ifmo
Institute for Mobility Research

URBAN MOBILITY IN CHINA

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Foreword

With their unparalleled market dynamics, Chinese cities are experiencing the fastest-moving trends in urban mobility seen anywhere in the world. Rapidly growing in terms of economic strength, human population, vehicle population – and, of course, in terms of annual distance travelled – the cities of this great country are burgeoning centres of activity, embracing a highly diverse mix of all manner of vehicles and kinds of mobility. In these metropolises, new concepts are being integrated into urban mobility at breakneck speed, as old concepts are being abandoned – witness the complete disappearance of motorcycles with combustion engines from public roads in the city centres of various urban areas in China. And in many such areas, an ideal breeding ground is being created for the fast implementation of new technologies and concepts, by the coming together of various framework conditions: the availability of large-scale finance, a mentality of trial and error, and an extremely strong desire to succeed as a first mover.

That's why, if we want to gain insight into the direction in which mobility is heading in urban areas globally, a good starting point would be a study of China's cities, which are leading the way in areas such as regulation, novel concepts, new technologies and – last but not least – consumer behaviour.

Enjoy the read!

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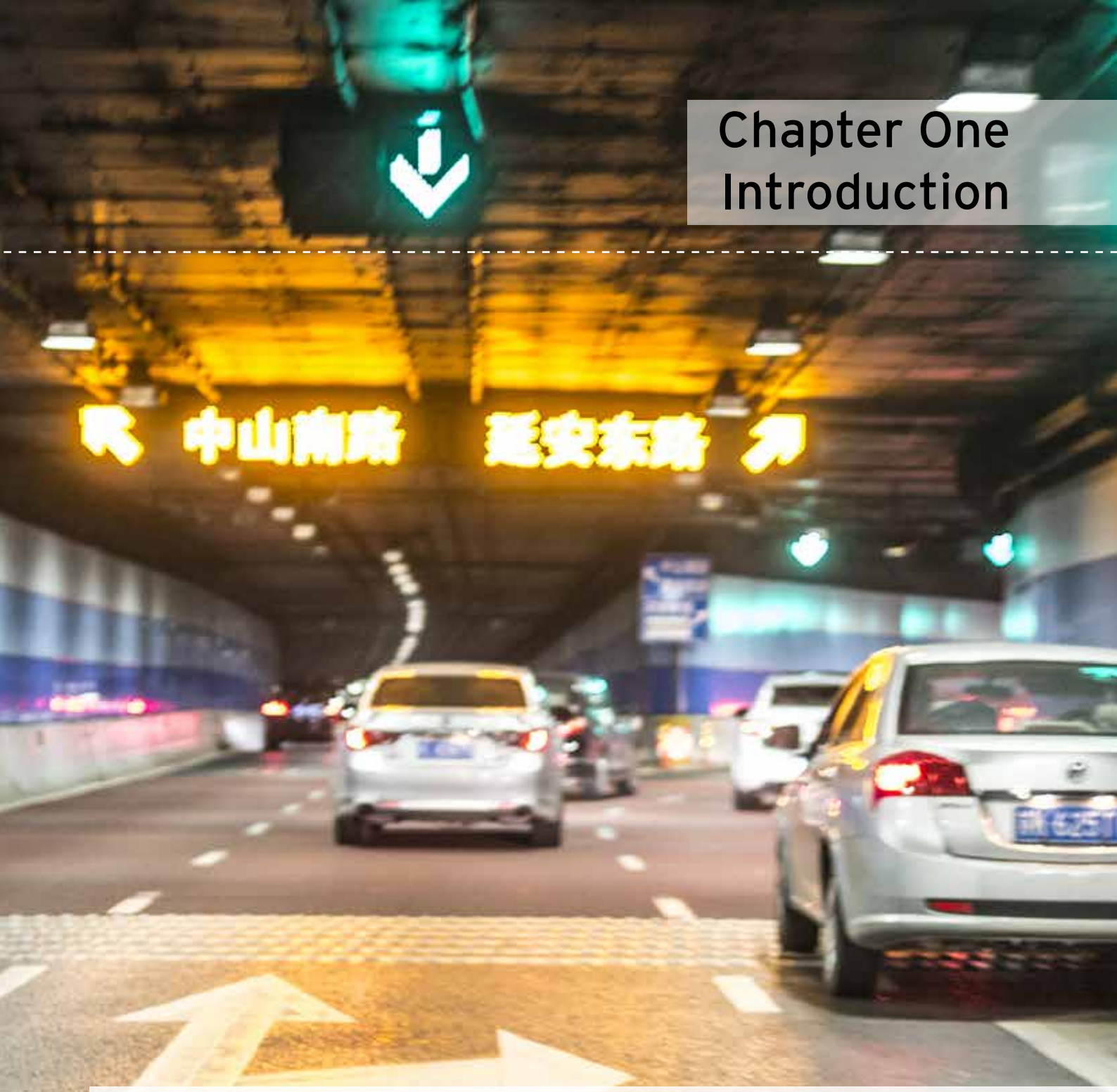
Chapter One
Introduction



This research project analyses the state of urban mobility in four selected Chinese cities, which differ in terms of transport and urban planning: Shanghai, Shenzhen, Chengdu and Chongqing. The principal objective is to identify the main factors influencing mobility behaviour and choice of transport mode, and to understand their impact on current urban mobility. The results with be analysed to discern potential trends and developments in future mobility in China.

China's cities and metropolises face rapid growth in population and income, and in the demand for transport. The speed of this development in the 'Middle Kingdom' is far faster than in European countries, with the consequence that there is a high level of uncertainty when it comes to deriving a strategic transport plan. One distinctive feature in China is the heterogeneity of its urban spaces: they are not comparable. The standard European decision-making culture and way of doing things is not always applicable in China. A deeper analysis is thus needed to gain a better understanding of the actual mobility culture in the context of the existing framework conditions, and in order to identify and anticipate future mobility systems.

In order to make the developments easier to grasp and to draw possible inferences from what the findings tell us about planning culture, both qualitative and quantitative research methods were applied. In this context, a comprehensive survey was used, split into three sections – the user, the city and technology – for the purpose of examining the prevailing mobility trends. The results of this survey were validated using video evaluations, city tours and expert interviews. To discover the specific features of China, especially as regards transport users, detailed analyses of different user groups were carried out, using techniques such as questionnaires covering more than 400 persons, personal in-depth interviews and focus groups. The structure of this project, and the research methods used, are shown in Figure 1.

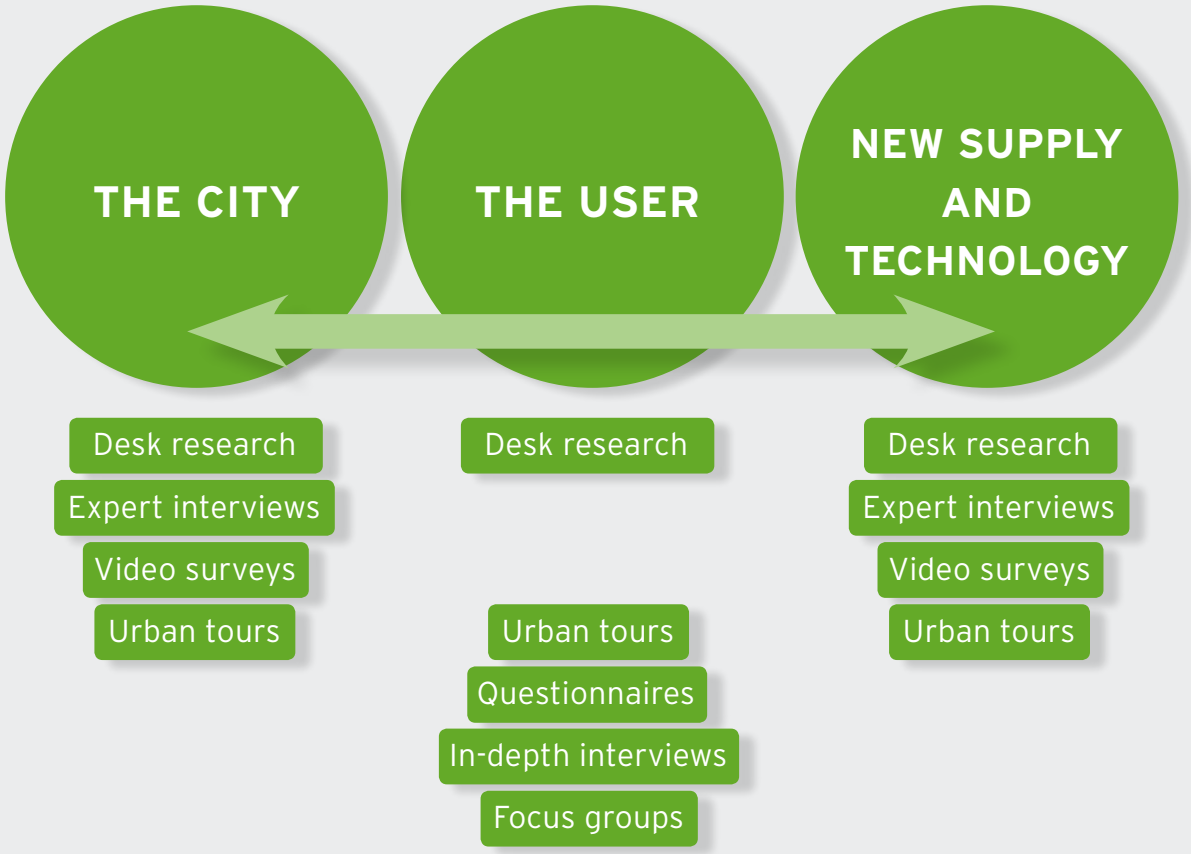


Figure 1. Project structure and research methods

SOURCE: ProRaum Consult & INOVAPLAN.

Chapter Two
The City

Four particularly dissimilar cities were chosen for this analysis, ones that differ from each other fundamentally with respect to their demography, urban development, transport, and regulatory environment.

The financial capital **Shanghai** is characterised by its progressive development, high population density and high income, and is known as a Western-oriented 'trendsetter' city. **Shenzhen** has a similar modern urban image, but is less densely populated, and therefore represents a counterbalance in terms of urban and transport planning. **Chengdu** and **Chongqing** stand for the less developed but economically emerging urban regions in China. Both cities have been identified as development centres of the 'go West' strategy of the Chinese central government, and have grown rapidly in recent years. **Chengdu** is characterised by a relatively high population density in the city centre, a less densely populated suburban area, and a new development centre in the south. **Chongqing** is considered the largest municipality in the world owing to its vast area. Its population density is particularly high in the core area as a result of topographical conditions.

In an attempt to deal with the increasing demand for mobility, a variety of approaches and development strategies adopted by the administrations of the respective cities have been identified. They are characterised not only by various challenges, such as those relating to urban pattern and topography, but also by political action, cultural characteristics and development targets.

The developed coastal cities, Shanghai and Shenzhen, show a strong regulative and prohibitive culture, limiting the access to ownership of a private car and regulating the use of road infrastructure. The trend in Shanghai is already clear, evidencing a move towards limiting motorised traffic, and simultaneously extending and investing in public transport, while at the same time improving multimodality and intermodality. In Shenzhen, the development of public and private transport is unfolding in parallel, and involves the extension of the metro network as well as a road construction programme. At the same time, the city has settled on a strategy aimed at electrifying both private and public transport. Furthermore, Shenzhen published its new regulations governing car ownership in early 2016.

The emerging cities of Chengdu and Chongqing are faced with rapid private motorisation, and are responding to the challenge without any sign of integrated planning. In contrast to highly regulated cities, the economic and financial policies of these two metropolises are more aligned to domestic markets, allowing an unrestricted admission of cars. Though there are access restrictions on using road infrastructures in Chengdu, both cities are less prohibitive than many of the highly developed cities. The transport policies administered in Chengdu and Chongqing are not currently oriented towards an integrated system, but are rather aimed at different, parallel mobility options for various groups of citizens. The limited supply of public transport in these cities leads to a high car ownership rate, as does the rapidly growing middle class and an economic policy geared to the internal market and local production of vehicles.

An overview of the four cities, showing their mobility development strategies, is given in Figure 2. Following this, as Figures 3 to 6, are city and mobility profiles for each of the study cities.

SHANGHAI

SHENZHEN

CHENGDU

CHONGQING

General Information

- Financial and commercial centre
- Polycentric development strategy
- Relatively low car ownership rate

- High-tech city
- Polycentric development
- Urban expansion with large distance between sub-centres

- Urban sprawl with low population density
- Car-oriented development and failure of the traffic system

- Main centre with sub-centres
- Hilly topography and thus high expense of construction

Road Infrastructure Strategy

- No more main road construction projects after 2020
- Strong regulation (applying to car ownership) and restrictions (applying to utilisation of infrastructure)

- Improvement of main road network, especially along East-West axis
- Strengthening the connection with the north of the city

- Accelerated extension of road infrastructures

- Extension of road network
- No existing regulations

Public Transport Strategy (Metro and Bus)

- Greater extension of public transport system (metro and bus)
- Promotion of intermodality
- Planned extension of BRT (bus rapid transit) systems
- Target: to become the largest metro network in the world

- Further extension of public transport system (metro and bus)
- Transit-oriented development
- Tripling the length and number of metro lines by 2020
- Planned BRT systems based on existing road network

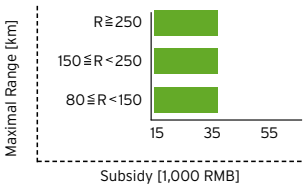
- Further extension of public transport system (metro and bus)
- Quadrupling the length and number of metro lines by 2020
- Planned extension of BRT system

- Tripling the number and doubling the length of metro lines by 2020
- No plans for BRT

SHANGHAI

Promotion of E-Mobility

- Special car plates
- Exemption from participation in admission auction
- Promotion of e-buses
- Vigorous installation of charging infrastructure
- Unified promotion strategy



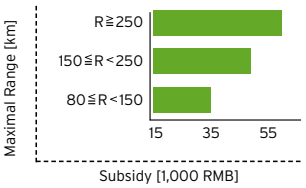
Planning Cultures

- Pronounced and transparent planning culture
- Coordinated and unified development traffic and urban planning
- Coordinated extension of transport infrastructure
- Tracking of defined objectives

SHENZHEN

Promotion of E-Mobility

- Very strong promotion of e-mobility
- Simplified admission for electric vehicles
- Subsidies related to range of EV
- Promotion of e-taxis and e-buses
- Installation of charging infrastructure



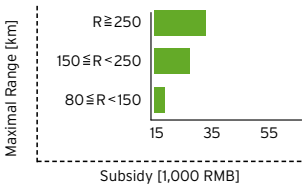
Planning Cultures

- Strong prohibition culture and enforcement of prohibitions and regulations
- Prioritisation of image of a modernised city and of motorised transportation

CHENGDU

Promotion of E-Mobility

- Limited promotion of e-mobility
- Subsidies related to range of EV



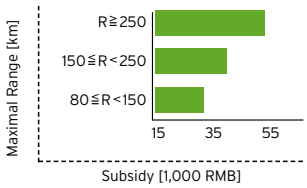
Planning Cultures

- Situational and passive planning
- Ambitious planning goals without adequate measures to attain them

CHONGQING

Promotion of E-Mobility

- Strong promotion of e-mobility
- Subsidies related to range of EV
- Installation of charging infrastructure



Planning Cultures

- Excessive management
- Culture of demolition and new building projects
- Thoughtless construction
- No regulatory culture

Figure 2. Synopsis of mobility development strategies in Shanghai, Shenzhen, Chengdu and Chongqing

SOURCE: ProRaum Consult & INOVAPLAN.

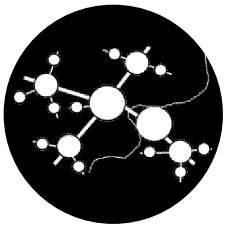
Key Figures
Population (2015): 24.2 million
Population growth (2010-2015): 0.97% p.a.
GDP (2013): US$400 billion
GDP per capita (2015): US$16,595
GDP growth (2005-2014): 13.5% p.a.
Area (urban agglomeration): 6,340 km^2

Urban Development

Development Strategy

- Double centres with sub-centres

Urban Structure



Current Situation

- High population density in the centres and along the transportation axes

Development of Private Transport

- Motorised vehicles (MVs): 3.3 million MVs
- MV ownership (2013): 97 MV/1,000 inhabitants

Road Network

Strategies and Goals

- No more main road construction projects after 2020

Ownership Regulations

- Auction (9,000 admissions per month; plate costs US$13,000 per car in 2016)
- No regulatory restriction for electric vehicles

MV Utilisation Regulations

Infrastructure Regulations

- Elevated expressway (for MVs without local number plates in Shanghai, during rush hours)
- Bus lanes (operative only in rush hours)

Development of Public Transport (PT)

Metro

- Metro lines: 14
- Metro length: 617 km
- Metro trips/day: 8.4 million

Development Target (Metro)

- 800 km by 2020

Strategies and Goals

- Orientation towards public transport, particularly metro
- Metro to take 60% of PT trips by 2020

Bus

- Bus lines: 1,429
- Bus trips/day: 7 million

BRT / Dedicated Bus Lanes

- 300 km marked bus lanes without physical separation, operative only during rush hours

E-Mobility

Strength of Promotion

- Average additional promotion
- Even promotion (unrelated to range of EV)

Subsidies for E-Bus/E-Taxi

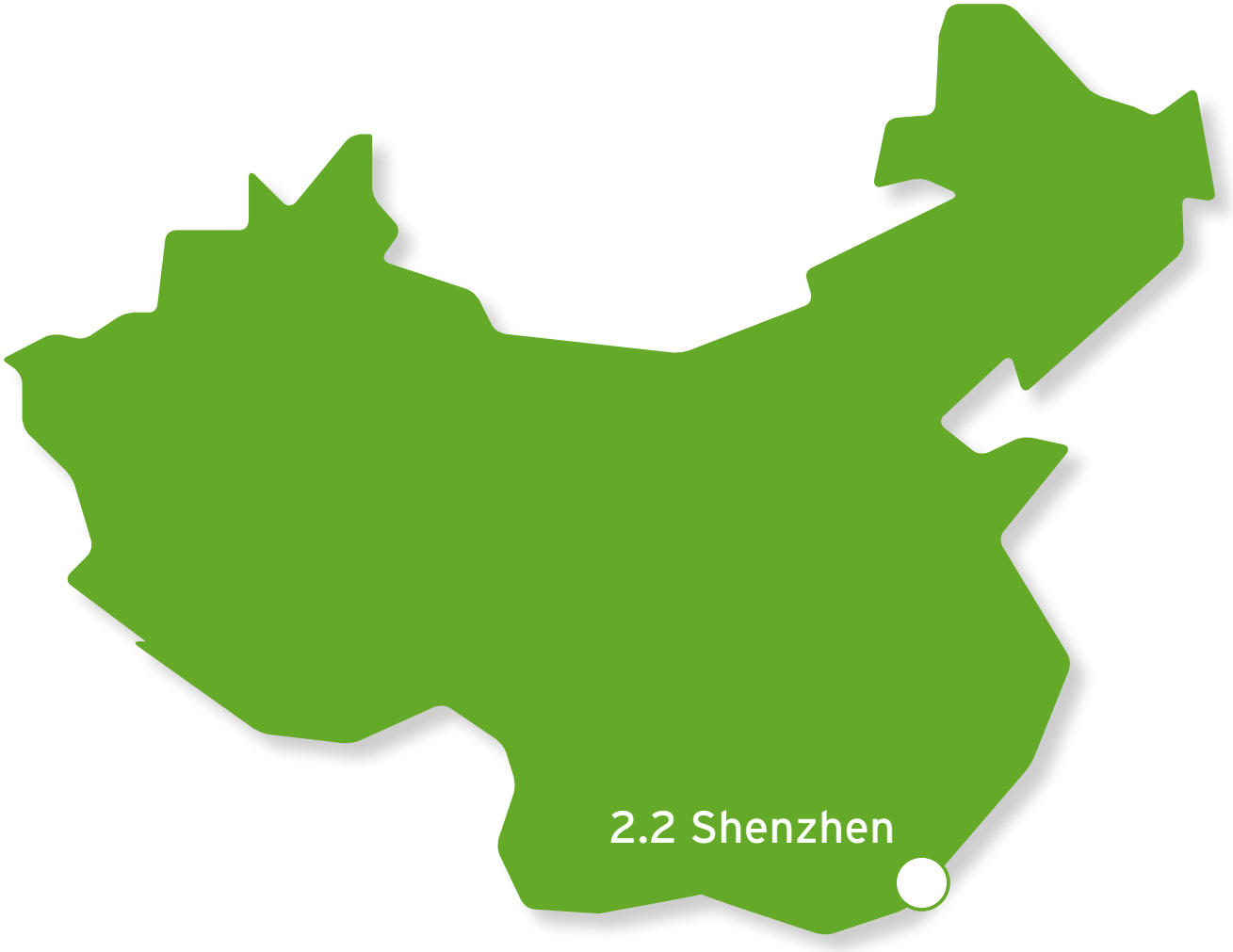
- By 2020, 50% of buses to be e-buses
- Subsidies for e-buses

Other Promotion

- Special car plates
- Exempt from participation in admission auction

Figure 3. Shanghai: City and mobility profile

SOURCE: ProRaum Consult & INOVAPLAN.



Key Figures
Population (2014): 10.8 million
Population growth (2010-2014): 1% p.a.
GDP (2015): US$281 billion
GDP per capita (2014): US$24,336
GDP growth (2005-2015): 16.6% p.a.
Area (urban agglomeration): 2,050 km^2

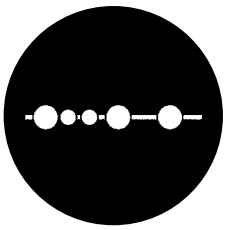
Shenzhen

Urban Development

Development Strategy

- Linear city in form of archipelago

Urban Structure



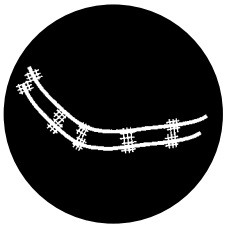
Current Situation

- High density in metro-politan areas
- Long commuting distances

Development of Private Transport

- Motorised vehicles (MVs): 2.3 million MVs
- MV ownership (2015): 296 MV/1,000 inhabitants

Road Network



Strategies and Goals

- Improvement of main road network, especially along East–West axis
- Strengthening the connection with the north of the city

Ownership Regulations

- Auction/lottery
- 100,000 licences by auction/lottery p.a., of which 20,000 are EVs

MV Utilisation Regulations

Infrastructure Regulations

- Ban on MVs with non-local number plates in specific areas, during (extended) rush hours
- High-occupancy vehicle lanes (applies to MVs)
- Bus lanes (operative only in rush hours)
- Electric two-wheelers (on expressways and main roads)

Development of Public Transport (PT)

Metro

- Metro lines: 6
- Metro length: 231 km
- Metro trips/day: 3.1 million

Development Target (Metro)

- 20 lines by 2030
- A total of 720 km

Strategies and Goals

- Transit-oriented city
- PT and non-motorised vehicles to take 65% of overall trips by 2020

Bus

- Bus lines: 917
- Bus trips/day: 5.7 million

BRT / Dedicated Bus Lanes

- 819 km (planned)
- Marked bus lanes without physical separation – postponed several times

E-Mobility

Strength of Promotion

- Very strong additional promotion
- Subsidies related to range of EV

Subsidies for E-Bus/E-Taxi

- Additional subsidies for taxis to switch to electric vehicles
- Subsidies for e-buses

Other Promotion

- Simplified admission for electric vehicles

Figure 4. Shenzhen: City and mobility profile

SOURCE: ProRaum Consult & INOVAPLAN.

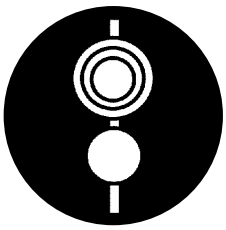
Key Figures
Population (2014): 7.2 million
Population growth (2010-2014): 0.67% p.a.
GDP (2014): US$164 billion
GDP per capita (2014): US$11,345
GDP growth (2005-2015): 19.6% p.a.
Area (metropolitan regions): 3,255 km^2

Urban Development

Development Strategy

- From concentric rings around a single centre to double centres

Urban Structure



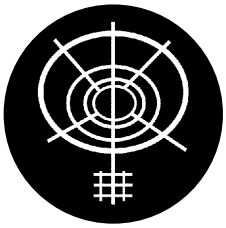
Current Situation

- Urban sprawl with low density
- Car-oriented development

Development of Private Transport

- Motorised vehicles (MVs): 4.3 million MVs
- MV ownership (2015): 245 MV/1,000 inhabitants

Road Network



Strategies and Goals

- Accelerated extension of road infrastructures

Ownership Regulations

MV Utilisation Regulations

- Entrance restriction
- Based on number plate, on during working days, between 2nd and 3rd rings

Infrastructure Regulations

- Separated bus lanes for BRT

Development of Public Transport (PT)

Metro	Development Target (Metro)	Strategies and Goals
• Metro lines: 3 • Metro length: 88 km • Metro trips/day: 1.2 million	• 13 lines by 2020 • A total of 383 km • 21 lines by 2050	• 65% PT share by 2020 • ...of which metro to have a 35% share
Bus		**BRT / Dedicated Bus Lanes**
• Bus lines: 426 • Bus trips/day: 5 million		• 29 km • Separate from normal traffic (on an elevated road) • Driving of normal car is treated punitively

E-Mobility

Strength of Promotion	Subsidies for E-Bus/E-Taxi	Other Promotion
• Limited additional promotion • Subsidies related to range of EV	----------	----------

Figure 5. Chengdu: City and mobility profile

SOURCE: ProRaum Consult & INOVAPLAN.

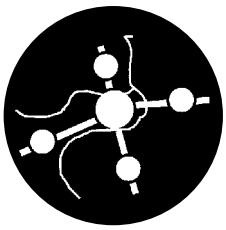
Key Figures
Population (2015): 8.3 million
Population growth (2010-2015): 2.3% p.a.
GDP (2015): US$110 billion
GDP per capita (2014): US$13,148
GDP growth (2005-2015): 21.3% p.a.
Area (urban agglomeration): 5,473 km^2

Urban Development

Development Strategy

- Main centre with sub-centres (i.e. multicentric)

Urban Structure



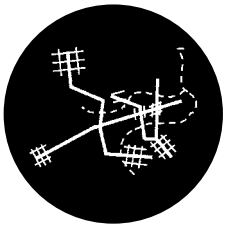
Current Situation

- Large variations in elevation, at the confluence of two rivers
- High expense of construction

Development of Private Transport

- Motorised vehicles (MVs): 1.2 million MVs
- MV ownership (2015): 132 MV/1,000 inhabitants

Road Network



Strategies and Goals

- 6,000 km road extension scheduled for completion by 2020
- Newly planned motorway (to be the 3rd ring road)

Ownership Regulations

MV Utilisation Regulations

Infrastructure Regulations

Development of Public Transport (PT)

Metro

- Metro lines: 4
- Metro length: 208 km
- Metro trips/day: 2 million

Development Target (Metro)

- 11 lines by 2020
- A total of 415 km

Strategies and Goals

- 47% PT share by 2020
- Metro to take 21% of total daily trips by 2020

Bus

- Bus lines: 511
- Bus trips/day: 5.4 million

BRT / Dedicated Bus Lanes

- Testing of BRT (2008–2012) now complete

E-Mobility

Strength of Promotion

- Strong additional promotion
- Subsidies related to range of EV

Subsidies for E-Bus/E-Taxi

Other Promotion

Figure 6. Chongqing: City and mobility profile

SOURCE: ProRaum Consult & INOVAPLAN.

Chapter Three
The User

In order to understand the mobility behaviour of Chinese city dwellers, an analysis of the residents living in metropolises was carried out. Four user groups were therefore investigated from the middle and upper class segments of society, and categorised into ‘Student’, ‘Young professional’, ‘Professional’ and ‘High-income’.

Various focus group discussions and expert interviews were conducted in this project. They reveal that car ownership plays an important role in the lives of members of all the groups investigated. Moreover, the importance to daily mobility of owning a car increases with both income and age. Since students often live within the university campus, walking and cycling account for a considerable proportion of their daily trips. The growing middle classes are more likely to move to the suburbs; as a result, the car ownership rate of this group is rising strongly. A privately owned car is generally considered to be the most reliable and safe mode of transport, and the one which is able to convey the maximum feeling of individual freedom. The prestige and image of automobile marques play an important role, especially among the older generation. Other features, such as interior design and technical equipment, tend to be a higher priority for younger users.

> "A car gives the first impression about you. People will overestimate you if you drive a premium car, and will underestimate you if you drive a low-class or cheap car."
>
> *(Zumin, Shanghai, Freelancer)*

> "For ride sharing, when I select between different service providers, like Didi, Uber and Yidao, I check the price and choose the cheapest one. It is normal for users to have more than one application on their smartphones."
>
> *(Jiang, Shanghai, Employee)*

Urban residents of Chinese cities have developed a strong affinity for digitalisation, and are open-minded when it comes to testing new technologies. Smartphones, apps and widgets are frequently incorporated into daily life, and this is the case across all the user groups. In contrast to Germany, there are almost no perceivable concerns about data protection. New technologies are quickly adopted provided they yield added value that can be recognised. New mobility servies – for example ride sharing, car- and bike-sharing, the ability to search for car parks, and facilities for booking via apps or smart cards for public transport – are spreading rapidly. Chinese users show a pragmatic approach when choosing their preferred mobility offers.

It was found that the overloading of the transport infrastructure does not influence individual mobility decisions. Traffic jams and difficulties in parking are perceived by many not as individual problems, but rather as common facts of life, which should be solved by the municipal governments. Regulations are considered necessary to mitigate the traffic problem. Some people even ask for more radical measures and stronger regulation.

> "The biggest change and improvement is the Internet. New technologies are playing an ever-greater role in changing transportation planning as well as mobility."
>
> *(Nicolas, Shanghai, Investment Banker)*

> "The government should regulate car utilisation more strictly. The current car utilisation regulations do not work, because many families plan to buy a second car to cope with this regulation. The government should also build more metro lines."
>
> *(Qian, Chengdu, Transportation Police Officer)*

Chapter Four
New Supply and Technology

The Chinese digital mobility service market has exhibited tremendous growth rates. Taking into account the habits of Chinese customers is extremely important for service providers and app developers. It should be also noted that many customers are very price-sensitive, and choose their traffic modes pragmatically according to cost. The integration of payment functions also plays an important role. Chinese users prefer to pay via app rather than by credit card, which is the more common means in the USA and Europe. 'All-in-one' platforms for social media and e-commerce enjoy a high user acceptance.

The extent to which ride sharing is used differs from city to city. It is becoming a popular mode for meeting daily mobility needs. The initial cautious exploratory phase has passed now that Didi has taken over Uber's China operations, and new regulations have been published. Didi's services tend to be carried out mainly by professional drivers. It is the parking problem, more than anything else, that makes ride sharing attractive to many users.

> "Compared with Uber, Didi provides a more convenient service, one that respects the habits of Chinese users. For example, Uber uses email to communicate with customers, while Didi does it by phone. Uber uses credit cards for payment, while Didi uses Alipay and WeChat pay."
>
> *(Ran, Chengdu, Freelance Designer)*

Car sharing is emerging in the form of pilot projects in more and more Chinese cities. It is, however, not widespread because of the limited number of users willing to permanently adopt the practice. Potential users still have concerns about the idea of sharing property, and unanswered questions about their rights in the event of damage – and these are not minority concerns. On the other hand, the driver of a ride-sharing vehicle must make sure that they return a clean and fully functional car to avoid poor ratings which could eventually lead to reduced business. Free-floating bike-sharing systems (where the bike does not have to be returned to a specific station, but can be secured in any of several designated locations in the city) have been set up in cities such as Shanghai to solve the 'last-mile' problem.[1]

E-mobility has been introduced to China's mobility sector, and product development in the Chinese automobile manufacturing sector is rapid, with makers already offering a wide range of both pure electric vehicles (EVs) and plug-in hybrids. The growth rate of e-mobility in China is fast compared to that in Europe. A total of 240,000 EVs were sold between January and August 2016. When launching new EV products, Chinese manufacturers have tended to focus on technology development and innovation in a way that differs from the approach of their European counterparts. They shift the maturing and perfecting of the product into the real-life phase, when the customer uses it. But the resulting marketing of immature technology is not the only reason why Chinese manufacturers have acquired an image problem in the eyes of their native customers. Driving a Chinese EV is not exciting, but rather an experience of the 'merely suitable'.

[1] The final leg (or last mile) from logistics hubs to individual homes and offices has traditionally incurred the highest cost and complexity – this is the 'last-mile' problem.

On the other hand, the American manufacturer Tesla is currently considered to be the epitome of e-mobility, and the name is sometimes even used in China as shorthand for electrical mobility. Tesla is a symbol of technically superior products that are emerging in the trend towards digitalisation. The company's image has made a deep and lasting impression on many wealthy Chinese, and plays an important role in selling their cars. Concerns surrounding e-mobility – range anxiety, battery systems, and charging infrastructure coverage – are still ongoing, and reflect those of European customers.

> "I think EVs have a potential in the future. It will still take time and technological development to improve the capacity of batteries and reduce their charging time. For my personal conventional car, I am always in a hurry to refuel. I am worried about the power of EVs."
>
> *(Hongjin, Chengdu, Teacher)*

Chapter Five
Future Vision

On the basis of the distinct development strategies of the four study cities, various visions of the future were developed as part of this project. The dynamic of change is subject to uncertainty arising from political willingness, unknowns affecting planning and economic activity, and social acceptance.

Generally speaking, the demand for mobility and the pace of motorisation is fairly certain to see phenomenal growth. All of the metropolises investigated in the study are therefore promoting the extension of their transport infrastructure. However, private and public transport will develop differently, owing to the different political objectives seen in each city. Figure 7 gives a projection of the future courses of urban mobility in the four study cities, with other world cities shown for comparison, in terms of their private/public transport emphasis and their mobility and motorisation.

In the developed cities of Shanghai and Shenzhen, developing the public transport system is a primary goal. **Shanghai** is on the way to evolving into a 'public transport city', as a result of the strict regulation of private traffic and high investment in public transport. In the longer term, it is possible that the image of the city and its traffic will be characterised by ecomobility. **Shenzhen** focuses particularly on being a paradigm of the electrification of transport modes, and pursues the goal of accelerating its shift to electric mobility by means of regulatory policies. Public transport in the city will develop in parallel with motorised private transport.

The emerging metropolises of **Chengdu** and **Chongqing** are both trying to face rising car ownership primarily with the support of an extension of road infrastructure, using administrative measures. Without a political and social rethink, transport infrastructures are expected to be saturated in the medium term. The extension of public transport, which is needed to ease traffic saturation, is lagging behind the rapidly rising demand for mobility. The degree of motorisation in these cities will depend to a large extent on whether car ownership is regulated in the future. Private transport will not cease to play an important role. Electric power trains will be promoted for both passenger cars and buses, owing to technical progress and development, as well as the economic and political orientation of central government. Customers can therefore be expected to soon lose their concerns, and the technology will become established.

Future visions of the urban mobility scene in our four study cities are depicted in Figures 8 to 11.

Dynamic of Change and Future Vision

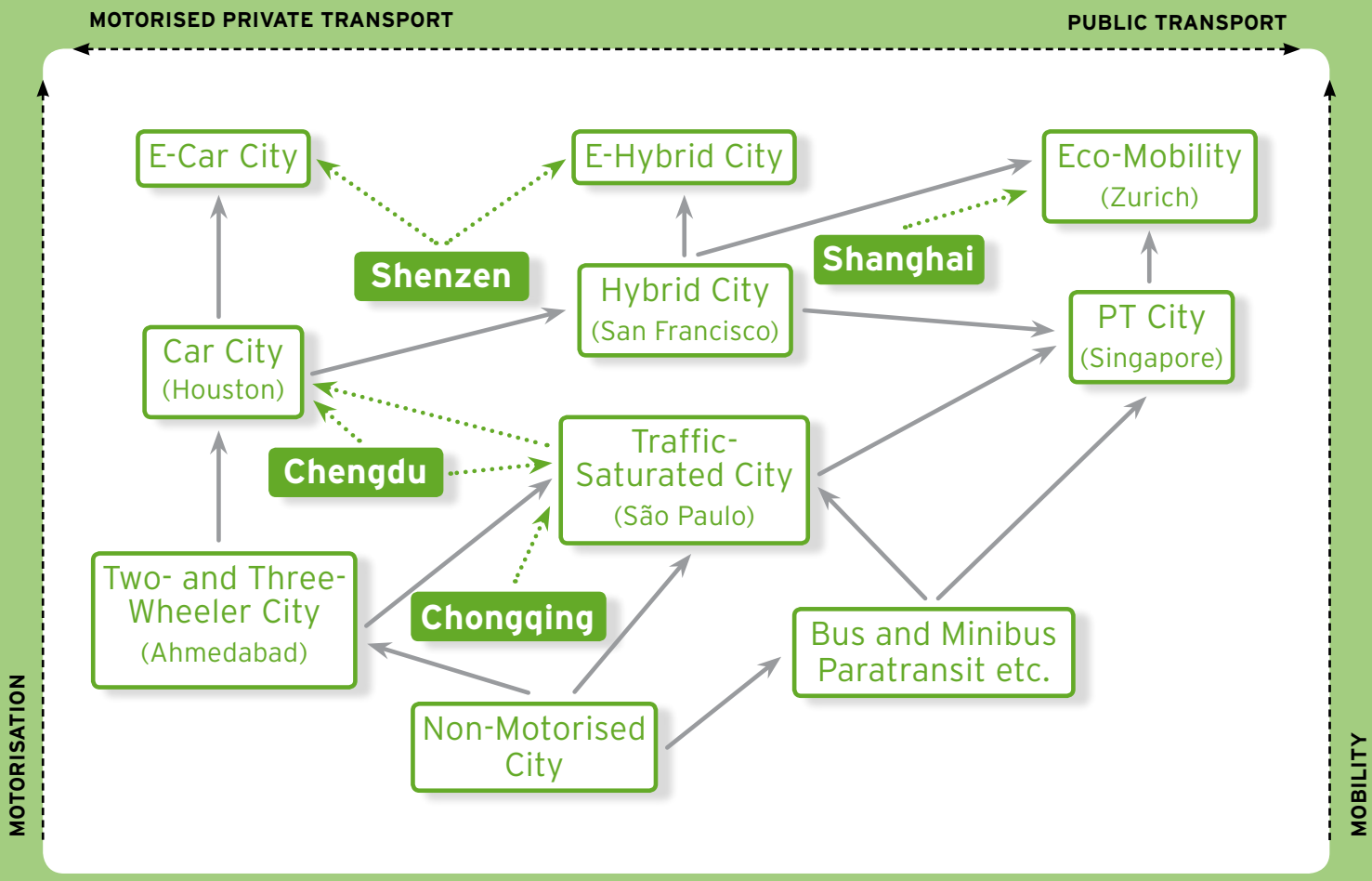


Figure 7. Projected courses of urban mobility in Shanghai, Shenzhen, Chengdu and Chongqing

SOURCE: ProRaum Consult & INOVAPLAN, typology concept adapted from Paul Barter (2004), *A Broad Perspective on Policy Integration for Low Emission Urban Transport in Developing Asian Cities*

Public transport is the backbone of transport in Shanghai and will be greatly extended in the coming years. In particular, the planned extension of the metro system will lead to the increasing attractiveness of the city. According to Shanghai's latest master plan, new main road construction projects will cease after 2020, reinforcing the dominance of public transport. The degree of motorisation will not increase significantly from now on. As a result, a controlled shift towards eco-friendly means of transport will take place. The inhabitants of Shanghai will therefore adjust their affinity for traffic modes in a more multimodal and intermodal direction. The travel behaviour of the young generation in Shanghai has revealed that they adjust their travel behaviour according to the situation in which they find themselves, and that this has been accompanied by a significant decline in the popularity of private motorised transport. At the same time, the main focus of mobility behaviour will turn to other mobility services (for example ride sharing), the yet further digitalisation of mobility, systems of transport sharing, and the electrification of vehicles. In conclusion, Shanghai will develop into a public transport city in the coming years. The long-term prediction is that the travel behaviour of Shanghai residents will be increasingly influenced by emerging environmental awareness and a consequent sense of responsibility.

Shanghai

Current Developments

- Vigorous extension of public transport
- No more main road construction projects after 2020
- Strong regulation of car ownership and road use
- Acute shortage of parking space
- Regulation of parking space
- Promotion of e-cars (subsidies, exempting from admission auction)

Current Trends

THE CITY

Infrastructure Development

Public transport	↗
Motorised private transport	→

Regulation

Car ownership	→
Car use	–
Infrastructure use	→
Ride selling	↗

Regulation

E-mobility	↗
Bike sharing	↗

THE USER

- Social status orientation
- Moderate population growth
- Economic growth
- Rising incomes

Use of public transport	↗
Use of non-motorised transport	↗
Use of motorised private transport	→
Premium mobility	↗
E-mobility	↗
Ride selling	↗
More mobility services	↗

TECHNOLOGY

- Creating different mobility services
- Applying smart cards
- Applying parking management apps
- Insufficient development of charging infrastructure

Charging infrastructure	↗
Mobility services - apps - business models	↗

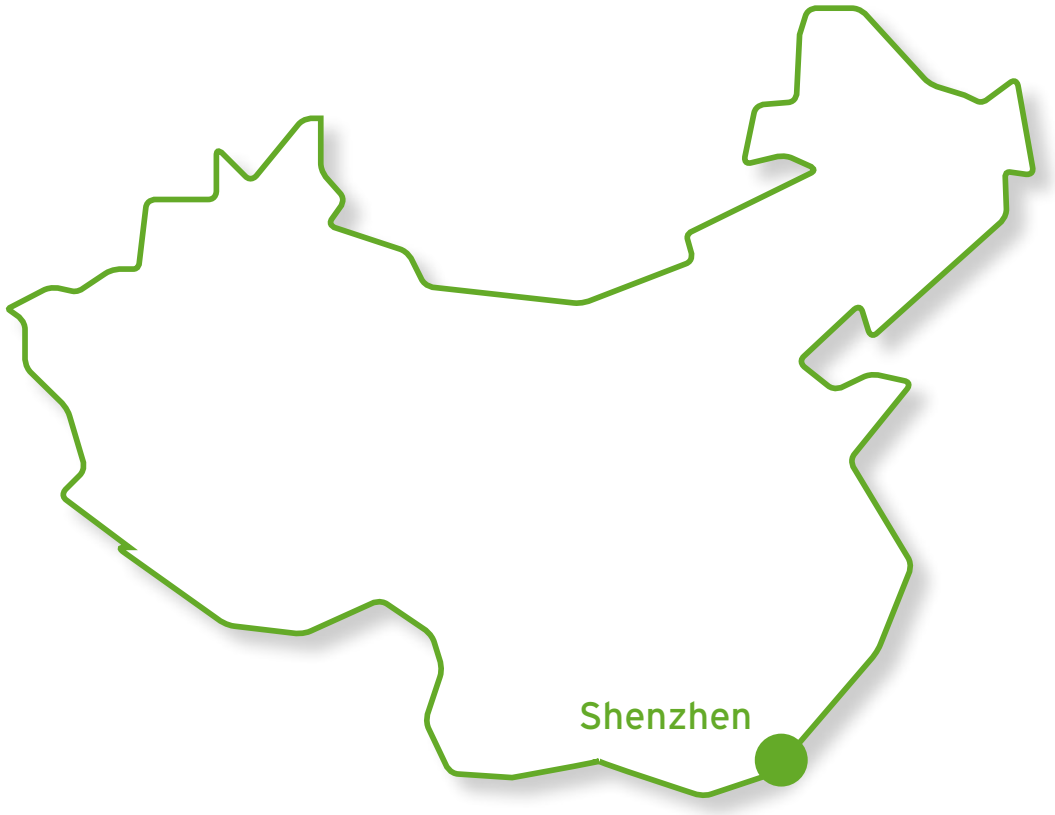
↗ Upward trend
→ Status quo remains
↘ Downward trend
– Not available

Shanghai

	Short-Term (< 5 years)	Medium-Term (5–10 years)	Long-Term (> 10 years)
THE CITY	**Controlled Shift** • Attractiveness of public transport • Bicycle- and walk-oriented • Decreasing attractiveness of motorised private vehicle • Stagnation in motorised private transport • Modal shift from motorised private transport to public and non-motorised transport	**Transit-Oriented Development (TOD)** • Integrated city and transport development • Further modal shift from motorised private transport to public and non-motorised transport • Increasing promotion of eco-friendly means of transport	**Eco-Mobility** • Restriction of conventional engines
THE USER	**Multimodal and Intermodal Behaviour** • Travel behaviour independent from traffic modes • Appreciation of quality of mobility services	**Quality-Conscious Mobility** • Further increasing appreciation of quality of mobility services • Premium-oriented private transport	**Environment-Conscious Mobility** • Incorporation of environmental criteria into mobility behaviour
TECHNOLOGY	**Eco-Friendly Technologies** • Increasing maximum range of EVs • Progressive digitalisation • Further development of eco-friendly engines • Integrated parking management	**Cross-Linked City / Smart City** • Integrated traffic management • Traffic flow optimisation • Communication between transport modes	**Autonomous Mobility** • Automation of transport modes
	Hybrid City	TOD City	Eco-Mobility

Figure 8. A future vision of urban mobility in Shanghai

SOURCE: ProRaum Consult & INOVAPLAN.



Shenzhen is pursuing the ambitious objective of becoming a low-carbon, economically sustainable, socially harmonious and environmentally friendly city. The Shenzhen government has implemented a strict transport policy, which has involved a tightening of environmental protection measures. For example, the priority of private cars has been limited by the new regulations after a long phase of their promotion. Furthermore, both private and public transport are facing the challenge of electrification to reduce air pollution. This goal is being achieved on the one hand by the culture of strict prohibitions, and the implementation of regulation applying to normal traffic modes; and on the other hand by subsidies/grants and statutory simplifications applying to electrically powered modes. Cars with electric engines will be admitted more easily. Regulation will ensure the construction of charging infrastructure. Public transport will be electrified step by step. In addition to public transport, conventional bicycles will be revived again, against the background of promoting environmentally friendly means of transport, with the aim of promoting the image of a green city. How successful Shenzhen's development into a public transport-oriented 'green city' turns out to be will depend to a very great extent on the development of an inner-city rapid transit system, which is necessary to reduce the long travel times within this vast city.

Shenzhen

	Current Developments	Current Trends	
THE CITY	• Planned development of public transport network (metro) • Regulation of car ownership and road use • Promotion of EVs • No further construction of road networks • Ban on electric two-wheelers on main roads • Integrated parking management	**Infrastructure Development** Public transport ↗ Motorised private transport ↗	
		Regulation Car ownership ↗ Car use — Infrastructure use ↗ Ride selling —	**Regulation** E-mobility ↗ Bike sharing →
THE USER	• High car ownership historically and still today • Decrease in affinity for the car	Use of public transport → Use of non-motorised transport ↘	
		Use of motorised private transport → Premium mobility ↗ E-mobility ↗	
		Ride selling ↗ More mobility services ↗	
TECHNOLOGY	• Developing mobility services (ride selling) • Parking management • Development of charging infrastructure	Charging infrastructure ↗	
		Mobility services ↗ - apps - business models	

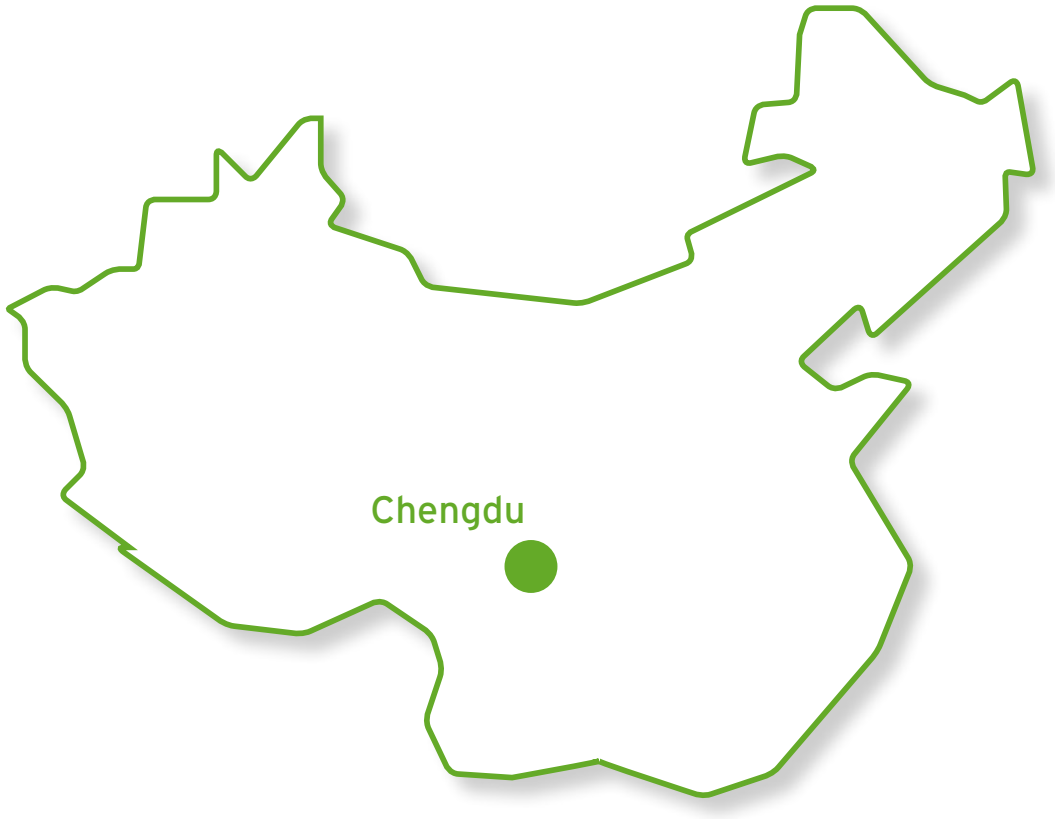
↗ Upward trend
→ Status quo remains
↘ Downward trend
— Not available

Shenzhen

	Short-Term (< 5 years)	Medium-Term (5–10 years)	Long-Term (> 10 years)
THE CITY	**Electro-Shift** • Vigorous expansion of transport infrastructure • Subsidies for EVs • Strong cooperation with manufacturers • Promotion of charging infrastructure • Regulation for building charging infrastructure into new buildings • Electrification of buses	**Low-Carbon City** • Private car remains the most attractive mode of transport • Electrification for both public transport and private transport • Integrated city and transport development • Enhanced promotion of eco-friendly modes of transport	**Green City** *Alternative 1* • Development of a rapid railway transit system inside the city *Alternative 2* • Non-development of a rapid railway transit system • Restriction on conventionally powered vehicles
THE USER	**Pragmatic Choice of Transport** • Mobility decision according to individual criteria (travel time, comfort, etc.) • Long travel distances (home–work, home–leisure journeys) • High willingness to travel	**Quality-Conscious Mobility** • Increasing appreciation of quality of mobility • Premium-oriented private transport	**Environment-Conscious Mobility** • Incorporation of environmental criteria into mobility behaviour
TECHNOLOGY	**Eco-Friendly Technologies** • Increasing maximum range of EVs • Progressive digitalisation • Further development of eco-friendly engines • Integrated parking management	**Cross-Linked City / Smart City** • Integrated traffic management • Traffic flow optimisation • Communication between transport vehicles	**Autonomous Mobility** • Automation of transport modes
	E-Car City	E-Hybrid City	E-Hybrid City (TOD City)

Figure 9. A future vision of urban mobility in Shenzen

SOURCE: ProRaum Consult & INOVAPLAN.



The city image of Chengdu is characterised by high motorisation and strong urban development in the suburban areas. The fast increase in car ownership and the monocentric city structure have led in the last few years to an overloaded road infrastructure. The municipal government cannot find an adequate response, and consequently implements only situational planning and individual measures; it has, moreover, attempted to invest heavily in the transport infrastructure in order to counter the impending traffic collapse. The investment has prioritised, however, the construction of road infrastructure. Although the municipal government has drawn up an ambitious plan for developing public transport, it is not yet possible to decrease car ownership without implementing tighter regulation on private cars. A paradigm shift in transport policy regarding public transport is the prerequisite for changing the city's fate: road traffic saturation and stagnation in a medium-term context. From the point of view of local residents, the dissatisfaction over the traffic situation will grow even further. It is necessary for the local residents to rethink their use of public transport. The question as to whether Chengdu will develop into a hybrid city with adequate private and public transport systems has yet to be answered.

Chengdu

Current Developments

Current Trends

THE CITY

- Regulation of car use (entry restrictions) and road use (BRT)
- Limited parking space
- Construction and extension of road infrastructure
- Planned increase in public transport

Infrastructure Development

Public transport	↗
Motorised private transport	↗

Regulation

Car ownership	—
Car use	→
Infrastructure use	→
Ride selling	—

Regulation

E-mobility	→
Bike sharing	→

THE USER

- Population growth and rising incomes
- Increasing car orientation and ownership
- Improving ride selling

Use of public transport	↗
Use of non-motorised transport	→
Use of motorised private transport	↗
Premium mobility	→
E-mobility	→
Ride selling	↗
More mobility services	—

TECHNOLOGY

- Developing mobility services (ride selling)
- Digitalisation

Charging infrastructure	→
Mobility services	→
- apps	
- business models	

↗ Upward trend
→ Status quo remains
↘ Downward trend
— Not available

Chengdu

	Short-Term (< 5 years)	Medium-Term (5–10 years)	Long-Term (> 10 years)
THE CITY	**Situational Planning** • No integrated city and transport planning and uncoordinated individual measures • Excessive demand on existing transport infrastructure (extension of travel times and distances) • Weak implementation of existing regulations • Shifting of functions in sub-centres without sufficient public transport • Competitive planning with Tianfu	**Collapse of Transport / Paradigm Shift** *Alternative 1* • Paradigm shift to public transport • Increase in regulation and application of park-and-ride facilities *Alternative 2* • No regulations • Strengthening polycentric development • No prioritisation of public transport • Increasing traffic standstill	?
THE USER	**(Multi-)Mobility Needs** • Rapid increase in car ownership and electric two-wheeler ownership • Decentralised housing and increasing dependency on motorised vehicles • Growing dissatisfaction with the inner-city traffic situation • Growing pressure on city administration to act	**Need for Optimisation** *Alternative 1* • Increasing use of public transport • Stagnation in car ownership • Increase in demand for ride sharing *Alternative 2* • Increase in car dependency • Increase in car ownership	?
TECHNOLOGY	**Demand Orientation** • Ad-hoc mobility solutions for the last mile • Continuing private digitalisation • Adoption of trends and developments from the eastern cities	**Demand Orientation** • Continuing digitalisation of mobility services	?
	Traffic-Saturated City Electric Two-Wheeler City	Car City Electric Two-Wheeler City	Hybrid City Car City

Figure 10. A future vision of urban mobility in Chengdu

SOURCE: ProRaum Consult & INOVAPLAN.

Chongqing is faced with uncontrolled growth in private car ownership as a result of its lack of regulation and the topographic constraints on infrastructure construction, making it the most congested city in China. In order to ease the problem, yet more development of the road infrastructure is the first approach from the city's administrative management. Regulation of private motorised transport is still not foreseeable within the near future. Users' high affinity for their own vehicles, together with increasing suburbanisation, have conspired to create this problem. It is therefore becoming apparent that the traffic situation will not improve in the short- to medium-term. The overloading of the road infrastructure will only become worse, because of the bottleneck caused by road congestion and a shortage of parking facilities. It is crucial to reverse the present transport policy and to take action, for example by strengthening regulations, promoting public transport, or introducing park-and-ride facilities. In order not to allow the traffic saturation to further deteriorate, it is also necessary for residents to rethink their travel behaviour, without which an improvement in the traffic situation cannot be expected.

Chongqing

Current Developments

Current Trends

THE CITY

- Massive development of and investment in road infrastructure up to 2020
- No regulation governing car ownership or use of infrastructure
- Development of metro network
- Strong pedestrian orientation
- No promotion of e-mobility
- Limited space for further construction

Infrastructure Development

Public transport →
Motorised private transport ↗

Regulation

Car ownership —
Car use —
Infrastructure use —
Ride selling —

Regulation

E-mobility —
Bike sharing —

THE USER

- High affinity for car ownership
- Ride selling not a part of everyday mobility
- Short-distance mobility very important
- Rapid population growth
- Rapid economic growth
- Increasing demand for mobility

Use of public transport →
Use of non-motorised transport →

Use of motorised private transport ↗
Premium mobility →
E-mobility →

Ride selling ↗
More mobility services →

TECHNOLOGY

- Planned installation of charging infra-structure
- Ride selling not popular

Charging infrastructure →

Mobility services →
- apps
- business models

↗ Upward trend
→ Status quo remains
↘ Downward trend
— Not available

Chongqing

	Short-Term (< 5 years)	Medium-Term (5–10 years)	Long-Term (> 10 years)
THE CITY	**Ad-Hoc Development / Collapse of Transport / Management under Pressure** • No foreseeable regulations • No comprehensive urban and transport planning • "Most congested city in China" (Didi) • Distributing urban function to sub-centres, but without sufficient public transport • Overload on existing transport infra-structure (public and private transport)	*Alternative 1* • Paradigm shift to public transport • Increase in regulation and application of park-and-ride facilities *Alternative 2* • No regulations • Strengthening polycentric development • No prioritisation of public transport • Increasing traffic standstill	?
THE USER	**Limited Mobility** • Large number of walking activities inside the block. Destinations outside the districts are difficult to reach. • Increasing motorisation • Confusing traffic management (private transport) • Growing dissatisfaction about the traffic situation • Growing pressure on city administration	**Limited Mobility** *Alternative 1* • Increasing use of public transport • Stagnation in car ownership • Increase in demand for ride sharing *Alternative 2* • Increase in car dependency • Increase in car ownership	?
TECHNOLOGY	**Traffic Demand Orientation** • Onward private digitalisation • Adoption of trends and developments from the eastern cities	**Traffic Demand Orientation** • Onward digitalisation of mobility services	?
	Non-Motorised / Traffic-Saturated-City	Traffic-Saturated City	Hybrid City 'Fail City'

Figure 11. A future vision of urban mobility in Chongqing

SOURCE: ProRaum Consult & INOVAPLAN.

Chapter Six
Implications for Urban Mobility

Urban development strategy

Most Chinese cities were not prepared for the rapid growth in private car use that has been seen in recent years. In the absence of timely and appropriate corrective action, they are currently suffering from congestion, lack of car parks, and air pollution. The municipal governments' response to the overloading of transport infrastructure varies from location to location. Some of them try to massively expand the transport infrastructure or regulate car ownership, while others try to further develop the public transport system. The developed metropolises, such as Shanghai and Shenzhen, are trying to extend the development of public transport in the long term. For many, the extension of the metro system will be the top priority. The central government creates the strategic orientation and sets objectives, whereas municipal governments implement policies in a different way. Changes in legislation and new regulations will in most cases not be foreseeable beyond the short term. New developments and technologies are usually regulated after a successful market launch.

Digitalisation of mobility

Urban Chinese residents have an especially strong affinity towards digitalisation. Most Chinese people are active on social media platforms and share their life experiences with friends and family. The most popular social media and communication platform in China is WeChat. Unlike WhatsApp, WeChat is not merely a messenger app, but has also been developed into an e-commerce platform with integrated payment functionality. Its all-in-one platform is very easy and convenient to use. Most Chinese have no concerns about data protection and the sharing of personal information.

Ride sharing

Ride sharing is not seen as a substitute for personal car ownership, but as either a substitute for or a supplement to public transport and the ubiquitous taxi services. Currently, the service providers are taking up a strategic position in the market for digital mobility services. Ride sharing also has potential to gain custom beyond the great metropolises. In the future, there are expected to be risks to its expansion arising from further tightening of the legal framework. Recently, after Didi took over the Uber operation in China, there was a tightening of the regulation of ride sharing. The newly published regulations were formulated to be strict. However, the way in which the new regulation is implemented on the ground will also be an important factor in determining its effects.

Car sharing

Car sharing is not yet a full and adequate alternative to public transport or ride sharing. It works as a supplement to private cars for most of its customers. For inner-city trips, users must search for car parks and also drive to car-sharing stations. Ride sharing or taxis are usually more cost-effective and comfortable options. Car sharing is, however, an especially good alternative to car rental for long-distance trips at weekends – for example when visiting the family in suburban areas. Nevertheless, potential customers are still sceptical about shared cars. Innovative car sharing with unique features – for example electric vehicles or free-floating (where users may return the car to any authorised space within the service area) – can attract additional demand from specific target groups.

E-mobility

E-mobility is now a feature of the mobility sector in China. Domestic manufacturers are supported by the government through very substantial financial promotion and subsidies. E-mobility is promoted financially and by regulatory means, both for public and private transport. On the one hand, it is intended to mitigate the problems associated with exhaust gases; on the other hand, it is regarded as helpful in strengthening the domestic automobile market. The concept of product development in China is applied differently to the way of the German mindset. It is not a must to have innovations which are mature from the moment a product appears on the market. On the contrary, innovation can still continue after the product launch. Immature technology and accidents, especially concerning battery systems, have already resulted in image problems and a poor reputation when it comes to Chinese manufacturers. Furthermore, for many Chinese customers, the short maximum drivable range, the limited coverage of charging infrastructure, and uncertainties about battery life all hold back the desire to purchase. Many Chinese people do not want to be one of the early adopters, but prefer to wait and observe the development of the products.

Premium vehicles

Premium automobile manufacturers from Europe have a very good reputation among most Chinese, and do in fact deliver excellent quality. On the other hand, Chinese automobile manufacturers are comparatively unpopular among high-income customers, and Chinese companies have to work hard to gain the trust of consumers. The Chinese government has taken various measures – such as introducing a special tax on the luxury segment – to reduce the country's dependence on foreign manufacturers and to strengthen the place of domestic products in the domestic market.

Second-hand vehicles

In terms of absolute sales figures, the number of resold second-hand vehicles is actually quite low. In the next few years, many second-hand vehicles with reasonable mileages will probably be replaced by new vehicles and have the potential to re-enter the market. Price-sensitive students, young professionals and the growing consumption-oriented middle classes who have limited financial budgets, will all show a great willingness to buy these second-hand vehicles. There is thus great potential for the second-hand vehicle market. The Internet and digitalisation are providing new channels for the sale of second-hand vehicles. Even though the online-to-offline-platforms (O2O) are still in an early phase, there is still great potential for further development. A wide range of business models, such as C2C (customer-to-customer), C2B2C (customer-to-business-to-customer), B2C (business-to-customer), and B2B (business-to-business) are applicable. New services, for example professional consulting, on-site inspections, registrations and so on will make this market more attractive as time goes on.

Autonomous driving

Users in China are particularly interested in the technology of autonomous driving. Autonomous driving has enormous market potential. The largest obstacle to its widespread adoption might turn out to be the capacity of the communication networks, especially the insufficient coverage in areas far away from metropolises. China has proved to be a country where construction and reconstruction can take place very fast, owing to planning and approval procedures that are simpler than in many other comparable countries. After a successful startup phase, both the automobile industry and individuals' mobility behaviour can be revolutionised. Public transport, including taxis and delivery services, will also be influenced by this technology.

Chapter Seven
Conclusion

The City

Urban development strategies tend to follow the pace of the development targets of the central government (e.g. promoting e-mobility, orienting the domestic market and strengthening Chinese manufacturers), and serve as 'experimental fields' in return.

Emerging cities are less regulatory than established ones. They are governed mostly under specific short-term plans, rather than strategic long-term visions and targets. Their traffic and urban plans are not integrated to the same extent as those of developed cities.

The emerging regulation of vehicle ownership and infrastructure promotes the purchase and admission of motor vehicles in less regulatory cities.

E-mobility is strongly promoted because of the national Chinese economic policy, which aims to facilitate the long-term competitive manufacture of vehicles for export.

The focus on Chinese automobile manufacturers and the nature of the regulatory policies limit the competitiveness of foreign manufacturers.

The User

Potential consumers have concerns about the maximum range of electric vehicles. As a result, electric vehicles are considered mainly as second cars for inner-city use.

Chinese manufacturers are not popular with Chinese consumers today. Their vehicles lack the image and innovative technologies of pioneer manufacturers such as Tesla.

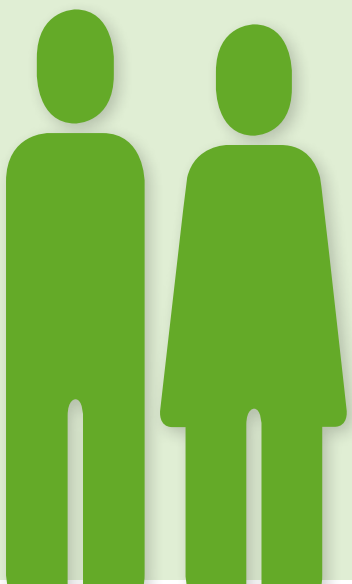
Premium vehicles are a status symbol in Chinese society. The appearance of the vehicle – both outside and in – is thus more important than, for example, the engine power. Even mid-range vehicles consciously imitate the appearance of premium saloons.

SUVs and vans provide, especially on the back seat, more space inside and convey a greater feeling of safety; they have therefore become increasingly popular.

The regulation of car ownership by means of admission lottery and auction increases the segment of premium vehicles in the study cities, which hinders low-income residents from purchasing cars. In these regulated cities, car driving is turning out to be a privilege.

Users tend to buy cars in the cities that have no regulations in order to avoid the restriction of number plate admissions.

The subsidising of Chinese vehicles distorts the price perception of vehicles made by foreign manufacturers.



New supply and technology

The recently introduced regulation for ride sharing professionalises riding services, and they are expected to gradually replace the traditional taxis. The exploration phase of ride sharing has come to an end, as a result of the strengthening of the monopoly of Didi.

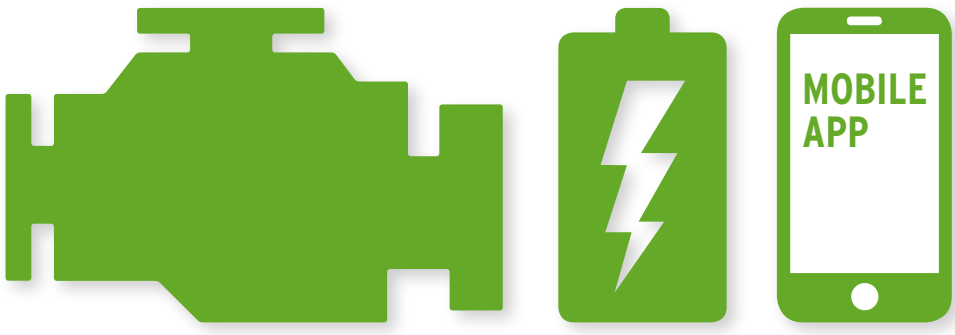
Ride sharing helps to solve the 'last-mile' problem of public transport. Cities like Shanghai also promote bike-sharing systems to increase accessibility, in conjunction with public transport.

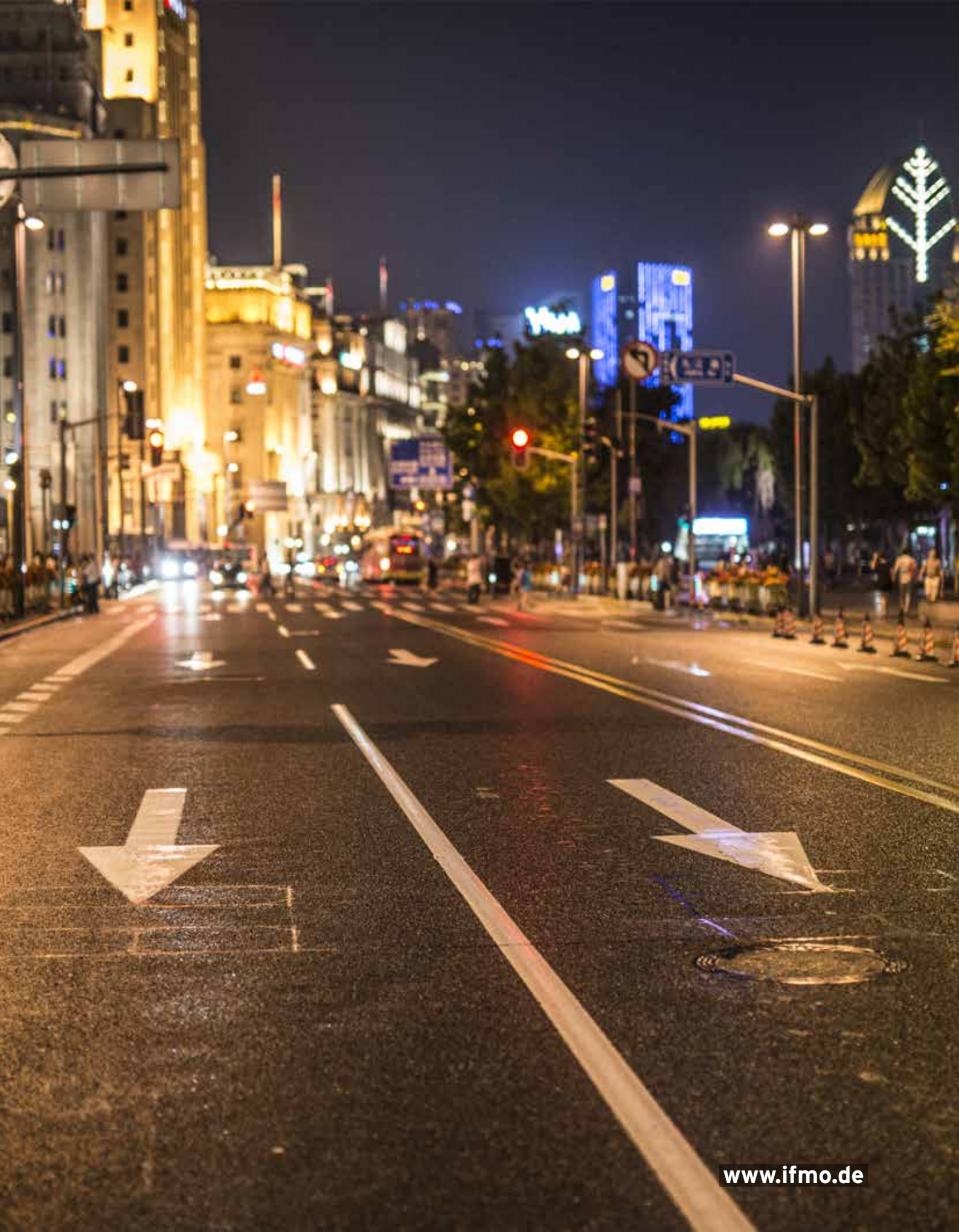
Free-floating systems are used for intermodal travel purposes, and can work in combination with or as a supplement to public transport. On the other hand, station-based systems require a lengthy search for somewhere to park.

Car sharing is not currently integrated into daily mobility, and is seen rather as an alternative to car rental for long-distance trips.

Due to the rapid development of private mobilisation, the overall service age of vehicles is young. Many used vehicles with low mileage are being replaced by new vehicles or high-quality used vehicles. New business models for distributing second-hand vehicles are emerging on the market. Repurchase offers and the management of the second-hand car are opportunities to keep customers loyal to a brand and to attract new customers.

Autonomous driving has great potential. Just owning a vehicle with a specific image is seen as being more important than driving it. Many urban residents visit their families, who live in other urban or rural regions, during the weekends. For these long weekend trips, driving autonomously on well-constructed roads can offer a higher added value compared to driving within the urban areas with their chronic shortage of parking.





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