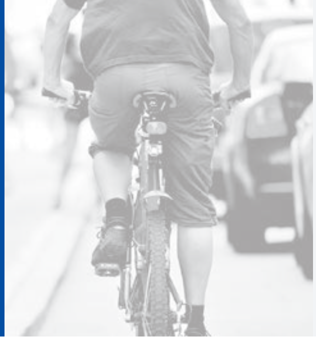
CIVITAS
Cleaner and better transport in cities

POLICY NOTE

Smart choices for cities

Cycling in the City



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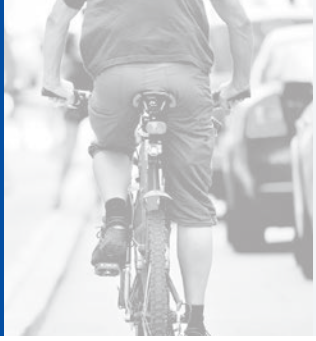


Preface

Thank you for reading the eighth and final policy analysis of the CIVITAS WIKI Policy Analysis Series.

The mission of the CIVITAS WIKI project was to provide information on clean urban transport and the CIVITAS Initiative to EU city planners, decision-makers and citizens. With its policy documents, WIKI wants to inform people in cities about a number of topics that currently play an important role in urban mobility.

This final policy analysis focuses on the topic of cycling in the city.

Over 70% of all Europeans live in cities and cities are becoming increasingly congested. Citizens suffer from poor air quality and noise, which makes the cities less liveable. This document provides information about measures that can be taken in order to increase the use of cycling as a transport mode in the urban environment. The authors are aware of the fact that cities differ in their infrastructural developments. The ease of implementing the measures might therefore differ from one city to another.

We hope you will enjoy the read,

The CIVITAS WIKI team

This publication was produced by the CIVITAS WIKI consortium. This policy note was compiled by Kerry Malone (TNO, the Netherlands). The author of this policy note would like to thank Steven Puylaert (StudioBereikbaar) for his research, Stefan Talen (TNO) for his support, and Mike McDonald (Emeritus Professor of Transportation Engineering, University of Southampton) and Tariq van Rooijen (TNO) for the review of the manuscript.

Introduction

THE CITY IS CHANGING

Currently, 72% of Europeans live in cities or suburbs (PBL Netherlands Environmental Assessment Agency, 2016) and this percentage is increasing. As a result, cities are becoming more congested, suffer from increasingly poor air quality, more noise and are generally less liveable. Increasing the number of people who cycle can be an important step towards more sustainable and liveable cities. Cycling also brings personal health benefits.

Many successful European cities view a vibrant cycling culture as providing a competitive advantage over other cities in attracting new businesses, tourists and key workers, and therefore, have adopted world leading approaches to encouraging and supporting cycling. Cycling projects an image of health and prosperity and has replaced the automobile "as the engine of urban economic growth and public health" (Oldenziel & de la Bruhèze, 2016). European cycling policies have been copied, for example, in New York under Mayor Bloomberg in his 2006 revitalisation plan for sustainable economic growth after the 9/11 terrorist attack (Oldenziel & de la Bruhèze, 2016).

The Netherlands, a country in which cycling is already very popular, shows clear cycling trends. In general, there is an increase in the percentage of trips made by bicycle in the urban environment. The share of trips made by bicycle within the city of Amsterdam increased to 53% in 2012 from 33% in 1989. Social differences emerge among the Dutch cyclists. The largest growth in the number and length of bicycle trips have been among the young adults aged 18-30 and among the elderly. The growth in the electric bicycle (e-bike) fleet has resulted in more and longer bicycle trips being made by the latter group. Finally, this growth has resulted in increased congestion on bicycle paths in cities such as Amsterdam and Utrecht (Harms, 2015).

However, there are differences between European cities and even between cities in the same country in terms of modal split and the share of cycling as a mode. The large capital cities of Amsterdam and Copenhagen are viewed as examples of world-leading cycling cities, and many other smaller European cities have substantial proportions of people cycling regularly. In Copenhagen (DK) and Zwolle (NL), 30% or more of all trips are made by cycle (EPOMM, 2016). Large national and city differences in levels of cycling persist despite the substantial evidence to support the benefits of cycling and of the factors which lead to its increase. Figure 1 shows the modal split (walking, cycling, Public Transport (PT) and car) for a selection of European cities. The range of the cycling modal split varies from 0% in Madrid to 30% in Copenhagen and Zwolle. It is important to note that the modal split of cycling has not always been as it is portrayed in Figure 1; measures have been taken to bring the cycling share up to the levels of Figure 1 from the lows in the 1950's and 1960's.

This policy note distils evidence to encourage cities to develop effective ways of increasing cycling and reducing the modal share of motorised vehicles.

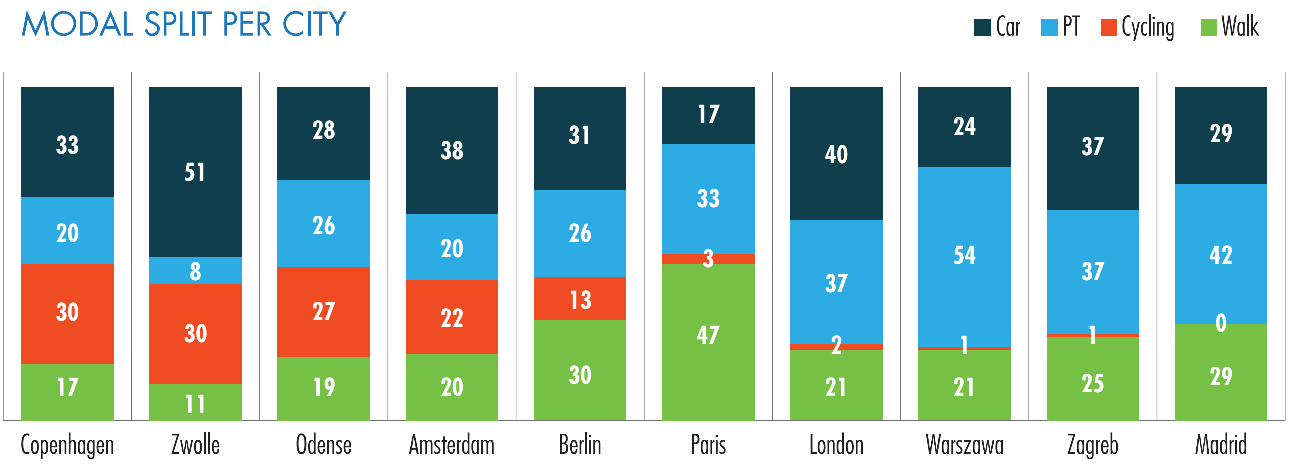


Figure 1: Modal Split by a selection of European Cities for (combined data from 2010 - 2013). *(EPOMM, 2016).*

E-BIKES

Electric bicycles (e-bikes) are gaining ground in the city. These bicycles have a battery and an engine to support the cyclist, resulting in longer trips being made. Typically, 7.5 kilometres is seen as the maximum range for cyclists. The e-bike doubles the range. This makes the e-bike not only relevant for inner city travel, but also for travel between cities. The main target groups for the e-bikes are commuters and the elderly. For commuters the e-bike is often an alternative for the car, for the elderly it is a way to stay mobile. In general, the e-bike is more flexible and faster in cities than the car or public transport.

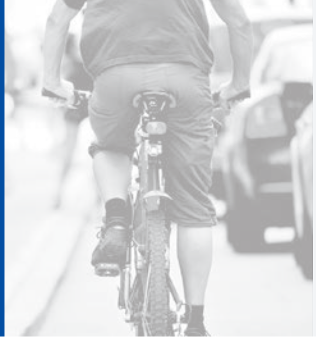
Two types of electric bicycles are considered. The lower electronically-powered version includes all e-bikes that have an engine, producing up to 250 watts with support up to 25 km/h. These are commonly called "e-bikes". All other electric bicycles, typically up to 45 km/h and supplying 500-1000 watts of power, are commonly called "speed pedelecs" and are actually considered two-wheeled mopeds (see Figure 2). These speed pedelecs require more rigorous testing and type-approval testing procedures. Speed pedelecs bring new design and policy questions: should speed pedelec users cycle on the road or on the cycling path, and should a speed limit be introduced on cycling paths? In 2017, the Netherlands will introduce new regulations regarding speed pedelecs in which they will be treated as mopeds. This means that the driver of the speed pedelec needs to be at least 16 years of age, have a driver's licence and not be allowed to drive on all cycling lanes (Rijksoverheid, 2016).

Figure 2: Left the E-bike (max speed 25 km/h), on the right the speed pedelec (max speed 45 km/h).
(Photo by Sparta and ABUS).

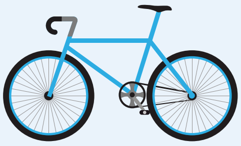
FREIGHT TRANSPORT

The bicycle can also be used to transport goods. In some countries parcel delivery in highly urbanised regions takes place by cycling messengers. These bicycles can be a cheap alternative for a car and possibly provide a faster way of delivering goods in inner cities. Another type of bike is the cargo bike where one or more people cycle a heavier load. The Ikea in Delft, in the Netherlands, rents these bikes to customers who want to move their furniture to their homes. Examples of the freight bikes can be seen in Figure 3. In an average European city, half of all motorised trips related to goods transport could be shifted to bicycle or cargo bike (Intelligent Energy Programme of the European Union).

Figure 3: Freight transport by bike in different forms. From small parcels to ikea furniture.
(Photos by SnapItaly, Albert Heijn and AutoKiosk).



WHY CYCLING?



Why is cycling making a resurgence in popularity? Why has it become a hot topic in European cities, demonstrated by the growth in the modal share of cycling and by the proliferation of bicycle sharing plans in Europe? Cycling improves the livability of a city and the health of citizens in several ways.

Mobility and space on the road

Bicycles use less space on the road than cars and increased cycle use with modal change from cars can lead to less congestion. Also, parked cycles use less space than parked cars and allows valuable space in the city environment to be used more efficiently and for other activities. Figure 4 shows the space demands for 72 people traveling by car, bus and bicycle in a playful way.

Emissions

Cyclists do not emit any air pollutants while most other engine driven transport modes emit, for example, PM and NOx. Cities are faced with the challenge to reduce the amount of emitted air pollutants since long-term exposure to PM is estimated to be responsible for over 400,000 deaths in 2012 for all EU-28 countries (European Environment Agency, 2015).

Affordability

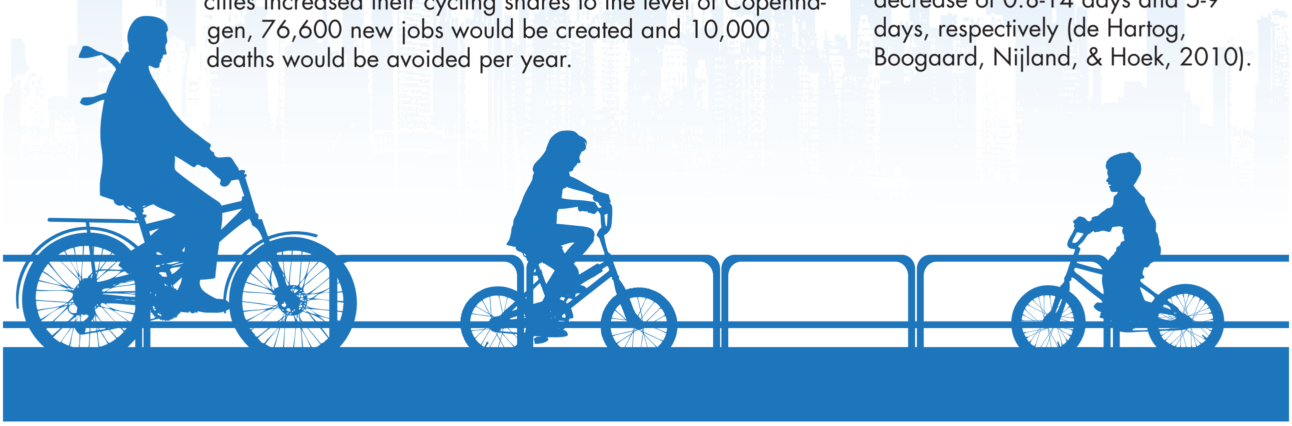
Cycling is a more affordable transport mode than a car. The purchase price and usage costs (euros per kilometre) of a cycle are lower than other modes of transport, making it accessible to a wide range of citizens.

Cycling makes the city a more pleasant place to live, and more

A healthier, safer and less polluted city makes it more livable. Furthermore, the social interaction of cyclists is different from other motorised road users. Cyclists communicate differently from car drivers in their body language and social interaction, as they are less physically separated from their immediate environment than those enclosed in a motorised vehicle. Cyclists also have a positive economic impact. The average cyclist spends more shopping than the average motorised customer and there is strong evidence that well-designed bicycle facilities reduce the accident risks for cyclists and increase road safety when they substitute car kilometres (Wegman, Zhang, & Dijkstra, 2012). Due to these reasons, investing in cycling can lead to positive secondary effects on the economy or safety in the city. According to the World Health Organisation's report (World Health Organisation Europe, 2014), if cities increased their cycling shares to the level of Copenhagen, 76,600 new jobs would be created and 10,000 deaths would be avoided per year.

Health

Regular physical activity reduces the risk of diabetes, some sorts of cancer, obesity and many other diseases (de Hartog, Boogaard, Nijland, & Hoek, 2010). Their research has shown that the health advantages of cycling outweigh the accident and environmental pollution risks of cycling. For every half a million people in the Netherlands using a bike instead of a car, the life expectancy increases by 3-14 months due to the physical activity while the inhaled air pollution and accident risks cause an average decrease of 0.8-14 days and 5-9 days, respectively (de Hartog, Boogaard, Nijland, & Hoek, 2010).



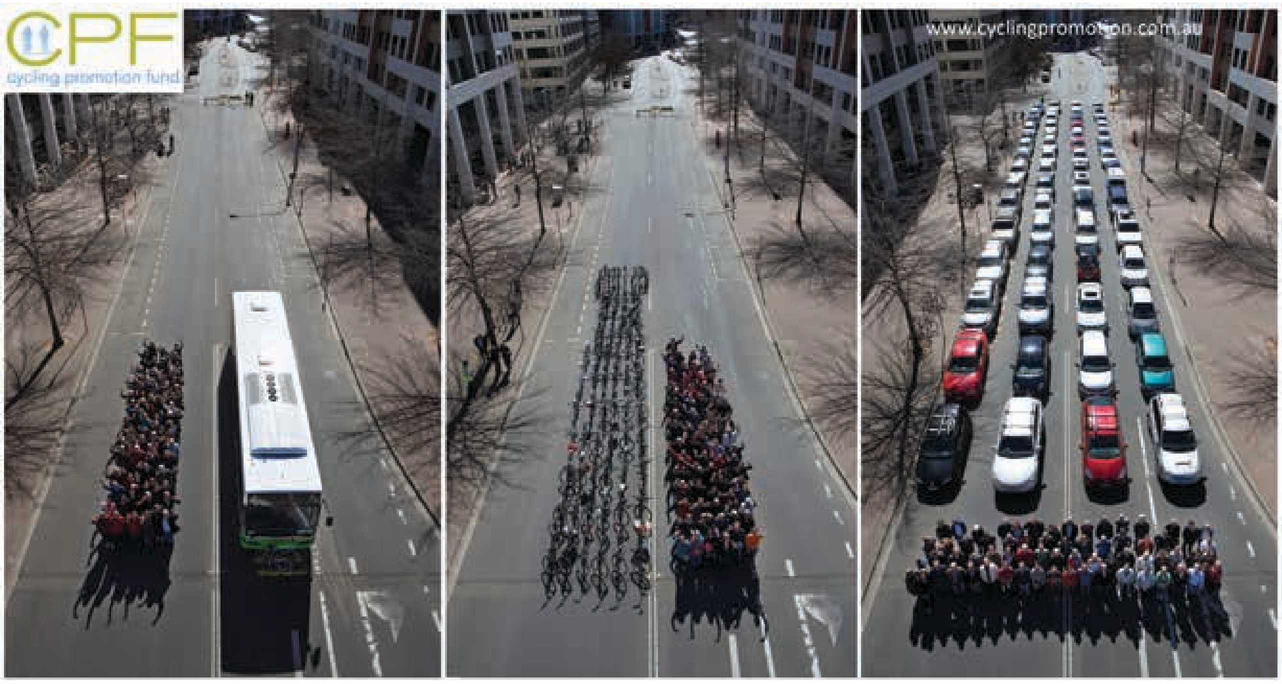


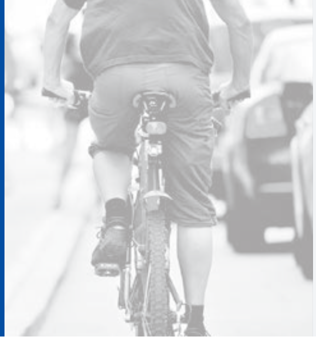
Figure 4: Recreation of the Munster iconic photograph from 1991 that shows the space required for 72 people traveling by car, bus or bicycle. *(Picture: Cycling Promotion Fund).*

AN INTEGRATED APPROACH TO CYCLING PROVISION IN THE URBAN ENVIRONMENT

Increasing levels of cycling is not a goal in and of itself. Rather, it is a means to improve accessibility, livability and overall attractiveness of the city for citizens, business and perhaps tourism. Therefore, it should be developed in the context of a long-term vision for the city. Cycling should not be a single measure. Rather, it should go hand in hand with other measures, all of which should fit into the long term vision.

Encouraging cycling in the urban environment cannot be achieved only by a top-down measure such as the investment in a bicycle path. A cultural change is needed to encourage road users to leave their cars and switch to cycling or to make new types of trips by bicycle (See Figure 4). Several stakeholders have roles in implementing a set of measures covering different types of areas, both infrastructure and support actions, in order to bring about this cultural change. Cycling projects are often more successful if they are undertaken in combination with urban renewal projects or high quality public transport projects, as a single cycling project often has only a small effect, but in combination it can bring about a bigger change. Often cities are biased towards the hardware of cycling, meaning the cycling paths, bridges and traffic lights. However, the support actions, including the behavioural, cultural and legislative aspects as well as the creation of cycling organisations are at least equally important for the success (Loendersloot, Embassy, & Groep).

This policy note provides information about the types of measures that can be taken in order to increase cycling in the urban environment. What is needed in a particular environment is custom work; it depends on the city's goals, the existing situation, the population, the physical infrastructure, the budget, etc. Measures can be infrastructural, which tend to mean a relatively large investment, and support actions covering developing a cycling organization, working with stakeholders, marketing, and education programs.



Infrastructure and equipment

INTRODUCTION

Infrastructure and equipment focuses primarily on keeping cyclists safe. Secondly, the infrastructure enables the smooth and uninterrupted mobility of cyclists. Both issues are addressed in this section.

Cycling infrastructure is generally the most visible aspect of a city's cycling policy and is often the most expensive element. As cyclists value continuous, safe and segregated cycling paths, a *network* of cycling infrastructure is important. Thus, one single cycling facility or street is unlikely to make a major difference to cycling in a city. Cyclists must feel safe and secure from the start to finish of their cycle trips, and the bicycle paths should form a comprehensive network. Practically, cyclists also need infrastructure to store their bicycle and also to keep them safe.

Equipment refers to equipment for the vehicle and the cyclist, in order to prevent accidents from occurring or, when they do, to mitigate the effects.

Infrastructure and equipment, or the lack thereof, can lead to unsafe situations for cyclists. Safe cycling in the urban environment is influenced by interaction among road users, road user behaviour, road infrastructure and vehicles using the infrastructure. This section focuses on infrastructure and equipment, whilst more focus will be given to the behavioural side in the supporting measures section. As safety is one of the most important aspects, the note starts with information about key cycling safety statistics and information, and draws lessons from this to other policy measures.

CYCLING SAFETY

Traffic is getting safer. However, cyclist deaths and injuries in Europe have not been decreasing at the same rates as those for other road users. Figure 5 shows that the decrease in cyclist fatalities is relatively low compared to other modes. In recent decades, most safety improvements have focused on the protection of motorised vehicle occupants. Policy makers recognize that number of vulnerable road users killed and severely injured is not decreasing as much as motorised vehicle occupants, and safety policies are beginning to focus more on cyclists. At the European level, priority area III (f) 4.2 of the ITS Directive (ITS Directive, 2010) focuses attention on the need to address cycling safety.

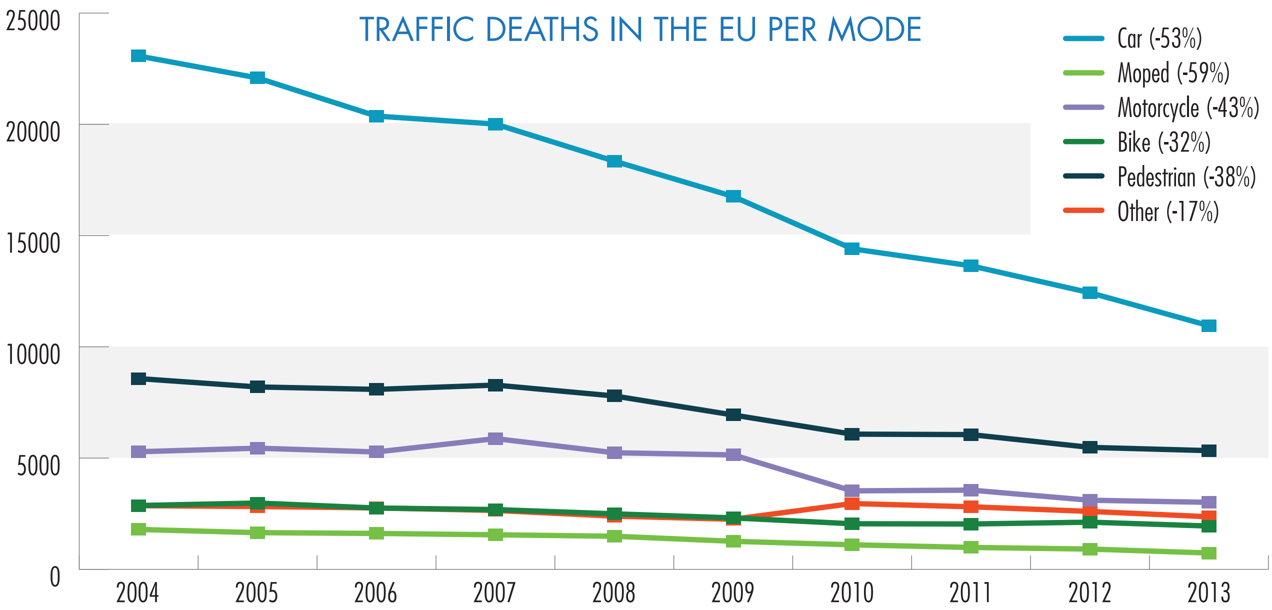


Figure 5: Number of traffic deaths in the EU per year per mode, excluding Lithuania. From the CARE-database. *(European Road Safety Observatory, 2015).*

WHERE DO MOST ACCIDENTS HAPPEN?

Cyclists are involved in two types of accidents: single-vehicle or multi-vehicle accidents. The single vehicle accidents are situations in which a cyclist has an accident in which no other participant is involved, for example, the cyclist slips and falls in a curve. A multiple-vehicle accident involves other road users.

The InDev project found that in the seven countries studied (Belgium, Germany, Denmark, Spain, the Netherlands, Poland and Sweden), most fatal accidents involving cyclists occurred in built-up areas (German Federal Highway Research Institute (BASt), 2016). These areas had the most cycling trips and most interactions with other road users (SWOV, 2013). The VRUITS project showed that the majority of European cycling accidents occurred at intersections (Bell, Chaloupka, & Ohg, 2015), and involved collisions with a motorised vehicle. The CATS project found that almost all collisions between cyclists and motorised vehicles result in death or serious injury when a cyclist crossed the trajectory of a motorised vehicle in a perpendicular direction, or when the motorised vehicle and cyclist are traveling in the same direction and the cyclist was struck from behind (Op den Camp, Ranjbar, Uittenbogaard, Rosen, & Buijssen, 2014). Collisions with a speeds higher than 30 km/hour lead to serious injury or death of the cyclist. In collisions between a cyclist and a motorised vehicle, every additional km/hour above 30 km/hour significantly increases the risk of death for the cyclist. Figure 6 shows the cumulative probability distribution of a pedestrian fatality in a collision with a car. A similar result for cyclists is expected.

Whilst collisions with another vehicle is a major factor in unsafe cycling situations, accidents involving only a single cyclist were found to be underreported in both the *CARE* and national datasets. No other vehicles were directly involved in these single vehicle accidents and the rider either collided with objects in their traffic environment or fell on the roadway or footpath for a variety of reasons. Methorst (Methorst, 2010) found that of 220 fatal cycle accidents, 50 (23%) were accidents not involving another road-user. However, when the data on non-fatal 'hospitalised' cyclists was examined, 600/7,600 (79%) were accidents not involving another road-user.

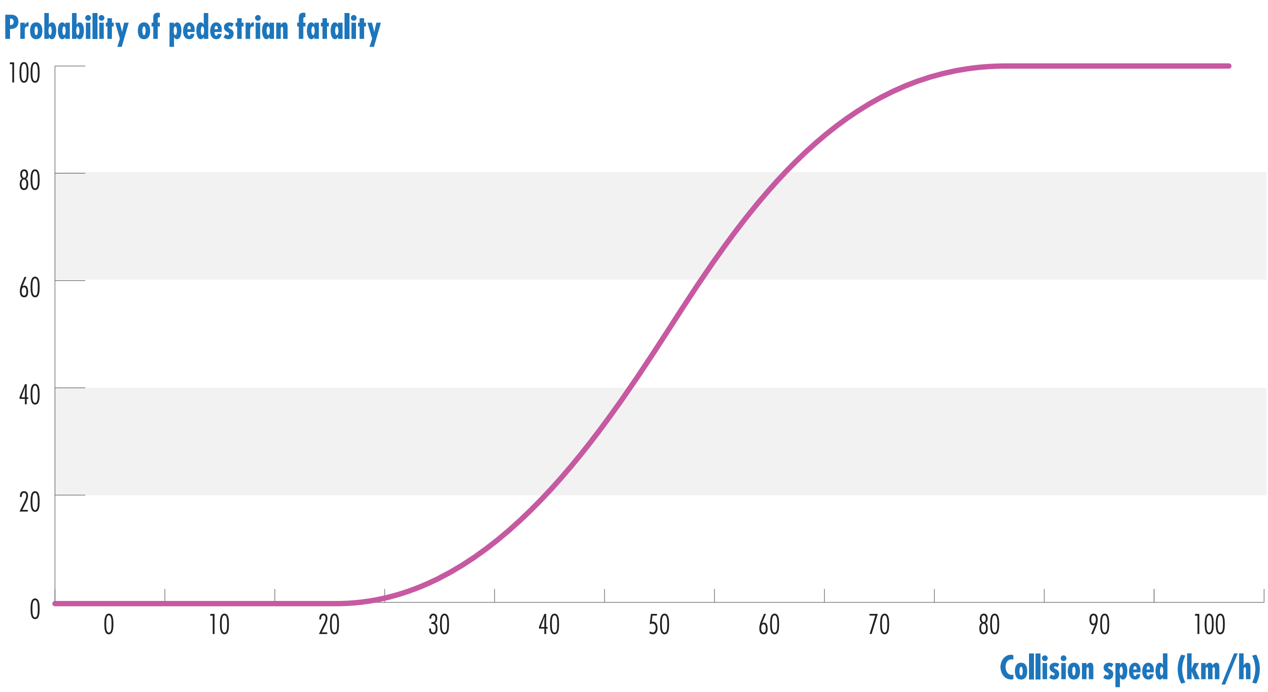
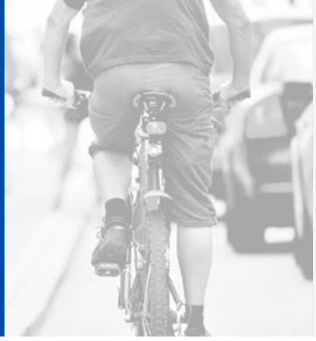


Figure 6: cumulative distribution of the change a pedestrian will die in a collision with a car. *(SWOV, 2006).*



SENIOR CYCLISTS AND SAFETY

In the Netherlands, both the number of seniors and the percentage of cycling seniors is increasing, due to demographics, the increase in leisure time and the introduction of the e-bike. Increased mobility among seniors improves their health, so increased cycling is considered to be positive. However, in the Netherlands, the number of cyclists over 75 who die as a result of a cycling accident is increasing. Most of these accidents are single-vehicle accidents. Therefore, whilst the introduction of the e-bike encourages seniors to cycle more, it also increases the number of accidents.

In 2013, SWOV stated that it lacked information to identify effective countermeasures for these types of accidents. Research has shown that most accidents happen when seniors are getting on and off a cycle or when they get scared by other traffic (De Hair, et al., 2013). Elderly themselves report that they would feel safer cycling if the construction of more new cycle tracks, the widening existing cycle tracks, and better maintenance of these tracks would take place. Other measures that can be taken to increase road safety for senior cyclists are a more predictable straightforward road and the removal of obstacles like bollards. If obstacles cannot be removed, they should be made more noticeable.

EQUIPMENT

Vehicle-based safety solutions

In addition to infrastructure, vehicle-based solutions can help cycling to become safer. Automobile manufacturers already have taken measures to mitigate the effects of vehicle–cyclist collisions. Volvo's Collision warning (Pedestrian and cyclist detection with Full Auto Brake) is already on the market. Campaigns for Blind Spot mirrors on heavy goods vehicles exist. London's "Safer Lorry Scheme" (Transport for London) requires vehicles over 3.5 tonnes to be fitted with mirrors giving the driver a better view of cyclists and pedestrians around their vehicles, and to be fitted with side guards to prevent cyclists from being dragged under the wheels in the event of a collision.

Vehicles equipped with an airbag that covers a larger part of the windscreen to protect pedestrians and cyclists in an accident, and automatic braking systems are in development. In 2016, EuroNCAP (European New Car Assessment Program) will make Pedestrian- Autonomous Emergency Braking (AEB) part of their test protocol and star rating. EuroNCAP intends to include Cyclist-AEB systems in the safety assessment from 2018 (TNO, 2016).

Cycle-based solutions

Helmets

Most European countries do not require cyclists to use helmets. Although research has shown that helmets lead to 1.72 times fewer head injuries (SWOV, 2012), their protective role for internal head injuries needs further investigation (Joseph, et al., 2014). Most countries do not require helmets to be used as they fear a decrease in the amount of cycling. As helmets do not prevent accidents, but only have an effect on the seriousness of an accident, most cities and countries do not have restrictive policies. However, it remains a topic for debate.

For children some European countries have helmet policies, mostly because their risk of falling is higher. Discussions about helmet policy have started around e-bikes: the introduction of speed pedelecs, electric bicycles that provide support to 45 km/hour, have led the Netherlands to develop the legal requirement to wear a helmet.

IMPLICATIONS FOR INFRASTRUCTURE

To ensure the safety of cyclists, a safe, well-maintained and connected infrastructure free of obstacles is needed. Interactions with other traffic determine how the infrastructure should be designed. Even careful consideration should be given to whether cyclists and pedestrians should share the same infrastructure. From a traffic safety perspective, the Dutch Institute for Road Safety Research (SWOV) developed guiding principles (SWOV, 2012). These are

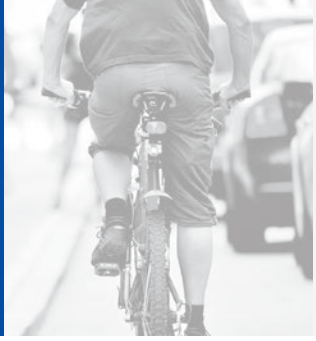
- Homogeneity in mass, speed and direction
- Recognisability of infrastructure
- Road design that is consistent with its function

These principles, and the translation into, practice, are presented below.

The Intelligent Bicycle

Looking to the future, intelligence will be added to the cycle itself to increase the safety and comfort of cyclists. TNO has developed a prototype cycle to improve safety. Figure 7 shows this bike in development. This cycle warns the cyclist of hazards from behind and in front of the cycle. Sensors on the bicycle can detect hazards in front of the cyclist using a radar, whilst situations behind the bicycle can be detected with a camera. Integrated hardware and software of the intelligent cycle are being tested (Engbers, 2013).

Figure 7: Intelligent bike from TNO, in development at this moment. *(Picture: TNO).*



BUILDING BLOCKS FOR SAFE INFRASTRUCTURE

Cyclists make use of roads that have different characteristics such as traffic volume, maximum speed, other road users, quality of the road, etc. These characteristics can make it more or less safe for cyclists. For example, in Cambridge, three levels are defined: primary roads, secondary roads and local roads. The primary roads and secondary roads are of a higher standard, with separate cycle paths to handle larger cycling flows. The local roads connect the main roads to all the trip origins and destinations of the inhabitants. Figure 8 shows the lay-out of these three types of roads.

The SWOV applies the guiding principle of homogeneity of mass, speed and direction to road types to preserve cyclist safety. These guiding principles are the ideal situation, which is not always possible in older urban settlements.

Roads with maximum speeds over 30 km/hour are used by cars and cyclists, if the cyclists are not prohibited such as on motorways. On roads with high vehicle speeds, high traffic intensities and high vehicle mass, mean that collisions between cyclists and cars or truck are almost always lethal (see Figure 9). The preferred infrastructure for cyclists in this case is to have a separate bicycle path from the motorised vehicle road. Roundabouts or signalised intersections guide the intersecting traffic, because the high speeds, mass and intensities reduce the cyclist safety.

Roads with combinations of lower motorised vehicle speeds and moderate vehicle intensity, or higher vehicle speeds but low motorised vehicle intensity are sufficiently safe by means of a visually separated infrastructure. The motorised vehicles and the cyclists each have their own designated area. This solution is less expensive than a physically separated cycling path.

Finally, local roads where both the speeds and motorised vehicle intensity are low do not need physical or visual separation.

Primary roads

When speeds are higher, a physically separated cycling path is needed.

Secondary roads

On streets with low vehicle intensity, visually seperated cyling paths are advised

Local roads

No cyling path needed, speeds and the vehicle intensities are low

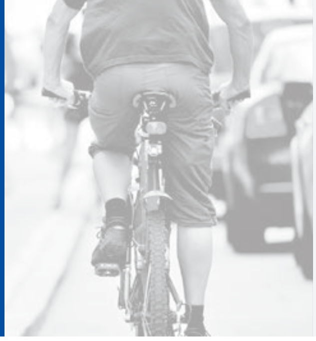
Figure 8: the intensities of cycles and cars, and the speeds of the car determine the lay-out of the infrastructure.

Figure 9: Poor example: Cycling along a highway. Large differences in mass and speeds lead to unsafe situations. *(Picture: Streetsblog.org).*

ALMERE

In the Dutch city of Almere, the cycling infrastructure is almost completely separated from the car infrastructure. This means that large distances can be travelled by cyclists without encountering obstacles (Gemeente Almere, 2013). Cars and cycles use different infrastructure networks, and cycle paths are often next to train tracks, waterways or bus lanes. This makes cycling comfortable, safe and fast (See Figure 10).

Figure 10: Separated traffic flows. Cycling path is parallel to the bus lane and cyclists have priority over the car traffic. *(Picture: Shutterstock, 2016)*



RECOGNISABILITY

Another principle from the SWOV Dutch Sustainable Safe guidelines is recognisability in design. This means that the same types of roads should have the same types of layout. This makes traffic regulations more natural and intuitive. The infrastructure elicits the desired road user behavior. For cycle paths, this means that the color and design of paths should be similar throughout the country or city. This is especially important at special constructions such as roundabouts or bicycle boulevards (see Figure 11).

SPECIFIC INFRASTRUCTURAL SITUATIONS

Intersections and roundabouts

The number of road casualties decreases considerably when an intersection is replaced by a roundabout. In the Netherlands, roundabouts often have separate cycling lanes (especially on 50 km/hour roads). The roundabouts are designed such that in cities, cyclists have priority and in rural areas, the cars have priority. There is no consensus on whether the safety on roundabouts is higher when cyclists have priority or not.

Figure 11: Roundabout with priority for cyclists.
(Photo: Omroep Castricum)

Cycling boulevards

In the Netherlands, Germany, Spain and Belgium the first bicycle boulevards have been introduced (see Figure 12). These are cycling paths where cars are allowed. This concept works only if traffic intensities and speeds are very low. Cars are not allowed to overtake cycles and are "guests" on the bicycle boulevard. The streets are essentially designed for cyclists, with small adaptations made for cars. Non-local car traffic is discouraged by low speed limits and other measures.

Figure 12: Example of a cycling street in Utrecht
(Photo: Cornutus)

MULTI-MODAL TRANSPORT

Cycling trips are mostly between the 2.5 and 7.5 kilometres on regular bikes and up to 15 km on e-bikes. For longer trips, the combination of cycling and train, or cycling and metro is appropriate. In the Netherlands, 47% (KIM, 2014) of all trips to a train station are made by bike. Therefore, investing in cycling infrastructure can also encourage modal shift as more people will use the train.

There are factors which can increase the popularity of the train-bicycle combination. The first is that the cycling infrastructure from and to the station should be of high quality. These are often busy roads which provide access to the train station. They are difficult to design well for cyclists, as other modes of transport such as buses or cars also need access to the train station.

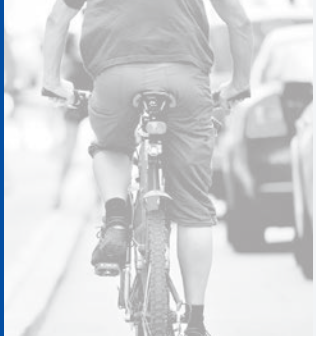
Secondly, cycle parkings near stations should have sufficient capacity, feel comfortable and be very near the station. Figure 13 shows a crowded and chaotic parking situation and a new neatly-organised cycle parking situation. In almost all newly-built stations in the Netherlands, the cycle parkings are neatly organised and located within a 3-minute walk to the platforms. The downside of cycle parking places is that they also introduce problems as they can get crowded and chaotic. Double layered, well-designed parking places with enforcement of incorrectly-parked cycles is a solution. To help users find a free spot, new signage systems can indicate how many free parking spots are left, similar to car parking systems. In Utrecht, such a system has already been put into place (Figure 14).

A third way to include bicycles in multi-modal transport can be found in several European cities. Paris is an example where cycling is a public transport mode. The rental prices are attractive (i.e. free up to 30 minutes) and bicycles can be picked-up and dropped off at over 1800 locations across the city (Figure 15).

Figure 13: A) a crowded cycle parking at Amsterdam Muiderpoort, B) the new cycle parking at Utrecht Central Station. *(Pictures from Mapio and Wikimedia).*

Figure 14: Smart signage displays available cycle parking places by location in Utrecht, the Netherlands. *(Picture: De Utrechtse Internet courant).*

Figure 15: Velib station in Paris. In the city of Paris there are 1800 stations like these. *(Picture: Wikimedia).*



BICYCLE CONGESTION

The Dutch cities of Utrecht, Nijmegen, Amsterdam and Wageningen are encountering problems with too much cycle traffic. Inner cities with many traffic signals, and cycle paths near universities, have to cope with bicycle congestion. The presence of too many cyclists leads to unsafe situations for the cyclists, but also causes problems for the car traffic. At locations where cars are required to give priority to cyclists, waiting times for cars increase (see Figure 16).

Wider cycle paths are a partial solution, but do not solve the problems at intersections in cities. Developing alternative routes to access busy locations is a necessary part of the solution. In this way the streams are less dense and there are more gaps for cars.

BICYCLE THEFT

In many European countries, especially in cities, cycle theft is a growing problem. An important aspect in reducing bicycle theft is to involve multiple actors to decrease the theft of cycles. Municipalities should make safer parking places available. Parking locations should be in sight of people passing by, lit at night, easy to reach and convey a feeling of safety.

In addition to infrastructure measures, support measures can be taken to reduce bicycle theft. Campaigns to inform cycle owners to improve the locks on their cycles or store them in safer places can be launched. As stolen bicycles are often sold in other cities, the national government and police can set up a registration system for bicycles. Furthermore, the local police can improve surveillance at places where bicycles are most frequently stolen. More advanced solutions such as chips in bikes can also be used.

Figure 16: A traffic jam of cyclists. *(Picture: fietsbult).*

Supporting Actions

INTRODUCTION

As already mentioned, an investment in infrastructure alone may not always bring about the desired increase in cycling. A cultural change is also needed. A change in culture can be realised when coordinated actions by stakeholders are set in motion. This section provides examples of these supporting actions, although this list is incomplete.

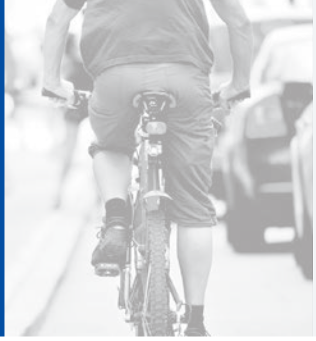
BUILDING AN ORGANIZATION IN (LOCAL) GOVERNMENT

Cycling policies start with a solid local governmental organization which is knowledgeable in the area of cycling. As soon as the city decides that cycling in the city should be improved, the internal organization should be organised. This means that civil servants should become knowledgeable on cycling, if they are not already, and should link cycling to other policy areas. As cycling is not a goal on itself, but a mean to reach other goals, cycling should be linked to the mobility plan or urban renewal plan of the city.

PROTESTS FOR MORE CYCLING INFRASTRUCTURE AND POLICIES

Cycling seems normal in countries as Denmark and the Netherlands, but even there the cycling space in the city was earned through struggle. In the 70's and 80's, many groups protested for more and safer bike infrastructure. "Even in Copenhagen – as indeed in Amsterdam and Utrecht – it took politicians, engineers, and cycling activists to defend cycling's share and increase its scope in their cities urban transit" (The Local DK). There are many things possible in the world of cycling, but they (the dreams) do not come to fruition without struggles (see Figure 17).

Figure 17: Protest of cyclist in London to widen cycle paths. *(Picture: aseasyasridingabike).*



WORKING WITH STAKEHOLDERS

CYCLING ASSOCIATION

A knowledgeable partner for support in lobbying and making cycling plans and policy are national cycling associations. The Fietsersbond is the Dutch Cyclists' Union that campaigns for better cycling conditions in the Netherlands (Fiestersbond, 2016). With a network of 35,000 members and 150 local organisations, the Dutch Cyclists' Untion can also provide grass-roots support to increase cycling enthusiasm in a city. In general, these organizations can also help to organise marketing or events to promote cycling. Member input can be valuable in generating new plans.

EMPLOYERS: BICYCLE TO WORK

A large proportion of the trips made on a daily basis are work-related. Employers can influence the way their employees come to work. In 2010, TNO (Hendriksen, Fekkes, Butter, & Hildebrandt, 2010) researched what employers could do, in order work best. For example by car-curbing measures such as paying for parking or providing a lower mileage allowance. Cycle lease plans or e-bike plans had a positive effect on the modal split of those commuting. Marketing cycling worked as stimulating measure only in combination with other measures.

CYCLE MARKETING

Marketing can be an effective instrument to support infrastructural measures. Often one part of the marketing is focussed on changing attitudes towards cycling, and another part is concerned with giving information on new cycling infrastructure. The image of cycling plays a key role in stimulating cycling. In some countries cycling is seen as something for the sport freaks and daredevils, whereas in Denmark or the Netherlands it is more common to cycle. The city of Munich (Sassen, 2011) launched a successful campaign to promote cycling in their city, with cycling events, posters and merchandise. Cycling was marketed as trendy and as being typically something essential to Munich. The campaign events received substantial and positive media coverage. An example of a poster is shown in Figure 18.

Urban cycling has become a tool for city branding in other cities, such as the Copenhagenize project does. Cycle chic or bicycle chic, a phrase coined by Mikael Colville-Andersen, refers to cycling in fashionable everyday clothes. This branding has inspired the city council to mobilize Copenhagen's cycling reputation as an effective branding tool and has marketed it as the way forward in the global pursuit for liveable cities.

Figure 18: Cycle branding in München Germany. Cycle is framed as typically München.

EDUCATION

In many countries, cycling is not yet common. Providing cycling or traffic lessons at a young age can help to decrease the number of accidents but can also lead to a change in culture (see Figure 19). It is important that cycling lessons have a mandatory place in the curriculum at primary schools. In some countries, non-obligatory traffic lessons for immigrants are offered. The city of Utrecht, for instance, has a program to improve traffic safety among immigrants (Walker, 2016).

INSIGHTS IN CYCLING BEHAVIOUR

Cycling counts were once common in European cities. However, the automated counting methods introduced in the 1970's omitted counting pedestrians and bicyclists. This means that the data on which to base investment decisions and for making policy – analogous to analyses for motorised vehicles – is missing. However, we live in the age of big data and sensor technology. These technologies and methods can help to provide a foundation for cycling policy and decision-making.

Background data can help to support policies in the future. Such data relates to questions about those who currently or potentially cycle, where and when they cycle, and how this may change in the future. This data can be used to formulate and evaluate measures. This data can also be used to feed models to consider overall mobility patterns and options for a city.

Figure 19: Traffic education can start at an early age. *(Photo: unicoz).*

GATHERING DATA

There are many ways to gather data: cycle counts, GPS tracking, (ad hoc) surveys, general mobility surveys (which can be used to generate modal split, etc.), information from interest groups such as a cycling union, and location-specific surveys. To develop policies, information about cyclist behaviour is needed: who cycles, use of the network, where cyclists travel from and to, where do they park their bikes, and what is the perceived and actual quality of the cyclist network?

Often data from multiple sources are used and combined. More high-tech solutions have recently been developed. Quantitative data from the roadside such as loops or sensors (Bluetooth, WiFi) on separate bicycle tracks, also at traffic lights, provide counts of cyclists. This data can be enriched with GPS data and can also be collected from the user's smartphone or by equipping the bicycle with GPS. Often this is done by an app on a smartphone. An example of this is the Dutch National Bicycle Counting Week (Holland Cycling.com, 2016). With this dataset, they hoped to get more insight in the behaviour of cyclists and their travel patterns.

Sometimes the measuring activities are combined with other projects. This occurred in the B-riders project in the Province Brabant in the Netherlands. Here, the car users were given a subsidised e-bike to travel to work. In addition, the B-riders received an app to prove their cycle use and to gather data for further research.

CYCLING IN TRAFFIC MODELS

Most traffic models are car and sometimes public transport-oriented. Modelling cyclists is rare. In the Netherlands, initiatives have been taken by the Province of Brabant and others to develop a cycling model. The model will use available cycling data (cycle counts and data from the network of the Dutch Cycling Federation) to determine how current multi-modal traffic models can incorporate cycling so that new cycling infrastructure can be most effectively planned. The model will allow new combinations of initiatives to be examined. For instance, how well will a train-bike combination work? The traffic model can be used to assess the increase in cycle traffic as a result of an upgrade in cycling infrastructure to a train station and to determine which infrastructural measures work best.

From ideas to policy: Recommendations for approaching investments in cycling.

Cycling in the city should be seen as a means to reach a goal. Goals, for example, can be to give part of city a new economic impulse or to make a neighbourhood more livable, without negative effects to the others. Cycling is not the only mode which can reach such goals, and the other way around, integration is key to success in cycling policies. Integration of cycling projects can be with other projects such as urban renewal, economic investment in neighbourhoods, or with policies for other modes (car or public transport). It is important that the right infrastructure or equipment is in place and the supporting actions are taken.

A successful cycling policy can only be developed and achieved by an organisation which has knowledge and data about cycling and has contacts with other organisations on cycling issues. Working within a municipality to develop cycling knowledge, and linking plans to those of other government policies, with the aim to generate recognition and funding for cycling, is important. In addition to municipal employees, contacts with external stakeholders are important. Relationships with engineering firms, schools, cycling associations and consultants should be developed to build cycling knowledge. A good way to start is with pilot projects as new knowledge can be generated. Finally, collect cycling data on which to base policies,

The creation of a Sustainable Urban Mobility Plan, or SUMP, offers is an opportunity to integrate and foster cycling in the urban environment. Cities are currently not obligated by the European Commission to create a SUMP, although this is encouraged.

A SUMP is more than a traditional traffic and transport plan. It aims to engage different stakeholders to cooperate on the development of a sustainable urban mobility plan. One of the main elements of a SUMP is the balanced and integrated development of all modes, including cycling, consistent with the approach described in this note. The European Commission offers support to European cities to tackle urban mobility challenges. For more information, see http://www.eltis.org/mobility-plans.

ODENSE

Odense, one of the five cities in the CIVITAS II MOBILIS project, implemented ambitious plans for a cycle and pedestrian bridge and other measures which created space for alternative modes. The MOBILIS project ran from 2005-2009. The Odense effort focused on modal shift and influencing habits in personal travel choice, and focused on 4 zones in the city. Groups of stakeholders cooperated to implement the measures. The approach integrated three dimensions in order to promote change in the use of the physical environment (CIVITAS MOBILIS , 2009). The three dimensions are:

- Transport site: spatial and infrastructural
- Transport form (modes)
- Transport users (interpersonal)

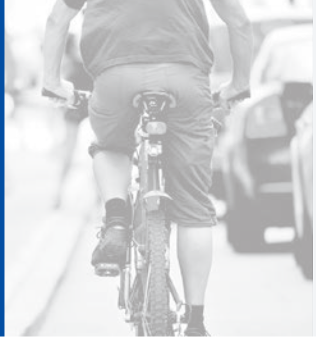
Integration took place at different levels. When planning the measures, existing and diverse plans and policies were brought together in the project. The Odense MOBILIS project depended upon cooperation between Public and private organizations in the area of transport. Odense piloted measures in “priority zones”, to test and learn from the pilots before expanding the application area.

The ring road and bridge (1997) completed the outer ring road around Odense, and offered the Odense City Council the opportunity to move transit car and lorry traffic away from the city centre, foster further local modal shift, improve the quality of the physical environment, improve traffic safety and improve conditions for public transport services.

Five measures taken by Odense were reported on. One measure, called “Environmental zones”, aimed to increase the quality of life in the pilot area for residents and road users, and to reduce the negative impacts of motor vehicles on residential environments. The measures focused on encouraging mobility by active modes, by implementing countdown signals, interactive information systems providing information for pedestrians and cyclists about cycle lanes, cultural information and safety recommendations, and implemented 4 cycle scanners to encourage and reward cyclists. Flanking measures included 30 km/hour zones, infrastructure such as street bumps and in some cases access restrictions for cars, and road narrowing. The environmental zone measures were achieved through cooperation between the resident and housing associations, public transport operation, the cyclist federation and public services.

In terms of transport effects, a drop of 35% in the volume of car traffic was measured in the pilot area with access restrictions by street closing. The volume of car traffic increased by 6% in the other pilot area, without access restrictions. The average car speed dropped by 12% and 22% in the two areas. Green waves, interactive information, countdown signals and cycle lotteries were useful for promoting cycling and walking in the area. Cycling increased by 62% in one of the areas, with the number of cyclists and pedestrians holding steady. The residents of the areas indicated in an internet-based survey that before the measures, 24% thought that the possibility to cross the street was good or very good; after the measures, the share increased to 61%.

In summary, Odense successfully showed that cycling can be promoted by implementing a combination of measures in the urban environment, deploying both infrastructure and supporting measures.



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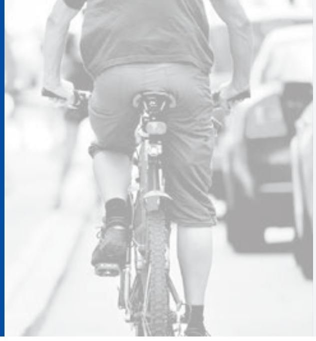

NOTES

NOTES

Smart choices for cities

Cycling in the City

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Cleaner and better transport in cities

POLICY NOTE