



Sino-German
Urbanisation
Partnership

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

On behalf of:



Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

of the Federal Republic of Germany

A stylized cityscape background in shades of pink and red, featuring white outlines of buildings and streets.

THE CURRENT DEVELOPMENT OF BICYCLE SYSTEMS IN CHINESE CITIES

A large, stylized white silhouette of a person riding a bicycle, set against a background of pink and red geometric shapes.

KEYSTONE PAPER 10



**Sino-German
Urbanisation
Partnership**

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

On behalf of:



Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

of the Federal Republic of Germany

This document is part of ten keystone papers looking at current emerging topics in the building and city sector, focusing on energy efficiency work of the Sino-German Urbanisation Partnership as a basis for the forthcoming working period and cover following topics:



01

Plus Energy Buildings
and Districts



02

Energy Efficiency
of Buildings and
Districts in Urban
Renewal



03

Transformative
City



04

Climate Risk
Management
in Cities



05

Urban Renewal
in Districts



06

Urban Climate
Adaptation in
Germany



07

Financing
Mechanisms for
Green Buildings in
Germany



08

Energierechtliche
Rahmenbedingungen
(Energy Law Framework)



09

Cycling Systems in
Germany and Europe



10

Radverkehrssysteme
in China
(Cycling Systems in China)

Supported by:

**BUROHAPPOLD
ENGINEERING**

Happold Ingenieurbüro GmbH
Pfalzburger Straße 43-44
10717 Berlin, Germany

CONTENTS

INTRODUCTION	1
1. TRANSPORT PLANNING AND DEVELOPMENT IN CHINESE CITIES AND TOWNS	3
2. CURRENT STATE OF DEVELOPMENT OF THE CYCLING SYSTEM IN CHINA	5
2.1 POLICIES AND GUIDELINES	5
2.2 STANDARDISATION	5
2.3 THE PUBLIC BIKE SHARING SYSTEM	6
2.4 THE “GREEN” TRANSPORT CONCEPT	6
3. EXAMPLES OF CITIES AND TOWNS	7
3.1 EXPERIENCE GAINED IN DEVELOPING THE CYCLING SYSTEM IN BEIJING	7
3.1.1 CURRENT DEVELOPMENTS IN URBAN TRANSPORT	7
3.1.2 PROBLEMS AND DEVELOPMENT TRENDS IN THE CYCLING SYSTEM	7
3.2 EXPERIENCE GAINED IN DEVELOPING THE CYCLING SYSTEM IN HANGZHOU	8
3.2.1 CURRENT DEVELOPMENTS IN THE CYCLING SYSTEM	8
3.2.2 DEVELOPMENT TRENDS IN THE CYCLING SYSTEM	10
3.3 EXPERIENCE GAINED IN DEVELOPING THE CYCLING SYSTEM IN TIANJIN	11
3.3.1 CURRENT DEVELOPMENTS IN THE CYCLING SYSTEM	11
3.3.2 DEVELOPMENT TRENDS IN THE CYCLING SYSTEM	11
3.4 EXPERIENCE GAINED IN DEVELOPING THE CYCLING SYSTEM IN XIAMEN	13
3.5 EXPERIENCE GAINED IN DEVELOPING THE CYCLING SYSTEM IN SHENZHEN	14
3.5.1 CURRENT DEVELOPMENTS IN THE CYCLING TRAFFIC SYSTEM	14
3.5.2 DEVELOPMENT TRENDS IN THE CYCLING SYSTEM	15
3.6 RESEARCH FINDINGS AND PROPOSALS FOR DEVELOPING THE CYCLING SYSTEM IN THE CITY OF ZHANGJIAKOU	15
3.6.1 CURRENT DEVELOPMENTS IN THE CYCLING SYSTEM	15
3.6.2 ANALYSIS OF THE PROBLEMS AND POTENTIALS OFFERED BY THE CYCLING SYSTEM	15
3.6.3 PROPOSALS FOR THE FURTHER DEVELOPMENT OF THE CYCLING SYSTEM	17
4. TECHNICAL AND POLITICAL PROPOSALS FOR THE PROMOTION OF THE DEVELOPMENT OF BICYCLE TRANSPORT IN CHINA	19
4.1 SIGNIFICANCE OF THE CYCLING SYSTEM	19
4.2 HIGHLIGHTING THE GUIDING ROLE OF PLANNING	19
4.3 CONTINUAL IMPROVEMENT OF INFRASTRUCTURE	19
4.4 SECURING SPACE FOR BIKEWAYS	19
4.5 ENHANCING DESIGN AND MANAGEMENT OF BIKEWAYS	20
4.6 STEPPING UP POLITICAL SUPPORT	20
4.7 ALTERNATIVE WAYS OF PROMOTING THE CYCLING SYSTEM	20
5. OUTLOOK	21
DISCLAIMER	22

LIST OF FIGURES

Figure 01: PLANNING FOR URBAN RAIL TRAFFIC IN 2020 IN CHINA	4
Figure 02: THE IMPACTS OF PRIVATE CARS ON CYCLE PATHS	7
Figure 03: THE DISTANCE TRAVELLED BY RESIDENTS OF BEIJING	8
Figure 04: MAP SHOWING THE URBAN RESTRUCTURING LAID OUT IN THE BEIJING URBAN MASTER PLAN (2016-2035)	9
Figure 05: CHANGES IN BICYCLE OWNERSHIP IN THE OLD DISTRICTS OF THE CITY OF HANGZHOU	10
Figure 06: COMPARISON OF CHANGES IN PERCENTAGE OF TRAFFIC ACCOUNTED FOR BY BICYCLES IN HANGZHOU, BEIJING AND SHENZHEN	11
Figure 07: INAPPROPRIATE ROAD LAYOUT	12
Figure 08: PARKED CARS AND BIKES BLOCK PAVEMENTS	12
Figure 09: THE EFFECTIVE PAVEMENT WIDTH IS INADEQUATE	12
Figure 10: INAPPROPRIATE LAYOUT OF AREAS BESIDE ROADS	12
Figure 11: UNREGULATED BIKE PARKING IN PARKS, AT UNDERGROUND STATIONS AND IN RESIDENTIAL AREAS (FROM LEFT TO RIGHT)	12
Figure 12: AN AERIAL VIEW OF THE YUNDING ROAD BICYCLE HIGHWAY IN THE CITY OF XIAMEN	14
Figure 13: BRIDGE LAYOUT (M)	14
Figure 14: CURRENT BREAKDOWN OF CYCLE PATHS	16
Figure 15: COMPARISON OF BUS STOPS BEFORE AND AFTER RENOVATION WORK	17
Figure 16: THE ACTIVE ROLE OF PUBLIC SPACE IN URBAN AREAS	21

LIST OF TABLES

TABLE 1: COMPARISON OF TRAFFIC STRUCTURE IN THE CITY CENTRE OF HANGZHOU IN 2005 AND 2010 (IN %)	10
TABLE 2: CLASSIFICATION OF CYCLE PATHS	13

INTRODUCTION

China is combining the concept of stemming climate change with its own national sustainable development strategy, and is planning to reduce CO₂ emissions per unit of GDP by around 65% between 2005 and 2030. In addition, China is actively going ahead with sustainable economic development and its own energy transition, to put its energy mix on a more sustainable footing. It is looking at different ways of reducing CO₂ emissions. In this, the development of pedestrian and bicycle transport in cities and towns play an important part, helping to reduce CO₂ and particulate emissions (PM 2.5), and improving the environment. The cycling system in many Chinese cities and towns is flexible and reliable and has developed consistently and steadily in recent years. Since bicycles are ideal for short and medium distances, they are an indispensable component of the overall transport system and an important factor in improving the quality of life in urban areas.



China was once known as the 'kingdom of bicycles'. Bicycles have a long and important history in China and have been considered to be one of the most important means of transport for people living in urban and rural areas. Statistics from 2005 counted 120 bicycles per 100 families in urban areas, and 98.4 bicycles per 100 families in rural areas. Even today, bicycles are still one of the most important means of transport in most Chinese cities and towns. China is the world's largest market for bicycles. According to the China Bicycle Association at the 2019 China Bicycle Industry Conference, Chinese people own close to 400 million bikes and around 300 million e-bikes, thus ranking number one in the world.

As published by the ministry of transportation in Dec 2018, China's total daily use of shared bicycles was around 10 million in 2018.

1. TRANSPORT PLANNING AND DEVELOPMENT IN CHINESE CITIES AND TOWNS

Since 1979 there have been three main phases of planning, constructing and managing urban transport in China:

From **1979 to 1990**, the focus was on planning, building and managing urban transport. Over this period there was no underlying theory or scientific and technological support for the development of urban transport. The construction of road infrastructure did not keep up with growing automobile traffic. Due to an increased use of private cars, in large cities, traffic jams and tailbacks became endemic. In 1982, cities and towns had only 2.8 square metres of surfaced roads per inhabitant. The number of vehicles offering local public transport services was extremely low and the vehicles were generally in a poor state of repair. The density of local public transport was only 3.6 vehicles per 10,000 inhabitants. In addition, the total number of private cars was below 2 million, while the number of bicycles was put at 35 million. Bicycles were thus the main component in China's urban transport sector.

From **1990 to 2000**, mainly expressways were built and the number of private cars on China's roads rocketed. In Beijing, Shanghai, Guangzhou and other cities, the pace of development of urban rail infrastructure improved and the traffic and transport

planning processes became more widespread. The urban transport development strategy, the planning, research and development of public transport, car parking lots etc., attracted the attention in more parts of China. In 1994, the number of private cars in cities and towns was about five million, and thus twice the 1983 level. In 1996, the Ministry of Construction declared that the core strategy of urban transport development was to promote the mobility of people and goods rather than the mobility of vehicles. The Ministry of Construction also called for future development policy and plans which shall be economically feasible, affordable, and socially and environmentally acceptable.

From **2000 until today**: The acceleration of urbanisation and motorisation including the increasing pressure of heavy traffic is confronting cities and towns with the problems of, for example, air pollution, health issues, lack of public space and following this dwindling energy and resources. Overall, the complexity of traffic and transport problems in the urban setting has increased and with it the difficulty of improving the situation. Gridlock is perceived as a serious problem in urban traffic. That is why today the priority in urban traffic and transport development is to promote public, smart, environmentally friendly traffic solutions.

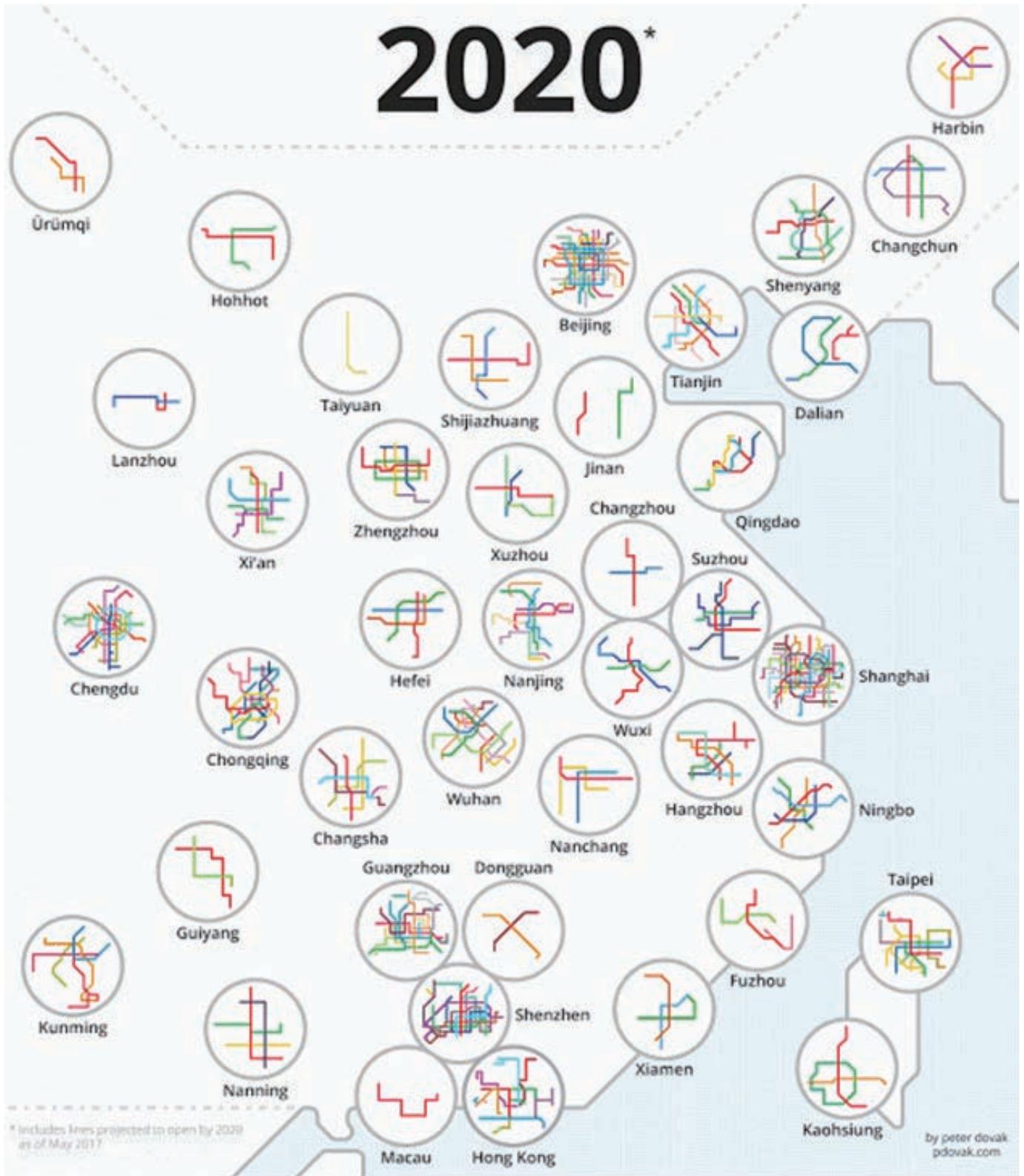


Figure 01: Planning for urban rail traffic in 2020 in China
 Source: Internet (<https://cd.esf.fang.com/newsecond/news/25279342.htm>)

2. CURRENT STATE OF DEVELOPMENT OF THE CYCLING SYSTEM IN CHINA

Cutting emissions in the transport sector is one of the most important goals of the development strategies of Chinese cities. Based on certain political guidelines and standards, the cycling systems in many cities and towns have been extended, where it has impacted positively on both the traffic conditions and the environment.

2.1 POLICIES AND GUIDELINES

Following the 18th National Congress of the Communist Party of China in 2012, an environmentally-oriented development strategy gradually emerged.

In September 2012, the Ministry of Housing and Urban-Rural Development (MoHURD) adopted guidelines to improve the development of the urban pedestrian and bicycle traffic system in conjunction with the National Development and Reform Commission (NDRC) and the Ministry of Finance (MoF). In major cities and metropolises, the guidelines focus on developing pedestrian and bicycle traffic, since these are the solutions for short and medium distances, as well as for the 'last mile' in conjunction with public transport. In small and medium towns, too, immediate priority is to be accorded to developing pedestrian and bicycle traffic, as the main means of transport. To this end, towns are to optimise the development of pedestrian and cycle paths and to create more spaces to park bikes. The management of road space is to ensure an adequate width for sidewalks and bike lanes and to appropriately push ahead with the introduction of electric bicycles.

In September 2013, the Chinese State Council released a statement on the development of urban infrastructure. It announced that pedestrians are to be prioritised in urban traffic and that the traffic environment is to be improved for residents, which is to enhance safety and reduce traffic-related CO₂ emissions. The creation of environmentally friendly streets for pedestrians and cyclists in towns, of spaces for parking bikes, and of greened streets, and the installation of lighting and other facilities shall be supported. This aims to change the direction of transport development and counter the excessive dependence on private cars.

In December 2013, MoHURD announced that pilot projects for urban pedestrian and bicycle traffic systems were to be implemented. To build pedestrian and cycle paths, and to set up site-appropriate facilities for bike parking, it was proposed that roads in cities and towns and in residential districts shall be redesigned, rivers re-directed and a new focus put on developing landscapes and green streets. These conditions then made it also possible for the cities and towns involved in the pilot projects to establish and improve a public bicycle traffic system. Between 2013 and 2016, MoHURD then drew up general guidelines and standards for planning and designing pedestrian zones and bicycle traffic systems.

In 2014, the national New-type Urbanisation Plan again stipulated that the development of green cities and towns was to be

accelerated, the conditions for pedestrians and bicycle traffic improved, and environmentally aware travel endorsed. Finally, at the conference on relevant urban issues in December 2015, The Chinese central government again pointed out that urban traffic and other infrastructure should be planned and developed in line with the green circle and low carbon concept.

In the course of the remarkable development of bike sharing systems, MoHURD published guidelines to promote and regulate the development of bike-sharing systems in 2017, jointly with the Ministry of Transport (MoT), the Publicity Department, the Ministry of Industry and Information Technology (MIIT), the Central Cyberspace Affairs Commission (CAC), NDRC and the Ministry for Public Security (MPS). MoHURD pointed out that bike-sharing systems satisfy the needs of the general public for transport and offer an effective solution for the 'last mile' in urban transport settings. The increased use of bicycles also reduces gridlock in urban traffic and results in a generally more environmentally friendly traffic system. It has also effectively fostered the development of the national economy as a whole.

To manage issues such as bicycle maintenance, a lack of responsibility on the part of bike-sharing companies, data privacy and ensuring the users' deposits are returned, the government ensured the appropriate supply of bikes for hire, improved infrastructure for cyclists and encouraged the development of places to park bikes. Certain standards and services were also developed for the business operations of bike-sharing companies. The parking management also needs to be stepped up, criminal prosecutions monitored and user safety and data privacy of the network ensured. In December 2018, at the national working conference on housing construction and urban-rural development, the ten key issues of 2019 were presented. The sixth of these, 'concentration on solving the problem of people's livelihoods and improving the quality of cities and towns', focused largely on the construction and maintenance of pedestrian and cycle paths.

2.2 STANDARDISATION

At national level, MoHURD has, for instance, identified and published standards for planning road traffic, designing roads, traffic routes, the roadbed and highway construction technology (GB50220-95, CJJ37-2012, CJJ194-203, GB51286-2018). These standards regulate the planning, design, construction and maintenance of roads. Bicycle traffic is considered an important element in planning urban traffic and the road system. In 2013, MoHURD published guidelines for the planning and design of pedestrian zones and bicycle traffic systems in cities and towns, and in 2016 began to research precise planning and design standards for these.

In 2008, at local level, Beijing modified the guidelines for the planning of pedestrian and bicycle traffic, adjusting these to the mandatory local standards, and in 2012 this was followed by a modification of the provisions for ensuring the optimum use of urban road space. Moreover, in 2014, the guidelines for planning

and designing urban road space were revised. In Shenzhen too, the regulations for the planning and design of pedestrian zones and bicycle traffic systems were drawn up in 2012. As in Jiangsu Province, where guidelines for planning urban pedestrian and bicycle traffic systems were introduced in 2012, provisions for the design of roads were drawn up in Shanghai in 2016. On the basis of national standards, these local guidelines stipulate specific indicators for pedestrian and bicycle traffic in line with local road planning requirements.

2.3 THE PUBLIC BIKE SHARING SYSTEM

In the 1990s, Beijing launched its first bike hire schemes. The 2008 Olympic Games marked the peak of bike hiring in Beijing, but numbers declined again in the years that followed. The number of bike hire stations operated by the company Baker Blueprint dropped from 100 to 12. Of the over 8,000 bicycles that had been available for hire, only 3,000 were in active use; the other 5,000 were put in storage. The 200 or so bike hire stations operated by the company Fangzhou were closed down and the bikes sold off cheaply. All in all, bike hire in Beijing over this period was not really considered as a modern public project in the strict sense. The government was not involved in the project and the bike hire companies' only motivation was profit. Bike hiring was generally manual, and did not involve the use of technology. People generally had to hire bikes and return them at the same station.

This was not in line with the demand for a flexible, public bicycle traffic system.

On 1 May 2008, a public bicycle project was launched in the city of Hangzhou. It was the first really important public bicycle project in China, based on the third-generation public bicycle traffic system information technology. Following the launch, in 2009, public bicycle projects also got under way in Shanghai and Wuhan. The public bicycle traffic project in Wuhan covered 90,000 bicycles, while in Hangzhou the scheme used 67,500 public bicycles. Wuhan and Hangzhou became the cities with the largest and second largest number of public bicycles in the world.

2.4 THE "GREEN" TRANSPORT CONCEPT

Today, China still has a low level of motorisation compared to other countries. The percentage of public transport is rather high compared with industrialised countries. China's environmentally friendly transport system in cities and towns is also based on stable foundations and can look back on a long tradition. In small and medium towns, in particular, non-motorised traffic is predominant. In cities with a population of between 3 and 10 million, non-motorised means of transport account for over 60% of the total, while in cities that are home to over 10 million people, the figure is over 25%.

3. EXAMPLES OF CITIES AND TOWNS

The following section will look at six typical Chinese cities and towns that have been selected as examples to analyse the current situation and developments of the bicycle traffic system in several cities, taking a number of different aspects into account. One of the studies was conducted in the city of Zhangjiakou, in the Beijing-Tianjin-Hebei (Jing-Jin-Ji) region. In view of the urban, demographic and climatic features of Zhangjiakou and taking into account development trends in other cities, a number of proposals are made with a view to fostering the development of the bicycle traffic system in Zhangjiakou.

3.1 EXPERIENCE GAINED IN DEVELOPING THE CYCLING SYSTEM IN BEIJING

3.1.1 Current developments in urban transport

At the end of 2018, the population of Beijing was about 21.542 million, and the population density was 1,313 inhabitants per square kilometre. The number of motor vehicles in Beijing had increased by 175,000 to a total of 6.084 million by the end of 2018. The vast population and high population density in Beijing's six districts cause heavy traffic. Beijing's regional traffic connections are based on a ring and radial design. The population, industry and commerce focus mainly on the centre, whereas development lags relatively far behind in the outer districts and surrounding satellite towns. The high real estate prices in the city centre force many people into residential districts far from the centre, increasing overall traffic significantly, giving rise to the phenomenon of 'traffic tides', which is well known in major cities.

3.1.2 Problems and development trends in the cycling system

According to a survey of Beijing residents conducted in 2005, some 45% of residents travelled a distance of less than 5km (not including the distance covered on foot) (Figure 03), while the actual percentage of journeys completed by bike was 30% (Beijing Travel Report).

Bicycle traffic in the inner city of Beijing faces the following problems:

- Cycle paths are too narrow
- The lion's share of cycle paths are clogged with cars
- There are too few places to park bikes
- Bicycle theft is a serious problem

In September 2017, the Master Plan for the City of Beijing (2016-2035) was published. It clearly recommends making Beijing a pedestrian and bicycle-friendly city, and includes the development of a comprehensive and safe traffic system for pedestrians and cyclists. The plan calls for the rights of pedestrians and cyclists to be safe in traffic and for the road layout to be developed with a focus on people. The plan thus aims to make it easier to live without a car, and to make traffic more environmentally friendly. The development of bike-sharing systems is to be actively promoted and standardised. Bike-sharing systems play an important role in linking other means of public transport and are very useful for transfers and short distances. The potentials offered by these systems must be fully exploited. For instance, special technical functions must be agreed on, and guidelines put in place for the designation of bike parking areas.



Figure 02: The impacts of private cars on cycle paths

Source: Li Wei. Planning and reality of pedestrian zones and bicycle traffic. Beijing Institute for Urban Planning and design, 2009

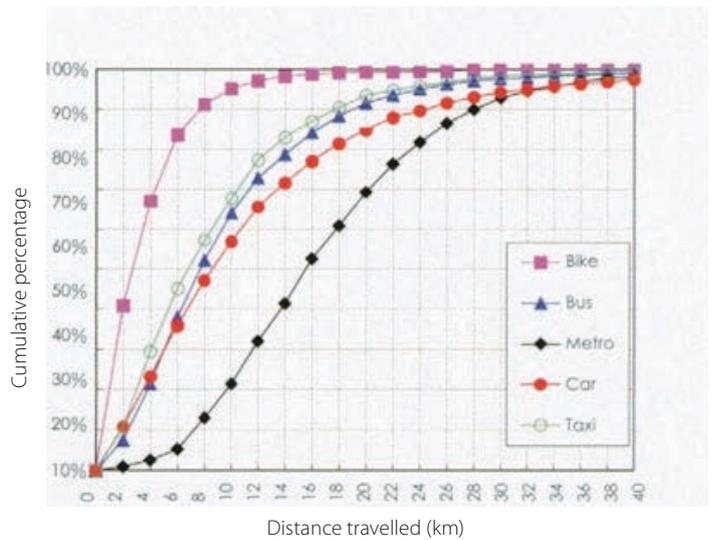
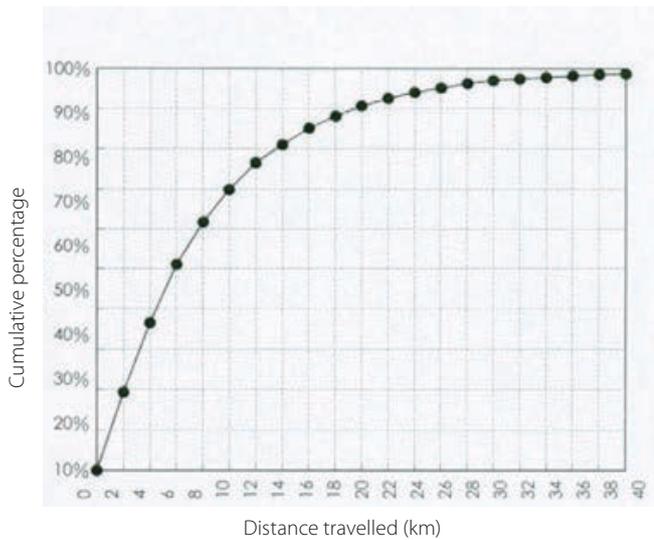


Figure 03: The distance travelled by residents of Beijing

Source: Li Wei. Planning and reality of pedestrian zones and bicycle traffic. Beijing Institute for Urban Planning and design, 2009

Shared bicycle parking facilities at stations and other important points of transfer are also to be established and optimised. By 2020, the percentage of emission-free traffic in cities is to rise from 70.7% to 75%, and further to at least 80% by 2035. By 2020, bicycle traffic is to account for 10.6% of the total and by 2035 this figure is to rise to 12.6%. As a result, pedestrian zones and bikeways will continue to be an indispensable part of the overall transport system in Beijing.

The test phase of the *Huilongguan-Shangdi* bicycle highway began on 31 May 2019. It is the first highway in Beijing dedicated exclusively to bicycle traffic. The Beijing Municipal Commission of Transport published a circular expressly banning the use of the highway by pedestrians, electric bicycles or any other motorised vehicles. It also set a maximum speed limit of 15 km/h for cyclists. Cyclists using the highway are required to cycle carefully and slowly and give hand signals before turning off the highway.

By 4 July 2019 the *Huilongguan-Shangdi* bicycle highway had been used by about 320,000 cyclists. The average number of bicycles using the highway on weekdays was around 7,500, with the number rising to some 8,500 at weekends. Every hour an average of about 1,200 bicycles used the highway. The heaviest traffic was recorded between 18:00 and 21:00 (Source: MoT).

3.2 EXPERIENCE GAINED IN DEVELOPING THE CYCLING SYSTEM IN HANGZHOU

With a total population of 6.35 million in 2013, the city of Hangzhou recorded 33.1 private cars per 100 residents. On average, every family owned 0.64 private cars. In recent years the city of Hangzhou has focused on building and renovating city roads and improving the bicycle path system. Today the city's cycle paths have attained a good level, but as motorisation continued to increase, there are still major challenges for cycling.

3.2.1 Current developments in the cycling system

By the end of 2015, 2.759 million normal bicycles and 1.897 million electric bicycles were registered in the (six) old city districts of Hangzhou. Figure 4 shows that the number of normal bicycles has remained constant over a period of several years, while the number of electric bicycles rose steadily at an average annual rate of 10.2% between 2011 and 2015. Overall, the number of bicycles increased to 4.656 million. About 2.227 million bicycles were used primarily in the old city districts, i.e. the 3.66 million residents of the old city districts owned 61 bicycles per 100 residents.

Beijing Urban Master Plan (2016-2035) Fig. 02 Map showing urban restructuring

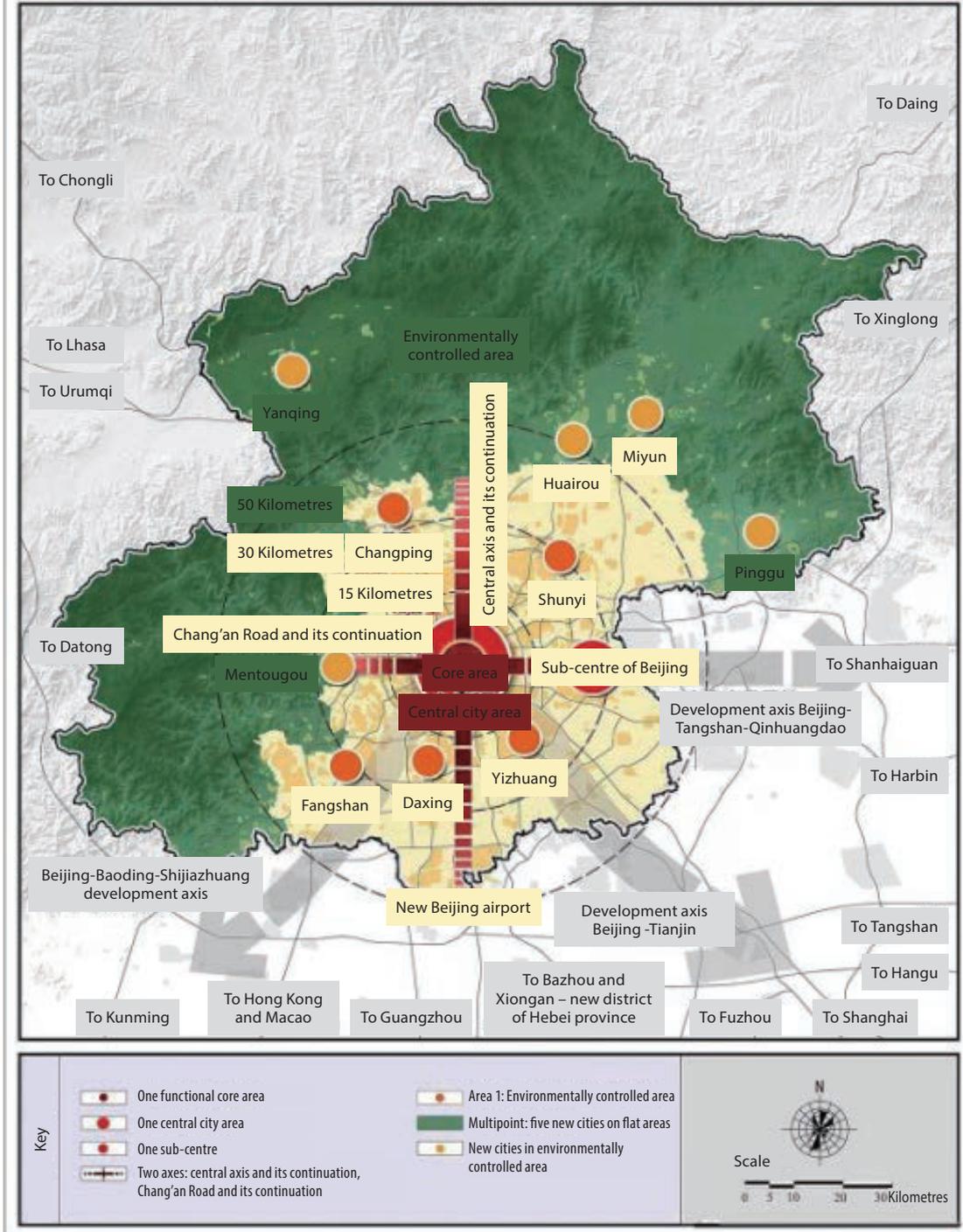


Figure 04: Map showing the urban restructuring laid out in the Beijing Urban Master Plan (2016-2035)

Source: Internet (http://www.beijing.gov.cn/zfxxgk/ftq11GJ20/gh32j/2019-05/17/content_1c5698489dfc415098b44d8debb17e6c.shtml)

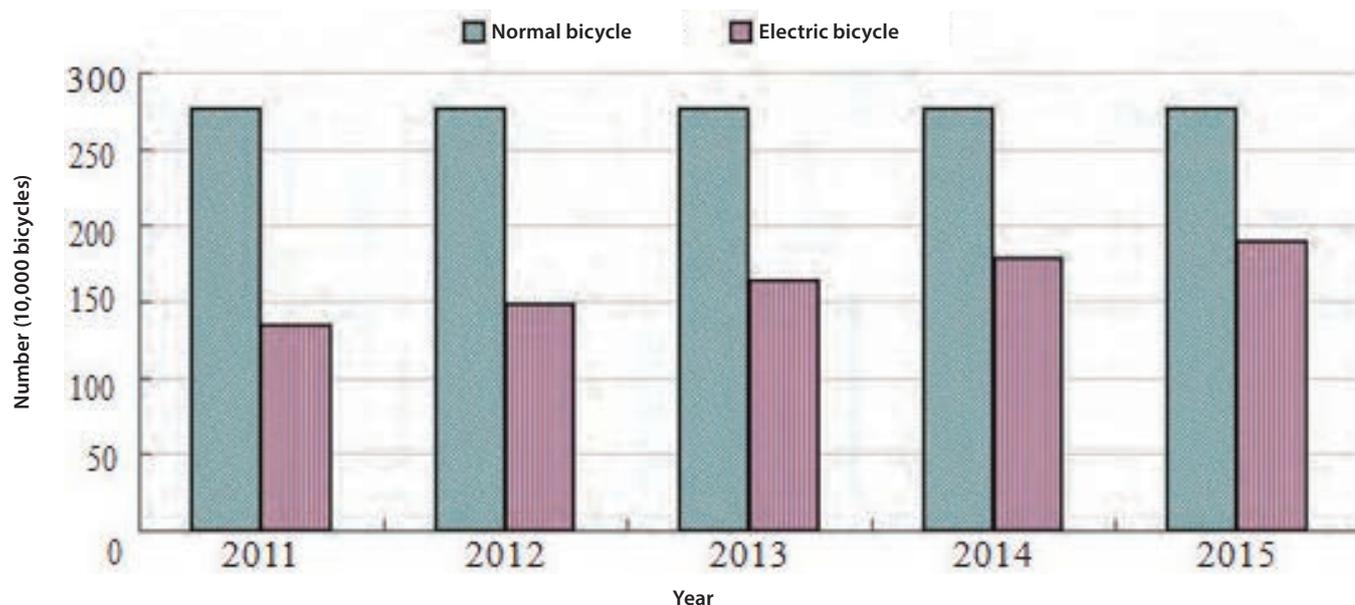


Figure 05: Changes in bicycle ownership in the old districts of the city of Hangzhou

Source: Wei Xiaodong. Research report on the urban pedestrian and bike traffic system in Hangzhou. Hangzhou Institute for Planning and Design, 2018

The public bicycle system in Hangzhou was opened on 1 May 2008. It was primarily promoted by the Hangzhou government through the introduction of a system which allowed people to use bicycles free of charge for a period of one hour. It has since become the largest and most successful public bicycle traffic system anywhere in the world. By the end of 2015, a total of 3,478 bike hire stations with 86,800 bicycles had been opened in urban areas. 115 million bikes were hired over a year through the public bike hire scheme, with an average of 314,000 bikes hired a day. 95% of hires were for up to one hour and thus free of charge.

To cover operating costs, the government has accorded bike hire companies the right to place advertisements on the bicycles themselves and at the bike hire stations and via service providers. The companies' annual income was RMB 45 million, which covered some of the operating costs. The companies do, however, receive annual subsidies from state-owned enterprises totalling between RMB 20 and 30 million a year. Given that 103 million hired bikes were in use in 2013, the government subsidised each bicycle with an amount of between RMB 0.20 and 0.29. These state subsidies were more cost-effective than annual subsidies for taxis and public buses.

3.2.2 Development trends in the cycling system

In 2007, the city of Hangzhou announced that it would be supporting the development of new pedestrian zones and cycle paths in the city. Consequently, Hangzhou incorporated the development of public pedestrian areas and cycle paths and other special plans such as the *Planning of non-motorised traffic in Hangzhou* and the *Planning of the public bicycle traffic system in Hangzhou* in its urban development plan.

In 2008, Hangzhou published a *Statement on the improvement of the development and management of public bicycle traffic*, to underline the importance of developing public bicycle systems. Hangzhou's extensive new development plan was based on a sound cycling infrastructure, which helped reintroduce bicycles as a means of transport.

According to a survey conducted in 2010, residents of the centre of the city used bicycles for 34.34% of their trips. This is broadly equivalent to the total of motorised means of transport (private cars and taxis, which together accounted for 34.84%; see Table 1). It can be seen that bicycles are an important means of transport in the city centre.

Means of transport	Bicycle	Pedestrian	Public transport	Private car	Bus	Taxi	Other	Total
In 2005	33.48	32.54	21.37	7.73	1.85	0.83	2.20	100
In 2010	34.34	30.35	20.92	11.56	1.26	1.10	0.47	100
Trend	↑	↓	↓	↑	↓	↑	↓	

Table 1: Comparison of traffic structure in the city centre of Hangzhou in 2005 and 2010 (in %)

Source: Wei Xiaodong. Research report on the urban pedestrian and bike traffic system in Hangzhou. Hangzhou Institute for Planning and Design, 2018

In comparison to other cities, such as Beijing and Shenzhen, bicycles account for a larger percentage of overall traffic in Hangzhou than in any other city in China (Figure 06). This can be attributed to the good roads, state support and the world-beating public bicycle traffic system. If we compare the traffic structure in 2010 with that in 2005, we can see that the percentage of private car use has risen most sharply, while the percentage of local public transport has remained largely unchanged. The percentage of trips taken on foot has dropped, whereas the percentage of bicycle traffic has risen steadily.

3.3 EXPERIENCE GAINED IN DEVELOPING THE CYCLING SYSTEM IN TIANJIN

3.3.1 Current developments in the cycling system

In former times almost everybody in Tianjin had a bicycle (apart from children and elderly residents). Still today, people cycled to work and to school. These trips accounted for 70% of all trips undertaken by bicycle. This is why the number of bicycles on the roads is particularly high in the morning and in the evening, coinciding with rush hour for motorised vehicle traffic. It is difficult to reconcile the divergent needs of bicycle and motor vehicle traffic. A large number of cyclists use the motor vehicle lanes on roads because there are no separate dedicated paths for cyclists. This worsens the conflicts between cyclists and the drivers of motorised vehicles, which has a negative impact on traffic management at crossroads and on the general traffic capacity. As the average daily distance travelled is short, bicycles account for 62.56% of the total traffic volume on working days.

The bicycle system in Tianjin is facing the following problems:

- Layout of traffic system is not appropriate for bicycle traffic
- Rules of the road are ignored
- Shortage of places to park bikes

3.3.2 Development trends in the cycling system

In 2011, the centre of Tianjin saw around 20,000 road users a day, which marked an increase of 42% over 2000. In recent years the structure of traffic in the centre has changed radically with a rapid rise in the percentage of motorised vehicles in road traffic. Non-motorised traffic volumes in the city centre have, by contrast, dropped from 53.4% to 35.7% since 2000. (Although the percentage of electric bicycles has risen from 2.4% to 10.1%.) By comparison, the percentage of private cars has risen from 3.2% to 13.4% and the percentage of public transport (rail traffic, buses, taxis) has risen from 8.7% to 16%. The number of pedestrians has remained unchanged at 34.9%. Broadly, the drop in the number of trips undertaken with non-motorised forms of transport have been replaced by private cars, while public transport has increased at a very much slower rate. In recent years bicycles are the only means of transport that have seen their traffic volume decrease on a large scale.

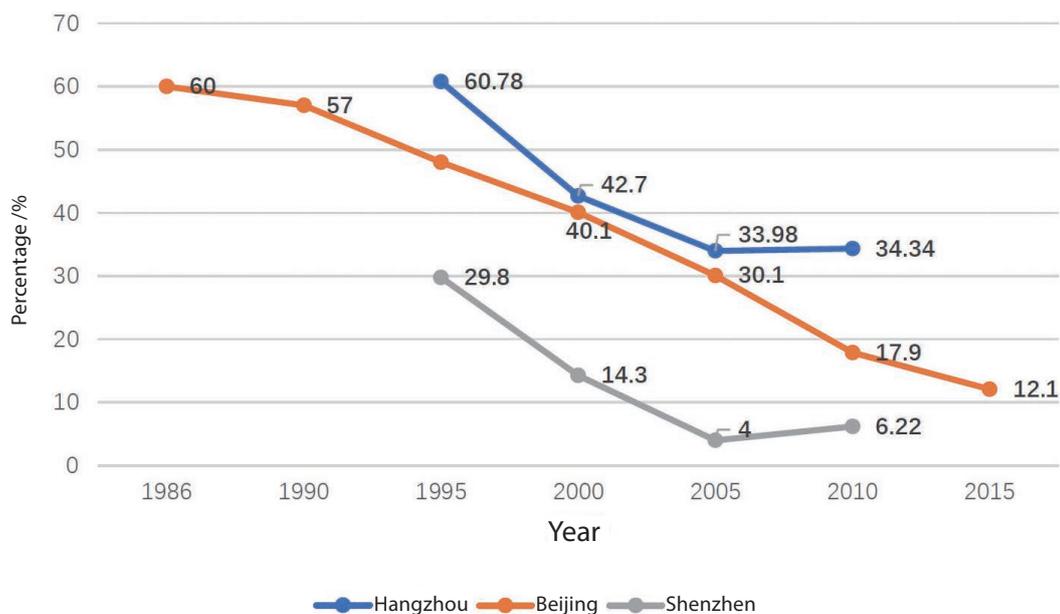


Figure 06: Comparison of changes in percentage of traffic accounted for by bicycles in Hangzhou, Beijing and Shenzhen

Source: Wei Xiaodong. Research report on the urban pedestrian and bike traffic system in Hangzhou. Hangzhou Institute for Planning and Design, 2018



Figure 07: Inappropriate road layout



Figure 08: Parked cars and bikes block pavements



Figure 09: The effective pavement width is inadequate



Figure 10: Inappropriate layout of areas beside roads



Figure 11: Unregulated bike parking in parks, at underground stations and in residential areas (from left to right)

Source: Yu Wei. Research on environmentally friendly and non-motorized traffic systems in Tianjin. Institute for Architecture, University of Tianjin, December 2017

3.4 EXPERIENCE GAINED IN DEVELOPING THE CYCLING SYSTEM IN XIAMEN

The *Strategic Plan for the Construction of a Beautiful Xiamen* underscores the importance of putting in place an environmentally friendly traffic system. Public and non-motorised traffic should preferably be predominant, with different means of transport integrated and the quality of service improved. The city of Xiamen is planning to build special high-quality lanes, improve road connections and crossroads and put in place a comfortable, safe and lasting traffic infrastructure. The combination of railway and local public transport stations, and the development of a bicycle traffic system, is to resolve the problem of the 'last mile'. The bicycle highway has now been integrated into the city's traffic planning.

In 2013 work began on developing the public bicycle system in the city centre of Xiamen. During the first phase of the project, 102 km of cycle paths were completed. The ongoing second phase will see the construction of a total of 92 km. The cycle paths in the centre of Xiamen do not have a dedicated lane with the exception of a few cycle routes for leisure purposes. Connections and comfort for cyclists are also fairly poor. A recent survey indicates that there are three types of cycle paths in the centre of Xiamen (see Table 2):

On 26 January 2017 the test phase began for the *Yunding bicycle highway*. The project in the city of Xiamen is the longest bicycle highway in the world, and was the first in China. The bicycle highway begins at Hongwen Metro station and ends at Xianhou Metro station. It is 7.6 km long, has got 11 exits and entries and connects six BRT stations, two Metro stations and four major commercial and administrative office buildings. The connections (4 lanes in each direction/net width 4.5 m/total width 4.8 m/maximum speed 25 km/h) to the airport, Wuyuan Bay, Phase II of the Software Park and the exhibition centre (Qianpu) are currently at the planning phase (as at summer 2019).

The bicycle traffic system in the centre of Xiamen is facing the following problems:

- There are a very small number of dedicated lanes and even these are generally not user-friendly;
- The location of some cycle paths is less than optimal consequently they are little used;
- No through cycle paths have been developed and there are many dead-end streets.

LANE CLASSIFICATION	FUNCTION	TYPE OF LANE	CROSSROAD DESIGN	AVERAGE/ MAXIMUM SPEED (KM/H)
Bicycle highway	Main routes	Separate lane	Complete separation of bicycles from vehicles and pedestrians	25 - 35
Special cycle paths	Secondary routes for cyclists, environmentally friendly roads, tourist cycle paths	Separate lane	Cycle lanes cross areas used by motorised vehicles	15 - 30
General cycle paths	Majority of cycle paths	Shared lane	Connections to roads and several levels	10 - 20

Table 2: Classification of cycle paths



Figure 12: An aerial view of the Yunding Road bicycle highway in the city of Xiamen

Source: Internet 26 June (http://www.sohu.com/a/235530471_818343)

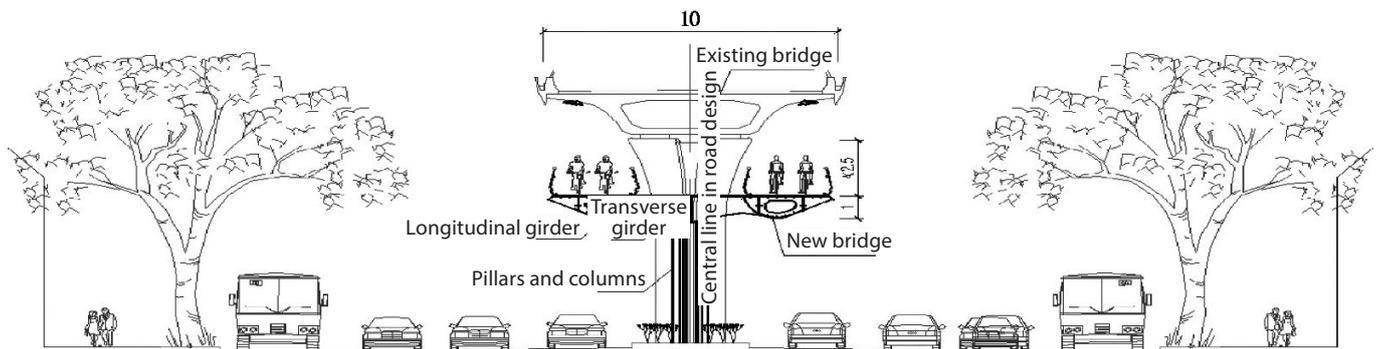


Figure 13: Bridge layout (m)

Source: Lin Huiyuan. Development strategies and bicycle traffic planning in Shenzhen. In: Municipal technology, 2017 (5): 17-21

3.5 EXPERIENCE GAINED IN DEVELOPING THE CYCLING SYSTEM IN SHENZHEN

3.5.1 Current developments in the cycling traffic system

Shenzhen's station-based bike hire scheme has proved effective in addressing the problems of the 'last mile'. As of 2016, a major effort was made to develop the non-station-based system (known as free floating bike-sharing).

Activities to develop the bicycle system in the city of Shenzhen are facing the following challenges:

- Imprecise markings of cycle paths result in chaotic sequencing in some places, resulting in conflicts between motor vehicles, non-motorised traffic and pedestrians.
- There is a lack of necessary traffic management aids such as signs and marking.
- At some crossroads the cycle paths are very steep, making it impractical for cyclists to cross the road.
- The failure to clearly separate cycle paths from pedestrian areas hampers cyclists.

3.5.2 Development trends in the cycling system

In view of the problems with the bicycle traffic system in its current form, the Traffic and Transport Committee adopted its implementation plan to improve bicycle traffic in Shenzhen in 2018, along with the Development and Reform Commission, the Urban Planning and Land Resources Committee, the Municipal Administration Council and the Traffic Management Office of the Ministry for Public Security (MPS). Under the provisions of the plan, the government is responsible for coordinating policies and market activities. Another aspect is the restoration of the bicycle traffic system, which shall be comprehensively networked and rendered user-friendly and environmentally friendly. In this way, cycling can be made more dynamic and attractive, while fostering the expansion and sustainable development of more efficient, social inclusive cities, with environmentally friendly traffic and a high quality of living.

Shenzhen requires that 100% of new and renewed roads be equipped with cycle paths. The intention is to avoid pedestrians and cyclists sharing paths whenever possible. Cycle paths are to be made wider by narrowing the lanes for vehicular traffic, to guarantee the right of cyclists to road space. By 2020, the city of Shenzhen is to build or renew more than 1,000 kilometres of cycle paths.

3.6 RESEARCH FINDINGS AND PROPOSALS FOR DEVELOPING THE CYCLING SYSTEM IN THE CITY OF ZHANGJIAKOU

The planned overall area of the city centre of Zhangjiakou is 65.03 square kilometres. Zhangjiakou is surrounded by mountains on three sides and has a population of 690,000. The location of the city offers unique geographical advantages. Currently, Zhangjiakou has 694,682 motor vehicles, a number which is rising by 10% a year. During a visit to Zhangjiakou in 2017, President and General Secretary Xi Jinping stressed that 'environmentally friendly development is a great wealth, an advantage and a valuable asset for Zhangjiakou'. The construction of the 'environmentally friendly water protection and promotion zone' has become an important and integral part of the systematic development of Beijing, Tianjin and Hebei. Taking into account the construction work for the 2022 Winter Olympics and the imperatives of a functional regional development plan, the strategic environmental planning concept is the precondition for the further development of the city of Zhangjiakou. In June 2019, the *Construction plan for hydrogen energy in Zhangjiakou (2019-2035)* was published in Beijing. The goal of becoming an internationally recognised hydrogen power city has become imperative for Zhangjiakou. By 2021, the city intends to move forward with the development of 1,500 hydrogen vehicles of different sorts, including 1,000 buses. With many extensive preconditions, the city of Zhangjiakou is to develop a bicycle traffic system, improve connections to municipal public transport and make the entire traffic system environmentally friendly.

3.6.1 Current developments in the cycling system

According to a survey of Zhangjiakou residents, bicycle ownership ranks second to private car ownership, although bicycles account for a relatively low percentage of the total traffic. There is a major discrepancy between the rate of bicycle ownership and the actual distances travelled by bike. Environmental influences, such as windy and cold weather in winter, high temperatures in summer, and steep streets impact adversely on bicycle traffic. Moreover, the gradual increase in standards of living is tempting people to use cars, buses and electric vehicles as their main means of transport. As a result, the rate of bicycle use is dropping steadily, as the rate of electric vehicle use rises. People currently using bicycles most as a means of transport are middle- and low-income groups with a monthly income of less than RMB 10,000. They only travel distances of between 1,000 and 2,000 metres.

The main factors that render cyclists unhappy with the local conditions include the low number of cycle paths and the fact that these are often blocked by motor vehicles. There is also a shortage of public spaces to park bikes in residential areas. Other problems include the poor-quality road surfaces, the unsatisfactory traffic light management and a lack of street greening. The interest in a public bike-sharing system is relatively high, but there is a lack of procedures for establishing an efficient and sustainable system. In regards to bike sharing, there exist some problems, such as difficulties in finding a bicycle, the lack of comfort involved in cycling, the low speeds, inconvenience of hiring and using bicycles, etc.

The plan for upgrading the image of central Zhangjiakou (2016-2020) proposed optimising the road layout, improving driving roads and making special dedicated cycle paths offering enough space. The focus is on extending a public bike-sharing system within cultural and business districts and at traffic hubs.

3.6.2 Analysis of the problems and potentials offered by the cycling system

The development of the bicycle system is an important and integral part of establishing an environmentally friendly traffic system in Zhangjiakou. Although great steps forward have been made over the last two years in separating motor vehicles from non-motorised vehicles, and in providing additional parking spaces for bicycles, the following problems still need to be taken into account in further development efforts:

- (1) The safety of cyclists and pedestrians is compromised by motor vehicles blocking cycle paths.
- (2) Inside cities, the parking spaces for bicycles are not well spread and are not in line with the general needs of residents. As a result, the use of these bike parks is very uneven, with some overwhelmed by the number of bicycles and others scarcely used.

(3) There are different layouts for crossroads, which impact adversely on the bicycle traffic system.

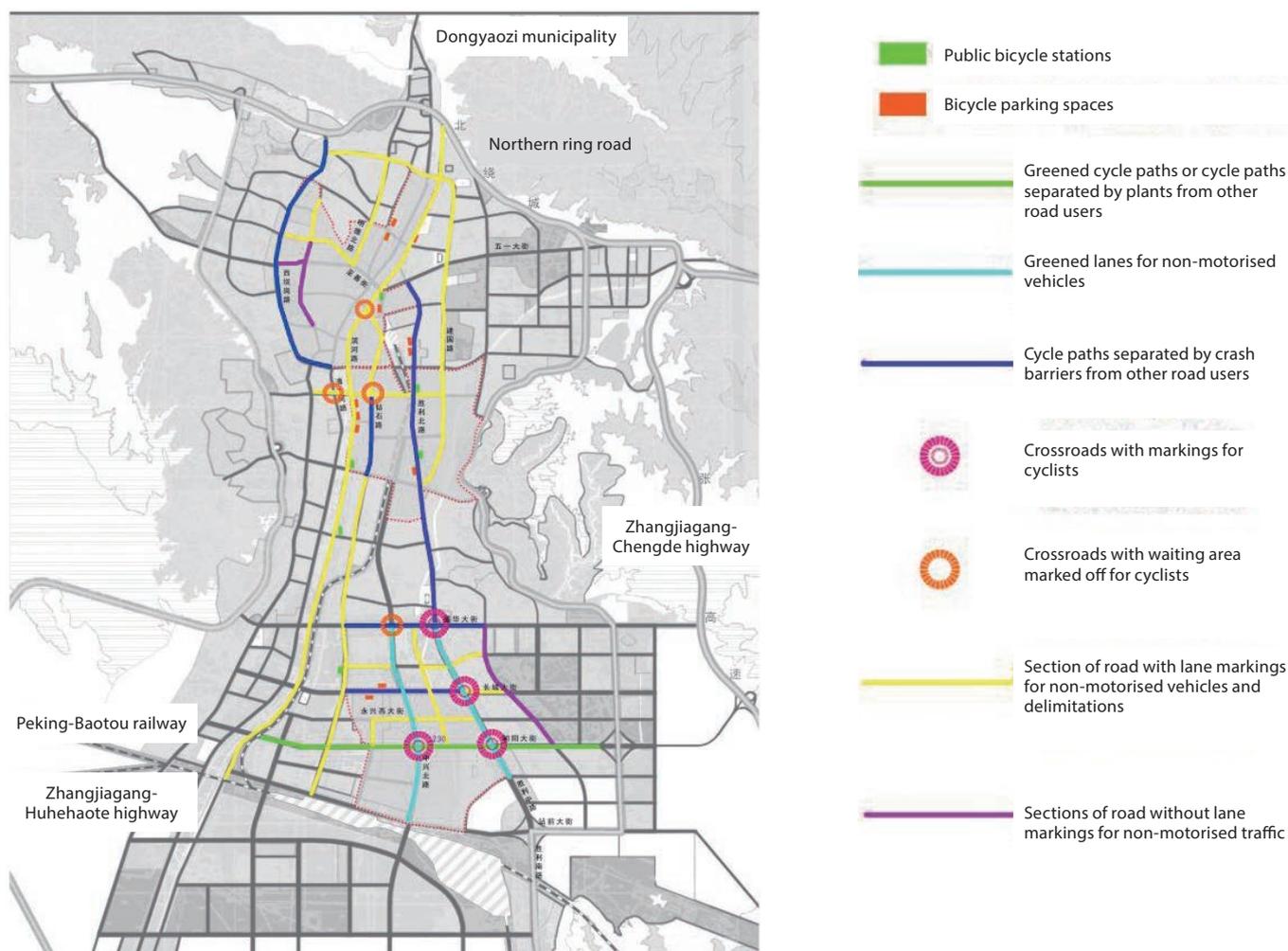
(4) Public bicycles are often abandoned carelessly, resulting in serious damage caused by other people. There is no government supervision of the income of public bicycle companies.

(5) The connections between public bicycle schemes and other public transport is not efficient or user-friendly, also in terms of transferring from one to another.

(6) Road maintenance is inadequate. The surface of some roads and also manhole covers are damaged, in some cases seriously, which impacts adversely on the comfort of cyclists.

(7) The social status of cycling is currently low.

Given the adverse impacts of traffic jams and the resultant change in concepts for environmentally friendly travel, the focus is again moving to bicycle traffic and pedestrians, however. In conjunction with this, the potentials and advantages offered by bicycle use are being addressed, such as the increase in the density of cycle paths, the gradual improvement in facilities and the coordinated development of the public traffic system. A large number of families in Zhangjiakou already have bicycles. The development of the southern part of the city centre, the upgrading of roads in old districts of the city and the establishment of special roads are expected to increase demand for cycling in future.



The cycle paths and Shengli Road are separated from other road users by crash barriers and are 2.4 metres wide. The cycle paths along Changcheng Road are separated from other road users by crash barriers and are 3 metres wide.

Figure 14: Current breakdown of cycle paths

Source: Bicycle Traffic System Research Group at Hebei University for Architecture

3.6.3 Proposals for the further development of the cycling system

(1) The cycling systems in cities should be seen as part of public transport. Zhangjiakou is also to become a cycling system model city in the Jing-Jin-Ji region.

(2) Bicycle traffic is to be better planned and different road user and traffic rights are to be introduced, including the establishment of cycle roads and banishing private cars from cycle paths. Existing bus stops are to be made bicycle-friendly (with cycle paths looping round behind the stop). Roads with street parking should provide for parking spaces to the left of the cycle lane (see Figure 15) and speed bumps should be installed at pedestrian crossings.

(3) In line with the topographical and geomorphic conditions in Zhangjiakou, a distinction must be made between suitable and unsuitable cycle routes. A study of the cycling system in Chongqing, for instance, states that a street with a slope of less than 3% is best suited for cycling. Roads with a slope of between 3% and 5% are still acceptable for cycling, but this is no longer true where the slope exceeds 5%. Warning signs should be mounted on roads that are unsuitable for cycling, to alert road users.

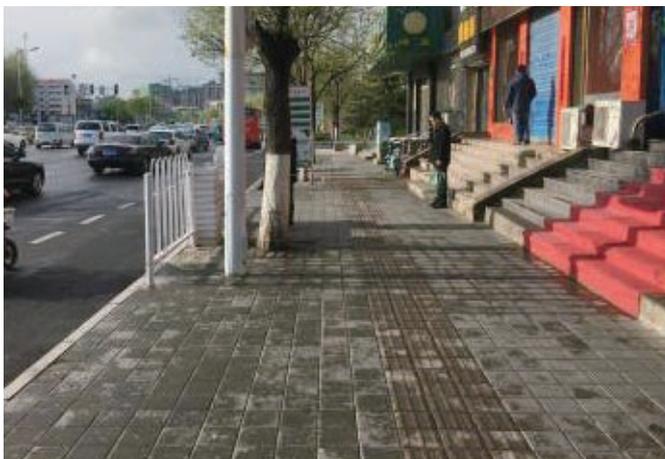
(4) Through bus connections are to be improved as the precondition for realising sustainable traffic involving bike & bus options. In addition to designating suitable bicycle parking areas at different bus stops, guidelines should be drawn up to facilitate cycling, covering, for instance, the option of taking bicycles onto buses and providing bicycle spaces in buses. Bicycle parking spaces should also be provided at stations and long-distance bus stations.



Street parking (current situation)



Street parking (target situation)



Bus stop (current situation)



Bus stop (target situation)

Figure 15: Comparison of bus stops before and after renovation work

Source: Bicycle Traffic System Research Group at Hebei University for Architecture

(5) The construction and maintenance of bicycle traffic systems are also to be improved. In accident black spots, light colours should be used to draw attention to hazards. Moreover, bicycle traffic lights are to be installed in addition to the lights for motor vehicles, and cyclists are to be given preferential treatment at lights. In this regard, Zhangjiakou can learn from the practical experience in Danish cities, where, for instance, a 'green wave' exists for cyclists. Various software solutions and apps are also to be used, so as to offer cyclists services such as seeking bicycle parking spaces and bike-sharing stations. Given the prevailing climatic conditions in Zhangjiakou, more roofed bike parking spaces are to be provided. The establishment of separate cycle paths along the abandoned Beijing-Zhangjiakou railway line should also be considered, and for areas with steep slopes, bicycles with gears or electric bicycles should be provided for the general public. Another point is the design of special cycle paths that take into account service facilities such as resting places for elderly cyclists and multifunctional service options to ensure environmentally friendly roads.

(6) Diversified and efficient land use is to be retained. To prevent one-sided land use, the planning of residential areas is to be brought into line with the location of workplaces. For instance, when residential areas are planned, there should be a focus on short and medium distances between home and the workplace so that people can walk or cycle to work.

(7) An assessment system should be introduced for bicycle traffic, and regular evaluations conducted. To this end solutions should be developed on the basis of the practical experience of the Danish Government. For instance, Denmark evaluates the national traffic system every two years in order to identify problems in implementing pedestrian and bicycle traffic and to ensure a vision that caters for the needs of different users.

(8) To stem the excessive rise in private car traffic, it is proposed that a parking management system be introduced in city centres, leaving more space for bicycles and pedestrians.

(9) During preparations for the 2022 Winter Olympics, priority should be accorded to (public) bicycles in the construction of stations for high-speed trains (traffic hubs) and the Minghu and Baozili blocks (tourist attractions). As a result, Zhangjiakou can cultivate a new image as an environmentally friendly and emission-free city. The development of safe, practical, comfortable and lasting spaces for public bicycles would go a long way towards enhancing the new image of Zhangjiakou.

(10) The model of developing public cycling systems through public-private partnerships should be retained. Proper management is to be introduced for public bicycles. The public bicycle traffic system should be further developed, so as to raise demand for privately owned bicycles in the long term. The government should cooperate with the bicycle companies in order to put in place an information-sharing platform for the public bicycle traffic system, so that it can support public bicycle companies. Companies should be encouraged to offer different sorts of bicycles, e.g. bicycles for transporting goods, for carrying children or for transporting several people, so as to meet the different needs of various consumer groups. The government should supervise the scrapping of bicycles, reduce theft and hone supply for the market, as well as upholding the lawful operation of public bicycle companies. Public bicycles should be permitted in shared residential areas to improve door-to-door transport and service.

(11) Advertising for cycling should be planned and developed on a larger scale. One option would be to follow a number of different cities inside and outside China on World Bicycle Day, for instance, and to stage an annual cycling competition in Zhangjiakou. Zhangjiakou can also learn from the practical experience of the Danish Government and other examples in Europe, including from the Netherlands. And cycling can be promoted through the engagement of influential ambassadors, who would extol the virtues of cycling. Cycling should thus become part of people's lifestyle.

4. TECHNICAL AND POLITICAL PROPOSALS FOR THE PROMOTION OF THE DEVELOPMENT OF BICYCLE TRANSPORT IN CHINA

Overall, a study of the current situation of the bicycle traffic system in different cities noted that motor vehicles blocking cycle paths, the inadequate number of bike parking spaces and the inadequate development of the bicycle traffic system are frequent problems in developing bicycle traffic in Chinese cities. Three main reasons for the problems with bicycle traffic outlined above were identified:

Conceptual issues

In the past, there has been a lack of understanding of the functioning of the bicycle traffic system. Private cars played the fundamental role in the planning of urban traffic, with bicycle traffic and the imperatives of ensuring a safe traffic environment for cyclists ignored in the planning, construction and management of traffic systems.

Standardisation issues

The norms and standards for planning and designing the bicycle traffic system have not yet been brought into line with the situation on the ground, and have thus not been able to effectively steer developments in the bicycle traffic system.

Management issues

Compliance with legislation governing bicycle companies and other cycling actors is inadequate and the government's criminal investigation and prosecution procedures are often not fully implemented. This applies to the planning, construction and management of bicycle traffic.

In view of the problems outlined above, the following recommendations are made:

4.1 SIGNIFICANCE OF THE CYCLING SYSTEM

It ought to be fully understood that bicycles are important for short and medium distances and for transfers between other means of transport. Increasing the percentage of traffic accounted for by bicycles can also significantly reduce travelling time, emissions of pollutants and energy consumption. This brings health benefits to the population and enhances the urban environment at a low cost. The benefits of expenditure on bicycle traffic outweigh those of spending on other government projects.

4.2 HIGHLIGHTING THE GUIDING ROLE OF PLANNING

The construction of a cycling system should be fully incorporated in urban planning and the development requirements for bicycle transport should be specified in the planning of the road transport system. In line with the scale, the environmental conditions, demand for traffic solutions and the public traffic and transport infrastructure, the percentage of road traffic to be accounted for by bicycles should be adapted in road transport planning.

The elaboration and implementation of special plans should be based on comprehensive urban and transport planning. The single most important point is the implementation of the bicycle transport strategy, taking into account the topography of cities, the environmental conditions, and current trends in urban transport, so that cycle paths, bicycle parking areas, and short-term construction projects can be better planned. The planning of urban bicycle transport should be linked to the urban local public transport concept and to the parking options available. Hearings or other participatory measures should be used to draw on the opinions of experts and of the general public.

4.3 CONTINUAL IMPROVEMENT OF INFRASTRUCTURE

Cycle paths should be incorporated in the construction and rebuilding of main roads and secondary roads in cities and towns. The authority responsible for urban and regional planning should not issue construction permits for construction projects where cycle paths are developed outside regular planning procedures.

An adequate number of user-friendly bike parking spaces should be made available in residential areas and at public facilities. Permanent bike parking spaces (garages) should be provided in new residential areas, although parking spaces along public roads should account for the majority of parking spaces for bicycles. In existing residential areas and in areas with single-storey buildings, the problem of where to leave bicycles should be resolved by building public bicycle parking spaces. It should be mandatory for public buildings, tourist attractions, historic city centres, parks and squares of over 20,000 square metres to provide parking spaces for bicycles in line with a special regulation. The development of parking and transfer options for cyclists should also be supported, for instance by establishing bicycle parking facilities at stations, bus stops and other public transport hubs.

4.4 SECURING SPACE FOR BIKEWAYS

With the proviso that space be ensured for bikeways, transport resources should be allocated and used, with the emphasis on integrating bikeway planning into the planning of road systems. At major traffic hubs, in particular, the planning of cycle routes should be aligned with the main requirements and demand.

Use of road lanes should ensure that bicycle lanes are sufficiently wide. There should be a ban on extending motor vehicle lanes onto bicycle lanes, and bicycle lanes already used by motor vehicles should be freed of the latter. Cycle paths should be completed in line with relevant national standards and norms and any unlawful use should be banned. Various steps should also be taken to prevent private cars using cycle paths. In areas where sufficient off-road parking is available for motor vehicles, no street parking should be allowed. In conjunction with the maintenance of urban roads, the maintenance of cycle paths and associated facilities should be improved.

4.5 ENHANCING DESIGN AND MANAGEMENT OF BIKEWAYS

In principle, travel is to be made easier for a large number of the steadily growing population. Cycle paths should be put in place, taking into account the main travel needs and the readiness of the population. Planning should also provide for leisure cycle routes with water bodies and greening. In the course of river engineering and the planning of parks in cities and towns, the bikeway network is to be expanded as far as possible. Cycle paths are to be built around landscape parks and lakes to make cycling an attractive leisure and sporting activity too.

Basically, every effort should be made to avoid having traffic areas shared by cyclists and pedestrians. Cul-de-sacs should be rebuilt, for instance, such that closed blocks are opened up and can be integrated into the road network. This can improve pedestrian and cycle traffic at micro level.

The construction of bikeways should be improved, for instance by ensuring an appropriate road surface. More roads should also be fitted out with appropriate lighting, greening and shade, to improve cyclist comfort. In inner-city roads and at crossroads where traffic is heavy, with both motor vehicles and bicycles, crash barriers and other measures should be used to prevent motor vehicles crossing cycle paths or blocking pavements, thus enhancing the safety of pedestrians.

4.6 STEPPING UP POLITICAL SUPPORT

Based on synergies between the administration, the market and companies, the public bicycle transport system should be developed in line with the major features of each town or city. Bike-sharing systems should continue to be supported and should be integrated into the traffic system, to put in place and enhance a multilevel, diversified urban transport system. In addition, the market conditions should ensure fair competition. Companies should provide appropriate bicycles and operations should be required to adhere to certain standards. Parking management and criminal investigations should also be stepped up to put in place favourable conditions for the safe and civilised use of vehicles. Monitoring of the safety of user capital and the protection of network and data security should be improved.

Electric bicycles play an important role in achieving greater efficiency in transport and promoting energy saving and emissions reduction. When urban infrastructure is developed, it is recommended that full use be made of renewables, such as solar power, wind power and hydrogen, as well as expanding the charging infrastructure for electric vehicles.

4.7 ALTERNATIVE WAYS OF PROMOTING THE CYCLING SYSTEM

The municipal government should allocate responsibility for the main facets of the bicycle traffic system, whereby coordination

and cooperation among responsible divisions should be stepped up to better develop the bicycle traffic system.

Furthermore, more should be done to promote cycling in cities and towns. Newspapers, television, internet and other media should be used on a large scale, and public-interest advertising conducted. Events such as *'Car-free day in Chinese cities and towns'* and other pilot projects will hone the environmental awareness of residents vis à vis cycling in road traffic, and will promote environmentally friendly travel options, such as walking or cycling.

Other pilot projects are to be conducted in the fields of scientific, social and technical research and development, and international cooperation in the scientific and technical field should be stepped up. Improving urban bicycle transport systems should be seen as an important assessment index in activities such as the *'National garden city'*, the *'Chinese award for an environmentally friendly habitat'* and the *'Barrier-free environmental design of cities and districts.'*

5. OUTLOOK

International cooperation should be innovative and relations at international and regional level should be strengthened. In certain areas it would be expedient to work with foreign companies and scientific research facilities in order to open up new opportunities, for instance for linking bicycle traffic and public transport. There should also be exchange and discussion on issues such as installing traffic lights for bicycles and introducing incentive mechanisms for cyclists. The feasibility and implementability of the Vision Zero¹ action plan in China should also be explored. Finally, relations to foreign cities of comparable size and moderate economic development should be stepped up.

The bicycle transport system has to meet a number of different requirements, including short routes, commuter routes, sporting activities and long-distance routes. Bicycles are used in different ways in cities and towns and the different forms of use imply different requirements. However, safety, comfort, accessibility, attractiveness and flexibility are the basic requirements of any bicycle traffic system. As an important and integral part of public space in urban areas, bicycle transport systems can be beneficial for the physical health and mental wellbeing of the population. As a result, it can enhance the standing of the town or city and give residents a feeling of belonging to that place. This makes bicycle transport systems an important part of urban culture.



Figure 16: The active role of public space in urban areas

¹ Vision Zero is a multinational traffic safety project that was launched in Sweden in 1997. It aims to achieve a road traffic system with no deaths or serious injuries.

DISCLAIMER

Title

Keystone Papers for the key topics of the Sino-German Urbanisation Partnership Project

Imprint

The keystone papers are published as part of the "German-Chinese Urbanisation Partnership Project". As part of the International Climate Initiative (IKI), the project is commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in cooperation with the Ministry of Housing and Urban-Rural Development of the People's Republic of China.

As a federal company, GIZ supports the German Federal Government in achieving its goals in international cooperation for sustainable development.

Editor

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
Sitz der Gesellschaft
Bonn und Eschborn
Sunflower Tower Maizidian Str. 37, Chaoyang District
100125 China, Beijing
Tel.: +86 10 85275180
Fax: +86 10 85275185
e-mail: giz-china@giz.de
Internet www.giz.de/china, www.sustainable-urbanisation.org/en

Main Authors

Center for Science and Technology and Industrialization Development (CSTID) under the Ministry of Housing and Urban-Rural Development of the People's Republic of China, Hebei University of Architecture (HUA)

Coordination and Responsibility

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
Markus Delfs, Wang Xu, Xia Yun

Layout & Graphics

Happold Ingenieurbüro GmbH Pfalzburger Straße 43-44 10717 Berlin
TOPPAN MERRILL LIMITED 7/F & 8/F, Gloucester Tower The Landmark, 15 Queen's Road Central, Central, Hong Kong +86 10 8637 0005

Disclaimer

GIZ and the authors assume that the information and information contained in this work is complete and correct at the time of publication. Neither GIZ nor the authors assume, expressly or implicitly, any guarantee for the content of the work, any errors or remarks. The cartographic representations are for informational purposes only and do not constitute international recognition of boundaries and areas. GIZ assumes no responsibility for the topicality, correctness or completeness of the provided maps. Any liability for damages resulting directly or indirectly from use is excluded. The respective provider is always responsible for the content of external sites referred to here.

On behalf of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

© Beijing, December 2020