RECHARGE AND REFUEL – CLEAN, SMART AND FAIR URBAN MOBILITY IN SLOVAKIA

Deliverable 6 – Report on good practices on development of cycling transport infrastructure and traffic calming

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Contents

1 Introduction

The European Commission (DG REFORM) supports the Member States for the preparation and implementation of growth-enhancing administrative and structural reforms by mobilising EU funds and technical expertise. Slovakia has requested support from the European Commission under Regulation (EU) 2021/240 establishing a Technical Support Instrument ("TSI Regulation"), following which the European Commission has agreed to provide technical support to Slovakia in transport.

To this end DG REFORM has launched a service contract Recharge And Refuel - Clean, Smart And Fair Urban Mobility In Slovakia. This report describes insights and good practices on the development of cycling transport infrastructure and traffic calming. It is the main outcome of Activity 6 (Report on good practices on development of cycling transport infrastructure and traffic calming) in the project.

The input for the report was collected by desk research, by interaction with the Slovak Ministry of Transport and by interviewing 10 persons from different ministries, organisations, or other stakeholders (5 inside and 5 outside Slovakia).

The report is structured as follows:

The report starts with a general introduction about cycling in Slovakia and elsewhere in Europe (Chapters 2 and 3). Subsequently, it introduces the concept of liveable cities (Chapter 4) and illustrates this by means of some examples for some typical measures (Chapter 5) and integrated examples from cities across Europe (Chapter 6).

Chapter 7 defines concepts and principles for designing safe road infrastructure for bicyclists. All these elements are illustrated in detail.

The three subsequent chapters focus on some specific topics that were deemed important: bicycle markings and signs (Chapter 8), data collection and bicycling network indicators (Chapter 9) and the combination of train and bicycle (Chapter 10).

The report concludes with recommendations to strengthen the capacity to design cycle infrastructure in Slovakia (Chapter 11).

All the concepts and principles in the report are illustrated by means of examples and pictures, originating from different countries across Europe: Austria, Belgium, Czech Republic, Croatia, Denmark, France, Italy, the Netherlands, Slovakia, Slovenia and Spain.

Some more background information is provided in the annexes:

- Annex 1: Fact sheets describing the status of bicycling in 3 relevant countries (Czech Republic, Denmark and the Netherlands)
- Annex 2: training material
- Annex 3: list of interview participants
- Annex 4: synthesis of the interviews
- Annex 5: details about the on-line knowledge sharing event held on 23 May 2023.

2 Reasons to develop a bicycling policy

2.1 Background

In Slovakia like in other countries, cycling transport used to be a popular intra-urban transport mode before the rocket of automobilism. Later, it gradually lost popularity as the use of motorized vehicles increased and comparatively little attention was paid to safety and comfort of bicyclists.

In recent years, bicycling is gaining momentum and Slovakia and elsewhere in Europe. The European Commission has set major priorities in the European Green Deal[1] and in its Sustainable and Smart Mobility Strategy[2]. Promoting bicycling is actively contributing to both strategies.

2.2 Functional versus recreational cycling

Functional cycling is cycling that is done for utilitarian purposes: to commute to school or work, to visit family of friends, for shopping, go to the sports club, etc. In that case, connections should be as direct as possible as utility cyclists want to get from A to B as quickly as possible.

Recreational cycling is different. It is cycling with the focus on leisure. The purpose of the trip is the fact of cycling itself. Recreational cycling can include signed long-distance routes, signed tourist themed routes or a collection of nodes and interconnected links, enabling cyclists to determine their own trip. Recreational cyclists are typically looking for a leisurely and attractive ride, which can allow them to explore an area, exercise or socialise.

To contribute to the achievement of the various policy objectives, specific attention is needed for functional cycling.

2.3 Benefits of functional cycling

- Congestion, more cyclists = less cars going from A to B to a certain extent.
- Health (an easy way to reach the WHO requirements of physical activity).
- Emissions, more cyclists = less cars to a certain extent (also electric cars cause direct (fine dust) pollution, as much as today combustion engine vehicles.
- Energy use, more cyclists = less cars to a certain extent.
- Liveability, more room for things that people need (besides mobility) open space, green, blue, social relationships.
- Public spending, more cyclists can mean less crowded public transport, less capacity needed for public transport.

Economists can translate part of these benefits in EUR. TML did this for the Benelux and Westphalia region. The figure below illustrates the costs and benefits of different types of cycling compared to other modes. The considered types of cycling concern muscular cycling, cycling with a pedelec or with a speed pedelec. The figure illustrates for example that using a muscular bicycle instead of a car provides a societal gain of 1.99 EUR per km. The gains

[1] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0789

compared to a bus, or a train are bit lower (Vanpée, 2022). The highest gains come from the health benefits. Environmental gains are rather small. The arrival of electric vehicles will therefore not bring significant changes to the figures below.

These gains are probably an underestimation as improvements in liveability made possible thanks to cycling are difficult to estimate in monetary terms and are not included in the figures below.

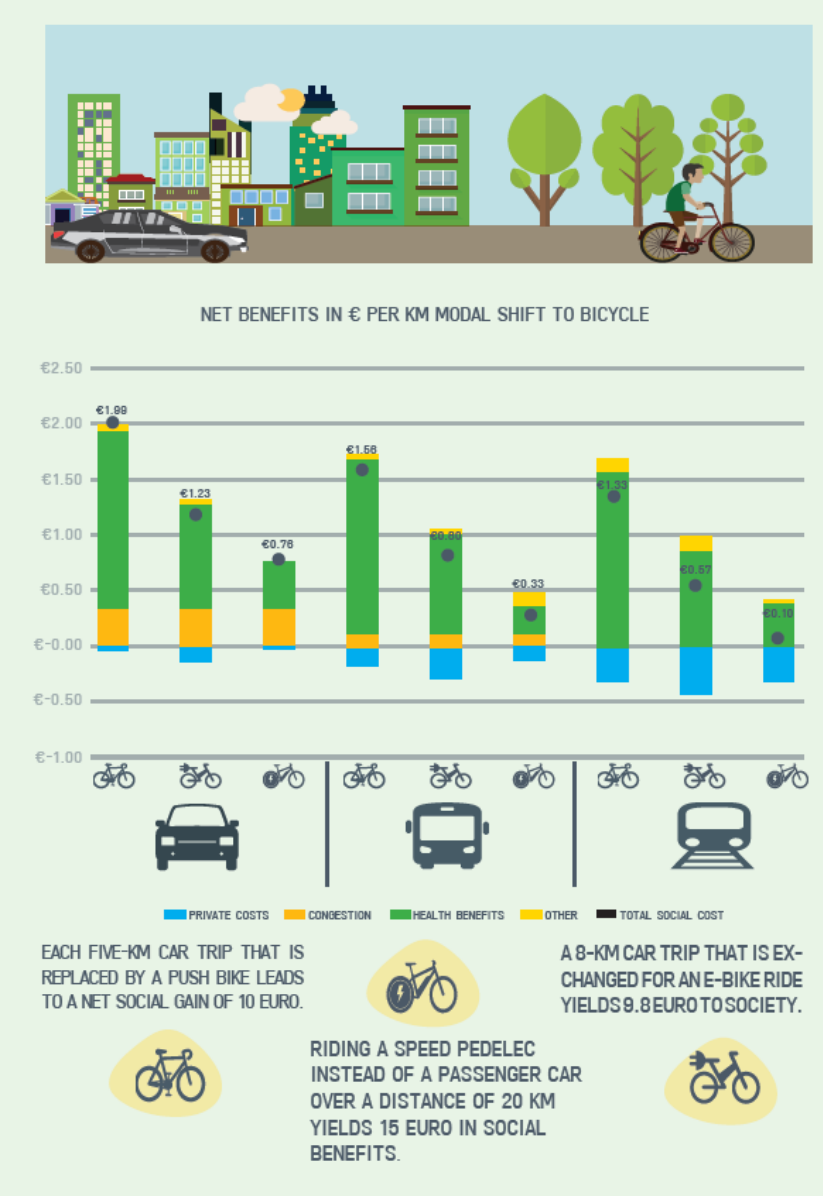

Figure 1: net benefits in EUR per km modal shift to bicycle (Vanpée, 2022),

©Transport & Mobility Leuven

The important gains of cycling are also illustrated in the Dutch cycling ambition document, Tour de Force. That document estimated following investments necessary in the period between 2019 and 2027. 1,8 Billion EUR for the 50 biggest cities, 770 million EUR in the regional cycle network, up to 650 million in bicycle parking around railway stations. These figures seem high, but the societal return is enormous and significantly bigger than the costs as the Tour de Force document explains. (Tour de Force, 2019).

2.4 Why is cycling different from other travel modes?

Modern traffic systems are largely designed from a car-user perspective, which results in a network that is adapted to the needs of cars and car drivers. Cyclists have different properties and different needs. Wegman et al. (2012) defined several characteristics that make cyclists different. Cyclists are:

- vulnerable (in a crash)
- flexible (in behaviour)
- instable (may fall off the bike)
- inconspicuous (difficult to see)
- a heterogenous group, having different abilities (e.g., according to age, gender, and preferences)
- conscious of effort (i.e., highly motivated to minimize energy expenditure)
- sometimes (also by themselves) seen as intruders in the traffic system, rather than as an integral part.

These key elements also occur in combination. It is important to keep these characteristics in mind when developing cycling infrastructure.

2.5 Focus of this report

This report is primarily aiming at providing guidance to Slovak stakeholders in the adoption of good practices for developing cycling infrastructure. This is different from a bicycle policy plan and has a more specific focus that is entirely on road infrastructure. However, both types of plans are interrelated, and road infrastructure should not be too strictly interpreted. Cycling infrastructure is also about bicycle parking, spatial planning, and accessibility of public transport hubs to bicyclists. Although cycling infrastructure is probably the single most important measure to promote bicycling, developing a coherent bicycle policy is more than that. A so-called integral bicycling policy should also include attention to other aspects that influence the choice of people to do a certain trip on a bicycle, such as the social norms (= 'status') of functional cycling. All these elements together can lead to an integral bicycle policy.

A bicycle policy plan for Slovakia is currently under development.

TAKEAWAYS

1 Cycling brings important societal benefits. A modal shift from car to bicycle has been demonstrated to provide a societal value of more than 1 EUR.

2 Increasing the modal share of cycling requires considerable efforts, political vision and courage, reallocation of space, financial means.

3 Reference countries

A concise benchmark with three relevant EU Member States is presented below. In concertation with the Ministry of Transport, it was opted to include the Czech Republic, Denmark, and the Netherlands as main reference countries. These countries are relevant to Slovakia as they are either among the best performing countries (Denmark and the Netherlands) or they are in situation that is well comparable to Slovakia. This is for example the case in the Czech Republic.

Fact sheets with more detailed information for these three countries are included in Annex 1.

A few elements are resumed below:

Modal share of bicycling (share of trips):

- Czech Republic: 3%
- Denmark: 15%
- The Netherlands: 28%

Annual investments in cycling infrastructure (€ per capita) (Source: ECF, 2022, information might be incomplete):

- Czech Republic: 0.6€
- Denmark: 3.1€
- The Netherlands: 13.6€
- Slovakia: 4.0€

Current focus elements of cycling policy

- Czech Republic: target levels according to city size, traffic rules, traffic signs, safety, cycling coordinators.
- Denmark: everyday cycling/active holidays and leisure/safe, new cyclists
- The Netherlands: bicycling in the city, bicycling in combination with public transport, high quality bicycle network, stimulating cycle use and cycle initiatives with focus on specific groups like commuters, socially disadvantaged, gather data on cycling and standardize them.

Lessons to learn.

- Czech Republic: renewed attention for cycling noticed and cycling is gaining popularity. Some cities or areas in the Czech Republic have a significant higher share of cycling in their modal split.
- Denmark & The Netherlands: Getting significant numbers of cyclists means a radical reallocation of public space towards cycling (pedestrians and living zones) and away from space for cars (roads and parking). This choice needs (very) courageous decisions in the short term but pays off in the longer term.

4 It’s not about cycling …. but liveable cities (and traffic calming)

4.1 What do we mean by liveable cities, villages, and neighbourhoods?

By liveable cities, villages, and neighbourhoods, we mean places where there is room for living, meeting another, for activities outside other than moving in a motorized vehicle. The basic requirement to enable this is a redistribution of public space that provides: More space for living, social relations, nature and less for mobility. At the same time, the remaining mobility and traffic takes place at a more human scale, slower, with lighter and smaller vehicles. …… In other words, it means more cycling, more walking, less cars moving and parked.

4.2 Why are traffic calming and liveable cities, neighbourhoods, villages important?

Human beings need:

1. Breathing fresh air and therefore good air quality.
2. To move physically, physical activity is the best preventive medicine.
3. To move safely, without risking an accident.
4. Social relationships, loneliness is more harmful than smoking (Galkin, 2022)
5. Meeting people (close to home is the most resilient)
6. Green and blue, nature
7. To feed oneself, to earn a living.
8. To be mobile

Public space **CAN** answer all these needs. Public space has the potential to provide good air quality, room for physical activity, room for meeting people, room for nature, room for mobility.

However, public space (too often) does **NOT** provide an answer to these needs. Public space today is (too often) mainly allocated to motorised vehicles mobility and car parking.

However, many cities and countries illustrate that a different use of public space is possible.

4.3 The key principles of liveable cities and neighbourhoods

Following elements are crucial in a global approach for liveable cities and neighbourhoods:

- choose a global approach,
- reorganise mobility to enable redistribution of public space.
- measure the realism of the choices,
- organise consultation and/or participation with a diverse group of citizens.
- think about logistics and (car) parking.

4.3.1 Choose a global approach.

Building and creating a liveable city or a liveable neighbourhood is much more than building a flower box or a speed bump and cutting a street here and there! Flower boxes, speedbumps

and street cuts can help resolve very local problems. If taken in isolation, without a global perspective, they can however influence traffic in other streets and come to a globally worse situation than before. Some citizens could be happier, others however could start complaining.

4.3.2 Reorganise mobility to enable redistribution of public space.

Liveable cities provide more space for encounters and nature, less for motorised traffic. Therefore, mobility needs a profound reorganisation to make it less space consuming.

The main principle of reorganised mobility is to organise mobility within the city in order that (nearly) all places in the city can be reached by car, but that for inner city journeys, other modes, bicycle, foot, or public transport are faster.

Historically, cities were customised for pedestrians and cyclists. From the 50ties till recently, cities were adapted towards car requirements making cities less attractive for cyclists and pedestrians. Some cities are making car access again more difficult. Figure 2 below illustrates this.

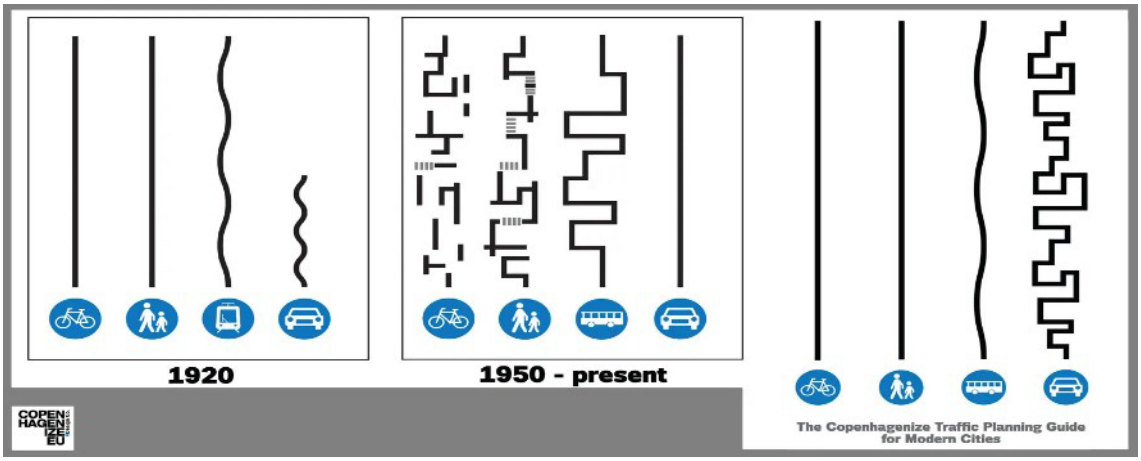

Figure 2: A_Short_History_of_Traffic_Engineering - a cycling advocacy pamphlet from Copenhagenize ; Licensed under a CC 2.0 licence)

"Cuts" are an important ingredient in realising the reorganised mobility principle. The figures below illustrate it. A simple "cut" for car traffic makes bicycle traffic more attractive to reach certain destinations. It implies also that there will be less car traffic in streets within the neighbourhood, which in turn makes cycling or walking more attractive, without investing in specific cycle infrastructure.

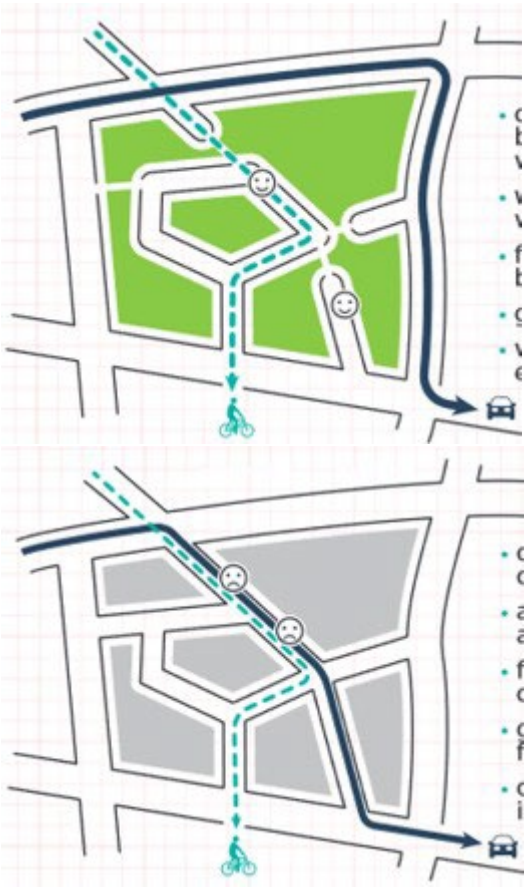

Figure 3: scheme for a simple cut in road infrastructure in a neighbourhood (Tridée, 2018)

The application of cuts needs to be done in an intelligent way to keep (car) traffic fluid and the neighbourhouds liveable, thus with a minimum of motorized traffic. A well-thought-out mobility plan is therefore necessary. It will contain:

- a pedestrian network
- a cycling network (and cycle parking plan)
- a public transport network.
- a car network (and car parking plan)

All different networks need to be integrated and to take one another into account. The right-hand figure illustrates how the traffic is well thought in a well-integrated mobility plan.

There is a kind of big ring road, where motorized transport can relatively easily travel. Within the city and neighbourhoods however, there are no transit roads for motorized traffic. There are however some collecting roads on which motorized traffic is collected and guided to the peripheral roads.

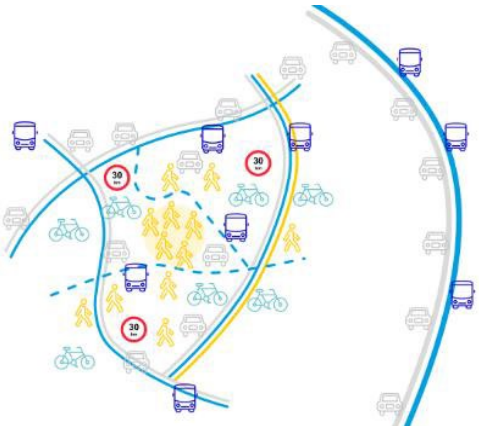

Figure 4:different networks to build liveable neighbourhoods (Mobility Brussels, 2020)

The next chapters focus on the principles of a cycle network.

4.3.3 Measure realism of the measures

As already said above, the cuts and reorganisation of car traffic need to be done in an intelligent way to keep traffic going and to avoid that the realisation of the plan leads to opposition of

citizens due to traffic chaos. By reducing room for car traffic without foreseeing where the car traffic will move, traffic chaos can occur, and will strongly reduce citizens acceptance of the plan.

Therefore, it will be important to prepare the redistribution of space with an analysis of traffic data and modelling. Depending on the results of these simulations, adaptations in the plan will be necessary or not.

The figures below illustrate the use of a simplified model to measure the impacts of a new mobility plan. Different colours in the map show how the traffic changes, increases, or decreases. In this example, it was seen that a cut in a street increased significantly the through traffic in front of a school. The plan was adapted to avoid increased traffic in front of the school.

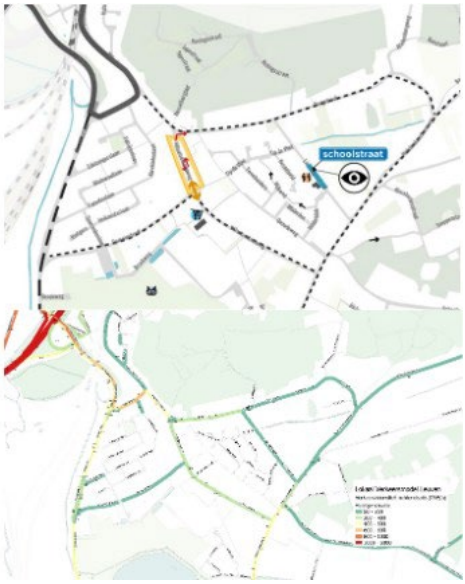

Figure 5: illustration of the use of a traffic model to measure impacts of a new traffic circulation plan (www.traffic-scout.net)

4.3.4 Organise consultation and/or participation with a diverse group of citizens.

Build your liveable city together, with citizens. Make sure that diverse groups are involved that will have at least different mobility profiles, citizens that are used to take their car, others that often walk or cycle and still others that are less mobile.

Figure 6: citizen consultation and participation on a mobility plan © Mobiel21

In the discussions on mobility with a diverse group of citizens, it will be important to be open and empathic to different mobility visions. This means listening and taking different world visions of people seriously. It will also help to understand where resistance comes from. Not by looking at single resistance themes and coming up with a counterargument for them each time, but by understanding from which vision, from which logic and from which emotions they stem. The table below illustrates two main visions and logics on mobility. A good discussion can only take place if the visions and their consequences are well understood.

The car-first logic	**The we-neighbourhood logic**
The car is simply the most important and fundamental means of transport for most people.	Most streets are in local neighbourhoods, and these are primarily a residential and living environment.
The car should therefore get everywhere as smoothly as possible, with as few delays and detours. It should also be parked as easily as possible, preferably in front of the door.	We therefore primarily want streets and squares in our neighbourhoods where it is a good living, where children and the elderly can also move around safely and pleasantly, with clean air and low noise, and beautiful and green surroundings.
Cars will therefore inevitably have a strong presence on many streets, including in the neighbourhoods, and take up a lot of space. That creates a lot of conflicts and tensions, awkward situations and difficult to respect rules, so that road users perceive each other as reckless competitors or enemies.	All this is impossible if there is too much and fast traffic through the neighbourhood and much space is taken up by parked cars. In local streets we want little and slow traffic, that's what many residents are asking for. Besides, in larger towns and cities, usually more than half of families do not have a car. And relative to car ownership, often too much public space goes into parking. Through traffic therefore does not belong in neighbourhoods. Those who need to be

	there by car should still be able to get in and out, but slowly and via the best approach route. Traffic that does not have a destination in the neighbourhood does not belong here and should drive on the larger connecting roads around the neighbourhood
Therefore, to make streets cyclable, we should therefore preferably separate cars and cyclists separate in as many streets as possible – which, by the way, then also applies to pedestrians and public transport.	Then we can also just have mixed traffic in most streets. With the occasional slow-moving car or two, this works perfectly. Everyone realises that this is a local neighbourhood, and we do look out for each other, for playing children, for crossing elderly people who have difficulty walking or for visually impaired people and wheelchair users.
Bike lanes are then the only real guarantee of safety. That's the opinion of many cyclists.	Just mixing cycling with car traffic is totally safe and pleasant, at least if we ensure that the neighbourhood is car-free.
Measures to divert cars or allow them to park further away are perceived as loss of car convenience or potential loss of accessibility, customers, and economic dynamism.	Measures to divert cars and allow them to park a bit further away thus create a huge gain for the quality of life in the neighbourhood as well as for society. The inconvenience for car users is all in all very limited and mainly a matter of taking some time during a period of adjustment. Cars can still reach everything, and shops and restaurants will get more customers on foot and by bicycle.

Table 1: overview of mobility logics (Tridée, 2018)

4.3.5 Think about logistics and (car) parking policy.

Even if traffic calming related to cycle policy is only indirectly linked to logistics and parking policy, it is also important to take these elements into account to avoid problems.

Urban logistics

Urban distribution requires attention in terms of possible routes to and through the neighbourhoods to make distribution not disruptive but economically and operationally organisable. Organising logistics hubs at the edges of the neighbourhoods where goods can be stored and transferred on cargo bikes or light (electric) trucks can contribute to a fluent logistic organisation.

Many European cities are drawing up a **Sustainable Urban Logistic Plan (SULP**), a sustainable urban logistics plan in which transport flows are mapped and sustainable solutions are worked out to reduce the pressure of goods transport in terms of congestion, liveability, and road safety.

Parking policy, consistent with the mobility vision

The parking structure must be in line with the organisational structure and layout of the liveable neighbourhoods. The parking strategy needs to support the structure and layout of the liveable neighbourhoods. Tensions between, citizens need to be avoided.

Therefore, car traffic to and from parking concentrations (e.g., parking buildings, large underground car parks) should be routed to and from the collecting roads via the best route (short and via streets with sufficient carrying capacity). Parking in the public space, on streets or squares, should be avoided or drastically reduced to give more public space to residents and visitors. Parking in narrow streets also adds an unsafety aspect to cyclists and pedestrians.

In line with the general mobility strategy to maximise sustainability, **Amsterdam**'s current parking strategy resolutely opts for parking in garages rather than on the street so that streets become more car-free while parking problems are reduced. This creates space to strengthen the city's residential climate and give more space to cyclists and pedestrians.

5 Examples of measures for liveable cities

We do not go into detail on each of the key principles but stress those that are directly linked with the bicycle and bicycle infrastructure.

We start with a list of filtering measures. The filtering possibilities we describe concern physical filtering and filtering with traffic lights. The physical filtering does not allow motorized traffic to take a certain route. Traffic light filtering does reduce the flow of cars entering a city or neighbourhood without cutting it completely off.

We also treat the school street under these measures as a school street organises a cut in motorized traffic although temporary.

We describe than traffic slowing measures. These measures do allow motorized traffic, although at a low(er) speed. We treat cycle streets and objects put on the street to slow down traffic speed.

5.1 Types of filtering measures

5.1.1 Physical filtering

The table below illustrates some potential physical filtering or cutting measures as proposed by Transport Scotland (SUSTRANS, 2021).

Measure	Purpose	Location	Example
Modal filter	To restrict vehicle movements whilst permitting walking, wheeling and cycling. (further guidance in Chapter 3)	On streets or at junctions where this will help to remove through-traffic. Care is needed to minimise the lengths of any reverse movements needed by local motor traffic.	
Pocket park	To create a green space between modal filters used for walking, wheeling, cycling and play.	On parts of streets where no local vehicle access is required.	
Diagonal filters	To enforce turning restrictions at crossroad junctions, whilst permitting walking, wheeling and cycling in all movements.	Crossroad junctions	
Turning restrictions	To restrict vehicle turning movements.	Junctions	
One-way streets	To limit vehicle access or egress from a street as part of a wider network plan. (further guidance in Chapter 3)	Only on streets which can be designed to avoid any potential for increased motor traffic speed resulting from one-way operation.	
Bus gates	To permit through-movements by local bus and cycling, whilst restricting through-traffic.	On key local bus routes that permeate low traffic neighbourhoods.	
For all measures, keeping sign clutter to a minimum is a key objective. Using planters and other measures sympathetic to the local environment will enhance the placemaking aspect of the neighbourhood.			

Table 2: overview of potential filtering measures (SUSTRANS, 2021).

5.1.2 Filtering incoming traffic with traffic lights

Traffic lights can strongly influence traffic flows by giving desired movements more green time (to the collecting roads) and by restricting green time to non-desired directions (into the neighbourhoods). As result of the works on the central tram line (the Northern Line) in

Antwerp (Belgium), the traffic lights at the Waaslandtunnel were adjusted so that the flow of traffic that can enter the city was reduced from 1,200 cars per hour to 500 cars per hour. This reduced the inflow into the city centre to a level that the road network can handle.

5.1.3 School street

A school street is meant to limit traffic chaos in the school neighbourhood. The street at the entrance to the school is closed to (entering) motorised traffic for half an hour at the beginning and end of the school day.

A first school street was created in Bolzano, Italy. Next cities to organise a school street were Milan and Ghent (Flanders, Belgium) in 2012. Today more than 170 schools have their school street in Flanders, more than 500 in London, more than 200 in France (FIA foundation, 2022).

The Netherlands saw their first school street in The Hague in the Abeel Street in 2019. The Abeel Street became, for twice half an hour on schooldays, the exclusive domain of cyclists and pedestrians. Previously, cars claimed the lane and Abel Street became a traffic jam full of idling and roaring cars during the school rush hour. Cyclists got displaced and fled onto the pavement, where they in turn caused frustration among pedestrians, according to the municipality. Taking the car out gave cyclists all the space on the carriageway and the pavement was entirely for pedestrians.

The evaluation shows that a street where a primary school is located can also be a very pleasant place to be during the school rush hour. And moreover, a street that is perceived as very traffic-safe by pupils, parents, school staff and residents, the municipality said.

This can start a positive virtuous circle. The street is perceived as traffic-safe, thus less people come by car which increases further the safety feeling and increases further the number of pupils coming without a car.

Besides a positive impact on traffic safety, school streets do also improve air quality and children's health (CROW Fietsberaad, 2021)

The setting up of school streets can be an opportunity to set up discussions with pupils on mobility and traffic. (CROW Fietsberaad, 2020 and Mobiel 21, Polis 2022)

Figure 7: example of a school street in Amsterdam (www.amsterdam.nl)

5.2 Traffic calming measures

5.2.1 Cycle streets

Cycle streets exist in different countries. The first bicycle street was built in Bremen, Germany, followed by Utrecht in The Netherlands in the last century. In the meantime, there are also bicycle streets in Denmark, Belgium, Luxembourg, France, Switzerland, Spain. The legislation is however not always the same in different countries. In The Netherlands, Switzerland and Spain, cycle streets are not part of the national legislation, although good practices for the use of streets are available.

The idea of a cycle street is however always similar, create an infrastructure where cycling feels safe and provides a positive experience. This means in general a limited number of motorized traffic, slow speed, and priority for cyclists. In Denmark, car traffic is only allowed with a particular signposting. Although, in other countries, car traffic is generally allowed and need to leave priority to cyclists. In Belgium for example, overtaking of cyclists by car is prohibited.

To make a cycle street a success and provide the positive experience to cyclists, it is important that the number of cyclists is high compared to cars and that also the absolute car number is relatively low. The Dutch Crow suggests that cycle numbers are double and ideally quadruple of the car numbers, although with very high number of cyclists, this threshold for cars can get too high. The Flemish guidelines suggest therefore that car numbers should be limited to 1000 a day and there should be in any case more than 500 cyclists a day. Installing a cycle street in areas with a low number of cyclists is a bad idea as it will cause frustration among car drivers.

Belgium also introduced the concept of cycle zones. This is a zone with connected cycle streets.

Figure 8 (left): a Dutch street transformed into a cycle street (right below) where the cycle street got flat asphalt and sharks' teeth to provide it with priority (© Mark Wagenbuur, bicycledutch.wordpress.com)

Figure 9 (right): different traffic signs to indicate a cycle street in the Netherlands as there is no official national sign. The above right is the most popular (© Mark Wagenbuur, bicycledutch.wordpress.com)

Figure 10: cycle street in Odense (DK) that saw over a three-year period a 74% increase in cyclists and 90% of cyclists feel safe in the bicycle street. (cyclingsolutions.info/bicycle-streets/ - Danish Cycling Embassey – © Troels Andersen)

5.2.2 Objects on the street combined or not with street parking.

Very often, in regions with limited numbers of cyclists, objects are put on the street to slow down car traffic by causing an axis shift. This can be done in combination with car parking. In such situation is very important to keep space for cyclists to avoid that they are squeezed between an overtaking car and the object on the street.

5.2.3 Good examples of keeping space for cyclists with street objects

Figure 11 and Figure 12 illustrate how to guarantee the necessary space for cyclists, respectively without parking and with carparking. Important in the latter figure is that the there is space between the cycle lane and the parked cars to avoid that a cyclist would be hit by an opening car door.

Figure 11: illustration of how to reserve secure space for cyclists with a narrowing street. (Sécurothèque.wallonie.be)

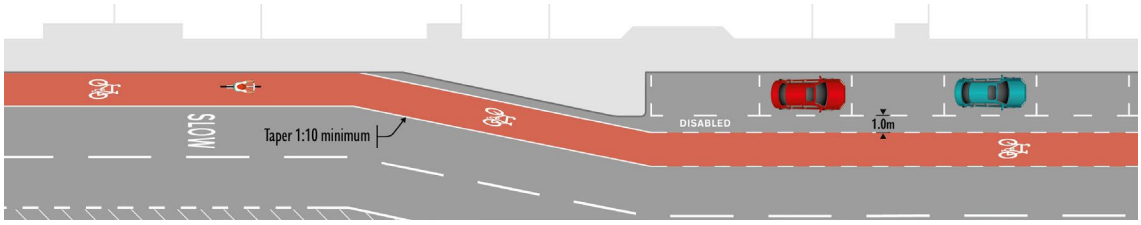

Figure 12:illustration of leaving space for cyclists with a turning road. Particular attention; on street parking (SUSTRANS-Transport for Scotland, 2021)

5.2.4 Objects on street creating dangerous situations.

As said above, the risk with objects on street narrowing the streets is that cyclists get squeezed between an overtaking car and the object on the street. Figure 13 illustrates this in a schematic way.

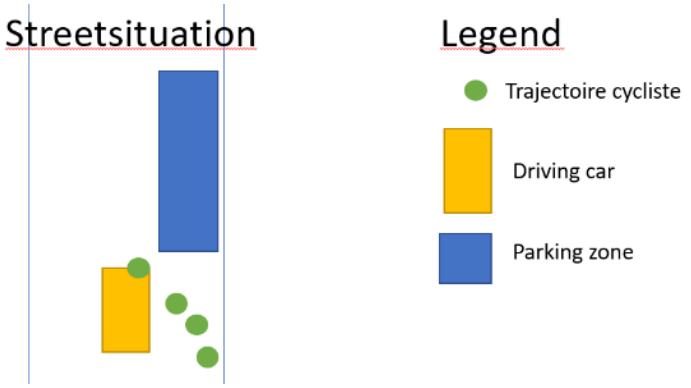

Figure 13:schematic illustration of dangerous situation created by objects on street © Transport & Mobility Leuven.

Figure 14: illustrations of how street objects can make live for cyclists difficult and lead to dangerous situations © Transport & Mobility Leuven.

Figure 15: illustration of how the markings guide the trajectory a cyclist should follow to limit danger of getting squeezed between car and obstacle ©Transport & Mobility Leuven.

The different photographs in Figure 14 illustrate how objects in street can create dangerous situations. In Figure 15 the markings try to avoid that a cyclist gets in front of the car when he drives around the obstacle at the very last moment.

6 Some integrated examples

In the previous section, we saw different very local examples of traffic calming and creation of slower traffic. As we said in the introduction, a global approach is required to create liveable cities. The examples in the previous section are therefore ingredients for more liveable cities, they need however to be incorporated in a global approach as already stated earlier. In this global approach, the mobility needs to be rethought thoroughly. That is what the cities in the examples below have done, with often very significant results.

6.1 Leuven and its circulation plan

6.1.1 The plan and its measures

Leuven is a 100 000 inhabitants city in Belgium, approximately 30 km east from Brussels. It was aware that the number of inhabitants, students and jobs would all increase by at least 10% between 2020 and 2030 while the mobility system was already touching its limits.

Therefore, an ambitious circulation plan was initiated and implemented. The aims were a significant modal shift (car -20%, public transport and bicycle *2), better accessibility, more liveability, and a nicer experience of the public domain in the inner city of Leuven.

Therefore, Leuven introduced a circulation plan. The circulation plan divided the city in different "islands". Each island is accessible by car. The car is however often not the most rapid mode. Car traffic is however limited and cannot transit through the city as illustrated in the figure below by the coloured islands. The purple middle island is a car-free pedestrian zone.

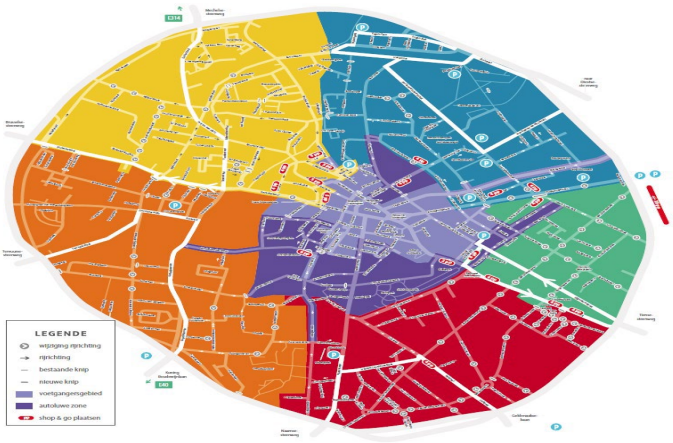

Figure 16: the islands of the Leuven circulation plan (www.leuven.be)

In the car-free pedestrian zone, parking in the public domain was suppressed and only certain categories of people have access rights (inhabitants, less valid people, medical staff…). Access control is organised by ANPR cameras. Car parking lots from where a shuttle bus can bring people to the centre (park and rides) were also foreseen around the city.

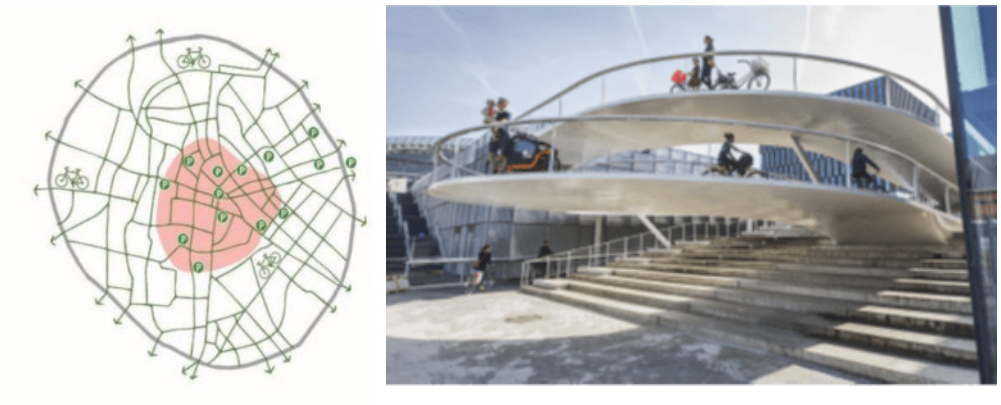

Figure 17: Cycling was facilitated thanks to a cycle network including cycle parking (left) and infrastructure (right) © City of Leuven

Cycling was facilitated via extra infrastructure, markings, extra bicycle parking, a zone 30 on the whole city centre territory, lots of one-way streets for car traffic with double flow for cyclists, a bicycle zone covering 75% of the area. A bicycle zone is a network of contiguous bicycle streets. In Belgian cycle streets, motor vehicles may not overtake cyclists and not exceed 30 km/h, cyclists may ride side by side.

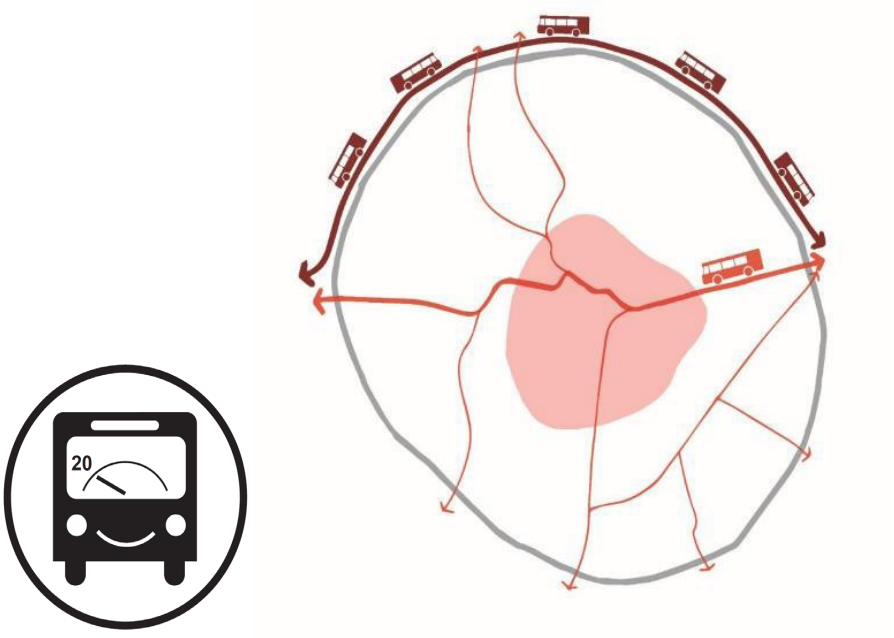

Figure 18:The reorganised bus network © City of Leuven

To stress the liveability and to upgrade the public space experience, the bus network was reorganised. It meant slower busses (max 20 km/h) on the main central road, better integrated, and less regional buses going through the city centre.

There was also more attention for shared mobility, shared bicycles, shared cargo bikes, shared kid's bikes, and more efficient logistics.

6.1.2 The results: significantly less cars, more cyclists and bus users

Thanks to the circulation plan, over the 2016-2019 period, the modal share of cyclists increased from 34 to 48% in the inner city (+ 44%). The car modal share decreased from 62% to 49% (-19%). The number of bus users increased by 18%.

6.1.3 Citizen participation in Leuven to make it more liveable.

Streets full of Leuven/life

In Dutch Leuven (the city) and leven (life) are close, streets full of Leuven is thus like streets full of leven (life). Different city administrations collaborated with citizens and made temporary city arrangements in the framework of this project.

Figure 19: an unpersonal place (right) was transformed in a more human and liveable place © City of Leuven.

"Defend your neighbourhood".

Citizens claimed "their" streets once streets got nearly car free. The city guided the neighbourhoods' citizens to strengthen the neighbourhoods.

Figure 20: an unpersonal roundabout (left) was transformed in a mini park with room for meeting (right) © City of Leuven

Other examples of how the city was transformed.

Figure 21: a square and junction (left) was replaced by a cut with extra green and banks (right) © City of Leuven

Figure 22: a square with lots of parking places (left) is replaced by terraces (right) © City of Leuven

6.2 Superblocks in Barcelona

Barcelona's 'superblocks', or 'superilles' in Catalan, aim to create green urban spaces and reduce road noise, air pollution and traffic accidents by reducing car traffic.

The city's grid structure forms the basis for 'superblocks' of 3 x 3 residential blocks (approx. 400 m2), which constitute a localised concept of traffic islands. Buses and cars have access at the periphery of the superblock, while streets between the blocks are reserved for pedestrians and cyclists and multifunctional urban spaces with room for play and recreation, possibly with residents' cars allowed. A total of 503 superblocks was planned in Barcelona. (Det Nationale Videnscenter for Cykelfremme, 2022).

Figure 24: Superblock model explained (2) (Ajuntament de Barcelona, 2016)

illustrates the concept where the left-hand figure illustrates the situation before the introduction of the superblocks. Cars can go everywhere. In the right-hand situation, after the introduction of the superblocks, cars can only go on the grey roads. Figure 25 illustrates how space has been reorganised.

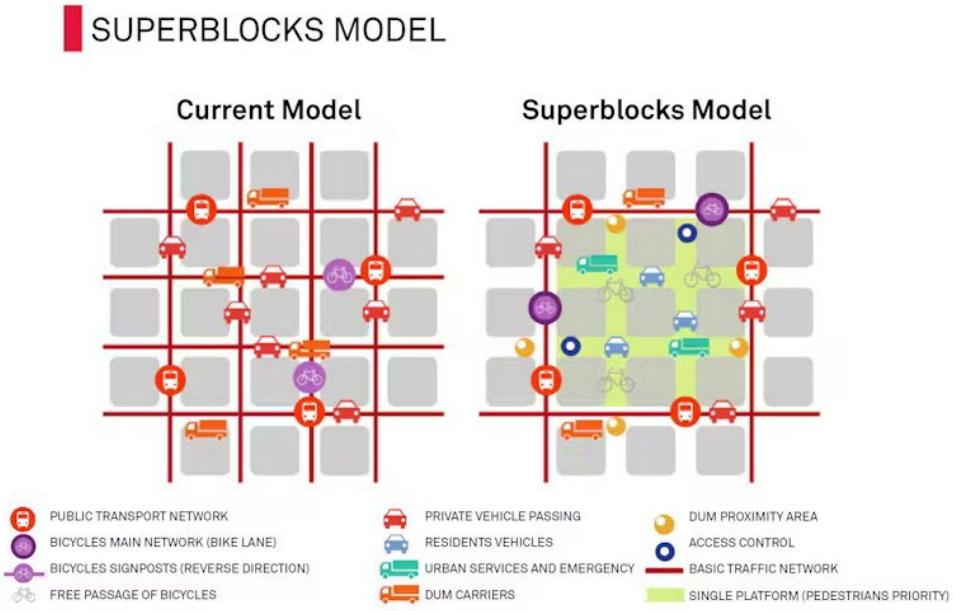

Figure 23: superblocks model explained (Ajuntament de Barcelona, 2013)

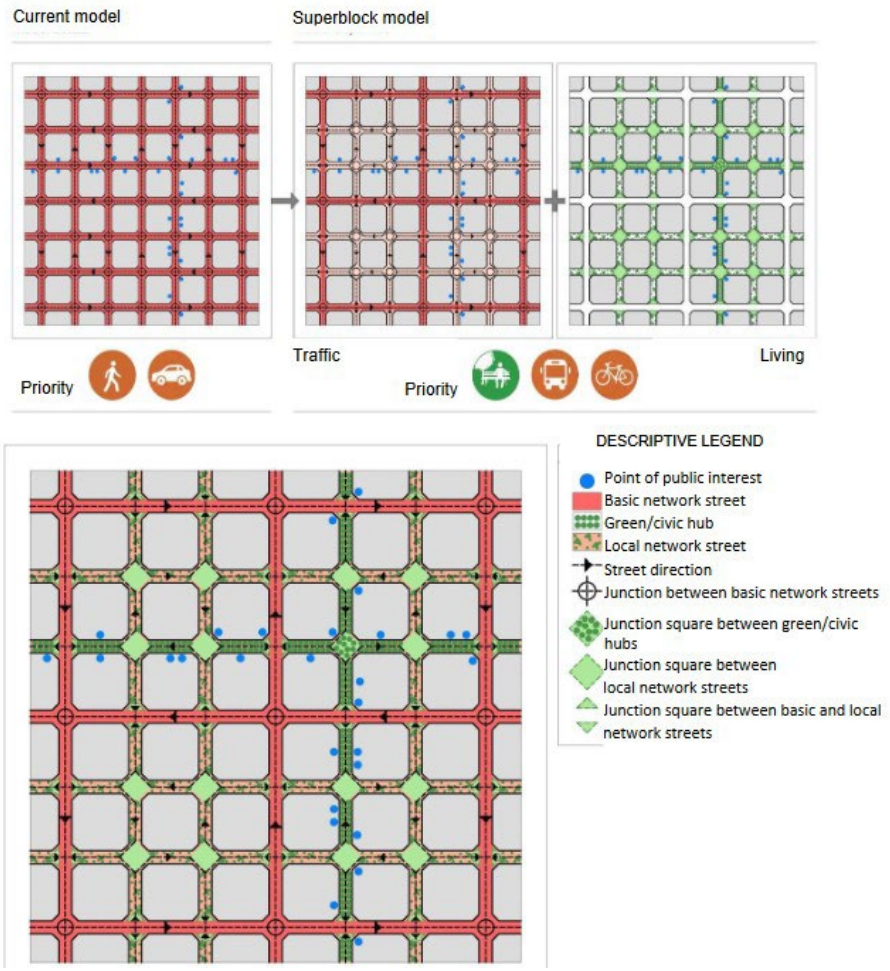

Figure 24: Superblock model explained (2) (Ajuntament de Barcelona, 2016)

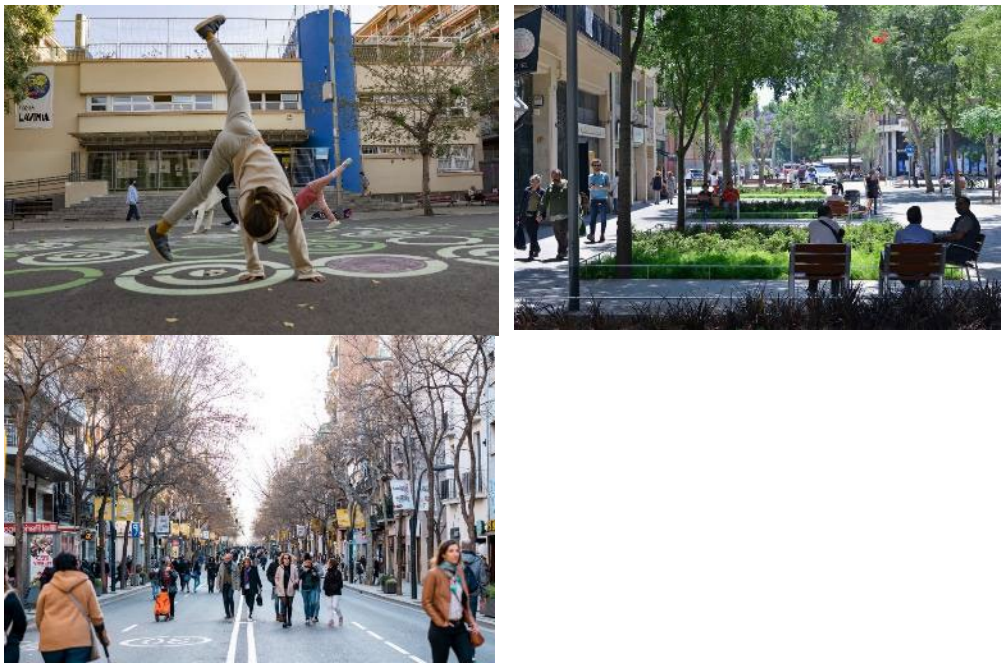

Figure 25: Transformed public spaces as part of a 'superilla' in Barcelona. © Ajuntament de Barcelona (https://www.barcelona.cat/pla-superilla-barcelona/en)

In Barcelona, it was argued that an overall 21% reduction in car use was appropriate for the collection roads to accommodate the additional traffic. To this end, the 'push' through the new circulation of car traffic was complemented by strong 'pull' measures, namely an optimised and strengthened public transport system and strong development of a coherent bicycle network with direct connections throughout the city. (Engels, 2022)

6.3 Low Traffic Neighbourhoods in London

London has been reorganising its mobility. London called its liveable neighbourhoods low traffic neighbourhoods. Low traffic is obtained by lots of cuts in streets for car traffic. Lots of these were introduced as temporary COVID measures that became permanent. The monitoring of the collecting car axes learned that the increase in traffic on these axes was only temporary. This means probably that car users shifted to other modes or stopped being mobile. (Engels, 2022)

Figure 26: Low Traffic Neighbourhood (LTN) trial of a modal filter in the London Borough of Kingston upon Thames CC by 2.0

6.4 15 minutes city Paris

Figure 27: illustration of the Paris 15 min city (City of Paris - https://www.paris.fr/pages/la-ville-du-quart-d-heure-en-images-15849)

The city of Paris wants to organise the city to be able to meet all basic needs within 15 min by foot or bicycle. Streets, squares, and places are rebuilt and organised. A reduced car dependence, bigger diversity in activities and a strong increase in bicycle use are the results.

6.5 Circulation plan and traffic islands in Ghent, Belgium

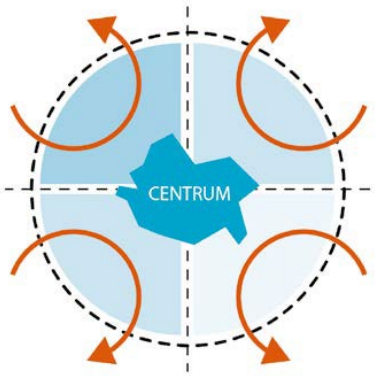

Figure 28: the general principle of the Ghent traffic plan (Urban Creator for Det Nationale Videnscenter for Cykelfremme, 2022)

To prevent motorists from driving unnecessarily through the historic city centre of Ghent (Belgium), a circulation plan has been introduced, dividing the area into six traffic islands.

The traffic islands are accessible by car, but car traffic is limited to errands in the area, e.g., for residents, businesses, and services.

Travelling by car between the islands is via the main road network and is thus not possible across an island or directly from one island to another. However, cyclists, pedestrians and public transport have free access across the traffic islands.

Figure 28: the general principle of the Ghent traffic plan (Urban Creator for Det Nationale Videnscenter for Cykelfremme, 2022)

and Figure 29 illustrate the logic of the plan. The first illustrates the general logic, the second one the application to the roads of Ghent.

As part of the introduction of the traffic islands, the city widened pedestrian areas by 150%, changed the direction of traffic in 80 streets and made it impossible for cars to drive through in 14 places.

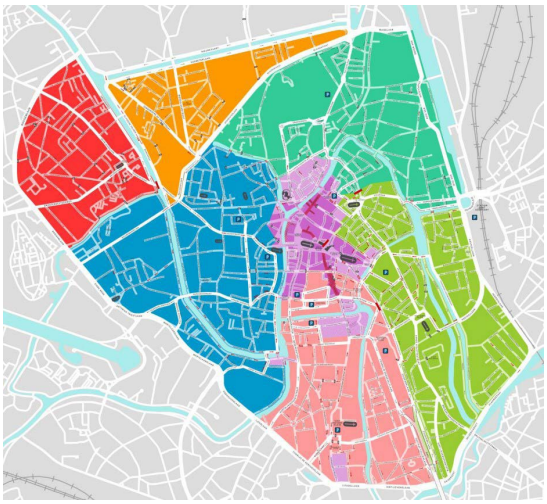

Figure 29: the detailed subdivision of Ghent in different traffic islands (City of Ghent)

Relevant observations concerning the Ghent circulation plan:

- The main axes for each subarea were chosen via the streets with the greatest carrying capacity, mostly the axes that also accommodated the most traffic in the past. They connect to the ring road in such a way that car traffic does not benefit from driving through the Maas instead of via the ring road.
- At intersections between the zones, intersections are split up with possibly selective passage for car traffic and passage for cyclists and public transport.
- The intersections of the ring road were optimised in advance to accommodate the changed traffic flows (higher due to more driving via the ring road and with other movements because people turn onto the ring road more than crossing it). After the new circulation was introduced, the light arrangements were further optimised, mainly with the aim of minimising the loss time of public transport crossing the ring road and maximising the flow of car traffic to avoid congestion on this ring road.
- Throughout the city centre area, the main cycling routes were made smoother and safer by restricting car traffic on or across these axes, greatly increasing cycling through the area. Crossing the ring road was not made smoother because the flow of car traffic takes precedence there, but all crossings were organised as safely as possible.

The central zone is car-free with an access card system for traders, suppliers, residents, and specific target groups during window times. This pedestrian area also forms the spatial centre of the area within the ring road.

6.6 Car-free city centre in Ljubljana, Slovenia

In 2007, the city introduced extensive traffic calming in the city centre, which covers over 10 hectares.

Speed humps only allow access for deliveries between 6am and 10am, and traffic is on foot, by bicycle and in small, free electric minibuses. On the edge of the centre are car parks where locals can park cheaply, making it easy to leave the car and continue walking or biking.

A major shopping street, Slovenska Boulevard, was also closed to through car traffic in 2015. As a result, car use has decreased, cycling has increased, and both CO2 emissions and traffic noise have been reduced.

Figure 30: Dynamic pedestrian bollards at the entrance to the car-free city centre, Ljubljana. ©Urban Creators.

6.7 Urban design quality – strategic places – best value for money

To guarantee the highest support for the reallocation of public space, it is important to show the benefits of it. It is therefore crucial to reinforce the spatial quality of the liveable neighbourhoods and create pleasant public spaces for residents and visitors.

However, a complete redesign of the entire neighbourhood is probably not possible given limited resources, time, and budget. A well-considered choice of what will be done where - perhaps in phases - with specific attention to strategic places, is therefore essential. Points where a lot of people will experience positive the added value will be privileged.

The organisation will be safe and legible good signage and markings are essential.

To reduce costs in an initial phase or as part of a trial operation, one can opt to realise the new layout with simple and temporary elements without compromising the quality.

Figure 31: Temporary good quality urban design with simple elements and markings (Leipzig, 2023 – Daniel Obst – CC by SA 4.0 - Schoolzone part of a superblock in Vienna, 2023 – Paul Asimov- CC by SA4.0 -Poblenou-Barcelona, 2016 – CC by SA 3.0)

Takeaways

Building liveable cities is the best way to attract cyclists and pedestrians and to reduce car use. Liveable cities contribute furthermore to a better health for people, creates the conditions for improved social relationships, and creates more nature and biodiversity in our cities.

To build liveable cities and neighbourhoods, it is important to reorganise mobility to offer walking and cycling the shortest and most attractive routes. This will limit motorized traffic. The remaining motorized traffic will be slowed down and or guided to collecting road.

To avoid chaos, it is important to measure the realism of the circulation plan and to adapt it if necessary.

The creation of liveable cities will increase the modal share of cycling significantly,

7 Cycle networks and infrastructure

7.1 Key principles to build a cycle network.

7.1.1 The technical basics

Five criteria of a cycle network are now commonplace (CROW, 2016):

- Coherence: cycling infrastructure is interconnected and connects logically to the place of origin and destination of the cyclist.
- Direct: cycling infrastructure provides cyclists with the shortest possible route between origin and destination, considering all factors that influence travel time. This means parking availability and distance between origin/destination are considered.
- Comfortable: cycling infrastructure enables a smooth flow of bicycle traffic, over pleasant and easily cyclable routes.
- Attractive: cycling infrastructure is so designed, equipped, lit, and sheltered that cycling is attractive and socially safe.
- Safe: cycling infrastructure guarantees the road safety of cyclists and other road users and reduces the risk of single-sided accidents is as low as possible.

7.1.2 Positive experience elements

The above criteria start from a traffic technical engineering vision of cycling infrastructure. To attract as many cyclists as possible, also spatial design elements leading to a positive experience needs attention (Artgineering, 2013):

- Spatial integration into the environment:
- Experience and perception: cycling infrastructure provides the cyclist, pedestrians, residents a pleasant experience. This concerns not only the design and aesthetics of the cycle route itself, but also the perception of the environment.
- Socio-economic added value: Cycling infrastructure creates added value for its surroundings in social and economic terms (customer, visitor, interaction with others).

7.1.3 An alternative visual presentation of technical basics (dissatisfiers) and positive experience elements (satisfiers)

Noor Scheltema (Scheltema, 2012) proposed a pyramid to illustrate requirements of cycle routes (and networks). Her approach is focused on cycle routes to railway stations, but most of the principles are generally applicable. In the pyramid, safety is the fundamental pre-condition for all other conditions. Directness is a condition for the ones above. Comfort and attractiveness can only be met if the ones below are fulfilled.

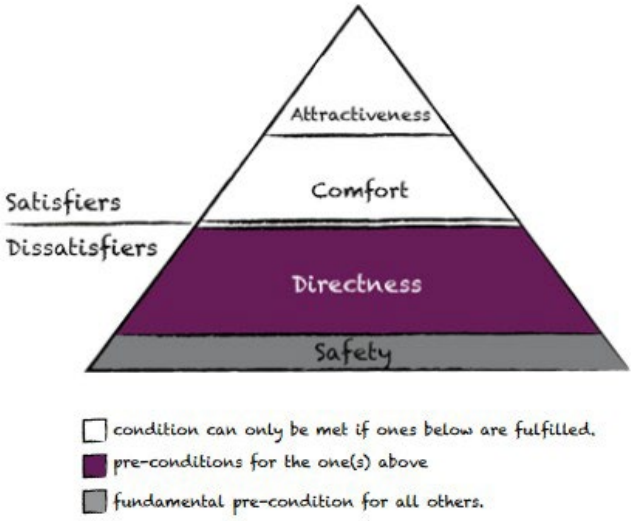

Figure: Re Cycle tool (© Noor Scheltema) illustrating the importance of safe cycle routes towards railway stations (Scheltema, 2012)

Safety is the fundamental pre-condition for all other conditions. Directness is a condition for the ones above. Comfort and attractiveness can only be met if the ones below are fulfilled.

Each of the four items cover following elements:

- Safety: Road division, visibility and lighting, pavement
- Directness: Linearity, continuity, right of way to bicyclists, orientation, fluency, flatness, legibility, transfer distance, bicycle parking capacity (the latter two are specific with respect to routes towards railway station, but also applicable for other destinations)
- Comfort: Human scale, special bicycle amenities, bicycle parking,
- Attractiveness: Maintenance, liveliness, experience

Directness covers the whole route from origin to destination. This also means the availability of good parking close to the destination are considered. If the bicycle parking is still a 5 or 10 min walk to your destination, the route is qualified as significantly less attractive.

7.1.4 Needs of different target groups, especially the most vulnerable

Network requirements can be different for different users. For leisure or recreation, directness will be of less importance, while comfort, pleasure and convenience will get greater importance.

Different types of cyclists exist. It is important to design cycle infrastructure with accessibility of the most vulnerable in mind. As most vulnerable are generally considered an 8-year-old child cycling starter and an 80-year-old senior. An important question to ask concerning infrastructure is, would I leave my child using this cycle route alone, for example to go to school.

Keep nevertheless in mind that the needs of these target groups can be quite different from other target groups like commuters. The first group won't be annoyed by a cycle route with lots of turns where speed will be naturally limited to 10 km/h while for a commuter this could be quite annoying.

7.1.5 Build futureproof, build for growing numbers, and reallocate space.

Number of cyclists will increase, the cycles used also evolve, with for example cargo bikes arriving. This means future infrastructure will need to accommodate more cyclists with potentially larger bicycles. It will therefore often be necessary to increase space allocated to cycle infrastructure (and/or to reduce drastically density of car traffic to mix car and cycle traffic). This was extensively treated in the previous chapter.

7.2 Road safety principles

Ensuring a high level of safety is a very important objective when designing routes/roads for bicyclists. In road traffic there exist in general two basic risks for bicyclists:

1 Collisions with other road users. Road users who collide with bicyclists can be diverse: cars, trucks, motorcyclists but also pedestrians or …other cyclists. Particularly risky for bicyclists are intersections and road crossings. The risk for bicyclists to get injured in case of collisions is strongly related to the impact speed during the crash and to the mass difference of the vehicles involved.

2 Single-vehicle crashes with bikes (= falls). This category is often not really considered by traffic planners as the outcomes of these crashes are usually less severe, but also because these falls are sometimes assumed to be mainly attributable to manoeuvring mistakes of bicyclists. Nevertheless, a road authority can also contribute to prevent falls, for example by removing obstacles that easily can cause falls of bicyclists, for example small poles, rectangular kerbstones, or potholes.

7.3 Safe System Infrastructure Policy

International associations such as the World Road Association (PIARC) emphasize the importance of road infrastructure in providing safety on roads. They advocate the adoption of an infrastructure policy based on a Safe System approach (PIARC, 2019).

The Safe System approach is based on an ethical position where it can never be acceptable that people are seriously injured or killed on the network. It provides a set of design and operating principles to guide action on the journey to the long-term goal. The long-term Safe System goal is the elimination of death and serious injuries on a country's roads.

The Safe System approach is adopted by the European Commission (2020) and by an increasing number of countries. It also forms the basis for the UN Decade of Action for Road Safety 2021-2030. The Safe System requires strong governmental leadership, as well as the engagement of a wide range of sectors. The prime responsibility of a road authority and other agencies is to support road users to reach the end of their trips safely.

The Safe System is based on well-established safety principles — of known tolerance of the human body to crash forces, speed thresholds for managing crash impact energies to survivable levels, and the capacities of vehicles and forgiving infrastructure to reduce crash impact energy transfers to humans. A focus on key crash types occurring on a network helps to identify the role and intervention options for each Safe System element.

System-wide intervention strategies are required to avoid fatal and serious injury crash outcomes, including emergency medical care for crash victims.

There is a shared responsibility between system designers (who design and operate the roads) and road users, for safe travel outcomes on the road network.

The Safe System approach compels system designers to provide a safe environment, and to consider the combined system as the major factor in crashes rather than the traditional approach that placed most responsibility for safety on the road user.

The system design and operation must become forgiving of routine human (road user) error. People are not perfect and frequently make errors. The principle of forgivingness means that the consequences of routine errors should be mitigated by the system and never should lead to fatal or severe injury crashes.

7.4 Specific actions for safe infrastructure for bicyclists

Two strategies are generally applied to reduce collision risks for bicyclists (Wegman et al., 2012): on road stretches, cycling is ideally as much as possible physically separated from motorized traffic, certainly if speed differences are considerable. At intersections, conflicts between motorized vehicles and bicyclists are inherent and speed reduction is important to reduce both the risk of collisions and the severity of collisions if they occur.

We first treat the principles concerning road stretches. In a second section we pay attention to intersections. In the last section we pay attention to maintenance and roadworks.

7.4.1 General principles concerning road stretches.

The figures below illustrate how the design principles of cycle infrastructure are influenced by the motor vehicle speed and the traffic volume, the number vehicles per hour or per day.

Figure 32 illustrates the cycle infrastructure to be privileged depending on the speed limit (columns) and the traffic volume (rows). The figure was proposed in an INTERREG-project developing guidelines to define a National Cycle Route Network in the Danube countries.

The higher the speed limit and the higher the volumes of motorized traffic, the higher the required level of separation of bicycle facilities to facilities for motor-vehicle traffic.

Figure 33 illustrates the same principle but in a more visual and graphic way.

The principle behind this graph and table also is that whenever the required level of cycle facilities cannot be realized (often due to budget constraints), speed limits should be adapted to enable safe bicycle traffic.

	speed km/h	30	40	50	60	70	80	90	
v/h	v/d								road
50	417								track
250	2083								lane
500	4167								mixed
1200	10000								
2000	16667								
2500	20833								

Figure 32: overview of types of cycle infrastructure depending on speed and traffic volume (table) (proposed for the Danube countries in Belamarić, 2021).

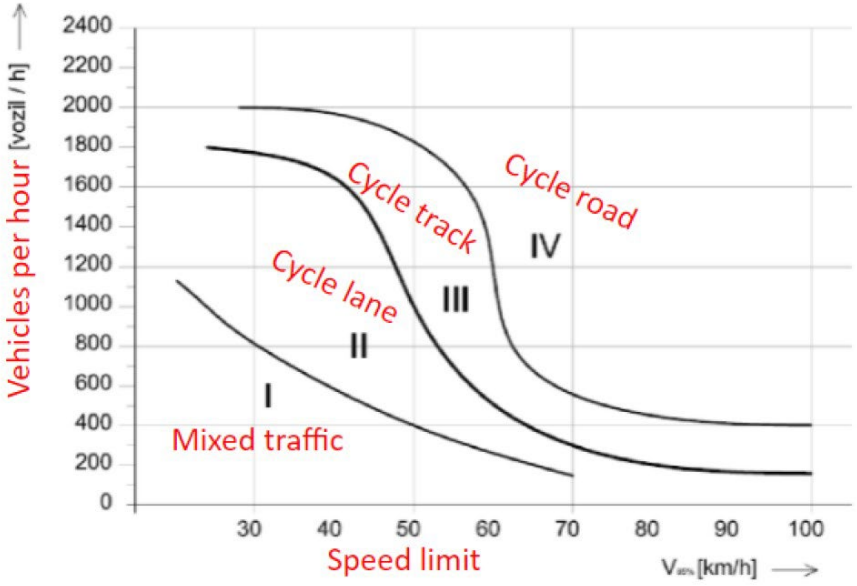

Figure 33 Overview of types of cycle infrastructure depending on speed and traffic density) (Belamarić, 2021)

However, dedicated cycle facilities are not by definition guaranteeing a better safety performance.

An example of the latter is provided below. Due to the very short lateral distance from the passing bicyclist to the parked cars, there is a continuous risk of suddenly opening car doors, potentially causing serious harm.

Figure 34 Curb-side parked cars too near to bicycle infrastructure, Austria. Source: SABRINA (2022, copyright @EuroRAP)

7.4.2 Crossings - junctions

Danish research shows that in urban areas, accidents are higher at intersections with cycle paths. It illustrates the importance to pay attention to a good design of cycle infrastructure at intersections. This makes it very clear that the challenges of building good cycle infrastructure are not in building cycle infrastructure along road stretches but is in how to design road junctions and crossings.

When designing crossings and junctions with cycle infrastructure the **leading principle** should be, **make cyclists visible for motorised traffic in anticipation**. In other words, we could also **put cyclists where car drivers expect them** or **avoid cyclists popping up unexpectedly**.

We provide some a further example to illustrate this, the comparison of a regular terminated cycle lane in signal-controlled intersections and a truncated lane in signal-controlled conditions.

Comparison of regular terminated cycle lane and truncated lane in signal-controlled intersections (Vejdirectoratet, 2022)

The figure below illustrates a regular Danish cycle lane at an intersection. The cycle lane is located next to a separate right turn or a combined straight and right-turn lane. In such a situation, the cyclist feels relatively safe as he has his own track on the intersection. Safety is also handled by an advanced stop line for the cyclists. This makes it easier to see the cyclists that are going straight. Not that often, especially in starting bicycle countries, the safety measure of advancing cyclists is not taken.

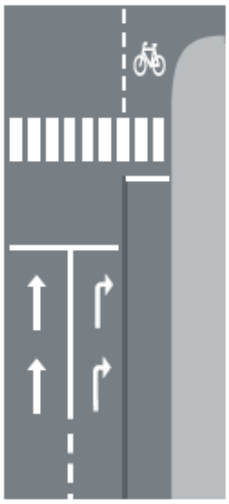

Figure 35: the two left hand side figures provide an example of a Danish regularly terminated cycle lane in signal-controlled intersections.

Figure 36: truncated cycle lane in signal-controlled intersections

Although, safety has been overthought in this design, the number of accidents in such a situation is increased by 130% in the case of a combined straight ahead and right-turn lane compared to a situation without and measure for cyclists.

Figure 36 illustrates another situation that could be subjectively felt as more insecure. Cyclists are mixed with the turning right flow of cars well before the crossing. The reduction in accidents compared to a situation without cycle infrastructure is 50%. Compared to the left hand, Figure 35 situation, the reduction in accidents is 60% rates. If we see it the other way round, the replacement of a Figure 35 situation by a Figure 36 situation increases accidents by 200 to 250%. This is a tripling of accidents!

The reason of the spectacular increase in safety by mixing is probably that cyclists are more visible and expected for motorized traffic. The inconvenience of the mixing in the example is that it “looks” less safe and beginning cyclists could be scared to cycle in such a situation.

This principle also explains why the liveable city where mixed traffic is the rule is also advantageous for cyclists’ safety.

Prefer grade-separated intersections to avoid problems at intersections.

As said above, crossings and intersections always decrease cyclists’ safety. Ideally, their inherent conflicts should be avoided by constructing overpasses or underpasses (tunnels) as illustrated in the figure below.

Figure 37: crossing of a heavily used road with 90 km speed limit, left an unsecure crossing with only some markings, right a cycle tunnel under the same road © Transport & Mobility Leuven.

7.4.3 Roundabouts

Roundabouts have intrinsic properties that have turned out to improve traffic safety for most road user types. Roundabouts considerably reduce speeds of motorized vehicles, and they decrease the number of possible conflict points between road users. Apart from their effects on traffic safety, roundabouts are adequate intersection types for accommodating high traffic flows, particularly in case of high quantities of left turning traffic However, roundabouts are much less favourable for cyclists as there is a particular conflict possible between cyclists and motor vehicles when the latter are entering or leaving the roundabout and crossing the path of cyclists that are following their way on the roundabout (Daniels, 2010).

There are two ways to accommodate cyclists more safely at roundabouts:

- create separate cycle paths that cross the entries/exists at a sufficient distance from the circulatory roadway so that the cyclist is well visible by the driver of the motor vehicle when crossing the roundabout entry/exit.
- Create a compact 'mixed traffic' roundabout in which the cyclist is riding on the middle of the road and thus stays in front of the motor traffic and thus cannot be overtaken. This solution is particularly suitable in low-volume roads.

In any case, cycle lanes on the outside of the circulatory carriageway should not be used.

7.4.4 The devil is in the details, getting on and off cycle infrastructure.

The point on the cycle lanes at intersection above is a particular illustration of getting on and off cycle infrastructure. Below we provide some further examples of potentially good cycle infrastructure becoming dangerous when it comes to reaching or getting off the infrastructure (Figure 38, Figure 39 and Figure 40). Especially Figure 38 and Figure 40 do not respect the leading principle of avoiding cyclists popping up unexpectedly.

Figure 38 (left): unsafe start/end of a bidirectional cycle path at a crossing © Transport & Mobility Leuven.

Figure 39 (right): start (and end) of a bicycle path with an uncomfortable level difference between cobblestone street and cycle path © Transport & Mobility Leuven

Figure 40: cycle path arranged over 100m with unsafe cycle path ending © Transport & Mobility Leuven

Figure 41: safe leaving of the cycle path © Transport & Mobility Leuven

Figure 41 is a good example of how leaving a cycle path can be organised. The cycle path at the left-hand side of the road stops on the photograph. The cyclists leaving the cycle path at that point are “protected” by the little island, car drivers need to avoid.

7.4.5 Bidirectional cycle paths: 4 times as dangerous at crossings for the left driving cyclists (Schepers, 2015)

For the Dutch situation, a one-way cycle path is safer than a cycle lane or riding on the carriageway, including at intersections.

Two-way cycle paths are less safe than one-way cycle paths. This is not new. It is related to the fact that many cyclists on the two-way cycle path on the left of the road and come from the unexpected direction for motorists exiting or entering the side road.

At priority intersections, the risk with two-way paths is on average twice as high as on one-way cycle paths (Zeegers, 2013). For cyclists riding to the left of the road (against the direction of traffic on the lane) face an approximately 4 times higher (Schepers & Voorham, 2010) risk of being involved in a crossing accident. Two-thirds of crossing accidents on two-way cycle lanes involve an accident involving a cyclist riding on the left side of the road (Schepers & Voorham, 2010 Wachtel & Lewiston, 1994). Two-thirds of crashes involving cyclists riding on the left involve a collision by traffic from side streets.

Figure 42 illustrates a bidirectional cycle path in Ostrava, Czech Republic. Many car drivers entering the intersection will only look to their left-hand side in order to observe oncoming traffic. Bicyclists coming from the right-hand side (looking from the viewpoint of the car driver) come from the unexpected direction and tend to be less well noticed.

Figure 42: bi-directional cycle path in Ostrava, Czech Republic. © Mark Wagenbuur, bicycle Dutch, https://bicycledutch.files.wordpress.com/2012/08/ostrava.jpg.

Important factors in accident occurrence:

- If the cyclist comes from the right and cycles on the left side of the carriageway, the motorist has less time to react.
- The car driver's viewing strategy (Summala, 1996). The viewing strategy when turning right relative to a cyclist riding on the left is the most error prone (Summala, 1996).
- incorrect attention of the motorists, i.e., their behavioural routines and viewing strategy is usually focused on the road where motorised traffic is driving (looked-but-failed-to-see-errors)
- Misplaced expectations of the cyclist, who thinks he has priority (Summala, 1996)
- Speed behaviour of the car driver

- Complexity (and therefore lack of time, especially among older road users)
- Visibility constraints
- Amount of bicycle traffic (if there is usually a lot of bicycle traffic at the spot, cyclists are expected and detected earlier: 'safety in numbers' effect
- Cover accidents (caused by other traffic, by objects and planting)
- A bi-directional cycle path should in general be avoided. If bidirectional cycle paths can reduce the number of crossings with side roads, they can be considered. If the decision is made to opt for a bidirectional cycle path, the following two elements need to be considered:
    - Bike paths ideally should be at a distance between two and five metres from the road. This is in line with knowledge from recent studies into blind spot accidents with right-turning lorries.
    - For car traffic attention-increasing measures, such as platforms, raised construction of the bike path, directional arrows for cyclists, marking of the bike path, warning signs.

7.4.6 Maintain cycle infrastructure.

It is so obvious that it is important to maintain cycle infrastructure. Below some examples of what happens when maintenance is not done.

Figure 43: Poorly maintained bicycle infrastructure © Transport & Mobility Leuven

7.4.7 Cycle infrastructure also available under snow and rainy conditions

Ensure that cycle infrastructure is comfortable to use under different conditions, snow, rain, ... The figures below illustrate that this is not always the case.

Figure 44: cycle paths covered with snow making save cycling nearly impossible © Transport & Mobility Leuven.

Figure 45: cycle paths with lot of water during and after rain making cycling very uncomfortable © Transport & Mobility Leuven.

7.4.8 Roadworks – foresee a suitable road for cyclists.

Another obvious fact is that a deviation for cyclists need to be foreseen in case of roadworks. This is however often neglected or badly organised. The example below illustrates that cyclists cannot go straight at this intersection (photograph right). They should take left (yellow sign on left photograph), although they are not allowed, and the street is not fit for cycling.

Figure 46: insufficient alternative cycle infrastructure during road works © Transport & Mobility Leuven

In the example below, works on the cycle path interrupted it and a kind of little bridge was put in place. This is something relatively comfortable for pedestrians (except for people with reduced mobility) but not for cyclists as they could touch the railing and fall.

Figure 47: uncomfortable crossing during works at the cycle path © Transport & Mobility Leuven

Takeaways

1. The challenge of building good bicycle infrastructure lies in the design of the crossings, junctions, ending and beginning of cycle paths.
2. The challenge is well illustrated by the fact that even well thought cycle infrastructure can significantly increase the accident risk.
3. The main explanation is that cyclists are in a place where motorized vehicle drivers do not see or expect cyclists. A leading principle in the design of cycle infrastructure needs therefore to be to make cyclists visible in anticipation and avoid cyclists popping up unexpectedly.
4. Dangerous situations can be created at the end of cycle paths at crossings and with bidirectional cycle paths crossing side roads.

8 Bicycle markings and signs

Traffic control devices, such as road markings, signs and signals, and other road safety elements, are an important part of road infrastructure. This is equally true for cycle infrastructure.

The Vienna Convention of the United Nations, officially called the Convention on Traffic Signs and Signals, is a multilateral treaty aimed at increasing road safety and standardizing international road traffic, which is still the basis for regulations in most European countries. Slovakia ratified the Vienna Convention in 1993[3].

The convention unified colours, shapes, and basic dimensions of road signs and defined the use of symbols to make the signs more understandable to road users from different origins. Besides road signs, the Vienna Convention also included and defined road markings.

The Vienna Convention does not contain specific requirements for markings or signs with respect to cyclists. This means that no uniformly accepted sign to indicate cycle lanes or a prescribed colour for cycle lanes exist in Europe. Consequently, a wide variety of signs and markings to indicate cycle facilities is in use across Europe.

In practice, some national guidelines such as the Dutch CROW guidelines or the German ERA 2010 guidelines are also used outside their respective countries, at least as reference guidelines.

[3] https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XI-B-19&chapter=11

9 Data collection and bicycling network indicators

Collecting proper data on societal phenomena is at the same time necessary and challenging. The same holds true for bicycling.

We can distinguish two steps in data collection and handling:

- **Data** collection
- Development and use of **indicators**

Data and indicators are related but separated concepts: they represent different levels of information within a monitoring framework.

Data can best be described by facts and statistics that are collected and that subsequently can be used for reference and analysis. Data are values of variables, whereas an indicator tries to measure a concept. For example, bike ownership can be used as an indicator for bike use.

9.1 Bicycling data

Some existing sources for data on bicycling in Slovakia are:

1. Population census 2021 - official portal:
2. Population census 2021 – modal split dashboard

Census data are particularly useful at a population level. They deliver a general insight in modal shares of different travel modes in a certain area, varying from the local (municipal) level to a national level. However, they lack the granularity that is needed to observe for example effects of local measures such as the construction of a cycle path.

Traffic counts can be useful to measure **volumes** of local traffic. Some types of devices and applications have been developed to monitor cycle traffic locally. They make use of video cameras, loop detectors, radar, or a combination of these. One example is the Telraam device (https://telraam.net/en/location/9000005012) that provides traffic counts, including counts of bicyclists, as open data.

Some other data sources rather apply to **infrastructural characteristics** of the (bicycle) road network. Some free to use, open geographic databases nowadays contain different layers of information that include data on roads and bicycling facilities. An example that also covers Slovakia is OpenStreetMap (https://www.openstreetmap.org). In many cases, road authorities will also have their own network information stored in dedicated databases that are used for road management purposes.

9.2 Bicycling network indicators

The Dutch Design Manual for bicycle traffic (CROW, 2016) defines 5 fundamental requirements for a cycling network: cohesion, directness, safety, attractiveness and comfort (see also section 7.1.1 on page 30).

Table 3 below shows some indicators that can be used to quantify each of these concepts.

Table 3: bicycling network quality indicators

Requirement	Indicator
Coherence	% of a typical bike trip that is made via the network of dedicated cycle routes
Directness	Detour factor of an average trip (= relationship between the shortest distance over the road and the distance 'as the crow flies')
Safety	The number of road crashes per 1000 trips
Comfort	Evenness of the road surface / % of an average bike trip in car-free zones
Attractiveness	User's appreciation of a certain route or network

Source: CROW, 2016

Researchers have also developed methods to assess the performance of a certain bicycling infrastructure network at an aggregate level. Typically, these methods also use indicators to express the outcomes of the assessment. Two examples of assessment methods include:

- CycleRAP (https://irap.org/cyclerap/): CycleRAP is a method of evaluating road and bicycling infrastructure for safety. It aims to reduce crashes and improve safety specifically for bicyclists and other light mobility users by identifying high risk locations without the need for crash data. The eventual safety level of the infrastructure is expressed by an aggregated score that depends on the crash type, the crash probability and its severity.
- BYPAD (www.bypad.org/en/): The Bicycle Policy Audit (BYPAD) was developed by an international consortium of bicycle experts. It assesses provides an overview of the applied measures and structures in local cycling policy, including the performance of the cycling infrastructure network. The entire quality chain consists of 9 modules which all together ensure a balanced cycling policy. Every module generates a separate quality score.

10 Combination of train and bicycle; the BiTiBi approach

10.1 BiTiBi: toolkit to replicate the successful Dutch approach.

BiTiBi was a European funded project that studied the successful Dutch approach concerning combining bicycle and train. In the Netherlands more than 40% use the bicycle to reach the railway station, illustrating the success of the combination.

After having analysed the approach, the study distinguished 6 building blocks providing a solution to overcome the different barriers that prevents making the bike-train combination successful. The approach was then replicated in other European countries based on which replication guidelines were written. Below we describe the 6 building blocks and provide some explanation for each of the building blocks.

Each of these Building Blocks provides a solution to overcome the potential barriers when implementing BiTiBi services. The potential barriers and the Building Block solutions are provided in the table below.

Table 4: overview of potential barriers and BiTiBi solutions to overcome those.

Barriers for implementing BiTiBi	BiTiBi solution	BB
Lack of safe and bicycle friendly railway access (first mile)	bicycle routes towards station thanks to implication of cities	BB6
Lack of safe bike parking (first mile)	Safe sheltered bicycle parking	BB1
Lack of shared bicycle (last mile)	Shared bicycle	BB2
Lack of coherence between bike and train service	Unity in bike and train organisation	BB3
Lack of fare integration	Integrated payment system	BB4
Lack of knowledge among users	Communicate about service	BB5
Cultural barrier	Make the service desirable	BB5

Detailed BiTiBi guidelines are available at https://www.tmleuven.be/nl/project/BiTiBi.

Below we provide further explanations for each building block:

10.2 BB1 Bicycle parking:

Imagine a city with no car parking… Right, there would be no single car in that city! The very same is true for cycling. A destination without safe and sheltered bicycle parking means no cyclists.

Providing safe and sheltered bicycle parking at a convenient place for the cyclist is crucial. A convenient place means a place as close as possible to the platform and easy reachable by cyclists. The most ideal place would be a parking on the platform. This is nearly what was done

in the Dutch city of Houten. A bicycle parking was built under the platform with direct access to it. Also in Como, Italy, the bicycle parking was built nearly on the platform (see photograph).

In many other areas, biycle parkings will suffice that are positioned in the immediate neighbourhood of major attraction points for bicyclists (Figure 49).

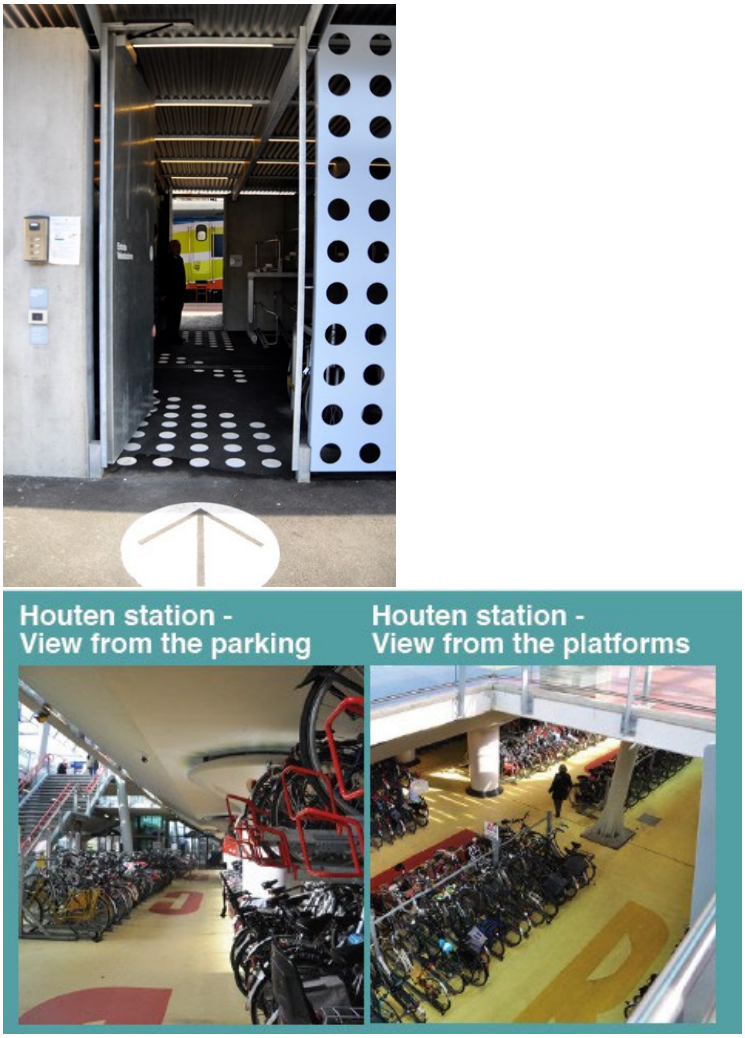

Figure 48: bicycle parking in Houten and Como with direct access to the platform © BiTiBi - Copenhagenize

Figure 49: short-term bicycle parking in Croatia. Source: Croatian cycling association

10.3 BB2 Shared bicycles

Imagine your destination is 3 km from a railway station.

Walking takes you nearly 45 min.

Public transport takes you 15 minutes due to congestion and detours. Waiting time before catching your bus is 10 minutes. Altogether, it would last at least 25 min in total.

A taxi takes you 10 minutes but can be quite expensive.

A bicycle would take you 15 minutes of good time, if only …there was a bicycle available at the train station.

A shared bicycle is a comfortable and robust bicycle, available at the destination station of the railway passengers. It allows bringing them to their final destinations. It bridges the last mile and adds lots of comfort and service to the rail service.

Figure 50: the Dutch shared bicycle, convenient and recognisable © BiTiBi -NS

10.4 BB3 Unity of bike train bike organisation

The importance of a door-to-door approach (instead of a station-to-station approach) is obvious.

Almost nobody travels from station-to-station. Almost each rail traveller needs to bridge first miles and last miles. In some cases, walking, public transport, or taxi provides a solution. However, in quite some cases other services can do better. It is therefore important that a rail company, organising the biggest part of the door-to-door journey, takes care of providing services for its clients to bridge these first and last miles.

10.5 BB4 one easy payment system

One public transport payment system able to pay for all available public transport services is of course much more convenient than a different payment system for each public transport service or for each separate service that is part of one bigger service. One integrated payment system has furthermore the advantage that commercial and marketing actions can be organised more efficiently.

Figure 51: The Dutch “OV Chip card” used by people all over the country © BiTiBi-NS.

10.6 BB5 communication

When good door-to-door transport solutions are available it’s important to raise awareness about it among potential users. In non-bicycle-friendly countries, it will be furthermore important to stress the convenience of a bicycle for first and last mile.

Figure 52: Promotion built on the fast, easy, and cool concept in the BiTiBi project © BiTiBi-Copenhagenize.

10.7 BB6 cycle ways to the railway station

The first and main condition to enable people to do first and last mile of a door-to-door train journey are safe cycling conditions towards the station. This is very well illustrated by the “Re cycle tool pyramid” from Noor Scheltema. No safe and (to a lesser extent) direct access to the railway station for cyclists means no cyclists at the railway station. The pyramid has been inspired by the Maslow pyramid displaying in the bottom the most fundamental needs. See also chapter 7.

10.8 Build partnership to leverage the approach.

Partnerships with (local) authorities are in most cases necessary to successfully implement the BiTiBi approach. If not strictly necessary, those partnerships will provide at least a boost to the approach. In the Netherlands, local and national authorities, Pro Rail, the railway infrastructure manager, and NS, the railway operator collaborate to implement the BiTiBi approach. Each of the partners provides financial means to implement the approach as illustrated above.

Local authorities furthermore take care of cycle infrastructure in their city and around the railway station. Without safe cycle routes, the BiTiBi approach cannot be a success.

In other countries than the Netherlands, authorities can also have a precious role in communicating to their citizens to increase the desirability of cycling.

11 Recommendations for cycling infrastructure development in Slovakia

This report concludes with 9 recommendations for a smart cycling infrastructure development policy in Slovakia:

- Develop guidelines that go beyond technical prescriptions.

  Guidelines for developing cycling infrastructure are needed to support road engineers in designing proper cycling infrastructure. Applying guidelines will also make approaches in the country consistent. These guidelines should be established at the national level and should be widely accepted in the country. They should put main principles central for planning cycling infrastructure: safety, directness, coherence, attractiveness, and comfort. Guidelines may contain technical prescriptions but should rather promote good practices than establish detailed rules[4]. Relevant stakeholders should be involved in developing guidelines. Guidelines should as much as possible be based on well-established national and international knowledge and available evidence.

- Attention to cycling should be present in every road (re)design project.

  As a rule of thumb attention to cycling should be given in every project to (re)build roads or public spaces. This does not necessarily mean that dedicated cycle infrastructure always must be constructed everywhere, but it means that a compulsory reflection is to be done about how the (re-)designed infrastructure contributes to making traffic smoother or safer, also for cycling. This requires engagement and support at all levels of strategic and operational decision making. This also requires organisational procedures at various policy levels.

- It's not only about constructing as many cycle paths as possible.

  Developing good cycling infrastructure should not be reduced to constructing cycle paths whenever and wherever possible. Above all, **traffic calming** and creating liveable neighbourhoods are key concepts and a cornerstones of a good cycling policy. Traffic calming means that motorized traffic slows down and properly considers the presence of cyclists (and other vulnerable road users) in traffic. Liveable neighbourhoods mean that public space is redistributed to meet more equally different human needs. This means that less space is reserved for motorized vehicles for driving and parking.

- Assess priorities.

  Government resources are scarce and can only be spent once. It can be good therefore to develop a 'value for money' approach or – otherwise stated – to carefully assess costs and benefits of planned expenditures. Projects should be prioritized that have the biggest return in terms of the number of people that will make use of the cycle

[4] Current technical standards are provided in TP 085 Designing cycling infrastructure: https://www.ssc.sk/files/documents/technicke-predpisy/tp/tp_085.pdf. Some interviewees reported that these guidelines are no longer adapted to the current legislation.

facilities. However, it should also be emphasized that anticipated current (low) volumes of cyclists should not be a reason not to execute basic investments in safe infrastructure for bicyclists. State funding for cycling infrastructure projects should also be dependent on well-established criteria that take at the use potential for functional cycling into account.

- Develop expertise.

  Good intentions are important, but more than that is needed. Design proper cycling infrastructure and networks is a skill that requires **education, practice, and knowledge exchange**. Currently, expertise in Slovakia is present, but not widespread. A community of properly educated and experienced cycling infrastructure **experts** in Slovakia should be established, both in the public and in the private sector. The Ministry of Transport could support this, e.g., by means of setting up courses and technical visits (or funding private organisations who do so), defining educational requirements for own staff and subcontractors, setting up symposia or fora to exchange information. Collaboration with the academic sector is advisable.

- Share knowledge.
  Establish or fund an organisation or an entity that is assigned the public task to develop, to collect and to publicly disseminate (via newsletters, workshops, symposia, social media…) knowledge on cycling infrastructure design. It is important to adapt knowledge sharing to the different target groups. Many countries have such knowledge institutes, for example CROW Cycling Council ('Fietsberaad') in The Netherlands, the academy of experts in active mobility (L'académie des experts en mobilité active, ADMA) in France, Cycling Council (Fietsberaad) Flanders in Belgium, the National Knowledge Centre for Cycling Promotion (Nationale Videnscenter for Cykelfremme) in Denmark and the Cycling Academy (Fahrrakademie) in Germany.

- Leadership
  Developing cycling infrastructure is beneficial to society in the long term. But it may require investments and clear choices in the short term. This requires leadership. Multiple respondents in the interviews, from Slovakia and abroad, emphasized the crucial role of political will and commitment in the development of cycle infrastructure. The best promotion for cycling is a mayor or important person that is using a bike for utilitarian purposes.

- Collaborate
  Local and national road agencies should collaborate well in designing cycling networks to make their efforts compatible. Developing safe and comfortable cycling networks should be part of their mission statement. Also, other stakeholders (public transport companies, merchants, inhabitants…) should be involved whenever relevant. Citizens should be involved and informed systematically. Ideally, efforts and inputs of all local stakeholders should be coordinated in local/urban mobility plans in which future policies are described and agreed upon.

- Integral planning
  Integral thinking starts in the spatial planning phase. New developments should consider accessibility by bike. Bicycling is most evident in short trips (<= 3 km). New residential developments should be realised as close as possible to existing city or town centres. Major developments like sports stadia, shopping malls, concert halls,

universities, schools etc. should be well accessible by bike. This accessibility could already be checked formally during the building permit phase.

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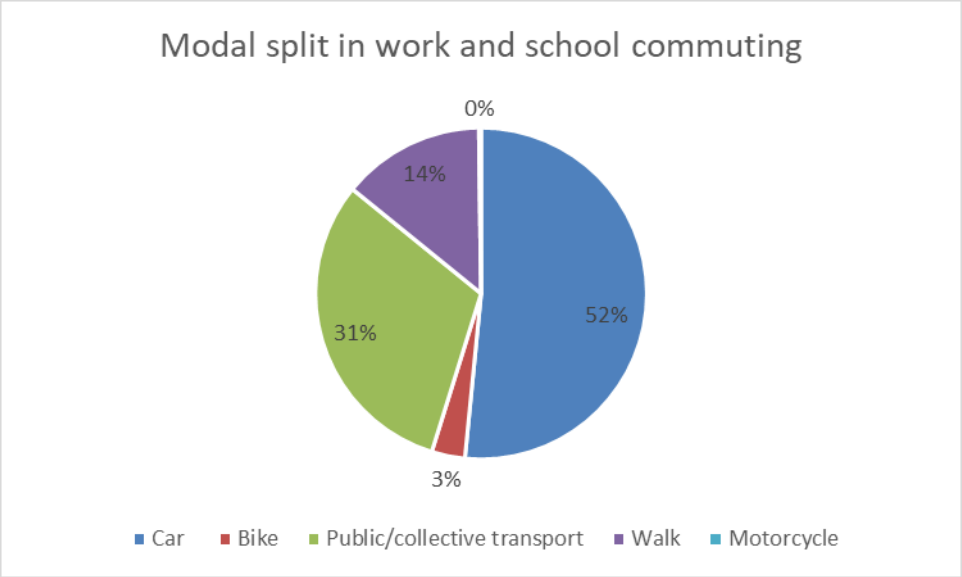
Annex 1. Country fact sheets

Czech Republic

- **Indicators**

  - **Modal share of cycling**



Source: Czech Statistical Office, Census data 2021

1) Modal share of cycling of all trips for work or school commuting is 3%.
2) The national cycling strategy 2014-2020 aimed to increase the overall share of cyclists in the Czech Republic to 10% (up to 25% in urban area).
3) The share of cycling in the Czech Republic is the highest in smaller cities (ECF, 2022). However, Hornik (2020). reported that commuting by bicycle has decreased over time in smaller cities in the Czech Republic.
4) Šucha (2017) observed that the Czech Republic has a rather low level of development of cycling. Culturally, cycling in the Czech Republic is rather perceived as a sport or a recreational activity.

  - **Annual investments in cycling infrastructure**

(Slovakia included to facilitate comparison)

Country	**Czech Republic**	**Slovakia**
Population 2021 (in million)	10.5	5.4
Investments (in million €) in cycling from central governments budgets	na	na
Annual investments per capita	na	na

Projected Investments from EU funds 2014-2020 (in million €)	25	28.65
Annual inv. 2014-2020 per capita	€ 0.30	€ 0.80
National Recovery and Resilience Fund 2021 - 2027	25	105.1
NRR annual per capita	€ 0.30	€ 2.80
Total annual investment per capita	€ 0.60	€ 4.00

Source: ECF (2022) (na = information not available)

- No data are available on regular investments in cycling from central governments budgets, in the Czech Republic.
- In the period 2014-2020, on average 0.3 € per year per capita from EU funds was invested in bicycling infrastructure in the Czech Republic. This amount is estimated to remain unchanged in the period 2021-2027.
- The level of EU-funded investments in the Czech Republic is therefore lower as compared to Slovakia (0.6€ versus 4€ per capita).

Stage of development of cycling network (qualitative score)

A long-distance cycle route network was established in 1997 in the Czech Republic. The network improved considerably since then and currently has a length of about 4.000 km (Czech Republic, 2021). This network is complemented by regional and local networks. Regional networks provide connections between municipalities. The local network is managed by the municipalities.

Source: www.dobramesta.cz

The Czech Republic is one of the European Member States developing EuroVelo, a European cycle route network aiming to be the backbone for national and regional cycle networks.

More recently, measures during the lockdown caused people in cities and beyond to start using bicycles to a greater extent. The boom in cycling thus recalled some shortcomings in the infrastructure that need to be remedied in the future.

- ## Guidelines/handbooks (CDV, 2023)

    - Technical Conditions 179 - Designing infrastructure for cyclists (Czech version for download here)
    - CT No. 361/2000 Coll., On Road Traffic.
    - The Czech Association of Cities for Cyclists disseminates full and short version of Specifications 179, also in seminars held in cooperation with the Transport Ministry.
    - The Czech TS 179 are based - among others - on the German ERA 2010 guidelines.

- ## Reasons why the level of cycling in this country is low.

Based on their analyses of the national census data of 2001 and 2011, Hornik et al (2020) state that local public transport, cycling and walking have become less attractive, which in turn has led to greater use of the car. Moreover, car dependency and increased decentralization of cities are difficult processes that are not easy to reverse. Šucha (2017) identified several reasons to explain the lower rate of cycling as compared to other EU countries: the insufficient quality of the surfaces of cycling paths (or their absence), cycling paths not being interconnected into a coherent network, a lack of places where bicycles can be parked securely, and a lack of facilities at workplaces for people who use bicycles to get to work. However, one of the main obstacles to a higher rate of bicycles being used as means of transport is generally the cyclists' low subjective feeling of safety, especially regarding roads used together with cars.

- ## Current focus elements of cycling policy

The Czech Republic adopted in 2021 its "Urban and Active Mobility Concept 2021-2030" which also includes cycling (Czech Republic, 2021). Previously, the 'national Cycling Development Strategy 2013-2020' (Czech Republic, 2013) was in place.

Focus elements of the current strategy are:

- Amendment to traffic rules in active mobility (to incorporate new types of active mobility).
- Changing traffic signs regarding active mobility (updates of legislation and technical requirements of infrastructure design).
- Improve safety of vulnerable road users.
- Funding cycling infrastructure development on the local and regional level.
- Active mobility coordination (cycling coordinators) at the various policy levels.

Perhaps unique in Europe, the Czech Republic recommends certain modal split targets depending on the population of the town or city (ECF, 2022). For smaller cities (up to 25000 inhabitants), a target level of cycling between 20% and 30% is set.

- ## Lessons to learn from this country?

In many respects the development of cycling in the Czech Republic has been like elsewhere in Europe: demographic evolutions, an increased car dependency and urban sprawl have decreased the modal share of bicycling until recently. However, a renewed attention for cycling has been noticed and cycling is gaining popularity. Some cities or areas in the Czech Republic

have a significant higher share of cycling in their modal split. These cities could serve as an example to cities in Slovakia.

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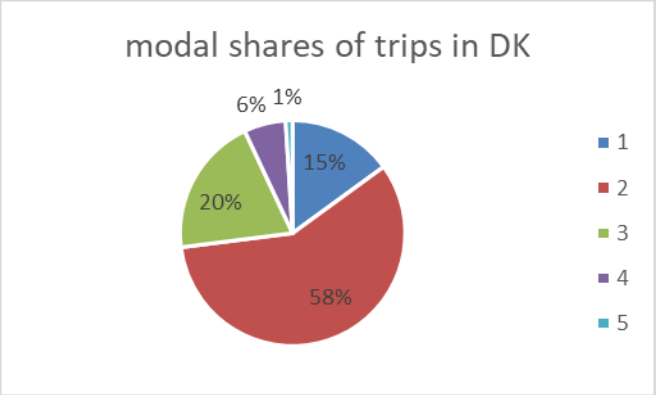
Denmark

- **Indicators**

  - **Modal share of cycling**



Source: Danish National Travel Survey 2016-2019 in https://www.vejdirektoratet.dk/tema/bicycles-danish-roads

5) Modal share of cycling of km travelled is 4%.
6) Cycle km are decreasing since 1990 with an increase between 2010 and 2014 while car km increase.

  - **Annual investments in cycle and other transport infrastructure (as a proxy for ability to invest in cycling infrastructure)**

Cycle infrastructure (ECF, 2022)

Country	Denmark	Slovakia
Population 2021 (in million)	5.8	5.4
Investments (in million €) in cycling from central governments budgets1	57.3	na
Annual investments per capita	€ 1.41	na
Projected Investments from EU funds 2014-2020 (in million €)	0	28.65
Annual inv. 2014-2020 per capita	€ 0.00	€ 0.80
National Recovery and Resilience Fund 2021 - 2027	70	105.1
NRR annual per capita	€ 1.70	€ 2.80

Total annual investment per capita	€ 3.10	€ 4.00

Other sources

- 1.1 billion EUR annually between 2014 and 2018 for road infrastructure (**website Statistica**)
- 22 billion EUR in 2021 -2035 period in rail and road infrastructure with improvement in highways to curb congestion (**website Cphpost**)
- 458 M $ to be invested in cycle infrastructure of which 64 M $ in 2022. Previous years Denmark invested around 10 M $/ year in cycle infrastructure (**www.visitdenmark.com**)

Stage of development of cycling network (qualitative score)

- Functional cycling is most developed in cities especially in the Copenhagen region. The Copenhagen region is also developing a network of cycle superhighways ((**website supercykelstier – (cycling highways**) see illustration)
- The network is less developed in more rural areas and of less quality.
- There is a good touristic national cycle network with 11 national cycle routes (nationale cykelruter). (**www.ruter.dk**)

Guidelines/handbooks

- "Handbog I cykeltrafik" from 2014 provides an extensive overview of the Danish rules to build cycle infrastructure (Celis Consult, 2014).
- The Cycling and Safety measures in Danish Road standards provide a condensed overview of the guidelines to build cycle infrastructure.
- The bicycle parking manual provides extensive guidelines for bicycle parking (**Danish Cycling Federation with support of municipality of Copenhagen**)
- Mainly marking and signing rules are mandatory, other rules are to be considered guidelines and best practices.

- ## Reasons why the level of cycling in this country is high/low.

In the 1960s, cars were threatening to displace bicycles in the main Danish cities. The oil crisis, the environmental movement and a couple of controversial road projects reversed the trend. In Copenhagen for example, there was a wave of protesting the building of a motorway across the lakes separating inner and outer city. From that point on more space was reserved for cycling and this brought also more cyclists are stopped the decline in cycling (Danish Cycle Embassy - (Danish Cyclists 'Federation's archive)

- ## Current focus elements of cycling policy

In 2014, The Ministry of Transport, Building and Housing published a new Danish bicycle strategy. The starting point was that bicycle traffic dropped by more than 10% between 1990 and 2013 nationwide. Three topics for action were chosen:

- **Everyday cycling** with a focus on good bicycle parking facilities at stations and other hubs, new cycle solutions at workplaces, cycle superhighways, cycling events, campaigns, filling in the missing links in a cohesive cycling network, green waves, and cyclist shortcuts.
- **Active holiday and leisure** with a focus on good recreational routes, signage, and a coordinated effort to develop Denmark as a cycling holiday destination.
- **Secure, new cyclists** with a focus on safe roads and paths, school activities, cycling campaigns, a program to prevent right turning accidents, and railway crossing protection. (https://www.trm.dk/media/qkfpoagy/engelsk-cykelstrategi-til-web.pdf (national bicycle strategy 2014) - https://cyclingsolutions.info/denmarks-cycling-strategy/

- ## Lessons to learn from this country?

Getting significant numbers of cyclists means a radical reallocation of public space towards cycling (pedestrians and living zones) and away from space for cars (roads and parking). This choice needs (very) courageous decisions in the short term but pays off in the longer term. Without a sustained strategy and measures discouraging car use, modal share of cycling decreases.

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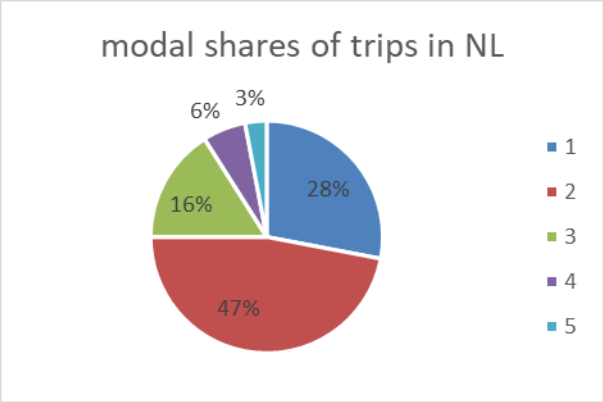
The Netherlands

- **Indicators**

  - **Modal share of cycling**



Source: KIM, 2019

Annex 1. Modal share of cycling of km travelled is 8%, for cars it is 69% and public transport 15%.

Annex 2. Cycle km are still growing. Car km are stable since 2003km, while they increased between 1985 and 2003. (Missine, 2021)

  - **Annual investments in cycle and other transport infrastructure**

Cycle infrastructure (ECF, 2022)

Country	The Netherlands	Slovakia
Population 2021 (in million)	17,5	5,4
Investments (in million €) in cycling from central governments budgets	950 (2022-2025)	na
Annual investments per capita	€ 13,60	na
Projected Investments from EU funds 2014-2020 (in million €)	0,2	28,65
Annual inv. 2014-2020 per capita	€ 0,00	€ 0,80
National Recovery and Resilience Fund 2021 - 2027	None	105,1

NRR annual per capita	€ 0,00	€ 2,80
Total annual investment per capita	€ 13,60	€ 4,00

Other sources

Government coalition agreement of November 2022 promises following national investments to make new housing projects accessible, over a period of approximately 10 years:

- Public transport (train) 4 billion EUR
- Road infrastructure 2.7 billion EUR
- Cycle infrastructure 0.8 billion EUR (with provinces and municipalities 1Billion EUR)

We assume these amounts come on top of the ECF figures in the table.

(**website Rijksoverheid, 2022**)

- **Stage of development of cycling network (qualitative score)**

The Dutch Cycle network is very well developed. It is probably the best developed in the world with a cycle network that is hierarchically build up with main routes/cycle corridors/cycle highways at the highest hierarchical level and supra local routes and local routes on the lower hierarchical levels. There is also a distinction between the recreational and the functional cycle network. The image illustrates the actual and planned cycle highways at the highest hierarchical level.

(**website Fietsberaad and Fietsersbond**)

- **Guidelines/handbooks**

The main design guide for cycle infrastructure is the "design manual cycle traffic" from CROW https://www.crow.nl/publicaties/ontwerpwijzer-fietsverkeer For cycle parking it is the "leidraad fietsparkeren 2011". https://www.fietsberaad.nl/Kennisbank/Leidraad-fietsparkeren

Besides these guidelines, cities have often their own guidelines inspired by the above guidelines. These are however often less strict.

The above texts are guidelines. It means that proper execution is not binding or guaranteed. A municipality or other public authority can adapt the application if it judges too difficult to allocate enough space for the realisation of cycle infrastructure. It can however also require the strict application of the guidelines.

- **Reasons why the level of cycling in this country is high/low.**

In the seventies, citizens organized manifestations asking for a reallocation of space to cyclists and pedestrians. Provide space for the bicycle was thus not a "natural" decision, but a decision that was taken thanks to courageous citizens and decisionmakers that went against the ideas of that time of providing as much space as possible to cars (see illustration CC0 -Wikipedia). From that point on more space was allocated to cyclists and a positive self-reinforcing circle occurred with ever more cyclists and more space for them consequently. Further elements that favour cycling are the Dutch planning, lots of facilities are within cycle distance and the regular strategic documents helped and help to keep the necessary attention for cycling (see also below).

- **Current focus elements of cycling policy**

The actual focus of cycling policy is gathered in the "Tour de Force" document. The document brings different stakeholders together and defines the strategic options for bicycle policy. Different stakeholders are public authorities, knowledge institutes, NGO's… The main objective is to get 20% more cycle km in 2027 compared to 2017.

Since 2021, the Netherlands started the second part of the "Tour de Force""Schaalsprong fiets" stressing following topics:

- *The bicycle in the city* requires organizing public space with sufficient, safe, and comfortable cycle infrastructure.
- *The bicycle in combination with public transport* requires good parking facilities at railway stations and main bus stops.
- A *high-quality bicycle network* that makes cycling safe, comfortable, and obvious
- *Stimulating cycle use and cycle initiatives* with focus on specific groups like commuters, socially disadvantaged
- *Gather data* on cycling and standardize them.

tourdeforce.nl

- **Lessons to learn from this country?**

Getting significant numbers of cyclists means a radical reallocation of public space towards cycling (pedestrians and living zones) and away from space for cars (roads and parking). This choice needs (very) courageous decisions in the short term but pays off in the longer term.

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https://whywecycle.eu/ accessed 18-04-2022.

https://bicycledutch.wordpress.com/tag/stop-de-kindermoord/ accessed 18-04-2022.

Interview with Wout Baert and Mirjam Borsboom (March 2022)

Annex 2. Training material

Based on the findings of the project and the collected input in the different interviews, training material was developed for the capacity building activities.

A2.1. Needs & requirements.

During interviews with stakeholders in Slovakia and in other countries (Czech Republic, Belgium, Slovenia, and the Netherlands), the needs for training were assessed.

First, it was asked whether participants were aware of existing initiatives/courses (in their own country) for professionals in traffic planning (e.g., road design engineers, urban planners…) aiming to develop skills and knowledge in designing bicycle infrastructure. The results for this question are summarized below:

- Slovak stakeholders:
  - I am gaining knowledge on the Coursera, Futurelearn, Edx, or Czech-Slovak Civitas courses https://civitas-learningcentre.talentlms.com/
  - We are currently training officials also in our region and offer a Spring and Autumn cycle transport training.
  - Expertise is present in Slovakia. However, the number of specialists is too small.
  - Much room for improvement
  - Last year event from the Ministry of Transport and Cyclocoalicia. In Summer they organised a road show.

- International stakeholders:
  - Slovenia: courses organized occasionally by the ministry of transport.
  - Czech Republic:
    - occasional courses organized by the Czech Chamber of Chartered Engineers
    - Road safety auditor training courses
  - Belgium:
    - Field excursions, for example by 'Cycling Council Flanders'
    - Symposia where good practices are presented.
    - Webinars
  - The Netherlands:
    - "Think bike workshops" organised by the Dutch Cycle Embassy = Dutch experts go to a city for a week to discuss the situation there and to propose solutions.

Subsequently, it was asked what topics should be treated in such courses. The results are summarized below:

- Slovak stakeholders:
  - Regulations and standards
  - Ways of settling property relations
  - Data
  - School streets
  - Language: should be in Slovak
  - Good examples
  - Mistakes/bad examples
  - Problems with current standards, Technical Specification

- International stakeholders:
  - Examples of good practice
  - Examples of bad practice
  - Emphasize on the importance of objective evaluation.
  - Be selective in the examples. Bring messages that target the group.
  - Political leadership: political responsible to be present during (at least part of) the discussions.

A2.2. Training material

The actual training material is developed as a series of PowerPoint slides that go in annex to this report:

Session 1 - Why is cycling important?

Session 2 - It's not about cycling …. but liveable cities (and traffic calming)

Session 3 - Cycle networks and infrastructure

Session 4 - Recommendations for Slovakia

Annex 3. Interview participants

The interviews addressed two target groups: Slovak stakeholders and cycling experts abroad.

The purpose of the interview was to get input about what is needed for a successful development of bicycling infrastructure in Slovakia. We defined cycling infrastructure means as all infrastructure that cyclists are allowed to use. This include bike paths and bike lanes, as well as roads that are shared with cars. Furthermore, we explicitly mentioned that cycling infrastructure also refers to facilities such as dedicated traffic signs and signals for cyclists, bike racks for parking and shelters.

The interview contained open-ended questions. Room was left for additional comments. After an initial round, response levels were very low among Slovak stakeholders.

Organisation	**Country**
Cycling Knowledge Centre Flanders	Belgium
Ministry for Infrastructure and Water Management	The Netherlands
CDV Transport Research Centre	Czech Republic
University of Maribor	Slovenia
University of Ljubljana	Slovenia
Bratislavský samosprávny kraj	Slovakia
Košický samosprávny kraj	Slovakia
Trenčiansky samosprávny kraj	Slovakia
Trnavský samosprávny kraj	Slovakia
Cyklokoalícia	Slovakia

Annex 4. Synthesis of the interviews

Background

The interviews addressed 2 main target groups:

- Slovak stakeholders
- Cycling experts abroad

The purpose of the interviews was to receive input about what is needed for a successful development of bicycling infrastructure in Slovakia. The interview contained mainly open-ended questions. Room was left to provide additional insights or comments.

The overview below contains a synthesis of the answers received from the interviews. The answers are grouped in two categories: Slovak stakeholders (labelled SK1 to SK5) and participants in other countries (labelled EU1 to EU5).

Respondents were given the option to respond in English or in Slovak (in written). Translations to English were done with the software DeepL.

Questions

- How important are – to your opinion - the following elements for a successful cycling infrastructure development strategy? (national guidelines, budget, Political commitment, Stakeholder involvement, a national cycling strategy, regulatory standards, good examples/demonstration projects)

(EU1) Political commitment is probably the most important. It is often underestimated but is of prior importance! Once there is political commitment, the other things follow, especially budget. A good example is Paris. A very convinced person (the mayor) is at the controls and decisions are taken in favour of cycling.

Regulatory standards are also interesting. Standards and guidelines get people involved on the ground level. Otherwise, lots of opportunities are missed as there can be money, but people do not necessarily know how to spend it and how to build cycle infrastructure.

National strategies are also important. It shows where to go. In the Netherlands, until 2015 there was no longer a national strategy in place. In that period, there was much less attention for cycling. It changed with the introduction of the “Tour de Force”, which was adopted in the time that the “Tour de France” got its start in the Netherlands. The “Tour de Force” brought various stakeholders together and set a new dynamic for cycling with some concrete objectives.

For starting countries, a top-down strategy and communication will be important.

(SK1) In my opinion, when it comes to a successful development of bicycling infrastructure in Slovakia, the most important part is the commitment of politicians. It is necessary to have cycling transport become a full-fledged part of transport. And this is where politicians should take a responsible approach to this topic. This is also evident from the impact of the budget on the development of cycle transport.

Another important topic is norms and laws. As the cycling coordinator of our region, I try to cooperate with organizations and communicate with local stakeholders, but sometimes it is very difficult due to ignorance of regulations and lack of funds. On the other hand, we try to look for good examples together and learn from them.

(SK2) Showing good practices is always very helpful. It can help people to gain expertise.

(EU4) expert opinion and political cooperation are decisive.

(EU2) Standards make it impossible to build trails and bike infrastructure lightly somewhere. Without funding, municipalities and the region usually can't afford it - project support from the state is important. If politicians, or anyone else, is not interested in the whole thing, usually nothing happens. Good projects are important, but if there is no will or resources, it won't help.

- From the above list, what do you think is the most important factor to successfully develop a cycling infrastructure strategy? Why?

(EU1) Political commitment is the factor with which it all starts. The political commitment needs to be translated in a strategy to clarify objectives for all people involved.

(SK1) It is not possible to develop cycling infrastructure without proper budget funds and land ownership settlement, which makes it clear that it cannot be done without the help of politicians. Another important aspect is also the lack of education in this area.

(SK3) Budget, Political commitment, Stakeholder involvement, Regulatory standards. Without political consent and cooperation with local stakeholders, it is not possible to build linear constructions such as cycle paths. Technical standards guarantee the quality of cycling infrastructure, which cannot be built without a budget.

(EU3) stakeholder involvement + budget

(EU4) A national cycling strategy. Here expert opinion and political commitment meet.

(SK4) The most important thing is to have good laws, standards, and political support to address cycling infrastructure. And of course, a national strategy that is not just on paper, but that is also implemented, that works. Money for cycling infrastructure will be found if the state is interested in building it.

If the building of cycling infrastructure is to move forward, two points must be met: political and legal support and funding to build it.

(SK5) Budget - decides how the whole strategy is set and conceived.

(EU2) Probably the willingness of someone to deal with it. And the possibility of funding from support (stat, EU).

(EU5) It is important that the needs of the people busy with policy at the very local and practical level are heard at higher levels of decision making. A cycle knowledge centre can have a role here as they can have a direct line with local stakeholders, but also with the ministry and or regional administration.

Also making visible cities and villages that do successful projects, for example at a cycling congress is important.

- When/how have you experienced the importance of any of the above factors in a project in which you were closely involved? Provide one example if possible.

(EU1) In the 60ties and 70ties, standards of living went rapidly up. Cars got accessible for nearly everybody and infrastructure was adapted for cars. At that time political leaders strongly committed for maintaining and re-establishing liveable cities end places with room for living and thus for pedestrians and cyclists. Without political commitment, backed by engaged citizen groups, the Netherlands wouldn't be a cycle country today.

(SK1) Currently, together with Cyklokoalícia, Mindop, OCI BB, our office organizes training for officials in the field of sustainable transport.

(EU3) In Slovenia, when designers proposed cycling traffic on existing roads, for each such a section must road safety auditor make a report with conclusions, if proposed solution is safe enough.

(EU4) National strategy and design guidelines together with political will (ministry, mayors) and finances form the basis for national projects.

(SK4) When the laws are not well set or the goals of the national cycling strategy are not met, it doesn't work. For example, cooperation between ministries or their subordinate companies.

(SK5) Budget - limits the quality of the design during project preparation and implementation. Regulatory standards - it is necessary to comply with the standard, which in some cases is very difficult to comply with financially due to the circumstances in practical terms.

(EU2) Most of the projects I assessed were financed by the SFDI, IROP projects, without which only small projects are implemented and only in exceptional cases.

(EU5) Hereby two examples of providing information and/or demonstration can be very useful to bring cycling a step further. In the two examples different groups of stakeholders had different opinions. Taking seriously these opinions and testing solutions enabled the different parties to agree on a solution, or to create conditions to agree on a solution.

Ex1: Right of way situations on bicycle highways. There was no right of way for cyclists on a certain bicycle highway crossing. Police and mayor found it to dangerous, cycle movement saw that in practice the give way to cyclists was nearly applied. After an experiment all parties saw that giving right of way for cyclists was a good solution.

Ex2: Organising mixed traffic (mixing cycling and motorised traffic). The regional administration was not willing to give money for creating mixed traffic conditions, while localities lacked the know how to know when and how to implement mixed traffic. Fietsberaad took the initiative to order a study on the topic leading to a publication clarifying things.

- Which errors should be avoided? Why do projects to invest in cycling infrastructure sometimes go wrong?

(EU1) The absence of a national cycle strategy should be avoided. The lack of smart objectives in that strategy should also be avoided. It is important that objectives in national strategies can measured and evaluated. You can for example fix an amount of extra cycle commuters, a doubling of cyclists' modal shares.

(SK1) Projects often go wrong due to the ignorance of regulations, standards, lack of quality designers and, as I mentioned above, due to the lack of knowledge.

(SK2) Some politicians/decision makers/mayors don't yet see cycling as a serious travel mode. In practice there is a sometimes an approach of "I want to build 1km cycling path, tell me where". This not necessarily leads to building cycle paths at the most appropriate locations. Good intentions are not enough: we sometimes see that even cities who want to invest a lot, do not necessarily do it in the right way. For example, they start constructing bi-directional cycle lanes.

(SK3) Routing that leads to complex property-legal settlements, such as land owned by the state but also privately owned. The complexity and lengthiness of legislative processes linked to bureaucracy.

(EU3) Because designers don`t look for a best possible solution – in terms of cycling infrastructure -, but rather look for cheaper and "less problematic" project solutions. For example, to put cycling paths near the roads rather than away from motorised traffic.

(EU4) expert opinion should dictate projects and politics should follow - and not the other way around.

(SK4) The biggest problem is the complexity of some of the processes in the design of cycling infrastructure, the long approval process, the settlement of land under cycling infrastructure. Many projects get stuck, or end up completely, or the various calls for funding for cycling infrastructure are no longer made due to the complexity of the processes.

(SK5) Inadequate project preparation, poorly set project objectives, insufficient project funding, unforeseen circumstances during implementation.

(EU2) Lack of continuity. The trail goes only a few hundred metres, without any further stages of the solution.

Poor inclusion in the project programme. Often it is a "cycle path" to be funded by projects, but it is obvious immediately that it is a path for pedestrians AND cyclists, or that pedestrians will use it AND, if not in line with the project brief, there is a deliberate misclassification.

Trail closure. Lacks the ability to safely connect to other street/road space.

Lack of trail widening where necessary due to grade or directional alignment.

Faulty treatment of trail crossing with road.

(EU5) National cycling strategies and cycling policies in general need to be sincere. Other policies need to be coherent with those. Thus, cycling should not just be a hang on, or an addition or an excuse for other policies. The intention needs to be increasing cycle modal share and not facilitating car use.

- If you need information on how to design cycling infrastructure, which handbook(s)/guideline(s) will you consult?

(EU1) The Dutch CROW handbook/guidelines. It used by the infrastructure managers, provinces, and municipalities.

(SK1) If I need any information, we consult it in a community that is inclined and knowledgeable about the issue. This includes Cyklocoalícia, OCI BB, City of Trnava, Cykloplatforma, University of Žilina, or representatives of SK8. The translated book (March) by Janette Sadik Khan – Boj o ulicu was also a great help. We also draw a lot of information from the Design Manual for Bicycle Traffic (Crow).

(SK2) There are national guidelines, 'standard 085'. Updated in 2018, still used, but already outdated at that time. Super outdated right now.

Law changed recently. Cars now must yield – when turning at intersections – to cyclists that are going straight. But the technical standards are still not reflecting this.

Also, the law on traffic signs changed a bit more than a year ago, huge change in very good direction. Copied DE and NL ways of doing it. Also, this update is not yet included in the technical standards.

It is important to realize that designing good cycling infrastructure requires a way of thinking that is much more than just prescribing things in technical guidelines.

The city of Trnava is producing some own guidelines, will be finished in a couple of weeks.

(SK3) Technical conditions for cycling infrastructure design TP085/2019N

(EU3) CROW manual

(EU4) my own national guidelines

(SK4) The national cycling strategy, the relevant standards, are particularly useful for this. And, of course, Technical Specification TP085 - Design of cycling infrastructure. We are also inspired by similar documents from the Czech Republic and Germany.

(SK5) https://www.ssc.sk/files/documents/technicke-predpisy/tp/tp_085.pdf (TP 085)

(EU2) TP 179 - Designing roads for cyclists; ČSN 73 6101 Design of roads and motorways; ČSN 73 6110 Design of local roads; Act No. 361/2000 Coll. and its implementing decrees.

(EU5) The Dutch cycle infrastructure guide (Ontwerpwijzer fietsverkeer) is of course an interesting work. Als Copenhagen has some interesting work. The Flemish (BE) guidelines are also good. It has been rethought and reworked to limit it to essentials. For additional stuff it refers to information elsewhere. Also, the French Cerema and German DIFU organisations have interesting information available.

- Are you aware of existing initiatives/courses (in your country) for professionals in traffic planning (e.g., road design engineers, urban planners…) that aim to develop skills and knowledge in designing bicycle infrastructure?

In Slovakia:

(SK1) I am gaining knowledge on the Coursera, Futurelearn, Edx, or Czech-Slovak Civitas courses https://civitas-learningcentre.talentlms.com/

As I mentioned above, we are currently training officials also at the Self-Governing Trnava Region, through the Spring and Autumn Cycle Transport School.

(SK3) Expertise is present in Slovakia, but the number of specialists is too small. There is much room for development.

Last year event from the Ministry of Transport and Cyclocoalicia. In Summer they organised a road show. Participants from officials (municipalities...) there.

Elsewhere:

- Slovenia: occasionally organised
- The Czech Chamber of Chartered Engineers occasionally issues some. Or the issue is discussed at road safety auditor training courses.
- Belgium: Fietsberaad Vlaanderen is doing this to a certain extent. It frequently brings together cycle and mobility professionals. It brings people together on study excursions and study days where good practices are presented, during webinars...
- "Think bike workshops" organised by the Dutch Cycle Embassy. During one full week, Dutch experts go to a city to discuss the situation there and propose solutions. Dutch experts are chosen depending on the needs.

- What should be - to your opinion - important elements of such courses? (e.g., specific content, theory, practice, good examples, terrain visits…)

Slovak stakeholders:

1. An important element of such courses should be the regulations and standards, ways of settling property relations, data, also the need to work with the data, school streets.
2. Willingness to organize such courses.
3. willingness to participate on the part of designers.
4. Language barrier determines the conduct of courses in the national language.
5. So, the course should first not only point out good examples from practice, but also point out mistakes in the design of cycling infrastructure. Possibly also point out the problems with standards, Technical Specifications to bring about positive change.
6. Examples of good practice

International stakeholders:

- Especially examples of good practice are needed.
- Knowing and explaining well why something is a good example and why something is (not) successful. Objective-factual evaluation is therefore important.
- Being selective in the examples and material you bring. Bring messages that target the group.
- If we want to bring a clear message to the audience, don't work with parallel sessions, but keep them all together and provide your clear message.
- Political leadership is also here important. This means that the political responsible needs to be present during (at least part of) the discussions. In that way, he shows it is important for him and he is also aware of what happens on the ground.

- Which particular ‘golden tip’ would you give to successfully develop cycling infrastructure in Slovakia?

(SK1) Inspiration that comes from cities that set out a good example, for example the city of Trnava (Slovakia) and abroad Vienna, Ghent, Hamburg.
(SK2) Leadership is missing. Can help a lot if this is present. An example: a smaller city of around 20 000 inhabitants invested a lot in cycling infrastructure, also thanks to successful applications for EU-funding. Attention to cycling should be an integral part of any plan to construct a new road or redesign an existing road. This is currently not yet the case.
(EU3) Design standards, political support
(EU4) to listen especially to those who do not yet cycle but would like to cycle if they felt safe.
(SK4) The tip is probably clear: improve the process of property-rights settlement, and the implementation of the national cycling strategy by all those involved.
(SK5) Be patient and persistent.
(EU2) Needs need to be talked about and it's not always necessary to design trails based on the intensities that are there - trails themselves pull traffic and it's a "bid" for better ways to move people, perhaps to work or play.

- (For Slovak stakeholders) Which actors (e.g., government agencies, ministries, municipal services, interest groups, citizens…) to your opinion should be involved when local roads are redesigned, to ensure that proper attention is paid to facilities for cyclists?

(SK1) The involvement of interest groups is necessary; they have the greatest knowledge and expertise.

(SK3) Local authorities, road managers, representatives of cyclists (e.g., cycling clubs and initiatives) traffic inspectorate, planners.

(SK4) The Ministry of Transport, the Ministry of the Environment, their subordinate companies, towns, municipalities, civic associations, and the inhabitants of the affected areas, where cycling infrastructure is planned, should certainly be involved.

- (For Slovak stakeholders) What makes Slovakia different? Why might some of the measures that are currently applied in other countries not work equally well in Slovakia?

(SK1) From the historical point of view, the mentality of our nation is much different when compared to the Netherlands, Germany, or Austria. In Slovakia, owning a car has become a form of a social status and it will take many years for this opinion to change. We continue to promote car transport over other modes of transport, while many still believe that other modes of transport are for the poor.

(SK2) Core of the problem in SK is suburbanisation that makes people much more car dependent.

Rural areas cycle more? => don’t agree in general. In some regions, people never stopped cycling. Even when there is no infrastructure at all. But in others, they did.

Trend is evolving negatively. Older people pass away. In cities, cycling is indeed a matter of a younger population. Completely different in Bratislava, much more cosmopolitan

Public support is in general better than what most mayors think. One mayor got re-elected 4 times despite of 'unpopular' measures (e.g., paying car parking). All other cities are finally following.

(SK4) The biggest problem in Slovakia is the fragmented land, its property-law settlement is a very complicated process and takes a disproportionately long time. Also, the lack of interest of some municipalities and towns to deal with cycling infrastructure, as they have other, more important problems in their municipalities and towns.

- Finally, is there anything else related to cycling infrastructure development that you want to mention?

(SK1) Just a few days ago, yet another terrible accident happened to a cyclist who was actively trying to make the bicycle an equal mode of transport. The driver who caught the cyclist, fled the scene of the accident. The cyclist is currently in an induced coma in the hospital. How many accidents and deaths must happen, for the competent to start dealing with other modes of transport?

(SK4) Do not forget to include electromobility, e-bikes, charging stations for e-bikes, e-bike sharing system in the development of cycling infrastructure.

(EU5) Besides strategies, budgets, conviction, also demonstration projects that can be easily copied because "seeing is believing" are important. A great part of cycle policy is implemented at the local level, and for those local people, very practical projects are important.

Furthermore exchanges, discussions with experts, organisation of conferences where you can confront your opinions with those of others will keep minds sharp and open for further improving your practice.

A cycle knowledge centre has probably an interesting role here. It is close to the local stakeholders and people busy with cycle and mobility policy at the very local level. It feels their needs. It can then propose to orient demonstration projects, research and budgets to these needs and provide selectively information on the themes answering these needs.

(EU5) Setting up a Slovak cycle knowledge sharing institute seems a good idea. It could be part of a larger European network of cycle knowledge sharing points. At top of this network could be a European focal point as mentioned in the Luxembourg declaration of EU Ministers of Transport. https://ecf.com/files/wp-content/uploads/Declaration-of-Luxembourg-on-Cycling-as-a-climate-friendly-Transport-Mode.pdf

Annex 5. Knowledge sharing event

On 23 May 2023 from 10:00 to 12:00, an on-line knowledge sharing event for stakeholder representatives was organised by the contractor.

During this event the conclusions of the project were presented.

The event was held via MS Teams.

Invitations were sent by TML to a list of stakeholders that was developed together with the Slovak Ministry of Transport in the course of the project. The invitations included the agenda of the event (see below) and a link to a form (developed in Google Forms) to handle the on-line registrations.

The event was held in English, with simultaneous translation to Slovak. Participants who wanted to follow the event in Slovak were requested to travel to the premisses of KPMG Slovakia in Bratislava (Address: Dvořákovo nábrežie 10, 811 02 Bratislava, 5. Floor).

Agenda

10:00	Welcome and introduction
10:05	Session 1: Facts and figures about cycling (Stijn Daniels, TML)
10:30	Session 2: It's not about cycling …. but liveable cities (and traffic calming) (Bruno Van Zeebroeck, TML)
10:55	Session 3: Cycle networks and infrastructure (Bruno Van Zeebroeck, TML)
11:20	Session 4: Recommendations for Slovakia (Stijn Daniels, TML)
11:40	Perspective from a Slovak stakeholder (Dan Kollár, Cyklocoalicia)
11:50	Q&A
12:00	End

About 15 representatives attended the event. Affiliations of participants to the knowledge sharing event:

- Slovak Ministry of Transport
- Slovak Ministry of Transport - Department of non-motorized transport
- Self-governing regions in Slovakia
- Cities in Slovakia
- Cyklokoalícia
- European Commission – DG REFORM
- KPMG/VVA/Transport&Mobility Leuven

Content

Session 1 set the scene by describing terminology and providing an overview of information about societal benefits of cycling. Moreover a description was provided of cycling policies in 3 countries: the Netherlands and Denmark as leading 'cycling' countries in Europe and Czech Republic as a neighbouring country to Slovakia.

Lessons to learn:

- Czech Republic:
  - Cycling is gaining popularity.

  - Some cities or areas have a significant higher share of cycling in their modal split.

- Denmark & The Netherlands:
  - Getting significant numbers of cyclists means a radical reallocation of public space towards cycling (pedestrians and living zones) and away from space for cars (roads and parking). This choice needs (very) courageous decisions in the short term but pays off in the longer term.

Session 2 focussed on the concept of **liveable cities** and as a higher level goal in which promoting bicycling fits. Four key principles were listed and graphically illustrated with pictures and sketches:

i. Global and well thought approach
ii. Redistribute space and reorganize mobility
iii. Measure the realism of measures
iv. Connect people, don't act alone

Subsequently some 'building blocks' for liveable cities were defined and discussed: filtering (physical – traffic light), school streets, cycle streets –cycle zones and finally urban design quality.

Some examples were provided of remarkable transformations in European cities: Leuven and Ghent (BE), Barcelona (ES), Ljubljana (SI).

Session 3 zoomed in to **cycle networks** and cycling **infrastructure**. Seven key concepts were illustrated with pictures:

i. Get the network right
ii. Infrastructure along road stretches
iii. Infrastructure at intersections
iv. Bi directional cycle paths
v. Getting on and off the infrastructure
vi. Attention with certain traffic calming infrastructure
vii. Maintenance and roadworks

In **session 4**, recommendations for a smart cycling infrastructure development in Slovakia were presented and motivated:

i. Develop guidelines that go beyond technical prescriptions
ii. Attention to cycling should be present in every road (re)design project
iii. It's not only about constructing as many cycle paths as possible
iv. Assess priorities
v. Develop expertise
vi. Share knowledge
vii. Leadership
viii. Collaborate
ix. Integral planning

During each of the breaks a short **on-line poll** ('Mentimeter') was done to trigger the attention of the audience and to stimulate the active participation among the audience. The questions were related each time to the content of the preceding presentation (e.g. 'What is the socio economic value per km from a shift from car to bicycle?'/'Are cycle- paths the preferred option for making cycling safe and attractive (in cities)?').

The four sessions were completed by some thoughts and reflections by a relevant Slovak stakeholder, from the cyclist association Cyklokoalícia.

Questions asked during the **Q&A-session** related to:

- Health benefits of a modal shift from car driving to cycling
- Importance of helmet wearing for cyclists

Furthermore, the representative of EC-DG REFORM depicted the context of the Recharge and Refuel program of the European Commission.

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