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BEST EUROPEAN PRACTICES IN PROMOTING CYCLING AND WALKING

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Best European practices in promoting cycling and walking

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Foreword

Planning city traffic is a growing global challenge. The growth in traffic volumes causes problems in many European cities, which is why the European Commission published the Green Book of city traffic in 2007 highlighting three of the biggest problems in cities: environmental nuisances, traffic congestion and traffic accidents. To solve these, the Green Book highlights increasing cycling and walking as the first objective. At the same time, significant advantages will be gained in the sector of health and physical activity.

Over the past decade, many countries and cities in different continents have made traffic policy definitions to develop the conditions for cycling and walking and to increase their modal shares. Tens of cities have signed the Charter of Brussels, which was released in the Velo-city 2009 conference in Brussels. The cities committed to for instance raise the modal share of cycling to 15% by 2020.

To reach the goals, strong changes have to be made in the coming years. Small improvements and fine tuning to the current transport system are not enough, but fundamental actions have to be taken. During the coming years, walking, cycling and public transport have to be increasingly favoured in the transport system instead of prioritizing private cars. This calls for re-evaluating current mindset and transport policy choices.

European countries are the forerunners in promoting cycling and walking. Planners and decision makers from all around the world travel to Europe to study the best practices in the Netherlands, Denmark, Germany, France, Switzerland and Belgium. There is a lot of information about the promotion of cycling and walking, but in many countries and cities this information finds its way to planning and decision making regrettably slowly. Ambitious goals have been set in the fields of transport, environment, physical activity and health, and increasing human-powered transportation is a key issue in reaching these goals.

This book presents the best practices of ten European cities in promoting cycling and walking. The purpose of this book is to share the newest information as well as to act as a stimulus for planners and decision makers of city regions and municipalities as well as state administration. This material has been collected in a two-year PYKÄLÄ research project executed by this Transport Research Centre Verne of Tampere University of Technology during 2009–2011. An extensive amount of material was collected in the ten cities relating to, for instance, infrastructure, land use, services, marketing and organization. Visuality has been highlighted in the presentation of the results, which is why the book includes many pictures gathered from trips to illustrate the best practices.

We thank the cooperating parties of the project in Finland and in rest of Europe. We have had the privilege to spend inspirational moments in European cities when conversing with experts as well as observing conditions in the "outdoor laboratories" of the cities. We hope that our enthusiasm reaches also the reader of this book, so that the reading experience encourages applying new innovations in promoting cycling and walking.

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Professor of Transportation Engineering

Kalle Vaismaa
Project Manager of the PYKÄLÄ project

Content

Introduction

Introduction

Cycling and walking replace motorized traffic decreasing carbon dioxide emissions, energy consumption, congestions and noise.

Background

In the future, growing challenges will be targeted at city transport both in Finland and internationally. The growth of traffic volumes in city centres is causing an increasing amount of problems such as environmental nuisances, traffic congestions as well as traffic accidents. Traffic is a significant producer of greenhouse gases, since its share of the carbon dioxide emissions of the world is about a third. In Finland the corresponding figure was about 20% in 2007, which corresponds to 13.7 tons of CO_2 equivalent. Without new measures traffic emissions are estimated to grow by 0.5 million tons or 4% by 2020.

Decreasing the need for traffic as well as increasing the modal shares of cycling and walking reduce the previously mentioned detriments. Cycling and walking replace motorized traffic and, thus, decrease carbon dioxide emissions, energy consumption, congestions as well as noise caused by motor vehicle traffic. Therefore, traffic policy definitions in Finland and internationally highlight the development of the conditions for cycling and walking as well as increasing their modal shares.

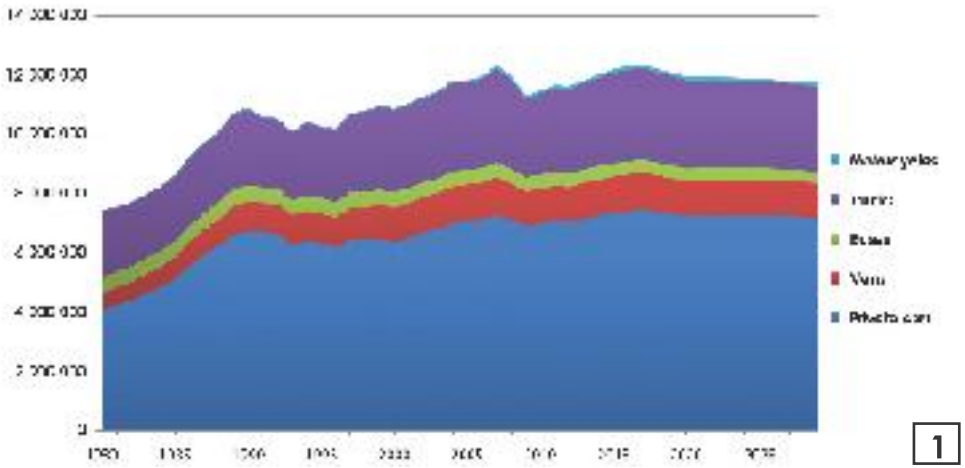
From the 1950s, transport policy has developed in favour of car transport and at the moment the foundation of the traffic system in Finnish cities is predominantly motorized traffic flow. The network of car traffic is extensive and coherent. Routes have been made for cyclists and pedestrians, but cycling and walking are not a comprehensive part of the traffic system in cities. In Finnish cities cyclists often have to face the fact that a cycle track ends suddenly or that parking possibilities are insufficient. Cycleways in city centres have been designed as cycling routes, along which cyclists may possibly go through the centre, but not to many destinations inside the centre. Often cyclists have to stop and walk their bikes to the other side of the street in order to continue riding the bike on an intersecting side street.

Walking is the most essential issue with regard to the functionality of the whole traffic system. All trips begin with walking and end with walking. Walking connects the parts of the traffic system; without walking the traffic system would not work. With regard to developing walking conditions, we still have a long way to go in Finland compared to Central Europe. Pedestrian streets in city centres and especially large pedestrian centres in Finnish cities are not yet very common.

A Change Is Needed

Although several definitions of policy have been made to increase walking and cycling, their modal shares have decreased year after year. The Climate Policy Programme of the Finnish Ministry of Transport and Communications states that the devised promotion programmes for walking and cycling have not been officially accepted nor has their implementation began at full throttle. Promoting cycling and walking has been left as a marginal goal also in traffic system plans of city regions as well as investments realized by cities and the state.

In order to decrease congestions and emissions, to increase traffic safety and the attractiveness of cities as well as to improve national health, strong changes have to be made in city traffic in the coming years. Small improvements and fine tuning of the current transport system are not enough, but fundamental changes have to be made so that the modal shares will change in cities. In the coming years, human-powered transportation and public transport should be favoured in the transport system more and more.



Source: VTT 2010

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1
Emissions of road transport in Finland in 1980–2009 and the prognosis until 2030. At the moment, the share of carbon dioxide emissions for road transport in Finland is nearly 90 %.

2
In Amsterdam it is easy for pedestrians and cyclists alike to travel in the centre. Due to a culture that appreciates cycling and walking, both of these modes of transport respect each other and are able to move safely in the same space.

Description of the Project

PYKÄLÄ is a research and development project of the Transport Research Centre Verne of Tampere University of Technology. The project has been realized to assist Finnish cities and ministries in traffic and land use planning, to guide political decision making as well as to promote cycling and walking as forms of transport. The project compiled wide-ranging material from ten European cities and this information has been applied to eight Finnish target cities. The main goals of the project are to make cycling and walking as part of the traffic system of cities as well as to promote the increase in the modal shares of cycling and walking and, thus, to promote everyday and health-related exercise in the target cities. The objective is to offer the latest information from Europe to support the strategic processes of cycling and walking. In addition, the goal of the PYKÄLÄ project is to improve the attractiveness of cities as well as follow-up and compilation of statistics of cycling and walking. The research information will also serve national promotion objectives of cycling and walking.

Ten European cities were chosen for the project: Stockholm and Växjö were chosen from Sweden, Copenhagen and Odense from Denmark, Groningen and Houten from the Netherlands, Ghent from Belgium, Strasbourg from France, Freiburg from Germany as well as Geneva from Switzerland.

Country	City	Population	Area km²	Population density residents/km²
the Netherlands	Groningen Houten	186 000 50 000	84 56	2 210 890
Denmark	Copenhagen Odense	520 000 189 000	88 304	5 800 620
Sweden	Stockholm Växjö	800 000 82 000	188 1 674	4 100 50
Belgium	Ghent	240 000	156	1 540
France	Strasbourg	273 000	78	3 500
Germany	Freiburg	218 000	153	1 430
Switzerland	Geneva	190 000	16	12 000

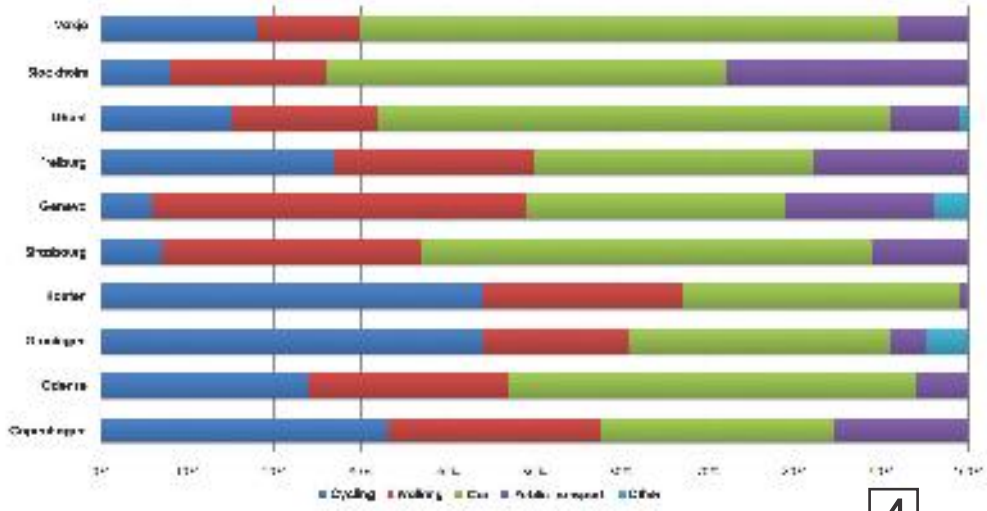
3
The cities chosen for the project on a map. The sizes of the cities range from Houten, which has 50,000 inhabitants, to Stockholm, which has over 800,000 inhabitants.

Example Cities

In several of the European example cities cycling conditions are among the best in the world, and in some promoting and planning of walking are of a high quality. Public transport has a significant role in some of the example cities, as well. The cities were chosen to provide an extensive and versatile overall picture of the best practices in Europe. Although other cities that excelled in promoting cycling and walking were studied as potential example cities, in the end ten cities were chosen, which all provided a new perspective for the project.

Copenhagen is one of the best cycling cities in the world and it has the world's longest continuous pedestrian street. The other example city of Denmark, Odense, has carried out a large variety of promotional campaigns for cycling and walking, and the city has new ambitious goals for promoting cycling. Freiburg has been named the ecological capital of Germany and its environmental policy goals have been ambitious. Strasbourg has a pedestrian centre, which is connected with public transport in a functional way. Intermodal trips work well in the city since cycling can be well combined with public transport. Geneva plans to promote walking as the main mode of transport and the city pays special attention to the accessibility of different destinations by walking. The city of Groningen is very compact and the modal share of cycling is among the top class in the world. The city of Houten has been built on the terms of cycling and because of this the conditions for cycling are excellent. The transport policy of Ghent is based on promoting cycling and walking and the city is a forerunner in marketing. Stockholm is the biggest example city in the project. It has been promoting cycling actively in recent years. The second project town of Sweden, Växjö, is the smallest of the towns chosen, and has a strong will and strategy to promote sustainable transport.

The strengths and development areas of the cities are very different, which can also be seen in the modal splits.



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4
The modal share of cycling is especially high in Copenhagen (32%), Groningen (44%) and Houten (44%). Volumes of walking are highest in Strasbourg (30%) and Geneva (43%). The modal share of public transport is the highest in Geneva (17%), Freiburg (18%) and Stockholm (28%).

1

Bon Voyage

The Influences of Cycling and Walking

1

Bon Voyage

A Good City Life

Throughout the ages, city areas have acted as meeting places for people where they spend time and catch up. Walking was earlier the most important form of transport and it was easy for people to mingle and meet in the city. The city also acted as a trading location and enabled the mobility of people by acting as a passage. However, with motorization the balance between the main tasks of a city changed. Since the presence of motor traffic creates noise and diminishes attractiveness, city centres have lost their value as the meeting places of people. On the other hand, the development of communications technology has decreased people's need to meet face to face and to share information in this way.

A good city is the kind where inhabitants feel comfortable and can be proud of their living environment. City dwellers can actively participate in the city life, the service structure is purposeful, activity possibilities are diverse, and moving around the city is easy and enjoyable. In a good city the centre and sub-centres are attractive and enjoyable in different times of the year and day. Functions have been placed diversely, so that areas have a suitable amount of life in the evenings as well as in the mornings. Modern city life is made up of opportunities for random encounters and mingling. People have the need for daily contacts, which are offered by city life. Moving around in the midst of other people, seeing and hearing others as well as receiving impulses from other people offer a positive experience and an alternative to being alone. Even if a person is not necessarily in the company of another person in a city, he or she is still among them. Even people who move around the city alone can feel that they are interacting with other people.

People form the heart of city life.

1 & 2
In order to preserve the attractiveness of the centre, we need to calm motor traffic and increase the amount of public space. (Strasbourg, Geneva)

Cyclists and Pedestrians in a Key Position

When driving around in cars people do not meet each other and socializing is more withdrawn in a public transport vehicle than in an open public space. Pedestrians and cyclists, on the other hand, meet face to face in traffic and can easily stop for a chat. A cyclist can quickly hop off the bike and stop by in a store, sit down in a café or rest on a park bench. A city with pedestrians and cyclists is softer, friendlier as well as more humane. Therefore, in the traffic system of a centre it is important to prioritize pedestrians first and cyclists second. Third on the list is public transport and only after that comes private car traffic. In centre areas planning must begin with the needs of pedestrians and cyclists, even when creating a space that has other traffic too. The whole traffic system of the centre must be planned on their terms.

The starting point for developing a city is to widely consider what kind of a place should be created for the city dwellers. The key words are 'city life'. What kind should life in the city be? The heart of city life is its people, without whom there would be no city. City planning must be done on the terms of the people, so that they enjoy the city and want to spend their time there walking on the streets, marketplaces, squares, play parks, beaches, and in other public spaces meeting other people. A distinct feature of a good city is good walking conditions. Enjoyable pedestrian routes and areas as well as places where one can stop and sit down, invite people to spend time in public spaces and as a result the social aspects of the culture develop in these places. Therefore, a city has to pay attention to developing modern public spaces to promote the creativity of people and they can meet for instance for the purposes of studying, business or spending time. The influences of traffic and space on the climate, the environment and the wellbeing of people are known, but also the influence of traffic and space on creativity must be taken into consideration more and more. Attractive city centres enable active business life as well.

Pedestrians and cyclists must be prioritized in the city centre traffic system.

3
Parks and recreational areas offer people an enjoyable space to move around and to momentarily escape the noise and pollution of traffic. (Geneva)

4
Other people and sociability are a firm part of being in a city. Good walking conditions create the basis for interaction. (Copenhagen)

Centre – the Heart of the City

An attractive city centre must be socially, economically as well as ecologically sustainable and it must be a comfortable place for the residents to live in and influence. In accordance with the principles of sustainable development, city dwellers should not have to face the consequences of air pollution, noise pollution or other health and safety risks. By taking people of different ages in to consideration when planning city centres and by quaranteeing accessibility, it is possible to increase the functionality and passability of the city centre and also quarantee an enjoyable city experience for all city residents. In fact, centres should first and foremost be planned in order to create a comfortable living environment for the residents by balancing the traffic systems of the centres. This is achieved by favouring cycling and walking instead of motor traffic. Cycling and walking should, however, be considered as two very different forms of transport in the planning. The differences between these two forms of mobility are, for instance, speed, daily travel range, different need for infrastructure as well as safety issues.

An appealing and enjoyable city centre for the people is created by balancing the mix of functions correctly.

It can be said that a functional and green centre area is the city's healthy heart that keeps the city alive. When planning centres it is important to try to maintain the liveliness and activeness of the centre as well as versatility of different functions. It should be possible to spend time in the streets of the centre in cafés, terraces as well as public benches. Thanks to different functions, people have a reason to spend time in the centre and in public spaces. Especially in larger cities the location of a university in the centre brings life to the city and increases the demand for commercial services. Thus, an active life is preserved in the centre especially during wintertime when students are in the city. During the summers, as the number of students is lower, tourists bring more liveliness to the city. The mixing of different functions and different kinds of people living in the same environment brings richness to the centre and moving around on lively streets is safer than on empty streets. However, a peaceful night-time has to be ensured for those living in the centre and this can be achieved by, for instance, placement of the houses and planning of city blocks. Balance needs to be reserved between different functions to achieve a good result, so that no function can dominate the whole centre.

5
The mixing of different functions brings safety to mobility in the dark, as well. (Ghent)

6
Possibilities to sit down are important in both the centre and recreational routes surrounding the centre. (Freiburg)

Less Traffic Problems

The growth of traffic volumes in city centres causes an increasing amount of problems in European cities. In 2007, the European Commission published the Green Paper on Urban Transport, which highlighted three major problems: environmental nuisances, traffic congestion as well as traffic accidents. The same problems are topical also in Finnish city areas as urbanization intensifies. Promoting cycling and walking increases the number of mobility alternatives and also improves the safety of cyclists and pedestrians as well as reduces the possibility of conflicts between different forms of transport.

Since favouring cycling and walking reduces private car traffic, the quantities of exhaust gases and pollution decrease. In addition to this people's activeness and the share of everyday physical activity increase. By reducing private car traffic we can transform unused parking places in the centre for the use of either pedestrians or cyclists, which increases the attractiveness and space in the area. One street-side parking space for a motor vehicle can be made into parking spaces for about eight bicycles. In addition financial savings are created for cyclists and pedestrians if they cut back on driving. Promoting cycling and walking also helps to increase tourism, as public spaces become more enjoyable. Especially the popularity of cycling tourism can grow.

An accessible environment enables easier mobility for physically disabled people. A livelier and more active centre area creates a sense of safety to the surrounding streets, thus making the area more attractive and enjoyable to live in. Promoting cycling and walking decreases the obstacles of mobility, thus enabling high-quality mobility also for those who do not use private cars. Alongside driving, human-powered transportation offers an affordable and healthy alternative that is suitable for a wider audience than driving and also for people with limited means. Using public transport is not possible for everyone, either, due to location or wealth, so cycling and walking can offer a worthy alternative.

Cycling is a suitable mode of transport in trips of less than 7km and an electric bicycle in trips of as much as 15km. Much like driving a car, cycling is very autonomous: the vehicle can be used in all hours of the day and it is suitable for all possible purposes and targets of use. It also offers a door-to-door mode of transport. In addition, cycling is not as dependent on schedules as public transport. With regard to the duration of the trip, cycling is more predictable in a centre environment than driving a private car or public transport, with the exception of the metro. Cycling and walking have an impact on ecology and quality of life, as well as financial development and sociality of the centre.

7
If one wishs to decrease the number of private cars in cities, one must offer high-quality alternatives to mobility. A high-quality infrastructure of cycling, walking and public transport attracts users. (Strasbourg)

An Enjoyable Public Space Makes Business Flourish

An active business life in a centre also requires an active and vital centre, where people feel comfortable and like to come to visit. As the use of public spaces increases, the vitality of the centre increases and this has a stimulating effect on business life as well. The goal of Copenhagen, for instance, is to develop the use of public spaces and to be the best metropolis in the world for people to live in by 2015. The vision of the city is to be "a city of sustainable development, where public spaces invite people for a unique and diverse city life." The city has devised three sub-goals:

- people are satisfied with life in the city
- people walk more and
- spend more time in public spaces.

Indicators, which are used to evaluate if the goals have been reached, are set for each of the sub-goals. The goals of Copenhagen are not impossible, since in 2008 the British newspaper Monocle chose the city as number one on its list of 25 best cities to live in.

The influences of cycling and walking on the economy of businesses in city centres has been studied for instance in Great Britain and Germany. According to the research, traders underestimate the number of pedestrians, cyclists and users of public transport visiting their shop and overestimate the number of motorists who visit their shops. A growth of tens of per cents was noticed in the turnover of shops situated in centres that are transformed as pedestrian spaces compared to the situation before the change. According to the research, this positive change in the turnover also partly influenced the area outside of the pedestrian space. In the study it was found that customers who travel by car shop less frequently compared to pedestrians and users of public transport. It was also noted that the monthly consumption of pedestrians is higher than that of motorists.

8
The shopping street in the Old City of Stockholm attracts tourists and local residents alike.

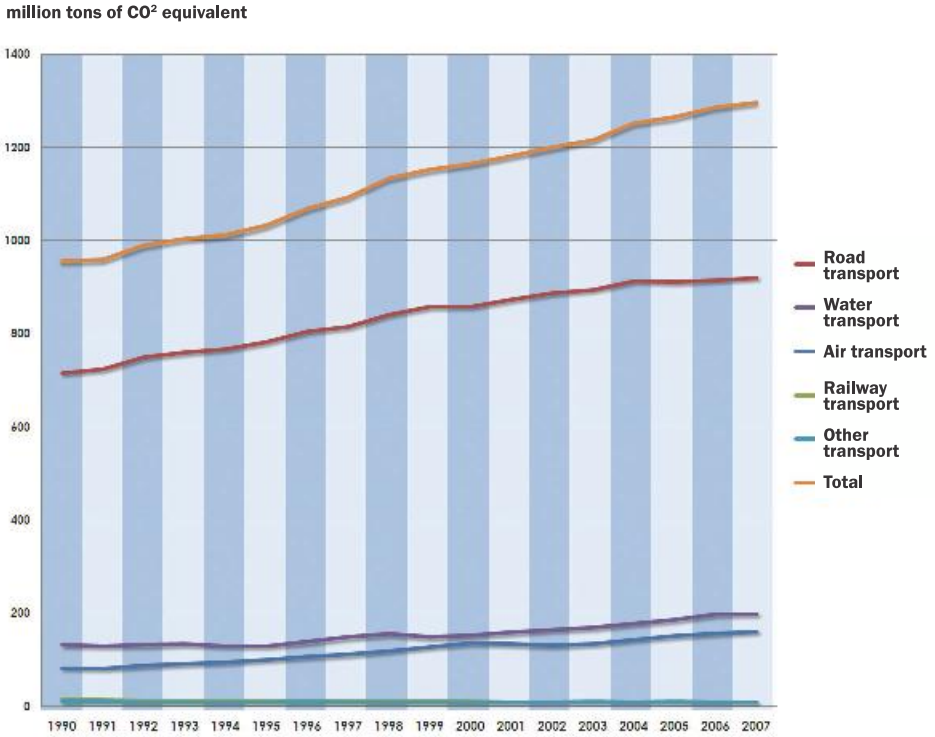
9
Possibilities to sit down increase the time people spend in public spaces. (Copenhagen)

Private Car Traffic the Biggest Producer of Carbon Dioxide

Private car traffic causes about 60% of the carbon dioxide emissions produced by traffic. These emissions cannot be decreased by methods of clean technology, but only by cutting down on fuel consumption or shifting to alternative forms of transportation, such as walking and cycling. Cycling is a competitive alternative to a private car also when it comes to speed, especially on short trips. For instance in a city area during a short drive the motor of a car does not have the time to warm up nor can the catalytic converter operate at full blast, so emissions are great compared to the distance travelled. For every travelled kilometre, when using a bike as an alternative to a petrol-driven private car, carbon dioxide emissions decrease by about 150 grams.

In addition to pollution, favouring cycling and walking prevents the growth of energy consumption and noise as well as decreasing congestion. A cycleway can convey the same number of bikes than a nearly twice as wide car route can convey cars. Bicycle parking takes up less space compared to car parking as well. As noise, pollution, congestion as well as motor vehicles looking for parking spaces are reduced in a centre area, the city becomes more easily accessible.

10
When cities start to favour cycling and walking, motor vehicle traffic jams in the centres are reduced, which significantly improves the air quality of cities. (Copenhagen)



Source: European Commission 2010

11
The table presents the carbon dioxide emissions caused by traffic in the EU27 countries between 1990 and 2007. The CO_2 emissions of road transport have grown nearly 30% in the inspection period, but their share of the CO2 emissions of the whole traffic has stayed near 70%.

Everyday Physical Activity Improves National Health

The health impacts of cycling and walking can be divided into three sections: savings in health care costs, decrease in absence from work as well as improvement in overall well-being. As lifestyle diseases increase, everyday physical activity is a way to prevent these. It has been estimated that daily physical activity of reasonable efficiency that lasts for half an hour, for instance a work trip of 4–5km by walking or cycling, fulfils this requirement.

It has been observed that people who do regular and long-term everyday physical activity, such as cycling or walking, receive diverse health benefits from this exercise:

- The risk of the development of coronary diseases is decreased by 50 per cent.
- The risk of the development of adult-onset diabetes as well as being overweight decreases by 50 per cent.
- The risk of the development of high blood pressure is decreased by 30 per cent.
- The development of osteoporosis slows down.
- Depression and anxiety symptoms are alleviated.
- The risk for cardiovascular diseases and psychiatric diseases is lower.
- The risk of suffering diseases of the musculoskeletal system, type II diabetes as well as colon cancer, breast cancer and stroke is lower.

In a study conducted in Denmark it was discovered that cycling to work for 3 hours a week decreases the mortality risk of people between the ages of 20–60 by 30%. Similar results were presented in a study realized in China in 2007. This research studied the impacts of cycling and walking on the mortality of Chinese women. As a result it was stated that, depending on different age groups, the mortality risk is 25–50% lower if the women cycle or walk regularly. Several studies support the health-promoting image of cycling and indicate that daily cycling has a clear positive connection to the decrease of health problems. However, people usually cycle due to the easiness and velocity of this mode of transport and not, for instance, due to health or environmental reasons. If we strive to achieve a change by influencing people's attitudes and opinions, this change is often very hard and slow. But if we make cycling and walking faster and easier than driving a private car, people will have better reason to choose cycling and walking as their new mode of transport.

The economic and health-related effects of cycling can be evaluated with different kinds of tools. For instance the HEAT tool (Health Economic Assessment Tool) is used to calculate the cost and benefit relationship of new infrastructure projects or to evaluate current infrastructure. To use this tool, the number and average length of daily cycling trips are needed. The necessary figures can be found out by, for instance, user inquiries or follow-up, travel diary studies, traffic counts as well as different quantity evaluations and prognoses. On the basis of the given information, the tool calculates an estimation of the savings in health costs gained by cycling.

12
Direct and fast cycling routes increase the modal share of cycling. (Copenhagen)

Safety Improves as Cycling and Walking Volumes Increase

The speeds of cycling, walking and car traffic are significantly different. The difference in speed between these different modes of transport creates a risk, and in an accident situation pedestrians and cyclists are always in a weaker position compared to a motor vehicle. Enhancing the role of cycling and walking increases respect towards these forms of transport and, thus, improves traffic safety.

Increasing cycling and walking has an impact also on decreasing traffic accidents that lead to death. Statistics prove that the accident risk of cyclists is smallest in countries where the modal share of cycling is the highest. As the number of cyclists reaches the critical mass, the traffic safety of cyclists is improved, as well, since cyclists are taken into better consideration. Motorists can take cyclists into better consideration also, due to the fact that they are often cyclists themselves. Due to the high number of cyclists, cyclists themselves have to be more observant when riding on cycleways.

Mobility in walking-oriented as well as shared space areas is often safe, since the traffic environment communicates the slow speeds. Since there are a lot of pedestrians, other modes of transport pay more attention to them. Traffic takes place on the terms of pedestrians, in which case the speeds are lower.

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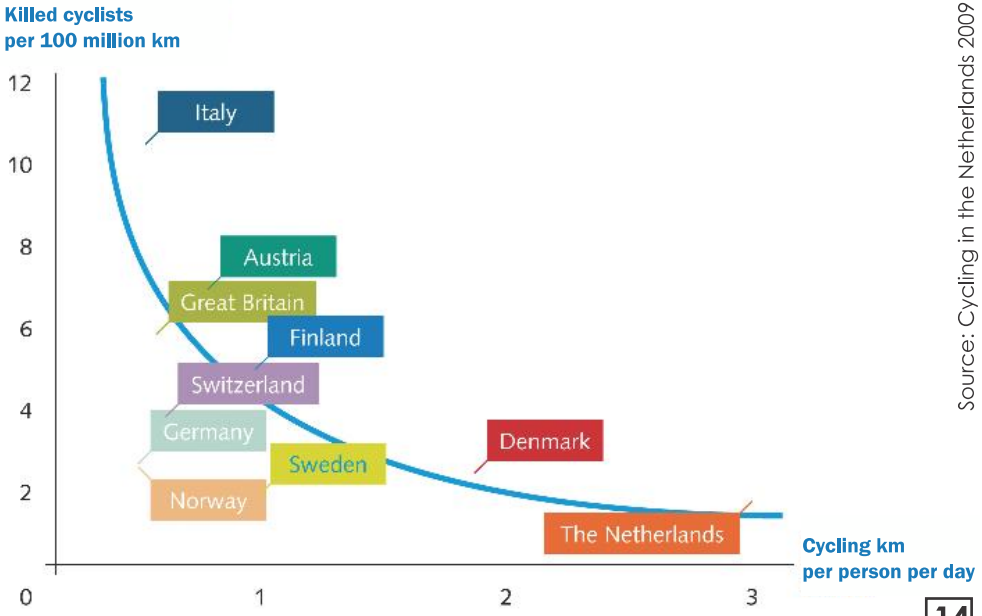


Source: Cycling in the Netherlands 2009

14

13
Co-existence of cyclists and motorists in Groningen. Due to the mutual respect between different forms of transport and a balanced amount of transport, mixed traffic is safe.

14
The risk of cyclists to end up in an accident that leads to death is decreased as the volumes of cycling increase.

2

Returning Cities to the People

Success Stories from Europe

2

Freiburg – from Destruction to an Environmental City

Starting from Reconstruction

"In Freiburg's city, it's clean and pretty", composed the poet Johann Peter Hebel over two hundred years ago. The same still holds true, since Freiburg is known as the ecological capital of Germany. The city has executed comprehensive environmental policy already since the 1970s. Freiburg, which has 213,000 inhabitants, is located in the south-western part of Germany in the beautiful region of Schwarzwald. The surrounding city region has about 615,000 inhabitants. Freiburg is a well-known student city, which has altogether 30,000 students.

In World War II, 80% of Freiburg's centre was destroyed. The city could have been built into a car-oriented city by widening the streets, but the city council chose to make the reconstruction in accordance with the old city plan. Freiburg was restored and so it took a step in a divergent direction. At the same time, several other European cities were restored by favouring the growing car traffic.

Controlling Emissions

Freiburg's environmental policy experienced significant changes in the 1970s. A nuclear power plant was planned in the vicinity of the city, which made the residents campaign strongly against the plan. Different groups of citizens started to envisage alternative forms of energy to nuclear power, which in the end paid off. When the nuclear power plant in Chernobyl exploded in 1986, the city council of Freiburg gave up the nuclear power project once and for all and decided to promote the use of alternative forms of energy. The target was to reduce the share of electricity from nuclear power from 60% to zero. Freiburg quickly became progressive in the utilization and research of solar power. In 1996 the council accepted an environmental protection concept, in which ambitious goals were set for reducing emissions: carbon dioxide emissions were to be reduced 25% from the current level by 2010. This goal was not quite reached, but in 2007 a new decision was made to reduce CO_2 emissions by 40% by 2030. Monitoring shows that the target is achievable. Waste recycling has been improved since 1991, when a new recycling concept was introduced. A recycling rate of 70% has already been reached. Waste that cannot be recycled is burned in a treatment facility, which produces electricity for 25,000 households.

Sustainable City Traffic for over 30 Years

Environmentally friendly policy has not been tied to political parties in Freiburg. Since the 1970s each party has had a representative who has spoken of, for instance, the importance of promoting cycling. In fact, the transport policy underwent a transformation in the 1970s. As of 1971, the city started to transform streets into pedestrian streets and in 1973 the whole centre of Freiburg was transformed into a pedestrian area. The city has one of the widest coherent pedestrian centres in Europe, about the size of a square kilometre. A decision was made in 1979 that all modes of transport would be favoured impartially, after which walking, cycling and public transport have been considered as equal forms of transport along with cars.

Between 1982 and 1999, the modal share of cycling grew from 15% to 28% in journeys inside the city, and the share of public transport grew from 11% to 18%. At the same time the share of private car journeys decreased from 38% to 29%. The first cycling plan was made in Freiburg in 1964 but coming up to the 1970s, Freiburg had very little cycle tracks. At present, the length of the cycling network is about 500 kilometres, although the quality level of the network still has to be improved in order to meet the needs of the users. In 1999 Freiburg made an improvement by opening the Mobile – mobility centre in the vicinity of the railway station. This centre serves cyclists as well as users of public transport. The mobility centre Mobile has, for instance, high quality bicycle parking space as well as rental and repair services of bicycles.

To the Centre by a Tram

Improvements in the city's rail traffic began in the 1980s. In 1983 the city started to expand the railway network, and during the next year, a new public transport ticket presented as an "environment ticket" was introduced. Public transport journeys became more affordable, and as a consequence, user numbers began to rise. The number of passengers doubled in ten years. A regional environment ticket was introduced in 1991, and as a consequence nearly 30,000 car journeys changed into public transport journeys. At the moment, public transport in the centre of the city is managed only with trams. Busses transport people to exchange terminals, where people change into trams. Tourists receive a free public transport ticket from their hotel for the duration of their visit.

Walking, cycling and public transport have been promoted in Freiburg by making land use more efficient. As an example, in the middle of the 1990s two residential areas, Rieselfeld and Vauban, were built a few kilometres away from the centre. The price level of the apartments has been kept low, so that even people with average income can afford to live in them. Both residential areas are ecological, which can be seen for instance in traffic planning. The areas can be reached by good cycling and tram connections, and car traffic has been limited by, for instance, moving car parking away from the vicinity of the apartments to parking lots or car parks.

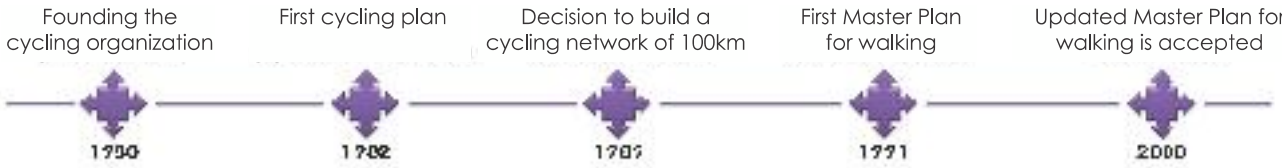
Geneva – Getting There by Foot

Little Big City

Geneva is known as the city of diplomacy, peace and money. The main offices of several international organizations, such as the United Nations and the Red Cross, are situated in Geneva. Activities in the field of finance and banking are internationally known, and the city is one of the most significant economic centres in the world. With regard to its size, Geneva is a very international city. The city has 190,000 inhabitants and accommodates over 170,000 conference guests from around the world annually. Geneva is called the "little big city", since the area of the city is only about 16 square kilometres. Population density is an amazing 12,000 citizens/km^2. Geneva favours compact city building and the aim is to place new residential areas inside the city instead of more spacious border areas.

Geneva is one of the most expensive cities in the world. The standard of living of its residents is high, since the level of wages is good. It is cheaper to live on France's side of the border, but Geneva offers better income which is why the border is crossed frequently every day. As much as 65% per cent of all traffic is headed beyond the border. From this, 72% are journeys related to work or studying. The working area of Geneva is growing fast; it is estimated that by 2030 the area will have 200,000 new residents and 100,000 new jobs.

Mobility in the city has for a long time been based on private cars. One reason for this is the location of the city at the end of Lake Geneva, which makes planning car traffic more difficult. There is no bridge going over the lake, which is why people have to drive through the centre of Geneva in order to get to the other side. One challenge is to control population growth so that traffic performance does not grow relative to the population growth. Despite numerous challenges, the city has decided to promote cycling and especially walking. Geneva has a common project with France to develop the region, where one of the goals is substantial advancement of public transport by improving the whole travel chain. The goal is to make public transport corridors from the centre across the border to the French residential areas. The use of public transport in the city has also been promoted by giving hotel guests a free ticket for the whole duration of their stay. Promoting public transport also promotes walking and cycling, which usually belong to the same travel chain with public transport.



Traffic System Based on Walking

The centre of Geneva does not have an actual pedestrian area like many other European cities but, nonetheless, Geneva is one of the forerunners in Europe when it comes to promoting walking. The first lawful master plan for walking was made in 1991, and nowadays the basis of traffic system planning is predominantly in increasing walking. The modal share of walking is as much as 43%, and the goal is to further promote walking as the main mode of transport. The promotion work has been persistent. Since the beginning of the 1990s, the aim has been to convince decision makers of the benefits of walking. For instance environmental and safety influences as well as improvements in the quality of life in the city along with the increase of walking have been emphasized for politicians. One main idea has been to highlight the fact that all city dwellers are pedestrians. Even those who drive have to park their cars and get to their final destination by walking. Influencing the decision makers paid off, since in 2000 they voted for the new master plan for walking and wanted to continue promoting walking. Politicians accepted the plan to give more and more space taken by cars to pedestrians as well as cyclists and users of public transport.

The master plan for walking has been implemented in small steps. Many small projects that belong to a larger whole have also incorporated into the plan. Thus decision makers have also been made to take an interest in promoting walking, since it has been better for them to commit to reforms that take place during their own term than extensive long-term plans. At first one small pedestrian area was opened in Geneva, after which small projects have been realized one step at a time. The aim has especially been to improve walking connections between residential areas and the centre as well as walking conditions in the recreational areas. All projects serve one large overall plan. Walking has also been marketed hugely to the city dwellers as well as employees of large international organizations. Different kinds of campaigns are often organized and many walking routes that guide people to different targets, such as tourist attractions, have been made in the city. Walking distances between different targets have also been marked on one map, so that city dwellers are able to see that they can reach many targets fast by walking. In the future Geneva wishes to adjust the walking network so that it is better for physically disabled people as well as to promote the safety of pedestrians and improve the cohesiveness of the network. Building a pedestrian centre is on the wish list of the city, as well.

Students as the Promoters of Cycling

A new era in cycling began in Geneva in the 1980s, and it was assisted by students as they demanded safer conditions for cycling. Before the decades of motorization Geneva had a lot of cyclists, but with the arrival of the 1970s, cyclists had disappeared almost completely. In 1976 students had already sent a request to the decision makers of the city regarding better cycling conditions, but the petition was rejected. To advance cycling the organized students founded a cycling organization in 1980, and later this became a part of the national *Pro Vélo* organization. Its members went through a lot of trouble so that a cycling network would be created in Geneva. In 1982 the city devised the first (unofficial) cycling plan, but the building of the cycleways did not begin until the beginning of the 1990s. In 1987 there were only eight kilometres of cycle tracks. The situation began to improve in 1989, when it was decided that a cycling network of 100 kilometres was to be built during the next five years. The work went well, and now there are about 100 kilometres of cycleways in the city of Geneva and 340 kilometres in the whole Canton. However, the execution of the plan made in 1989 has still not been completed. The problem is that originally the plan did not take the whole traffic system into account. Merely creating a bicycle network turned out to be impossible without an overall plan that takes all modes of transport into consideration.

Ghent – from a City of Cars to a Meeting Place of People

Medieval Glory

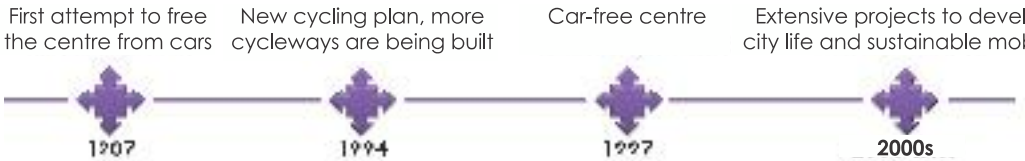
Ghent is the fourth largest city in Belgium. It is situated in the region of Flanders, about 60km from Brussels. In the Middle Ages the city was the second largest city in Europe after Paris, and a lot of its medieval glory can still be seen in the centre. The National Geographic Traveller Magazine chose Ghent as one of the top travel destinations in the world, since the city mixes history, cultural tradition as well as modern city life in a real and fluent way.

There are 245,000 inhabitants in Ghent and about 400,000 people in the city region. Ghent is a significant student town, which has 60,000 students. The city is situated on a crossroads of motorways, so it can be reached easily by car. However, the vicinity of the motorways also causes excess use of private cars in the area. Ghent is an inland city, but it has an important harbour since the city has a channel connection to the North Sea, to the harbour city of Terneuzen in the Netherlands. Ghent also has five railway stations, where both national and international trains stop. About 45,000 passengers travel on the railways of Ghent on a daily basis.

"Well Planned, Well Communicated"

In the middle of the 1990s the streets in the centre of Ghent were filled with cars, although people wished to return the beautiful historic centre from cars to people since the 1980s. In 1987 a traffic plan was devised that would have ended car traffic in the centre. However, the plan was not accepted. A new attempt was made in the 1990s, when a breakthrough occurred. A new cycling plan was accepted in 1994, as a consequence of which three new main cycleways were built, a cycling unit was implemented into the organization of the city, and the development of a cycling culture began. Important reasons for the acceptance of the reforms were comprehensive planning of high quality as well as extensive communication. In the 1990s one of Ghent's theses in making plans was: "Well planned and well communicated".

In 1997 a plan was accepted to reorganize mobility in the centre (*Mobiliteitsplan*), and this was expanded in 1998 to cover the whole city. In the beginning the mobility plan received a lot of resistance partly due to the fact that driving was severely limited in the centre.



Despite the resistance in the beginning, Ghent's traffic policy started to favour walking, cycling and public transport in the mentioned order, which can be seen in decision making, as well. Driving cars through the centre was prohibited and a ring road was established around the city centre. The ring road was built on the grounds of the former medieval city wall in the 1860s, but in the end of the 1960s it was improved to include four lanes. Also market place and kerbside parking of cars was strongly limited by building underground parking facilities and by improving the directions leading to them. At present the centre of Ghent has 10 parking facilities, where altogether 24,000 cars can be parked. Kerbside parking is allowed only for people living in the centre.

Different Modes of Transport Working Together

In accordance with the plan of 1997, the city began to build a large pedestrian space, which is now the size of 0.35km^2, in the car-free centre. The aim was to highlight the beauty of the city centre and restore it into its medieval glory. In the beginning of 2010 the centre was further developed by sizeable renovation work, which improved the functionality of the pedestrian space and the public transport system. The pedestrian area is surrounded by a 30-zone covering 1,400 streets. This zone has the speed limit of 30km/h, and cycling takes place mainly as mixed traffic on the street together with cars. Two-way cycling is allowed on the one-way streets nearly without exception, and cycling is allowed on the pedestrian streets, as well.

People have been cycling in Ghent throughout history, but the share of cycling diminished in the 1970s–80s. After the middle of the 1990s, cycling has been promoted more and more, which has paid off. The first cycling plan was devised in the city in 1994. The goal of this plan was to expand the cycling network and to define the cycle policy. In about ten years, the modal share of cycling has doubled from approximately 10% to nearly 20%. At the moment, Ghent has 380km of separate cycling network, but there are altogether about 1,000km of street network at the disposal of cyclists. The wide public transport network is comprised of three tramlines and ten bus lines, which are used by about 150,000 passengers daily. This use has been intensified by, for instance, offering free public transport departures during weekend nights as well as by distributing a free public transport ticket to people under the age of 15. The surroundings of Sint-Pieters station will be developed in the 2010s, when the accessibility of internal public transport of the city will be improved. At the same time, the number of bicycle parking spaces will grow to more than 10,000.

Since the 1990s, marketing and communications have been an integral part of the traffic policy of Ghent, in fact the city uses about 200,000 Euros annually for marketing cycling. The city publishes a free newsletter to residents a few times a year, as well as devising a number of different kinds of brochures and maps to promote sustainable mobility. Ghent is known for its many campaigns the city organizes annually to persuade citizens especially to cycle. The city has strived to increase the use of bicycles in journeys to work and school as well as among students. "*Gent, wild van fietsen*" (Ghent, wild about cycling) is a campaign that promotes cycling as the best mode of city transport. In addition, the city has organized cycling weeks, campaigns supporting the use of bicycle lights as well as strived to prevent bicycle thefts through education.

Groningen – Compact City Structure Invites Cyclists

The Cyclist is the King

Groningen is situated in the north-eastern part of the Netherlands, near the German border. When measured by population, it is among the ten largest cities in the Netherlands. There are 186,000 residents in Groningen and about 500,000 in the whole region. Groningen has a university and a polytechnic, both of which have over 20,000 students. Nearly one fourth of the residents are students, which is why the average age of this city marketed as the most youthful city in the Netherlands is under 35 years.

The modal split comprised of journeys inside Groningen reveals the dominating position of cycling. About 40% of journeys are made with a bicycle and a little less than one fifth by walking. The share of cars is about 37% and public transport only 4%. The city has strived to increase the share of public transport by building six Park+Ride areas on the edges of the city, from where travellers can continue their journey by bus to the centre. In addition, the city aims to increase the share of public transport with new tramlines. Two lines will be finished in 2015 and, in addition, a third line is under consideration. An important direction is improving accessibility to the hospital by public transport, since 30,000 people drive there on a daily basis.

First version of the traffic plan (*Verkeerscirculatieplan*)

Second version of the *Verkeers-circulatieplan*

Car-free centre, ring road is finished

First cycle policy programme

Bicycle parking centre (*Stadsbalkon*) is finished in the railway station

An Overall Picture of the Puzzle

The first cycle policy programme was devised in Groningen in 1986, but already long before that the city had promoted cycling and walking. An overall vision to renew the traffic system was created already in the 1970s, and this is still the basis of planning. In 1969 the city devised a traffic plan (*Verkeerscirculatieplan*), which presented the idea of a ring road for the first time. Resistance was so strong that the decision was made to further develop the plan. A revised plan was presented in 1975. In this plan the centre was divided into four sectors and a ring road with the diameter of one kilometre was built around the centre. Drive-through traffic in the centre was prohibited, and at the same time, better prerequisites were created for cycling and walking. People can move from one sector to another directly by walking, by bicycle or by public transport, but they must make a detour along the ring by car.

The plan was implemented a couple of years later in 1977. Car traffic was restricted in the centre only after the cars could be directed to the inner ring. There are car parking facilities in the centre, so it is possible to drive to the heart of the city, but drive-through is not allowed. However, the building of parking facilities has been restrained, so that car traffic in the ring road will not grow too much. New cycleways were built one step at a time and at the moment Groningen has 205 kilometres of good quality cycling network.

City Structure the Key to Success

Groningen uses a concept of a compact city, which is one of the most important factors in the success story of cycling and walking. New residential areas are built in the immediate vicinity of the centre, which results in the fact that about 80% of city dwellers live within three kilometres of the city centre. Direct cycling and pedestrian connections have been built from residential areas to the centre, while motorists have to go around a longer way. One of the principles guiding the planning is to maintain the liveliness of the centre during all times of the year and day. Different functions have been diversely located in the centre, and building large shopping centres outside the city has been restricted to ensure the vitality of the centre.

By the end of the 2000s, Groningen had invested in developing bicycle parking. In 2007, a new covered bicycle parking area that has a place for nearly 5,400 was finished in connection with the main railway station. The parking problem is represented by the fact that this parking area has been overloaded since the beginning, since 10,000 bikes may be parked there during the weekends. The city plans to develop the whole station area in 2020, so that the area would meet the demands of, for instance, the new tramline. In the same context the aim is to increase the number of bicycle parking spaces to as much as 20,000. An extensive bicycle parking plan, in which new solutions are pondered to both the street level and underground, is being made in the centre. To make commuting smoother, traffic connections to the industrial areas located in the perimeters of the city will be improved.

Houten – Cyclist's Paradise

Into a village of 30,000

Thoughts about expanding Houten began to emerge in the 1960s, when more residential space was needed around the city of Utrecht. Houten was conveniently situated along the track ten kilometres from Utrecht. The village of 3,000 residents was meant to be made into a town of 30,000 residents. The residents agreed to the change, provided it would be made on their terms. They wanted to preserve the feeling of a village in the new town and to keep the old centre as it was. So the planners started to develop a new centre one kilometre away from the old village centre, and they made it their main line to plan a low and cosy town, the kind the old Houten was. They wanted to restrict mobility by cars, since traffic congestion and noise did not belong to a village-like environment.

Pioneer of the Sector Model

The planners had the idea to divide the city into 16 sectors, through which there was no direct connection by cars. A ring road was sketched around the city through which motorists had to go if they wanted to go from one sector to another by car. People could cross the sector boundaries by bicycle and by walking, which made bicycles clearly the fastest vehicles in the city. A journey of one kilometre may mean five kilometres by car. In addition, a wide green area was sketched crossing the whole city in both directions, east-west and north-south. All of the schools were placed on the edge of the green area, so that it would be safe for the children to ride bikes to school. When the officers of the Ministry of Transport saw the plan, they were sceptical. The ring model and sector division were new, and the officers did not believe that this kind of a city model could work. Nowadays the same model is copied in many cities around the world.

The first development phase of Houten began in 1975, and the city grew quickly. In 1979, 1,000 new apartments were built. The city was flooded with residents, and by the 1990s, there were already 30,000 inhabitants. People wanted to move to Houten because it was such an attractive place.

First development phase of the city, community structure is executed on the terms of cycling

Population is nearly ten-fold compared to ten years ago

Second development phase of the city begins. Building Vinex begins

New square in the centre is finished

Improvements to the surroundings of the railway station and Onderdoor are finished

The second development phase began in 1998, and during the first decade of the 2000s, an area called Vinex was built in the southern side of the city. This doubled the area of the city. Vinex was realized with the same principles as the northern part or Noord. In 2010 the population of Houten was about 50,000, and more people arrive all the time, even though apartments are more expensive than in the neighbouring cities

Top Conditions for Cycling

The bicycle is the easiest and fastest vehicle to move around in Houten, since the cycling conditions are of a very high quality. The whole city structure has been built to favour cycling. In a research performed in 2008 it was revealed that 95% of the residents were very pleased with the city's cycleways. The fact that 58% of the residents cycle every day is also indicative of the quality of the conditions. The modal share of cycling is 44% and 23% of journeys are made by walking. Houten has a principle that guides planning, namely that cars are directed to the ring road and people cycle inside the ring road.

Car traffic has not been prevented, since residents can reach their homes and even the city core by cars. However, the mobility environment encourages residents to use bicycles rather than cars. Motorists give way to cyclists all around the city, except for the ring road. Cycleways intersect on different levels of the ring road, which makes both cycling and driving more convenient. The ring road has been raised on the spot where pedestrian underpasses are placed, so that it has not been necessary to dig the cycle tracks very deep. The percentage of car ownership is quite high in Houten, however, people do not use their cars very much in the internal traffic of the city, since a bicycle is a faster and easier vehicle.

Quality over Quantity

Houten has only 21 kilometres of cycle tracks and approximately the same amount of route or ring road meant only for cars. Otherwise traffic takes place as mixed traffic of bicycles and cars on the "bicycle streets" (*Fietsstraat*), where car traffic has to yield to the cyclists. Streets have been built to look like cycle tracks, which gives the travellers a visual impression that the cyclist is king. Visual and technical methods have been skilfully used to calm down the traffic in other ways as well. Pedestrian traffic has, as a main rule, been separated from other traffic. There is very little public transport inside Houten; the modal share is only 1%. In the centre there is a railway station, and nearby there is also a bus terminal. However, buses do not drive inside the ring road except when they arrive at the terminal. In practice they only go around the ring road. A new railway station was opened in the district of Vinex, as well, in the fall 2010.

The centre of Houten has been developed to be far more enjoyable than it was at the end of the 2000s. In 2008, a new pedestrian square intersected by a small channel was finished. As a landmark in the centre there is the La Place cafe, the terrace of which rests alongside the channel. Notable reformations have also been made to the surroundings of the railway station in the centre, and the renewed station area was opened in 2011. At the same time Onderdoor, the main street of the centre functioning as a cycle street, got a new look as well.

Copenhagen – the Cycling Capital

Cycling along Horse Tracks

The British magazine Monocle chose Copenhagen as number one on its list of the 25 best liveable cities in the world in 2008. The city has been a forerunner in creating high quality city life, and it has set its goals high for the future as well. The capital of Denmark has about 520,000 inhabitants and the capital region has in total about 1.8 million inhabitants. The population of the city is younger than elsewhere in Denmark, since 43% of the residents are between the ages of 20 and 39.

One element of city life in Copenhagen is promoting human-powered transportation, i.e. cycling and walking. Cycling is a significant mode of transport in Copenhagen in trips to both work and school as well as during free time. Cycling is not only favoured by a specific limited population group, all kinds of people belonging to different social classes and age groups cycle in Copenhagen. There are altogether about 400 kilometres of cycleways in Copenhagen. Building them started 100 years ago. Cycling became more widespread at the beginning of the 1900s, when cyclists began to use private horse riding tracks along the beaches. The surface of these routes was even, so riding bikes was more comfortable than in the cobblestone streets. Since the routes were private, the city did not maintain them. However, the number of cyclists grew fast and the demands for better cycling conditions increased. The riding routes started to be transformed into separated cycle tracks and by 1934 there were already 130 kilometres of paved cycleways. These routes had a lot of users, since at the time there were 400,000 bicycles in Copenhagen. After the Second World War, the governing planning principle became separating different forms of transport from each other by main routes. Separate cycle tracks were built for all new main streets, and by the 1950s about a half of the current cycle track network existed. The cross-section of the streets was the same as these days: half a kerb separates the cycle track from the road. The pavement is next to the cycle track, also separated by half a kerb.

Early 1900s – First cycle tracks are built on old horse riding tracks

1934 – 130km of paved cycle tracks

1962 – First phase of the pedestrian street *Stroget* is finished

1996 – First Bicycle Account report is published

2002 – New cycle policy programme for 2002–2012

2004 – Green wave for cyclists on *Nørrebrogade*

2013 – New bicycle parking area for 7,000 bikes in the main railway station

Political Will the Key to Change

Although motorization increased in the 1950s–70s, the share of cycling in Copenhagen did not decrease as dramatically as in many other European cities. A third of the adult population used a bicycle regularly. When arriving to the 1980s, the position of cycling required improvements from the point of view of the citizens, which is why the residents organized a demonstration for cycling. Politicians and decision makers realized how much the people of Copenhagen liked cycling, and the political will changed in favour of it. There was a turn for the better also on the state level in the beginning of the 1980s. During 1982–2001, an allowance was reserved in the state's budget to build and maintain cycle tracks as well as to improve cycling conditions. In the beginning of the 2000s this allowance was cut, but along with the climate change discussion promoting cycling has gained momentum again. Several programmes related to promoting cycling have been devised in the 2000s, and during 2006–2026 the aim is to build 70 kilometres of new cycle tracks.

Green cycling routes (*Grønne cykelruter*) of a high quality going through green and recreational areas disconnected from the rest of the infrastructure have also been built in Copenhagen. These routes are meant to be for fast commuting as well as for free time cycling and walking. The plan is to build a network of 100 kilometres, from which 40km already exists in 2010. In addition, Copenhagen plans to build fast and even higher quality cycling connections from the surrounding residential areas to the centre. The city has also paid attention to promoting the safety of cyclists. The aim is to reduce the number of cycling accidents by half, and to increase the feeling of safety of cyclists so that at least 80% of the cyclists feel safe in traffic.

Clear Goals for Mobility and City Life

According to the goals set in 2008, the aim is to make Copenhagen a cleaner, healthier, and a more environmentally healthy city that entices people to move and act. The city's goal is to be the best cycling city in the world by 2015 and a city in which half of the trips to work and school are made by bicycle. At the moment, this figure is 37%. Cyclists can be seen in the street image of the city, since 30,000 cyclists ride on the busiest cycle tracks daily. A high quality follow-up of cycling conditions has been realized in Copenhagen for a long time. Since 1996, a Bicycle Account report has been published every other year evaluating the development of cycling and the realization of the cycle policy in the city.

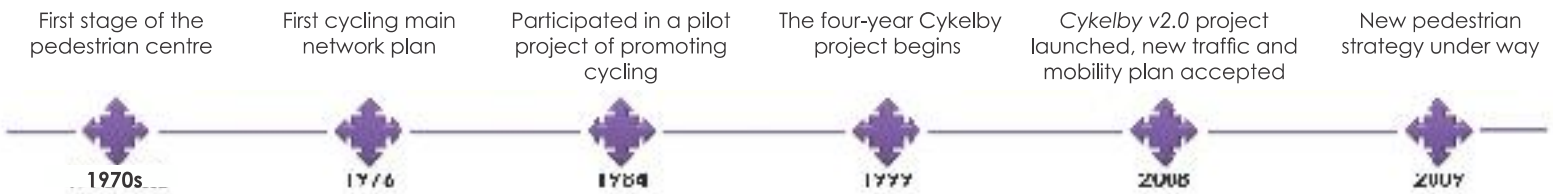
Copenhagen is a forerunner in promoting walking as well. Developing the liveliest shopping street of the city core, *Strøget*, began in the 1960s. The first phase was built in 1962, and the pedestrian area has been expanded in small steps since to its current size. Currently *Strøget* is the world's longest pedestrian street, nearly 3.2km long. The city's goal is that by 2015 Copenhagen will be known as an ecological metropolis that has the world's best city environment, and where people's quality of life is the best of all the metropolis areas. There are three central goals in promoting city life: to improve quality, to promote walking, and to increase the utilisation rate of public spaces. The aim is that by 2015, 80% of the people will be satisfied with the possibilities offered by city life, the number of walking journeys will grow by 20%, and that people will spend 20% more time in public spaces than at present.

Odense – Joy of Creativity in a High-quality City Environment

Conditions of High Quality

Odense is situated on the island of Fyn and with its 189,000 inhabitants it is the third largest city in Denmark. Odense is among the oldest cities in the world; it celebrated its 1,000 year anniversary in 1988. One of its most famous inhabitants was the storyteller H. C. Andersen, whose home is now a popular tourist attraction. Andersen's stories can also be seen in street art, since statues and details depicting his stories can be seen all around the city. There are a lot of students in Odense, since the office of the *Syddansk Universitet* which has 12,000 students, is situated there. However, the campus area is located six kilometres away from the centre, so students cannot be seen in the street scene as much as in many other university cities.

Odense has become known as an innovative promoter of cycling and walking. According to the BYPAD audit, the cycle policy realized in the city is the best in Europe. The first cycling main network plan was accepted in 1976, after which new cycleways and recreational routes have been built in the city. In the 1980s Odense had 350 kilometres of cycleways and by 2010 the network of cycleways had widened to altogether contain some 550 kilometres. Cycling conditions throughout are of a very high quality. It is easy and enjoyable to drive along the cycle tracks, and proper attention has been paid to the quality of bicycle parking. The parking shelters in the centre are stylish and the city has clearly invested in their looks and usability.



A Boost from Creativity

Odense participated in a national pilot project of promoting cycling in 1984. As a result, a quality two-way cycle track was built in the centre. At the turn of the century, the Ministry of Transport and the road administration of Denmark chose Odense as the national "cycling laboratory", and during 1999–2002 the city realized a four year long Cycling city project (Cykelby). The experience and knowledge gained in Odense was meant to be applied to other municipalities in Denmark. During four years the city received 10 million Danish crowns from the government to be used for promoting cycling. The aim was to develop new kinds of measures in which cycle traffic would be improved. The project aimed at developing, for instance, the functionality and safety of intersections, smoothness of the cycling commute, bicycle parking as well as the marketing of cycling. The overall volume of cycling grew by 20 per cent during the project, and the overall growth in cycling trips was 25,000 trips per day. Without the project, about half of these trips would have been made by car. The number of cycling accidents was reduced by 20 per cent during the project and as a positive health effect, 500 extra years of life were gained for the town residents. In 2008 the project *Cykelby v2.0* was launched to continue the project.

Many innovative development steps have been taken in Odense. For instance the cycling barometer and the green wave for cyclists have been invented in Odense. The purpose of the barometer was to give cyclists more visibility, since passers-by can see the number of cyclists on the screen of the barometer. To help cyclists follow the green wave, innovative traffic planners of the town developed a light system next to the cycle track instructing people to travel in an appropriate speed. Thus, cyclists can regulate their speed in accordance with the green wave. Cyclists are allowed to turn freely to the right in many traffic light intersections, even if the light is red. In addition, several campaigns have been organized in which the aim has been to promote cycling, especially in trips to school and work.

Attractive City Spaces with Design

Developing a pedestrian area in the centre of Odense began in the 1970s, when car traffic going through the centre was banned. The pedestrian area is enjoyable, because attention is paid to the design and aesthetics of the public spaces. Thanks to the Cykelby project, the car-free area of the centre grew by over 50 per cent during 1998–2008, but otherwise promoting walking has stayed in the background since the beginning of the new millennium. One reason for this was the wide attention received by cycling. However, promoting walking has been invested in as well, since the end of the 2000s. In 2008, a wide traffic and mobility plan was made in the city in which one of the most important goals, in addition to promoting cycling and public transport, is to improve the conditions of pedestrians. In 2009 Odense began preparing a strategy to develop pedestrian traffic. Relating to it, eight quality requirements that guide the development work have been devised for the pedestrian areas.

Odense is starting to implement a sector model with ring roads in accordance with the model of the Netherlands. Four sectors, in which one could drive from one sector to another only by going around using the ring road, have been planned for the centre. These plans also include removing the bus route going through the centre and replacing it with a cycleway. The plan is to develop the main cycle routes as faster and shorter short cuts compared to the routes of the car traffic. The quality and attractiveness of the routes will be invested in as well, in the future. The underlying thought is to offer cyclists better conditions than motorists. The city of Odense has set a goal that by 2020, the share of cycling will grow from the current 24% to 33%. One challenge in promoting cycling is the incoherence of the city. Some of the residential areas are over 10 kilometres away, and from there residents travel to the centre by car. Odense's goal is thus to condense the city structure.

Strasbourg – Quick Rise to the Top in Sustainable City Traffic

Trams Started the Success Story

The old, wealthy industrial and cultural city of Strasbourg is situated on the border of France and Germany along the river Ill and it is the centre of business life in the county of Alsace. The medieval centre of Strasbourg has been chosen in UNESCO's World Heritage List, and the vicinity and influence of Germany in the history of Strasbourg can be seen in the architecture, language, and food culture of the city. Since the end of the 19th century, Strasbourg has changed its nationality between France and Germany five times in 75 years. Nowadays Strasbourg is known as the location of the European Parliament, the Council of Europe and the Court of Human Rights. The city has about 273,000 inhabitants. A lot of young people live in Strasbourg: 24% of the residents are under 20-year-olds and 60 per cent are under 40-year-olds. Therefore, there are a lot of residents who potentially favour walking, cycling and public transport.

Strasbourg is known for its high-quality and fast public transport. Strasbourg was one of the first French cities that reintroduced trams in the beginning of the 1990s. In the 1960s, rails had been removed from the streets but in 1992 building work began for the first new line. At the same time, more cycleways were built. A significant force was the new mayor who had just stepped into power. The platform of the new mayor included rebuilding the tramline network. This was in accordance with the alignments of France, since the government had guided cities towards a more sustainable city traffic planning with laws and regulations. The success story of Strasbourg began with the implementation of the tramline and the city is still strongly investing in public transport and cycling. The tramline network resembles a metro, which is why travelling by tram is fast and clear. The lines are comprised of a little more than 50 kilometres, so the network is the widest in all French cities.

Strong Will to Increase Cycling

The first cycling plan made in Strasbourg was in 1978. At the time, the prevailing planning convention was to make new cycle tracks separate from car traffic, so cycling infrastructure began to emerge alongside rivers and canals. In 1983, cycling in both directions was accepted in some one-way streets. When building the tramlines began in 1992, promotion of cycling was intensified at the same time and two-way cycling was accepted in even more one-way streets. In 1994 a goal was set to build a cycling network of 350 kilometres by 2005. This required 230 kilometres of new cycleways. However, this goal was exceeded generously, since currently there are 520 kilometres of cycleways in the city and two-way cycling has been accepted in 360 one-way streets. The modal share of cycling is 7%, so increasing cycling is one of the important objectives of the city. Continuous development operations speed up the growth of this share.

In 2010 the centre was divided into three zones: meeting zone ("the living room"), 20 zone and 30 zone. The principle is to reduce driving in the city and to restrict speeds. The plan is to build more and more streets in which cars and bikes can travel safely in the same space. Bicycle parking has been strengthened in the centre since 2004. One of the most important improvements was made in 2007, when an underground bicycle parking facility for 1,900 bikes was built in tandem with renovating the railway station. However, there is still a lack of bicycle parking spaces, but development work is carrying on vigorously.

Trip Chains Lead to the Beautiful Centre

The first area reserved only for pedestrians and cyclists was made in 1983. Ten years later, when introducing the tramline, the centre was completely alleviated of car traffic. Car traffic was then guided to the ring road circling the city centre. Different parts of the centre area can now be accessed from the ring road. Even buses cannot drive through the city core, only people can walk, cycle or take the tram through the centre. There are interchange stops outside the centre in which bus travellers can change into a tram. Several interchange parking areas that are easy to reach from different entrance ways have been built for motorists also. Continuing the journey to the centre by public transport has been made user-friendly. Bike-and-ride facilities have been invested in by building bicycle racks or locked bicycle parking spaces, which work with travel cards, on many tramline and bus stops. There are locked parking spaces called véloparcs in 21 stops and these have places for 20–100 bikes. Bicycles can also be taken on the trams outside rush hours.

The pedestrian streets, squares and riverfronts of the river Ill in the historic centre create idyllic city spaces that are favoured by tourists. There are different kinds of pedestrian areas in the centre with different kinds of functions. The square of *Kléber* is a cosy living room with its main shopping streets, whereas the *Petite France* is a romantic idyll with its nice restaurants. Enjoyable public spaces invite people to walk, and in fact, over half (52%) of the journeys in the centre are made by walking.

Stockholm – Improving Cycling Culture Paves the Way

European Environmental City

Stockholm, which is situated on the shores of the Baltic Sea, is the capital of Sweden. Founded in 1252, Stockholm is comprised of as many as 14 islands, the best known of which is the Old City or *Gamla Stan*. The first fortresses were built there long ago, and there are a little over 800,000 inhabitants in the city and nearly two million in the whole province region. Most of the inhabitants are students, since Stockholm is the largest student city in Sweden with about 80,000 students as well as 21 universities and polytechnics. The city is green; nearly 40 per cent of the area consists of green and park areas.

The goal of Stockholm is to create an attractive and safe living environment for all its inhabitants. In fact, the goal of the city for 2010 was to be the most accessible capital in the world. Environmental issues have become an important target for development in Stockholm as well, and since 1995 reducing green house gases has become one of the main goals in the city. It is also indicative of the work undertaken by Stockholm for the environment that the city was chosen as the first environmental capital of Europe in 2010.

Change of Power – and Mode of Transport

It has been estimated that the biggest environmental problem in Stockholm is the traffic, which is why reducing traffic emissions is an integral part of the environmental work of Stockholm. Thus, promoting cycling and walking have become important factors in reaching the city's emission reduction goals. The number of cyclists has grown fast in Stockholm since the first half of the 1990s, but it has been at its fastest since the cycling plan (*Cykelplan*) was completed in 1998. At that time, commuter traffic was congested with cars, metros as well as busses. To lighten the load, the city wanted to make cycling a real alternative for commutes. The goal was to create direct and coherent cycling routes from residential areas to the centre, and a new high-quality cycling network has been purposefully built since 1998.

The possibility for broad changes opened up after the municipal elections in 1998, when the *Stockholm partie* became the leading party in the city board. One of its main themes was promoting cycling in Stockholm. Due to the party's influence, the annual allowance for promoting cycling was raised from two million crowns to about 60 million crowns, or from a little over 200,000 Euros to almost 16.5 million Euros. A bicycle traffic solution was planned for nearly each main street in the centre, and about 50 kilometres of new cycle tracks and lanes were built to the centre alone. In 2007 the overall length of the cycle tracks was about 800 kilometres.

Massive Reformations during the New Millennium

In the 2000s, Stockholm also introduced bicycle boxes, which are currently used in over 300 traffic light intersections. In addition, thousands of bicycle parking spaces, cycle track signposts, bicycle pumps, and bicycle maps improved cycling conditions. Stockholm gained significant results in ten years, since the number of cyclists grew by as much as 75%. Currently the modal share is 8%. The cycling promotion schedule slowed down in 2006, when the city's government base changed. Allowances for cycling were reduced to about 15 million crowns or about 1.6 million Euros per year.

A bicycle sharing system of about 1,000 bikes makes moving around much easier in Stockholm. This system covers most of the city. The shared bikes can be used by both residents and tourists during the snowless season from April to October. A route service, the help of which one can find either the shortest route or a route that contains the most cycle tracks inside the city, has been developed on the Internet site in order to make planning trips easier. With this service users can also see the calories burned during a cycling trip as well as the time consumed.

Better Walking Conditions in the Future

Traffic safety has been improved by traffic calming measures, and in 2005 speed limit areas of 30km/h were set in all residential areas. The centre is made more enjoyable by pedestrian streets that are mostly situated in the areas of the Gamla Stan and in the business centre. The main shopping street in the centre, *Drottninggatan*, has been a pedestrian street since 2000. During the 2010s, Stockholm will be developed into an even more pedestrian-friendly city, and a walking strategy is being devised for the city. The plan is to, for instance, improve the pedestrian connection from the *Globen* hall to the centre, so that the whole journey of little more than five kilometres can be travelled through pedestrian-oriented streets. As an indication of the political will, the notion that Stockholm is a "Walking City" has been recorded in the general plan of promoting walking.

Växjö – with Comprehensive Strategy Work to Number One in Europe

The Greenest City in Europe

In 2007, BBC wanted to make a report of the greenest city in Europe and they approached the international association for sustainable development (ICLEI). ICLEI guided the reporters to the city of Växjö in southern Sweden. Växjö has for a long time worked to improve environmental issues and to reduce carbon dioxide emissions. One of the long-term goals of the city is to completely get rid of fossil fuels. BBC's production group visited the city, after which Växjö was heralded as the greenest city in Europe by the international media. The reputation started to spread, mainly since magazine articles being rapidly published in different countries. In 2008 alone, over 500 articles were written about the city in international press.

Lakes Have Shaped the History

Växjö is an attractive city in Småland surrounded by lakes. The location of the lakes has influenced the fact that the city has been built compactly. Nearly 90 per cent of the 83,000 inhabitants in the city live within five kilometres of the centre. There are 20,000 students in the city. The lakes have played a big role in Växjö's path of sustainable development. As recently as 50 years ago all the lakes surrounding the city were severely polluted from sewage discharges from industry and households. The first step towards more extensive environmental actions was taken in the 1960s, when a decision was made to clean Lake Trummen on the south side of the city. One significant incentive for this action was the "Million Programme" driven by the Swedish government. The purpose of this programme was to reduce a shortage in accommodation by building a million new apartments in the country in ten years. Växjö did its bit and bought more land around the city. However, on all sides the builders were faced with a lake, so the only possibility was to expand to their shores. Before this, the lakes had to be cleaned.

- **1960s** – Lake Trummen is cleaned
- **1980s** – The city begins to use bio fuel in district heating distribution
- **1986** – Decision to build a pedestrian area in the centre
- **1995** – First cycling strategy is approved
- **2004** – *Växjö runt* – a pedestrian and cycle track around Växjö city is finished
- **2007** – BBC names Växjö the greenest city in Europe
- **2009** – New cycle track plan is devised

During the 1980s, the environmental operations were expanded when the city's energy company began to use bio fuel in its district heating distribution. During the 1990s the work had been very organized and more and more different operators, such as companies and the university, joined in. Växjös strenght is its comprehensive strategy work, which is done on the upper level of the city's organization. Different administrative parties, external companies, organizations, business life, and residents work together and develop the city together towards sustainable goals.

The City Centre of the Year in 2010

Cycling and walking has been promoted in Växjö since 1986, when a radical decision was made to transform the main street of the centre, *Storgatan*, and a few of its cross streets into pedestrian areas. The purpose was to solve the congestion problems of the centre. Building the pedestrian centre began in 1990, and later it was expanded in different stages. At the same altogether 1,500 residential and slow streets have been realized. The centre of Växjö is enjoyable and attractive. Proof of this is the City centre of the year award that Växjö received in 2010 from the Swedish City Centres organization. Nearly the whole city has participated in developing the centre, since city dwellers, decision makers, and entrepreneurs are all represented in the development work group.

The Need for Traffic Information Increases

In 1995 Växjö approved a cycling strategy, the purpose of which was to give guidelines for developing the cycle traffic. This strategy was improved in 2000 with a cycle track plan. The newest cycle track plan was finished in 2009, and it includes 37 kilometres of new cycle tracks to the city of Växjö. Växjö has four main cycle routes that go from the centre to the perimeter areas of the city. Each route has its own colour marking that is the basis for the signage system of cycle tracks developed during 2001–2004. In 2004, *Växjö runt*, a pedestrian and cycle track that is 42 kilometres long, was finished. This track goes through nature parks and lake shores around the city along routes that are easy to travel.

During the last years, work with traffic and especially promoting cycling and walking have become increasingly important parts of Växjö's environmental work. One method to reduce the carbon dioxide emissions of traffic is to get more and more people cycling. The goal of the city is to become the best cycling town in Sweden. At the same time as more and more people start to travel by bicycle the need for traffic information increases. During the past couple of years Växjö has successfully concentrated the work on the combination "soft" and "hard" traffic safety measures. In 2011, the traffic-safety campaign "I am looking for Eye-contact in the traffic" had been running for ten years. To date, the Traffic Department has received three awards for its efforts undertaken in the city, e.g. with speeding limits of 30 km/hour. A new Speed limit plan was approved in September 2011.

From a Vision into Practice

Transport Policy – A & O

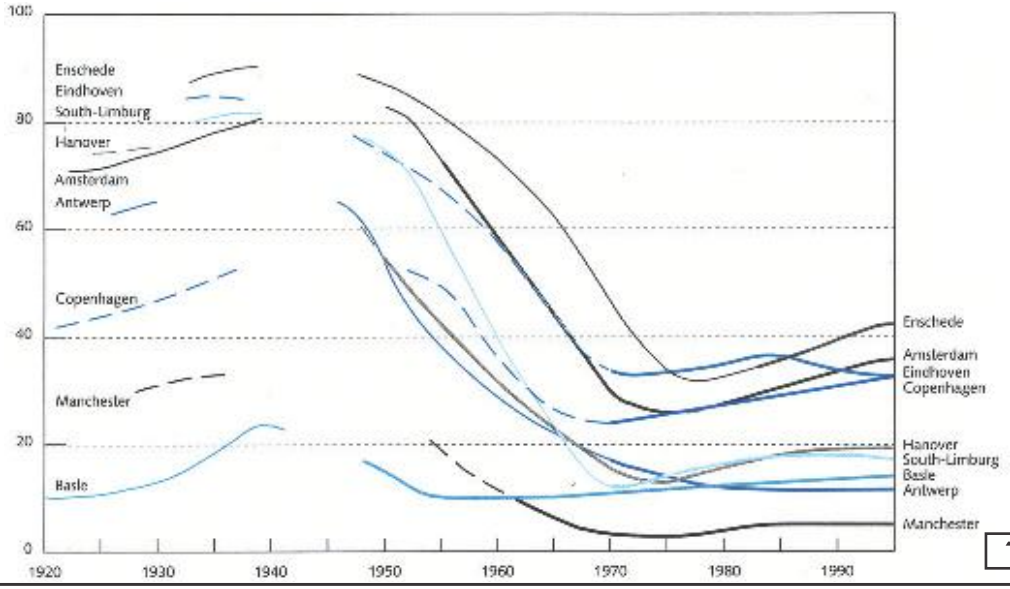
3

From a Vision into Practice

Towards Success with a Sense of Direction

Why do People Cycle so much in The Netherlands? The answer is not simple, since many factors influence the popularity of cycling. Cycling is easier on a flat surface than a hilly route, and the compactness of Dutch cities also favours cycling, since the trips are short. History and culture bring along their own influences, since cycling has been a common way to move around in The Netherlands already for decades. Even during the most intense motorization the Dutch people cycled more than other Europeans. This has been influenced by the easiness of cycling due to the flat landscape and short distances.

However, one of the most important reasons for the popularity of cycling in the Netherlands has been the country's determined transport policy. When in many other countries traffic environments were planned more and more on the terms of car traffic, the Netherlands made significant political decisions to promote cycling. In the middle of the 1970s the country started to make city-specific, comprehensive traffic plans, in which cycling and walking were taken into consideration as equal forms of transportation along with cars and public transport. In 1976 the Ministry of Transportation of The Netherlands (Ministerie van Verkeer en Waterstaat) made a decision to pay the cities 80% of the building costs of cycle tracks built on city areas and 50% of the costs of cycle tracks alongside roads. The combined length of the cycle tracks increased 73% during 1978-1988, when at the same time the car transport network grew only by 11%. In 1988 there were altogether 16,100 kilometres of cycle tracks and 101,000 kilometres of car traffic routes in the Netherlands. Considerable resources are still being targeted at promoting cycling in the cities. The cycling budget of Amsterdam was altogether 100,000,000 Euros during 2006-2010 or 26.95 Euros a year per resident. Groningen spent altogether about 13 million Euros for promoting cycling during 2007–2010 or 16.80 Euros per resident annually.



Source: Cycling in the Netherlands 2009

1
Cycling-friendly transport policy has been seen in the Netherlands in the budgeting of resources of the state as well as cities and towns. A lot of resources have been targeted at promoting cycling, which can be seen, for instance, in the modal split of Amsterdam. When comparing the development of the modal shares of different cities in Europe it can be seen that the modal share of cycling in Dutch cities has not, despite motorization, dropped permanently below 30%.

Why Does Geneva Invest in Walking? Private cars have had a significant role in the traffic system of Geneva for a long time. The growth rate of the city has accelerated, which is why the amount of traffic has grown in the city, as well. Street space cannot be increased, so the city has started to influence people's mobility habits. Geneva is a densely built city where distances are short. Therefore, walking is a genuine alternative as a mode of transport. Geneva is not against the use of private cars, but lack of space, environmental problems as well as the will to improve traffic safety and quality of life in the city have made it necessary to restrict private car traffic. In the beginning of the 1990s the city began to take actions to transfer space from cars to people. It was stated that pedestrians are a necessity to the city, since they revitalize the city and its business life.

In 1991, Geneva accepted the first master plan for walking, which included five development steps:

- encouraging people to walk more
- increasing pedestrian areas and public spaces for walking
- promoting walking as a mode of transport
- improving accessibility in pedestrian routes
- calming the motor vehicle traffic

This plan is comprehensive and it presents an extensive vision to promote walking. It includes many small projects that are a part of the whole. Geneva has gained significant results over the past twenty years. The modal share of walking is over 40%, so it has surpassed car traffic. The city has concluded that it is easier for elected officials to commit themselves to sub-projects that are realized during one council term. Communicating the significance of walking to decision makers has been successful, which is proved by the fact that the council accepted the updated master plan for walking unanimously in 2000. Thanks to persistent work also many private land owners have understood the positive influences of walking and have opened up pedestrian routes through their plots.

Geneva has determinedly developed infrastructure as well as promoted walking in general by, for instance, good marketing. Direct and enjoyable main routes have been built from residential areas to the centre and, in addition, walking conditions have been developed in the centre and inside residential areas. At the same time, car traffic has been calmed. Walking maps of different kinds of theme routes that go through different areas of the city have been made for residents and visitors. Further information of the ways of marketing walking in Geneva can be found in Chapter 8.

2
In Geneva walking is the basis of the traffic system and the shores of waterways have been built for pedestrians. The shores of lakes, rivers and canals offer enjoyable connections between different areas of the city.

3
Pedestrian streets can be found in residential areas, as well, and in Geneva these are used for instance to guarantee safe walking connections to children from their home to schools and day care.

Why do the Danish Cycle? Copenhagen is the cycling capital of Europe where the especially huge cycling streams of commuting traffic may surprise even a Dutch person. In the city, 37% of trips to work are made by bicycle. Like in many Dutch cities, the popularity of cycling is influenced, among others, by the flat terrain, strong cycling culture, and progressive cycling conditions. The first cycleways were made already in the beginning of the 20th century, and by the 1950s about half of the current cycling infrastructure was finished.

Studies are regularly made in Copenhagen concerning the development of the volume of cycling as well as influences of the choice of mode of transport. The city has also clarified what people's motives for cycling are. In the Bicycle Account report of 2006 in total 61% announced easiness, speed and convenience as their reasons for cycling. A little less than fifth (19%) cycle to stay fit and maintain their health and only 1% has chosen the bicycle to protect the environment.

People's motives for cycling in Copenhagen (2006):

- 54% cycle because it is fast and easy
- 19% cycle because of physical advantages
- 7% cycle because it is comfortable and convenient
- 6% cycle due to economic reasons
- 1% cycle due to environmental reasons

To bring the advantages of cycling and walking for a society into effect, people need to be activated to move with their own feet. To make them cycle or walk these modes of transport must be made fast, easy and convenient. This requires the right kind of transport policy. The most important reason for the popularity of cycling in Copenhagen is the city's cycling-friendly policy, which guides decision making and allocation of resources. During 2006–2009 the city was allowed to use over 40 million Euros to improve cycling conditions. This is about 22 Euros per resident each year.

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4
In Denmark cycling really is the whole nation's mode of transport, since everyone cycles from children to the elderly. For the Danish people cycling is a natural way to move from one place to another. Cyclists of different levels who travel in different speeds are taken into consideration in the traffic due to the country's progressive cycling culture and the high number of cyclists.

5
Marketing and different kinds of actions to increase the visibility and attractiveness of cycling are important also in the model cities of cycling. A cycling barometer shows the number of cyclists who have travelled on the cycleway during the day as well as during the whole year.

Returning Cities to the People

Most of the cities in Europe have been car-oriented cities, which has greatly influenced the look and attractiveness of city centres. When significant routes of through-traffic have been taken through centres, traffic volumes have been high and congestions a daily problem. Market places and squares have been filled with parked cars. By-products have included noise, exhaust gases and accidents. Accessibility of the centre has not been good any more due to the high volumes of traffic.

In the 1970s-1990s several cities decided to revise their transport policy. People wanted to make city centres enjoyable areas, where it is safe and easy to run errands and spend time. For instance in Groningen, Freiburg, Ghent and Strasbourg car traffic was restricted in the city core by forbidding drive-through. Cars were directed to ring roads, and public spaces for people were built in the centres. The cities were returned from cars to people. Still a couple of decades ago for instance the Kleber square in Strasbourg was circled by 40,000 private cars daily, whereas now people sit around water pools reading a book or going shopping in a noiseless environment. Cyclists paddle through the market and a beautifully shaped tram travels on the side.

In addition to livening up city life, one of the most important advantages of pedestrian centres is safety. This means both traffic safety and social safety. When there are little or no cars, the risk level is considerably lower. When people travel in the area at almost all hours of the day, a person can feel socially safe, as well.

The principle "everything evenly everywhere" is not practical in traffic planning. We have to prioritize what kind of traffic will be favoured in different areas of the city. Thus, other forms of transport will adjust to it. Transport policy choices are needed in decision making.

The principle "everything evenly everywhere" is not practical in traffic planning.

Photo: Karin Temmerman

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6 & 7
The side of the canal going through the centre of Ghent was occupied by cars before the decision was made to calm the centre from car traffic. Nowadays the canal-side acts as a meeting place and a place where people spend their free time.

A Daring Vision behind it All

The example cities of Europe have not reached their positions as good cycling and walking cities by accident. In the background of the development there has been a vision of which direction the city will be developed. Instead of sitting by and watching the change take place and just passively adjusting to it by building more and more private car infrastructure, the cities of Europe have themselves defined what kind of city the city would be made into and what life in the city would be like. Instead of increasing motorization, cities have wished to move in a more humane direction. There has been a vision of another road of development.

Courage is needed for groundbreaking envisaging, since often it is easier to settle for the "business as usual" way of thinking than to think innovatively. When inspecting the example cities it can be stated that their path has been the right one, but initially the decisions have called for a daring and visionary way of thinking. Now other cities can also benefit from the examples and experiences of these forerunners.

What is also common to the most successful cities is that they have dared to set their goals high. A model example of this is Copenhagen, which is one of the forerunners in goal setting and envisaging when it comes to cycling, walking, and the quality of city life. Freiburg created a future image of a green city, where, instead of building a nuclear power plant and producing more energy, the decision was to promote more sustainable ways of living and moving. In the background of the cyclists' paradise Houten there is, on the other hand, an idea of a completely different city model than what people were used to. This inspiring and motivating vision has been in the background of change and development in all the example cities.

A clear overall picture helps to look for suitable pieces to the puzzle.

Copenhagen will not settle for mediocrity, but declares that their vision for 2015 is to be the best city in the world to live and spend time in. Copenhagen aims to be the eco-capital of the world by 2015. The vision of the city, "A metropolis for people", contains a strong concept of what city life should be like in Copenhagen from the point of view of an individual person.

Copenhagen's vision is not meant to be just rhetoric, but in order to reach the vision the city has set certain city life related sub-goals and indicators related to them. According to the sub-goals, by 2015 in Copenhagen

- 80% of the residents are satisfied with the possibilities provided by city life,
- the number of pedestrians has grown 20% and
- the residents spend 20% more time in public spaces.

The purpose is to monitor the development by measuring the amount of city life before the development projects of public spaces as well as after them. The amount and quality of city life is evaluated by examining the number of people spending time in the public spaces and the amount of different events and activities as well as by interviewing the city residents. These ambitious goals as well as measuring their realization ensure that development really does take place.


Groningen in the 1960s

Photo: The City of Groningen


Strasbourg in the 1990s

Photo: Strasbourg Communauté Urbeine


Groningen's realized vision


Strasbourg's realized vision

Photo: Strasbourg Communauté Urbeine

The Whole Picture of the Puzzle

The word "politics" originates from the Greek work *polis*, meaning city. The first meanings of politics had to do with developing, governing or beautifying a city or a country. Still the political decision making of municipalities has similar goals: from different alternatives it is strived to pick the solution that best develops the municipality in different sectors. Politics defines how the vision is achieved.

Political decision making is guided by values that have been chosen and adapted in the municipalities as well as the vision of the future of the city. The puzzle is difficult to put together if the whole picture, the common idea of what is strived for, is not known. Therefore, a development policy based on the common vision must be chosen for the development work of a municipality. The city strategy can be founded on this policy. Values are actualized only when making decisions, and only concrete solutions show what kind of values guide the development of a municipality.

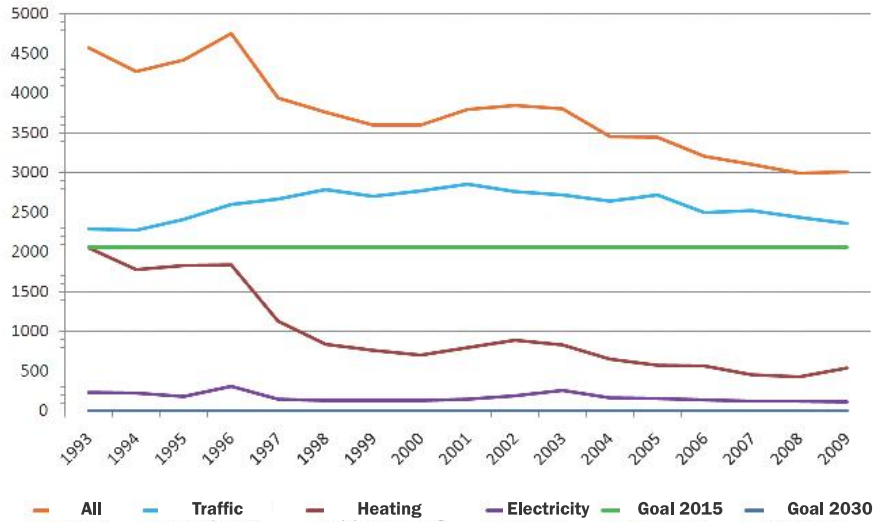
City strategy is a tool for reaching goals and a functional plan to actualize the policy. In the development work of municipalities it is important to devise a comprehensive, long-term strategy that is derived from the development policy of the city. Different administrative organizations, business life, and residents must be brought along when devising the strategy, so that it is truly a document concerning the whole city. The strategy must be taken into consideration in decision making, so that it guides political choices. When the overall picture is known, placing individual pieces in the puzzle is easier. When the right direction has been approved, the municipality can be developed one piece at a time.

8

Växjö relies on strategy. The city of Växjö in Sweden is an example of comprehensive strategy working. The strategy planning department is one of the most central actors in the organization of the whole city. The department has a representative from different administrative organizations and together they devise goals in which everyone commits to. Thus for instance the environmental department, transport department, and school system do not define their own goals and strategies unaware of each other, but everyone works together toward a common goal. The strategies and programmes of different administrative organizations are connected to the whole.

In addition to different departments of the city, for instance industry, business life, university as well as residents have participated in the strategy work. Due to the comprehensive working Växjö has reached significant results in, for instance, energy efficiency and environmental protection. This is one of the reasons BBC chose Växjö as the greenest city in Europe in 2007.

Carbon Dioxide Emissions per Resident in Växjö, kg



Source: Thorvaldsson Kristina 2011

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When the common vision and the overall picture have first been defined, it is easier to develop smaller sections so that they work well together. Thus also the goal is reached more easily and faster.

9
Växjö's goal is to reduce carbon dioxide emissions with a comprehensive strategy. The goal of 2030 is to lower CO_2 emissions per resident to zero.

Towards a Sustainable Traffic System

Programmes for smaller sections are derived from the city strategy. One of them is the traffic policy programme, in which the first step is to set a comprehensive goal and sub-goals. These goals must begin on the traffic system level, so that all forms of traffic are taken into consideration. All forms of traffic cannot be favoured at the same time in the whole municipality area, but their prioritization order in different zones must be considered. The forms of traffic do not have to be placed against each other, but redistribution must be considered area-specifically. Walking and cycling have been prioritized in an attractive city centre or sub-centre, whereas there must be undisturbed access for heavy vehicles in an industrial area.

The most important sections of transport policy are:

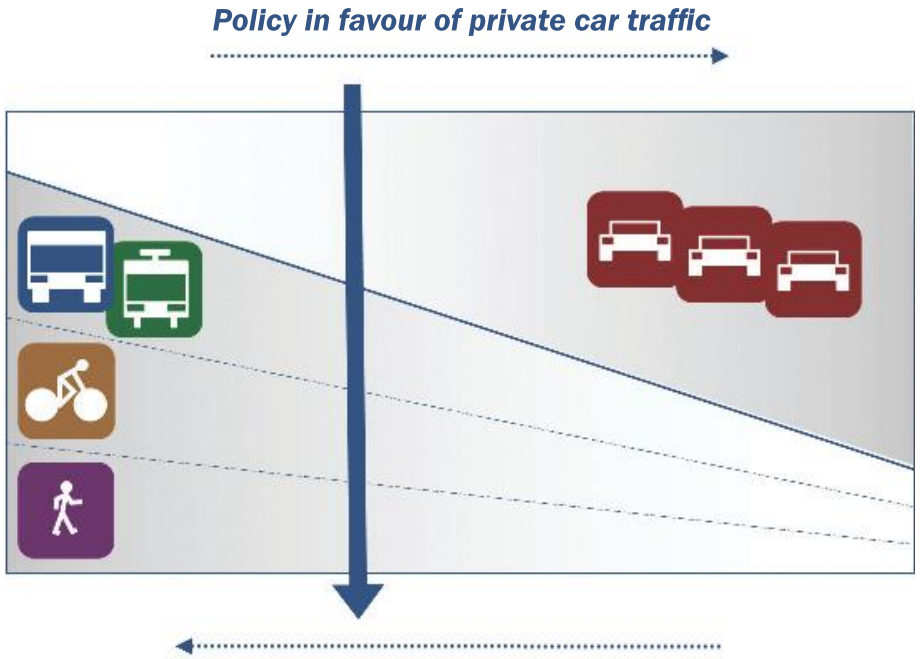
- the position of different modes of transport
- a sustainable and efficient traffic system
- infrastructure: routes and parking
- mobility management
- safety
- economy

Along with the climate change, the whole world has been made increasingly responsible for controlling the change. Climate policy goals are strict, which is why traffic emissions have to be reduced significantly, as well. At the same time, urbanization has continued, which has brought more and more people to city regions. Along with traffic congestion comes more noise, pollution as well as travel time costs. In addition, acknowledging traffic safety has been highlighted and people's demands for attractiveness have grown. Due to these reasons, an important transport policy principle in cities of sustainable traffic is reducing private car traffic. Residents are encouraged to move away from the steering wheel of a car and start walking, cycling and using public transport.

Political commitment towards promoting sustainable transport is a prerequisite for the development of cycling and walking conditions. If private car traffic is primarily favoured in the decision making of a city, it inevitably means that significant results cannot be obtained in promoting cycling, walking or public transport. And correspondingly, when cycling and walking are promoted in a city, private car traffic must be restricted.

"Values are goals guiding our choices and they are only actualized in situations when choices are made."

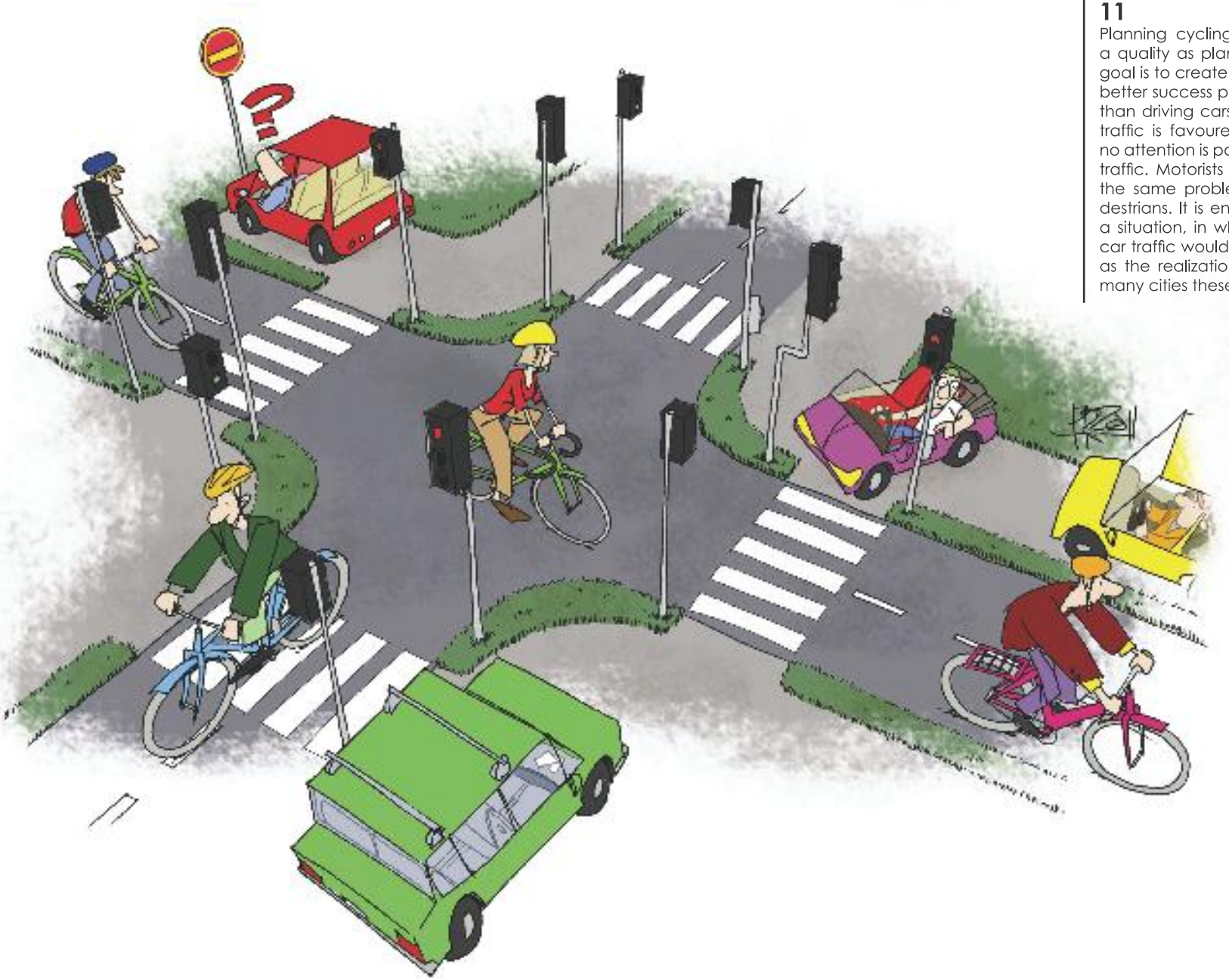
- Dr.Pol.Sc. Martti Puohiniemi



Source: Adapted from Delft University of Technology 1991

10

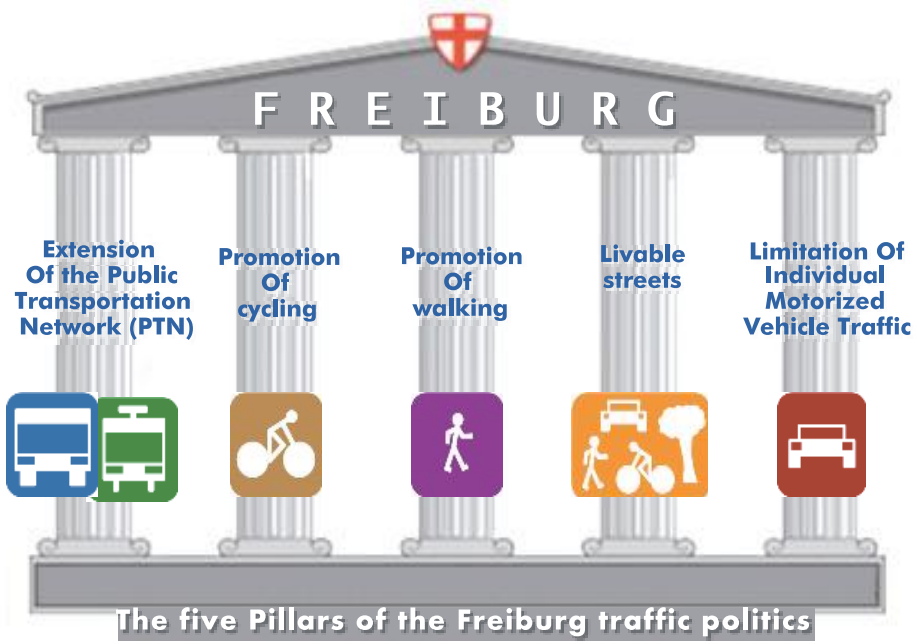
10
The modal split is regulated by transport policy. The moving arrow of transport policy depicts the transport policy of the country and municipalities, and decision makers can move the arrow horizontally towards the target state. The closer the arrow is to the left side, the more walking, cycling and public transport are favoured.



11

Planning cycling must be of as high a quality as planning car traffic if the goal is to create equally good or even better success prerequisites for cycling than driving cars. At the moment, car traffic is favoured in many cities and no attention is paid to planning cycling traffic. Motorists seldom have to face the same problems as cyclists or pedestrians. It is enlightening to consider a situation, in which the realization of car traffic would be on the same level as the realization of cycle traffic is in many cities these days.

Photo: Pekka Rahkonen 2011



The five Pillars of the Freiburg traffic politics

Photo: Schick Peter 2011

The transport policy of Freiburg is based on five pillars. Freiburg has made a comprehensive decision to promote sustainable transport. The basis of the strategy consists of five pillars that guide all transport policy decision making: expanding the public transport network, promoting cycling and walking, revitalizing the streets as well as reducing private car traffic. Already the order of the pillars conveys the fact that promoting public transport is emphasized in the decision making of the city and resources have also been used to increase cycling and walking. As early as in the 1970s the city made the decision that all modes of transport will be equally considered in planning. They are merely given different roles in certain zones. Equal planning of the different forms of transport can also be seen in the modal split, since different modes of transport are used equally on daily trips. The share of all modes of transport – walking, cycling, public transport and private cars – of trips made in the city is about 25%.

To be able to fairly consider all forms of traffic, it is important to focus on the level of the whole traffic system.

12
There must be good mobility conditions on residential streets, whether people are moving on foot, by bike or by car. All modes of transport are equally taken into consideration in the traffic system planning of Freiburg, which can also be seen in the street image.

13
Marketing is important when promoting walking and cycling, and it is possible to encourage city residents to cycle and walk by, for instance, appealing to environmental reasons. In Freiburg city dwellers can follow what kind of influences traffic has on their own environment in real time with the help of a device that measures the quality of air.

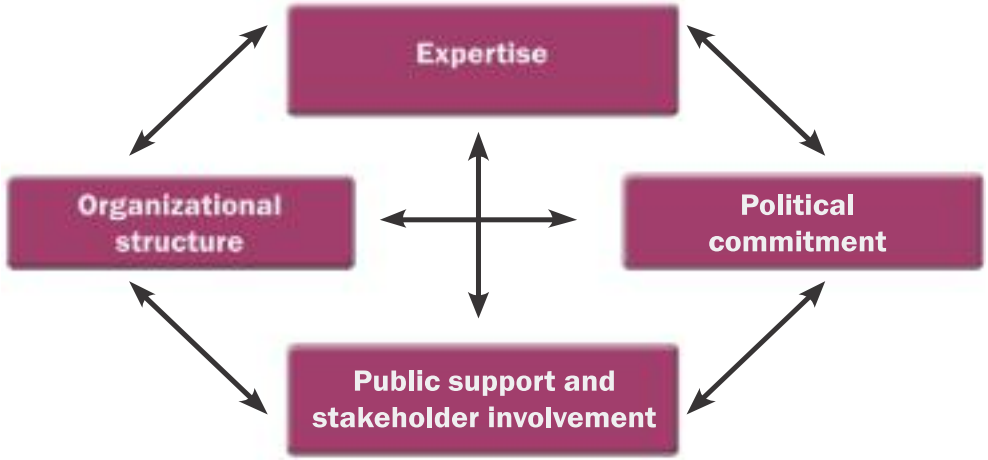
Key Factors Are Needed in Promoting Cycling and Walking

Political Commitment leads to success

Political commitment is the most important prerequisite in order to change the conditions of cycling and walking. Without the contribution of politicians and the city's officers it is impossible to obtain significant reformations. In all the example cities the success factor has been long-term commitment to comprehensive, sustainable policy. As a starting point, promoting cycling and walking must be included in the strategy concerning the whole city as well as the transport policy programme. The needs of these modes of transport must be considered in all planning: land use planning, transport and street planning as well as general city planning. Cycling and walking infrastructure must be planned to be of equally high quality as car traffic routes and not just as a by-product of car traffic planning. Also with regard to maintenance, cycling and walking routes must be highly prioritized. They have to be maintained at least as well as car routes.

14

The infrastructure of cycling and walking cannot be just a by-product of planning car traffic.



Source: ICE 2009

15

14
When cycling has been planned like car traffic, travelling by bicycle is similar to vehicle traffic, as well. (Zwolle)

15
Key factors influencing the implementation of transport policy and their mutual relationship.

Reaching the Goal with Teamwork

The city of Växjö is exemplary in comprehensive strategy work. The city of Odense in Denmark, on the other hand, is one example of a city that has developed planning cooperation. A few years ago the planning teams were renewed so that the city started to realize projects with as wide a consortium as possible. The teams are led by project managers, and there are a specific number of project managers in different departments. The responsibility to lead a project varies between different departments according to the focus of each project. The extensiveness of the project, on the other hand, influences the composition of the team. The more administrative organizations the project concerns, the wider is the basis for cooperation. The planning team can have a representative from, for instance, land use planning, city planning, street planning and street building, traffic planning, house building department, water and environment department as well as other administrative organizations, such as physical activity or health.

The strength of comprehensive planning is that the project is run by the same leader the whole time and the "host" does not change in midstream. Thus, we can ensure that the realization corresponds with the plan and, on the other hand, the plan is feasible. Another strength is the reduction of contradictions between different departments caused by differing opinions. In Odense, the experience has been that disputes have decreased along with the new planning process.

The city also considers it important that communications as well as residents are involved in different stages of the planning process. Citizens not only receive truthful information related to the project but, in addition, they get to participate in the planning concerning their living environment from the beginning. This reduces objections from the residents towards the projects and also enhances the "us" mentality. Residents accept the new solutions and also adapt them more easily, because the solutions have been "made together". The speciality of Odense is also the participation of a design planner in the project group.

Expertise Provides Vision

The ability to see the correct problems and find suitable solutions is needed when launching a policy that promotes sustainable traffic. This requires the right kind of expertise that planners, officials and decision makers can obtain from different sources, such as further training, conferences and literary material. One important method is to create an expert network, which includes representatives from, for instance, business life, sports organizations, the police, associations of the visually or physically impaired as well as users of cycling, walking and public transport and voluntary organizations. Their expertise in their own sector is valuable, which is why representatives from different fields significantly aid in clarifying the problem areas as well as developing solutions and new visions. They can also support the civil servants of the city in conveying political and practical measures to different interest groups.

Public Support Creates Change

Citizens have a significant role in promoting political will. In Copenhagen, the city residents organized a demonstration in the 1980s where they demanded that cyclists should be better considered in traffic planning. Politicians noticed that the citizens liked cycling, after which the policy began to favour it more. In Strasbourg, the residents chose a person whose platform included promoting sustainable city traffic as their new mayor in 1989. When voting for a new mayor, the residents made an impact on the creation of a new kind of a traffic culture. Political will has been promoted in several cities with a strong dialogue between the citizens and decision makers. Politicians have been informed of, for instance, the benefits of cycling and walking as well as the wishes of the citizens with regard to city traffic.

These dialogues are important, since through them political decision makers receive the latest information related to cycling and walking. Often they have wrong preconceptions, which is the biggest obstacle in promoting cycling and walking. Politicians may think that no general support exists among the residents for promoting sustainable city traffic. However, according to research made in 2000, even in the car-oriented United States most of the residents (55%) would rather walk their daily trips than drive a car. Two thirds (65%) wished that motor vehicle traffic would be reduced in the cities by improving public transport or developing living communities and the service structure so that the need to use private cars is reduced. From Werner Brög's studies in 2003 it became evident that most Europeans experience the influences of car traffic as intolerable (22%) or barely tolerable (54%).

Individual citizens can converse with decision makers and make wider dialogue initiatives through, for instance, newspaper articles. However, it is important that a city also has well organized citizen groups that have good dialogue connections with the decision makers. Often European cities have reached the best results by gathering people who favour the promotion of cycling and walking. When the group and expertise of citizens who wish for a change have grown, the weight of their opinions has increased, as well. Due to a constructive and determined dialogue culture, for instance, Ghent has made significant changes in its transport policy in a short time towards favouring walking, cycling and public transport. The results have been good, since the modal share of cycling has nearly doubled during the ten years (1997–2007) from about 10% to 20%.

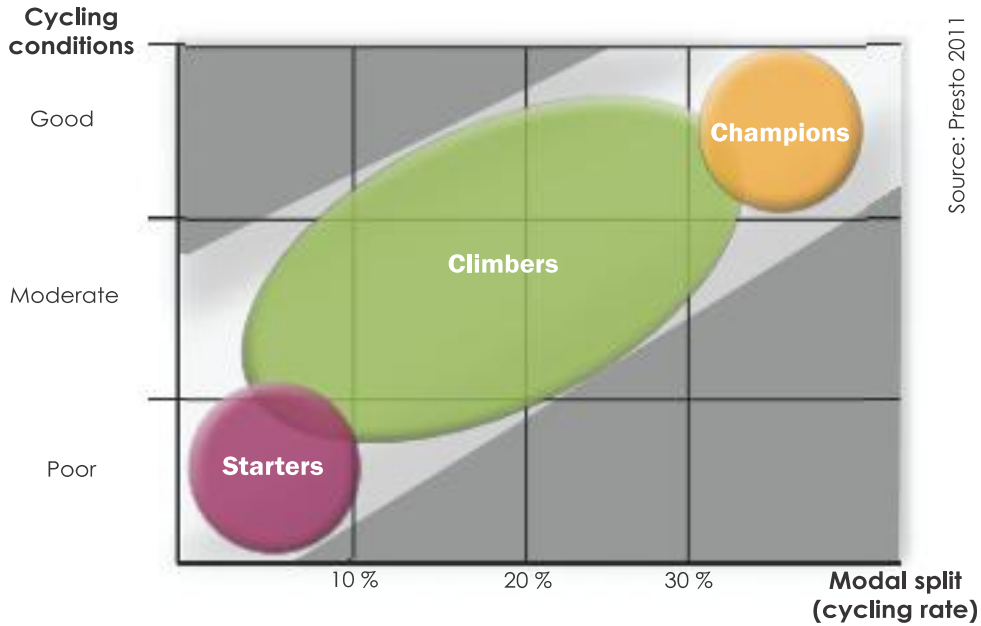
Better Results by Combining Different Promotion Methods

Two Lanes in Promoting Cycling and Walking

There are two lanes in promoting cycling and walking: improving infrastructure and general promotion. Both are needed if the aim is to increase non-motorized transport. A high-quality route network with trip chains is a key issue, so that cycling and walking can be real alternatives to a private car. Marketing, education as well as sharing information are also needed however, so that people start to use bicycles and walk more. People's attitudes are one obstacle to mobility by bikes and by walking. The table on the right-hand side lists sections on both lanes, with regard to infrastructure as well as general promotion, related to cycling and walking.

From a Starter to a Champion

In the European Presto project, cycling cities have been divided into three classes: Starters, Climbers and Champions. Starters are cities in which the modal share of cycling is less than 10%. In the climbing cities, approximately 10-30% of trips are made by bicycles and champions are the top cycling cities, in which the share of cycling is over 30%. With this classification, Geneva is a starter when it comes to cycling, whereas Ghent and Freiburg are climbers. For instance Copenhagen, Houten and Groningen are among the champions.



Source: Presto 2011

Town vision, policy and strategy

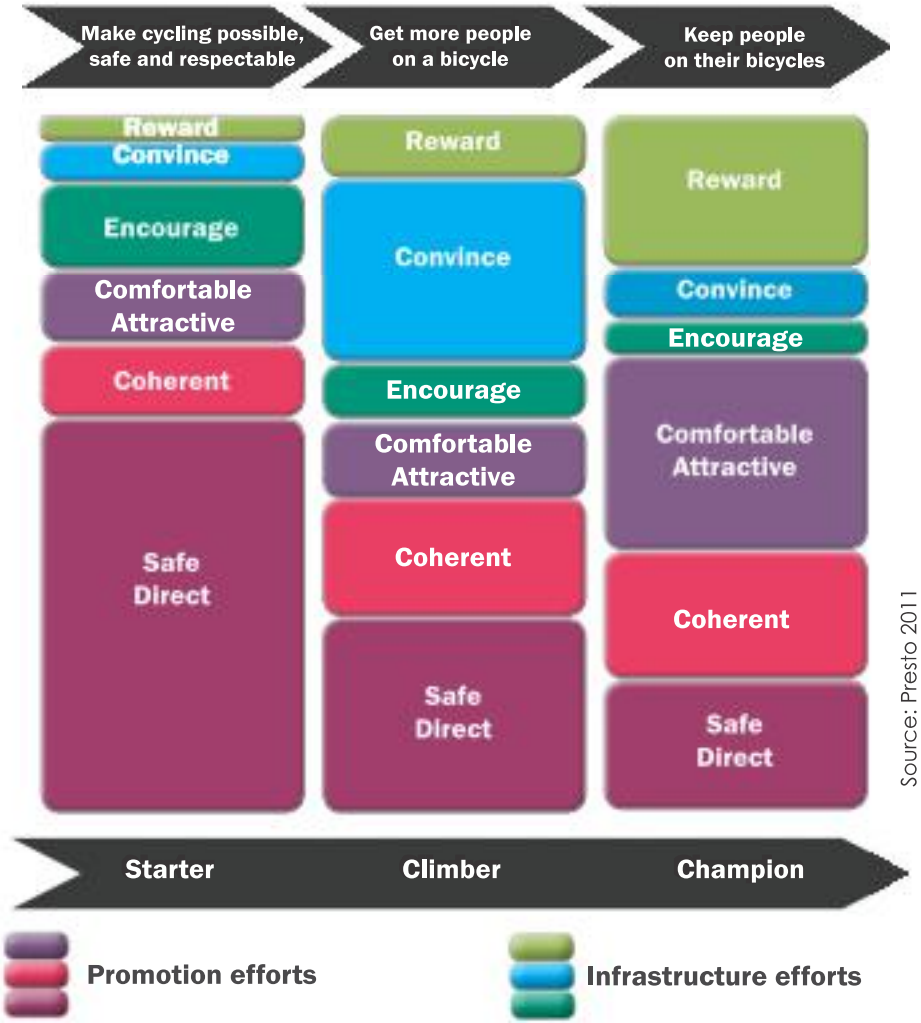
Transport policy and strategy
Walking and cycling

Infrastructure	General promotion
Routes	***General promotion***
• Main cycleways	• Pedestrian maps and signposts
• One-way cycle tracks	• Cycling maps and signposts
• Two-way cycle tracks	• Route guides
• Cycle lanes	
• Cycle streets	***Services***
• Pavements and pedestrian roads	• City bikes
• Parks	• Supporting commute mobility
• Pedestrian and cycling bridges	• Bicycle or sustainable mobility centres
• Slow streets	• Intermodality
• Contra-flow cyclingShared space	
• Mixed pedestrian route and cycleway	***Marketing***
	• Marketing and information campaigns
Intersections	• Teaching and education
• Right-of-way intersections	• Individual marketing
• Roundabouts	• Teaching and education targeted at children
• Traffic-light intersections	• Campaigns encouraging cycling and walking to work
• Cycle boxes	
• Rights of way in (traffic light) intersections	***Follow-up of the development***
	• Counting
Parking and resting places	• Travel diaries
• Bicycle stands	• Interviews
• Bicycle storage spaces	
• Bicycle parking in the centre and in residential areas	
• Interchange parking	
• Possibilities to sit down	
• Protection from rain, sun and wind	
An attractive environment	
• Design	

Source: Adapted from Presto 2011

Transport Policy Actions in Different Cities

Transport policy actions are emphasized differently depending on the class. In cities that belong to the starter class, transport policy actions should be targeted at developing infrastructure. Infrastructure must be developed, so that it can manage the growing cycling volumes. On the other hand, the success of other promotion measures is based on a high-level infrastructure. As the modal share of cycling grows, transport policy actions have to be emphasized more and more towards maintaining the achieved cycling volumes.



Source: Presto 2011

Master plan of walking combines pieces into a coherent vision

Walking as well as pedestrian areas have been promoted in many European cities alongside attractive centre and recreational areas, but only recently attention has been paid to walking as a mode of transport and a creator of city life. In addition, many progressive cycling cities have noticed that walking has been overshadowed by cycling in the master plans of the city. For this reason Copenhagen and Odense now want to increasingly and in a more organized manner promote walking and improve the walking conditions of the city. Geneva had noticed the influences of walking on the quality of city life already in the beginning of the 1990s, when the city's first master plan for walking was devised.

The fact that usable walking infrastructure, such as pavements, already exist makes it easier to improve the walking conditions of the city. Often this is not true for cycling. This does not yet necessarily mean that walking in the city would be enjoyable or that the environment encourages it. It does, however, provide the possibility to develop the surroundings to a more walking-friendly direction, in accordance with the overall plan. It is easy to widen the pedestrian area little by little, since the already existing infrastructure guarantees the continuity of the route.

16

When the master plan of walking has been defined, it can be pursued in pieces that are the size of a council period.

Quite large projects are often related to improving walking conditions, but also many small actions can create development. Different promotion measures must be gathered as one big overall plan for walking – the Master Plan – from which suitable sized projects can be highlighted for the decision makers. Thus, what can be achieved is that large projects and the overall picture can be reached for in suitably small pieces, the size of a council period. On the other hand, it is also ensured that by combining several small projects with larger entities, small promotion measures will not be overshadowed by other, seemingly more significant projects.

The walking strategy of Odense is based on eight quality requirements, the help of which aims to make walking a high-quality and positive experience in the city. Odense wishes that, when walking around the town, pedestrians will notice that the town values them. By offering a first-class walking environment the town wishes to grow the modal share of walking and to bring about the fact that people would be more willing to leave their car a little farther away from the centre and to walk longer trips.

The eight quality requirements of Odense:

- **Traffic safety** – reducing accidents
- **Social safety** – feeling safe also in the evenings
- **Accessibility** – taking the physically disabled into consideration
- **Easiness of mobility** – easiness, confidence and speed to walking
- **A coherent walking network** – reducing dependency on cars
- **An interesting environment** – longer walking trips full of experiences
- **Convenience** – protection from noise, the wind as well as sun or rain
- **Sociality** – interaction between people and city life of high quality

The walking strategy covers the whole city of Odense, not just the centre area, and is in line with the city's environmental and health policy as well as traffic plan. In addition to the general goals, the strategy includes numerous concrete suggestions and plans of action.

16
Odense wishes to take pedestrians into better consideration than before and to make them feel like VIPs. This can also be seen in winter maintenance, which has to be as high a quality on the pedestrian routes than on car routes and cycleways.

The Walking Strategy of Odense

Quality Requirement	Specification	Example measures
Traffic safety	**In the city centre and sub-centres, near schools and where there are a lot of pedestrians, the traffic must occur on the terms of pedestrians** **Separating slow and fast modes of transport** **Improving the safety at intersections, good visibility distances**	• Campaigns and newsflashes • Use of Shared space in the centre, planning the street environment to restrain driving speeds, enabling eye contact • Good accessibility by bike and car to the edges of the pedestrian centre • Improving the safety and lighting of dangerous pedestrian crossings
Social safety	**People and life in the city also after the closing time of shops** **Reducing conflicts between cyclists and pedestrians** **Good lighting; clean, open and clear environment**	• Planning the safety of pedestrian routes combining the most important destinations during the night • Enhancing the emotional bond between the city residents and the city • Mapping streets that cause a feeling of insecurity, improving maintenance • More extensive bicycle parking in the centre
Accessibility	**Enabling mobility for all people in the city**	• Good maintenance of streets, guidance paths and tactile pavements, improving guidance • Benches with backrests every 100m on busy pedestrian ways, public toilets every 300m • Sufficiently long green lights for pedestrians on pedestrian crossings
Easiness of mobility	**A feeling for the pedestrians that they are VIPs**	• Wide enough pedestrian routes in accordance with measurement instructions • Removing disruptive obstacles (e.g. placing of street furniture) from the pedestrian routes • Preventing the forming of too great an obstacle effect of car routes in residential areas
Coherent walking network	**Creating a pedestrian network that combines the centre, residential areas, city districts, green areas and important destinations** **Reducing dependency on cars**	• Devising a plan for good pedestrian connections covering the whole city, widening busy pedestrian routes • 80% of new apartments within 15 min walk from a kindergarten, school, shopping areas and green areas • Placing stairs and lifts in parking facilities so that they lead directly to a pedestrian-friendly area
Interesting environment	**A city environment with a strong identity offering variety and experiences** **The city is planned for the needs of pedestrians, by taking the speed of pedestrians into consideration** **Walking is perceived as high-quality**	• Information with brochures, from the internet, to the mobile phone; guided tours, activities and campaigns targeted at pedestrians • Highlighting the identity of different city districts • Placing "active" facades of buildings alongside busy pedestrian routes • Activities and targets of interest to where there are none, increasing "play streets"
Convenience	**An environment that is not too noisy or windy** **The possibility to seek either sun or shade and protection from rain**	• Devising a noise prevention plan, mapping the microclimate of the city • Use of plantings and buildings so that a balance is reached between light and shade, the creation of too windy areas is avoided and protection is offered from rain
Sociality	**Assisting and enabling interaction between people**	• Traffic planning, with the help of which similar people find each other in the street environment; organizing different kinds of events • Creating meeting places all around the city

Walking Favours Trade

The first pedestrian areas and streets were made already in the 1950s–70s to meet the needs of business life. Their main purpose was encouraging people to shop more. This was the starting point of opening, for instance, the pedestrian street Støget in Copenhagen in 1962. In the background there was an idea that in a car-free environment people have better prerequisites to focus on shopping. Other advantages of pedestrian areas, for instance with regard to recreation and city life, have been recognized only afterwards.

Several representatives of business life in the current society, were motorization is even stronger, have however, distanced themselves from this point of view. Around Europe – and the rest of the world – traders have been concerned with what happens to net sales when a radical change is made to the traffic system of the centre. However, when well-planned reformations have gradually been performed, the situation has been better than before with regard to business life. People have occupied the attractive city centres and trade flourishes. People visit an attractive walking environment more often and stay there longer. When the pedestrian centre is realized piece by piece, representatives of trade see the benefits of the project through the examples of the first pedestrian areas and it is then easier to involve them in realizing an enjoyable pedestrian centre.


17


18

17
In Geneva, the overall plan of walking is realized one project at a time. One of the first projects was transforming the shore of Lake Geneva into a pedestrian area at the point of Quai du Mont Blanc. After the project, the city was ready to commit more strongly to promoting walking.

18
Driving was vigorously restricted in the centre of Ghent at the end of the 1990s and an extensive pedestrian area was realized at the same time. Street space has been freed for people, which has made people crowd the streets and increased the clientele of shops.

The Wheel of Politics Goes around

Promoting sustainable city traffic is a continuous process, at the centre of which, there is quality monitoring. Results and solutions have to be evaluated at every stage, so that the best end result can be reached. For instance problem analysis may lead to redefining problems, and evaluating solutions can create more alternatives or return the process back to defining problems. In different stages of the process it is important that different key factors, i.e. expertise, political commitment, organization structure and public acceptance, are balanced. The different key factors have differences of emphasis during the promotion process depending on, for instance, the problem or planning context.

19
Attention has to be paid constantly on the quality monitoring of cycleways and pedestrian routes, not just during the route's building stage. Problem analysis may reveal problems that can be removed with simple procedures, such as by improving instructions.

Measure of Political Accomplishments

BYPAD (Bicycle Policy Audit) is a tool for evaluating cycling policy. The tool has been developed in international cooperation with EU's support. The BYPAD process evaluates planning practices, implementation as well as follow-up of cycling. These have been divided into nine modules or components that form a balanced cycling policy. These components include management of the planning process and the extent of cooperation, finance and personnel resources, infrastructure and safety as well as information and education. Visually the modules have been set on a ring that depicts the policy as a dynamic process. A score is given to each of the nine components, and together these scores show the quality level of the city's cycling policy. BYPAD auditing can be ordered for a city, municipality or city region. It has been realized in over 100 cities and nearly 20 city regions in different countries.

Other methods for monitoring cycling and walking volumes as well as the development of conditions should be developed in cities as well. Collecting follow-up data is essential, so that different stages of the political process and the influence of the measures can be evaluated. Methods include collecting user feedback with different methods, using travel diaries as well as counting walking and cycling volumes manually and automatically. Follow-up methods are presented later in this report.

Source: BYPAD 2008

4

Small Cog in a Big Machine

Starting from the Traffic System and Land Use

4

Small Cog in a Big Machine

Land Use and Traffic Systems Are Dependent on Each Other

The formation of the transport system can be directed with the help of land use. However existing traffic solutions and accessibility of the target have a strong influence on the location of new functions and planning of land use. The development of the urban structure is most often just increasing the already existing structure and not starting from scratch. So the possibilities provided by an existing structure for developing a new structure in accordance with sustainable development must be recognized. Complementary building is an example of this. A city can be expanded "inward", in which case a larger portion of the population is placed within an area of short distances. For instance in the Netherlands densifying cities has been seen as so valuable that the country has committed to pay higher building costs by complementing the centre, even though it would be cheaper to build outside. Compact land use is seen as an investment for the future.

Planning land use as well as placing functions and routes are strategically important matters with regard to the creation of the need for transport. They have a significant impact on people's mobility habits, energy consumption of traffic as well as traffic safety. The need for mobility can be reduced with good land use planning and increased with poor planning. Land use can also have an effect on what kind of modes of transport are usable. Walking and especially public transport as well as bicycle traffic are very sensitive to land use planning: the success requirements of these modes of transport can be created or destroyed in the planning stage of land use. The competitiveness of different modes of transport is influenced by the placing of their routes. In context with land use planning, space can be reserved for direct cycleways, for instance from residential areas to the centre, and car traffic routes can be directed to go around a longer way. Thus, cycling becomes a more competitive mode of transport compared to driving due to speed. The cities of Groningen and Houten in the Netherlands are examples of the placing of routes in favour of cycling.

The traffic system is a whole that enables smooth mobility of people and goods safely, economically and by consuming as little energy and burdening the environment as little as possible. The traffic system must be developed so that all forms of traffic, such as walking, cycling, private car traffic, bus traffic, rail traffic and city logistics, are taken into consideration

The need for mobility can be reduced with good land use planning and increased with poor planning.

It is important to plan city traffic as a whole, in which the characteristics of different forms of traffic are combined in the best possible way.

In Geneva, a task was given to traffic planners at the end of the 1980s to plan 100km of a new cycle track network. However, execution of the plan was not successful, since the planners were not able to interfere with the planning of other modes of transport. It was impossible to just glue the cycle track network on top of the existing traffic network. The city discovered that a high-quality end result could only be reached by planning the traffic system as a whole. With the same principle, when expanding pedestrian areas car traffic routes and directions have to be planned so that the traffic system remains functional even though, for instance, driving through the centre would be prevented.

It is important to plan city traffic as a whole, in which the characteristics of different forms of traffic are combined in the best possible way.

It is important to plan city traffic as a whole, in which the characteristics of different forms of transport are combined in the best possible way. Cities have many possibilities for an energy-saving traffic. In city centres and nearby areas trips are reasonably short, in which case walking and cycling are usable modes of transport. Cities are inhabited by groups of people, so public transport has good prerequisites to transport people energy-efficiently and safely. A private car still has its place, but people should not be encouraged to use their cars for everyday journey, if other alternatives are offered. City regions that have different populations differ in their modes of transport and, therefore, their goals for developing traffic are very different.

A development plan of a city must aim high. Political decision makers greatly influence the development of the traffic system and land use, but political reigns are very short for long-term development. Traffic and building projects easily resemble a mosaic: let's do this here today and that there tomorrow. The danger is that in the long run the traffic system develops uncontrollably and loses its power. During the era of scant resources it is especially important that each little project carries the city towards the objective of the overall plan. When the vision and the desired state of mind have been formed, an overall plan covering the whole traffic – a Master plan – should be formed, and each future project should realize this for their part.

1 & 2
In Strasbourg public transport has been developed patiently by taking trip chains that combine walking, cycling as well as bus and tramline transport into consideration. It is easy and fast to travel to the centre by tram, and walking is the number one mode of transport in the centre. The connection from bus traffic and cycling to the tram has been made user-friendly.

Important to Remember in Planning Land Use and the Traffic System

- land use and the traffic system go hand in hand
- cooperation between planners is a key issue
- walking and cycling can be either promoted or decreased with land use measures
- there is a place and a recommended purpose of use for each form of traffic
- creating an overall plan is important
- compact land use promotes walking and cycling
- compact land use reduces the need for travel
- pedestrian is the king in the centre
- travel related zones of urban form make the centre clearer
- road hierarchy must be functional

A City of Short Distances Is Worth Pursuing

Land use planning begins with planning city structure. By unifying the community structure the need for mobility can be reduced and necessary trips can be realized in a more sustainable way. Short distances increase walking and cycling, and destinations that generate cycling and walking located extensively in each region guarantee the use of these forms of traffic. Targets that produce cycling and walking include schools and institutions, workplace regions near residential areas and the centre as well as shopping possibilities. These targets should be placed evenly in land use, and high-quality routes for both cycling and walking should be guaranteed for the spaces between these targets as well as the residential areas. Thus, as large a portion as possible of the potential users of these modes of transport would choose cycling or walking as their mode of transport instead of a private car. If there are no high-quality connections from a large residential area to, for instance, grocery shops or the shop has been located very far away, this land use solution guides the residents of the residential area towards becoming users of private car. Functions of different city regions should also be mixed, so that trips would become shorter and no unnecessary need for mobility would be created in the city. Thus, the probability of choosing a private car as a mode of transport is decreased. For instance residential and workplace areas must be mixed to improve the traffic system and to strengthen the area centres that increase cycling and walking. Good-quality planning of land use also enables the minimization of building and operating costs of the traffic system as well as taking harmful environmental influences into consideration. These can be enabled by placing new functions alongside already finished, good-quality public transport connections or cycleways and pedestrian routes.

By harmonizing the community structure the need for mobility can be reduced and necessary trips can be made in a sustainable way.

The larger the portion of a population that is located within 3–5km of the city centre, the better the prerequisites for building a functioning cycle track network and a dynamic pedestrian centre. In cities of short distances it is possible to make the majority of trips to the centre by bike or even by walking. Freiburg is a good example of a city of short distances. From its 231,000 inhabitants 90% live within 5km of the centre, so there is great potential for cycling and walking. When there is furthermore a wide pedestrian area of about one square kilometre in the centre, the conditions are favourable for walking.

Cooperation from the Beginning

Land use planning and city planning are extensive processes, in which cooperation with different parties is recommended. Land use, transport, street planning and maintenance are examples of cooperation areas, but it is good for the planner to communicate as early as possible also with business life – such as trade, industry, and service producers – as well as residents about different zoning alternatives. The situation is easier if dialogue has already taken place before functions and routes are being placed on the map. Then it is possible to start from a principle level and avoid juxtaposition. When different parties understand their role as the promoters of a sustainable and safe community, common goals can be set. Otherwise each party views the matter only from their own perspective and sees other viewpoints mainly as restrictions. The speed of the land use planning process should be increased, if possible.

Groningen favours compact land use. The town has for years already used a so called concept of a compact city. The area of the city has not been increased at all in the 2000s, but the town borders of 1980 have been preserved up until the present day. Due to the compact city structure, cycling is a very competitive mode of transport. Little less than 80% of the residents live within three kilometres of the centre and 90% of workplaces are situated within the same area. For a town of about 180,000 inhabitants this alone is quite an achievement. Groningen is in fact, one of the best cycling cities in Holland, and the share of cycling in all trips is approximately 40%. The centre area, which can be thought of as the focal point of the city due to different functions, such as shopping possibilities and workplaces, has been dedicated to pedestrians, cyclists as well as public transport. The centre has been divided into four sectors and cars cannot drive directly between these sectors. Thus, drive-through traffic is kept away from the centre area.

The picture on the right-hand side compares the length of trip in Groningen from a residential area to a parking space in the centre by bike and by car. Due to the dense cycle track network, bicycles can travel on a direct route from the starting point to the destination. A motorist has to go around through bigger streets. People can usually also drive outside the car routes marked on the map, but it is slow to drive on these streets, since other vehicles use these streets as well, from pedestrians to cyclists. On the trip in question, a bicycle is also faster than a car thanks to good-quality main cycleways, since they make cycling fast and easy.

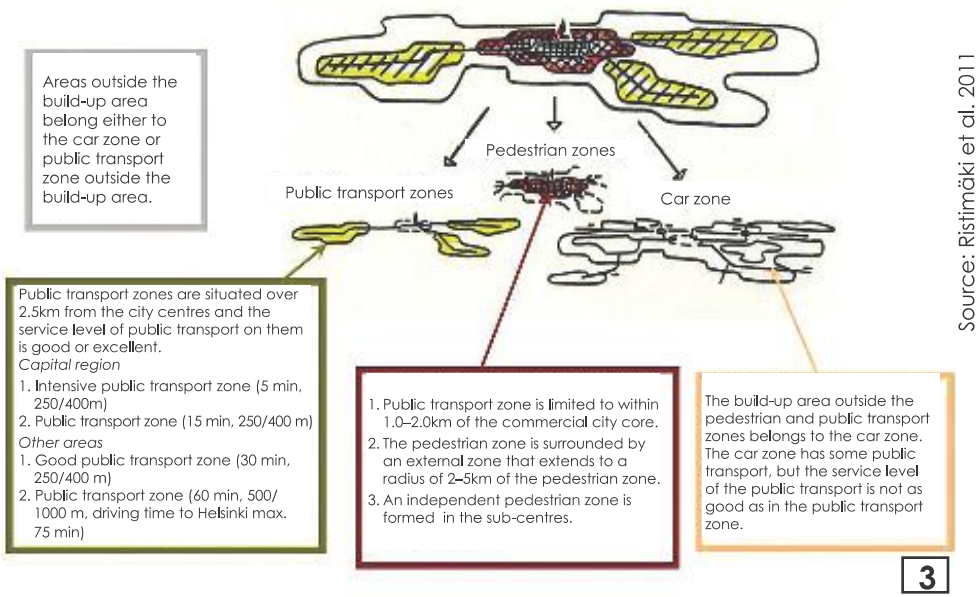
Map: Gemeente Groningen 2011A & B

Dividing the City into Zones Makes Planning Clearer

As the price of energy rises, a dispersed community structure will be expensive: infrastructure is expensive and people's mobility costs grow. Persistent creation of a compact community structure is important on behalf of the energy economy of the future. With land use planning we can create different zones inside a city. They differ on the basis of their population density, what kinds of functions are typical for them and what kind of a form of transport will be the most natural in them to fulfil people's travelling needs. Holland uses an ABC system, in which cities have been divided into A, B and C zones. The A zone has a lot of services and it can be reached well by public transport, bike or by walking. The B zone can also be reached by car, so residential areas are often situated in it. Industrial plants and other functions, where smooth access must be granted for car traffic, are placed in the C zone. There are less public transport and bicycle connections in these areas.

The main rule in Central European cities is that the pedestrian is the king in the centre. The closer we are to the centre the more walking is prioritized, and the farther away we go from the centre the better are the conditions for car traffic. Cities must have pedestrian spaces, which each has their own recognized function. Trade is one of the most important functions. Also different kinds of services and attractive public spaces belong to a pedestrian centre. This is why pedestrian zones are most naturally created in the core of the city centre, where there are a lot of people and different functions and the trips are reasonably short. Mobility by walking must be favoured in these zones. A pedestrian zone can also be realized somewhere else than the city centre. If several areas, that have been calmed from private car traffic are combined by pedestrian routes, it is possible to travel long distances by walking and by bike in an enjoyable environment. At best, long pedestrian zones from one area to another can be created.

Banded pathways can be formed with land use planning, in which case it is easy to organize a line for public transport. There are different kinds of functions on a public transport zone, which creates different kind of demand during different times of the day and evens out the demand for public transport. Car traffic is a part of a modern city, as well, although it should not be allowed to dominate all of the space. Driving must be convenient in a car zone, and functions that necessitate the use of a private car must be located in it.



Source: Ristimäki et al. 2011

3
A city can be divided into car, public transport and pedestrian zones according to the characteristics of different areas. Bicycles can be used within almost all of the zones, as long as the network is planned well and good-quality connections are in order.

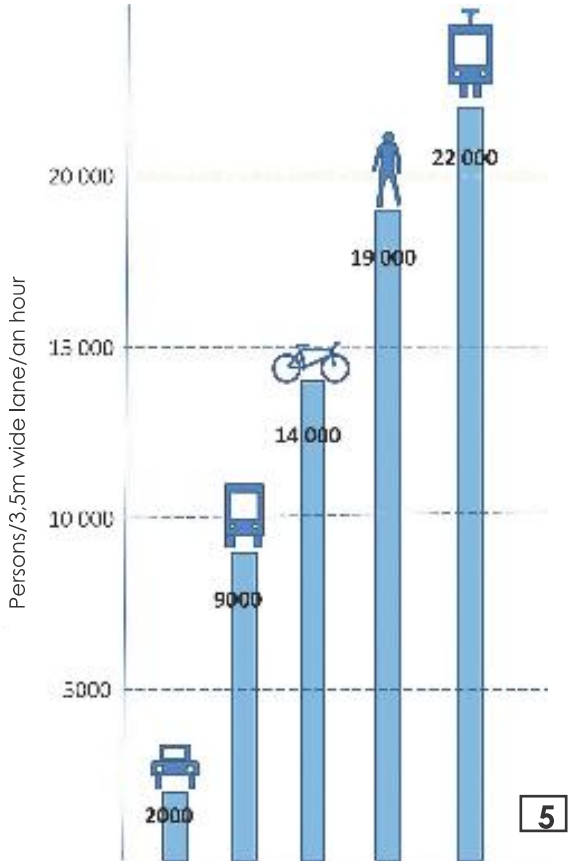
4
Different pedestrian areas often have a recognizable main function, such as trade or services, public transport connection, studying, recreation, culture or restaurant concentration. (Strasbourg)

Easily to Shops and Services

When a population is more and more concentrated in city regions, demands for the development of the cities' traffic system grow. Noise and pollution nuisances as well as safety risks of car traffic are great and, in addition, cars require considerably more space compared to other modes of transport. Space is limited in city centres and all the private car traffic that would be needed to take care of the travel needs of people will not fit there. In addition to environmental and safety nuisances, congestions and time costs grow. This holds true especially in larger cities. In an hour, a street can convey about ten times as many pedestrians as people travelling by car – presuming all cars are filled with passengers. Even seven times as many cyclists can travel on the same route than car passengers.

There is a shortage of land in city regions, which is why it has to be considered how much space can be reserved for each function when placing the functions. Lack of space holds true especially in the centres of larger cities. Thus, it is justified to realize a traffic system that reserves enough space for mobility. Walking, cycling and public transport are the best forms of traffic with regard to the use of space.

Accessibility is crucially important with regard to trade and services in the centre. The shopping areas of the centre must be reachable by all forms of traffic. It has to be fast to walk to the core of the centre from nearby areas, and there must be direct and high-quality cycleways to the centres within a radius of a few kilometres. Public transport connections must be smooth and driving sufficiently close to the centre by car must be possible. However, all targets do not have to be reachable by private cars, so that the attractiveness of the pedestrian centre is not lost. Many European cities strive to reduce the number of private cars coming to the centre precisely due to the lack of space as well as environmental and safety issues. Thus, good alternatives must exist for driving private cars, so the traffic system must be planned as a whole. Space must be utilized as precisely as possible, so a maximum amount of people can be transported to the city as smoothly as possible. This is a great advantage also for commerce and service providers.



Source: Botma & Papendrecht 1991

5
The number of people a 3.5m wide lane can convey with different modes of transport in an hour. The weakest in the comparison is a private car, which only transports about 2,000 people in an hour. As much as 19,000 pedestrians can travel through the lane during an hour.

Needs of the Business Life are Needs of the People

Making the centre vital means that the centre must have very different kinds of functions and life around the day. When a centre is made into an area of commerce and versatile services as well as experiences, it can succeed even though commercial services are nowadays more and more concentrated on shopping centres outside the city centres. A city centre must be unique and, with regard to its functions, stand out from shopping centres. Otherwise the centre will wither away. In the end, the needs of trade and business always go back to the needs of people. Therefore, there is no reason to place the needs of business life and people against each other. What is good for people is also good for trade and other business life. With regard to the business functions of a centre, pedestrian areas have proved to be good. When planned correctly they have increased the turnover of shops as the numbers of visitors have increased.

The principles of sustainable development must also be taken into consideration when developing the business life of cities. Small corner shops, department stores in the centre as well as hypermarkets outside the centre differ on behalf of products and clientele. Convenience goods are bought often and in smallish batches, whereas consumer goods are bought less frequently and they can be heavy to transport.

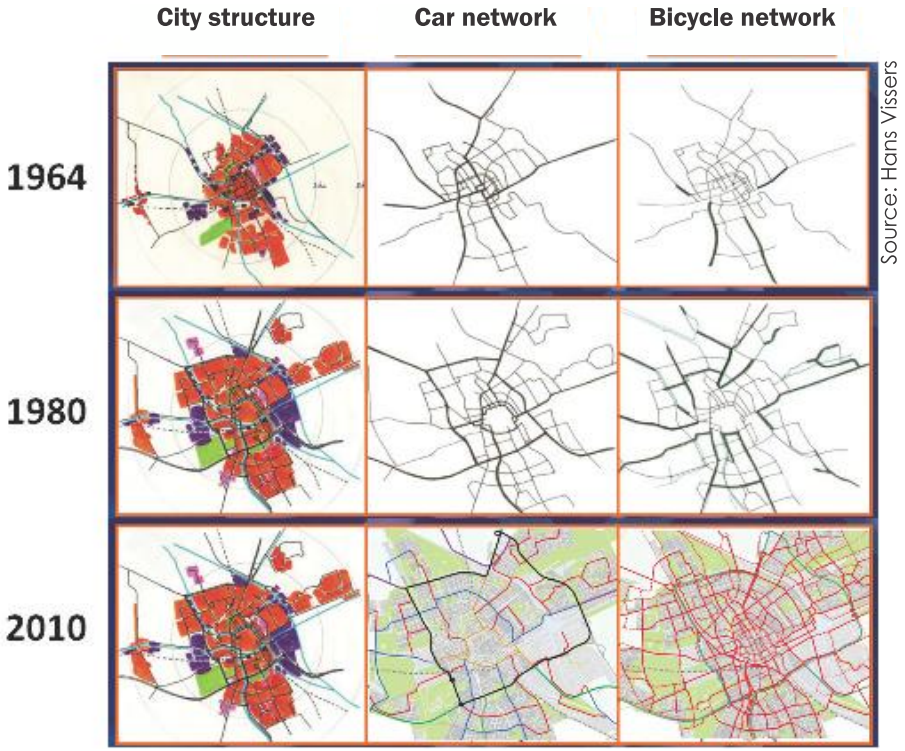
When placing shopping centres outside the centre it must be considered carefully what kind of a need they create for transport and how this need could be met in a safe and energy-saving manner. Also in the trade areas of the centre, different mobility and transport needs must be planned sustainably.

Street Hierarchy Must Be Visible

It is important to aim for high-quality and smooth traffic with the networks of different forms of traffic. Traffic networks must connect different routes well, be coherent and the hierarchy must be logical. Traffic must be directed purposefully to routes of a different level so that for instance when driving a private car from one area to the other, people use main routes and do not take short cuts along residential streets and collector roads. This is possible by building a high-level main route network, where car traffic is made as smooth as possible. Drive-through in different areas and between them must be prevented by structural solutions. In the Netherlands the route network is built so that the cross-section and structure of a street speak a clear visual language of the hierarchy class and purpose of use of the street. Therefore, structural solutions are in line with the hierarchy class and use of the route.

Traffic networks of different forms of traffic must be planned as a whole so that the needs of walking, cycling and public transport are considered comprehensively in the city region and in different areas. Depending on the purpose of use, different modes of transport can be separated, but on certain routes different modes of transport can also be mixed. Bicycle and car traffic can use the same route on slow-speed street. If the number of pedestrians is low, walking can be allowed on a cycle track. However, cycling should not be allowed on a pavement or a route of a pavement level. Separate pavements are not needed in slow-speed access street and cosy slow-speed residential streets, but pedestrians can safely travel in the shared street space too. Also shared space solutions, in which different forms of transport have been mixed, work when planned well. However, if different forms of traffic are mixed on the same routes, especially physically and visually handicapped people have to be taken into consideration. Safe mobility must be enabled for them in different areas.

6



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6
In a residential area in Houten, structural solutions of the route communicate what speed can be used on the route. Thus pedestrians, cyclists as well as motorists travel together in harmony.

7
Developing traffic networks must be based on the overall plan and the work must be persevering. The picture shows the gradual realization of the car and bicycle networks of the city of Groningen from the 1960s to the present day. The area of the city has not grown after the 1980s.

The route hierarchy of Houten has been planned as a whole, which can also be seen as an exemplary car and bicycle network. In the town of 50,000 residents there is only about 20 kilometres of routes meant only for cars and the same amount of cycle tracks. The system is based on good planning, with which driving and cycling have been safely guided to the same routes. Most of the streets of Houten are cycle streets that have been visually built to resemble cycle tracks. Through these people can drive to a plot, but cars need to travel on the terms of cycling. Drive-through along the low-speed residential streets has been prevented. Promoting cycling is the main principle in city planning, but the attitude towards driving cars is not negative. The ring road exists only for cars, and people can access the city core by cars as well. However, cars are not allowed to dominate cycling and walking, which is why moving around with environmentally friendly forms of traffic has been made easier and faster than travelling by car. Primary schools are placed on green areas along good cycleways, so that children can ride bikes to school safely. In Houten the planning starts from the scale of an individual person.

Source: Willy Wagenmans 2009

The Sector Model

Houten and Groningen were among the first cities that adopted the sector model in the 1970s. At the time, its functionality was doubted, but still many cities copy this model, because it calms the centre, makes cycling and walking faster as well as clarifies and reduces car traffic. In the model the ring road of car traffic circles the centre, which has been divided into sectors. People cannot drive over the sector limits, but they must go around through the ring. Drive-through from one sector to another has been prevented with structural solutions, so driving through the centre by car is not possible either. Instead, walking, cycling and public transport have direct access from one sector to another. Likewise, it is allowed for emergency vehicles and, partly, delivery and service traffic to drive over the sector lines. A certain amount of driving can be allowed in the centre as well, but the criteria must not be speed or smoothness, but access to a certain destination. The size of the city determines what kind of a system is suitable.

In Groningen the centre has been divided into four sectors, and the ring road outlines the city core of about the size of one square kilometre. The accessibility of the city core is good for cycling and walking. The city has natural prerequisites for cycling and walking, since the distances are short and the landscape flat. Groningen has made an overall plan concerning the city centre that defines the use of public space. Realization has proceeded with the policy of small steps. Thus, the city has become one of the leading cycling cities in the world, even though the reformation began as a reconstruction of one square and one street. Cars have been moved from the streets to parking facilities, so space has been freed for pedestrians and cyclists. Parking facilities have been built also for cyclists near larger destinations.

Map: Google Maps 2011

When driving is directed to a ring road circling the centre, the centre can be calmed to other modes of transport.

8
The sector limits of the centre of Groningen have been realized structurally. Certain routes can be accessed only by bicycles or on foot and cars have to go around a different route.

9
In Groningen the centre area has been divided into four sectors, in between which there are no direct car road connections. Thus, car traffic is directed to the ring road and the centre is calmed mainly for pedestrian as well as bicycle traffic.

All Forms of Traffic Have Their Place

Walking Is a Part of the Traffic

One important goal of planning traffic system and traffic network is that driving private cars is minimized. The most important measure is to offer real alternatives to driving, so that as many people as possible travel by walking, bicycle or public transport. Walking is one form of transport, with which people go, for instance, from their homes to business centres or day care. Therefore, realizing a coherent pedestrian network is an important part of city planning. In Geneva, the basis of traffic system planning is increasing walking. Pedestrian connections are direct, enjoyable and safe, so they are pleasant to use. The speed of walking compared to driving has been increased with the help of different short cuts, such as pedestrian bridges.

Walking must be the number one mode of transport in areas where there are a lot of pedestrians. This is especially true in shopping and service blocks in the city core, where other forms of traffic must be planned in terms of walking. This means calming car traffic in the centre area as well as creating car-free zones. In areas where there is car, bicycle as well as pedestrian traffic, conflicts between these modes of transport must be minimized.

However, when restricting car traffic it should be taken into consideration that full accessibility must be provided for waste management as well as fire and rescue service vehicles in car-free zones. In addition, city logistics must be taken into consideration in pedestrian centres, since products have to be delivered to shops. Planning city distribution is a challenging task, where good operation models must be searched thoroughly, cooperating with, for instance, the business life of the centre. Everyone benefits from functioning goods distribution and city logistics.

Walking must be the number one mode of transport in areas where there are a lot of pedestrians.

10
Walking is firmly connected to public transport and in order for these two modes of transport to work well together, pedestrian connections to public transport stops must be safe, enjoyable and purposeful. In Strasbourg public transport stops are planned to support effortless interchange between walking, cycling as well as bus and tramline traffic.

11
Direct and enjoyable routes increase the attractiveness of walking compared to driving. In Geneva, short cuts have been made for pedestrians for instance over a river and a railway.

In Strasbourg pedestrian spaces form a whole, in which different pedestrian areas have different kinds of functions and the areas are connected with enjoyable pedestrian routes. Trade functions have been concentrated in the surroundings of the central square in Strasbourg, Place Kléber. A pedestrian and shopping street that is nearly half a kilometre long combines the area of the centre square and the main terminal of public transport with the surrounding of the cathedral favoured by tourists as well. A passage allowed for goods distribution and city logistics has been lined by paintings on the pedestrian street. There is a pedestrian connection from the cathedral to the attractive canal-side, and concentrations of restaurants have been formed in the narrow pedestrian streets. The canal-side and especially the area of Petite France is a popular place to spend free time.

12
In Strasbourg, public transport stops can be reached well by walking and special attention has been paid to accessibility.

A Bicycle Is a Vehicle

In the European example cities an important principle is that cycling is not walking with tyres underneath. A bicycle is a vehicle, which is why planning cycling must be made with the planning principles of vehicle traffic. This is the starting point in the traffic planning of the best cycling cities and it can also be seen in the traffic environment.

Firstly, the "bicycle is a vehicle" principle has an impact on the fact that cycling and walking are, as a rule, separate from each other. However, a small number of pedestrians are allowed to travel on the cycle tracks – especially outside cities on quieter routes. However, cyclists are not allowed to use the pavement. Cyclists can only ride on some walking-oriented streets, but the bicycle does not belong to pavements. Even on the walking-oriented streets the cyclists always have to ride on the terms of pedestrians. A pedestrian crosses a cycleway like any other street. Busy intersections have pedestrian crossings over the cycle tracks. Thus, conflicts between cyclists and pedestrians are at a minimum. Pedestrians do not have to look out for cyclists on the pavements.

Secondly, the "bicycle is a vehicle" principle can be seen in the best cycling cities, so that cycling has been made at least as logical as driving a car. In the centres on busy car traffic streets, cycleways are mainly one-way, so bicycles travel the same direction as the rest of the vehicle flow. This makes intersection behaviour easier, since when coming to an intersection people do not have to think about where the cycleway continues after the intersection. The route continues logically alongside the car traffic flow in the same direction. One-way cycle traffic also increases safety, since in this case there is no oncoming cycle traffic. On two-way cycle tracks traffic going in opposite directions is always separated with a centreline, just like car traffic on the streets.

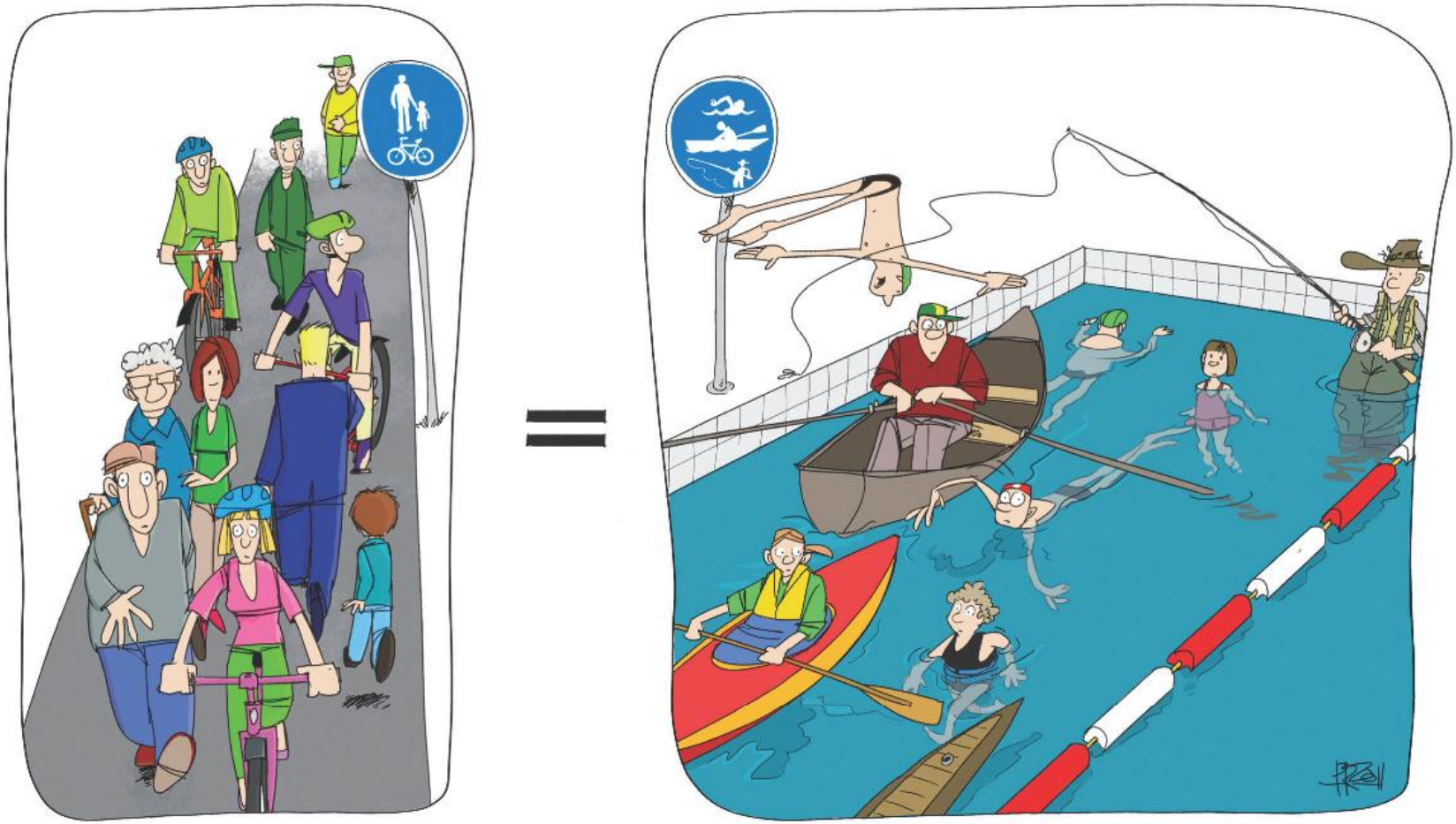
The traffic environment must be built as such that the road users do not have to carry a rule or a law book with them in traffic. If cyclists have an obligation to give way to car traffic, this will have been communicated with a give way sign. Likewise, the obligation to give way of motorists compared to cyclists has been clearly marked. If cycleways cross each other, the give way sign tells which direction has the obligation to give way. If there are no give way signs, the directions are equal, in which case the person coming from the right has the right of way. The same rules apply with regard to both crossing car and cycle traffic and crossing cycleways.

The planning principles of vehicle traffic should be applied when planning cycling.

13
A bicycle is an equal vehicle with a car, and when the traffic environment has been built as the right kind, the road users know who has the obligation to give way. (Utrecht)

14

When the speed of a pedestrian is about 5 km/h, a cyclist travels about 15–25 km/h, even 30 km/h. With racers and electric bicycles the top speeds can be even considerably greater. Walking and cycling are two different forms of traffic, for which different kinds of planning principles apply. As a form of traffic cycling is closer to driving a car than walking and mixing cycling and walking as equals on the same busy route is at its worst like combining a rowing and swimming in the same stadium.



Picture: Pekka Rahkonen 2011

Cycling and Public Transport Made Competitive

Especially in Denmark and the Netherlands there are good examples of cities that have persistently developed their cycling conditions. Cycling has been made an easy, fast and safe way to move around, so people choose a bicycle as their vehicle instead of a car. When promoting cycling it is important that a bicycle is a competitive vehicle compared to a car in the distances of a few kilometres. First of all, this requires a good-quality, direct and fast cycling network, so that cyclists can reach different destinations conveniently. In the best cycling cities, such as Copenhagen, Odense and Groningen, the basis of the network consists of high-quality cycleways, through which cyclists can travel directly and fast from residential areas to the centre. In the traffic system the main route network of cycling has been complemented with necessary collector street connections and area routes, just as logically as in car traffic. In a functioning traffic system, intersections that that are dangerous to cyclists have been planned as safe and of good quality.

In a city region public transport is a natural part of traffic, since the amount and density of population enable the transport of large numbers of passengers. Public transport is safer than private car traffic and it guarantees mobility possibilities for people who do not have their own car or who, instead of owning their own car, wish to use the bus or tramline traffic for part of their trips. The energy consumption and emissions of public transport calculated per person are less than those of car traffic when there are enough passengers. As the size of the municipality decreases, the operational requirements of a cost-efficient public transport decrease, as well.

Also when planning public transport the aim must be that it is a competitive mode of transport compared to driving private cars. The level of service and quality must be invested in, so that the public transport system is humane. Travelling comfort and speed are crucial when choosing the mode of transport. It is important to create direct main lines for public transport from residential areas and other important locations to the city centre. Strasbourg and Freiburg have a public transport system based on tramlines that is realized in the style of a metro. The line is clear and connections are fast. Car traffic is prohibited in the centre. Thus, trams can reach the heart of the centre fast, since traffic lights do not slow down the journey. Passenger information on stops and in the trams is of a high quality and purchasing a ticket is easy for the user, as well. Bus traffic works like a feeder to the rail, since busses are not permitted to drive to the city core either. Good-quality interchange terminals increase comfort and reduce stress factors caused by the waiting time.

In addition to good cycle tracks, in many European cities good-quality public transport connections have been planned to shopping centres outside the centre. Customers of the shopping centres can choose to use a bicycle or public transport instead of a private car when they go shopping. Building interchange terminals in context with shopping centres benefits the shops as well as users of public transport. Customer potential grows and, on the other hand, the quality of the interchange time is improved. The shopping centre offers activities for passengers waiting for an exchange connection and increases the social safety of the terminals and stops.


15


16

15 & 16
Good-quality main cycleways are fast and easy to use during the summer as well as the winter. (Left: Houten, right: Copenhagen)

17
Good public transport connections to shopping centres benefit both the shops and users of public transport. (Fredriksberg, Copenhagen)

Source: Gemeente Groningen 2011B

18

17

Source: Compagnie des Transports Strasbourgeois

19

18
The cycling network of Groningen is dense. Fast main routes take you easily for instance from residential areas to the centre. Smaller collector road connections complement the network.

19
The metro-like public transport network of Strasbourg is clear and easy to use. Bus and tramline connections cover the whole city region well. Bus lines work as feeders to the rails, since busses are not allowed to drive to the city core.

Smooth and Energy-efficient Car Traffic

A private car is a necessary vehicle in certain types of trips, like when public transport cannot offer a sufficiently good service level and there are no other alternatives for mobility. For instance in sparsely populated areas and in small municipalities a car is often essential. A private car is a good vehicle for families with children, because there are a lot of people or goods to be transported and the family needs to arrive to their destinations quickly. The flip side is that people get too easily used to travelling only by car. The use of a car must be enhanced by good traffic network planning so that traffic is as smooth as possible on a car zone and the main car traffic routes. However, when getting closer to the centre and sub-centres the more walking, cycling and public transport should be favoured.

In the European example cities the smoothness of the ring roads surrounding the city core is not improved without purpose, although the ring roads are the main car routes. This prevents the growth of car traffic in the centre. The aim is to keep the threshold for using a car on such a level that sustainable modes of transport are used for short trips inside the city. Efficient use of a car also requires finding a parking space quickly. This requires good guidance to parking facilities for instance from entranceways and ring roads of the centre. Furthermore, there should be functioning further connections from the parking facilities on foot, by bike or by public transport. The goal is a functioning and energy-efficient system, in which the best sides of each mode of transport are utilized in trips best suited for each mode of transport.

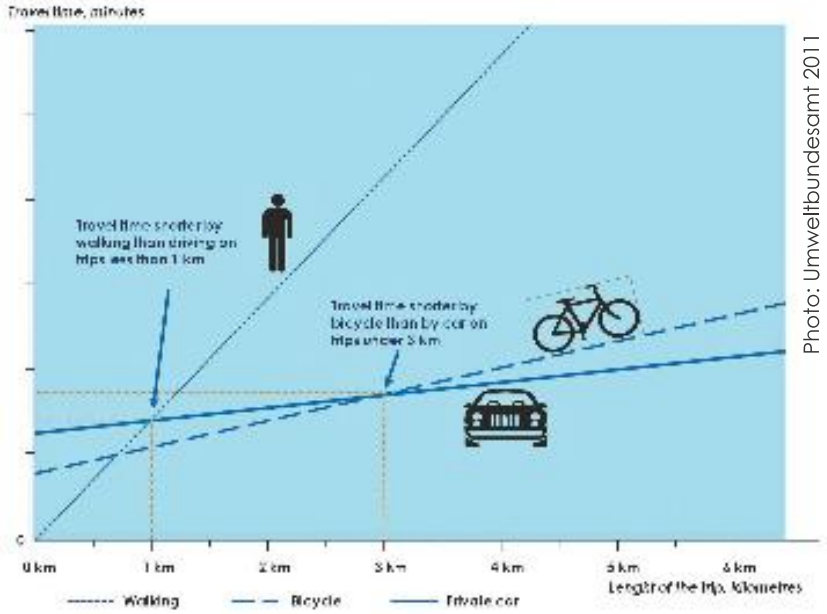


Photo: Umweltbundesamt 2011

20

Photo: Google Maps 2011

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22

20
In city traffic a bicycle is competitive compared to a car even on longer trips, if the conditions are good. By making short cuts for cyclists and pedestrians, it is possible to shorten the distance covered by these modes of transport and, therefore, improve their speed even more. The duration of a trip by car is increased, among others, by looking for a parking space.

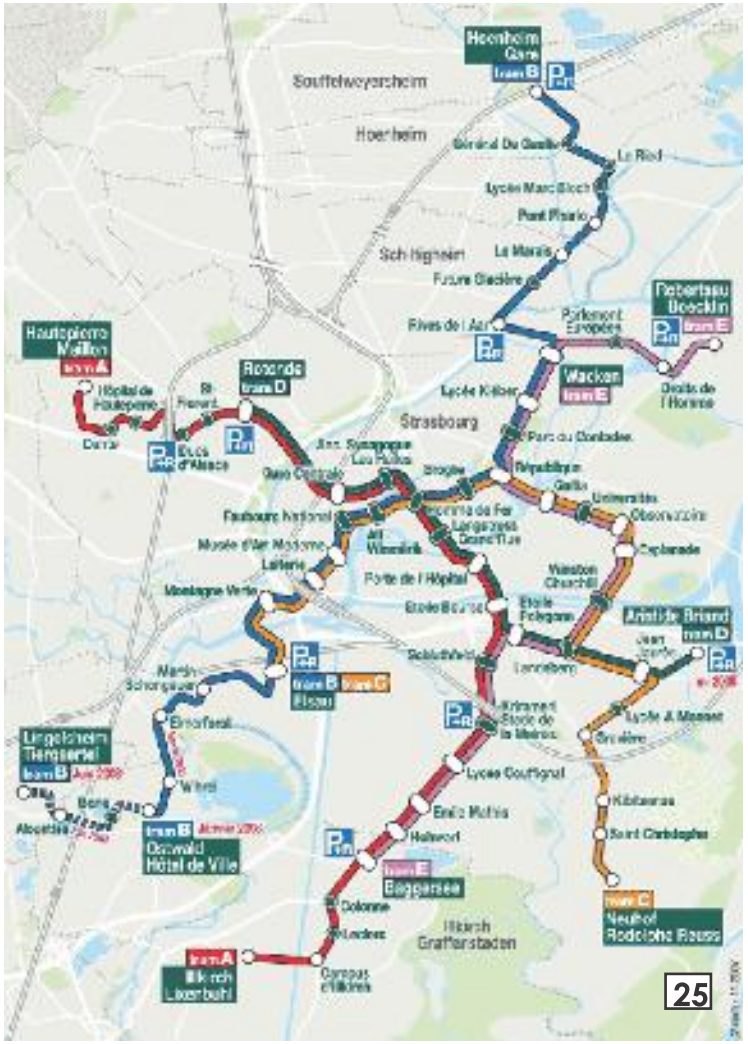
21 & 22
A clear network hierarchy is a part of a logical and systematic traffic system. The ring road in Houten circles around the centre and directs car traffic away from the city core.

23
Traffic must flow smoothly and be energy efficient on main car traffic routes. In Ghent motorists are directed from the entranceway to the centre's ring road, where they find their way to a parking facility. A clear traffic system improves the smoothness of car traffic, as well. Promoting cycling is one focus point in Ghent, so the city has also invested in fast cycling connections.

Trip Chains Promote Sustainable Traffic

When reducing car traffic to a city centre, one of the most important actions is to promote the functionality of the trip chain. Freiburg and Strasbourg are examples of cities in which extensive Park and ride as well as a Bike and ride systems have been planned. Easily reached parking facilities, from where travellers can conveniently continue on by public transport, have been built in the vicinity of car traffic entranceways. Saturday is an important day for running errands and shopping, so the use rate of private cars is high. In Freiburg this has been taken into consideration with the pricing of tickets, since on Saturdays passengers of the same private car who park in the Park and ride area can travel with one public transport ticket to the centre. The purpose of this is to increase the attractiveness of public transport.

Public transport terminals and stops must be easily reached by walking and bicycles also. Good and safe bicycle parking solutions, high-quality passenger information as well as comfortable sitting possibilities increase the attractiveness of trip chains. In Strasbourg locked bicycle parking facilities, which can be used with a public transport travel card, have been built in context with tramline and bus stops. The smooth flow of pedestrian traffic has been ensured by, for instance, investing in the accessibility of the stops. The role of social safety in public transport, especially in underground and remote stops, is important. Attractive, clean and safe surroundings of public transport stops makes the use of public transport more attractive.



Source: Compagnie des Transports Strasbourgeois

24
The new and the old meet in the railway station of Strasbourg as the modern glass roof provides protection to both the old facade and passengers.

25
The clear and easy to use Park and ride system brings public transport services also within reach of people living in the car zone. In Strasbourg people can go directly to the centre from the parking facilities in the uptown of the city in 8–20 minutes.

Car and Bicycle Parking Are a Part of the Traffic System

A car and a bicycle are parked most of the time, which is why space has to be reserved for parking wisely. In the best example cities bicycle and car parking norms have been attached to the land use plan in both residential areas as well as shopping and business concentrations. Groningen and Houten attract people to use bicycles by the placing of parking areas. Bicycle parking is in the immediate vicinity of apartments, whereas car parking is further away. A common practice is to divide the car parking areas into different zones so that it is more expensive to park near the centre. In order to reduce unnecessary car traffic caused by searching for a parking space, the accessibility of parking facilities in the centre and guidance leading to them have been realized efficiently.

In the centre of Ghent parking houses and underground parking facilities have been built for car parking, so that public space can be freed for pedestrian areas. The historic centre of the city is impressively beautiful, so the city has wanted to remove cars from the picture. Residents parking practices in the centre area vary in different cities. In Ghent, residents leave their cars alongside the street elsewhere than in the city core. The centre area has been divided into parking sectors, in which residents can leave their car depending on their address. Residents cannot have their own street-side places. In Groningen street-side parking has been restricted also for residents. Parking areas have been reserved for them in the centre area so that in some cases they have to leave their car several hundred meters away from their apartment. Cycling is the main mode of transport in Groningen and also public transport works well, so a resident living in the centre needs a car very rarely.

When running errands, a cyclist needs to get close to the desired destination, since the travel range tolerated by a cyclist is about 150 metres around the parked bicycle. This is why there is often need for several smallish bicycle parking spaces in centre areas. By organizing safe and good-quality parking conditions, the travel range grows a little. Covered parking solutions increase quality especially during winter in countries that have snow. In longer-term parking, safety and comfort requirements grow. Thus people are more prepared to take their bicycles to parking facilities, which are located in, for instance, railway stations. The physical parking space required by a bicycle is considerably smaller than that of a car. The city of Odense transferred space from cars to bicycles in a car park in the vicinity of the railway station. By removing 32 car parking slots, parking space was gained for 800 bicycles, when two-tier stands were put in place.

26
In Strasbourg cars and bicycles are in the same parking hall. Entrance to the parking hall has been marked clearly to both cyclists and motorists. Collisions are avoided when both modes of transport have their own routes.

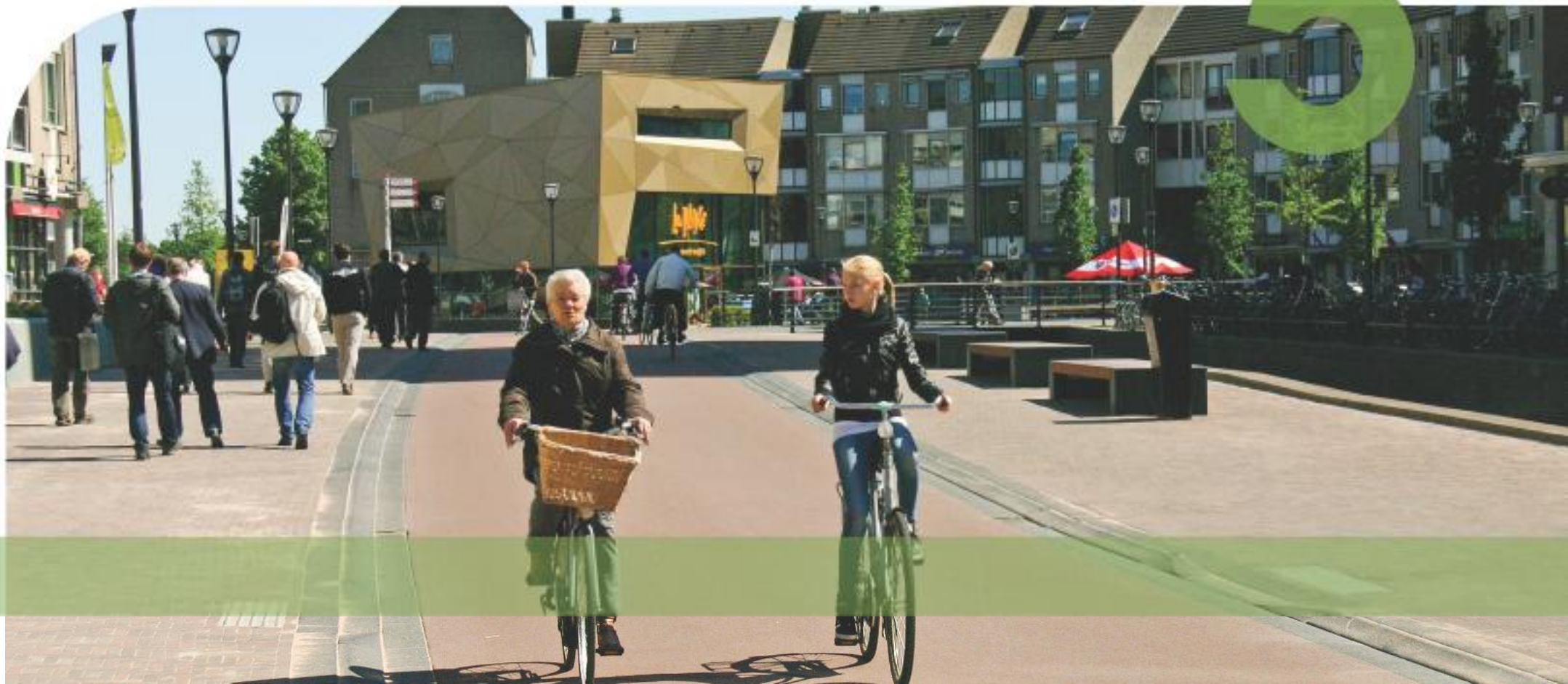
27
Near the centre, guests parking are usually guided to parking facilities. To which there are good connections from the access routes. (Ghent)

5

From a Line to a Net

Best Solutions for Cycleways and Pedestrian Routes

5



Planning the Routes

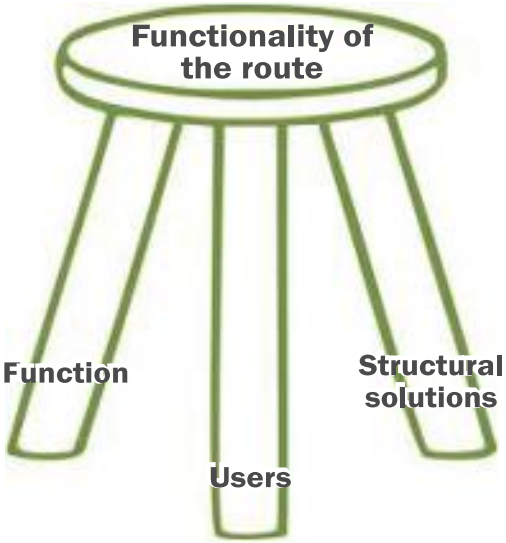
Planning a Route Begins with the Function

Road and street networks are comprised of routes of different levels as well as intersections connecting them. It is possible to enable practical and safe mobility by correctly applying different types of routes and by taking the whole traffic system into consideration. The prevailing transport policy guides the development of the traffic system. It becomes concrete through choices made and can be seen for instance in how different forms of transport are taken into consideration with different route solutions.

In route planning the best end result is reached when the route correctly serves its purpose of use. The function of a route depicts its functionality, i.e. reveals whether the purpose of the route is to be a high-level main route, a collector road collecting traffic from smaller routes or a street leading to plots. Also whether it is a part of the main network or if the purpose of the route is to make a target reachable. In addition to the function, the potential users of the route and their modes of transport must be examined as well as for what kind of trips the route is used for. Different zones of a city influence whether it is sensible to prioritize walking, cycling, public transport or private car traffic in the area. The function and users of a route determine what kind of structural solutions are made for it. The measurements of the route must support its purpose and use.

The function and users of a route determine what kind of structural solutions are the most suitable.

1



2

1
Curves and chicanes have been built in Houten to keep the car speeds slow on residental streets. The aim is to have at most 75 metre long straight street portions. These slowing down measures support the function of the streets as slow and attractive routes in residential areas.

2
Route planning can be seen as the sum of three factors, i.e. the function of the route, user groups and structural solutions. With regard to the functionality of the route, all these factors have to be taken into consideration equitably in planning.

Also Cycleways and Pedestrian Routes Have to Be Planned

Like car traffic routes, cycleways and pedestrian routes have to be planned from the point of view of their function and use. They cannot be just by-products of other traffic and street planning. If, for instance the goal is to create a fast cycling connection from a residential area to the centre, a space for a main cycleway corresponding with the requirements has to be reserved in the cross-section of the route.

Depending on the hierarchy and purpose of use of the street, solutions can be a two-way cycle track alongside the street or one-way cycle tracks on both sides of the street. A main cycleway can also be a two-way main route separated from car traffic, alongside which there are separate pavements. In all cases, structural solutions have to be decided according to the function and use of the route. Pedestrian routes have to be planned in the same way, as well. If there are a lot of pedestrians, space must be reserved for them. Thus, pavements must be widened or a street must be reserved wholly for the use of pedestrians. Likewise, the structural solutions of pedestrian main routes from residential areas to the centre have to be considered according to the purpose and use.

Stages of route planning

What is the function of the route?

- main route, collector road or residential street
- speed, accessibility

Who are the users, how is the route used?

- motor vehicles, cyclists, pedestrians
- work and business trips, recreational trips

Structural solutions

- what is the cross-section of the route like
- what forms of traffic are prioritized
- what solutions are used to support the function

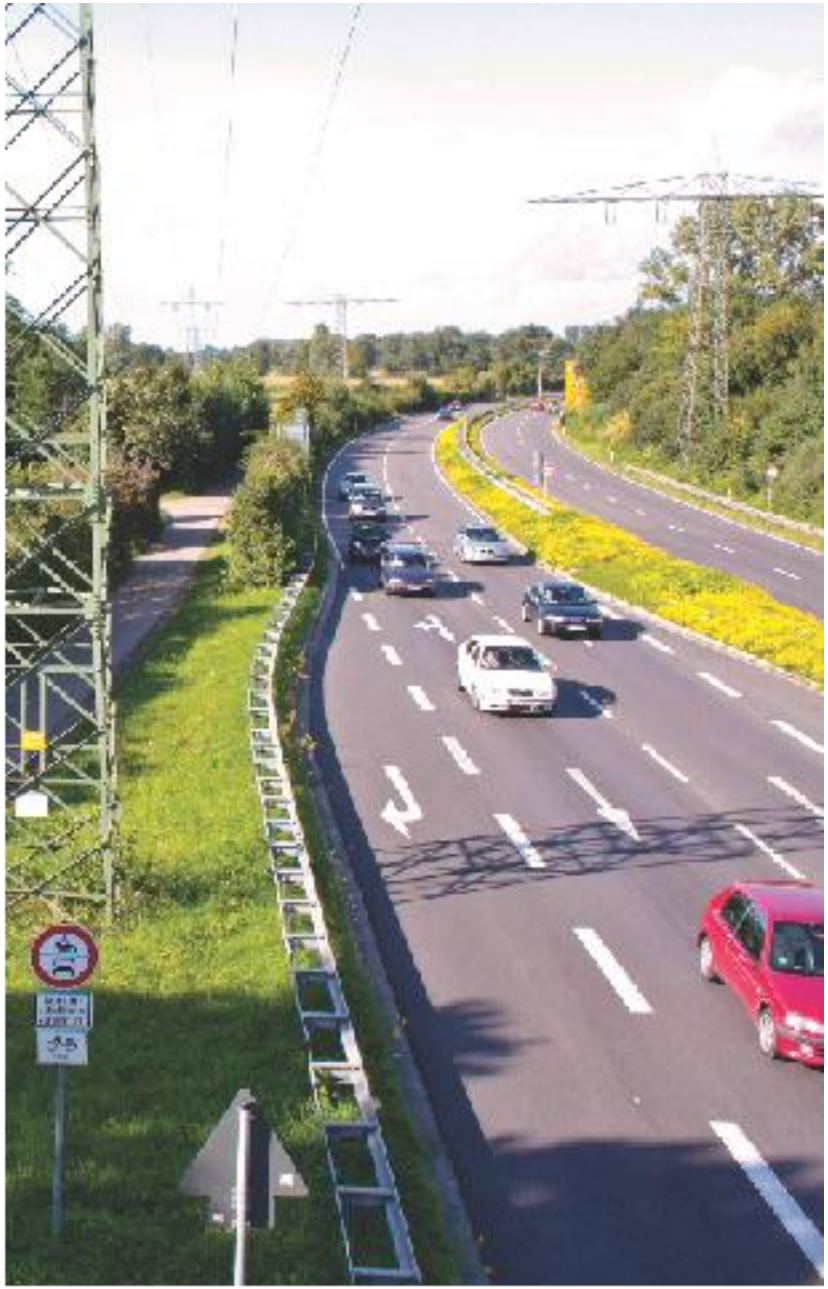
3

4

3
When there are a lot of pedestrians on a route, planning must be done on their terms. The main street of Geneva, Rue du Stand, is favoured by pedestrians and, in fact, most of the street is reserved to pedestrians.

4
In Houten the goal has been that as many people as possible who come to the centre use a bicycle. The main street of the centre has been planned on the terms of cyclists and car traffic is not allowed on the main street.

5 & 6
The role of traffic in different zones of the city has to be taken into consideration in traffic planning. The function of routes is formed on the basis of that. For the network of slow connections to work, there must also be a network of high capacity and fast connections in a traffic system. (Left: Houten, right: Freiburg)



Cycle Network

Quality Factors of a Cycle Network

A functioning cycle network necessitates the consideration of different kinds of factors. These are speed, safety, convenience of use as well as attractiveness of the surroundings. When all these quality factors are considered and realized in a balanced way, a good-quality and user-friendly cycle network can be enabled. A purposeful cycle network also better serves the users of electric bikes, the number of which is constantly growing. The average speed of an electric bike is higher than that of a regular bike, so the cycle network must enable smooth mobility. Electric bikes also improve riding comfort and increase the number of potential cyclists.

7
Houten has paid special attention to the quality of the cycle network. In most trips inside a city, a bicycle is the fastest alternative and travelling is enjoyable due to high-grade surroundings. Proportioned to the volumes of cycling, Holland is one of the safest cycling countries in the world. (Houten)

Quality factor	Specification	Explanation
Speed	Direct connections	There are fast cycling connections of good quality between the most popular targets. In addition, the number of curves and sharp turns has to be minimized.
	Steady speed	A route has to be planned so that a traveller can maintain a sufficient average speed with as little stops as possible.
Safety	Minimizing the accident risk	The possibility of a conflict with a motor vehicle on the route has to be minimized.
		Separation is favoured on routes where the speeds of bicycles and motor vehicles differ significantly.
		On a mixed route of bicycles and motor vehicles the speeds of these modes of transport must be close to each other.
		Special attention has to be paid to visibility on a separated route.
Comfort	Minimizing hold-ups	In normal circumstances a cyclist should be able to travel with the planned speed on the route.
	Straightforwardness	The routes have to be wide enough and unnecessary curves have to be avoided.
	Evenness	The surface of the routes has to be even, there should be no crossings of kerbs.
	Protection from damages	Separating cyclists from motor vehicles reduces the exposure of a cyclist to nearby emissions and noise.
	Protection from the weather	Protection from wind and also controlling slipperiness in the winter have to be taken into consideration.
Attractiveness	Social safety	Routes are lighted, well maintained and near a populated area.
	Aesthetics	Utilizing lakes, rivers, parks and other nature improves attractiveness.
	Reducing traffic damages	At times attractiveness can require separation, although the numbers and speeds of motor vehicles on the route were small. In addition, separation can reduce exposure to noise and harmful emissions.

Speed and Attractiveness as Key Factors

With regard to the speed of cycle traffic, important factors are direct connections and routes as well as an average speed that is as high and even as possible. Route planning should favour solutions that minimize the distance between the most common destination. The obstacle effect of main motor traffic routes usually brings the most challenges for building fast cycling connections.

To guarantee smooth flowing cycle traffic it is important to create a clear overall network hierarchy. Cycle network hierarchy should not be built as separate, but it should be a part of the whole street network hierarchy. The cross-section of the route has to change as the hierarchy and purpose of use of the route changes. Long lengths of the cycleways measured in kilometres are not what is important, but a logical and efficient placing of the routes. Direct and fast main routes carry most of the cycle traffic efficiently, whereas smaller collector routes convey the traffic towards the main routes. When volumes and speeds of traffic are low, mixed traffic is a functioning solution, as well. All routes do not have to be on the same level as main routes. But it is important that the level of quality of the main routes is high.

Increasing the modal share of cycling requires improving the attractiveness of cycling. Convenience can be improved by concentrating on the quality of the routes and functionality of the intersections. When riding on a quality route a cyclist can proceed without having to unnecessarily slow down or stop. Evenness and directness of the route support smooth flowing mobility. The attractiveness of routes can be improved by building them separately from car traffic close to beautiful surroundings near waterways, parks and residential areas. This increases the safety of the route, too. Exposure to noise and emissions can be reduced by giving cyclists benefits in intersections.


8


9

8
In longer distances the attractiveness of cycling can be improved by offering fast connections of high quality that are made as enjoyable as possible. (Strasbourg)

9
In Copenhagen the infrastructure of cycling has been planned to be of as high quality as the solutions of motor traffic. Even in the centre cycling is fast and easy despite the high volumes of traffic.

Safety above All

The basic principle of the Vision Zero of safety is that no one has to die or become seriously injured in traffic. From the point of view of cycling, safety is in fact an important basic requirement, so that cycling maintains its attractiveness and position as a sustainable mode of transport. Cyclists have very little equipment that provides protection, so preventing accidents must be invested in. Clear rules on how to act in the traffic environment play an important role in regard to the safety of routes. The traffic environment must be made as clear and unambiguous as possible, so that people know how to travel safely without a rule book. When the solutions are systematic and clear, they guide the traveller of making decisions correctly and faster. Especially as speeds grow, the time that can be used to react is reduced, in which case the risk of making mistakes grows. Bicycle traffic must be guided with traffic signs following the same principles as car traffic, so that cyclists know their own place, and for instance, their obligation to give way in traffic.

Most often the best solution with regard to safety is to separate cycling from motor traffic and to place it on its own route. If, for instance due to lack of space, separating cycling and car traffic is not possible, speed differences between the vehicles must be minimized.

Head-on collisions are often the most serious accidents with regard to consequences. Thus, on two-way cycle tracks attention has to be paid on sufficient wideness and directionality of the route, or if possible to separate the lanes and make the route one-way. Problems caused by oncoming traffic will be removed with a one-way route.

Also social safety must be taken into consideration when planning a route network. The vicinity of a populated area and lighting increase the feeling of social safety on the route, as does effective maintenance. Lighting also improves traffic safety, when visibility on the route is improved.

10
Accidents with oncoming vehicles are usually serious. The risk of a head-on collisions between two cyclists can be reduced by making a raised sidestrip in the middle of a two-way cycle track. This would be ideal for instance in situations in which the cycle track is winding or before intersections, where cyclists have to cross a busy road.
(Groningen)

High-quality Main Cycleway

Main Routes Are the Backbone of the System

Main cycleways form the main connections for cycling in the same way as main streets do for motor traffic. So that the main routes can work as good-quality main cycling connections to the centre, three characteristics must be taken into consideration in planning them: speed, usability and safety.

The riding speed of a bicycle is lower compared to a car, but due to smooth flowing traffic as well as direct routes, fast parking and shorter waiting times, cycling is competitive even in surprisingly long trips. The speed of the main routes can be improved by alignments, benefits, signposting and visual guidance. These speed up especially the journey of a user who is not familiar with the route. With the help of signposting, information on distances between destinations can also be offered. The most developed signposting systems help to maintain a cycling speed with which the cyclist can pass traffic light intersections in the green wave. When cyclists can maintain an even average speed on the main cycleway and cyclists do not have to reduce their speed or stop often, the energy used for cycling is minimized. To ensure quality, measurable quantities can also be given to a route. These can be, for instance, the number of likely stops on a trip of one kilometre and the likeliness to have to stop in an intersection.

Evenness is an important characteristic of a route, so that cyclists can maintain a steady average speed. On a good-quality route the surface is even as well as in good condition, and cyclists do not need to ride over kerbs when travelling through intersections. Uphill slopes decrease the attractiveness of cycling, but usually topography cannot be influenced in. If the road needs to go around high slopes, the rule of thumb is that in order to avoid a rise of one metre, a cyclist will go around a route that is 10 metres longer. The convenience of the main route can also be increased by placing more plants along the route.

With regard to safety, a main cycleway must be wide enough and there cannot be too sharp turns or bends when riding with the target speed. Since most cycling accidents occur in intersections, they have to be planned as safely as possible. A safe intersection directs the road user to make good decisions when arriving at the intersection, when going through it as well as when turning into the intersecting cycleway. Minimizing the number of conflict points on the main route is one approach to improving traffic safety. This can be influenced by the choice of an intersection type. The probability of conflicts can be reduced by improving visibility distances. When road users see each other, they can better predict each other's movements.

People choose bicycles the more easily the more competitive a bicycle is compared to a car when it comes to speed, usability and safety.

11
In Holland cycleways have been divided into different classes. The highest in the hierarchy are high-quality and fast cycleways for example from a residential area to the centre.
(Groningen)

12
The main street of Houten is comprised of a wide cycle track lined by pavements. There is also a direct connection from the main street to a covered bicycle parking facility in the railway station, directly under the platforms.

Speed

Smooth flowing cycling on the route

- The feeling of safety on the route
- Average speed
- Number of stops / km
- Continuity

Routesignage

- Number of signposts
- Quality of signposts
- Informational value

Speed in relation to a car

- Short cuts
- Benefits of a cyclist
- Waiting times in intersections

Usability

Evennes

- Height of the kerbs
- Evenness of the surface
- Topography

Parking

- Parking in the place of origin and in the destination
- Quantity and quality
- Accessibility
- Interchange

Convenience

- Lighting
- Social safety
- Aesthetics

Safety

Continuity of the cycle network

- Clear route hierarchy
- Visual guidance

Cross-section

- Width of the route
- Curves, turns
- Noise and emissions

Intersections

- Safety
- Directionality
- Number of conflict points
- Visibility

13
A one-way cycle track is suitable as a main cycleway in central build-up areas in a city. In the route as well as in intersections, bicycle traffic goes logically along with others in the traffic flow, which also improves the role of cycling as a part of vehicle traffic. Intersecting espexcially becomes easier.

14
A good-quality main cycleway arrives to the heart of the centre, from which there are good connections to the rest of the city. There are also good possibilities for bicycle parking alongside the main route. The picture shows the important commercial centre of Copenhagen, Strøget, which can be reached easily by bike from every direction. Cycling is prohibited in Strøget during day-time.

15
Nørrebrogade in Copenhagen is a popular main cycleway. Wide, one-way cycle tracks run on both sides of the busy street. Especially in commute traffic the volumes of cycling on the street are among the highest in the world.

Characteristics of a Main Cycleway

Bicycle parking

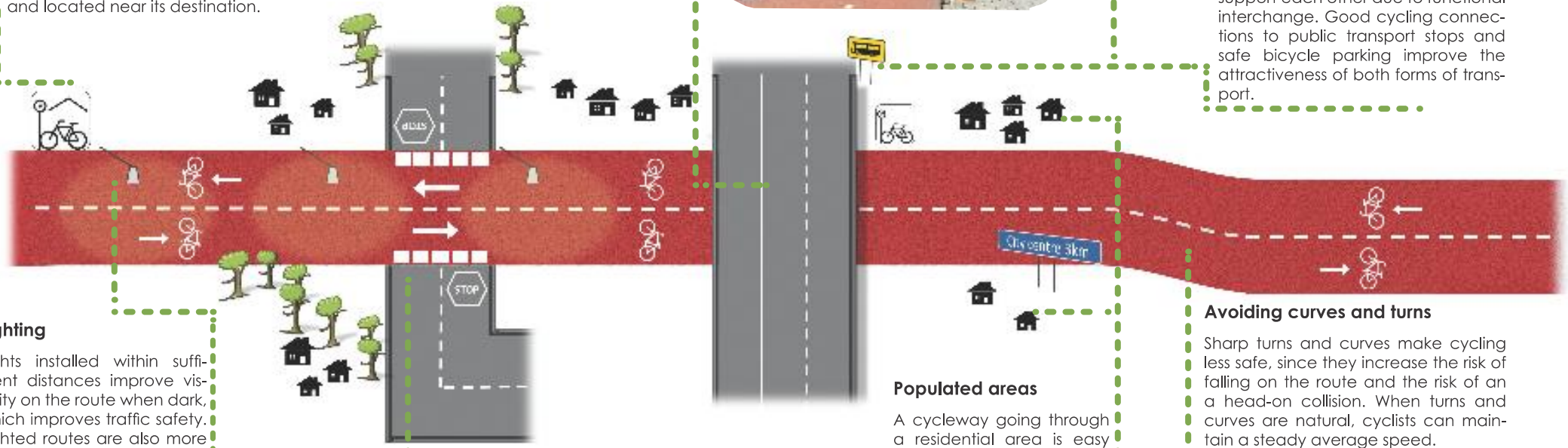
The possibility of good-quality, safe parking is an important characteristic of a main cycleway. Bicycle parking spaces meant for longer-term storage should offer the possibility to store the bike inside or under a cover. In addition, there should be the possibility to lock the bike from its frame. Short-term parking on the other hand should be easily accessible and located near its destination.

Grade-separated intersection

When a main cycleway crosses with a busy collector road or with a road of a higher level, it is justified to use a grade-separated intersection arrangement in order to improve safety and the smoothness of traffic. With regard to cycling, a grade-separated intersection is the safest solution for the intersecting parts.

Interchange

Cycling and public transport can support each other due to functional interchange. Good cycling connections to public transport stops and safe bicycle parking improve the attractiveness of both forms of transport.



Lighting

Lights installed within sufficient distances improve visibility on the route when dark, which improves traffic safety. Lighted routes are also more comfortable to use and social safety is improved.

Right of way

When driving on a main route, a cyclist must have right of way when crossing residential streets and quieter collector roads. Maintaining the average speed becomes easier when there are few stops while travelling on the route. In addition, accelerating again to the target speed takes up energy from the cyclist.

Populated areas

A cycleway going through a residential area is easy to reach as well as socially safe. Good accessibility of the route increases attractiveness of cycling and reduces motor traffic as the attractiveness of the residential area improves.

Avoiding curves and turns

Sharp turns and curves make cycling less safe, since they increase the risk of falling on the route and the risk of an a head-on collision. When turns and curves are natural, cyclists can maintain a steady average speed.

Directionality of an intersection

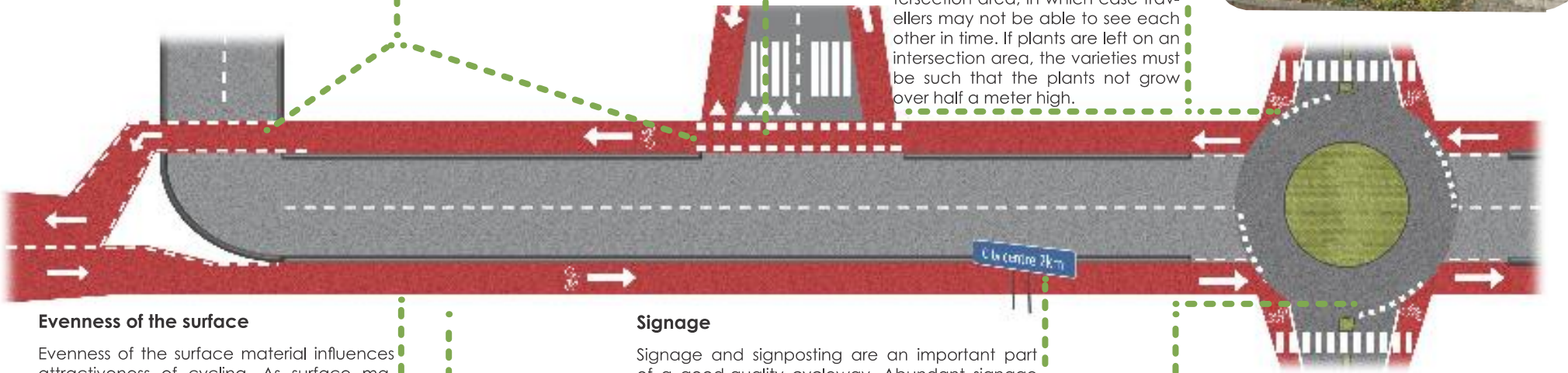
Intersections along a good-quality main route have to be clear, so that cyclists know well beforehand how to cross the intersection when they arrive at it. Directionality can be improved with the help of surface materials, colourings or elevations. For instance, continuing a one-way cycle track through an intersection as a coloured cycle lane is a good solution.

Traffic light advantages

For instance a green wave can be used in a main cycle route or green light can be given faster to cyclists in traffic light guided intersections than to the rest of the vehicle traffic. In addition, automatic systems can be used for recognizing cyclists, in which case cyclists do not have to press the button to make the light turn green.

Good visibility distance in intersections

Plants along a main cycleway increase attractiveness, but plants must be avoided in intersection areas. High and dense vegetation weakens visual clearance in an intersection area, in which case travellers may not be able to see each other in time. If plants are left on an intersection area, the varieties must be such that the plants not grow over half a meter high.



Evenness of the surface

Evenness of the surface material influences attractiveness of cycling. As surface material, asphalt is comfortable to cycle on. When using different kinds of stone materials it should be taken into consideration that the seams of the plates do not cause unpleasant bumps. With regard to safety and convenience of crossing an intersection, kerbs must be avoided on a cycleway.

Logic

In a centre area the functionality and safety of a cycleway are especially influenced by the fact that travelling on the route is logical. Travelling on and crossing a one-way cycleway and cycle lane is consistent with other vehicle traffic, so also other traffic users can more easily predict the movements of a cyclist.

Signage

Signage and signposting are an important part of a good-quality cycleway. Abundant signage of good quality is also a good marketing method and improves the position of cycling as a form of traffic worth considering.

Roundabout

A grade-separated solution is the best with regard to safety, but a roundabout is also a safe and, furthermore, an economic alternative. A one-lane roundabout without a separate cycle lane has been proved to be safer than an intersection with a cycle lane, since cyclists and motorists travel on the same lane and do not have to cross each other when exiting the roundabout.

Parking in a city centre

In the centre people usually park a bicycle for the time it takes for them to run errands, so parking is quite brief. There has to be many parking spaces around the centre, so that cyclists can get near to their destination. Larger parking centres should be placed primarily in context with popular targets. There should be easy access to the parking spaces from the main cycleway and services have to be easily reached.

Two-way Cycle Track

Enjoyable and Fast Connections

A two-way cycle track can go as a separated route alongside other vehicle traffic or on its own route. It is also possible to make short cuts, with the help of which the distance between targets is shorter by bicycle than by car and, thus, the route is more attractive.

Since cycle tracks have been separated from motor traffic, they enable safe and quick mobility between residential areas and the city centre. They are also well suited for free time cycling, since they offer pleasant surroundings for recreation. A pavement can run along a two-way cycle track, but cycling and walking should be separated structurally if the volumes of traffic are high. Furthermore the speeds of cycling can rise quite high on the route.

A two-way cycle track enables a good-quality main route that is safe and enjoyable.

Oncoming Traffic as well as Intersections as Risks

On a two-way cycle track one security risk is formed by oncoming cyclists, especially when it is dark. Therefore, it is important to show the place of a cyclist on the route with lane markings. If a pavement runs alongside a two-way cycle track, the place of the pedestrian has to be shown clearly as well. Walking on a cycle track should not be allowed except on such portions where there are few pedestrians. Crossings with car traffic should be realized clearly and safely. A cycle track that runs along a motor traffic route, which has a lot of intersections, is risky with regard to accidents at the intersections. Motor vehicles and bicycles travelling on their own routes do not have to consider each other, but crossing of these forms of traffic in intersections can lead to surprising conflicts.

Special characteristics of two-way cycle tracks:

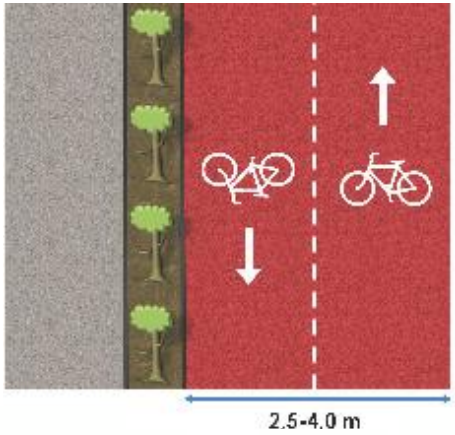
- Two-way cycle tracks are enjoyable, especially when separated from the rest of the traffic.
- A cyclist is safe when riding on the route.
- They can take the cyclists away from the visual range of drivers.
- With regard to safety, the weakest spot is at the intersections.
- In two-way cycle tracks there is the danger of a head-on collisions but, on the other hand, a wide route gives space for safe passing.

16
A two-way cycle track, which is separated from the pavement with a rumble surface, has been built along a city rail. (Strasbourg)

17
An attractive two-way cycle track in the middle of nature. Opposite directions have been separated by a centreline. Separation between pedestrians and cyclists has been made clear by using plants. (Freiburg)

Recommended Use

Two-way cycle tracks are especially suitable outside build-up areas and in perimeter areas, where car speeds are high. Two-way cycle tracks are also suitable as main routes when coming to the centre as well as when the cycle lane goes separately from car traffic. Realizing a two-way cycle track requires good planning in car traffic streets in the centre, since in this case it is as if there are two streets going alongside each other, which creates challenges for intersection arrangements.



Source: PRESTO 2011

18
The target width of a two-way cycle track is 2.5–4.0 metres. It is recommended to make the separation from the motor traffic route with a sidestrip, in which plants in the route portions increase attractiveness.

19
Cycling is made safe with the right kind of route solutions, so that everyone can travel by bicycle regardless of age. Copenhagen uses a lot of cargo bikes, which can be seen in the picture, to transport children and items. The picture is from the "Green route", which is an attractive recreational route but which is also used a lot as a short cut in commute traffic.

20
An example of an attractive two-way cycle track at the European Parliament buld-ing in Strasbourg. Separating pedestrian traffic and cycling has been made with plates which are considered functional by both visually impaired people and cy-clists. A simple way to increase the safety of a two-way cycle track is to separate the directions of travel from each other with road markings. (Strasbourg)

21
A one-way cycle track enables fast and safe mobility of large volumes of cycling. The picture shows the main cycleway between the centre and the university. (Groningen)

One-way Cycle Track

Cycling on a one-way cycle track is as logical as car traffic. Cycles go to the same direction as the other vehicles.

Logic as the main advantage

One-way cycle tracks are suitable along busy motor vehicle routes with fast traffic as well as for popular cycleways between city centres. Using a one-way cycle track is logical, since cyclists travel in the same direction as the rest of the vehicle traffic. This especially makes intersection behaviour clearer, when bicycles follow the same logic as cars. When using a one-way cycle track, the place of the cyclist in the traffic is unambiguous, which highlights the position of cycling as vehicle traffic.

Separating cyclist from the rest of the vehicle traffic on a one-way cycle track can be made by using kerbs, or if space allows, for instance plants. Due to the one-way traffic, the average speed of cycling stays quite high, in which case the capacity on quite a narrow cycle track is sufficient for even large cycling volumes.

Safety

A one-way cycle track offers a safe and high-quality setting for cycling when separated from the rest of the vehicle traffic. When compared to a two-way cycle track, the safety of cycling is improved by the fact that the risk of head-on collision does not exist on a one-way cycle track. Between two cyclists, many serious accidents happen in conflicts with oncoming cyclists.

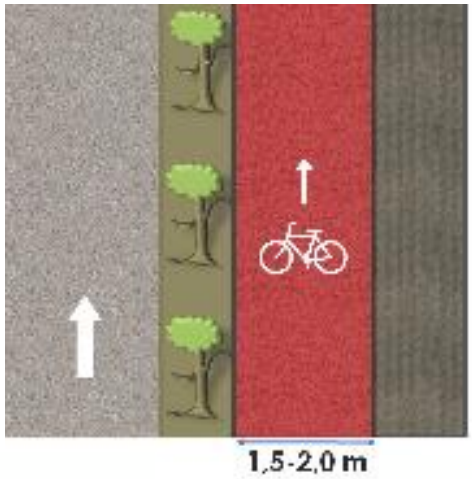
From the point of view of a cyclist, intersections are the most dangerous parts of traffic. The logic of cycling is also connected to safety. Cyclists travel in the same way as the rest of the traffic on a one-way cycle track, so the behaviour of cyclists is predictable. When a motorist can predict the movements of a cyclist, it is easier to take the cyclist into consideration.

22
A separated cycle track offers a high-quality route for areas that have high numbers of cyclists. Separated cycle tracks should be convenient and fast to use, so that as many people as possible will choose cycling instead of driving private cars as their mode of transport. (Groningen)

23
One-way cycle tracks enable a logical and consistent traffic network for cycling. (Zwolle)

Recommended Use

A one-way cycle track is well suited for main cycleways, for instance between residential areas and centres, when the route runs on the same street as car traffic. In build-up areas, a one-way cycle track is suitable along routes where the speeds are 40 km/h or more. If traffic volumes are high, physical separation of cycling from the rest of the vehicle traffic is justified even with lower speeds. In the fringes of build-up areas one-way cycle tracks work also along busy routes with higher speeds (60–80 km/h).



Source: PRESTO 2011

24

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24
The target width of a one-way cycle track is 1.5–2.0 metres. When the speeds of motor traffic are high, a wider sidestrip can be used to separate the cycle track. In city centres a level difference made with a kerb is enough.

25
In the centre of Copenhagen cyclists travel mainly along one-way cycle tracks. The modal share of cycling is 32% in Copenhagen.

Cycle lane

A cycle lane is a visually separated space that is used only by cyclists and that enables safe and visible mobility.

A Solution to a Limited Space

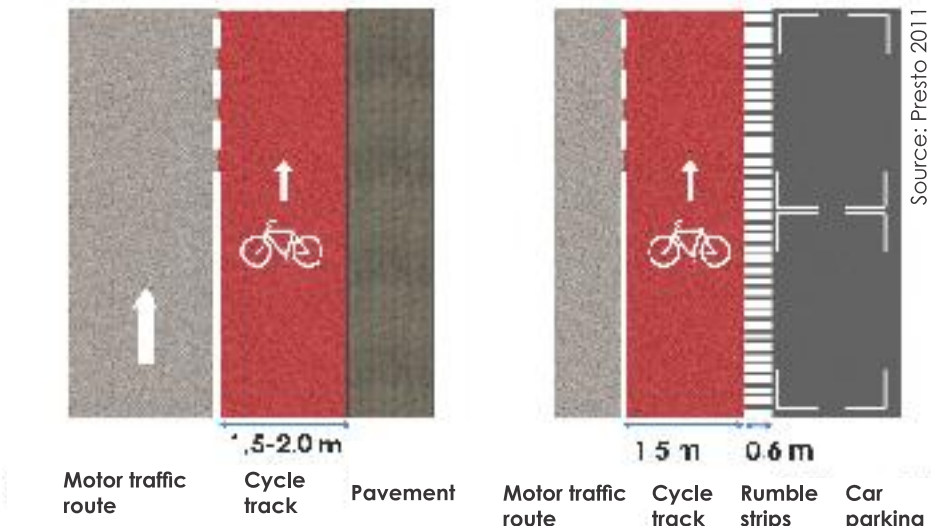
A cycle lane refers to a visually separated area on a street used only by cyclists. The solution is suitable for streets where people travel the allowed speed of an urban area at most, traffic volumes are moderate and there is very little heavy traffic. One-way cycling on cycle lanes is as logical as motor vehicle traffic on the same street.

The advantages of a cycle lane solution are its clearness, speed, flexibility and low building costs. A cycle lane is a suitable alternative to a one-way cycle track, when what is needed is a functioning solution for a limited space. However, a requirement to using a cycle lane is that safety on the lane is taken into consideration.

Markings

Different countries have given their own orders on markings of cycle lanes, but as a rule cycle lanes must clearly stand out from the rest of the street environment by marking them with, for instance, either a continuous or a dash line. In addition, cycle lanes are marked with a bicycle symbol, which should be painted on the cycle lane in suitable distances (50-100 metres in a city area).

When the speeds of motor vehicle traffic are high (over 50 km/h), it is recommendable to mark a safety area between the cycle lane and motor vehicle route. To catch the interest of motorists, also a coloured pavement is used in cycle lanes either along the whole lane or only in intersections as well as in spots perceived as dangerous. The most common colours used for cycle lane surfaces are red (Holland), blue (Denmark) and green (France).



26
When planning cycle lanes it is important that the width of the lane is sufficient. An immobile cyclist takes up about 0.75 metres of space, but the minimum width of a cycle lane should be 1.5m. In Denmark it has been noticed that accident numbers proportioned to the volumes of cycling double or triple if the cycle lanes are too narrow (less than 1.2m).

27
Cycle lanes can be used outside urban areas and also on roads where speeds are higher. However, this solution is not suitable along busy roads. To guarantee the safety of cycling, the width of the cycle lane must be sufficient and in addition, an extra traffic line should be used to separate motorists from cyclists. (Ghent)

28
In built-up areas, cycle lanes are suitable along streets where speeds are less than 50 km/h, when there is little space and mixed traffic is not suitable. Thanks to the coloured surface, a motorist notices the cycle lane easily when there is no snow. (Groningen)

Recommended Use

It is recommended to use a cycle lane on routes of the same level as a collector roads and roads that are not too busy, but where mixed traffic is not safe due to driving speeds. A mixed traffic route is usually a functioning alternative on residential streets, but it is justified to use a cycle lane on busy residential streets.

Outside build-up areas cycle lanes are suitable for regional routes, which have a speed limit of at the most 60 km/h and the volumes of car traffic are low. Special attention has to be paid on the sufficient width of the lane when planning cycle lanes.

Safety

The biggest difference between a cycle lane and a cycle track is that the cycle lane is on the carriageway. The place of the cyclist can be pointed out clearly, which improves safety. The Dutch have found that on busy main routes mixed traffic is in some cases safer alternative to cycle lanes. Cycle tracks can create an excessive feeling of safety for the travellers, and at the same time, the speeds of motor vehicle traffic grow and taking cyclists into consideration is reduced.

Minor street space can lead to making cycle lanes too narrow. Mixed traffic is in fact, often a safer alternative than a narrow cycle lane. A narrow cycle lane forces the cyclist near the edge of the carriageway, so the risk of an accident with motor vehicle traffic or parked cars grows. In addition, motorists are not necessarily aware of the measurements of a cycle lane that is narrower than normally. In this case a cyclist can have an accident as the consequence of even a small slip or evasive movement.

29
With the help of a cycle lane, the place of the cyclist on the street can be pointed out clearly, which makes traffic behaviour easier and improves safety. (Stockholm)

30
When there is car parking next to a cycle lane, opening car doors can cause dangerous situations. However, the accident risk is smaller if the parked car has direct eye contact with the oncoming cycle lane. The accident risk can also be decreased by leaving space between the cycle lane and parking space. (Strasbourg)

Cycling in a Pedestrian Area in the Centre

Many Practices

A pedestrian centre is attractive from the point of view of a cyclist: A lot of services are offered, distances are short and there are no cars causing an obstacle effect and a safety risk. Organizing cycling in a pedestrian centre is challenging however, since cycling is faster and more straightforward than walking, and in addition, bicycle parking requires space. Easy motion should be enabled in a centre, but on the other hand, enjoyable surroundings of a good quality as well as versatile services should be offered to the residents. Often lack of space restricts the implementation of different kinds of solutions. Here are presented different types of practices on how cycling has been realized in the car-free city centres of European cities.

Groningen: Separate Cycleways in the Centre

Cycling is the most popular form of traffic in Groningen and the high modal share of cycling can be noticed also in the city centre. Cycling and walking are the main modes of transport in the streets of the city. They have been completely separated into their own routes. Apart from exceptions, car traffic has been prohibited in the centre of Groningen since the 1970s, and the old carriageways are now used by cyclists. Pavements have been widened, so that pedestrians have gained more space. It is safe to walk on the pavements, but when crossing a cycleway, pedestrians should be careful of the busy cycle traffic. In the centre there are also a few walking-oriented streets, where cycling has been forbidden during the day time. In the centre, distribution traffic travels along cycle tracks.

The policy of the city is that they do not want to build more areas meant only for pedestrians. This is due to the fact that the city wants to maintain the popularity of cycling in the centre. On the other hand, experience has shown that cyclists use the walking-oriented streets regardless of the cycling prohibitions.

Växjö: Marked Space for Cyclists on the Pedestrian Street

On the pedestrian street Storgatan in the centre of Växjö, a separate space has been marked for cycling with a different surface. There is no actual cycle track on the street, so walking is allowed everywhere on the pedestrian street. However, pedestrians use the space reserved for cycling quite freely, since the different surfaces visually guide pedestrians to avoid the route pointed out for cyclists. This is why cycling in the centre of Växjö flows smoothly during rush hour. Storgatan is a former main car street, so it is wide. There is also enough space to point out a separate place on the street for cyclists.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Ghent: Mixed Traffic in the Centre

Cycling is allowed on the streets of the wide pedestrian centre in Ghent. The streets are very narrow, so due to lack of space it has been impossible to build separate cycle tracks. However, although there may be conflict situations between cyclists and pedestrians, the city has not wanted to forbid cycling. The city wished that the shops in the centre could also be reached by bicycle. However, cyclists have to ride on the terms of pedestrians, so they cannot ride fast on the pedestrian streets. If cyclists wish to go fast through the centre, it is best if they go around along faster routes. In the "30 zone" surrounding the centre, cycle traffic travels on the same mixed traffic route as cars and trams. Safety risks have also been minimized on the mixed traffic routes by reducing speeds and volumes of motor traffic.

Freiburg: Cycling Forbidden on the Pedestrian Streets

The pedestrian centre of Freiburg is one of the widest continuous pedestrian centres in the world. Cycling has been forbidden on the pedestrian streets within time limitations so that cycling is forbidden between 6 a.m. and 7 p.m. Restrictions are used especially in the old city, where the aim is to create as good a prerequisite for walking as possible during the day. The pedestrian centre is very busy especially during business hours.

Cycling will not be allowed in the pedestrian centre of Freiburg in the future either, but the aim is to guide cyclists to a road, that circles the pedestrian area and has connections to the centre. Cycling has been forbidden in the pedestrian centre for the safety of both modes of transport in order to avoid conflicts. Furthermore, the pavement of the pedestrian centre is problematic especially with regard to the safety of cyclists.


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31
There are a lot of cyclists in the centre of Groningen, but travelling is fast thanks to the wide cycleways. Cyclists can also travel through the centre fast.

32
In the pedestrian centre of Växjö, cycling has been separated from walking with a different surface, but walking is allowed in the whole street area. The centre of Växjö has been chosen as the best pedestrian centre in Sweden in 2010.

33
Cycling is allowed in the pedestrian centre of Ghent. The city wishes that shops could also be reached by bicycle, but lack of space prevents building separate cycleways.

34
The pedestrian is the king in the wide pedestrian centre of Freiburg. Cycling is forbidden on the pedestrian streets.

Pedestrian Routes and Areas

Vehicle traffic has to be restricted in areas where the aim is to increase walking.

A City the Size of a Person Attracts Pedestrians

Pedestrian routes and areas play an important role in promoting walking. Short distances especially in a city centre entice people to choose walking as the main mode of transport or at least as a part of the trip chain. The attractiveness and allure of the centre area increase enthusiasm towards walking.

Zoning has a significant role in promoting walking. As a result of successful zoning, pedestrian areas and centre areas have been built so that services and functions can be easily reached by walking. Centre areas must be planned on the terms of pedestrians, so that they are the size of a person. Distances between different functions have to be short and vehicle traffic has to be guided so that the journey of passengers is safe and pleasant and they do not have to suffer from noise pollution.

Commercial services and public spaces along walking routes attract pedestrians. To improve convenience, pedestrian routes and areas should provide a possibility of protection against the weather. Good methods are, for instance, partly covered routes, practical winter maintenance, snow melting system in the pedestrian areas as well as protection against wind with the help of plants.

35
The most important functions of a city area are realized in the street picture of Ghent: the city acts as a meeting place of people, a market place as well as a passage.

City Traffic Is Based on Walking

In centres and sub-centres, most of the people moving in the streets are pedestrians. The pedestrian is king, so traffic in a centre should be planned on the terms of pedestrians. An attractive city has alluring public spaces and pedestrian areas, where people can spend time. There, people can move freely and safely, enjoy different kinds of activities and possibilities for mobility and sitting down, as well as a attractive environment. Public space and enjoyable pedestrian areas enable one of the main functions of a city. They act as the meeting places of people. A city centre is also a significant market place, and to entice pedestrians, the pedestrian areas and routes have to be near commercial services. Thus, the needs feed each other: business life flourishes and pedestrians enjoy free mobility and spending time there while shopping. To make people travel on foot in a city, walking has to be pleasant, convenient and safe. Thus, a third important function of a city area is realized: the centre must also act as a passage. Excellent walking conditions increase traffic safety, when motor vehicle traffic has been restricted and guided elsewhere. The access of motor vehicles to the front of buildings has to be made possible when needed, but their role in city centres is however, always that of a visitor.

Although walking is not the main mode of transport in all trips, it is however, always a part of the trip chain. An efficient way to increase both walking and public transport trips is to offer fast and enjoyable walking connections to public transport stops at the beginning and end of the trip. Promoting public transport is at the same time promoting walking. Efficient and fast public transport is a competitive mode of transport, so it is a real alternative to a car. When developing public transport, improving walking conditions as a part of the trip chain should always be taken into consideration.

People can also make the whole trip by walking, for instance to work or hobbies. Everyday physical activity has to be supported in every way, which is why it is important to ensure good-quality walking connections from nearby residential areas to for instance, the centre and workplace concentrations.

Walking is as natural to people as breathing.

Benches Are the Parking Spaces of Pedestrians

Walking is an active form of transport that tires people. Every now then people have to sit down and rest their feet. Benches are in a manner of speaking the parking places of pedestrians. Benches placed like street furniture increase the attractiveness of a pedestrian area and make people spend more time there. In addition, benches support the function of a city as a meeting place of people.

Comfortable benches and good-quality seating possibilities offer an opportunity to quiet down, rest, and follow the activities of the city and socialize. Therefore, it is important to offer seating possibilities diversely around the city in different public spaces for larger groups as well as for people in need of their own space.

The suitable number of benches is case-specific, but generally it can be said that benches should be located every 50–100 metres in pedestrian areas. The placing of the benches matters as well. Benches should be placed so that they are situated in comfortable places and protected from weather as well as possible. A possibility should also be offered for cafés and restaurants to organize attractive table groups outside, since they attract more customers and offer sitting possibilities as well.

A planner should be aware that a pedestrian always chooses the most direct route to the destination.

36
People will enjoy and spend more time in pedestrian areas if the space also offers a possibility to rest and become refreshed.
(Strasbourg)

37
Since people produce the energy required for walking themselves, a pedestrian tries to choose the shortest route possible. (Växjö)

Quality Factors of Pedestrian Areas and Routes

When planning pedestrian areas and routes, usability, accessibility, convenience, attractiveness as well as safety have to be taken into consideration. With regard to usability, what is most important is that the pedestrian route is logical and follows the shortest route possible between destinations. The principles of accessibility takes the needs of different user groups into consideration. By improving convenience and attractiveness the aim is for instance, to reduce pedestrians' exposure to noise and emissions.

Pedestrians travel in the traffic flow without any kind of protection. Unlike walking and cycling, high speeds and great vehicles masses are typical for other forms of transport. This is why pedestrian routes are often structurally separated from other traffic. The greatest threats to the safety of pedestrians occur in the crossing of a carriageway, where over half of injuries or accidents leading to death occur. Dim lighting and dark also increase the accident risk significantly. Planning intersections is one of the most important ways to improve the safety of pedestrians. A considerable amount of individual accidents, such as slips or falls, happen to pedestrians as well. These can be influenced especially by maintenance.

Quality factor	Specification	Explanation
Usability	Function	A pedestrian route or area serves the purpose of use designed for it.
	Directness	The route follows the shortest route between destinations.
	Width	The width of the route is sufficient with regard to the number of pedestrians.
	Continuity	Pedestrian routes and areas are coherent, so there is all little variation between the quality level and hierarchy as possible.
	Consistency	There are good walking connections between the pedestrian areas, as well.
	Separating forms of traffic	It is important to separate walking and cycling to their own routes.
	Signage	Pedestrians have their own signposts.
	Interchange	Fast and accessible connections exist for the interchange points of public transport.
Accessibility	Directionality of kerbs	Kerbs guide the visually impaired. The level difference has to be clear, but not over 50mm.
	Visually impaired and hearing-impaired people	Guiding stripes or contrast differences are used in the route or pedestrian area, in intersections the guidance takes place with the help of kerbs and cobblestones as well as sound effects. Good visual clearance in intersections helps hearing-impaired people to anticipate.
	Physically impaired people	Different kinds of solutions are e.g. slopes, lifts, railings and lowering the kerbs.
	Children and the elderly	Good visual clearance in intersection areas. Mixed-use streets and Shared space planning can be utilized.
	Waiting areas	The waiting area has to be sufficiently big and there must be good visibility distances.
Convenience, attractiveness	Speed of motor traffic	Convenience and safety of walking are improved when the speeds of motor traffic are reduced.
	Distance to the carriageway	The noise experienced by pedestrians as well as their exposure to nearby emissions are reduced by separation.
	Crossing a street	Crossovers exist in necessary places, and the time it takes to cross over is as short as possible.
	Surface	The condition of the surface is good and the material purposeful.
	Level difference	The level difference with the carriageway or cycleway most often improves the convenience of walking.
	Sitting possibilities	Benches are the parking places of pedestrians. Attention should be paid especially to their number, quality and location.
	Plants	Plants are a good separation method for the carriageway and, at the same time, increase attractiveness.
	Protection from the weather	The convenience of walking can be improved by, for instance, building protection from wind or rain.
	Lighting	Sufficient lighting improves both comfort and the feeling of safety.
Safety	Type of intersection	Intersection areas are the biggest risk areas with regard to the safety of pedestrians. When planning intersections, especially safety and smooth flowing traffic have to be taken into consideration.
	Visibility distance	Improving visibility distances in intersection areas helps travellers to anticipate the situation.

38
The Kléber square in Strasbourg is a good example of a functioning pedestrian area. The square is a short distance away from services as well as public transport stops, and walking is unrestricted.

Pedestrian Streets

In the vicinity of pedestrian streets business life flourishes and the area has a friendly atmosphere.

Peaceful surroundings for pedestrians

Pedestrian streets can be used individually to improve the walking conditions on a specific street section, or they can be connected to each other, in which case wider car-free areas can be created. By linking several pedestrian streets it is possible to create a calm and accessible pedestrian area. In many European cities the city core has been cleared of cars by using pedestrian streets. They are popular especially in old city centres and sub-centres. A pedestrian street enables more free and care-free mobility of pedestrians without the barrier effect and noise pollution caused by car traffic. Also traffic safety improves as the number of conflicts reduces when car traffic has been forbidden.

Pedestrian streets have become more popular during the past decades. Strøget in Copenhagen was made into a pedestrian street in the 1960s, but developing the area into an attractive pedestrian area has taken place little by little with the policy of small steps. In these cities, pedestrian streets usually also form a popular commercial centre, where business life flourishes and the atmosphere is very friendly. Street art and design are used to create a personal look that mirrors the identity of the city in the pedestrian streets. The surface of the pedestrian streets is usually paving stone and in northern cities it is possible to use a snow melting system, so that the streets are snow-free also in the winter.

Motor Vehicles on the Pedestrian Streets

A pedestrian street differs from a shared space in such a way that motor vehicle traffic is forbidden, apart from emergency and distribution vehicles. Travelling to properties along the pedestrian street may be allowed for motor vehicles. However, in a pedestrian street a driver of a vehicle always has to give pedestrians unrestricted access and the speeds of vehicles have to be adapted according to pedestrians. The maximum speed is 20 km/h. Motor vehicles cannot be parked on a pedestrian street, except for service traffic. Service traffic can be allowed with a traffic sign either around the day or only during specific times.

39
In a city centre, wide pedestrian streets also act as an enjoyable public space and a meeting place. (Strasbourg)

40
Service traffic can be allowed on pedestrian streets with a separate sign. In the centre of Groningen service traffic is allowed in the morning before the shops open and in the evening after the closing time.

41
The pedestrian street Strøget is the popular heart of the commercial centre of Copenhagen. During the tourist season, 250,000 people visit Strøget daily and even in the winter season there are 120,000 visitors every day.

Pavements and Walkways

Pedestrians can be offered benefits, such as covered routes as well as short cuts.

Benefits and Safety

A pavement is usually separated from motor vehicle and bicycle traffic with a kerb. The separation can also be made with plants to improve the safety and attractiveness of the route. Benefits can be given to pedestrians by for instance, building short cuts or covered routes. In the best European walking cities, walking has been taken into consideration as its own mode of transport that can also be used to arrive to the centre and not only to move around inside the centre. Direct and enjoyable routes lead from nearby residential areas to the centre.

The pavements are often perceived of as very safe, because they separate vehicle traffic and pedestrians physically from each other. Pavements are safe in the route sections and in fact the accident risk is at its highest at intersections. When planning pavements it is important that the attention of the pedestrian and driver of a vehicle are aroused early enough before the intersection, so the travellers can take each other into consideration. The feeling of safety brought along by a pavement can never surpass the actual safety.

42
A pavement on the level of the carriageway can also be safe and enjoyable, when the traffic environment has been planned as peaceful. Guiding people with visual impairments has to be taken into consideration, by for instance using a paving stone to separate the carriageway and the pavement. (Ghent)

43
A well planned walkway is safe to pedestrians of all ages. (Houten)

44
The traffic system of Geneva is based on walking. One of the main ideas of traffic planning is that it is easy, fast and enjoyable for residents to come to the centre of the city by walking.

Parks

Parks are enjoyable places to spend time in and they act as links between different pedestrian areas.

Close to Nature

Parks offer pedestrians the closeness of nature they long for. Therefore, parks and green areas should be integral parts of public space as well as the traffic system. As pedestrian areas, parks are attractive and make centres more enjoyable. Parks act as recreational places for people and they are also places where social interaction is natural.

Cities often have a lack of street space, so it is challenging or even impossible to plant vegetation along the streets. Parks in city centres offer residents good-quality public space, but they also act as the green lungs of the centre. Parks can also form links between different pedestrian areas, in which case they are used as passages in addition to spending time there. At best, the pedestrian areas in a city form a diverse whole and with their help the city stays alive during all times of the year and day.

Safe Activities

Safety is a feature which should also be realized in parks. To attract people, an environment has to be safe physically as well as socially. A safe environment can often be recognized from the fact that there are a lot of people. Cleanliness improves the attractiveness of areas, but also has a positive influence on the experience of safety. In addition, it is good if parks provide protection from the weather, such as rain or direct sunshine.

At best, parks offer activities to people of all ages. This can be influenced by, for instance, the furnishings of the parks. By making play and game areas, the park is made more alluring to families with children. Different parks in a city can also have different kinds of functions. A park can be a cosy place to spend time in or act as a sports park or activity park for families with children. Good seating and beautiful scenery, on the other hand, entice older people. To guarantee social safety, it is good if parks are situated near a populated area or in the direction of the facades of buildings. Also lighting should be well realized.

45
Height differences can also be utilized in city planning. Parks that have been built on high places enable wide scenery over the city and, on the other hand, make people enjoy themselves and exercise. (Freiburg)

46
A safe environment encourages children to cycle. They are in a key position with regard to the development of a cycling culture, since their choices have a lot of impact in the future. (Strasbourg)

47 & 48 & 49
In planning this multi-purpose park in Strasbourg, all age groups have been taken into consideration. The park has a playground and climbing frames for the children, an outdoor gym for people who wish to work out and table tennis tables as well as an area where people can play pétanque.

Walking and Cycling Bridges

Fast links can be created between pedestrian routes with the help of pedestrian bridges.

Over and under

Since people use their own muscles to move, they strive to minimize the energy used for moving in all possible ways. To make walking and cycling alluring alternative for other modes of transport, trip frictions should be reduced by land use planning. A functional way is to make as direct routes as possible over waterways and other barriers, such as rails and main car routes. Thus, it is possible to create short cuts that increase the speed of walking and cycling as well as its competitiveness compared to driving.

If a bridge is used by both pedestrians and cyclists, it must be wide enough so that these modes of transport can be separated. The challenge of bridges is that usually they bring height differences to the route. One solution to this is that the street going under the bridge is lowered where the walking and cycling bridges are situated. Thus, the bridge does not have to be very high. Correspondingly, the street can be raised where it crosses with pedestrian underpass.

Advantages of bridges

- accessibility is improved
- utilization possibilities of water elements increase
- widening the pedestrian area for instance on top of water is enabled
- residents can reach new areas better
- attractiveness of walking increases
- trips become shorter
- safety is improved when the carriageway is crossed on a different level

50
With the help of bridges, it is possible to improve the accessibility of walking and cycling. In the picture, walking and cycling have been separated on the bridge, which combines a residential area to the centre of Copenhagen and the shopping centre Fisketorvet.

51
In Freiburg, a high-quality connection from a residential area to the centre has been built over the ring road circling the centre.

52
Cycling and walking bridges are practical ways to shorten the trips of these forms of transport, and thus, to increase their competitiveness compared to motorized forms of traffic. (Strasbourg)

Mixed Traffic Routes

In the right conditions, it is justifiable to combine different forms of traffic on the same route. When planned right, mixed traffic routes slow down speeds and can improve safety.

Safe when Realized Well

In mixed traffic routes, two or more forms of traffic use the same route. A mixed traffic route can be, for instance, a joint route of walking and cycling or a shared space, in which one can travel on the same route on foot, by bike or by car. As a general rule, it is safest to separate different forms of traffic to their own routes, but due to lack of space it can be justified to use mixed traffic routes. However, mixed traffic routes have to be planned safely. The speeds of motor traffic have to be kept low with structural solutions. Normally the speed limit on a mixed traffic route is 20–30 km/h. The functionality of a mixed traffic route also depends on the number of cyclists, pedestrians and cars. The share of heavy traffic has to be minimal.

Because the mixed traffic route is used by different forms of traffic, it is important that the traffic environment guides to take other travellers into consideration. This is why it is recommended that there are equal shares of users of all forms of traffic on a mixed traffic route. Thus, none of the forms can dominate the traffic.

53
In residential streets reducing the speed limits to 20 km/h requires rebuilding the whole street. Just installing a mixed-use street sign is not enough, but hints have to be given to the traffic environment that motorists have to go slowly in the area and take, for instance, playing children into consideration. (Geneva)

54
A route changes from a two-way cycle track into a mixed traffic street. The change is shown visually with a traffic sign, street markings as well as the ending of the coloured pavement. (Zwolle)

55
Cyclists coming from a two-way cycle track join the mixed traffic route just like motorists. The intersection is raised to improve safety. (Copenhagen)

Slow Street

Lower Driving Speeds

Slow streets are routes that combine cycling and motor traffic and are most often at the level of residential streets, where the traffic environment guides the driver to use a desired target speed. Methods to slow down traffic are, for instance, narrowing the street, speed bumps or deliberate restriction of the field of vision. Often bicycles and cars drive on a slow street on the same carriageway, with a pavement that has been separated for pedestrians alongside of the street.

Narrowing the street can be made by widening the pavement, adding more plants on the carriageway or with traffic islands. Zebra crossings can be raised or traffic calmed with speed cushions. In a speed cushion, private cars have to drive into a bump but with wider vehicles, such as busses and trucks as well as larger emergency vehicles, the bump stays between the tires.


56

Recommended Width of a Street

On a slow street, the speeds of motor vehicles can be at the most 30 km/h. The recommended width of a slow street is either a carriageway of less than 3 metres or a wider carriageway that is over 3.85 metres wide. The recommendations are based on the following safety issues, that have been found in the Presto-project:

- When the width of a street is less than 3m, a motorist will not typically pass a cyclist.
- When the width of the street is 3–3.85m, a motorist often strives to pass the cyclist, but the passing is not safe.
- With small traffic volumes, passing is safe on streets that are 3.85m (car + bike) or 4.85m (bike + car + bike) wide.


57

Methods that guide towards slowing down traffic include making the street narrower or using speed bumps or restricting the field of vision.

56
In the centre of Freiburg, the speed of motorists has been lowered with large pot plants. Pedestrians do not travel on the carriageway, but pavements have been made for them separately. However, pedestrians are allowed to cross the street at any point.

57
In Växjö, flower boxes are used to slow the streets in residential areas. In the spring, the city brings the boxes to the residential areas and puts them in place. The residents, on the other hand, take care of planting flowers in the boxes.

58
Slow streets are well suited as residential streets. Bicycles and cars travel on the same carriageway and for pedestrians there is a pavement, from which there is convenient access to houses. Curves on the residential street slow down car speeds. (Houten)

Contra-flow Cycling

A Solution that Takes Little Space to Promote Cycling

Two-way cycling on a one-way street is an excellent way to increase the smooth flow and speed of cycling as well as to improve the competitiveness of cycling compared to a car. This solution takes up little space and is an efficient way to promote cycling possibilities. It has been found safer also on narrower streets, when traffic volumes and speeds are low. Contra-flow cycling is allowed in several top cycling cities.

One-way streets are very common in city centres. Streets can be too narrow for two-way traffic or the other lane is needed for parking. One-way streets are used to direct motor traffic along desired routes and to reduce drive-through in a populated environment.

59
In Ghent, contra-flow cycling is systematic throughout the whole city. The no entry traffic sign is used in signage, below which is the extra plate allowing cycling.

60
In Sweden, two-way cycling on a one-way street can be realized with a separate cycle lane that goes on the right-hand side of the no entry traffic sign. (Växjö)

Contra-flow cycling streets offer cyclists short cuts in a city.

Safe when Used Systematically

At a glance, two-way cycling on a one-way street can seem risky, but many cities and countries that have implemented the solution have experienced it, without exception, as positive. The accident risk of a cyclist going in the wrong direction of travel is lower than with a cyclist going in the same direction as a car. When a cyclist and a motorist come from opposite directions they see each other, so they can predict each other's behaviour. Most accidents occur when a car is passing a cyclist who is going in the same direction. An oncoming cyclist on a one-way street has the highest accident risk in intersections with equal roads, if the motorists do not notice or become aware of the cyclists coming from a direction of travel forbidden for motorists.

The best way to improve safety and smooth flowing mobility of cyclists is to implement the solution on a large scale. If two-way cycling is allowed only on some one-way streets, cyclists do not necessarily realize or dare to use this to their advantage. On the other hand, motorists also do not know to watch out for the cyclists. When contra-flow cycling is a common practice in a city, traffic is more predictable for motorists and cyclists can utilize faster routes.

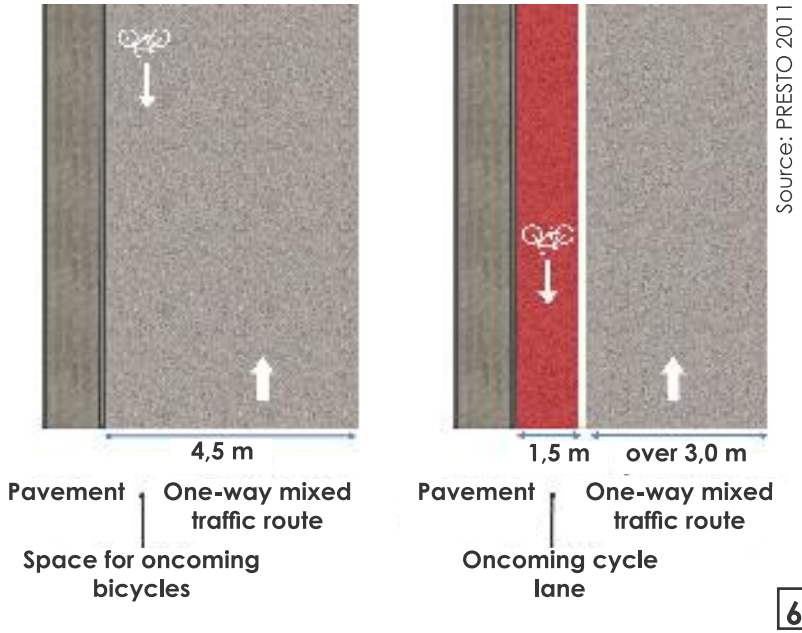
61
In intersections, two-way cycling can be clearly marked with cycle lanes on both sides of the street. In the route sections, a place can be pointed out for contra-flow cycling with a separate cycle lane. This also reminds the motorists that cycling is allowed to both directions. (Ghent)

62
On one-way streets, the greatest risks of two-way cycling occur at an intersection, since a motorist does not necessarily notice a cyclist coming from a forbidden direction of travel. In the picture the cyclist has the obligation to give way in the intersection, which has been pointed out with street markings. (Copenhagen)

Shorter Cycling Trips in a City Centre

From the point of view of a cyclist, one-way streets, where cycling in both directions is not allowed, often make the trip longer and less smooth. Contra-flow cycling shortens the trip. One-way streets are used to direct vehicle traffic to busier streets. Allowing two-way cycling enables the fact that cycle traffic can be concentrated on less busy streets, as a result of which traffic safety is improved.

One-way streets especially support the principle according to which a motor vehicle should take passengers to as many places as possible in a city, but the routes do not have to be direct. One-way streets reduce the number of different route possibilities, which usually simplifies the choice of route. However, cyclists choose the shortest route possible and, if the aim is to favour cycling, it is beneficial to allow cycling to the prohibited direction of travel on one-way streets. In addition people who cycle to work and who often use the same route on their way to and back from work, experience cycling as being more convenient when they can use the same streets when cycling in both directions.



63
Two different kinds of marking methods are used on a one-way street to point out two-way cycling. Contra-flow cycling can either be marked with a traffic sign or road paintings, or alternatively by painting a cycle lane on the road.

64
Road markings show all road users that two-way cycling is allowed. (Strasbourg)

65
In Ghent, cycling is allowed in both directions on 95% of the one-way streets. The city core is car-free, but mixed traffic of bicycles and cars is favoured in the 30 zone surrounding the pedestrian centre.

Shared Space

In Shared space planning, the aim is to return the streets their diverse function that prevailed earlier.

Returning to the Original Meaning of the Street

In traffic planning, pedestrians have traditionally been separated from motor traffic, since it has been experienced that travelling on the same route results in a high accident risk and, when an accident occurs, a serious risk of injury. According to the Shared space principle, walking, cycling and motor traffic can be combined in the same space when certain prerequisites are realized. The traffic environment must be changed as such that it guides people to drive calmly as well as to take other travellers into consideration.

One principle in the planning of Shared space areas is to restore the function streets had before motorization. In those days, the use of street space was diverse: it was a place of business and a place where people enjoyed meeting others and spending time with them. Children were playing and mobility took place in the same space as well. Travelling speeds were low, due to which the streets were safe. Outside build-up areas and often even inside it, the separation of forms of traffic is justified, but in a centre-like environment and residential areas the combination of the forms of traffic can, when planned well, improve safety.

66
In Växjö, car traffic was forbidden in the main street Storgatan in 1990. The picture shows the intersection area between Storgatan and Västra Esplanaden realized with the shared space principle.

67
It is difficult for people with visual and physical impairments to use a shared space, in which different forms of traffic travel on the same route. Therefore, there should always be a safe space area for pedestrians on the edges of the shared space. In the picture the pavement becomes so narrow that the convenience of using the route is reduced. The pedestrian is left in the weakest position.

Traffic Environment Guides Behaviour

When planning shared space areas it is important to recognize different forms of traffic behaviour and how the traveller can be directed, by means of planning, to behave suitably with regard to the environment and situation. Public spaces guide people towards social behaviour, whereas a highway as a traffic environment guides people to drive with high speeds.

Weak spots in the traffic system are such areas that give contradictory messages of the desired behaviour of a traveller. These are areas in which, for instance, public space changes into traditional street space. Planning should, in fact, minimize the risks of these kinds of transition areas. Misunderstandings can arise between different travellers. The table on the right-hand side presents the differences of social behaviour, social traffic behaviour, and formal traffic behaviour.

68

	Social behaviour	Social traffic behaviour	Technical cum legal traffic behaviour
Charasteristics of the behaviour	Pluriform and pluralistic	Pluralistic	Uniform
Movement mode	Unfocused	Largely focused	Extremely focused
Appropriate speed	< 30 km/h	< 50 km/h	> 50 km/h
Predictability of behaviour	Largely unpredictable	Limited predictability	Largely predictable
Eye contact	Frequent	Limited	Minimal
Determinants of behaviour	Social environment (people) and physical environment	Social environment (people) and physical environment + basic traffic rules	Control system - Traffic engineering and legal system (vehicles and traffic engineering environment, road markings and road signs)
Behaviour expected from other road users	Social behaviour	Social behaviour with legal and technical constraints	Technical and regulated traffic behaviour
Signals from spatial layout that are relevant to behaviour	Context of built and natural environment	Built environment, design of public space, road design and contextual references	Traffic signs and lights, road markings, signposts

Source: Shared space 2005

69

68
Mixed-use streets are also shared space areas. When realized well, they enable a safe environment for children's activities, but they still offer a slow route for vehicles.

69
Different forms of behaviour in traffic have been gathered in the table. In Shared space areas people move according to social norms. The environment has to be planned so that it guides the traveller to act with consideration towards others. For instance the significance of eye contact is great when travellers strive to anticipate each other's movements.

Five Memory Rules for Shared Space Planning

1 The traffic environment should guide behaviour

During the course of time, traffic environments have been shaped to guide travellers towards a more simpler behaviour. Roads and streets have been built just for mobility and people's behaviour is guided with the help of different kinds of traffic signs and signposts. The traffic environment should also be planned so that it communicates with the travellers and gives tips on behaviour.

2 A traveller has to have space to make solutions

Some traffic accidents happen in right-of-way intersections, when the other road user holds on to his or her right of way and the other does not notice it. The traffic environment has to guide travellers to reduce speed, take other road users more into consideration, and make them together and wordlessly decide who has the right of way.

3 Users along in the planning

Since the starting point of Shared space planning is to offer travellers an environment that is as natural as possible, it is good to include users and different kinds of interest groups in the planning.

4 Details can improve or ruin usability

Planning details gives the space a finished look. Well-chosen street furnishings make it, at best, seem like a living room. On the other hand, a badly chosen surface material can be unpleasant for a cyclist or dangerously slippery when wet or icy for a pedestrian.

5 Chaotic better than falsely safe

Traffic that seems safe is not necessarily always safe and vice versa. One of the worst mistakes of traffic planning is to create an environment that gives a false feeling of safety. People stay more alert in traffic if the experienced safety is weakened. In a Shared space area travellers have to take each other into better consideration compared to a situation where separated routes are used.

Source: Presto 2011

70
A Shared space residential street leading to a residential area, which at the same time acts as a public space and a square enabling the organization of different kinds of events. (Växjö)

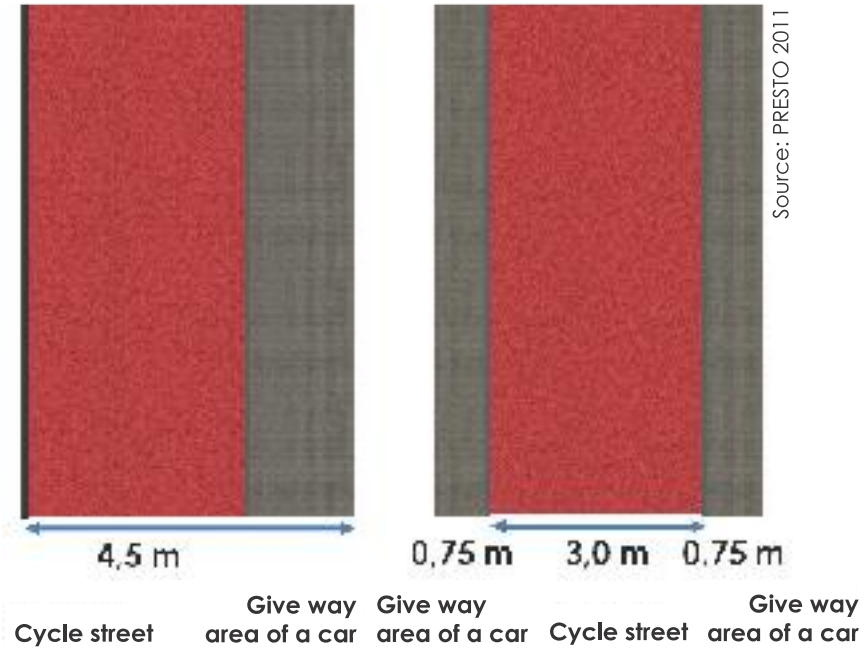
71
Shared space thinking has been used in planning the mixed traffic streets of Houten. On an attractive residential street bicycles and cars use the same carriageway, and separate pavements have been made for walking. However, walking is safe due to low speeds and minor traffic also in the same space with cars and cyclists.

Cycle Street

A Car Is a Visitor

On a cycle street cyclists are the main users of the route and motor vehicles are treated as visitors. In practice this means that motor vehicles need to drive on the terms of cyclists and their speed must be adjusted according to cycling. In the town of Houten, the Netherlands, cycle streets are as wide as normal residential streets, but they look like cycle tracks because a standard-width red cycleway has been painted on the road. This visually shows the motorists that they are driving on a cycle street. On the edge of the "red carpet" for cyclists there is 1–1.5 metres of gray paving stone, so that the street is wide enough for two cars to meet.

A cycle street shows that cycling has the primary position compared to driving a car in the residential area and the whole city. Driving speeds stay low due to for instance speed bumps. Traffic volumes are low as well, because a drive-through by car is not possible. People can only drive to plots.



Source: PRESTO 2011

72

Cycle streets are mixed traffic routes, where motor vehicles are only visitors.

73

72
The picture shows the recommended cross-sections for a cycle street. 3,5 metres wide cycleway has been marked on the street with a coloured surface.

73
In the Netherlands, there is a separate cycle street traffic sign, which highlights the higher priority of a cyclist and the role of the car as a visitor. There are often separate pavements on cycle streets, but they are lacking in quieter areas. In this case, pedestrians use the same carriageway.

Recommendations of use of a Cycle Street

Cycle streets are best suited for streets where the aim is to prioritize cycle traffic. There cannot be a lot of car traffic on cycle streets, and car parking is not recommended. A cycle street is a recommended alternative, if the daily traffic of vehicles is low; recommendations of daily traffic vary between 2,000–3,000 vehicles. Many residential streets can be realized as cycle streets, in which case a policy that favours cycling can be seen immediately when leaving the house. At the same time, traffic in the residential areas calms down, as drivers are guided with traffic signs and road markings to drive on the terms of cyclists.

As a general rule in cycle street planning it is thought that the number of cyclists can be presumed to be at least twice that as the amount of motor vehicle traffic, to make the use of a cycle street justified. However in planning cycling potential has to be taken into consideration, not just the present numbers of cyclists.

Checklist for Applying a Cycle Street

- A cycle street is suitable for build-up areas, where the speed limit of motor vehicle traffic is at most 30 km/h and traffic volumes are low.
- A cycle street is planned on the terms of cycling.
- Right of way of cyclists on cycle street improves speed and attractiveness.
- Asphalt is best suited as the surface material.
- A coloured cycleway highlights the priority of cycling on the cycle street.
- To improve continuity and safety, attention has to be paid on the directionality of intersections.
- Car parking is not recommended alongside a cycle street.

Source: Presto 2011

74
Houten has only about 20 kilometres of cycle tracks and the same amount of streets meant only for cars (the ring road). Other streets are cycle streets, on which cars drive on the terms of cyclists. The position of the cycle streets has been highlighted with right of way of cyclists.

75
In practice, a cycle street corresponds to an ordinary residential street, on which a 3.5 metres wide cycleway has been marked with a coloured surface. When no separate pavement exists, pedestrians use the cycle street.

Cycling and Walking on the Same Route

Applicability Depends on the Number of Pedestrians

Walking and cycling have similar characteristics. They are social forms of transport and by using them people can enjoy the nature and easily stop for instance to chat with an oncoming person. Both modes of transport are quite unprotected when compared to motor vehicle traffic and their speeds are fairly low. In certain circumstances, mixing them on the same route is a suitable solution.

For instance in Finland is used a mixed pedestrian and cycle track. This term is generally not used in the best European example cities, but mixed routes have always prioritized one or the other of the modes of transport. Therefore, walking may be allowed on a cycle track or cycling on a pedestrian-oriented route. The modes of transport are rarely in an equal position on a mixed route. Prioritizing makes traffic planning easier as well, especially with regard to intersections: it is known on the terms of which mode of transport the intersection will be planned. Crossing intersections on a Finnish mixed pedestrian and cycle track has to be done on the terms of walking, in which case the smooth flow of cycling is weakened.

Mixing walking and cycling on the same route is dependent on traffic volumes and the width of the route. If there are few pedestrians, they can travel on the same route as cyclists. But when the number of pedestrians is high, they need their own routes if good conditions for both wants be guaranteed. When the number of pedestrians surpasses 100 pedestrians/hour per one meter width of route, cycling is no longer smooth on the mixed route.

The example cities do not favour a mixed pedestrian and cycle track. At some places there are cycle tracks where people can walk or walking-oriented streets where people can cycle.

Pedestrians per hour / width (meter)	Recommended route type
< 100	Mixed pedestrian and cycle route
100 – 160	Pedestrian and cycle route separated with a line
160 – 200	Pedestrian and cycle route separated with a line and a level difference
> 200	Structurally separated routes

Source: Presto 2011

76
In Strasbourg, there is a pedestrian route, where people can also cycle in the middle of a park street going between the centre and the university. Cycling is smooth in quiet times, but during weekdays the large numbers of pedestrians cause conflicts between cyclists and pedestrians.

77 & 78
The term "mixed pedestrian and cycle track" is not used in the best example cities of Europe. Depending on the function and users of the route, one or the other of the modes of transport is prioritized. At times people can cycle on walking-oriented streets (Ghent, picture 77) and if there are few pedestrians, walking may be allowed on a cycle track (Houten, picture 78). With pedestrian underpasses it is justified to use a pavement for pedestrians for safety reasons, since in underpasses the speeds of bicycles often grow.

Mopeds on Cycle Tracks

The number of mopeds and light motorcycles is growing strongly in many European cities. Due to their speed and handiness, they have replaced many car trips. Compared to a car, a two-wheeled motor vehicle takes up less space both when driving it and when it is parked. However, the role of mopeds is still unclear in many cities and it is not known whether mopeds will be treated like cars or if they can use some of the main cycleways. In addition, parking mopeds and motorcycles in centre areas raises many questions, and in many cities the explosion in the number of mopeds is experienced as a problem that is difficult to solve.

In many cities in the Netherlands, mopeds are allowed on some main cycleways, if no other safe route can be pointed out to them. The number of mopeds in the traffic of the Netherlands is quite low, so they do not pose a great safety risk on the cycle tracks.

79

79
In Geneva, the number of mopeds and motorcycles has grown strongly during the past twenty years. The fronts of office buildings are filled in the mornings by two-wheeled vehicles, since the popularity of motorcycles has grown especially in commute traffic.

80 & 81 & 82
Mopeds are allowed in the Netherlands on some main cycleways. Speed bumps are used in the vicinity of intersections to reduce the speeds of mopeds. The bumps are gently sloping and do not reduce the comfort of cycling with regular speeds.

80

81

82

Applying Cycle and Pedestrian Route Types

Use of Cycleways

The choice of a suitable cycleway is first and foremost influenced by the speed limit as well as volumes of traffic on the motor traffic route that possibly goes along the cycleway. Attached is a Dutch (below) and Danish (right) example of the suitability of cycleways. The Danish example is easy to apply and it provides a good general recommendation for the use of cycleways. The Dutch example takes into consideration also the volumes of cycling and gives more detailed recommendations.

When the speeds of motor traffic are less than 30 km/h and volumes of traffic are less than 5,000 vehicles/day, the recommendation is to use mixed traffic routes. If the daily traffic of motor vehicles consists of over 5,000 vehicles/day, cycle lanes are recommended. They are suitable when the speeds of motor vehicles are at the most 50 km/h. Even then the traffic volume of cars has to be less than 6,000 vehicles/day. When planning a cycle lane, it has to be taken into consideration that enough space is reserved for the cycle lane, since accident risk grows on a cycle lane of less than 1.2 metres.

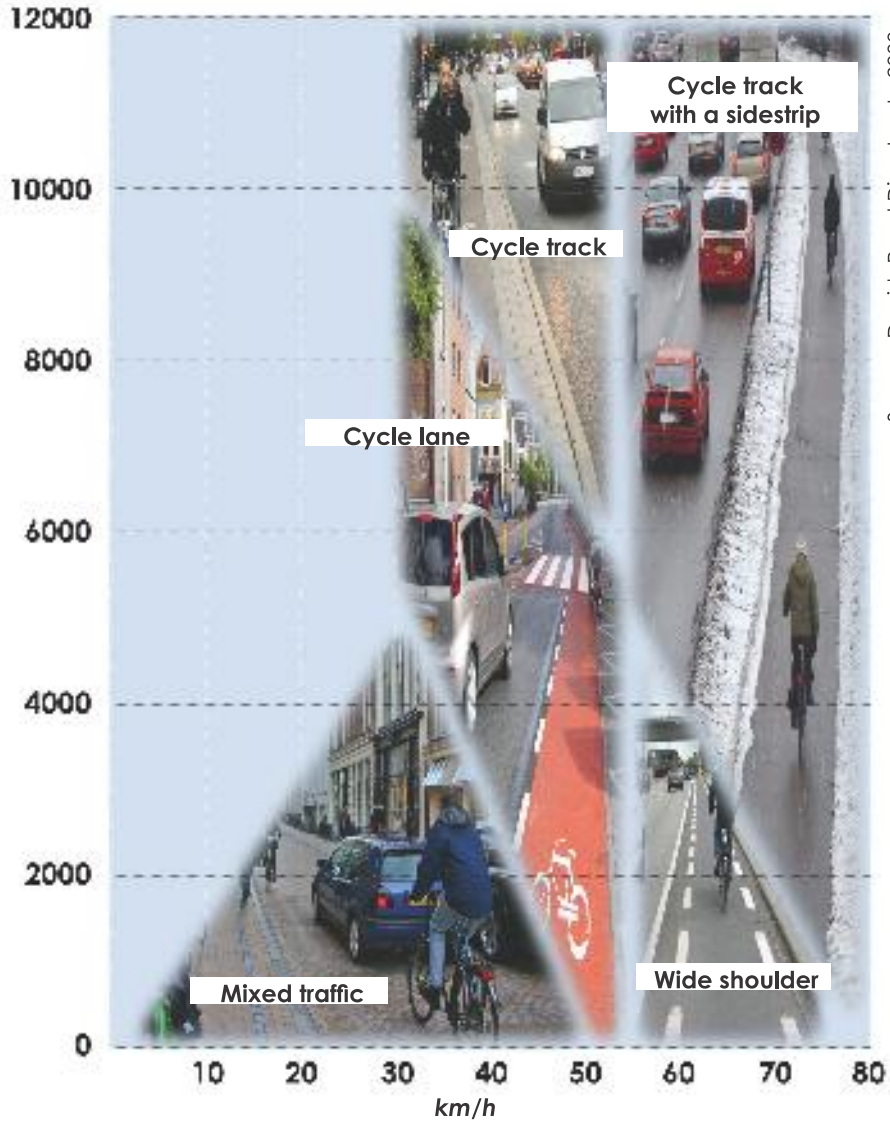
When the speeds of motor traffic are over 50 km/h or volumes of traffic over 8,000 vehicles/day, it is recommended to separate cycling to a separate cycle track. In speeds of over 60 km/h and with great volumes of car traffic, it is justifiable to separate the cycle track from the carriageway with a sidestrip. To improve attractiveness and to reduce noise as well as emissions experienced by cyclists, the sidestrip can be quite wide and plants can be placed on it. A wide (at least 1.5 metres) shoulder can be used as a cycle lane on main routes that have little cycle and motor vehicle traffic.

Cycle network category

Road category	Max. Speed of motorised traffic (km/h)		Motorised traffic intensity (pcu/day)	Basic network ($1_{bicycle}$ > work 750/day)	Cycle route ($1_{bicycle}$ 500-2500 /day)	Main cycle route ($1_{bicycle}$ > 2000 /day)
	n/a		0	solitary track		
Estate acces road	walking pace or 30 km/h		1 - 2500	combined traffic		cycle street or cycle lane (with right of way)
			2000 - 5000			
			> 4000	cycle lane or cycle track		
District acces road	50 km/h	1x2 lanes	irrelevant	cycle track or parallel road		
		2x2 lanes				
	70 km/h			cycle track, moped/cycle track or parallel road		

Source: CROW 2007

Cross-section of motor traffic
vehicles/day



Speed limit of motor traffic

Source: Danish Road Directorate 2000

Model City of Cycling

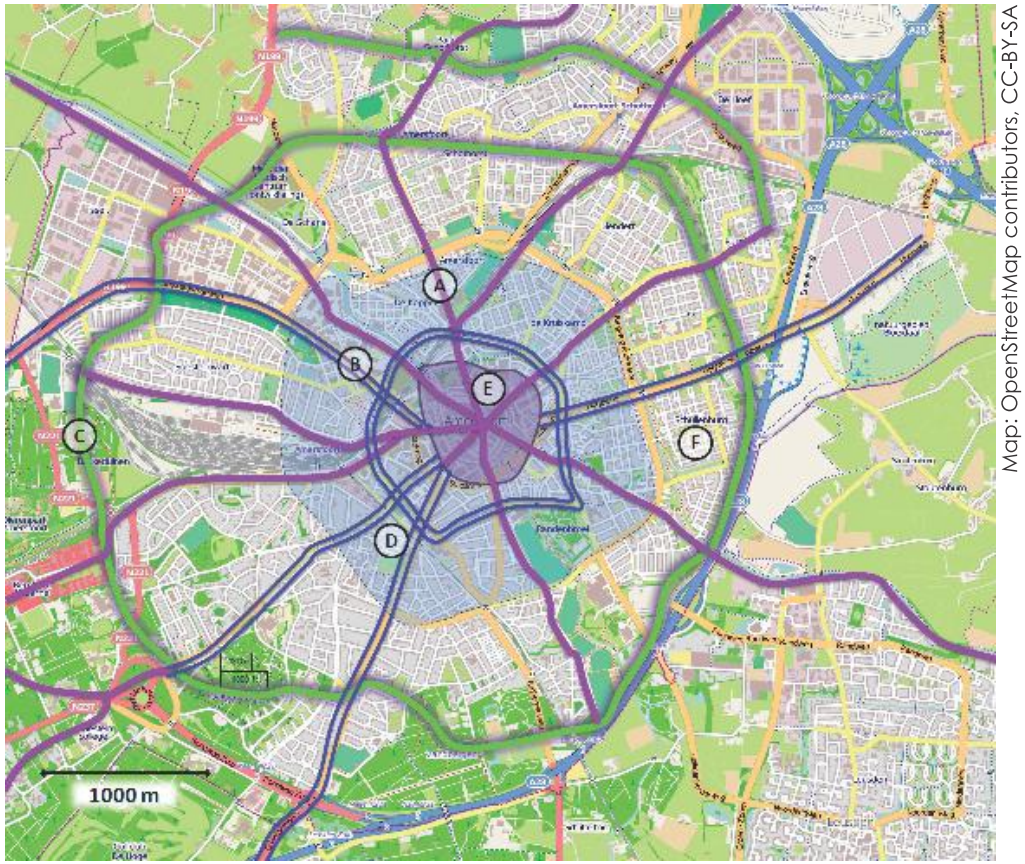
Main Connections of Cycling Are the Heart of the Model City

The picture on the right presents a fictional model city of cycling. The city structure is dense and over 80% of the residents live within three kilometres of the centre. In the city core there is a car-free zone, where driving to plots and distribution traffic can be allowed. The pedestrian is king in the car-free zone, but cycling can be allowed there on separate cycle tracks.

The city centre will have two types of cycleways (A and B) that are at the highest place in the hierarchy of the cycling network. These are the main routes of cycling, on which the speeds of cycling are typically high and a person travelling on the route normally has the right of way. In the picture the routes marked with purple (A) are two-way main cycleways. They go along car traffic routes or as their own routes radially from residential areas to the centre. These routes are like motorways for cycling: they are wide routes on which the speeds of cycling are quite high and usually people travelling on them have the right of way. On two-way cycleways that go as their own routes, crossings with motor traffic have to be carefully planned so that visibility is good. Cycleways marked with blue (B) are one-way routes on both side of the street on which cycling is as logical as car traffic.

The routes marked with green in the picture (C) are cross-directional links that combine the main routes. With regard to their hierarchy, they are on a lower level than the main routes and lead, for instance, from residential blocks to main cycleways. These links can go separately from motor vehicle routes, in which case they offer a safe route for, for instance, children's school trips. At the same time, they serve as attractive recreational routes.

In a centre area outside the car-free zone, a functional solution is to use one-way cycleways (D) if the roads are at the level of collector roads. Thus, cycle traffic is logical with car traffic both on the routes and at intersections. In the area of the city core on a car-free zone the most functioning solution with regard to cycling is to use two-way cycle tracks (E) with separate pavements. Cycle tracks can also be used by service and rescue vehicles coming to the centre. Speeds are low on a residential area, so a safe and practical solution is to use narrow mixed traffic routes, such as cycle streets (F).



Main cycleway (two-way cycle track)
Main cycleway (one-way cycle track)
Link (two-way cycle track)
Car-free area (two-way cycle track)
Centre area (two-way cycle track)
Residential areas (cycle street)

A. Main cycleway
(two-way cycle track)

B. Main cycleway
(one-way cycle track)

C. Link
(two-way cycle track)

D. Centre area
(one-way cycle track)

E. Car-free area
(two-way cycle track)

F. Residential areas
(cycle street)

Model City of Walking

The Pedestrian Is the King of the Centre

The the model city of walking is also very dense and most of the residents live within two kilometres of the centre. Since walking is a considerably slower mode of transport than cycling, the area that can be reached by walking is a little smaller than the area that can be reached by cycling. Despite this, good-quality routes as well as good conditions for mobility in both the centre and residential areas have to be offered to pedestrians. Especially in the city core the rest of the traffic has to adjust its speed to the speed of pedestrians. Also pedestrian routes outside the pedestrian centre are safe, enjoyable and interesting both socially and with regard to traffic.

The city core is a pedestrian area (A), where the pedestrian is king. In a compact city centre services are near and can be reached by walking. There is a direct connection from the railway station to the pedestrian area in the city centre and the university campus is situated within short walking distance. A dense network can be created from the pedestrian routes combining the most central targets, such as public transport terminals or shopping centres in the centre. Outside the pedestrian area (B) a space has been given to other modes of transport but, despite this, walking is safe and enjoyable. With the help of beautiful and interesting public spaces, also the centre outside the pedestrian area (C) forms an attractive area that attracts people to move around on foot in the city.

Main routes of walking leading from residential areas to the centre (D) have been drawn on the map. It is safe for pedestrians to move along these routes, separated from the rest of the traffic. They are direct routes from residential areas to the centre as well as between different sub-centres. When the routes go through interesting targets, such as parks or riverbanks (D), they encourage people to walk longer distances.

Although clear main routes have been set for walking, walking conditions have to be of good-quality also outside them. Walking is an easy way to go to different services of the sub-centres, and for instance, to free time activities. Residential streets (F) have been planned so that it is safe for all modes of transport to travel on the same route. The traffic environment guides motorists to drive slower.

When needed, the pedestrians look for the most direct routes between different destinations and easily form short cuts outside official routes. To enable the directness of the route as well as to improve the competitiveness of walking, for instance crossing a railroad or a river has to be easy and fast for a pedestrian. With the help of pedestrian bridges, pedestrians can be given the possibility to cross barriers also in places where it is not possible for motorists. This helps in forming direct walking routes inside the city and to favour walking as a mode of transport.

Map: OpenStreetMap contributors, CC-BY-SA

A. Pedestrian centre

B. Pedestrian routes in a centre area

C. Public spaces

D. Main pedestrian routes

E. Utilizing green areas

F. Walking on residential streets

6

Untying the Knots

Functioning Intersection Arrangements

6

Square One of Intersection Planning

Functioning Intersection Arrangements

The highest accident risk of cyclists and pedestrians occurs at intersections. Intersections also form significant conflict points in cycling and walking routes. They are bottlenecks, which define the capacity of the route and comfort of mobility. Careful planning of intersections, especially from the point of view of a cyclist and a pedestrian is therefore an important part of traffic planning.

When planning intersections, usability has to be taken into consideration and the number of conflict points need to be minimized. It is important that intersections serve their purpose of use, so mobility is smooth and safe for different forms of transport. On the other hand, paying too much attention to only limiting the conflict points can lead to unnecessarily complicating the traffic system.

Directness, clearness, safety and comfort are the most significant requirements for a useful intersection. A cyclist has to be able to cross the intersection as directly as possible: the crossing has to happen quickly and it cannot make the route unreasonably longer. If a cyclist has to cross kerbs in an intersection, comfort suffers fundamentally. Directions for cycle traffic must be so clear that when arriving at an intersection cyclists perceive how they will cross it. From the point of view of a pedestrian, important characteristics of an intersection are short waiting times as well as accessibility, i.e. the smoothness of walking as well as the consideration of people with visual and physical impairments.

To improve safety it is important to plan intersections so that cyclists and pedestrians are in the field of vision of motorists. In addition, cyclists must be able to see pedestrians in order to avoid conflicts. The speed of motor vehicles must be minimized, because the risk of a cyclist or a pedestrian seriously injuring themselves or dying in an accident grows as the speed of the vehicle grows.

The traffic environment must be clear but must also provide stimulus. If people feel like they control everything in traffic, their attention may become weaker. This can lead to accidents.

The Most Important Principles of Intersection Planning

- Visibility distances must be sufficient, since bad visibility distances are a risk despite the carefulness of road users.
- Road users must be able to notice each other easily.
- The traffic environment supports the obligation to give way and reduces speeds.
- Intersections must guide road users to make the right decisions.
- Crossing an intersection must be smooth and it cannot form heavy barrier effects.
- Crossings and underpasses cannot make the trip of pedestrians and cyclists longer.

1
In Copenhagen, the main directions of cycle tracks continue over the intersections coloured as blue. All directions have not been marked because, according to studies, this decreases safety.

Quality Factors of an Intersection

Safety	**Danger of serious conflicts**	Conflicts with motor traffic have to be minimized. If the route of a pedestrian or a cyclist crosses with fast and/or heavy traffic, grade-separated intersections are recommended. The speed differences of vehicles intersecting on the same level must be minimized.
		The traffic environment must guide travellers as unambiguously as possible. Cyclists and pedestrians must be in the field of vision of a driver of a motor vehicle. Lighting has to be sufficient during dark.
Convenience clearness	**Evenness**	The surface of the cycleway has to be even and travelling must be smooth along with lowered kerbs. Interchanges cannot cause unnecessarily great differences in height.
	Convenience of crossing	Intersections must have sufficiently space. Good visibility enables anticipation, in which case cyclists can better adjust their speed according to the situation.
	Minimizing delays	The probability for a need to stop must be minimized.
	Protection from traffic nuisances	Separating cyclists from motor vehicles lowers the exposure of cyclists to harmful nearby emissions and noise.
	Protection from the weather	Protection from wind and rain and, in addition, preventing slipperiness in the winter increases the comfort and safety of cycling and walking.
	Directionality	The traffic environment must guide road users to make the right decisions in intersections.
	Attractiveness	Also social safety, cleanliness, visibility and lighting have to be taken into consideration in intersection planning, especially in underpasses.
Smoothness	**Speed of crossing**	The probability for a need to stop must be low and the waiting time when crossing an intersection as short as possible. Traffic lights have to have benefits for cyclists and pedestrians.
	Smoothness of crossing	A cyclist does not have to make sharp turns due to the intersection. In addition, the trip cannot be longer due to going under or over an intersection area.

Intersection Planners in Cities

In the most advanced cycling and walking cities of Europe, special attention is paid to developing safe and functional intersections. For instance Copenhagen has separate planners who focus specifically on planning intersections. The challenges caused by intersections for cycling and walking are taken seriously and the aim is to minimize problems.

When it comes to functionality, an intersection is good when the probability for stopping is low and the waiting times short. Crossing an intersection is logical when the travel route is straightforward and clearly guided over the intersection. In many countries, the focus point of intersection planning is still in car traffic. Especially with regard to cycling this leads to the fact that cycling has no infrastructure of its own. Thus the intersection has to be crossed on the terms of car traffic on the carriageway or along a pedestrian crossing on the terms of pedestrians.

2
An example of straightforward and clear guidance for cycling through an intersection. (Copenhagen)

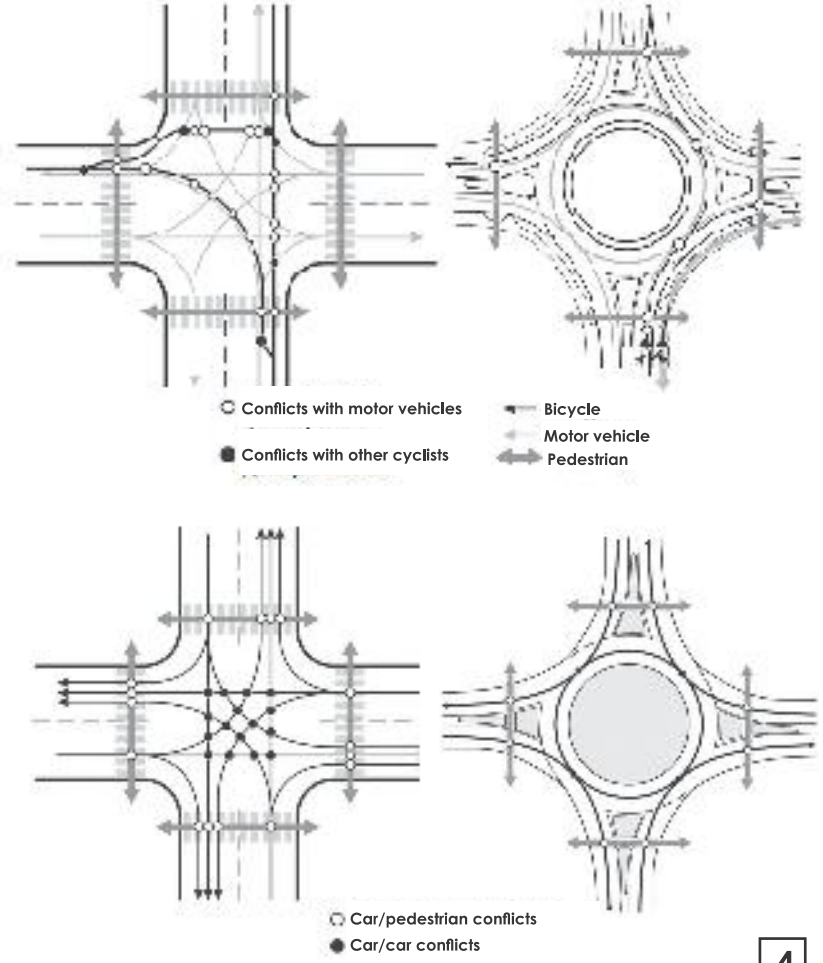
Minimizing Conflict Situations

Related to the safety of intersections, one perspective is to view how many possible conflict situations can arise when crossing the intersection. The safest type is a multi-level intersection, since with the help of it the possibilities of a conflict can be eliminated. Since a multi-level intersection is most often not possible, crossing has to be made on the same level. In this case it is important that travellers can easily notice each other and anticipate each other's movements.

With regard to safety it is important to minimize such situations at intersections in which conflicts can arise. In addition, when planning it has to be taken into consideration that cyclists and pedestrians are in the motorist's field of vision in an area where the forms of transport intersect. T-intersections that intersect cycle and walking routes are safer than four-way intersections, since there are fewer conflict points and both pedestrians and cyclists are easier to detect. When inspecting the number of conflict points, a roundabout is the safest level crossing, because it has fewer possible conflict situations.

	Type of intersection	
Parties of the conflict	Four-way intersection	Roundabout
Car vs. car	16	4
Car vs. pedestrian	16	8
Car vs. bicycle	18	8

3



Source: FHWA 2000

4

3
In addition to few conflict points, the advantage of a roundabout is its clearness. All vehicles go to the same direction in the intersection and, due to the curves, speeds stay slow.

4
The picture shows conflict points in four-way intersections and roundabouts from the point of view of a cyclist and a motorist. In a four-way intersection there are 18 possible conflict points between a cyclist and a motor vehicle, whereas there are only 8 in a roundabout.

5
In The Netherlands, a direct walking connection goes from the railway station of Zwolle towards the centre. Special attention has been paid on the directness of the pedestrian crossing point in the intersection. In addition, the crossing point has traffic islands to improve safety and accessibility has been considered. Cyclists travel along the road and in roundabouts like other vehicle traffic.

Choice of Intersection Has an Effect on Safety

With regard to smoothness and traffic safety, the best intersection alternative for a cyclist and a pedestrian is a grade-separated intersection, if it has been developed so that the level variations are not too steep and the solution does not make the trip longer. However, the most common intersection type is a level crossing, and the safest alternative is a roundabout. Cyclists can go around the same space with private car traffic, if car speeds are at most 30–40 km/h. With higher speeds, a sidestrip should be made between cyclists and the motor traffic. Traffic light intersections are the second safest choice, if the speeds and volumes of car traffic are high. It is often important to make separate light guidance for all forms of traffic, and if possible, benefits should be given for cycling and walking, such as the possibility to turn freely to the right regardless of the traffic lights. To calm car traffic for instance, speed bumps, elevations or traffic islands can be used in an intersection area.

Main cycleways have to have right of way when intersecting with the residential streets, calmer collector roads and lower-level cycleways. Unambiguous indication of the obligation to give way is important with regard to traffic safety and smoothness of traffic.

6

In general, the following use recommendations can be stated for intersection alternatives on the basis of the driving speeds of motor traffic. In addition, traffic volumes and the width of the routes influence the choice of the intersection type.

Grade-separated intersection:

- When speeds are over 70 km/h

Traffic light intersection:

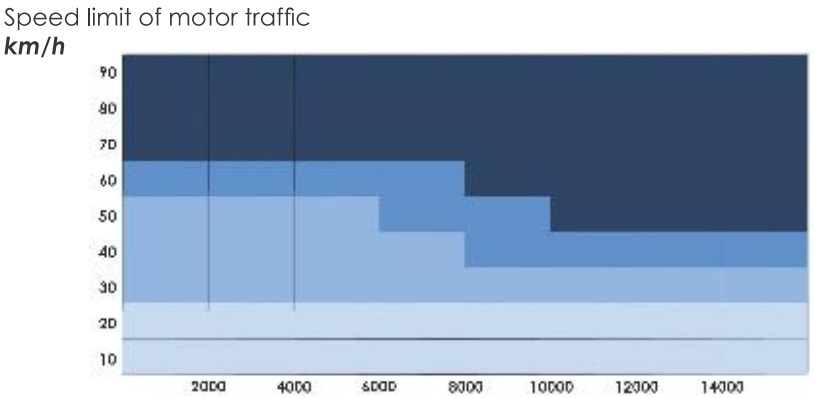
- When speeds are 40–50 km/h

Pedestrian crossing with a traffic island and/or speed bumps:

- When speeds are 30–40 km/h

Pedestrian crossing without a traffic island:

- When speeds are 30 km/h or under



Cross-section of motor traffic

Source: Tielaitos ja Suomen Kuntaliitto 1998

6
All modes of transport have to be taken into consideration equally in an intersection. The picture shows a well-designed intersection, in which all forms of traffic have been guided clearly. (Amsterdam)

7
Copenhagen uses a lot of resources especially for promoting the safety of cycling. The city has separate planners who concentrate on planning intersections. Safety and functionality are important criteria for an intersection of good quality.

Cycle Traffic Has to Be Guided

Information provided with traffic signs and road markings has to be clear and unambiguous. Especially at intersections it is important that the traffic environment guides the traveller. Good planning of the environment reduces the need for traffic signs. If there are a lot of unnecessary signs, their credibility and notice value decrease. In addition, the continuity of routes is supported by the fact that road markings and signage are up to date.

A bicycle is a vehicle, so guiding cycling has to be made according to the requirements of vehicle traffic. In the best cycling cities of Europe, cycling in intersections is as logical as driving a car, as can be seen in the pictures 8 and 9. The environment guides how cyclists should behave. For instance cyclists turning in different directions are often guided to separate lanes in the intersection. It has to be noted that the intersections of cycle tracks have also been made according to the criteria of vehicle traffic. For instance the obligations to give way have been clearly pointed out with give way signs and street markings.

Sufficient Visibility Distances Help to Anticipate

Thanks to good visibility distances, travellers notice each other from a sufficient distance, so they have enough time to act safely. To achieve sufficient visibility distances for instance in intersections, plants should be low. Ensuring sufficient visibility distances is important also during maintenance works, in which case intersection arrangements may deviate from the usual in other ways. If sufficient visibility distances cannot be ensured, for instance due to the forms of the landscape, the conditions of the intersections have to be altered. Measures for this are, for instance, reducing speeds and using warning signals, narrowing the route or using traffic islands.

8
In an intersection of two cycle tracks, right of way has been clearly pointed out with road markings. (Houten)

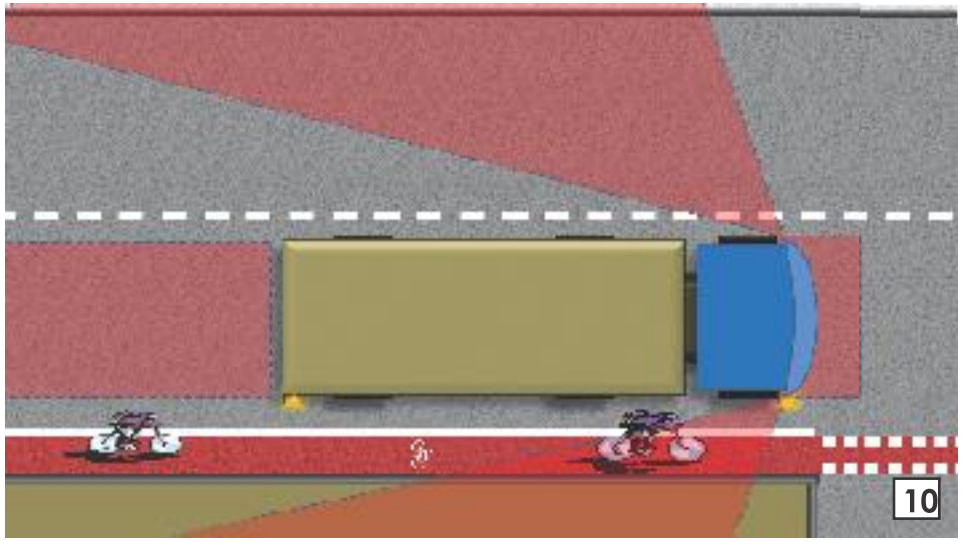
9
Good visibility distances increase the safety of the intersection. In Houten, motorists give way to cyclists.

Blind Spot a Threat to the Safety of Cycling

Cycle boxes and moving the stop line of car traffic further back improve the safety of cyclists in traffic light guided intersections. Cyclists are made more visible, since it is easier for motorists to notice cyclists who stop in front of them. A risky situation is created when a cyclist arrives at an intersection during the green phase and a motor vehicle turns right straight in front of a cyclist. It is therefore difficult for a motorist to see any bicycle coming from behind. The greatest danger is when a heavy vehicle turns right, since in a truck the visibility on the right side is limited.

Accidents between a bicycle and a heavy vehicle are usually very serious. In Holland studies show that 32% of them are fatal for the cyclist. Accidents between a truck that is turning right and a bicycle are even more serious, since the death rate of cyclists is as much as 41%.

The risk of accidents due to the blind spot can be reduced by, for instance, installing extra mirrors or cameras into heavy vehicles or at intersections. Daytime running lights that are activated when a bicycle and a car are simultaneously in a dangerous intersection can be installed on popular cycle routes, along which there is also a great deal of heavy traffic. A recommended solution is to separate the cycleway from the carriageway with a sidestrip at the point of the intersection.



10
The red areas form a blind spot when viewed from the side mirrors of a truck. A cyclist who is riding on the cycle lane on the right-hand side of the vehicle is in danger if the truck turns right at the intersection and the cyclist continues straight ahead.

11
A mirror has been installed at the intersection, so that the drivers of heavy vehicles can see whether there are cyclists on the cycle lane next to the road. (Freiburg)

12
A residential street intersects with the main cycleway. Cars have the obligation to give way, which has been pointed out with the give way sign. In addition narrowing and elevation guides the motorists to slow down. (Groningen)

13
Two-way main cycleway crosses the residential street. The coloured surface and clear markings highlight the right of way of the bicycle. The pavement has been separated on the left side of the cycle track as well.

Directionality of an Intersection

Travellers Have to Be Able to Choose the Route on the Run

People usually make their decisions in traffic according to how they anticipate the situation will develop and not how it is seen at a specific moment. Expectations of the behaviour of other road users as well as people's own behaviour in these kinds of situations are tied to the experience they have gained in traffic. Especially in intersections the anticipation can be supported with clear guidance and good visibility. Anticipation can also be improved by, for instance, traffic lights that include information predicting the change of the light.

When arriving at an intersection it is important that travellers perceive easily and quickly how the intersection has to be crossed. The route decision has to be made before coming to the intersection, so that the crossing is smooth and safe. The traveller must know which lane to choose and where to stop, if necessary, and know which direction has the right of way. With regard to functionality it is also important that all users of the intersection are taken into consideration when planning it. The city region zone and the role of routes at intersection define which transport modes are prioritized. For instance public transport can be favoured at intersections along a public transport route. Well designed lanes and traffic lights make the intersection run smoothly.

14 & 15
In The Netherlands, arriving at an intersection and crossing it by bike is clear, smooth and safe. Cyclists who are turning in different directions get in their own lanes on the cycle track. In The Netherlands a cyclist can also turn right when the red lights are on. (Up: Groningen, down: Zwolle)

16
Clear and logical intersection. In Groningen intersections are planned so that cyclists don't have to cross car lines unnecessarily. The coloured surface helps in perceiving the cycle lane.

A residential street connects to a one-way cycle track

When coming from a residential street to higher-level route, the changing of the hierarchy level can be highlighted with material as well as level difference. When coming from a residential street cyclists and motorists give way to vehicles as well as pedestrians travelling on the higher-level route. The hierarchy level can also be seen clearly when arriving from a higher-level route on the basis of the level differences and narrowing of the street. (Groningen)

Collector road connects to the main route

People coming from a collector road on the left have an obligation to give way at the intersection. Changing of the surface material, a small level difference, and a change in the cross-section of the routes shows the change of hierarchy. (Zwolle)

Cycle street connects to a cycle track

The obligation to give way is realized as in car traffic when coming from a cycle track to a cycle street. Cycle coming from right has a right of way. Car traffic is allowed on the cycle street, but not on the cycle track. The traffic island in the middle of the intersection works as a speed bump. (Houten)

Connecting cycleway connects to the main cycleway

Cyclists coming from the left on the two-way cycle track are obligated to give way, which is shown by the give way signs painted on the street. (Groningen)

Residential street connects to a collector road

When coming from a collector road to a residential street, the change of hierarchy level is clear. The surface material changes from asphalt to pavement and the cross-section is clearly narrower. A pavement, which can be noticed from low kerbs and the change in the surface material, has to be crossed when coming from both the residential street and the collector road. (Groningen)

Two-way cycle track connects to mixed traffic route

The speed of cyclists is slowed down with bumps before the intersection. Cyclists on cycle track have obligation to give way, which has been shown with road markings. (Copenhagen)

Solutions in Different Intersection Types

Priorities in Traffic Light Guided Intersections

Traffic lights are used so that all connected directions and routes can be served purposefully. Light guidance is a functioning solution at intersections that are used by 10,000–30,000 vehicle units daily. However, safety at light guided intersections does not reach the safety level of roundabouts and interchanges, which is why they are not considered as the best possible alternatives.

Waiting times in traffic lights are longer for cyclists and pedestrians than for cars. Cyclists and pedestrians cross the intersection slower than motor vehicles and the duration of the green light is short. However, the waiting time can be shortened considerably with different kinds of solutions, in which case the mobility of cyclists and pedestrians becomes smoother, safer and more comfortable.

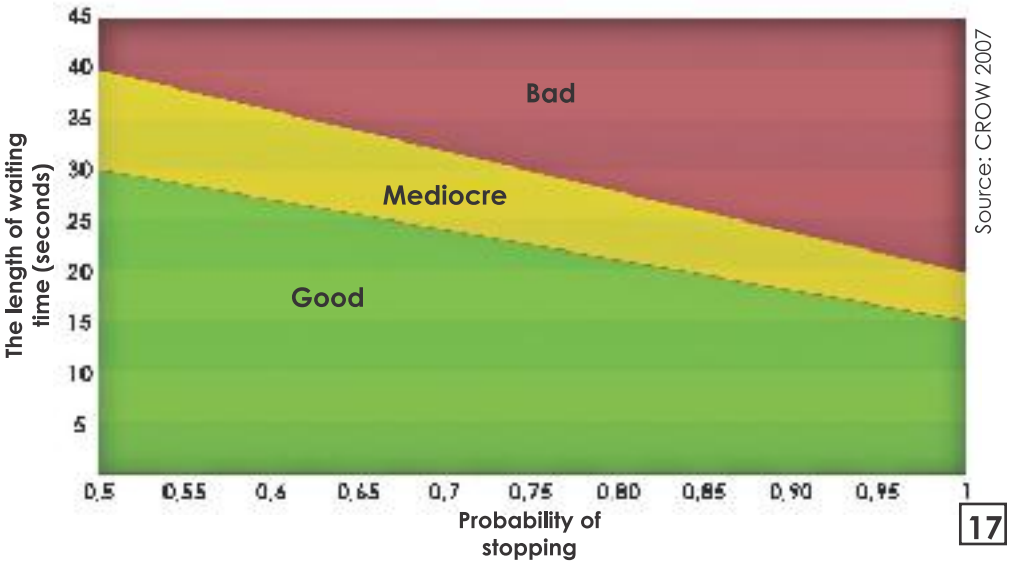
If a cyclist or a pedestrian has to stop at traffic lights, a waiting time of less than 15 seconds can be thought of as desirable. On the other hand, if the probability for stopping at the traffic lights is small, cyclists and pedestrians tolerate longer waiting times. Predictability in traffic can be improved by, for instance, equipping traffic lights with a screen that shows the time until the lights change.

Different Light Guidance for Different Forms of Traffic

In a desirable traffic system, each form of transport has, as a main rule, its own route. If car, bicycle and pedestrian have their own light signals they can be guided separately. In addition, benefits can if necessary, be given to certain forms of traffic, if we wish to improve their smoothness.

Many European cities have good examples of the priorities of cycling and walking in light guided intersections. Traditional methods have been showing the remaining waiting time and making the traffic lights of cyclists turn green before the motor vehicle's lights. The development of technology has also enabled the recognition of cyclists and pedestrians, so benefits can be given to them automatically. For instance, the light guidance of pedestrians can be changed either according to the time of day or season. The green stage of traffic lights can be increased during morning and afternoon rush hours on pedestrian routes that have a lot of commuters. During the winter on the other hand, it takes longer for a pedestrian to cross the road, so the green light stage can be made longer for pedestrians.

The next pages present solutions with which the priorities of cyclists and pedestrians have been improved at intersections.



17
Contentment with the function of traffic lights is based on the length of waiting time for the green light as well as the probability to have to stop in red lights. If the probability for stopping in red lights is low, mobility is experienced as smooth. The average waiting time of a cyclist and a pedestrian should be less than 30 seconds, so that crossing intersections along the route is experienced as convenient.

18
To anticipate the waiting time, these pedestrian traffic lights in Copenhagen have a screen showing the remaining seconds.

19
Groningen has separate traffic lights for cyclists and pedestrians. At the intersections of the busiest routes, traffic lights have a light beam which shows the waiting time.

20
An extra yellow light shows that cyclists have the possibility to turn right freely in the intersection. This solution is at an experimental stage in one intersection in Strasbourg.

21
Odense has a signpost for pedestrians at the traffic lights showing the time until the lights change. With the help of the screen, a pedestrian can anticipate whether it is safe to start crossing.

Free Right-turn for Cyclists

One functional solution for improving the advantages of cyclists at traffic light intersections is allowing a free right-turn. In this case however, special attention has to be paid in planning on minimizing conflicts between cyclists and pedestrians.

There is two alternatives for implementing the free right-turn. Cycle traffic can be guided past the traffic light signal on the right-hand side or cyclists can be allowed to turn right towards a red light. The latter is allowed for instance in the Netherlands.

22
According to the traffic rules, in the Netherlands a cyclist can turn right also when the red light is on. Separate preselection lanes highlight the position of bicycle as a vehicle. (Zwolle)

23
Freely turning right can create a conflict between cyclists and pedestrians. Free right-turn is sometimes forbidden in the Netherlands due to the safety of pedestrians. Thus, cyclists who turn right have separate light guidance. (Zwolle)

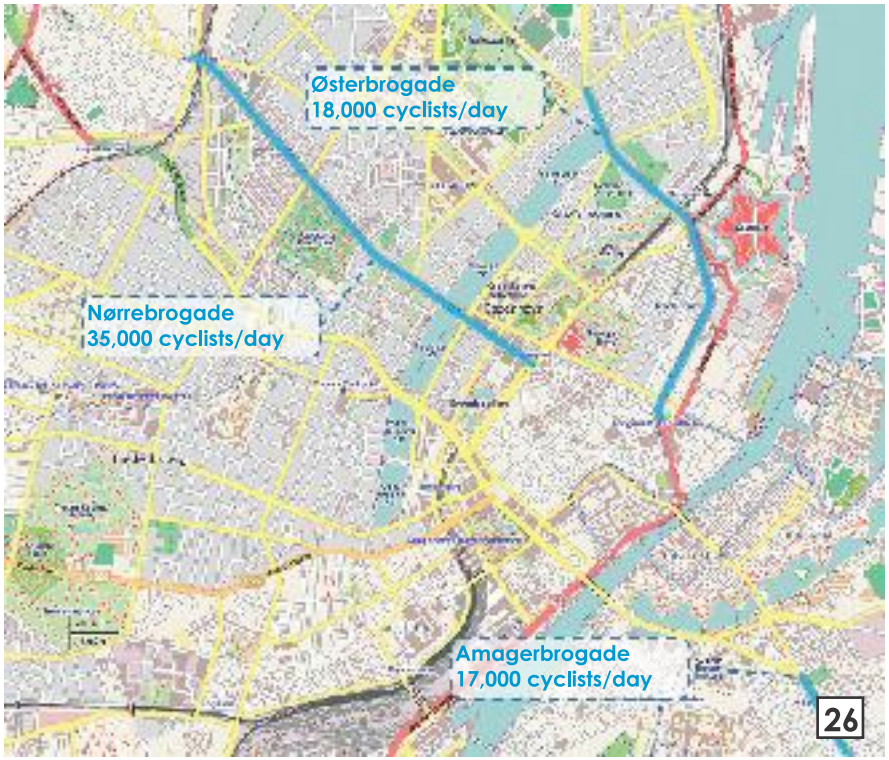
24
Benefits can be given to cyclists also on mixed traffic routes. In the picture cyclists have the right to pass light guidance when turning right along a cycle track. The route continues to the opposite direction on a one-way street. (Stockholm)

25
A high-quality intersection, in which each form of transport has been taken into consideration. Cyclists have their own light guidance and free right-turn. Lanes have been separated by a centreline on the two-way cycle track. Pedestrians have a separate pedestrian crossing. (Amsterdam)

Green Wave for Cyclists

In many cities light guidance has been connected in the most used motor traffic routes so that when driving with the planned average speed, motor vehicles face a green light in successive traffic lights. The green wave has also been applied to cycling in, for instance, Copenhagen and Odense. In Copenhagen, the light guidance of intersections has been timed so that when riding 20 km/h, a cyclist can ride without interruptions. The green wave is applied especially in commute traffic. In the morning the wave works towards the centre and in the afternoon away from the centre, when people are returning home from work.

In Odense, the green wave for cyclists has been refined with the help of ICT. Lights that show that cyclists are on a green wave have been installed alongside the cycle track. Thus, cyclists can more easily maintain the correct average speed, with which travelling proceeds without interruptions. When connecting in a route, by following the lights a cyclist can either accelerate or slow down to get to the green wave.



Automatic Detectors

In Stockholm, inductive loops that automatically recognize a cyclist approaching a light guided intersection have been installed in the asphalt on some of the main cycling routes. The advantage of this solution is that cyclists do not need to separately press the button on the traffic light pole. This makes cycling easier and also speeds up travelling, when the detectors automatically request a green light for cyclists. They also enable adding a counting device of cycling to the system. In this way, it is easy to count cyclists at an intersection and follow the development of the numbers of cyclists.

The Netherlands has experimented with traffic light guidance that functions according to the weather. In addition to a detector of cyclists and pedestrians, the system includes a rain detector. When rain drops fall from the sky, the changing of the green light is made faster and the duration is made longer for cyclists and pedestrians.

26
Copenhagen has a few routes that have a green wave for cyclists. When travelling on the route, a cyclist faces continuous green when the speed is 20 km/h.

27
An innovation has been developed in Odense with which cyclists are guided to the green wave. The middle cyclist always gets a green light on the route by maintaining his or her current speed. The cyclist on the left has to slow down a little and, correspondingly, the cyclist on the right has to speed up a little to get to the green wave.

28
Cycling has been prioritized in Groningen by giving green lights simultaneously to all cycling directions. Thus, cyclists do not have to wait long for the green light. This solution has been found to be safe, and there have been no real conflicts between cyclists. When turning left, the intersection area can also be crossed in the middle on a slant.

Earlier Green for Cyclists

In Copenhagen, light guidance has been timed on some main cycleways so that cyclists get a green light five seconds earlier than drivers going in the same direction. Cyclists get to go over an intersection before the motor vehicle traffic, which reduces the risk of cyclists ending up in an accident, especially with cars turning right.

29
In central cycleways in Copenhagen, traffic lights change green five seconds before the lights of car traffic.

The Waiting space for Motor Vehicles farther back

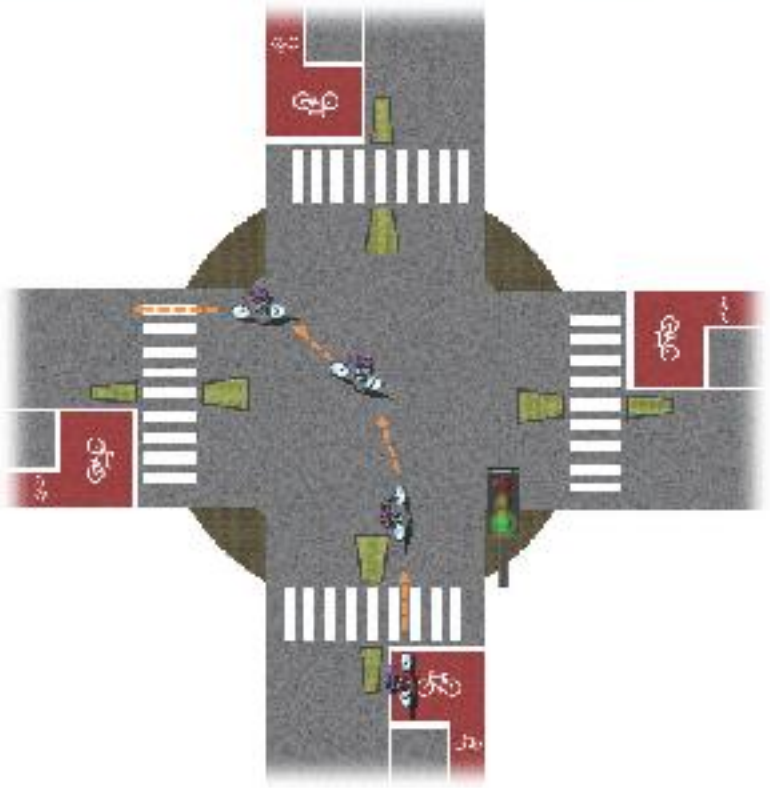
By moving the stop line of motor traffic 4–5 metres farther back, a waiting area can be created at a traffic light guided intersection for bicycles. This waiting area can also be expanded to be as wide as the carriageway, and for clarity, a bicycle symbol can be painted on the area and its surface coloured for instance red. An area created like this is also called a cycle box.

This solution provides safe way to cross the intersection. When cyclists can go and wait in front of cars, the visibility is good and cyclists are in the field of vision of motorists. A further advantage for cyclists is that they are the first to start off at the intersection and they do not have to wait for the change of the traffic lights in the middle of the exhaust gasses.

30
On a motor vehicle lane the stop line is a few metres farther back than the stop line for cycling. This solution increases the visibility of cyclists at an intersection, because they can ride to the front of cars. (Geneva)

Two Different Models for Turning Left in an Intersection

In Denmark and The Netherlands, the traffic rules of cyclists differ when turning to the left. In Denmark, at a traffic light guided intersection and when turning left, cyclists have to make a long turn (left picture), in which case they have to first cross the connecting street direct and then make a right-angled turn to the left. In The Netherlands, cyclists can take a short cut right through the intersection (right picture). In the Danish model, the stop line of motor vehicles is five metres behind the stop line of cyclists. At intersections one-way cycle tracks often change into cycle lanes, which have been coloured blue through the intersection in the main directions of cycling. In the model of The Netherlands, cyclists ride along the cycle lane at traffic light intersections to cycle boxes in front of cars.



Cycle Boxes

Cycle Boxes are Suited for a Small Space

A cycle box is a waiting space in front of car traffic reserved for cyclists at traffic light guided intersections. The advantage of cycle boxes is that cyclists can start off safely and smoothly in front of cars. It is also more pleasant to wait for the changing of the lights in front of cars. Cycle boxes enable a logical way to cross intersections for a cyclist, but they do not give privilege to turns, if turning has been forbidden otherwise.

Using cycle boxes requires that cyclists ride like other vehicles on the carriageway either as mixed traffic or on a cycle lane. Usually a cycle box is marked with a bicycle symbol and, to make the boxes clearer, its surface material can be coloured.

31
Cyclist can start crossing before cars using cycle box. Cycle boxes are a familiar sight in the centre of Groningen.

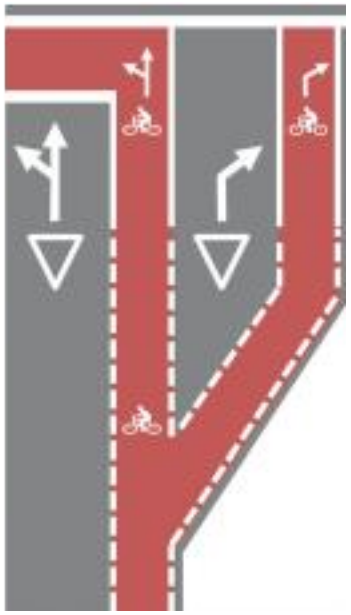
32
When there is a lot of traffic turning right or a lot of heavy vehicle traffic, it is safe to guide cyclists along the cycle lane to the left side of the right turning traffic. This reduces the accident risk between motor vehicles turning right and cyclists who are in the blind spot.

33
The city of Växjö has implemented bicycle lanes and cycle boxes. The logic is the same as in the model of The Netherlands, so when turning left cyclists take a place at the left side of the box.

The Logic of Cycle Boxes Varies

Intersections are very clear in Groningen. The coloured surface increases the visibility of the cycle lanes and the preselection lane arrows make route selection easier. This intersection has a cycle box for cyclists who turn left and ride straight forward. Cyclists who turn right get in their own lane and the stop lines of cars and bicycles are in line.

The accident risk is the highest on the point where right turning cars drive over the cycle lane.

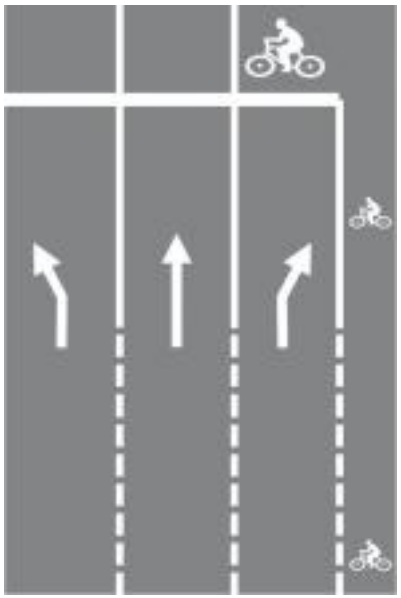


Sense of safety ★★★★☆

Ease of use ★★★★★

Copenhagen has built only a few cycle boxes. The cycle box in the picture is in Fredriksberg. At the intersection cyclists can travel straight ahead or turn right. It is not possible to take a place at the left-hand side of the cycle box when turning left at the intersection, since in that case a so called long turn has to be made.

The stop line of cyclists is further on than the stop line for motorists, which increases the safety of cyclists. The highest risk in this solution is a conflict between cars turning right and cyclist riding straight ahead. Starting off from the box is made easier because the green lights change a few seconds earlier for cyclists than they do for cars going in the same direction.



Sense of safety ★★★★☆

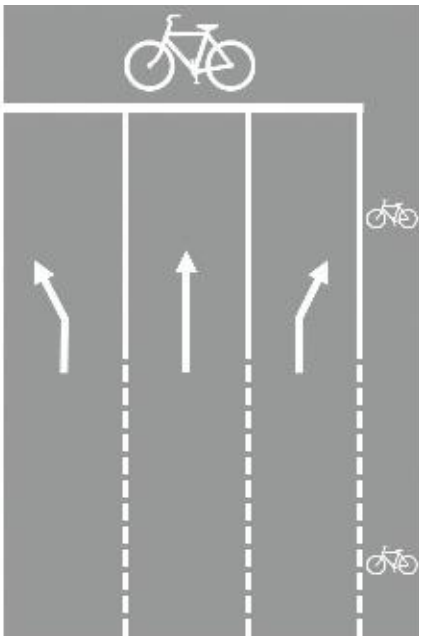
Ease of use ★★★★☆

The cycle lane leads to a cycle box, from which cyclists can turn left or ride straight ahead. When turning right, a cyclist has to use the same lane with the motor vehicle flow. In this solution, cars drive over the cycle lane when turning right at the intersection.

Especially during rush hours, cars that wait for the change of lights on top of the cycle lane create problems. Thus, bicycles going straight forward or turning left in an intersection pass cars on the cycle lane from the left alongside the car lane (Freiburg).

Sense of safety ★★★☆☆

Ease of use ★★★☆☆



In Stockholm, a cycle box on a multi-lane street has been built as shown in the picture. The box is as wide as the whole carriageway, thus making it easier to get into the correct lanes in front of car traffic going in its own direction of travel. The cycle box does not have separate lane markings.

Especially when turning left, the sense of safety of a cyclist remains weak. Cyclists have to give way to oncoming car traffic and if they have to stop, a line of cars going in the same direction forms behind the cyclists. Cyclists can feel that they are "squeezed" by car traffic. In addition, zigzagging between cars during rush hours reduces the sense of safety of cycling.

Sense of safety ★★☆☆☆

Ease of use ★★★☆☆

Roundabout

A Safe Intersection Type

Roundabouts are safe, since the number of conflict points is smaller than for instance at a four-way intersection. Well planned roundabouts are safe and smooth also for cyclists. When riding on a roundabout, cyclists can ride along with car traffic. It is natural to join the roundabout by bicycle either straight from the bicycle lane or, alternatively, from a mixed traffic street where motor vehicles and bicycles travel on the same carriageway.

One-lane roundabouts, where bicycles and cars travel as mixed traffic, have been found to be the safest. However, a separate cycle lane improves the smoothness of cycling in certain situations. If the volumes and speeds of car traffic are high and there is a lot of heavy traffic, it is recommendable to make a separate cycle track at the roundabout to improve safety. Existing roundabouts can be made favourable to cyclists with some quite small measures.

With the help of roundabouts, the traffic environment can be planned so that speeds are lower. On the other hand, the use of roundabouts can also communicate to motorists the beginning of a build-up area or smoothly change the route hierarchy for instance from a regional main route to a collector road.

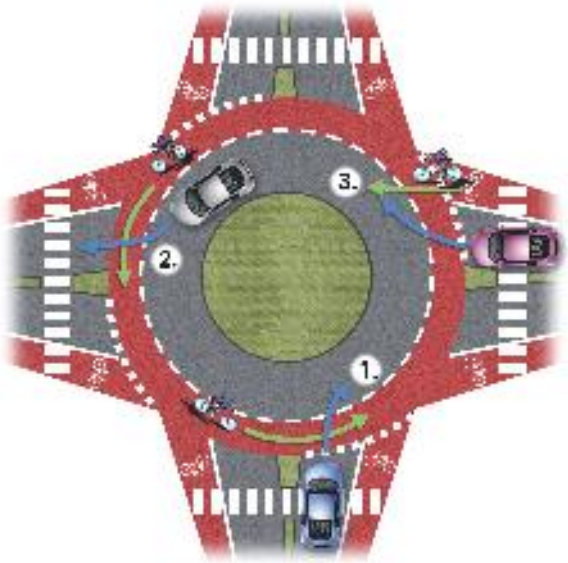
Roundabouts are best suited for the crossing of two routes that have pretty much the same volumes of traffic. Typically roundabouts are suited for points in which two collector roads or a collector road and a residential street cross each other.

Three Conflict Situations

Roundabouts do not completely remove the possibility of a conflict between a cyclist and a motorist, but reduce their number compared to other intersections. There are three kinds of typical conflict situations.

1. One possible conflict situation is created when a motorist arrives at the roundabout and does not notice a cyclist riding at the intersection. This situation is more common in multi-lane roundabouts, where cyclists can stay unnoticed as a motorist strives to come to the inner lane of the intersection.
2. Another possibility for a conflict is created when a motorist exits an intersection and does not notice a cyclist riding on the outer ring of the intersection. This situation occurs most often at roundabouts where cyclists ride on their own lane on the outer ring of the roundabout.
3. A third possible conflict can be created when a car and a bicycle drive to the roundabout at the same time and the cyclist cuts across the cycle lane against the rules right in front of the motorist.

Source: Presto 2011



34
A roundabout with bicycle lane. This is a functional solution for instance on main cycleways, when the speeds of vehicle traffic are at the most 40 km/h and there is little heavy traffic. (Copenhagen)

A One-lane Roundabout Is the Safest

Small one-lane roundabouts are safe for both car drivers and for cyclists. For this reason, they are also well suited for crossings in a high-quality cycling and walking network. Separating cycling on a cycle lane at a roundabout increases the smooth flow and feeling of safety of cycling in certain conditions.

The safety of a one-lane roundabout is based on these factors:

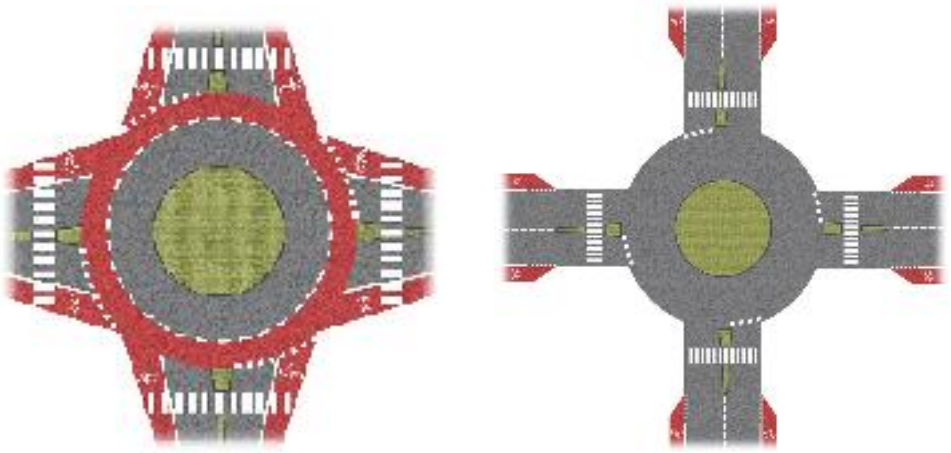
- In a four-way intersection there are altogether 34 conflict points between pedestrians and cars as well as cyclists and cars, whereas there are only 16 in a roundabout.
- In a roundabout the logic is always the same with regard to obligation to give way.
- In roundabouts speeds are reduced in conflict points, since a curve has to be made at them. In addition, there is no danger of an encounter accident at the conflict points, but the parties of a possible conflict already travel nearly towards the same direction.
- The capacity of a roundabout is high, which reduces waiting times compared to, for instance, a four-way intersection.

Source: Presto 2011

Planning Instructions for a One-lane Roundabout

- The recommended width of the road is 5–6 metres, the diameter of the outer ring 12.5–20 metres and the diameter of the traffic island 6.5–15 metres.
- A patch separated with a small level difference can be built on the island in the middle of the intersection. Thus, heavy traffic gains extra width for turning.
- There is no need for a cycle lane along 20–30 metres before the roundabout, so bicycles ride to the roundabout as mixed traffic along with car traffic.
- Exit lanes can improve the conveying ability of an intersection and the safety of motor traffic, but they add one significant conflict point for cyclists.
- A cycle lane forces cyclists to the outer ring of the intersection, where the number of conflict points is doubled compared to a situation in which a cyclist rides along with car traffic in the turning space. According to studies, a cycle lane creates a false sense of safety in a roundabout.

Source: Presto 2011



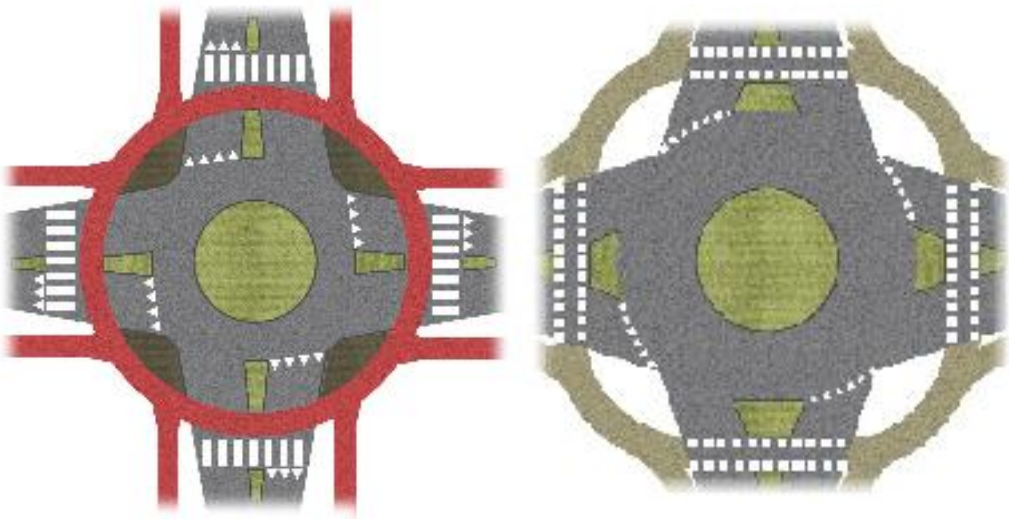
35
With small volumes of traffic a roundabout that does not have a separate cycle lane but where cyclists ride on the same carriageway as cars has been found to be the safest alternative. Cycleways connect to the carriageway before the roundabout and cycling moves once again to its own route after the intersection.

Planning a Roundabout with a Separate Cycle Track

In busy one-lane roundabouts (over 6,000 vehicle units/day) or two-lane roundabouts cycle traffic is usually separated onto its own cycle track. In this solution, cyclists have to go around a longer way but, correspondingly, safety is improved. Special attention has to be paid in planning to good visibility when it comes to the pedestrian crossings.

- The width of the cycle track for the whole way is 2–2.5 metres.
- The lane of the carriageway coming to the roundabout is made narrower to reduce speed. Furthermore, this shortens the length of the pedestrian crossing.
- Separating the carriageways coming to the intersection by a traffic island leaves a safety area for cyclists and pedestrians at the points where the street is crossed.
- By using only one lane to exit the intersection in two-lane roundabouts, the safety of cyclists and pedestrians is improved.
- Raised pedestrian crossings improve the visibility of cyclists and pedestrians as well as gain the attention of motorists and slow down traffic.
- The attention of motorists is directed at possible conflict spots better when the crossing points of cyclists and the pedestrian crossings are placed next to each other.
- High plants have to be avoided between the cycle track and carriageway of a roundabout, because they lessen visibility.

Source: Presto 2011



36
At intersections of busy routes, a cycle track can be built separately from the carriageway. The cycle track that has been coloured red in the picture has right of way through the whole intersection. (Groningen)

37
A roundabout where cyclists ride like motorists. This solution is clear, smooth and safe, when the speeds of vehicle traffic are low and there is little heavy traffic. (Groningen)

Grade-separated Crossings

The Safest Way to Crossing

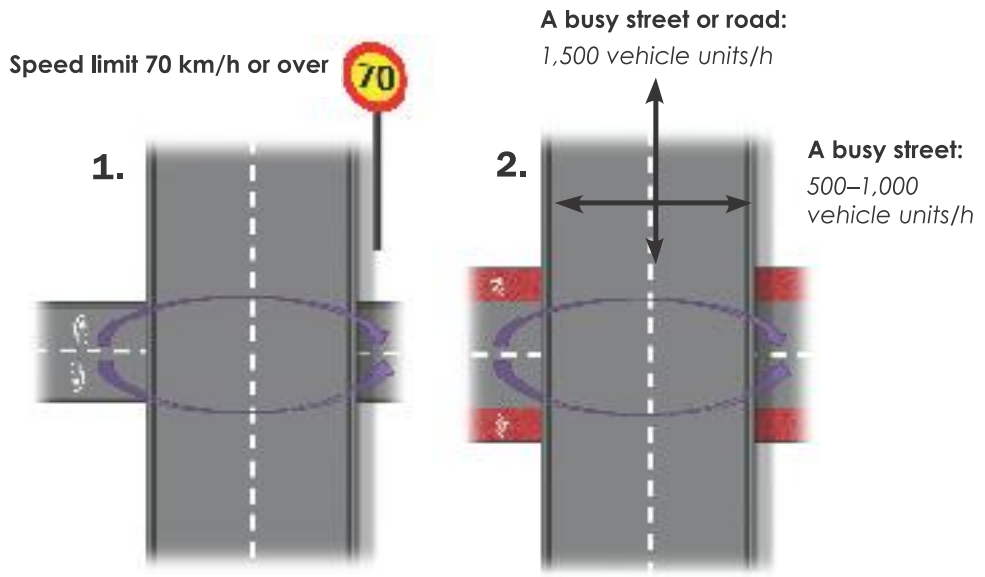
Grade-separated intersections can create safe and direct connections despite different kinds of barriers, such as busy routes and intersections as well as canals and railways. When planning grade-saparated solutions it has to be taken into consideration that cyclists and pedestrians do not have to go around too much and that height variations are not too great. In addition, the grade-separated solution has to be planned so that it improves both the experienced and the actual safety.

There are two demands for a functional grade-separated intersection. Firstly, it has to speed up the journey, so the arrangements cannot create a detour or steep uphill slopes nor decrease the attractiveness of the route. Secondly, the arrangement must improve safety. It is a suitable solution for places where safe crossing with cars cannot be arranged on the same level for cyclists and pedestrians.

Suitability of a Grade Separation

In the EU-funded PRESTO project recommendations have been devised for separating carriageways onto different levels. According to these recommendations, a grade-separated solution is well suited for instance in the following situations:

1. When a significant pedestrian route or cycleway crosses a road on which the speed limit is over 70 km/h.
2. When a busy street (500-1,000 vehicle units/h) equipped with cycling or walking connection crosses with a busy street or road (1,500 vehicle units/h).



Grade-separated Intersections Enable a Smaller Loop Size

City areas often have different kinds of barriers for cycling and walking. Often the distances of crossing points are quite long, in which case the loop size of the cycle and walking network grows. Parts that are difficult to cross can also create a psychological barrier, in which case the attractiveness of the route notably suffers.

There are two alternatives of grade-separated arrangements: a bridge or a tunnel. Both alternatives have their good and bad sides. When planned poorly, a tunnel can reduce the experienced safety. In addition, building a tunnel is quite expensive. Bridges on the other hand, are cheaper compared to tunnels and with them it is possible to create landmarks that are visually of a high quality. On the other hand, bridges often bring uphill slopes to the route, which decreases the attractiveness of the route.

So that the grade-separated solution would not cause unpleasant height differences for a pedestrian and a cyclist, the carriageway can be lowered when there is a cycle or walking bridge and raised when there is a tunnel. These solutions improve the attractiveness of cycling and walking, but do not specifically influence the comfort of a passenger travelling with a motor vehicle.


39


40

Grade-separated solutions can improve the smoothness, speed and safety of a cycling and walking network.

38
When a main cycleway crosses with a busy main route of motor traffic, it is justified to use a grade-separated solution to improve safety and smoothness. (Groningen)

39
In Groningen, a pedestrian bridge has been made on both sides of a lift bridge on a main cycleway that crosses a busy river route. These are meant to be used when the connection through the lift bridge has been disconnected due to boat traffic.

40
The challenge of grade-separated arrangements is often that a complicated solution has been made to improve safety causing detours on the route. The function of the route in the picture was changed from a main route of motor traffic to a quality route for cycling and public transport. At the same time, crossing the street became easier and the grade-separated arrangements were removed. However, stairs were left on location as a symbol to remind people of the development of traffic planning. (Strasbourg)

Pedestrian in an Intersection

On the Terms of the Weakest

Pedestrians are the most unprotected traffic users, which is why their safety has to be taken into consideration especially carefully in traffic. The greatest accident risk occurs in places where a pedestrian route crosses with vehicle traffic. Therefore, intersections have to be well planned from the viewpoint of pedestrians.

A common practice is to mark the crossing of pedestrians with pedestrian crossing markings on the street. This is a safe solution respected by motorists in Europe. It has to be noted that cycling is vehicle traffic, which is why pedestrian crossings have to be marked also on cycleways.

A pedestrian crossing is a recommended solution, when the speeds of vehicles are over 30 km/h or traffic volumes are high. In some traffic environments, such as in a residential street, removing pedestrian crossings is however, often a practical alternative. Thus pedestrians can cross the street where ever they want. Correct traffic behaviour is improved when all travellers have to take each other into better consideration.

41
A pedestrian crossing has been marked also on the cycleway. This clearly shows that cyclists have the obligation to give way as well, when a pedestrian is crossing the road. (Odense)

42
When the traffic environment has been planned from the point of view of calming traffic, crossing the street is safe in any place. Thus, the crossings do not have to be marked with a pedestrian crossing. On a residential street even a roundabout can function with mixed traffic. (Växjö)

Car Traffic Creates a Barrier Effect

Accessibility is important for people with physical and visual impairments, which is why taking these groups into consideration is essential in street planning. However, it is good to be aware of the fact that streets and roads often form a barrier to other pedestrians as well. Children living on different sides of a motorway can hardly travel alone to each other to play. The same can be true in a city area, as well. Small children cannot be allowed to go over wide and busy streets. If these kinds of streets exist along the school trip, parents make the decision to drive their children to school. At shopping areas in the centre, car traffic prevents smooth walking on the street from one shop to another. Busy car traffic also reduces the comfort of walking. Noise and emissions are not the characteristics of an attractive city.

Walking must be as enjoyable, safe and easy as possible in pedestrian zones. Crossing with vehicle traffic causes a bottleneck for walking in the same way as with cycling. Therefore, the aim must be to minimize the crossings of walking and motor vehicle traffic in pedestrian zones. One way is to prevent car traffic in certain areas or streets.

43
Tramline traffic does not create a big barrier effect on pedestrian streets when planned well. (Freiburg)

44
The barrier effect of wide and busy car traffic routes in a city centre is high. (Paris)

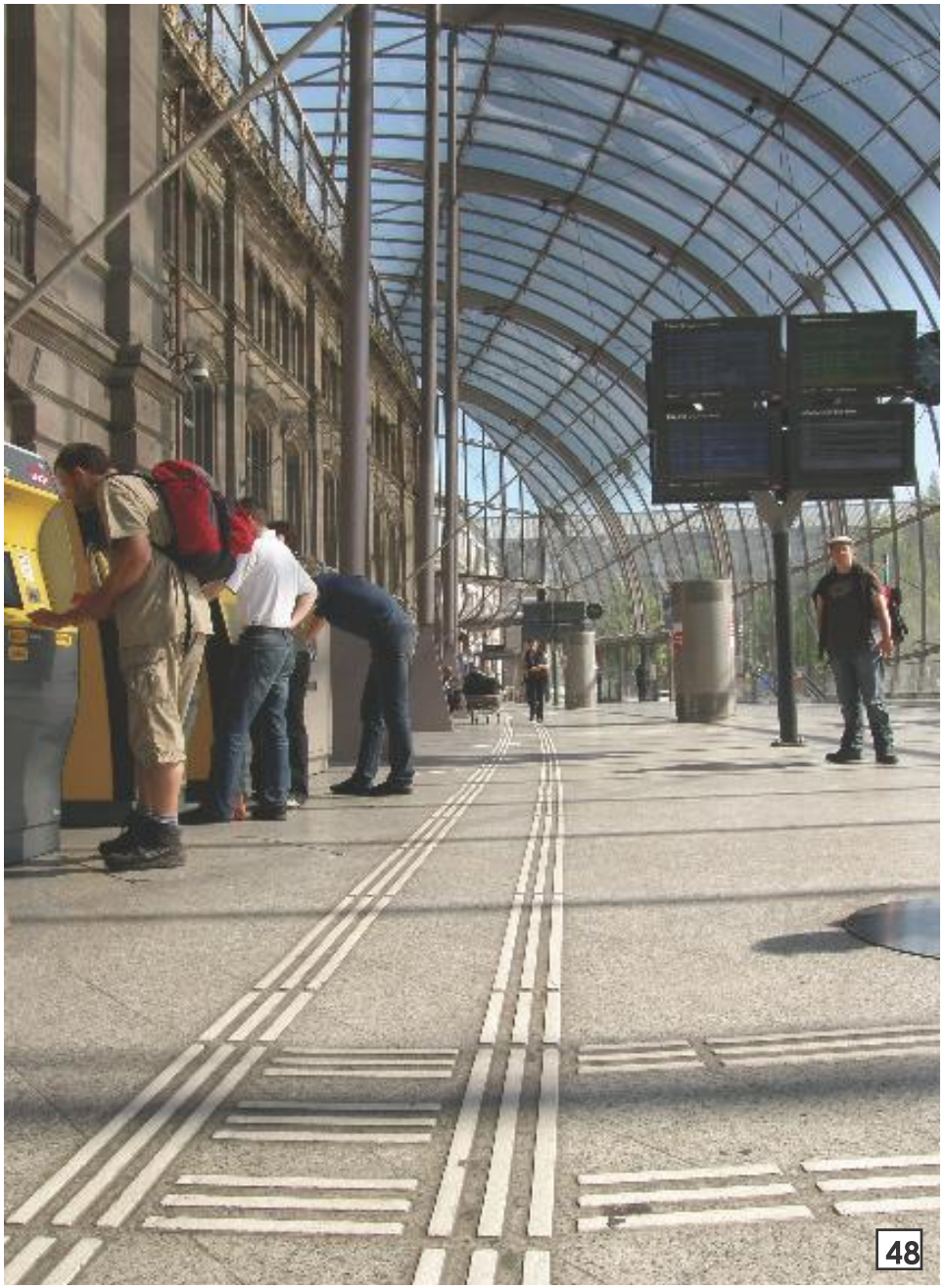
Accessibility is a Part of a Good-quality Mobility

Mobility connects people to life. If people are unable to move, they can lose connection with the society. Therefore it is important to make sure that all groups have the possibility to move around in a city. Special groups that have to be considered are people with physical and visual impairments. These include, in addition to people moving with different kinds of aids, older people, children, pregnant women as well as people with prams. Accessibility must be provided for them on pedestrian routes, public transport stops, terminals and vehicles as well as all the most important destinations their journeys take them to. The co-operation of planners with organizations that promote the benefits of people with visual and physical impairments is important when planning walking environments and public transport services.

45
A slope that enables access across the street has been made on the side of the pavement. (Stockholm)

46
The slope leading to the railway stop also provides access to people in wheelchairs or with prams. (Strasbourg)

47
It is an advantage to both the customers and the shopkeepers when special groups have unrestricted access to running errands. (Växjö)



48
In public transport terminals it has to be ensured that using public transport is possible for the visually impaired. (Strasbourg)

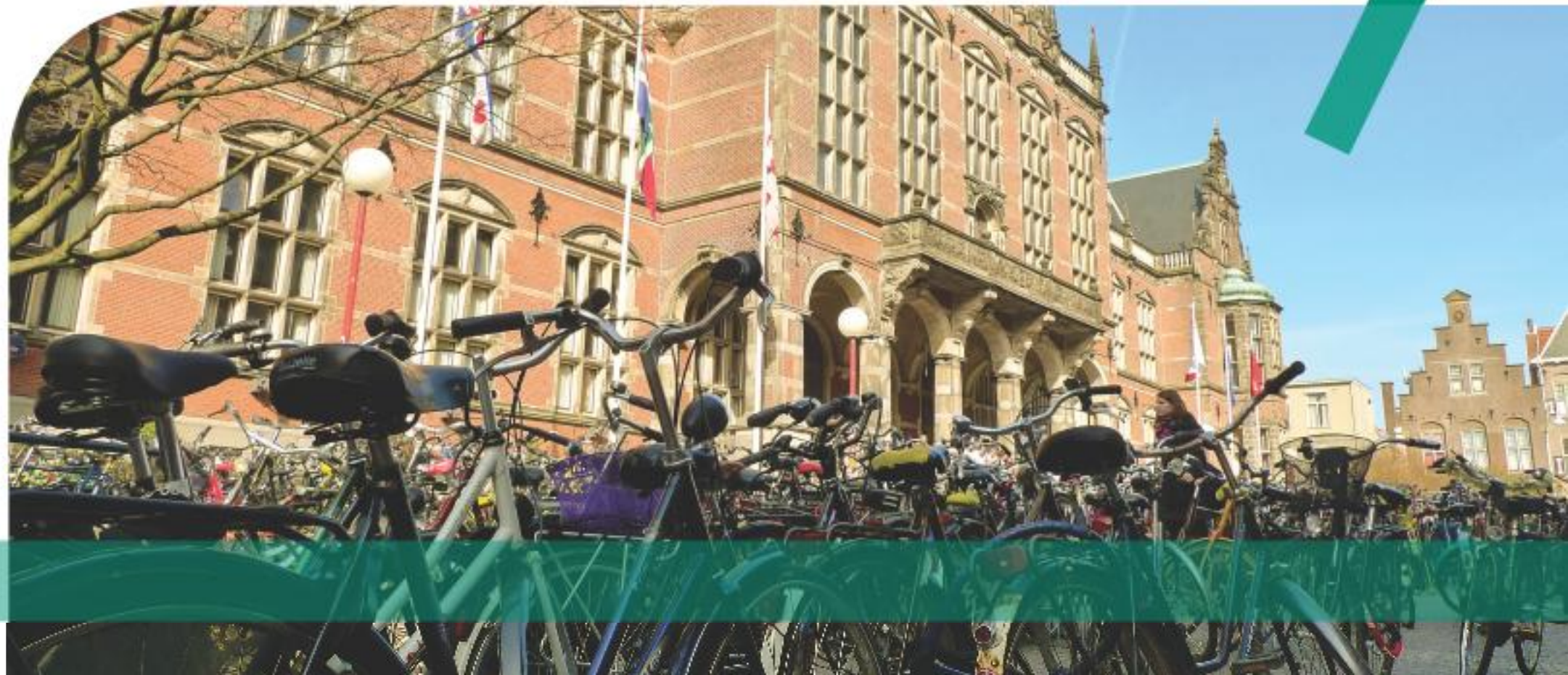
49
The mobility of visually impaired people must be effortless starting from their home door. (Växjö)

7

Smoothly from the Beginning to the End

Parking and Maintenance as Prerequisites

7



Bicycle Parking

Bicycle Parking Is an Essential Part of the Trip Chain

Bicycle parking is an essential part of each journey travelled by bicycle at both the beginning and end of the trip. Well planned and realized parking solutions encourage people to cycle and increase the quality of cycling. Although it is easy to lock a bicycle at the destination, to for instance a lamp post or park bench or leave it against a house wall, this does not decrease the necessity of good bicycle parking facilities. In a village-like environment where there are little residents and everyone knows their neighbour, leaving a bicycle unlocked against a shop wall can in fact, be a functional solution, but in bigger cities and especially in a centre area, random parking of bicycles can lead to chaos. Bicycles that have been parked in unofficial places easily form a barrier for pedestrians and have a negative impact on cityscape. Carefully planned bicycle parking solutions can have an influence on where cyclists leave their vehicle. Bicycle parking areas that are easy to use, safe as well as near the destination are an appealing alternative. They also encourage moving around in a city by bicycle. When repelling bicycle thefts, appropriate bicycle parking is an efficient solution. Good-quality parking opportunities at both the beginning and end of a trip chain, combined to a high-quality cycle network create a clear, continuous and good-quality conditions for cycling.

The planning of bicycle parking must be as essential a part of promoting cycling as building good-quality road connections or other infrastructure. Often parking is forgotten from the planning process and solutions that are made hastily at the last minute do not fulfil the requirements of high-quality parking. In fact, a part of the problem is that there are no clear, unambiguous instructions regarding good parking practices. This influences the decision making process as well as the realization of parking solutions of good quality. In Europe, parking is an essential part of the trip chain and should therefore, be a part of all planning from the very beginning.

1 & 2
Among other things, parking must be safe, near the destination, easy to use as well as purposeful. A shelter protects bicycles from rain and hoop bicycle stands provide good support as well as a safe locking possibility. A two-tier stand is an innovative solution to maximise the use of space. (Freiburg, Groningen)

Quality factor	Explanation
Attractive	Parking must attract cyclists and be compatible with the surroundings as well as good-looking.
Easy to use	Using the bicycle stand must be sufficiently simple and fast.
Situated in a visible place	Parking must be situated in a logical and visible place, so that for instance tourists find it easily.
Safe	It has to be possible to lock the bicycle and parking must be protected from thefts and vandalism. Good lighting and clear routes to the parking create social safety.
Well placed	Parking must be close to the destination and accessible. It cannot cause a barrier, especially for pedestrians. Parking must also be connected to the cycle track network.
Easy to maintain	The parking space must be easily maintained, so that its attractiveness and functionality remain throughout the year.
Enough capacity	The capacity of the parking space must be sufficient also during rush hours and all cyclists must have the possibility to leave their bicycles to the parking space.

Short-term and Long-term Parking

Bicycle parking can be roughly divided into two groups: short-term and long-term parking. These two groups greatly define what kind of a parking solution will be selected for each location and what kinds of demands are placed for parking. Short-term and long-term parking both have their own roles in planning parking and both must be considered when preparing a parking plan or policy of high quality.

Short-term parking mainly refers to for instance parking near shops, shopping centres or restaurants, where it is assumed that bicycles are parked at most for a few hours. From the viewpoint of a cyclist, the most important factor in short-term parking is its close location to the destination as well as easy and fast parking. Therefore, parking places have to be placed primarily near the main entrances. When parked in the vicinity of the destination or along a busy street, also social safety is improved and the probability of bicycle theft is decreased, since there are a lot of passers-by and the cyclists themselves often have the opportunity to keep an eye on their vehicle. If there is no parking possibility in the immediate vicinity of the destination, cyclists often leave their bicycles at unofficial parking spaces. In short-term parking, there is rarely a need for sturdier solutions than ordinary parking solutions, such as a bicycle stand.

3
Short-term parking must be fast and easy to use. When placed on a busy street, parking is also quite safe and often cyclists can keep an eye on their bicycles themselves. (Odense)

There is a need for long-term parking in, for instance, public transport stations, workplace areas as well as residential areas, where bicycles are kept locked the whole day or through the night. Unlike short-term parking, the most important factor of long-term parking is safety. Cyclists have to be able to leave their bicycles carefree at the parking area during the day, even if there is no visual connection to the bicycle. Therefore locked parking solutions that are protected from the weather are a prerequisite for long-term parking. When cyclists can rely on the safety of the parking space, they are often also more willing to walk a longer way to their destination. It can be considered a rule of thumb that it is good to place bicycle parking space as near as the closest parking space for cars. Solutions used in context with long-term parking as well as storage solutions are, for instance, bicycle lockers, larger bicycle centres or guarded spaces.

Bicycle parking is an essential part of the cycle trip and infrastructure.

4
A covered parking area, where a bicycle can be locked from the frame, can be a sufficiently safe solution to parking for one day.

5 & 6
In Strasbourg, a covered, two-level bicycle parking centre has been built in context with office buildings. The parking area has, in addition to stands, for instance lockers as well as air pumps. High-quality parking possibilities encourage employees to cycle.

Parking Is Needed in both the Beginning and End of the Trip Chain

Bicycle parking must be organized in all significant end points of the trip chain, where city residents have the potential to cycle to. These include, for example, centre areas, train stations as well as workplace areas. On the other hand, there must be good parking possibilities also at the beginning of the trip chain, i.e. residential areas, since many trips begin and end at the home door. It can be concluded from the travelling habits of people from where to where they cycle to and, on the basis of this, it can be evaluated which destinations may have the need for parking. It is easy to place parking spaces in predictable destinations or places where people are known to travel to. Also for instance a local bicycle organization can be utilized in planning bicycle parking locations, since the organization often has knowledge of such cycling destinations that planners would not necessarily consider.

Parking has to be located at least in the following locations:

- Residential areas
- Workplaces
- Institutions
- Public transport terminals
- City centre and sub-centres
- Shopping centres
- Sports centres
- Recreational targets

Parking in Residential Areas

Good-quality and safe parking solutions in residential areas attract cyclists. A stand placed along a street does not alone guarantee safety. In single-family houses residents can store their bicycles in their own yard, in which case a separate parking space meant for all residents in the housing area is not necessarily needed. In context with blocks of flats, larger bicycle parks are necessary to guarantee safe storage. Although, within the framework of construction legislation, the aim nowadays is to build functional bicycle parking solutions storage in context with houses, there might not be bicycle parking opportunity in context with houses in some older districts. Compactly build city blocks in the centre of the city create their own challenges to planning parking. Thus, locked, commonly used bicycle storage solutions that the residents maintain together can be built in the neighbourhood. Separate, locked storage buildings or parking solutions placed alongside a street, for instance in the place of a car space, are functional in this purpose. However, parking should be near the apartment and easy to access, so that it is fast to take the bicycle out of the parking space. In Houten, car parking has in some residential areas been placed farther than bicycle parking, which encourages the town residents to cycle. When planning parking in a residential area, guest parking cannot be forgotten either. Due to the short-term duration, simple stands in the vicinity of the houses are often a sufficient solution.

7
An easy to use parking solution near the entrance is fast to use. In unsafe areas, where the risk of theft and vandalism is high, a locked parking space can, however, be a better solution. (Freiburg)

Parking in Centre Areas

Centre areas are one of the most common and important end points of the trip chain. Services, workplaces as well as recreational targets are all located in the centre, so the need for parking is great. Due to its versatility, a parking infrastructure that serves cyclists arriving at different targets has to be planned carefully in the centre area. In many cities bicycle parking in a centre area has caused challenges, since there is a great need for bicycle parking spaces, but often the space is limited. There is especially a lot of short-term parking.

Many shopkeepers in Europe have opposed increasing bicycle parking in a centre and especially opposed turning car parking spaces into parking for bicycles. However, it has been stated that cyclists use more money while shopping than motorists, since cyclists visit the centre often and live nearby. After increasing the number of bicycle parking spaces, shopkeepers have usually changed their opinion and noticed that it has been profitable to increase the bicycle parking places. In addition, bicycle parking is efficient, since about 10 bicycles can fit into a two-tier stand in one car parking space. In a parking facility in Odense, the space of 32 car parking places were turned into a bicycle parking area. As much as 800 places were gained for bicycles instead of cars.

8
In Odense, 32 car parking spaces were changed into parking spaces for 800 bicycles in a parking facility. The bicycles are on a two-tier stand, so space has been used efficiently.

9
Good-quality bicycle parking at a railway station makes it easy to combine bicycle and train on the trip chain. In Houten, free parking has been built directly below the rails. The parking space can be directly accessed from the surface and the rails are accessed along stairs.

10
In a centre, short-term parking has to be easy, fast as well as near the destination and the main entrance. (Copenhagen)

Parking Must Be Located Logically near the Destination

The placement of bicycle parking has a great significance with regard to its usability. A bicycle works best as a door-to-door vehicle, and this advantage can be enabled with well-placed parking. If cyclists have to park their vehicle far away from the destination and walk a long way, the sensibility of cycling and the functionality of parking suffer. Parking must be placed in as logical and visible a place as possible, so that cyclists find it easily. Parking must also be located along a cycle route, so that cyclists do not have to ride past their destination for parking and walk back. The placement of bicycle parking area is different in short-term, long-term and over-night parking.

In short-term parking, a bicycle has to be parked near the destination, ideally only tens of metres away. If, in short-term parking, walking from the stop to the destination increases the length of the visit considerably, cyclists will not necessarily use the parking space in question. Instead, they will leave their bicycles as close to the target as possible, regardless of whether the space in question has official parking or not. On pedestrian streets there should be a possibility to park a bicycle directly outside the shops. When having parked a bicycle near the destination, people walk within about a 100–150 metre radius from the parked bicycle, according to a Dutch estimate. When going beyond this, cyclists take their vehicle with them and park it closer to the new destination. Therefore, parking possibilities have to be located with sufficient density in short-term parking and often it is more sensible to have many smaller parking places in a centre area instead of one big one.

Long-term parking should also be placed near the destination, if possible, but the walking distance can be a little longer than in short-term parking, however at the most 30–50 metres. If parking is of a high quality, guarded as well as covered, people are more willing to walk a little further. In over-night parking the walking distance from the stop to the destination can again be a little longer, however no more than 100 metres.

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11 & 12
When parking short-term, cyclists wish to leave their bicycle as close to the main entrance as possible. If suitable parking possibility is not provided, bicycles are easily left in unofficial parking places, such as next to lamp posts. This can make the mobility of pedestrians more difficult.

Signage and Visibility

If cyclists do not know where bicycle parking is located or the parking area is not in a visible place, they will not probably use it. It is not sensible to spend a long time looking for a parking place. Parking must be placed in a logical and visible place, so that cyclists find it as easily as possible. If cyclists find the parking place easily, it is possible to strive towards not needing signage at all. However, if there are a lot of tourists or random cyclists in the area or if parking is situated underground, using signage can be very necessary. Signage must be comprehensive and clear so that it is easy for cyclists to find their way directly to the parking place and there is no room for guessing the location. In context with signage, it is also possible to inform of other services that are offered in the parking centre.

Bicycle parking should be located	Explanation
As a main rule on the level of the surface	Parking can be accessed most easily on the surface level. In underground or multi-storey parking, good connections must be ensured for instance with slopes.
In context with the main entrance	The location of parking in context with the main entrance or in immediate vicinity of it makes parking easy and safe, since there are a lot of passers-by.
In a visible and logical place	Bicycle parking must be easily seen and in a logical place. There are also a lot of passers-by in a visible place, which reduces the risk of thefts.
In an accessible location with regard to other forms of transport	Bicycle parking can easily become a barrier for pedestrians. Especially visually impaired people should be taken into consideration in the placement of parking. Bicycles cannot form a barrier to other modes of transport, either.
In all essential locations	Bicycle parking should be located in a place that has a special need for parking. These kinds of places include workplaces, institutions, the centre, sub-centres, train and bus stations, residential areas, sports centres as well as culture and recreational locations.


13


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13
In Groningen, a partly underground parking facility in context with the railway station can be reached easily and it is also visible from the surface. It is easy to ride inside the facility along a gentle slope and there is room for as much as 4,600 bicycles. Parking is free and there is camera surveillance.

14
In Strasbourg, directions painted on the ground guide cyclists to the parking facility from both directions.

Different Kinds of Parking Solutions

There are already various solutions to park and store bicycles, and the supply grows constantly. Parking solutions must always be considered case-specifically by taking the needs of cyclists and the conditions of the city into consideration. For instance weather conditions and especially winter influence planning of the parking solution. However, none of these factors prevents developing and building good-quality parking. The circumstantial factors just need to be taken into consideration. Parking solutions can be roughly divided into two groups: bicycle stands and bicycle storage facilities.

Bicycle Stands

Choosing the right kind of a stand can be challenging. Althought nowadays there are various bicycle stands available, not all solutions are directly applicable in all environments. Many countries have ended up using two stand-types that are best suited for bicycle parking: a vertical butterfly rack as well as a hoop bicycle stand that is also called a Sheffield stand.

The table in the next page presents the commonly used stand alternatives, the suitability of which varies in different locations. Although recommendations for stands are very different in different countries, safety and usability of the stands are common factors.

The Bicycle Parking Facility in Groningen

In January 2007, Groningen opened a large, partly underground bicycle parking facility. City Balcony was built in context with the railway station. Since it opened, the free parking facility has been a great success and its 4,150 bicycle spaces were instantly filled. Although the parking space is largely situated underground, the space is, however, full of light thanks to large holes in the ceiling. Routes leading to the parking facility are wide, so it is easy and safe to travel along them. Gentle slopes take travellers directly from the surface to the parking facility, so there is no need to use the stairs or a lift. The facility has a lot of two-tier parking, which enables efficient use of space.

The parking facility is supervised during the day and incorrectly parked bicycles are controlled. Also abandoned bicycles are removed as quickly as possible, so they do not take up space. To ease monitoring, a sticker is placed around the tires of the bicycles. If the sticker has not been removed for four weeks, the bicycle will be taken aside.

The parking facility in the railway station feels safe due to the amount of light. Attention has been paid on safety also in the architecture, since the columns supporting the ceiling have been placed on a slant, so people cannot hide behind them. Small details influence the quality of parking quite a lot.

	Stand Type	Advantages	Disadvantages	Other observations
	**Vertical butterfly racks**	+ Suitable for short-term parking + Easy to install and maintain + Relatively economical	– Does not support the bicycle from the frame – Bicycle can slip away from the stand if there is no gentle slope towards the stand	In the vertical butterfly racks the holders have to be wedge-shaped.
	**Horizontal butterfly racks**	+ Easy to install and maintain + Relatively economical	– Does not support the bicycle enough – Not possible to lock the bicycle from the frame – The front tyre often leans against the holder and can be damaged – Bicycle can fall over easily	The use of horizontal butterfly racks is often not recommended at all.
	**Sheffield stand, hoop bicycle stand**	+ Possible to lock the bicycle from the frame and one of the tyres + Locking the bicycle is easy + Easy to maintain + Relatively economical	– The whole capacity cannot always be used, since cyclists do not necessarily lock two bicycles on different sides of the same stand.	Sheffield stands are very popular and, in some cities, the primarily used bicycle stands.
	**Two-tier stand**	+ Enables efficient use of space + Bicycle is on a separate stand, so it can be handled without touching the other bicycles + Clear	– Lifting the bicycle to the second level can be difficult, especially for the elderly. – Not always very good-looking aesthetically.	Well suited to places where there is little space but a great need for parking as well as for long-term parking. Covering reduces the appearance problem.
	**Two-level wheel or handlebar racks**	+ Easy to install + Relatively economical + Saves space	– The bicycle has to be lifted on the stand – Not possible to lock the bicycle from the frame to the stand – Bicycle cables are easily attached to the stand when lifting it away	The use of a two-tier stand that requires lifting is often not recommended.
	**Standless parking**	+ Easy to maintain + Very economical + Easy to adjust to the environment	– Bicycle cannot be locked anywhere – If the bicycle does not have a kickstand, it is difficult to park – Bicycles fall over easily – Parking easily spreads outside the marked space	Well-suited especially for short-term parking. The parking area must be marked clearly, so that bicycles are not left outside the official parking area. A cover can also be added to standless parking.

As the stand markets are becoming more diversified it is good to remember that a stand must be first and foremost safe, easy to use and purposeful. It has to be firmly anchored to the ground, so that theft and vandalism are made as difficult as possible. Especially when a bicycle is left on a stand for several hours, and the cyclist cannot keep an eye on the bicycle, it should be possible to lock the bicycle from the frame and, when possible, one of the tyres. The stand must be spacious enough, so that locking the bicycle is easy also when considering possible supplementary parts, such as a child seat. The parking of bicycles of different sizes, such as children's bicycles, must be possible. A well-planned stand does not damage the bicycle in any way, for instance by scratching or bending the tyre.

A bicycle stand can be an element that goes well together with surrounding environment, is easy to maintain and, when taken care of properly, attracts cyclists. Although functionality and usability are the most important factors when planning bicycle parking, the appearance of parking and making it fit into the environment cannot be forgotten. Even though especially in centre areas bicycle parking is often opposed on the basis of its messy appearance, innovative planning can create solutions, with the help of which parking can be made a part of the environment.

Quality factor	Characteristic
Safe	• Firmly attached to the ground • Enables locking the bicycle from the frame and one or two tyres
Easy to use	• Spacious • Suitable for bicycles of different sizes • Simple locking possibility
Purposeful	• Sufficiently supports the bicycle • Does not damage the bicycle in any way • Goes together well with the environment • Easy to maintain

The willingness of cyclists to pay for parking varies in accordance with the quality and length of parking. Cyclists are more willing to pay for safe, covered, high-quality and easy to use parking that is situated near the destination and where people can safely leave their bicycle for the whole day or even for the night. However, charged parking has to be of very good quality, so that cyclists rather pay for parking than leave their bicycles on unofficial parking spaces. The charges of parking always have to be considered case-specifically. In short-term parking, where the purpose is to be fast and smooth, charges can guide cyclists to park outside the stand. In long-term parking, however, the situation is different. In Denmark, cyclists pay a certain charge a year for lockable parking spaces in context with train stations. With these payments, the cyclists get a key or a key card to the parking area. The price is usually 100-200 Danish crowns (about 15-30 EUR) per year. Even if cyclists were willing to pay for good-quality parking, free parking of high quality can, on the other hand, attract more people to cycle and use the parking.

In Strasbourg, parking in the parking facility is free for an hour, five hours costs 50 cents, parking the whole day one euro, and day and night two Euros. As a return cyclists gain a safe and good-quality parking space for their bicycle.

Bicycle Storage Facilities

Parking solutions related to bicycle storage facilities are an alternative when bicycles need to be parked for longer periods of time. Storage facilities can be divided into three different types: individual and collective bicycle lockers as well as monitored parking space. All these three parking solutions are safe and very efficient when preventing theft and vandalism. However, bicycle lockers especially take up considerably more space than regular bicycle stands. That is why attention has to be paid to placing them already in the planning stage of residential areas. Also their appearance is often inferior to other parking solutions and difficult to fit into the environment. Storage solutions usually also require a functional key control system and a party who takes care of the issue. When it comes to safety, however, they are definitely the most efficient solution when compared to other parking solutions.

Individual bicycle lockers work like a storage, but each bicycle has its own locker. The system is suitable in situations where there is a need to protect individual bicycles against theft and vandalism, but there is no demand for a larger bicycle parking system. The lockers usually operate with a key or a key card, which can be claimed either free of charge or against compensation depending on the location and user group of the locker.

Photo: Heijmerink Wagemakers, Bicycle Box

In collective lockers several cyclists can lock their bicycles in the same space. All of the users have their own key, with which they can put their bicycle in the locker and take it out. Shared bicycle lockers take up considerably less space than individual ones, but the key owners have to trust each other that the locker is kept in good condition and the door is always locked after use.

Surveillance in context with parking should be considered in targets that have a lot of bicycles, plenty of long-term parking or a high theft risk. Railway stations are a good example of this kind of parking. Surveillance can either be managed with the help of hired guards or video surveillance. In some places, placing bicycle parking along a busy street provides enough surveillance. In Houten, a bicycle parking area has been built under the railway station. This area is guarded for about 20 hours a day from the first train in the morning to the last one.

Véloparc is Strasbourg's own parking model that has been developed especially for interchange parking. These covered parking spaces are safe, storage-like buildings that can hold 20–100 bicycles. Véloparcs have been placed in context with the largest tram stops as well as some bus stops and they are open 24 hours a day, every day of the year. Véloparcs function with a public transport card, which makes combining for instance bicycle and tram trips easy and fast.

Other Parking Solutions

Underground parking is, as the name suggests, a parking facility built under the surface of the ground. In underground parking signage and the clarity of the entrance have to be taken into consideration especially well. This parking system is particularly suitable in a centre area, where there is often little space on the surface but a great need for parking. The routes of an underground parking space have to be clear, for instance gentle slopes, and the space has to be well lit. Usually underground parking is only recommended in special situations.

In automatic parking bicycles are placed in an entrance station that transports them automatically to a tower-like parking space situated either underground or on the surface. The bicycle can be received easily from the same station. This solution is very safe, since there is no separate access to the bicycles. The entrance station can be placed on the ground level, in which case parking can be reached easily. Underground parking facility is suitable in locations where space is limited on the surface.

Multi-level parking can be considered in places where there is a high demand for bicycle parking but little space. The advantage of a multi-level parking facility compared to underground parking is its good visibility and clarity of the entrance. Enough space has to be reserved in a multi-level parking facility to enable good accessibility with a bike between different storeys. Bicycles can also be placed on two levels inside one storey, in which case the use of space is more efficient.

Bicycle key (Cykelnøglen) is a system developed in Odense, with the help of which bicycles can be locked to the ground safely. A key chain in the end of a wire is strung through the bicycle's own lock peg, so cyclists do not have to carry a separate lock with them, but the bicycle is firmly bound to the ground. Loose wire goes back underground, which keeps the key hidden when it is not in use.

Choosing a Suitable Parking Solution

Choosing a bicycle parking type depends greatly on the location and duration of parking. There are several different alternatives, but the most important factor to consider is to choose parking solutions that serve each location best. As a main rule, fast and easy solutions, such as bicycle stands or a separately reserved space on the street level, are recommendable in short-term parking. In long-term parking, on the other hand, guarded storage solutions that are protected from the weather are often more recommendable than just stands. However, choosing the parking method depends on the profile of the location as well. In unsafe areas, where the risk of theft and vandalism is high, sturdier parking solutions are a better alternative. Whereas in safe areas the need for surveillance or a locked parking space can be considered case-specifically.

15
In short-term parking it is important to place parking near the destination as well as to offer, in some cases, a possibility to lock the bicycle from the frame. In Strasbourg, a good-quality bicycle parking area has been placed right in front of the main entrance.

	Short-term parking < 30min	Short-term parking 30min – 4h	24 hour parking	Over-night parking
Requirements	• In the immediate vicinity of the destination • Quick • No need to lock the bicycle from the frame	• In the immediate vicinity of the destination • Quick • Possibly the need to lock the bicycle from the frame	• Safe • Possibility to lock the bicycle at least from the frame	• Safe • Guarded • Locking the bicycle at least from the frame
Solutions	• Parking the bicycle on the kickstand • Bicycle stand	• A bicycle stand on which the bicycle can be locked • Possibly a cover	• Covered • Locking the bicycle to the stand from the frame • Possible surveillance in the parking area	• Covered • Locked and/or guarded
Location	• Centre area • Shopping areas	• Centre area • Shopping areas • Restaurants • Recreational locations locations	• Workplaces • Institutions • Schools • Public transport stops	• Residential areas • Public transport terminals

Parking Norms and Dimensions Guide Planning

Parking Requirements as a part of Legislation

Even if cities have information on what kind of parking solutions would be most efficient, this alone is not enough to guarantee good parking. Bicycle parking has to be a part of both the planning process and legislation, so that good parking principles are transferred from theory into practice. Taking parking into consideration has to be a part of all building projects from the beginning. Often bicycle parking is not a part of project definition, in which case no money has been budgeted for it and, therefore, building it is not invested in. Thus, often the goal is to organize parking as quickly and inexpensively as possible at the end of the project. This can result in poorly planned parking solutions that do not meet the requirements of cyclists and do not attract users.

In the planning process it has to be clear whose responsibility planning bicycle parking is, who is in charge of the costs and who of execution. Planning bicycle parking should occur in cooperation with other parties of the city, such as planners and builders, much like car parking is planned. For instance in Odense an order has been given to shopping centres to build as many bicycle parking spaces as there are spaces for cars. Building orders have to have clear instructions and rules for building bicycle parking. Clear instructions on the quantity of parking in different targets are the basis for planners and builders. Very often cities only have a mention of sufficient organization of bicycle parking in their norms and legislation. This kind of a mention is, however, too unclear and ambiguous and does not reveal anything of the actual quantity or quality of parking.

Municipalities can influence the building of bicycle parking through, for instance, town planning, building order as well as building permits. Organizing bicycle parking in certain areas has to be mentioned in the city plan. The plan strongly guides the building and creates limits and instructions for building in the city area. Through building permits municipalities can supervise the builders to take bicycle parking into consideration in new locations as defined in the plan. In addition to the number of bicycle parking spaces, the orders should also consider the functionality of parking and choosing the best solutions. Even if the number of parking spaces would be correct, this does not necessarily mean that parking is functional and purposeful or that the stands have been placed correctly. Therefore, municipalities have to devise instructions including the number of bicycle parking spaces as well as placement solutions and technical solutions. Also separate parking policy and parking plan guide the realization of parking facilities and set goals for the municipality regarding the level of bicycle parking. Parking should also be a part of the cycling plan.

There Should Always Be Space for One More Bicycle

Evaluating the number of needed parking spaces can be very challenging and often it is easier to roughly estimate the need and follow how the use rate will develop. On the basis of this, parking can be increased if necessary or moved to a place where there is more need or where there are bicycles in any case regardless of the parking possibility. However, systematic planning and follow-up are the most efficient ways when defining the need for bicycle parking. At first it is good to map all parking spaces and mark the bicycles on them on a map without forgetting bicycles that are placed outside stands. If bicycles are parked a lot outside official parking spaces, it can be assumed that the parking arrangements are insufficient, badly placed or unsuitable for the use of cyclists. For conclusion the need for parking in the future is estimated based on travelling behaviour studies, new building targets that have the need for parking as well as user profiles of cyclists. On the basis of this information it can be deduced if there are enough parking spaces as well as if they are correctly placed and of good quality. However, the most important factor is that the supply and demand for parking are balanced.

To make sure the capacity of bicycle parking stays sufficient and parking would be sensible, there should always be about 20% empty space in a bicycle parking area. A rule of thumb in increasing parking spaces is that when the use rate reaches 80%, the number of parking spaces is increased by 20%. Thus, parking space is offered to those who need it and the quality of parking stays good. Well-organized bicycle parking encourages people to cycle, and the number of cyclists can grow surprisingly fast. Therefore it is important to monitor the development of parking and, if necessary, increase or move the parking spaces.

The bicycle parking norms of cities guide towards reserving a certain amount of parking, for instance in context with shops, residential areas or office spaces, already in the building stage. Parking norms act as a good foundation when planning bicycle parking and give an idea of where and how much bicycle parking should be placed.

16
In Odense, the need for parking is estimated with temporary stands (in the picture). A temporary stand is brought to a place where it is estimated that there is the need for parking, and the number of bicycles collected on it is monitored. If the stands are continuously in use, a more permanent parking solution will be built on the location. The stands are also used for instance during festivals where there is a need for temporary parking.

Target	Parking norm
Residential buildings and blocks of flats	2–2.5 spaces / 100 m² of living area for blocks of flats 1.0 spaces/student in student flats
Childcare institutions	0.4 spaces/employee and a separate area for bicycle trailers and special bicycles
Schools	1.0 spaces/pupil from year 4 and 0.4 spaces/employee
Colleges and universities	0.4–0.8 spaces/student and 0.4 spaces/employee
Retail trade/shops	2.0 spaces/100 m² in the capital region and 1.0 spaces/100 m² outside the capital region
Workplaces	0.3–0.4 spaces/100 m² of gross floor area and 0.4 spaces/employee
Stations	10–30% of daily passenger numbers
Public transport stops and terminals	1.0 spaces for every 10 passengers during rush hour (06:00 a.m.–09:00 a.m.)
Movie theatres and theatres	0.25 spaces/seat and 0.4 spaces/employee
Hotels and restaurants	1.0 spaces for every 15 guests and 0.4 spaces/employee
Sports centres	0.6 spaces/athlete on a daily basis and 0.4 spaces/spectator
Offices and industry	0.4 spaces/employee
Recreational areas	1–4 spaces for every 10 visitors

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Source: Celis & Bolling-Ladegaard 2008

17
Parking norms vary between countries and cities. Denmark has presented a model providing guidelines on the number of parking spaces in residential areas and hotels as well as shopping locations.

18 &19
Parking norms guide the evaluation of the volume of parking for instance in public transport stops as well as office buildings. Although norms are a good basis for planning, each target must, however, be planned separately by taking special characteristics into consideration. (Stockholm, Ghent)


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18

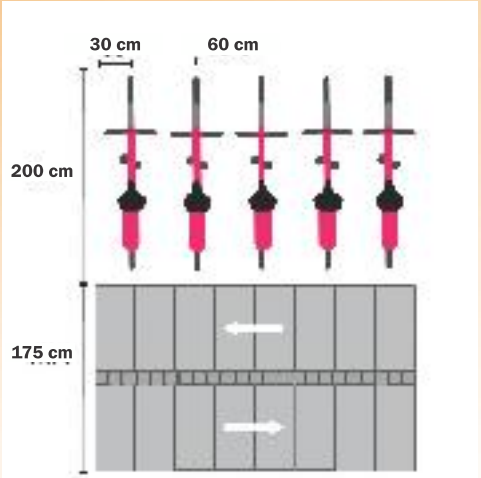
Dimensioning Enables Parking of All Bicycles

Bicycles exist in very different sizes and models depending on their purpose of use as well as user group. Different accessories, such as bicycle bags, banners, handlebars and carts require their own space and they cannot be an obstacle to the use of a parking space. Bicycle parking should in fact be planned so that bicycles of different sizes and shapes can be parked on the parking places. It is of course not possible to meet all the requirements, but a parking area of basic measurements should enable fast and easy parking of bicycles. The need for different kinds of parking solutions can be evaluated according to the location of parking. For instance in places where a lot of families with children visit a separate area can be reserved from the parking space for bicycles pulling a cart, although the stands would otherwise be measured according to standard sized bicycles. A parking space can be reserved in context with shops for cargo bikes that are especially designed to transport items.

Different types of stands and parking systems require different kind of measurements and, therefore, it is quite challenging to make clear, unambiguous directions. For instance Sheffield stands require more space around them than butterfly racks, since it must be possible to lock a bicycle on both sides of the rack. Also usable space greatly defines the measurements of the stand. However, minor space should not affect the usability of the bicycle stand, but in these situations also other parking solutions, such as two-tier or underground parking, should be considered.

Bicycle Parking Dimensioning in Denmark

In Denmark the recommended distance between two bicycles at a bicycle stand, such as a vertical butterfly rack, is 60cm. The distance of 50cm can only be used in special situations, where there is little space and the parked bicycles have the same measurements. However, very often with a bicycle distance of less than 60 cm only every other bracket is used due to lack of space. If, on the other hand, the distance is increased to 70cm, this can result in bicycles parked in the gaps of the stand, and these can make parking bicycles in the stand itself more difficult.

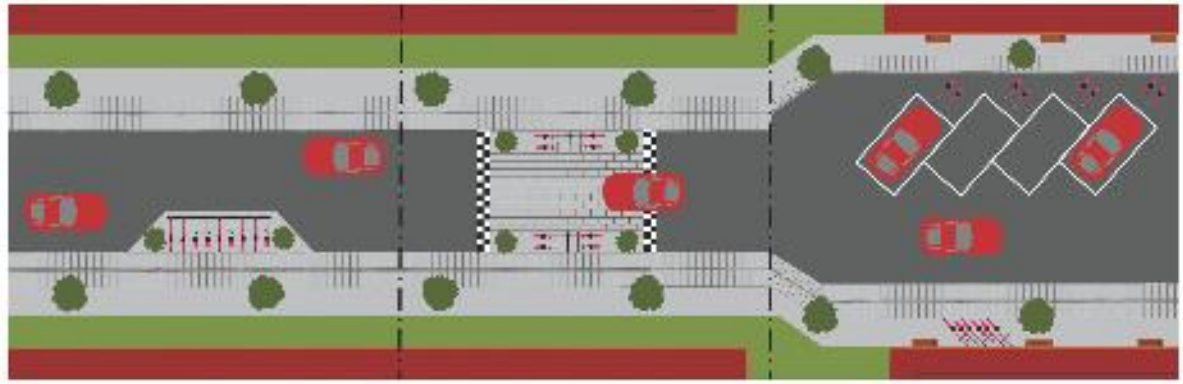


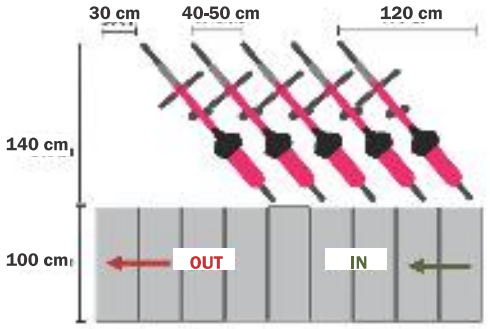
Denmark has also paid attention to the mobility area needed in bicycle parking area. A suitable space for two cyclists to meet each other and look for an empty parking space is 1.75m.

Although counting the space needed for parking is not completely unambiguous, Denmark has ended up evaluating the need of space with a formula:

the number of bicycles x 0.6m x 3.75m.

The need for space is naturally also influenced by the used stand models as well as their placement. Angled parking takes up less space and often it is easier to park bicycles in a stand that is placed on an angle. Angled parking is used in Denmark in situations where space is limited.





Source: Celis & Bolling-Ladegaard 2008

Social Safety Is as Important as Surveillance

A safe parking possibility is the deciding factor for many cyclists. Lack of safe bicycle parking possibilities can even prevent people from arriving by a bicycle, for instance to a public transport station. This can even reduce the use of public transport as a part of the trip chain. In many towns and cities bicycle thefts have become a big problem, which the cities strive to reduce by reminding people, with the help of different kinds of campaigns, of the importance of locking bicycles as well as by offering bicycle stands in which bicycles can be locked from the frame. Often the targets of theft are bicycles that have been inadequately locked or left in a remote location. Therefore it is important to remind cyclists of efficient bicycle locks as well as leaving bicycles only in a parking area reserved for them. Good locks are one of the easiest ways to prevent thefts.

In context with long-term parking, safety can be increased for instance by guarding or video surveillance. Bicycle lockers are safe with regard to thefts, since they can be opened only with a key or a key card. In short-term parking the parking area should be placed so that as many passers-by as possible travel alongside the area. This reduces the amount of thefts and vandalism considerably. If, however, a bicycle is stolen, a serial number that is put on the bicycle helps in finding the right owner if the bicycle is found. This number helps in finding out the owner's information, so the bicycle can be returned.

28
Limited access to the parking area makes parking safer. In Freiburg, the parking facility in context with the Mobile – mobility centre can be accessed for payment. One day ticket costs one euro, ticket for a month 10 Euros and for a year 80 Euros. Bicycles are protected from rain and parking is guarded.

29
When evaluating the need for parking, bicycles parked in both the stand and outside of it have to be taken into consideration. If the capacity of the bicycle stand is not fully in use, but bicycles have been parked outside of it nonetheless, this can result from the impracticality or bad placement of the stand.

30
Bicycles of different sizes and models also have to be taken into consideration when planning parking. A cargo bike takes up more space than a regular bike and requires its own space in a parking area, for instance in the context of shopping centres.

Maintenance

Maintenance Improves the Quality Level of the Route

Maintenance classes can be divided according to the importance and busyness of the route regardless of whether the route is meant for cars, bicycles or pedestrians.

Maintenance Reveals Transport Policy

Maintenance is an important part of the functionality, smoothness and safety of bicycle and pedestrian traffic. Good maintenance is a simple way to ensure the quality level of bicycle and pedestrian traffic and to increase traffic volumes. The significance of winter maintenance is highlighted in countries that have snow and ice during the winter. Pedestrian accidents occur by far the most during winter time, which is why removing snow and preventing slipperiness must be handled efficiently. The elderly especially suffer significantly more pedestrian accidents during winter than during summer. Bad route surface is one of the most common individual reason for cycling accidents, which in the winter means a layer of snow or slush as well as slipperiness. In the summer, tears in the pavements as well as sanding left over from the winter increase the accident risk. According to Swedish research, a road keeper can prevent as much as 60% of individual accidents of cyclists. If maintenance is managed purposefully, cycling is possible during the winter as well.

Maintaining cycleways and pedestrian routes – especially winter maintenance – proves undeniably what kind of transport policy is realized in the town or at state level. Problems in maintenance are often the result of a lack of funding, which is a result of policy. However, savings are often made in the wrong place when neglecting the maintenance of cycling and pedestrian routes. The saving of one Euro may mean an expense of three Euros in the health sector. A slipping accident can put a person who is able to work on a sick leave for a year or cause even worse health care costs. Municipalities and the state should perform comprehensive budget reviews, so that the advantages and results for different administrative organizations can be taken into consideration.

In the best example cities of Europe, cycling and walking are respected as equal forms of traffic, which also influences the planning and realization of maintenance. In countries or cities that practice transport policy favouring cars, the maintenance of cycleways and pedestrian routes is often insufficient. Routes are built worse with regard to their quality level from the foundation to the pavement, and maintenance is neglected. From the adjacent carriageway snow is ploughed to a newly ploughed cycle track or pavement. During winters even important cycling and pedestrian connections are left unmanaged, and in many places the routes of these modes of transport are kept as snow storages so that car traffic runs smoothly. However, it is important to favour cycling and walking also in winter traffic. Important traffic policy principles are not limited only to the summer in northern countries.

31
In Groningen cycleways are high in the maintenance class. This reveals the appreciation of cycling in traffic policy decision making.

Unclear Responsibilities and the Range of Actors

Problems in realizing maintenance are also caused by unclear responsibilities between the municipality and property owners. According to pan-European practice, maintaining pavements is the responsibility of property owners and cycle tracks belong to the municipalities. This practice causes problems especially in countries that have snowy winters. Some property owners manage their responsibility in an exemplary manner, but others neglect winter maintenance of pavements completely, in which case the quality level of pavements varies considerably with different properties. It would be best if a responsible route keeper would manage the whole network, including pavements. Thus it would be easier to ensure the quality level and unnecessary confusions with regard to maintenance responsibilities would be avoided.

Some municipalities manage maintenance themselves, but many hire contractors whose areas of responsibility are divided for instance on the basis of local districts. It may even be so that one contractor is only responsible for, for instance, the streets or cycle tracks in one area. Often a municipality has several valid agreements with different contractors at the same time. When several actors manage maintenance independently in their own area, synchronizing the operations and quality assurance can turn out to be difficult. Although different areas often have the same directions for maintenance and methods for managing the maintenance, the order of the management can vary from region to region. The consistency of quality levels should be guaranteed also when moving from one municipality to another. Thus, mutual cooperation in maintenance as well as consistency of the quality and methods in different areas of responsibility is very important.

Route-specific Maintenance

From regional maintenance the alternative is to move on to route-specific maintenance, especially with regard to main routes. Thus, there will be no problems in the regional borders due to quality variations especially during winter time, and the use of main routes is smoother and safer.

In Finland the management level of cycleways and pedestrian routes is divided into two management classes. Previously routes have often been placed into the same category with the adjacent carriageway in Finland. Nowadays, however, the most important routes of walking and cycling can be taken into consideration separately regardless of the maintenance class of the adjacent street area. This is progress, since in Europe it is common to divide maintenance classes according to the importance and busyness of the route regardless of whether the route is meant for cars, bicycles or pedestrians. In this way it is possible to equally promote cycling and walking by guaranteeing a constant quality level of the routes during winter as well.

32
Even surfacing of good quality raises the quality level of the cycleway and makes cycling as easy and convenient as possible. (Houten)

On main routes a transition should be made from regional maintenance to route-specific maintenance.

Clean Routes and an Even Surface

The purpose of summer maintenance is to keep the cycling and pedestrian routes enjoyable and safe. Tasks include maintaining traffic signs and road markings, public sanitation, managing green areas as well as structures and equipment, such as patching pavements, filling the border of the pavement and emptying rainwater wells. Attractiveness is highlighted in pedestrian and cycling routes, since cyclists and pedestrians move slower than motor vehicles. They observe the cleanliness of the environment more carefully. The most important maintenance work that influence safety during the snowless season are cleaning loose sand and pieces of glass as well as fixing pavement damages.

Several European countries use a feedback system that works on the Internet or by telephone, the help of which a road user can quickly and easily give feedback or report, for instance glass pieces on a cycleway, bad condition of the pavement or other factors such as an unclean environment, that lowers the service level of the route. Thus the problem is brought to maintenance immediately. Fixing pavement damages, i.e. rises, holes and unevenness as well as frost damage must be taken care of fast, since the damages make especially cycling or moving with a wheelchair unpleasant and create a safety risk. Cycling and pedestrian routes should be maintained with the same quality level as carriageways.

The slipperiness of winter is prevented with sanding in many snowy countries. It is important that loose sand is collected away from the routes in the spring, since it increases the risk of falling down of cyclists especially in turns and under hills. Unfortunately collecting the sand is often delayed until nearly summer, which significantly decreases the safety of the cycleways and the service level. Collecting the sand should be prioritized according to the main cycleways, so that busy routes leading to the centre would be cleaned as fast as possible. Equipment in accordance with the width and weight recommendations of the route should be used for cleaning the route, so that cleaning is done quickly and efficiently.

Keeping the road markings up to date and in good condition improves traffic safety, so maintaining them is very important. Clearing brushes is also important with regard to visibility especially in intersection areas. These operations are cheap to realize and they improve the safety of cycling and walking.

33
In Copenhagen cycleways are kept unfrozen by using a saline solution.

34
Routes that are in good condition encourage people to use them. In the fall, removing leaves and trash increases attractiveness. (Växjö)

Winter Quality for Cycle Tracks

In snowy countries, volumes of cycling are often reduced during the winter, but the number of winter cyclists can be increased with high-quality winter maintenance. Quality requirements of maintenance are related to preventing slipperiness, removing snow and slush from the route as well as making the surface more even, managing signage for ploughing, lowering snow banks, moving snow when the storage space for snow fills up as well as preventing the access of melting waters to cycleways and pedestrian routes.

One of the biggest problems in ploughing is removing the snow as efficiently as possible along the surface of the route. This requires resources, good maintenance planning as well as a route environment where ploughing is easy and fast to realize. In the event of hard snowfall the challenges are great since the snow has to be removed quickly. If a layer of snow and ice is left on the surface of the route, the use of the route is weakened. In this case the surface is not even, especially as the air gets warmer and the melted snow forms a layer of slush that makes cycling impossible. One problem with regard to preventing slipperiness is the melting waters during the spring. During the night the water freezes on the surface of the route, especially in pedestrian underpasses, creating dangerous situations for travellers.

In Sweden, removing snow with a powerful brush, which sweeps the snow from the route instead of ploughing, has been studied. Often the result is better with a brush than a plough. By spreading a saline solution on the surface of the route after brushing slipperiness is also efficiently prevented and the route is kept unfrozen. However, brushing is considerably slower than ploughing and, thus, also more expensive. According to estimates made in Sweden, brushing and spreading a saline solution are 2–3 times as expensive as ploughing. On the other hand, the service level of the route is kept better with the help of brushing and salting. The best result with a combined effect of brushing and salting was gained in southern Sweden, where the annual amount of snow is less than in the northern and central parts, but a considerable amount of ice is formed on the routes.

One of the biggest problems in ploughing is removing the snow along the surface of the route. As the air gets warmer, the melted snow forms a layer of slush that makes cycling impossible.

35
With high-quality maintenance volumes of cycling are kept high round the year. In cycling cities people often choose a bicycle as their vehicle, even if the weather conditions are at times challenging. (Copenhagen)

36
In Copenhagen winter maintenance equipment has been chosen according to conditions and the routes.

More Heated Pedestrian Routes

Slipperiness can be efficiently prevented with the use of salt, but often the concern, in addition to environmental reasons caused by salting, is the rusting of bicycles. Cycleways are, however, salted in for instance Copenhagen and Odense. In Denmark users have been very satisfied with the salted routes, and also in Sweden users of cycleways that are maintained by brushing and salting noticed a considerable improvement in the service level of the route and were more satisfied than before. Salt has also been used in mixed bicycle and pedestrian routes, but it is not recommended since the shoes of pedestrians are damaged by the salt.

Often slipperiness is prevented with sand instead of salt. With this the problem is finding the right kind of stone material. Sharp macadam punctures bicycle tyres, but round grit, on the other hand, does not stay on the route as well. Often it has to be warmed or mixed with salt so that the slipperiness caused by even a thin layer of snow can be prevented. Many cities have installed a snow melting system on pedestrian streets as well as some pedestrian and cycle tracks, so that the routes stay unfrozen during winter time. This is the most efficient winter maintenance method. The route acts the same way as during the snowless time and safety is clearly improved. In snowy countries, heated streets should be built as much as possible especially for pedestrians, so that slipping accidents are reduced.

Maintenance Equipment According to the Route

The road networks of Finland and Europe are similar, apart from bicycle routes. In Finland nearly the whole cycle network has been combined with the pedestrian network, so it is shared by pedestrians and cyclists. Winter maintenance is usually managed with the same equipment as maintenance of the carriageways. The size of the equipment has in some cases even been the justification for building mixed pedestrian and cycle routes. The aim has been to make the routes wide enough so that the same plough can manage the whole street. However, the equipment should be adjusted to the requirements of the traffic environment and not vice versa. The best example cities of Europe – such as Copenhagen, Groningen and Odense – naturally have separate maintenance equipment for cycle tracks and pavements. Carriageways are maintained with larger machines.

In Odense cycle tracks belong to the first class. The town of Odense in Denmark uses three maintenance classes: A, B and C. All cycle tracks, apart from the smallest routes, belong to class A. In fact, many cycle tracks are in better condition during the winter than smaller carriageways. The town uses small tractors to plough snow and a saline solution is used for preventing slipperiness instead of dry salt. In addition, measures are taken immediately if there is the danger of freezing on the wet streets. Sand is not used to prevent freezing, since it has been proved to be bad for bicycle tyres. In Odense, the town is responsible for all maintenance and the town owns some special equipment needed for maintaining cycleways and some of it is owned by contractors. Maintenance is ordered from external companies, with whom cooperation is made in planning the maintenance.

Quality on the Same Level with Car Routes

A town and preferably the surrounding municipalities should have uniform criteria for maintenance. Thus commuting cyclists going from one neighbouring municipality to another do not meet different kinds of conditions along the way. The service level of the route stays the same during the summer as well as winter with regard to the evenness of the surface and thickness of snow as well as slipperiness. Maintenance must also have a follow-up system, so that the progress of the work and fulfilment of contractual terms are easier to follow. Thus, road users can be informed of for instance already ploughed cycle routes during the winter. Follow-up and cooperation are also needed so that maintenance performed by several different contractors is functional and the working methods of different contractors are compatible so no blind spots are created in maintenance. Blind spots can also be reduced by choosing winter maintenance equipment correctly.

For the duration of maintenance and building work, appropriate detour and guidance for the singular situation should be made on cycleways and pedestrian routes. The detours of bicycle and pedestrian traffic have to be managed with the same quality level as redirecting car traffic with appropriate information.

The level of maintenance of bicycle and pedestrian routes has to be at least on the level of maintaining routes for motor vehicles. Unfortunately, many towns do not take as good care of cycleways and pedestrian routes as roads and streets. By prioritizing the maintenance of motor vehicle traffic cities also prioritize motor vehicle traffic ahead of cycling and walking and thus imply that private car traffic is a more recommendable mode of transport in city centres than bicycle and pedestrian traffic.

37
When a construction site breaks a cycle track or pavement, detours and guidance to them must be made with as high quality as for car traffic.
(Copenhagen)

38
Maintenance work made in a street area has to be planned so that possible maintenance traffic does not interfere with or block cycle traffic.
(Copenhagen)

Maintenance of Bicycle Parking Areas

Well Managed Bicycle Stands Function throughout the Year

A bicycle parking area as well as bicycle stands must be in good condition and look clean throughout the year for the duration of their whole life cycle. Unclean and broken stands do not encourage users and create a messy and unsafe impression. When bicycle stands are planned to be easily maintained and durable against weather conditions as well as possible vandalism, their use is pleasant. Keeping bicycle parking areas clean has to be routine-like as well as regular. Especially during winter time, when snow can cover bicycle stands fairly quickly, maintenance is necessary but also challenging. Covered bicycle parking areas prevent snow from piling up at the bicycle stands most efficiently. However, even if a parking area isn't covered, it still has to be kept usable during the winter time, so that as many users as possible can use bicycles during the snowy season. By maintaining parking areas and routes, the possibility for round the year cycling of a good quality is created for cyclists. In addition to general maintenance, bicycle stands have to be inspected on a regular basis and broken stands have to be fixed. Particularly the attachment points of the stand to the ground have to be checked.

Bicycles that have been forgotten and abandoned in bicycle stands take up unnecessary space and often weaken the appearance of parking. Abandoned bicycles pile up in every city, and preventing this phenomenon is nearly impossible. However, it is possible to try to reduce the number of abandoned bicycles by regular cleaning of the bicycle parking area. Bicycles in a certain area can be marked with for instance stickers placed around the tyre. After a few weeks the marked bicycles are checked and those bikes that still have the sticker in place can be removed. Removing these bicycles is also cheaper than building new bicycle parking areas, so cleaning up really pays off. In Finland it has only been legislated that abandoned and incorrectly parked cars are taken away, but separate legislations have not been made for abandoned bicycles.

39
In Geneva a white loop is placed on the bicycle tyre with the help of which it is monitored whether the bicycle is being used or not. If the loop has been broken during a certain time, it can be assumed that the bicycle is still in use and if, on the other hand, the loop is intact, the abandoned bicycle can be removed from the stand.

Vibrant Cities –
Mobility Management, Marketing and Design in Activating Citizens

8

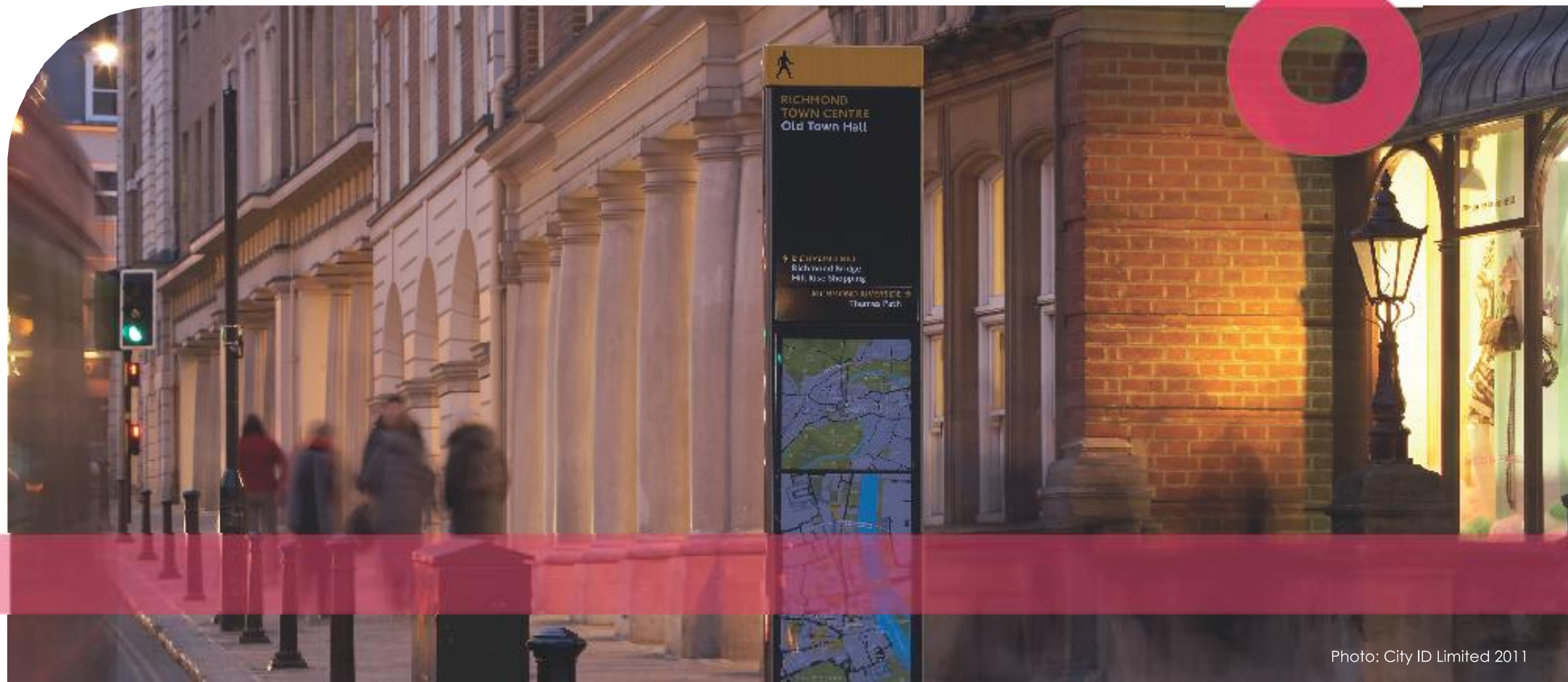


Photo: City ID Limited 2011

Wayfinding

Maps and signposting encourage people to walk and cycle by making the city legible.

It is Easier to Get There when You Know Where You're Going

Good maps and signposting are an essential part of supporting walking and cycling. City signposts differ from paper maps and route planners in such a way that signposts can also produce spontaneous and unplanned trips. Signposts and maps encourage people to walk and cycle as well as help to perceive the city and distances between its neighbourhoods. They make moving around in the city easier by making the city legible. Good-quality signposting benefits business life, cultural offerings, tourism as well as the residents of the city.

People who are not used to walking or cycling or who live in bigger cities may have difficulties in perceiving which trips would be most convenient to make on foot or by bike. Good signposts and maps can direct and encourage making more walking and cycling trips. The better the signposting is the more walking and cycling trips are created. Many European cities also have Internet and mobile based route services. Signposting and maps are important also with regard to the attractiveness of recreational routes.

Information for Easier Route Selection

The purpose of cycling maps is to bring forth the fastest and most recommended routes between different areas. The hierarchies of different routes must be visible, so that a cyclist knows which route to favour. A map that shows all cycle track portions, even unfinished ones, as equal, mainly shows the scope and development of the cycle network to planners but does not bring additional value for cyclists. A cyclist is interested in coherent and good routes instead of cycle tracks on individual road portions. Streets on different levels of hierarchy in a cycle network can be separated with colour codes. Also the most important bicycle parking areas, city bike locations and locations of bicycle bumps interest cyclists. Cycling is firmly connected to public transport, so for instance the possibilities for interchange parking as well as the most important public transport routes should be seen on a map. A bicycle map should not, however, contain too much information, but the essential information should be distinguished clearly.

1

Source: Växjö Kommun 2011

A Cyclist Navigates like a Motorist

In European cities, cyclists navigate with the help of signposts directed at either motorists or cyclists. Signposts for cyclists alone can show the route best suited for cycling especially when it does not go along the main route of other vehicle traffic. In addition, main cycleways have usually been given their own colour, number and name, which makes it easier to find the fastest route.

Special cycling routes have their own symbols and names. For instance in the Netherlands there is an extensive network of long distance routes, altogether 20 different routes and 6,000 kilometres that have their own signposts. Cities also have their own city-specific recreational routes, such as Växjö Runt, which has its own signposts and maps, going around the lake Växjö.

The most important parts of cycling signposting are logic and consistency. The principles of bicycle signposting are very close to signposting for motorists. In a city a cyclist must receive information of different route alternatives before driving to an intersection, so that the cyclist can get in the correct lane at the intersection. In addition, the signposting must reveal the hierarchy between different routes so that cyclists can, if they wish, favour the fastest route and find the main cycleways easily.

Cycling by Numbers in Holland

In Holland cycling is made easier with numbered nodal points of the cycle network so cyclists can, if they so wish, beforehand plan their route on the Internet, print a list of intersection numbers and follow them on the signposts along streets and roads. This method has originally been developed for navigating in mines. However, the primary task of cycle signing is supporting spontaneous and "unplanned" cycle trips. For this reason the number signposts act as a complement to traditional signposts in the Netherlands.

In the Netherlands, small frames, where the route can be written under a see-through cover, are sold to cyclists. These frames, which have achieved great success, are attached to the handlebars and make navigating by numbers easier. In the Netherlands some signposts change into low "mushroom signposts" in the countryside. These do not change the scenery as much as high, traditional signposts. Also an ID number, which can be found on cycling maps and with the help of which travellers can check their location, has been marked on these signposts.

1
When studying the cycling map of Växjö it becomes clear what the fastest main cycleways are.

2
In the Netherlands, the most important nodal points of the cycling network have been numbered, which makes navigating easier. A beforehand printed list of the numbers of intersections on the route is easier to keep in hand and remember when cycling compared to a large, foldaway cycling map. Also long distance LR or "Landelijke Fietsroutes" cycling routes have been marked on the signposts.

3
In Växjö the main cycleways have been clearly shown with different colours and they are consistent with the cycling map.

Photo: City ID Limited 2011

Photo: City ID Limited 2011

Signposts and Maps Encourage to Walk

The main goal of walking maps and signposts is to enable the formation of a clear mental map. With their help, people who move around in a city can form a picture of unknown areas and their destination in their mind, which increases the confidence of a pedestrian towards moving in the city. The task of signposts and maps is to give pedestrians the ability to find their destination efficiently or to stroll around the city confidently. People walk longer trips if they experience travelling as safe, they have a good concept of the scale of the city and they are convinced of the location of their destination.

Numerous targets can be included on maps and the most important land marks and targets can be presented in 3D format to make perceiving the environment easier. Essential information must look important also on the map. Map signposts on streets can show a more specific map of the environment of the street and many targets and things can be included on the map, but the readability of paper maps that represent larger areas can suffer from excess information.

Map Signposts Improve the Quality of Walking Signposting

The most advanced city signage systems of Europe rely, instead of the traditional signs showing directions, on map signposts and direction signs which complement the signage. This improves the quality and comprehensiveness of information. Map-based signage can reduce the amount of street furniture produced by signage by as much as 30-40 per cent, thus making the city cleaner and, at the same time, easier to read. Map signposts can well be integrated into other street furniture, such as lighting as well.

A map that is presented from the viewpoint of a person standing in the street makes forming a mental map easier, unlike direction signs that can only show straightforward routes and rough directions to targets. Travel time is one of the most important factors when choosing a mode of transport. When marked on a map signpost, an area that can be reached for instance in five or ten minutes by walking helps to perceive distances and encourages walking.

Photo: City ID Limited 2011

4
On a map signpost an area that can be reached within two minutes can be marked and also calories burned during the walking trip in question. A large map enables more specific presentation of pedestrian connections and the most important targets as well as entrances to buildings.

5
The Sheffield signposts also include information about the location's public transport connections and transport connections. Instead of arrow signs, walking connections of the neighbourhood have been presented under the picture portraying the street view.

Photo: City ID Limited 2011

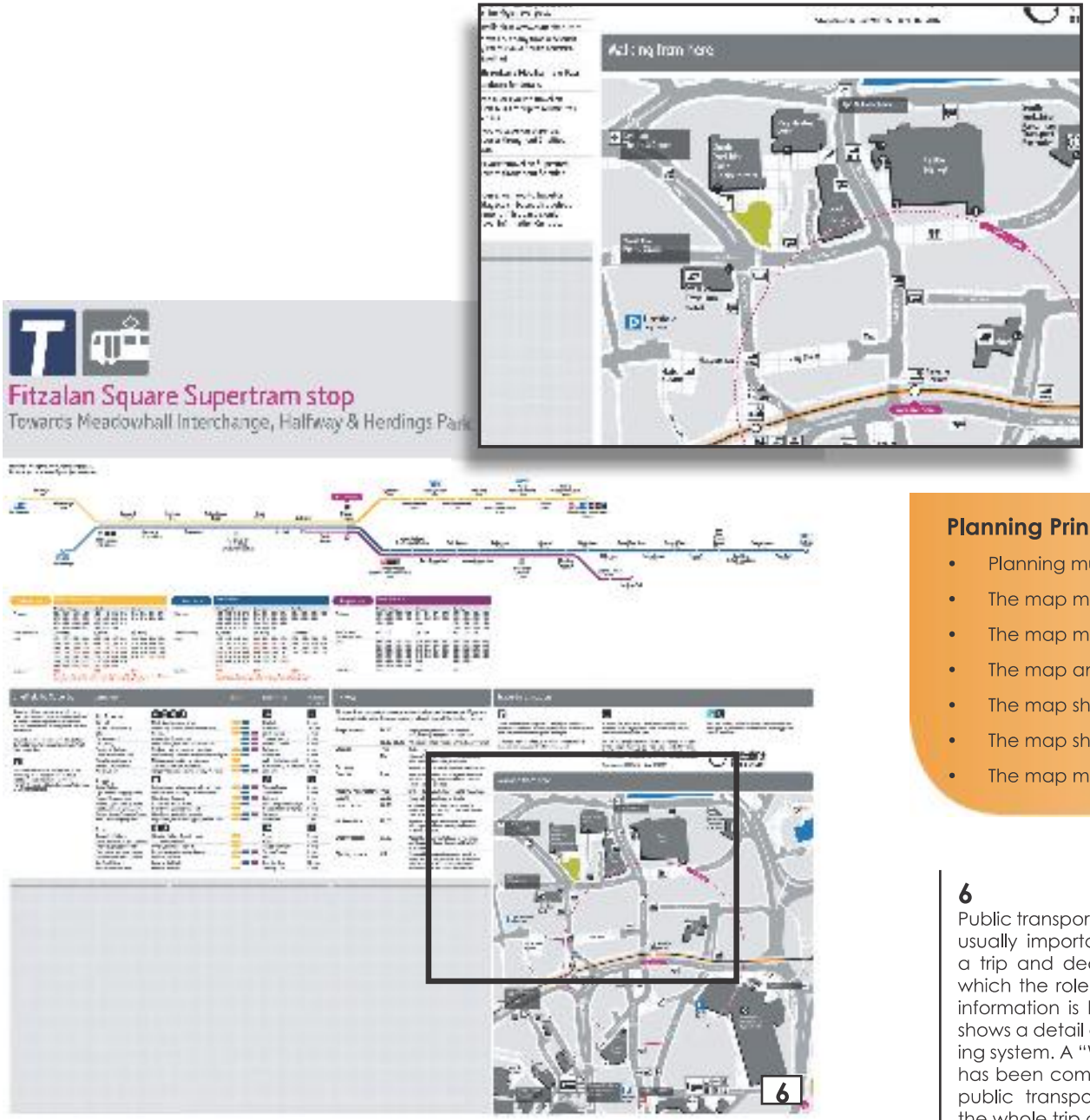


Photo: City ID Limited 2011

Planning Principles of a Walking Map

- Planning must begin with the needs of the customer group
- The map must encourage walking in a city or town
- The map must help in the formation of a mental map
- The map and signposting must be consistent
- The map should reflect the identity of the city
- The map should offer essential information, no more and no less
- The map must be easily updated

6
Public transport stops and terminals are usually important nodal points during a trip and decision making points, in which the role of clear and illustrative information is highlighted. The picture shows a detail of the Sheffield signposting system. A "Walking from here" map has been combined with the Sheffield public transport signposts to support the whole trip chain.

It Is Worth Investing in Planning a Wayfinding System

With regard to the quality of the wayfinding systems what is important is comprehensiveness. When planning the system, different parts of the trip must be taken into consideration so that each stage offers information that makes mobility easier. Maps, signposts, information boards, services in the nodal points of the trip chain as well as other elements related to travelling must work together well and give cyclists and pedestrians the confidence and desire to move around in the city.

A good wayfinding system is unambiguous, clear, consistent and reliable; at its worst failed signing can cause only confusion and uncertainty. The clarity and reliability of the system are highlighted in the signage of recreational routes, since a wrong turn can result in wandering for several kilometres and there may not necessarily be clear land marks to make route selection easier. Signage must be continuous. Especially with regard to walking signposts, quantity does not replace quality, but the signposts must be located in places where there is a real need and where they actually support navigation in the city. Cyclists cannot stop and study a map signpost as frequently as pedestrians, so for them the need for signage is greater. On the other hand, a logical cycling network that utilizes different hierarchy levels reduces the amount of needed signposts, since so called selection points do not occur as often.

Along with signage, the goal of comprehensive wayfinding systems is to improve the street scene and image of a city, strengthen the identity of the city as well as promote the use of sustainable modes of transport. In fact, the idea of what kind of an image the city wants to portray and how the readability and attractiveness of the city can be improved have been pondered when planning a wayfinding system in many cities.

For instance in Southampton in Great Britain the planning of the wayfinding system covers

- **planning the trip** by utilizing maps as well as mobile and Internet services,
- **navigation to a nodal point of the trip** with the help of map signposts as well as information provided on travel cards and parking fees,
- **mobility management** with the help of map signposts, signage, lighting and street furniture,
- **needs of interchange mobility** with regard to schedules and stops
- **as well as arriving to the destination**, with the help of target maps and info boards.

Source: Southampton Legible City – Direct/Guide/Show

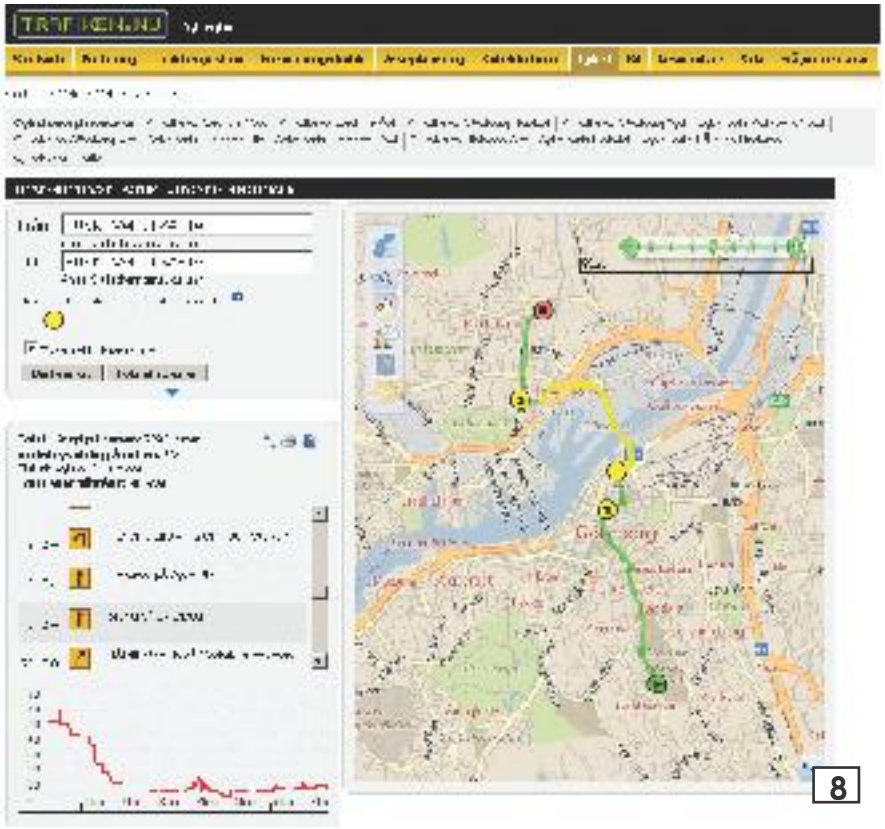
Electronic Services Give Power

With regard to promoting cycling and walking, it is essential to offer information on local cycling and walking conditions. Nowadays information can be easily searched on the Internet, so offering information in an electronic format is an important channel in reaching potential pedestrians and cyclists. Maps as well as Internet or mobile based route services are essential channels of information, since often being unaware of cycling and walking possibilities is an obstacle to utilizing them. In addition to the route, information on points of interest, recreational areas as well as services can be included on maps, especially on electronic ones.

Electronic maps and route guides have become more common during recent years, and many good examples of services directed especially at cyclists and pedestrians can be found in Europe. In addition to the mere route, route guides give information on travel time, calories burned on the route as well as topographic features of different sections of the route. Some route guides enable users to add their own recommended routes and some are even based on route information inserted by users.

Customized walking and cycling trips can be searched on the basis of the beginning of the route from the site ANWB, which is an organization of sustainable mobility, travel and free time in the Netherlands. In the Netherlands, the quality of signposts as well as cycling and walking routes is maintained by maintenance service numbers where people can inform them about lacking or insufficient signage on recreational routes or broken glass on the route also.

7
The cycling route guide of Stockholm shows bicycle parking spaces, bicycle rental spots as well as locations of bicycle pumps.



8
With the route guide of Gothenburg, it is possible to choose starting points and end points on the map, in addition to inputing address information. In addition to route directions, length of the trip and time consumed during the trip, the route guide shows the portion of cycle tracks on the route, calories burned as well as a topographic picture of different parts of the route. It is easy to revise the route suggested by the route guide by moving the route, for instance, to go around higher hills.

Services

More Variety with City Bikes

City bike systems are becoming more general around the world. The idea of the system is that renting and using city bikes is fast, effortless and flexible. In addition to tourists, the service is also especially targeted at city residents who use the bikes for commuting in the morning and afternoon as well as for running errands and free time trips in the evening. Therefore, city bikes have both random and regular users and the user base is formed according to the service level of the system. The best city bike systems in Europe have been planned for the needs of everyday and interchange cycling.

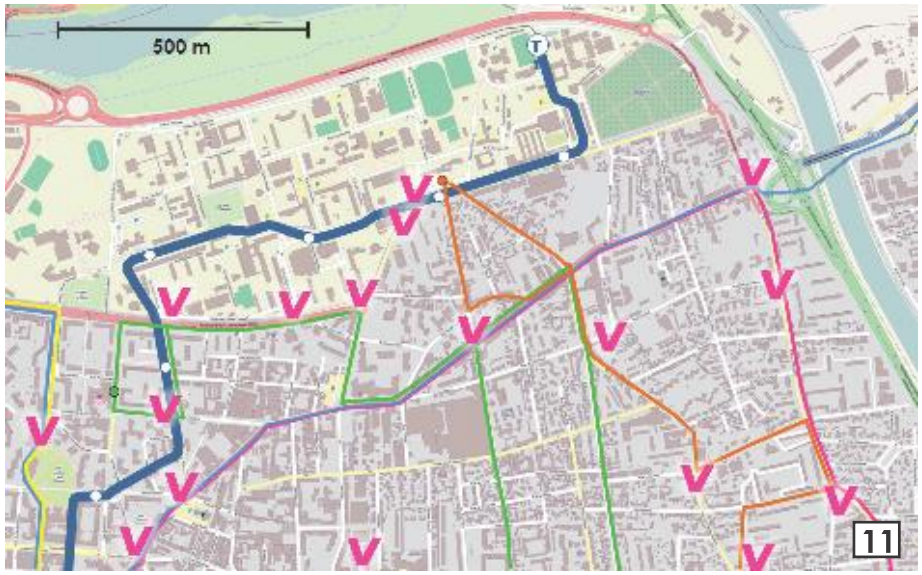
The use of city bikes is cheap and environmentally friendly and promotes the use of sustainable forms of transport instead of private cars. Already the existence of a city bike system helps towards favouring cycling and it is a worthy support method for increasing the modal share of cycling, especially in cities that do not yet have a strong cycling culture. The system can, along with increasing the number of cyclists, increase the acceptability and interest towards city cycling as a mode of transport worth considering.

The image of cycling as a modern, everyday mode of transport of a good quality can be improved by city bike systems. However, it has to be kept in mind that a pre-requisite for using the system is a cycling infrastructure that supports safe and smooth city cycling.

9
In the centre of Stockholm city bikes are a familiar sight during the summer. In the summer 2011, there were 94 bike points altogether and the rental points expand year after year.

10
One car parking space can fit about five city bikes, which are used by twice as many people. (Paris)

The city bike system is a personal public transport service.



Map: OpenStreetMap contributors , CC-BY-SA

11
In Lyon, the Velo'V city bike stations (red V on the map) have been placed by taking everyday cycling and interchange cycling into consideration. The area in the picture is situated about five kilometres away from the city centre.

12
In Paris, like in many other cities, a bicycle can be used by touching the reader on the bicycle stand with a personal smart card and the rent is free for the first 30 minutes.

City Bikes of the Third Generation

The history of city bikes began in Amsterdam in 1965. The city bikes of that first generation were bicycles lying around the city meant for free use, but in just a few days a good idea of city bikes ended up in the numerous canals of the city or in private use due to vandalism. The first larger-scale city bike system of the second generation was launched by Copenhagen in 1991. A bicycle from a system maintained by a non-profit organization could be used with a coin pawn. Although the system was an improvement compared to Amsterdam, many bikes ended up in the hands of thieves due to the anonymity of the user.

City bike systems of the third generation utilize personal smart cards, electronic locking in bicycle stands or the bicycles themselves as well as communication networks or even travel computers. In some systems a bike can be rented and locked again by a phone call. With these technical improvements the use of the bikes is easy and smooth, but at the same time vandalism and thefts are prevented and the availability of the bikes at the rental points can be guaranteed. The first extensive third generation system was launched in France in the city of Lyon, which has nearly 500,000 residents, with 1,500 bikes in 2005. Lyon was soon followed by Paris, where there are at the moment nearly 18,000 bikes within about 300 metres of 1,200 rental points. The number of bicycle rental systems is growing fast: for instance in France there are over 30 systems and even in Austria over 80 (situation in 2011).

Services according to Target Groups

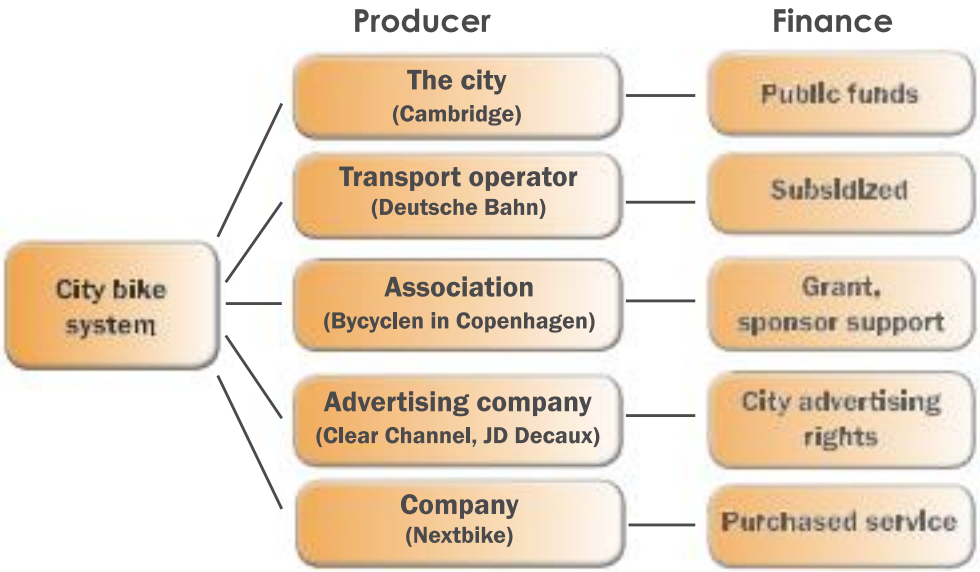
A city bike system can be planned for different kinds of purposes. In Stockholm the rental network covers the downtown area and serves especially those cycling in the centre. Lyon, on the other hand, has an extensive, widely used network that is well suited for everyday and commute cycling covering the whole city. In Germany and the Netherlands, national rail traffic operators have integrated interchange bikes into their service. These can be taken from the railway station for the day and returned for instance after the work day. Call-a-Bike in Germany and OV-Fiets in the Netherlands direct their services especially to commuters travelling by train by offering a door-to-door public transport service by city bikes. The Call-a-Bike in Germany also offers extensive city bike systems in several larger cities, where bikes can be left locked anywhere and the information on the location of the nearest bike can be received with the help of an Internet service. Also other city bike systems offer up-to-date information on, for instance, available bikes, their location as well as rental rates on the Internet.

A city bike system can be planned for irregular use, and also for visitors. For this purpose, the network does not have to be as wide as in a system that supports interchange and everyday cycling. Often the rental fees are also higher and temporally restricted. A system directed at tourists and free time cycling does not encourage city residents to become users of the bikes in the same way as a wider system. This kind of a system is mainly suitable for cities that already have a strong cycling culture and where most of the residents own their own bikes. For tourist cities this kind of a city bike system is a good opportunity to market the city and cycling during the summer.

	Recreational and centre cycling As an example Stockholm, City Bikes	**Everyday cycling** As an example Lyon-Villeurbanne, Velo'V	**Interchange cycling** As an example Germany's Deutche Bahn, Call-a-bike
Population in the area of influence	357,000	616,000	About 50 railway stations around the country
Population density	13,215 residents/km^2	9,950 residents/km^2	-
Tariff type	Fixed	According to use	According to use or fixed
Rental method	Smart card: season card or 3-day card	Smart card: 1-day, 7-day and long-term card	Phone call, discount with BahnCard
Prices	14€ (3-day card), 28€ (season card)	0–30min free, next hours 0.5–2€ Registering payment: 1–5€	0.08€/min, max 9–15€/day, max 45–60€/week, 27–36€/year, 0–30min free with year card
Maximum rental time	3h (unlimited in the 3-day card)	24h	None
Operation time	6 a.m.–10 p.m., April-October	24/7, around the year	24/7, from spring until autumn
Number of users	-	15,000–25,000 rentals/day	750,000 trips/year, 110,000 customers nationally (2009)
Bikes (residents/bike)	1, 000 (357)	4 ,000 (154)	5–20 bikes/railway station
Number of bike points	94	340 (also the possibility to lock elsewhere)	One/railway station, return to the same location, possibility to lock during use
Density of the rental network	about 450m apart	about 350m apart	-
Network coverage	27km^2	62km^2	-
Orderer/Producer	The city of Stockholm / Clear Channel	The city region of Lyon/JC Decaux	Deutche Bahn
Contract/Finance	City advertising rights	City advertising rights	Subsidized

Finance

City bike systems have traditionally had very different organization methods that include the purchaser and producer of the system as well as defining finance. Usually the purchaser of the system is the city or town, but also large organizations, such as universities, can implement the system. Service producers vary from non-profit organizations to city bike companies. The most common producer is, however, an advertising company from whom the service is bought either completely with public funds of the city or by incorporating advertising rights in the city in the contract. What nearly all the city bike systems have in common is that the service has been subsidized and the profits gained from bike rentals do not cover the operational costs of the system. However, the advantages gained from the existence of the service, for instance, changes in the mode of transport from private cars to cycling are experienced as more significant in many cities, just as with public transport. In addition, the rental is free in many systems for the first 30 minutes, so profits from the service are mainly comprised of registering fees. The implementation costs of the system vary between 2,500–3,000 Euros per bike and most of this is generated from foundation work for the fixed rental points, for instance connecting it to a power distribution network. However, there are also rental points that function with solar or battery power and are bolted to the ground. In the widest city bike systems, the operating costs of the service vary between 1,500–2,500 Euros annually per bike.



13

The costs of Barcelona's El Bicing city bike system are distributed percentually as follows:

Implementation and infrastructure costs:

- Rental points: rental terminals, bicycle stands and locking technology, planning work, foundation work and cabling 70%
- Bicycles 17%
- Installation work 6%
- Marketing 5%
- Administration 2%

Operation costs:

- Transporting bikes between the bike points 30%
- Bicycle maintenance 22%
- Maintenance of the rental points 20%
- Background system 14%
- Administration 13%
- Compensation of damaged bikes and rental points 1%

The El Bicing system includes 420 bicycle rental points and 6,000 bikes, and 40,000 trips are made with the bikes daily.

13
Examples of different organization methods of city bike systems. For example in Barcelona the city finances its city bike system with parking fees as well as rental income from the bikes, and buys the service from the ClearChannel advertising company.

Basic characteristics of European city bike systems

- Everyday and commute cyclists as a target group
- Planned to work together also with public transport
- Variable organization methods (finance/operation)
- Often a subsidized service
- Easy and fast availability for the customers
- Registration of customers (no anonym use)
- Automated rental and return
- Utilization of smart cards
- Concise network of rental points
- Free use during the first 30min
- The possibility for one-way cycling trips (return in any rental point)

14 & 15
In Paris the city bikes can be clearly seen in this street image and one can see that most of the bicycles travelling on the street are city bikes. The efficient public transport system of Paris and the city bikes support each other in the traffic system.

16
In Stockholm the purchaser of the city bike system has been the city and the costs of the system have been reduced by selling city marketing rights to the marketing company operating the system.

Everybody Wins in Supporting Sustainable Commuting

Directing attention to commuting when promoting cycling and walking probably cannot be emphasized enough, since the greatest potential for reducing the number of private car trips inside cities can be found in commuting. In addition, when promoting cycling and walking trips to work, all parties win regardless of investment. Supporting walking, cycling and public transport for commuting is an efficient way for companies to improve employees' stress levels at work, reduce the number of absences due to illnesses, reduce the need for car parking space, and improve corporate image. These can all be seen in the growth of the company's productivity, which is a good motive for companies to invest in services and facilities offered to employees who arrive to work by walking, cycling or public transport. Therefore, the cycling and walking potential hidden in commuting has started to be utilized in companies throughout Europe.

Some of the biggest obstacles for walking or cycling to work are bad weather, fear of bicycle theft and avoiding sweating. These obstacles can easily be lowered by offering the right kind of services for employees at the workplace. In order for employees to dress appropriately in case of, for instance, bad weather on their way to work by bike, public transport or on foot, companies should offer employees dressing rooms with lockers and showers. Safe bicycle parking possibilities near the workplace are essential with regard to people cycling to work. It must be possible to leave the bicycle in a safe place either behind locks or in a guarded space. For instance, the bicycle shelter door of the employees of the city of Strasbourg opens with an ID card.

Bike sharing schemes of companies provide bicycles for common use by the employees, and they can be used for free. The most important motive of companies and public organizations for acquiring shared bikes is improving the health and well being of employees by encouraging cycling to work. Trips similar to commutes are also daily trips made by students and the same issues that affect cycling and walking apply to their trips as well. Students are the most typical cyclists and shower facilities are often found in institutions. Universities and other institutions can however, be active by informing about these issues and by taking care of the quality and availability of bicycle parking spaces and cycling as well as walking connections.

The role of companies in increasing cycling and walking to work is of utmost importance. An employer can easily encourage employees to cycle and walk with quite small measures. A company can offer for instance:

- Good premises for showering and changing clothes
- Safe bicycle parking
- Kilometre allowance for trips to work by bicycle or by walking
- Own bicycles of the workplace for short work trips and lunch breaks
- Good information on the advantages of cycling and walking as well as cycling and walking opportunities
- Different kinds of events, such as participation in Cycling or Walking to Work campaigns.

The state can assume an active role as well. In France, the Air Protection Act of the state obliges cities of over 100,000 residents to make a city traffic plan (Plan de deplacéments urbains, PDU), the goal of which is promoting environmentally friendly forms of transport. One section of the plan is encouraging companies to make a commute mobility plan (Plan de déplacements d'entreprise, PDE) with the goal of replacing driving private cars with alternative modes of transport. Promotion of alternative modes of transport includes, for instance

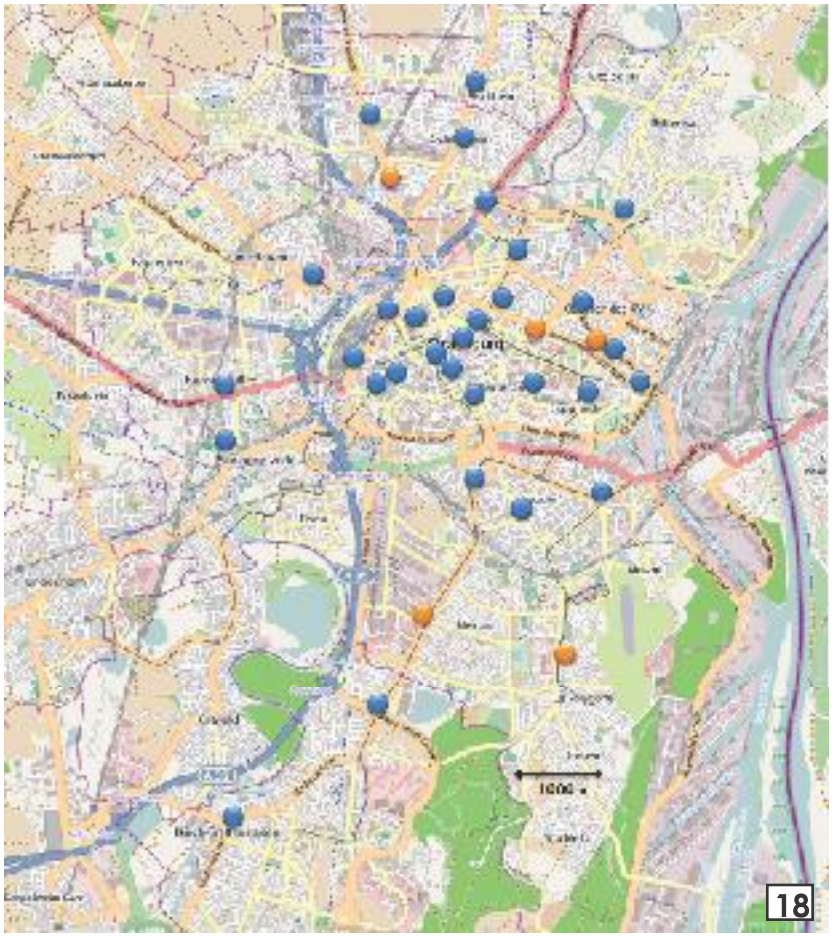
- promoting cycling by offering services that support it,
- ensuring direct and accessible walking connections to workplace buildings,
- promoting the use of public transport in cooperation with public transport operators,
- enabling flexible working times,
- enabling the use of a taxi or shared cars on the way home in exceptional circumstances,
- offering shared cars in trips related to work and between home and the workplace as well as
- creating a carpool system and offering parking spaces for carpool cars.

The state of France financially supports workplace projects in accordance with PDE. Local city transport authorities and chambers of commerce offer advice and contacts for completing shared projects of different companies. The state finances 30 percent of the planning and investing costs of initiatives by companies of over 300 employees, with a maximum budget of 75,000 Euros, and 20–30 per cent of operating costs with a maximum budget of 300,00 Euros.

17
The covered bicycle park for the employees of the city of Strasbourg can be accessed with a personal entrance permit, and in addition to bicycle pumps, the premises offer lockers for bicycle helmets.

Strasbourg Encourages Sustainable Commuting

The city region of Strasbourg decided to pay 50 per cent of the price of its employees' public transport tickets as of 2001. Nowadays French law obliges an employer to pay half of the prices of public transport tickets or the bicycle rent of employees in trips between home and the workplace. In addition, the city region organization of Strasbourg offers its employees both red shared bicycles for occasional work-related trips and blue bicycles for trips between the home and workplace. The blue bikes can be rented for about 70 Euros per year, which includes a bicycle for women or men with or without a child seat, theft insurance as well as two annual services. The car sharing scheme of the city, Auto'trement, is also used to try and increase the number of daily trips made by walking and by bicycle.



Map: OpenStreetMap contributors, CC-BY-SA

In Strasbourg city residents or companies can register as customers of the Auto'trement car sharing scheme. Together with good public transport as well as cycling and walking possibilities, the city residents are offered the same advantages as car-owning citizens or companies that use company cars, but without the need to own their own car that would be in a parking spot 95 per cent of the time. The shared cars are either hybrids or low carbon cars, and by paying 28 Euros monthly, 18-26-year-olds receive the Auto'trement card and the right to use public transport freely. The price of the card in question is 49 Euros for people over the age of 26. In addition, a user of a shared car pays for the use of the car in accordance with use hours or driven kilometres. For instance a round trip of 15 kilometres outside the city, during which the car is reserved for altogether four hours, costs about 15 Euros. Often people who own their own cars use it for trips that would be more convenient on foot or by bike. When the car exists in one's own yard, it is easy to take it into the traffic without thinking about it, no matter what the trip. The aim of Auto'trement is to enable diverse mobility possibilities for city residents, and at the same time reduce the motoring level of the city.

18
The accessibility of shared cars has been ensured by placing nearly all rental points along rail connections. There will be over 30 rental points in the city of Strasbourg, and in addition, there are about 20 more points in other cities in the county of Alsace. Orange blue spots on the map are rental points that will be opened during 2011 and the blue spots mark existing rental points.

Bicycle on Public Transport

In European cities public transport, walking and cycling are planned in the traffic system so as to support each other by taking the whole trip chain into consideration. The area of influence of public transport can be increased, in addition to offering interchange parking, by allowing the transport of bicycles in trains, trams and busses. In many European cities, transporting a bicycle in public transport vehicles is allowed at least outside of rush hour. Thus, cyclists can continue their journey with their own bicycle after arriving at the terminal point.

Allowing bicycles in public transport vehicles is especially important for people who do not own a car, since it enables travelling to areas that are outside the reach of public transport. One of the most important goals is to entice motorists towards more sustainable forms of transport by increasing the flexibility of public transport. The combination of bicycle-public transport-bicycle increases the number of destinations that can be reached with public transport considerably, and offers a worthy alternative for motorists who are used to door-to-door type of travelling.

19


20

21

19, 20 & 21
The option to transport a bicycle in public transport vehicles expands the possible use of a bicycle to both ends of the trip chain. In Copenhagen, the possibility for transporting bicycles is expressed by the large bicycle symbols on the side of the carriages. Transporting bicycles on the trains is free but during rush hour in the morning between 7 a.m.-8 p.m. and during afternoon between 3.30 p.m.-5 p.m. one is not allowed to transport bicycles in the carriages.

Bicycle Centres as the Messengers of a Cycling Culture

More and more cities have a bicycle centre that gathers information and action related to cycling under one roof. The purpose of a bicycle centre is to promote cycling and improve its image by offering extensive information on cycling and services related to cycling.

The variety of services offered by bicycle centres in different cities is extensive. Services can include cycling courses, bicycle rental, repair and maintenance services as well as information on local cycling routes and conditions. The role of cycling centres is often significant especially in guiding and encouraging schoolchildren. The goal of a cycling centre is to get both children and adults to try cycling. Cycling especially in a city can be new to many people, which is why people may have misconceptions about cycling. A bicycle centre can also help with buying a bicycle and also with the sale of used bicycles.

Along with maintenance services, several centres offer customers the premises and tools for independent service and maintenance of bicycles, and the centres may even have shower facilities for locals and tourists who have cycled from a far. The bicycle centre acts as a facilitator for the city residents and attracts new residents to cycling. A bicycle centre is also often used to aid in employing the long-term unemployed.

A bicycle centre can offer, for instance

- Brochures and maps
- Information on local cycling routes
- Help in buying a bicycle
- Cycling courses
- Possibility of bicycle parking
- Bicycle maintenance courses
- Help in organizing cycling events
- Bicycle clubs for children and young people
- Presentation of different kinds of trailer solutions
- Collecting feedback on cycling conditions
- Repair and maintenance services
- Do-it-yourself maintenance points
- Bicycle and gear sales
- Bicycle and trailer rentals
- Shower premises for cyclists who have come from a far
- Making bicycle exercise programmes
- Cycling exhibitions
- Own publications
- Lockers
- _____

Centre of Sustainable Mobility

In cities where creating a strong cycling culture is just beginning it may be advantageous to combine cycling with other forms of transport in a centre of sustainable mobility. In addition to cycling it offers information on public transport, walking and carpools as well as car sharing schemes. Thus the user base of the centre is wider and a centre of sustainable mobility has the possibility to attract people who are interested in public transport, but may not be looking for information on cycling, to cycle or walk.

24
In Freiburg the bicycle centre is situated in a central location in proximity to the main railway station in Mobile, the centre for sustainable mobility. Due to its central location the mobility centre Mobile has the potential to attract a large number of passers-by for a visit.

Marketing

Marketing as a Part of the Planning Process

A good cycling and walking city combines functional infrastructure as well as a cycling- and walking-friendly philosophy. Marketing is increasingly a part of the transport strategy of cities as a way to increase the modal shares of both cycling and walking. Many cities have noticed that people cannot be attracted to these forms of transport only by improving infrastructure, increasing services or enabling a safe mobility environment. The awareness of potential cyclists as well as pedestrians of good mobility possibilities has to be increased with the help of active informing and marketing. When people's awareness of alternative modes of transport grows and their use is increased, the volume of driving a car can be reduced at the same time.

In addition to increasing awareness, marketing can also help in changing people's attitudes as well as maintaining their existing way of thinking that favours walking and cycling. It is good to remember that people are more willing to change their behaviour if they can try and experience new things themselves. Information alone is not always enough, but the aim must be to involve people in the change.

"Locked bicycle, disappointed thieves"

"Ghent, crazy about cycling"

26

Source: Stad Gent 2005

25

Source: Stad Gent

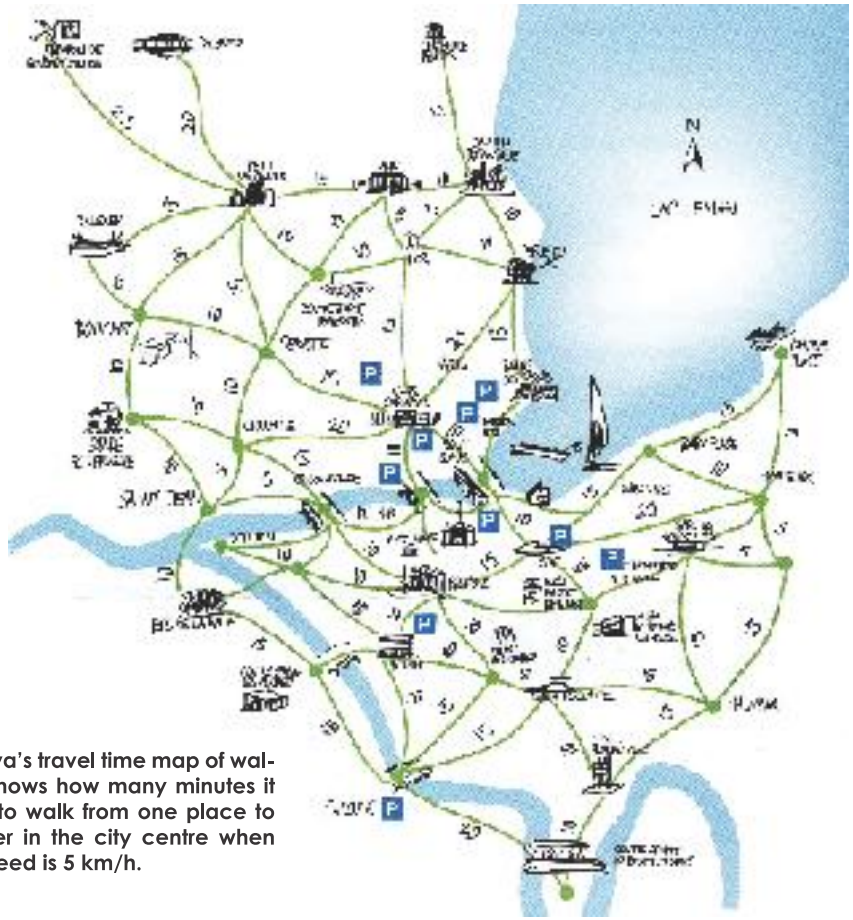
"A bicycle always looks good on you"

25 & 26
Ghent has invested in marketing cycling for several years. Different kinds of campaigns offer residents information on the fact that cycling is the best mode of transport in the city when going to shops, work or even the theatre. In addition to the practicality of cycling, the city reminds people to look after their bicycles and to lock them with appropriate locks to prevent theft.

Marketing Campaigns

From Public Events to Door-to-door Marketing

Throughout the years, all sorts of campaigns for promoting cycling and walking have been realized in Europe. Some of these are singular events lasting only for a day, whereas some become an annual tradition, in which a great number of city residents participate. Some campaigns are targeted at a wide audience, whereas some are tailored to a small, specifically defined group, such as children or working adults. All promotion activities do not require active participation by people, but they can be seen in the street environment as pictures or catchy advert slogans. Marketing campaigns can be roughly divided into three groups: information and awareness-raising campaigns, training and education as well as indivisualised marketing.



Source: Ville de Genève 2000

Geneva's travel time map of walking shows how many minutes it takes to walk from one place to another in the city centre when the speed is 5 km/h.

Information and Awareness-raising Campaigns

The purpose of information and awareness-raising campaigns is to increase the awareness of a large audience regarding the advantages of cycling and walking. These kinds of high-profile campaigns rarely influence the travelling behaviour of people, but they help to change attitudes towards alternative forms of transport in a positive manner. However, it has to be kept in mind that it is not profitable to organize impressive cycling campaigns unless the mobility conditions are already on a good level and the possibility to cycle quickly and safely already exists.

With the help of different kinds of cycling and walking festivals and events, people have the opportunity to hear about the advantages of these forms of transport and to gain personal experiences in a fun, but at the same time educational way. Although the campaigns mainly attract active exercisers, there are always people who do not yet actively cycle or walk. If the events inspire at least a few people to cycle and walk more, they have been worthwhile, since as the number of cyclists grow, it is easier for others to start pedalling too.

Billboards, posters or ads that raise attention are an effective way to make people ponder the use of alternative forms of transport and their own mobility, as well as its impact on the environment, if only for a second. In 2000, Strasbourg hung posters over 4 metres high around the city aimed at advertising cycling as a modern and fun mode of transport. With the help of maps, people can be enticed to walk or cycle on certain routes and find the best areas of the city for cycling and walking. A route that goes through all free cultural targets, such as historical monuments and museums, has been marked on the cycling map of Ghent. The map guides people to sights, but also encourages making the trip by bicycle

Plan Piétons, or the walking master plan of Geneva, is a good example of how marketing can be included as a part of planning. Geneva strives to actively promote walking by advertising it as a convenient, easy and economic way to move around the city, especially in the centre. The city has developed pedestrian routes by taking the attractiveness of routes into consideration. They have been classified according to themes, and travellers can experience the finest sights of Geneva on each route. Along these routes, there is something to see and experience for every traveller, tourist and city resident.

The city also organizes guided Sunday walks, all of which have their own theme. Guides are, among others, architects, engineers as well as historians. To promote walking, Geneva has also made a map of the city centre area including the walking times for each marked route. The purpose of the map is to communicate to people that walking is easy and surprisingly fast, since no location is too far in a city centre. Geneva, the Walking City, therefore encourages people to get to know different locations on foot and to find the best sides of the city by walking.

Training and Education

A lack of cycling skills and poor knowledge of traffic rules often reduces the willingness of people to cycle. However, training and education can increase cycling willingness, teach skills, encourage cycling as well as inform people of its health benefits. Training can concentrate on learning traffic rules or cycle routes as well as efficient use of other infrastructure. Training and education can be directed at certain groups, such as schoolchildren, the elderly, immigrants or adults who have not cycled before. In addition to the theory portion, an important part of the education is practical training, during which people have a good opportunity to notice how easy a vehicle a bicycle is to use. Through practical experience people absorb a new concept and change their behaviour accordingly. People can also be educated of the advantages of walking in conjuction with seminars related to health and fitness. With the help of education, walking can be made an essential part of the daily mobility of people, since walking is a mode of transport as much as cycling and driving.

Hands-on experience is one of the most efficient form of marketing.

Photo: Pédibus, Geneve 2011

Campaigns aimed at children

Children are one of the most important target groups when changing mobility habits, since attitudes towards traffic and mobility are created very young and habits learned as a child will easily continue into adulthood. Children are one of the age groups who move around the most and they usually enjoy walking and cycling. Walking and cycling have a lot of health promoting influences, but these modes of transport offer other advantages for children as well. By walking and cycling children observe their environment better and their observation ability grows with regard to the rest of the traffic.

In order for children to learn from a young age to take up cycling and walking as a part of their everyday mobility, schools have to offer active and up-to-date traffic education. The role and example given by parents to their children is also very significant when creating the mobility habits as well as attitudes of children. This is why parents must be taken into consideration when planning traffic education. Geneva has developed a guidebook advising parents on how children can be thought cycling-related skills. This book contains clear instructions with pictures of doing different kinds of exercises, such as riding a circle or an eight. It also teaches the skill of riding in traffic, such as turning left or right as well as rights of way. Växjö has developed a textbook of cycling and the traffic environment for children in the classes 4–6 in primary school. This book has been illustrated in a fun way and it is colourful, which will surely increase children's interest towards the tasks in the book and also traffic in general.

However, traffic education can start before school age. For instance in Ghent marketing is started very young. Free bicycle helmets are sent to 3-year-olds, cycling vests for 5-year-olds and reflector vests for 8-year-olds. At the same time the children's parents receive information on cycling. In Freiburg children learn to cycle from a young age, but traffic rules are, as a general rule, aimed at 9–10-year-old children. In Odense, a Cycling Duckie goes around kindergartens teaching young children about cycling. In Geneva children go to school together with the help of the "walking school bus" or Pédibus. Adults, such as parents or relatives, take part in escorting the children of the neighbourhood to school safely by walking.

The needs of the target groups must be taken into consideration especially when the marketing is targeted at children, as their ways of thinking differ from that of adults. It is also significant how old the children are. The thoughts of a 7-year-old child differ quite a lot from those of a 15-year-old teenager. Also schools differ in their methods quite a lot, since in a primary school one class is taught mainly by one teacher whereas in secondary school the teacher changes with different subjects. By targeting campaigns and education at children of different ages it is possible to ensure the conveyance of the right kind of message and the efficient learning of traffic habits.

Individualised Marketing

Individually planned campaigns are the most effective way to influence people's travelling habits. Although these campaigns are usually quite expensive and require a lot of man power, they have the most efficient short-term as well as long-term effects. In individualised marketing, it is possible to get personally tailored information that takes people's own needs and life situation into consideration. Marketing campaigns directed at individuals often act as support along with extensive marketing campaigns. When planned and realized carefully, they can be very cost-efficient when trying to change people's mobility habits. The challenge is therefore to create campaigns that take different kinds of individuals into consideration as well as to get them involved on a personal level.

Residents who have just moved into an area are usually a good target group for individualised marketing, since they have not yet had the time to form embedded travelling habits, unlike those who have lived in the area for longtime. Deep-rooted behaviour might be difficult to change if people do not see a particular reason for a change in their behaviour. A start-up package that contains the most essential information regarding cycling and walking as well as their possibilities and advantages can be given to new residents. For instance in Geneva, a start-up package is given to international organizations containing information on cycling and walking in the city as well as maps and brochures. It is easier to encourage the staff of international organizations to cycle, since they do not have the driving habits related to commuting like the local community.

No Need to Reinvent the Wheel

Campaigns related to marketing have been planned and organized around the world, not least in Europe. Although some campaigns have been developed by taking the needs and requirements of one city into consideration, there are also campaigns that have been planned for wider distribution. Some of these have even been meant for world-wide use, so that the message given by them would spread as extensively as possible to different countries and continents. An example of these is the PARK(ing) Day, in which one or more parking spaces in a centre is changed into a green area where people can spend time for the duration of "parking". The purpose of this campaign is to make people think of the functions and attractiveness of the centre, since in many cities a large part of the area of the centre has been reserved for car parking. This event has gained popularity around the world and each year more and more cities participate. Utilizing and realizing these kinds of campaigns is usually easy and, therefore, participating in them pays off. Although innovativeness is good when planning marketing, sometimes it is unnecessary to reinvent the wheel.

27 & 28
In context with the TravelSmart project, Australia has tried out the effectiveness of door-to-door marketing in changing travelling habits. Residents of a certain area were given tailored information on walking and cycling possibilities and informed of their health-promoting influences. As a result of the project, the share of walking increased from 12% to 15%. In a follow-up study performed two years later it was noticed that the changes had been permanent.

29
During PARK(ing) Day, a green oasis set up in the place of a parking space in the centre reminds people of the importance of park-like areas with regard to the attractiveness of the city.


Photo: Chandra Prasad/Sustrans
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Photo: Rachel Purdy/Sustrans
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Photo: Rebar 2010
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Target Groups

Choosing Target Groups is the Basis for a Successful Campaign

The role of the target group in planning and realizing a marketing campaign is significant. For instance the education needs and understanding of children and schoolchildren with regard to traffic differ considerably from the needs of middle-aged or retired motorists. Marketing targeted at groups in the process of important transition in their life has also proved more effective than trying to influence the behaviour of people who have gotten used to their everyday life. Good examples of this are the previously mentioned new residents of a city or people in the process of retiring. Marketing is most efficient when it is directed at people who have a great potential for increasing cycling and walking in their everyday mobility. People who do not use alternative modes of transport at all and have no intention of doing so are difficult to persuade to reduce car driving. Messages targeted at these people with the help of marketing must be planned especially carefully. It is important to understand why people behave the way they do before their behaviour can be influenced.

Cycling is trendy and the form of transport of all people regardless of age and gender.

Messages given by marketing have to be planned according to the needs and attitudes of each target group. For instance, older people value safety and easiness of mobility, whereas young people value speed and sportiness. It is especially important however, to make cycling as trendy as possible and to make it the mode of transport for all city residents. In addition to being fast and easy, cycling should be compared to driving cars with regard to being as interesting and attractive. Nowadays cycling is too often considered as the mode of transport of poor or unfortunate people or active, sporty people. For instance Copenhagen has tried to get rid of this way of thinking by making cycling trendier than driving a car, which many people in fact now consider as more old-fashioned.

In addition to taking the needs of different target groups into consideration, marketing campaigns must also pay attention to the development phase of a city in promoting cycling and walking. In cities where people already cycle and walk it is not necessary to further convince residents of the advantages of these modes of transport. In this case it is more important to make the residents utilize walking and cycling for all kinds of trips from commutes to shopping as well as recreational trips. The idea is reversed in cities where there are only a few cyclists and pedestrians. People have to be reminded of the benefits of cycling and walking constantly, so that they are convinced of the advantages of human-powered transportation.

Cycling and walking must be marketed as everyday mobility, not just as forms of exercise.

Cycling to Work

In promoting cycling and walking, one of the most important target groups of marketing is working adults. The route from home to the workplace is one of the daily trips that have to be made regardless of weather, time of the year or mode of transport. Therefore many cities have taken commute cyclists as one of their main target group of marketing and developed cooperation with local companies, so that they would encourage their employees to travel to and from work with alternative modes of transport instead of private cars. Companies benefit considerably from active commute cycling by saving in parking fees and parking spaces reserved for cars. It has been noticed that employees who cycle to work are more alert and efficient than their driving colleagues.

In most campaigns, companies have a big role in the implementation and successful completion of the event. Althought fewer campaigns have been invented in the companies themselves, employers have noticed the advantages of cycling and started to support commute cycling of their employees themselves.

Campaigns used for promoting cycling to work range from short, one-time events to large campaigns lasting for many years. In Geneva from time to time the custom is to visit larger companies and take employees for a bicycle trip or picnic for the duration of lunch. In Odense employees have been given an opportunity to try electric bikes as well as folding bicycles. These quite small scale campaigns strive to awaken people's interest towards cycling and do not require large investments from the company itself. Already for many years Copenhagen has organized a month-long campaign in work places, Vi cykler till arbejde, during which employees are encouraged to cycle to work. The most enthusiastic cyclists are rewarded. Brussels requires a Green Travel Plan from companies with over 200 employees. Companies must view their current travelling behaviour and on the basis of it, make an action plan detailing how employees are encouraged to use alternative modes of transport. The realization of the actions is followed with annual surveys and if necessary, the plan can be updated.

Vi cykler til arbejde or "Cycling to Work" project is one of the most extensive campaigns promoting cycling in Denmark. As the name suggests, the purpose of the campaign is to get as many people as possible to cycle at least a part of their trip to work. The campaign was organized for the first time in 1997 in a few cities in Denmark. From the first time the campaign was a success, so it has been expanded to more and more cities. Nowadays as much as 80,000–110,000 employees participate in the project annually. The project lasts for one month, usually May, during which employees write down how many days they have cycled to work. In the competition it is also possible to travel part of the trip to work by bicycle and combine a train or a bus in the trips. Thus also people who travel a longer distance can likewise participate in the competition.

Employees enrol in the competition in teams of 4–16 people and the participation fee is 40 dollars from each member of the team. Each team can go and record their cycling days on the website, where people can also check how much each participant has cycled compared to other teams or members of one's own team. The jackpot of the competition is a trip around the world, but also smaller prizes are handed out, such as bicycles, bicycle stands or a bicycle for the company in its own colours. The campaign clearly inspires people to cycle even longer trips to work. Often the trip to work is longer than seven kilometres for as many as 46% of the employees and longer than 15 kilometres for 15%.

Cooperation Parties

Media creates visibility for a campaign and increases awareness.

Not Everything Has to Be Done Alone

Especially in the early stages, planning and realizing marketing requires both time and resources. It can be desirable to use external marketing professionals, but the starting points and initiative for marketing are often given by the city. Planners must include marketing as a part of the planning process and goals. For instance the city organization of Odense does not have a marketing department, but external professionals are often used to help in creating ideas and realizing them. The help of marketing professionals assists in realizing successful, well-planned and correctly timed campaigns. It is also worth including parties that promote cycling and walking as partners, since they can provide support and help in realizing the campaign. These cooperation partners can be, for instance, environmental organizations, cycling organizations, employers, schools, the police, tourist agencies, bicycle manufacturers as well as local newspapers.

One of the most important cooperation partners is however the media. To gain as wide a visibility as possible and to spread awareness, the presence of media is important especially in the early stages of campaigns. At the very least the media should be utilized when significant improvements are made in a city to the infrastructure or services for pedestrians and cyclists. Cooperation with the media brings with it the desired publicity and raises awareness in city residents, thus helping to communicate with the target groups. Including the media also ensures that people are aware of the reforms and begin to use them. Sometimes the presence of only the local media, for instance a city newspaper, can be sufficient, whereas sometimes informing on a national level can be necessary. Positive attitude of the media towards cycling and walking campaigns brings additional value to the campaign, since often a campaign that has been presented in the media is taken more seriously and a newsworthy campaign is appreciated.

Source: Ville de Genève 2006

Photo : Kopf an: Motor aus. Fuer null CO_2 auf Kurzstrecken

30
In Geneva different kinds of cycling maps guide people to see the city sights by bicycle. A clear map and interesting sights encourage both locals and tourists to get to know the city by bicycle.

31
Imagination can be used in marketing slogans as well as where the text is printed on. An utterance "What is good for the feet is also good for the climate" in shopping bags will surely gain visibility in a city centre.

Modern technology enables innovative marketing of cycling.
In the Netherlands, the 16 kilometre long cycle track that will combine the cities of Arnheim and Nijmegen in the future is planned to be marketed in many different ways. Cyclists who use the route can glue a sticker containing a micro chip to their bike and follow the accumulated kilometres, burned calories and saved CO_2 emissions on the Internet with the help of electronic loops embedded in the cycle track. In addition, it is possible to realize on the basis of measuring cycling speeds, a playful presentation of the physical condition class of cyclists in the Internet service, where users can advance from "Sunday cyclists" all the way to "Sports nuts". By using the route people can collect points with which they earn discounts in, for instance, local bicycle service shops. The cycle track is meant to be made from a material that reflects light and it would lite with LED lights. The LED lights in the tunnel situated on the route are activated due to the chips on the bicycle and they would display the finer light shows the more the route has been used

The Influence of Marketing Campaigns

Can Marketing Make an Impact?

The impact of marketing campaigns on people's travelling behaviour is challenging to study, and there is still little information available on the achieved benefits. Very often follow-up research is not done, so information on the influences of the campaign on people's travelling behaviour in both the short-term and long-term is not achieved. Opinion polls can be done immediately after the campaign, but long-term follow-ups on the influences of the campaigns are very rare.

However, the campaigns from which research data is available have been successful and show that travelling behaviour has changed in the long run. Often the influences of the campaign diminish a little over the years if new campaigns have not been done. Therefore continuous and systematic marketing is the starting point for changing people's attitudes and behaviour.

Marketing must be performed systematically, so that permanent changes in people's behaviour can be achieved.

One Step Higher with Marketing

Marketing requires systematic work and the changing of attitudes one step at a time towards favouring cycling and walking. With continuous and systematic marketing people can understand the benefits of human-powered transportation and these forms of transport can be a part of their own daily mobility. These marketing steps presented by Åke Ståhlspets, an engineer in the Transport Organization of Sweden, depict the marketing process. According to him, marketing can be divided into five steps: awareness, acceptance, attitude change, action as well as loyalty. When people first understand the problem and accept the consequences of their actions, they change their behaviour more easily and make new habits a permanent part of their daily life.

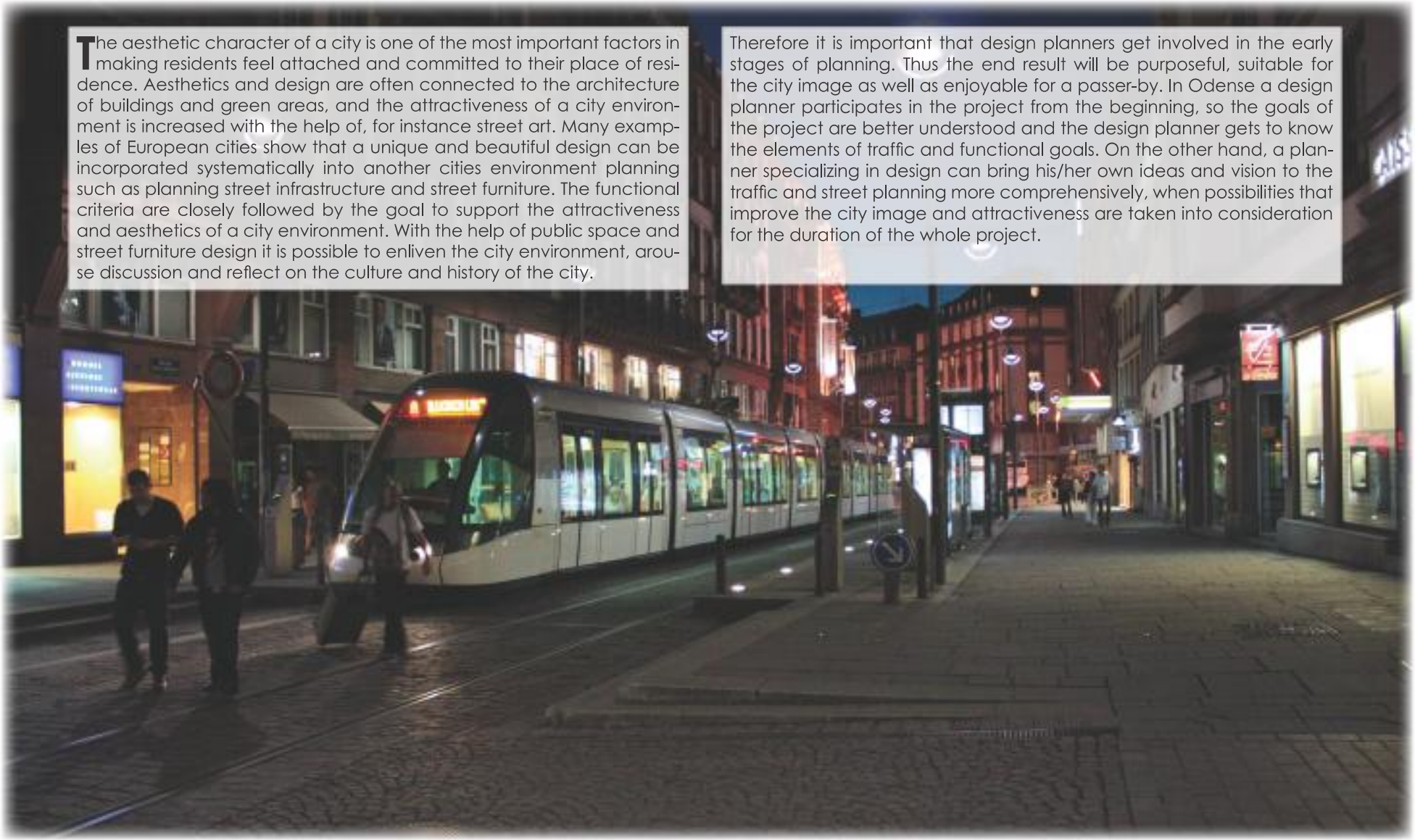
Life Cycle is a European project started in 2009 that aims to make cycling a part of people's everyday activity. As obesity as well as other illnesses resulting from low activity become more general, the significance of everyday activity in daily life grows, and cycling is one of the most efficient forms of everyday sports. Good cycling habits are created as a child, but the cycling habits of adults can be also influenced with efficient marketing. Therefore, the project includes target groups from all age groups.

The participating organizations from different countries have developed their own campaigns suited to the project, with the help of which the aim has been to reach the set goals. The project's handbook reveals the best marketing methods to entice targets groups to cycle and one of the most important methods for this is accumulating practical experience. Realized cycling promoting projects can be utilized by cities, cycling organizations, research centres, ministries and other parties. The project aims to give all countries and cities the possibility to learn from the campaigns made by others and to choose the marketing methods that are best suited for their own city.

Photo: Åke Ståhlspets 2009

Design

An Integral Part of a City



The aesthetic character of a city is one of the most important factors in making residents feel attached and committed to their place of residence. Aesthetics and design are often connected to the architecture of buildings and green areas, and the attractiveness of a city environment is increased with the help of, for instance street art. Many examples of European cities show that a unique and beautiful design can be incorporated systematically into another cities environment planning such as planning street infrastructure and street furniture. The functional criteria are closely followed by the goal to support the attractiveness and aesthetics of a city environment. With the help of public space and street furniture design it is possible to enliven the city environment, arouse discussion and reflect on the culture and history of the city.

Therefore it is important that design planners get involved in the early stages of planning. Thus the end result will be purposeful, suitable for the city image as well as enjoyable for a passer-by. In Odense a design planner participates in the project from the beginning, so the goals of the project are better understood and the design planner gets to know the elements of traffic and functional goals. On the other hand, a planner specializing in design can bring his/her own ideas and vision to the traffic and street planning more comprehensively, when possibilities that improve the city image and attractiveness are taken into consideration for the duration of the whole project.

Good Design Allures to Get to Know the City

People walk for longer in an interesting and pleasant environment. The street environment offers numerous possibilities for using creative and aesthetic design. With designs that deviate from the norm and by paying attention to details, functional elements, such as lighting, become a part of an enjoyable street environment.

Good design does not only influence how public spaces will look but it also has an impact on how the space is used. Carefully considered details and street art tempt people to spend more time in the public space. Design can communicate for instance, a space meant for spending time or guide travellers to a certain direction. With the help of attractive, good-quality lighting and street material, people can be guided to get to know more remote targets, or alternatively, the continuation of a walking, recreational or shopping area can be communicated. In Odense beautiful street design is used to make people park their cars a little further away from the centre and to create a feeling that the centre is near, even though the trip consists of 500 metres instead of 50. Interesting details tempt people to get to know the city, and according to the Danish Gehl Architects, main pedestrian routes should offer interesting details, experiences and activities every four seconds. This is the principled goal for instance in Odense, where the aim is to influence people's mobility by shaping the city environment as a more interesting and enjoyable place.

Impressive Bicycle Parking

In Europe, the appearance of bicycle parking and adjusting it to the environment have been taken into consideration well. Often bicycle parking is resisted in centre areas on the basis of its unclean appearance and inability to blend with the environment.

However, innovatively planned bicycle stops can be their own kinds of works of art that create colour and a look to their environment. A beautiful bicycle parking space attracts users. In addition, bicycle shelters are beautifully lighted during dark in Odense.

Design must also take into consideration what the stand will look like when there are no bicycles. With the help of design, it can be strived to make good-looking stands that still look modern even as time goes by. However, design cannot have a weakening effect on the functionality or usability of bicycle parking.

Details Matter

European cities have known how to pay attention to the fact that a fundamental street infrastructure with surfaces and columns can increase attractiveness due to good planning. By using different kinds of forms, colours and materials, street infrastructure can be part of a pleasant city experience or an experience in itself. Instead of settling for passive solutions it can be recognized that a city is the people's living room and its streets are a part of everyday life, not just temporary environments, where people spend time, or use mobility routes. Unlike motorists, the terms of whom streets have traditionally been planned during the last few decades, cyclists and especially pedestrians can observe small and delightful details planners have embedded in the street environment.

Street Art to Delight Travellers

Street design and art in a city or town can act as land marks and they can be included in planning a signposting system which is one factor that improves the readability of the city. Especially in large cities, identifying different parts and areas can be made clearer with the help of design and art. The enjoyment of daily trips and commutes for city residents are increased by using the street space as a temporary exhibition place for art, in addition to permanent street art. This enables versatile use of space and brings dynamism and variation to daily city life.

Design as the Enhancer of the Identity and Image of a City

Design is used to enhance the identity and image of a city by incorporating elements that are characteristic to the city and define the nature of the city in the city environment. For instance, planning bus stops and signage or the use of the surface material of streets can create a distinct street image for the city and influence the look of the city. Different kinds of elements, such as street lighting, can function as the city's business card. Design can communicate the city's values and goals, history or elements that are closely tied to the city, such as waterways or an important industrial field. The story of the stable tin soldier by H. C. Andersen, who was born in the city of Odense, has acted as a source of inspiration when planning street bollards. With the help of design a city can stand out among other cities and also enhance the feeling of the residents of their own and unique living environment.

In Bristol in Great Britain, design is used to enhance the identity of different sections and places of the city in addition to the identity of the city. Bristol wishes to highlight the characteristics and best sides of different areas by integrating art and design closely to the city image, so that the city would not be perceived only as a "fragmented, undefined collection of easily forgettable places" (Lamacraft 1999). The goals of Bristol include making mobility easier and improving the readability of the city. With regard to reaching these goals, the use of design and art is in a central position. With the help of detailed design and art, the aim is to partly replace traditional signposts that guide towards recommended directions.

Photo: City ID Limited 2011

Photo: City ID Limited 2011

9

Towards the Targets with Follow-up

Counting Methods of Cycling and Walking

Counting

Counting Creates the Basis for Goals

Counting pedestrian and cycling volumes can be used as a base for road investments.

As the amount of built up city areas grows and environmental goals become stricter, high growth objectives have been set for cycling and walking. However, so far measuring these quantitative goals has not been focused on. Features and influences that reduce the congestion of bicycle and pedestrian traffic as well as the need for space have been known for a long time, but still their infrastructure has not been developed to correspond with the service level of motor vehicle traffic routes. Often the volumes of bicycle and pedestrian traffic are estimates and no precise traffic volumes can be found, so it is not justifiable to make route investments for cycling and walking either. Therefore, more attention should be paid on counting the traffic volumes of cycling and walking.

The characteristics of cycling and walking differ greatly from motor vehicle traffic. The characteristics of cycling and walking, which also differ from each other with regard to speeds and daily travel ranges, are highlighted especially when comparing these modes of travel to the speeds and daily travel ranges of motor vehicle traffic. The speeds of walking and cycling and especially the daily travel range of walking are considerably smaller than the respective characteristics of motor vehicle traffic. Typical factors for the variation of user numbers in cycling and walking are changes in weather and the air temperature, since their influence on user numbers is considerably greater in walking and cycling than motor vehicle traffic. Therefore the mobility profiles of cyclists and pedestrians are of a different type when compared to counting motor traffic, and the counting methods and equipment or expansion factors cannot be directly used for cycling and walking.

Many goals for increasing cycling and walking, such as an reduction in environmental damage and traffic congestion, enabling livelier residential areas and streets, increasing a healthier and more active life style, improving the safety of cyclists and pedestrians as well as forming safe routes to schools have inspired to pay attention to the follow-up of the volumes of bicycles and pedestrians. Follow-up information is needed for the development of cycling and walking volumes and temporal and weather variations on national, regional and local levels. On a national level, information of walking and cycling is needed to view traffic policy goals and indicators. On a regional and municipality level, the need for information is directed at municipalities' own promotional goals of cycling and walking. On a project level the use of counting data is targeted at the follow-up of potential cycling and walking volumes in context with some specific projects. In addition, information on accident risk is needed as well as the role of walking and cycling in a part of the trip chain, for instance as a form of feeder traffic in public transport. Often municipalities and towns need to know where cyclists and pedestrians move and what routes they use, how land use and changing it influence the volumes of walking and cycling, what the demographic characteristics of pedestrians and cyclists are as well as how much services are offered to pedestrians and cyclists and where these services are located. Quality of services is also necessary information, as well as scenes of accidents.

1
With the help of counts, the often surprisingly high traffic volumes of cycling and walking receive the attention they deserve. This can also be seen in the service level of routes, which should not decrease even during maintenance works.

Counting Methods

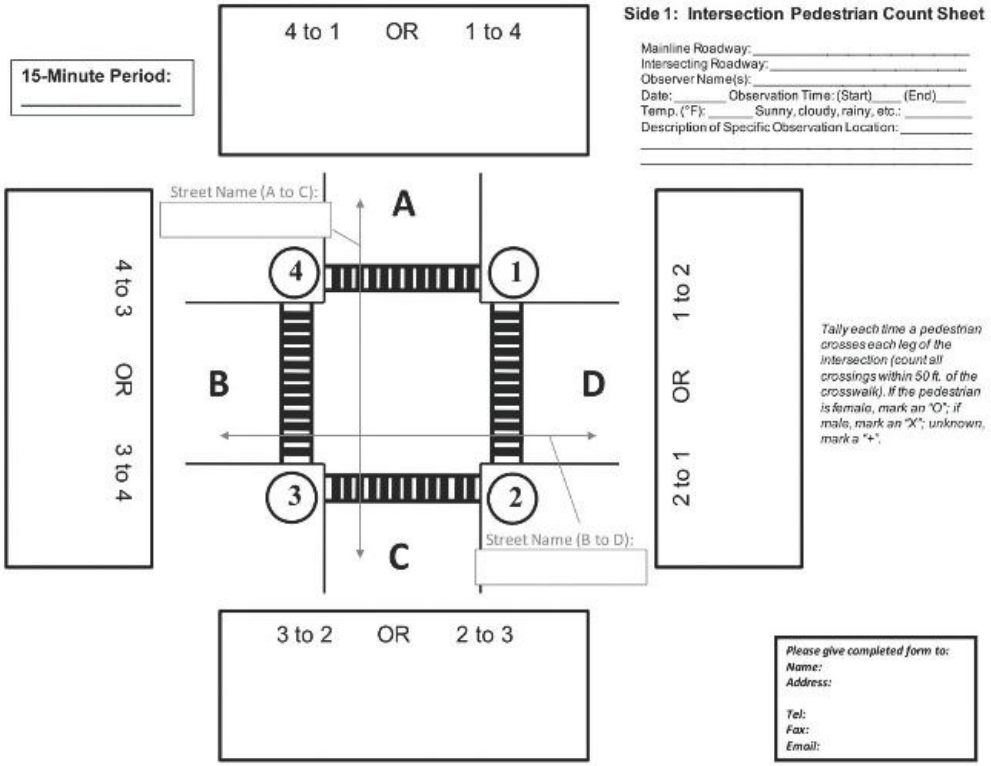
There are many kinds of methods for counting cycling and walking. There are one-time as well as continuous counts and counts can be performed either manually or with the help of an automatic counting device. One-time sample counting is the most cost-efficient way to evaluate volumes of traffic at the counting point, but accuracy is not as good as in continuous counting. With the help of continuous measuring points it is also possible to define seasonal variation and expansion factors, unlike with one-time sample counts. Counts can either be made as cross-section counts or as intersection-specific. Cross-section counts are often used to observe changes and trends occurring in volumes of traffic as well as to recognize factors that influence walking and cycling. Intersection counts are most often used for making safety analyses and they should be made in as busy a location as possible.

Manual Counting Has its Place

Short sample counts are most often made by hand at the counting location or by interpreting a video image. Manual counting is most often done by recording on forms or with the help of IT. When the observation happens manually, it is possible to observe things from cycling and walking other than volumes, such as the age of the people or forms of transport, i.e. roller skaters as well as cyclists and pedestrians. The possibility of human error may become a problem in manual counting. The accuracy of the count is largely dependent on the motivation as well as alertness of the observer. The accuracy of counts can in fact be improved by reducing the number of observed targets.

The mode of transport can so far only be attained without error in manual counting. Thus, manual counting is despite high costs, especially useful for calibrating automatic traffic counters as well as observing additional information. That information can be as such as age and gender, taking turning into consideration or executing for example peak hour counts in a fast schedule.

In manual counting the number of counts must be high enough so that the results are statistically significant. Often the relatively high costs of manual counting prevents its use as the only counting method of walking and cycling. Manual counting is also made more difficult by the observers getting tired, since a manually counting person can only produce reliable information for a short time. In congested manual counting points a sufficient number of observers must be used, since using only one counter limits the observation of the environment.



Source: NBPD 2011

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2
In manual counting the results are marked on an observation form that looks like, for instance, the one in the picture.

Automatic Counting

Automatic, mechanical counting can mean continuous counting all year round or sample counting. Automatic counting is a cheaper method than manual counting in long-term sample counts. With automatic counting, for instance the mode of transport is not identified, so manual counts complement the results of automatic counts. Automatic counting increases understanding of the characteristics of bicycle and pedestrian traffic. With the help of automatic counters making counts all year round, it is possible to identify daily, weekly and seasonal changes in traffic as well as, when combined with weather information, form expansion factors to expand the sample counts to cover a longer period of time.

Automatic counting of bicycle and pedestrian traffic is harder than counting motor traffic, since the routes of pedestrians are not as lined and consistent as with motor vehicle traffic. Therefore, when choosing the type of automatic counters the special characteristics of the mobility of pedestrians should be considered. Other things to consider are the price of the equipment, installation costs as well as location, maintenance costs, size of the device and the space it takes up in the installation location. Also the data saving form, laws related to installation, and accuracy of the device must be taken into consideration. Installation is important when guaranteeing the accuracy of counters. Different devices have different installation instructions and different devices are suitable for different locations and conditions depending on the width of the route.

When making long-term counts with counters, the possibility of vandalism aimed at the devices must always be taken into consideration, especially if the devices are in a noticeable place. However, often this risk is taken since it being in a public place can also prevent vandalism. In fact, screens that show the daily, weekly or monthly number of cyclists travelling on the route can be placed along the route for several counting devices. The screens have a great visibility and marketing value, since often the highness of the number of cyclists that can be seen on the screen surprises passers-by and, thus, cycling receives visibility as its own mode of transport.

Nowadays it is possible to get many different kinds of software and tools compatible with most formats for the management of counting data. With these, data can be saved and distributed locally, regionally or nationally. Transferring the data and counting results from the device's main unit to a user can happen, for instance, through GPRS when the data is updated daily, with Bluetooth on location or when GPRS connection is missing, via satellite. Several devices can also share information with a telemetric connection.

3
An inductive loop recognizes a bicycle going over it with the help of a magnetic field.

Counting Devices

Loop

The counting method of an inductive loop that counts bicycles is based on a cable buried in the ground. This cable creates a magnetic field. When a sufficiently large metallic target passes the loop, the counting unit registers the change in the magnetic field and recognizes a bicycle. With some loop devices, direction information can be defined in addition to the passing-by time. The loops are very durable. The problem with a fibre optic cable that is placed near the surface of the street and used instead of an inductive loop is that it may become damaged during winter maintenance. The benefit of fibre optics however is that it also detects bicycles with aluminium or plastic frames, which an inductive loop cannot do. However, when correctly installed a loop device can be very accurate. Many precision problems related to loops have been solved during the past few years as the devices are now able to separate motor vehicles from bicycles with the help of for instance wheelbase.

Bicycles that go over the loop at the same time have been seen as problematic for the operational accuracy of a loop. However, the loop counting devices have been developed so that the width of the loop has been reduced to nearly half its former size. Thus, a combination of two wider loops can be replaced with the combination of three narrower loops, in which case it is nearly impossible for two bicycles to cross one loop simultaneously. Also prams as well as shopping or luggage trolleys and mopeds may create a false counting result of the device, since the loop can register the previously mentioned as a bicycle.

Infrared Counter

The operation of an infrared device is based on observing heat radiation changes and the device can be either active or passive. An active infrared counter sends infrared rays to the desired area and observes a traveller as the ray breaks. Speed and direction can be observed as well.

A passive infrared device observes the radiation of a human body. By placing two counters on the route, such as with an active infrared device, speed and direction of the travellers can be observed. However, it is not possible to define the mode of transport, so the device is an overall number counter. The reliability of the device is weakened by its tendency to incorrectly count animals as well as in some cases even falling leaves. Such as with an active infrared device, the device can count a false result when several people happen to be in the area of the device at the same time. The benefits of the device are for instance, its fast and easy installation as well as the transferability and compatibility of the device with other computer software. In addition, the operation of the device is not influenced by other sources of light, temperature or weather conditions.

Counting pedestrians and cyclists and separating them can be done with a combination of several devices, so both pedestrians and cyclists can be counted separately on a mixed route. This device is comprised of an inductive loop that counts cyclists and a passive infrared device that counts pedestrians. The infrared device counts all travellers passing the device with the help of heat radiation. The loop device, on the other hand, recognizes bicycles passing the device. The counter finds out the number of pedestrians by subtracting the result of the loop device from the result of the infrared device.

A Radar Detector

A radar detector, the appearance of which resembles an infrared counter, observes moving targets in the cone with microwave technology and is suitable, in addition to vehicle traffic, for observing bicycle and pedestrian traffic. The device can separate arriving and exiting traffic from each other inside the cone.

SDR radar can separate bicycle and pedestrian traffic from each other as well as from car traffic. The separation is based on the outer measures and speed of the observed target. The benefit of radar is its easy installation, since the device can be installed on a pole along the road and there is no need for interrupting traffic or digging the street.

Source: Via Strada Ltd 2008

Source: Via Strada Ltd 2008

4 & 5
A passive infrared counter observes heat radiation of a human body. The devices are easy to install and transfer when needed.

Photo: Traffic Technology Ltd 2011

6
SDR radar is easy to install, for instance on a pole. It is also able to separate pedestrian, bicycle and car traffic from each other.

Pressure Sensors

Devices based on pressure changes are the most unnoticeable counting devices as they are hidden underground. There are several counting devices based on a pressure sensor, but there may be different applications for their use. Pressure changes can be observed as acoustic waves, for instance as hydro acoustic in water or mechanic acoustic in other materials. The counting technique of a slab sensor is based on an electro-mechanical membrane, on which a tension change occurs as a result of the weight of a pedestrian. The tension change arriving to the device is observed with the help of a data collector. A slab sensor is suitable as a counting device only for counting pedestrians and it can also count situations in which several travellers cross the slab simultaneously. Since a bicycle causes a different kind of tension level than a pedestrian, it would be possible to develop a more efficient version of the device for counting bicycles as well. Slab sensors are commonly used for instance in counting the visitor numbers of department stores.

An acoustic sensor plate is suited only for counting pedestrians, just like a slab sensor. The device is very accurate, invisible to travellers and thus safe from vandalism. Plates that are installed underground observe even small changes happening in the pressure levels caused by pedestrians and thus recognize a traveller. The timer of the device prevents counting the same person several times. The device can be installed in all soil types except for stony ground.

Pressure devices installed underground are not however, totally immune from the weather. When the ground is frozen the device will not work. Also in very wide routes accurate counting can be challenging. Most devices cannot separate the mode of transport either, so it is not possible to define the cause of the pulse as a pedestrian or a cyclist, but the counter counts the total numbers. Also consecutive pressure changes can cause false results, since the device may not be able to return to its normal pressure state immediately after someone has stepped on the device. Thus, immediately consecutive pressure changes can be left unregistered.

Photo: Eco counter 2011

Laser Sensor

A laser sensor can observe and separate motor vehicles, bicycles as well as pedestrians. The device records its environment by recognizing vehicles as well as cyclists and pedestrians on the basis of outer measurements and shapes. Detecting the speed as well as the route of the target can help in recognizing it. This counter works in all weather conditions during the day and with its help it is easy to also observe conflicts between different forms of transport and traffic safety. The device is clearly visible, so the possibility of vandalism, increases. Another problem of the device is also that it cannot separate bicycles and mopeds or pedestrians travelling in groups.

A laser sensor can count and observe targets that are occasionally hidden, for instance behind another target travelling alongside. The device can also produce environment reports on snow, the amount of fog, heavy rain as well as vandalism targeted at the device.

Air Photo Interpretation

Counting pedestrians is also possible with air photo interpretation occurring with the help of a laser picture file. However, it can be difficult to reliably distinguish pedestrians from, for instance, lids of rain water wells, patching on the asphalt as well as cyclists on streets that are shadowed by buildings and trees. Therefore, counting must be performed only on sunny street surfaces, so that recognizing the pedestrians would be reliable. In Finland air photo interpretation has been used in Helsinki in context with the research programme LINTU handling the safety of street crossings. The aerial photography was performed with a helicopter.

7
An acoustic sensor plate can be installed in anything other than stony ground. It is protected from vandalism since it is placed underground.

Pneumatic Tube

A pneumatic tube is suitable for the short-term measurements of bicycle traffic. This method utilizes a thin rubber tube that has been stretched over the street and connected to a counting unit. The tube has air pressure, which breaks as a bicycle rides over it, in which case the machine counts the observed bicycle. The advantages of this device are that it is easy to install and relocate as well as cost-efficient. The problem with the device is its sensitivity to external influences and the breaking of the rubber tube. Therefore, the device needs repeated checking and maintenance. Another problem is registering a bicycle twice, which causes false counting results. Counting by the pneumatic tube is not reliable also during the winter, since the rubber tube cannot maintain its characteristics needed for counting in cold conditions.

If the counting target is on a combined traffic route, using a tube pair helps the device to separate bicycle traffic from other traffic with the help of the crossing speed and strength of the pulse. In this way it is possible to gain additional information on the vehicle, such as direction and speed.

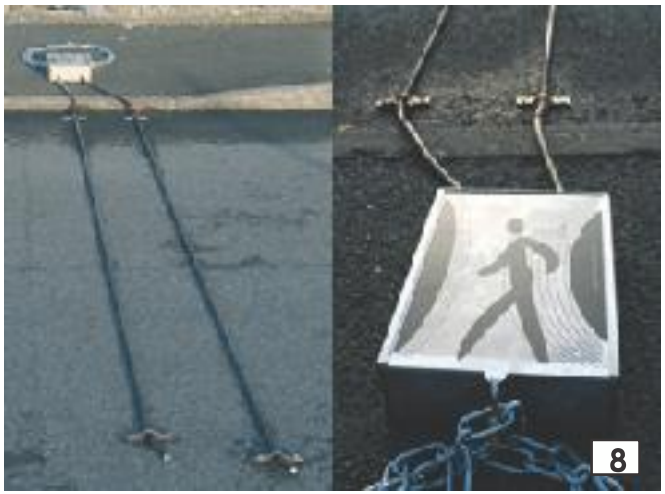


Photo: Eco counter 2011

8
A pneumatic tube placed in the direction of the cross-section is suited to short-term counts.

Radio Beam

A counting device based on sending radio beams observes pedestrians and cyclists as the beam it sends is broken. There are two kinds of radio beam sensors: sensors that observe metal and count bicycles and reflecting sensors that observe pedestrians. A device that observes metal can recognize all types of bicycles, whether they are made of steel or a composition metal. A radio beam device can separate pedestrians and bicycles by using those sensors on both sides of the route. The device cannot yet define speed and direction.

A radio beam penetrates plastic, so the counting device can be installed out of sight, safe from vandalism. The problem of a radio beam is reliable observation when pedestrians and cyclists move in groups or side by side. The device works best when they move in line. The error of a radio beam that detects metal is increased by extra sources of metal, which the device may count as bicycles.

Photo: Via Strada Ltd 2008

9
Since the radio beam penetrates plastic, the counting device can be placed so that it is protected from vandalism.

Video Image Processing

The advantage of video image processing is its ability to replace several manual counters with video recordings. With video, a very large area can be recorded efficiently and economically, even in a fast schedule. Video recording is also more discreet than manual counting and thus a more representative counting method. The benefit of using video, when compared to manual counting is checking the counting result from the tape over and over again from any point. The possibility of error in the counting is quite small. From the video it is also possible to analyse traffic safety and observe certain special situations.

The disadvantages of video image processing is for instance, the difficulty in finding a suitable place for installing the camera. There might also be problems in the accuracy of counting during rain as well as night time, due to the lack of light. This counting method also requires regular monitoring as well as easy access to the device for changing the batteries in the video recorder. Maintenance procedures can also cause breaks in the continuity of the video image, thus causing a possible error in the count. Interpreting a video image is costly, since it is usually done manually. Possible perception of a video device can also cause behaviour changes in the traffic flow.

The technology of video image processing has developed a lot in recent years. Various algorithms have been developed for counting to aid in recognizing pedestrians and cyclists. Technology based on pattern recognition automatically recognizes pedestrians and cyclists from the video image on the basis of, for instance, size and shape and can thus count their numbers, as well. Counters that are based on shape recognition are available for total number counting, but developments are still needed for separating modes of transport as well as for other characteristics of the device.

Bicycle Barometers

Bicycle barometers that are based on inductive loop technology are used, in addition to counting, also for marketing cycling. The device increases the visibility and interest towards cycling by being visible in the city image. The barometers can show, for instance, the number of cyclists going by in a day or the overall number in a year.

With the help of barometers the aim is to make cycling an acceptable form of traffic in centres as well as to make people notice the surprisingly high number of cyclists. For instance a free bicycle pump can be attached to the barometer to improve the service level of cycling.

10
The bicycle barometer in Copenhagen shows the number of cyclists a day and in a year. Temperature and time can also be seen from the barometer.

Comparing Devices

The table below compares the features as well as advantages and disadvantages of automatic counting devices presented in the previous chapters. The comparison also considers recognition of direction and speed.

In the comparison, most devices were found to be good with regard to easiness of relocation, many can recognize both pedestrian and bicycle traffic and many can separate these two traffic modes from motor vehicle traffic. However, not all the devices offer separation between bicycle and pedestrian traffic, so they are total number counters. The comparison of the devices found that the correct recognition of people moving in groups was a challenge.

	Pedestrians	Cyclists	Separation	Directions	Speed	Separation from motor vehicle traffic	Unnoticeable	Advantages	Disadvantages
Loop		X		X		X	X	Unnoticeable and durable in use	Does not recognize aluminium or side-by-side riding bicycles, installation under asphalt
Passive infrared	X	X		X	X	X		Easy to relocate	Snow or dirt weaken counting accuracy or even prevent counting
Active infrared	X	X		X	X	X		Easy to install and relocate	Does not always recognize people moving side by side
Radar	X	X	X	X	X	X		Easy and affordable	Difficulties in observing slow pedestrian traffic
Pneumatic tube		X				X		Easy installation	Only for short-term counting, breaks easily
Pressure sensor	X	(X)				X	X		Frozen ground prevents operation
Laser sensor	X	X	X	X	X	X		Also counts occasionally hidden travellers	Problems in observing mopeds and bicycles as well as people moving in groups
Radio beam	X	X					(X)	Weatherproof	People moving in groups are not recognized
Video Image Processing	X	X	X	X	X	X		Large size of the observed area, checking data, safety research at the same time	Interpreting the video image is expensive and slow
Pattern recognition	X	X	(X)			X		Cost-efficient	Partly in a developmental stage, accuracy depends on the programme
Air Photo interpretation	X	X				X	X	Also e.g. unmoving people in the pedestrian area can be counted	Shadows interfere with recognition

X = available feature, (X) = feature in a developmental stage

Recommended Counting Model

Location of the Counting Points

Counts are recommended to conduct in both intersection areas and as cross-section counting in separate routes or on the streets to gain an extensive result. The counting points can be either automatic or manual counting points according to the needs of each counting party. Automatic counters are however, only suited for cross-section counting. The most recommended counting points are for instance:

- City centres, central blocks
- Surroundings of parks
- Points that are narrowed to calm traffic
- Routes used by many different modes of transport
- Future project targets (as a comparison for the future)
- Finished project targets (for follow-up data and comparison)
- Previously counted points
- Places proneness to accidents
- Active cycling and walking areas
- Typical points in suburbs and countryside areas
- Workplace areas
- Universities and schools
- Points that need improvements as well as
- Locations that have as few alternative routes as possible.

For comparability it is also important that the counts are performed in the same places every year. In addition, it is recommended to form a counting point ring around a central area or to perform screen line counting, i.e. to incorporate as counting points all intersection points of a barrier, such as a river or a railway.

The number of counting points must be sufficient and they must be placed in functional locations evenly around the municipality, for instance in entranceways to places where skipping the counting points by using a different route is unlikely. The counting points cannot be along the one route, so that the same people are not counted several times in different points. Counting points of cyclists should be in different variation category (work, business and free time) evenly, but there should be less points for the counts in leisure time category. Some points can be the same for cyclists and pedestrians. In addition, manual counting points should be placed at intersection areas and manual or automatic counting points for cross-section counting in straight street portions. In the counts of intersection areas, the same counting reveals both volumes of traffic and traffic safety data. Cross-section counting points of pedestrians are recommended to be placed in shopping areas or other streets or areas the city experiences as interesting and the counts should be made on both sides of the street in both directions.

The sample gained by manual counting can also be expanded so it covers a longer time span than a few hours, such as a week, month or year, so that comparable information is gained. National factors can be used as expansion factors of cycle traffic. Also regional and more specific expansion factors can be created for bicycle and pedestrian traffic with the help of automatic counting devices.

In a ring model the locations of the counting points should be chosen on routes that have as few alternative ways as possible and where the counting point can be skipped. Thus it is possible to count as much of the traffic going through the ring as possible. Counting should be performed on both sides of the streets, if there is a route suitable for the counted mode of transport on both sides.

The ring counting model is often more suitable for counting cyclists, especially in larger cities where distances are long. In a compact city people often come to the centre area on foot or on a bicycle, in which case walking is not only a mode of transport inside the centre. Thus, ring counting of a compact city gives an estimation of the number of people arriving to the centre on foot.

Placement of Automatic Counting Points

When choosing automatic pedestrian counting points, operational restrictions of the counters must be considered. For instance wide market place areas are not suitable for most automatic counters due to their quite narrow operating range. In most automatic counters uncertainty of operation occurs especially when measuring crowds and when several people are in the observation area of the device simultaneously. In such congested areas manual counting may in fact offer a more precise counting result as sample counting. An automatic device can however provide information on daily, weekly and seasonal changes in the area, even if the hour-specific volume of traffic counted by the device would be faulty.

Automatic counting points must be chosen according to the functionality of the automatic counter. When choosing a location for continuous, automatic counting of bicycle traffic, hills must be avoided as well as locations where cyclists or pedestrians can take a short cut past the counting location. Counting should not take place on a hill because the downhill speed of a bicycle grows so high that it is difficult for an inductive loop device to receive and recognize a signal from the bicycle. When cycling uphill the speed of a bicycle is, on the other hand slow and the signal so strong that the device may register one cyclist two times. A bicycle may also be walked uphill, which complicates the prerequisites of the device for making the right assumption of the mode of transport. It should also be taken into consideration that a counter may count prams as a bicycle, and therefore a separate cycle track would be a good place for counting bicycle traffic. Nearby car traffic should also be avoided, since an inductive counter may be disturbed by the magnetic field of cars. For instance a tunnel or a bridge is a good counting point for both cyclists and pedestrians, as there are no alternative routes for the travellers but the whole traffic flow goes through the chosen route. Thus it is possible to gain a reliable estimate of the changes and characteristics of the traffic volumes in the area.

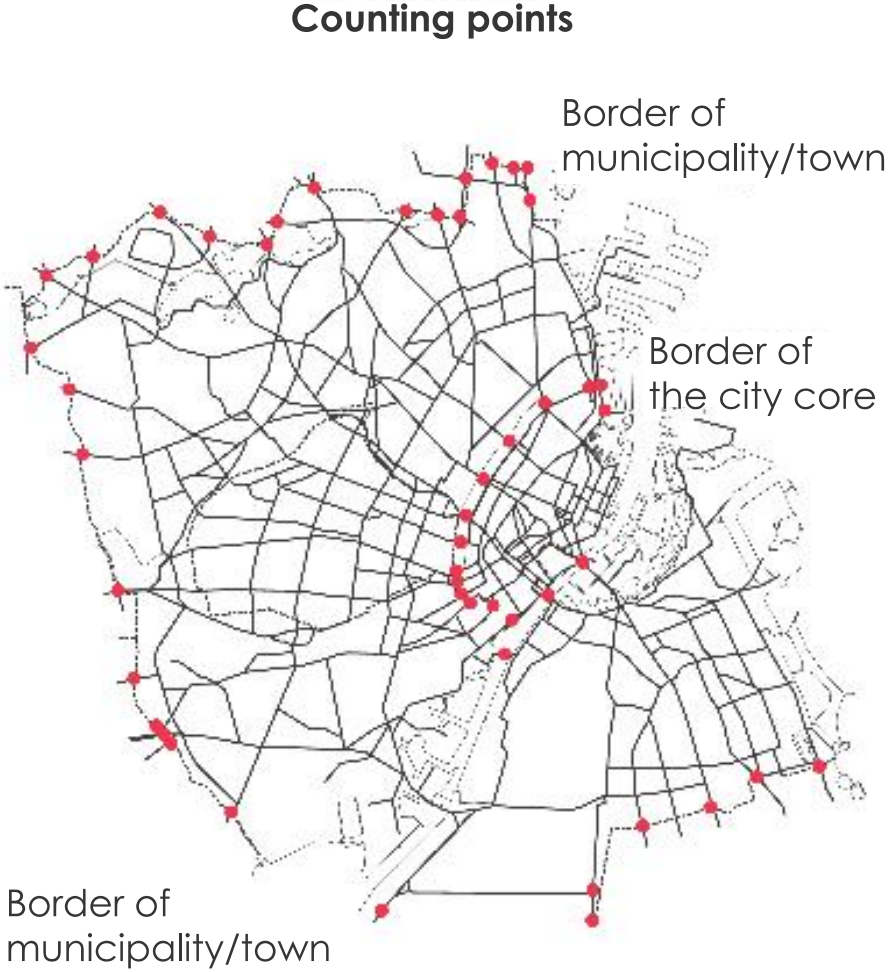
11
Bridges are excellent places for counting, since often there are only a few alternative routes.

The Two-ring Counting Model of Copenhagen

The entrance and exit traffic of cycling and walking in city centres can be best monitored by forming either one or two counting rings around the city centre, depending on the size of the city. Copenhagen uses a counting model of two rings. The city has about 500,000 residents.

Picture 12 shows Copenhagen's two counting rings, where counting is done manually. The two-ring example of Copenhagen is excellent in bigger cities of more than 100,000 residents. The counting points of the ring can also all be automatic counting points or some of them automatic as well as manual. The inner counting ring is situated right at the edge of the city core and the outer, on the border of the city. The radius of the inner ring is about two kilometres and the outer ring about seven kilometres. Pedestrians and cyclists going towards and away from the centre are monitored on the inner ring, whereas the number of people coming to the city from nearby municipalities and from residential areas farther away from the city as well as people leaving these areas are monitored on the outer ring.

The purpose of the counting model of one ring, which is suitable in smaller towns and municipalities, is to follow traffic coming to and from the city core. Inside the ring there may be other counting points that interest the city in addition to the ring points, such as counting points of pedestrian traffic on the main street. The counting points of the ring are placed on main cycleways, the purpose being to reach most of the cyclist flows. Local knowledge must however be applied in placing the points to find the most suitable place. Especially when manual counting points are replaced with automatic counters, the place planned for the counting point must be checked with the installer of the device carefully, so that the functionality and reliability of the automatic counter can be ensured.



12
In Copenhagen the city is surrounded by two counting rings, the inner of which counts the traffic coming to and from the centre and the outer the traffic coming to the city from nearby areas.

What Can the Counting Data Be Used for?

Follow-up data is needed in the development of the volumes of walking and cycling and temporal variations, as well as variations due to weather. The need for information is great on a national, regional and local level as well as on a project level. It is possible to follow the change of point-specific volumes of traffic with counts performed annually in the same location. The results of manual counts can also be expanded with national or city-specific expansion factors. With these factors the use of possibilities of the counting results grow. In addition to project-specific results, the results of the counting method can be utilized for health, environmental and economy studies as well as studying the influences of individual measures on traffic volumes. In addition, the counting method can be developed with different kinds of city-specific interviews, questionnaires and bicycle parking studies that expand the amount of data received by counts alone. The follow-up model can also be supplemented with accident studies so that it covers all sections.

It is important to perform further research and give instructions on the purposes and possibilities of use of the follow-up data. That way the collected information is utilized in the best possible way. Before the final placement of the counting points it is recommendable to perform test counts, in which the suitability of the chosen location is checked. When, with the help of automatic counters and considering variations in weather, expansion factors are created for each city, the results of project counts made by the city for its own needs can be transferred to the national database to improve comparability of the results.

A special reason for compiling counting data is the need to clarify and observe changes occurring over time as well as trends in the number of cyclists and pedestrians. Starting counting is important so that it is possible to create a good start for the measurement routine and a comparison basis for future measurement results. In addition to the development in traffic volumes, counting results can also be used for other purposes. For instance point-specific counts benefit individual projects when deciding on their necessity or order of execution. With the help of counts, it is possible to count benefit and cost relationships for the projects and thus evaluate their urgency.

The counting method can be expanded with interviews, questionnaires and bicycle parking studies.

Clarifying the Influences with before-after Counts

It is important that cycling counts are always done before and after realizing cycling promotion measures, to find out the changes occurring in the volumes of traffic due to changing the soft methods, i.e. marketing, and strong measures, i.e. infrastructure, as well as changes caused by changes in policy. Comparison before and after changes helps to predict the development of traffic volumes after investments. In addition, it helps to evaluate the value and necessity of each investment. Counting is also needed for acquiring more specific information, to find out details of the special characteristics and behaviour of walking and cycling. Counts related to individual plans are needed as well so that it is possible to evaluate the changes caused by new methods or political decisions in the volumes of walking and cycling. In addition, an important part of the need for information on walking and cycling is related to finding out the number of trips and trip generation as well as passenger mileage.

Manual counting as well as automatic counters cannot however, clarify the passenger mileage of bicycles or pedestrians, but national travel surveys can be utilized for clarifying them. In the future there is however, a possibility for defining the passenger mileage of individual cyclists, with a data collection device attached to the bicycle. This device on each individual bicycle collects information on the movement of the bicycle and passenger mileage as well as changes occurring in the surroundings. It is also possible to predict the passenger mileage of walking and cycling as well as traffic volumes with different kinds of traffic models.

Counting Supports Maintenance

Counts of walking and cycling are also done in order to develop and maintain infrastructure. With the help of follow-up it is possible to define maintenance classes of routes based on for instance, traffic volumes. The maintenance class defines the level of winter maintenance and priority of ploughing on the route. Counting data is also needed for executing studies related to emissions caused by traffic as well as making health studies relating to the movement of people by bicycle and by walking. With the help of counting data it is possible to evaluate the financial advantages caused by exercise and the savings for health care. As well as general information on the counts, different parties wish to receive in addition to the volumes and safety of walking and cycling, for instance peak hour readings and seasonal variation factors that can be used to estimate the volumes of these modes of transport. In addition, information is needed on the location of walking and cycling routes in need of improvement, counting data to help in planning cycling and walking as well as to connect cycling and walking as a part of traffic models and analyses.

Counting as Support for other Research Methods

With the help of counting it is possible to estimate city-specific growth objectives of the traffic volumes of cycling and walking and by combining these counts to, for instance, results of questionnaires more precise numbers of the volumes of cycling and walking can be gained in the whole city. Questionnaires also enable further information to be acquired on the targets and lengths of trips. In this way it is possible to collect information on the functionality and experienced safety in certain points. This can be used together with the counting data when evaluating the functionality of the route and flow of traffic as well as possible need for improvements.

Each party can perform counts they choose themselves in addition to nationally instructed counts and collect precisely the information that is the most useful and interesting to them. Also elective counts can be expanded to longer-term data with the help of expansion factors received from automatic counters. In Finland, national expansion factors have been devised for bicycle traffic for finding out different key ratios, but each party that performs counts can define more specific and reliable expansion factors with the help of their own, continuously counting automatic counters while at the same time observing changes in weather. With the help of expansion factors the results of even a short sample count can be expanded to cover a longer period of time, and thus the use purposes of the counting results multiply.

Pedestrian counts are mainly done as intersection counts, so in addition to volume information it is possible to receive information on the safety of intersections. The number of accidents has generally been studied in intersections, so by counting the traffic volume information at intersectionsit is possible to, on the basis of accident and traffic volumes, count the accident rate of the intersection. Thus, results from counts can also be used in traffic safety work. Also the intersection-specific accident rate of bicycles is found out if the traffic volume of bicycles is counted in the intersection.

Pedestrian counts can also be utilized in timing traffic lights. By comparing the number of pedestrians travelling through a traffic light guided intersection and the time elapsing until the traffic lights turn green, evaluations on the functionality of the green wave and the cycle of the light turning green can be performed. With the help of counts it is also possible to influence the flow and convenience of pedestrian traffic, and therefore promote walking.

Traffic volume information is also useful for studying the attractiveness of cycling and walking. By collecting traffic volume data in the vicinity of a centre area or a shopping area, the potential volume targeted at shops can be estimated. The purpose of these counts is not, however, necessarily performing long-term or continuous counting, but sample counts provide sufficient approximate results, especially if the results are expanded with the help of expansion factors from automatic counters.

Information from counts can be utilized with the help of travel surveys and other inquiry studies to find out the environmental and health influences of cycling and walking as well as the savings made by them. There are also other targets of counting data and the use possibilities of data expand along with the increase of counting data. Even individually, once a year done manual counts can be used to compare traffic volume data and to give estimates of changes in traffic volumes and the reasons for them. By expanding the counting results into new key ratios with the help of national instructions or automatic counters, the possible uses of information are expanded to traffic safety studies as well as other applications. These can be comparing the volumes of motor vehicle traffic and developing the maintenance of routes. By combining counting data to materials of questionnaires and travel surveys, the results can be utilized even more extensively for making versatile and diversified analyses, more specific follow-up of the growth goals of traffic volumes and creating prediction models. What is important however is to start counting cycling and walking and make them a part of the counting routine of municipalities and cities as well as other parties. It is also important to first and foremost meet the needs of cities and municipalities and thus to efficiently develop the conditions of cycling and walking on a local level.

13
With the help of traffic data it is possible to evaluate the potential customer numbers of shops in a centre.

14
Counting can be used as an aid in timing traffic lights so that pedestrian traffic would be as fluent and convenient as possible. The results of counts can be utilized in defining maintenance classes as well.

10

Best Practices

16 Innovations from Europe

10

Many Pieces in the Puzzle

A Big Picture Is Needed

Promoting cycling and walking is a part of comprehensive city planning. Cycling and walking conditions cannot be developed separately, but a wide vision of developing the city is needed. Without an overall picture of the puzzle it is impossible to fit individual pieces in place with high quality. This on the other hand requires a policy that supports sustainable city development. Without the political will of decision makers promoting cycling and walking will not succeed, and high goals in the traffic, environment, physical exercise and health sectors are left unattained. Certain values, which are actualized in choices, reign in the decision making of cities. Budget is one value indicator. Money directed at promoting walking and cycling reveal how much the city is prepared to invest in these modes of transport. Developing a city is a team effort in which the mutual connection between different administrative organizations, modes of transport, land use, business life, residents, and other interest groups is necessary. Good-quality planning and management of development work as well as efficient directing and follow-up of budgets require a functional organization structure.

Traffic System is a Whole

The role differentiation as well as cooperation of different forms of transport has to be considered on a traffic system level. All modes of transport, the network they use as well as land use have to be viewed as one whole. Car traffic coming to the centre has to be reduced by offering real alternatives to cars. Depending on the size of the city, user-friendly conditions of good quality have to be developed for public transport and/or cycling. In addition, in larger cities high quality interchange possibilities from a car to public transport have to be realized outside the centre. Also smooth interchange from cycling and walking to public transport has to be enabled. High-quality main pedestrian routes have to be built between targets that generate walking. It is important to be aware of the fact that walking is a worthy mode of transport for instance when arriving to the centre from nearby residential areas.

The Purpose, Use and Structural Solutions of Routes in Line

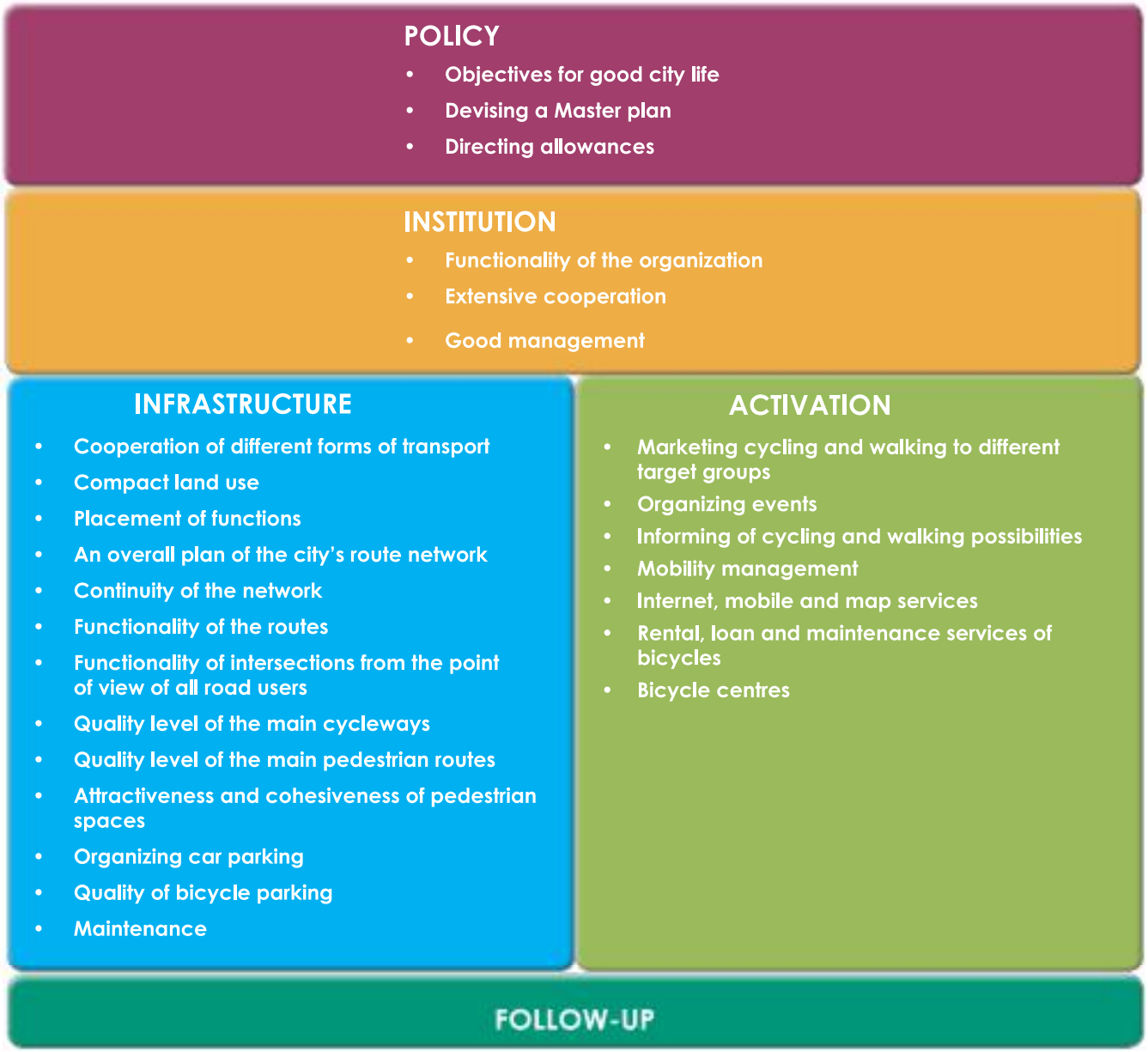
One key factor in developing a traffic system is route planning. The whole street and rail network has to be viewed in a city and analyse whether the route hierarchy, use and structural solutions of each route are in line. Has car traffic been efficiently directed to main routes and parking facilities? How has traffic been calmed on lower level streets? Are the main routes of public transport direct and fast? Do the main cycleways fulfil the criteria set for them? Is walking a competitive mode of transport in short trips? Are intersections clear, functional and safe for all travellers? Bicycle parking and maintenance are also an essential part of infrastructure. They have to function so that cycling and walking are possible during all times. Recreational and fitness mobility also have to be taken into consideration and enjoyable routes have to be built for their needs.

Residents Have to Be Activated

In addition to developing infrastructure, activating cyclists and pedestrians is essential. Infrastructure alone will not make the volumes of cycling and walking grow as desired. Marketing these modes of transport to different target groups is one key issue, so that more people are made to use human-powered transportation. Also services and measures focused on mobility management have to be planned. Internet, mobile and map services as well as good-quality guidance offer information for trip planning and make cycling and walking easier. Rental, loaning and maintenance services of bicycles increase the number of potential users.

To ensure the quality of development work it is important to create a good follow-up method. This includes, for instance, regular counting of the number of cyclists and pedestrians, follow-up of budget as well as estimating the influences of performed measures. Without functional follow-up it is difficult to continue the development work. It has to be a wheel that spins forward evenly.

Promoting Cycling and Walking



16 Best Practices from Europe

Mobile – mobility centre in Freiburg

In the vicinity of the main railway station of Freiburg there is the Mobile – mobility centre that offers many kinds of services for cyclists and users of public transport. Mobile has for instance, a locked bicycle parking space as well as equipment lockers. There are also bicycle rental and maintenance services, a café as well as an info point that offers information on the city's transport services.

Main Cycleways in Groningen

Groningen has ensured the competitiveness of a bicycle compared to a car with good route planning. High-quality cycle tracks go directly from residential areas to the centre, whereas by car one needs to go around the ring road. The journey from home to the city centre may be three kilometres by bike and nearly twice as much by car. Cycling along the good quality cycleways is pleasant, because they run separately from car traffic. Their convenience and speed is increased by the fact that the cycle tracks have right of way compared to collector roads and residential streets.

Véloparc Interchange Parking Spaces in Strasbourg

In Strasbourg, lockable bicycle parking spaces for interchange parking have been built for busier tramline and bus stops outside the centre. There are different sizes of Véloparc spaces depending on the need. The smallest can fit 20 bicycles and the largest over 100 bicycles. They function with the city's public transport card (Badgeo card) and can be used round-the-clock.

Cycling in the Traffic System of Copenhagen

Cycling in Copenhagen provides a wonderful experience in city traffic in which a cyclists are real parts of the traffic flow. Cars and busses travel alongside cyclists along multiline streets and many tens of thousands of cyclists per route travel on the wide cycle tracks on a daily basis. Despite the busy traffic cycling feels safe. The city has used a lot of resources so that the safety of cycling and the feeling of safety experienced by cyclists are top-level. In addition, cycling has been made easy, fast and convenient.

Cycling Innovations in Odense

Odense is known for many cycling innovations that the city has developed. For instance the bicycle barometer as well as the green wave for cyclists are the inventions of Odense's creative planners. They have also encouraged many other cities around the world to promote cycling. (In the picture the bicycle barometer in Copenhagen)

City Bikes in Stockholm

Using the city bikes in Stockholm is easy and practical. There are about 100 points in differenet parts of the downtown where people can rent a bicycle. The bicycles can be returned to any point. Renting the bikes works with a smart card that can be collected from a service point. With a card the service can be used during the whole summer season from April until the end of October and is available for locals. Tourists are offered a possibility to use the city bikes for three days.

Compact City Structure in Groningen

Groningen has for a long time executed a policy that favours cycling. One important political focus point has been building a compact city, so that trips would be short. This has been an important factor for Groningen becoming an international top city of cycling. Nearly 80% of the city residents live within three kilometres of the centre and 90% of workplaces are situated within the same area. The modal share of cycling in Groningen is about 40%.

Coloured Bicycle Routes in Växjö

Four bicycle routes, which have been marked with their own colours in signposts, go through the centre of Växjö. Behind this idea there has been a goal to market cycling epecially to tourists, but this solution has raised the status of cycling as a form of transport from the point of view of the residents as well. The colour codes have also been used in the cycling map, which makes it easier to find and perceive the route. With the help of colours, the higher hierarchy of routes can be highlighted.

Pedestrian Areas in Strasbourg

In Strasbourg, pedestrian areas form a whole in which different pedestrian areas have different functions. Shopping functions have been concentrated in the surrounding of the Place Kléber square, and in the surroundings of the cathedral, which is favoured by tourists, where there are for instance, restaurants and street art. The canal-side, and especially the area of Petite France, is a popular place to spend free time. Different pedestrian areas have been connected with enjoyable pedestrian routes.

Public Transport in Strasbourg

Strasbourg is known for its good-quality public transport. The railway network resembles a metro, so it is fast and easy to use. The lines comprise of a little more than 50 kilometres, so it is the widest in French cities. The city core is car-free, so even busses do not travel there but act as feeders to trams. There are interchange stops outside the centre in which bus travellers can change to a tram. Several interchange parking areas have also been built for cars and bicycles. The system supports walking and cycling in the city.

Copenhagen's Goals for City Life

In Copenhagen, one basis of city planning is developing good city life. The goal is that by 2015 Copenhagen will be known as an ecological metropolis that has the world's best city environment and where people's quality of life is the best of all metropolis areas. The goal is that by 2015 80% of people will be satisfied with the possibilities offered by city life, the number of trips by walking to grow by 20%, and for people to spend 20% more time in public spaces.

The Role of Walking in Geneva

In Geneva the basis of traffic system planning is promoting walking as the main mode of transport. Pedestrian connections are direct, enjoyable and safe, so that they are pleasant to use. The speed of walking compared to driving has been increased with the help of different short cuts, such as pedestrian bridges. The modal share of walking in the city is as much as 43%. Walking has been marketed a lot to the citizens as well as employees of large international organizations.

The Route Network of Houten

The town of Houten in the Netherlands is like a big park. The whole city structure has been built on the terms of cycling. Even the main street in the centre is a wide cycle track, on the sides of which there are pavements. People can go nearly everywhere by car, but they have to go around the ring road. Bicycles can travel directly, so they are clearly the fastest means of transport. In research performed in 2008 it was revealed that 95% of the residents were very pleased with the cycleways of the city. Houten has large green areas intersecting the whole city. Schools have been placed on the edges of these parks, so that it is safe for children to cycle to school.

Vauban and Rieselfeld in Freiburg

Freiburg is one of the leading cities in sustainable development in the world. Walking, cycling and public transport have been promoted in Freiburg by making land use more efficient. In the middle of the 1990s, two residential areas, Rieselfeld and Vauban, were built a few kilometres away from the centre. Both of these residential areas are ecological, which can be seen in traffic planning. Good cycling and tramline connections lead to the area and private car traffic has been restricted by moving car parking away from the vicinity of the apartments to parking areas or car parks. The aim has been to keep the price of the apartments low, so that many different social classes would have the ability to live in them.

The Centre of Ghent

The magnificent centre of Ghent started to be restored into its former medieval glory at the end of the 1990s, when a plan for reorganizing the traffic in the centre was accepted (Mobiliteitsplan). Drive-through of cars was prohibited in the centre and a ring road was made around the city. Also market place and kerbside parking of cars was strongly limited by building underground parking facilities. A large pedestrian space was built in the area, and nowadays this is an area of 0.35km^2 for shopping and experiences. The area combines historic beauty and modern trendiness in a harmonic way.

The Environmental Strategy of Växjö

Växjö has a long history of environmental work and it has been strongly organized in the city's government. Comprehensive environmental strategy work is done on the upper level of the city organization. Different administrative parties, external companies and organizations, the business life, and residents work together and develop the city towards sustainable goals. In 2007 the BBC named Växjö the greenest city in Europe.

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