Sustainable Urban Mobility in Eastern Asia

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BRT	Bus rapid transit
CO	Carbon monoxide
CO_2	Carbon dioxide
HC	hydrocarbon
HK$	Hong Kong dollar
MTRC	Mass Transit Railway Corporation, Hong Kong
NO_2	nitrogen dioxide
NOx	nitrogen oxides
PM	particulate matter
RMB	Chinese renminbi
SO_2	Sulphur dioxide
US	United States of America
US$	US dollar

Currency conversions

US$1	=	7.79540 HKD	(Hong Kong dollar)
US$1	=	81.3100 JPY	(Japanese yen)
US$1	=	6.55780 CNY	(Chinese yuan)
US$1	=	143.079 KPW	(DPR Korea won)
US$1		1,109.75 KRW	(Republic of Korea won)
US$1	=	8.02926 MOP	(Macao pataca)
US$1	=	1,202.00 MNT	(Mongolian tugrik)

1. Introduction

The main objective of this report is to review the current condition and trends of urban transport in the countries/regions of Eastern Asia, which include Japan, China, mainland; China, Hong Kong SAR; China, Macao SAR; Taiwan, the Democratic People's Republic (DPR) of Korea; Mongolia; Republic of Korea. Those countries/regions can be divided to 3 types: first, well-developed region with high economic level and sound transport infra-structure services. Japan, Hong Kong SAR, Macao SAR, Taiwan and the Republic of Korea belong to this type; second, developing regions with rapid economic growth and imperfect urban transport system needed to be improved. Many cities in Chinese mainland can be ranged to this type; third, the remaining – Mongolia and the DPR Korea – are less developed, with poor urban transport facilities.

This report is structured in three parts. The objective of this introductory chapter is to introduce the chapters in the report and briefly describe the topics they cover.

1.1. Global conditions and trends in urban transport

The purpose of this part is to present the development trend of different urban transport forms in Eastern Asia region and the challenges the region is facing with current condition. It then examines how efficient different planning institutions integrate land use and transport planning.

Chapter 2 focuses on non-motorized transport and the policy responses to integrate this form of transportation into the urban transport infrastructure. Chapter 3 compares the development trend of public transport in the Eastern Asia region and evaluates their differences. 'Public transport prioritization' has been a widely adopted policy in the Eastern Asia region. This chapter examines how different public policies can shape the growth of public transport. Chapter 4 shifts the focus to informal motorized transport and examines its role in the urban transportation system. Chapter 5 focuses on the development of private motorized transport. It compares the data among the countries/cities with different develop-ment level and describes their trend of motorization, growth of urban road construction and existing parking systems respectively. Chapter 6 presents the transport and infrastructure related to good movement. It examines its relative importance compared to passenger traffic in the urban transport system. Chapter 7 summarizes how efficient different countries/cities within the Eastern Asia region integrate land-use with transportation planning.

In this part, each chapter highlights the issues of different aspect of urban transport and evaluates the challenges different countries/cities in the Eastern Asia region are facing in order to achieve a sustainable transportation system.

1.2. Policy response in urban transport

Although the expansion of urban transport fulfils the increasing travel demand, sustainability issues associate with its development has caught the attention of many policy makers. Four of the most important issues – the social, environmental, economical and institutional aspects of urban transport sustainability are discussed in this part.

Chapter 8 addresses the social aspect of urban transport which covers topics from traffic safety, social segregation to travel expenditure. The challenges in balancing the social interest and urban transport are evaluated. Chapter 9 describes the current environmental impact from urban transport in Eastern Asia. Subsequently, it presents the adopted environmental friendly transport policies in the region and reviews the challenges in achieving an environmental

sustainable transportation system. Chapter 10 concentrates on the financial viability of urban transport, particularly in public transportation which is often heavily subsidized. Different examples are presented to illustrate how different public policies and management of public transport could affect the economic sustainability of public transportation. Finally, Chapter 11 discusses urban transport governance. It presents different urban transport institutions in the region and explains how various departments under the institutions cooperate with each other to execute urban transport policies decisions. It outlines the problems under the existing system and suggests the changes or initiatives necessary to improve the governance of urban transport.

1.3. Future policy directions

Based on the findings of the preceding chapters; the final part of this report explores feasible future policies that are or could be taken in promoting a sustainable urban transport. Chapter 12 summarizes the common features of Eastern Asia's transport system and suggests a list of potential policies which urban governance in Eastern Asia could adopt in achieving sustainable transport.

2. Non-Motorized Transport

2.1. Brief overview

Non-motorized transport has an unambiguously benign environmental impact. In many cities, it is the main mode of transport for the poor, and in some a significant source of income for them. It therefore has a very significant poverty impacts. Where non-motorized transport is the main transport mode for the work journeys of the poor, it is also critical for the economic functioning of the city. For very short trips, walking is the main mode of transport in most societies, rich or poor. Indeed, most trips in all countries involve some walking as access and egress to the main mode. Furthermore, trips undertaken primarily by public transport also involve significant walking distances.

Walking – the most basic urban transport mode for all short-to-medium length travel – and bicycling play an essential role in urban transport in most low- and middle-income countries. For lowest-income groups, these modes affect survival. In countries like mainland China, until very recently, this was true of most population strata. In an entirely different dimension – urban air quality – a shift to non-motorized modes is always a net gain.[1]

Mainland China used to be the country of bicycles, even now, no matter the average ratio of bicycle ownership or bicycle modal split is much higher than in Hong Kong SAR, Macao SAR, the Republic of Korea or other Eastern Asia countries/regions. However, in recent year mainland China has greatly developed its automobile industry, which has posed a big challenge to development of bicycle, and thus in many cities bicycle modal split has dropped significantly. With the rise of progressive concepts of low-carbon city and green transport, Chinese mainland cities have put great emphasis on bicycle transport, and have begun building specific bicycle lanes. Before mainland China realized the importance of bicycle transport, Hong Kong SAR, Japan and the Republic of Korea cities have made great effort to develop it. Furthermore, some cities in China, Japan and the Republic of Korea have implemented public bicycle programme, which have yielded highly desirable results.

2.2. Trends and conditions

2.2.1. Number of registered bikes and rickshaws

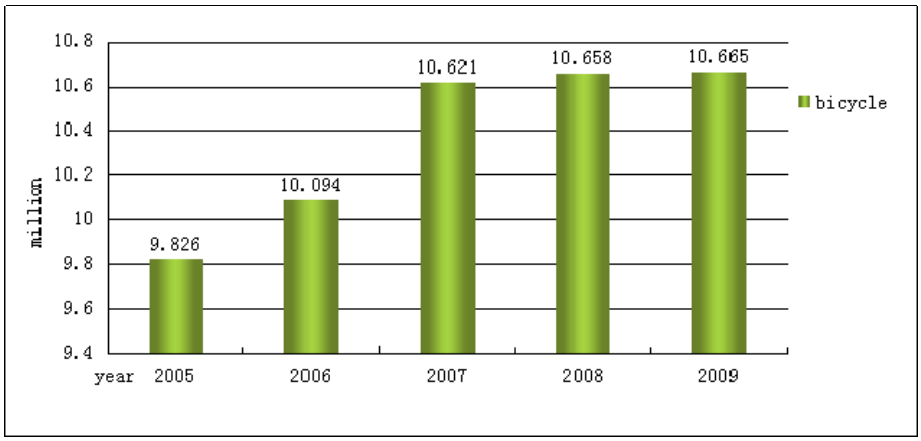
Mainland China is the world's largest country in terms of producing and using bicycles. The ownership of bicycles in mainland China is much higher than in other Eastern Asia countries.

It can be observed from Figure 1 that number of bicycles in Shanghai has increased only slowly, by 8.5 per cent, between 2005 and 2009. The number of rickshaws experienced almost no change and the total number has remained at 21,000 since year 2005.

In Shanghai rate of bicycle ownership in year 2009 was 555 vehicles per one thousand persons,[2] far more than cities in the Republic of Korea, where the average rate of bicycle ownership was 166 vehicles per one thousand persons.[3] In contrast, in the city of Taipei, the bicycle ownership was only 0.25 per household (with an average household size of 3 persons in 2008,[4] this implies a bicycle ownership rate in city of Taipei of approximately 82 vehicles per one thousand persons.

1. World Bank, undated.
2. Shanghai City Government, 2005–2010.
3. Hee Cheol Shin, 2008.
4. Hee Cheol Shin, 2008.

Figure 1. Number of bicycles in Shanghai (2005–2009)

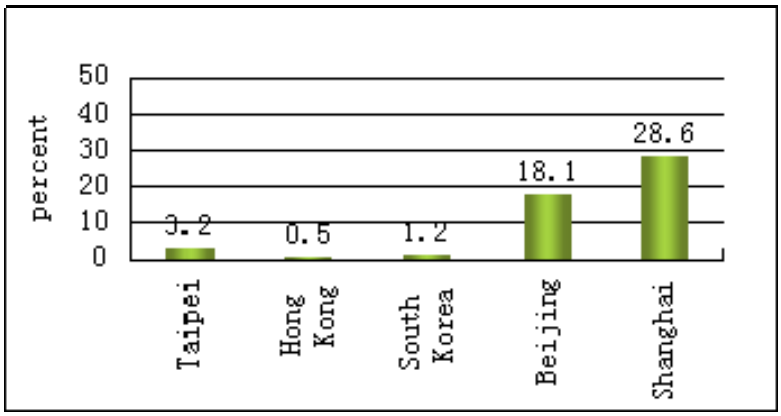


Source: Shanghai City Government, 2005-2010.

2.2.2. Bicycle modal split

As illustrated in Figure 2, cities in mainland China have a much larger bicycle modal split than city of Taipei, Hong Kong SAR and cities in the Republic of Korea. In Hong Kong SAR, cycling accounts for about 0.5 per cent of the daily *weekday* trips overall, and 97 per cent of the daily cycle trips take place in the New Territories and Outlying Islands while only 3 per cent take place on Hong Kong Island and in the urban areas of Kowloon. Bicycle modal split in the Republic of Korea is also very low, at 1.2 per cent in 2005. In city of Taipei, the bicycle modal split accounts for 3.2 per cent. Bicycle modal splits in other countries in Eastern Asia, like Mongolia and DPR Korea, is much lower than even than Hong Kong SAR and the Republic of Korea. In DPR Korea, bicycles are not only expensive but also have limitations in use; it is for example illegal to ride bicycles in Pyongyang city,[5] thus bicycle modal split is extremely low. Although the bicycle modal split in mainland China is much higher than in other countries in the regions, in recent years, this number has decreased, especially in big cities.

Figure 2. Bicycle modal split in different cities/countries*



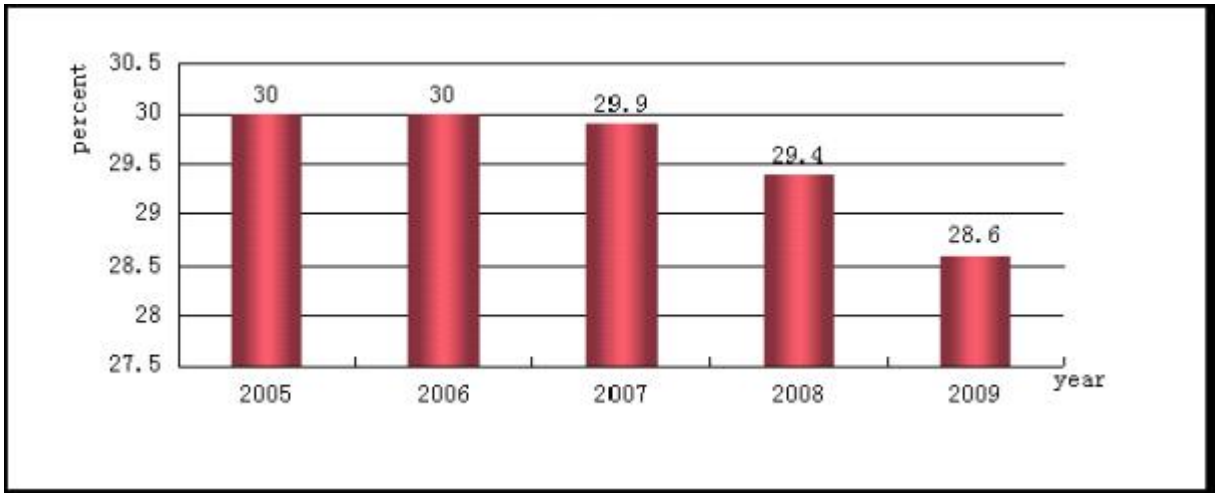
* In mainland China, the statistics on e-bike are included in 'bicycle'.

Source: Hong Kong Transport Department, 2004; Pucher and Buehler, 2008; Kaparias et al, 2010; Taipei Transportation Bureau Statistics Department, 2009.

5. Global Times, 2008.

Figure 3 illustrates that Shanghai's bicycle modal split declined from year 2005 to year 2009. The main reason was due to the rapid increase of automobiles, which occupied more road space and making bicycle transport less desirable.

Figure 3. Bicycle modal split in Shanghai (2005–2009)[6]



Source: SCCTPI, 2010.

According to a survey on bicycle trips, carried out by China central television oriental horizon programme in 2006, among those persons who have given up bicycle trip, as much as 68 per cent considered a worsened environment for bicycle trip as the most important factor. The survey also found that the limited parking space for bicycle, the narrower bicycle lanes and few supporting facilities are the main reasons why it is less convenient for bicycle riders.

In the last several years, many cities in mainland China have planned specific non-motorized transport network. Japan has a special non-government organization called Japan Bicycle Promotion Institute, which formulates comprehensive bicycle safety planning.

Cities in the Republic of Korea have bicycle master plan, which integrate with transit, supply safe bike stations, public bike system, and manage high quality bikeways to attract bicycle trip. Besides of bicycle master plan, in the Republic of Korea more bicycle parking facilities are being added near subway stations in order to facilitate transfer from the subway to a bicycle. Furthermore, local governments are strongly recommended to close the streets to cars on weekends to promote a change over from automobile-oriented to pedestrian-oriented transport policies.

2.2.3. Public bike

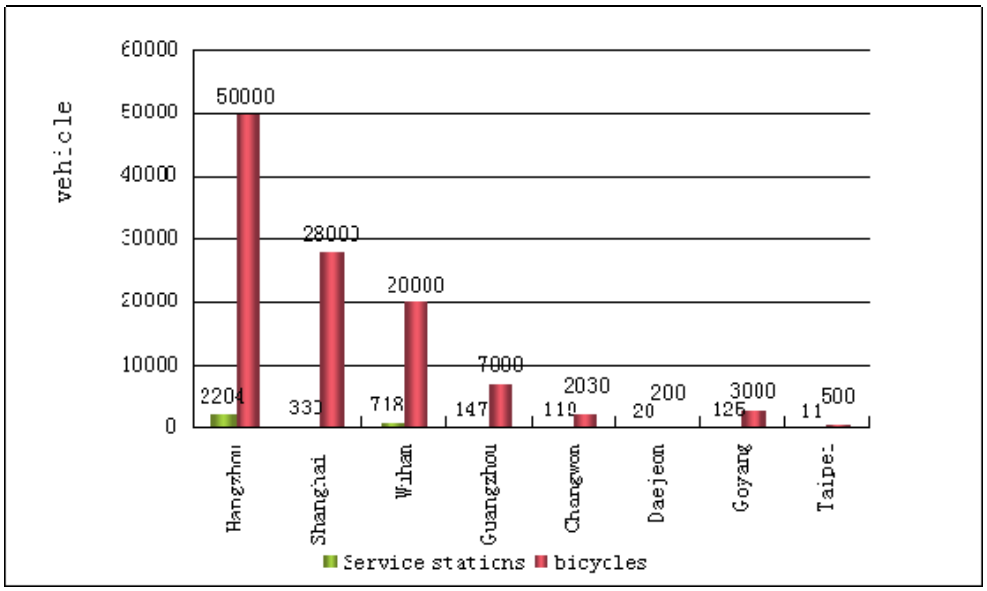
Currently, only a few cities in mainland China, Japan and the Republic of Korea have started public bike programmes. In mainland China, more than twenty cities are carrying out or preparing to carry out public bike programmes, such as Beijing, Shanghai, Hangzhou, Wuhan, Jinan, Changzhou, Sonya, etc. The first such programme in China was started in Beijing in August 2005, although did not operate well. Hangzhou started a public bike programme after May 2008, and it has since been quickly developed. By 2008 only Beijing and Hangzhou had public bikes. However, only after two years, the number of cities having public bikes in mainland China has increased to more than twenty. In the Republic of Korea, Changwon,

6. Bicycles and e-bikes were classified as bicycles in many travel surveys.

Daejeon, Goyang also have public bike service. Furthermore, there are bicycle rental systems in city of Taipei and in Tokyo.

Figure 4 illustrates that Chinese mainland cities have a much larger number of public bike service stations and bicycles. Among them, Hangzhou has the largest number in public bikes. According to a survey to public bike users in Shanghai Minhang district, 14 per cent people transfer personal bicycles to public bikes. This has reflected that public bikes not only encourage people who don't ride bicycles to use them, but also attract private bicycle riders to use public bikes.

Figure 4. Number of public bike service stations and public bikes in selected cities



Source: Hee Cheol Shin, 2008; ITDP, 2011.

Figure 5. Hangzhou public bikes

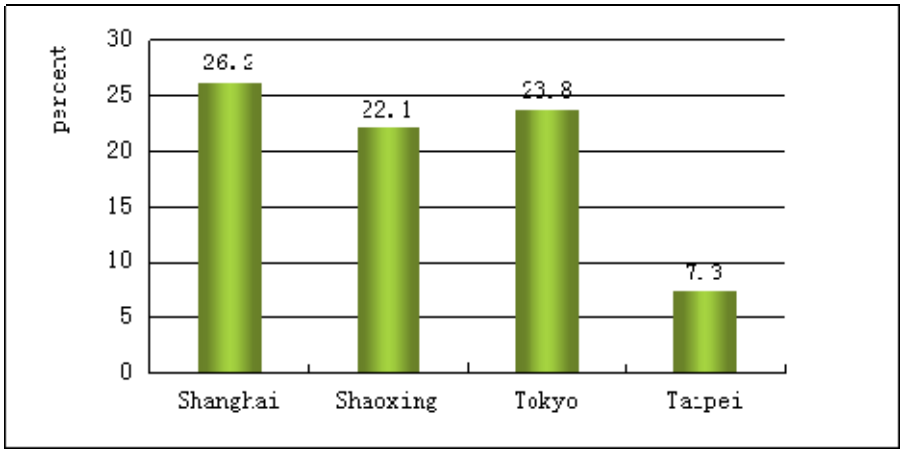
Photo: ITDP, 2010.

2.2.4. Pedestrian system

Walking is the most optimal transport mode for short-to-medium length travel, and it dominates for shorter trips. At the same time, it is always an essential transfer mode for long distance trip. Public transport trips often involve significant walking distance. In medium and smaller cities, the share of all-walking trips is quite large.

From Figure 6, we can see that walking accounts for a relatively high rate in cities like Shanghai, Shaoxing and Tokyo.

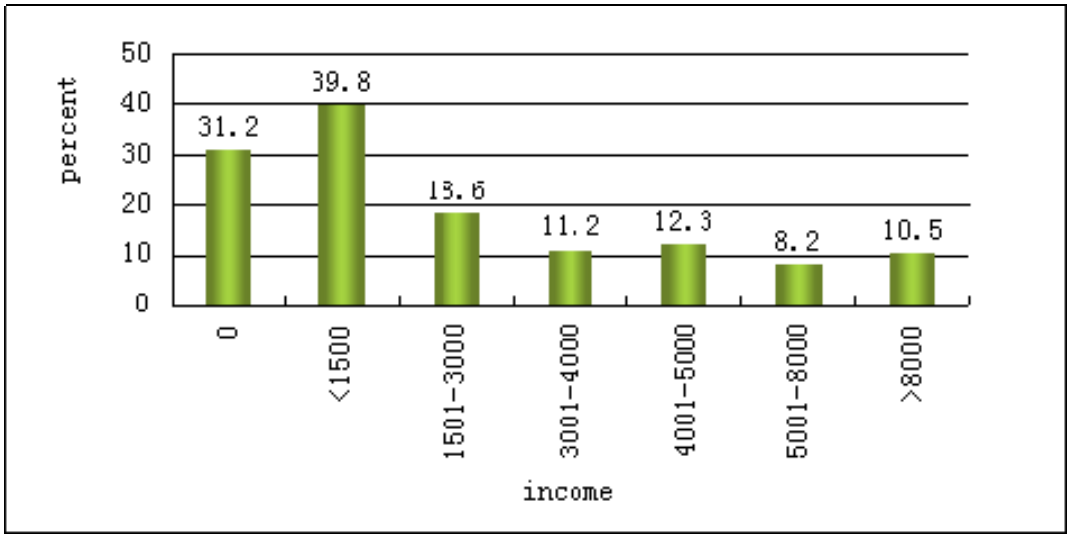
Figure 6. Modal split of walking in different cities



Source: Kaparias et al, 2010; Tongji University, 2010; Shanghai Environmental Protection Bureau, forthcoming.

It can be seen from Figure 7 that in Shaoxing, walking modal split of low-income group accounts for 30–40 per cent. With citizen's income increasing, modal split of walking decreases.

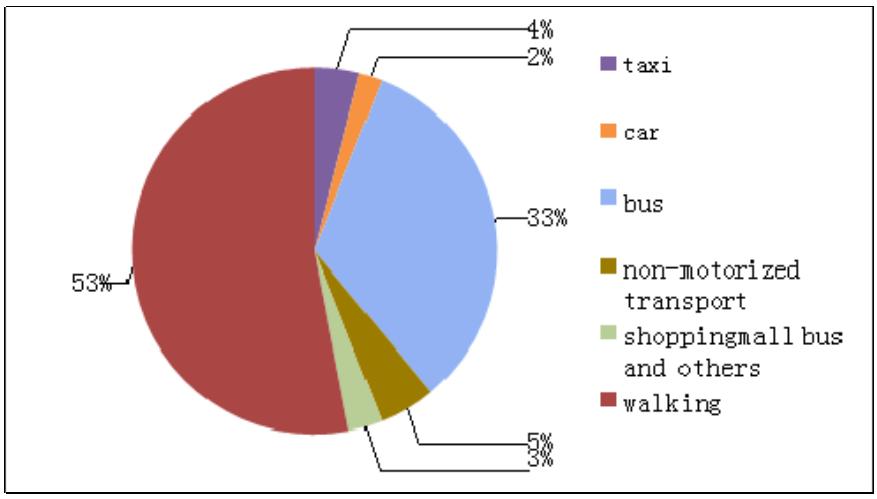
Figure 7. Walking modal split of different income group in Shaoxing



Source: Tongji University, 2010.

As can be seen from Figure 8, in Shanghai walking plays an important role in transferring to mass rail transit (MRT), and it accounts for 53 per cent, which is much more than other form of transport. Walking is the first choice for people living surrounded the MRT to reach the stations. In conjunction with another form of transport, walking is the implacable transport mode.

Figure 8. Modal split of different transport transferring to MRT in Shanghai urban area*



* Non-motorized transport includes bicycle and e-bike.

Source: SCCTPI, 2010.

Mainland China has clearly defined in *Urban Road Transportation Plan and Design Criterion* (GB 50220–95) that the design of pedestrian transportation system in cities should ensure the traffic security of the pedestrians, and avoid interval without any reason. The planning of pavements, pedestrian bridges, pedestrian underpasses, business pedestrian streets and urban river bank pavements should be tightly connected with the pedestrian system in bus station, passenger terminal squares, and public transport interchanges, so as to form an integral urban pedestrian system.

Construction of pedestrian systems has gradually received much attention in mainland China, especially in large and medium-sized cities such as Shanghai, Chongqing, Wuhan, Xiamen, all of which have begun planning non-motorized transport systems or specific pedestrian systems, and building pedestrian lanes or pedestrian zones. In 2001, in *White Paper of Shanghai Urban Transport Development*, the Shanghai government formally declared that importance should be given to non-motorized transport.

In Hong Kong SAR, the most distinctive part of its pedestrian system is the pedestrian bridges, which are very important components of Hong Kong SAR urban transport system. In central areas, there are many pedestrian bridges linking public service facilities, government, recreational facilities, shopping malls, etc., providing pedestrians safety and convenience.

Since the year 2000, Hong Kong SAR Transport Department has been implementing pedestrian schemes in several areas, to improve the overall pedestrian environment. Pedestrian schemes include three types of streets, full-time pedestrian streets, part-time pedestrian streets and traffic calming streets. In full-time pedestrian streets, pedestrians have absolute priority. Vehicular access is restricted to emergency services only, but service vehicles may be allowed in specific period for selected locations. In part-time pedestrian streets, vehicular access is only allowed in specific periods and there is no on-street parking space. In traffic calming streets, footpaths are normally widened and on-street parking spaces are reduced as far as possible. Vehicles are slowed down through the use of traffic calming measures, such as speed tables, herb build-outs, sharpened corners, road narrowing, gateways, etc.

The Macao SAR government has also planned to build two specific pedestrian lanes, which are made up of elevators, conveying belt, escalators, flat roads, slopes and stairs. Like

the pedestrian bridges in Hong Kong SAR, pedestrian lanes also connect different kinds of facilities, and existing bus station or the future light railway stations, to provide citizens a convenient traffic environment

2.3. Impacts /challenges

Eastern Asia cities are quite different in terms of the condition for non-motorized transport. In mainland China, although the modal split of bicycle and walking is much larger than other Eastern Asia countries/cities, cities have experienced a reduced modal share for bicycles. On one hand, with increasing income, many Chinese people begin to pursue personal motorized vehicles for a more comfortable travel environment. On the other hand, the Chinese government has implemented policies of promoting automobile industry. These two factors have encouraged Chinese to convert to private automobiles. Furthermore, in many Chinese mainland cities non-motorized lanes are often occupied by automobiles, thus obstructing people walking or bicycling. Even in Beijing, it is still illegal to park bicycles in front of many modern office buildings, while, in contrast, there are many parking spaces for cars. In many mainland China cities, bicycles are considered as the transport mode for low-income groups.

However, public bikes have taken a good role in solving the problem of the last kilometre, and thus these programmes carried out in many Chinese mainland cities have a good impact in promoting people to use bicycle. Furthermore, bicycle lanes constructed in some Chinese mainland cities have provided riders with a safer riding environment. Similar to Chinese mainland cities, cities in the Republic of Korea have also taken measures such as carrying out public bike programmes and constructing bicycle lanes to increase bicycle modal split.

While more developed countries/cities in Eastern Asia have a less non-motorized transport modal split than mainland China, China is facing a big challenge in keeping non-motorized transport modal split at a relatively high level. Promoting non-motorized trips not only requires the construction of supporting facilities and the creation of a safer and cleaner environment, but also needs stable and long term support policies.

3. Public Transport

3.1. Overview

Although 'public transport prioritization' is a widely adopted policy towards achieving a sustainable transportation system, each Eastern Asia countries have different views on which mode of public transportation should be prioritized, based on their social, economical and political climates. In the more developed cities, rail has been identified as the most efficient and environmentally friendly mass carrier and its importance in the public transportation system continues to grow. In the less developed cities, informal transport and non-motorized vehicles still play a crucial role to meet travel demand. Table 1 shows the modal share of major public transport and non-motorized transport in the Eastern Asia cities.

Table 1. Modal split of major public transportation and non-motorized transport

Country	City	Most recent data (year)	MRT (%)	Bus (%)	Taxi (%)	Bicycle (%)	Others* (%)
Japan**	Metropolis traffic range	2006	57	7	3	N/A	33
	Chukyo traffic range	2006	22	4	2	N/A	72
	Keihanshin traffic range	2006	49	8	3	N/A	40
China	Shaoxing	2006	–	12	1	49	38
	Shanghai	2009	5.7	12.9	6.6	13.5	61.3
	Hong Kong SAR	2009	35 5	33.6	8.4	–	22.5
	Taipei	2009	12.9	14.4	2.2	4.2	66.4
Rep. Korea	Seoul	2006	34.8	27.5	6.5	N/A	31.2

Note: Data from Macao SAR, Taiwan, DPR Korea and Mongolia is not available.

* 'Others' include private cars, mini-bus, informal transport, ferry, tram, scooters.

** Metropolis traffic range refers to the radius of 50 kilometres with Tokyo station as centre. Chukyo traffic range, to the radius of 40 kilometres with Nagoya station as centre; and Keihanshin traffic range, to the radius of 50 kilometres with Osaka station as centre.

Source: MIAC, undated; National Bureau of Statistics of China, undated; Tongji University, 2010; Korea Ministry of Land, Transport and Maritime Affairs, 2009b; Hong Kong Transport Department, 2010a; Taipei Transportation Bureau Statistics Department, 2009.

3.2. Trends and conditions of the current public transport development (including related transport infrastructure)

3.2.1. Mass rail transit (MRT) system

Japan, China (mainland), Hong Kong SAR, Taiwan and the Republic of Korea have developed a substantial network of mass rail transit. In the following section, 6 major cities in China: Beijing, Tianjin, Shanghai, Chongqing, Guangzhou and Wuhan were selected to represent the trend of mass rail transit development in China.

3.2.1.1. Investment for mass rail transit system construction

As shown in Table 2, both China (mainland) and Hong Kong SAR recorded an increase of investment for mass rail transit between year 2007 and 2009, while the Republic of Korea experienced a decline in mass rail transit investments.

Table 2. Investment for mass rail transit system construction

	Year (US$100 millions)		
	2007	**2008**	**2009**
Beijing (China)	14.0	56.5	–
Tianjin (China)	2.1	12.8	–
Shanghai (China)	31.1	39.7	–
Chongqing (China)	1.2	2.1	–
Guangzhou (China)	11.2	13.1	–
Wuhan (China)	1.3	5.0	–
Hong Kong SAR	0.5	0.8	–
Seoul (Rep. of Korea)	0.1	0.05	0.06

Note: Data is not available in Japan and Taipei.

Source: Beijing Welfare Investment Consulting Company, 2009; Korea Ministry of Land, Transport and Maritime Affairs, 2009b; MTRC, 2009.

3.2.1.2. Length of mass rail transit systems

Table 3 compares the length of mass rail transit system among the region in the last two decades. In Japan, total length of mass rail transit is very large because the data includes not only urban metro but also the rural rail lines. There are two main urban subway companies: Tokyo subway company and Tokyo metropolitan metro. As shown, Hong Kong SAR and China (mainland) experienced the fastest growth of mass rail transit network in Eastern Asia, with Shanghai and Beijing demonstrated the strongest growth of mass rail transit network between year 2004 and year 2008 (see Figure 9).

Table 3. Length of mass rail transit system (in km) year 1990–2009

	Year									Net increase (2006–2009) (%)
City	**1990**	**1995**	**2000**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	
Japan										
Tokyo*	_	_	_	_	_	2,309	2,309	2,369	2,369	2.5
Tokyo subway company	_	_	_	173.2	173.2	173.2	173.2	185.1	185.1	6.9
Tokyo metropolitan metro	_	_	_	106.2	106.2	106.2	106.2	106.2	106.2	0
Osaka*	_	_	_	–	–	1,454	1,456	1,469	1,483	2.0

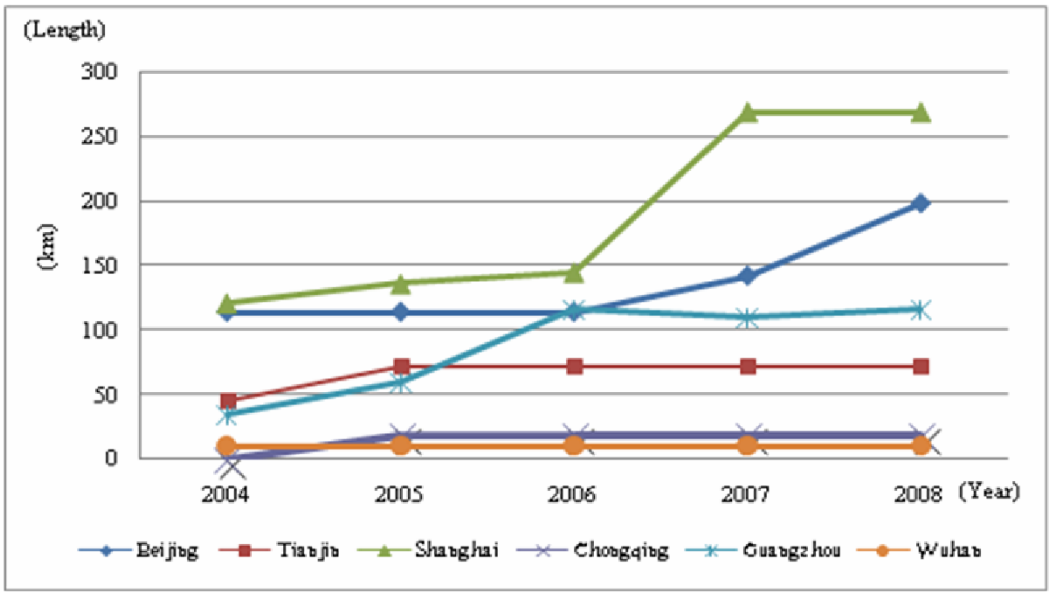
City	Year									Net increase (2006–2009) (%)
	1990	1995	2000	2004	2005	2006	2007	2008	2009	
China (mainland)										
Beijing	30.5	30.5	54	114	114	114	142	198.2	229	100
Tianjin	7.4	7.4	7.4	45.4	71.6	71.6	71.6	71.6	72	0.6
Shanghai	–	16.1	43.5	121.0	136.0	145.0	269.0	269.0	323	122.8
Chongqing	–	–	–	–	18.6	18.6	18.6	18.6	18.6	0
Guangzhou	–	–	18.5	35.00	60.00	109.6	116	116	150	36.9
Wuhan	–	–	–	10.2	10.2	10.2	10.2	10.2	10.2	0
Hong Kong SAR	-	82.5	111.7	130.4	131.6	135.8	211.6	218.2	218.2	60.7
Taipei	–	–	76	77.4	77.4	77.4	77.4	77.4	90.6	17.05
Seoul (Rep of Korea)	118.1	146.1	287.0	289.3	289.3	289.3	289.3	289.3	316.3	9.3
DPR Korea	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	0

* Includes urban and rural rail lines.

Note: MRT was not opened until after 1990s for most Chinese cities. Therefore, data was not available for those until the recent years. For other cities/countries outside of China, earlier data were not found.

Source: Korea Ministry of Land, Transport and Maritime Affairs, 2009b; MTRC, undated c; National Bureau of Statistics of China, undated; Tokyo Metropolitan Government, 2009; Taipei City Government, 2009; Shanghai City Government, 2005–2010; China Railway, 2009; Institution for Transport Policy Studies, Japan, 2009.

Figure 9. Length of mass rail transit system in selected Chinese cities (2004–2008)



Source: National Bureau of Statistics of China, undated.

3.2.1.3. Mass rail transit ridership

Mass rail transit ridership was compared among Japan, China (mainland), Hong Kong SAR, Taiwan and Seoul (see Table 4). As calculated, Beijing and Tianjin recorded the most significant growth of ridership, followed by Hong Kong SAR between year 2007 and 2008. Mass rail transit ridership in Japan shows a slight decline affected by the unfavourable business environment due to sluggish economy, the aging population and low birth rates. Ridership in Seoul remained comparatively constant in the past decade due to the year 2004 bus reform.

Table 4. Yearly mass rail transit ridership by country /city(2003–2008)

City	Year (data in millions)						Net change (2007–2008) (%)
	2003	2004	2005	2006	2007	2008	
Japan	–	–	12,738.7	12,883.0	13,155.8	12,225.8	-7
Tokyo	–	–	–	8,983.5	8,970.8	9,435.7	+5.1
Osaka	–	–	–	2,706.2	2,665.4	2,657.3	-0.3
China (mainland)	1,064.9	1,328.2	1,650.5	1,816.0	2,205.8	3,373.9	53.0
Beijing	472	607	678	703.1	654.9	1216.6	85.7
Tianjin	–	–	–	–	35	63	80.0
Shanghai	–	478.2	594.1	655.7	814	1128	38.6
Chongqing	–	–	–	–	33	40	21.2
Guangzhou	–	–	–	–	473	594	25.6
Wuhan	–	–	–	–	9	12	33.3
Hong Kong SAR	777.3	841.6	866.4	876.3	948.3	1,485.1	56.6
Taipei	316.1	349.3	360.6	384.0	416.1	449.0	7.9
Seoul (Rep. of Korea)	2,249.2	2,300.7	2,277.3	2,269.4	2,267.7	2,293.8	1.1

Note: Data from DPR Korea is not available.

Note: MRT was not opened until after 1990s for most Chinese cities. Therefore, data was not available for those until the recent years. For other cities/countries outside of China, earlier data were not found.

Source: MIAC, undated; National Bureau of Statistics of China, undated; Korea Ministry of Land, Transport and Maritime Affairs, 2009b; MTRC, undated d; Institution for Transport Policy Studies, Japan 2009; Taipei City Government, 2009.

3.2.1.4. Mass rail transit future plan

The length of future planned mass rail transit networks and the respective construction costs are shown in Table 5. As projected, Chinese cities have the most ambitious plan for future mass rail transit development, with Guangzhou leading the most aggressive expansion of its existing railway system.

Table 5. Mass rail transit future construction year 2010–2020

Country/City	Length (in km)		% increase	Construction cost (in US$100 million)
	2009	2010–2020*		
Japan				
Tokyo	2,369	N/A		N/A
Osaka	1,483	N/A		N/A
China (Mainland)	1,000			
Beijing**	229	561.0	145.0	106.0
Tianjin	72	234.7	226.0	91.5
Shanghai	323	510.0	57.9	121.8
Chongqing	18.6	304.0	1534.4	110.7
Guangzhou	150	570.0	280.0	62.8
Hong Kong SAR	218.2	250.4	14.8	N/A
Taipei	90.6	191.6	111.5	N/A
Seoul (Rep. of Korea)	316.3	378.5	19.7	4.7

* Includes the length of existing lines.

** Future planning length between years 2003–2015.

Source: MTRC, undated a; China Railway, 2009; Seoul Metro, undated; Taipei Metro, 2009.

3.2.2. Bus systems

3.2.2.1. Length of bus networks

Table 6 shows the change of bus network length among 2 major cities in Japan and 4 major cities in China between the years 2006 and 2008. As portrayed, most cities recorded an expansion of their bus networks, with that of Guangzhou more than doubling. The shrinking of bus network in Beijing is due to the expansion of mass rail transit system and the increase of private car usage, which has decreased the dependence the bus system.

Table 6. Length of bus networks in selected Japanese and Chinese cities (2006–2008)

City	Year			Net change (2006–2008) (%)
	2006 (km)	2007 (km)	2008 (km)	
Japan				
Tokyo	14,272	14,574	15,918	11.5
Osaka	10,540	10,939	10,827	2.7
China (mainland)				
Beijing	18,468	16,659	17,857	-3.3
Shanghai	21,776	22,375	22,919	5.2
Chongqing	2,589	2,922	3,033	17.1
Guangzhou	8,126	19,443	20,600	153.5

Source: National Bureau of Statistics of China, undated; Institution for Transport Policy Studies, Japan 2009.

3.2.2.2. Bus fleet and seats

Table 7 and Figure 10 summarize the size of buss fleet in selected countries/cities. Data is not available for DPR Korea. In terms of bus-to-population ratio, Japan has the most extensive bus service. As shown, the bus inventory in Beijing and Shanghai exceeded other cities' significantly. However, in contrast to the other cities (and as noted above) their bus fleets have contracted during the last few years.

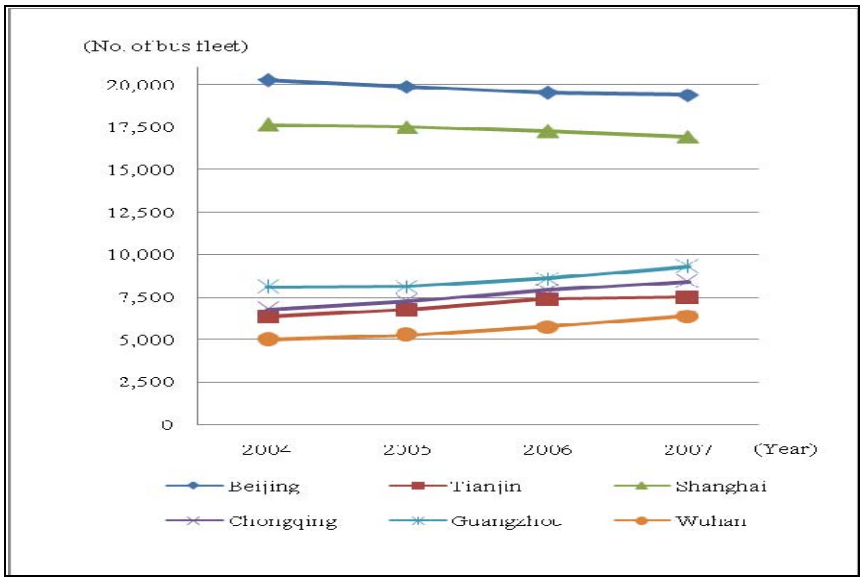
Table 7. Size of bus fleets by country/city (2009)

Country/City	Population size (in million)	No. of buses	No. of buses per 1,000 person
Tokyo (Japan)	13.0	8,972	0.7
Osaka (Japan)	2.7	2,276	0.8
Hong Kong SAR	7.0	5,799	0.8
Macao SAR*	0.5	578	1.0
Taipei	2.6	4,100	1.6
Seoul (Rep. of Korea)	10.3	7,598	0.7
Mongolia	2.7	3,000	1.0

* Year 2008 data was used.

Source: Korea Ministry of Land, Transport and Maritime Affairs, 2009; Institute for Transport Policy Studies, 2009; Hong Kong Transport Department, 2010a; Government Information Bureau of the Macao SAR, 2009; Osaka Prefectural Government, 2009; Asian Development Bank, 2010.

Figure 10. Size of bus fleets in selected Chinese cities (2004–2007)



Source: National Bureau of Statistics of China, undated.

3.2.2.3. Ridership

As shown in Table 8, bus ridership in Japan and Hong Kong SAR has declined, in contrast to the growing trend in other countries within the region. Within the 6 major cities in China, Figure 11 indicates that Tianjin, Chongqing and Wuhan experienced a significant increase of

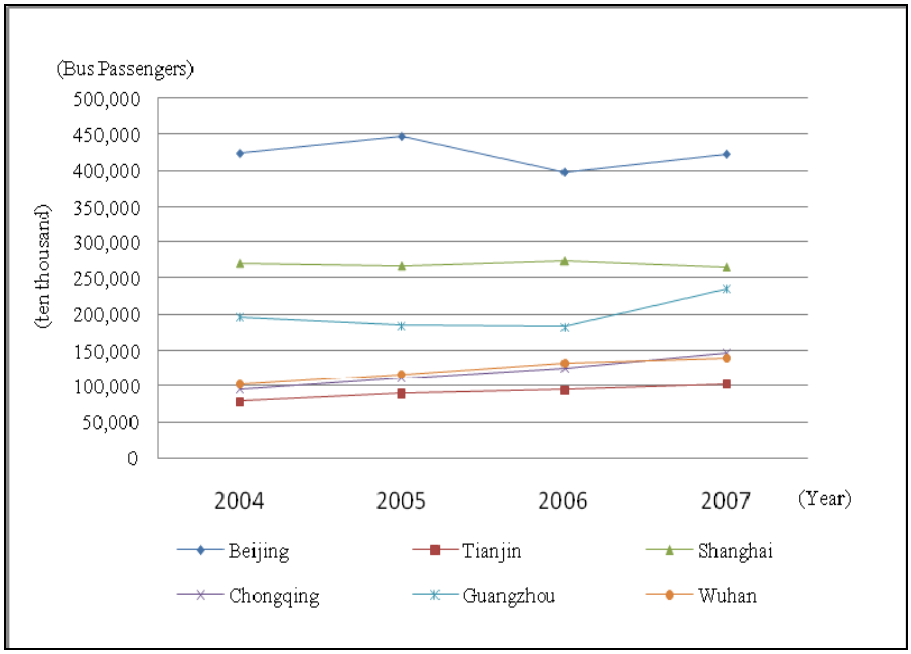
bus ridership during the 2004–2007 period. These are medium-sized cities where urbanization is rapidly growing but lack sufficient rail infrastructure.

Table 8. Number of bus passengers by country/region (2006–2008)

City	Year (data in millions)					Net change (2004–2007) (%)
	2004	2005	2006	2007	2008	
Tokyo (Japan)	208.0	207.6	206.0	207.4	205.6	-0.3
Osaka (Japan)	321.1	316.2	310.0	305.0	N/A	-5.0
China (mainland)	40,486.5	46,068.7	44,776.5	53,258.6	66,926.1	+31.5
Hong Kong SAR	1,489.6	1,430.1	1,439.2	1,446.9	1,413.3	-2.9
Macao SAR	100.6	106.8	113.2	115.0	116.6	+14.4
Rep. of Korea	9404.8	8,801.8	9,014.7	9,518.8	N/A	+1.2

Source: Korea Ministry of Land, Transport and Maritime Affairs, 2009b; National Bureau of Statistics of China, undated; Hong Kong Transport Department, 2010a; Osaka Prefectural Government, 2009; Government Information Bureau of the Macao SAR, 2009; Tokyo Metropolitan Government, 2009

Figure 11. Bus ridership in selected Chinese cities (2004–2007)



Source: National Bureau of Statistics of China, undated.

3.2.2.4. BRT system

Nagoya (Japan), Seoul (Republic of Korea), Taipei and more than 10 major cities in China (mainland) have developed BRT systems. Along the bus reform in Seoul in year 2004, the government initiated the BRT project to improve the bus service and BRT continues to gain its modal share in the urban transport system. In China, the BRT system in Guangzhou has proven to be the most successful in term of daily ridership. Table 9 presents data on BRT systems in Eastern Asia.

Table 9. Bus rapid transit system by city

City	Year commenced	No. of lines (main/sub)	Development progress (in km)	Total length of bus-ways (km)*	Daily ridership (in 10,000s)	Future development
Nagoya (Japan)	2001	1/0	6.5	6.5	1.2	N/A
China (mainland)						
Hangzhou	2006/2008	2/8	23/22.5	45.5	26	N/A
Beijing	2004/2008	3/0		34.5	12	N/A
Changzhou	2008/2009	2/0	21.7/21.5	43.2	13	N/A
Jinan	2008/2009	6/0	11.5/63.8	75.3	22	200km by 2020
Xiamen	2008	5/0	115.0	115.0	10	
Zhengzhou	2009	1/8	140.5	140.5	21	N/A
Guangzhou	2010	42	22.5	22.5	80	N/A
Seoul (Rep. of Korea)	2004/2009	7/12	57.1/117.6	174.7	N/A	N/A

* Includes dedicated busways and mixed traffic portions.

Source: www.chinabrt.org/defaulten.aspx.

3.2.3. Financial cost of public transportation

3.2.3.1. Ticket price, fare revenue and subsidy

Table 10 compares the most up-to-date ticket price for a one-way mass rail transit ride and bus fare in Eastern Asia. As shown, Beijing is the only city in China which implements flat fare throughout its mass rail transit system. For the rest of the cities, the fare is distance based, with a wider range for mass rail transit fare being implemented in Hong Kong SAR and the Republic of Korea (Seoul). In addition, the table compares the revenue/subsidy of mass rail transit and bus within the region. As shown, all countries/cities recorded a subsidy except Hong Kong SAR. More discussions on public transportation subsidies can be found in Chapter 10.

Table 10. Comparison of ticket price, revenue and subsidy between mass rail transit and bus

	Mass rail transit			Bus (with a/c)		
Country/City	Fare (in US$)	Revenue (+) (in US$ million)	Subsidy (-) (in US$ million)	Fare (in US$)	Revenue (+) (in US$ million)	Subsidy (-) (in US$ million)
Japan						
Tokyo	2.0–3.7	N/A		2.5	N/A	
Osaka	2.5–4.4	N/A		2.5	N/A	
China						
Beijing	0.3	-22.9		0.15	-167.0	
Tianjin	0.3–0.8	N/A		0.3	N/A	
Shanghai	0.46–1.54	-44.8 **		0.3	-560.2 **	
Chongqing	0.3–0.8	N/A		0.3–0.8	N/A	
Guangzhou	0.5–1.8	N/A		0.3	N/A	

Country/City	Mass rail transit			Bus (with a/c)		
	Fare (in US$)	Revenue (+) (in US$ million)	Subsidy (-) (in US$ million)	Fare (in US$)	Revenue (+) (in US$ million)	Subsidy (-) (in US$ million)
Wuhan	0.2–0.3	N/A		0.3	N/A	
Hong Kong SAR	0.3–5.5	+ 3,786.6 **		0.2–6.2	N/A	
Macao SAR *	–	–		0.4–0.8	N/A	
Taipei *	0.7–2.0	N/A		0.5	N/A	
Seoul (Rep. of Korea)	0.9–4.5	N/A		0.27–1.62	N/A	
DPR Korea	–	–		0.03	N/A	
Mongolia	–	–		0.08	N/A	

* Discount is available when using electronic card.

** Data for 2009.

Source: Tokyo Metro, undated; Toei Transport Information, undated; Osaka Municipal Transportation Bureau, undated; Government Information Bureau of the Macao SAR, 2009; MTRC, undated b; National Bureau of Statistics of China, undated; Seoul Metro, undated; SCCTIP, 2010; Asian Development Bank, 2010.

3.2.3.2. Personal income and travel expenditure

Table 11 compares the household expenditure on public transport by income group in the cities where data is available. As shown, the spending on public transportation typically accounts for less than 5 per cent of the average household income. However, the data reflects the high transportation cost in Hong Kong SAR and the Republic of Korea, especially in Hong Kong SAR where public transport is actually the third largest expenditure for households, following housing and food.

Table 11. Household expenditure on public transport by income group

Country/ City	Most recent data (Year)	Yearly income (2008) (in US dollars)				% of income used on public transport expenditure			
		Average	Low	Middle	High	Average	Low	Middle	High
Japan (Tokyo)	2008	60,572.4	21,571.6	54,308.1	127,036.7	3.2	2.6	2.7	3.7
China (Shanghai)	2009	4,389.4	2,009.9	3,762.2	8,785.5	2.6	3.4	2.9	2.2
Hong Kong SAR	2004	23,847.7	N/A	N/A	N/A	9.0	N/A	N/A	N/A
Taipei	2009	43,428.1	18,285.3	37,892.1	82,198.1	N/A	N/A	N/A	N/A
Rep. of Korea	2010	38,731.2	12,702.8	35,134.0	73,726.6	7.5	N/A	N/A	N/A

Sources: Taipei City Government, 2009; Tokyo Metropolitan Government, 2009; Korea Ministry of Land, Transport and Maritime Affairs, 2009b; Hong Kong Census and Statistics Bureau, undated; SCCTPI, 2010; Taipei DBAS, 2009, pp2,16.

3.2.4. Taxi

3.2.4.1. Number of registered taxis

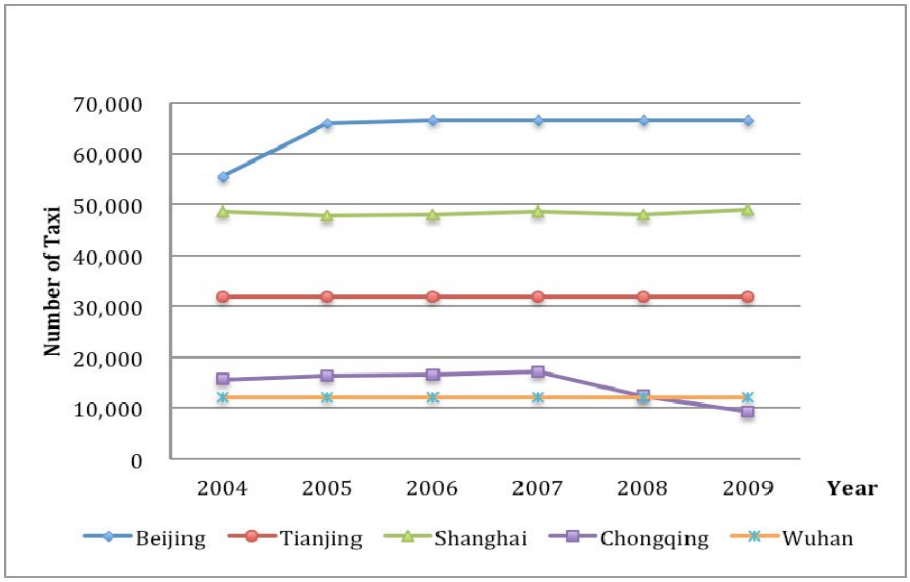
As shown in Table 12, Taiwan has the most extensive taxi service in terms of taxi-to-population ratio. Figure 12 displays the number of registered taxies within the 5 major cities in China between 2004 and 2009.

Table 12. Amount of taxies by city/country (2009)

City	Population size (in million)	Number of taxies	No. of taxis per 1,000 person
Tokyo	13.0	60,000	4.6
Hong Kong SAR	7.0	18,138	2.6
Macao SAR	0.5	980	2.0
Taipei	2.6	30,857	11.9
Seoul	10.3	72,365	7.0
DPR Korea	23.9	1,000	0.04
Mongolia	2.7	560	0.2

Source: Hong Kong Transport Department, 2010; Tokyo Metropolitan Government, 2009; Taipei City Government, 2009; Government Information Bureau of the Macao SAR 2009; Korea Ministry of Land, Transport and Maritime Affairs, 2009b; Asian Development Bank, 2010.

Figure 12. Number of taxies in selected Chinese cities (2004–2009)



Source: National Bureau of Statistics of China, undated.

3.2.4.2. Ridership

Taxi ridership in the major cities in China (mainland), Hong Kong SAR, the Republic of Korea has been relatively constant when compared to other public transportation modes in the past four years. Japan showed a decline of taxi ridership from 2000 to 2006. Table 13 shows the taxi ridership change in three major cities in China from 2006 to 2009.

Table 13. Taxi ridership by China city (in million) year 2006–2009

China City	Year				Net change (2006–2009) (%)
	2006	2007	2008	2009	
Beijing	641.2	641.1	690.0	680.0	6
Shanghai	589.2	577.6	616.0	609.3	3
Guangzhou	603.3	707.54	–	–	

Source: Shanghai City Government, 2005–2010; Beijing City Government, 2005–2010.

3.2.4.3. Ticket price and fare revenue

Table 14 compares the taxies fare within Eastern Asia.

Table 14. Taxies fares

Country/City	Fare	
	First km (US$)	Every subsequent km (US$)
Japan (Tokyo) (5am–11pm)	2km, $8.7	$1.1, 0.275 km
Japan (Tokyo) (11pm–5am)	(30% added to total fare)	
China (Mainland) (RMB)		
Beijing	3km, $1.5	$0.3, 1 km
Tianjin	3km, $1.2	$0.3, 1 km
Shanghai (5am–11pm)	3km, $1.8	$0.4, 1 km
Shanghai (11pm–5am)	3km, $2.4	$0.5 1 km
Chongqing	3km, $0.8	$0.3, 1 km
Guangzhou	2.3km, $1.1	$0.4, 1 km
Wuhan	3km, $1.5	$0.3, 1 km
SAR*	2km, $2.3	$0.19, 0.2 km
Macao	1.6km, $1.6	$0.03, 0.23 km
Seoul (Rep. of Korea)	2km, $2.1	$0.09, 0.14km

* For meter fare below HK$70.5 only. If meter fare of HK$70.5 and above, HK$1 for every 0.2 km

Source: MIAC, undated; Government Information Bureau of the Macao SAR, 2009; MTRC, 2009; National Bureau of Statistics of China, undated; Seoul Metro, undated.

3.3. Impacts and challenges from the current trends of public transportation development

Four countries with unique trends can reflect the public transportation development structure in Eastern Asia.

- **Japan**: Mass rail transit, bus and taxi ridership have been deteriorating, due to increasing car usage, sluggish economy and aging population. In 2009, Japan drafted a ‘comprehensive projects on invigoration and revitalization of local public transport’ to reform the current bus operation, increase subsidies on railway and local bus routes and better coordinate the different transportation modes in order to cope with its changing population structure and urban decentralization.

- **China (mainland)**: Major cities will prioritize the expansion of mass rail transit while middle-sized cities will adopt BRT as an appealing alternative, as the construction cost of BRT is one-tenth of that of mass rail transit. For example, the BRT in Xiamen is constructed on an elevated busway and dedicated lanes on bridges. Public transport in China will expand exponentially in the coming decades. Transportation management and better integration of land use and transportation planning will be the primary challenge.
- **Hong Kong SAR:** An integrated public transport network has been established. Due to a high population density, rail will continue expanding its modal share of public transportation to alleviate the congested road traffic. The challenge in the coming years will be lowering the cost of public transportation for low-income group.
- **Republic of Korea**: The year 2004 bus reform has constructed an integrated network and converted the evoked competition between the subway and buses in to a mutually beneficial supplementary linking system. A new distance-based transfer-free fare system is introduced which consists of a free-of-charge fare system for transfers between the subway and buses, or between buses when using an electronic card. The reform has balanced the ridership between bus and mass rail transit and improved the overall quality of the public transportation system. The upcoming agenda is an aggressive development of BRT and to organize a more integrated public transport network.

4. Informal Motorized Transport

4.1. Brief overview

This chapter summarizes the recent developments of informal motorized transport in Eastern Asia. In general, informal transport plays a more vital role in the less developed regions. For example, it has been found that informal transport such as motorcycle taxi, company bus, shopping mall bus and informal transport service has contributed a significant amount of trips in urban areas in China (mainland), especially in suburban or urban fringe areas such as the case of informal motorized transport around metro stations in the less central areas of Shanghai. In contrast, informal transport is almost non-existent in Hong Kong SAR, Macao SAR, the Republic of Korea and Japan. Car pooling has appeared both in developing countries such as China (mainland) and developed regions such as the Republic of Korea, Japan and Taiwan. Theoretically, Chinese government encourages carpool. However, carpool directly competes with the formal public transport and no policies or law have passed to confirm the legality of carpool.

4.2. Trends and conditions with respect to informal motorized transport

As mentioned above, many daily trips in China (mainland) still rely on informal transport, especially the trips which bridge the 'last-kilometre' connection between transit stations and destinations. Since the reliance on informal transport is higher in China (mainland), this section focuses on presenting and describing the different types of informal transport in China (mainland).

The informal transport system comprises of company bus service, shopping mall bus, informal transport service and carpooling. The providers for these diversified informal transport modes are summarized below in Table 15.

Table 15. Different informal transport modes in Shanghai fringe area

	Company school bus	**Shopping mall bus**	**Informal transport service**	**Carpooling**
Provider	Government agency or company	Shopping mall	Individual or private operator	Individual

Source: Zhai, 2010.

4.2.1. Company bus

Company bus, which also includes school bus, not only makes travel more convenient for the staffs and students, but also alleviates the pressure on the public transport system. Many international companies in China such as Nippon Paint Corporation, General Electric Corporation provide company buses for their employees. Company bus is considered as part of the company benefit packages, of which the companies bear the operating costs. Depending on company policies, company bus could be provided free of charge or with a discount fare. Company bus operates during working days only, in particular during rush hours. Table 16 shows an example of company bus schedule within a development zone.

Table 16. Zhang Jiang Business Zone Company bus schedule

Bus route	Operating hours		Operating days	Fare	Method of payment
Zhang Jiang Business Zone Free Shuttle	East line	am: 9:10–10:40	Mon-Fri	Free	–
		pm: 13:00–15:50			
	West line	am: 9:10–10:45			
		pm: 13:00–15:55			
Ji Dian Jiang	am: 8:05–8:45 (Every 5 minutes)		Mon-Fri	2 RMB	By cash/ card
	pm: 17:15/17:35–18:20 (Every 10 minutes)				
Chuang Yi Building	am: 8:45–9:15		Mon-Fri	Free	–
	pm: 7:10–18:05				
Ji Dian Jiang Direct Shuttle	–		Mon-Fri	2 RMB	By cash/ card
Software Zone Shuttle Bus	am: 7:55–9:30		Mon-Fri	2 RMB	By cash/ card
	pm: 16:35–20:05 (Every 10 minutes)				
East District	8:00–16:15 (Every 40 min during peak period, every hour during off-peak period)		Mon-Fri	2 RMB	By cash/ card

Source: Zhai, 2010.

According to the Fourth Comprehensive Transport Survey of Shanghai there are 2,479 school buses operating in the Shanghai urban area alone, with which 46,000 students are transported.[7]

4.2.2. Shopping mall bus

Free shopping mall shuttle services are provided by shopping malls in hope of increasing sales. Shoppers can enjoy this free service by their shopping receipts or membership cards affiliated with the malls. Shopping mall buses typically have fixed routes, stations and schedules which provide direct connections between residential areas and the shopping malls. In particular, residents who live in remote districts have a stronger demand for this service. Shopping mall bus network has become an ancillary public transit network in Shanghai.

According to the Fourth Comprehensive Travel Survey of Shanghai there are 112 shopping malls operating 922 shopping mall bus routes, with 910 shopping mall buses transporting 319,000 people in one day.[8] [9].

7. SCCTPI, 2010.
8. SCCTPI, 2010.
9. According to the *Shanghai bus and tram lines regulations*, the shopping mall buses are informal transport.

4.2.3. Informal transport service

For residents who live further away from metro stations, bus stops or in areas with poor public transport services, informal transport services are the primary option for a commute. A case study is presented below in section 4.2.5 to illustrate the modal share of journeys of informal transport. In the area which public transit service is infrequent, the flexibility of informal transport services also becomes an attractive transport mode. Currently, there are three main types of informal transport service: Trishaw, motorcycle taxies and taxies.

According to discussion in section 4.2.5, the modal share of journeys supplied by informal transport service around metro station in Shanghai fringe area is about 15.5 per cent. The usage of informal transport is mainly due to three factors: 1) To make the 'last kilometre' connection between public transportation and final destination; 2) To meet travel demand when public transportation is not in operation at night; and 3) To meet mobility demand in area with low level supply of public transport service.

Table 17 shows the typical fare of informal transport service in Shanghai. The starting rate for legal taxies in Shanghai is 12 Yuan, and the basic fare of public bus is 2 Yuan. As shown in the table, informal transport service is much cheaper than legal taxies, but higher than most public transport.

Table 17. Basic fare for informal transport service in Shanghai

Type	Trishaw	Motorcycle	Taxi
Starting rate (RMB)	5	5	7

Source: Zhai, 2010.

4.2.3.1. Motorcycle taxi

Motorcycle taxis are popular in small to middle-sized cities. According to a survey conducted in 2008, there were about 30,000 motorcycle taxies compared to 50,000 official taxies in Shanghai.[10] And most of motorcycle taxies serve in the area near metro stations, bus stops and suburban districts.

Figure 13. Motorcycle taxi in China mainland

Source: http://www.flickr.com/photos/23929741@N04/2524822090/.

10. Wang, 2009.

4.2.4. Carpooling

Carpooling is gaining its popularity and recognition in China (mainland), Taiwan and Japan. Currently, two types of carpooling services are available in China (mainland): non-profit and for profit carpooling. Non-profit carpooling is organized by a group of people who voluntarily join together for sharing the costs of some common journey. An agreement is usually established among the participants in the programme, in which carpoolers agree to share a portion of fuel costs, toll fees, parking fees or car depreciation costs. For-profit carpooling is organized by carpool business services. People who are interested in carpooling could submit their carpool requests through the website created by the carpool company. Based on matching the travel time and destination between the registered carpoolers, the carpool company could effectively organize a car share between the carpoolers. Based on a statistic from the China's first carpool website, approximately 60,000 people in Guangzhou commute to work using carpool service. Currently, more than fifty cities in China (mainland) have developed carpooling service.[11] To further illustrate the trend of carpooling in China, a case study of a community carpool is presented in Box 1.

Box 1. Neighbourhood carpooling programme in Changqing Garden community, city of Wuhan

In 2009, the residents' committee for the Changqing district in Wuhan launched an original scheme: 'cars-haring with neighbours'. The idea began with a study on the reasons for the traffic jams that were creating gridlock in the district every morning and evening: the results showed that 80 per cent of drivers carry no passengers. In order to encourage residents to share their cars, a way had to be found to resolve the legal prohibition on the use of unregistered vehicles to carry passengers. In response, the residents committee, with the advice of experts, set up a system of regulation which would ensure quality of service by monitoring drivers and vehicles, and would also impose strict operating rules: car owners and passengers sign a contract which enforces the non-paying nature of the service and the sharing of responsibility in the event of an accident. All the vehicles in the scheme are marked with an identifying sticker bearing the words 'car sharing with neighbours'. Since its inception, the residents' committee has received dozens of requests from car owners wishing to register, and participation continues to rise. A website has been set up to put passengers and drivers in contact. The committee is now working to improve the system in order to attract more car owners. The Changqing scheme has begun to make waves, since several other districts of Wuhan have now decided to launch similar operations.

Source: Prize for Innovative Urban Mobility Solutions, 2010.

In Japan there are many websites organizing the carpooling, and the information about carpool is very rich, so carpooling in Japanese cities is quite convenient.

4.2.5. Case study – Informal motorized transport around the metro station in Shanghai fringe areas[12]

This case study is base on a study reviewing the local transport services connecting to urban rail services at three railway stops in the peripheral areas of Shanghai.

11. Carpooling in Guangzhou, 2006
12. Zhai, 2010.

Table 18. Modal share of transportation connecting with urban rail, Shanghai

	Gongfuxincun station (%)	Xinzhuang station (%)	Zhangjiang station (%)
Bus	61.3	35.4	79.1
Railway	0.0	50.5	0.0
Taxi	14.8	7.8	13.7
Formal mobility service supply system	**76.1**	**93.7**	**92.9**
Community bus	3.2	1.5	1.1
Company bus (school bus)	5.2	1.8	2.2
Informal mobility service supply system	**8.4**	**3.3**	**3.3**
Informal motorcycle	3.9	2.1	1.1
Informal tricycle	9.0	0.0	1.6
Informal minibus	1.3	0.0	1.1
Informal taxi	1.3	0.6	0.0
Informal mobility service supply system	**15.5**	**2.7**	**3.8**
Car pooling	**0.0**	**0.3**	**0.0**

Source: Zhai, 2010.

Gongfuxincun station is in the developing suburban area, where formal mobility service supply system is poor. The Xinzhuang and Zhangjiang stations lie in relatively developed areas in Shanghai, as a result informal transport plays a much smaller role in these areas than in the area around Gongfuxincun station, where informal transport is responsible for 23.9 per cent of all motorized trips connecting to the urban rail system (see Table 18).

Public transportation serves as the primary transportation mode to connect the Shanghai fringe area to urban area. However, community buses and informal motorized transportation have been expanding its services to complement the service problems in public transportation.

4.3. Impacts and challenges about informal transport

Rapid urbanization in Eastern Asia leads to an accelerated increase in mobility infrastructure. It is increasingly difficult to satisfy the city's development of diversification and mobility by applying traditional mobility development principles. Objectively, we must introduce new management principles for managing city mobility development.

- Urban fringe areas are the extension of urban spatial areas, absorbing the overflow of population and industries from the city centre. However, the region's public transport services are insufficient due to the lack infrastructure, traffic management and other factors. As a result, informal motorized transport emerges as an important transport tool in the fringe areas.
- Both company bus and school bus not only make travel more convenient for staffs and students, but also alleviate the pressure on the public transport system. Similarly, shopping mall bus supply convenient service for customers while reducing the public transport pressure. However, owing to the absence of a strict contractual relationship, shopping mall buses cause troubles when encountering disputes.

- Carpooling. This resident independent behaviour not only satisfies the strong demand on mobility but also decreases the pressure on road resources. However, carpool directly competes with the formal public transport and no policies or law have passed to confirm the legality of carpool. It will also bring some problems on carpool realization process like unclear responsibility when legal destruction occurring, and competition with formal taxi business. Wuhan Changqing Garden Community is a good example (see Box 1).

5. Private Motorized Transport

5.1. Brief overview

This chapter summarizes the recent development of private motorized transport in Eastern Asia. As the standard of living improved within the Eastern Asia countries, the demand for private vehicles has also increased. The modal share of private motorized transport has thus increased rapidly in the Eastern Asia, and most prominently so in Chinese cities (see Table 19). In Shanghai, the modal share of cars and motorcycles increased 1.5 times between 1995 and 2009, and the share of e-bike grew even more. However, in smaller city like Shaoxing, the split of private motorized is nearly 50 per cent, which was even higher than Shanghai's 35.2 per cent in 2009. Shanghai's well-developed public transport has a major contribution to that aspect. The usage of motorcycles has also increases in the southern parts of China.

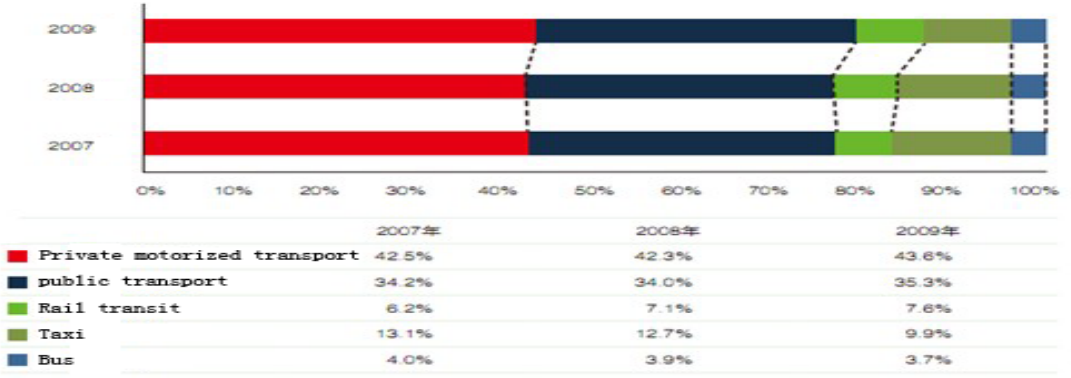
Table 19. Split of private motorized transport (including e-bike) (per cent)

City/country	Year	Car and motorcycle	e-Bike
Shanghai (China)	1995	7.9	3.0
	2004	17.8	5.3
	2009	20.0	15.2
Guangzhou (China)	2005	19.5	
	2007	42.5	
	2008	42.3	
	2009	43.6	
Shaoxing (China)	2006	10.5	
	2010	13.8	31.6
Taipei	2005	60.0	
Seoul	2005	53.0	
Japan (weekday)	1987	56.5	
	1992	57.9	
	1999	61.4	
	2005	63.2	

Source: MLIT, 2007; Guangzhou Transport Planning Research Institute, undated; Tongji University, 2010; SCCTPI, 2005; SCCTPI, 2010; Lan, 2005.

Figure 14 provides details on the modal split between different modes in Guangzhou.

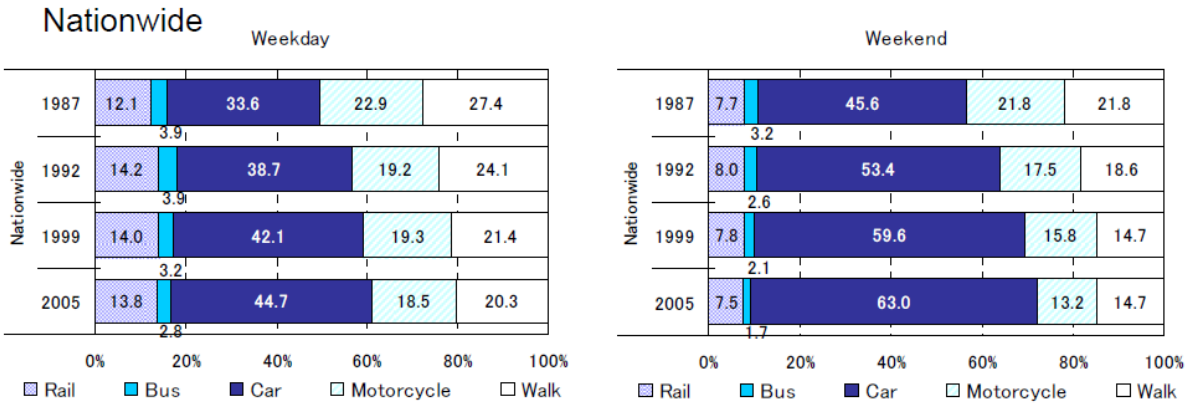
Figure 14. The modal split of passenger traffic in Guangzhou's urban area



Source: Guangzhou Transport Planning Research Institute, undated.

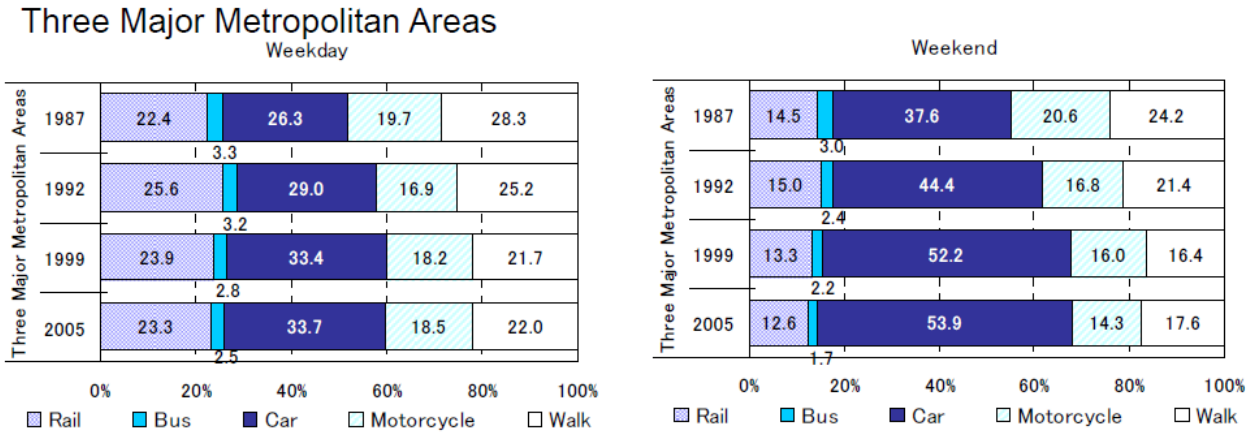
The modal share of cars increases in Japanese cities every year (see Figure 15), although the modal share of cars decreased in the three major metropolitan areas when compared to other cities (see Figure 16).[13]

Figure 15. Modal split of each transport mode in Japan



Source: MLIT, 2007.

Figure 16. Modal split of each transport mode in three major Japanese major metropolitan areas

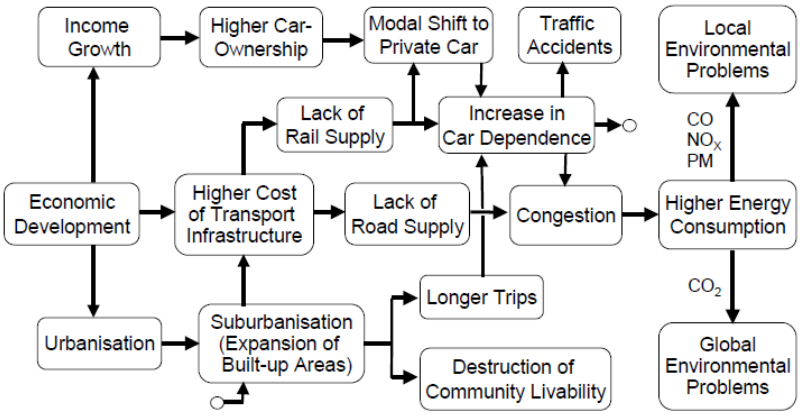


Source: MLIT, 2007.

As demand for personal automobiles increases rapidly in Eastern Asia, the production of vehicles and construction of roadways must be able to keep pace. The increase in spending on vehicles and roadways also means more parking spaces will be needed (see also Figure 17).

13. MLIT, 2007

Figure 17. Causalities of deterioration in transport-related environment



Source: Yoshitsugu et al, 2004.

5.2. Trend of motorization

5.2.1. Motor vehicle production

China is one of the fastest growing motor vehicle producers in the world. In 2004, China only produced 5,070 thousand cars, trucks and passenger vehicles and 16,640 thousand motorcycles. In 2008, the production of car was doubled and the production of motorcycles jumped by approximately 65 per cent (see Table 20). The production of motorcycle in 2008 was half of the world's.

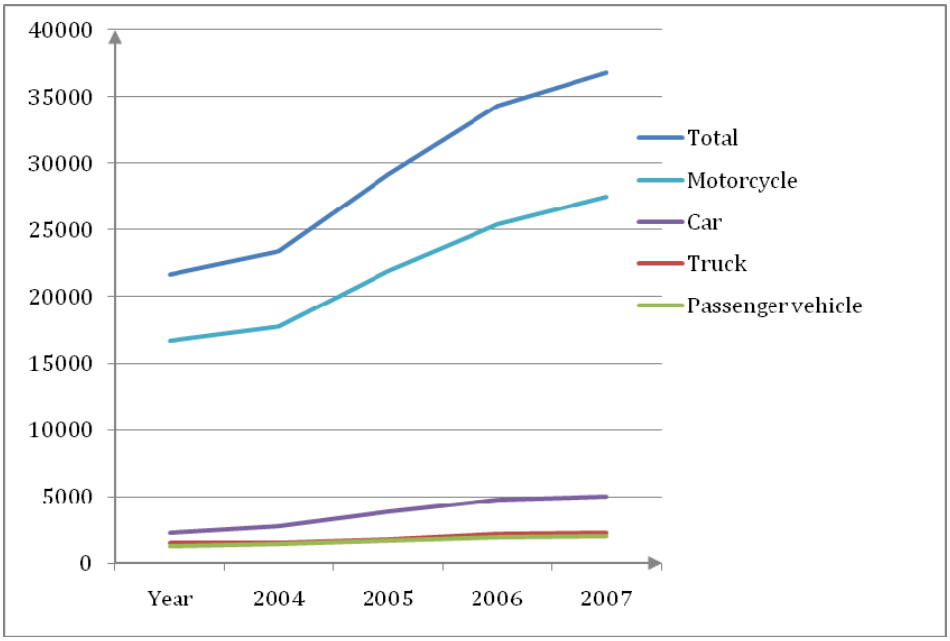
Table 20. Motor vehicle production by country

Area	Year	Annual production (in thousands)				
		Total	Trucks	Passenger vehicles	Cars	Motorcycles
China (Mainland)	2004	21,714.7	1,514.9	1,243.0	2,312.6	16,644.2
	2005	23,454.4	1,509.9	1,430.0	2,767.7	17,746.7
	2006	29,214.1	1,753.0	1,657.3	3,869.5	21,934.1
	2007	34,332.1	2,157.3	1,927.4	4,797.7	25,449.6
	2008	36,846.2	2,270.2	2,037.5	5,037.3	27,501.1
Republic of Korea	2009	3,510.0	–	–	–	

Source: China Automobile Industry Yearbook, 2004–2009.

As noted above the production of motor vehicles in China increased rapidly from 2004 to 2007, especially the production of motorcycle and car (see Figure 18). Besides, e-bike is an important transport mode in most cities of China, because it is relatively cheap and convenient. E-bike production of China increased more than 500 times from 1998 to 2010 (see Table 21).

Figure 18. Motor vehicle production, China mainland (2003–2007)



Source: China Automobile Industry Yearbook, 2009.

Table 21. E-bike production, China mainland (1998–2010)

Year	1998	2000	2001	2002	2004	2005	2006	2010
Production (thousand units)	54	293	400	1,580	6,567	9,600	20,000	30,000 (estimate)

Source: Lee, 2010.

5.2.2. Motor vehicle ownership (national wide, city based)

The Eastern Asia countries can be divided into three categories in terms of motorizations:

5.2.2.1. Low motorization, but rapid increase (DPR Korea and Mongolia)

In 2000, it was estimated that there were only approximately 40,000 private cars in DPR Korea, and all the owners were businessmen. In the last decade, the number of cars has increased by10 per cent per year.[14]

Data is insufficient in Mongolia. It was recorded the number of registered vehicles in Ulaanbaatar, Mongolia was 21,326 in 1998.[15]

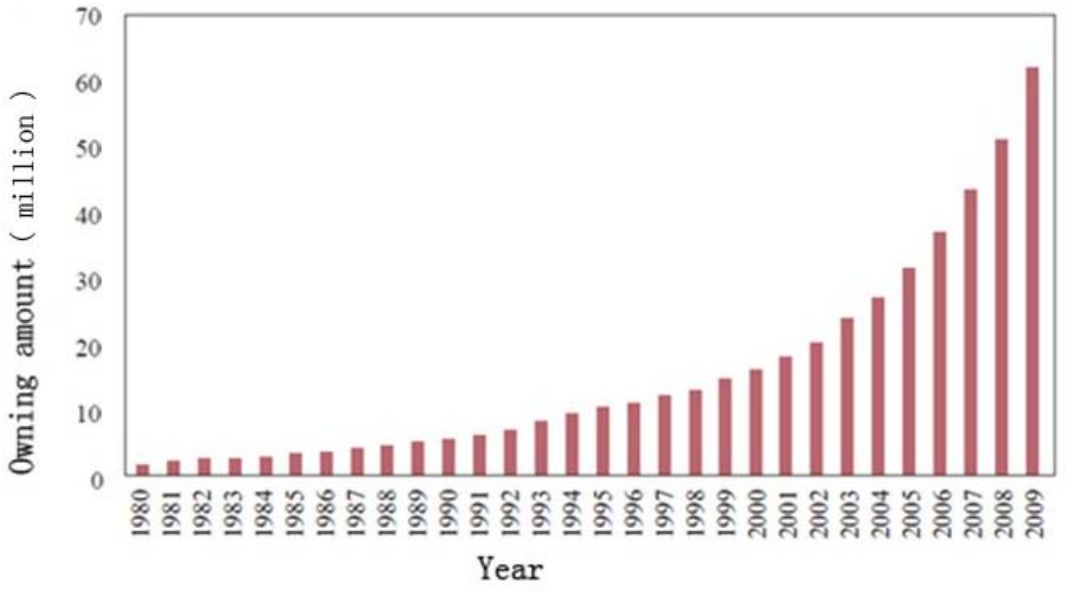
5.2.2.2. High motorization, but high traffic congestion (major cities in China mainland)

In 2009, in response to the international financial crisis and ensure the steady development of the overall economy, a series of policies have been put forward to stimulate the purchase automobiles and motorcycles in China. As a result, Chinese automobile ownership increased quickly and China ranked the first in automobile production. From 1980 to 1989, Chinese automobile ownership increased by 11.1 per cent per year (from 1.783 million to 5.113

14. http://www.ccpit-sichuan.org/ccpitsc/Site/CCPITSC/Upload/2008/web2j/cxgj.htm, last accessed February 2011.
15. http://tjsj.baidu.com/pages/jxyd/5/39/fa90313ea968fd0046cfc4ea4bd5e3c6_0.html, last accessed May 2011.

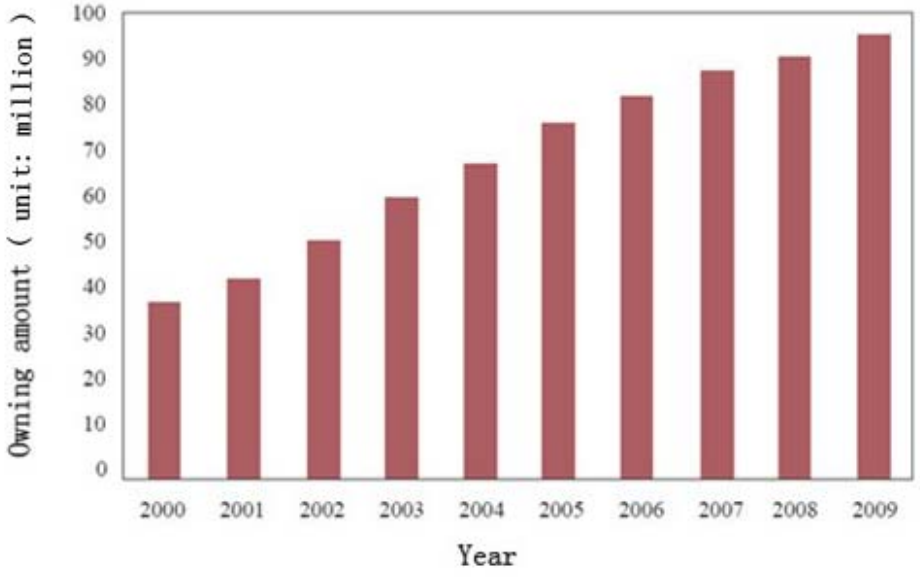
million). From 1990 to 1999, automobile ownership increased by 10.2 per cent per year (from 5.114 million to 14.529 million). From 2000 to 2009, the annual growth rate increased to 14.5 per cent (from 16.089 million to 62.094 million) (see Figure 19), while the motorcycle ownership increased by 9.6 per cent (from 37.718 million to 94.531 million). But the ownership rate is still very low in China (see Figure 20).

Figure 19. Automobile ownership in China (1980–2009)



Source: MoE, 2010.

Figure 20. Motorcycle ownership in China (2000–2009)



Source: MoE, 2010.

5.2.2.3. Steady motorization (Republic of Korea, Macao SAR, Hong Kong SAR, Japan)

Table 22 shows trend of motor vehicles for civilian use ownership in Eastern Asia countries/ cities.

Table 22. The ownership of civil auto vehicle by city

	City	Year	Civil auto vehicle		Passenger vehicle		Truck		Others		Motorcycle	
			Total	Per 1,000 people	Total	Per 1,000 people	Total	Per 1,000 people	Total	Per 1,000 people	Total	Per 1,000 people
China	Beijing	2008	3,137	185.1	2910	171.7	181	10.7	45	2.7		
	Tianjin	2008	1,085	92.2	917	78.0	147	12.5	21	1.8		
	Shanghai	2008	1,321	70.0	1107	58.6	214	11.3				
	Chongqing	2008	736	25.9	467	16.4	255	9.0	15	0.5		
	Guangzhou	2004	668	90.6	477	64.7	191	25.9	26	3.5	1,028.0	139.4
		2005	745	99.3	567	75.5	179	23.8	24	3.2	1,050.0	133.9
		2006	871	114.5	685	90.0	186	24.5	26	3.4	933.0	122.6
		2007	1,049	135.6	836	108.0	185	23.9	28	3.6	774.0	100.1
		2008	1,179	150.4	969	123.6	180	23.0	29	3.7	660.0	84.2
		2009	1,350	132.6	1,130	111.0	185		34	3.3	605.0	59.4
	Shaoxing	2004	502	115.5	94	21.6	39	9.0	2	0.5	367	84.4
		2005	565	129.8	125	28.7	38	8.6	2	0.5	400	92.0
		2006	642	147.3	164	37.5	47	10.8	3	0.6	428	98.4
		2007	701	160.7	207	47.5	51	11.8	3	0.7	440	100.8
		2008	732	167.6	235	53.7	42	9.6	3	0.7	453	103.5
		2009	781	178.5	293	66.9	48	10.9	3	0.6	438	100.0
	Macao	2008	183	328.5	78	140.0	5	9.0			97.7	175.5
		2009	189	348.7	80	147.6	5	9.2			102.6	189.2
Republic of Korea	Seoul	2004	2,780	273.3							380	37.3
		2005	2,809	276.0							382	38.0
		2006	2,857	280.6							390	38.3
		2009	2,993	293.4								
	Kyonggi	2004	3,358	321.0							263	25.2
		2005	3,506	327.7							265	24.8
		2006	3,651	334.8							273	25.1
	Incheon	2004	783	299.9							54	20.8
		2005	800	307.7							55	21.0
		2006	822	313.3							56	21.1
Japan	Total	2006	79,236									
		2007	79,080									
		2008	78,800									
		2009	78,693									
	Tokyo	2006	4,619	364.3	2,893	228.2	458	36.1	1,268	100.0	332	26.2
		2007	4,591	358.9	2,856	223.3	450	35.2	1,285	100.5	333	26.0
		2008	4,519	350.3	2,798	216.9	430	33.3	1,291	100.1	329	25.5
		2009	4,539	349.5	2,810	216.3	432	33.3	1,297	99.9	331	25.5
Mongolia	Total	2004	120	47.7	80	39.1	25	12.6				
		2005	131	51.3	88	36.0	27	11.5				
		2006	141	54.3	94	32.3	29	10.5				

Source: China Automobile Industry Yearbook, 2009; Institution for Transport Policy Studies, Japan, 2009; Tokyo Metropolitan Government, 2009; MILT 2009; Tongji University, 2010; Government Information Bureau of the Macao SAR 2002–2009; Korea Ministry of Land, Transport and Maritime Affairs, 2009b.

In recent years, the number of e-bikes has increased significantly in Chinese mainland cities such as Shanghai. From 2004 to 2009, the growth rate of e-bike ownership was 27.1 per

cent per year (from 0.750 million to 2.485 million) (see Table 23). Table 24 shows the e-bike ownership in major Chinese cities in 2004. Different cities are undertaking different approaches to encourage or discourage the use of e-bikes.

Table 23. E-bike ownership, Shanghai (2004–2009)

Year	2004	2005	2006	2007	2008	2009
E-bike ownership	750,000	1,358,000	1,876,000	2,134,000	2,330,000	2,485,000

Source: Shanghai City Government, 2005–2010.

Table 24. E-bike ownership, selected Chinese cities (2004)

Area	Wuhan	Guangzhou	Shanghai	Tianjin	Beijing
E-bike ownership	180,000	70,000	750,000	250,000	120,000

Source: Lee, 2010.

Table 25 summarizes the investments in urban road construction in the region. The investments in Shanghai increased by approximately five times between year 2005 and 2009, but decreased by half in Guangzhou by half. Between the year 2004 and 2009, most cities in the region extended their road network, but the more developed cities have showed a slower rate (see Table 26). The different trends illustrate how different cities prioritize the investment and construction in roads. As studies have proved increasing urban road would cause induced travel demand, more cities realized road construction may not the best solution to alleviate traffic congestions, but traffic management.

Table 25. Investment on urban road construction

Area	Year	Unit	Investment (local currency)	Investment (US$ million)
Shanghai	2005	100 million RMB	50.70	771
	2006		35.20	535
	2007		69.21	1,053
	2008		224.99	3,422
	2009		253.01	3,848
Guangzhou	2007	100 million RMB	87.62	1,333
	2009		41.23	627
Republic of Korea	2006	billion WON	854	854
	2007		1,254	1,254
	2008		2,100	2,100
	2009		2,440	2,440
Japan	2006	billion JPY	8,853.0	109,335
	2007		8,392.1	103,642
	2008		8,314.2	102,680
	2009		7,786.9	96,168
Hong Kong SAR	2004–2009	million HK$	31,472.8	4,038

Source: Guangzhou Transport Planning Research Institute, undated; Shanghai City Government, 2005–2010; Tokyo Metropolitan Government, 2009; Government Information Bureau of the Macao SAR, 2002–2009; Hong Kong Highway Department, 2009; Korea Ministry of Land, Transport and Maritime Affairs, 2009b.

Table 26. The development of urban roads in Eastern Asia

City	Length of urban road by city (in km)						Area of paved roads per capita (m^2)				
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008
China (Mainland)	222,963.8	247,014.9	241,351	246,172	259,740	26,9141	8	8.58	9.06	9.01	9.01
Beijing	4,064	4,073	4,419	4,460	6,186	6,247	4.30	4.84	4.59	4.67	5.27
Tianjin	4,240	5,460	5,991	5,679	6,012	5,482	8	8.67	10.20	9.89	11.58
Shanghai	4,020	4,117	4,227	4,295	4,347	4,401	5.54	4.33	4.40	4.50	4.63
Hangzhou	1,558	1,782	1,942	1,993	2,030		7	9.99	10.18	9.98	10.04
Wuhan	2,161	2,174	2,369	2,515	3,034.7		5	5.12	8.63	8.87	11.34
Guangzhou	4,864	5,076	5,208	5,335			13	13.49	13.85	14.13	–
Chongqing	3,448	3,630	4,011	4,349	4,589	4,882	5	4.82	4.49	4.08	5.44
Hong Kong SAR	1,944	1,955	1,984	2,009	2,040	2,050					
Macao SAR	357.9	364.0	379.6	396.8	404.6	434.5					
Seoul	8,011	8,011	8,067	8,078	8,093	8,102	7.30	7.34			
Kyonggi	12,671	13,477	12,748				30.59	30.54			
Incheon	2,187	2,192	2,307				21.8	22.2			
Tokyo			24,105	24,167	24,255	24,316					
Osaka			19,748	19,881	19,994	20,120					
Ulaanbaatar	464	464	464	464	464	464					

Source: National Bureau of Statistics of China, undated; Institution for Transport Policy Studies, Japan, 2009; Government Information Bureau of the Macao SAR 2002–2009; Hong Kong Highway Department, 2009, Korea Ministry of Land, Transport and Maritime Affairs, 2009b.

5.2.3. Travel distance and time (city based)

In most cities of Eastern Asia, the trip rate has increased over the last few years. Travel distances have also increase in many major cities in China due to urban sprawl. At the same time, the average travel time per trip has also increased. But in Hong Kong, Shanghai, and Incheon, travel time by car decreased. It was due to the urban road construction. Table 27 shows a trip survey based on selected Eastern Asia cities. In addition, Table 28 summarizes the travel time and distance of private motorized transportation modes in the selected Eastern Asia cities. Figure 21 shows the trip rate development in Shanghai.

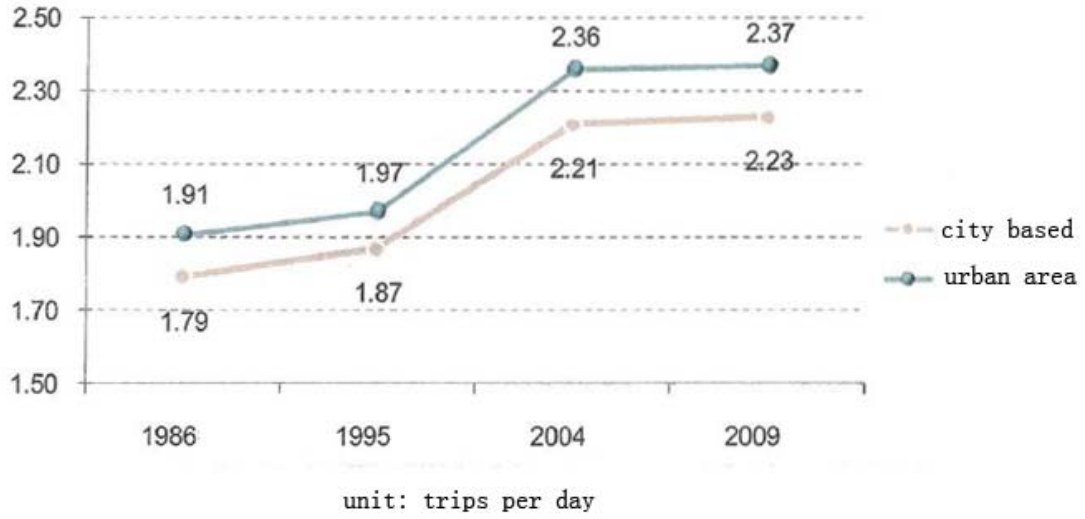
Table 27. Trip survey by city

Country/ China City	Year	Trip rate (trips)	Travel distance (km)	Travel time (min)	Trips (million person-time)
Shanghai	1995	1.87	4.5		28.30
	2004	2.21	6.2	29.2	41.00
	2009	2.23	6.5	29.8	45.40
Wuhan	2008	2.41			
Tianjin	2000–2006	2.19			
Hangzhou	2000–2006	2.07			

Country/ China City	Year	Trip rate (trips)	Travel distance (km)	Travel time (min)	Trips (million person-time)
Beijing	1986	1.61	–		9.39
	2000	2.77	8.0		23.01
	2005 (within sixth ring)	2.64	9.3		29.20
Shaoxing	2006	2.77			
	2010	2.23	3.0		5.38
Hong Kong SAR	1992	1.85			10.30
	2002	1.82			12.30
Japan	2005	2.31 (weekday)			

Source: MLIT, 2007; SCCTPI, 2005; SCCTPI, 2010; Tongji University, 2010; Hong Kong Transport Department 2010c, WHTPI, 2009; Beijing Transportation Research Centre, 2007

Figure 21. The development of trip rate in Shanghai



Source: SCCTPI, 2010.

Table 28. Travel time by mode

Country/ China City	Year	Mode	Morning peak	Evening peak
Beijing	2006	Car	37	45
			Mean journey time (minutes)	
Hong Kong SAR	1992	Private vehicle and taxi	28	
	2002	Private vehicle and taxi	24	
Shanghai	2004	Car	41	
		E-bike/Gas-moped	24	
		Motorcycle	21	
	2009	Car	36	
		Motorcycle	25	

Country/ China City	Year	Mode	Morning peak	Evening peak
Seoul	2004	Car	26	
	2005	Car	26	
Incheon	2004	Car	39	
	2005	Car	37	

Source: Beijing Transportation Research Centre, 2007, SCCTPI, 2005; SCCTPI, 2010, Hong Kong Transport Department, 2010c, Korea Ministry of Land, Transport and Maritime Affairs, 2009b.

5.2.4. Parking system

5.2.4.1. Parking availability

Parking in China (Mainland, Hong Kong and Macao) is divided into on-street and off-street parking.[16] In the Republic of Korea, parking is classified into street parking; off-street parking and parking buildings.

During the period 2004 to 2009, in two major Chinese cities (Wuhan and Shanghai), the number of parking spaces increased quickly, especially Wuhan, where it increased 3 times from 2004 to 2008 (see Table 29). There are 2,000 parking spaces in Ulaanbaatar,[17] Mongolia (the estimated number of cars that enter Ulaanbaatar each working day is 10,000).

Table 29. Parking space in Eastern Asia (2004–2009)

Area	Parking spaces (10,000s)					
	2004	2005	2006	2007	2008	2009
Wuhan	52		214	216	226	
Shanghai		170	183	219	247	284
Republic of Korea			2,587	2,993	2,949	2,954
Seoul	21	23				
Kyonggi	15	17				
Tokyo*		202 6	289.3	285.7	279.9	N/A

* Charged spaces only.

Source: SCCTPI, 2005; SCCTPI, 2010; Korea Ministry of Land, Transport and Maritime Affairs, 2009b; Institution for Transport Policy Studies, Japan, 2009; WHTPI, 2009.

5.2.4.2. Parking charge

In Eastern Asia, most cities have flexible parking charge rate, because of the demand to control the number of cars in the high density areas. Generally, parking charge rate in Hong Kong and Seoul is much higher than in China mainland (see Table 30). And the parking charge has another function to restraint cars going to the core zone. Beijing, Guangzhou, Shanghai, and the Republic of Korea have all adopted this method to control traffic capacity of key areas

16. Hong Kong Transport Department, 2010a.
17. World Bank, 2010.

Table 30. Parking charge rate of cities

Urban	Parking charge
Beijing	• The open air, daytime (7:00–21:00): inside of fourth ring road US$0.3 per hour; outside of fourth ring road US$0.2 per hour; crowded downtown area US$0.8 per hour. • The open air, night time (21:00–7:00): US$0.2 per two hours. • Underground parking garage, parking structure US$0.8 per hour.
Guangzhou	• The open air, the first district US$0.5 per hour, the second district US$0.3 per hour, the third district US$0.2 per hour; on-street park US$0.6 per hour
Hangzhou	• With in the first 4 hours, US$0.6 every time; 4–24 hours, US$1.2.
Shanghai	• Prime location: Daytime: Garage (US$2.31, 1st hour; US$1.54 every 30 minutes after, on-street parking: US$0.62, 1st and 2nd15 min; US$1.08, 30-60 min; US$1.54 every 30 min after; Nighttime: US$1.54 per night • Inner ring: Daytime: Garage (US$1.54, 1st hour; US$0.93 every 30 minutes after, on-street parking: US$0.46, 1st and 2nd15 min; US$0.62, 30-60 min; US$0.93 every 30 min after; Nighttime: US$1.23 per night • Outer ring: Daytime: Garage (US$1.08, 1st hour; US$0.62 every 30 minutes after, on-street parking: US$0.31, 1st and 2nd15 min; US$0.46, 30-60 min; US$0.62 every 30 min after; Nighttime: US$0.77 per night
Wuhan	• On-street parking US$0.3 per hour, wine shop, bazaar US$0.8 every time.
Hong Kong SAR	• On-street parking: US$2 for each 15 minutes or each 30 minutes; off-street parking spaces: the price is decided by the market.
Seoul (Rep. of Korea)	• Grade 1 (US$5.5 per hour), Grade 2 (US$2.7 per hour), Grade 3 (US$1.6 per hour), Grade 4 (US$1.1 per hour), Grade 5 (US$0.5 per hour)

Source: Liu, 2005.

5.3. Conclusion

Most major cities, except Hong Kong, are experiencing high rates of increase in car ownership. In Hong Kong's case, low vehicle ownership and use can be directly attributed to its well-documented restraint policies. The Japanese cities, Seoul and Taipei are between the above two extremes in terms of their restraint of private vehicles. Seoul and the Japanese cities contrast in many ways but their histories of private vehicle restraint have much in common. Both Japan and the Republic of Korea subsequently relaxed their restraints on vehicle ownership and allowed increased motorization. However, some disincentives to vehicle ownership and usage remain in force or have been introduced as congestion has become a greater problem. In addition, there are important legacies of the earlier period of restraint.[18]

The fact that Eastern Asia has lagged behind most developed regions in urbanization rates means that as a whole it still has a high potential for further large increases in urban population. This is rapidly creating large numbers of significant cities in the region, each of them facing considerable challenges and growing pains, including in the arena of urban transport. The Republic of Korea and Japan have been aware of this earlier. In China, Beijing and Shanghai have made the decision to limit private automobile use. The experience of Hong Kong, Japan and the Republic of Korea shows that restraining private motorization, and developing high quality public transport policy must be applied as early as possible.

18. Barter et al, 2003.

6. Freight Transport

6.1. Overview

This chapter focuses on the transport associate with good movement. Despite the global financial crisis, Eastern Asia continued to record a growth in gross domestic product, especially China which retained its rapid gross domestic product growth within the range of 8–10 per cent after the crisis. As the region's economies continue to grow, freight Transport becomes a key urban transportation issue. Goods movement is, in fact, the fastest growing segment of Eastern Asia's transportation sector.

Freight or goods movement is a term used to denote goods or produce transported by ship, plane, train or truck. Table 31 shows the annual domestic freight traffic by mode in Eastern Asia based on the most recent data available. As indicated in the table, road delivery overwhelmingly accounts for most of the domestic good movement in the region, except Hong Kong SAR and Macao SAR, where domestic good movement is limited. Most good movement in these two countries is related to international trading, therefore sea and air logistics are more efficient and practical. The following sections will provide detailed data to illustrate the recent trend of each mode of urban transport related to goods movement.

Table 31. Annual domestic freight traffic by mode (per cent)

Country/ City	Most recent data (year)	Rail	Road	Sea	Air
Japan	**2008**	**30.36**	**64.45**	**5.18**	**0.02**
Tokyo	2007	2.6	72.3	24.9	0.1
Osaka	2008	0.6	75.4	23.9	0.1
China	**2008**	**13.59**	**69.11**	**17.28**	**0.03**
Beijing	2008	8.45	91.10	0	0.46
Tianjin	2008	22.41	49.76	27.82	0.01
Shanghai	2008	1.17	50.66	47.81	0.36
Nanjing	2008	3.97	56.84	39.11	0.08
Hangzhou	2008	2.14	74.60	23.20	0.06
Wuhan	2008	35.01	36.08	28.88	0.03
Guangzhou	2008	14.48	68.47	16.91	0.14
Shenzhen	2008	2.69	71.20	25.84	0.28
Chongqing	2008	3.28	85.75	10.95	0.02
Hong Kong SAR *	**2009**	**0**	**3.0**	**95.6**	**1.3**
Macao SAR *	**2008**	**0**	**4.1**	**57.8**	**38.1**
Seoul (Rep. of Korea)	**2007**	**6.23**	**76.94**	**16.79**	**0.04**

* No domestic freight traffic available.

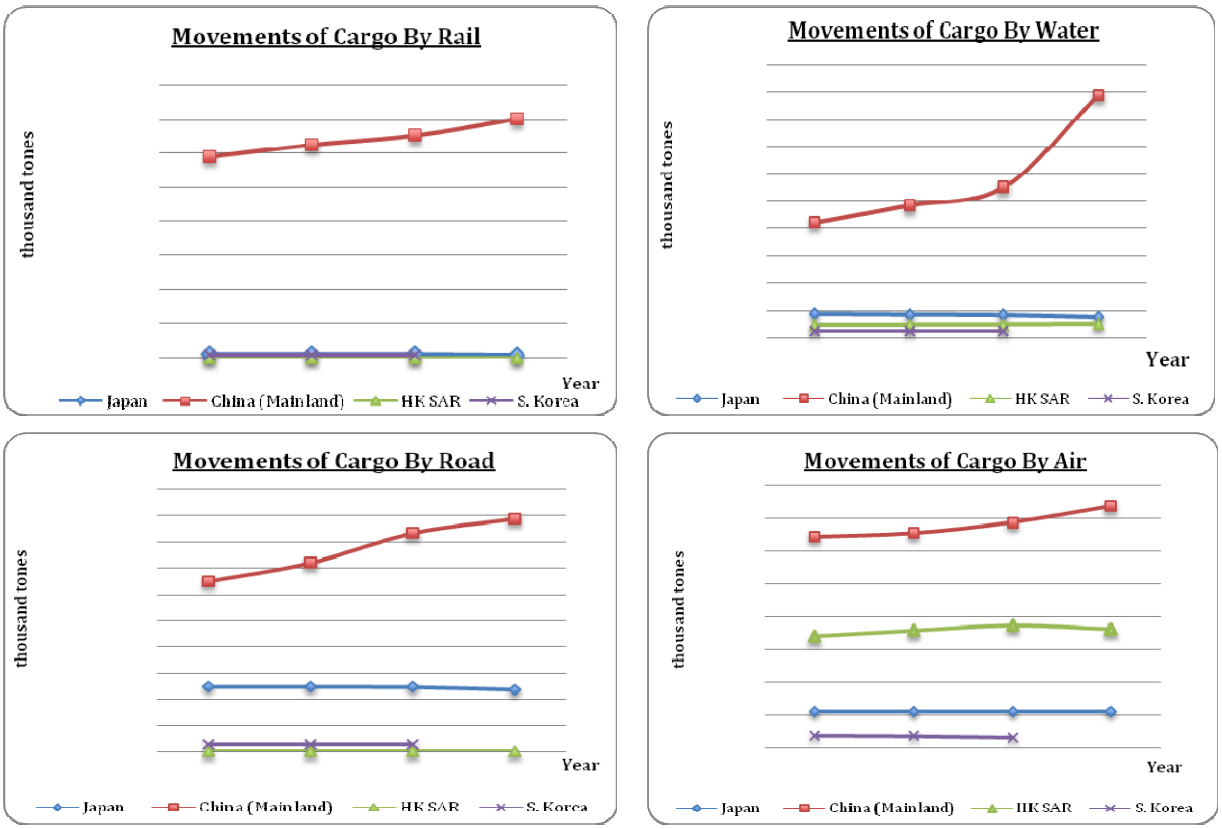
Source: MIAC, undated; National Bureau of Statistics of China, undated; Hong Kong Census and Statistics Bureau, undated; Tokyo Metropolitan Government, 2009; Government Information Bureau of the Macao SAR, 2009; Korea Ministry of Land, Transport and Maritime Affairs, 2009b; Osaka Prefectural Government, 2009.

6.2. Trends and conditions of goods movement transport

6.2.1. Freight transport in Eastern Asia

Figure 22 compares the development trend of four major modes of freight traffic in Japan, China (mainland), Hong Kong SAR, Taiwan and the Republic of Korea between year 2005 and 2008. Comprehensive data is not available for comparison in Macao SAR, DPR Korea and Mongolia.

Figure 22. Freight transport by rail, water, road and air (2005–2008)



Source: MIAC, undated; National Bureau of Statistics of China, undated; Hong Kong Census and Statistics Bureau, undated; Korea Ministry of Land, Transport and Maritime Affairs, 2009b.

China (mainland) has the largest freight traffic in Eastern Asia and experienced the most substantial growth of freight traffic volume in all four modes. Especially in the freight volume by water, China (mainland) recorded a 54 per cent growth in four years. As shown, most goods movement in Japan is facilitated through land transport. However, it has experienced a declining overall cargo volume in the last decade, particularly through land and water transport.

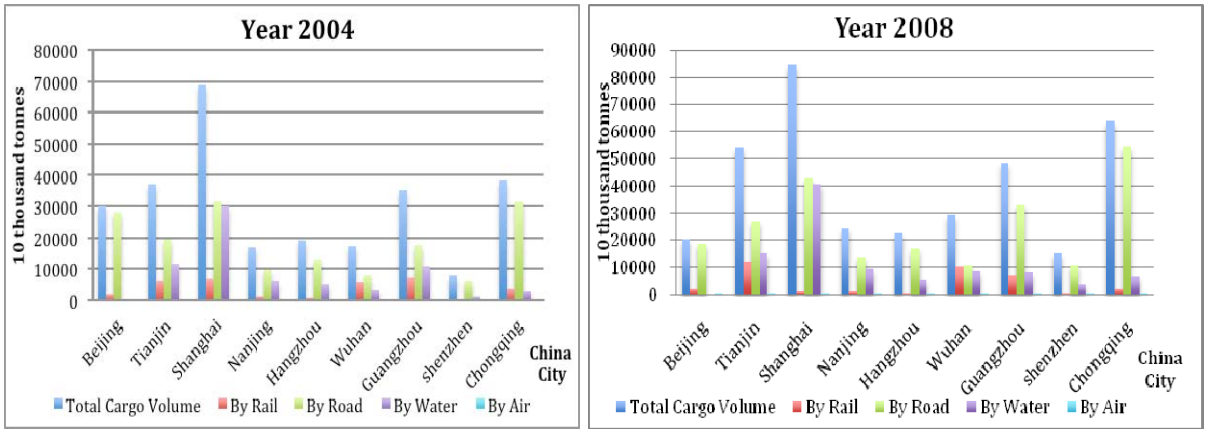
Hong Kong SAR has little domestic goods movement and most data represent the freight movement with other countries. As illustrated, Hong Kong SAR had shifted its freight movement from rail and land, to water and air. According to Hong Kong's MTRC, it had terminated the railway cross-boundary cargo transportation services from 16 June 2010 onwards. As shown, the Republic of Korea recorded a stably increase of freight volume in all goods movement transport mode.

6.2.2. Freight transport in China (mainland)

The previous figures identified China (mainland) as the largest contributor to goods movement traffic in Eastern Asia. Figure 23 focuses on comparing the growth rate of four major modes of freight traffic among nine major Chinese cities. From year 2004 to 2008, road transport continued as the major contributor in freight traffic within the nine cities. Only Shanghai utilized water transport as an important mode of goods movement transport due to its coastal location. The figures also illustrated the growing trend of freight movement traffic by rail in China.

In 2004, Shanghai handled the largest amount of good movement traffic, but by 2008 cities such as Tianjin, Guangzhou and Chongqing had caught up. Within five years, all cities recorded a growth in their freight movement except Beijing, with a decline in rail and air freight traffic. As road and rail goods movement transport continued to increase their modal share in freight movement transport, relevant infrastructures were built to support their growth.

Figure 23. Freight transport volume by mode in Chinese cities (2004 and 2008)



Source: National Bureau of Statistics of China, undated.

6.3. Impacts and challenges of freight transport

In Japan, freight transportation business recorded a slight decline. In year 2008, there was a decrease in freight flow due to a jump in light oil prices and because of the sluggish economy, it dropped for the first time in two years, after the establishment of regulation relaxation (see Table 32). As measures for ensuring security and environmental control are being required, competition is becoming intense, with a foreseeable fare decline trend, and the business conditions of the operators is severe.

Table 32. Quantity (by tonnes) transported by trucks, Tokyo, Japan (2004–2008)

Fiscal year	Total	For business			For private use		
		Medium	Light	Minicar	Medium	Light	Minicar
2004	173,422	90,874	5,989	2,266	54,958	15,593	3,742
2005	172,763	91,285	6,107	2,347	53,484	15,925	3,615
2006	171,883	94,757	6,105	2,460	51,437	13,477	3,647
2007	159,551	87,030	6,021	2,491	48,063	12,685	3,261
2008	151,913	81,717	5,360	2,471	45,431	13,457	3,477

Note. Excluding special-use motor vehicles.

Source: MLIT, 2009.

Comprehensive logistics policies were being pushed forward based on the 'Comprehensive Logistics Policy Outline (2005–2009)' in China. However, in the coming years, there will be various changes to the circumstances surrounding logistics such as further globalization of economic structures, the increasing necessity of global warming measures and increasing demand for ensuring freight security.

To cope with the issues triggered by the above situations quickly and precisely, the government determined the 'Comprehensive Logistics Policy Outline (2009–2013)' via the State Council in July 2009. This outline acts as the basic direction of the measures in three aspects and will comprehensively push forward logistics policies. The three aspects are: 1) the realization of efficient logistics for supporting the global supply chain; 2) the realization of logistics with little burdens on the environment; and 3) the assurance of safe and accurate logistics. Based on this outline, the promotion of low-carbon logistics, through the improvement of regional logistics environment in each Asian country and the cooperation between various related parties such as logistics corporations, shippers, regional public organizations, etc., will be encouraged.

The rising demand for transport and expansion for logistics in Eastern Asia has been particularly reflected in China (mainland). Goods movement transport will continue to play a significant role in urban transport and the mitigation of associated impacts to local communities will become increasingly more important in that equation, particularly with respect to traffic and train congestion along local corridors, streets and railways; and the environmental problem associate with increasing freight traffic by road.

7. Integrated Land-Use and Transport Planning

7.1. Brief overview

This chapter summarizes the trend of integrated land-use and transport planning in Eastern Asia as a tool for transport demand management. Integrated land-use and transport planning, such as TOD (transit-oriented development) is not widely practiced in Eastern Asian cities, however, there are some exceptions, such as Tokyo, Shanghai, Hong Kong, etc.

Historically, TOD-style development were implemented in Tokyo and other Japanese cities, where mass rail transit construction and surrounding residential development are synchronized, leading to high dependency of residents on railway use. Recently, TOD-style development has started around public transport nodes served by mass transit, tram and bus in Beijing, Shanghai and Seoul. Also, Hong Kong has developed a quite distinctive node and corridor urban development form related in particular to the mass transit system. Other Eastern Asia cities may find alternative ways for realizing TOD by a combination of existing systems for seamless travels.[19]

7.2. Strategies for integrated land-use and transport planning

The following will present some examples to explain three typical integrated planning strategies in Eastern Asia.

7.2.1. Tokyo – 'Rail-oriented development' strategy

In Japan, the private rail companies have been keen to venture into real estate developments. For example, housing, shopping centres, entertainment, etc, around stations is used to expand their businesses and ensure maximum use of their rail networks and infrastructure. Associated with these developments has been high land value increases close to stations that has encouraged rail companies to acquire vast areas of land along proposed rail extensions prior to any development.

Tama New Town is such an example and is a joint venture of the Tokyo metropolitan government and the Japan Housing Corporation. It is planned to house 360,000 people in 21 residential areas around a number of new rail stations on the two major rail lines serving the area. Tama centre is the largest station surrounded by office towers, a shopping plaza and nearby residential areas. The Tama District was designed with a number of town centres and housing developments adjacent to rail stations. The stations were on private rail lines extending west out of Tokyo.

The region contains two of the largest rail-oriented new towns: Tama Denin Toshi, a private development, and Tama New Town, a public private partnership development. Tama Denin Toshi has new town centres and housing developments adjacent to most of the 19 stations along the Tama Denin Toshi private rail line which runs through the District. Most suburban rail systems that link transit and new town developments have been privately developed by large industry consortiums. This trend mirrors Japan's lack of land and chronic traffic problems which have seen the need for urban development to follow transit rail lines as the only practical means of transport access to central Tokyo. The national and local government policies in Japan have helped promote the Tokyo metropolitan's region rail-oriented developments.

19. Doi, 2008.

Tama Centre has excellent public transport facilities, including the Keio Sagamihara Line and the Odakyu Tama Line, as well as the Tama Urban Monorail and a network of bus services.[20]

Figure 24. In front of Tama Centre Station

Source: Tokyo Metropolitan Government.

Figure 25. The stations of the Odakyu and Keio lines

Source: Tokyo Metropolitan Government.

The Minami Osawa area acts as the main centre for the western part of the Tama New Town. Development of the infrastructure and facilities necessary for an urban centre is taking place around the station area. A number of universities have come to Tama New Town, including Tokyo Metropolitan University which has established itself in front of Minami Osawa Station. The presence of so many different universities is making Tama New Town an important centre of intellectual exchange. Residential developments in the area attach great importance to scenery for example, Belle Colline Minami Osawa has been designed with a small stream and other arrangements to give residents a sense of relaxation and tranquillity.[18]

Figure 26. The outlet mall La Fete Tama Minami Osawa

Source: Tokyo Metropolitan Government.

Figure 27. Tokyo Metropolitan University

Source: Tokyo Metropolitan Government.

It is notable that one instrument named ‘land readjustment’ has greatly promoted the rail-oriented strategy in Japan. In essence, it is a method whereby an irregular pattern of agricultural land holdings is re-arranged into regular building plots and equipped with such basic urban infrastructure as roads and drains. A percentage of each landowner’s holding is

20. http://www.toshiseibi.metro.tokyo.jp/newtown/e/tama_center.html, last accessed 2011.

contributed to provide land for roads and parks, and to cover the costs of the project – a type of self-financing technique for urban land and infrastructure development that is known as the *genbu* contribution.

Under special legislation adopted in 1954, land readjustment was used extensively in Japan's post-war urban reconstruction process. It is responsible for some 30 per cent of the existing urban area and is commonly referred to as 'The mother of city planning'. Another 1955 law created the Japan Housing Corporation with a view to promoting and carrying out land readjustment for residential areas in metropolitan regions.

Land readjustment also involves a carrot and stick policy: the carrot is a zoning bonus that encourages large-scale projects in 'Urban Control Areas'. If such projects provide their own roads, sewers and other public facilities such as parks, a re-zoning to an 'Urban Promotion Area' is possible. The stick, on the other hand, is that designated 'Promotion Areas' can be downgraded to 'Control Areas' if agreement cannot be reached on a land readjustment project.

7.2.2. Shanghai – 'urban spatial and transport coordinated plan' strategy

Urban spatial plans play a more and more important role in macro control, integrative balance, and supervision and induction. At present, the legislation of city planning is playing a very strong role in China. Shanghai is directly under the jurisdiction of the central government like Beijing, Tianjin and Chongqing. Thus the administration structure is different from that of other provinces. There are more close relations between the urban spatial plan and transport plan in Shanghai. First, the Shanghai Urban Planning Bureau is in charge of the master planning, planning of separate districts and the detailed planning of important districts. A transportation plan is prepared at the almost at the same time. Therefore, the transportation plan is made under the guidance of the urban spatial plan, and meanwhile some useful feedback can be given to the Planning Bureau to improve the plan.

In the Shanghai master plan, the polycentric spatial structure was pursued, that is, to build one city centre with four sub-centres. However, the city plan did not integrate the planning of the city's mass rail transit. As a result, only the city sub-centre in Xujiahui based on Metro Line No 1, came into form, while other city centres originally planned along Metro Line No 2 were not developed. Instead, Humu city was built as a sub-centre in Pudong area. Furthermore, under the influence of mass rail transit-centred transportation system, on the north part of Metro Line No.1, a new Daning commercial centre as shown in Figure 28, is being formed, despite the fact that it was not included in the master plan. The new centre has attracted more passenger flow to the north section of metro line 1 which was previously underutilized.

Originally planned, Pudong New District was designed as the new centre of Shanghai which its transportation system would be environmental friendly and public transit-oriented. Unfortunately, the lack of metro development and careful land use planning has encouraged the use of cars in the area instead of public transport. Learning from this, the city realized the promotion of low carbon transport could only be achieved through the integration of land use and transportation planning.

Figure 28. The development of Shanghai

Source: Tongji University, 2008.

7.2.3. Hong Kong – 'rail +property development' strategy

Hong Kong is a city where more than 90 per cent of journeys are made by public transportation. The concentration of population ensures high ridership on the city's extensive metro system. The Mass Transit Railway Corporation (MTRC) is constructing new projects at a steady pace, like the 4.3-mile South Island Line and a 1.6-mile extension of the Kwun Tong Lineto Whampoa, both of which will open for operations by 2015. All this is being built in the context of relatively high construction prices: The Kwun Tong Line[21] is being constructed at a total cost of HK$5.6 billion (about US$450 million) per mile. How is it able to continue building new metro expansions – and plan for more – when many other cities are being forced to postpone their transit projects due to the recession and the resulting government cutbacks?[22]

The answer is that the MTRC, in association with the local government, has become one of the city's major property developers. MTRC has always relied on the development of properties next to railway stations for its profits (although the rail lines are profitable themselves); many recently built stations are incorporated into large housing estates or shopping complexes. Examples of this type of construction can be seen at Tsing Yi station,[23] which is built next to the Maritime Square shopping centre, and directly underneath the Tierra Verde housing estate.[24] It has used profits from those new housing, commercial, and retail schemes to pay for part of the cost of constructing new subway lines. Along the urban rail lines, the MTRC has funded dozens of new housing projects with 300 to 7,000 apartments each.[25] The metro is operating entirely without subsidies from the local government.

This approach – called 'Rail+Property' by the MTRC – does not involve the city simply handing over development land to the transit agency at no costs (land in Hong Kong is all

21. http://www.mtr-kwuntonglineextension.hk/en/home/, last accessed 24 May 2011.
22. http://www.thetransportpolitic.com/2010/12/14/hong-kongs-expanding-metro-a-model-of-development-funded-transit/, last accessed 3 May 2011
23. http://en.wikipedia.org/wiki/Tsing_Yi_%28MTR%29, last accessed 24 May 2011.
24. http://en.wikipedia.org/wiki/Maritime_Square, last accessed 24 May 2011.
25. http://www.mtr.com.hk/eng/properties/urban_lines_sdd.html, last accessed 24 May 2011.

owned by the government, though it is leased out to private individuals and corporations for long-term periods). Rather, it is expected to pay the government the land costs estimated based on a no-rail scenario. Thus the MTRC is not forced to deal with the problems many agencies face when they use eminent domain to take land, such as escalating values in anticipation of the new transit service. Rather, it is rewarded for the added value it will produce once its new transportation project is completed.

For the South Island Line, the government has agreed to provide the MTRC with development rights to a site at the former Wong Chuk Hang estate. In turn, the transit agency expects the government to pay for less than half of metro construction costs.[26] The rest of the tab will be picked up by the MTRC. This process, which directly associates transit operator with transit-oriented developer, makes the financing and construction of new underground transportation links far simpler than the typical approach, which requires governments to use public tax funds to pay for most of the cost of transit projects. The latter funding mechanism, common in the US and Europe, is politically difficult and financially troublesome, especially in times of increasing budget deficits.

Hong Kong may be a very unique case. It is hemmed in from all sides by natural features – the ocean, mountains, and parks – that force all new development to be quite dense. Similarly, most housing and commercial activities are stuck in the relatively narrow strip of land between the ocean and the mountains. That density and linear concentration removes space for potential transportation infrastructure and limits the amount of walking necessary for anyone who lives along a transit line that follows the rough line of urban landscape; this makes transit work better here than most place. In summary, you have conditions almost ideal for transit-oriented development.

7.3. Conclusions

The ‘rail-oriented development’ strategy has greatly promoted the rapid development of new towns in Tokyo, and solved the commuting problems from new town to central area scientifically. The strategy of ‘urban spatial and transport coordinated planning’ has consolidated the status of the central business district and sub-centres in Shanghai, and consequently optimized the urban structure. The strategy of ‘Rail + Property Development’ in Hong Kong returns the external benefits from real estate developments to the metro enterprise. The strategy has made Hong Kong’s public transport sector to be a self-sufficient system, which is very rare success.

The above three integrated planning strategies are essential to form a transit oriented development pattern. Such kind of transit-oriented development pattern will bring Eastern Asia some good consequences, such as:

- There are strong urban centre and sub-centres, and mixed land-use.
- More resident commuters choose public transport.
- The one-hour travel circle can cover whole city centre by metro.

26. http://www.info.gov.hk/gia/general/201011/30/P201011300265.htm, last accessed 24 May 2011.

8. Social Sustainability of Urban Transport

8.1. Brief overview

With a rapid increase in the number of motor vehicles and lack of emphasis on traffic safety, mainland China has a relatively high fatality rate in traffic accidents when compared with other Eastern Asia countries. However, mainland China has begun taking various measures to reduce the rate in the recent years. Hong Kong SAR, Japan and the Republic of Korea have been the models for other Eastern Asia countries in terms of promoting traffic safety. For many years, they have been taking different efficient measures which include children traffic safety education, severe punishment to traffic accidents and road or vehicle safety performance improvements.

In most Chinese mainland cities, low-income groups face the most serious challenge. First, the increasing housing price around the metro station areas has made housing less affordable for the low-income groups in mega cities, thus compelling the people with less wealth relocating to the suburbs. Second, the proportion of travel fare to disposable income has been increasing for the low-income group. Fortunately, some cities in mainland China (such as Beijing) has begun to spend large amounts of public funding to subsidize public transport, which partially relieve the burden of transport costs for the low-income groups. But bike can also provide the fundamental mobility for low-income people. Currently, Hong Kong SAR and Mongolia have introduced subsidy on public transport for the low-income group.

In terms of barrier-free transport, Hong Kong SAR, Japan and the Republic of Korea have made great achievements. Although many Chinese mainland cities have barrier-free transport facilities, the disabled still find it inconvenient to use them. Some big cities in mainland China (like Shanghai) have realized the importance of barrier-free facilities in the last few years, and they have been striving to improve barrier-free transport or other facilities.

8.2. Policy responses

8.2.1. Traffic safety

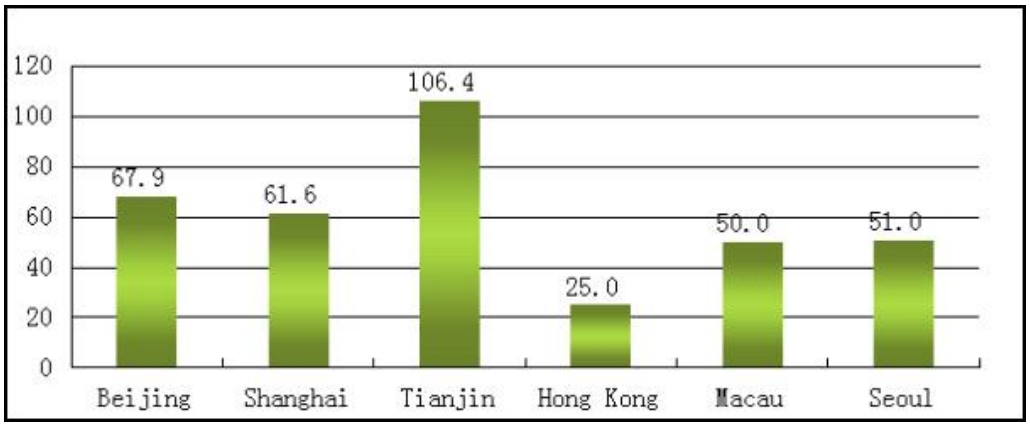
8.2.1.1. Traffic accidents conditions

Figure 29 shows that the fatality rate in mainland China is much higher than in other countries. The total number of automobiles in Chinese mainland cities accounts for 3 per cent of the whole world, however, the fatality number accounts for 16 per cent of the world's.[27] Every year, the number of deaths caused by traffic accidents all of China is more than 0.1 million. The main reasons why traffic safety conditions in mainland China is serious are that, firstly, compared with Japan and other developed countries, mainland China lacks sound traffic safety laws to effectively punish people causing the accidents. Secondly, it fails to arouse enough attention. The whole society is indifferent to traffic safety and has a low quality of traffic politeness. Lastly, roads and vehicles have no enough safety performance.

Although the fatality rate in mainland China caused by traffic accident is higher than other Eastern Asia countries (see Figure 29), this rate has decreased year by year (see Figure 30). The decreasing fatality rate is being achieved due to the introduction of traffic accident control measures in mainland China.

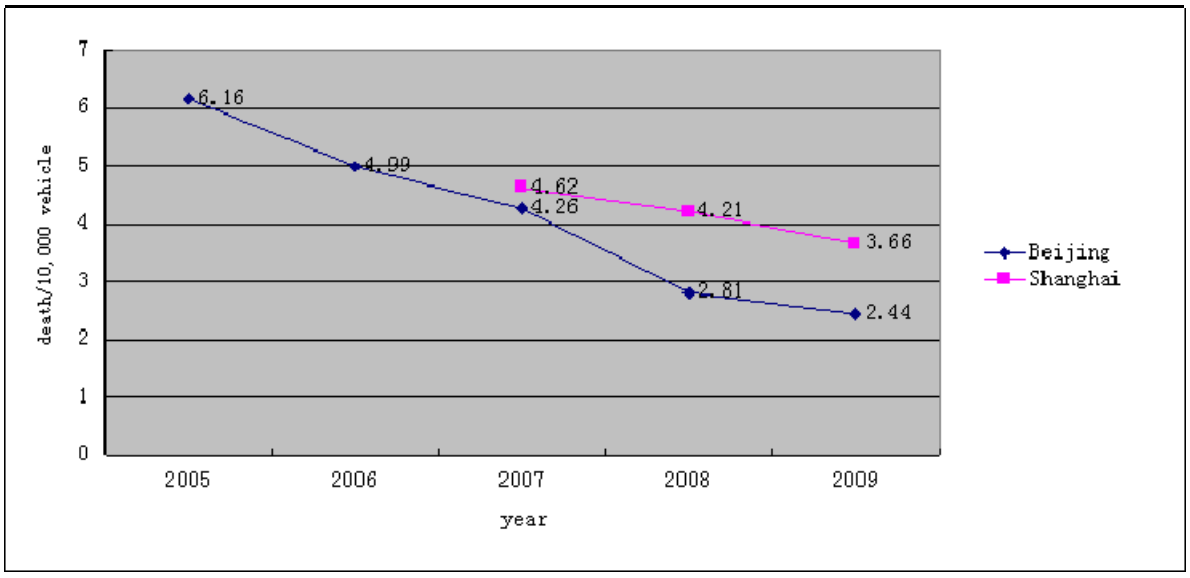
27. Sichuan Transport Information, 2010.

Figure 29. Traffic fatality rates in different cities (deaths per million population)



Source: Hong Kong Transport and Housing Bureau, undated; Beijing City Government, 2005–2010; Shanghai City Government, 2005–2010; TJZB, 2005; Government Information Bureau of the Macao SAR 2002–2009, Korea Ministry of Land, Transport and Maritime Affairs, 2009b, Hong Kong Transport Department, 2010a

Figure 30. Traffic fatality rates in Beijing and Shanghai (2005–2009)



Source: Beijing City Government, 2005–2010; Shanghai City Government, 2005–2010.

8.2.1.2. Traffic accident control measures

In mainland China, Hong Kong SAR, Japan and the Republic of Korea, there are clear speed limits in urban roads and all the above countries have given serious penalty for speeding and drunk driving. In the last several years, drunk driving has caused extremely serious social problems in mainland China. For example, on 14 December 2008, a Chengdu citizen crashed into five cars because of drunk driving, which resulted in four deaths and one seriously injured. The incident alarmed the society to pay more attention to drunk driving and Chinese government has amended relevant laws to increase penalties to drunk driving. According to the regulations of Amendment IX to Criminal Law of People's Republic of China, as long as the driver has been drunk when driving, speeding or exhibiting other dangerous driving

behaviour, even if resulting in no serious consequence, he or she will be still punished by criminal law.

Figure 31. Road safety town programme in Hong Kong SAR

Source: Hong Kong Road Safety Council, 2003.

Another common traffic accident control measure in these countries is the installation of traffic monitoring cameras on urban roads, to check for speeding in accident-prone areas. This system allows for quick identification of accidents.

Moreover, these countries have road safety education. In Japan, various civil society organizations – such as the All Japan Traffic Safety Association, the Japan Automobile Federation and others – conduct comprehensive traffic safety education to different kind of people (including the elderly and children).[28] In Hong Kong SAR, the police operate four road safety towns[29] to provide hands-on training for young pedestrians, and opportunities for the children (as future drivers) to practice and instil the concept of a safe driver. The Republic of Korea police agencies initiate several education-related programmes for improved road traffic safety,[30] and these are life-long programmes. In mainland China, although in primary schools there is some education for traffic safety, this has not functioned well, and has failed to arouse enough awareness.

Each country has taken different control measures based on their different traffic safety problems. For example, the Republic of Korea has enforced fines for unbuckled seat belts, introduced a financial reward system for traffic violation evidence, and applied a road safety inspection system to all roads constructed since 2001.

Japan has established a standard to select locations with frequent traffic accidents. For these spots, it is necessary to make analysis on the reasons why traffic accidents occur, in order to take appropriate measures to improve traffic environment.

In Hong Kong SAR, there are detailed definitions for safety of roads and vehicles. In terms of safe roads, they provide pedestrian facilities, facilities to minimize consequences of car crashes, such as crash cushions and truck mounted attenuators, and road design review, such as black site investigation, mass action to control the same kind of traffic accidents and

28. Beijing Traffic Management Bureau, undated.
29. Hong Kong Road Safety Council, 2003.
30. Yang and Kim, 2003.

anti-skid materials on asphalt pavement. They also have control measures for vehicles, for example, equipping public light buses with safer seats, providing devices to enhance school transport safety and examining vehicle safety performance.[31]

8.2.2. Mobility divided

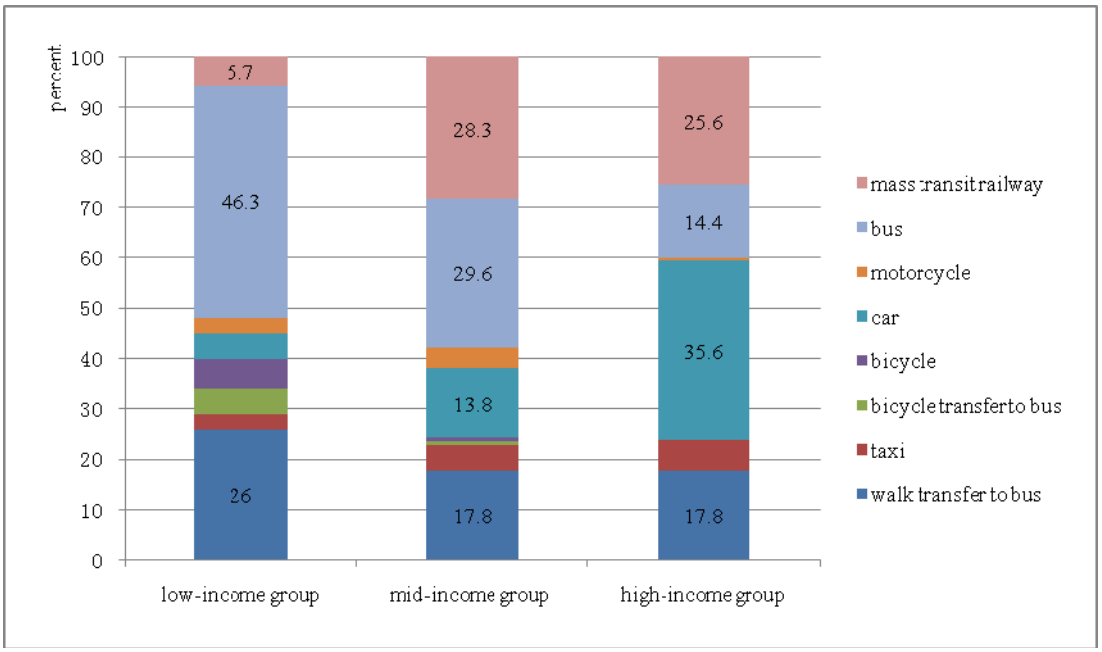
8.2.2.1. Social segregation

Improvements in urban transport facilities greatly enhance mobility. Although urban transport construction plays a positive role in enlarging the opportunity of urban employment and living activities, it could also lead to social segregation.

Even the construction of a metro will have some negative impact on low-income people in Chinese mainland cities. The main purpose of metro construction is to improve travelling conditions for low-income and middle-income groups. However, because of centralization of public facilities around metro stations, the housing prices of areas surrounding metro stations has been increasing rapidly, and as a result most people living in these areas are relatively high-income group. Low-income people mainly live in inner city poor areas or remote suburbs which really sufficient public transport services. From this perspective, improved mobility also segregates urban space and disrupts social distribution equality.

As observed in Figure 32, the mass rail transit modal split of low-income group is far less than the other two groups. On one hand mass transit railway construction has spent a large amount of money with the purpose to improve the traffic condition of the society; on the other hand it has benefited the low-income groups less than other segments of society. The reasons are that the price of a ticket on mass rail transit is relatively high for low-income group and that properties along the metro lines are too expensive to afford. Thus, for these people, the mass rail transit system doesn't provide a more convenient traffic mode. Thus, the expensive

Figure 32. Travel modal split for different social group to the Shanghai city centre



Source: Haixiao, 2008.

31. Hong Kong Road Safety Council, 2003.

construction of mass transit railways may result in serious problems related to social segregation.

The 2006 'Questionnaire on Travel of Urban Residents in Shanghai' selected three peripheral residential areas including Xinzhuang, Sanlin and Jiangqiao as sample areas to investigate their trip characteristics. Analysis shows that 64.5 per cent of high-income respondents spend less than 30 minutes in a trip from rural to central area and only 6.5 per cent of them spend more than 60 minutes (see Table 33). About 40 per cent of medium-income respondents spend less than 30 minutes in a trip and another 40 per cent spend 30–60 minutes. However, 38.5 per cent of low-income respondents spend 30–60 minutes in a trip and 27 per cent spend more than 60 minutes.

Table 33. Travel time from the periphery to the central areas of Shanghai, by income group

Item	Number of respondents	< 30 minutes		30–60 minutes		> 60 minutes	
		No.	% of total	No.	% of total	No.	% of total
High-income	93	60	64.5	27	29.0	6	6.5
Middle-income	280	111	39.6	110	39.3	59	21.1
Low-income	319	110	34.5	123	38.5	86	27.0

Source: Tang, 2006.

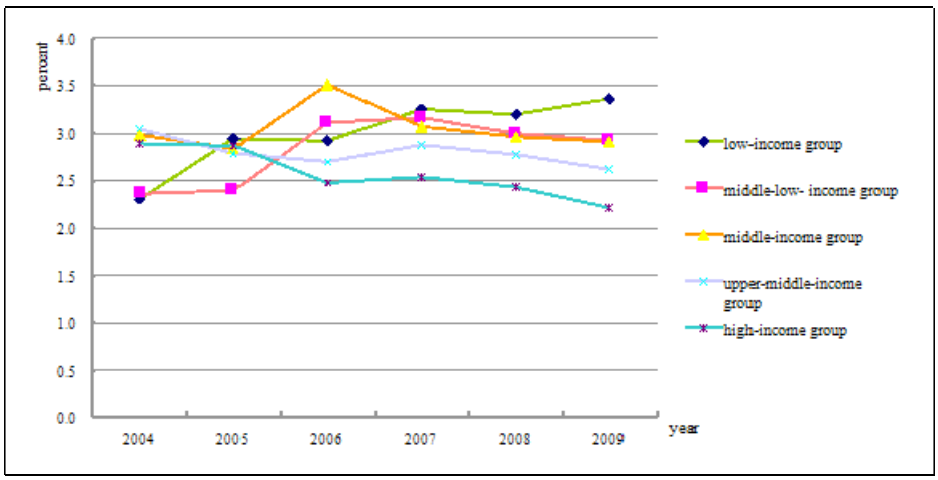
This analysis also shows that 36 per cent of high-income respondents mainly travel by car and 26 per cent by rail transport, and seldom ride bicycles or electric-servo bicycles. 18 per cent of medium-income respondents choose to walk, 29.5 per cent by bus and 28.3 per cent Due to the fact that low-income cannot afford other options, 46.3 per cent of low-income respondents take buses. They seldom take taxis or rail transport, because fees of taxi and rail transport is relatively high, and the other reason is that they live in poor locations with no rail transport to choose nearby.

Mainland China government has not adopted effective policies or measures on reducing social segregation. However, Hong Kong SAR is considered as an example in effectively solving the problem of social housing. Actually, 29 per cent Hong Kong residents live in affordable public housing, many of which are located around mass rail transit stations and convenient in transport. Thus, low-income groups have good access to public transport, which minimizes the problem of social segregation caused by transport.

8.2.2.2. Travel expenditures of different income groups

As illustrated in Figure 33, in Shanghai, the proportion of travel fare to disposable income of low-income and middle-low-income groups is still high, while the proportion of upper-middle-income and high-income groups has gradually declined. Especially for high-income group, this trend is quite obvious.

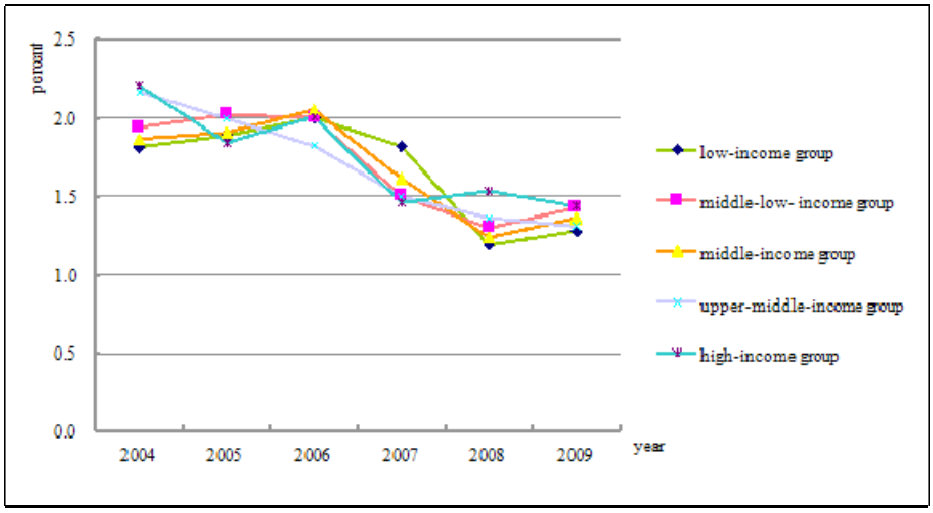
Figure 33. Proportion of travel fare to disposable income of different income groups in Shanghai



Source: Beijing City Government, 2005–2010; Shanghai City Government, 2005–2010.

On the other hand, Beijing has totally different trend (see Figure 34). In Beijing, before 2006, except for upper-middle-income and high-income groups, the proportion of travel fare to disposable income had increased for all income groups. However, since year 2006, that proportion has been dropping by a big margin for all income groups. This situation is mainly caused by the Beijing government's subsidy to transit. In 2010, 12.8 billion Yuan[32] has been spent subsidizing Beijing public transport, much more than other similar megacities, and these subsidies are beneficial to all income groups.

Figure 34. Proportion of travel fare to disposable income of different income groups in Beijing



Source: Beijing City Government, 2005–2010; Shanghai City Government, 2005–2010.

A few cities in mainland China – such as Beijing, Tianjin, and Wuhan – have subsidies for the aged using public transport. In Hong Kong SAR and Mongolia, there are also subsidies for some people. For example, to ease low-wage earners' burden and encourage them to stay in employment, Hong Kong SAR will roll out a 'Work Incentive Transport Subsidy Scheme' to help all eligible employees territory-wide meet part of their travelling

32. Chinese 163 news, 2010.

expenses. The monthly allowance will be pitched at HK$600 per person.[33] Mongolia has provide discounted travel fees by public bus to low-income people, and a 50 per cent discounted rate for students and free travel for older persons and children under the age of 8.[34]

8.2.2.3. Barrier-free transport

Mainland China, the Republic of Korea and Japan are all facing the problem of an aging society. By the end of 2009, the proportion of people who are over the age of 60 years old in Shanghai is more than 22.5 per cent, which is much higher than the average rate 12.5 per cent across the whole country.[35] With the increasing aging population, the demand for barrier-free transport environment continues to grow. In addition, the demand from disabled people is increasing, and as result the construction of barrier-free transport is encouraged. Within the Eastern Asia region; Japan, the Republic of Korea and Hong Kong SAR are leading in barrier-free transport.

In 2006, Japan passed the new accessibility law, which has covered all aspects of barrier-free transport, such as buildings, vehicles, streets, roads, parks, parking facilities, etc. This new law has clearly defined the responsibility of facility manager in construction and improvement of barrier-free facilities, and has enacted relevant standards and regulations. Property owners and operators who violate the law will be fined heavily.

Other Eastern Asia countries – such as Hong Kong SAR and the Republic of Korea – have quite advanced barrier-free transport facilities. What's more, they also have specific regulations to direct the construction of barrier-free facilities. The Hong Kong SAR government has taken a variety of relevant measures to facilitate the access of disabled persons to public transport services. For example, all metro stations provide barrier-free access, with facilities such as lifts, ramps, wide gates, tactile guide paths, etc. The old buses are gradually replaced by low-floor buses, and Hong Kong SAR has installed bus stop announcement systems and other facilities to support the disabled.[36] Wheelchair users can almost go to everywhere by themselves.

The Republic of Korea has implemented a *law to facilitate trips of the disabled, the aged and pregnant women* since 10 April 1998, which demanded that barrier-free facilities should be constructed in parks, public buildings, buses, railways and metros. Since 28 January 2006, another relevant law *mobility improvement law for the disabled* has been in operation to facilitate trips of people who have poor conditions in transport. It clearly declaims that barrier-free facilities should be installed in buses, metros and roads to improve traffic condition for those people.

Mainland China has *Codes for Design on Accessibility of Urban Roads and Buildings (JGJ 50-2001)*, and it has defined barrier-free facilities for urban roads, bridges and interchanges. But most Chinese mainland cities don't put enough emphasis on barrier-free facilities. The existing barrier-free facilities are neither standard nor systematic. At the same time, the facilities often lack management and are not well-utilized.

Shanghai is one of model cities in barrier-free facilities construction in mainland China and its central area has relatively complete barrier-free facilities in primary public facilities and pubic space, especially for barrier-free transport in central area's roads and public transit hubs. Shanghai has made great achievements in establishing barrier-free facilities in metro

33. Hong Kong Labour and Welfare Bureau, 2010.
34. UN, undated.
35. Tongji University, 2011.
36. Lai, 2010.

system. Since the world expo in 2010, Shanghai has significantly improved its overall barrier-free environment. But Shanghai has also common problems in barrier-free facilities like the other Chinese mainland cities, such as lacking appropriate connection and management, which has directly resulted in low efficiency of using barrier-free facilities.

Figure 35. Barrier free facility at metro station entrance in Shanghai

Source: Authors.

Figure 36. Slope in urban road curb in Hong Kong SAR

Source: http://www.pof.org.hk/new/s247_content.php?id=227&type=&display=20.

8.3. Challenges for future policy development

The population suburbanization is a new trend in urban development in mainland China, while this phenomenon has already existed in Japan and the Republic of Korea for many years. As cities are getting larger and larger, low-income people have to spend more money in transport. At the same time, suburbanization has brought up another problem, namely that low-income group and high-income group are isolated from each other in living space. Particularly in mainland China, urbanization has just begun to speed up, and there will be a huge number of rural populations moving to the cities in the years to come. If different income groups are segregated, many social problems will arise. Thus, the mainland China government needs to cope with challenges of social segregation by urgently enacting effective policies to resolve problems that low-income group are segregated from high-income group in space, and how to help them reduce travel cost and travel time. Although Beijing has huge subsidy in public transport for all Beijing residents to reduce their expenditure in transport, high transportation cost remains a concern for low-income people in many mainland Chinese cities. More effective policies should be made in response to this.

Population aging in China, Japan and the Republic of Korea has made barrier-free transport an important concern. Japan, the Republic of Korea and Hong Kong are experienced in construction and management of barrier-free transport facilities and are leading the world. They have enacted a series of laws to ensure that disabled can travel in city with ease. Although the Chinese government has passed relevant laws and regulations to enforce the construction of barrier-free facilities, their design and management are yet to be improved.

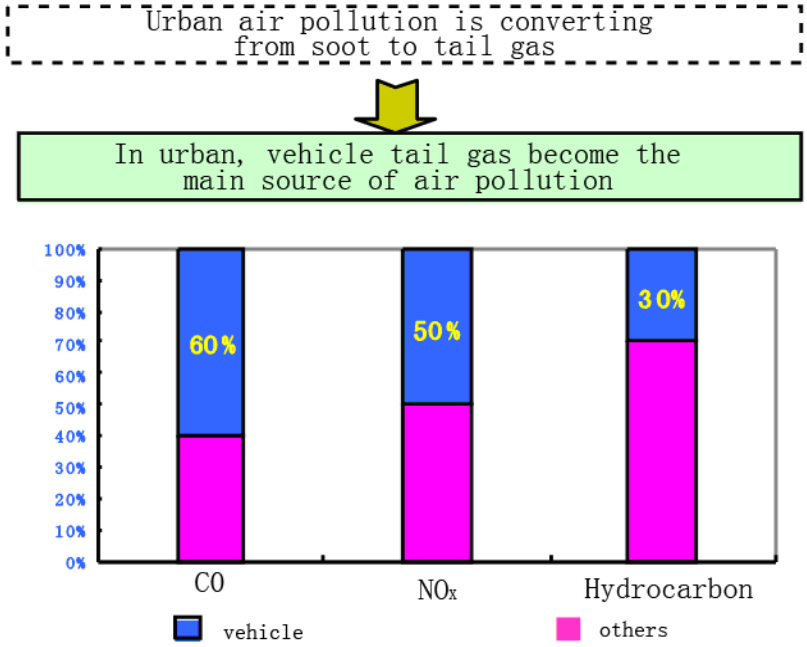
9. Urban Transport and the Environment

9.1. Brief overview

Along with the rapid urbanization and motorization, vehicle emissions have created serious environmental problems, especially air and noise pollution. Although private vehicles bring convenience to daily life, the booming of private vehicles usage could worsen the pollution in many Eastern Asia countries. Pollutions created by urban transport have not only caused high economic and environment cost, but have also threatened public health. According to the 'China Human Development Report 2005', 16 of the world's 20 top polluted cities are in China.[37]

Tail-gas from motor vehicles is considered a main contributor to air pollutions. Based on the most recent data, 60 per cent of the CO, 50 per cent of the NO_x and 30 per cent of the hydrocarbons are produced from vehicles' tail gas in China (mainland) (see Figure 37).

Figure 37. Sources of air pollution in China, a comparison between vehicle and others



Source: Zuo, 2009.

9.2. Current environment impact

In China, the main air pollutants are particulate matter (PM), CO_2, SO_2 and NO_2. As the economy developing rapidly, motorization also increased fast, and, as a result, emissions of greenhouse gases and other pollutants increase year by year.

Data from China's State Environmental Protection Agency and Health Ministry shows that about 79 per cent air pollutants are from automobile pollution. The study found that automobile pollution has hundreds of compounds, such as PM, CO, HC, NO_x, SO_2, which are harmful to humans.

37. UNDP, 2008

In 2009, CO emission from motor vehicle was 40.188 million tonnes, HC 4.822 million tonnes, and PM 0.590 million tonnes. Automobiles were the main contributor, which accounted for 70 per cent of the CO and HC, more than 90 per cent of NO_x and PM. In economically developed cities – such as Beijing, Shanghai, and Guangzhou – CO, NO_x, PM discharge by auto vehicles amount to 80 per cent, 75 per cent, 50 per cent respectively of total emissions. The automobile pollutants have become the biggest source of air pollution. According to a scenario analysis recently, in 2030, the Chinese energy consumption and CO_2 emission will be twice of those in 2005. During the same time, energy consumption and CO_2 emission from transportation will have increased 3–4 times. Thus, controlling carbon emission from transportation is very important for Chinese future carbon emission reduction.

As indicated in Table 34, the Republic of Korea has better air quality than China.

Table 34. The air quality index of major cities in China and the Republic of Korea

City	Year	Milligrams of pollutants per cubic metre of air		
		PM	SO_2	NO_2
Beijing	2008	0.123	0.036	0.049
Tianjin	2008	0.088	0.061	0.041
Shanghai	2008	0.084	0.051	0.056
Nanjing	2008	0.098	0.054	0.053
Hangzhou	2008	0.11	0.052	0.053
Wuhan	2008	0.113	0.051	0.054
Guangzhou	2008	0.071	0.046	0.056
Chongqing	2008	0.106	0.063	0.043
Seoul	2004	0.061		0.037
	2005	0.050		0.028
Incheon	2004	0.062		0.028
	2005	0.061		0.025

Source: National Bureau of Statistics of China, undated; Korea Ministry of Environment, 2005

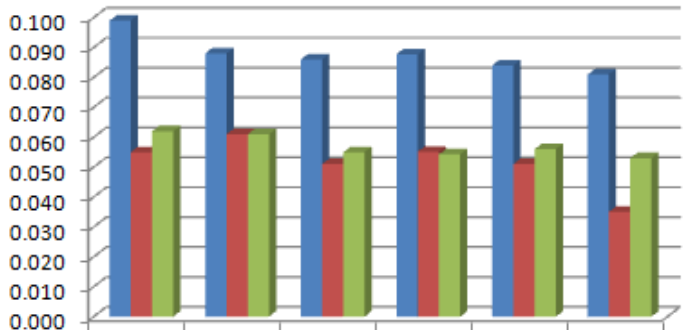
CO_2 emission per capita in China has increased dramatically in the last few years due to rapid urbanization and motorization. Table 35 and Figure 38 show the change of air pollution in Hong Kong SAR and Shanghai.

Table 35. Greenhouse gas emissions in Hong Kong SAR by sector

Year	Greenhouse gas emissions (in thousand tonnes of CO_2-equivalents)	
	Transport	Total
2004	7,640	39,800
2005	7,480	42,000
2006	7,480	42,300
2007	7,380	43,300
2008	7,350	42,000

Source: Hong Kong Environmental Protection Department, 2009.

Figure 38. Results of monitoring the major air pollutants in Shanghai (mg/m³) (2004–2010)

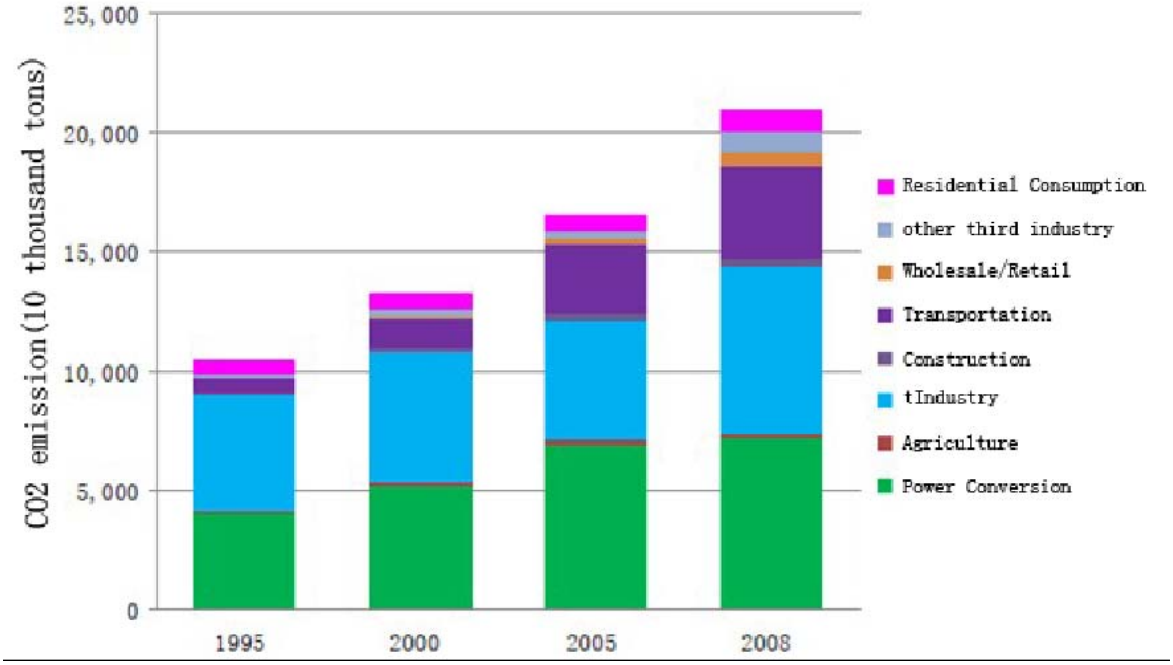


	2004	2005	2006	2007	2008	2009
PM	0.099	0.088	0.086	0.088	0.084	0.081
SO2	0.055	0.061	0.051	0.055	0.051	0.035
NO2	0.062	0.061	0.055	0.054	0.056	0.053

Source: National Bureau of Statistics of China, undated.

In 2005, it was calculated that the amount of CO_2 emitted from urban transportation in Beijing and Shanghai was 7.640 and 7.410 million tonnes respectively.[38] Within these CO_2 pollutions, 7.0 per cent and 4.6 per cent of them were emitted by motorized vehicles respectively for Beijing and Shanghai. Furthermore, greenhouse gas emission from transportation has increased rapidly, and has reached one fifth of Shanghai's greenhouse gas emission (see Figure 39).

Figure 39. CO_2 emission by sector in Shanghai



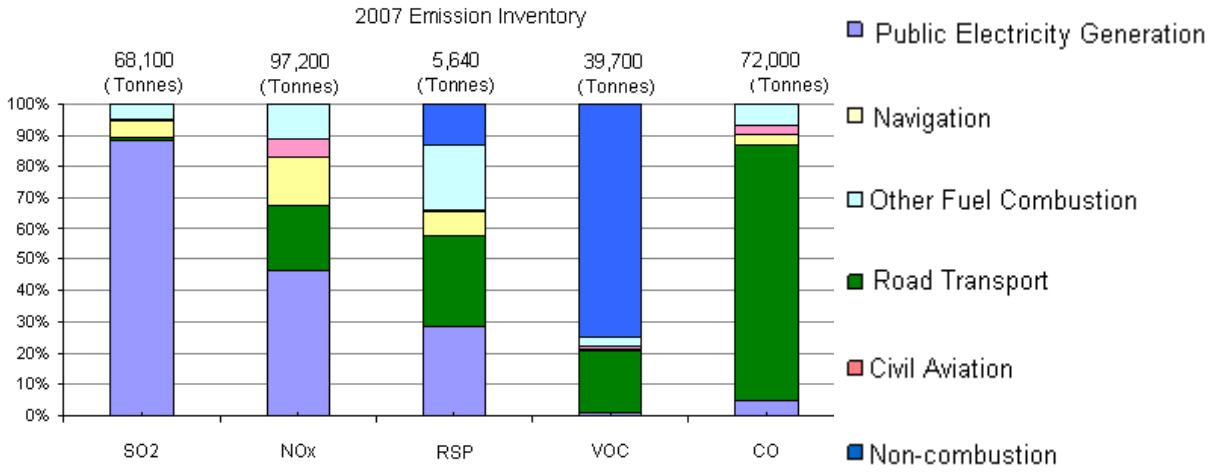
Source: Shanghai Environmental Protection Bureau, forthcoming.

38. Urban traffic energy consumption and greenhouse gas emission comparison between Beijing and Shanghai.

Transportation is high energy consuming and high emission. Restricting the use of motor vehicle will be an important strategy to reduce emission of CO_2 and other air pollutants.[39]

Figure 40 shows the emission inventory in China (Hong Kong SAR) for 2007 under different source categories including public electricity generation, road transport, navigation, civil aviation, other fuel combustion sources and non-combustion sources in Hong Kong. As the figure further indicates, emission from road transport is the primary source of CO. It was recorded road transport contributed to 82 per cent of total CO emission in 2007.

Figure 40. Pollution emission inventory of Hong Kong (2007)



RSP= Respiratory suspended particulate; VOC= Volatile organic compounds.

Source: Hong Kong Environmental Protection Department, 2009.

9.3. Environmental friendly transport policies

In order to discourage automobile dependency, some cities in Eastern Asia have started to adopt transportation demand management measures. Seoul introduced congestion pricing at Namsan Tunnels, resulting in an increase in occupancy of buses and subways. Therefore, average vehicle speed in the downtown area has also improved. Many cities are adopting a park-and-ride system to promote a modal shift to public transport.

Improvements in emission control are among the main challenges to mitigate air pollution in most Eastern Asia cities. A number of measures to strengthen vehicle inspection programmes are being pushed forward in a number of cities. In China, green management initiative of auto vehicle includes three parts:

- **Green management initiative for auto vehicle production:** Since 1983, Chinese standards on vehicle emission are being highly developed. In 2000, state standards on vehicle emission were introduced, and later revised in 2004 and 2007. And duty-free or low duty rates were applied for low pollution vehicles.
- **Green management initiative for auto vehicle usage:** Auto vehicles have to take periodic examination. A green license was applied in Shanghai. A car without a green license is not allowed to drive in the city centre.
- **Fuel management for auto vehicle:** Up to 2009, fuels for auto vehicles had two important reforms: using lead-free and low sulphur petroleum.

39. Shanghai Environmental Protection Bureau, forthcoming.

On the other hand, public transport largely relies on buses using low-quality fuels in many Eastern Asia cities, leading to further air pollution. Promotion of cleaner fuel for buses and motor vehicles has been undertaken in major cities.[40] As indicated in Table 36, Eastern Asia countries make a number of environmentally friendly transport policies in order to protect the environment, and reduce pollutants emission. The main strategy is restraint of auto vehicles usage and encouragement of public transport or low-speed travel modes.

Table 36. Environmental friendly transport policies by country

Area	Environmental friendly transport policies
China (mainland)	• Impose fuel oil tax, encourage metro and bicycle, new energy automobiles; • Implement license auctions in Shanghai; • Congestion pricing (under discussion); • Restrict high-pollution vehicles in some districts. • China mainland enforce the State III emission standards for light vehicle in 2007; and • Shanghai enforced the State IV emission standards for light vehicle in 2008.
Mongolia	• Execute the new Excise Duty Tax Law of 2006; • Establish new standard 'MNS 5012:2008'; • Establish the Law on Road and Transportation; • Establish over 24 auto diagnostic inspection centres in all *aimags* (provinces) and big cities.
Hong Kong SAR	• Impose fuel oil tax, toll charge; • Integrate land-use and transport planning to reduce the need for travel; • Maximize rail usage, restraining the growth and usage of vehicles.
Republic of Korea	• Continuing mass rail transit investments; • Transport demand management (congestion fees in Seoul); • Public transit reform in Seoul and its integration to other Seoul metropolitan area; • Continuing the 'Special Accounts of Transportation Facilities' using fuel tax.

9.4. Conclusion

The evidence in this chapter suggests that an earlier decision to prioritize public transport and non-motorized transport investments over private transport-oriented investments can bring long-term benefits. The benefits include less pollution and better traffic environment. For example, Hong Kong develops public transport extensively, and discourages private motorized transport through the high costs imposed. Therefore, transport pollution is comparatively less than in other major cities of China. The more balanced transport systems is particularly important for cities that are already large and dense, since dense cities are particularly vulnerable to the negative impacts of traffic.[41]

40. Yoshitsugu et al, 2004.
41. Barter, 2000.

10. Economically Sustainable Urban Transport

10.1. Overview

Despite the global financial crisis, most Eastern Asia countries continue to experience both rapid urbanization and improvement of household incomes, which have induced an increasing travel demand and motorization respectively. As demonstrated in the previous chapters, the increasing travel demand is being met by the multiplication of different transportation modes and related infrastructures. At the same time, more private vehicles were produced to meet the travel demand of individuals who can afford the cost. However, it has been proved that the increase of private vehicles not only increases city traffic congestion, but also imposes environmental problems as presented in the previous chapter. Therefore, public transportation prioritization, encouraging bikes and walking is considered as a solution to meet the increasing travel demand sustainably.

However, the financing of public transportation has been the biggest obstacle to its expansion. Public transportation is usually treated as a public service and most Eastern Asia cities have suffered deep deficits from it. Many countries in the region implemented transportation policy reforms in the past decade to strive for a balance between social equality and economic sustainability in their public transportation system. As shown in chapter 3, only Hong Kong made a profit in public transport. The city treats public transport as a model of business. Government's role in transit is that of a 'regulator,' who impassively maintain a fair competition between the different modes of transportation.

This chapter uses Hong Kong SAR as a successful example to illustrate how public transportation can be profitable and indicates its negative impacts. In addition, some examples are selected to describe how public transport can be a huge financial burden on the government and outline some policies which China mainland is undertaking in response to improving the financial viability of public transportation projects. The policies include exploring different funding strategies to build and operate the public transportation system, such as 'public-private partnerships', 'build and transfer', 'build-operate-transfer', 'transfer-operate-transfer', 'build-own-operate' or consortium loans.

10.2. Current finance system and policy responses

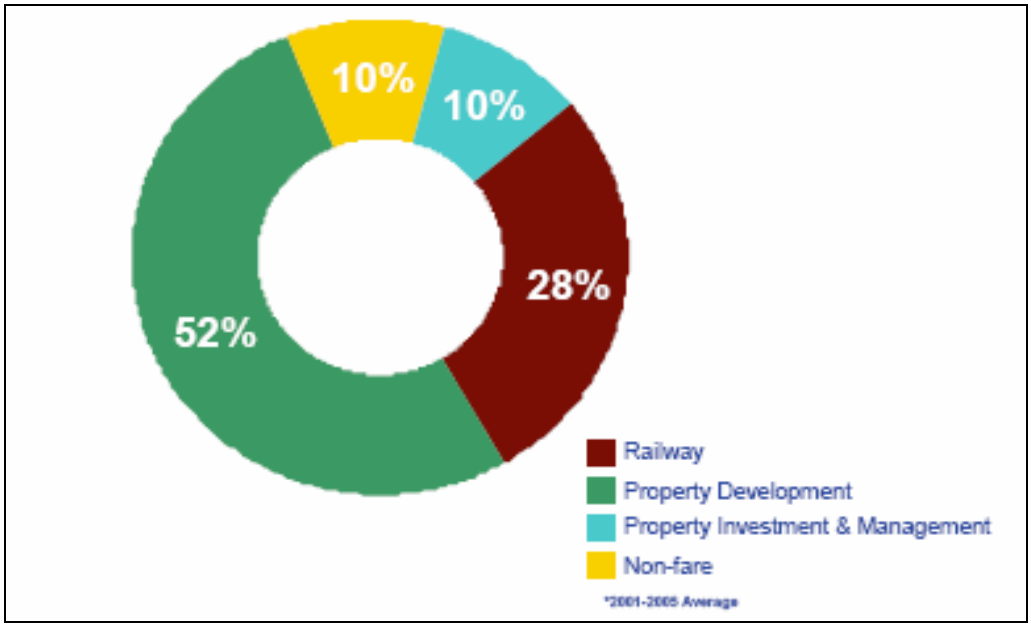
10.2.1. Hong Kong SAR[42]

Compared to the rest of the region, public transport in Hong Kong SAR is a profitable system, which requires no cash subsidy from the government. In Hong Kong, the new railway lines were built, owned, operated and managed by the MTRC with the Hong Kong government as the major shareholder. MTRC receives an in-kind contribution in the form of a land grant that gives the company exclusive development rights for land above and adjacent to its stations instead of receiving cash subsidies from Hong Kong government.

During the 2001–2005 period, property developments produced over half of MTRC's revenues. Figure 41 shows the revenue sources of MTRC between 2001 and 2005. By contrast, railway income, made up mainly of farebox receipts, generated 28 per cent of total income. Together, MTRC's involvement in property-related activities – i.e. development, investment, and management – produced 62 per cent of total income, more than twice as much as user fares. The 10 per cent non-fare is income generated from advertisement, ownership of other assets (e.g. telecommunication leases, convenience retail shops).

42. Cervero and Murakami, 2008.

Figure 41. MTRC revenue sources, 2001–2005 average



Source: Cervero and Murakami, 2008.

MTRC purchases development rights from the Hong Kong government at a 'before rail' price and sells these rights to a selected developer (among a list of qualified bidders) at an 'after rail' price. The differences are often substantial, easily covering the cost of railway investments. The Hong Kong government, the majority shareholder of MTRC, seeds the process by granting MTRC exclusive development rights based on the 'greenfield' site value (i.e. pre-rail price). MTRC also negotiates a share of future property-development profits and/or a co-ownership position from the highest bidder. Thus MTRC receives a 'front end' payment for land and a 'back end' share of revenues and assets in-kind.

10.2.1.1. Shanghai

Shanghai has experienced many reforms in the **bus system**. However, none of them were successful to turn the system into a profitable one. Before 1996, the government made lump-sum subsidies. Under the most recent system, the government gives bus operators money for individual projects such as free riders for senior citizens, bus upgrades and route planning. In 2009, it received 3.7 billion RMB (US$564.2 million) in subsidies for the bus service due to the world expo. Although the subsidy remains a high price tag, the subsidy under the current system is more efficiently used to ensure the overall quality of bus service.

The **rail-based public transport system** is constructed with government's investment (42 per cent of financing comes from revenue and 58 per cent comes from government loan provided by banks), but operated by Shentong Rail Company. Line One is a joint-stock company. The urban rail fare structure is distance-based that the basic fare is 3 yuan within a distance of 6 kilometres then the fare increases 1 RMB per 10 kilometres. Passengers can either purchase a single ticket or use transit integrated circuit card. As the urban area expands, more and more passengers need transfer to reach destination. From 25 December 2005, a discount is given when transfer is made between lines. Since the ticket price is artificially low, no revenue is made. The Shanghai government provides a subsidy of 200–300 million RMB (US$30.5–US$45.7 million) every year.

In response to the deficits of rail operation, the Shanghai government has not only expanded its mass rail transit system substantially in the recent years to capture more ridership, but has also put more emphasize on intensifying the land use around metro stations.

Shanghai is one of the rare cities which implement a different price system for taxies during daytime period (5am–11pm) and night time period (11pm–5am) to improve the profitability of taxi. However, the revenue is not sufficient to cover the operating cost. In 2009, Shanghai government provided 0.25 billion to subsidize the taxi system. [43]

10.2.1.2. Beijing

Due to the increasing traffic congestion in the city, the Beijing government has implemented a new subsidy measure: a revolutionary step in Beijing's public transportation planning which aims at reducing private car use. In 2009, 1.3 billion yuan (US$167 million) was provided to help Beijing's **bus** companies reduce fares to only 1 yuan (US$0.13) per ride. Passengers and students using the 'smart card', an electronic debit card can get 60 per cent and 80 per cent off respectively. However, the aggressive reduction of fares has only attracted the increase ridership of existing users, without persuading car drivers to move to public transport. Therefore, the deficits of bus operation have been deepened in the recent years.

For four decades, Beijing government is the sole controller of its metro system. Because of the low flat rate, Beijing **mass rail transit** has suffered from deficits and the government has been exploring new financing strategies to its mass rail transit construction and operation. Some 150 million RMB of subsidies were recorded in 2009. In 2006, the construction of Beijing Metro Line 4 (BJL4) marked mainland China's first public-private partnership arrangement for the development and operation of metro systems. It would be built though a public-private partnership between the Beijing Capital Group, Beijing Infrastructure Investment Company Limited and Hong Kong's MTRC. This project is under a 30-year operating franchise, the 'build-operate-transfer' contract allows Hong Kong MTRC the opportunity to integrate its expertise into building and operating the metro in China, which helps to reduce the burden of government investment in the metro.

10.2.1.3. Republic of Korea[44]

For decades, **bus services** in Seoul were operated primarily by private firms. Most private firms sought only to maximize the profits while disregarding the bus quality which led to a decrease of bus ridership. By 2002, local government subsidies was needed to cover the operating deficit of US$65 million, on top of US$66 million in capital subsidies for investment in new buses. A bus reform took place in year 2004 in which a 'semi-public operation system' was introduced. It retains private bus firms to operate, but increased the power of the Seoul metropolitan government to control bus routes, schedules, fares and overall system design. The government began to reimburse bus firms on the basis of 'vehicle kilometres of service' instead of passenger trips. This reform was intended to improve service quality; and cut down on speeding, reckless driving, and discrimination against the elderly and disabled.

In contrast, the investment in **mass rail transit** has shifted from national government to private entities. The total construction costs of the Phase 1 (between 1971 and 1994) and Phase 2 (between 1990 and 2000) in the Republic of Korea are estimated at 120 trillion won (US$110 billion). Both phases were financed by the national government and were considered

43. SCCTPI, 2010
44. Bhang, 2003; Pucher et al, 2005.

as a heavy burden on the central government. Starting from 1991, the national government revised its subsidy policy which it contributed 30 per cent (25 per cent in Seoul) towards the cost of constructing mass rail transit systems by regional autonomous bodies. This amount was increased to 50 per cent (40 per cent in Seoul) from year 1998. More recently, the government has started to refuse to provide financial support if the local government does not contribute at least 50 per cent of the construction costs. In 2007, Seoul – which runs its eight existing metro lines by local administration – signed the first contract with Veolia Transport (a private operator) to entrust its operation of its ninth metro line. This line is a consortium which 80 per cent of the line is owned by Veolia and 20 per cent by Hyundai-Totem (a subsidiary of Hyundai).

10.3. Challenges and policy response

Although public transport is financially viable in Hong Kong SAR, the public transport spending of household is the highest in the region. According to the household expenditure survey, public transport is the third largest expenditure for households in Hong Kong SAR, amounting to approximately 9 per cent of the total household income. To alleviate the burden of transport cost on households, policies are being proposed to government in subsidizing public transport cost for the low-income groups who are also long-distance travellers. However, a decision on how long-distance travellers should be subsidized is still under discussion.[45]

10.3.1. China (Mainland)

Among all urban transport modes, mass rail transit systems have the highest fixed costs. Therefore, mass rail transit in China (mainland) is usually treated as a social benefit which most systems are publicly owned, by local governments, transit authorities or national governments. Investments are often financed by taxation, rather than by fare revenue. China is undertaking many researches to adopt public-private partnerships for urban rail. However, government's ownership and control of land is one obstacle to the partnership. Unlike Hong Kong MTRC who receives the right of land development around the station, private companies in China cannot own the land development right, which reduces the profitable model which Hong Kong MTRC adopts.

Despite the obstacles, the funding source and strategy for mass rail transit in China (mainland) has become more diversified since 2001. Table 37 illustrates the different types of financial methods and sources of constructed rail in some cities in China (mainland).

Table 37. Summary of financial cost, method and source of constructed rail in China (mainland)

Cities		Financial method	Financial source
Beijing	Line 1, 2	Public owned	Local government
	Line 4	Public-private partnership	Beijing Infrastructure Investment Company Limited:2%; Beijing Capital Group: 49%; Hong Kong MTRC: 49%
	Line 9	Design-build-finance-operate	Government: 70%; Private entity: 30%
	Line Olympic	'Build and transfer'	Built by China Railway and bought by local government

45. China Daily, 2011.

Cities		Financial method	Financial source
Shanghai	Line 1	Consortium loan	City government + foreign Investment
	Line 2	Consortium loan	Foreign loan: 1/3; city government: 1/3; local government:1/3
	Line 3	Consortium loan	Foreign investment: 18.7%; local bank loan 49%; government direct investment:32%
Guangzhou	Line 1	Consortium loan	Foreign loan; local bank loan; government direct investment
	Line 2	Consortium loan	Government: 60.35%; commercial banks: 39.65%
Shenzhen	Line 4 (1st phase)	Public owned	Government: 70%; commercial banks: 30%

Source: Beijing Welfare Investment Consulting Company, 2009.

11. Urban transport institutions and governance

11.1. Urban transport institutions

This section summarizes the transport institutions in China mainland, Hong Kong SAR, the Republic of Korea and Japan and is presented in two parts: 1) the organizational structure and management functions; 2) the organizational structure and the management function of mass rail transit.

11.1.1. Organizational structure and management functions

Table 38 presents three different transport management models which are in operation in different Chinese cities.

Table 38. Three transport management models in China mainland

Model types	Model 'A'	Model 'B'	Model 'C'
Management system model	Multiple regulations on transportation by Urban Transport Bureau, Municipal Engineering Bureau, Urban Construction Department, Police Security Bureau, etc.	Overall regulation on urban and rural transportation	General regulation on transportation
Examples of cites	Kunming, Chengdu, Fuzhou, Nanning	Shenyang, Harbin, Hangzhou, WuLuMuqi, Xining, Changsha and Lanzhou	Beijing, Shanghai, Guangzhou, Chongqing, Shenzhen and Wuhan

Source: Zhou and Szyliowicz, 2005.

In model 'A', urban transportation is managed by Urban Transport Bureau, Municipal Engineering Bureau, Urban Construction Department, and Police Security Bureau respectively. The Urban Transport Bureau is responsible for the regulations on highway transport, construction of highways, and water transport; the Municipal Engineering Bureau takes responsibility for the regulations on buses and taxies; the Construction Department takes responsibility for the planning and construction of road; while the Police Security Bureau regulates the transport operation safely and smoothly.

In model 'B', only the Urban Transport Bureau regulates urban and rural transportation. In addition to highway plan and construction and water transport regulation, the Urban Transport Bureau is responsible for the overall regulations on highway transport, urban transport, buses and taxies.

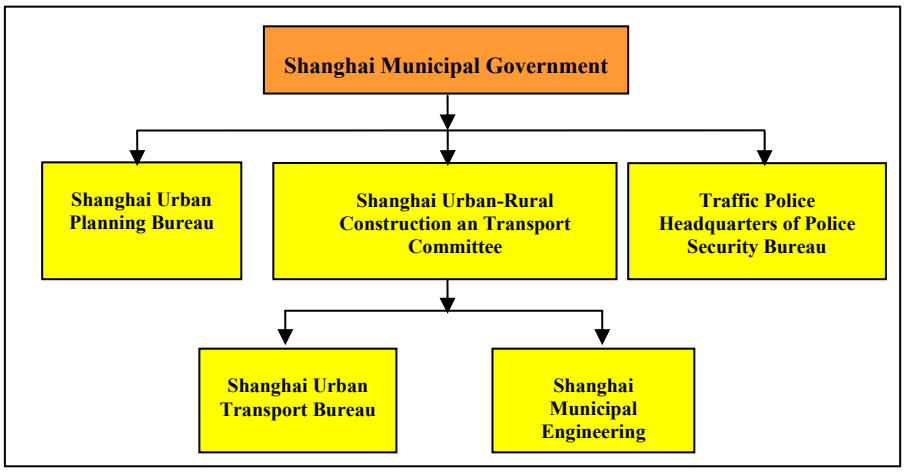
In model 'C', only one department, usually named Urban Transport Commission under the municipal government, is responsible for the regulations on transport plan, highway (highway and urban roads), water transport, public buses, taxies, urban railway, air transport and other transports. For example, Shanghai Urban-Rural Construction and Transport Committee is comprised of two organizations, Shanghai Urban Transport Bureau and Shanghai Municipal Engineering Bureau. They are responsible for general regulating on transportation.

The tendency of administrative system reform on Chinese transportation can be divided into three areas: integrate and uniform management on transportation; set up a perfect and

unified professional administrative system of transportation; divide powers between the central and local governments reasonably.

Take Shanghai as an example, urban transportation is managed by Urban Planning Bureau, Urban-Rural Construction and Transportation Committee and Traffic Police Headquarters (see Figure 42). The Urban Planning Bureau is responsible for coordinating various specialized planning including transport planning and formulating transport development strategies and transport planning; Urban-Rural Construction and Transportation Committee is divided into Shanghai Urban Transport Bureau and Shanghai Municipal Engineering Bureau, the former one formulates policy guidelines as to industry criteria and nourishes the transportation market, and the latter one take responsibility for constructing, maintaining administration for urban roads and bridges; Traffic Police Headquarters of Police Security is responsible for managing road traffic, promoting streets public security order, administering motor vehicles, non-motor vehicles and all the vehicle drivers and preventing road traffic accidents.

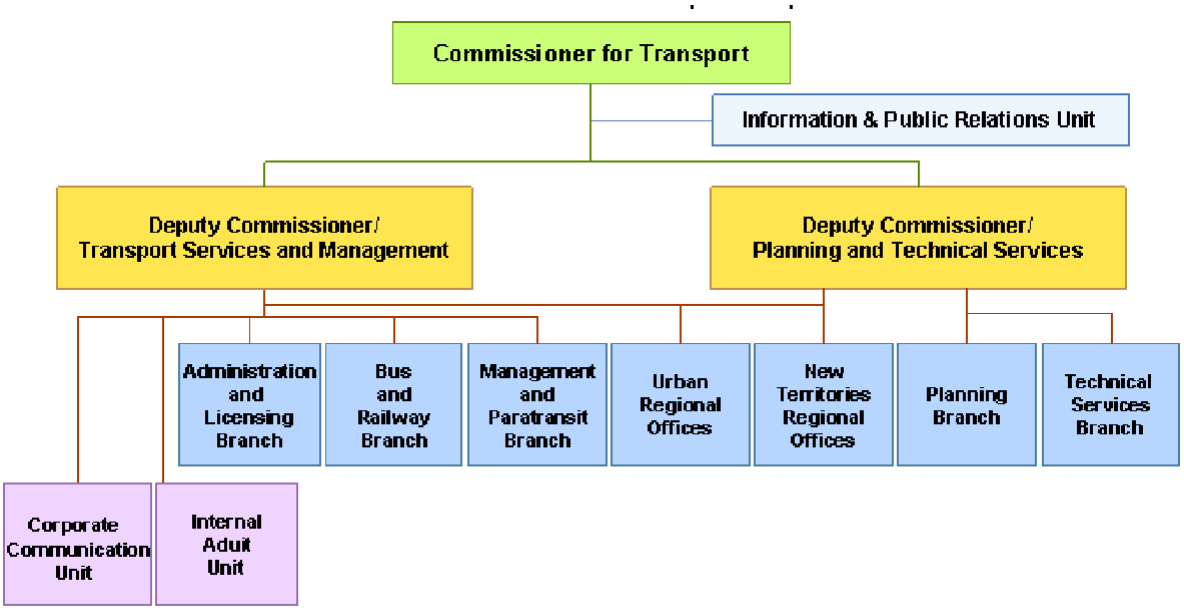
Figure 42. The organization structure of transport institutions in Shanghai, China



Source: WBCSD, 2008.

In Hong Kong, the administrative department which is related to transportation planning comprises of the Planning Department and the Transport Department (see Figure 43). The Planning Department is responsible for the preparation of various types of town plans to guide the proper use and development of land, working closely with neighbouring cities on cross-boundary planning and development matters and providing services to the Town Planning Board. The Transport Department is administering the Road Traffic Ordinance and legislation for the management of road traffic, regulating public transport services and operating the major transport infrastructure.

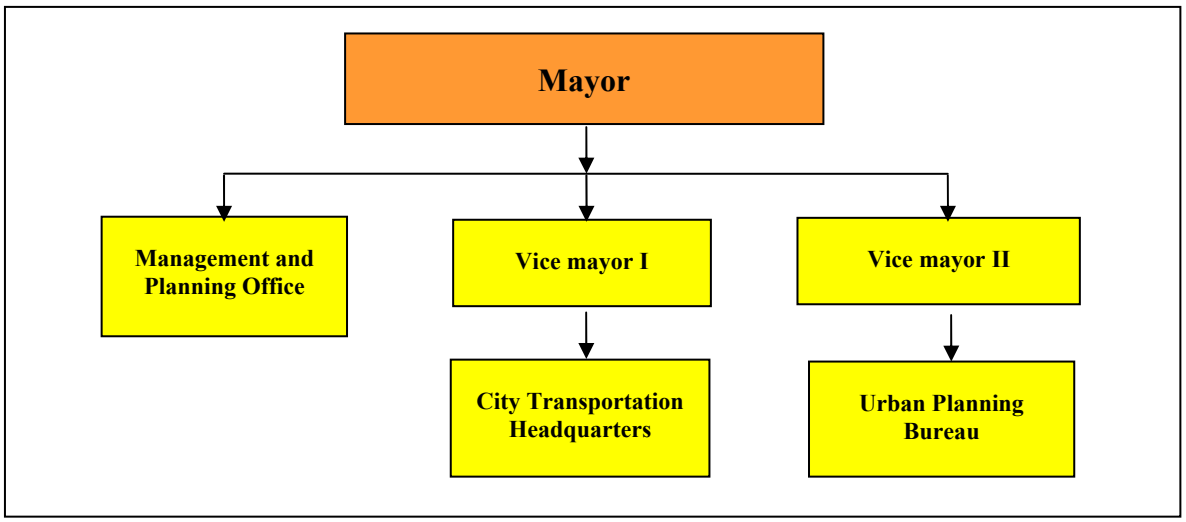
Figure 43. The organization structure of urban transport institutions in Hong Kong



Source: Hong Kong Transport Department, 2010b.

In the Republic of Korea, organization of transport institutions is comprised of City Transport and Urban Planning Bureau (see Figure 44).

Figure 44. The organization structure of transport institutions in Seoul, Republic of Korea



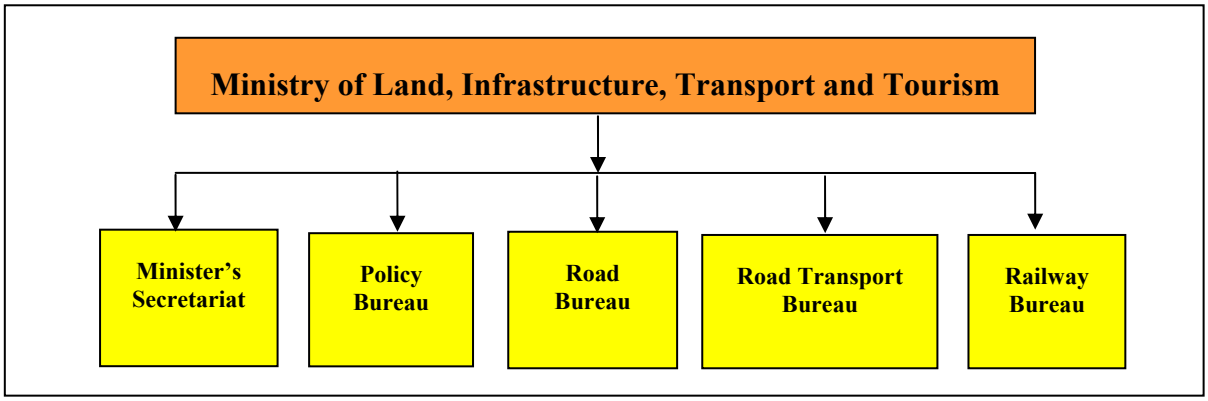
Source: City of Seoul Government, 2009.

We could easily get the conclusion that transport institutions comprise of urban planning department and urban transport department in Eastern Asia. Urban planning department is responsible for the making transport planning and strategy. Urban transport department take the responsibility for the construction, operation and management of transport infrastructure.

In Japan, the Ministry of Land, Infrastructure, Transport and Tourism take responsibility for the urban transport policy. Under the leadership of the Ministry of the Land, Infrastructure, Transport and Tourism (MLIT), there are five departments responsible for the development of urban transport (see Figure 45). The Minister's Secretariat oversees the

administration of the bureaus and policies with the MLIT. The Policy Bureau is responsible for activities such as creation and promotion of the MLIT's basic plans and policy proposals. The Road Bureau grasps various demands on roads in an accurate manner and clarifies its objective to develop effective measure with an intensive of speed. Railway Bureau is responsible for developing the urban rail in the metropolitan area. The Road Transport Bureau copes with various issues to develop sustainably Japan's automobile society. There is a strong collaboration among central, local government and private sector in urban transport for planning process, financial burden sharing and public transport operation.

Figure 45. The organization structure of transport institutions in Japan



Source: MLIT, 2009

At local level, Japan is divided into 8 regions, which are in turn divided into 47 prefectures. Tokyo metropolitan region is under the Tokyo Metropolitan Government as a regional government and 23 Special Wards as local government units. As a result of the amendment of the Local Autonomy Law in 2000, the Tokyo Special Wards were authorized as 'basic administration bodies' which function in the same way as general municipalities. As to transport problems, the Special Wards take leadership in comparatively small projects in their jurisdiction areas even if they have legal and financial limitations. For the programmes related to planning and management of roads, parks, green spaces, open spaces, and redevelopment projects of an urban area, and land readjustment, role assignment between the metropolitan governments Tokyo Metropolitan Government and local government Special Wards is defined clearly. For example, arterial roads authorized in city plans are managed by the Tokyo Metropolitan Government, other roads are managed by Special Wards.

11.1.2. The management of mass rail transit transportation

In China mainland, the National Development and Reform Commission is responsible for developing and planning railways. Meanwhile, the Ministry of Railway manages and constructs them. Both agencies work closely with the Ministry of Housing and Urban-Rural and the Ministry of Public Security. Metro system planning will also be approved by central government. Generally, the metro company of each city is responsible for the construction and operation of the metro.

Hong Kong's MTRC is a listed company with the government as its largest shareholder. This is different from many other countries which receive direct government subsidies. The development model of metro and property in Hong Kong covers two main aspects: 1) join the development of metro system with property development; 2). overall management of metro system and property development.

11.2. Urban transport governance

As mentioned, the role of urban transport governance in China mainland, Hong Kong SAR and the city of Seoul in the Republic of Korea could be divided into four areas

11.2.1. Renewing transport planning

In China mainland, transport planning comprises the following:

- **Urban road and transportation development planning**: Ensure the transportation development goal and quality, and ensure transportation network according to existing transportation demand along with transportation mode.
- **Urban road and transportation comprehensive network planning**: Making public transportation plan, ensure the bus route available on road, and evaluate the planning in the aspects of economic feasibility.

Japan makes transport plans with mixed land use. It is a wise way to transform single centre development orientation to multi-centre development orientation in order to alleviate transport pressure. Railway plans are also prepared.

In Hong Kong SAR, the Third Comprehensive Transportation Study makes a comprehensive transport planning, using a wide range of criteria to evaluate transport projects and policies: operational, economic, financial, development, budgetary, acceptability and environment. It adopts an approach to integrate land-use, transport, and the environment; incorporate pedestrian's facilities into transport and land-use planning; and maximizes railway usage.

11.2.1.1. Formulating urban transportation policy

In Eastern Asia, many cities are reforming urban transport policies, paying more attentions to transport demand management, public transport policy, etc.

In the Republic of Korea, the administration department adopted a transportation demand management policy and a public transport priority policy. As suburbanization has progressed rapidly since the 1990s, transportation demand management has been more attractive for policy decision-makers, which leads to constructing integration and multimodal transport systems at the regional and national level. And, the Seoul transport department implements bus reform in eight aspects: adjusting bus routes, constructing excluded bus lane, transfer facility, bus, ticket system, operation, intelligent card, bus management system.

In Japan, transportation demand management is adopted as an important way to solve traffic jams, and to make a balance between travel demand and transport infrastructure.

In Shanghai, a public transport priority policy has been formulated recently. The main content of this policy is: Rationalize the efficient usage of public transport land; secure public transport capital; operate the public transport efficiently; ensure the convenience of public transport transfer.

In China mainland, the auction policy of license tag has restrained the increase of car ownership in Shanghai. In Beijing, a car license quota has also been introduced to limit the increasing number of cars according to the suggestion from the urban transport research institute in Beijing.

11.2.1.2. Adopting new financing strategy and technology

In Eastern Asia, in order to provide people with better travel, transport institutions adopt many new financing strategy and technologies.

In China mainland:

- Bus ticket reform: Implement the bus ticket reform, which cancelled the monthly ticket system; improve the financial subsidy system.
- Intelligent transport system: Some mega-cities in China, such as Beijing and Shanghai, have introduced intelligent transport systems to monitor the traffic information.
- New energy automobiles: In 2010 Shanghai EXPO, 1017 new energy cars were introduced to decrease the emissions of greenhouse gases. According to a plan, there will be 4000 new energy cars in 2012.

In Japan:

- Intelligent transport system: Tokyo is one of the most successful cities in the development of intelligent transport systems. Through computer systems and road monitoring systems, it collects transport data in order to operate the transportation smoothly and safely.
- Low-carbon transport card: this card shows the emission of CO_2 from all kinds of transportation modes, in order to encourage people to choose low-carbon modes.

In China Hong Kong SAR:

- Tolling strategy: The Hong Kong government has increased the toll charge for private cars using the Cross Harbour Tunnel from HK$10 to HK$20 effective from September 1999. It is projected that, with a more balanced revised toll scheme, the need for a 4th harbour crossing could probably be deferred until 2016 or beyond.
- Intelligent transport system: Collect and transmit information on public transport service schedules for travellers before and during their trips. Automatically collect tolls and parking charges through a common transponder technology.

In the Republic of Korea:[46]

- Parking policy: Implement parking policy to reduce parking spaces in business districts in order to minimize car use in city centre; constructing 'park-and-ride' facilities; employ parking-related charges in order to better reflect the cost of providing and maintaining parking spaces.
- Bus ticket reform: Seoul transport department implemented the bus ticket reform to improve the bus service quality.
- Intelligent transport system: The Seoul Metropolitan Government has established a new bus management system using intelligent transport systems to monitor all bus locations and speeds, adjust the number of buses, communicate with bus drivers, and provide real-time information to passengers.

11.2.1.3. Restructuring organization and institution

In Eastern Asia, some countries such as China mainland and the Republic of Korea, have made efforts to reform public bus systems.

46. Korea Ministry of Land, Transport and Maritime Affairs, 2009a.

In Shanghai, the administration department of the bus system introduced more competition in the public bus system. But the quality of service cannot meet the demand of people. Recently, a new round of public transport reform is being implemented to maintain the function of public transport as a public service. With this reform, now public transfer discount policy can be applied to cover all the public transport modes in urban and rural area of Shanghai.

In the Republic of Korea, the Seoul metropolitan government increased its control over bus routes, schedules, fares, and overall system design. A 'semi-public operation system' was established to retain buses operated by private companies, but leaving the route, schedule, and fare decisions to the Seoul metropolitan government.

11.3. Challenges for future urban transport institution and governance

Recently, transport institutions in Eastern Asia have made great progress in many areas, such as making new transport planning, renewing transport policy and so on. Nevertheless, the region also faces many challenges to be overcome in the future. For example, local governments in Eastern Asia have many transportation organizations and decentralized management function, which is hard to manage efficiently; the policy formulation between central government and local government on transportation lacks the necessary coordination; special transportation plan and utilization of urban master plan lacks communication. Except Hong Kong, subsidies for public transport in Eastern Asia are massive, which raises the question of economic sustainability of public transportation. The following outlines a list of establishments for future urban transport institution and governance.

- a decision-making mechanism for integrated modal public investment;
- an authority over metro-wide concerns, e.g. traffic management, land use and development control;
- a strong planning body for transport network development;
- a good system of monitoring transport system performance; and
- strong regulatory and enforcement bodies to set and enforce rules, regardless of the type of service provision.

12. Towards Sustainable Urban Transport

12.1. Regional trend of sustainable urban transport in Eastern Asian cities

This report has reviewed the recent trends of urban transport within Eastern Asia and discussed some challenges towards sustainable urban transport in the region. Some cities are fully aware that transport policies made today will shape sustainable urban development tomorrow.

As a result of political changes and increasing household incomes, Chapter 5 showed a rapid growth in car ownership in many cities which threatens the sustainability of urban transport, especially in China. The increase of private vehicles will always outpace the construction of urban road, which has led to more traffic congestion and other transport problem, more wide streets, less mobility and pollution. In addition, Chapter 9 showed vehicle emissions have created serious environmental problems, especially air and noise pollutions. In Chapter 8, both traffic accident data and social segregation patterns suggested private vehicle hinders the sustainability of urban transport. We have to place more emphasize on more sustainable urban transport policies in the very beginning of motorization. Hong Kong is the extreme case in pursuing public transport oriented development.

Chapter 3 showed the region's arising awareness of public transportation as a more sustainable urban transport mode. Different policies and reforms were implemented in response to improving public transportation service. 'Public transport prioritization' is a widely adopted policy in the region to accommodate the exponential growth of travel demand with economic growth. Because of high densities, in the more developed cities, rail has been identified the most efficient and environmentally friendly mass carrier and its importance in the public transportation system continues to grow. Too ambitious plan in urban rail construction, however, may increase the financial burden of government. The number of passengers carried per kilometre of urban rail network is declining with the increase of the network size. Multi-modal urban transport systems should thus be promoted. In the dense urban environment conventional surface bus will not be attractive to people, only rapid bus system, which is much cheaper than urban rail, can compete with private motorization. In the less developed cities or the region where public resources are insufficient, informal transport and non-motorized vehicles still play a crucial role to meet the travel demand. However, Chapter 10 reflected that public transportation in most cities is heavily subsidized. The debate over this huge deficit remains the biggest challenge to the economic sustainability in most of cities in this region.

As discussed in chapters 2 and 4, non-motorized and informal transport serve important role in bridging the 'last kilometre' in many cities. Especially in China, bicycles or e-bikes are still very important to provide the fundamental mobility for low-income people. Their advantages in flexibility, convenience in door to door transport cannot be replaced by any other transport modes. Policy makers have slowly recognized the potential of bicycle on promoting low-carbon transport. Bicycle lanes and associate infrastructures have been constructed to strengthen its function in the urban transport system. However, their safeness remains the biggest concern and the government is developing specific policies and plans to integrate bicycles in a sustainable urban transport system. It is great success in Hangzhou, where the city now has more than 50,000 public bicycles, and in Shanghai's Minhang district where 5 per cent of car drivers have shifted to public bicycles.

Disparity of mobility is also a critical dilemma of urban transport in Eastern Asia. For the less developed countries, such as DPR Korea and Mongolia, the lack of urban road network and public transport has underserved the mobility demand and hence, economic growth. For

the more developed countries, mobility disparity also falls into the balance between the suburban and urban areas, the low and high income household or the disabled and healthy. More attentions should be given to address this aspect of transport system.

12.2. Future policy towards sustainable urban transport

For more developed Eastern Asia countries like Japan, the Republic of Korea, Hong Kong SAR and Macao SAR, the primary target is to realize a low carbon and economically sustainable transport system. As summarized above, the region is facing multiple challenges in achieving a sustainable transport. Therefore, an integrated policy package is necessary in the future. The following shows the recommended policies.[47]

12.2.1. Land use and transport integration

Most cities in this region still keep high density. This is a great potential in order to make cities less dependent on the private car. With the successful experience of rail-based transit-oriented development in the past, we should encourage multi-modal green transport oriented development, as rail is not the only solution for the future. Introducing bicycles or keeping bicycle in city will be great contribution to sustainable development, high density and mixture of urban fabric and the safer environment is the prerequisite for people to choose bicycle. High concentrations of employment in a single urban core may result in heavy public transport passenger flow to the city centre each morning, but it is also waste the public transport capacity in the reverse direction. So that poly-central spatial structure should be encouraged with the support of a rapid public transport system.

12.2.2. Establish an integrated transportation administration system

It is necessary and imperative to carry out institutional reform of the transportation administration system, by establishing a comprehensive coordination mechanism to cover all modes of urban transport, so as to uniform the administration of the planning and policy and build the foundation for an integrated transportation system with effective resource allocation and utilization of various transport modes. The Seoul metropolitan government demonstrated a good start by introducing a unified, coordinated fare structure that integrates both bus and rail services. Fares are now based only on distance travelled, with free transfers permitted between bus lines as well as between metro and bus. The weak road construction in Japan and strong influence from rail does carry much more passenger by rail, but also serious congestion in Tokyo. The over construction of wide street in Beijing resulted in transport crisis which make people have no way to move easily in the city. Thus, a comprehensive coordination mechanism is an important vehicle to optimize transport system performance following the principle of sustainable development.

12.2.3. Reform transportation related financial and taxation policies to support public transport

The government should continue to establish special financial funding systems for transportation development, and expand the funding sources and make sure that there is enough funding input into transportation infrastructure development and operation. The reform on the financing system should be carried out based on taxation reform and diversification of funding strategies. Institutional and regulatory reform should be implemented to facilitate multi-channel investment and to establish sound investment funding systems for infra-

47. Zhou and Szyliowicz, 2005.

structures of each of the transportation modes. Public transport is considered as a public service and raising the transportation fare is often not favoured. Subsidy to public transport is a critical measure to maintain the service quality.

12.2.4. Strengthen technological innovation to enhance sustainability

Technological advancement has greatly supported and promoted the implementation of sustainable development strategies worldwide. Support for the application of new technologies not only to satisfy passenger and freight transportation demands but also to support sustainable transportation development. The government should give more support to promote the technological advancement in transportation sector; and by taking advantage of market competition mechanism, to facilitate the application of new modern technologies to improve transportation infrastructure, transportation tools, organizational management and service.

There are barriers in matching the information of travel demand and supply in transportation. Over-supply in public transport service will be the burden of local government. Lack of public transport information is the main reason why people do not take it. Information and communication technologies will help us to improve service with less cost. Currently, Seoul is developing a pilot 'personal travel assistant' programme in two downtown districts. The key goal is to deliver real-time, integrated information for all the different modes of available transportation. The 'personal travel assistant' pilot service has proven how information and communications technologies can help provide opportunities to choose alternative transport mode. The Seoul 'personal travel assistant' programme works with smart phones and devices that have embedded GPS and wireless internet capabilities. They provide details of the most environmentally friendly travel routes, based on an individual user's current location and real-time traffic situation. Route information, in this instance, includes all transportation modes, including bicycle and pedestrian routes.[48]

12.2.5. Strengthen international cooperation

Eastern Asia is a dynamic region which comprises a mixture of well-developed countries, moderate developing countries, fast developing countries and less developed countries. With Japan leading in technology innovation and China (mainland) leading the economic growth, there is a great potential and variety of experience for international cooperation to mutually achieve a sustainable transport. Increasing coordination, technology and skills transfer, and experiencing sharing will help each government in the region to formulate and implement measures for a sustainable transportation development, tailoring for each specific local context in built environment and institutional setting.

12.2.6. Providing environmentally-friendly transport systems

Environmentally-friendly transport systems can be improved with the existing motorized transport through technological improvements and innovations to make engines and fuels less carbon intensive, such as electric or hybrid vehicle. However, it can also be achieved by facilitating non-motorized transport. Traditional transportation planning has given priority to private vehicles, followed by public transport, with the least attention payable to non-motorized transport. In the future, non-motorized transport will receive more public attention in Chinese (mainland) cities, by enhancing the safety of its riding environment and strengthening their connection between with other transportation modes.

48. Cisco, 2009.

12.3. Conclusions

The experience of mobility management in Eastern Asia is very rich, knowledge sharing is very important to improve urban management capacity due to the unique characteristics of this region to avoid failures or crises in urban transport. High levels of motorization cannot be sustained in dense cities, but these high density populations are also a great potential for the adoption of sustainable urban transport generally.

Early public intervention to promote public transport, non-motorized transport and with restrain on private cars are key to achieve sustainable development with less cost under the condition of high growth rate of motorization. Well established freight transport will not only improve the production but will also contribute to mitigating congestion and pollution, especially for less developed cities which still to a large extent depend on industry to improve their economic development. Highly advanced information and communication technologies may also improve the service quality in passenger and freight transport.

Intensifying the integration of land and transport planning and adopting innovative funding strategies to improve the financial viability of urban transport projects are also inevitable. Although better cooperation between government institutions is still necessary to improve the aspect of mobility management, there is a strong political will in the Eastern Asia region to achieve urban transport systems which are economically, socially and environmentally sustainable.

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