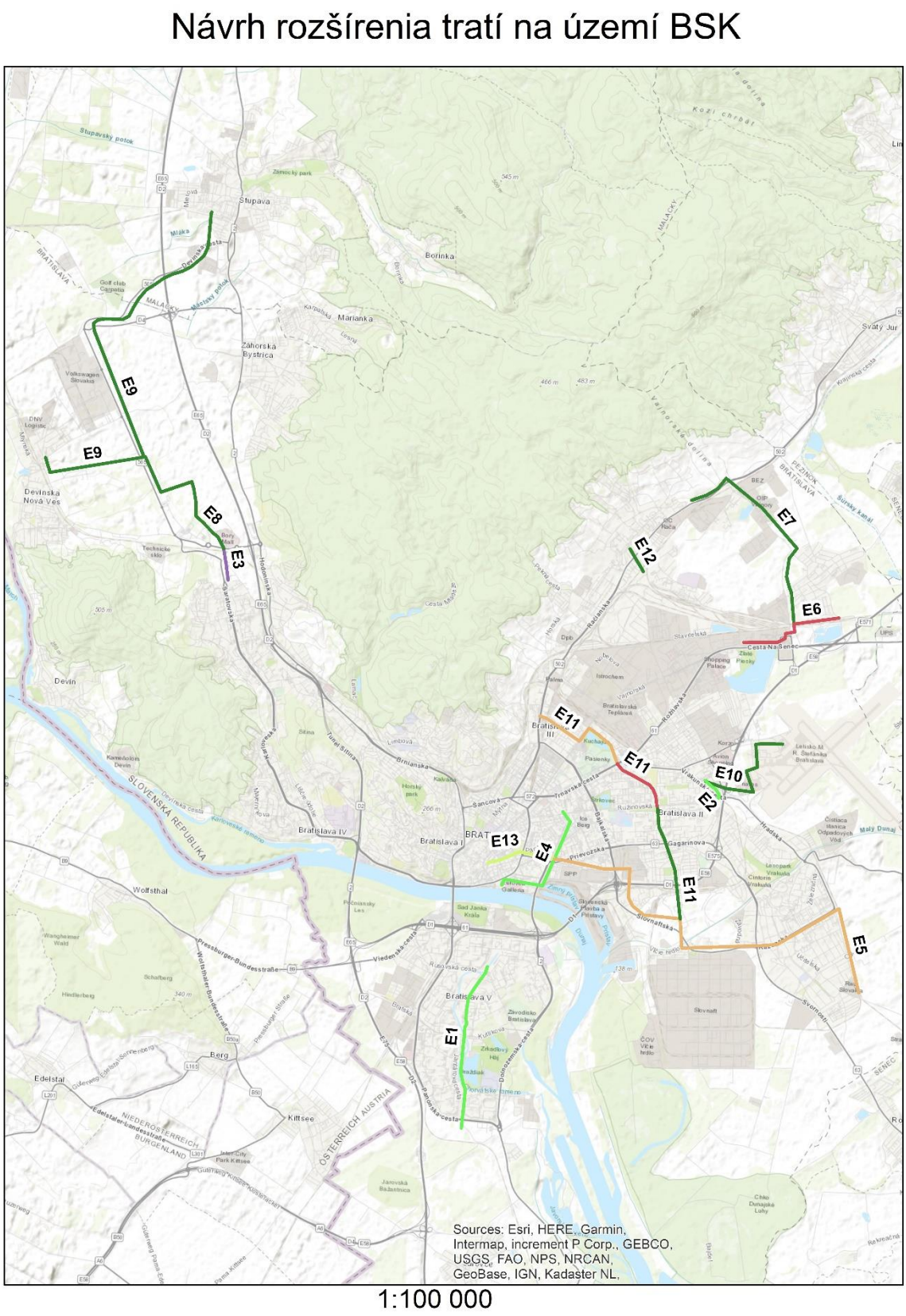
The measure has an impact on the zoning plan

Novobudované a modernizované trate na území BSK



A picture 4-8 Newly built and modernized lines on the territory of BSK

4.2 Tramway - Extension and modernization of tram lines



A picture 4-9 Tram transport - Extension and modernization of tram lines - tracing is schematic (Source: Processor)

Description of newly proposed lines:

1. *Bosákova - Janíkov Dvor line*
2. *Extension of Ružinov radial after TIOP Ružinov*
3. *Extension of the Dúbravsko-Karloveská radial to TIOP Bory*
4. Connection from Šafárikový nám. via Košická ul. with connection to Ružinovská radial
5. *Connection Košická - ŽST Podunajské Biskupice*
6. *Extension of the Vajnorská radial to the Vajnory railway station*
7. *Connection of Vajnorská radial with Račianská radial*
8. *Extension of the Dúbravsko-Karloveská radial from TIOP Bory to the Bory locality*
9. *Extension of the Dúbravsko-Karloveská radial from the Bory locality to VW and Devínská Nová Ves, possible extension to Stupava*
10. *Extension of Ružinov Radial from TIOP Ružinov to MR Štefánik Airport*
11. *Tangential connection of Račianská, Vajnorská, Ružinovská and Vrakuňsko-biskupická radials*
12. *Track to the railway station in Rača*
13. *Connection Kamenné nám. - Košická through the locality Mlynské Nivy*

The preference of rail public transport lies in the application of such a system of intersection management, in which the principle of differentiation of traffic participants according to the established hierarchy is applied, at the highest level of which tram transport stands. Depending on the tool used, we distinguish two types of tram preferences:

- Preference in fixed signaling plans. It is an arrangement of control of a system of two or more intersections, where the principle of so-called green waves for trams. The wave is triggered in a fixed mode, ie without triggering a demand by the tram. With this method of control, the tram stops on the first stop and the other intersections pass smoothly without stopping. This method of management is suitable for smaller groups of intersections with a minimum of stops on the coordinated section. It is generally applied as the first phase of preference before the introduction of dynamic management.
- Preference at dynamically controlled intersections. Unlike the previous type, the "free" signal for trams can appear outside the proper phase sequence, based on the trick's prompt using the installed detection system. In this case, the proper sequence of phases is interrupted, followed by the phase intended for the tram, including all collisions without collisions (usually parallel directions for car traffic and parallel pedestrian crossings). The vehicles are fitted with devices to communicate with the system. They inform him of their arrival at the crossroads and, for example, the current delay. According to this information, the system can set the green wave for this VOD vehicle, but taking into account the occupancy of other traffic flows. In practice, this means that if the VOD vehicle is not delayed, the controller is controlled by a classic program or according to the current traffic situation detected by traffic sensors. In case of high delays, the system tries to find the most suitable way to speed up the passage of traffic lights.

In 2014, as part of the UNDP / GEF Sustainable Transport project in Bratislava, a new method of public transport preference was implemented at three already light-controlled intersections with public transport on the Račianská radial. It consists of communication between a public transport vehicle - its on-board computer and the controller of a light-controlled intersection using the TETRA radio network, which is owned by Dopravný podnik Bratislava, as. The difference in the implemented method of preference is in the use of new technologies and the use of other transmission paths, as well as another method of detection than has been used so far. This approach does not require the installation of physical equipment on the track (induction loops, contact contacts ...), but based on tracking the vehicle's position via GPS, the on-board computer of the vehicle evaluates the passage through the detection zone, on the basis of which it sends a request for a preference to the road traffic controller

via the TETRA digital radio network. Feedback on the acceptance of the request and on the provision of the green phase for the public transport vehicle is also provided. This technology allows greater possibilities for control changes within the intersection, when when changing the control logic (eg forced by construction modifications) and the need to change the detection distance of the public transport vehicle, it is possible to move each of the detection zones in any way. The intersection can also contain all kinds of detection zones (challenge-check-in, confirmation and check-out). At the time of the project, DPB spoke of 90% of the success of the public transport crossing the intersection, ie only 10% of the vehicles were forced to stop in front of the intersection border and wait for their green signal.

In 2014, the modernization of the tram line on the Dúbravská radial in Bratislava in the section Hanulova - final Pri kríži was carried out. The modernization of the tram line was focused on ensuring the active preference of trams to the maximum possible extent at the Sch. Trnavského / Alexyho / Pod záhradami and Saratovská / Drobného / Repašského. In 2015, the Traffic Engineering Department of the Bratislava City Hall evaluated the operation of the modernized tram section, reaching the following results: speed accelerated by 24% due to modernization (ie travel time decreased by 2 minutes and 32 seconds), public transport preference accelerated by another 4% (ie reduced driving time by 18 seconds), the synergistic effect of modernization and preferences brought an acceleration of 28% (ie by 2 minutes and 50 seconds).

Dynamic preference of trams is also realized on the first section of Petržalská radial Šafárikovo nám. - Jungmann.

At present, there are 20 light-controlled intersections in Bratislava with a dynamic preference for public transport, of which 14 with priority for trams, 4 with priority for buses and trolleybuses, and four also have a conditional preference for other non-rail public transport. Of these intersections, 6 are on the Račianská radial, 4 in the city center, 3 on the Dúbravská radial, two in Petržalka and the rest are in other parts of the city.

The above findings clearly point to the need to modernize the tram lines and the current equipment of all intersections, which are located on them for dynamic control.

The modernization of the Karlovy Vary radial in the section Molecova - Hanulova is currently being implemented and the last stage of this radial in the section Molecova - Chatam Sófer is ready for implementation. Further modernization is being preparedRužinovská, Račianská and Vajnorska radials.

Evaluation of measures

Extension of tram lines

The construction of the new infrastructure will expand the reach of the main tram transport, thus increasing the accessibility of the traveling public to the tram network. The quality of transport services for areas with the reach of new infrastructure will increase significantly, as the basic shortcomings in the accuracy and reliability of public transport are eliminated.

Users: passenger

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport
- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- The capital of the Slovak Republic, Bratislava

Dates of implementation and investment costs

Table 4-2 Dates of implementation and estimated investment costs for the implementation of new tram lines

Name of the project	Date of implementation	Investment costs (EUR)	Variant
Bosákova - Janíkov Dvor	Until 2025	84,000,000	Zero
Extension of Ružinov radial after TIOP Ružinov	Until 2025	25,000,000	Maximalist
Name of the project	Date of implementation	Investment costs (EUR)	Variant
Extension of the Dúbravsko-Karloveská radial to TIOP Bory	Until 2025	35,000,000	Maximalist
Connection from Šafárikový nám. via Košická ul. with connection to Ružinovská radial	Until 2025	39,200,000	Maximalist
Connection Košická - ŽST Podunajské Biskupice in touch of P + R and TIOP Port bridge	Until 2030	60,000,000	Maximalist
Extension of the Vajnorská radial to the Vajnory railway station	Until 2035	27 000 000	Maximalist
Connection of Vajnorská and Račianská radials through the Vajnory district	Until 2040	20,000,000	Maximalist
Dúbravsko-Karloveská radial from Bory to VW and DNV, possible extension to Stupava	Until 2040	80,000,000 (+70,000,000 - Stupava)	Maximalist
Dúbravsko-Karloveská radiála from TIOP Bory to the locality Bory	Until 2040	70,000,000	Maximalist
Ružinov radial from TIOP Ružinov to MR Štefánik Airport	Until 2040	44 000 000	Maximalist
Tangential connection of Račianská, Vajnorská, Ružinovská and Vrakuňsko-biskupická radials	Until 2030, 2035, 2040	90,000,000	Maximalist
Track to the railway station in Rača	Until 2040	5,000,000	Maximalist
Connection Kamenné nám. - Košická through the locality Mlynské Nivy	Until 2050	20,000,000	Maximalist

Note: Implementation dates are informative. The end dates are in the Implementation section.

Bosákova - Janíkov Dvor line.The route with the appropriate platform infrastructure reflecting the increase in demand due to the expected increase in passengers follows on from the already implemented 1st stage and continues along the Amber Road to the 2.4 km long intersection with Rusovská cesta. The route is in accordance with UGD Bratislava and from the transport point of view it solves the optimal concept of Petržalka transport service with connection to the city-wide transport system.

Connection Kamenné námestie - Košická via the locality Mlynské Nivy. It is recommended to check the section from Kamenný námestie to Košická street by a study.

Tangential connection of Račianská, Vajnorská, Ružinovská and Vrakuňsko-biskupická radials. The track is in accordance with UGD Bratislava. It is of great transport importance in ensuring tangential relations, and from an operational point of view, the tangent will be beneficial even in emergency situations and exclusions. The first part of the tangent, which connects the Rača and Vajnor radials, is complex. This section still needs to be studied.

Extension of the Dúbravsko-Karloveská radial to TIOP Bory. The route is a continuation of the tram line in Dúbravka, it leads under the railway to TIOP Bory).

Extension of the Dúbravsko-Karloveská radial from TIOP Bory to the Bory locality.

Extension of the Dúbravsko-Karloveská radial from the Bory locality to VW and Devínská Nová VsI. Both branches are designed only ideologically and the exact tracing will depend on the urban design for the construction of areas. UGD is considering the line at the level of the territorial reserve, with regard to the already implemented and also planned urbanization of the area up to Stupava, the implementation of the line seems justified.

Extension of the Vajnorská radial to the Vajnory railway station.The route feeds into the existing Vajnor radial on Zlaté piesky and continues to the Bratislava Vajnory Railway Station. The line is in accordance with UGD and provides a connection between public transport and rail transport.

Track to the railway station in Rača.The route solves the transition between tram and train and is designed as a turn-off from the tram line in Rača in the area of Detvianská Street. The termination of one line is also addressed here, as the frequency of passengers does not require all connections until the final Commissioner. The track is UGD compliant. However, it is in a confined space and will require a fairly extensive remediation. From a traffic point of view, this route is not decisive.

Extension of Ružinov radial after TIOP Ružinov. In terms of the possibility of transfer from public transport to railways, ÚGD BA recommends extending the tram line to the planned TIOP Ružinov - Ružinovská and Vrakunská roads.

Extension of the Ružinov radial from TIOP Ružinov to MR Štefánik Airport. Extension of the route to UGD airport is not recommended.

Connection from Šafárik Square via Košická Street with connection to Ružinovská Radial. The line will provide transport services to the newly built city center and will ensure the rounding of tram lines, thus reducing their vulnerability.

Connection Košická - ŽST Podunajské Biskupice. The route follows the Kamenné nám. - Mlynské Nivy - Košická in contact with TIOP at the Port Bridge to Podunajské Biskupice. UGD BSK recommends the tram line only in the level of the territorial reserve, the capital city of Bratislava has recently been reconsidering its implementation in connection with the line through Košická Street.

Connection of Vajnorská and Račianská radials

UPN R BSK, as amended, proposes the extension of the existing tram line on the Vajnorská radial from the Zlaté piesky turn to the BA-Vajnory railway station.

In the area between the district of BA Vajnory and Rača there are already existing areas with many job opportunities (Rybničná and ul. Na pántoch) and in the near future the construction of Nové Vajnory, Nemecká dolina and CEPIT Vajnory (equipment with many new job opportunities and housing) is being

prepared. for about 16,000 inhabitants) in the area of the former Vajnory airport, which already requires the strengthening of the public transport network in the whole area. Several urban studies have been prepared in this area in the past period.
With regard to the planned new construction, as well as to the requirements of strengthening rail public transport in this part of the area, a prospective connection of tram lines between Golden Sands and the Commissioners through an area with great development potential is proposed. The public transport operator considers these connections to be desirable, also from the point of view of operation.

The operation of these lines by individual lines will determine the development of investments in these areas.
Impact on the Spatial Plan
The measure has an impact on the zoning plan

4.2.1 Dynamic control of light signaling

Dynamic intersection management is one of the highest measures to prioritize public passenger transport based on wireless communication of on-board computers of public transport vehicles with road traffic light controllers. The measure pursues the absolute priority of rail transport, its fluidity, speed, safety and travel comfort.

In addition to equipping the reconstructed and modernized tram lines on all radios (Dúbravská, Račianska, Vajnorská, Ružinovská) with dynamic control of intersections with tram preferences, we recommend to ensure the priority of trams in the city center at intersections:

- Štúrova - Jesenského
- Imrich Karvaš - Radlinský
- Radlinsky - Vazovova
- Vazovova - Krížna

Users: passenger

Strategic goals:

- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region

Dates of implementation and investment costs
The data are given above. In the case of newly built lines, as well as in the reconstruction and modernization of existing lines, it is necessary to take into account the factor of dynamic control of light signaling and incorporate it into individual projects.

4.2.2 Separation of the tram body from the IAD at road level

The subject of the measure is primarily to increase the safety of tram transport. By eliminating possible collisions of trams with car traffic, an increase in its speed and smoothness will also be achieved.
Users: passenger

Strategic goals:

- Increased security

Task holders:

- The capital of the Slovak Republic, Bratislava

Dates of implementation and investment costs

It is assumed that the total length of 8.24 km of longitudinal guide sills will be realized by 2030. The investment costs per km of longitudinal guide lane are about 6,000 €. The total cost of 8.24 km of guide sills is about € 50,000.

Impact on the Spatial Plan

The measure does not affect the zoning plan

4.2.3 Modernization of tram lines

The measure aims to increase the transport speeds of tram transport, shorten travel time and increase travel comfort. For the carrier, it will mean reducing the costs of track maintenance and traffic by reducing the number of vehicles deployed and reducing the number of drivers required.

Users: passenger

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport
- Increasing the efficiency, reliability and accessibility of public transport
- Increased security

Task holders:

- The capital of the Slovak Republic, Bratislava

Dates of implementation and investment costs

Table 4-3 Dates of implementation and expected investment costs for the modernization of tram lines

Name of the project	Date of implementation	Investment costs (EUR)	Variant
Dúbravsko-Karloveská radiala	Until 2025	56,000,000	zero
Račianska radial	Until 2030	70,000,000	zero
Vajnorská radial	Until 2025	59 000 000	zero
Ružinov radial	Until 2025	39 000 000	zero

Impact on the Spatial Plan

The measure does not affect the zoning plan

5 Preference for public passenger transport

The increase in individual transport, which is more comfortable for its users, especially during peak hours, adversely affects the quality of transport and the environment. All the negative effects of individual transport have a significant impact on public transport, which becomes unattractive for its users, despite the fact that in many cases it can provide comparable and sometimes even better transport options.

The preference for public passenger transport vehicles is one of the most important measures that can be implemented to increase the attractiveness of urban and suburban public transport and to influence the positive redistribution of transport in favor of the environment. Reducing the driving time of VOD leads to an increase in its efficiency, and thus to a possible reduction in the number of VOD vehicles dispatched while maintaining transport capacity.

Public passenger transport enables significantly more efficient use of roads than individual car transport. Therefore, it is desirable to give preference to VOD vehicles over other vehicles. The only way to reverse the current undesirable situation and achieve the required change in the share of transport work in favor of public passenger transport is its strong and massive preference. The territory of the city of Bratislava and the Bratislava self-governing region is given by historical development and is characterized by limited possibilities of expanding the transport infrastructure. Finally, it is known thatby adding a lane on the road, more car rides will be generated, even those that would otherwise take place e.g. by public transport or would not take place at all. If to extend the communication, then for the purpose of establishing public transport lanes. Thus, if public passenger transport is to be preferred in the traffic flow, this cannot be done at the expense of bicycle or pedestrian traffic, but must be done at the expense of individual car traffic.

The basic parameter of vehicle selection is the time of movement, which is defined as the time spent in the vehicle and the time spent outside it. It is therefore the time required for walking to the stop, the time waiting for the connection, the time of stay in the vehicle, the time required for a possible transfer and the time of walking from the stop. As a result, the shorter the relocation time, the more attractive the public passenger transport will become. The nature of public transport vehicles is very different from that of passenger cars. This is due to the stopping of buses at stops between junctions, boarding and alighting of passengers. This means that the speed of public transport is lower than the speed of passenger cars. As a result, light-controlled junctions included in the coordination for IAD can become a "brake" for public transport vehicles.

The basic goal of the VOD preference is to increase the smoothness of the VOD, which also increases its cruising speed, shortens driving time, improves regularity and reliability, and ultimately reduces the number of vehicles dispatched, the number of personnel required, fuel and energy savings. The preference also brings the attractiveness of public transport in the eyes of passengers. When preferring one mode of transport, it is necessary to determine at the expense of which mode it will be preferred. It is not possible to favor one road user without harming the others. In this case, the preference of VOD naturally brings harm to other road users.

5.1 Preference trams

Part of the priorities of the capital of the Slovak Republic, Bratislava, is also the program of tram transport preferences. The basic philosophy of this program is a system solution of complete sections of tram lines in the mode of tram traffic preference with the aim of minimizing the delay of trams at light-controlled intersections so that the only place of tram arrest on the line is a stop. Due to the radial configuration of the tram network, the system unit is the radial from the edge of the central urban area to the final one.

Traffic management is dynamic. In this sense, the object of interest is the following:

- Connection of existing light-controlled intersections to the system
- Establishment of signaling at all intersections where its effectiveness has been proven (capacity problem, road safety) in the regime of tram traffic preference
- Traffic management at level crossings, also used as a waiting area when giving priority

The most important element of tram preference is the segregation of their lines from other car traffic. Segregation of trams will increase their speed, smoothness, accuracy, reliability and safety.

The most significant and significant is the line of the tram line on a separate track body outside the lane for automobile traffic. In this case, the tram has contact only with passengers at stops, or exceptionally with pedestrians at pedestrian crossings.

Tramway management on a separate railway body must be implemented in long-term projects for the extension of existing tram radials - especially the extension of Petržalská radial, then Dúbravská radial to Devínská Nová Ves and Vajnorská radial to Vajnory. At the necessary crossings of the tram with car traffic and pedestrians, it is necessary to ensure the absolute priority of the tram transport by hardware and software means within the managementtraffic lights. To prevent a collision between the tram and pedestrians, or animals, it is necessary to separate the tram line from the rest of the area in the undeveloped area by barriers or railings.

The guidance of the tram line in the main traffic space on the raised tram strip is a suitable way of segregation of trams. It is less demanding in terms of space, but it is prone to disruptive contacts with other modes of transport. To ensure the required speed, it is necessary to reconstruct and modernize the tracks at regular intervals. Dúbravsko-Karloveskejradials. On theit is to be gradually followed by reconstructions and modernizations of the Račianská, Vajnorská and Ružinovská radials.

Simultaneously with the reconstruction and modernization of tram radials, it is necessary to reconsider the number and location of crossings for car traffic over the tram line (tram crossings). Where it ispossible is good at allow the nearest traffic light to turn vehicles in the opposite direction while maintaining the preference of trams (see Dúbravka). At the crossings that need to be left, it is appropriate to ensure traffic safety by prioritizing traffic lightstram transport. It is recommended to structurally change the pedestrian crossings through the tram line so that they do not allow direct pedestrian crossing. At the same time, it is desirable that they be equipped with a warning light and sound signaling to warn of the passage of the tram well in advance.

The CSS-controlled intersection must be technologically capable of preferring public transport on the basis of information obtained from the vehicle by holding or smoothly changing the signal phases while ensuring conditional or absolute preference. To prefer a tram at intersections controlled by fixed signal plans or in line coordination, the CSS must be equipped with pre-signals for the passage of trams through the intersection before the first controlled intersection. Pre-signals inform the driver in advance of the expected signal for trams to pass through the intersection. This also applies to tram crossings.

From the point of view of segregation of trams, it is least suitable to guide them on a non-raised tram strip. As a rule, segregation is ensured only by horizontal traffic signs (traffic sign V1a), which is insufficient. Tram traffic is disrupted by car traffic, pedestrians and bicycle traffic. Tram lines

on an unincorporated tram line are located mainly in the city center, where the width of the roads is limited and in the past it was necessary to create space for individual car traffic.

In the city center, if the track body is part of the roadway and the vehicles have their own lane, the tramway must be separated from the road by physical or construction measures (eg installation of road conveyor belts, guide thresholds, fitting physical barriers to the road body such as precast concrete units, etc.) at the same time enabling the traffic of selected vehicles along the track body (eg vehicles of the integrated rescue system, alternative transport, etc.)

In Bratislava, road-level tram lines run in the city center, on Vajnorská Street and on Nábreží L. Svoboda, in the section from the Chatam Sofer stop to the SNP Bridge. All these sections are designed for physical protection by means of guide sills with a total length of 8.24 km.

A picture 5-1 Tram body protection by guiding threshold
(Source: Processor)

6 Road and motorway infrastructure

Infrastructure measures

The scope of the road network in BSK has been stabilized for a long time, while its development goals were initially defined in UPN R BSK 2013. Subsequently, this network scope was verified by calculation in a mathematical model for all required development states as well as development time stages of development 2025, 2030, 2040 and 2050

ZERO VARIANT
Based on the available information, the processor determined a zero variant of the road network. This zero variant contains only currently under construction sections, or sections that are in the stage where their implementation is "certain", whether from the point of view of processing project documentation, the public procurement process and the like.

Table 6-1 Zero variant of road infrastructure

Name of the project	Time variant	Responsible
D4 motorway in the section Jarovce - bridge over the Danube - on II / 502 in Rača	Until 2025	Ministry of Transport and Construction of the Slovak Republic
R7 expressway in the section Bajkalská - border of the BSK - Hubice region	Until 2025	Ministry of Transport and Construction of the Slovak Republic
Construction of the Triblavina level crossing on the D1 with connection to I / 61	Until 2025	Ministry of Transport and Construction of the Slovak Republic
Construction of a new regional road - connection to the intersection Triblavina - Chorvátsky Grob (Warm spring)	Until 2025	Bratislava self-governing region

MAXIMUM VARIANT Based on the available information, based mainly on UPN R BSK 2013 and based on the results of the transport model, the processor also determined a maximalist variant in the road network, which includes all constructions whose implementation can be expected by 2050. These are the following road constructions. The list below does not list buildings that are in the zero variant. Based on the available information and using price norms, the processor determined the approximate prices of individual investment costs for the built (reconstructed) sections.

Table 6-2 Road constructions in the maximum variant

Name of the project	Time variant	Investment costs (EUR)	Responsible

Capacity building of the D1 motorway in the section Vajnory - Senec-východ + modification of the motorway exit in Senec	2025	330 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
Capacity building of road II / 505 in DNV in connection with ongoing construction in the area north of OC Bory.	2030	3 mil. EUR	The capital of the Slovak Republic, Bratislava
Capacity building of the D2 Lamač - Stupava motorway.	2030	130 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
Name of the project	**Time variant**	**Investment costs (EUR)**	**Responsible**
D2 Crossroads Mat	2030	10 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
D2 Intersection Studienka	2030	10 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
D2 Crossroads Čunovo	2030	10 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
D4 Devínska Nová Ves - state border SR / RR	2030	40 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
Extension of Eisnerova street	2030	35 mil. EUR	The capital of the Slovak Republic, Bratislava
Road II / 502 Pezinka bypass	2030	50 mil. EUR	Bratislava self-governing region
Road II / 502 Modry bypass	2030	35 mil. EUR	Bratislava self-governing region
Marchfeld - Záhorie road bridge	2030	14 mil. EUR	Bratislava self-governing region
Regional route Chorvátsky Grob (Teplý prameň) - Pezinok	2030	22 mil. EUR	Bratislava self-governing region
Construction of the road with the intersection of I / 61 with a continuation between the villages of Bernolákovo, Ivanka pri Dunaji, the bypass of the village of Zálesie up to the crossroads on the D4	2030	27 mil. EUR	Bratislava self-governing region
D4 motorway - in section II / 502 - Carpathian tunnel	2035	1 billion EUR	Ministry of Transport and Construction of the Slovak Republic

R1 expressway - future route in the corridor from the intersection with the D4 with the intersection of the road II / 572 southeast of Most pri Bratislave - Tomášov - feeder from II / 510 - Vlčkovce - continuation to the direction of Nitra	2035	500 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
Road I / 2 - Stupava bypass	2035	40 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
Road II / 590 - Malaciek bypass	2030	25 mil. EUR	Bratislava self-governing region
Capacity building of the road I / 61 - Vajnory - Senec	2025	60 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
Capacity of the D2 Lozorno - Stupava motorway	2035	90 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
Capacity building of the D1 motorway in the section Senec-východ - Trnava	2040	360 mil. EUR	Ministry of Transport and Construction of the Slovak Republic
Capacity building of road II / 503 - Creation of the county circuit - tunnel under Baba)	2040	100 mil. EUR	Bratislava self-governing region
Name of the project	**Time variant**	**Investment costs (EUR)**	**Responsible**
Capacity building of the road II / 503 - Creation of the county circuit - section Senec I / 61 - MUK D1 “Senec“ - Pezinok	2025	48 mil. EUR	Bratislava self-governing region
Relocation of the road II / 510 in Tomášov	2040	10 mil. EUR	Bratislava self-governing region
Northern Tangent (Pražská - Jarošova)	2050	70 mil. EUR	The capital of the Slovak Republic, Bratislava
Baikal - removal of level crossings	2050	80 mil. EUR	The capital of the Slovak Republic, Bratislava
Vrakuňa - bypass in the extension of Galvaniho street	2050	40 mil. EUR	The capital of the Slovak Republic, Bratislava
Vajnory - northern and eastern bypass	2050	40 mil. EUR	The capital of the Slovak Republic, Bratislava
Rača - relocation II / 502 (Rybničná - Pri Šajbách - Račianska)	2050	55 mil. EUR	The capital of the Slovak Republic, Bratislava

Connection Žabí Majer - Krasňany	2050	8 mil. EUR	The capital of the Slovak Republic, Bratislava
Connection Krasňany - Polianky	2050	250 mil. EUR	The capital of the Slovak Republic, Bratislava

Note: Implementation dates are informative. The end dates are in the Implementation section.

Reconstruction and delays of roads II. and III. classes, which are proposed in the UPN R BSK and in the UPN of individual settlements, must be verified by updating the traffic-engineering assessment and evaluation of road safety in such sections, in order to prepare for their reconstruction. The timetable for their implementation must be subject to CBA evaluation. These are measures of a local nature and will be implemented according to the needs and possibilities of BSK. This procedure affects the implementation of all proposed bypasses of individual settlements (eg bypasses on roads II / 501, II / 502, II / 503, ..., as well as new roads such as the Senca, Stupava, Malaciek bypass ...).

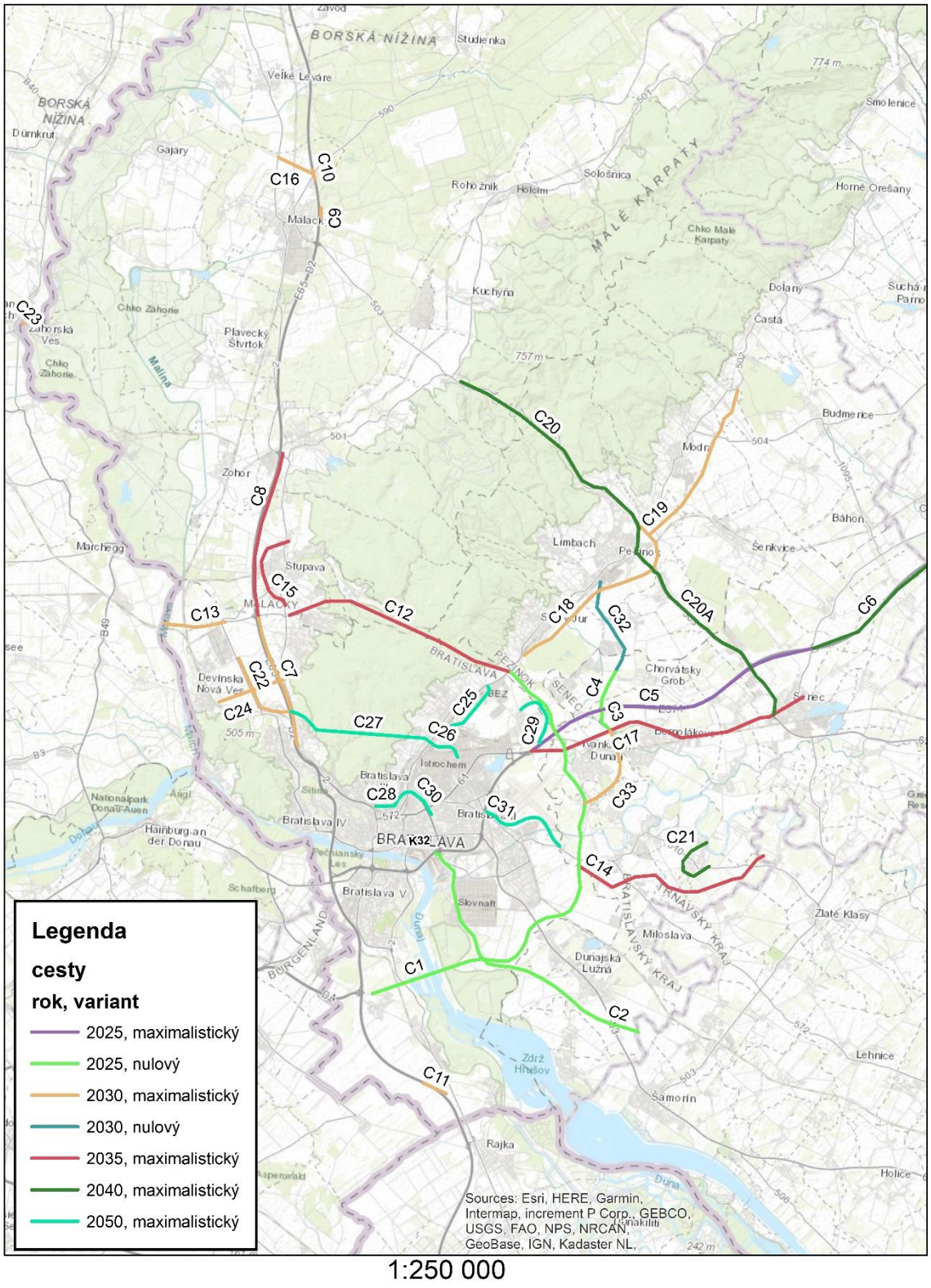
Similarly, it is necessary to approach the requirements for reconstructions and repairs of bridge structures, for which it is necessary to prepare ongoing bridge inspections and to permanently update the repair plan according to their results.

There are many connecting and connecting roads III in the territory of BSK. classes, a large part of which has limited width and direction ratios with a width of about 6.0 m. Many VOD bus lines are routed on these roads, which need a lane with a minimum width of 3.50 m for safe driving, which means that when driving on such roads they necessarily interfere in the opposite direction.

In the future, it is also necessary to deal with the modification of these basic characteristics of roads III during the reconstructions. classes. For the needs of an approximate estimate of the price in the modernization / reconstruction of roads II. and III. classes can be used approximate costs per kilometer of road reconstruction price, which includes costs associated with risks (10% of basic investment costs) and costs associated with project preparation (6% of basic investment costs).

For a category C route 9.5 it is 854,484 EUR / km and for a category C 7.5 route it is 674,880 EUR / km.

Novobudované a modernizované cesty na území BSK



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A picture 6-1 Designed and modernized roads on the territory of BSK (Source: Processor)

Table 6-3 Legend to the newly built road network

D4 motorway in the section Jarovce - bridge over the Danube - on II / 502 in Rača	C1
R7 expressway in the section Bajkalská - border of the BSK - Hubice region	C2
Construction of a level crossing Triblavina on the D1 with a connection to I / 61	C3
Construction of a new regional road - connection to the intersection Triblavina - Chorvátsky Grob (Warm spring)	C4
Capacity building of the D1 motorway in the section Vajnory - Senec - east + modification of the motorway exit in Senec	C5
Capacity building of road II / 505 in DNV in connection with ongoing construction in the area north of OC Bory.	C22
Capacity building of the D2 Lamač - Stupava motorway.	C7
D2 Crossroads Mat	C9
D2 Intersection Studienka	C10
D2 Crossroads Čunovo	C11
D4 Devínska Nová Ves - state border SR / RR	C13
Extension of Eisnerova street	C24
Road II / 502 Pezinka bypass	C18
Road II / 502 Modry bypass	C19
Marchfeld - Záhorie road bridge	C23
D4 motorway - in section II / 502 - Carpathian tunnel	C12
R1 expressway - future route in the corridor from the intersection with the D4 with the intersection of the road II / 572 southeast of Most pri Bratislave - Tomášov - feeder from II / 510 - Vlčkovce - continuation to the direction of Nitra	C14
Road I / 2 - Stupava bypass	C15
Road II / 509 - Malaciek bypass	C16
Capacity building of the road I / 61 - Vajnory - Senec	C17
Capacity of the D2 Lozorno - Stupava motorway	C8
Capacity building of the D1 motorway in the section Senec-východ - Trnava	C6
Capacity building of the road II / 503 - Creation of the county circuit (Senec I / 61– MUK with D1 „Senec“ - Pezinok) - tunnel under Baba	C20A C20
Relocation of the road II / 510 in Tomášov	C21
Northern Tangent (Pražská - Jarošova)	C28
Baikal - removal of level crossings	C30
Vrakuňa - bypass in the extension of Galvaniho street	C31
Vajnory - northern and eastern bypass	C29
Rača - relocation II / 502 (Rybničná - Pri Šajbách - Račianska)	C25
Connection Žabí Majer - Krasňany	C26
Connection Krasňany - Polianky	C27
Regional route Chorvátsky Grob (Teplý prameň) - Pezinok	C32
Construction of the road with the intersection of I / 61 with a continuation between the villages of Bernolákovo, Ivanka pri Dunaji, the bypass of the village of Zálesie up to the crossroads on the D4	C33

7 Traffic flow quality

The assessment of the quality of the traffic flow was performed according to the technical regulation MDV SR TP 102 "Calculation of the capacity of roads" and was compared with the following description of individual stages of the quality of the traffic flow (QSV):

7.1 Quality levels (QSV) according to TP 102

Grade A - the driver is only very rarely influenced by other drivers; the degree of utilization is very low, the driver does not have to limit his speed if the road characteristics allow it; there is complete freedom within the traffic flow, also with regard to lane changes; traffic flow is free;

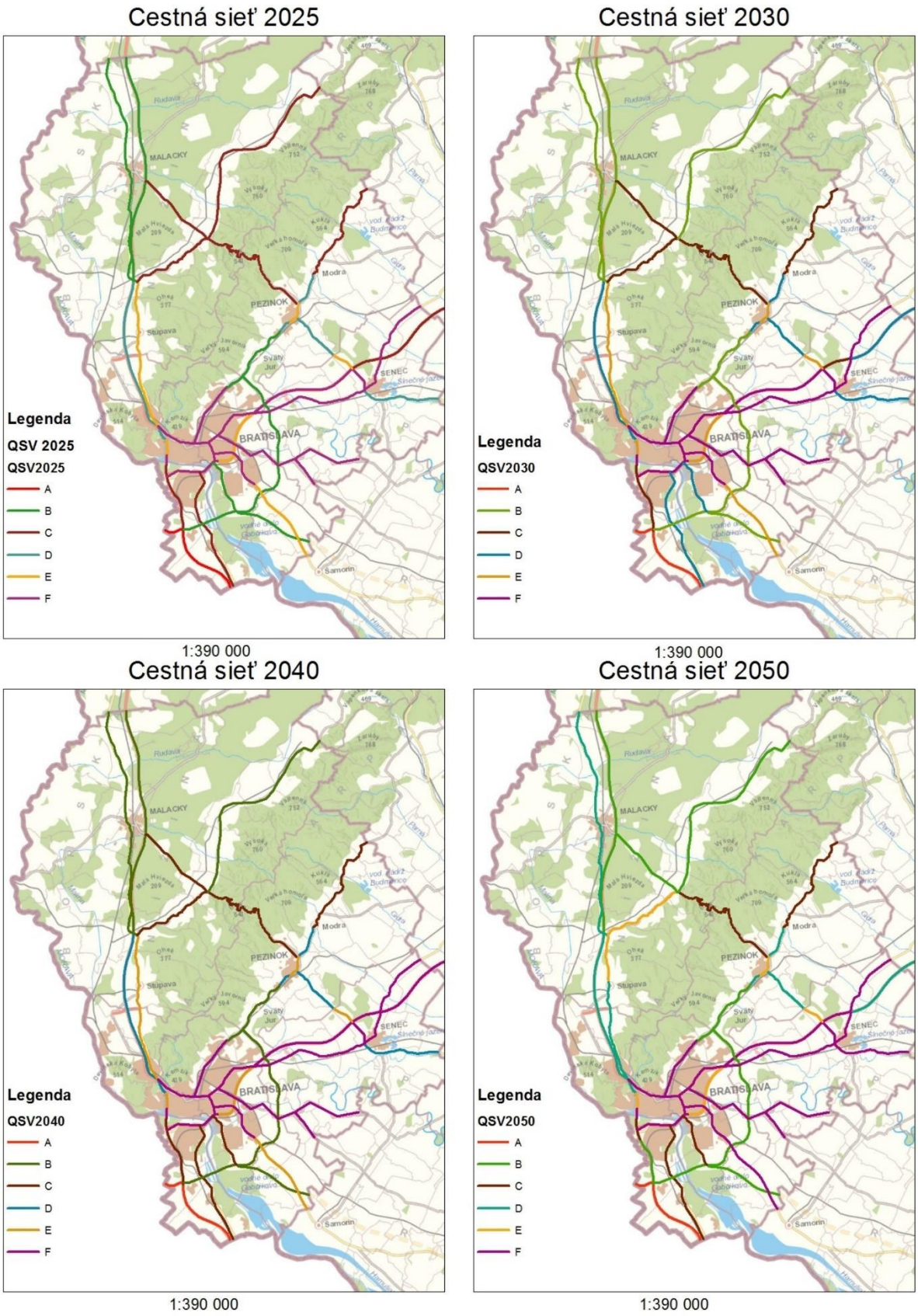
Grade B -the driver is exposed to minor influences from other drivers, which are not of a serious nature; the degree of utilization is minimal; speed can be achieved at the required level; traffic flow is almost free;

Grade C- the presence of other road users is appreciable; individual freedom of movement is already restricted; the degree of utilization is approximately in the middle; speed is no longer fully selectable; traffic flow is stable;

Grade D -there is a constant interaction between transport participants, leading to conflict situations and mutual barriers; the degree of utilization is high; the possibilities of individual choice of speed and lane are severely limited; the traffic flow is still stable;

Grade E- cars move roughly in columns; the degree of utilization is very high; even a small or short-term increase in intensity can cause traffic congestion and stepping of vehicles; there is a danger of the traffic flow collapsing due to a small irregularity in the traffic flow; traffic flow varies from stable to unstable; current capacity is reached;

Grade F- the intensity of incoming traffic is higher than the capacity; traffic collapses, ie. there are stops and congestions that alternate with stop-and-go traffic; the situation will be resolved by a significant decrease in incoming traffic; the section is crowded.



A picture 7-1 Quality levels QSV 2025 - 2050 (Source: Processor)

The proposed infrastructure measures in road transport will be reflected in the individual time stages in the quality of the traffic flow. The emphasis in the proposal on the significant development of public passenger transport and its preference is reflected in the persistent, resp. slightly declining quality of

traffic flow, especially at the entrances to Bratislava. This trend is most pronounced in the south direction, where the initially implemented R7 expressway will ease the I / 63 road, later due to dense construction and limited access to the R7 the load on the I / 63 will increase again.

8 Cycling infrastructure

Bicycle transport expresses a general term describing routes for various purposes using a bicycle.
According to the purpose of individual goals, we divide bicycle transport:
Current day bike paths: a) regular (for work, for school)
b) irregular (for culture, for sports, for amenities)
Cycling routes - short-term, weekend, long-term
For the sake of clarity in the legislation, it is necessary to unify the individual concepts related to bicycle transport.
In terms of processed analyzes, bicycle transport must be divided into two separate groups (everyday cycling and recreational cycling), which require different approaches. However, in terms of the objectives of this documentation, which are aimed at achieving sustainable mobility within the BOD, maximum attention is paid to daily bicycle transport, the so-called everyday cycling, ie daily trips to work, school, shopping, entertainment, etc. These roads take place in the vast majority of urban areas of municipalities, or as access roads to VOD stations and stops (rail and bus transport).
It is a general goal to support the development of cycling, especially the daily type (attendance at work, school, business ...), which is a very achievable goal in smaller municipalities.

Cyclingroads are a special case, which are realized on longer routes in the extra-urban environment and with destinations in natural-tourist localities. UPN R BSK ZaD no. 1 were focused on the design of cycle paths within the BOD, which are located in the outskirts of municipalities and are used mainly for cycling.
The developed zoning plans of individual municipalities generally reflect the requirements for the expansion of cycling by designing safe and independently managed cycle paths.

Everyday cycling is gaining in popularity and takes place on working day conditions, such as commuting to work and school. Also in an irregular form, this type of light transport is used for shopping, sports and leisure activities. These roads vary in length depending on the size of the village. In Bratislava it is about 5 - 6 km, while in smaller villages these distances are up to 3 km.
A separate part of these daily cycling routes is the so-called the first or last km on regular journeys over longer distances (arrival at VOD boarding points).

8.1 Design of a network of cycle paths in BSK (according to UPN R BSK ZaD 1)

Cycling routes are proposed on the territory of BSK and complement the network of existing cycle routes.
The network of proposed cycle routes is according to the development of cycle routes and complements the already existing network of cycle routes and creates a comprehensive network of routes in BSK.
Important routes were selected and placed on a separate body so that they are not in parallel with the road where there is a high intensity of traffic or passenger or freight.

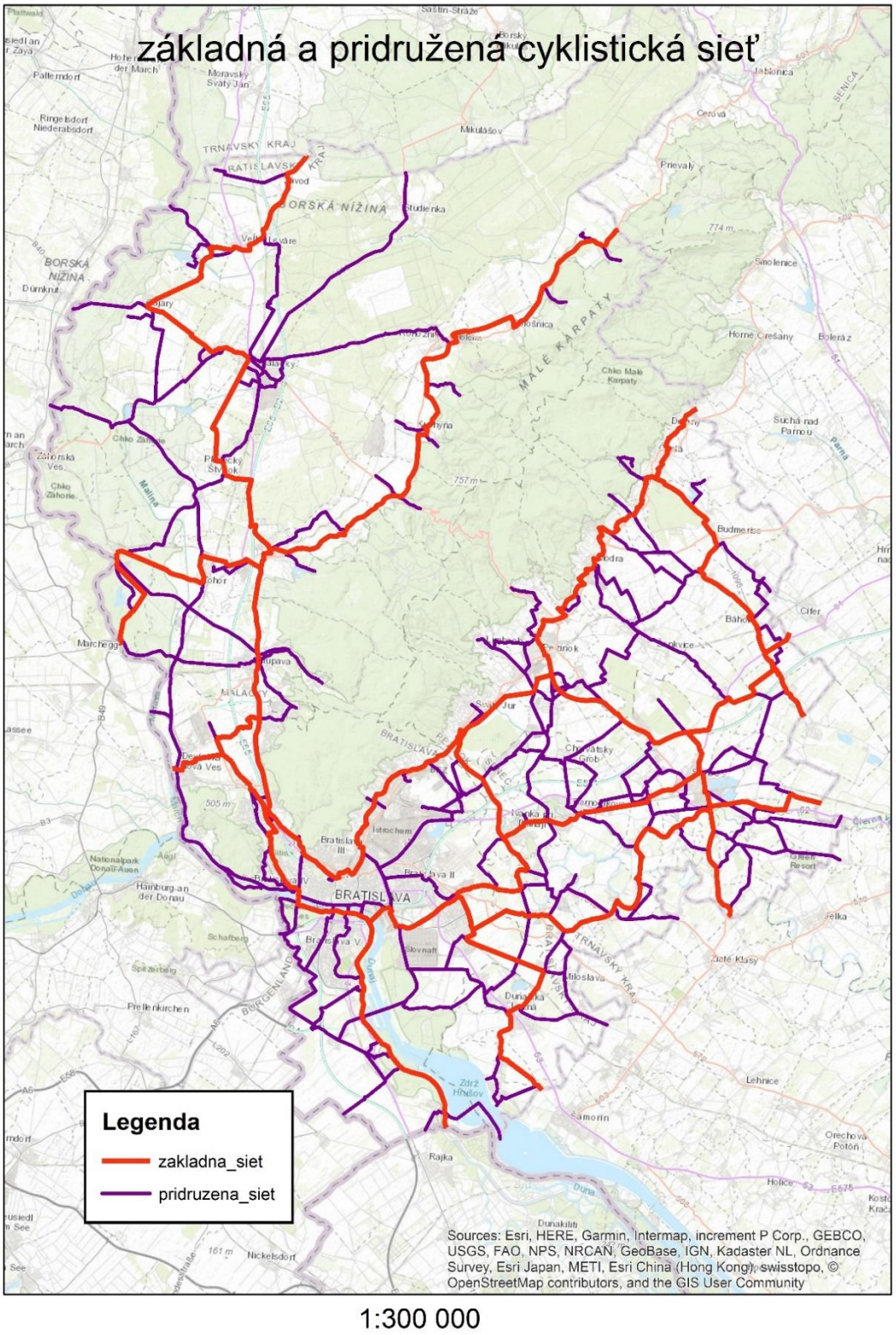
The network of proposed cycle paths according to the "ÚPN R BSK as amended from 2017 complements the already existing network of cycle paths and creates a comprehensive network of routes in BSK. The conclusions of this document were taken over in the draft RPUM BSK. The proposal also takes into account the cycle routes from the "Concept of the development of cycle routes of the Bratislava self-governing region in relation to the integrated transport system and important points of

tourism - Update 2017", which is an integral part of the Sustainable Mobility Plan in the section dedicated to bicycle transport.

ÚPN R BSK, as amended, selected important routes and placed on a separate body so that they are not in parallel with the road where there is a high intensity of traffic or passenger or freight.
The most important cycle routes, mostly of a recreational nature in the BOD area, are:

- Danube cycle route (EV-6) - Berg border crossing - Lafranconi bridge - SNP bridge - Port bridge - winter port - Hamuliakovo; Harbor bridge - Rusovce - Čunovo - hr. SK / HU (International cycle route EuroVelo 6, the cycle route has two branches, old designation 001, 001a)
- Iron Curtain Road (ICT) (EV-13) - Malé Leváre - Gajary - Suchohrad - Záhorská Ves, Vysoká pri Morave - Devínska Nová Ves - Lafranconi Bridge - Petržalka - Jarovce / Kittsee border crossing (EuroVelo 13 International Cycle Route, old designation 004)
    - Small Carpathian cycle route (003) - Vysoká pri Morave - Zohor - Lozorno - Jablonové - Pernek - Kitchen - Rohožník - Sološnica - Plavecké Podhradie - Plavecký Mikuláš - border with TTSK (National cycle route),
- Záhorácka cycling route (024) - Devín - Devínske Jazero - Zohor - Láb - Malacky - Gajary - Veľké Leváre - Race - border with TTSK (National cycling route)
- Vinohrady cycle route (048) - Bratislava - Svätý Jur - Pezinok - Modra - Častá
- Doľany (National cycle route)
- JURAVA (2002) - Svätý Jur - Vajnory - Ivanka pri Dunaji - Most pri Bratislave - Rovinka - Hamuliakovo (part of the regional cycle route)
- Malodunajská cycling route (5008) - Vrakuňa - MR Štefánik Airport - Most near Bratislava
- Vištucká cycling route (8039) - Tri Kopce - Fugelka - Dubová - Vištuk - border with TTSK (Báhoň)
- Rohožnícka cycle route (8040) - Rohožník - Malacky, footbridge over the D2 motorway
- Dúbravská cycling route (2007) - Lamač - Dúbravka - Bory - Devínska Nová Ves (regional cycling route)
- Border thematic cycle route (N2001) - Lafranconi bridge - border crossing Petržalka / Berg - Kopčianska ul. (thematic regional cycle route)
- Štefánikova cyklomagistrála (047) - Most SNP - Kamzík - Biely kríž - 5003 Hrebeňovka - Pezinská Baba - Čermák - sedlo Hubalová - 2204 Sklená huta - 2201 (National cycle route with a view to the connection with TTSK)

Within the scope and goal of the BSUM RPUM solution, it is not possible or expedient to focus on local solutions for the location of individual cycle routes, because the scale for the solutions of the entire BSK area does not allow it.
Within the solution of bicycle transport in BSK, the essential intention is to focus on the equipment of individual transfer and boarding points for VOD funds, especially railway stations and stops. These points must be equipped within the P + R and TIOP facilities as well as appropriate facilities for the safe and adequate parking of B + R bicycles. Each location of the required P + R facilities must be completed also for the needs of bicycle transport in sufficient capacity and also with the appropriate local access cycle routes to these transfer points.



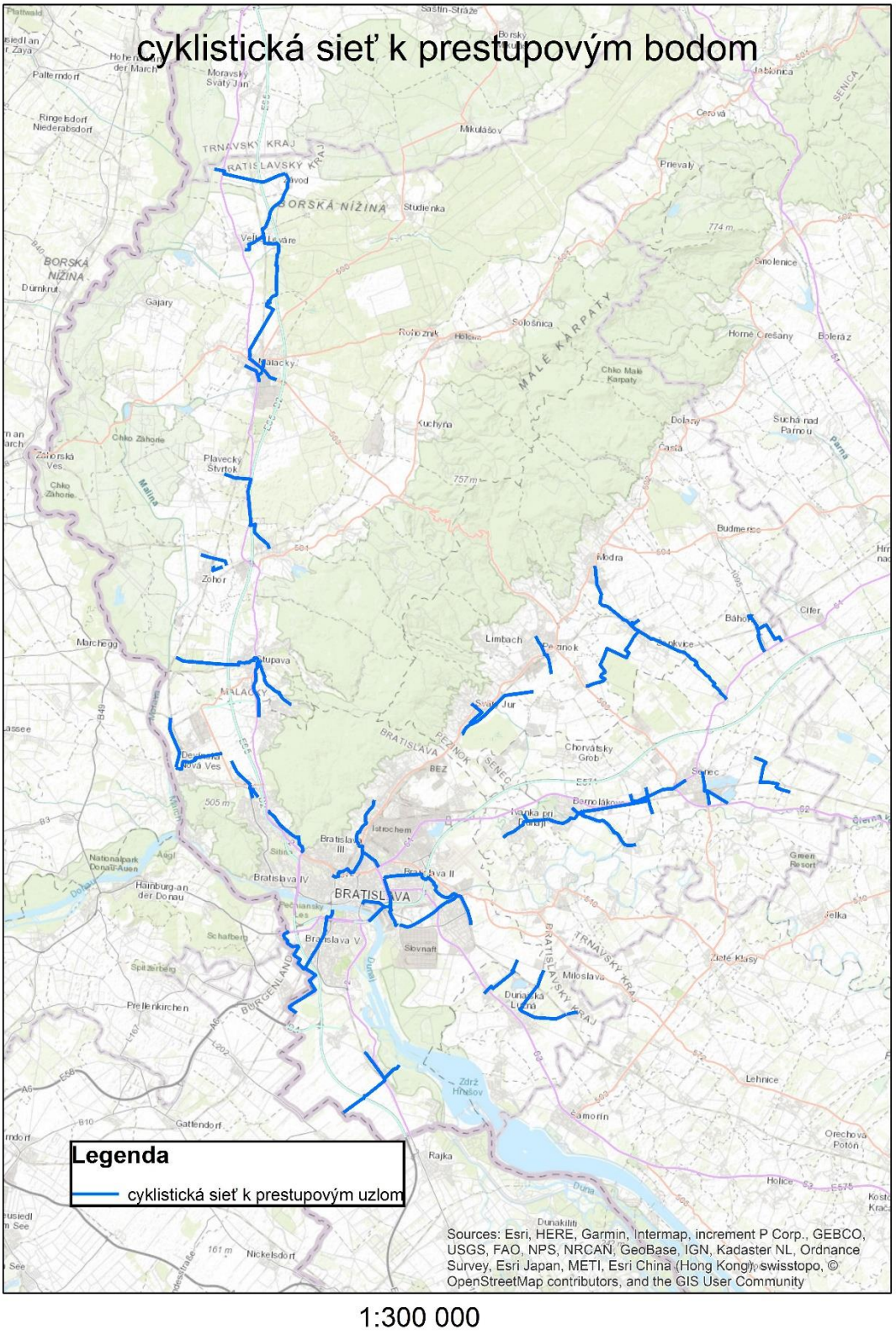
A picture 8-1 Scheme network of cycle paths on the territory of BSK (Source: BSK)

The network of cycle routes on the territory of BSK is connected to cycle routes in Austria. For this purpose, the study "Urban study of cross-border interconnection of the BOD and neighboring Austrian

municipalities in the form of cycle paths across the Morava River", BSK, October 2015 is prepared. - Stillfried and Vysoká pri Morave - Marchegg. ”It is necessary to build cycle connections with Austria in accordance with the prepared urban study.

From the point of view of RPUM BSK, it is important for bicycle transport to focus on the maintenance and construction of all cycle routes, but with priority focused on cycle routes that lead to transfer nodes in the territory of BSK. In the localities of the region, where there are important employment centers, the construction of bicycle paths from the nearest surrounding municipalities to these centers is one of the priorities. These are cycle routes that have the character of both a basic and an ancillary network, and their illustration is given below. The total length of these cycle paths is approximately 185 km and their construction is, from the point of view of the objectives of RPUM BSK, one of the key soft measures (measures with low investment costs with the assumption of great benefits). Of course, the construction of these cycle paths must be linked to other measures concerning everyday cyclists, such as the construction of safe shelters, parking spaces for bicycles and the like, which is discussed in other parts of the document. In the centers of municipalities, in their residential areas and in the vicinity of railway stations, where the support of non-motorized transports is preferred, it is desirable to create traffic calming zones.

The drawn cycle routes are only schematic, they will be addressed in detail in the Concept of Territorial Development of Cycle Routes of the Bratislava Self-Governing Region.



A picture 8-2 Scheme of the cycling network to the transfer points (Source: Processor)

9 Pedestrian traffic

As already mentioned in the Analysis section, pedestrian transport is practically not used at all within regional transport. Pedestrians mostly travel on roads that take place within settlements, or as a walk from means of transport. Within the region, it is possible to address especially the area of pedestrian safety in relation to regional roads.

The projects themselves at the regional level should be created mainly on the basis of close cooperation with local governments, from which suggestions and proposals should come.

It is necessary to build safe barrier-free pedestrian routes to VOD stations and stops with suitable lighting, navigation system, technical equipment, greenery, furniture and the like.

It needs to be implemented support of traffic calming in the vicinity of VOD stations and stops, where there is movement of pedestrians in different directions within the seat.

10 Water and air transport

Given that water and air transport have a minimal impact on the sustainable mobility of BOD, the processor will summarize in this section only the basic characteristics of these modes of transport.
Water transport for the needs of RPUM was researched and proposed in its part - passenger transport, which occurs in the following possibilities:

- Long-distance recreational cruising with the use of the Danube River, especially for international passenger boat cruises
- Recreational cruise by small tourist boats on the river Danube, but also the Little Danube and Moravia
- Personal recreational sightseeing cruise on the river Danube near Bratislava
- Regular passenger cruise from Bratislava to Vienna, Budapest, or Gabčíkov,
- Kompa on the rivers Danube and Moravia Záhorská Ves - Angern)
- Dunajbus, IN = 60 mil. Euro, 7 ships, sailing time (Šamorín - BA) 38min (planned)

It is proposed to place a support service for small vessels (marinas) on the Danube River in the localities Botanical Garden, Lafranconi Bridge, Slovak Rowing Club (new Incheba), Nábr. L. Svoboda (Nový most) and Tyršovo nábr. (Lida premises). Similar facilities need to be located on the Morava River in the area of Devínska Nová Ves, Záhorská Ves and on the Malý Dunaj River in the localities of Zálesie and Tomášov.
It is proposed to place a port of international and domestic passenger water transport in the area of today's Danubius passenger port and the Pribinova zone (warehouse building no. 7) in connection with the customs.
For the prospective period, the possibilities of construction of waterways on canals along Moravia and in the direction Bratislava - Malý Dunaj - Sereď with a connection to the Vážská waterway are being studied. When assessing the variants of the solution of these canals, it will be necessary to take into account the fundamental condition of nature protection (Ramsar Agreement, PLA of Upper Rye Island) and the environment in general in accordance with Act no. 127/1994.

10.1 Lair transport

The territorial development of the MR Štefánik International Airport in Bratislava - Ivanka with a separate operation of passenger and freight transport must be supported by quality links to the system of motorways, roads and rail transport.
The airport will play a significant role in the international division of airspace and will provide services as a diversion airport for Vienna, Budapest and Brno, thanks to its better climatic and weather conditions. It will therefore be necessary to ensure a fast, high-quality and high-capacity connection of the MR Štefánik International Airport to the supra-regional and regional transport system focused on:

- D2 and D1 motorways in the Ivanka V and Ružinov junctions,
- the railway at the Airport stop sunk under the terrain,
- freight railway to the siding Cargo-Biskupice.
- supporting system of public transport hl. of the city on the Ružinov collection tram radial.

Passenger traffic is oriented to the current exploited western quadrant, adjacent to the D1 / Ivanská cesta motorway junction. The current annual capacity of the airport is 5 million passengers, which was filled to almost 50% last year (2.3 million passengers).

The multifunctional use of the territorial perimeter of the airport, its southern quadrant (cargo-oriented) supports the economic and social attractiveness of the capital. of the City of Bratislava, in connection with continental air transport.
The higher supra-regional equipment of the commercial space of the LOGO-C-EUROGARE airport (in connection with the Danube port) can be specified by the functions of extensive operations related to long-distance transport, agricultural land and commodity exchanges:
agrotechnics, plant production, outdoor exhibitions, communication and transport services
The outlook at MR Štefánik Airport in Bratislava is being considered with the construction of a runway parallel to the existing runway 13-31, which is also in the design of UPN BSK (2012).

10.1.1 Expected state of air transport by 2050

The current annual capacity of the airport is 5 million passengers, which was filled to almost 50% last year (2.3 million passengers). Expected state of air traffic at MRŠ Airport. will continue to grow.
In the next development, attention will be focused on strengthening parking capacities and transport provision of quality and fast public transport.

10.1.2 Air transport, forecast

Airports must therefore anticipate the situation for 30-50 years in advance, estimate how the operation will develop, what infrastructure they will need for it and where they can build it. Such a planning process is also taking place at Bratislava Airport.
The airport itself divides the runway system of two intersecting runways and thus creates 4 natural quadrants in which the airport plans its development. Quadrants 1 and 4 are the most important for the development of the airport.
However, the current scope of the infrastructure already limits the operation of the airport to some extent. The number of stands has expanded only thanks to more efficient use of space and a change in the configuration of aircraft stands from swivel to nose-in, which are dimensionally optimized for the most common types of aircraft that can be seen in Bratislava (B737 / A320).
The area northwest of the current tower (Quadrant 1) is set aside for further expansion of the terminal. It should expand the airport's capacity to 10-12 million passengers a year.
In the event that the airport really expands with a parallel runway, it is possible to build a completely new terminal in the space between them. As with the parallel path 13-31, this case is more of a purely theoretical consideration, the realization of which is unrealistic for decades. Looking ahead, there is more than enough capacity of the current terminal for the near future, in the case of its extension by the northwest wing (Quadrant 1), its capacity will more than double.

10.1.3 VOD terminal at MRŠ Airport, a new railway station

ÚPN BSK (2013) has long proposed the creation of a railway transfer junction directly in contact with the arrival hall of MR Štefánik Airport, this intention will also require new sections of the railway line. The new line will connect lines 130, 131 and 132 with the railway station Bratislava - MR Štefánik Airport with the function of an international stop of express and fast trains, especially for the connection of airports Bratislava - Vienna and all main routes via the station Nové Mesto or Petržalka, underground stop connected to direct airport service system and supporting system of public transport in Bratislava.

11 Transport equipment

11.1 TIOP, transfer terminals

Transfer points in the IDS network must be designed in such a way as to make the transfer obligations from one type of VOD to another more pleasant for the traveling public. Transfer points must be equipped according to IDS BK standards. This simple principle must be fulfilled with a certain degree of comfort as defined in the TIOP models. The key transfer points in the first place include VOD stops at TIOP, P + R at railway stations, the most important VOD stops in municipalities. The detailed solution of these transfer points must be solved in the following stages of documentation in a more detailed scale, where paved areas, pedestrian routes and technological equipment of these transfer points will be designed.

In particular, all solutions include:

- o shortening the transfer distance between individual means of transport to the minimum possible extent, and thus reducing the time lost on the road in the event of the necessary transfer between transport systems
- creating a safe and smooth transfer route that is orientationally simple, illuminated and marked
- the entire area of the transfer point, including transfer and access points, especially pedestrian routes, must be under camera surveillance with a connection to security authorities
- the length of the transfer route should not be longer than 5 minutes of walking, which means a length of about 300 - 350m
- the equipment of the transfer point will increase according to the number of passengers at the point
- creating a safe and smooth transfer route that allows easy orientation, will be illuminated and marked

Transfer points located at railway stations and stops must be equipped with an appropriately capacitive car park for OA in the P + R, K + R system, as well as a protected area for bicycle parking (B + R).

The network of integrated passenger transport (TIOP) terminals, which will be implemented in connection with railway stations, will also be a part of the future network of the transport system in BSK.

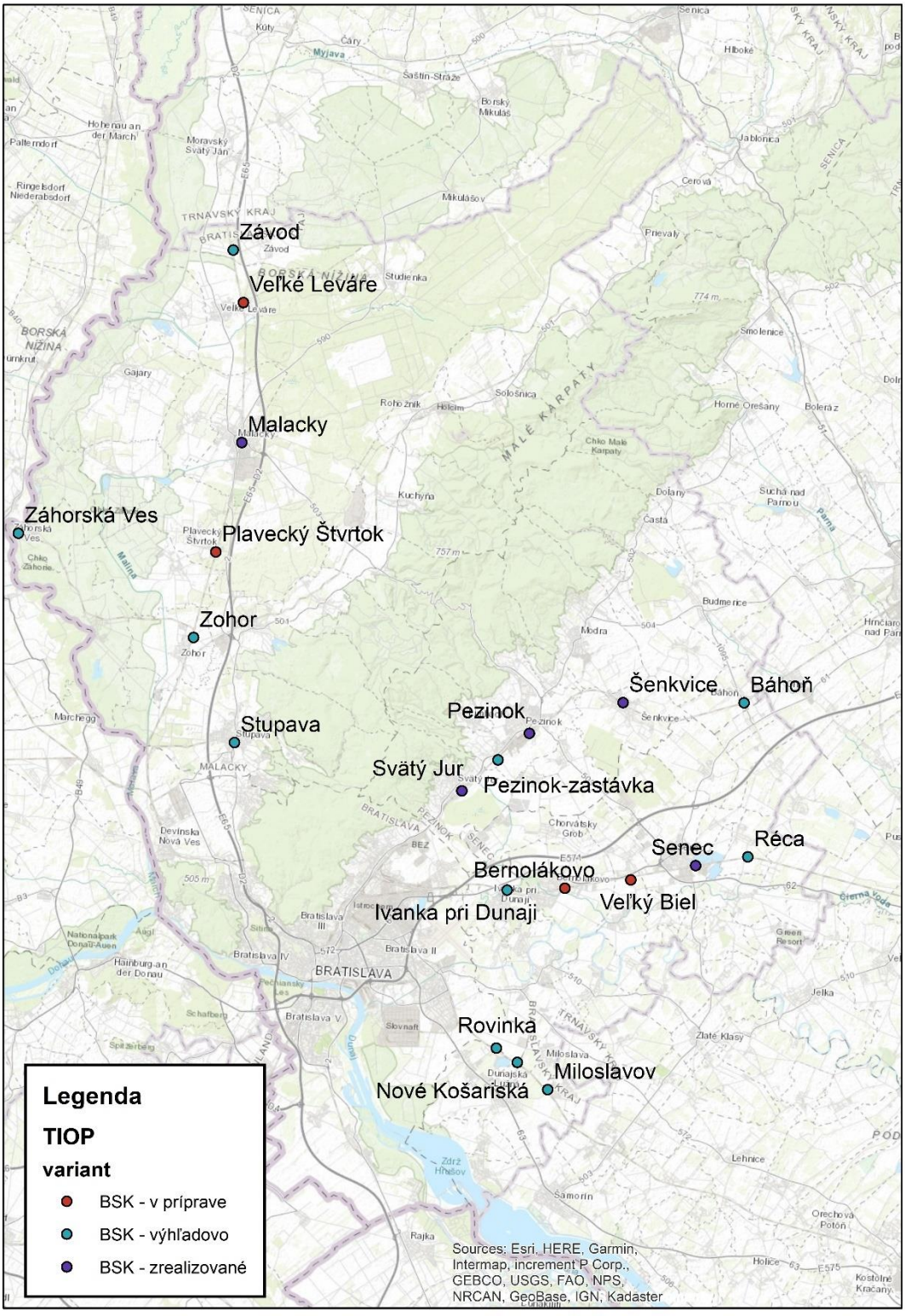
The design and establishment of TIOP aims to facilitate and speed up transfers between passenger modes. The continuity of individual connections of various types of passenger transport, the interconnection of charts, with the minimization of lost time required for the transfer is a basic precondition for the meaning of building TIOPs to be fulfilled. Within TIOP, information service and comprehensive equipment for passengers must be provided.

The proposal envisages the construction of such facilities to facilitate and in particular speed up the transfer possibilities for passengers between railways, VOD and public transport at all railway stations and stops in BSK.

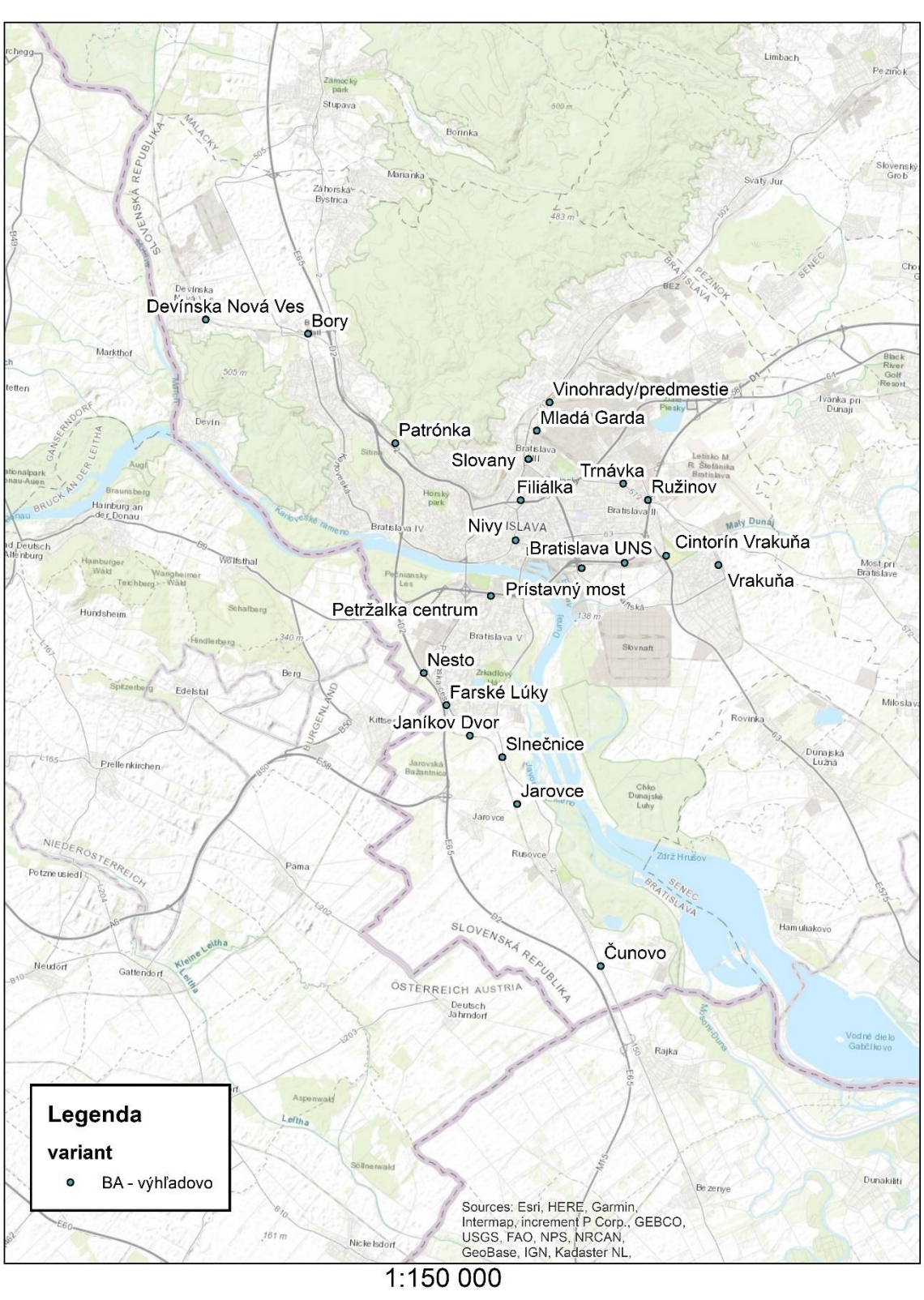
The construction of TIOP on the territory of Bratislava is being prepared for implementation, where implementation is expected in the localities of Vrakuňa, Lamačská brána, Patrónka / Železná studienka, Ružinov, Vrakuňa cemetery, Petržalka - Centrum, Mladá Garda, Přístavný most, Janíkov dvor, Trnávka, Devínska Nová Ves.

On the territory of BSK outside the capital Bratislava, TIOPs have already been built in Malacky, Pezinok, Senec, Šenkvice and Sv. Jure, TIOPs are currently being prepared in Bernolákov, Veľký Biel, Veľké Leváry and Plavecký Štvrtok. By 2030, Zohor, Závod, Pezinok stop, Báhoň, Ivanka pri Dunaji, Réca, Rovinka, Nové Košariská, Miloslavov, Stupava, Záhorská Ves should be built.

Navrhované rozmiestnenie TIOP na území BSK (okrem BA)



A picture 11-1 Integrated transport terminals on the territory of BSK (Source: Processor)



A picture 11-2 Integrated transport terminals in the territory of BA (Source: Processor)

The solved TIOP will be a part of IDS for Bratislava and adjacent regions. Within the framework of TIOP, new platforms, roads for barrier-free access, operational sets and construction objects of the related

railway infrastructure and other objects of induced investments will be built on the existing line. The length of platform edges at each railway station is at least 180 m. Barrier-free access to the platforms is provided by personal lifts or. ramps. If necessary, they are built, resp. renovated public transport stops. In some locations there is a parking lot.

Evaluation of the measure

The subject of the measure is the acceleration of transfer times, between individual types of passenger transport, in particular arrival and departure from railway stations and stops.

Users: passenger VOD

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport
- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- Railways of Slovak Republic
- Bratislava self-governing region
- The capital of the Slovak Republic, Bratislava

Dates of implementation and investment costs:

Table 11-1 Implementation dates and estimated investment costs for the implementation of TIOP (Source: Processor)

Name of the project	Date of implementation	Investment costs (EUR)	Variant
Bory	Until 2025	9,500,000	zero
Patrónka / Žel. student	Until 2025	9,600,000	zero
Ružinov (including branch)	Until 2025	9,200,000	zero
Vrakuňa	Until 2025	2,700,000	zero
Petržalka-center	Until 2030	6,000,000	maximalist
Young Guard	Until 2030	4,200,000	maximalist
Harbor bridge 1)	Until 2030	5,000,000	maximalist
Janíkov Dvor	Until 2030	5,000,000	maximalist
Trnávka	Until 2030	8 100 000	maximalist
Bratislava ÚNS	Until 2030	1,500,000	maximalist
Devínska Nová Ves stop	Until 2030	18,000,000	maximalist
Vinohrady / Suburbs	Until 2030	7,000,000	maximalist
Branch	Until 2040	It will be part of the new station	maximalist
Nivy	Until 2040	It will be part of the new station	Maximalist
Vrakuňa Cemetery 2)	Until 2030	6,000,000	maximalist
Sunflowers	Until 2030	4,000,000	maximalist
Nesto	Until 2030	3,500,000	maximalist
Slovany	Until 2030	3,200,000	maximalist
Jarovce	Until 2030	2,000,000	maximalist
Čunovo	Until 2030	2,300,000	maximalist
Parish Meadows	Until 2030	2,100,000	maximalist
Malacky	2019		realized
Pezinok	2019		realized

Name of the project	Date of implementation	Investment costs (EUR)	Variant
Senec	2019		realized
Šenkvice	2019		realized
Svätý Jur	2019		realized
Bernolákovo	Until 2025	698 000	zero
Big White	Until 2025	135 000	zero
Veľké Leváre	Until 2025	315 000	zero
Swimming Thursday	Until 2025	180 000	zero
Zohor	Until 2030	1,800,000	maximalist
The race	Until 2030	700 000	maximalist
Pezinok stop	Until 2030	1,500,000	maximalist
Báhoň	Until 2030	765 000	maximalist
Ivanka pri Dunaji	Until 2030	1,400,000	maximalist
River	Until 2030	800 000	maximalist
Rovinka	Until 2030	600 000	maximalist
Nové Košariská	Until 2030	1 485 000	maximalist
Miloslavov	Until 2030	135 000	Maximalist
Stupava	Until 2040	1,500,000	maximalist
Záhorská Ves	Until 2030	350 000	Maximalist
University of Economics	Until 2040	7,000,000	maximalist

1) TIOP Přístavný most - a new transfer railway stop on line 132 in the section Bratislava-ÚNS - Bratislava-Petržalka and a new public transport stop near the intersection of the line with the Slovnaftská - Bajkalská road. Check if a sufficiently attractive offer of railway transport is ensured (trains in the direction of Bratislava-Petržalka and Bratislava-Nové Mesto). It is appropriate to lead tram transport to this point and set up a P + R car park (for IAD from direction R7), a transfer from this direction (Šamorín) to a tram direction center, train direction Petržalka and Nové Mesto, as well as between train and tram will be provided. each other within the public transport support network.
2) TIOP Cintorín Vrakuňa - a new transfer railway stop on line 132 in the section Bratislava-Nové Mesto - Bratislava-ÚNS and a new public transport / PAD stop at the intersection of the line with road I / 63 (Popradská ul.). Check if a sufficiently attractive offer of railway transport will be ensured (trains in the direction of Bratislava-Petržalka and Bratislava-Nové Mesto).

11.2 P + R Parking

Park and Ride facilities improve transportation in many ways. System users benefit from reduced travel costs, avoiding frustration and danger when using the car on congested roads. Passengers are shifting to more capacity-based alternative transport systems, reducing the requirements and needs of costly capacity collection roads. Transport using P + R as a whole benefits from reduced energy consumption, pollutant emissions and the need to expand roads and increase their maintenance.

The policy of developing the P + R system is aimed at improving the operational performance of transport, increasing the share of VOD in transport and reducing road congestion. P + R car parks should generally achieve the following objectives:

- They should provide adequate parking capacity to meet current and future needs.
- They should be durable, durable, resistant to abuse and easy to maintain.

- They should provide an attractive, clear and high-quality environment that meets modern requirements for comfort and safety.
- P + R elements should be clearly located and easily identifiable in the transport system.
- The P + R elements should be designed to support direct access to the train, resp. to the bus on foot, by cyclist and by car.

The size and type of a suitable P + R car park for a specific location will be primarily determined by the level of P + R demand. P + R car parks will be most effective when located in close proximity to a downstream mode of transport and minimize excessive walking. They must be designed to avoid unreasonable time lost in their use. According to foreign experience, the distance to the boarding point is 120 m, an absolute maximum of 250 m should be considered. The distance of about 450 m discourages drivers from using the parking lot. P + R car parks can be implemented in two ways - either in an existing car park (near a shopping center or other amenities) or separately with exclusive use for P + R. Shared car parks can be used for demand testing and can be implemented relatively quickly and at low cost.

Capacityand P + R car park equipment should be such as to stimulate the growth of rides and P + R users. Parking capacity requirements are estimated from the population and the number of cars in the area of interest. It is estimated that the use of parking from the attendance zone can be in the prospect of up to 25% of the population in developed car countries. The P + R car park should be dimensioned for an expected 95% occupancy.

Parking equipmentP + R should meet the standard requirements for car parks according to the valid STN 73 6056, including the required number of parking spaces for vehicles of drivers with limited mobility. It is necessary to ensure the safety of the car park, either through construction measures or security services. Security staff may perform other functions than informing or collecting parking fees. Passengers with a valid VOD travel document should have free parking, in the territory of the city of Bratislava there may be a bonus for the passenger on a VOD ticket.

All newly established car parks of the P + R system must be technologically equipped so that the entrance to these car parks is favored by passengers with a valid time travel document for VOD.

For the design of P + R car parks in BSK, we can use the Brawisimo traffic behavior survey. The survey showed great potential for the use of the combined P + R mode of travel, when it was found that up to 48% of respondents use a car to travel to work. The survey of parking at selected railway stations also provided relevant data on current capacity requirements for P + R car parks.

P + R car parks, especially those with a larger capacity, should be designed as multi-storey car parks of simple building construction, the so-called parking houses. This method of building a car park is advantageous in terms of a significantly smaller land area and also due to the shorter walking distance from the car park to the train platform.

In July 2019, a newly built transfer terminal was opened in Svätý Jur to motivate people to use public transport more. Its facilities include a parking lot, bus stops and a bicycle shed. It also includes urban furniture, greenery and barrier-free access. The main goal of the project was to improve the infrastructure of public passenger transport by integrating transport systems. Stops and parking spaces for buses, 58 parking spaces for cars (P + R) and facilities for cyclists in the form of bicycle stands (B + R) were built, which are located in close proximity to the railway platform. The whole implemented area is barrier-free. The total costs for the implementation of the project reached € 612,889.07, of which € 582,244.62 comes from EU resources and the state budget.

At present, P + R car parks are being built in Pezinok and Ivanka pri Dunaji with the participation of ŽSR, and car parks in Nové Košarisky and Zohor are being prepared for implementation. In addition to these car parks, municipalities are also preparing P + R car parks (eg Veľký Biel, Veľké Leváre, Senec, Bernolákovo, which together with PAD stops can be considered a TIOP bus-train transfer)

The findings obtained from the survey of parking at selected railway stations show that in order to dimension the design of P + R car parks, it is necessary to carry out a previous survey of the required demand. The design of each car park in the implementation phase must be supported by an up-to-date analysis of parking requirements.

The survey of parking at a railway station can be suitably combined with the number of passengers boarding trains at that station. The ratio of the number of cars actually parked to the number of passengers embarking will provide a real need for the number of parking spaces at present. For individual design periods, it is necessary to count on an increase in the use of the car park; by 2050, increase capacities by min. 50%. For each new P + R car park, it is necessary to find out the survey actually needed capacity and implement it with the required minimum reserve.

Table 11-2 Percentage of parking use at railway stations (Source: Processor)

parking lot	Number of OA	number of entries	% usage
Malacky	135	1916	7.05
Pezinok	379	2051	18.48
Senec	318	1443	22.04
Šenkvice	144	714	20.17

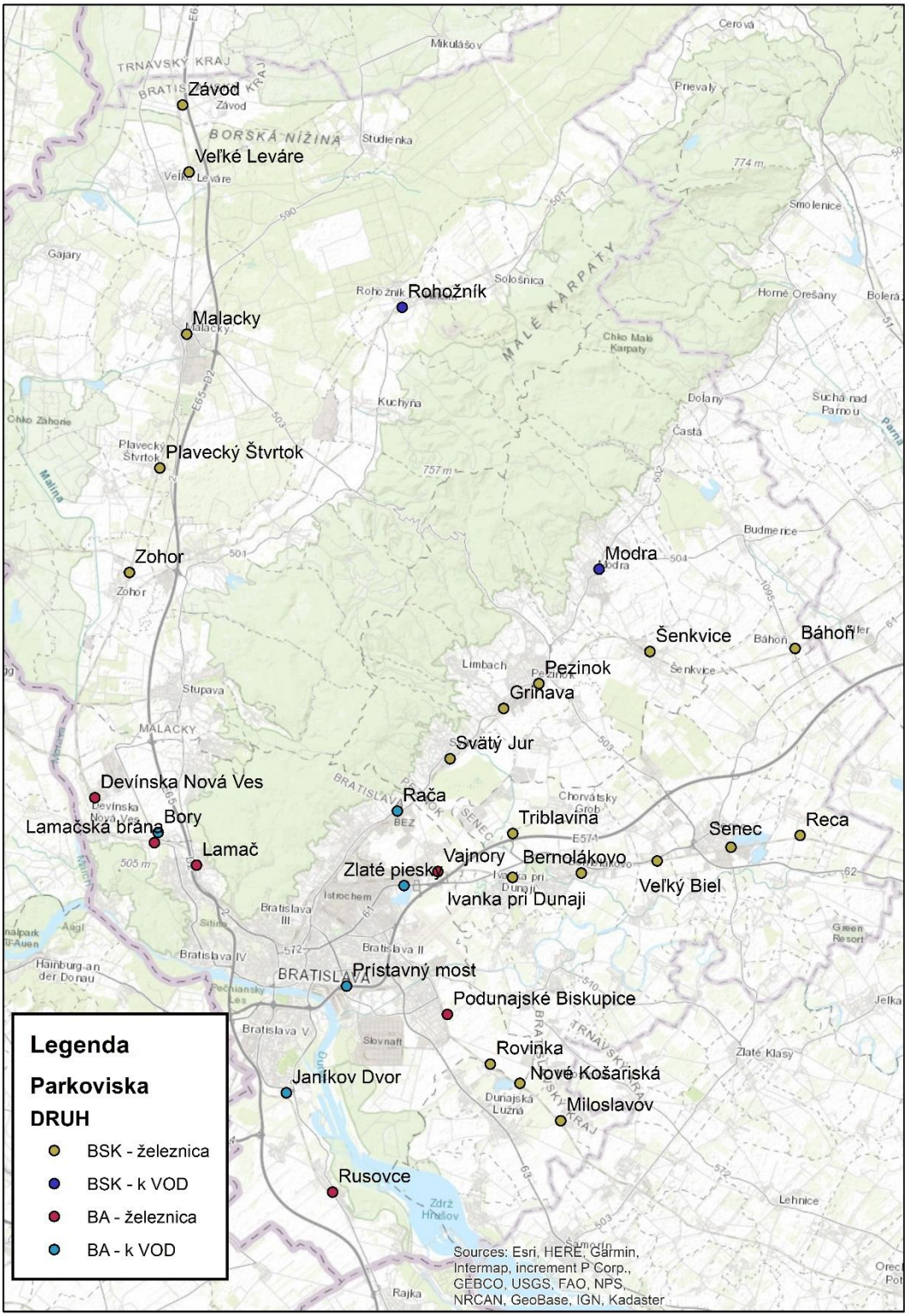
It follows from the above that the current share of parked vehicles in the number of boarding passengers is about 20%. The lower percentage of use in Malacky is probably due to insufficient available capacity of parking spaces, inappropriate positioning of the car park in relation to the station, unsatisfactory layout and management of access pedestrian roads.

On 4 September 2019, the processor carried out a verification survey at the newly built car park in Svätý Jur and at the existing car park in Pezinok. In Svätý Jur there is a newly built parking lot with a capacity of 58 parking spaces and 14 uncovered bicycle stands and a parking lot at the old station building with a capacity of 10 parking spaces and about 6 places for bicycles without stands, but with a shelter. Bicycles are not protected. Both car parks are occupied by 23 vehicles (utilization at 33.8%). Within the P + R car park, there are 14 bicycle stands and in front of the old station building there is a bicycle shelter without stands with a capacity of approx. 6 bicycles.Of all the places, they were occupied by 4 bicycles (utilization at 28.6%).

In Pezinok, there are a total of 58 marked parking spaces in front of the railway station, and a total of 189 vehicles parked in the marked and unmarked spaces (utilization at 326.6%). In total, there are 30 places in bicycle stands in front of the Pezinok railway station. However, a total of 75 bicycles are parked in the entire area (utilization at 250%). After the construction of the new car park, the requirement for parking vehicles will be covered (total capacity 349 vehicles), but the capacity of 60 bicycle stands will not cover the current requirement either.

Interceptor car parks of the P + R system are designed with priority in the surrounding villages. On the territory of Bratislava, they are designed where they can fulfill both the function of a restraint system (P + R during the day) and the function of a collective garage (at night) for the inhabitants of the city.

P+R na území BSK



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A picture 11-3 Proposed location of P + R car parks on the territory of BSK (Source: Processor)

Table 11-3 Area of interest for P + R (Source: Processor)

The village	distance to P + R (km)	village	distance to P + R (km)
P + R Zohor		**P + R Báhoň**	
Lozorno	5.2	Chapel	1.6
Apple trees	10.1	Igram	2.9
Foot	5	Chat	4.6
Swimming Thursday	8.9	Budmerice	6.4
Vysoká pri Morave	9.7	Vistuk	6
P + R Malacky		**P + R Ivanka pri Dunaji**	
Jakubov	9.8	Zálesie	3.4
Church	3.5	Malinovo	6.3
Gajary	9	**P + R Bernolákovo**	
Studienka	15.2	Nová Dedinka	6.7
P + R Veľké Leváre		Tomášov	9.9
		Croatian Tomb	3.3
Little Levars	4.3	**P + R Senec**	
P + R Mat		Turen	6
The kitchen	6.1	Kráľová pri Senci	6.1
Sološnica	5.2	Hrubá Borša	9.3
Swimming Podhradie	8.6	Reca	6.7
Plavecký Mikuláš	14	**P + R Nové Košariská**	
P + R Svätý Jur		Kalinkovo	4
P + R Pezinok		Hamuliakovo	6.3
Cajla	5.2	Alžbetin Dvor	4.7
Viničné	4	Dunajská Lužná	2.4
Vinosady	4.2	Miloslavov	5.8
P + R Grinava		**P + R Race**	
Limbach	3.4	Lakšárska NV	14.7
Slovenský Grob	3.2	Šaštín-Stráže	23
P + R Šenkvice		Borský Mikuláš	21.8
Blue	4.9	**P + R Swimming Thursday**	
Vistuk	5.9	Foot	3.3
Blatné	7.8	Jakubov	9.8
P + R Blue		Suchohrad	15.5
Queen	2.5	**P + R Reca**	
Oak	5.2	Great Tomb	4.9
Saw	8.8	Chat	7.9
Frequent	8.9	**P + R Veľký Biel**	
Doľany	12.1	Nová Dedinka	2.9
Štefanová	12.9	Tomášov	8.2
Budmerice	9.4	**P + R Rusovce**	
P + R Miloslavov		Čunovo	4.2
P + R Rovinka		**P + R Triblavina**	especially for passengers outside the BOD

A total of 17 P + R car parks in connection with railway transport and two in connection with bus transport are proposed for the proposed time periods proposed in the surrounding towns and municipalities. In Bratislava, 5 parking lots are proposed in connection with the railway and also 5 in connection with the IAD to the VOD. The total capacity of these proposed car parks is 2006 parking spaces and 614 bicycle spaces.

In Bratislava, the P + R interceptor car parks can be divided into two groups. Car parks in connection with railway transport, mainly affecting the inhabitants of the city in order to use fast rail transport for transport within the city. The proposed car parks in this locality are the localities Bratislava-Devínska Nová Ves railway station, Lamačská brána, Bratislava-Lamač railway station, Bratislava-Podunajské Biskupice railway station, Vajnory railway station. The second group includes parking lots for visitors to Bratislava from Slovakia and abroad with good connections to tram transport. This includes the proposed car parks in the localities of Zlaté piesky with a connection to the Vajnorská radial, Rača with a connection to the Račianská radial, Janíkov Dvor with a connection to the Petržalská radial after its extension, Bores with a connection to the Dúbravská radial after its extension and in case of extension of the tram lines Přístavný most. The capacity of intercepting car parks depends on the intensity of traffic entering the city in order to capture in the first stage 15 - 20% of visitors coming to the city by car.

A total of 29 P + R car parks with a total capacity of 5695 parking spaces are designed for the BSK area. After 2025, the implementation of car parks is divided evenly according to both capacity and expected investment costs. It is assumed that by 2040, all proposed car parks will be built.

After its introduction, the P + R car park system will form an important part of the integrated transport system. Thanks to the car parks, it will also be possible to integrate individual car transport into the system, providing access to public transport boarding points. The involvement of IAD will thus expand the catchment area of integrated transport without the direct need to expand the network of public transport lines itself. Similarly, intercepting car parks will create the potential for an increase in the number of passengers and thus support its efficient operation and the consequent increase in the standard of services provided.

The organizational connection of the operation of P + R car parks with the system of public transport and the integrated transport system of the city and the region, with the appropriate setting of the pricing policy, should be an incentive for users of car parks with the use of cumulated tariff bonus. In this way, the attractiveness of public transport will be increased and at the same time the city's road network will be relieved of the added traffic load. This fulfills the basic goal of IDS, to offer easier and more comfortable travel at a reasonable price and to make public transport more attractive so that residents travel less in their cars and save the environment.

Evaluation of the measure

Park and Ride car parks

The measure seeks to strengthen public passenger transport by creating the conditions for its connection to road transport. It allows users to restrict car travel and combine it with public transport. The measure creates personal benefits for the user in his financial and time savings as well as social benefits in positive impacts on the environment.

Users: passengers by individual car transport and by public passenger transport

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport
- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- The capital of the Slovak Republic, Bratislava
- Municipalities
- Ministry of Transport and Construction of the Slovak Republic
- Railways of Slovak Republic

Dates of implementation and investment costs:

Table 11-4 Proposal for the implementation of P + R on the territory of BSK (Source: Processor)

Parking P + R	year of implementation	capacity OA	Bike capacity	costs (€)
Svätý Jur	2019	58	14	612 889
Pezinok	2019	291	30	1,950,000
Ivanka pri Dunaji	2020	158	80	1,700,000
Nové Košariská	2022	165	50	1 485 000
Zohor	2023	207	50	1,860,000
Malacky	2019	89	50 (3492))	750 000
Veľké Leváre	2022	35	15	315 000
Triblavina	2050	5000	300	90,000,000 1)
Mat	2030	75	25	675 000
Blue	2030	107	20	960 000
Báhoň	2022	85	30	765 000
Senec	2025	320	100	2,880,000
Šenkvice	2019	87	60	1,200,000
Bernolákovo	2020	96	48	698 000
The race	2040	20	15	135 000
Swimming Thursday	2030	40	20	180 000
Reca	2040	15	10	90 000
Big White	2030	30	15	135 000
Miloslavov	2030	35	15	135 000
Rovinka	2040	20	15	135 000

1) P + R Triblavina is currently under consideration. Construction in two stages with a total parking capacity of 5,000 cars is considered. Construction costs are estimated at 90 mil. €, most of which are costs for the construction of the railway line (with connection to the existing railway line in ŽST Vajnory. The line from Vajnory to the Triblavina locality may represent the 1st stage of the regional line, which could continue in the future to Pezinok.

2) Planned after the completion of the modernization of the railway line 110

Table 11-5 Proposal for the implementation of P + R on the territory of Bratislava (Source: Processor)

Parking P + R	year of implementation	capacity OA	costs (€)
Devinska Nova Ves	2040	80	800 000
Lamač	2035	150	1,500,000
Podunajské Biskupice	2025	750	7,500,000
Lamač Gate	2025	750	7,500,000
Golden sands	2025	700	7,000,000
Harbor bridge	2025	800	8,000,000

Raca	2035	350	3,500,000
Vajnory	2040	700	7,000,000
Janík's court	2040	800	8,000,000
Bory	2020	370	5,580,000
Rusovce	2035	160	1,600,000

Impact on the Spatial Plan

- The measure has an impact on the zoning plan

11.3 B + R Parking

Cycling is becoming an increasingly popular way to move, but also to transport from place to place. As a means of reaching railway stations, the role of cycling in our country currently remains insignificant. The reason may be insufficient equipment of railway stations with bicycle stands, but also insufficient cycling infrastructure directly in the seat.

Bike and Ride is a form of combined transport with the connection of bicycle transport to public passenger transport. It is made possible in particular by the construction of facilities for the safe storage of bicycles near railway and bus stations and stops. B + R is an important tool for supporting public passenger transport and integrated transport systems.

If we want to increase the role of bicycle mobility in conjunction with public passenger transport (Bike and Ride), we must not only provide sufficient parking spaces for bicycles, but also ensure their safe storage, or provide the possibility of their repairs. No less important is the support of the surrounding communities in providing safe - segregated bike paths that lead to VOD stations.

In principle, it can be said that bicycle parking lots (often several bicycle stands) are to be set up at all, even insignificant, stops and VOD stations. It is difficult to lay down any general rules for proposing the number of places for bicycles; for specific places, it is necessary to proceed from a survey or a survey organized in the area of interest of the place.

Due to the longer absence of the owner of the bicycle, it is appropriate to build a secure and lockable parking lot for bicycles at railway stations. A good example is from Dunajská Streda, where a cyclist can store a bicycle in a fenced parking lot for bicycles, while the condition of storage is the use of a chip carrier's chip card. If he also takes a bus on that day, he has free parking for bicycles. It works similarly for passenger cars. In the past, it happened that people who did not use public transport at all parked their cars. Another example is in Trnava, where a parking house for 120 bicycles is built. This project is less space-intensive, but financially more demanding.

The potential for the use of B + R car parks is very high. If we accept the premise that cycling is attractive within about 5 - 6 km, it is about 15 minutes drive, then all settlements with P + R parking lots are accessible by bike. According to the table in the article Park and Ride, 63% of municipalities in the area of interest of P + R car parks lie within the limits of acceptable accessibility of cycling.

In general, any assessment of bicycle parking needs is an assessment of current, existing needs. The construction of a new car park is also an incentive for other passengers to switch to bicycles. In the future, this may lead to an increased demand for bicycle parking, so these car parks should be planned with the possibility of expanding them.

A guide to the construction of bicycle parking facilities (www.bicy.it), from which the directive for bicycle parking systems coordinated by the Bratislava self-governing region is also taken over, states the following numbers of bicycle parking stands:

- Tram and bus terminals - 1 stand for 3 - 10 passengers
- Public passenger transport stops - 5 stops per stop
- Park and Ride car parks - 1 stand for 20 car parking spaces.

One bicycle stand for 20 parking spaces for cars in P + R car parks seems to be considerably underestimated. The knowledge of the processor implies in our conditions the need for one bicycle stand for 3-4 parking spaces for cars. The proposal for the number of bicycle stands is also based on

this consideration, which is given in the table in the Park and Ride section. The table also shows the proposal for the year of implementation and construction costs, which are included in the construction costs of the P + R car park. The stated numbers of bicycle stands must be considered as indicative, the specific requirements for the stands must be assessed according to local conditions.

11.4 K + R Parking

Kiss and Ride (kiss and travel by public passenger transport) is a form of combined transport with the connection of IAD to VOD. It is made possible by setting up places for short-term stopping of carsnear stations, stops and other VOD terminals. The driver usually transports another person or persons to the place of public passenger transport, where he allows them to change and continues with the vehicle to the destination of his journey. The passenger or disembarkation points should be arranged in such a way that they do not provoke the parking of the vehicle. It can also be used in other cases where the driver is not required to park his vehicle, e.g. near school and preschool facilities, medical facilities, cultural and sports facilities and the like. In those cases, it is more of a Kiss and Go process, which is in principle different from Kiss and Ride, only it has no connection to VOD. K + R car parks are an important motivating tool for supporting public transport, integrated transport systems and the efficient use of IAD. At the same time, K + R car parks reduce the number of traffic accidents and increase traffic safety by removing the chaos of unorganized disembarkation and boarding of passengers. The K + R car park area is not intended for waiting and parking. A driver who is waiting for a child or a passenger from the VOD will park in the adjacent car park and in the K + R car park, this person will only enter the vehicle.

Survey of the contractor on 16.9.2019 in the period from 7.00 to 8.00 h. the demand for K + R was found in front of the Primary School on Sokolíková Street in Bratislava. The school has 561 students, 193 of whom were brought by their parents by car.

In the Czech Republic, the IP 13e traffic sign has been in force since 2010, which indicates a car park where it is possible for people who continue to use public passenger transport to get on and off.

A picture 11-4 Traffic sign K + R

On the territory of BSK, it is proposed to create Kiss and Ride car parks in front of all railway ones stations, bus stations and major VOD stops. It is appropriate to place bays - Drop Off (K + R) especially in front of primary schools, where there is a high proportion of students whose parents drive to school by car. Here it is necessary to focus the educational work of BECEP, local governments and the media on children but also their parents, so that they preferentially use VOD, bicycles and walking to school.

So far, the Slovak legislation does not recognize the traffic sign for the Kiss and Ride car park, therefore it will be necessary to initiate a legislative change and add such a sign to the legislation. Decree of the Ministry of the Interior of the Slovak Republic no. 9/2009 Coll. For this purpose only knows the traffic sign B 33 Prohibition of standing. This oneIt shall be used, in particular, in cases where, in the interests of road safety and traffic flow and in the light of local conditions, it is necessary to prohibit the parking of vehicles and to allow them only to be stopped, for example for supply purposes. According to § 8 of the said decree, the traffic sign IP 19 Park and Ride car park cannot be changed, ie the text P + R cannot be exchanged for the text K + R.

K + R car parks must be taken into account prospectively when building buildings that will serve the public interest, such as school facilities or hospitals.

12 Principles of accessibility and directness of pedestrian relations to IDS VOD

Equal access for everyone to the use of public services and the possibility of the maximum possible use of public space is one of the basic principles of equal access of society to people with specific needs. The most numerous target group are people with disabilities, but the accessibility of transport as a public space is also important for other users. Accessibility is important for the following target groups of transport users:

- People in a wheelchair
- Passengers with a stroller and mobile luggage
- People with physical disabilities
- Seniors and people with reduced mobility
- People with visual impairments

- People with hearing impairments
- People with mental disabilities

Movement problems can also be related to age, illness, temporary condition (pregnant woman, temporary injury, or, simply, carrying luggage), with a temporary or permanent handicap (illness, blindness, a person moving on barrels or on a wheelchair).

The UN has accepted Convention on the Rights of Persons with Disabilities (Notification of the Ministry of Foreign Affairs of the Slovak Republic No. 317/2010 Coll.), Which aims to promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities and to support respect for their natural dignity. One of the principles of the Convention is admissibility in order to enable persons with disabilities to live an independent way of life and to participate fully in all aspects of life. The Slovak Republic has committed itself to taking appropriate measures to ensure that persons with disabilities have access on an equal basis with others to transport, as well as to other means and services available or provided to the public, both in urban and rural areas.

In recent years, the EU has been focusing more intensively on the issue of governance and public services for everyone. There are basically two approaches:

- Design and build public services from the beginning so that they are accessible and usable
- For existing services, meet the requirements for their accessibility as much as possible.

There are ten basic areas that Governance Accessibility deals with, one of which is barrier-free transport.

In the conditions of the Slovak Republic, the issue of access for people with disabilities and limited mobility is addressed by legislative and technical standards. These are mainly Act no. 50/1976 Coll. (Building Act),Decree of the Ministry of the Environment of the Slovak Republic no. 532/2002 Coll. And STN 73 6110 Design of local roads.

A picture 12-1 Ignorance of handicapped and non-handicapped pedestrians (Source: Processor)

A picture 12-2 Improperly placed public lighting pole and traffic sign carrier (Source: Processor)

12.1 Measures to remove barriers in public passenger transport

12.1.1 Measures for stops

Stops serve as important connecting points between VOD and pedestrian traffic, so we must perceive them not only as places where VOD vehicles stop and are marked with a sign or marking on the road surface.

Public transport stops are often not designed to take full advantage of low-floor and barrier-free vehicles, and are often without the appropriate equipment to allow full use by people with reduced mobility. A set of barrier-free elements, measures, technical and construction modifications serves to facilitate and accelerate the movement and orientation not only of handicapped persons, but of all passengers.

The stop environment fulfills a number of functions that need to be taken into account. It is a connection to walking routes, passenger comfort, type and height of curb, shelters and seating for passengers, information for passengers, ticket machines, marking the surface of the stop, lighting the stop.Stops should be built and equipped according to IDS BK standards.

It is necessary to ensure the access of passengers to the stop by a barrier-free route. Stops shall be equipped with a warning strip along the entire boarding edge of the stop and a signal strip leading to the boarding point to the first door of the vehicle. Stops should also be clearly marked for visually impaired people with information in Braille and a text / pictogram. The height of the boarding edge of wheelchair accessible stops for wheelchair users depends on the types of public transport vehicles that serve them (usually 350 mm - tram, 320 mm - bus / trolleybus, this dimension must be adapted to the public transport vehicles in operation).

Access to the stop should be user-friendly, safe, without lost slopes, barrier-free without elevation solved by stairs, without sloping surfaces on a steep slope, with a flat surface, should be illuminated and reinforced.

A picture 12-3Improperly located shelter at a public transport stop. There is space to place it behind the edge of the sidewalk. At the same time, the design of the shelter with an opaque side wall filled with advertising on the side of the arrival of the public transport vehicle is also inappropriate (Source: Processor)

12.2 Parking areas for bicycles at P + R, local stops and bus stations

Increasing the role of bicycle mobility in conjunction with public passenger transport (Bike and Ride) is conditioned by the provision of sufficient parking spaces for bicycles, but also by ensuring their safe storage, or providing the possibility of their repairs. No less important is the support of the surrounding communities in providing safe - segregated bike paths that lead to VOD stations.

In principle, it can be said that bicycle parking lots (often several bicycle stands) are to be set up at all, even insignificant, stops and VOD stations. It is difficult to lay down any general rules for proposing the number of places for bicycles; for specific places, it is necessary to proceed from a survey or a survey organized in the area of interest of the place.

A picture 12-4Example of a rural PAD stop with bicycle stands. Bicycle stands should be in accordance with TP 085 Design of cycling infrastructure. (Source: Gestaltung von Strasse und Ortsraum, Amt der Niederösterreichischen Landesregierung)

Due to the longer absence of the owner of the bicycle, it is appropriate to build a secure and lockable parking lot for bicycles at railway stations.

A picture 12-5 Secure and unsecured parking for bicycles in front of the railway station in Zohor (Source: Processor)

12.3 Equipment of VOD stops and railway stations

There are 1431 VOD stops in Bratislava. On the tram lines, only the stops on the new line in Petržalka and on the newly reconstructed tram line in Dúbravka are built as barrier-free, ie access to the stop and access to the vehicle is suitable for people with disabilities and limited mobility. Other stops have only a few barrier-free elements or are not barrier-free at all. Slovak Lines connections at BSK at 517 stops. According to the processor's knowledge, bus stops are not barrier-free at BSK. The Mlynské Nivy bus station in Bratislava is barrier-free. Passengers who need assistance can contact the cashiers in the lobby of the Mlynské Nivy bus station.

Equipping a stop with the necessary components depends on its importance in the network, the load on passengers and the frequency of connections, spatial possibilities, as well as its location in the territory. The minimum equipment of the stop should include:

- a sign indicating the lines which stop at a stop
- shelter
- rubbish bin
- bench
- timetables for the lines which stop at the stop
- IDS BK tariffs
- bike rack
- installation of stair grooves on bicycles, unless another measure makes it possible to cross the staircase with the bicycle without the need to carry it

Strategic stops and other important stops should include:

- a sign indicating the lines which stop at a stop
- shelter
- line network map
- map of tariff zones
- IDS BK tariffs
- a map of the territory in which the stop is located
- navigation directions to lines traveling on another road - transfer
- rubbish bin
- benches
- timetables for the lines which stop at the stop
- information on extraordinary events, lockouts, detours, etc.
- electronic panel with departures of individual lines
- hours
- ticket machine
- bike rack
- installation of stair grooves on bicycles, unless another measure makes it possible to cross the staircase with the bicycle without the need to carry it
- WC, or directing to the nearest usable WC.

It is proposed that all new stops be consistently built throughout the BOD in accordance with legislative regulations and technical standards as barrier-free. Stops must also be built with regard to the technical standards of IDS BK. At the same time, it is proposed that in the city of Bratislava and in the other territory of BSK, all stops be rebuilt by 2030 according to the above requirements.
There are 43 railway stations and stops in BSK, of which 16 are barrier-free. It should be mentioned that this accessibility is of different design and scope. The actual barrier-free platforms are on the

modernized section of line 120 (Sv. Jur - Báhoň) and partly on line 131 (Detailed breakdown of individual stops with the definition of the state of accessibility is given in the analysis section).
The proposal assumes to reach the maximum level of accessibility at all stations and stops of ŽSR in BSK in the design year 2040. The establishment of high platforms (550 mm above the TC), which are barrier-free, is possible only within the overall modernization of the relevant line 110 and 130, or 131.

In order to achieve the basic goal in the design of suburban passenger transport, it will be necessary to increase the share of VOD, especially its part - rail (rail) transport. Measures to achieve this goal do not only affect the quality and capacity of the railway infrastructure, but especially its accessibility and, last but not least, the accessibility of railway equipment and vehicles.

The aim of this measure is to achieve maximum accessibility, as most railway stations and stops are in a very unsatisfactory condition in this respect.
These complicated pedestrian crossings over adjacent tracks are highlighted in height, while the platforms themselves are disproportionately narrow and dangerous for a large number of passengers, especially with an oncoming train. The actual passage through the adjacent tracks is concentrated by lowering the platform into 1 to 2 localities, which are in an unsatisfactory width of about 3.00 m. Railway stations without island platforms with level access, in addition to reduced safety, accessibility and a culture of travel, also have a negative impact on track throughput and traffic technology - the interval on the platform.

Evaluation of the measure

The measure seeks to eliminate discrimination against persons with reduced mobility in public passenger transport in order to enable them to live a full life and freedom of movement. At the same time, it facilitates travel for non-handicapped persons, speeds up the boarding and alighting of passengers, shortens delays at stops and thus shortens VOD travel time.
Users: passengers, carriers

Strategic goals:

- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- Municipalities
- Railways of Slovak Republic
- Transport company Bratislava, as
- PAD carriers operating in BSK

Dates of implementation and investment costs:
Increasing the share of barrier-free stations and PŽD stops from the current 37.2% to 50% in 2025, 70%
in 2030 and to 100% in 2040. Due to the fact that it is impossible to calculate the flat price for the adjustment of individual stations to barrier-free, it is necessary to solve each station / stop individually, which is beyond the scope of the assignment.
Impact on the Spatial Plan

- The measure does not affect the zoning plan

12.4 Requirements for vehicles

Deployment of low-floor and barrier-free vehicles into traffic is currently one of the priorities of VOD carriers. The operation of these vehicles allows passengers with reduced mobility who have difficulty traveling to expand their mobility.

At present, DPB and Slovak Lines operate to a greater extent on low-floor vehicles. DPB also provides transport of immobile children by special lines to special schools. Rail carriers have fewer wagons available to carry immobile passengers. The intention of the proposal is to gradually equip 100% of regional VOD vehicles with low-floor vehicles when replacing the vehicle fleet.Very restrictive is the boarding and alighting of currently operated types of trainsets, which were not originally designed for intensive suburban passenger rail transport. With narrow and barrier doors on train carriages, there is a significant delay, and thus an increase in travel time, which is directly related to the reduction of the capacity of the line. This is also related to achieving the necessary capacity of the railway line and accelerating railway transport.

The new trainsets, which are operated on suburban railway lines, have already been designed to be as suitable as possible in terms of barrier and width of doors with automatic opening.

The interior of the vehicles itself is user-friendly with the appropriate technical equipment for the traveling public (wi-fi, 220 V, air conditioning, toilet, space for bicycles, etc.).

A picture 12-6 Limited boarding of the train (Source: Processor)

Acoustic and visual information in the vehicle is also important for passengers with sensory impairments. Public transport vehicles in Bratislava are becoming more and more sufficiently equipped with information light panels showing the course of the line as well as audio messages about the current and next stop.

Evaluation of the measure

The measure seeks to eliminate discrimination against persons with reduced mobility in public passenger transport in order to enable them to live a full life and freedom of movement. At the same time, it facilitates travel for non-handicapped persons, speeds up the boarding and alighting of passengers, shortens delays at stops and thus shortens VOD travel time.

Users: passengers, carriers

Strategic goals:

- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- Carriers operating in BSK

Dates of implementation and investment costs:

Public transport vehicles currently have 71.4% barrier-free vehicles. The goal is to reach 80% of barrier-free vehicles in 2025, 90% of barrier-free vehicles in 2030 and 99% of barrier-free vehicles in 2040.

PAD vehicles currently have 25.4% barrier-free vehicles. The goal is to reach 40% of barrier-free vehicles in 2025, 75% of barrier-free vehicles in 2030 and 99% of barrier-free vehicles in 2040.

PŽD currently has 68.4% barrier-free connections. The goal is to reach 75% of barrier-free connections in 2025, 85% of barrier-free connections in 2030 and 99% of barrier-free connections in 2040.

Note: It is impossible to achieve 100% due to operational reasons and technical parameters of specific connections

It is not possible to quantify the individual investment costs for the purchase of barrier-free vehicles / wagons to achieve the required condition.

13 Public passenger transport

If we consider only with a relatively short history of public transport, the first was provided by public passenger transport by rail. First "horse" from r. 1840 on the line from Bratislava to Svätý Jur, later from 1848 it was already a steam railway from Marchegg to Bratislava. During the period of the first Czechoslovak Republic, bus transport operated by private carriers also began to develop. While rail infrastructure has developed relatively slowly, bus transport, less infrastructure-intensive and more flexible, has developed much faster. Individual car transport developed even more dynamically. This is despite the fact that in the middle of the 20th century, the state doctrine of decline, almost the liquidation of private individual transport. To the extent that in 1959 the ratio of public transport to individual transport at the entrance to Bratislava (excluding public transport) was 91.8:

This unfavorable trend can only be changed by a fundamental change in the philosophy of transport services in the area. Philosophy must be based on real life, statistics, surveys, it must know the history of problems and only then can philosophy be truly applicable and usable. Likewise, the new transport philosophy must be based on knowledge of reality and learn from the negatives of previous developments. Therefore, the basic idea of the new philosophy is to provide the population with modern, high-quality, efficient, fast, accessible public passenger transport that maximally eliminates its impact on the environment. In order for public passenger transport to be able to compete with individual car transport, we must provide it with competitive advantages in all aspects, even at the cost of restrictions on individual car transport.

13.1 Basic characteristics of VOD transport service design

13.1.1 Regional train transport - design from model load

Based on the results of the model load of individual arms of railway lines in BSK, the numbers of trains in the design years 2025, 2030, 2040 and 2050 were gradually proposed under the following conditions:

- Occupancy of passenger trains (Os) 300 roads / train
- Occupancy of regional express trains (Rex) 600 roads / train
- When calculating the prospective numbers of trains in the period after 2030, it considered increasing the capacity of individuals train sets 400-500 roads / Pers

The model calculation of transport for the prospective years took into account the effort to change today's division of transport work in regional relations from a ratio of about 30%: 70% in favor of IAD, in 2025 32%: 68%, in 2030 35%: 64%, in of the 2040 proposal, the ratio is 42%: 58% and for the 2050 forecast period the minimum equilibrium target is 50%: 50%.

The tendency to change the division of transport work must be strongly supported by increasing the share of rail modes of public transport, which means support for railways in the region and support for railways as well as tram public transport in Bratislava.

In traffic modeling in BOD, traffic loads on all railway routes in BOD were separated. Cartograms of the load of railway lines in BSK in the years 2025, 2030, 2040 and 2050 are presented, which are attached to the report.

For the period of 2050, the state of railway infrastructure is assumed to be in the target dimension so that this type of transport can take over, together with PAD and MHD, within the division of transport

work, 50% of all daily mobility performance in BSK. All types of public transport in BOD must be so attractive in the destination state that passengers themselves exchange their cars for public transport. Due to the fact that the model solution does not take into account the desired division of transport (50%: 50%), the values obtained from cartograms for individual assessed periods multiplied by reduction coefficients, which are described and defined in the section for evaluating the effectiveness of individual investments.

By assessing the traffic loads in the proposed time periods on the individual branches of the railway lines in BSK, it was possible to propose indicative numbers of sightseeing trains, which would need to be provided during the peak hour on individual line sections.

Table 13-1 Forecast of intensities on railway lines in BSK - two-way (Source: Processor)

track	section	2025 Max	2030 Max	2040 Max	2050 Max
100	Marchegg - Bratislava	3415	4361	6039	7949
110	hr. BSK / TTSK - Malacky	7179	9009	12317	17102
	Malacky - Bratislava	15991	23248	35392	42651
113	Zohor - Záhorská Ves	510	590	718	996
120	Bratislava - Pezinok	28004	36955	51328	66697
	Pezinok - hr. BSK / TTSK	15210	18645	20572	29978
130	Bratislava - Senec	17138	22467	32417	42958
	Senec - hr. BSK / TTSK	12792	17254	24136	31928
131	Bratislava Miloslavov	6892	9856	23672	31018
	Bratislava - Kittsee	3800	4650	6038	8384
	Bratislava - Rajka	920	1550	3477	4606
	Vajnory - Pezinok	1292	1637	2266	2959
	Pezinok - Smolenice	2063	2590	3612	4669
	Devín Lake - Stupava - Lozorno	1702	2195	3101	4041
	Swimming Mikulas - Jablonica	51	64	93	119

In these data, only regional traffic within the BOD is calculated on the basis of the transport model, while the intensities and capacities of long-distance trains such as R, EC and IC trains are not taken into account.

	cest/3špo (38%deň)				cest/1šph (50%špo)			
úsek	2025 Max	2030 Max	2040 Max	2050 Max	2025 Max	2030 Max	2040 Max	2050 Max
Marchegg - Bratislava	831	1061	1469	1933	415	530	734	967
hr.BSK/TTSK - Malacky	1746	2191	2995	4159	873	1095	1498	2080
Malacky - Bratislava	3889	5654	8607	10373	1945	2827	4304	5186
Zohor - Závorská Ves	124	143	174	242	62	72	87	121
Bratislava - Pezinok	6811	8987	12483	16221	3405	4494	6241	8110
Pezinok - hr.BSK/TTSK	2758	3751	4733	7291	1379	1875	2366	3645
Bratislava - Senec	4168	5464	7884	10447	2084	2732	3942	5224
Senec - hr.BSK/TTSK	3111	4196	5870	7765	1556	2098	2935	3882
Bratislava Miloslavov	1676	1920	5757	7544	838	960	2879	3772
Bratislava - Kittse	924	1131	1468	2039	462	565	734	1019
Bratislava - Rajka	224	377	846	1120	112	188	423	560
Vajnory - Pezinok	314	398	551	720	157	199	276	360
Pezinok - Smolenice	502	630	878	1136	251	315	439	568
Devínske Jazero - Stupava	414	534	754	983	207	267	377	491
Plavecký Mikuláš - Jablonica	12	16	23	29	6	8	11	14

A picture 13-1 Conversion of railway traffic intensities to peak hours on individual lines in one direction (Source: Processor)

Table 13-2 R. 2025 calculation of train demand / šph / one-way on individual lines (Source: Processor)

2025	Calculation for Os and REX in BOD			2025Max	2025Max
ID	section	train capacity	roads / šph / unidirectional	number of train axes / h	interval in min
1	Marchegg - Bratislava	300	415	1	43
2	hr.BSK / TTSK - Malacky (Os + REX)	400	873	2	27
3	Malacky - Bratislava (Os + REX)	400	1945	5	12
4	Zohor - Záhorská Ves	150	62	1	60
5	Bratislava - Pezinok (Os + REX)	400	3405	9	7
6	Pezinok - hr.BSK / TTSK (Os + REX)	400	1850	5	0
7	Bratislava - Senec (Os + REX)	400	2084	5	12
8	Senec - hr.BSK / TTSK (Os + REX)	400	1556	4	15
9	Bratislava - Miloslavov	300	838	3	21
10	Bratislava - Kittse	300	462	2	39
11	Bratislava - Rajka	300	112	1	60
12	Vajnory - Pezinok	150	157	2	30
13	Pezinok - Smolenice	150	251	2	30
14	Devín Lake - Stupava	300	207	1	60
15	Swimming Mikulas - Jablonica	150	6	1	60

Table 13-3 R. 2030 calculation of train demand / šph / one-way on individual lines (Source: Processor)

2030	Calculation for Os and REX in BOD			2030Max	2030Max
ID	section	train capacity	roads / šph / unidirectional	number of train axes / h	interval in min
1	Marchegg - Bratislava	300	530	2	34
2	hr.BSK / TTSK - Malacky (Os + REX)	400	1095	3	22

3	Malacky - Bratislava (Os + REX)	400	2827	7	8
4	Zohor - Záhorská Ves	150	72	1	60
5	Bratislava - Pezinok (Os + REX)	500	4494	9	7
6	Pezinok - hr.BSK / TTSK (Os + REX)	500	1875	4	16
7	Bratislava - Senec (Os + REX)	500	2732	5	11
8	Senec - hr.BSK / TTSK (Os + REX)	500	2098	4	14
9	Bratislava - Miloslavov	300	960	3	19
10	Bratislava - Kittse	300	565	2	32
11	Bratislava - Rajka	300	188	1	60
12	Vajnory - Pezinok	150	199	1	60
13	Pezinok - Smolenice	150	315	2	30
14	Devín Lake - Stupava	300	267	1	60
15	Swimming Mikulas - Jablonica	150	8	1	60

Table 13-4 R. 2040 calculation of train demand / šph / one-way on individual lines (Source: Processor)

2040	**Calculation for Os and REX in BOD**			**2040Max**	**2040Max**
ID	section	train capacity	roads / šph / unidirectional	number of train axes / h	interval in min
1	Marchegg - Bratislava	300	734	2	25
2	hr.BSK / TTSK - Malacky (Os + REX)	400	1498	4	16
3	Malacky - Bratislava (Os + REX)	500	4304	9	7
4	Zohor - Záhorská Ves	150	87	1	103
5	Bratislava - Pezinok (Os + REX)	500	6241	12	5
6	Pezinok - hr.BSK / TTSK (Os + REX)	500	2366	5	0
7	Bratislava - Senec (Os + REX)	500	3942	8	8
8	Senec - hr.BSK / TTSK (Os + REX)	500	2935	6	10
9	Bratislava - Miloslavov	300	2879	10	6
10	Bratislava - Kittse	300	734	2	25
11	Bratislava - Rajka	300	423	2	30
12	Vajnory - Pezinok	150	276	2	30
13	Pezinok - Smolenice	150	439	3	20
14	Devín Lake - Stupava	300	377	1	60
15	Swimming Mikulas - Jablonica	150	11	1	60

Table 13-5 R. 2050 calculation of train demand / šph / one-way on individual lines (Source: Processor)

2050	**Calculation for Os and REX in BOD**		roads / šph / unidirectional	**2050Max**	**2050Max**

ID	section	train capacity		number of train axes / h	interval in min
1	Marchegg - Bratislava	300	967	3	19
2	hr.BSK / TTSK - Malacky (Os + REX)	400	2080	5	12
3	Malacky - Bratislava (Os + REX)	500	5186	10	6
4	Zohor - Záhorská Ves	150	121	1	74
5	Bratislava - Pezinok (Os + REX)	500	8110	16	4
6	Pezinok - hr.BSK / TTSK (Os + REX)	500	3645	7	0
7	Bratislava - Senec (Os + REX)	500	5224	10	6
8	Senec - hr.BSK / TTSK (Os + REX)	500	3882	8	8
9	Bratislava - Miloslavov	300	3772	13	5
10	Bratislava - Kittse	300	1019	3	18
11	Bratislava - Rajka	300	560	2	30
12	Vajnory - Pezinok	150	360	2	25
13	Pezinok - Smolenice	150	568	4	15
14	Devín Lake - Stupava	300	491	2	30
15	Swimming Mikulas - Jablonica	150	14	1	60

Table 13-6 Required number of trains (Os and REX) during peak hours on individual lines in one direction (Source: Processor)

Calculation for Os and REX in BOD	**number of Os + Rex train / h**			
section	**2025Max**	**2030Max**	**2040Max**	**2050Max**
Marchegg - Bratislava	1	2	2	3
hr.BSK / TTSK - Malacky (Os + REX)	2	3	4	5
Malacky - Bratislava (Os + REX)	5	7	9	10
Zohor - Záhorská Ves	1	1	1	1
Bratislava - Pezinok (Os + REX)	9	9	12	16
Pezinok - hr.BSK / TTSK (Os + REX)	3	4	5	7
Bratislava - Senec (Os + REX)	5	5	8	10
Senec - hr.BSK / TTSK (Os + REX)	4	4	6	8
Bratislava - Miloslavov	3	3	10	13
Bratislava - Kittse	2	2	2	3
Bratislava - Rajka	1	1	2	2
Vajnory - Pezinok	2	1	2	2
Pezinok - Smolenice	2	2	3	4
Devín Lake - Stupava	1	1	1	2
Swimming Mikulas - Jablonica	1	1	1	1

In the framework of this work, the respective capacity needs on the most congested sections were investigated. It was assumed that in the perspective period after 2030, there could be an increase in transport capacity due to trains with greater occupancy.

The results of the feasibility study of the Bratislava railway junction were taken over, while the feasibility of individual actions in the development of the railway junction was not specifically verified within the elaboration of the RPUM BSK.
Individual infrastructure plans of railway transport were defined in the previous sections and from these above conditions, the following data on the expected number of passengers in 24 hours were obtained by model calculation, both ways on a working day on the busiest sections of railway infrastructure (sections before entering Bratislava).
Rail transport is an integral part of IDS BK and, with the operation of passenger trains and regional express trains, it forms the supporting skeleton of all suburban public transport.
To increase the attractiveness of rail transport, measures are proposed that are of great importance in attracting passengers, especially from IAD. These are in particular:

- Parking lots of the P + R type, for long-term parking of passenger cars with subsequent transfer to the train. These car parks are proposed at all railway stations and stations in BSK.
- B + R car parks, to enable the safe parking of bicycles, thereby increasing the transport potential for rail transport and improving transport accessibility in the adjacent area of railway stations and stops.
- K + R car parks which do not have exceptional space requirements and must be located at the shortest possible distance to the railway platforms.
- TIOPs aim to facilitate and accelerate passenger transfers between individual types of suburban public transport and are located in selected stations in BSK and the city of Bratislava. PAD and public transport lines are used to these places.

The fundamental goal of the regional plan for sustainable mobility is to create conditions for a fundamental change in the division of transport work in favor of public transport, which means creating the best possible conditions in the environment of public transport so that the traveling public makes maximum use of all modes of public transport.
This intention can only be achieved through the implementation of measures in public transport:

- Improving quality,
- Speed increase,
- Increase the offer,
- Capacity increase,
- Price advantage

13.1.2 Regional and long-distance train transport on the territory of BSK

To ensure the required number of trains from the PUM BSK transport model for the observation year 2040, it is necessary to modify the railway infrastructure not only at the Bratislava railway junction, but also on each line entering Bratislava from the region. At present, the capacity of the lines at peak times from all directions is full and it is not possible to add more trains.

The number of passenger trains going to Bratislava, which were considered for the prospective year 2040 in the feasibility study "ŽSR, transport hub Bratislava" is significantly lower than the actual need:

extent of long-distance and interregional transport on estuaries according to the study (both directions together)

- EC trains ... - Budapest - Bratislava hl. st. - Prague - ... (2-hour cycle, 18 trains / day)
- IC Bratislava - Žilina - Košice (4 hours, 8 trains / day)
- R Bratislava - Vienna (2-hour cycle, 16 trains / day)
- R 6xx Bratislava - Žilina - Košice (2 hours, 18 trains / day)
- R 8xx Bratislava - Banská Bystrica / Košice (2-hour cycle, 22 trains / day)
- R 10xx Bratislava - Prague (2-hour cycle in rush hours, 6 trains / day)

- RR 7xx Bratislava - Žilina (2 hours, 14 trains / day)
- RR 72x Bratislava - Leopoldov - Prievidza (4 hours, 8 trains / day)
- REX 74x Bratislava - Leopoldov - Trenčín (1-hour cycle in peak traffic, 14 trains / day)
- REX 87x / 86x Nové Zámky / Levice - Bratislava hl. st. - Kúty (transit line through the node) (1-hour cycle at peak traffic times, 12 trains / day)
- REX Bratislava - Komárno (peak hours, 4 trains / day)
- REX 76xx Bratislava Petržalka - Kittsee - ... (Vienna) (1 hour, 36 trains / day)
- REX 25xx Bratislava hl. st. - Marchegg - Vienna (1 hour, 34 trains / day)

the extent of regional transport according to the study (both directions together)

- Os Leopoldov - Bratislava (1 hour, 72 trains / day)
- Os Kúty - Bratislava (1 hour / 1 hour, 54 trains / day)
- Os Nové Zámky - Bratislava (1 hour, 72 trains / day)
- Os Dunajská Streda - Bratislava (1 hour / 1 hour, 54 trains / day)
- Os Györ - Bratislava (2-hour cycle in peak hours, 10 trains / day)

This number of trains is basically filled already at present, when new trains Trnava - Bratislava-Nové Mesto and Senec - Bratislava-Nové Mesto - Bratislava-Petržalka were introduced on June 11, 2018 and create an all-day 30 min. interval Os trains Trnava - Bratislava and Senec - Bratislava. Introduction 30 min. The Malacky - Bratislava train axis interval is planned from GVD 2020/2021. The introduction of a new layer of Vienna - Bratislava fast trains is planned by the Austrian side in 2023.

As mentioned, the required number of regional trains (Os + REX) on the PUM BSK transport model is significantly higher during the peak hour unidirectionally for the observation year 2040 compared to currently running trains and as expected by the node study for 2040. Higher number of regional trains than expected by the study node for the year 2040 is also listed in PDO BK Stage C year 2030. For the purpose of verifying the possibility of tracing a higher number of trains on the railway infrastructure, ŽSR was given the task of creating a working symmetrical clock GVD - regional trains (Os + REX) one-way per hour in the range of:

- Bratislava - Trnava → 6 trains
- Bratislava - Galanta → 6 trains
- Bratislava - Kúty → 6 trains
- Bratislava - Kvetoslavov → 6 trains
- Bratislava - Marchegg → 2 trains
- Bratislava - Kittsee → 2 trains
- Bratislava - Rajka → 2 trains

It will also be necessary to run long-distance trains one-way per hour in the range of:

- Bratislava - Trnava → 2 trains (IC 60 min. Cycle direction Žilina, R 60min. Cycle direction Žilina), in case of reconstruction / electrification of the Leopoldov - Nitra line also trains direction Nitra
- Bratislava - Galanta → 2 trains (EC 60 min. Cycle direction Budapest, R 60 min. Cycle direction Zvolen), in case of construction of the line Trnovec nad Váhom - Nitra also trains direction Nitra
- Bratislava - Kúty → 2 trains (EC 60 min. Cycle direction Prague, IC commercial 60 min. Direction Prague)
- Bratislava - Marchegg → 1 train (IC 60 min. Direction Vienna)

The specified number of trains was simulated at ŽSR in model GVD, where it was possible to find out what measures can be used to increase the throughput performance of individual sections.

Bratislava-Petržalka - Rusovce - Rajka

zero variant / current state- it is possible to run for 30 min. interval Train axes, but only at peak times, 60 min. in the saddle due to the possibility of running freight trains in the saddle + the possibility of setting up 3 TIOPs

max. variant - with a shorter interval / higher number of TIOPs, it is necessary to build an island platform with an underpass in ŽST Rusovce / double-tracking Bratislava-Petržalka - Rusovce

Bratislava-Petržalka - Bratislava-Nové Mesto

zero variant / current state - it is possible to run 6 trains per hour at rush hour, 4 trains per hour in the saddle due to the possibility of running freight trains

max. variant - no increase in permeability is required

Dunajská Streda - Kvetoslavov - Pod. Biskupice - Bratislava-Nové Mesto

zero variant (branch Ružinov / TIOP Ružinov) - 4 trains per hour (3 Os, 1 REX) (+ possibility to run in the common section branch Ružinov - BA-NM also 6 trains Os per hour from BA-Petržalka)

max. variant- doubling of the whole section BA-NM - Podunajské Biskupice (doubling of the section only Ružinov - Pod. Biskupice is not enough for the required number of trains) together with the doubling of BA hl.st. - BA-NM allows, compared to the zero variant, to lead the required number of connections Kúty - BA hl.st. - BA-NM - Pod. Biskupice, after the subsequent double-tracking of the line to Kvetoslavov, resp. after DS will enable the management of the required number of connections also on the route DS - Kvetoslavov - BA.

Bratislava hl. st. - Dev. Nová Ves - Kúty

zero variant- planned modernization of DNV - Kúty until 2030 + 1st stage of capacity building BA hl.st. - DNV (reconstruction of ŽST BA-Lamač and ETCS L2).

Island platforms with underpasses on the entire line BA hl.st. - Kúty will provide in the section BA-MA in an hour 1 EC 60min., 1 IC commercial 60min., 1 REX 60min., 3 Os 20min., Then 1 REX BA - Vienna (60min.) Deficiency: between MA-Kúty fit only 1 Axis (60min.) In the whole route BA-Kúty. It is necessary to run at least 2 axes in this section (it can be solved by passing the train) and another shortcoming is the impossibility of stopping at TIOP Bory due to the capacity of the line. Requirement to run 1 IC train from Austria (since 2023) - this train was not drawn in the proposal, as it will not fit there (there is a fear of its introduction at the expense of restricting the offer in the direction of Malacky).

max. variant- zero variant + machine track BA hl.st. - DNV

In contrast to the zero variant, it will enable the management of new trains to Austria, freight transport and stopping at TIOPs, it will also enable the management of another train in the direction of MA (possibility of overtaking the Os / REX train by EC train on section BA hl.st. - DNV). The continuation of the second Os po Kúty (with the predecessor in the MA) was also added. Not even in max. variant, the assignment was not fulfilled and other possibilities of increasing the throughput will have to be found. Note: the machine track and the section DNV - Kúty may not be required - in the hour BA-MA 3 Axis (20min.) And 1 REX (60min.) And MA-Kúty 2 Axis may not provide the fully required number of trains, but it might be sufficient , as the frequency of BA-Kúty passengers is still lower than BA-TT and BA-GA.

Bratislava – Trnava

zero variant - there is no possibility to increase the number of connections compared to the current one without the third track, a partial measure increasing the number of track sections cannot bring a higher number of trains, it will only ensure an improvement in case of delays

max. variant - the management of the required number of trains (without the management of freight

trains at peak hours) will be ensured at the 3rd track on the whole section
max. variant (alternative)- in case of impossibility to build the third track BA-TT and BA-GA, it is appropriate to consider a separate new double-track line for long-distance and freight transport from BA led approximately in the route of the D1 motorway outside the municipalities and branched into the headway ŽST Trnava and ŽST Galanta. Original BA-TT and BA-GA double-track lines for regional transport purposes.

Bratislava - Galanta
zero variant - there is no possibility to increase connections compared to the current without the third track, partial measure only the construction of island platforms with underpasses on the current double track BA-GA can not bring new trains, only ensure the introduction of symmetrical clock and extension of 1 pair of axes per hour from SC to GA.
max. variant - the management of the required number of trains (without the management of freight trains at peak hours) will be ensured at the 3rd track on the whole section
max. variant (alternative)- in case of impossibility to build the third track BA-TT and BA-GA, it is appropriate to consider a separate new double-track line for long-distance and freight transport from BA led approximately in the route of the D1 motorway outside the municipalities and branched into the headway ŽST Trnava and ŽST Galanta. Original BA-TT and BA-GA double-track lines for regional transport purposes.

Therefore, it will be necessary to implement all infrastructure measures at the Bratislava node recommended in the node study, as well as to verify those measures that the study recommends re-checking in case of a requirement to run a higher number of trains. It is also necessary to check the possibilities of increasing the throughput performance of the lines Bratislava - Trnava, Bratislava - Galanta, Bratislava - Dunajská Streda (feasibility study of the BA-DS-KN line is currently being prepared), Bratislava - Malacky (modernization is currently being prepared) and subsequent implementation of necessary measures . The task of PUM BSK is not to select specific technical solutions for increasing the permeability of lines, these must be the subject of subsequent technical-economic and operational specialized studies.

Train management in the Bratislava junction
Regarding the management of trains at the Bratislava junction, the feasibility study "ŽSR, Bratislava transport junction" in its final stage recommended two alternatives, namely Alternative no. 2 and Alternative no. 4. PUM BSK recommends from the feasibility study "ŽSR, transport junction Bratislava" Alternative no. 4 containing the renewal of the section Bratislava Predmestie - Bratislava-Filiálka, where PUM BSK proposes to check the extension of the line to ŽST Bratislava-Nivy in contact with the bus station (common HUB). It is also necessary to check the possibilities of a suitable rail connection of the final station of this line with Petržalka. A higher number of trains will be run to Bratislava-Filiálka / Bratislava-Nivy than the study of the junction considered, therefore the capacity of the section will be needed. Močiar - Bratislava Suburb, where odb. The swamp is already a collision point.

- Trnava, Pezinok will be led to the Bratislava-Niva railway station
- Galanta, Senec will be managed to the Bratislava-Niva railway station
- Kúty, Malacky will be led to ŽST Pod. Biskupice
- Dunajská Streda, Kvetoslavov will be led to ŽST Dev. Nová Ves
- Marchegg will be led to ŽST Pod. Biskupice
- Kittsee will be led to ŽST Bratislava Predmestie
- Rajka, Rusovce will be led to ŽST Bratislava Predmestie

This will create 3 associated lines in the city of Bratislava:

- West - East (Dev. Nová Ves - Bratislava hl. St. - Bratislava-Nové Mesto - Pod. Biskupice)
- North-South (Bratislava-Rača / Bratislava-Vajnory - Bratislava suburb - Bratislava-Nivy)

- Suburb-Petržalka (Bratislava suburb - Bratislava-Nové Mesto - Bratislava-ÚNS - Bratislava-Petržalka - Kittsee / Rusovce - Rajka)

Transfer between regional lines:

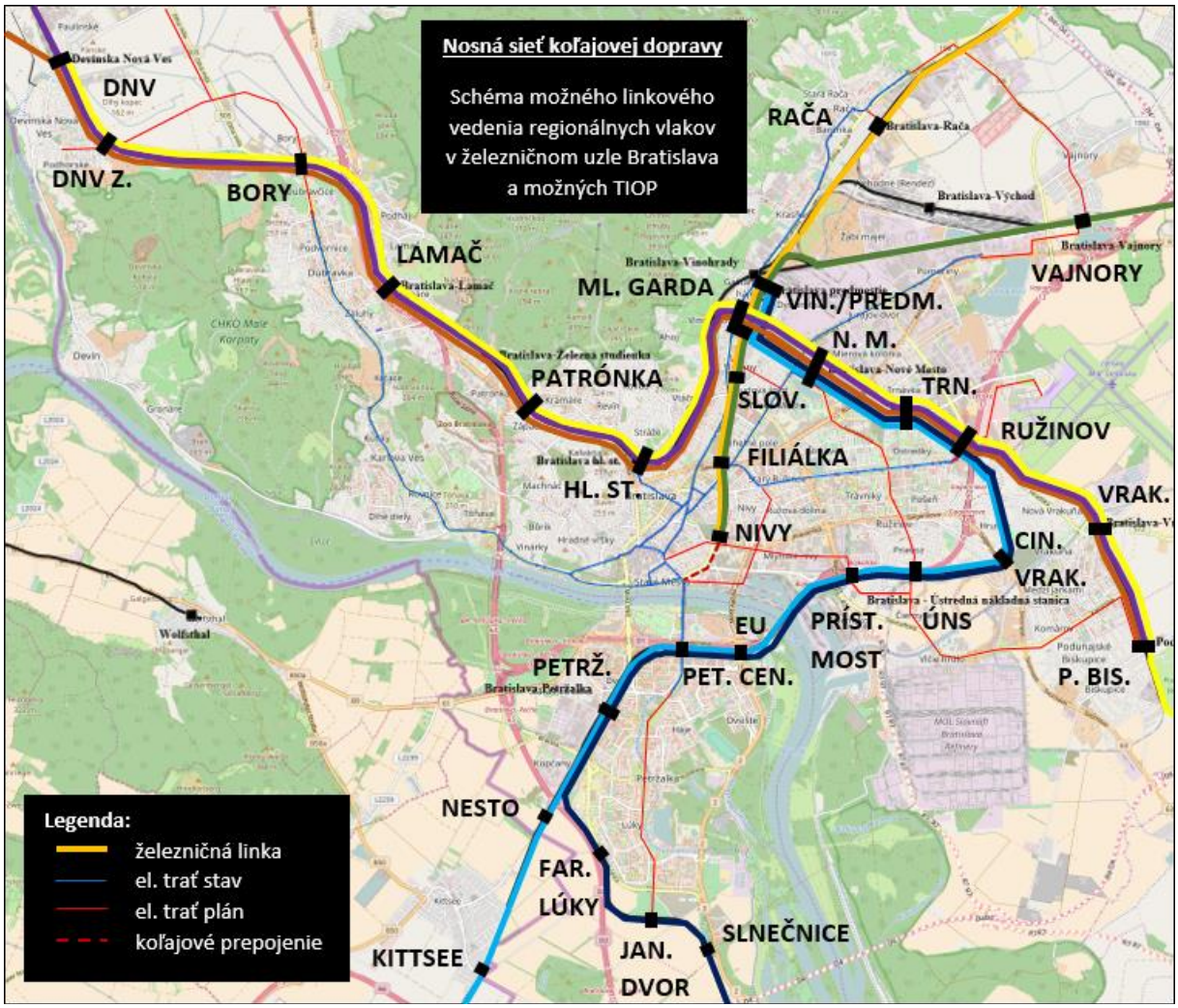
- The transfer between the West-East and North-South lines will be carried out in TIOP Mladá garda, where the study of the node in the case of the implementation of Alternative 4 states the possibility to adjust the position of the stop
- The transfer between the lines Západ-Východ and Predmestie-Petržalka will be implemented in ŽST Bratislava-Nové Mesto, resp. TIOP Ružinov
- The transfer between the lines North-South and Suburb-Petržalka will be realized in ŽST Bratislava suburb

Long-distance trains will be led to ŽST Bratislava hl. st., trains also stop at Bratislava-Vinohrady. It will be possible to switch between them at both points.

- IC Košice - Bratislava - Vienna
- EC Budapest - Bratislava - Prague
- IC commercial Bratislava - Prague
- R Košice / Žilina - Bratislava
- R Banská Bystrica / Zvolen - Bratislava

Transfer between long-distance trains and regional trains:

- The transfer between long-distance trains and the West-East line will be implemented at ŽST Bratislava hl. st.
- The transfer between long-distance trains and the North-South line will be implemented at the Vinohrady / Suburbs point
- The transfer between long-distance trains and the Predmestie-Petržalka line will be implemented at the Vinohrady / Predmestie point



A picture 13-2 Scheme of possible line management of regional trains in the Bratislava railway junction and possible TIOP (Source: Processor)

13.1.3 Regional bus transport

13.1.3.1 *Design of VOD transport service in BSK (system measures in the creation of VOD lines - express and additional BUS VOD lines)*

The way to achieve the goal of significant competitiveness of VOD is in its maximum preference and its hierarchical arrangement so that the most capacity and fastest transport providing the highest traffic flows is at the highest level and gradually at lower levels were transport modes providing the necessary service of individual districts.

In practice, the hierarchical arrangement of individual modes in the Bratislava self-governing region is proposed as follows:

<u>The highest level - rail transport</u>

- **REX - regional express. They are in**national or interstate trains connecting several regions. Compared to express trains, they usually have a larger number of stops, but they do not stand at every station.
- **Os - passenger train.** Passenger trains usually stop at all (or almost all) stops and stations.
- **Tram transport on the territory of Bratislava with the possibility of its extension to suburban areas.**

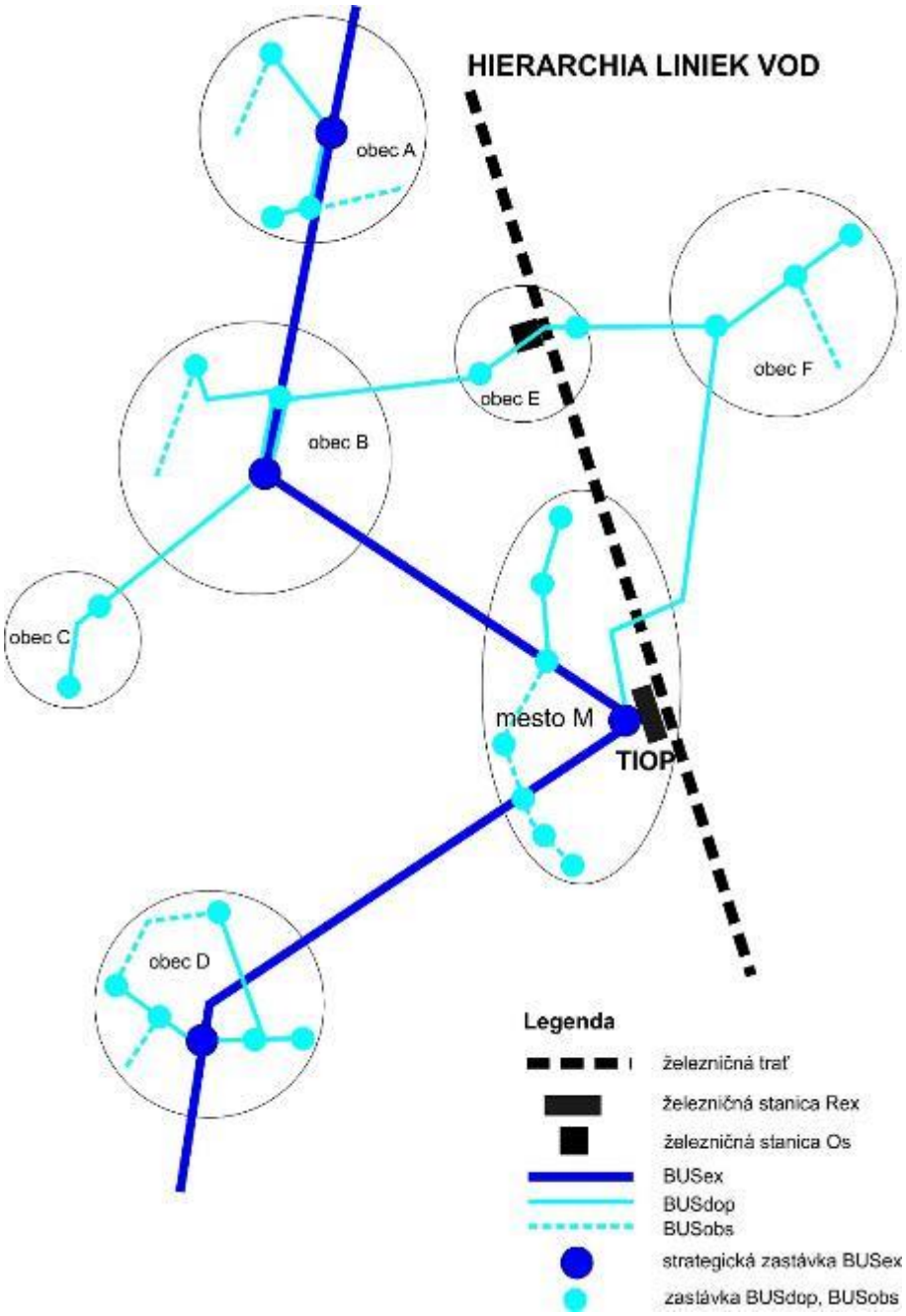
Medium level

- **BUSex - express bus line.** Express bus lines provide fast connections of areas not served by rail transport with railway stations or areas where there is insufficient capacity of railway lines and it is necessary to cover the missing capacity. In case the railway transport capacity is not sufficient to ensure the required transport demands, the express bus can supplement the railway transport capacity in an undersized direction. The change in the line management philosophy will ultimately increase the transport performance of the PAD. These express bus lines are usually routed through TIOPs in connection with rail transport. In Bratislava, express bus lines provide fast connections to areas not served by tram transport and fast connections to the outskirts of the city. The express bus line in the region usually stops at one, strategic, stop in the village.

The lowest level

- **BUSdop - additional bus line.** Additional bus lines provide a direct connection to express bus lines through strategic stops and service within municipalities. Stops on additional bus lines are located in the sources and destinations of real transport needs. The distance of stops is 500 m and more according to local conditions.
- **BUSobs -**service bus line. Service bus lines provide basic transport services to parts of municipalities that have minimum requirements for service by public passenger transport. These can be residential areas with a low density of buildings, commercial or industrial areas with special requirements for service at certain times of the day and the like. Stops are located according to the local conditions of the part or area being served and the minimum distance between stops may not be observed. In areas with low population density and scattered housing, there may also be other forms of flexible service with low occupancy of vehicles, e.g. general taxis, on-call transport, etc.

The basic arrangement of individual types of lines and their function in serving the area is shown in the diagram.



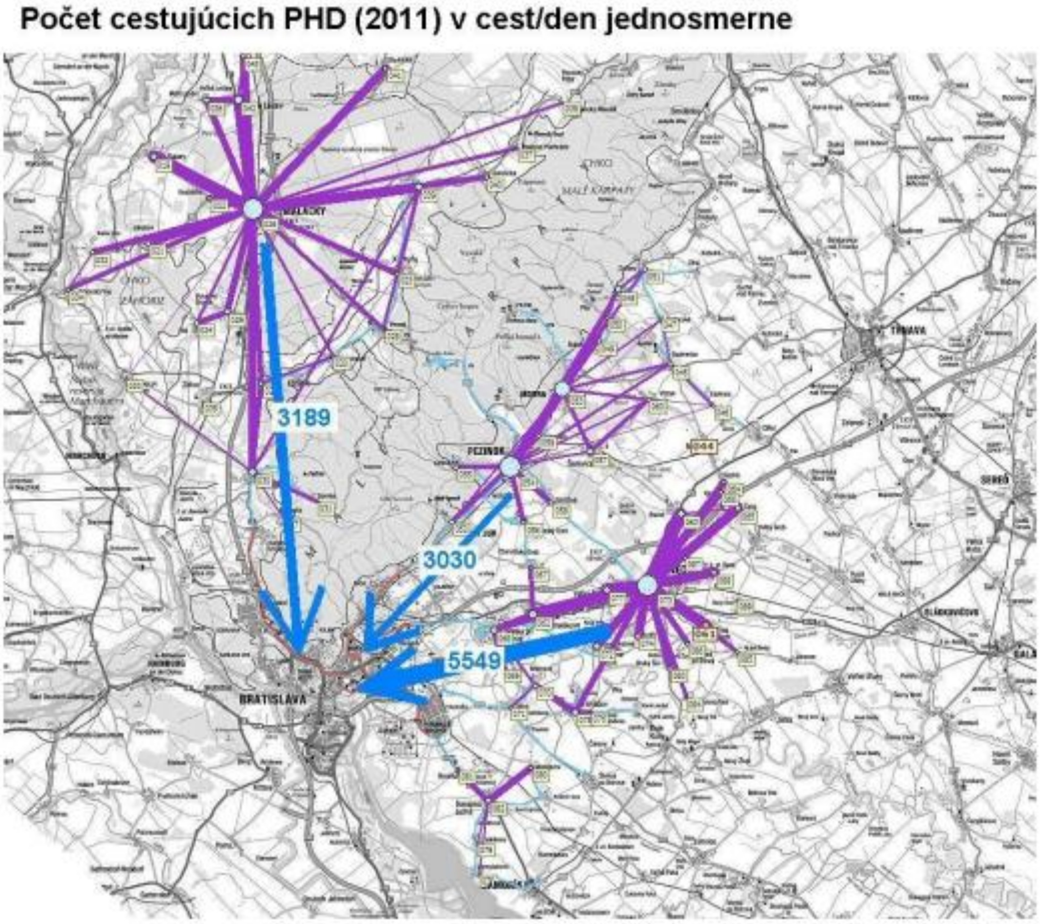
A picture 13-3 Schematic arrangement of VOD lines (Source: Processor)

13.1.3.2 *Basic characteristics of PAD traffic service design*

The aim of the design of transport services in the area is to determine the appropriate method of line PAD for basic transport relations in the area with regard to their intensity and the possibility of transport infrastructure. A detailed solution of linking, intervals in individual periods of the day and week, required mileage and other indicators should be addressed in more detailed documentation of transport service plans.

For the design of RPUM BSK, it is important to design a sufficiently supply model of transport service for the solved area, so that it can attract passengers from IAD to VOD.

Lines must be routed to destinations in accordance with the prevailing traffic flows. These relations have already been documented by the BSK Spatial Plan, when it recorded the predominant transport relations within districts, to district cities and to Bratislava as a metropolis.



A picture 13-4 Number of PAD passengers one way ((Source: UPN BSK, 2011)

The transport system of the region must be effectively built on the principle of supporting lines, additional lines and service lines. The load-bearing line means a railway line or a PAD line which runs in the direction of the strongest radial or tangential transport relations in the region, serves the most important seats in the relevant direction and offers a sufficiently attractive travel speed compared to individual car transport. The role of load-bearing lines is to ensure a decisive share of transported persons in the strongest transport directions. In BSK conditions, these are railway and express bus lines and tram transport. Ancillary line means a line which serves to serve the catchment area of the city or the defined area, serves to satisfy local transport relations, in terms of the number of stops and their availability, it has good access to sources and destinations of roads and serves as a complementary line to the main railway and bus express lines. Additional lines are usually run through TIOPs at railway stations. The service line serves areas or locations that are not serviced by additional lines, whether due to distance, low transport potential or specific service requirements in time or space. Service lines can provide buses with lower capacity (midi, mini). The timetables of the service and supplementary lines must follow each other and the timetables of the supplementary lines must follow the timetables of the carrier lines. Additional lines are usually run through TIOPs at railway stations. The service line serves areas or locations that are not serviced by additional lines, whether due to distance, low transport potential or specific service requirements in time or space. Service lines can provide buses with lower capacity (midi, mini). The timetables of the service and supplementary lines must follow each other and the timetables of the supplementary lines must follow the timetables of the carrier lines. Additional lines are usually run through TIOPs at railway stations. The service line serves areas or locations that are not serviced by additional lines, whether due to distance, low transport potential or specific service requirements in time or space. Service lines can provide buses with lower capacity (midi, mini). The timetables of the service and supplementary lines must follow each other and the timetables of the supplementary lines must follow the timetables of the carrier lines. Service lines can

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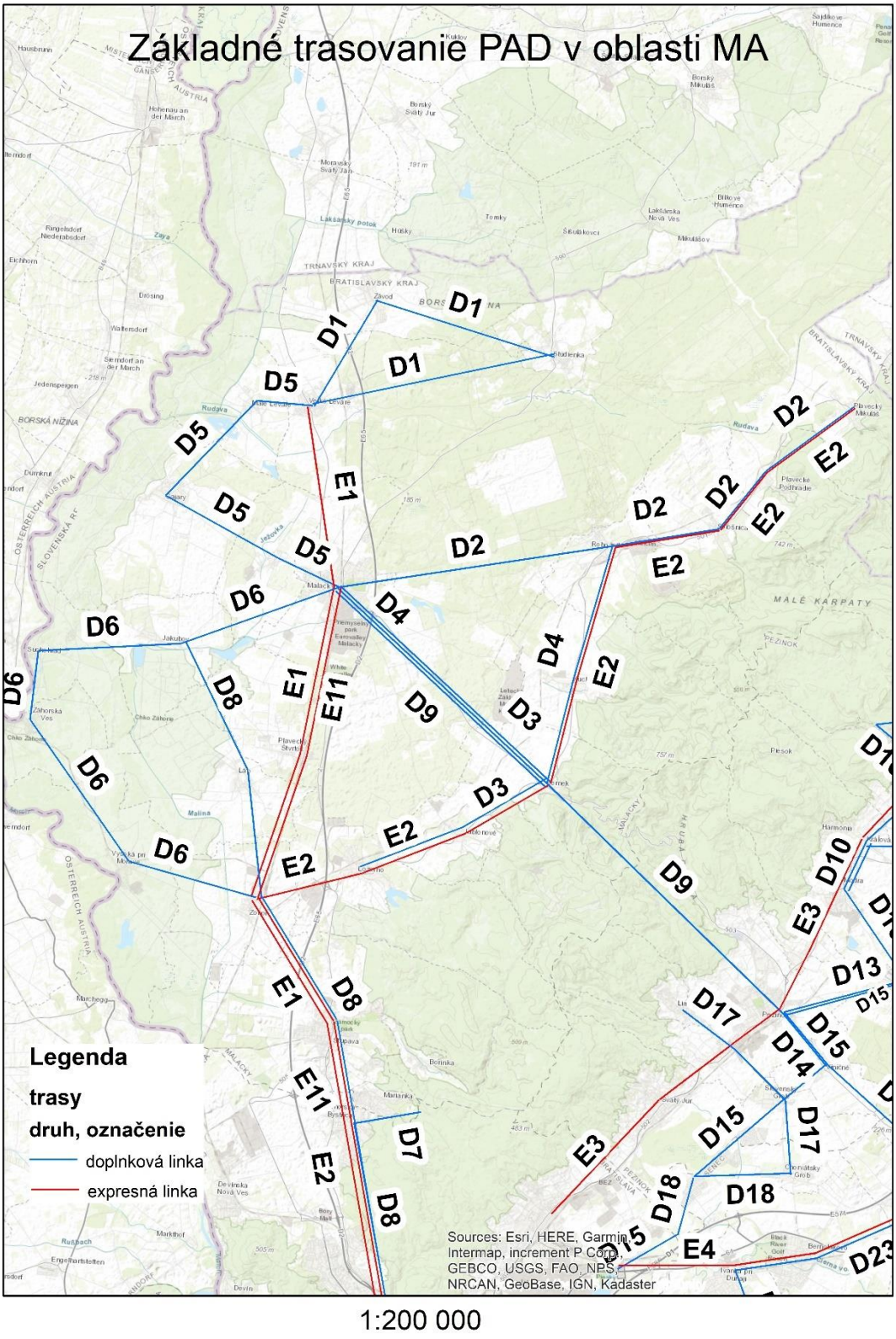
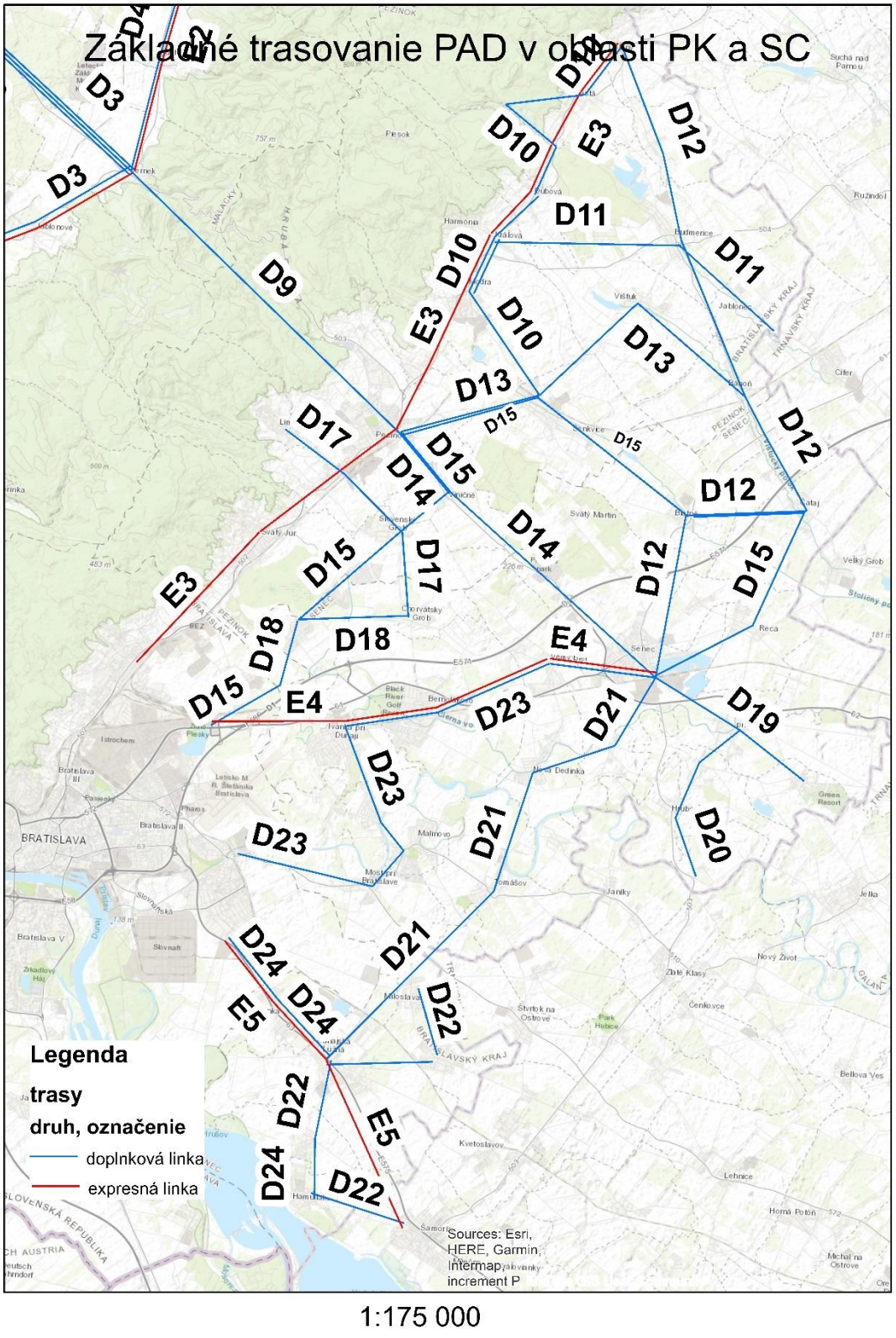


A picture 13-5 Basic tracing of public bus transport in the district of Malacky for the year 2025 (Source: Processor)



A picture 13-6 Basic tracing of public bus transport in the district of Pezinok and Senec for the year 2025 (Source: Processor)

At present, the railway infrastructure is already busy and it is possible to add additional capacity to meet transport needs only to a very limited extent. Therefore, express bus lines are

designed to partially replace the carrier rail transport and are therefore not parallel transport. However, this situation is not permanent and by increasing the capacity of railway transport, the share of bus transport on these routes will decrease. The lines of additional lines are directed to strategic stops with a transfer to railway transport or express bus routes. On the routes of express and auxiliary buses, the intervals of lines that will run on these routes are determined so as to cover the load on the route calculated by the transport model for individual design periods. Additional lines on routes should be designed in such a way that

The territory of the Bratislava self-governing region is served by passenger transport in multimodal corridors, which are led from the external territory through or in contact with the district towns of Malacky, Pezinok and Senec and go to the metropolis of the region. In the west it is a corridor formed by railway line no. 110, the D2 motorway and the I / 2 road. In the north it is the railway line no. 120 and road II / 502, on the east railway line no. 130, motorway D1 and road I / 61 and in the south-east railway line no. 131 and road I / 63. These transport corridors, together with the Little Carpathians massif, also form barriers limiting tangential transport connections and minimize these transport relations. These conditions must respect the design of the operator by public passenger transport.

Railway express (REX) and passenger trains run on the designated railway lines. Public bus transport is designed hierarchically on express lines (in the annexes marked with the letter E) and on lines of additional lines (in the annexes marked with the letter D). The specific tracing of additional lines and service lines is the subject of more detailed documentation of traffic service plans. (Fig. 13-6 and 13-7 schematic tracing of PAD in MA, PK, SC)

The transfer nodes proposed by the processor, or the final stops of PAD on the territory of Bratislava between PAD and public transport, are in the localities of Patrónka, BA-Vinohrady, BA-Vlčie Hrdlo (Slovnaft), BA-Zlaté Piesky.

One of the basic attributes of the proposed VOD lines is the tact resp. interval timetable. This will ensure good memorability and systematic management of connections on individual lines at regular intervals. A necessary condition is the time sequence of additional lines to carrier lines in order to shorten the transition times between these modes as much as possible. It is generally accepted that a maximum of two transfers is acceptable for passengers to travel regularly, but with better connection, even a higher number of transfers can lead to shorter travel times, which is the most important parameter. A higher number of transfers reduces the attractiveness of the public transport system.

13.1.3.3 *Hierarchy of VOD stops*

The hierarchy of lines must also correspond to the hierarchy of public bus stops. Just as in rail transport, REX trains do not stop at every stop or station, express bus lines should only stop at strategic stops, usually only at one stop in the village. These are usually the most important stops in the village center with the largest turnover of passengers. The minimum mutual distance of stops on additional lines should be 500 m, stops on service lines are placed in the sources and destinations of real needs of passengers. Mutual pedestrian accessibility between stops, where the transfer takes place between the various levels of lines, should not exceed 100 m.

13.1.4 Preference for buses and trolleybuses

Bus and trolleybus transport share the same transport space as individual car transport. For this reason, its preference is more difficult and it has fewer options than it is for trams. The solution is the construction and establishment of separate reserved lanes (if the width of roads allows), but also other technical measures such as setting the line coordination of road traffic lights in favor of public transport and taking into account the station time (stay of trolleybuses and buses at the stop), further controlled departure from the stop by traffic lightfor the purpose of "overtaking" a convoy of cars, traffic signs, reassessing the positions of stops, controlled exit from turnstiles, etc.

The preference of VOD buses and trolleybuses is a set of such measures, which aim to ensure the least possible negative impact on the operation of VOD buses by individual car traffic intensities and possible congestion, to ensure the greatest possible safety and smoothness of VOD buses within the street.

In cases where VOD is negatively affected by IAD traffic, the optimal solution is to reserve a carriageway for VOD. It can bereserved lane for busesand VOD trolleybuses, possibly with possible use, depending on the intensity of VOD, also for other modes of transport (taxis with customers, cyclists, trucks up to a certain load capacity). It is obvious that the VOD bus occupies a significantly smaller area in the road area than passenger cars carrying the same number of people. Therefore, focusing on moving people instead of moving vehicles justifiably justifies priority access to buses. E.g. in Warsaw after the introduction of reserved lanes for buses in 2009 stated that Mr.the number of passengers in bus transport increased significantly throughout the day, the average speed of buses in both directions increased by 19% to 30%, the average speed in both directions increased from an average of 10 km / h to 26 km / h compared to the situation before the introduction of lanes.

The average transport speed of buses on reserved lanes varies, depending on the location where the lane is located, according to the specific traffic situation, according to the time period studied. The best is the measurable transport speed from the database of bus on-board computers and the speed of the parallel current IAD using the measuring floating vehicle.Carriers do not evaluate the transport speed of buses, although they have data available, the transport speed of IAD is not monitored in our conditions. Therefore, it is very difficult to determine the increase of the transport speed on the reserved lanes and it can only be deduced from the delays at the light-controlled intersections. E.g. at the Patrónka crossroads, the bus will stay on average by half the length of the red, the IAD will stay in the afternoon peak for 4 to 5 cycles, when the convoy of vehicles standing in front of the stopper regularly reaches a length of up to 340 m. In the opposite direction to the center, a column of vehicles up to 1.9 km was recorded in the morning rush hour.

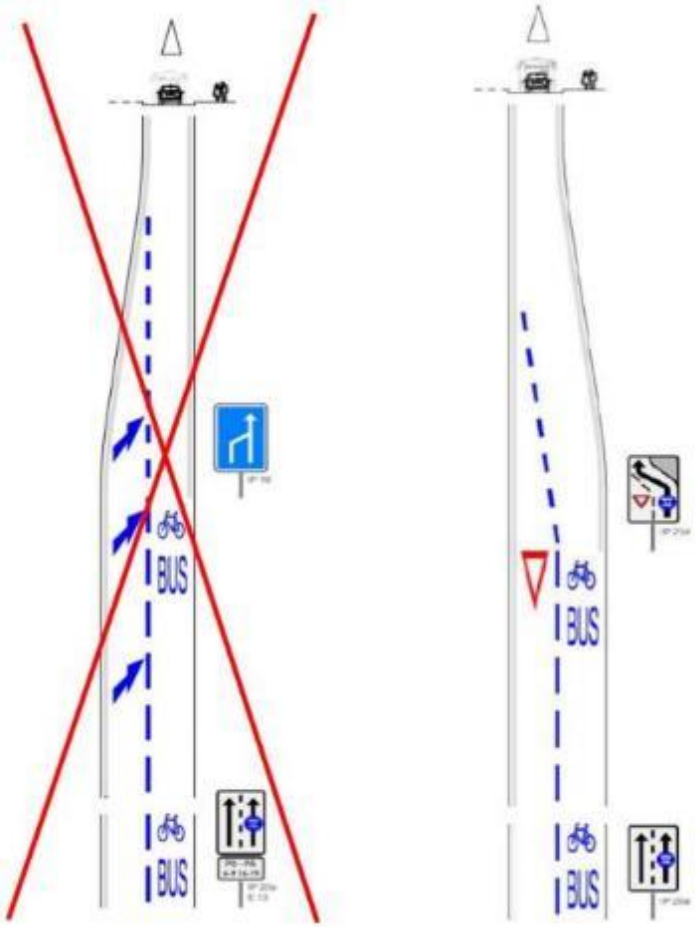
The smoothness of the traffic flow, and thus also the smoothness of the bus traffic in the reserved lane, can be expressed by a change in its accelerations and decelerations, or by a change in the ripple of the traffic flow. The frequency of accelerations and decelerations also depends on the density of the traffic stream, its speed and the frequency of its interference. This is also the case with the amount of exhaust fumes produced from bus transport, in this case the factor of dispersion conditions in a specific locality also applies. However, this examination is beyond the scope of the task.

Dedicated lanes for VOD should also be set up on three- and four-lane roads. In these cases, they also serve as an effective means of limiting IAD. In the interest of VOD preference, it is appropriate to set up reserved lanes even at lower intensities. Furthermore, it may be a dedicated radiation lane in front of the intersection, whether separate or common to another, e.g. turning direction. This radiation lane should be specially controlled and should allow entry into the intersection for VOD vehicles well in advance, and trams may be used instead of the three-color signal system.

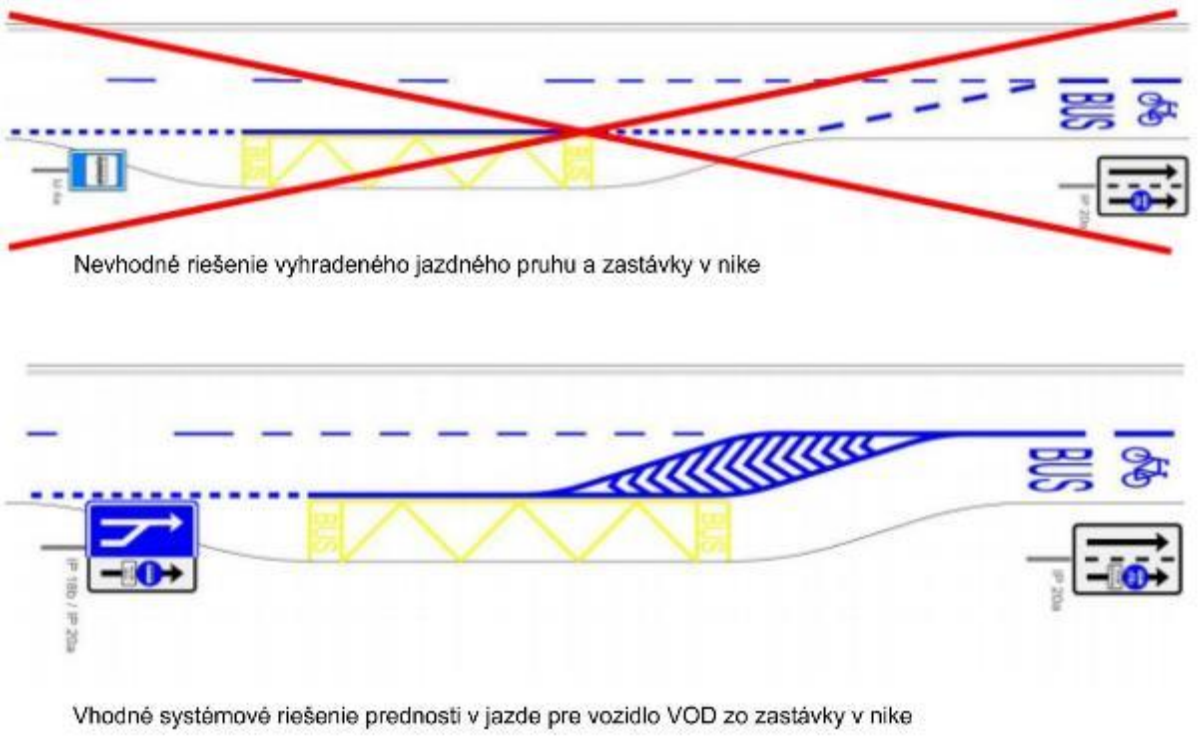
The contractor did not find any simple criteria that would define the legitimacy of the introduction of reserved lanes for VOD. We can assume that the capacity of the lane is about 800 vehicles per hour, which will carry about 1000 people. The same number of people will carry about 20 buses with half occupancy. That is, if there is a common bus interval of 3 min in the road profile. and smaller, the introduction of a reserved lane is justified. In cases where the VOD intensities do not reach the stated value, the reserved lane reserved for VOD can be only during certain - peak - hours and in the remaining time it can also be used for IAD, other modes of transport, e.g. taxi vehicles, supplies, etc.

When using dedicated lanes for VOD, it is extremely important to pay attention to the start and end of the reserved lane. The arrangement and marking of the beginnings and endings of the reserved lanes always ensures a smooth entry of the VOD vehicle into the reserved lane. (See the inappropriately designed Pražská in the direction of the center in Bratislava. When the reserved lane was implemented in the eighties of the last century, it was right.)At the end of the reserved lanes, it is necessary to adjust the organization of transport so that the continuous lane is the ending reserved lane for public transport vehicles and the extinct lane is until then the continuous lane of road transport. A suitable

solution is to end the reserved lane in the area of the intersection at the bus stop. It must be ensured that the bus has a free exit from the reserved lane and does not have to maneuver into another lane. This change must be carefully marked with horizontal and vertical traffic signs.



A picture 13-7 Example of improperly and correctly terminated reserved lane (Source: Principles for designing and establishing preferences for buses and trolleybuses VHD, CTU in Prague)



A picture 13-8 An example of an inappropriately and correctly solved advantage in the VOD bus ride from the stop (Source: Principles for designing and establishing preferences for VHD buses and trolleybuses, CTU in Prague)

In our conditions, the efficiency of BUS lanes is not systematically monitored and evaluated. In 2012, an experimental marking of temporary reserved lanes for public transport on Štefánikova Street from Hodžova Square to Leškova Street was carried out in Bratislava. After the end of the experiment, the City of Bratislava prepared an evaluation of the experiment, which concluded that the reserved BUS lane on Štefánikova Street, despite the time saving for public transport of about 72 seconds, is justified at higher traffic intensity than 850 vehicles / h. At a lower intensity, there is no reason to expect delays in vehicles, including public transport vehicles. PZ did not allow the preservation of the BUS lane even after the end of the experiment. At present, the BUS lane on Štefánikova Street has been re-implemented.

The condition of filling the capacity does not have to be borderline, other disturbing influences can also have an effect on the realization of BUS lanes, such as standing supply vehicles in the lane, non-acceptance of the BUS lane by other vehicles and others.

The existence of BUS lanes on Gagarinova Street in connection with construction activities in the area of Mlynské nivy was also assessed very positively by passengers. They were used for objective evaluationdata from censuses of public transport passengers and on-board computers that record the position and time of the journey. From theseThe figures show that the speed of public transport on Gagarinova Street tripled out of the city and the number of public transport passengers in this section increased by about a third. In only two trolleybus lines running on Gagarinova Street (201 and 202), the number of passengers in the three-hour afternoon peak rose from an average of 2569 passengers to 3524, and the journey time between the Hraničná and Vrakuňa Cemeteries was reduced from 31 minutes to 10.5 minutes.

Abroad, simulation methods are mainly used to evaluate the effectiveness of BUS lanes. For example. S. Basbas of the Aristotle University of Thessaloniki (Evaluation of bus lanes in central urban areas through the use of modeling techniques, S. Basbas, Aristotle University of Thessaloniki, Greece) states that the introduction of BUS lanes in Thessaloniki reduced travel time in RŠO by 21.2%, PŠO by 26.1%, fuel consumption of buses decreased in RŠO by 24.22% and in PŠO by 28.32%. The travel speed of buses increased in RŠO by 4.35% and in PŠO by 11.57%. The benefits of immissions produced by

buses are not negligible. For all types of exhalates, it shows a reduction of 7.3% CO, 6.7% hydrocarbons, 4.4% NO_x, 2.5% Pb, 5.8% CO2.

Yanyan Chen *, Guannan Chen, Kehan Wu in "Evaluation of Performance of Bus Lanes on Urban Expressway Using Paramics Micro-simulation Model", Yanyan Chen, Guannan Chen, Kehan Wu, Beijing University of Technology)report an increase in bus travel speeds from 23.0 to 28.1 km / h for Beijing on the sections of the reserved lanes. and a reduction in travel time from 19.46 min. for 15.12 min.

VOD stops are set up on the roads of functional group A in a physically separate stop lane. On other roadsVOD stopsin the interest of its fluency, they set up in the lanes, or even the lanes. In the interest of the safety of passengers at stops, central dividing islands are being set up on two-lane roads with stops in lanes, which prevent the prevention of public passenger transport vehicles at the stop and prevent endangering passengers. VOD stops in the lane allow vehicles to stop closer to the curb and allow them to leave the stop smoothly.

At uncontrolled intersections in the interest of the preference of VOD, the construction solution and traffic signs should be marked as the main road along which the VOD is led, even if its importance and load does not require it.

If VOD is to be attractive to the public, its time lost at light-controlled intersections must be minimized. Therefore, they must all belight controlled intersectionsadapted to allow preference for VOD. At intersections without collision movements of VOD vehicles and where VOD is led to an intersection on a dedicated carriageway (electric body, dedicated lane or radiation lane), an absolute VOD preference is appropriate. This is a way of controlling the intersection, which in normal traffic will allow a completely smooth passage at a light-controlled intersection without stopping and delaying all VOD vehicles. At intersections with collisional movements of VOD vehicles and high IAD intensities, a conditional preference is appropriate. This is a way of driving that does not allow all VOD vehicles to pass smoothly through a traffic light, but will provide a significant reduction in delays and the number of stops of VOD vehicles before CSS compared to non-preferential driving.

As part of the modernization or construction of each junction controlled by a traffic light through which VOD operates, it must be equipped with a controller enabling dynamic VOD preference. It must be technologically capable of preferring VOD based on information obtained from the vehicle by holding or continuously changing the signal phases while ensuring conditional or absolute preference. At intersections where a reserved VOD lane ends at the intersection boundary and a VOD vehicle from this lane must turn into a continuous lane behind the intersection, the road traffic light shall allow a preferred exit from this lane over vehicles traveling in the continuous lane. In these cases, tram signals may be used instead of the three-color lane signaling system.

A possible way to prefer bus VOD is enabling buses to run on the body of the tram line. This method provides the bus with the same preferential advantages as a tram, but it depends on the technical condition of the tram line. The advantage of such a solution is that it allows the transfer between the tram and the bus at one edge. The current lines are not suitable for this type of bus operation and in the reconstruction and modernization of tram lines it is necessary to consider and assess this possibility from all aspects and to design an already combined tram and bus belt.
However, it should be noted that in Bratislava up to 80% of tram lines are on a separate body, led mainly on radials to the CMO, which are regularly congested by road congestion, especially in peak periods, running buses on a separate combined strip would significantly increase the attractiveness of bus public transport, increasing the volume of passenger transport and significantly reducing their transport time, shortening the running time of buses and thus saving their fleet, increasing the safety of transferring passengers "from one leading edge" and reducing road accidents. These factors have a massive impact on the transfer of passengers from IAD to public transport and thus on the desired positive change in the division of transport work in favor of alternative transport, which is the main goal of the measures of the BOD Sustainable Mobility Plan.

The establishment of reserved lanes for bus and trolleybus public transport in Bratislava has been taking place gradually since the end of the 1990s. At present, a total of 59 sections of roads with

marked BUS lanes with a total length of 26,652 are in operation km of reserved BUS lanes. Of the total number of sections, only 20.3% are sections longer than 500 m. In addition, a number of interchange lanes in the interchange area of intersections are reserved for public transport in order for these vehicles to enter the intersection preferentially. In the districts of Malacky, Pezinok and Senec, lanes for VOD are not currently reserved.

	Navrhované BUS pruhy		
	Názov	*smery*	*dĺžka (km)*
Bratislava	Saratovská	smer do centra	1,5
	Trnavského	smer do centra	1,2
	Harmincova	obojsmerne	2,2
	Lamačská	smer do centra	3,2
	Hodonínska	smer do centra	2,6
	I/2 Záhorská Bystrica - Kremarórium	smer do centra	3,2
	I/2 Krematórium - rondel	obojsmerne	1,2
	Nám. F. Lista	obojsmerne	0,8
	Šancová	smer k SAV	0,9
	Štefánikova	smer do centra	0,7
	Trnavská	smer z centra	2,9
	Tomášikova	obojsmene	7,2
	Gagarinova	obojsmerne	15,3
	Mlynské Nivy	obojsmerne	2,4
	Kazanská	obojsmerne	2,2
	II/502 Rača -Grinava	obojsmerne	20,4
	Dostojevského rad	smer k UK	0,9
	Karadžičova	obojsmerne	1,7
	Legionárska	obojsmerne	1,3
	Jarošova smer k Bajkalskej	jednosmerne	0,6
	Most Apollo - Košická	jednosmerne	5,5
	Dolnozemská	smer do centra	4,8
	Spolu		**82,7**
Pezinok	*Názov*	*smery*	*dĺžka (km)*
	Bratislavská	smer k stanici	1,7
	Senecká	smer k stanici	1,3
	Holubyho	smer k stanici	0,4
	Spolu		**3,4**
Malacky	*Názov*	*smery*	*dĺžka (km)*
	Stupavská, Štefánikova	smer k stanici	2,6
	Radlinského	smer k stanici	0,7
	Spolu		**3,3**
Senec	*Názov*	*smery*	*dĺžka (km)*
	Bratislavská - Trnavská	smer k stanici	3,7
	SNP - Štúrova	smer k stanici	1,6
	Spolu		**5,3**
	Celkom		**94,7**

A picture 13-9 Proposed lanes with VOD preference (Source: Processor)

Evaluation of measures

Reserved lanes for VOD

The measure monitors the separation of VOD vehicles in the traffic flow into the reserved lanes, protects them from traffic jams and delays, increases the speed, smoothness and reliability of services in congested traffic. The introduction of reserved lanes will have different results depending on local circumstances. In addition to the obvious benefits such as an increase in transport speed and thus time savings for passengers, smoothness and reliability of transport, there will also be benefits for the public transport operator and the carrier, such as reduced transport costs.
Users: passengers, carriers

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport
- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- Regional Directorate of PZ Bratislava

Dates of implementation and investment costs:
By 2025 it is appropriate to create 15 kilometers of BUS lanes, by 2030 another 30 kilometers. Continuously until 2040 to implement the remaining approximately 58 kilometers. The approximate price for 1 km of the BUS lane of horizontal traffic signs is 3000 EUR, when incorporating other necessary costs (such as vertical traffic signs and the need to perform minor construction work), the price for the implementation of 1 km of BUS lane can be estimated at 7000 EUR.The construction of combined tram and bus lanes should be included in the costs of the planned reconstruction and modernization of tram lines, according to specific conditions and, given the urgency, they should be included in the first stage of the RPUM.

Impact on the Spatial Plan

- The measure does not affect the zoning plan

Preference at light-controlled intersections

The purpose of the measure is to provide bus and trolleybus public transport with adequate operating conditions, increase its speed, save passengers' time in means of transport and, to a significant extent, save transport costs for the public transport operator and carriers.
Users: passenger

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport
- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- Municipalities of district cities
- Regional Directorate of PZ Bratislava

Dates of implementation and investment costs:
It is necessary to consider the use of controllers in every reconstruction / new construction of the intersection.

Measures to promote public passenger transport

Through dedicated lanes, public transport is separated and independent of other traffic and its ability to get into collision situations is significantly reduced. The islets at the stops, which prevent prevention, protect pedestrians, but they also prefer buses. All these measures can speed up public transport, make it safer, more reliable and thus more attractive.

Responsible:

- The capital of the Slovak Republic, Bratislava
- KR PZ Bratislava

Editing stops

Stops should be located to ensure safe and smooth traffic. They should be placed in clear places and should lie in a straight line. It is necessary to ensure a clear viewing space at intersections and pedestrian crossings.

Responsible:
Municipalities

Separation of tram lines by longitudinal traffic thresholds

By separating the body of the tram from the car lanes, the tram transport is separated and independent of other traffic and its possibility of getting into collision situations is significantly reduced.

Responsible:

- The capital of the Slovak Republic, Bratislava
- KR PZ Bratislava

Combined use of the tram body for rail and non-rail transport

Up to more than 75% of tram lines are run on a separate body, physically separated from road lanes, which can also be used to run bus lines (see Hamburg, Ostrava). This will result in collision-free bus routing even during peak periods and congestion and safe boarding / disembarking, but above all the transfer of passengers from rail to urban and suburban public transport from one boarding edge, which completely eliminates passing passengers through heavily congested communications. A bright local example in our country is a Viennese-type stop on Radlinského Street in Bratislava, which has brought together a number of previously dispersed public transport stops in the wider area. A number of rail and non-rail transport connections pass through it at a maximum peak load of car traffic of more than 300 w / h, while so far no serious traffic accident has occurred here, boarding / disembarking is possible, but also transfer from one boarding edge, resp. also from the opposite stop, which is situated opposite in the same place. This stop is very popular among passengers and increases public awareness and the attractiveness of traveling by public transport.
Responsible:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- KR PZ Bratislava

14 Integrated transport system

14.1 Basic principles of IDS

The city of Bratislava was aware of the need to integrate public passenger transport in the Bratislava region as early as the 1980s. Experimentally, only on the basis of a "gentleman's agreement", the owners of public transport subscription tickets were allowed to use the free capacities of the lines of the then ČSAD Bratislava on the Rača radial. This initiative lapsed because the legislation at the time did not recognize the term "integrated transport". Seriously, integrated transport began to emerge only in 1996, when an experiment was implemented to integrate rail and urban public transport, and since 2001 as the first stage of Bratislava integrated transport with the involvement of Slovak bus transport in Bratislava.

From the very beginning of transport integration considerations, a single fare for all carriers has been considered, a strong preference for long-term subscription tickets, coordinated timetables, the creation of a zonal tariff, with a one-time tariff zones so that the territory of Bratislava was divided into two tariff zones and the remaining territory of the region was divided into other zones with a distance of about 10 km.

Only a systematically developed public transport system can be competitive with individual road transport. Well-organized and especially used integrated suburban public transport with a significant share of rail transport has a significant impact on reducing IAD traffic intensities, and thus on the need for capacity roads. The establishment and operation of integrated VOD is significantly cheaper than investing in the widening of road and motorway routes. Integrated transport system in general, and thus also the Integrated transport system in the Bratislava self-governing region must comply with the following basic principles:

- Flat rate
- Unified network of lines
- Uniform transport regulations
- Unified information system
- Raising share of subscription tickets
- Coordinated timetables

By adhering to these principles, the integrated transport system creates the conditions for minimizing travel times and a favorable user environment for passengers. During its current duration, the current IDS BK meets the partial requirements of the basic principles, it can be said that it is currently implementing the short-term horizon of its development. However, it does not yet offer the required attractiveness of the system leading to a significant increase in the share of VOD in the division of transport work and the economic efficiency of the system. The proposed IDS BK removes the current limits, which prevent a more significant increase in its use towards the desired share of the division of transport work.

14.1.1 Flat rate

For occasional trips on a one-time ticket, there is a zone-time tariff in the city for the entire public transport, PAD and ŽD and in the region for public transport. It is inappropriate for the same source and destination of the journey to pay different fares due to the different routing of the connection. For regular passengers, there are subscription tickets that are valid for an unlimited number of trips within their zonal and time validity.

When traveling by bus of Slovak Lines, as, it is always necessary to request a ticket for a specific stop at which the passenger will get off, and if he / she will change to the next trip at this stop, he /

she asks for a ticket up to it. Then the driver will issue a ticket to the passenger without the necessary knowledge of zoning and tariffs.

In 2018, BID, as records a decline in ticket sales for one trip. This decrease is offset by an increase in PCL sales, which continued in 2018 in the positive growth trend of previous years. IDS BK's ticket sales strategy is aimed at developing electronics, especially in the area of mobile applications and the use of bank cards. This is the right direction, but it does not solve the fundamental problem of a single tariff.

One of the basic principles of integrated transport systems is a uniform amount of the fare, even in the case of different routes from the source to the destination. This means that the passenger should not be interested in which means of transport and which carrier to use. Alternatively, in what combination of carriers will make their journey.

We recommend that in the IDS BK system no carrier be allowed to have, in addition to the common IDS BK tariff, the dual possibility of using the carrier's tariff, even in the case of ŽD performed by a carrier with nationwide scope

14.1.2 Unified check-in system

The introduction of a single tariff is directly related to the introduction of a single check-in system. At present, each carrier has its own check-in system with different possibilities of using electronic check-in. While in suburban bus and rail transport the check-in system enables the registration of passengers and their journeys, in public transport in Bratislava this check-in system does not allow.

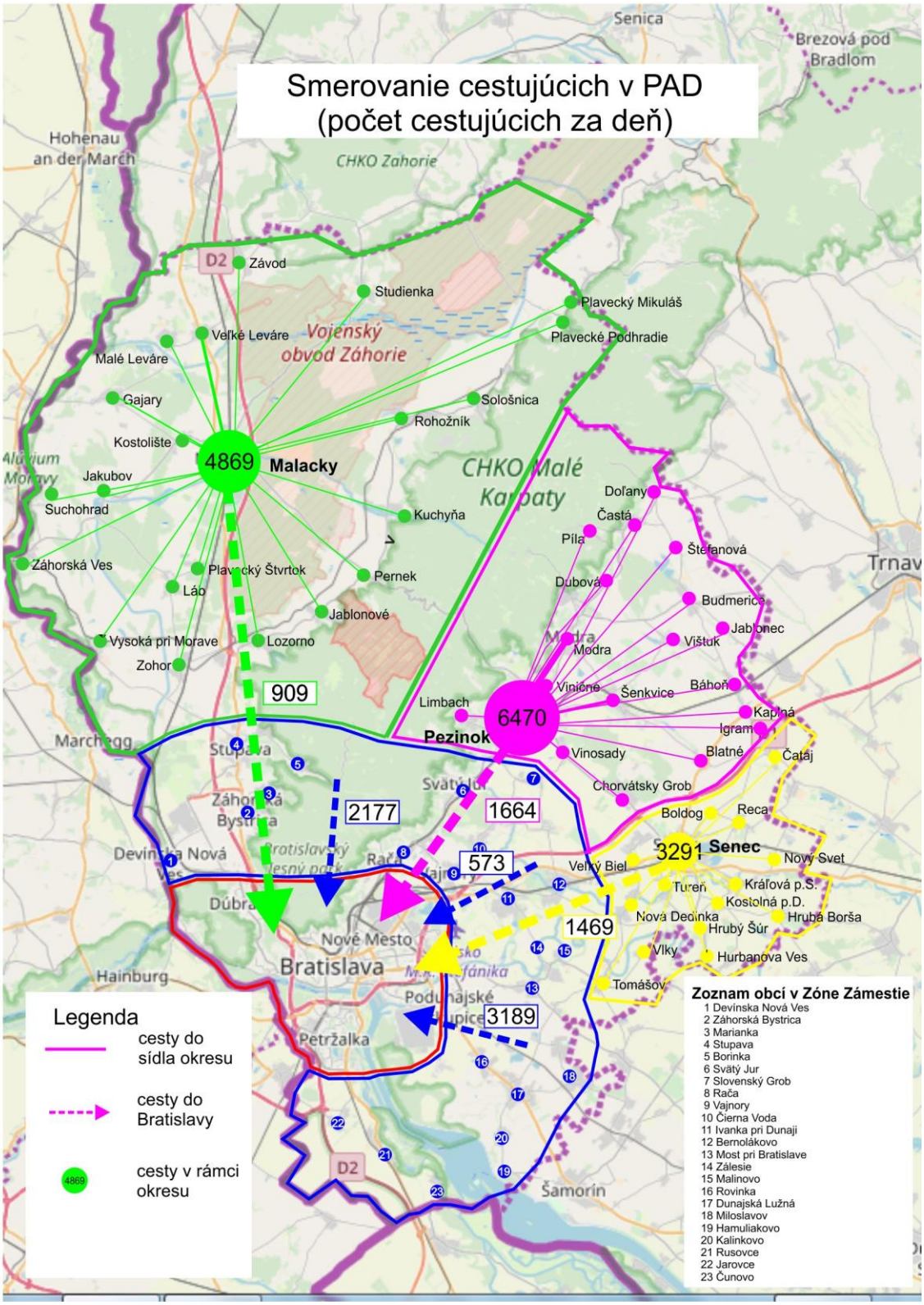
In accordance with the proposed uniform tariff system, a uniform check-in system is proposed on the same technological basis, while ensuring the registration of passengers and their journeys by the check in system. Such a check-in system will simplify the use of public passenger transport for passengers, speed up their check-in and provide sufficient information for operational decision-making as well as long-term planning of integrated transport.

14.1.3 Uniform timetables

The timetable should contain data determining the planned movement of the vehicle on the road during the specified time period. It should be unambiguous, clear and easy to read. It must contain basic information such as the line number, the course of the route, departures of means of transport divided into working days, school holidays and public holidays. Deviations from the standard route, the so-called notes, it may contain only exceptionally. Stop timetables should contain data on the connections of all carriers whose vehicles stop at the stop.

14.1.4 Territory scope and principles of zone design

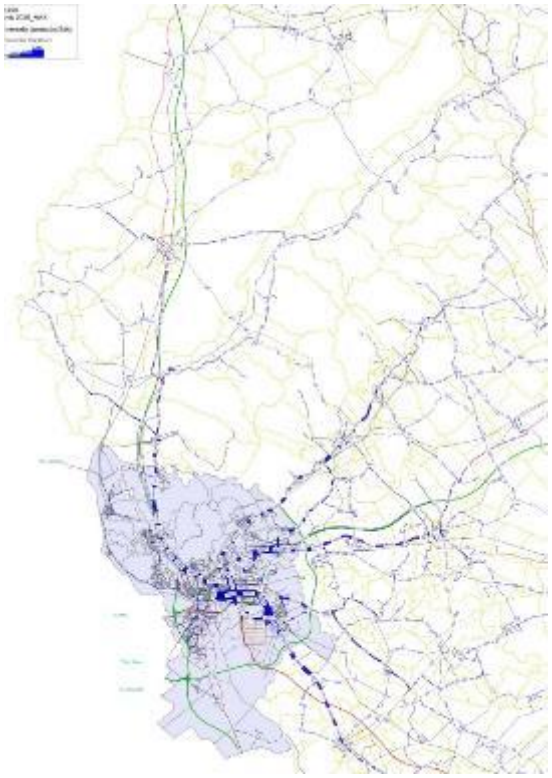
IDS BK has achieved its basic goal and provides service to the entire BSK territory, it has even expanded its scope partially to the territory of the Trnava self-governing region. The territory of IDS BK is divided into 51 zones (two on the territory of Bratislava and 49 on the territory of the districts of Malacky, Pezinok, Senec and the Trnava region), which are also tariff zones. The territory thus divided into zones is very disproportionate. In Bratislava, an average of 213 thousand inhabitants are served per zone on an average area of 148 km², in the rest of the territory it is 4.5 thousand inhabitants on an average area of 35 km². The zoning should be based on the natural zoning of the territory according to transport relations. The vast majority of passengers travel to and within their district city. Significantly fewer of them travel from the districts of the region to Bratislava, and minimal numbers of passengers travel tangentially between the districts and outside the region. The area forming the ring around Bratislava consisting of peripheral city districts (formerly independent municipalities) and municipalities relatively closely connected to the city has a fundamentally different character. This area can be defined as the city of Bratislava and from it there are predominant transport relations to the city. The predominant passenger routes in the BOD are shown below.



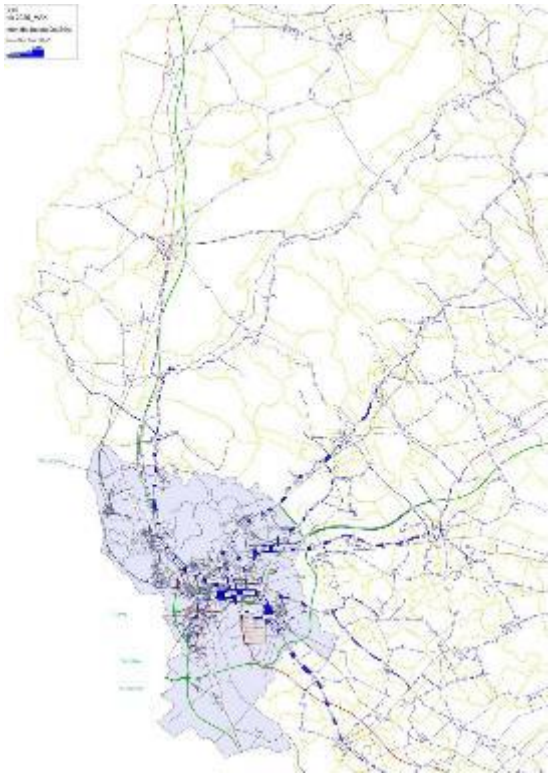
A picture 14-1 Routing of passengers by suburban bus transport in BSK (Source: Processor)

Public bus transport lines are naturally run on a real communication network. For the design periods 2025 and 2050, traffic flow loads were calculated in a combination of a zero variant for individual car transport and a maximum variant for public passenger transport. This means that measures to increase the capacity of the road network have been suppressed and all measures supporting the development of rail, tram, trolleybus and bus public passenger transport have been highlighted. The following figures show in the form of a ribbon diagram the load of the communication network by VOD

passengers for the years 2025 and 2050. The individual ribbons show the size of the passenger load per day.



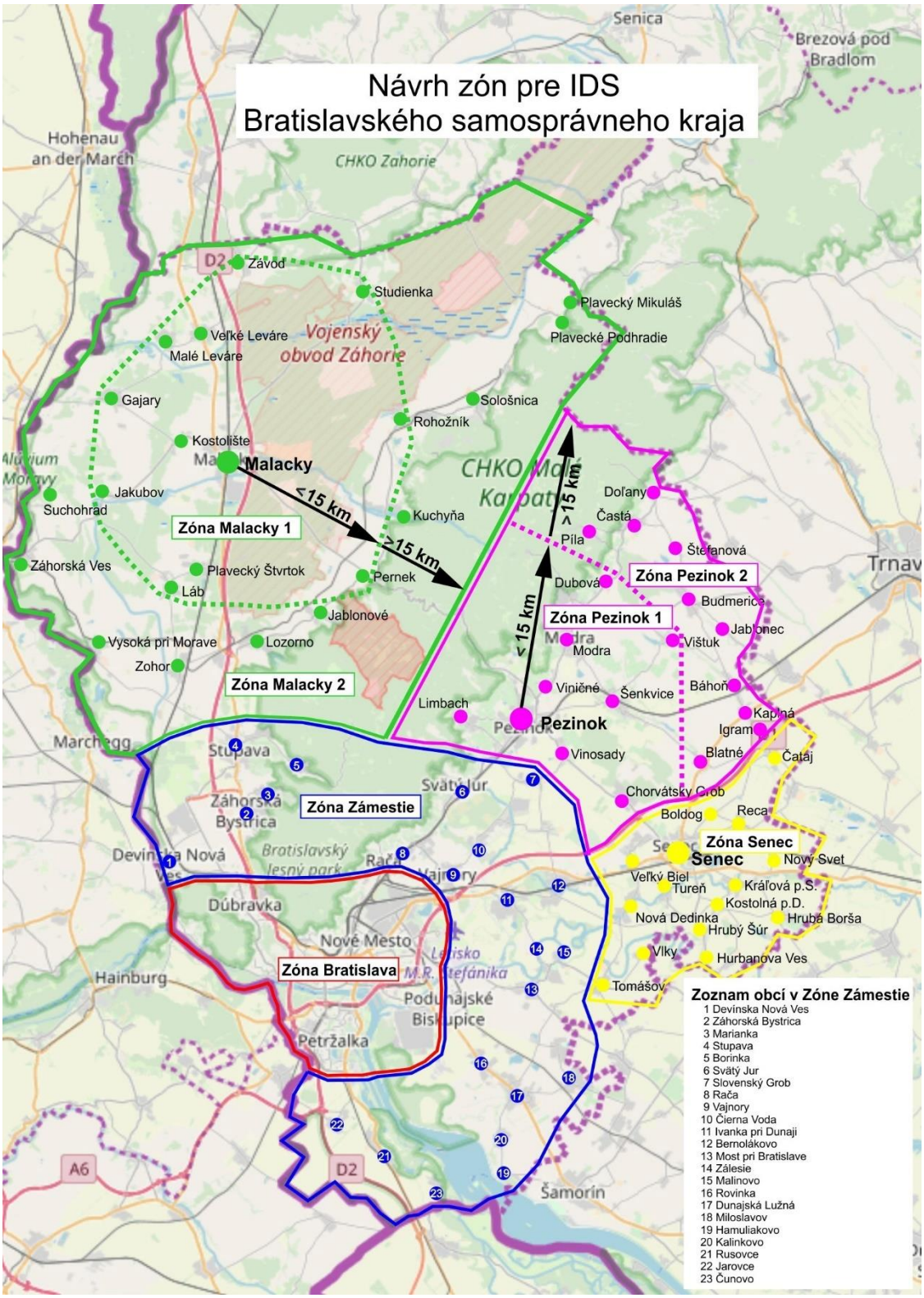
A picture 14-2Load of PAD network in BSK - year 2025, max. variant - number of passengers / day (Source: Processor)



A picture 14-3PAD network load in BSK - year 2050, max. variant - number of passengers / day (Source: Processor)

The current higher number of small zones respects the distance traveled, as the current tariff zones were created during the transition from the kilometer tariff to the zone-time so that the difference in price on the route with the old and new tariff remains at the same level or does not change significantly. This bus access carrier is unusual and does not include its own contribution to transport integration. It does not take into account that the provision of benefits for passengers, especially at the time of transport (cruising speed) and in the price of transport, will generate more passengers and higher revenue from revenues. Knowledge of foreign integrated systems shows that the larger the central city and the larger the region served, the larger the zones or zones into which the region is divided.

For the purposes of the integrated transport system, the territory of the Bratislava self-governing region is proposed to be divided into zones in accordance with the requirements for a uniform tariff system, a uniform check-in system and uniform timetables. The proposal contains the existing zone Bratislava 100 extended by the peripheral city districts of Bratislava and municipalities of the region, whose interest in trips to Bratislava is at the level of 70-80% of roads.



A picture 14-4 Design of IDS BK zones (Source: Processor)

The areas of the districts of Malacky and Pezinok behind the castle are divided into two zones. In principle, the first zone is defined by a distance of 15 km from the residential district town and the second zone is defined for municipalities further than 15 km from the residential district town. The remaining territory of the Senec district behind the castle is no longer divided into several zones due to the small area and short distances of the municipalities from the district 's capital.

The implementation of the new zoning is expected in the horizon 2025 - 2030 and is conditioned by a uniform tariff and a uniform check-in system.

14.2 Necessary and fast extension of IDS to TTSK

Based on the analyzes, the requirement to extend the IDS BK to the territory of the neighboring Trnava self-governing region was stated. From 1 August 2019, the Trnava railway station was involved in IDS BK, which de facto extended the integrated system to the regional city of the Trnava region. However, significant transport relations are mainly from the directions of Šamorín, Dunajská Streda, which, even due to the short distance from Bratislava, first aspire to join the IDS BK. The extension of the integrated system can follow the proposed method of creating zones with a diameter of about 15 km, which preserves the uniform structure of the division of zones into zones.

14.3 Integrator and coordinator of the integrated transport system

The integrated transport system in the Bratislava Region is currently organized and coordinated by the company Bratislavská integrovaná doprava, as The company was founded to:

a) elaboration of principles of organization of public transport of persons, determination of necessary volume of performances for individual carriers and transport subsystems and their discussion with the capital of the Slovak Republic Bratislava and self-governing regions and MDV SR,
b) proposals for the economic provision of the operation of the Integrated Transport System in the Bratislava Region with the effective use of available funds,
c) design of tariffs, transport regulations, fares and transport charges in the Integrated Transport System in the Bratislava Region,
d) elaboration of a regional project of public transport organization,
e) preparation of contracts for ensuring the operation of the Integrated Transport System in the Bratislava Region between the Capital City of the Slovak Republic Bratislava, the Bratislava Self-Governing Region and the ICE SR on the one hand and carriers on the other hand,
f) organization of financial flows within the Integrated Transport System in the Bratislava Region,
g) ensuring a unified information system within the Integrated Transport System in the Bratislava Region,
h) inspections of transport performance and quality within the Integrated Transport System in the Bratislava Region.

Since its establishment, BID has been gradually developing its activities and fulfilling its set tasks within its capabilities. Nevertheless, the company does not have the necessary competencies and does not perform the activities that the organizer and coordinator of public passenger transport should perform. The authority of the integrator must be based not only on the content of his work but especially on his competencies. The integrator should take over most of the competencies of the carriers, which should ensure operation on the basis of the integrator's directive. The basic functions that the integrator should perform are the following:

- creation of a strategy for serving the region by public passenger transport,
- traffic and transport surveys throughout the region and in cities,
- collection and processing of data on public passenger transport in the region,
- creation of assignments, schedules and timetables according to the results of surveys for public transport, PAD and regional railway lines,
- determining an economically justified maximum price for the provision of services in the public interest in the region,
- setting fares and establishing a uniform pricing policy for each group of passengers,
- organization of public tenders for the selection of a supplier of services in the public interest,

- organization and coordination of technical and technological means for a uniform tariff system for passenger handling throughout the region in all vehicles and at all stations and stops,
- organization of a common unified information system for passengers and carriers,
- redistribution of subsidies and revenues,
- development of uniform standards for the level of service,
- operation of a dispatching center,
- determining the conditions and approving the induced changes in the organization of the VOD and quantifying the reimbursement of costs caused by these changes.

14.4 Further expansion of IDS BK (NSK, A and H)

Border municipalities in the Republic of Austria and the Republic of Hungary also have a strong potential for transport relations with Bratislava and it will be necessary to explore the possibilities of their transport integration within the IDS BK. With the Austrian side, it will be important to examine possible conflicting relations with the VOR. After the extension to the whole territory of TTSK, it will be appropriate to gradually include the municipalities of NSK. Finally, by expanding the integrated transport system outside the territory of the Bratislava self-governing region, it will be appropriate to consider changing the name of IDS BK to e.g. IDS of the West Slovakian region.

15 Other measures to support sustainable mobility in BOD

15.1 Collection and registration of transport data

A necessary part of the efficient, qualitative and efficient function of the transport system process is sufficient information about the ongoing traffic situation, their reassessment and the retroactive application of knowledge to the process itself.

- information on the operating parameters of individual transports
- information on the ongoing transport process
- information for users of the current transport process
- dynamic traffic management
- continuous monitoring and analysis of knowledge

15.1.1 Information on the operating parameters of transport segments

- An unequivocal need for assessing the conditions of the transport process is the knowledge of its elements and their parameters. Digitization and electronic communication must be a matter of course, resp. possibility of use without any manual processing. In essence, these should be static and dynamic parameters.
- Static parameters should include elements such as road, rail, water, bicycle network. Uniform and unambiguous marking, construction of names, digital location of intersections, municipal boundaries, stops, stations and other transport facilities must be introduced for these elements.
- Dynamic parameters should include digitized public transport routes, timetables, registers of lines, trains with unambiguous markings and detailed characteristics such as capacity, age, equipment, etc. The same should apply to signal plans of light-controlled nodes, capacity ratios of public car parks, garages, P + R sites, TIOPs and the like.
- A necessary precondition for the implementation of this information must be a separate unifying study, which methodically evaluates the level of parameters, sets the format of presentation and prescribed structures, determines the responsibility for collection and updates.

15.1.1.1 *Collection and registration of data in public passenger transport*

Levels of knowledge - static parameters:

Railway and tram tracks

designation (line number and name)

stationing (mileage) - start, end, points á 0.5 km, switches - crossings, controlled - uncontrolled crossings, station boundaries - stops

layout parameters - number of tracks, directions, switches, platforms

regulatory restrictions section speeds, signaling devices

Levels of knowledge - dynamic parameters:

Digitized public passenger transport routes

designation - line number and name, function
stationing - start, end, crossings, stops and stations
alternatives - differences in tracing
arrangement - location of stops at the node, character of stops

Digitized public passenger transport timetables

designation - line number and name (route description)
tracing - list of stops
alternatives - differences in tracing, notes
arrangement - operating mode resolution

15.1.1.2 Data from surveys of suburban VŽD - boarding and alighting at stations

- Surveys record the number of passengers disembarking, resp. boarding at individual railway stations, these are currently carried out by train staff and the results are not always transparent
- the record includes the day of the census, line number, railway station code and train number (time and direction), the survey is carried out annually, approximately 3 times a year in the range of 10 census days (Friday - Sunday - Monday - Sunday)
- modern train carriages are already equipped with an automated recording of boarding and alighting at all stations and stops, which could significantly expand the scope of knowledge and its objectivity
- special software should be used to evaluate the data files, which could be used to calculate the dependencies and especially the direction of passengers in time sessions (week, day)

15.1.1.3 Outputs from railway station cash registers

- provided files from the sale of travel documents should contain data for each issued ticket (one-time or time)
- each document should contain data - code of the station and ticket office, date and time of issue, date of travel, type of ticket and fare, destination station and fare
- special software should be used to evaluate data files, which can calculate the direction of passengers in time sessions (week, day), according to tariff groups and according to the regularity of use

15.1.1.4 Data from on-board computers of suburban PAD vehicles

- each boarding of a passenger in a VAD vehicle is recorded as part of the issue of a ticket to the on-board computer of the respective vehicle
- this is how it is recorded at each boarding - date and time of boarding, line number, connection number, boarding stop number, destination stop number, tariff group designation, ticket price and possible chip card number
- The customer of the service must properly treat the contract so that the carrier is obliged to provide all data to the customer
- for the objective assessment of the obtained data, it is necessary that the data files contain records for longer periods of time, because the longer the time, resp. is from several seasons, making the assessment and subsequent conclusions more transparent and binding
- evaluation of the provided data files will have to be performed by special software on the principle of digitization of the network, routes, stops, timetables

15.1.1.5 Current traffic information

- Information boards at stops and stations - departures, delays, platforms
- Information boards in vehicles and trains - stations, stops, delays

15.1.1.6 Dynamic traffic management

Any manifestation of the difference in the traffic situation should evoke an adequately optimal solution.

- Traffic lane preference - triggered free signal,
- Intelligent traffic signs - lane reservation

15.1.2 Information for users of the current transport process

The most effective significance of acquiring, processing and analyzing knowledge about the transport process is the immediate feedback of the participants.

15.1.2.1 In road transport

Levels of knowledge - static parameters:

Road communication network

designation - number and type - motorway, feeder, expressway, roads I., II., III., Local roads, special-purpose roads, service roads, streets

stationing (mileage) - start, end, points á 0.5 km, crossings, village boundaries)

width parameters - directional division, number of lanes, lane widths, parking lanes

regulatory restrictions - section speeds, prohibitions of stopping, prohibitions of overtaking, crossings for pedestrians and cyclists

15.1.2.2 Data collection and continuous monitoring

An important condition for optimal solutions of the transport system is sufficient up-to-date, reliable and detailed information about its functionality. The present shows a significant lag in the meaningful collection of data and information on mobility and the transport process. Moreover, if such knowledge exists, it is difficult to obtain, resp. quite unavailable. In fact, in most cases, this is solved in our country only by one-time manual traffic surveys, which is difficult to organize due to the potential of manual counters, and moreover the obtained results are very often affected by accidents resulting from a complicated traffic situation.

For the collection and continuous monitoring of up-to-date and reliable mobility data and information, it is therefore important to find ways and create conditions that will be created in connection with the intention to build intelligent transport systems in BOD on the principle of continuous and automated monitoring and collection of information on ongoing phenomena. and communication technologies.

The following are currently available for obtaining up-to-date and reliable mobility data and information:

Informative speed meters

Automatic traffic counters (ASD) - in NDS management, resp. SSC

ECV truck toll records

ECV records of passenger cars from the inspection of electronic highway stamps

Data processing from detectors at light-controlled intersections

Data from on-board computers of suburban PAD vehicles

Data from surveys of suburban railways - boarding and alighting at stations

Outputs from railway station cash registers

It is necessary to include mobility data and information from other domestic and cross-border carriers by air and sea passenger and cargo transport, or other transport in the system collection of data and information. Significant sources of information on relocation relations can be obtained from the mobile phones of residents and visitors to the BSK region, which, however, must be anonymised from the point of view of personal data protection.

In order to ensure comprehensive collection and continuous monitoring of up-to-date and reliable data and information on mobility behavior of the traveling public, freight transport and supply, it is necessary to connect existing passenger and freight management centers, urban and external transport and create a cooperative mobility management system under the auspices of the Regional Mobility Authority. The creation of the KOoperative Mobility Management Center in the BOD region is a necessary prerequisite for ensuring the functionality of the BOD region's transport system, ensuring links between its subsystems, as well as for effective reduction of excess momentum / hypermobility, consolidation of relocation processes, balancing transport division in favor of alternative modes of transport,

A detailed description of the current possibilities for monitoring and collecting mobility data and information according to individual modes of transport is currently as follows:

15.1.3 Informative speed meters

- many towns and villages of BSK have so-called Informative speed meters (IMR), which, in addition to immediately alerting undisciplined drivers who do not comply with the prescribed speed, can record the number of passing vehicles in both directions and can record the instantaneous speeds of passing vehicles
- records from IMR (data files) can be transferred via SMS gateway to a computer, resp. can be stored on storage media and such data files, can subsequently replace continuous monitoring of traffic intensity
- Due to the relatively low input costs, data would be permanently and fully obtained, which are currently solved every 5 years by the so-called national traffic census, which, in addition to being very costly, is also incompatible due to short census times and related recalculations
- Informative speed meters should be located at the entrances to the village and in the centers of the village, where car, bicycle and pedestrian traffic is concentrated. The specific location of the speedometer depends on the solution of the development, the width and directional arrangement of the traffic intensity traffic, or on other factors.

THE TASK

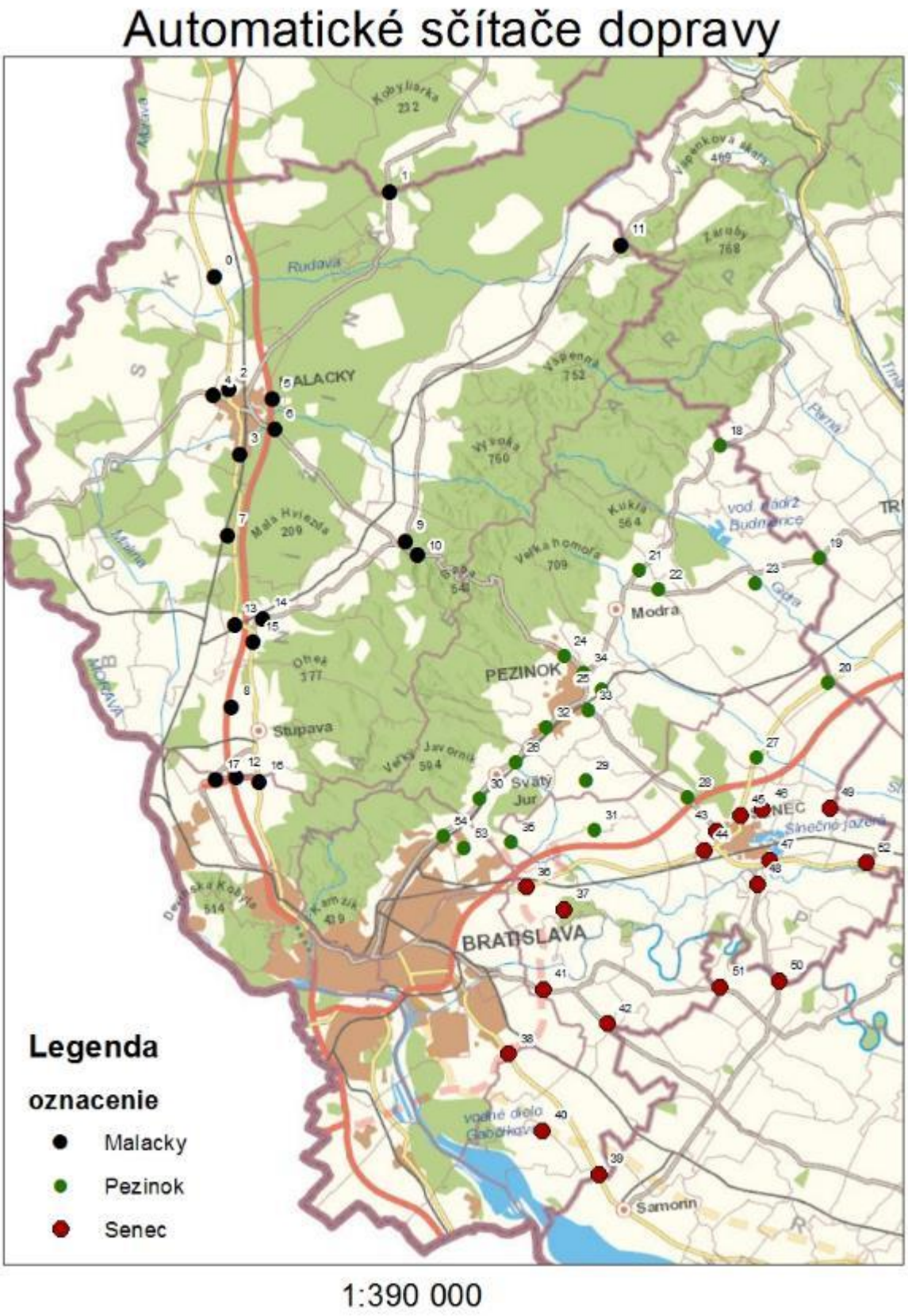
- find out the current state of the number of deployed IMRs, supplement them with data buses, resp. to cover important entrances and other sites
- identify the possibilities of using data files for the needs of a unified information system

15.1.4 Automatic traffic counters (ASD) - in NDS management, resp. SSC

- NDS has ASD installed on approximately 16 profiles on motorways in BSK, including the territory of the city of Bratislava, which continuously record the number of passing vehicles divided by length categories, and in addition record the instantaneous speeds of these vehicles.
- processing of data from these sources should have a certain standard and the obtained data files should be used for specific analysis by a computer program to know the time course of traffic load (daily, weekly, annual and development), to find out the connections in regularity, fluctuations and level of traffic characteristics (peak hour, capacity, peak transport times, limit states), which can then be used in professional activities
- similarly to build a parallel deployment of ASD at SSC on Class I roads, resp. on some important routes II. classes so that the acquired background data sets allow knowledge from a wider scope of the territory

THE TASK

- ensure that the current state of deployed ASDs can be used for the benefit of a single traffic information system
- to supplement ASD on roads I. and II. classes and also to ensure their use for the needs of a unified information system



A picture 15-1 Proposal for the deployment of ASD on the territory of BSK (Source: Processor)

Location of ASD census stations - Malacky area

0 I / 2 Veľké Leváre from Moravský Ján
1 II / 590 HR-BSK from Studienka
2 I / 2 Malacky from Veľká Levára
3 I / 2 Malacky to Plav. Thursday
4 II / 503 Malacky od Kostolište
5 III / 1113 Malacky od Rohožník
6 II / 503 Malacky od Perneku
7 III / 1103 Plav. Thursday before I / 2
8 III / 1106 Stupava od Zohoru
9 II / 501 Kitchen perch
10 II / 503 Pernek direction Baba
11 II / 501 Plav. Mikuláš HR-BSK
12 II / 505 MÚK Stupava from I / 2
13 III / 1105 MÚK Lozorno to Zohor
14 II / 501 MÚK Lozorno from Lozorno
15 I / 2 MÚK Lozorno to Stupava
16 I / 2 MÚK Stupava to Záh. Bystrice
17 II / 505 MÚK Stupava to DNV

Location of ASD census stations - Pezinok area

18 II / 502 HR-BSK before Doľany
19 II / 504 HR-BSK before Budmerice
20 I / 61 HR-BSK before Kaplná
21 II / 502 Modra od Dubová
22 II / 504 Blue from Budmerice
23 III / 1095 Budmerice to Báhoň
24 II / 503 Pezinok by Baba
25 III / 1086 Pezinok to Šenkvice
26 II / 502 Svätý Jur to Pezinok
27 I / 61 D1 from Blatná
28 II / 503 D1 from Pezinok
29 III / 1083 Slovak Tomb to the Croatian Tomb
30 II / 502 Svätý Jur to BA
31 III / 1083 Chorvátsky Grob direction I / 61
32 II / 502 Pezinok before odb. Limbach
33 II / 503 Pezinok to Viničná
34 II / 502 Pezinok to Vinosada
35 III / 1282 Čierna Voda to Vajnory
53 MK Rybničná from Vajnory
54 II / 502 Rybničná to the Commissioner

Location of ASD census stations - Senec area

36 I / 61 Ivanka pri Dunaji from BA
37 III / 1041 Ivanka pri Dunaji od Zálesie
38 I / 63 Rovinka od BA
39 I / 63 HR-BSK to Dunajská Lužná
40 III / 1156 Dunajská Lužná to Kalinkovo
41 II / 572 Most pri Bratislave from BA

42 II / 572 HR-BSK to Most pri Bratislave
43 II / 503 Senec to Viničná
44 I / 61 Senec to Veľký Biel
45 I / 61 Senec to Blatná
46 III / 1040 Senec to Boldog
47 I / 61 Senec for odb. Kráľová pri Senci
48 II / 503 Senec from Kostolná pri Dunaji
49 III / 1043 HR-BSK to Reca
50 II / 503 HR-BSK to Hurbanova Ves
51 II / 510 HR-BSK to Tomášov
52 I / 62 HR-BSK from Lúčny Dvor

15.1.5 ECV truck record in a highway toll

- NDS ensures the process of controlling the passage of trucks as part of the payment of tolls, which gives the possibility to monitor the direction of freight routes, transit routes and invoke restrictions on other participants
- it is obvious that the mentioned data are very sensitive and could be misused, but any such problem may have a solution already in the initial record, when the ECV can be coded, resp. only a part of it can be provided (the probability of repeating the same part of the ECV is negligible)
- special software should be re-used to evaluate these data files, publishing only the nature of the tracking (routes, intensity and time)

15.1.6 ECV record of passenger cars from the control of electronic highway stamps

- NDS ensures the process of one-time inspections of electronic motorway signs by recording ECV vehicles passing through motorway gates
- as with lorries, it is necessary to proceed with regard to abuse and to choose a similar procedure of collection and evaluation

15.1.7 Data processing from detectors at light-controlled intersections

- the vast majority of modern light signaling devices at controlled intersections have detectors installed to record the intensity of passing vehicles, there are even differences according to the type of vehicle
- the obtained data can be used for immediate dynamic traffic management, resp. the data can be archived in controllers and can then be downloaded to an external environment for a certain period of time
- together with the installation scheme of the respective intersection, it is then possible to obtain the complete load of the intersection directions, inputs and outputs, as well as subsequent profiles within the processing of the evaluation of the obtained data files.
- all evaluated data will also present continuous monitoring of the load within the time distribution, directional diagrams of the node, the load of adjacent sections and routes
- the evaluation of the data files obtained in this way will have to be provided by special software which, in addition to the usual knowledge, will also solve specific combinations of parameters available within the data range.

15.1.8 Current traffic information

- Information boards - traffic jams, traffic restrictions, traffic accidents
- Variable traffic signs - speed, lane closure, icing, wind
- Digital traffic signs - free parking spaces, garages, P + R, TIOP

15.1.8.1 Dynamic traffic management

Any manifestation of the difference in the traffic situation should evoke an adequately optimal solution.

- Line coordination of traffic routes - green wave
- Variable signal plans - load change, transient deadlines
- Intelligent traffic signs - speed, lanes
- Intelligent pedestrian crossings - speed limit, triggered signal

15.1.9 Continuous monitoring and analysis of knowledge

The transport process is characterized by a certain regularity and dependencies of mobility-space-space variations, but this knowledge is not absolute and any change in the usual habits will cause their new arrangement and requires an adequate solution. Therefore, it is important to continuously monitor and obtain knowledge so that each new condition is evaluated so as to provide an immediate solution that could be applied from the available immediate information.

15.1.10 Collection and registration of data on bicycle traffic

- Measurement of bicycle traffic intensity using automatic cyclist counters (existing cyclist counters in the BSK area, installation of new cyclist counters on important existing cycle routes, or during the construction of new cycle routes)
- Use of data on the use of bike sharing from individual operators
- Use of data from car parks and bicycle parking facilities with records
- Re-monitoring of bicycle traffic intensities within the national traffic census
- Utilization of existing and new equipment for the collection of road traffic data as much as possible through appropriate software and hardware solutions as well as for the collection of information on bicycle traffic

15.1.11 Water and cycling routes

- **designation** (number, name)
- **stationing** (mileage) - start, end, points of 1 km, crossings (bridges, roads), municipal boundaries
- **width parameters -** width, directional division

15.2 Expanding the information base on urban supply

The first step in addressing the issue of urban supply is to create a city-wide strategy for the development of urban supply. Other selected measures are partial steps that will support better organization of the movement of supply vehicles in the city.

Weaknesses that the Contractor came up with during the processing of the work include, among others, the lack of concept and knowledge of logistics in the city or. region and the supply process and the deterioration of conditions for rail freight. The solution to this issue in the city with an overlap in the region is the development of a county-wide logistics strategy with the main focus on the city of Bratislava. At the same time, we recommend the establishment of the position "Freight Transport Specialist", while from this position the compliance with the strategy will be checked. It is necessary to build logistics hubs and prefer the distribution of goods by emission-free means of transport.

Users:

- Public
- Carriers

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport

Task holders:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region

Dates of realization of investment costs :

- Until r. 2025 Development of a strategic document
- costs for the elaboration of a strategic document approx. € 200,000
- establishment of the position "Specialist in freight transport" approx. € 30,000 / year

Impact on the Spatial Plan

- The measure does not affect the zoning plan

15.3 Creation of an analytical workplace and creation of a traffic-engineering information system

The integrator of public passenger transport ensures, in particular, the coordination of carriers, timetables and other activities related to the operation of public passenger transport in the entrusted territory. In order to be able to carry out these activities professionally, in addition to the relevant competencies, it needs, above all, comprehensive data on static phenomena and dynamic processes of all modes of transport, which it integrates and coordinates. This data needs to be analyzed, the needs and requirements of passengers identified and the most appropriate solutions and technologies designed to meet these needs. The tasks set in this way exceed the possibilities of the integrator and it is appropriate to consider the creation of a separate workplace at the regional level, resp. regions served by the integrated transport system, as a service workplace for the contracting authority of public passenger transport and transport integrator. The task of such a workplace would be to procure and collect data on all modes of transport, their analysis, quantification of transport processes, their simulation, identification of bottlenecks in transport and with regard to urban impacts. From the conclusions of the analyzes, the workplace will develop proposals for solutions and recommendations for the contracting authority and the integrator for the management of transport processes in the area.

15.4 Road safety

15.4.1 Road safety

Transport safety is not only a serious transport, social but also an economic problem. Traffic accidents are associated with great material damage, permanent damage to the health of the population and very often with irreparable loss of human life.

In addition to the serious traumatic experiences of road accident victims and their loved ones, the accident rate also contributes to significant social losses, which are expressed in monetary units. The process of valuing losses from traffic accidents results from the calculation according to the methodology Value of Human Life, developed by the Research Institute of Transport, as, in 2009, which takes into account direct (health care costs, material damage) and indirect (production losses, social expenses) cost items. As statedThe strategy of increasing road safety in the Slovak Republic in the years 2011 - 2020 in the case of fatal accidents accounts for up to 95% of the total cost of a traffic accident, and 65% for serious injuries.

Although road safety in the EU has improved in recent decades, the number of deaths and injuries is still too high. Therefore, the EU adopted the so-called a zero vision (vision of zero casualties) and a "Safe System" approach to eliminate deaths and serious injuries on European roads.

Traffic safety is one of the most important indicators of the quality of the transport process. A substantial part of the deficiencies is reflected in the occurrence of traffic collisions, which in accordance with the law are divided into traffic accidents and damage events.

Car accident**is an event in road traffic which is directly related to the traffic of a vehicle and in which a person is killed or injured, material damage is likely to exceed the specified amount or other legal conditions are met. Other road traffic events are a loss event.**The registration and investigation of traffic accidents (DN) is provided by the Police of the Slovak Republic, damage events are resolved only through insurance companies.

In the Slovak Republic, the Ministry of Transport and Construction of the Slovak Republic, which ensures the road safety agenda through the Road Safety Department, is responsible for activities to support and increase road safety. Department in particular

- prepares proposals and suggestions for research activities, cooperates and comments on the intentions of the development of science and technology in the field of road safety
- ensures the coordination of educational and awareness-raising activities aimed at all categories and age groups of road users
- cooperates with the media and other actors in order to ensure effective influence on road users
- coordinates the process for setting up a system of education and training of road safety professionals at the level of volunteering in accordance with EU rules
- coordinates activities in the field of road safety management according to Act no. 249/2011 Coll. on road safety management

From the point of view of traffic accident prevention, it focuses on traffic education of children and youth and on the provision of educational materials on road safety.

Pursuant to the Act of the National Council of the Slovak Republic no. 249/2011 Coll. on road safety management is responsible for the activities of the road safety audit, which is to be carried out but onlyfor roads which are part of the trans-European road network at the stage of their planning, construction and use. It is recommended that the road safety audit also be performed on constructions of all roads I. to III. class, thus eliminating their safety deficiencies already in the project preparation phase.

15.4.2 Statistical indicators of traffic accidents

The basic indicator is the number of traffic accidents according to territorial or local affiliation. The consequences of a traffic accident are a measure of the severity of a traffic collision, and are divided into people killed (SZ), severely (TZ) and slightly (LZ) injured persons and the amount of proven material damage (HS in thousands).

In order to interpret traffic safety indicators, it is necessary to define the categories that can be influenced by effective measures. For this purpose, it seems more appropriate to indicate the severity of traffic accidents. The severity of traffic accidents is a quantity that objectively cumulatively evaluates the individual consequences and at the same time identifies weak points from the point of view of traffic safety. The most commonly used index method is recalculation by relation:

1 SZ = 500, 1 TZ = 150, 1 LZ = 25 and one thousand Euro HS = 1

resulting from the equivalent of consequence groups. The following formula for the severity of traffic accidents is then:

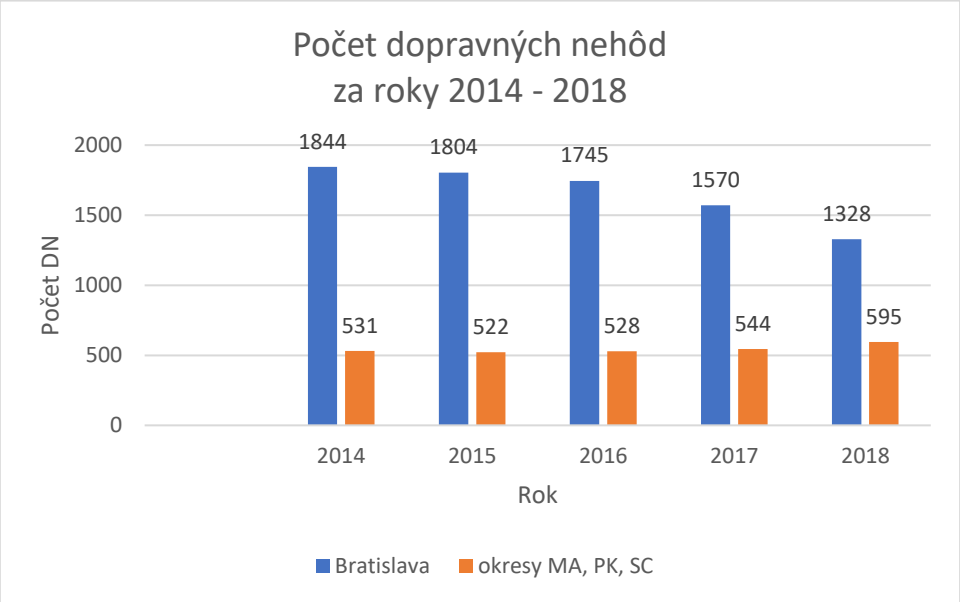
(SZ * 500 + TZ * 150 + LZ * 25 + HS / in thousands) / AM

SZ = killed / TZ = seriously injured / LZ = slightly injured / HS = material damage in thousands of € / PDN = number of traffic accidents

15.4.2.1 Development of statistical indicators of traffic accidents

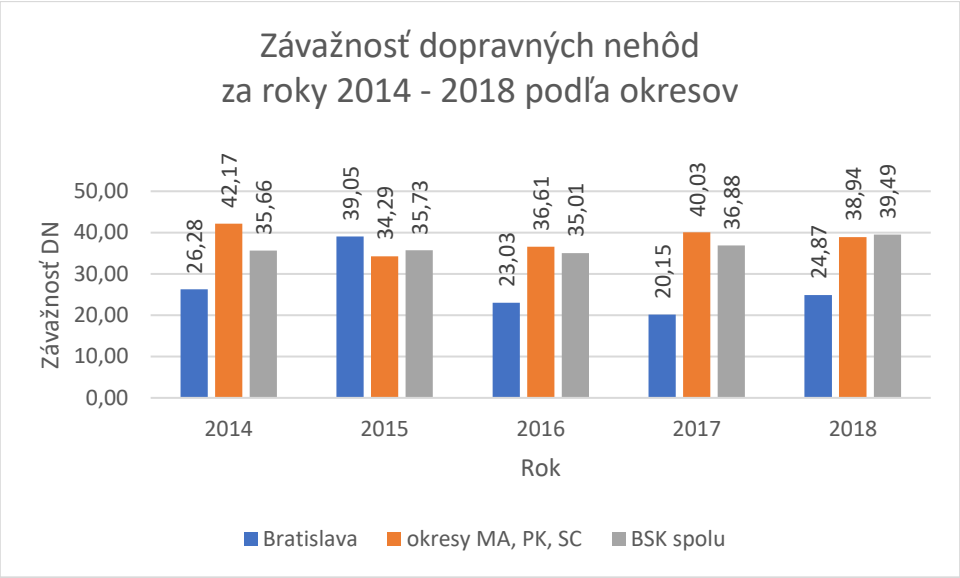
The source of data for the evaluation of the development of traffic accidents is publicly accessible statistics obtained from the website of the Police of the Slovak Republic. The territory and road network of BSK has a significant difference in road traffic conditions compared to other regions. A substantial part of the communication network of the region is the urban area of the city of Bratislava, which consists of 5 districts, but where there are also minimal sections of the classification of urban areas. Therefore, it is important to distinguish districts outside the territory of Bratislava, namely the districts of Malacky (MA), Pezinok (PK), Senec (SC) and the city of Bratislava itself.

The number of traffic accidents in Bratislava has decreased by almost 30% over the last five years, while in the districts of Malacky, Pezinok and Senec the number of accidents has increased by 12%. The development of the consequences is just as favorable in Bratislava as in the surrounding districts. In Bratislava, there was a decrease in fatal consequences for the period by 60% to 6 deaths, as well as the number of seriously and easily injured decreased by 26, respectively. 19%. In the districts of Malacky, Pezinok and Senec, the number of fatal consequences decreased by one, the number of seriously and easily injured, on the contrary, increased by 6, resp. 16%.



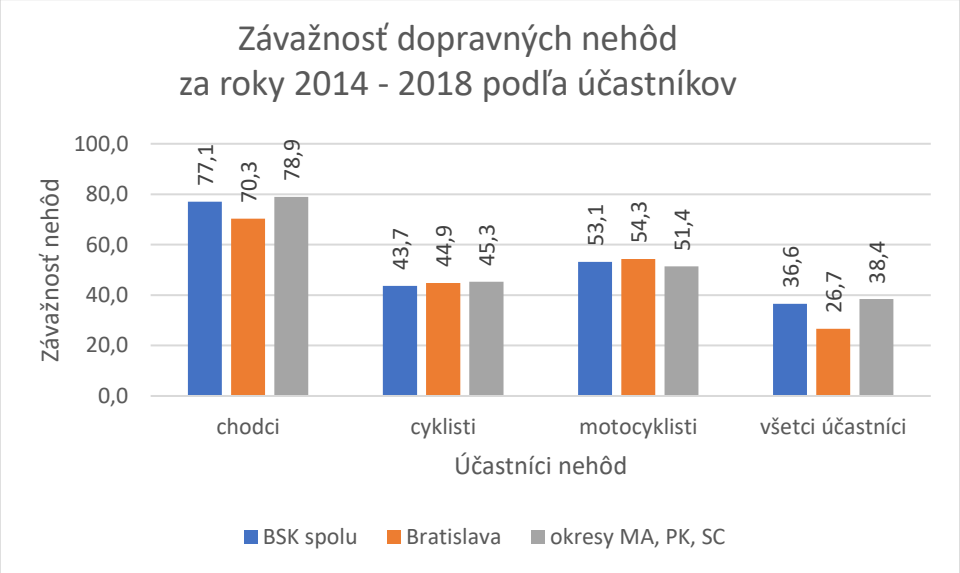
A picture 15-2 Number of traffic accidents in 2014 - 2018 (Source: MV SR)

Indicators of the severity of traffic accidents according to localities of occurrence also show more favorable results in Bratislava, except in 2015, when the severity of traffic accidents in the city was higher than in the rest of the region. This is natural, because in Bratislava there are higher traffic intensities, lower speeds and thus a lower incidence of accidents with consequences for health.



A picture 15-3 Severity of traffic accidents in 2014 -2018 by district (Source: MV SR)

The structure of road accident participants is closely related to their normal share in road traffic, also taking into account the location. The largest share clearly belongs to the crews of motor vehicles. Recognition by lower incidence is characterized by groups of participants who are much less secure against traffic collisions. From this aspect, the severity of the consequences is also significantly higher in these groups. This includes mainly pedestrians, cyclists, but also motorcycle crews.



A picture 15-4 Severity of traffic accidents in 2014 - 2018 by participants (Source: MV SR)

While the total severity of traffic accidents of all participants in BSK is at the level of index 35, the severity of traffic accidents involving pedestrians reaches 2.2 times higher in Bratislava and in districts outside Bratislava. Among the most vulnerable road users, the consequences with the participation of a motorcycle are slightly less serious and cyclists have the lowest severity. The above findings indicate the focus of measures that will be aimed at reducing the consequences of traffic accidents.

15.4.3 Measures to reduce road accidents

There are a number of possible technical, psychological, educational, propaganda and other measures to reduce the number of road accidents and their consequences. The sustainable mobility plan cannot

cover all this wide-ranging issue, it can only deal with measures affecting mobility in the region. Therefore, we will address only the following groups of measures:

- Increasing the level of road infrastructure safety
- Increasing the level of safety in public passenger transport
- Reduction of traffic accidents for vulnerable road users

15.4.4 Increasing the level of road infrastructure safety

Application of the gateway effect to the village.

Description of the measure:

In the area of the entrance to the village, they usually drive at a higher speed, the drivers do not immediately reduce the vehicle speed to the prescribed speed. Therefore, it is useful to apply various elements supporting speed reduction, such as narrowing the road, changing the route of the road, the so-called bullying, central islet, planting of greenery, highlighting of road lighting, etc. This measure is primarily aimed at reducing the speed at the entrance to the village. At the same time, the municipality can improve its image with this measure.

Responsible:

Road administrators in cooperation with municipalities

Construction of traffic thresholds

Description of the measure:

By raising the road in some places, a reduction in speed can be achieved. Preferably, this measure is used in pedestrian crossing points, where it facilitates pedestrians to cross the road and increases their safety. The places where the traffic threshold is to be built should be correspondingly constructed and consistently marked with vertical and horizontal traffic markings. It is not appropriate to propose the measure on roads on which public transport is conducted.

Responsible:

Road administrators in cooperation with municipalities

Use of psychological brake

In some cases, it is enough to create so-called "psychological brakes" instead of construction measures. These can be optical or acoustic and are created by horizontal traffic signs. The horizontal markings are constantly narrowing towards the approaching "dangerous place" and should encourage drivers to reduce speed and increase attention. Using a psychological brake, the drivers' attention is directed to a certain place. It is used e.g. in front of pedestrian crossings, in front of dangerous curves or railway crossings.

Responsible:

Road administrators in cooperation with municipalities

Introduction of informative speed meters

Informative speed meter is a device that displays the instantaneous speed of vehicles in the incoming direction with the recognition of the vehicle registration number and collects individual statistics such as vehicle intensity, composition, speeding, etc. The device is suitable for the analysis of the traffic situation and also serves as a traffic light. The device is intended for informative measurement of vehicle speed. The basic tasks of the device are:

- show the driver the instantaneous speed of the vehicle
- record traffic data that can be statistically evaluated
- provide recorded photos
- record traffic offenses
- share data with other devices

The main usability is mainly in places with reduced or limited speed or in places with a higher incidence of traffic accidents. It increases safety in places with a high concentration of pedestrians, e.g. pedestrian crossings in front of schools and hospitals. The task of the device is to improve the state of transport, ie. increasing road safety in certain localities, improving traffic flow, reducing the number of road accidents, reducing the number of road deaths, reducing emissions and improving living standards in cities and towns.

Responsible:
Road administrators in cooperation with municipalities

Regular maintenance of horizontal and vertical traffic signs and traffic equipment
In order to ensure the safety of road users, reduce accidents and increase the safety and smoothness of road traffic, it is necessary to pay attention to regular inspection, maintenance and renewal of traffic signs and traffic facilities. These are used in the outdoor environment and are subject to their technical and effective life. Their proper functioning contributes to ensuring the safety and smoothness of traffic.

Responsible:
Road managers

Improving the condition and surface of roads
Increased noise levels and high accidents are often related to the condition of the road, respectively. its surface. Repairing the road can fix these problems. Restoring the road surface will increase road safety and reduce road noise.
Responsible:
Road managers

Reduction of obstacles in the view
Ensuring visibility is a key requirement for meeting the safety requirements of all road users. The driver may only drive at a reasonable speed to be able to stop the vehicle at a distance within sight. Especially with reduced visibility, the length of the view is significantly reduced, so it is extremely important that there are no obstacles in the driver's field of vision. There must be no obstacles in the view of the viewing field - shrubs, fences, advertising constructions, container stands, etc.
This is especially important at intersections and their outward triangles.

Responsible:
Road managers

Elimination of interfering light sources

Dazzling effects can be disturbed by road users while driving or walking. Therefore, it is important to eliminate or at least minimize these interfering light sources. The following non-vehicle elements may cause glare:

- illuminated or illuminated advertising structures
- artificial lighting for sports grounds
- artificial lighting of car parks, company premises
- a light cone that illuminates e.g. signboards, landmarks
- direct sunlight or areas that reflect sunlight on traffic participants (eg glass facades of buildings)

- The effect of glare can be prevented or at least reduced, for example by planting trees or shrubs

By eliminating interfering light sources, the glare effect and thus the distraction of traffic participants is reduced. This improves visibility to other road users as well as to the street space and the driver or. the pedestrian has the opportunity to react more to unforeseen events.

Responsible:

- State administration and self-government bodies
- Road managers

Traffic light lighting

Street lighting and light traffic devices should, among other things, facilitate the understanding of the directional direction of the road and draw attention to curves or well in advance. crossroads. Properly implemented lighting equipment can reduce conflict situations and accidents. Overall, traffic safety and public safety need to be taken into account in this measure. Its uniformity, glare reduction, adaptation zones, optical guidance and information are important for lighting. Care must be taken to distribute the light evenly to avoid dark places. Adequate lighting will allow:

- better observation of poorly visible or dimly lit road users and objects
- better optical guidance and recognizability of transport equipment even in bad weather conditions (eg fog, rain, snow)
- lighting of intersection areas and crossing points in order to highlight them, increase clarity and orientation

Responsible:

- State administration and self-government bodies
- Road managers

15.4.5 Reduction of traffic accidents for vulnerable road users

Optimization of the solution of crossings for pedestrians and cyclists

Crossing the road means an increased risk for pedestrians and cyclists to encounter dangerous situations when colliding with motor vehicles. As unprotected road users, pedestrians and cyclists are most at risk in collisions. Crossings and secure passages are intended to help reduce conflicts and the risk of accidents and to increase road safety. The pedestrian crossing, marked by appropriate vertical and horizontal signs, indicates the area on which the pedestrian crossing over the road is directed and which ensures that pedestrian traffic takes precedence over traffic. A safer arrangement is a secure passage with a light signaling device. In the case of pedestrian crossings, special attention must be paid to the safety of traffic for (visually) disabled people. Crossings for pedestrians and cyclists must be clearly visible, highlighted by public lighting, good visibility of pedestrians and cyclists and drivers of motor vehicles must be ensured. We recommendconstruction of passages in the form of elevated passages, ie in the level of the sidewalk, in all places where traffic calming is desired. Such a measure is a very effective element in calming traffic, thus increasing the safety and at the same time the attractiveness of pedestrian traffic. As far as possible, the cycle routes under construction must be separated from road and pedestrian traffic. It is important that local authorities respect important cycling routes when marking cycle paths.

Responsible:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region

- Municipalities
- KR PZ Bratislava

Provision of crossings for pedestrians and cyclists with traffic lights

If the limit intensities of traffic are exceeded, if it is difficult for pedestrians to find a sufficiently long time gap for a safe crossing of the road, it is necessary to establish a passage secured by traffic lights. Demand light signaling devices, which serve to ensure the safety of crossings for pedestrians and cyclists, are controlled by means of a button and respond to the requirements of pedestrians, resp. cyclists. This measure is driven by the needs of passers-by and increases the acceptance of passage by motor vehicle drivers. Demand traffic lights, in contrast to conventional traffic lights, respond to the individual requirements of pedestrians and cyclists regarding crossing the road and allow them to cross safely.
Light signaling devices (SSZ) are designed to increase road safety and improve traffic quality (performance). From the point of view of traffic safety, the construction of SSZ depends on the following facts:

- recurrence of accidents which cannot be prevented by other measures
- communications with two or more lanes in each direction
- insufficient vision that cannot be improved by other measures
- significant risk to certain groups of people (eg children, the elderly, the disabled)
- large width of the roadway at the crossing point
- high speed motor vehicles
- high intensity of motor vehicles and pedestrian traffic per hour.

Responsible:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- Municipalities
- KR PZ Bratislava

Checking the minimum pavement width

Too narrow sidewalks are difficult obstacles to overcome, especially for wheelchairs and prams. If the sidewalks are too narrow, not everyone can use them. Their width should therefore be reviewed and extended as necessary. It is necessary to ensure that the sidewalks have an appropriate width arrangement, longitudinal and transverse slope. There should be no obstacles on the sidewalk narrowing its passage profile, especially parked cars, advertising equipment, urban furniture, etc. The specific minimum width must be taken into account for the safe and comfortable movement of pedestrians, with the pedestrian intensity being an important indicator of pavement width. In order for the sidewalk to be built at least in the minimum width, the area for motorized transport must also be used in some cases.

Responsible:

- The capital of the Slovak Republic, Bratislava
- Municipalities
- KR PZ Bratislava

Construction, resp. improving sidewalks and paths for pedestrians

The construction of pedestrian paths is important especially for the protection of pedestrians (especially children) against motorized road users. By physically separating the pedestrian path from the road, pedestrians can move along it almost safely. The construction of footpaths for pedestrians is also important outside the built-up area for connections between neighboring municipalities; with lower intensity of pedestrians and cyclists, the path may be common. A desirable improvement for wheelchair users or for parents with a pram is to reduce the curb at intersections, or to increase the level of the road at the continuation of the sidewalk (or cycle path).

Responsible:

- The capital of the Slovak Republic, Bratislava
- Municipalities
- KR PZ Bratislava

Construction of the central island (dividing strip)

Roads with heavy traffic and only small time gaps for crossing the road are an insurmountable obstacle, especially for seniors and people with reduced mobility. Through the central islands, the road is divided, creating two short sections, which represent about half of the original distance to be crossed, and the traffic flow only needs to be observed from one direction. When implementing the central islet, it is necessary to pay attention to barrier-free adaptation for transport participants with disabilities (reduction of curbs on the sidewalk and the islet) and that the persons on the islet are clearly visible. The dividing belt is also proposed at the entrances to the village in order to reduce the speed of incoming vehicles.

Responsible:

- The capital of the Slovak Republic, Bratislava
- Municipalities
- Communications Administrators
- KR PZ Bratislava

15.5 Intelligent transport systems

Innovation in transport until 2050 is a very broad topic covering technical, technological and legal aspects of possible developments. The issue is addressed in detail by the European Commission in its strategy "Towards Clean, Connected and Competitive Mobility", which sets out key areas for transport innovation and the necessary steps to accelerate the development and deployment of innovative low-carbon transport technologies. To support innovation, the Slovak Republic adopted the Act of the National Council of the Slovak Republic no. 317/2012 Coll.on intelligent transport systems in the field of road transport; and Strategic plan for the development of transport in the Slovak Republic until 2030. Innovative solutions in transport are also being explored by many commercial companies with the main goal of eliminating or at least reducing the dependence of transport on fossil fuels and increasing the safety of transport participants.

The Ministry of Economy of the Slovak Republic supports Smart City as a new approach in the development of cities and urban regions. Projects were supported under this supportPilot project of public transport preferences at intersections in Bratislava, FAST-E & EAST-E construction of fast charging infrastructure for electric vehicles along the TEN-T road corridors in western Slovakia, Bratislava city card as support for the development and improvement of the use of urban services, in particular in urban public transport.

Although we associate the concept of intelligent vehicles mainly with the future, several vehicles already have elements supporting their autonomy today (various assistants such as adaptive cruise control, automatic parking and others). They also apply to traffic management such as public transport preference by dynamic control of traffic lights based on vehicle positioning by GPS.

The main feature of intelligent transport systems is the provision of services, which include the activities of the road network operator and operator, the transport service provider, carriers, as well as the road user himself. For the efficient functioning of intelligent transport systems, the cooperation of all transport professions with information service operators, urban planners and, of course, with the traveling public is essential. Services provided on the basis of intelligent systems can be divided into several levels:

Services for passengers and drivers:
1) information on traffic routes
2) information on transport connections
3) traffic information presented by the driver via IS on motorways
4) traffic information presented by the driver via radio, television, internet
5) information sent directly to the car (dynamic navigation)
6) services of mobile operators

Services for the infrastructure manager:
1) monitoring the quality of transport routes
2) infrastructure maintenance management
3) economics of transport routes
4) monitoring and managing road safety

Services for the transport provider:
1) selection of the most advantageous route
2) fleet circulation management
3) vehicle maintenance
4) vehicle diagnostics
5) delivery of spare parts

Services for state and public administration:
1) connection of the intelligent transport systems system to the public information system
2) monitoring and evaluation of the number of transported persons and kilometers
3) monitoring and managing the financing of transport infrastructure
4) tools for the implementation of transport policy

Safety and rescue services:
1) the interconnection of intelligent transport systems to an integrated rescue and safety system
2) ensuring better organization of work in the liquidation of accidents, accidents, increasing prevention against emergencies

The aim and task of intelligent transport systems is to provide information to users of the transport process in advance and during the use of means of transport. In this way, conditions are created for smooth and safe transport to achieve the everyday goal in the life of society. Intelligent transport systems consist of a large number of devices and tools to manage the transport network and provide services to road users. Intelligent transport systems can in principle be divided into five parts:

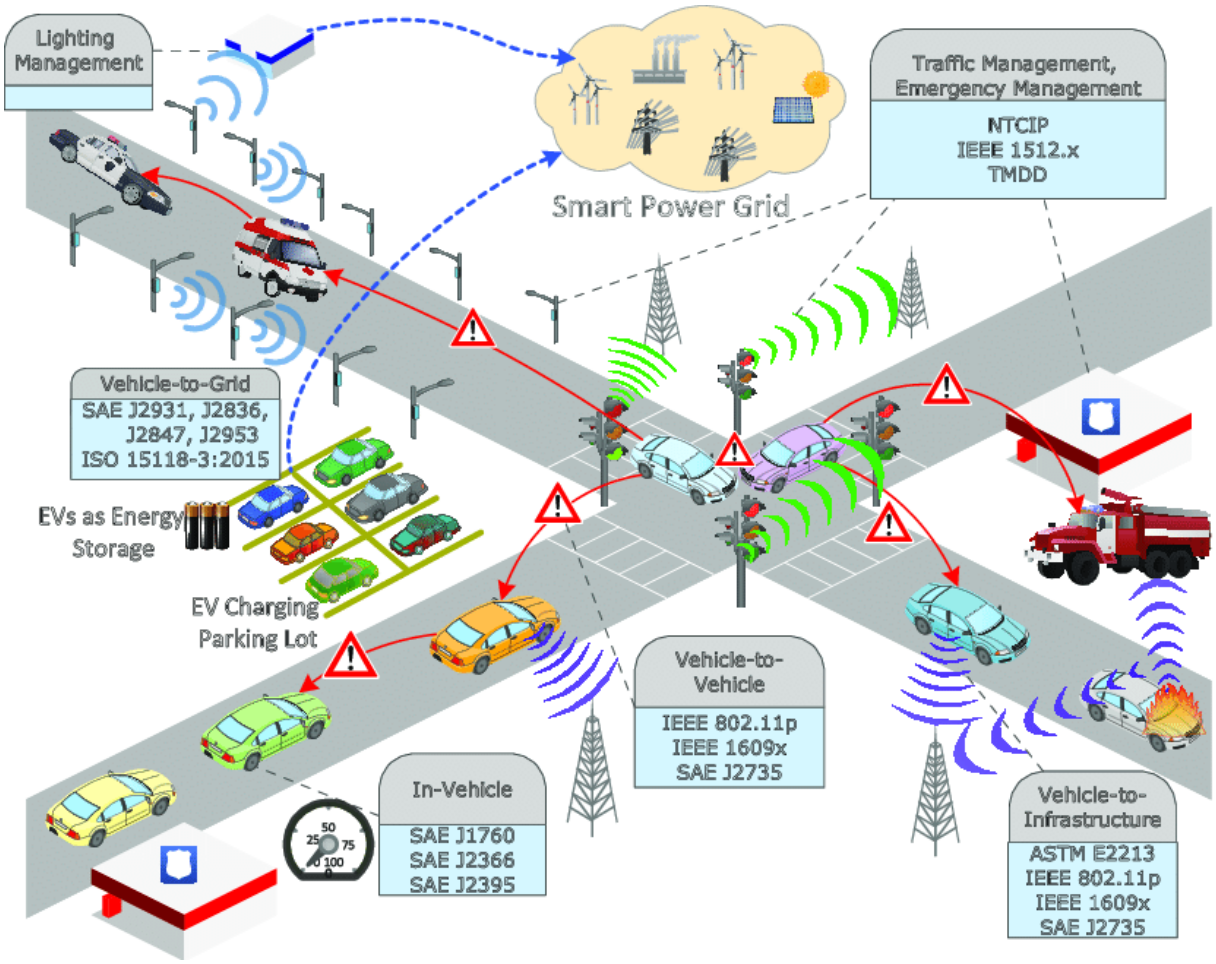
- passive traffic signs (horizontal and vertical traffic signs)
- active traffic signs (traffic lights, text and graphic fields,)

- technical equipment of communications (sensors and detectors of various types, transmitters and receivers (radio beacons) for one-way and two-way communication with vehicles,)
- technical equipment of vehicles (receivers, transmitters, automatic location of vehicles, electronic identification, automatic control systems,
- dispatching systems (integrating a range of information processing technologies)

Intelligent transport systems are based on the collection, processing, integration and provision of information, as well as communication and integration. The technical core of the systems is the applicability of information, its complex use together with control technologies in the transport process.

The basic intention of intelligent transport systems is the communication integration of individual elements of the transport system so as to provide timely, up-to-date and reliable information to users to increase road safety, increase transport efficiency in terms of transport time, as well as environmental quality company activities. Intelligent transport systems open up opportunities for sustainable mobility, creating the basic conditions for a quality communication and information society.

Transport systems are based on three basic principles, namely information, communication and integration. The core of these systems is to collect, monitor, process, integrate and provide mobility information. The trend in transport in the Bratislava self-governing region shows a steady increase in vehicles on roads and since it is not possible to constantly expand road infrastructure, as one of the ways to optimize transport demand and make better use of the transport network is intelligent transport systems.



A picture 15-5 Intelligent Transport Systems (Source: https://www.researchgate.net/figure/Intelligent-Transportation-System)

Intelligent transport systems enable all stakeholders to be better informed, guided and more "intelligent" in decision-making. Already today, these systems provide:

- continuous driving speed control
- observance of safety distances between vehicles
- dynamic guidance of vehicles to a predefined destination; and
- optimize paths between source and destination

Other systems optimize the transport of people and goods by using multimodal modes of transport, increasing the speed of transport of people and goods. They provide passengers with comprehensive information, increase safety and travel comfort. The use of traffic management in intelligent transport systems reduces congestion, increases safety and reduces transport costs and air emissions. Intelligent transport systems help carriers to effectively improve service delivery, enabling urban and regional administrations to create space for sustainable mobility and the development of a comprehensive transport process.

Individual applications of intelligent transport systems in road transport can be divided into five categories in terms of their benefits.

Table 15-1 Identification of benefits of the implementation of intelligent transport systems (Source: Developer, PUM NSK)

Benefit	Benefit characteristics	Most frequently used applications
Reducing traffic accidents	Contributing to reducing the number of accidents and saving time in emergency and safety vehicle interventions. Increasing the safety of road users, children, the elderly or disabled in direct traffic	Exception detection and warning systems Systems for faster response to rescue operations Camera systems to force the change of speed and light signals Anti-collision systems Automatic control of pedestrian and bicycle traffic
Mitigation of congestion	The formation of columns and traffic jams is a fundamental problem of the transport process. The basic program goal of IDS is to eliminate time losses during transport by managing demand, improving the efficiency of the entire transport network and changing the transport system.	Adaptive speed control for undisturbed traffic flow Demand management: electronic payment, access control to the transport network Efficiency of the transport network: area control of traffic, management of traffic flow, regulation of access roads, detection of exceptional phenomena and their management, provision of information to the driver. Recommendation to change the mode of transport: preference for public transport.
Environmental Protection	Many cities in the world have implemented air pollution monitoring and forecasting under IDS. The worst conditions of air pollution occur during congestion, while IDS effectively ensures the smooth flow of urban traffic and thus the reduction of emission levels.	Strategic demand management Access control to highly concentrated communication network points Air pollution monitoring Air quality information
Performance and operational efficiency	The integration of IDS systems often reduces operating costs and enables increased productivity and improved process performance.	Automatic vehicle location Automatic freight tracking Computer-controlled control Fleet operation management Driver monitoring Electronic collection of fees
Comfort driving factors	The basic requirement of users of transport systems is to create a feeling of comfort, safety and trust in the transport network and the transport system they use.	Real-time traffic information Dynamic vehicle guidance to the destination Tracking of safety or rescue vehicles Real-time transit information Payment by magnetic / chip cards in public transport.

15.5.1 Technologies in intelligent transport systems

For the effective implementation of intelligent transport systems, basic technologies are defined - active technologies. Active technology, in addition to setting out the main principles and technical rules for the transmission and content of information, includes services so that they are also considered to

be clearly useful to all operators. Active technology is technical devices based on microelectronics, which capture various physical phenomena and convert them into pulses and signals. The telecommunications infrastructure ensures the transmission and transmission of information to the control center through its stationary and mobile technologies. Microwave and infrared frequency devices are e.g. basic technologies for single-purpose short-range communication, which allows communication over short distances between the vehicle and an external device without stopping the vehicle.system (GPS) also provides a technical alternative at affordable prices for location data collection vehicles (many ITS services are based on this principle). Mobile communication is also beginning to provide visual information and does not remain just at the voice level.

The basis for various information services (traffic data exchange, vehicle guidance, passenger information, route selection and means of transport ...) are various databases of digital maps and standardized reference location schemes. While digital map databases are essential for guidance (navigation) systems and location reference systems, they provide wide variability for transport services while allowing the market to expand in other life activities.

15.5.2 Logical architecture of intelligent transport systems

The technical core of intelligent transport systems is information and traffic-management engineering, which is a branch of complex transport transport system engineering. The tools used provide a clear description of the required data flows and data processing between largequantity diverse elements of intelligent transport systems. Thisthe process allows to be highly efficient for targeted ITS services. The software as the resulting system engineering tool therefore needs a defined logical architecture. By logical architecture we understand a model that describes the essence of the system based on the process of information management and their functions in terms of ensuring its internal organization.

15.5.3 Financing of intelligent transport subsystems

The financing of intelligent transport systems must be the result of a conceptual interconnection of the intelligent transport systems subsystems, where an information superstructure over transport is created, which makes it possible to implement the same management tools for this network industry. Knowledge of economic processes related to transport will facilitate the implementation of state transport policy and offer a meaningful investment strategy in this sector. In this sense, intelligent transport systems can offer clear, controllable and transparent rules for the entry of private investors into transport infrastructure. It is important to know the economic limits and create a cost benefit analysis - a business model based on which these systems should be provided. Because these users benefit from these systems, such as: passengers, drivers, government and public administration; carriers and therefore need to be quantified and a business model developed accordingly. Experience to date has shown that the best partnership between the state / public administration and the private sector is based, although the establishment of such a model is very problematic due to ignorance of all the essentials. Efficiency is how the model can be calculated. Intelligent transport systems will help reduce accidents, and it is now necessary to process this information and appreciate the whole chain, which affects several departments, such as transport, healthcare and others who know how to appreciate this benefit. Another benefit is the reduction of lost time spent in traffic columns. Based on the above, the said business model must be determined. Experience to date has shown that the best partnership between the state / public administration and the private sector is based, although the establishment of such a model is very problematic due to ignorance of all the essentials. Efficiency is how the model can be calculated. Intelligent transport systems will help reduce accidents, and it is now necessary to process this information and appreciate the whole chain, which affects several departments, such as transport, healthcare and others who know how to appreciate this benefit. Another benefit is the reduction of lost time spent in traffic columns. Based on the above, the said

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15.6 Mgrain as a service to the shared economy

The pressure on economic development, the desired prosperity and successful competitiveness is exacerbated by the demand for relocation of people, costs and information, which creates enormous demands on the capabilities of the available transport infrastructure. The degree of motorization in our country has long exceeded the expected "saturation" and continues to grow. Congestion in the road network is no longer typical only for large cities, but small villages in remote areas are also crowded throughout the day.The paradox is constipation at peak times with the occupancy of cars by mostly one person and at the same time an unused offer of public transport. Thus, the fictitious overcrowding of transport demand "externally" but the non-utilization "inside" of the transport

A picture 15-6 A clogged street with unoccupied cars ...
(Source: Processor)

A picture 15-7 ... and at the same time a half-empty trolleybus
(Source: Processor)

system, while this spiral of unjustified demand is constantly growing and becomes a forced argument for building another surplus transport supply.

15.6.1 Natural transformations of mobility

The dilemma of "comfort in the vehicle and congestion on the street" is the result of inappropriate treatment of the impacts of traffic, a lack of understanding of the causes of increasing momentum, the pressure to prioritize the consequences of hypermobility by building redundant infrastructure. Disproportions in the poor transport offer and in the lengthy implementation of the necessary mobility measures are solved by passengers spontaneously, for example when switching to a train by parking their cars on unused areas of railway stations and creating natural P + Rs. Meanwhile, the Internet is transforming public spaces and means of public transport into mobile offices, study rooms or games rooms and a navigable road"Just in Time" freight transport turns crowded roads into dynamic warehouses. Gradually, freedom of movement is lost, freedom of decision and the ability to control one's own behavior is restricted. However, the available space is finite and therefore cannot be occupied indefinitely by extensive human activity and excess momentum.

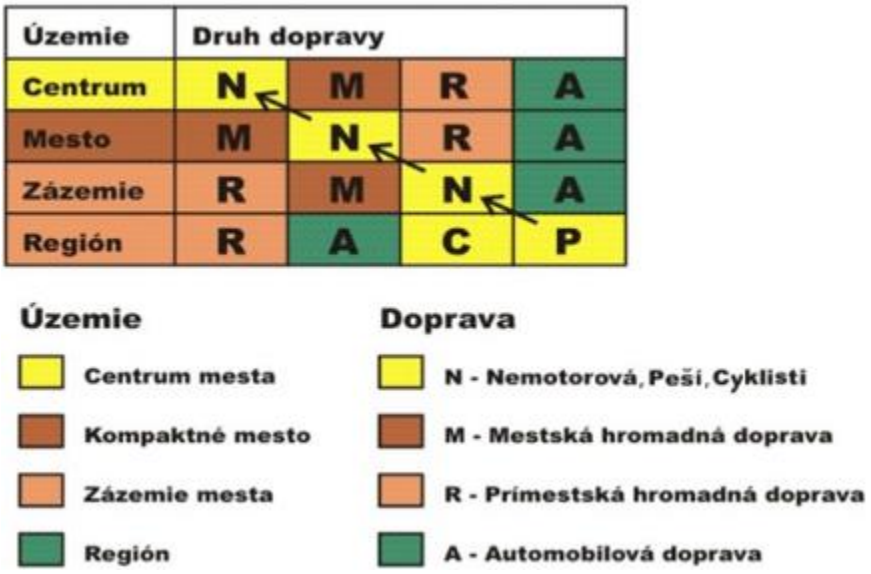
A picture 15-8 Spontaneous P + R in Bernolákov (Source: Processor)

15.6.2 Balance of supply and demand in mobility

Addressing a collapsing situation in transport requires balancing transport demand and transport supply. These are, in particular, organizational, regulatory and integration measures "within" the mobility system, which can significantly reduce traffic congestion by shifting excess transport demand to a more efficient and sustainable alternative mode of transport and thus the need to build additional transport infrastructure. However, this requires sufficient up-to-date and reliable data and information on transport demand and in-depth knowledge of the possibilities of building a transport offer that go beyond the capabilities of an individual or a specialized team. Therefore, the use of new information and communication technologies must be part of an efficient transport system.

15.6.3 Hierarchy of transport in the territory

The protection of the region's territory against excessive traffic pressure must be ensured through nationwide system integration measures, including all modes of transport, including individual road and freight transport. Each territory of the region has its specific requirements for transport services, depending on the function of the territory, its location, density and extent. This also implies the priority of individual modes of transport, which changes hierarchically in relation to the area addressed.



A picture 15-9 Priority of modes of transport in the region (Source: Rakšányi, P., Kováč, B, Bezák. B. et al .: The potential of Bratislava is in synergies man, water, transport, landscape. Information study. Hydrostav Bratislava, 1998)

The most compact central urban area of the region, with a high population density and population, often overlaps the historic core of the city, and its size as well as its structure usually corresponds to walking distance. Therefore, pedestrian movement should be preferred here in connection with alternative transport. In a compact area around the city center, the extent of the area exceeds the walking distance several times. Therefore, the city has a priority role to play here public transport (M), which is followed by the main routes of non-motorized pedestrian and bicycle transport (N) and regional public transport terminals (R), and only then are the demands of individual automobile transport (A) addressed. The suburban area has low densities, covers a large area and does not create sufficient transport potential for public transport. Therefore, outwards into the suburban area, the role of individual car transport (A) is growing, which is to fulfill the complementary function of regional bus and rail public transport (R) and local transport service. Pedestrian (P) and bicycle (C) transport in the outer territory of the city is to perform the access function to the stations (R) of suburban public transport. In particular, cycling, with a considerable radius of accessibility, can create significant potential for more efficient external public transport here. Thus, the priority and continuity of individual modes of transport changes in relation to the type of city territory, with the importance of non-motorized pedestrian and bicycle transport increasing towards the center and the preference for individual car transport decreasing due to space, traffic and environmental demands (A). However, in the outer area (extravillain), especially in sparsely populated or deprived areas, it has an irreplaceable role in the transport of persons and goods as a supplementary system (feeder) for VOD, which is ineffective in this area.

The functionality of a hierarchical transport system requires both horizontal and vertical integration of interconnections between individual transport subsystems, using new information and communication technologies.

15.6.4 Up-to-date mobility data and information

A major barrier to the application of the new principles of sustainable mobility is the lack of data, in particular the reluctance to provide and ensure their ongoing monitoring, processing, evaluation and publication. In obtaining data and information today, there are insufficient procedures in place to

guarantee the outputs of quality data sets for planning, designing and managing sustainable mobility. Informed decision-making must be based on the continuous collection, updating and analysis of the data obtained and their provision to the public as widely as possible.

15.6.5 New approaches to sustainable mobility

*The European Green Agreement, which is "... a new growth strategy for further growth that gives back more than what it pays off", is the hope for a new approach and the accelerated promotion of sustainable mobility (U.von der Leyen,***Green Deal, European Union).**

Great hope for sustainable mobility is placed in the introduction of electric cars. Various support measures (subsidies, E-infrastructure) are being taken at the level of the EU and the countries of the Union, which should contribute to its rapid implementation. However, it also has strong opponents who claim that it will have more disadvantages than advantages in terms of sustainability. In terms of sustainable mobility, it isquestionable whether only the replacement of traditional vehicle propulsion with electric propulsion will contribute to reducing the further enormous increase in traffic load and whether it will prevent collapses in the communication network. Rather, it will encourage even greater growth in individual motorisation, a further increase in the load on the road network and requirements for expanding the transport infrastructure for both dynamic and static transport.

So far, this seems to be just an attractive business for car manufacturers, who will be churning out hundreds of thousands of other vehicles. At the same time, many wrecks of old abandoned cars will have to be disposed of and additional resources spent on a collapsing environment. Therefore, it is necessary to support the development of mobility that is energy, social and environmental sustainable and in line with the requirements of a shared economy.

15.6.6 Shared mobility

New information and communication technologies (ICT) are increasingly influencing transport processes through the gradual introduction of new mobile applications, which are becoming so universally accessible**..** They make it possible to obtain and share up-to-date data and information immediately, even in different languages, cross national borders and thus operate across the board.

Increasingly, new players with advanced technologies are emerging who use data and information on consumer behavior, know how to use it for the needs of individuals and create a service from various sources (eg providing accommodation, shopping, services, navigation, etc.). Here, some differences in the use of these services can be observed from a generational point of view. Older people use mobile services less. However, the young generation has already grown up with these technologies and considers it natural to use and share them, adapted to individual needs.

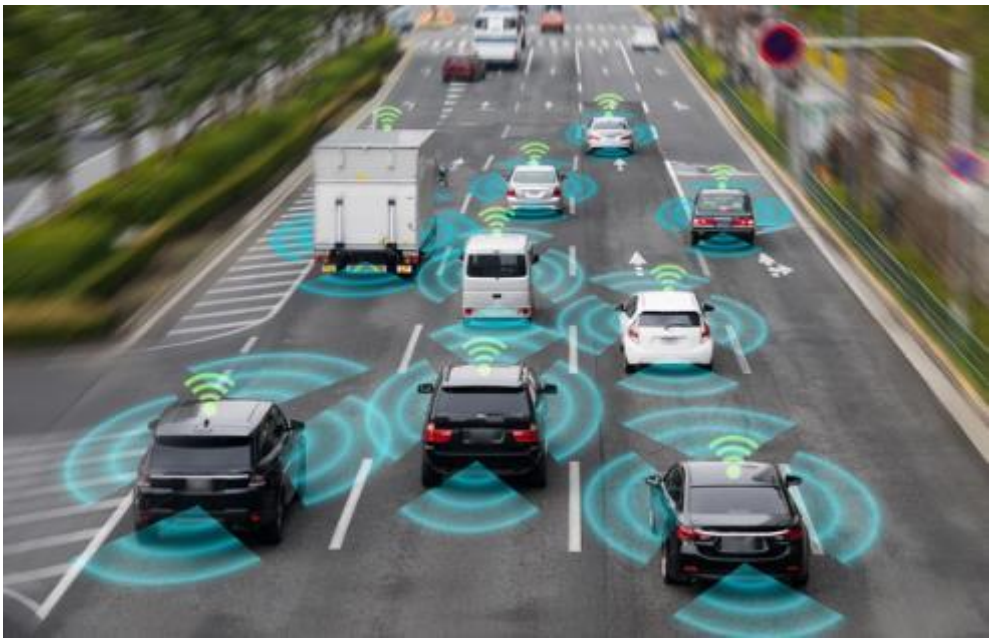
European mobility studies point to a trend of declining car use in cities in developed countries. Many restrictive and regulatory measures and parking restrictions contribute to this, which gradually reduces the attractiveness of the car in cities. The need for alternative relocation options also reduces the need for a car. The younger generation is less willing to use cars and prefers a more shared economy and an emphasis on experience instead of owning them.

The chains of the roads performed are becoming more and more complex and traditional transport, especially public transport, is no longer able to fully satisfy this transport demand. Thanks to ubiquitous internet access, new ICT-based transport services are developing very rapidly, including shared mobility car / bike pooling, or car / bike sharing, or Uber. One shared car will replace 5-8 cars in service. With a 2% share of shared cars, the volume of traffic can be reduced by 10 to 15%.

Sharing enables better use of vehicles, reduces the number of trips made by car, space requirements for parking and valuable space, reduces fuel consumption and emissions from transport. Shared momentum thus has a positive effect on the reduction of traffic volumes and the load on the communication network, and thus helps to free up, in particular, a rare congested urban space for useful residential and creative functions.

15.6.7 Autonomous and connected vehicles

Just as digital technology has changed the camera, similarly, information and communication technologies are gradually changing the transport system, a mode of transport service where transport will serve as a service. It is assumed that Autonoumos and Connected Vehicles will independently provide passenger and freight services without a driver in the near future.



A picture 15-10 Autonomous vehicles (Source: www.topspeed.sk)

Many developed countries have long understood this challenge, including the Czech Republic, which is currently cooperating in a pilot project (9 EU countries) to address the intelligent transport cooperation systems C-Roads Czech Republic (C-Roads CZ). This cooperative system is intended to enable the transmission of current traffic information between vehicles and between the vehicle and the transport infrastructure on selected motorways, cities, railway crossings and public transport vehicles in the Czech Republic. The system offers a security solution that ensures the credibility of the messages transmitted between traffic information providers and drivers. At the same time, it will guarantee international interoperability so that warning information can be obtained anywhere in the EU. By participating in this project, the Czech Republic wants to ensure the high competitiveness of its economy on the international market. The project aims to harmonize and cooperate in the implementation of C-ROADS systems in Central European countries. It is a pity that Slovakia, as the largest car manufacturer per capita in the world, is not involved in the project.
However, these radical changes in mobility were quickly understood by car manufacturers. They anticipate a further increase in motorization and gradually convert production into the production of electric cars and focus on shared mobility services, which are developing exponentially in the developed world. That's how he does it successfullyŠKODA AUTO DigiLab, which already operates shared social mobility services in Munich, Germany and intends to expand these services further into Central Europe.

15.6.8 Substitution of transport demand due to new technologies

The use of the possibility of working remotely outside the office (e-working) is becoming increasingly popular in Slovakia as well. A survey in 19 European countries shows that up to 35% of workers use the "Home Office" and work from home, in addition to traveling (13%), in cafes (6%) or in shared offices (19%), but also in other places. In everyday life, e-Banking, e-Health, e-University, e-Governmet and

other portals are also increasingly used, which allow a person to include them from one place. At the same time, the integration of these services is underway, which will significantly simplify their use in the future. Changing the way of carrying out existential activities and concentrating them in the place of residence significantly changes the daily cycle and mobility profile of persons, which significantly affects the reduction of relocation requirements and thus the volume of transport relations. Thus, it can be assumed that the increasing use of ICT will also have a greater impact on the substitution of tangible for intangible mobility. Therefore, this "substitution effect" of ICT must also be considered when designing and designing transport infrastructure, which must be flexible enough to cope with these anticipated changes.

15.6.9 The impact of ICT on the transformation of the settlement structure

The massive dispersion of the housing function into urban hinterland in the 1990s created large enclaves of individual housing with a low population density and insufficient transport potential for efficient public transport. It is not able to provide requirements for effective individual passenger transport in this area. At the same time, at present, there is a growing interest in housing in deprived areas with dilapidated infrastructure, without transport services. These are mainly young people who routinely use new information and communication technologies for work from home, education and the required services.The number of such independent forms of housing is gradually increasing and foreshadows changes in the settlement structure. The Internet provides the freedom to share information and frees people from confined places. It allows them to live in a healthy environment, with a decent standard of "urbanity" and easily accessible resources for existence and a safe life. On the other hand, cities are falling under ever-increasing environmental pressures, frequent failures in the communication network, and life in them is several times more demanding than in the countryside. Dilapidated rural settlements and small towns in deprived areas offer ample resources. New information, communication and production (automation / robotization) technologies release people from the grip of large cities, enable "work from home" and thus concentrate the basic housing and creative functions (housing, work, leisure) back into individualized housing in the open country. At the same time, they reduce the demand for material relocation and the potential for generating traffic volumes, thus relieving pressure on urban space in nuclear sites. In this respect, it is essential that the BSK Regional Sustainable Mobility Plan (R-PUM) also addresses the requirements of sustainable mobility in small municipalities and deprived areas of the region. There is a hidden significant potential for reducing the volume of excess momentum, saving transport costs,

15.7 Parking and parking policy

15.7.1 Parking in BA and its impact on the division of transport work in BSK

The parking policy has been developed only for the capital of the Slovak Republic, Bratislava, and only its principles have been adopted by the Bratislava City Council in June 2019.

The launch of regulated parking is expected gradually in the individual city districts of Staré mesto, Nové mesto, Petržalka and Ružinov from 2021. The new parking policy in Bratislava is set to a strong preference for permanent residents of Bratislava, which will significantly reduce attendance from the region to Bratislava. Parking will be charged according to the Fair Parking Proposal in Bratislava. A resident - the owner of a parking card - will be able to be any Bratislava resident with a permanent residence in the future resident zone and in relation to a specific car. 3 resident cards can be issued per household.

Fair parking will be launched in specific zones, which will not be introduced until 2021. Such resident zones will be introduced when, on the basis of previous analyzes, sufficient parking capacity is provided for residents.

For those who come to Bratislava from the region (non-residents in Bratislava), they will pay an hourly rate for parking and at least 11 new car parks in the region will be ready for them by 2021. By 2021,

the city will also provide a significant improvement in the quality and accessibility of public transport - 22 km of new bus lanes and 39 intersections with a preference for public transport will be created.
The prices of hourly parking will be divided according to the set tariff zones in the range of 0.50 - 2.00 euros / h.
This new parking policy with a strong preference for permanent residents of Bratislava will fundamentally affect the price for driving and parking IAD to Bratislava, which makes it possible to legitimately assume the transfer of part of the traveling public from IAD to VOD funds.

15.7.2 Parking regulation in BSK (outside BA)

In the district cities of MA, PK and SC, parking was regulated and charged without the development of a comprehensive transport policy of the city, including parking. In these cities, paid car parks have been created in the city centers with the price for parking according to the hours used for parking in the regulated car park.
As part of the support for the development of the share of public transport, the terminals of integrated passenger transport (TIOP) at the railway stations MA, PK and SC, Sv. Jur and Šenkvice. The construction of TIOP Bernolákovo, Veľký Biel, Plavecký Štvrtok, Veľké Leváre is being prepared. Part of the mentioned TIOPs in the region are also parking spaces. In the city of Bratislava, TIOPs are being prepared in the localities of Vinohrady-Predmestie, Vrakuňa, Ružinov, Bory, Železná Studnička / Patrónka, Mladá Garda, Janíkov Dvor, Petržalka-centrum and others. TIOP in the city of Bratislava does not necessarily have to include parking spaces; in the first place, these are integrated transfer stops.
The parking system (P + R and B + R) is supported at railway stations and stops in BSK. In district cities - PK (ŽSR 2019 project) MA (2019 city project), Senec (2020 city project) and Ivanka pri Dunaji (ŽSR 2019 project). This will be followed by Nové Košariská (ŽSR) and Zohor (ŽSR). This need is clearly demonstrated by the results of surveys carried out at selected railway stations in the BOD, which are published in the Surveys section. These car parks within P + R and TIOP are not yet charged. But in the future there is the possibility of charging them within the subscription of a ticket for public passenger transport in the IDS BK system.
Regulation of parking in city centers as well as in contact with railway stations in the region has a major impact on changing the division of transport work in favor of HD. At this stage, the sufficiently rapid development of the quality and capacity of the entire VOD network in BSK must not be neglected.

15.8 Media support for improving mobility in BSK

Campaigns promoting sustainable mobility contribute to the overall awareness of BSK residents and visitors. In the territory of BSK, IDS BK has a key role, therefore campaigns must be focused mainly on supporting the use of the integrated transport system. IDS BK should be a modern and quality service for passengers and so it must be promoted. Campaigns must be aimed at promoting the benefits of using public transport, promoting public transport services, promoting new connections and lines, and more. The campaign to support the use of IDS BK will complement the campaign for good and safe behavior in public transport, at stations and at stops.

15.9 Legislative support

Problems in the functioning of public passenger transport occur at all its levels - organizational, operational, infrastructural but also legislative. Many have a serious impact on passengers and the attractiveness of public passenger transport. Among the most serious are the problems associated with the organization and operation of public passenger transport and legislative problems. Slovak legislation is based on the principles, objectives and law of the European Union in similar regulations, directives and decisions. The current normative basis provides a legal basis for the implementation of the business activities of carriers, for ordering and implementation of transport services in the public

interest, as well as the rights and obligations of some parties participating in the transport process. However, some areas need to be defined by updating or issuing new legislation, respectively. adjust.

- identification and concretization of basic principles and mechanisms of ordering transport services in the public interest
- position, fundamental rights and obligations of individual entities in public passenger transport
- defining the public interest in public passenger transport
- competences for ordering public passenger transport and their distribution among the participating entities
- functions and competencies of the public passenger transport integrator
- defining the structure of the system of financing and co-financing of public passenger transport
- promoting more environmentally friendly, healthier and sustainable modes of transport
- low flexibility in the area of legislative and normative environment, especially in the area of introduction of modern systems in the field of public passenger transport
- mutual harmonization of legal acts in the field of public passenger transport
- setting and adapting legislation to reduce growing individual traffic, especially in urban agglomerations
- development of a legislative framework governing integrated transport systems

Publicly funded transport services should not compete with each other but complement each other. One of the significant shortcomings in the organization of public passenger transport is also the discrepancy in the ordering and implementation of transport services in the public interest. Different sources of ordering services in railway transport (ministry), road transport (higher territorial unit) and urban public transport (city) cause considerable disharmony of the transport system and from the passenger's point of view inefficient, unreliable and unattractive setting of the public passenger transport system.

15.10 Support for emission-free and low-emission fuels (electric cars, hydrogen cars, autonomous cars)

The greening of transport, like Ariadne's thread, is to blame for the entire RPUM BSK proposal. Whether it is a proposal for a VOD solution with the highest priority of rail transport, a change in the philosophy of serving the area by suburban transport, VOD preference, intelligent dynamic traffic management at traffic lights to support solutions to increase the share of non-motorized traffic in total transport work.

BSK narrowed the assignment of RPUM to the priority axis for reducing air pollution, noise pollution and carbon footprint. The team defined a solution to reduce the environmental burden by increasing the electrification of transport performance, in particular by shifting major bus routes to rail, promoting zero-emission and low-emission fuels and creating conditions for active mobility as a natural part of everyday work, education and leisure activities.

RPUM BSK sets a goal to replace all diesel-powered buses with buses powered by alternative media by 2050. In this regard, two basic solutions are offered - electric and gas propulsion, each of which has its specific advantages. Other alternatives are possible (eg hydrogen), but today there is still too little knowledge about the possibility of its use in VOD, which, however, may change radically by 2050. Among the buses with electric drive we can also include buses with hybrid drive.

Pure electric propulsion when used in transport alone produces no emissions, has significantly lower operating costs and has a very low noise level. Of course, emissions are produced in the production of electricity itself, depending on the method of its production. The disadvantage is that it usually has

lower performance, limited range and a higher price. The most contracted arguments against electric vehicles, such as the high weight of batteries, their low capacity, their lifespan and their disposal problems, are being addressed relatively quickly and should not be a counter-argument to the 2050 vision.
An alternative to a clean electric bus can also be a hybrid drive. It is a combination of energy sources for vehicle propulsion, usually an internal combustion engine and an electric motor with batteries. The advantages of the hybrid drive are ecological operation, high range comparable to the combustion drive, low fuel consumption and the associated lower emissions and lower operating costs. The batteries are usually charged while driving by regenerative braking, but there is also the possibility of external charging.

One of the alternative fuels that can replace petrol and diesel in road transport is liquefied natural gas (LNG) and compressed natural gas (CNG). Natural gas will not help much in the transition to renewable fuels, as it is still a fossil fuel. However, it can also be produced from renewable energy sources, with the resulting product being, for example, biogas. This type of drive produces a lower volume of exhaust fumes and operating costs are lower than with a diesel drive. Due to the increase in gas prices after the introduction of a high excise tax, DPB abandoned the further development of gas buses in public transport in Bratislava.
Based on the existing knowledge, it is not possible to unequivocally recommend or exclude any of the alternative bus drives in VOD. It turns out that pure electric drive is more usable in public transport on shorter lines, where the interval allows recharging the batteries during operation. The hybrid drive can also be suitable in urban operation, where energy recovery can be used to advantage and the operation is close to a purely electric drive. Gas propulsion may be more advantageous in suburban bus service on longer lines with higher mileage during the day, when it is necessary to ensure a longer bus journey.

The development of electromobility is closely linked to the development of support infrastructure. Following the concepts of fleet renewal, it is necessary to develop a program for the construction of charging stations for VOD buses and the completion of public charging stations for passenger cars. For charging stations, it is necessary to set aside the necessary places in all larger car parks, but also in garages, public lighting poles, etc. Part of the program to complete the charging stations should include a map of their location to ensure that they are evenly distributed throughout the area.

Technological development makes it possible to consciously plan the use of emission-free and low-emission vehicles in IAD. The EU expects the share of cars of this type to be around 50% by 2030. The Government of the Slovak Republic also supports this trend by providing financial support for the purchase of new vehicles.
CNG, LNG and LPG vehicles will be taken into account to the extent determined by EU regulations. Today, it can be stated that vehicles with the above-mentioned propulsion are not preferred in terms of general regulations.

Around 325,000 passenger cars are expected in the BOD in 2030, of which, according to the EU's intentions, up to 160,000 passenger vehicles should be emission-free or low-emission.

The development of electromobility will also require investment costs in the distribution network of charging stations, which in turn will have a serious and wide impact on the network of electrical distribution in urban and also (especially) extra-urban charging stations. The authors of RPUM are of the opinion that the trend of today's significantly overestimated and supported electromobility will

have to be adjusted in the near future also in view of the already known difficulties with the operation of e-cars and especially with the construction of sufficient capacity infrastructure.

There are currently a total of 113 filling stations in BSK, the occurrence of charging stations at filling stations is minimal, charging stations are implemented without an overall concept in various locations (eg shopping centers, selected parking lots in city centers). Classic filling stations in BSK have the following location and their number and location for the needs of BSK is sufficient:

- district Bratislava I. 3 pcs
- district Bratislava II. 36 pcs
- district Bratislava III. 18 pcs
- district Bratislava IV. 14 pcs
- district Bratislava V. 18 pcs
- district of Malacky 12 pcs
- district Pezinok 14 pcs
- district Senec 16 pcs

Intentions for the development of electromobility will require the implementation of at least 100 charging E-stations in the BOD by 2030, because with 50% representation of electric vehicles in the IAD fleet, it is also necessary to take into account a significantly longer charging time than the pumping time of conventional liquid fuels. In this context, new advances in technological equipment serving E-mobility can also be expected.
Users: public

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport

Task holders:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- Ministry of Transport and Construction of the Slovak Republic

Dates of realization of investment costs :

- Build at least 40 charging E-stations by 2025, build another 60 charging E-stations by 2030. The price of the charging E-station for two cars is from 5000 EUR,

Impact on the Spatial Plan

- The measure does not affect the zoning plan

In connection with this Article, as well as Article 8.2, the Contractor presents a summary of the materials of the Ministry of Economy of the Slovak Republic "Draft National Policy Framework for the Development of the Market for Alternative Fuels."
From 2020, car manufacturers must achieve average CO2 emissions of 95 g / km (down from 130 g / km). In Slovakia, the average emission value of a new passenger car in 2017 was up to 126.1 g / km.
CNG consumption decreased year-on-year in that period. In 2016, CNG consumption decreased by 9.6%, in 2017 by 2.8% and in 2018 it decreased by 15.8%. On the contrary, consumption of diesel and petrol increased year-on-year. In 2016, diesel increased by 6.7% and petrol by 3.3%, in 2017 diesel increased by 4.4% and petrol by 1.3%, and in 2018 diesel increased by 4.1% and petrol by 1, 2%. In 2016 and 2017, there was a year-on-year increase of 12.1% and 10.5%, respectively, in LPG consumption. In 2018, this type of fuel showed a slight year-on-year decrease of 0.8%.

On 27 March 2019, the European Parliament adopted a legislative resolution on the proposal for a regulation of the European Parliament and of the Council[1]setting emission standards for new passenger cars and new light commercial vehicles as part of the Union's integrated approach to reduce CO2 emissions, which set a reduction target of 37.5% for passenger cars and 31% for light commercial vehicles for 2030 vehicles compared to 2021. The European Parliament also adopted a resolution on the proposal for a regulation of the European Parliament and of the Council on 18 April 2019[2]setting CO2 emission standards for new heavy duty vehicles, according to which the specific emissions of CO2 of new heavy duty vehicles will be reduced by 15% compared to the reference CO2 emissions from 2025 and by 20% from 2030 and later.
The development of the market for alternative propulsion vehicles recorded only a slight increase between 2016 and 2008. In 2018, alternative propulsion vehicles had a share of 2.30%, while in 2016 this group of vehicles accounted for 2.16%. The sector of battery and plug-in hybrid electric vehicles was the most dynamic.

The development of the market with alternative vehicles so far has significantly influenced the first project of direct support for the purchase of vehicles with alternative propulsion - "Nationwide support of the Ministry of Economy processes in their subsequent processing '. The project provided contributions for the purchase and registration of M1 and N1 category vehicles of the BEV type (battery electric vehicle) in the amount of EUR 5,000 or for PHEV vehicles with a battery rechargeable via an external power source (plug-in hybrid electric vehicle) in the amount of EUR 3,000 .

The market for electric vehicles has started to develop, even under the influence of the project and related activities. While the market for electric vehicles (BEV + PHEV) was at the level of 643 vehicles in 2015 and similarly in 2016 it represented 926 vehicles, in 2017 it was already 1,587 registrations of new electric vehicles. As of 31 December 2018, the number of registered electric vehicles reached the level of 2,109 vehicles.

In 2018, a total of 277 new CNG-powered vehicles in various categories were registered in the Slovak Republic. This represents a year-on-year increase of 121.6% in new registrations. As of 31 December 2018, a total of 2,469 CNG-powered vehicles in various categories were registered in the Slovak Republic, which, however, represents only 0.077% of the total number of registered vehicles.

15.10.1 LPG vehicles and other alternative carbon - based fuels

LPG has built a relatively extensive network of filling stations for the real needs of motor vehicle operators, which covers the entire territory of the Slovak Republic. The offer of passenger cars with modified LPG engine drive directly from the manufacturer does not currently represent such a broad portfolio as in the past, and car companies are no longer adding new models to their portfolio. The infrastructure in the area of LPG filling stations is constantly expanding and parallel development with the development of filling stations for conventional fuels is expected.

15.10.2 Hydrogen powered vehicles

The NRP did not anticipate the registration of electric fuel cell vehicles (FCEV) in the Slovak Republic in the coming years (until 2020). The number of registered FCEVs as of 31 December 2018 in the Slovak Republic was zero.

[1]) Source: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+TA+P8-TA-2019-0304+0+DOC+PDF+V0// SK.
[2]) Source: http://www.europarl.europa.eu/doceo/document/TA-8-2019-0426_EN.html#title1.

15.10.3 Hydrogen filling station

The NRP did not envisage the registration of electric vehicles with fuel cells by 2020, nor the construction of hydrogen filling stations (VPS).
The number of filling stations as of 31 December 2018, as well as vehicles, was zero in Slovakia.
At the end of 2018, the Slovak Republic joined the international hydrogen initiative, the aim of which is to maximize the potential of hydrogen produced from renewable sources. The development of hydrogen infrastructure will be important for ensuring the international passability of the Slovak Republic for the FCEV. In order to meet the above objectives, it will be important to ensure the availability of cheap renewable (green) hydrogen, or blue hydrogen produced from fossil sources with CO2 capture, or its further use in the production of other products.

Evaluation of the measure

At present, it is not possible to determine specific numbers of vehicles or their composition. The measure envisages the gradual purchase of vehicles as part of the natural renewal of the vehicle fleet. It monitors the reduction of the carbon footprint,increased overall mobility, increased health benefits.
Users: inhabitants, passengers, carriers

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport
- Increased security

Indicators:

- the share of buses in public passenger transport using alternative propulsion systems will increase from the current 22.7% in DPB to 100% and in Slovak Lines from the current 0% to 100%.

Task holders:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- VOD carriers

Dates of implementation:

- to r. 2025 Develop a conceptdevelopment of public passenger transport based on alternative drives, the concept of vehicle fleet exchange for companies and organizations managed by local governments, the program of building charging stations for VOD buses and the completion of public charging stations for personal electric cars
- to r. 2025 When renewing the vehicle fleet, procure min. 50% of alternative buses. At the same time, build the infrastructure of charging stations for alternative drives
- to r. 2030 Continue with the renewal of the vehicle fleet in the procurement of min. 80% of alternative buses
- to r. 2040 Continue the renewal of the vehicle fleet by procuring 90% of buses with alternative propulsion
- to r. 2050 Decommission the last internal combustion buses and ensure full fleet renewal with alternative propulsion vehicles

Impact on the Spatial Plan

- The measure has an impact on the zoning plan, especially in the need to build charging stations

15.11 FROMinfrastructure

Green infrastructure has become one of the European Union's major policies, which is being pursued in a number of areas - from protecting biodiversity to climate change, protecting water resources, preventing floods and, in particular, planning the urban environment. Green infrastructure

is one of the main preconditions for the sustainable development of a resilient urban environment and its function can be peacefully included to support sustainable and safe transport.

It is widely acknowledged that the negative impact of transport on the environment needs to be reduced. As current trends continue, greenhouse gas emissions from transport will increase. The negative effects of transport on the environment, such as exhaust fumes, noise and dust, are only one aspect of the problem.Transport structures generally form barriers in an urban environment that prevent the free transverse movement not only of humans but also of many animals. At the same time, their natural migration routes are often disrupted. Impermeable solid materials and surfaces are used as standard when building roads and traffic areas. These have, in addition to indisputable advantages, such as better grip when moving vehicles, skid resistance and the like. as well as several demonstrable disadvantages. In particular, impermeable surfaces such as asphalt and concrete represent a horizontal barrier on the surface, which prevents the infiltration of rain, resp. surface water into the soil. During heavy rainfall, rainwater accumulates on impermeable surfaces, increases the speed of its movement and creates a risk of floods.

There are currently a number of green infrastructure measures that can reduce the negative environmental impact of transport structures. In line transport constructions, they are mainly greenecobridges and ecoducts. Passages under communication structures, which primarily serve to carry constant or occasional water, can be used to allow the animals to move.It is also suitable to build a so-called frogs, which is actually a network of tunnels under the road and at the same time the construction of concrete walls along the asphalt road.The function of safe corridors for migrating larger game is performed by the so-called ecobridges over highways. Such a bridgehas been built since 2018 over the D2 motorway near Moravian St. John, the so-called Záhorácky green bridge.The bridge is 80 m wide and was built in order to preserve the migration route for game within the Alpine-Carpathian corridor.

Vegetation center dividing strips and planting trees for public spaces, street alleys, parking lots, landscaped areas, etc. belongs to the basic green adaptation measures. For planting in car parks, it is necessary to apply and comply with STN 736110, which specifies one tree for every 4 parking spaces.

The change of road surfaces and paved surfaces in publicly accessible areas to bright, resp. reflective surfaces. Vegetation middle dividing strips, planting trees for public spaces, street alleys, parking lots, landscaped areas, etc. belongs to the basic green adaptation measures.

A picture 15-11 Parking lot in Bratislava from concrete vegetation blocks (Source: Z. Hudecová

In the construction and modernization of tram lines, an effort is being made to integrate track lines in urban agglomerations into areas of urban greenery to improve the environment and the urban microclimate. In the Slovak Republic, the first grassy section of the tram was set up in Bratislava on Záhradnická Street in August 2009 with a total length of 473 m. Operational experience in this section has confirmed the assumption that the grassy track is perceived by the population and passengers more kindly both in terms of aesthetics, urban climate, and in terms of reducing noise and vibration in the outdoor urban area and the interior of vehicles. At present, the reconstruction and modernization of the tram line in Karlova Ves is being carried out with a track with a vegetation layer with dry-loving plants. It is desirable

A picture 15-12 Grassed tram line in Bratislava on Záhradnícka street (Source: Bratislava courier)

The impermeable surface of less congested roads and car parks can be solved by a permeable surface, e.g. grass paving, blocks or panels.The main advantage of grass paving is that when covering the same area, the surface permeability is significantly higher.

The use of grass paving to create moving and parking areas is a method that requires year-round professional care. In the case of using vegetation blocks for sidewalks or bicycle paths, movement on them is less comfortable compared to classic paved surfaces.

There are several ways to deal with rainwater infiltration from the road infrastructure. These can be surface or underground infiltration devices, or retention infiltration rain tanks. The conditions for their design, dimensioning and operation are solved by the Technical Conditions of TP 122/2019 Management of Rainwater Drained from Roads and Car Parks. It is necessary to proceed in accordance with the catalog of adaptation measures.

In Park and Ride car park designs, it is desirable to use surface solutions in a way that allows water to be trapped and soaked into the soil.

A picture 15-13 Drainage of the car park into the infiltration pit with greenery (Source: Processor)

15.12 Removal of visual smog

The term visual smog is a technical term for the infestation of public space by aggressive, tasteless, unadapted and inappropriate size of its surroundings, often placed illegally, without any permission (sometimes in protected areas or directly on free-standing buildings). In connection with transport, we understand visual smog as outdoor advertising. It is mainly represented by billboards, backlights (billboard format, but all backlit), citylights (backlit advertising spaces at public transport stops), megaboards, bigboards, advertising on VOD vehicles, posters in VOD vehicles). Unlike

television, radio, magazine or the Internet - outdoor advertising cannot be turned off, dimmed or delayed. The outdoor campaign therefore operates regardless of the will of the recipient and it does so continuously.

Outdoor advertising, in addition to its positive or negative aesthetic effect, also affects road safety by being in the driver's field of vision at all times, and the driver must perceive it, even if only subconsciously. No research is currently being carried out in Slovakia on the impact of outdoor advertising on traffic safety and traffic accidents. The traffic police only report the number of accidents to a fixed obstacle, which was an advertising banner. However, it does not examine whether the cause of the traffic accident was an advertising banner or not.

Pursuant to the Act of the National Council of the Slovak Republic no. 50/1976 Coll. on Spatial Planning and Building Regulations An advertising building is a building structure whose function is to disseminate advertising, promotional, navigation and other information visible from public spaces. In this regard, the U.S. definition is more precise: “An advertising device is any outdoor board, display, device, notice, number message, image, banner, poster, billboard, or other thing that has been designed and is intended or used to advertise or inform any advertising or information content that is visible from anywhere on the road or from any part of the highway ”(Highway Safety Research Center, University of North Carolina, USA).

If billboards and various banners are also placed between the traffic signs, the driver often has a phenomenon of negative contrast. This means that if different banners and traffic signs of different color and size are placed behind each other, those that are less pronounced disappear. The ones that are more pronounced, ie advertising banners, are automatically injected into the attention and consciousness. In the event of a collision behind or in close proximity to such a billboard, the driver often does not even realize that it was the advertisement which distracted him from driving, nor do the law enforcement authorities provide for such a possibility. The blame falls simply on the human factor, the driver's inattention, the vehicle's inadequate speed adjustment
conditions, etc.

A picture 15-14 Dazzling the space with backlight and suppressing the visibility of traffic signs at the Trnava toll in Bratislava (Source: Processor)

A specific problem is advertising on VOD vehicles. In addition to distracting other road users, it seems inappropriate. DPB resigned from the historic color image of red and cream vehicles, which he exchanged for black. However, on several vehicles, there is advertising on the entire surface of the vehicle, which makes it difficult for passengers to orient themselves. Glasses on the vehicle glued with advertising make it difficult to see from the vehicle and also make it difficult for passengers to orient themselves. The VOD vehicle should not have any advertising on the front and rear face and on the windows of the vehicle.

In 2003, the City Hall of the Capital City of the Slovak Republic, Bratislava, developed the "Principles for the Placement of Advertising, Information and Promotional Facilities on the Territory of the Capital City of the Slovak Republic, Bratislava". These were discussed and agreed by all city districts, but there was no political will to approve them. In 2016, the Capital City prepared a Concept for the Placement and Assessment of Outdoor Advertising, which is still not approved. The concept includes the territory of the city of Bratislava, consisting of districts, city districts and cadastral areas, and also contains city-wide principles for the placement of advertising structures.

The current state of advertising constructions is very unfavorable. Advertisements limit drivers' attention, reduce the legibility of road signs and have a negative impact on road safety. Ads placed on sidewalks reduce traffic and restrict pedestrians. Previous efforts to regulate advertising structures

A picture 15-15 Public transport vehicle completely glued with advertising (Source: Processor)

have not led to the desired results. It is therefore necessary to prepare a special law on advertising constructions in the near future, which will determine the conditions for placement of advertising constructions, obligations of their owners and the method of their removal, enable municipalities to issue generally binding regulations governing relations with advertising constructions and especially strengthen the competencies of state administration and self-government bodies. proceedings on advertising constructions. Simultaneously with the law, it is necessary to issue an implementing decree, which precisely sets the rules for the placement of advertising structures.

Evaluation of the measure

The purpose of the measure is to increase road safety and improve the quality of public spaces.
Users: residents, visitors, passengers and road users

Strategic goals:

- Increased security

Task holders:

Initiative for the elaboration of a bill and an implementing decree:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- Ministry of Transport and Construction of the Slovak Republic
- Ministry of the Interior of the SR
- National Council of the Slovak Republic
- Carriers in public transport, PAD and PŽD

Dates of implementation and investment costs

Preparation, discussion and approval of the law on visual smog by 2025.
By 2030, the removal of advertising structures on highways and 1st class roads. Remove ads from VOD vehicles.
By 2035, the removal of advertising structures on the roads II. and III. classes.
There are no investment costs, as the removal should be at the expense of the builders.

15.13 Detours

In its Annual Report for 2018, Dopravný podnik Bratislava, as states: “In addition to contractual services, DPB, as provided unplanned changes in the organization of transport and extraordinary changes in the organization of transport in the provision of sports and cultural events in the capital. In 2018, 121 km of roads were repaired in the city, which required a number of changes in the direction of the lines. ”In the annual report, Slovak Lines, as does not state any services other than those planned and contracted with BSK.

Unplanned changes in the organization of VOD have different durations and also different demands on the range of required performance. They can take several hours, such as sports, cultural, social events, but during construction interventions can take months with a large number of detours.

VOD within the BSK is provided by self-governing bodies of the region through the carriers Slovak Lines, as (PAD) and DPB, as (MHD). PAD in the region is provided by BSK, public transport in Bratislava, the Capital of the Slovak Republic, Bratislava and Železničná transport is provided by the

state through the company ZSSK, as and RegioJet, as All these companies manage subsidies or payment for services in the public interest, which accounts for a substantial part of their revenues (DPB 56%, Slovak Lines 61%). The infrastructure manager shall not bear planned or unplanned interventions in the communications network and shall be discriminatory if the carrier has to pay for the costs of public passenger detours from subsidies of the contracting authority. It should be in the competence of the contracting authority of public passenger transport, whether the reason for the induced detour is in the public interest and the applicant for the detour will not be charged compensation for increased costs of VOD.

DPB, as had planned extraordinary reinforcements and detours for planned events in 2019 in the amount of 69 thousand vehicles, and for unplanned events that will occur during the year and will be approved by the city council for another 100 thousand vehicles. In addition, these services cost the city of Bratislava and DPB, as more than € 495,000. We can reasonably assume that DPB, as will spend another € 100,000 on all smaller detours during the year. The largest investment project in Bratislava, the Mlynské Nivy complex, which lasts throughout 2018 and 2019, required an additional output of 226,000 vehicle-km / year, which represents a cost of more than € 392,000 / year. In total, therefore, only DPB, as spent approximately € 987,000 on detour costs in 2019.

The costs incurred by carriers for unplanned and non-ordered services in the public interest are not negligible. If we take into account the costs of Slovak Lines, as in the amount of approx. 2.0 € / vehicle and the costs of DPB, as 2.93 € / vehicle, assuming the extent of detours in Bratislava to the same extent and in the rest of the region in the range of about 20% in Bratislava, then the additional costs of the performance of VOD carriers due to detours represent approx. 1.12 mil. € / year.

Self-governing regions and municipalities finance their activities, among other things, from their own revenues (Act No. 302/2001 Coll. On self-governing regions, Act No. 369/1990 Coll. On municipal establishment). Fees are also a possible form of financing. Thus, these laws would allow municipalities and regions to collect fees for VOD detours in the amount of their additional operating costs. However, Act No. 135/1969 Coll. - the Road Act, which in § 7 par. Article 1 provides that "users of a motorway, road or local road shall not be entitled to reimbursement of any higher costs incurred as a result of the closure, detour or diversion". In this way, VOD discriminates against applicants for closure, whose interests take precedence over the public interest of VOD.

A picture 15-16 VOD bypasses at the closure of Mlynské Nív (Source: DPB, as)

Evaluation of the measure

The measure seeks to eliminate discrimination against VOD against detour applicants by removing the obligation to bear the increased costs of VOD operation, reducing public subsidies for public transport contractors and contributing to increasing the financial sustainability of transport and, last but not least, by improving the quality of public spaces by forcing detour applicants. organize their activities more effectively. At the same time, this will reduce the consequences of increased emissions and noise on roads that are not primarily intended for increased traffic.

Users: inhabitants, passengers, carriers

Strategic goals:

- Increasing financial sustainability

Task holders:

Initiation, elaboration and submission of a proposal for legislative changes for approval:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- Municipalities

- Carriers in BSK

Implementation of the measure:

- Municipalities of BSK and Bratislava

Dates of implementation and investment costs:

- to r. 2025 approval of legislative changes
- from r. 2030 collection of fees for detours
- the measure will not require any investment costs

Impact on the Spatial Plan

- The measure does not affect the zoning plan

15.14 Determining conditions and creating a market environment

The aim of the market environment is to create transparent conditions and minimize the risks in accessing the transport market and transport infrastructure and to ensure the ever-growing transport needs of the company in the required time, quality while reducing the negative effects of transport on the environment. The purpose is to ensure sustainable development / economic development, social solidarity and environmental acceptability /.

A fundamental aspect of the market environment is the creation of transparent and harmonized conditions of competition in the transport market for all participants.

Transport as such affects all areas of life and serves society as a whole. It is governed by the principles of a market economy. Market liberalization requires a functioning regulatory framework by which local government promotes societal interests.

The environment creating the relationship between the customer and carriers has the task of reflecting development trends in transport and setting conditions for transport service providers. This process must be carried out in accordance with applicable legislation with reference to the socio-economic conditions governing its implementation. From the societal point of view, VOD has the character of a public service satisfying the transport needs of the population. Funds from the BOD budget express a degree of interest in the preservation and development of transport due to the need for sustainable development as an alternative to the ever-increasing IAD.

The efficient use of funds from the BOD budget and the introduction of more attractive services for a wider range of carriers should ensure a higher competitive environment between providers of transport services and the optimization of the volume of services in the public interest.

Transport services in BSK provide for the transport needs of the population (travel for work, education, medical facilities, offices and public institutions, etc.). Transport services do not primarily belong to the basic rights of Slovak citizens, but indirectly support the fulfillment of rights related to mobility (the right to work, education, health care, etc.), which significantly affects the quality of life of BSK residents.

15.15 Carsharing

Shared mobility is in line with the societal trends of the world's cities and represents a natural development of the transport system. Carsharing is the sharing of cars by several people who, due to their low frequency of use, would not pay to own and operate a car themselves. It can take the form of an official or informal association of people who are then co-owners of cars, but also a business form, ie as a service of public car rentals.

The Carsharing service enables the operation of the vehicle fleet via a mobile application without the need to physically hand over the keys to the vehicle. It is a cloud solution, so access to data is possible from PCs and mobile applications. The mobile unit in the vehicle provides communication via Bluetooth and LTE network and contains one of the keys for the vehicle.Unlocking the car usually requires only a smartphone, or. electronic card.

Companies that share their vehicle fleet with the public are gradually being established in Slovakia in order to provide people with quick access to a car at a reasonable price, while at the same time facilitating transport in large cities.
The Bratislava region lags far behind in this and the ambition of the region must be closer to a similar level as world capitals. In Bratislava, there is an Up & go service, which operates 7 electric cars and Carrivederci, both on a private basis. Increasecarsharing leads to a reduction of negative impacts on the environment and also to an increase in the quality of life in the city. Residents of the city of Bratislava, the region, as well as visitors can take advantage of the shared economy in the form of passenger cars. Promoting carsharing will reduce dependence on buying your own car, which will lead to a reduction in the total number of cars.
This measure can only be seen as complementary, but may prove important for the functioning of the transport system.
Users: public

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport

Task holders:

- The capital of the Slovak Republic, Bratislava, through PPP
- Bratislava self-governing region through PPP
- Ministry of Transport and Construction of the Slovak Republic through PPP

Dates of implementation:

- Until 2025 - Elaboration of a document supporting carsharing and possible changes in legislation supporting carsharing

Investment costs:

- costs for elaboration of document and legislative proposals approx. € 25,000

Impact on the Spatial Plan

- The measure does not affect the zoning plan

15.16 Bicycles in public transport

15.16.1 Transport of bicycles

At present, the number of people who prefer to transport bicycles is already growing in our country. However, if it is necessary to travel longer distances, this option becomes less feasible. It offers a good opportunity to combine cycling with public transport.

Binding documents (National Strategy for the Development of Cycling and Cycling in the Slovak Republic, Program of Economic and Social Development of the Capital of the Slovak Republic, Bratislava 2010-2020), valid for the programming period ending in 2020, state support for bicycle integration through specific measures, including creating conditions for the convenient transport of bicycles by public passenger transport.

Nevertheless, carriers offer the transport of bicycles mainly for recreational purposes. This also implies the offer that carriers make to cyclists. The transport company Bratislava, as offers in the summer seasonin Bratislava, buses with bicycle carriers on lines number 29 and 65 during the recreational transport period, ie from May to October. Slovak Lines has on offerMalokarpatský expres, which runs every Saturday, Sunday and during public holidays until the end of September on the route Bratislava - Budmerice via Svätý Jur, Pezinok, Modra, Zochova chata and Červený Kameň. The bus is accompanied by a tourist guide. During the summer season in Záhorie there is a cycle train on the route Záhorská Ves - Zohor - Plavecké Podhradie.

A picture 15-17 Bicycles on a carrier at the back of a bus in Bratislava (Source: www.imhd.sk)

In terms of requirements to reduce the share of IAD in total transport work and increase the share of non-motorized traffic, integrating cyclists into public passenger transport throughout the network is one of the most important ways to achieve this. It is not possible to achieve this goal with the mentioned offers of carriers, it is necessary to ensure that the transport of bicycles is possible during the entire operating time of the carrier with departure and embarkation at any stop.

Within IDS BK, the conditions for transporting bicycles are not uniform. Transportation of bicycles in public transport vehicles in Bratislava is possible on weekdays only from 09:00 to 13:00 and from 18:00 to 06:00 and on Saturdays, Sundays and holidays without a time limit. Transport is only possible with the driver's knowledge. The driver has the option of refusing to transport a bicycle if the operating conditions in the vehicle do not allow such transport. A passenger with a bicycle is not entitled to priority transport. An import fee must be paid for the transport of the bicycle. Transporting a bicycle in the passenger compartment is not suitable, the bicycle may move while riding and annoy other passengers.

Transport of bicycles in Slovak Lines regional buses is possible only during free days and only in the connections marked in the timetables with the bicycle pictogram. Transport is only possible with the driver's knowledge. As in public transport in Bratislava, the driver has the option of refusing to transport a bicycle if the operating conditions in the vehicle do not allow such transport. A maximum of two bicycles can be transported in one vehicle.

The Slovak railway company offers the possibility of transporting bicycles in almost all trains in Slovakia. Trains in which the transport of bicycles is excluded are marked with the corresponding crossed-out wheel pictogram. The transport of bicycles in trains is divided into simplified transport of bicycles and transport of bicycles in a mobile luggage storage room (luggage wagon). For simplified transport, you travel with your bicycle in the reserved area of the first or last wagon, or in the area in the wagon marked with the bicycle symbol. In this case, you are responsible for the luggage yourself. The second variant, the transport of bicycles in a mobile luggage storage room (especially in long-distance trains), takes place only on trains marked with a suitcase pictogram in the timetable.

One of the serious obstacles to increasing the transport work of bicycle traffic during the normal commuting of citizens is the provisions of traffic regulations on the limited transport of bicycles outside rush hour traffic. The predominant part of the traffic performance during the daily commuting of cyclists takes place during rush hour and precisely because of the impossibility of transporting passengers with bicycles from home to work and back (which takes place during rush hour) this transport is impossible for a normal commuter passenger with a bicycle. For cyclists who want to use a bicycle for part of their journey, it is important that public transport is available throughout the opening hours. Making the "first and last" kilometer of the journey on one's own bicycle and transporting the bicycle anywhere is of particular importance to the cyclist. After all, every bike ride can potentially be a car ride. The transport of bicycles during the entire transport time of public passenger transport, at least on the basic public transport network and in hilly areas, belongs to the very essence of multimodality of transport. Restricting transport, either in terms of time (it is not possible to use a bicycle for transport to and from work), the type of bicycle (it is not always possible to use or own another type of bicycle) is a fundamental intervention in the functional model of sustainable transport. Public passenger transport is important for all passengers, discrimination against one or more types of passengers only because of the technical unpreparedness of carriers is unacceptable and very restrictive in terms of the usability of public transport. It is therefore important that the transport of bicycles is possible during the whole operating time of the carrier with departure and embarkation at any stop.

Although current legislation does not allow this, it is a very good solution to equip vehicles with bicycle carriers located on the front bumper. Storing the bicycle is very simple and is done by the cyclist only under the supervision of the driver. The loading and unloading of the bicycle is handled by the passenger without the need for driver assistance in a time interval not exceeding the normal length of parking of the vehicle at the stop. The advantage is that the bicycle is under the supervision of the driver and the cyclist himself while riding. When using this type of carrier, the driver has a direct view of the loading and unloading of the bicycle, which increases the speed and safety of transport, at the same time the passenger has an overview of the fullness of the carrier directly from the stop, as well as direct eye contact with the driver. Carriers abroad use carriers for two or three bicycles.

A picture 15-18 Folded bicycle carrier on the front bumper of the bus (Source: http://www.ridesmartsolutions.com)

For carriers operating in the BSK area, it is proposed as a target solution to gradually equip all buses and trolleybuses with bicycle carriers on the front bumper. In the first stage, by 2025, when purchasing new vehicles, provide manufacturers with a bicycle carrier as mandatory equipment. At the same time, prepare a technical solution for equipping existing vehicles with bicycle carriers.

Evaluation of the measure

The subject of the measure is to strengthen bicycle transport, to increase its share in the total transport work

Users: cyclists

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport
- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- initiative to amend the technical license of vehicles with bicycle carriers on the front bumper - Dopravný podnik Bratislava, as carriers in PAD in cooperation with PZ SR.
- inclusion of bicycle carriers in the competition conditions for the purchase of new vehicles - Dopravný podnik Bratislava, as carrier PAD in the territory of BSK
- equipping old vehicles with bicycle carriers - Dopravný podnik Bratislava, as transporter PAD on the territory of BSK

Dates of implementation and investment costs:

Initiate the necessary legislative changes by 2025 to enable the implementation of this measure.

15.17 Bikesharing

Public bicycles(bikesharing) is a service that provides bicycle rental to persons who do not own them, or does not have access to their own bicycle at a given moment. The main idea is to provide these bicycles for free or at an affordable price for short journeys in urban areas as an alternative to public or individual transport and thus reduce traffic congestion, noise and air pollution. Bicycle sharing is basically lending bicycles to customers who need to use them for a specific purpose and time period, but do not need to own them. The location of docking stations near transport hubs allows users to combine cycling and public transport. For this reason, bicycle sharing systems play a role in the "last mile or kilometer" of a journey.

In Bratislava, the Bratislava City Hall decided to cooperate with a private investor, and on September 7, 2018, a bikesharing service was introduced under the Slovnaft Bike brand. The service is commercial and places minimal demands on the local government budget.There are currently 78 docking stations in Bratislava. In four parts of the city - Petržalka, Staré Mesto, Ružinov, Nové Mesto, there are 400 - 500 bicycles in the streets at the same time. Bikesharing is not operated in districts outside Bratislava. The docking stations are within 500 m of each other. The average distance per rental is around 2 km and lasts approx. 10 - 15 minutes. From the launch of the system until 31 September 2019, more than 400,000 borrowings took place, which represents an average of more than 30,000 km. The daily mileage of bicycles depends on the number of rentals. There are 700 to 1,500 rentals per day, depending on whether it is a weekend or a weekday, and depending on the weather. The operator plans to expand the service to all parts of Bratislava, or to adjacent municipalities. Introduction of bikesharing service in Malacky districts,

It is important that the information is interconnected and that ŽSR stations are equipped with docking stations for shared bicycles and information on the possibility of using bikesharing. Also catchment parking lots in the form of Park and Ride as well as PAD and public transport stops.

Bikesharing can help solve some of the problems and obstacles to cycling by offering several advantages over private bicycles:

- Bicycle sharing makes it easier to intermodal with public transport
- Bicycle sharing provides an energy-efficient mode of transport even for transport routes not allowed for other modes of transport (eg motorized)
- Bicycle sharing avoids the inconveniences associated with bicycle ownership, such as e.g. maintenance and vandalism
- Bicycle sharing provides a convenient mode of transport for tourism
- Bicycle sharing provides bicycles for unexpected cycling trips

Municipalities that are considering the introduction of a bikesharing service and are looking for an investor and operator should take into account the factors that determine the success of the service. These are in particular:

- The potential of using public bicycles resulting from the size of the seat, the number of inhabitants - potential users
- Topography - Hilly topography can discourage potential customers from using bikesharing, especially those who do not own a bicycle and are not physically fit enough for effort, and can in turn motivate them to use a bicycle on a one-way "downhill" route.
- Climatic conditions, especially winter conditions
- Price for the service, the possibility of short-term rent, full-time rent, or rent for a longer period
- The level of technology of docking stations and bicycles, enabling the rental of bicycles at any time of the day
- Availability of the service during the year

- Possibility of integration with public passenger transport - technical, tariff
- Existence of quality cycling infrastructure - motivates to use bikesharing, especially not everyday cyclists who need a greater sense of safety
- Tourism - the potential of visitors to the residence and the possibility of using bikesharing to visit important places in the residence
- Vandalism - fears of damage or theft of your own bike may motivate you to use a public bike

Evaluation of the measure

The measure follows increasing mobility, reducing congestion, increasing the use of public transport and alternative modes of transport, increasing health benefits, integrating cycling into transport systems to make it easier to become everyday.
Users: inhabitants, passengers.

Strategic goals:

- Improving air quality, reducing the carbon footprint (mitigating the negative impact of transport on the climate situation) and increasing the spatial efficiency of transport
- Increasing the efficiency, reliability and accessibility of public transport

Task holders:

- The capital of the Slovak Republic, Bratislava
- Bratislava self-governing region
- Municipalities
- Carriers and private investors

Dates of implementation and investment costs:

- to r. 2025 expansion of bikesharing to the whole territory of the city of Bratislava and Malaciek
- from r. 2030 expansion of bikesharing to the territories of the districts of Pezinok, Senec
- the measure is a commercial service, it will not require any investment costs from local governments

Impact on the Spatial Plan

- The measure does not affect the zoning plan

16 Mobility indicators

Mobility indicators provide information on the material fulfillment of the defined vision, goals and actual fulfillment of measures. They represent a tool for measuring and evaluating the fulfillment of goals, progress or achieved effects of individual time stages.

Relevant indicators, which make it possible to effectively describe and capture the observed facts, have already been defined in the introduction of this document in Chapter 3. Definition of the main objectives. In order to monitor the expected impacts of the Regional Plan for Sustainable Mobility of the Bratislava Region on mobility in the area of interest, indicators describing the most important characteristics of the transport system were selected. It will also be possible to retrospectively evaluate the success of the Regional Sustainable Mobility Plan in relation to meeting the indicated values.

These indicators, which can be used to assess the success of the mobility plan in the evaluation plan, are set out below:

Indicators of transport-operational and transport-technical character:

- Increasing the average cruising speed VOD
- Reducing the length of communications with QSV grade D -F
- Increasing the number of transported VOD passengers
- Length of new or modernized roads in the region
- Length / number of newly built bypasses
- Transport performance of public passenger transport (VOD) - [person-km]
- Transport capacity VOD - [vehicle, vlkm]
- Increase in the share of public transport in the division of transport work - [%]
- Increase in transported passengers in electric traction - [person]
- Length of the cycle path network - [km]
- Increasing the share of public, pedestrian and bicycle transport in the division of transport work [%]
- Increasing the number of passengers in electric traction
- Increasing the average occupancy of vehicles
- Increasing the capacity of the P + R system (B + R)

Indicators of traffic safety character:

- Reduction of the total number of traffic accidents registered by the Police
- Reducing the number of people killed and seriously injured in road accidents
- Reducing the number of people injured in traffic accidents
- Reducing the number of injured and killed pedestrians

Indicators of transport-environmental and socio-environmental nature:

- Reduction of specific greenhouse gas emissions (CO_2) from transport
- Reducing the number of residents permanently in areas where night noise exceeds 50 dB
- Reduction of NO emissions$_x$ from car transport
- Increasing the share of hybrid buses / electric buses in public transport
- Increasing the share of hybrid buses / electric buses in PAD
- Increasing the share of low-floor connections in public transport
- Increasing the share of low-floor joints in PAD
- Increasing the share of low-floor connections in PŽD
- Increasing the share of barrier-free stations and PŽD train stops

At this stage, however, the mobility plan cannot describe all defined indicators, resp. at this stage, the values are not comparable for all indicators. These will only be available after the application of the mobility plan and after a period in which sufficient relevant data and data can be collected. The following table therefore documents only those indicators that are comparable at this stage and it is possible to determine relevant values for the current situation (2018) - the base year of the RPUM BSK project and also the transport model, basic development ("zero variant").) - the situation when the transport offer (transport network) includes all existing constructions (as of 2018) and, in addition, includes only those constructions that were under construction in 2018 (respectively their implementation will start by 2020 at the latest). Outlook state ("maximalist variant") - development of the transport system and transport network according to this document PUM BSK (all proposed measures). This table therefore provides an overview of individual indicators, which clearly compare the individual states and thus express the impact and success of the proposed measures of this Plan for Sustainable Mobility of the BOD.

Table 16-1 Indicators of BOD characteristics current state (Source: Processor)

Indicator	**Current State (2018/2019)**	**Indicator units**
Increasing the average speed of trams	17	Km / hour
Increase in average PAD speed	33.2	Km / hour
Reduction of communication length with QSV = C	209.2	Km
Reduction of communication length with QSV = D	42.7	Km
Reduction of communication length with QSV = E	17.3	Km
Increasing the number of transported passengers in IDS BK	268 390 000	Number of passengers
Length of new or modernized roads in the region	0	Km
Length / number of newly built bypasses	0	Km
Transport capacity of VOD	7,392,196,000	passenger-kilometers
Increasing the share of public transport in the division of transport work within the BOD (VOD / IAD)	30:70	%
Increasing the share of public transport in the division of transport work at the entrance to Bratislava (VOD / IAD)	28:72	%
Increase of transported passengers in electric traction	17 667 552	passenger-kilometers during a normal working day
The length of the cycle path network	150	km
Increasing the share of public, pedestrian and bicycle transport in the division of transport work	42:58	%
Increasing the share of bicycle traffic in all	3.58	%

modes of transport in BA		
Increasing the share of bicycle traffic in all modes of transport in BSK	4.48	%
Increasing the number of passengers in rail public transport (rail + tram)	82,679,000	Number of transported persons during the calendar year
Increasing the average occupancy of vehicles	1.3	Persons on an IAD vehicle
Increasing the capacity of the P + R system (B + R)	688 (124)	Parking spots
Indicator	**Current State (2018/2019)**	**Indicator units**
Reduction of the total number of traffic accidents registered by the Police	1918	Number of accidents
Reducing the number of people killed and seriously injured in road accidents	112	Number of killed and seriously injured
Reducing the number of people injured in traffic accidents	594	Number of injured
Reducing the number of injured and killed pedestrians	188	Number of pedestrians killed and injured
Reduction of specific greenhouse gas emissions (CO_2) from transport	2592	[t] value for the whole Slovakia (year 2016)
Reducing the number of residents permanently in areas where night noise exceeds 55 dB	85 700	The number of BOD residents is permanently affected by night noise from car and rail traffic
Reduction of NO emissions$_x$ from car transport	6317.5	[t] value for the whole Slovakia (year 2016)
Increasing the share of hybrid buses / electric buses or alternative propulsion vehicles in public transport	7	%
Increasing the share of hybrid buses / electric buses or alternative propulsion vehicles in the PAD	0	%
Increasing the share of low-floor connections in public transport	71.4	%
Increasing the share of low-floor joints in PAD	25.4	%
Increasing the share of low-floor connections in PŽD	68.4	%
Increasing the share of barrier-free stations and PŽD train stops	37.2	%

Indicator	Current State (2018/2019)	Year 2025	Change from the current situation	Year 2030	Change from the current situation	Year 2040	Change from the current situation	Year 2050	Change from the current situation	Indicator units
Increasing the average speed of trams	17	18	1	19	2	20	3	20	3	Km / hour
Increase in average PAD speed	33.2	35	1.8	37	3.8	40	6.8	40	6.8	Km / hour
Reduction of communication length with QSV = C	209.2	200	-9.2	200	-9.2	200	-9.2	200	-9.2	Km
Reduction of communication length with QSV = D	42.7	25	-17.7	10	-32.7	0	-42.7	0	-42.7	Km
Reduction of communication length with QSV = E	17.3	10	-7.3	5	-12.3	0	-17.3	0	-17.3	Km
Increasing the number of transported passengers in IDS BK	268	286	18	311	43	375	107	447	179	Number of passengers per year (in millions)
Length of new or modernized roads in the region	0	63	63	80	143	150	293	150	443	Km
Length / number of newly built bypasses	0	0	0	1	1	3	4	3	7	
Transport capacity of VOD	7 392	7 888	496	8 578	1 186	10 343	2 951	12 329	4 937	Passenger-kilometers (in millions)
Increasing the share of public transport in the division of transport work within the BOD (VOD / IAD)	30:70	32 68	2	35 65	5	42 58	12	50:50	20	%
Increasing the share of public transport in the division of transport work at the entrance to Bratislava (VOD / IAD)	28:72	29 71	1	32 68	4	39 61	11	48: 52	20	%
Increase of transported passengers in electric traction	17, 667	19.3	1.6	26.2	8.5	43.3	25.6	66.0	48.3	passenger-kilometers during the normal working day (in millions)
The length of the cycle path network	150	200	50	250	100	350	200	500	350	km

Increasing the share of public, pedestrian and bicycle transport in the division of transport work	42:58	45 58	3	48: 52	6	56 44	14	65 35	23	%
Increasing the share of bicycle traffic in all modes of transport in BSK	4.48	5.2	0.72	6.5	2.02	10	5.52	15	10.52	%
Indicator	**Current State (2018/2019)**	**Year 2025**	**Change from the current situatio n**	**Year 2030**	**Change from the current situatio n**	**Year 2040**	**Change from the current situatio n**	**Year 2050**	**Change from the current situatio n**	**Indicator units**
Increasing the number of passengers in rail public transport (rail + tram)	82, 679	90.4	7.7	122.7	40.0	202.5	119.8	309.3	226.6	Number of transported persons during the calendar year (in millions)
Increasing the average occupancy of vehicles	1.3	1.4	0.1	1.6	0.3	1.8	0.5	1.9	0.6	Persons on an IAD vehicle
Increasing the capacity of the P + R system (B + R)	688 (124)	1544 (532)	856 (408)	1831 (627)	1143 (503)	2006 (712)	1318 (588)	2006 (712)	1318 (588)	Parking spots
Reduction of the total number of traffic accidents registered by the Police	1918	1850	-68	1780	-138	1730	-188	1650	-268	Number of accidents
Reducing the number of people killed and seriously injured in road accidents	112	106	-6	99	-13	93	-19	87	-25	Number of killed and seriously injured
Reducing the number of people injured in traffic accidents	594	560	-34	530	-64	510	-84	480	-114	Number of injured
Reducing the number of injured and killed pedestrians	188	179	-9	171	-17	159	-29	93	-92	Number of pedestrians killed and injured
Reduction of specific greenhouse gas (CO2) emissions from transport	2592	2203	-389	1814	-778	1426	-1166	1037	-1555	[kt] value for the whole Slovakia (year 2016)

Reducing the number of residents permanently in areas where night noise exceeds 55 dB	85 700	70 000	-15 700	50 000	-35 700	45 000	-40 700	40 000	-45 700	The number of BOD residents is permanentl y affected by night noise from car and rail traffic
Reduction of NOX emissions from road transport	6317.5	5369. 9	-947.6	4422. 3	-1895.3	3476. 6	-2842.9	2527	-3790	[t] value for the whole Slovakia (year 2016)
Indicator	**Current State (2018/2019)**	**Year 2025**	**Change from the current situatio n**	**Year 2030**	**Change from the current situatio n**	**Year 2040**	**Change from the current situatio n**	**Year 2050**	**Change from the current situatio n**	**Indicator units**
Increasing the share of hybrid buses / electric buses or alternative propulsion vehicles in public transport	7	20	13	30	23	45	38	50	43	%
Increasing the share of hybrid buses / electric buses or alternative propulsion vehicles in the PAD	0	5	5	10	10	20	20	30	30	%
Increasing the share of low-floor connections in public transport	71.4	80	8.6	90	18.6	99	27.6	99	27.6	%
Increasing the share of low-floor joints in PAD	25.4	40	14.6	75	49.6	99	73.6	99	73.6	%
Increasing the share of low-floor connections in PŽD	68.4	75	6.6	85	16.6	99	30.6	99	30.6	%
Increasing the share of barrier-free stations and PŽD train stops	37.2	50	12.8	70	32.8	100	62.8	100	62.8	%

Table 16-2 Mobility indicators for BOD (Source: Processor)

17 Conclusions

17.1 General conclusions of the proposal

a) The basic strategic goal of RPUM BSK for 2050 is to change the current division of transport work, which is 70%: 30% to the detriment of public passenger transport to a balanced ratio of 50%: 50% in 2050. To ensure this goal, all proposed infrastructure, technical , technological, organizational and legislative measures. These measures are designed to be implemented gradually, over the time horizons of 2025, 2030, 3040, 2050, so as to create a steady pressure to gradually change the habits of changing mobility and to allow adequate and even spending of funds. The measures are mainly focused on the development of public passenger transport and restrictive measures for individual car transport, supported by the information and communication technology system towards a change in mobility behavior.

b) With the required division of transport work, in 2050 all modes of public transport will have to transport more than 800,000 passengers per day.

c) All measures contribute to the decarbonisation of the BOD mobility system and at the same time to the fulfillment of the goal set by the European Union and to which the Slovak Republic has committed itself, to a climate-neutral economy by 2050.

d) The RPUM BSK document respects the international obligations of the Slovak Republic in the field of transport infrastructure, when creating transport routes across the BSK borders.

e) It ensures compliance of the mobility requirements of BSK, including Bratislava, with the valid ÚPN BSK as amended and creates conditions for the creation of a synergistic effect of sustainable mobility.

f) Suburban growth in the vicinity of Bratislava, especially in the district of Senec and in the border area, where the population has increased by 30% in the last 10 years, causes significant social, transport and environmental impacts and should be one of the reasons for procuring amendments to the Bratislava Regional Plan. self-governing region as amended.

17.2 Development of rail transport

a) Priority should be given to the construction of railway infrastructure providing a significant increase in the efficiency (capacity) of railway lines, modernization of lines and electrification of hitherto non-electrified lines in the direction from the region to the capital city of Bratislava.

b) Simultaneously with the construction of railway infrastructure, it is necessary to implement high-quality transfer options from trains to public transport in Bratislava in the form of TIOPs with emphasis on minimizing and barrier-free transfer distances and equipping TIOPs with transport and commercial services for passengers.

c) The proposal envisages the construction of such facilities to facilitate and in particular speed up the transfer possibilities for passengers between rail, bus VOD, public transport and IAD at all railway stations and stops in BSK

d) It is especially needed in cooperation with ŽSR, municipalities and the county to build Park and Ride and Bike and Ride car parks at railway stations to support public passenger transport. Build car parks in the closest possible contact with platforms and use multi-storey solutions to minimize the coverage of areas and transfer distances

e) In total, there are 17 P + R car parks in connection with railway transport and two in connection with bus transport for the proposed time periods proposed in the surrounding towns and villages. In Bratislava, 5 parking lots are proposed in connection with the railway and also 5 in connection with the IAD to the VOD. The total capacity of these proposed car parks is 2006 parking spaces and 614 bicycle spaces.

f) In tram transport in Bratislava, the priority is to continue the modernization of tram lines not only on radials, but also in the city center. In order to increase the share of tram transport, the proposal emphasizes the construction of new tram connections, either by extending the existing radials or by building new lines providing service, especially the dynamically developing new city center.

g) In order to ensure the preference for tram transport, it is necessary to build light signaling devices operating in a dynamic mode at the intersections as part of their modernization and construction, giving priority to tram transport.

h) An important element of the preference for tram transport is its segregation from car transport. On new lines, especially in the outskirts of the city, it is necessary to build tram lines on a separate track body, in more cramped conditions on a raised tram strip. On the existing lines in the city center, it is appropriate to protect the tram line with longitudinal traffic thresholds.

17.3 Development of roads

a) In the road infrastructure, the narrowest places are the entrances of roads to Bratislava. The most critical situation is from the east on the D1 motorway and the I / 61 road, where the traffic load from the BOD area accumulates with the load from the rest of Slovakia. However, other directions are also critical,especially I / 63 from SE direction from Dunajská Streda, especially in the morning and the afternoon peak working day.

b) The situation on the third class roads, which serve the city of Bratislava, is unsatisfactory. This space needs to be addressed urbanly by balancing civic amenities, job opportunities and housing. In the transport solution, it is proposed as the preferred solution by rail transport.

c) In addition to the currently implemented tangential connection with the D4 motorway and the new R7 radial, the design emphasizes the capacity of the D1 and D2 motorways, first and second class roads and the so-called county circuit on road II / 503.

d) For more efficient use of transport supply and more flexible management of transport demand in order to eliminate congestion and more efficient use of network and road infrastructure, it is necessary to integrate city (CSS control center, DP public transport and others) and regional (NDS and other) traffic management centers under the responsibility of the Integrator , that the expected excessive volumes of traffic be distributed in advance along the free sections of the region 's road network.

17.4 Non-motorized types of transport

a) In cycling, the emphasis is on everyday cycling, which can make a significant contribution to reducing the share of car traffic. These are roads mainly within settlements of the order of up to 6 km and the great potential for their development is in synergy with public passenger transport. The network of proposed cycle paths complements the existing network of cycle paths and creates a comprehensive network of routes as proposed in the BOD documents.

b) In BSK, pedestrian transport takes place practically only within the territory of settlements. In pedestrian transport, the emphasis is mainly on safety, protection, accessibility, comfort and the incorporation of pedestrian routes into public space.

c) The proposal pays great attention to measures to remove barriers to the movement of pedestrians and passengers. All newly built pedestrian roads and VOD stops must be consistently implemented to suit people with reduced mobility and orientation. For VOD stops, the documentation prescribes the minimum equipment of stops according to their significance, while making sure that they are friendly to people with visual and hearing disabilities. The documentation also sets out the basic requirements for the accessibility of VOD vehicles.

d) An important part of the proposal are measures to increase traffic safety in the region. The proposals are specified for the following groups of measures:
   1. Increasing the level of road infrastructure safety
   2. Increasing the level of safety in public passenger transport
   3. Reduction of traffic accidents for vulnerable road users

e) For more effective enforcement of measures to increase traffic safety, it is necessary to put into practice the outputs of the ROSEMAN project (ROad SafEty MANagement-Road Safety Management - customer / strategic partner of BSK), especially the Manual of Measures to increase road safety and vulnerable road users;

17.5 Water and air transport

In its volumes, it significantly exceeds the scope of BSK. In terms of mobility, recreational cruises on the Danube, Little Danube and Moravia and related port facilities are interesting. In air transport, a more significant growth of transported passengers is expected. This is also related to the proposed extension of the rail infrastructure to MR Štefánik Airport with a possible connection of the airports in Bratislava and Vienna by rail.

17.6 Public transport

a) Public bus and trolleybus transport is of significant importance in the mobility of BSK. The proposal introduces express bus lines, which ensure a fast connection of areas not served by rail transport with railway stations, especially through TIOPs or areas where there is insufficient capacity of railway lines and it is necessary to cover the missing capacity. Express bus lines are followed by additional lines, which provide strategic services within municipalities through strategic stops, and service lines, which provide basic transport

services to parts of municipalities that have minimum requirements for service by public passenger transport.

b) The stops are hierarchized on the same principle. Strategic stops allow transfer between additional lines and express lines and rail transport and are usually at the most important location of the headquarters (in its center) with a direct link to its amenities. There may be more than one strategic stop in cities and large municipalities. Stops on additional bus lines are located in the sources and destinations of real transport needs. The mutual distance of stops is 500 m and more according to local conditions.

c) One of the basic attributes of the proposed VOD lines is the tact resp. interval timetable. This will ensure good memorability and systematic management of connections on individual lines at regular intervals. The necessary condition is the time continuity of the additional lines to the carrier lines and the time continuity of the bus transport to the railway transport, in order to shorten the transition times between these modes as much as possible.

d) Public bus and trolleybus transport shares a common transport space with individual car transport. In order for public transport to be attractive to the passenger and to choose it voluntarily as its mode of transport, it must have a significant advantage over road transport, and often at its expense.

e) An important element of bus traffic preference is the establishment of dedicated lanes. It can be a reserved lane exclusively for buses and trolleybuses VOD, or with possible use, depending on the intensity of VOD, also for other modes of transport (taxis with the customer, shared vehicles, cyclists, trucks up to a certain load capacity) or even with a reservation only for a certain time of the day (rush hour traffic).

f) The reserved radiation lane for VOD in front of the intersection, in conjunction with its preference in the control of the intersection by road traffic lights, significantly prefers bus VOD.

g) In the urban environment, concentrate "scattered" stops into an integrated stop of the "Blumentál" type (Vienna or Brno stop), enabling a transfer from one boarding / alighting edge, significantly shortening the boarding / alighting / transfer time of passengers and circulating time, which contributes to the reduction / fleet optimization, speeding up transport and passenger safety.

h) A total of 103.1 km of BUS lanes have been proposed on the territory of BSK, of which 91.1 km on the territory of Bratislava.

i) At present, the transport of bicycles in VOD vehicles mainly supports recreational bicycle transport. RPUM BSK proposes to support everyday bicycle transport with the possibility of transporting bicycles at the front of the vehicle with the possibility of use from any stop to any stop.

j) Place docking stations for car and bikesharing in strategic stops.

17.7 Integrated transport

a) The efficiency of the comprehensive BSK transport system can be ensured only by the integration of transport modes performing public passenger transport organized and coordinated by the central transport authority. The BSK integrated transport system must meet the following basic principles:

1. Flat rate
2. Unified network of lines
3. Uniform transport regulations
4. Unified information system
5. Common price for all modes of transport in the system for the same transport distance
6. Efforts to increase the share of prepaid tickets

7. Coordination of itineraries on the routes

The current IDS BK does not yet meet the comprehensive basic principles and does not offer the required attractiveness of the system leading to a significant increase in the share of VOD in the division of transport work, economic efficiency of the system and increased user satisfaction.

b) A time - space tariff is proposed for IDS BK based on the tariff used in the territory of Bratislava. This means time tickets for one-off trips and zone tickets for subscription tickets. Such a tariff will significantly simplify the passenger's decision-making, allow him greater travel variability and increase his preferences for the use of public passenger transport.

c) The introduction of a single tariff is directly related to the introduction of a single check-in system. In accordance with the proposed uniform tariff system, a single check-in system is proposed on the same technological basis, while ensuring the registration of passengers and their journeys.

d) Uniform timetables for all carriers involved in the integration process are important for an integrated transport system. The timetable should, in particular, be favorable to the passenger, ie it should be unambiguous, clear and easy to read, and should contain all the basic information such as the line number, the course of the journey, departures of vehicles divided into working days, school holidays and public holidays.

e) In line with the prevailing transport flows, the proposal redefines the arrangement of the IDS BK tariff zones. The vast majority of passengers within the region travel to their district city and within their district. The area forming the ring around Bratislava consisting of peripheral city districts (formerly independent municipalities) and municipalities relatively closely connected to the city has a fundamentally different character. This suburbanization belt can be defined as the city of Bratislava and from it there are predominant transport relations to the city. The proposal contains the existing zone Bratislava 100 extended by municipalities of the region, whose interest in trips to Bratislava is at the level of 70-80% of roads. The territories of the districts of Malacky and Pezinok are divided into two zones. In principle, the first zone is defined by a distance of 15 km from the residential district town and the second zone is defined for municipalities further than 15 km from the residential district town. The remaining territory of the Senec district is no longer divided into several zones due to the small area and short distances of the municipalities from the district's capital. The implementation of the new zoning is expected in the horizon 2025 - 2030 and is conditioned by a uniform tariff and a uniform check-in system.

f) Based on the analyzes, the requirement for a wider extension of IDS BK to the territory of the neighboring Trnava self-governing region was stated. From 1 August 2019, the Trnava railway station was involved in IDS BK. However, significant transport relations are mainly from the direction of Šamorín, Dunajská Streda, which, due to the small distance from Bratislava, first aspire to join the IDS BK. The extension of the integrated system can follow the existing way of creating zones with a diameter of about 15 km, which will maintain a uniform structure of division of areas into zones. The border municipalities in the Republic of Austria and the Republic of Hungary also have a strong potential for transport relations with Bratislava and it will be necessary to explore the possibilities of their transport integration within the IDS BK.

g) A necessary part of the efficient, high-quality and efficient function of the transport system process is sufficient information and data on the current transport situation, their reassessment and the retroactive application of knowledge to the mobility process itself. They are:

1. information and data on the operating parameters of individual types of transport
2. information on the ongoing transport process

3. up-to-date information on the transport process for users of the transport system
4. dynamic traffic management
5. continuous monitoring and analysis of knowledge

This data must be provided by each carrier to the contracting authority in full form and continuously (for control, operational management and traffic planning and further use).

h) The integrator of public passenger transport ensures, in particular, the coordination of carriers, timetables and other activities related to the operation of public passenger transport in the entrusted territory. In order to be able to carry out these activities professionally, in addition to the relevant competencies, it needs, above all, comprehensive data on static phenomena and dynamic processes of all modes of transport, which it integrates and coordinates through the Transport Engineering Center (DIC).

i) The transport offer and the price for transport in the IDS BK system must be so advantageous for the passenger that he voluntarily changes the chosen mode of transport from IAD to HD.

17.8 Intelligent technologies in transport

a) For the foreseeable future, the proposal also addresses the progressive trends of technical, technological and organizational innovations in transport, generally covered by the concept of intelligent transport systems. The proposal recommends that local authorities support and participate in the provision of services based on intelligent transport systems:

1. Passenger and driver services
2. Services for infrastructure managers
3. Services for carriers
4. Services for state and public administration
5. Safety and rescue services

b) Autonomous and connected vehicles will in the near future, even without a driver, independently provide services for the transport of persons and goods. For their successful implementation, it is necessary for BSK to be actively involved in international cooperation within the C-Road.EU project.

c) The proposal envisages the creation of a Transport-Engineering workplaces (DICs) which will procure and collect data, whether to process and distribute BigData on mobility and all modes of transport, analyze them, quantify transport processes, simulate them, identify bottlenecks in transport with regard to urban impacts. From the conclusions of the workplace analyzesdevelop proposals for solutions and recommendations for the contracting authority and the integrator and use them for cooperative management of mobility, consolidation of transport processes in the territory and meeting the growing demands of the shared economy.

d) Use emerging ICT to promote mobility management by creating mobility centers and workplaces as municipal and corporate institutions.

17.9 Parking policy

a) Vehicle parking is an accompanying negative phenomenon of the enormous growth of motorization. Parking regulation is an important tool for solving public space and supporting public passenger transport. Parking policy, although it seems radical, is still the way to a possible compromise.

b) Approved parking politics is formeasured to satisfy residents and significant economic impacts (parking fee) on daily commuting by car from a suburban area. More radical price measures in particular are needed for more effective parking regulation.

c) In the district towns of BSK, especially in the centers of their cities, the regulation of parking is also of fundamental importance. Due to the fact that district cities are important sources and destinations of roads, it is of great benefit for the change of the division of transport work in favor of VOD construction of sufficient capacity Park and Ride car parks in contact with railway stations and important strategic bus stops.

d) Gradual substitution of mobility processes by the emerging shared economy (car sharing, carpooling, bike sharing, home working, ...), flexibly use the freed up areas of static transport to create grouping points and docking stations in strategic points of the region's transport network.

17.10 Multimedia support

a) In order to increase passenger awareness and acquire a relationship with sustainable mobility, its media support with promoting the benefits of using public transport, promoting public transport services, promoting new connections and routes ....

b) Campaigns promoting sustainable mobility must focus in particular on promoting the use of the integrated transport system. Campaigns must be comprehensive and continuous, with a focus on raising public awareness of sustainable mobility.

17.11 Greening of sustainable transport

a) The draft RPUM BSK emphasizes the need for greening transport, not only individual passenger but also public passenger transport. As a contribution to the Slovak Republic's commitment to achieving carbon neutrality by 2050, the proposal sets a target to replace all diesel-powered buses with buses powered by alternative media by 2050. Given that the share of vehicles with alternative propulsion is still very low in the region, the proposal envisages the need to address the necessary infrastructure for them.

b) Green infrastructure is one of the main preconditions for the sustainable development of a resilient urban environment and its function can be peacefully included to support sustainable and safe transport. RPUM BSK promotes the grassing of the track superstructure during the modernization and construction of new tram lines. On less congested roads, the proposal recommends the use of grass paving and rainwater infiltration equipment.

c) Visual smog is a serious intervention in the aesthetic and visual logic of the city and in the overall image of the space. Outdoor advertising, in addition to its positive or negative aesthetic effect, also has an effect on road safety by being in the driver's field of vision at all times, and the driver must perceive it, even if only subconsciously. RPUM BSK proposes to remove advertising structures located on highways and roads I. to III. classes and advertisements from VOD vehicles. At the same time, he proposes to amend the legislation to support this process.

d) Shared mobility is a natural development of the transport system. It enables better use of vehicles, reduces the number of trips made by car, space requirements for parking and valuable space, and contributes significantly to reducing fuel consumption and emissions from transport. RPUM BSK supports shared transport systems such as carsharihg and Bikesharing.

e) In addition to passenger revenues, public passenger transport is financed by a significant share of public funds. During the year, there are often situations where short-term but also longer-lasting changes in the organization of transport caused by either investment construction or the organization of sports, cultural and other events increase the number of kilometers of water traveled and thus increase the requirements for public resources. RPUM BSK proposes that detour applicants compensate the VOD contracting authorities for the

increased costs caused by the detour, which may be one of the sources of revenue of the transport contracting authority.

17.12 Recommendations for further action

a) Based on the implementation plan to process the so-called "Action plan", which will prepare and implement the individual proposed measures resulting from the RPUM according to the development of the transport and financial situation of the BSK.
b) BSK must initiate a change in legislation that directly affects transport processes in BSK.
c) BSK and TTSK need to create a jointly organized IDS.
d) The predominant cross-border mobility for work and housing is directed to the natural catchment area of Bratislava and represents a significant share of the volume of regional passenger transport (BRAWISIMO), therefore it is necessary to coordinate these mobility demands with foreign partners and use the results of implemented projects Transport model VKM AT_SK_HU legislative issues of mobility (strategic partner of BSK).
e) The elaboration of the RPUM BSK proved that the creation of the transport system of this area is so interconnected that it is necessary for the entire transport sector to be managed from one center.
f) Initiate a change in legislation so that all operational information from individual carriers is available in digital form, available to transport planners.

17.13 Suggestions for further reflection on the development of hypotheses towards the direction of sustainable mobility

a) The current collapse of the transport system is caused by the constant growth of excess momentum, the living space is filling up and the environment is deteriorating globally. The theory of prosperity growth and extensive development has failed.
b) It is essential to prevent the spontaneous development of mobility and to ensure sustainable mobility it is necessary to start from an analysis of the real ones causes of increasing momentum and not to be pressured to prioritize the consequences of hypermobility by building redundant transport infrastructure.
c) The starting point is to ensure a balance between transport demand and transport supply, which can only be achieved organizational, regulatory and integration measures "inside" the mobility system using new information and communication technologies.
d) An effective integrated transport system can only be created by hierarchical links of transport in the territories in which the priority of individual types of transport results from positional factors and functional requirements of the solved area of the region.
e) Up-to-date and reliable mobility data and information must be based on the continuous collection, continuous monitoring, updating and analysis of the data obtained and their provision to the widest possible public.
f) New approaches to sustainable mobility are conditional on "... a new growth strategy for further growth that gives back more than what it pays" within the meaning of the "EU Green Agreement";
g) Shared mobility enables better use of vehicles, reduces the number of trips made by car, reduces space requirements for parking and valuable space, and contributes significantly to reducing fuel consumption and emissions from transport.
h) Autonomous and connected vehicles they will independently provide passenger and freight services in the near future, even without a driver. For their successful implementation, it is necessary for BSK to be actively involved in international cooperation within the C-Road.EU project.

i) Substitution of transport demand due to new technologies and the use of a shared economy will make it possible to optimize transport demand and contribute to quality transport services in the region.

j) The impact of ICT on the transformation of the settlement structure is already reflected in the higher quality of the "urbanity" of the countryside and encourages its better interconnection in the BSK region.

k) Mobility as a service (MaaS) is conditioned by the widespread use of new information and communication technologies, which will make it possible to make more effective use of the conditions of a shared economy.

List of used literature

1. A guide to the construction of bicycle parking facilities (www.bicy.it)
2. How accurate are speedometers for traffic analysis purposes? Ondruš, Gogola, Kubíková, Svet Dopravy 2019
3. Analysis of transport in the Bratislava self-governing region, BSK 2017
4. Barrier-free use of transport structures, Ing. Zdařilová, Ministry for Regional Development of the Czech Republic, 2014
5. Transport and communication system, col. authors, DOLIS sro 2015
6. Traffic Engineering, col. authors, Alpha 1991
7. Evaluation of bus lanes in central urban areas through the use of modeling techniques, S. Basbas, Aristotle University of Thessaloniki, Greece, 2004
8. Evaluation of Performance of Bus Lanes on Urban Expressway Using Paramics Micro-simulation Model, Yanyan Chen, Guannan Chen, Kehan Wu, Beijing University of Technology, 2016
9. Design of the street and town hall, Amt der Niederösterreichischen Landesregierung1998
10. http://www.nechajmeautodoma.eu/svet-cyklistov/kolko-co2-usetria-cyklisti/
11. http://www.ridesmartsolutions.com
12. https://ecf.com/what-we-do/cycling-economy/economic-benefits
13. https://slovnaftbajk.sk
14. https://www.cyklodoprava.cz/infrastruktura/
15. https://www.planetizen.com/node/79633/when-bus-lane-warranted
16. https://www.researchgate.net/figure/Intelligent-Transportation-System
17. Catalog of selected adaptation measures to the adverse consequences of climate change in relation to land use, Slovak Environment Agency 2018
18. Concept of public transport development in Bratislava for the years 2013 - 2025, Capital City of the Slovak Republic Bratislava, 2014
19. Concept of public transport development in Bratislava for the years 2013-2025, Capital City of the Slovak Republic Bratislava, 2016
20. Methodology - Design of bicycle roads, DIC Bratislava 2014
21. Methodological manual for the compilation of traffic models and traffic forecasts, MDV SR, 2019
22. Methodical guidelines for the creation of sustainable mobility plans, MDV SR, 2017
23. National Strategy for the Development of Bicycle Transport and Cycling in the Slovak Republic, MDVRR SR 2015
24. Design of roads for cyclists, EDIP sro, 2006
25. Parking systems for bicycles, Cykloprojekt, 2018
26. Pedestrian safety, A road safety manual for decision - makers and practitioners, World Health Organization, 2013
27. BSK traffic service plan, BID sro, University of Žilina, 2007
28. Transport service plan of the Bratislava region, University of Žilina, 2017
29. Prague City, 2018
30. Requirements for solving public transport stops in the Czech Republic and abroad, Faculty of Civil Engineering, Brno University of Technology
31. Transport regulations IDS BK, BID 2019
32. Surveys of suburban passenger transport, Capital City of the Slovak Republic Bratislava, 1995

33. Program of economic and social development of the capital of the Slovak Republic, Bratislava 2010-2020, Akademia Istropolitana Nova, 2010
34. Intelligent Transport Systems Development Support Program - National Traffic Information System of the Ministry of the Environment of the Slovak Republic 2009
35. Framework plan of transport service and standards of transport service, MDV SR, 2019
36. Framework plan of transport service and standards of transport service, MDV SR 2019
37. NSK Regional Sustainable Mobility Plan, 2019
38. Annual transport organization project for 2019, DPB, as 2018
39. Smart mobility and services, Expert group repotr, European Commission, 2017
40. STN 73 6021 Light signaling devices
41. STN 73 6110 Design of local roads
42. STN 73 6425 Bus, trolleybus and tram stops
43. BSK development strategy, BSK 2013
44. Strategic road development and maintenance plan II. and III. classes, MDVRR SR, 2014
45. Strategic Transport Development Plan of the Slovak Republic until 2030, Ministry of Transport, Construction and Regional Development of the Slovak Republic, 2016
46. Šveda Martin: Suburbanization in the hinterland of Bratislava in terms of analysis of changes in land cover. In Geografický časopis, 63.2011
47. Technical and operational standards IDS BK, BID, as 2013
48. TP 012 Use of vertical and horizontal road signs on roads
49. TP 017 Design of drainage equipment on roads
50. TP 018 Principles of designing elements of traffic calming on sections of road junctions in municipalities and cities
51. TP 030 Intelligent transport systems and transport technological equipment
52. TP 048 Proposing debarrierization measures for people with reduced mobility on roads
53. TP 102 Calculation of road capacities
54. TP 112 Management of rainwater drained from land and parking lots, 2019
55. Location and distinguishability of traffic signs from a psychological point of view, Lacho, Kokavec, Sochor, ALFA 1979
56. Territorial General of Transport of the Capital of the City of the Slovak Republic in Bratislava, Transport Research Center, 2015
57. Territorial plan of the region - BSK, AUREX, spol. s ro, 2013
58. Exploratory study of the possibilities of realization of catchment car parks and parking houses in Bratislava, Institute of Spatial Planning, 2017
59. Decree no. 294/2015 Coll., Which implements the rules of traffic on roads
60. Decree no. 9/2009 Coll. Ministry of the Interior of the Slovak Republic, which implements the Road Traffic Act, the current wording
61. Annual Report 2018, BID, as 2019
62. Annual Report of DBP, as 2018
63. Annual Report of Slovak Lines, as 2016
64. www.busnews.blogspot.com
65. www.imhd.sk
66. Act no. 135/1969 Coll. on Roads - Road Act, current wording
67. Act no. 302/2001 Coll. on self-governing regions, current wording
68. Act no. 317/2012 Coll. on intelligent transport systems in the field of road transport, current version
69. Act no. 361/2000 Coll., On traffic on roads
70. Act no. 369/1990 Coll. On municipal establishment, current wording

71. Act no. 50/1976 Coll. on spatial planning and building regulations, current wording
72. Act no. 513/2009 Coll. Railways Act,current wording
73. Act no. 56/2012 Coll. on road transport, current version
74. Act no. 8/2009 Coll. on road traffic, current version
75. Principles for designing and establishing preferences for buses and trolleybuses VHD, Novotný, Prousek, Javořík, CTU 2017
76. Urban study of cross-border interconnection of the BOD area and neighboring Austrian municipalities in the form of cycle paths across the Morava River ", BOD, October 2015
77. [1] C-Roads.CZ - https://c-roads.cz/
78. [2] Debauche, W .: Are new Mobility Servicies going to Redefine the Urban Lanscape? (Will new mobility services redefine the urban landscape?), Route / Roads, n0 379-4thquarter 2018, World Road Association, www.piarc.org
79.] from home /
80. [4] Johanisova, N .: Ecological Economics: Selected Chapters, Masaryk University, FSS, KES, Brno 2014
81. [5] Project: BRAWISIMO, (BRAtislava - WIen StudIes of Mobility), Cross-border cooperation project ITMS 000127, 2011-2014, https://www.fvv.tuwien.ac.at/forschung/projekte/international-projects/
82. [6] Project: Verkehrsmodell VKM AT-SK, (Transport Model AT-SK), Cross-border cooperation project ITMS 000043, 2009-2012,
83. https://www.fvv.tuwien.ac.at/forschung/projekte/international-projects/
84. [7] Project: WiWiT, (Who Is Who In Transport), Cross-border cooperation project ITMS 0001, 2014-2015, https://www.fvv.tuwien.ac.at/forschung/projekte/international-projects/
85. [8] Rakšányi, P., Kováč, B, Bezák. B. et al .: The potential of Bratislava in synergies is man, water, transport, landscape. Information study. Hydrostav Bratislava, 1998
86. [9] von Weizsäcker, EU, Wijkman, A .: Come On! Capitalism, Short-termism, Population and the Destruction of the Planet, 1st ed. 2018, XIV, 220 p. 46 illus., 42 illus. in color. Springer, ISBN 978-1-4939-7418-4
87. [10] EU Green Agreement, in: https://inodpady.cz/evropska-zelena-dohoda-vyresi-klimaticke-a-environmentalni-problemy/
88. [11] Bezák, B. Current principles of designing urban communications, in: Urbanita 2019, also: https://www.archinfo.sk/diskusia/blog/urbanizmus-a-samosprava/aktualne-principy-navrhovania-mestskych-komunikacii. html? preview = 1

Attachments

Graphic outputs from the transport model of the Bratislava self-governing region.