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Sustainable mobility in Bratislava. An indicator-based assessment.

A short expertise for Greenpeace in Central & Eastern Europe

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1 Introduction

Transport is a key economic sector in Europe, it influences the opportunities of production and consumption. By improving access to markets, goods and services, employment, housing, health care, and education, transportation projects can increase economic productivity and development. The ability to be mobile is also a prerequisite for inclusion. At the same time, transport induces a range of negative effects, most notably the emission of greenhouse gases. At the urban level, motorised transport significantly contributes to air pollution.

Since 2013, the European Commission has increased EU funding for projects: The "Urban Mobility Package" provided €13 billion for investments into sustainable urban mobility between 2014 and 2020. This has allowed cities across Europe to put in place a range of initiatives. European funding programmes and financing institutions such as the European Investment Bank increasingly insist on a contribution to more sustainable mobility systems in their financing commitments.

The impact, however, is mixed. The European Court of Auditors warned that EU cities must shift more traffic to sustainable transport modes. They found that EU-funded projects were not always based on sound urban mobility strategies and were not as effective as intended (European Court of Auditors 2020).

In many EU member states, the transfer of EU funds to cities is contingent on the existence of a SUMP. A statistical analysis of the modal split of 396 cities in the European Union revealed that the implementation of Sustainable Urban Mobility Plans positively correlates with a reduction of the share of the private car in the cities (Rudolph & Damert 2017). Such plans include strategies and activities to pursue sustainable mobility.

This report analyses transport and mobility in ***Bratislava*** with a view to providing a clear picture about its current sustainability state. It points to both good practice and areas of improvement. In so doing, it provides recommendations how mobility in the city can be developed increasingly sustainable. Bratislava is the capital and largest city of Slovakia. In 2016, the population of the city was 426,000 inhabitants, the Bratislava region was home to 642,000 inhabitants (Statistical Office of the Slovak Republic 2017).

Methodology

The report assesses transport and mobility in Bratislava by using four categories (as elaborated in chapters 2, 3, 4 and 5):

1 | Modal behaviour and transport infrastructure: This chapter builds upon the modal split of the city of Bratislava as a main indicator. It gathers related information, mainly about the state of transport infrastructure, to find reasons for these particular modal shares. It also collects such information for other cities to to find factors how Bratislava can increase the shares of sustainable transport modes.

2 | Road safety: Cycling and walking fatalities on urban streets in selected European countries are compared with the corresponding numbers of the city of Bratislava. Based on this, measures to increase road safety in the city are discussed.

3 | Air pollution: The chapter provides information about ambient air quality in Bratislava. It compares the city with other cities in the region. The values also provide insights of the impact of the COVID-19 pandemic on ambient air quality.

4 | Strategies for Sustainable Transport and Mobility:
First, this chapter assesses the development of Bratislava's SUMP framework: Does its development follow the principles of a sound SUMP as stipulated by the European Commission's guidelines?
Second, the chapter examines the city's ambition in more detail by comparing the planned policies and measures to an ideal list of areas of action. In so doing, it identifies strengths and weaknesses of the city's mobility policy.

Based on these four chapters, the report concludes with final recommendations to the decision makers, how transport and mobility in Bratislava can be made more sustainable.

2 Modal Behaviour and Transport Infrastructure

This chapter describes the modal behaviour in Bratislava and discusses the reasons for the share of walking, cycling, public transport and private car use in the city. Moreover, in order to find best practice and to highlight potential areas of improvement, the report compares the situation in Bratislava to the situation in comparable cities in neighbouring European regions.

In Bratislava, the private car dominates the modal share. Modal share (or modal split) depicts the percentage (%) share of trips by different transport modes in a city. Cities with a high share of sustainable modes i.e. public transport, walking and cycling, have a higher possibility to increase or maintain the share of these modes, if the right policies and measures are put in place. In Bratislava, apart from motorised transport, public transport and walking play an important role. They account for 37 and 27 percent of all trips, respectively.

Krakow, Brno and Dresden are of the same size; Budapest and Vienna are capital cities nearby. It appears that Bratislava, Krakow, Brno and Dresden show a more or less similar share of private car use, between 36 and 40 percent. Bratislava has a similar modal share to Brno and Krakow, with a public transport being by far more significant than cycling (which is relatively high in Dresden, amounting to 18%).

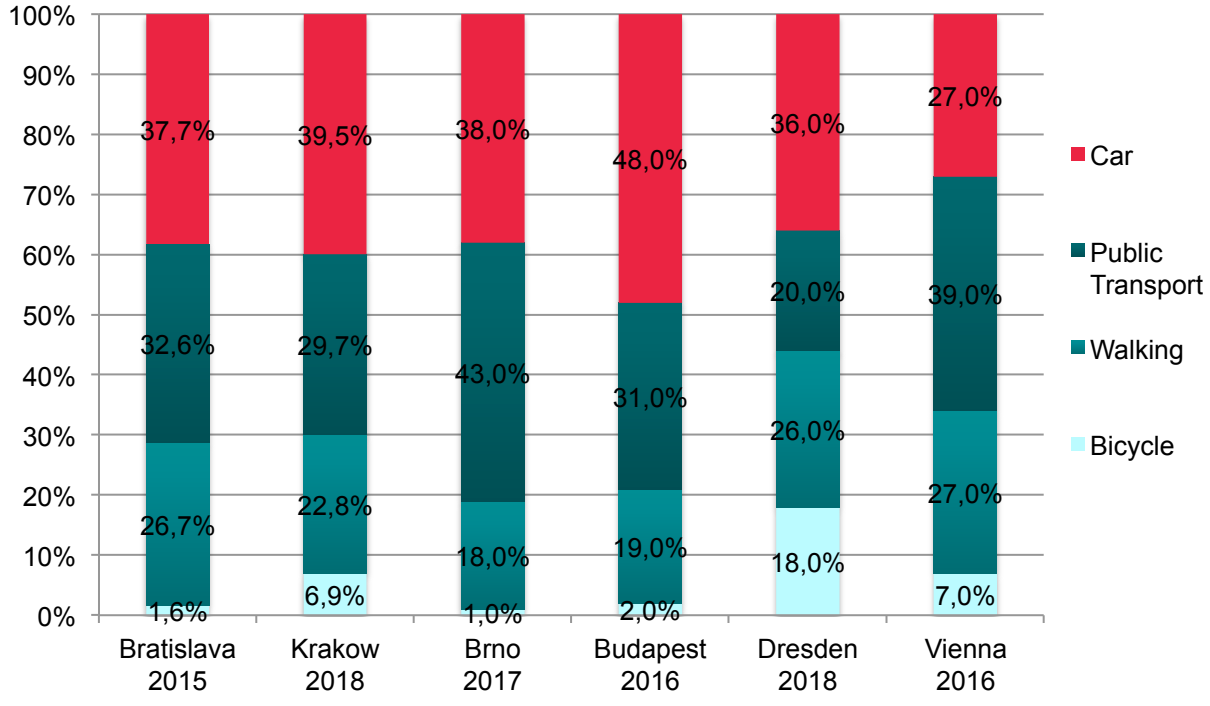

Fig. 2-1 **Modal Split of Bratislava compared to other cities. Sources: References section**

Transport infrastructure and development in Bratislava

Since 1989, mobility in the city of Bratislava has undergone considerable change. The number of cars in Bratislava and their share in traffic volume has been increasing (Bratislava 2016). At the same time, the share of public transport in the modal split has been decreasing. It still accounts for 32 percent, but 37 percent of the city's trips

are currently made by car. There are some negative effects associated with this development, namely emissions of traffic-related air pollutants, a decline in traffic safety and a general reduction in the functionality of the city's transport system (congestion). This development was accompanied by increasing dissatisfaction of the city's residents and visitors with the traffic situation (Bratislava 2016).

The considerable increase in motorized individual transport and the associated growing burden on the transport network is increasingly affecting the functionality of public transport and thus its quality and reliability. One of the consequences of this development is an increasing number of cancelled trips and an increase in delays on many lines, as public transport and private transport often (have to) use the same lanes. In addition, there is often a lack of funds for the adequate maintenance of the transport infrastructure, especially for tramway and trolley buses.

The reasons for the increase in car traffic in the city, and corresponding decline of local public transport, are diverse. The most important explanation is the enormous increase in private car availability. The number of cars registered in Bratislava rose from around 181,000 vehicles in 2005 to around 294,000 vehicles in 2017. The car density rose in the same period from 0.42 to 0.67 cars per inhabitant and is thus significantly higher than that of many other European big cities (Bratislava 2019, S. 146).

In contrast, the public transport offer was reduced in the past despite the increasing number of inhabitants, albeit only to a small extent. While the line network and the number of public transport lines have remained almost unchanged (with bus lines being replaced by tram lines), there was a decline in journeys (2013-2017) by five percent (Bratislava 2019, p. 148/149).

Politics and administration in Bratislava have realised this sustainability challenge and are making efforts to regain shares that public transport had lost to cars in the past.

So promoting public transport is a high priority in the city's activities in order to improve urban sustainable mobility. Among other things, public transport shall be accelerated by separate routes and by prioritising over private motorised traffic, for example at intersections. The routing is also planned to be optimized in order to reduce travel times, stops shall be reached more comfortably and safely, and buses and trains shall be more comfortable and barrier-free (see annex).

Cycling currently plays a minor role. Only one percent of all trips are made by bicycle, a consequence of the lack of a network of safe and comfortable bike paths. A local NGO has counted the length of separated bike lanes, it adds up to a total of only 72,3 km. However, in recent years, some increase in bicycle use could be experienced. Some connections between the suburbs and the city centre have been established, the budget for infrastructure has been increased, and a bike sharing service developed (Websites eltis).

The low share of bicycle traffic is a result of the city's traffic planning, which has been heavily focused on cars for many years. Most importantly, a number of multi-lane roads in the city centre disconnect certain urban areas. Pedestrians and cyclists can only cross them through tunnels or overpasses.

Thus, too little has been done to promote cycling in Bratislava for years. But the bicycle is becoming increasingly important in urban traffic planning. The city aims to achieve a modal share of ten percent by 2030 – which seems moderately ambitious – mainly through the expansion of a separate bike network (Kirchner 2019, see annex).

Budapest

Budapest has a 48% modal share of public transport and 31% of personal motorised modes. The city was traditionally oriented towards public transport and has retained its infrastructure favouring trams and trolley buses. The data also shows that the city has 2% of cycling and 19% of walking (Kerenyi 2017).

Budapest has a firm public transport infrastructure in trams and metro. The result of which is that the current system in Budapest carries about 1.8 billion people annually. This means a resident of Budapest makes 1,037 trips annually on average, which is quite a high number. To further improve sustainable transport in the city, the General Assembly of the Municipality of Budapest has established “Budapesti Közlekedési Központ” (BKK, Centre for Budapest Transport) in 2010. BKK’s tasks relate to an integrated urban transport management and transport strategy development.

To further improve public transport BKK has implemented a smart card system called RIGO. The need to purchase multiple tickets if a user changes from metro to a bus, made public transport less attractive to a regular car.

Furthermore Budapest has a high number of shared mobility services. BKK launched its MOL Bubi public bike sharing system in September 2014 with 1,100 bikes and 76 docking stations - many in the congested inner city. It is well integrated with the public transport network and therefore does not only serve for touristic purposes but also for the last mile of commuters. MOL Bubi was extended in 2015 up to 1,150 bikes and 91 stations due to the first successful period of operation. Other sharing schemes have emerged as well, namely micromobility and car sharing, however without significantly decreasing the share of passenger cars in the city.

Further decrease of passenger car traffic in Budapest would need measures to push the mobile user away from the car. An hour of parking in Budapest is cheaper than a single journey public transport ticket and there is no other fiscal instrument to control the use of personal automobile in place (Kodukula et al. 2018).

Krakow

Krakow is Poland's second largest city with 760,000 inhabitants. Despite of a continuously increasing number of cars in the city, sustainable transport in Krakow still has a comparatively high share (60%) in the modal split, which is characterized by a high share of public transport and a high walking share. 40 percent of trips in Krakow are made by car. Sustainable transport was promoted by both push and pull measures (City of Krakow 2018).

Already in the 1990s several programs were launched and measures implemented to make the use of the car less attractive. These included the designation of areas in the city to which the access of motorized private transport is restricted. Compliance with

this access restriction is ensured by an electronic access control system. Other restrictive measures for car traffic in the city are the designation of pedestrian zones, bus priority lanes and the prioritization of buses and trams at intersections. In addition, parking space management in the urban area was expanded and tariffs increased (Civitas Caravel 2009).

The fact that almost 30 percent of trips in Krakow are still covered by public transportation is primarily due to the implementation of a series of measures. For example, old trains and buses have been and are still being replaced by modern vehicles, rail routes have been rehabilitated and bus stops have been extended. In addition, accessibility has been improved especially for elderly people and structural and organizational barriers to access have been removed. These improvement measures include the cost-reduced and free use of the service for elderly people and the increased use of streetcars and buses with a low-floor function that facilitate the entrance and exit. These infrastructural measures are flanked by intensive public relations and communication to the public aimed at sensitizing all population groups to the special mobility needs and mobility opportunities of elderly people and also at introducing elderly people to the various possibilities of sustainable mobility in the city (Website AENEAS project).

Brno

Brno has 380,000 inhabitants and is the second largest city of the Czech Republic. The choice of transport in the city is strongly influenced by public transport. After Prague, the second largest tramway- and the country's largest trolleybus network contribute to the fact that around 43 percent of trips in the city are made by public transport (Website EPOMM). Walking, on the other hand, currently plays a much smaller role and cycling is almost completely irrelevant.

Brno started a process of developing a SUMP in 2014. At that time there were no national guidelines on how the municipal sectoral planning relevant for urban and transport planning should cooperate institutionally in order to achieve the highest possible degree of strategic and content-related coordination and at the same time avoid conflicts of objectives and conflicting developments.

Dresden

Dresden is the capital of the German federal state of Saxony and has a population of around 557,000. In the city’s modal share, the car accounts for 36 percent of all trips and public transport for 20 percent. 18 percent of all trips are made by bicycle and 26 percent on foot (City of Dresden 2020).

After the reunification of West and East Germany, Dresden’s motorisation steadily rose. By the turn of the millennium, the modal share of the private car had increased up to 44% at the expense of the shares of public transport and walking.

Since, the city has made significant and successful efforts to decrease motorised transport. Public transport has regained customers and, even more importantly, cycling shares could be doubled. One main reason for the continuous increase in the

use of these sustainable transport modes is the continuous upgrade and extension of respective infrastructure.

To promote cycling, infrastructure and communication measures are likewise implemented. As part of the Dresden Cycling Concept for the city centre, which was launched in 2010, and the subsequent Cycling Concept for the entire city from 2017, the quality of the cycle traffic network is continuously improved and expanded. Moreover, the connection between bicycle and public transport is improved (B+R), and the general conditions for bicycle parking are improved as well. Further infrastructural measures are the opening of one-way streets in both directions for cycling, the improvement of crossing options, and the closing of gaps in the cycle path network. In addition, the city's ca. 400 kilometers of cycle path network is connected to two national and one international cycle route (Website City of Dresden).

For public transport, the continuous qualitative improvement of the tramway service is particularly noteworthy. This improvement includes, among other things, the rehabilitation of routes, the improvement of the accessibility of stops and the use of modern and comfortable vehicles. In addition, there is a continuous construction of new lines and the extension of existing connections (Dresdener Verkehrsbetriebe 2019).

The improvement in the conditions for using alternatives to the car has led to almost all mobility indicators in Dresden developing in favour of environmentally and climate-friendly mobility. The use of bikes and car sharing is increasing, the driving license rate is falling among young people and reached only 72 percent for men between 17 and 25 years of age, and only 68 percent for women in the same age group. Dresden also shows that owning a car does not necessarily lead to its intensive use. Although the proportion of households with private vehicle ownership is increasing, the proportion of trips travelled by car is decreasing simultaneously.

Vienna

Vienna has a 27% share of trips by personal automobiles and over 70% of the trips are by sustainable transport modes, of which walking and public transport takes a major share. The city has an extensive public transport system and a good integration of fares, timetables and infrastructure. Due to the extensive public transport system and the constant provision of alternative modes of transport, the automobile share in Vienna has remained at 27% since 2010 (Website City of Vienna).

The city has an affordable public transport system; both single trip costs and lumpsum prices are well known for being very cheap. The annual ticket in Vienna is an incentive for people to use public transport regularly. The annual ticket costs 365 Euros a year, which translates to 1 Euro a day and allows the user to make unlimited trips in the core Vienna region.

The city does have a good share of pedestrian trips at 27%, but a low cycling share (7%). The city has almost 50% urban green cover which is encouraging for pedestrians and leisure activities. The low cycling can be improved if the safety conditions for cyclists are improved. From the data available, Vienna had 11 pedestrian fatalities in 2016, and 2.7 crashes for every 1mn pedestrian trips. There were 2 bicycle fatalities

and 7.6 bicycle-crashes for every 1mn bicycle trips. This is a comparatively high share of bicycle crashes and justifies the low bicycle share in Vienna (Kodukula et al. 2018).

Conclusions for Bratislava

The approaches of the cities presented here in promoting sustainable mobility provide some good practice which could be pursued in Bratislava.

Promotion of public transport

Krakow has managed to keep its high share of public transport in the modal split thanks to the attractive design of the existing offer. The use of modern and comfortable buses and trains with low-floor functionality, which enable easier boarding and landing, and the cost-reduced and free use of public transport for the elderly has made public transport more attractive, especially for this population group. The communication and public relations work is also specially tailored to the needs and opportunities of the elderly.

The example of the city of *Vienna* as well shows how the use of public transport can be promoted through attractive tariffs. The "one Euro per day" annual ticket and also very cheap single trip tickets, along with an attractive network of routes, have contributed to 39 percent of journeys in the city being covered by public transport.

Promotion of cycling

With its high modal split share of cycling, *Dresden* can serve as a good example for Bratislava in promoting cycling. By consistently promoting cycling, Dresden has succeeded in almost doubling its share of the modal split to 18 percent since the turn of the millennium, and this primarily at the expense of car traffic. Infrastructural and communicative measures have been and are being carried out.

The groundwork has been laid by a bicycle concept in 2010 for the city center; and a bicycle concept for the city as a whole in 2017. As part of the implementation of these concepts, both quality and length of the bicycle network is continuously being improved. Public transport lanes can be used by cyclists, providing important links between districts.

Promotion of innovative mobility offers

Budapest is an example of how innovative mobility offers, if they are organizationally and structurally linked with conventional public transport, can be an alternative to private car use. Bike sharing serves for both tourists and as last-mile option for public transport users.

Restrictions for private car use

The promotion of alternatives to the car is particularly effective when restrictive measures for the use of the car are implemented at the same time. These are, for example, temporal and spatial access restrictions for cars for certain sub-areas of the city. *Krakow* is a pioneer in this regard and already imposed such access restrictions for cars in the 1990s.

3 Road Safety

A total of 9,500 people were killed on urban roads in the EU in 2017, accounting for 38% of all road deaths. Cyclists and pedestrians together make up over half of all road deaths in urban areas– pedestrians account for 39% and cyclists for 12%. In the EU, road deaths on urban roads decreased by just 14% over the period 2010-2017 compared to 24% on rural roads (Website EC, see also Engels 2019).

In Bratislava in 2017, the police registered 1,571 road traffic accidents, which caused 532 injured or killed persons and a material loss of € 4.2 million. Out of the 532 persons, 10 were killed and 75 were heavily injured (Statistical Office of the Slovak Republic 2018).

The following Table 3-1 compares bicycle and pedestrian fatalities of urban streets in Europe with such fatalities in the city of Bratislava. Cyclists and pedestrians are the most vulnerable mobile users.

Tab. 3-1 Bicycle and Pedestrian Fatalities per 100,000 inhabitants in Bratislava and on urban streets in selected European countries. Source: Website Ministry of the Interior of the Slovak Republic (city of Bratislava); Website EC (CARE database)

Basis: Urban roads	Bicycle fatalities	Pedestrian fatalities
Bratislava 2015-2019, annual mean	0.09 (2 in 5 years)	1.26 (27 in 5 years)
Slovakia 2016	0.28	1.58
Austria 2016	0.25	0.54
Czech Republic 2016	0.26	0.86
Denmark 2016	0.33	0.47
Germany 2016	0.30	0.44
Hungary 2016	0.41	0.93
Netherlands 2016	0.36	0.15
Poland 2016	0.40	1.54

As can be seen from the table, bicycle fatality rates in Bratislava have been lower in the recent years than the Slovakian national average 2016 (which is the last date available in the CARE database). The main reason for the low number of cases is the low cycling modal share: As there are only few cyclists, cases can't be high either.

However, higher cycling shares are usually a consequence of a dense network of safe infrastructure. Safe infrastructure, in turn, decreases the probability of traffic accidents. Moreover, car drivers usually get used to cycling as the number of cyclists and trips by bicycle increase. As a result, they adapt their driving behaviour. The table above shows this correlation, as it depicts fatality rates from EU countries with high cycling shares, namely Denmark and Netherlands. These countries' rates are similar to other countries despite cycling being a main mode of transport. Denmark and

Netherlands can thus be taken as a prove that more cycling does not lead to more traffic accidents which involve cyclists.

With respect to pedestrian safety, the statistics for both Bratislava and entire Slovakia are not encouraging: Fatality numbers per 100,000 inhabitants are among the highest in Europe and more than the double of most of the countries listed in Table 3-1. The reasons for these high numbers may be as follows:

- Frequent exceeding of the maximum permitted speed, no enforcement of speed limits.
- High maximum permitted speed on many roads and infrastructure design allowing high speed.
- Infrastructure is not meeting the needs of pedestrians (lack of physical infrastructure such as desire lines, barriers, extra-level solutions).
- Insufficient protection of pedestrians at crossings in Slovak legislation.

4 Air Quality

Air pollution is the evident and first-hand experience of the effects of the increased combustion of fossil-fuels which are predominantly used in motorised vehicles. As a result, people walking and cycling inhale high doses of pollutants, while motorists also have a high exposure (Cepeda et al. 2017).

Air quality has been one of the most pressing environmental issues in Europe in the last few years. Many cities in Europe do not comply with the legal thresholds set by the European Union. The EU has been approached by many think tanks and non-governmental organisations with petitions to tackle the growing air pollution problem across European countries and cities.

This chapter discusses three major pollutants, namely nitrogen dioxide (NO_2), particulate Matter PM_{10} and $PM_{2.5}$. These three pollutants cause the greatest harm to human health and to the environment. The EU limit for NO_2 and PM_{10} annual mean concentrations is 40 µg/m³. and for $PM_{2.5}$ annual mean concentrations it is 25 µg/m³. The World Health Organisation (WHO) guideline for NO_2 concentrations is 40 µg/m³, for PM_{10} it is 20 µg/m³ and for $PM_{2.5}$ is 10 µg/m³.

Thus, the WHO global guidelines for particulate matter – the substance that can be dangerous even at low concentrations – is much stricter than the EU standards. The particulate matter is also a reason for respiratory problems and is also carcinogenic. Particulate matter is not visible for the naked eye, it settles in the respiratory track and in the lungs of the people inhaling it.

In addition to the annual mean, the actual exposure during certain timespans is meaningful as well; and the EU legislation stipulates that a concentration of 25 µg $PM_{2.5}$ per m³ must not be exceeded during 24 hours.

Cities measure air quality through monitoring stations. These stations are usually located in high volume traffic areas, residential areas, and on the outer periphery of the city to measure background values for certain concentrations of pollutants. In addition to the above stations, there are also measuring stations located in rural areas and in industrial areas.

In Bratislava there are not only official measurement stations, but also measurements from non-governmental initiatives, complementing the official information. The European Environment Agency (EEA) compilates the *public* collected data and has recently released a detailed database on air pollution, the “Air quality and COVID-19” database (Website EEA).

Figure 4-1 (next page) presents results for NO_2 exposure of traffic measurement stations (street-side) in Bratislava in the year 2019 as compiled by the EEA. The figure compares the offical averages from the city with those from other cities in the region. The red line indicates the EU threshold for mean annual NO_2 exposure (40 µg/m³). It appears that Bratislava complies with the legal thresholds. According to these (offical) numbers, only the cities of Budapest and Krakow were above the threshold in this selected list of cities. Bratislava is below the legal threshold, however, air pollution appears to be a much bigger issue than in Slovakia’s second largest city Košice.

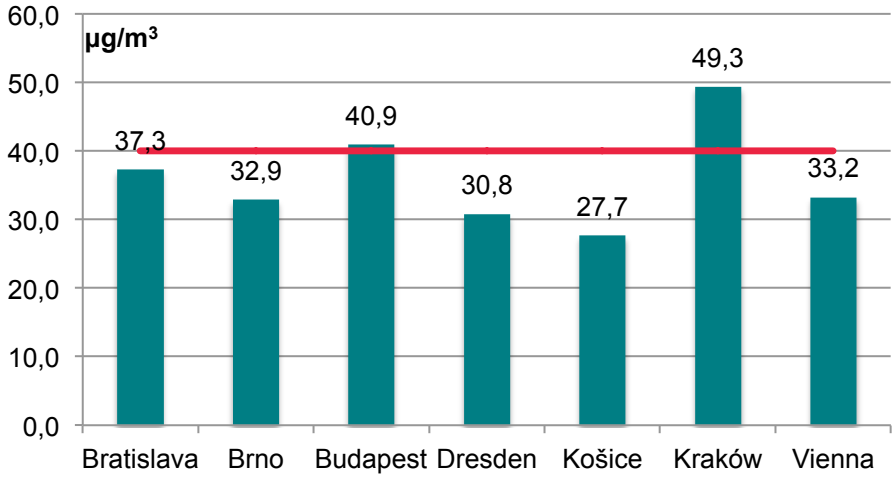

Fig. 4-1 2019 mean of NO_2-levels in Bratislava and other cities. Source: Website EEA

Similarly, the next figure 4-2 compares exposure to PM_{10}. Again, the same cities are compared using the numbers as measured by the cities themselves and compiled by the EEA. Bratislava's measurements are well below the legal threshold of maximum exposure. Unfortunately, offical values about $PM_{2.5}$ are not available for 2019.

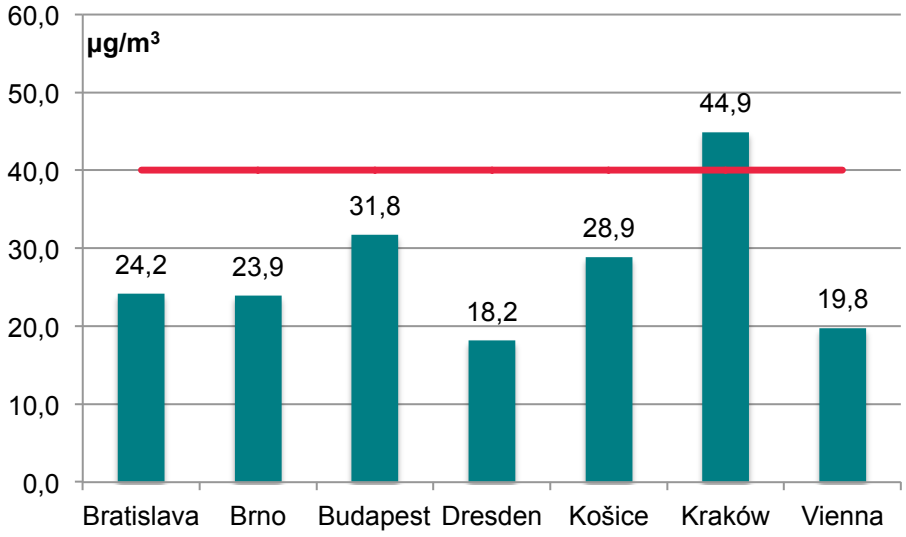

Fig. 4-2 2019 mean of PM_{10}-levels in Bratislava and other cities. Source: Website EEA

As mentioned above, the local NGO "Cyclokoalicia" has installed a number of additional street-side measurement stations in the city complementing the official data. According to these measurements, the 2019 average of $PM_{2.5}$ was 9.16 µg/m³ - the legal threshold stipulated by the EU being 10 µg.

However, it turned out that the threshold for a 24-average of $PM_{2.5}$ concentrations (25µg/m³) was exceeded regularly in 2019 at different measurement stations: Figure 4-3 provides the 24-hour average of eleven measurement stations between September 2018 and September 2020. Problematic exposure took place during the colder months from October to February with some 24-hour averages exceeding 40, 50 and

even 60 µg/m³. The measurement stations are located at primary schools and at some big junctions (see Websites Cyclokoalicia for details).

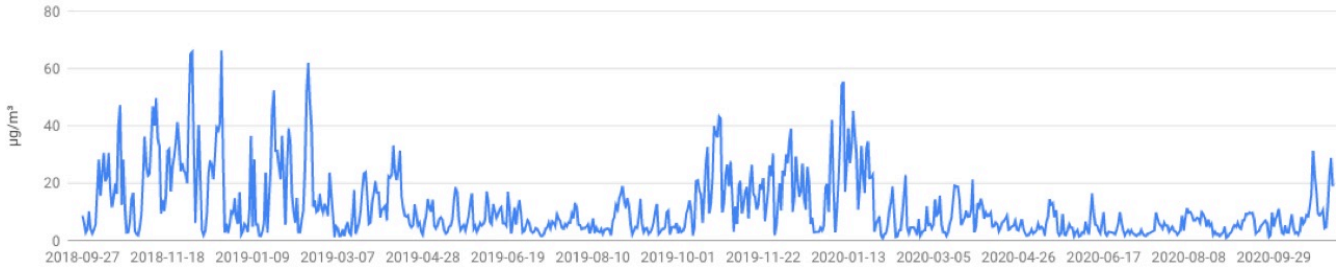

Fig. 4-3 **24h averages of $PM_{2.5}$-levels at private measurement stations in Bratislava from 9/18 to 9/20. Source: Website Cyclokoalicia**

Some of the measurements of the NGO took place in primary schools, thus indicating a need for action. The NGO's measurements also show a clear drop of air pollution during the COVID-19 pandemic (see also below).

Air pollution and COVID-19

The COVID-19 pandemic has forced governments to introduce measures of social distancing.

Figure 4-4 compares mean monthly values of NO_2 exposure in 2019 and 2020 in Bratislava as measured by public street-side measurement stations. It shows the monthly values from January to October in both years. It clearly shows the Corona safety measures' impact on NO_2-emissions, therefore reduction of motorised traffic.

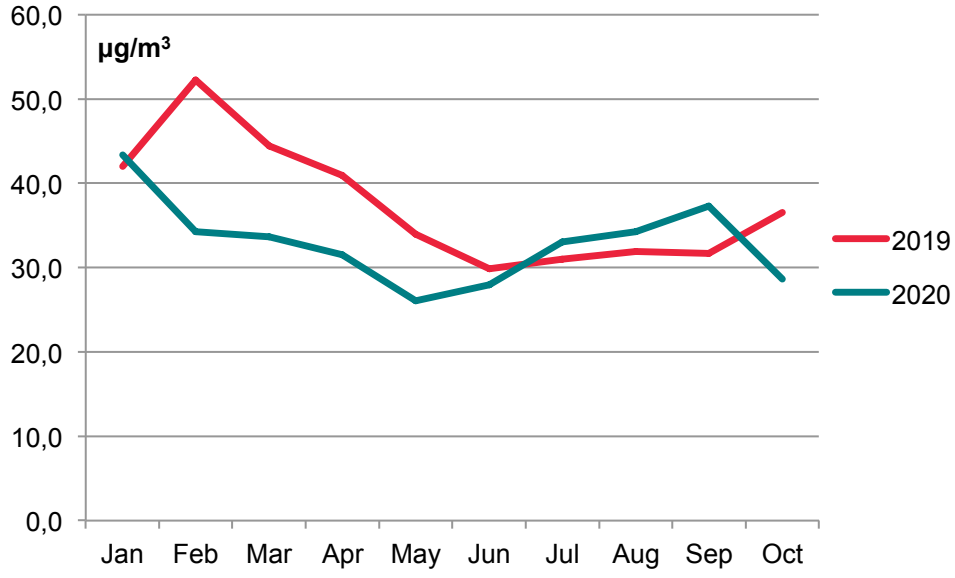

Fig. 4-4 **Monthly averages of NO_2-levels in Bratislava 2019 and 2020. Source: Website EEA**

The numbers clearly show that less motorised traffic increases ambient air quality.

5 Strategies for Sustainable Transport and Mobility

This chapter assesses actual and future policies, measures and other interventions to foster sustainable transport and mobility in Bratislava. The assessment criteria are based on the 2nd edition of the Guidelines for developing and implementing a sustainable urban mobility plan (Rupprecht et al. 2019). The guidelines stipulate eight principles for a successful and ambitious SUMP implementation (see Figure 5-1).

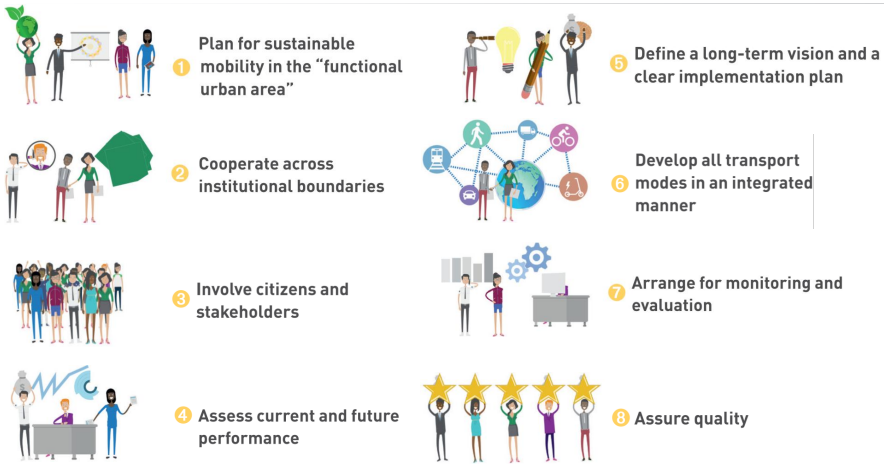

Fig. 5-1 Eight principles for sustainable urban mobility planning. Source: Rupprecht et al. 2019

The figure shows that sustainable urban mobilty planning does not oblige certain policies and measures, but the eight principles rather aim at establishing a new planning approach for local and regional administrations: moving away from the focus on traffic flow improvement towards a perspective that aims at improving mobility of the cities' inhabitants. Thus, the primary objective of sustainable urban mobility planning is to improve accessibility and quality of life, including social equity, health and environmental quality, and economic viability.

Bratislava's ambitions for sustainable urban mobility are currently formulated in the following documents:

- a proposal for a regional plan for sustainable mobility (Kopecky et al. 2020) and a corresponding implementation plan
- a main framework document for the transport in Bratislava city (Centrum dopravního výzkumu 2015, this is the current SUMP)
- rules for development of cycling and pedestrian infrastructure (Magistrat Hlavneho Mesta 2014)
- a plan for public transport development 2013-2025 (Bratislava 2016)
- Action plan for sustainable energy development (Bratislava 2013)
- Programme statement 2019-2022 (Bratislava 2019)

Table 5-1 (next page) lists key facts of the current political ambition regarding sustainable urban mobility in Bratislava. The criteria for political ambition (left column) are based on the above mentioned eight prinicples for sustainable urban mobility planning. The actual situation in Bratislava as described in the right column are based on an analysis of the above listed documents.

Tab. 5-1 Political ambition in Bratislava. Source: Own analysis

Criterion for political ambition	Situation in Bratislava
SUMP principle #1: Does the city/functional urban area have a SUMP?	Yes, a regional SUMP is under preparation and planned for 2021. The city has a transport plan from 2015.
SUMP principle #2: Does the the mobility plan commit to integrated planning?	SUMP development itself is mainly done by the department for transportation, there is room for further cross-sectoral cooperation (source: telephone call with city administration).
SUMP principle #3: Has public participation been conducted during the mobility plan's development?	Yes, regular particpation took place (source: telephone call with civil society).
SUMP principle #4: Do the relevant documents assess current and future performance?	Yes, this is integral part of all relevant documents.
SUMP principle #5: Does the SUMP/mobility plan provide a vision for future urban mobility?	No longterm vision, no dedicated vision for transport and mobility, but some programme statements for the period 2019-2022 for transport and mobility.
SUMP principle #6: Does the city administration develop all transport modes in an integrated manner?	Yes, as walking and cycling are put on the agenda. These two modes of transport had been neglected in the planning of the past.
SUMP principle #7: Is the implementation of measures subject to periodic monitoring and evaluation?	There is reflection on the success of some measures, e.g. travel time savings, but no formalised and holistic evaluation (source: telephone call with city administration).
SUMP principle #8: Does the city have binding targets (laws) and time schedules for the promotion of walking, cycling and public transport?	No, but the city has a voluntary target, which is to increase the share of cycling in the modal split to ten percent by 2030.
SUMP principle #8: Does the city have a financing plan for measure implementation? Which financing and funding sources are being used?	The overall financing of the city's infrastructure is mainly based on income tax and not on corporate tax. The strategy is to attract companies. There is awareness of European funding. A number of budgeted measures are already outdated and in need of redesign. In the past, longterm sustainable projects were often omitted, but the focus was on short term success. Some potential interventions are difficult to finance due to bureaucracy (source: telephone call with city administration).

As can be seen from the analysis in Table 5-1, the administraiton (most importantly the department of transportion of the city of Bratislava) makes significant efforts to planning urban mobility sustainably; and the city's decision makers have the ambition to further develop transport and mobility sustainable. Most of the eight SUMP principles are accounted for.

However, some of the steps of a regular SUMP are only in an early stage. It remains to be seen if recent planning efforts can be sustained. Most importantly, Bratislava is

lacking a longterm vision for sustainable urban transport and mobility. This is crucial for a number of projects such as development of infrastructure for sustainable transport modes. Infrastructure cannot be developed during one legislative period, but a common vision can compensate political volatility.

Similarly, the administration of the city of Bratislava should seek for further interdepartmental cooperation towards sustainable mobility (principle #2): For example, according to a telephone call with the department of transport, rearrangements of junctions in Bratislava do not necessarily account for safety of cyclists due to traffic flow considerations. In this example, the department of transport and the traffic management should clearly collaborate on strategies to strengthen non-motorised transport. Any maintenance of a street segment or a junction should prioritise walking and cycling - traffic flow being a secondary target.

Policies and measures in key action areas

In addition to an overall framework for a successful SUMP, ambitious policies and measures fostering sustainable transport and mobility need to be planned and implemented. The annex details which policies and measures are already implemented or currently envisaged by Bratislava and compares these measures/bundles of measures to other potential policies and measures. The rationale is to understand the state of activities in the individual action areas and to provide ideas how to increase the level of ambition where appropriate.

The list in the annex shows that the city has already planned a number of reasonable policies and measures, but could easily increase its ambition. Similar to Bratislava's SUMP framework, it appears that the city administration is in an early stage of reducing the private car's relevance and will need further efforts in the short, medium and long term: Public transport shall be extended. In addition, the bicycle is clearly planned to become more relevance as a mode of transport. Most importantly, the city plans restrictive measures, namely parking management. It should strive to act more restrictive towards the private car - the classic "carrot and stick" approach still lacks the stick, even as planned in the near future.

6 Conclusion: Areas of improvement

The decision makers of the city of Bratislava have realised, that sustainable mobility will increase the livability of the city and the region and that it is possible to steer urban transport and mobility sustainably.

In the past, Bratislava has worked on improving its public transport system both by increasing the quality and by extending its infrastructure. This work will continue in the medium term. The new task, however, is to significantly improve the conditions for walking and cycling. The city administration has started to work on safe, seperated infrastructure. However, existing infrastructure is yet not dense and safe enough to attract a significant number of mobile users to regularly choose the bicycle as mode of transport. This will happen as cycling infrastructure improves, however it should not be regarded a no-brainer.

Improving the conditions for walking and cycling is a marathon rather than a sprint. It needs prioritisation of these modes each and every time street segments or junctions are maintained/built. A good example is the city of Oslo: Oslo has declared the „Vision zero“ - no traffic fatalities - in the year 1975. In this year, Oslo reported 41 traffic fatalities. 2019 was only the first year, in which Oslo could eliminate pedestrian and cycling deaths.

Oslo is also a good example that a clear vision is needed to achieve relevant policy targets. If a vision is developed in a participatory process, it will sustain political volatility and will contribute to the ultimate aim, which is sustainable mobility. The city of Bratislava is currently lacking such a vision, a clear shortcoming of its SUMP. Such a vision would strengthen the efforts to prioritise walking, cycling and public transport over the private car both in the short and long term.

Finally, the city of Bratislava needs a more restrictive approach towards the use of private cars. Measures to push mobile users away from the car are part of the equation to support public transport, walking and cycling. Introducing parking pricing is an important step, but more efforts are needed in this regard.

Bratislava is in the early stages of becoming more than a livable city: The central European capital has the potential to be equally sustainable like Amsterdam, Copenhagen and Oslo.

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8 Annex

The following sections compare policies and measures as currently implemented or planned in the city of Bratislava, organised along a number of key action areas. The tables indicating policies/measures per action area also provide other policies and measures, which decision makers should consider to plan and implement for Bratislava's transport system to develop more sustainable.

Area 1: Achieving affordable and attractive public transport

Public mass transport is the backbone of sustainable urban transport systems, specifically for daily commuting. Affordable ticket prices are key to provide mobility for all and to overcome the need of owning a private car. Moreover, ensuring reliable high-quality services and convenient vehicles can attract additional passengers.

Bus, tram, and urban rail service providers, both public and private, usually do not operate on a cost-effective basis, i.e. they are dependent on public subsidies. Public transport services are either operated by city-owned companies, or services are procured through public tenders. This allows municipalities to set the price, quality standards, and service level for public transport. Some cities even provide free public transport for their citizens (e.g. Tallin), for certain areas (e.g. Madrid on certain lines in the city centre), or for certain groups (e.g. Berlin for school kids).

This section includes all measures aiming at an affordable and attractive public transport system on the *operational level*. It includes pricing measures, the extension of the service area and operating hours, integrated mobility, vehicle standard, and campaigns.

Related measures might be funded through increased contributions from the public budget; and/or co-financed from alternative revenue sources, such as parking management, or specific taxes. Examples for such earmarked taxes are Nottingham's workplace parking levy, which is a tax that employers have to pay for each parking space they provide for their employees.

Tab. 8-1 Public transport system masures. Source: Own compilation

Guiding measures	Status
Free public transport for school kids	Free for kids up to six, fare reduction for older pupils
Permanent free public transport	No, but the publicly owned PT operator aims to attract more annual ticket holders be decreasing prices
Simplification of public transport zoning system	Planned (by 2025)
Information boards at stations and on vehicles	Planned (by 2025)
Quality standards for public transport operators (punctuality, comfort, cleanliness, security, etc.)	Standards are of high quality
Integrated public transport fare system	Planned (by 2030)
Joint app for all mass transport providers (bus, tram, urban rail)	Planned
Mobility hubs	Planned (by 2030 / 2040)
Further potential measures	
Procurement of new vehicles and rolling stock, using quality and comfort criteria (information systems, Wlan, USB charging,...)	
Increased public transport service level (frequency and service hours)	

Area 2: Extending the public transport network and improving public transport infrastructure

Enhancing the attractiveness, availability, and accessibility of public transport may also require infrastructural measures, for example the construction of tramway lines or the removal of barriers at public transport stations. These measures are usually not taken by the transport operator, but through the city.

This section includes all *infrastructural* measures to extend and improve the public transport system, including network extension, priority measures for public transport vehicles, and increased accessibility through barrier free and safe stations.

Infrastructure measures can be financed through public budget reallocations - in the best case at the expense of car-related infrastructure investments - or through dedicated taxes and charges. Examples include the *Versement Transport* in Île-de-France, or the *Dienstgeberabgabe* in Vienna (see Area 9). Both are taxes that employers pay and which are earmarked for public transport related expenses, including infrastructure investments. For new land developments, value capture instruments can be employed to (re-)finance the provision of transport infrastructure. These are usually surcharges on the purchase price of a property. The rationale behind value capture instruments is that those who benefit from a development and/or the provision of infrastructure and public services should also make some financial contribution.

Tab. 8-2 Extension of public transport. Source: Own compilation

Guiding measures	Status
Removal of physical barriers at stations and on vehicles (to increase accessibility)	Planned (by 2030)
Priority measures and preferential lines for public transport vehicles	Planned (by 2025); preferential lines / induced green wave / PT preference at traffic lights
Extension of public transport network (bus, tramways, urban rail)	Planned (starting 2025); Introduction of urban rail network, increase capacity of vehicles
Further potential measures	
In certain cases, Bus Rapid Transit can provide comfort equal to trams or undergrounds, but be significantly cheaper.	

Area 3: Extending and improving the cycling infrastructure

During the Covid-19 pandemic, cycling has received unprecedented attention in many urban areas. Pop-up bike lanes were introduced as measures to enhance the resilience of the mobility system; and many of them can be expected to remain in place. Also before the pandemic, cities started to re-allocate urban space from cars to bikes, for example through the establishment of bike streets. Other measures to support cycling are the introduction of 30km/h zones or the improvement of cycling infrastructure.

This section includes all structural and infrastructural measures that promote cycling, including new cycle paths, bike highways, safe road crossings, or the opening of one-way-streets for cyclists.

Tab. 8-3 Extension and improvement of cycling measures. Source: Own compilation

Guiding measures	Status
Qualitative improvement of the existing cycling network	Yes (Mobility plan 2015) durch standard if they rearrange intersactions for tram standard
Approval of the use of bus lanes for bicycle traffic	Exists
Conversion of car lanes into bike lanes	under consideration for the future
Extension of the bike network	Planned (by 2030)
Speed reduction measures (speed bumps, road narrowing, etc.)	Planned (by 2025)
Further potential measures	
General speed limit 30 km/h (including main arterials)	
Safety standards for buses, trucks and delivery vehicles (e.g. cameras)	
Campaigns and awareness raising to promote cycling as modern, pleasant, and sustainable kind of mobility	
Provision of bike parkings at the expense of car parking	
Establishment of bike streets	

Area 4: Encourage walking and enhancing the liveability of streets

Walking is the most natural and most sustainable way of moving around. Making cities walkable reduces the need to use (fossil fuel powered) vehicles and to provide costly infrastructure for transport. Increasing the walkability of cities requires a combination of urban planning (mixed use quarters, car free districts, 'city of short distances', see Area 11), the re-distribution of public space, but also qualitative improvements of existing infrastructure and measures to make walking the 'natural' choice of mobility.

Tab. 8-4 Walkability and livability. Source: Own compilation

Guiding measures	Status
Establishment of 30 km/h zones and traffic calming	Planned (2030)
Attractive design of the public space (seatings, green spaces)	Mobility plan 2015
Pedestrianization and conversion of parking lots and car lanes into walking areas	Mobility plan 2015; Planned (2025)
Qualitative improvement of the existing walking infrastructure	Planned (2025)
Optimisation of pedestrian and cyclist crossings (enhance safety)	Planned (2025)
Further potential measures	
Introduction of school streets (temporary closure of streets when schools start)	
Walking buses to schools	
Redesign of intersections to enhance safety for pedestrians	
Stricter enforcement of parking violations (on sidewalks and cycle lanes); increased penalties, strict towing policy	

Area 5: Support and organise new mobility services

New mobility services (such as sharing systems for cars, bikes, and micro-mobiles), and ride-hailing and -sharing offers may complement traditional public transport offers. They can serve as first- and last mile solution, specifically when integrated in public transport apps. This section includes all measures that promote new mobility services or limit the negative side effects of new mobility services.

Tab. 8-5 Mobility as a service (MaaS). Source: Own compilation

Guiding measures	Status
Implementation of a bike sharing system	Planned (2025)
Implementation of a car sharing system (using electric cars)	Planned (2025)
Implementation of a private car-pooling system	Planned (2025)
Further potential measures	
Integration of sharing systems with public transport app	
Provision of parking spaces for shared cars at the expense of private car parkings	
Integration of MaaS with the public transport app	
Mobility management in municipal administration and private companies	

Area 6: Foster the electrification of public transport and municipal fleets

The conversion of diesel- and petrol fuelled municipal vehicles has received increased attention in the recent years. More and more cities start to procure electric buses and other vehicles for their fleets. This section includes measures for fleet conversion, development of charging infrastructure and upgrading of the electricity distribution network, in particular the grid connection of depots.

Tab. 8-6 Fleet electrification. Source: Own compilation

Guiding measures	Status
Procurement of e-buses	Planned (by 2050 / very long time horizon)
Linking concessions for mobility providers and sharing operators to the use of electric vehicles	Mobility plan 2015
Further potential measures	
Procurement of e-vehicles for municipal fleets (beyond public transport)	

Area 7: Foster the electrification of private mobility

The electrification of private vehicles can contribute to reducing greenhouse gas emissions and air pollution in cities (though not ease urban space use or reduce the number of accidents). Cities can support the diffusion of e-vehicles through the provision of e-charging infrastructure, or other measures that encourage the use of electric cars. This section includes measures to promote charging at home, charging in public places, or incentives for the procurement of e-bikes.

Tab. 8-7 Electrification of bikes and cars. Source: Own compilation

Guiding measures	Status
Development of public e-charging infrastructure	Ongoing
Further potential measurs	
Adaptation of the power distribution network to the needs of e-mobility	
Promotion of the development of charging infrastructure on company and private parkings	
Ban of diesel cars from city centre	
Ban of combustion cars from city centre	

Area 8: Reduce negative impacts from freight and commercial mobility

A growing amount of urban transport volume is linked to the delivery of goods to individuals and enterprises. Delivery vehicles are relatively large, often diesel-powered, and the increasing parcel delivery requires dedicated loading space. This section includes measures to promote low carbon and space efficient urban logistics.

Tab. 8-8 Freight and logistics. Source: Own compilation

Guiding measures	Status
Logistics and consolidation centres	Planned (by 2025)
Further potential measures	
Dynamic pricing of freight vehicle access (by weight, size, or emission category)	
Emission based access restrictions for commercial vehicles	
Support programme for the procurement of e-cargo bikes	

Area 9: Reduce private car use through pricing measures

The use of private car use is the underlying cause of many urban issues, including congestion, emission of greenhouse gases, air and noise pollution, or accidents. Besides pull measures, such as the improvements of public transport offer and active mobility infrastructure, push measures that discourage private car use are needed to achieve a profound change of mobility patterns. The rationale behind pricing measures is that recent cost structures do not reflect the 'true costs' of private car use to the society, and that (implicit) subsidies disturb the competition between mobility modes. This section includes measures like parking management or road pricing.

Tab. 8-9 Pricing measures to reduce the usage of private cars. Source: Own compilation

Guiding measures	Status
Parking management	Planned (by 2025): Currently parking is free and the city acknowledges the urgency to introduce pricing. The aim is to develop something user-friendly.
Congestion charges	Under consideration
Further potential measures	
Workplace parking levies	

Area 10: Reduction of private car use through access and parking regulations

Another means to reduce the use of private cars is to restrict the access of vehicles to the city centre or to remove parking spaces. This section includes restrictive measures in certain parts of the city.

Tab. 8-10 Restrictive measures to reduce the usage of private cars. Source: Own compilation

Guiding measures	Status
Expansion of residential parking	Mobility plan 2015
Further potential measures	
Construction of district garages	
Reduction of on-street car parking spaces	
Low emission zones (emission based access restrictions)	
General access restrictions for vehicles (UVAR)	
Building codes: Maximum number of parking for new buildings	

Area 11: Urban planning for sustainable mobility

Overcoming car-centred planning and realising walkable and short-distance cities encourage sustainable mobility. Integrated urban and mobility planning can strongly influence mobility patterns and travel behaviour. The concept of transit-oriented development, for example, provide dense and compact urban form while simultaneously providing for efficient public transport options to the city centre. On a smaller scale, municipal authorities can require major employers to define company mobility plans. Brussels-Capital Region, for example, made transport and action plans mandatory for companies with more than 100 employees. This section includes planning activities that reduce transport needs and trip distances (e.g. densification, use of brownfield land, internal rather than external development) and provide viable public transport options for new developments.

Tab. 8-11 Urban planning for sustainable mobility. Source: Own compilation

Guiding measures	Status
Potential measures	
Bicycle expressway connections to the city centre for all new development areas	
Mandatory transport plans for companies/ institutions with more than a certain number of employees/ visitors	
Regional cooperation with surrounding municipalities in traffic and urban planning	
Provision of public transport services as precondition for new land developments	