Current Status of Public Transportation in ASEAN Megacities

Edited by
Changhwan MO
Young-in KWON
Sangjun PARK

THE KOREA TRANSPORT INSTITUTE
ASSOCIATION OF SOUTHEAST ASIAN NATIONS
Ministry of Foregin Affairs Republic of Korea

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The Korea Transport Institute (KOTI)

KOTI is an official research agency for the government of the Republic of Korea (South Korea) and a leading think tank for Korea's transport policies. It has been committed to building a safe, convenient, efficient and environmentally sound transport system for the nation since 1987. It is a pioneer in providing new ideas and future perspectives about transport issues in Korea, while positioning itself as one of the world's leading transport research institutions.

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Preface

This book is the result of the ASEAN-Korea public transport project for low carbon and green growth. Dr. Changhwan MO and other researchers at the Korea Transport Institute (KOTI) visited 10 megacities in ASEAN countries and held two ASEAN-Korea Public Transport Workshops where public transport experts and officials from 10 ASEAN countries, Indonesia, Malaysia, Singapore, Brunei, the Philippines, Cambodia, Laos, Myanmar, Thailand and Vietnam, discussed desirable public transport strategies for the ASEAN countries.

The purpose of this project is to develop the public transport strategies of ASEAN megacities for low carbon and green growth. Last year, KOTI completed the first-year project of the ASEAN-Korea transport capacity-building project.

We are living in a global age where no one country can survive alone, and every country is interdependent. This consulting project for the development of public transport strategies required professional cooperation among public officials and experts in the ASEAN region. This book, the "Current Status of Public Transport in ASEAN Megacities," will provide a precious opportunity for public officials and experts in ASEAN countries to share the current situation and issues of urban transport.

In the process of rebuilding society after the Korean War in 1950, Korea received a great deal of oversea support in the form of training and financing. In the same manner, the Korean government is willing to share experiences and lessons with ASEAN neighbors in the form of global cooperation. This ASEAN-Korea project symbolizes such an effort.

We will share our knowledge of public transport policies and technologies with ASEAN member countries through this book and other activities. I hope this effort significantly contributes to the condition of the public transport situation in ASEAN countries. More importantly, we will share friendship to build the future together.

Chang Woon LEE
President
The Korea Transport Institute

Chapter 1

Introduction

Changhwan MO

The total population of ASEAN is 600 million, making up about 10% of the world's total population, and the rate of population increase is 1.93% as of 2010, which is significantly higher than the world average of 1.14%.[1]

Vehicle ownership in ASEAN was 26 vehicles per 1,000 people in 2000, but rose sharply to 40 vehicles per 1,000 people in 2010. It is a drastic increase of 53.8 percent, and is going to continuously increase. The increase rate of car ownership in the ASEAN region is alarming, and without taking quick measures to improve public transport services, the region's environmental problems will get worse on a large scale. Effective policies for public transport are absolutely necessary for the sustainable growth of major cities in the ASEAN region (KOTI, 2009).

The amount of transport infrastructure in most ASEAN countries is relatively poor, especially highways and railways, which are significantly less than the OECD average. Rail, in particular, including urban rail and trams, are environmentally friendly, and some reports suggest that rail in the ASEAN region should be expanded five to ten times for minimum sustainability. The strategy to be established in the currently proposed project will address urban public transport issues, such as bus rapid transit (BRT) systems, trams, light rail transit (LRT), and urban rail.

The Association of Southeast Asian Nations (ASEAN) and the Republic of Korea government started their first dialogue relationship in 1989, and established the ASEAN-Korea Cooperation Fund with the objective of supporting cooperative projects between the nations involved. These projects include sharing of economic growth experiences, transfer of

1 KOTI, *ASEAN-Korea Transport Cooperation Roadmap*, 2009.

knowledge and technology, and development and exchange of human resources under mutual agreement and benefits.

The ASEAN Secretariat and the Korean Ministry of Foreign Affairs (MOFA) agreed in 2013 that the public transport consulting project, "Development of public transport strategies for low carbon and green growth," proposed by the Korea Transport Institute (KOTI) was an appropriate one that met the criteria of conditions set out by the ASEAN-Korea Cooperation Fund. Last year, KOTI completed a capacity-building project which focused on the education and training of ASEAN public officials in the field of transport.

KOTI has been hosting the Korea-ASEAN Transport Cooperation Forum since 2010 with the Ministry of Land, Transport and Maritime Affairs in the Korean central government. This short-term forum is a two-day event for transport officials on the vice-ministerial level. And it is a logical sequence for the relationship to develop into a working-level ASEAN capacity building program, and eventually into a consulting program that deals with detailed and practical issues of public transport and other policy development.

The project is publishing two reports: one about the current status of public transport in ASEAN megacities and another about the problems and strategies of public transport in these megacities. This report is the first one.

The purpose of this report is to provide information on urban and public transportation in ASEAN megacities. Those megacities are Vientiane in Lao PDR, Yangon in Myanmar, Hanoi in Vietnam, Jakarta in Indonesia, Phnom Penh in Cambodia, Bangkok in Thailand, Manila in the Philippines, Kuala Lumpur in Malaysia, Bandar Seri Begawan in Brunei Darussalam, and Singapore.

This report fully reviews the current status and issues of urban transport in ASEAN mega-cities. It will be utilized for the second report, which is on how to develop public transport strategies to solve urban transport problems in those cities.

On March 6, 2014, KOTI held the first public transport workshop in Manila, Philippines. About 15 public transport experts and public officials from four countries, Indonesia, Malaysia, Singapore, and the Philippines, joined the workshop and gave professional presentations and actively participated in discussions. Also, one transport expert joined from the Asian Development Bank (ADB). At the second public transport workshop, which was held in Jakarta, Indonesia on August 5, 2014, KOTI invited qualified public transport experts and public officials from five countries, Vietnam, Laos, Cambodia, Thailand, and Myanmar, to present the current status and problems of urban transport in ASEAN megacities and discuss possible solutions for them. The role of KOTI was to share Korea's experiences of public transport development with ASEAN countries and to find out about specific public transport projects for future investments.

This report aims to provide information on urban transport in ASEAN megacities and to show common characteristics among these megacities in terms of public transport issues.

It is the result of a consulting project that was carried out by on-site visits, interviews and workshops in the ASEAN region. KOTI researchers directly visited each city and interviewed public officials and public transport experts on various subjects. At the two workshops, participants reviewed the current status of urban and public transportation in the ASEAN target cities, because public transportation can reduce greenhouse gases and support green growth.

Chapter 2

Overview of Public Transport in ASEAN Megacities

1. Bangkok

Changhwan MO, Young Seok PARK, Arie KIM, and Ryan HUNTER

1.1 National and City Statistics

Table 2.1.1 Basic facts about the Kingdom of Thailand (2014)

Contents	Status
Land area (thousands km^2)	513 (Land: 511, Water: 2)
Population (thousands)	67,741
Major languages	Thai (official) 90.7% (Burmese 1.3%, other 8%)
Capital city	Bangkok
Currency	Baht, Satang(1/100 Baht)
GDP (US$ billion, 2013)	385
GDP per capita (US$, 2013)	5,647

Source: Central Intelligence Agency. (2014). "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/th.html> (Accessed on 17 Oct. 2014).

The Kingdom of Thailand is a Southeast Asian country situated in the middle of the Indochinese Peninsula. It is surrounded by Burma and Laos to the north, Laos and Cambodia to the east, the Gulf of Thailand and Malaysia to the south, and by the Andaman Sea and the southern tip of Burma to the west. Thailand's government is a constitutional monarchy, with King Bhumibol Adulyadeg, Rama IX as their leader.

Thailand has experienced high economic growth since the 1980s, except for the periods of world economic crises such as the "Asian Crisis" of 1997-1998 and the global financial crisis of 2008-2009. Since 2009, there has been an unstable political environment and a persistent environmental crisis in Thailand, which have slowed its economic growth. The growth rate is gradually returning back to its normal state and is expected to be around

4% by the end of 2014. The main economic sectors in the country include manufacturing, agriculture and tourism. According to KOTRA and the World Factbook of the CIA, the Kingdom of Thailand included 513,000 km^2 of land area and had a population of 67,741,000 as of 2014, with a GDP of US$385 billion in 2013.

Table 2.1.2 Overview of Bangkok Metro (2014)

Contents	Status
Population (million)	14.6
Land area (km^2)	7,762
GRP per capita (US$, 2010, Bangkok)	14,301
Metro density (km^2)	1,900

Source: wikipedia. "Bangkok." <http://en.wikipedia.org/wiki/bangkok> (Accessed on 16 Spet. 2014).

The capital city of Thailand is Bangkok, with a population of 15 million and land area covering some 7,760 km^2. The Bangkok Metro had an output of US$ 149.39 bn, or 44.2 percent of GDP. The GRP per capita of Bangkok alone was US$14,301 in 2010. Bangkok is also the fifteenth most populated city in the world. While the city is enjoying an economic and cultural boom, the rest of the country is not so fortunate. Income inequality and lack of equal opportunities have persisted.

1.2 Public Transit Level of Service

The public transportation on land in Bangkok consists of bus, rail, and para-transit systems. There are three types of bus transit services: Bus Rapid Transit (BRT), private buses, and minibuses. BRT is operated by a public company and has operated air-conditioned buses. As for rail transit, elevated and underground rail transits are available. The elevated rail transit is called BTS SkyTrain, and the subway is called Mass Rapid Transit (MRT). In addition, Bangkok has a rail connection from the urban center to the airport called Airport Rail Link (ARL). Para-transit is composed of conventional and unconventional ones: taxis and tuk-tuks are in the former category, while passenger vans and hired motorcycles are in the latter.

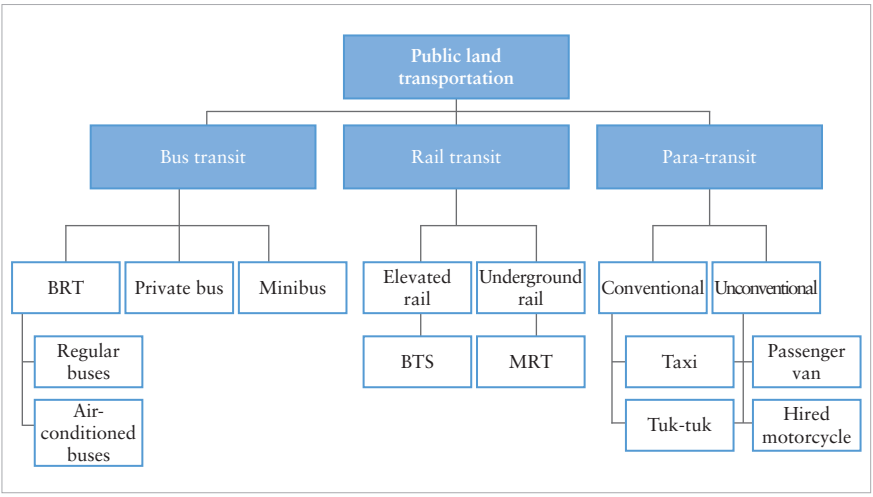


Figure 2.1.1 Overview of public land transportation in Bangkok

Source: Pravinvongvuth, Surachet. (2014). "Public Transportation Problems and Green Solutions in Bangkok." In *Proceedings of 2nd ASEAN-Korea Public Transport Workshop*. 4-6 August. Jakarta, Indonesia: The Korea Transport Institute. p. 167.

1.2.1 Urban Rail System in Bangkok

The metro public transportation routes include the BTS, the MRT, the ARL and the BRT. The rail system consists of BRS, MRT and ARL, which in Figure 2.1.2 are the dark and light green, light blue and dark blue lines, respectively. The BRT line is represented by the yellow line.

SkyTrain (BTS)

The BTS is an elevated rail system which was opened for service in 2011. There are two lines in service, with 35 stations covering 47 provinces of Bangkok. The typical BTS station consists of a concourse and platform level. The concourse level is where passengers can get tickets and other passenger amenities. The platform level is for people waiting for, boarding and alighting from trains. The trains are designed to fulfil international standards. Doors open and close automatically. Beeper sounds are used to warn the passengers regarding the impending closure of the train doors. For the sake of their safety, there are several notices to passengers with warnings regarding overall safety.

Riders can make fare payments either by purchasing single journey tickets or through stored value cards. Various types of stored value cards are available according to passenger type. The child card is available for

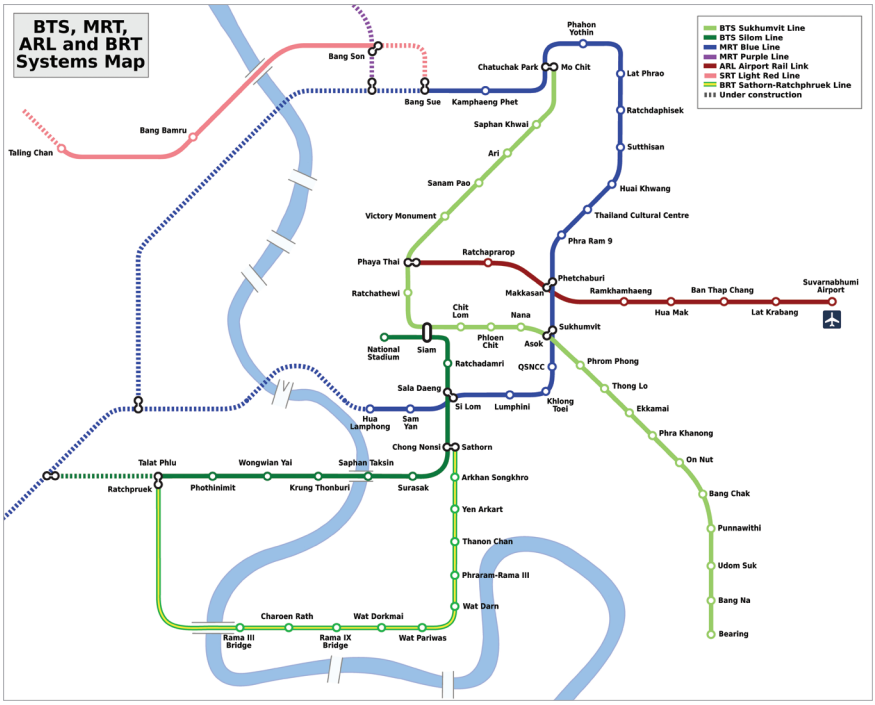


Figure 2.1.2 *Bangkok Metro public transportation routes (including BTS, MRT, ARL, and BRT)*

Source: MetroEasy.com. "Bangkok Metro (MRT)." <http://www.metroeasy.com/wp-content/uploads/2013/10/Bangkok-Metro-Map-PDF.pdf> (Accessed on 5 Oct. 2014).

Figure 2.1.3 *Skytrain/BTS*

people under the age of 14 and with a height of 91 to 120 cm tall. The elder card is available to those who are 65 years old or older. The distance-based fare depends on the number of stations travelled. Students get 10% discounts, while children and senior citizens get 50% discounts on stored value cards. A one-day pass provides unlimited rides for the duration of a single day, from its first use until midnight of the same day, for a total fare of 120 Baht. Additionally, three-day and 30-day passes are available for consistent users of this mode of transit.

Subway (MRT)

The MRT adopts a similar ticket system to that of the Skytrain (BTS), but the systems are not compatible with each other for the time being. All the stations of the underground train can be reached via ramps, elevators, and escalators. Currently, there are 18 stations available to passengers.

The first MRT line in Bangkok is called the Blue Line which connects between Hua Lamphong and Bang Sue. The length of MRT is 20 km. The Bangkok Metro Public Company Limited operates it, but the owner is the Mass Rapid Transit Authority of Thailand. The MRT is operated by the Bangkok Metro Public Company Limited (BMCL) under a concession granted by the Mass Rapid Transit Authority of Thailand (MRTA). The BMCL has the exclusive right to collect fares and undertake activities and commercial development, including advertising, leasing space and

Figure 2.1.4 MRT

telecommunications services in the stations and in the trains, for 25 years. The daily ridership is about 240,000 and the annual ridership is about 81 million. It started operation on 3 July 2004.

Airport Rail Link (ARL)

The Airport Rail Link services are composed of two lines: Non-stop Express services and City Train services. Both lines operate from 6:00 a.m. until midnight. The City Train line is linked to the BTS line at Phaya Thai station, thus allowing passengers to conveniently transfer between the two lines.

Table 2.1.3 Bangkok Metro fares

(Unit: baht)

A single journey token fare												
Stations	0-1	2	3	4	5	6	7	8	9	10	11	12-17
Adult	16	19	21	23	26	28	30	33	35	37	40	42
Children & seniors	8	10	11	12	13	14	15	17	18	19	20	21
When paid with stored value card												
Stations	0-1	2	3	4	5	6	7	8	9	10	11	12-17
Adult	16	19	21	23	26	28	30	33	35	37	40	42
Children & seniors	14	17	19	21	23	25	27	30	31	33	36	38

Source: Bangkok Metro Public Company Limited. (2014). "Fare Rate." <http://www.bangkokmetro.co.th/ticket.aspx?Lang=En&Menu=13> (Accessed on 17 Oct. 2014).

Figure 2.1.5 ARL

1.2.2 Common Metro Ticket to be Implemented by the End of 2014

The fare and ticketing system are not currently integrated across lines, meaning that passengers cannot simply buy a ticket that uniformly covers their transportation across all the different lines. The specific fare is priced based on both the length of travel and the age of the travelers. There is a plan to implement a common Metro ticket that will integrate the ticketing system across the different types of mass transportation such as the MRT, BTS, ARL and BRT. The implementation of a common ticket will have several beneficial effects, such as reducing overall travel time and cost, making the ticketing process more comfortable and user friendly, reducing cash use, promoting public transportation usage, reducing the cost to increase an operator's revenue and facilitating statistical data collection. This plan is going to be operational by the end of 2014 (Thanya, 2012).

Bus Rapid Transit (BRT) and City Buses

There are two main types of bus transit in Bangkok, the BRT and city buses operated by private companies. Local buses, mostly operated by the Bangkok Mass Transit Authority (BMTA), are the most affordable method of transportation in the city. They have complex routes and many of them are not air-conditioned. To relieve passengers of the complexity and heavy traffic, the city of Bangkok has implemented its first Bus Rapid Transit (BRT) system after years of thorough examination. The fare price is between 12 and 20 Baht depending on the distance of travel. The BRT system is called Bangkok Rapid Transit (BRT). The system, which began operating in May 2010 ranges 15.9 km in length and has a total of 25 buses and 12 stations along the route. There are two terminals at each end of the trunk line, and

Figure 2.1.6 BRT and BUS

these are also the only air-conditioned stops along the route. The system handled 18,000 passengers per day as of July 17, 2010 and ran at an average speed of 30 km/hr (Transitbangkok, 2010). The average headway is five minutes during peak hours and 10 minutes during non-peak hours. There are two stations that connect the BRT to the SkyTrain line, and these stations have high platforms which afford the convenience of escalators and electronic ticket verification systems. The buses only have one door each, and the automatic door of the station is three meters wide.

Para-transit (Tuk-tuks and Taxis)

All taxis are now metered and air-conditioned: the meter starts at 35 baht and most trips within Bangkok cost less than 100 baht. There are no surcharges except when taking a taxi to and from the airport. Tuk-tuks are motorcycle taxis used exclusively for short-distance travel.

Table 2.1.4 Types of public transportation

Transit	Service	Rate (baht)
Skytrain (BTS)	A monorail called Bangkok Mass Transit (BMS) opened for public service on 12 Aug. 2011.	15-52
Subway (MRT)	The subway system, called Mass Rapid Transit (MRT) reaches from the northern train station of Bangsue to the Hua Lumphong main railway station in a loop, connecting to the SkyTrain at three different stations.	16-40
Airport Rail Link (ARL)	Its official operation started in August 2010. To relieve the city's congestion, the 28.6-km journey from Bangkok to the international airport is made quicker by the rail service of 30 minutes or less.	15-45 150
Taxis	This is a quick and comfortable way to get around town, at least if there is no traffic congestion.	100-
Trains	The three main stations in Bangkok are: Hualamphong, Bang Sue, and Thonburi. Trains mostly connect Bangkok to outer cities.	–
Buses	This is the least costly travel method in Bangkok, but they often face traffic congestion. To relieve this problem, there was the implementation of the Bus Rapid Transit (BRT) route.	6.5-25
Motorcycle taxis	When traffic slows to a crawl and there are no mass-transit alternatives, motorcycle taxis are the fastest mode of transport. This is for short-distance travel.	5-25
Tuk tuks	With Bangkok's densely congested traffic, Tuk-tuks are an alternative way to get around the city. But they are uncomfortable, due to air pollution, and travel is mostly within a particular neighborhood.	30-

Source: Transit Bangkok. (2014). "Bangkok BRT." <http://www.transitbangkok.com/brt.html.> (Accessed on 1 Sept. 2014).

1.3 Transportation Infrastructure Investment and Financing

The Thai government is putting effort into passing a proposal to borrow funds amounting to 2.2 trillion Baht (US$60 billion) for a mega-infrastructure plan. This plan is designed to enhance regional connectivity and transform Thai cities into regional hubs before the implementation of the ASEAN Economic Community (AEC). This proposal could increase per capita income from the current US$5,000 to US$10,000 per year within a decade, according to the Current Status of Infrastructure Development in Thailand and the Fiscal Policy Research Institute Foundation. The infrastructure plan proposes 55 projects to be completed by 2020. If the plan is approved by the parliament, 64% of the total budget will be spent on 31 individual railway projects, 24% on road projects and 12% on water and air transportation infrastructure.

Table 2.1.5 Infrastructure development programs

(US$1=30 baht)

Mode	Projects	Budget (US$ billion)
Rail transport	37	55.04 (82.57%)
Road transport	14	8.1 (12.15%)
Water transport	5	1.09 (1.51%)
Boarder facilities	40	0.41 (0.61%)
Contingency	–	2.10 (3.00%)
Total	70	66.66

Source: OTP. (2013-2020). Report on Investment Plan for Transport Sector.

According to the Office of Transport and Traffic Policy and Planning (OTP), a total of 70 projects are in progress starting in 2013 and will continue through to 2020. In Bangkok specifically, the government is attempting to extend the current metro rail system. Bangkok is served by a mass transit system with three lines for a distance of 80 km. The 10 mass transit lines, construction of which is expected to be completed by 2019, would add a further 410 km to the lines. Of these, six lines (100 km) are under construction and should be completed by 2017. The details regarding the plan for the metro rail system are shown in Table 2.1.6.

The lines under construction amount to 90 km. All of the lines are to be constructed and start operating by 2017.

Table 2.1.6 Construction plan of urban rail system

Project	Length (km)	Status	Operate
Under construction			
Purple Line	23	53% civil work completed	2015
Blue Line extension	27	27%	2016
Green Line extension (Mochid-Sapanmai)	12	Waiting for approval from EIA, Expect to bid early 2013	2017
Green Line extension (Baring-Samudprakam)	13	4%	2015
Red Line: West bound (Bangsue-Talingchun)	15	Civil work completed Track work - Bangsue-Rungsit contract Bidding	2016
Prepared for bidding			
Red Line: Missing link (HuaLumpong-Bangsue-Hua Mak)	19	EIA approved	2017
Airport Rail Link extension	21	EIA approved	2017

Source: "Thailand's Transportation Infrastructure Projects." <http://www.bombaychamber.com/uploads/Thailands%20Transportation%20Infrastructure%20Projects.pdf> (Accessed on Aug. 2014).

1.4 Ownership, Operation, Regulations of Public Transport

1.4.1 Ownership and Operations

Passenger transportation in Thailand consists primarily of personal vehicles; this includes cars, personal pickups and motorcycles. The ownership, operation and regulations of public transport vary depending on the type and area. The government usually owns public transportation modes, and the systems are operated by government enterprises such as the Bangkok Mass Transit System Public Company Ltd. (BTSC) and the Transport Company Ltd.

For passenger public transport there are four categories of fixed routes, and two government agencies operate bus transportation. The BRT is owned by the Bangkok Metropolitan Administration (BMA) and operated by the BTSC. The bus operations of Bangkok are usually under the BMTA, with private subcontractors allowed, and in provincial areas, some private firms operate in the market under a licensing system.

Table 2.1.7 Operation of passenger bus transport services by government and private sectors

Bus route category	Government and private operations	Maximum private equity permitted
Category 1 in Bangkok has contiguous routes in the perimeter area by running on the main road in the community area, which has business centers, schools and universities, government agencies, etc.	The BMTA has 89% (321 route licenses) and allows private subcontractors. The Premier Metro Bus Company operates 10% (35 routes). The Thonburi Bus Service Company Ltd has 1% (four routes).	The BMTA has the government's share (51%) and the private share(49%). The other two firms are 100% private equity.
Category 1 in provincial areas	Many private firms operate in the market under a licensing system.	100% private equity is permitted.
Category 2 Routes link Bangkok and the provinces.	The Transport Company Ltd has all licenses and allows private subcontractors.	The Transport Company Ltd has the government's share (51%) and the private share (49%).
Category 3 Interprovincial routes that link one province with another and may pass through other provinces.	Many private firms operate in the market under a licensing system.	100% private equity is permitted.
Category 4 in Bangkok Route, mainly on subordinate roads and feeder roads to the main road to link with Category 1 in Bangkok.	The BMTA operates 76% (113 routes) and allows private subcontractors. Private firms operate 24% (36 routes).	100% private equity is permitted.
Category 4 in provincial areas services the community (villages, districts and cities) in the provinces.	Many private firms operate in the market under a licensing system.	100% private equity is permitted.

Source: Pomlaktong, Narong, Jongwilaiwan, Rattana, Theerawattanakul, Prakai and Pholpanich, Rapee. (2011). "Road Transport in Thailand." In *Proceedings of The Impacts and Benefits of Structural Reforms in the Transport, Energy and Telecommunications Sectors*. p.271.

1.4.2 Characteristics of Public Transport Regulations of the Road Transport Industry

Public transits of non-fixed routes include vehicles for hire such as taxis. The Department of Land Transport (DLT) only regulates the licenses of drivers and vehicle standards. There are no regulations on entering the taxi market. However, there are state-legislated regulations for fixed-route vehicles such as buses.

The main regulator of bus and truck transportation in Thailand is the DLT, which is a government agency under the Ministry of Transport. Established on September 11, 1941, the DLT is in charge of the systematization and regulation of land transport. It conducts monitoring and inspection of the whole system for smooth running and conformity with relevant land transport laws and regulations. Below is a list of the

authorities that fall under the DLT.

Table 2.1.8 Authorities of Department of Land Transport

Department of Land Transport	
Authorities	• To supervise and control fixed-route buses to run on a fixed route and on the condition of picking up passengers at specific locations according to a timetable • To collect bus fares at government-regulated rates and to stop at regulated bus terminals • To stipulate, improve and revoke bus routes and to renew/withdraw bus operation licenses • To stipulate and improve the condition of vehicle operations, and the number and category of vehicles • To give the information of fixing the fare rate to the Central Land Transport Control Board for approval • To stipulate bus standards, to supervise the quality of the transport operators' service for passengers, to control bus safety (speed, duration of parking and the age of buses) • To control and examine the operation of the transport operators, crews and vehicles • To encourage and develop a system of mass transit by bus

Source: Pomlaktong et al. (2011). p. 270.

Licensing conditions are implemented to regulate the passenger transport market. The regulations for fixed-route buses in Thailand are implemented under the "Land Transport Act 1979 (BE2522)." Regulations are implemented by appointing a Land Transport Policy Committee, Central Land Transport Control Board and Provincial Land Transport Control Board that have the authority to approve fixed-route buses.

Table 2.1.9 Functions of the Central Land Transport Control Board

The Central Land Transport Control Board	
Functions	• To stipulate the category of fixed-route buses • To fix the routes, the number of bus operators and the number of vehicles for fixed routes in Bangkok, between provinces and between economies • To fix the rates of transport charges and other service charges • To designate the sites, arrange for or set up and regulate bus terminals • To specify the types or conditions of vehicles not acceptable for registration • To prescribe the classes or categories of vehicles that must stop or park for picking up and setting down passengers or for loading and unloading goods at bus terminals • To stipulate places for parking to pick up passengers • To lay down measures for prescribing, permitting and controlling transport businesses • To carry on other actions as provided in the Act and according to the regulations of the Land Transport Policy Committee

Source: Pomlaktong et al. (2011). p. 270.

Table 2.1.10 Functions of the Provincial Land Transport Control Board

The Provincial Land Transport Control Board	
Functions	• To fix bus routes, the number of transport operators and the number of vehicles in the provincial area • To fix the rates of transport charges in the provincial area (the same criteria as prescribed by the Central Land Transport Control Board) • To carry out other actions as provided in the land transport regulations according to the Land Transport Policy Committee and the Central Land Transport Control Board

Source: Pomlaktong et al. (2011). p. 270.

1.4.3 Route Licensing

Bus Route Category 1, in the provincial area, is open for private company operation. Generally, the license for a fixed route is THB 7,000 (US$217) and is valid for a period of seven years; for a non-fixed route it is valid for five years. A bus company has to acquire a license for each route that it operates.

Table 2.1.11 Characteristics of the passenger transport industry

Bus route category	Characteristics of competition
Category 1 in Bangkok	Concessions are granted to three operators. The government-owned BMTA is entitled to grant sub-contracts to private companies and collect royalty fees. The passenger van is a new mode that serves the niche market.
Category 1 in provincial areas	A "one license per route" policy is implemented. Firms that receive a license are able to sub-contract to small-scale operators. The market is highly competitive between overlapping route operators.
Category 2	Only the government-owned Transport Company Ltd is entitled to provide services for all routes, to sub-contract to private companies and to collect royalty fees. The passenger van is a new mode that serves the niche market.
Category 3	A "one license per route" policy is implemented, which is a monopoly. Firms that receive a license are able to sub-contract to small-scale operators. The market is highly competitive between overlapping route operators. The passenger van is a new competitor in this category.
Category 4 in Bangkok	A "one license per route" policy is implemented, which is a monopoly. Firms that receive a license are able to sub-contract to small-scale operators. The market is highly competitive between overlapping route operators.
Category 4 in provincial areas	A "one license per route" policy is implemented. Firms that receive a license are able to sub-contract to small-scale operators. The market is highly competitive between overlapping route operators. The passenger van is a new mode that serves the niche market.

Source: Pomlaktong et al. (2011). p. 272.

1.4.4 Bus Fare Regulations

The public bus fare is regulated by the Land Transport Committee, the

Land Transport Policy Committee, the Central Land Transport Control Board and the Provincial Land Transport Control Board. Prices are based on a cost-plus formula, including a target rate of return and an allowance for an expected load factor.

While most bus operations are done by BMTA, the rail operations are in the hands of the Mass Rapid Transit Authority (MRTA), a state-owned enterprise in charge of operation of the Mass Rapid Transit. The MRTA board of directors consists of 15 members with the composition of a chairperson and government-appointed independent directors, representatives from stipulated government agencies, and a board of director and secretary to the board. The responsibilities of the MRTA include providing a network for the MRT system that is convenient, fast, safe and punctual, as well as well-connected with other transportation modes. It also includes setting the appropriate fare structure for its target passengers and conducting various business matters to establish its brand name to be more beneficial to and well-accepted by the public.

Table 2.1.12 Public bus pricing

Bus route category	Pricing
Category 1 in Bangkok Category 4 in Bangkok	The Central Land Transport Control Board regulates the price based on the calculation of the cost/person/trip plus a 15% margin, and it fluctuates according to the oil price.
Category 1 in provincial areas Category 4 in provincial areas	The Provincial Land Transport Control Board regulates the price based on guidelines set by the Central Land Transport Control Board. The price differentiation depends on the cost of operation in each province. The calculation of the margin is based on a Minimum Retail Rate (MRR) plus 5% (i.e., MRR =13 +5, margin =18%). Price adjustment is used to cope with the oil price fluctuation and is tabulated in 25 steps. Yet the real price adjustment is subject to negotiation between the DLT and bus operators rather than being adjusted automatically.
Category 2 Category 3	The Central Land Transport Control Board regulates the price adjustment according to the fuel price. The price differentiation depends on the cost of operation in each province. The calculation of the margin is based on MRR plus 5% (i.e., MRR =13 +5, margin =18%). Price adjustment is used to cope with the oil price fluctuation and is tabulated in 25 steps. Yet the real price adjustment is subject to negotiation between the DLT and bus operators rather than being adjusted automatically.

Source: Pomlaktong et al. (2011). p. 273.

1.5 Road Infrastructure

There was a total of 115,679 km of roads in Thailand as of 2012. Of these, the length of paved roads consisted of 114,290 km. The ratio of paved roads to total road length was 99%. The total length of the expressways

was 208 km (AJTP, 2012). The total road length in Bangkok, which extends to 4,076 km, accounts for 3.5% of the national road length.

1.6 Railway Infrastructure

Table 2.1.13 Urban rail development in Bangkok

Type	Length (km)
BTS	24
Subway (MRTA)	20
Green Taksin-Wongvienyai	2.2
Airport Rail Link	28.5
Total urban rail length	76.4

Source: Padet. (2014).

The rail services provided by the public transportation system in Bangkok extends 76.4 km in length. Of this, 24 km is provided by BTS, 20 km by MRT, 28.5 km by ARL and 2.2 km by Green Taksin-Wongvienyai. Thailand has a plan to extend this rail system to 236 km by the year 2016, and further to 509 km by the year 2029 (Padet, 2014).

1.7 Vehicle Statistics, the Modal Share of Public Transportation

1.7.1 Vehicle Statistics

The number of in-use vehicles in Bangkok as of 2010 totaled in excess of 3.3 million.

Cars and motorcycles are the vehicles most available in Bangkok. Together they made up around 75% of all the vehicles in the city in 2010. Of the total number of Thailand's vehicles, 22.51% are found in Bangkok.

Of the total number of privately owned vehicles in Bangkok as of 2013, 3,518,862 were cars and 3,028,153 were motorcycles. The number of cars and motorcycles has clearly been on an upward trend since 1992. As of 2009, the number of cars surpassed the number of motorcycles, and the difference keeps increasing every year. The rate of increase in the 2013 reached 15%/year, while the average growth rate amounts to 6.62%/year.

Table 2.1.14 *The number of in-use vehicles in Bangkok (1994-2010)*

Type of vehicle	1994	2003	2010	Average annual growth (%)	2010	
					Share of fleet in Bangkok (BMA)	Bangkok fleet as % of Thailand's
Cars	716,951	1,162,704	1,203,764	3.77	36.14%	53.59%
Microbuses & passenger vans	241,120	149,613	104,703	-5.78	3.14%	50.35%
Vans & pickups	245,942	583,045	522,511	5.53	15.69%	20.44%
Urban taxis	22,256	63,228	49,224	5.83	1.48%	98.90%
Motor-tricycle taxis (Tuk tuks)	3,645	7,394	4,876	2.10	0.15%	41.94%
Motorcycles	851,853	857,460	1,299,637	3.06	39.02%	14.46%
Trucks	73,145	75,800	61,732	-1.20	1.85%	14.39%
Buses	17,457	26,225	18,831	0.54	0.57%	27.26%
Other	13,220	11,248	65,298	12.09	1.96%	27.30%
Total	2,185,229	2,936,717	3,330,616	3.06	100.00%	22.51%

Source: Pomlaktong et al. (2011). p. 269.

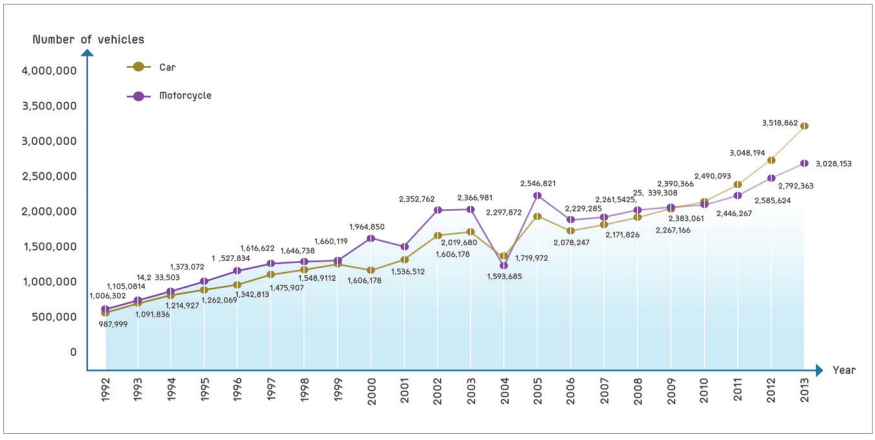


Figure 2.1.7 *The number of registered vehicles (1992-2013)*

Source: Mass Rapid Transit Authority of Thailand. (2013). *Connecting Today for the Future*. Huai Khwang, Bangkok: Mass Rapid Transit Authority of Thailand. p. 14. <http://www.mrta.co.th/en/aboutMRTA/annualReport/All2556eng.pdf>.

Unlike the upward trend of private transportation modes, the number of bus users has shown a depreciating trend. In 1992, buses were utilized to the point where approximately four million trips were taken per day on

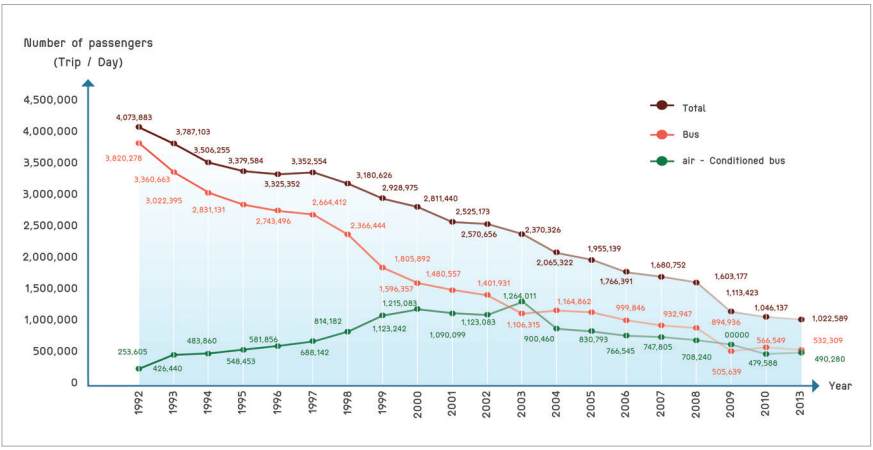


Figure 2.1.8 The number of BMTA (bus) passengers since 1992

Source: Mass Rapid Transit Authority of Thailand. (2013). p. 14.

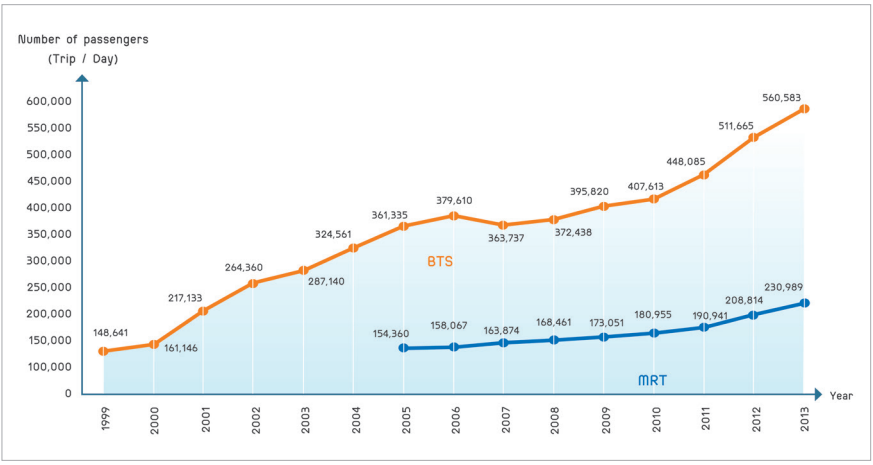


Figure 2.1.9 The number of passengers using mass transit system (BTS and MRT)

Source: Mass Rapid Transit Authority of Thailand. (2013). p. 15.

them. This has decreased to about one million trips per day.

While the number of daily passengers using the BMTA has decreased significantly, the number of passengers using mass transit systems, including the BTS and the MRT, has shown an increasing trend. Since 1999, the number of BTS users has risen from 148,641 to 560, 583.

Furthermore, since the implementation of the MRT system in 2005, MRT users have increased from 154,360 to 230,989. However, this increase is in spite of the fact that the overall number of public transportation users

has been on the decline, meaning that private vehicles are being favored by the citizens of Bangkok. However, due to the punctuality and speed of the MRT and BTS, user numbers keep increasing, and with the convenience offered from the common ticket between the MRT and other systems and extended coverage of the routes, the number of passengers using the MRT in the future has been envisioned to increase by a great amount according to a report released in 2013 by the MRTA. (MRTA, 2013)

1.7.2 Passenger Trip Demand in Bangkok

Table 2.1.15 Passenger trip demand in Bangkok

(Unit: million trips/day, %)

	Bus	MRT		Car
		BTS	BMCL	
Daily trips	6.3	0.50	0.2	10
Modal share	37	3	2	58

Source: Pravinvongvuth. (2014).

The travel demand in Bangkok is as high as 17 million trips per day in the metropolitan area. Cars and motorcycles are more prevalent than other vehicles in the city. Car trips accounted for 10 million daily trips per day, and were just ahead of buses, which accounted for 6.3 million daily trips. According to the table Table 2.1.16, buses serviced 84% of trips on public transportation per day. The next highest was the MRT (BTS), which services 10% of daily trips. This huge disparity shows that the citizens of Bangkok, when travelling on public transportation, favor buses a lot more than any of the other modes available to them.

1.7.3 Public Transportation

Table 2.1.16 Public transportation modal split

	MRT (BTS)	MRT (Subway)	MRT (ARL)	BRT	BUS
Traffic usage	0.6 mil trips/day	0.2 mil trips/day	-0.1 mil trips/day	-0.05 mil trips/day	4-5 mil trips/day
Percentage	10%	3.5%	1.7%	0.8%	84%

Source: Jenpanisub, Anchalee. (2014). "Public Transport in Bangkok." In *Proceedings of 2nd ASEAN-Korea Public Transport Workshop*. 4-6 August. Jakarta, Indonesia: The Korea Transport Institute. pp. 189-206.

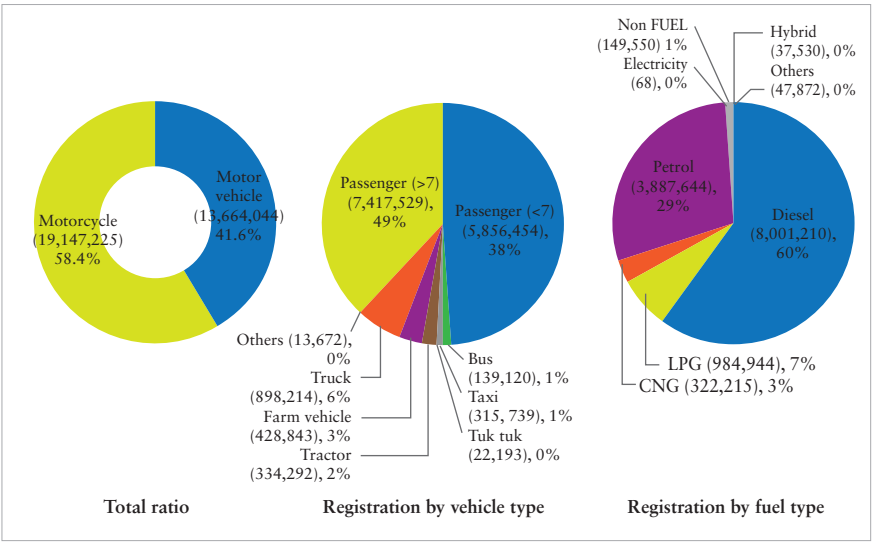


Figure 2.1.10 *Number of vehicle registrations by vehicle and fuel type (2013)*

Source: Laoonual, Yossapong. (2013). "EV Current Status in Thailand." <http://www.jari.or.jp/Portals/0/resource/pdf/AAI%20Summit/H25/3.%20EV%20TAI.pdf > (Accessed on 7 Oct. 2014).

1.8 Traffic Safety Indicators

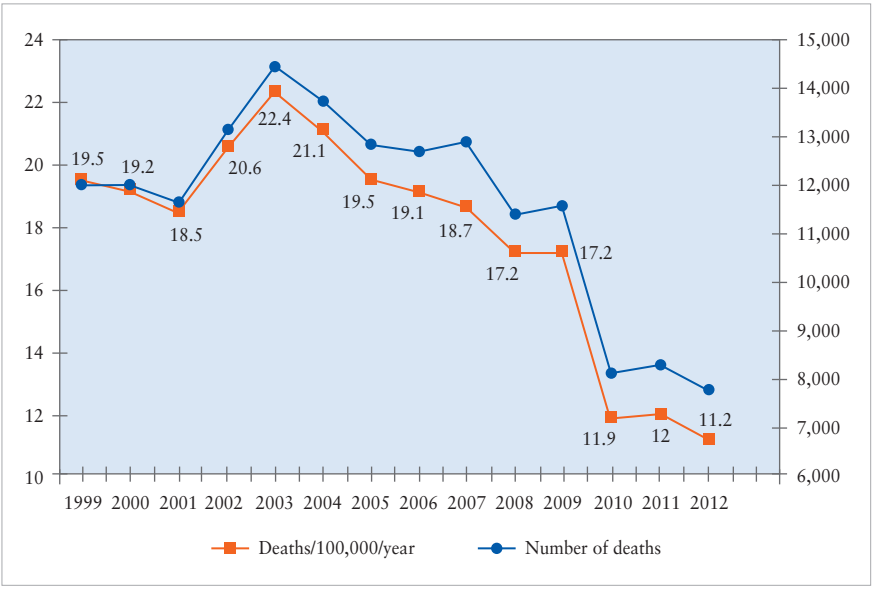


Figure 2.1.11 *Annual trends of traffic accidents*

The number of deaths as a result of traffic accidents has been showing a declining trend since 2002, when the number hit its highest point of around 14,500 deaths per year. As of 2012, this number had fallen to approximately 7,700 deaths per year.

1.9 Travel Behavior

Bangkok operates in a mono-centric fashion because all travel is concentrated in the center of the city. The most commonly used method of travel is the car, which accounts for over 58% of total transportation demand per day (Pravinvongvuth Surachet, 2014).

1.10 Air Pollution and Vehicle Maintenance Standards

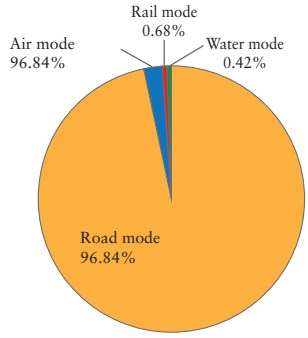
Table 2.1.17 Fuel quality and vehicle emission standards

Division	Contents and standards	
Sulphur (max, ppm)	Diesel	350
	Petrol	500
50ppm target date	2012	
Fuel quality comments	Lead phased out in 1999. In 2006, planned to adopt Euro 4-equivalent fuels (50 ppm) by 2010, now modified to 2012. Source: CAI-Asia, ACFA.	
Vehicle import restrictions*	Importation of used vehicles is banned; new imported vehicles must have a catalytic converter.	
Vehicle standards & inspection and maintenance(I/M)	DIESEL is an emissions testing program for diesel vehicles; Euro 3 vehicle standards are in place; Euro 4 vehicle standards came in 2012.	
Vehicles comments	The Pollution Control Dept. has 71 air quality monitoring stations across Thailand.	

Source: UNEP. (2012). "Status of Fuel Quality and Vehicle Emission Standards in Asia-Pacific." <http://www.lead.org.au/PCFV/Lead_Matrix_AP_201206.pdf> (Accessed on 17 Oct. 2014).

Listed above are the fuel-related vehicle emission standards for Thailand. The amount of sulphur is limited to 350 ppm in diesel and 500 ppm in petrol, and lead has not been included in the contents of fuel since 1999. The importation of used vehicles is banned for now, and newly imported vehicles must be equipped with a catalytic converter for environmental reasons.

The data show the current air pollutant status in Bangkok. According to the data, most of the city's air pollution is caused by land modes of transportation.



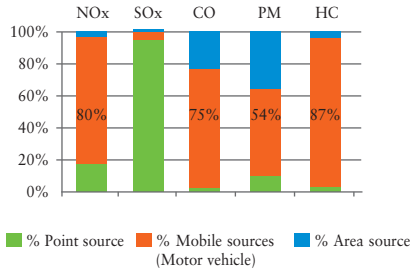


Figure 2.1.12 *Volume of greenhouse gas released by Thailand's transport sector*

Figure 2.1.13 *Ratio of air emissions (pollutants) in Bangkok*

Source: Office of Transport and Traffic Policy and Planning. (2014). "Thailand's Experience on Emission Measurement and Mitigation Policies." p. 7, 12. <http://www.unece.org/fileadmin/DAM/trans/doc/themes/ForFITS/3.9.Thailand.pdf> (Accessed on 24 Oct. 2014).

1.11 Traffic Congestion and Traffic Demand Management

1.11.1 Traffic Congestion

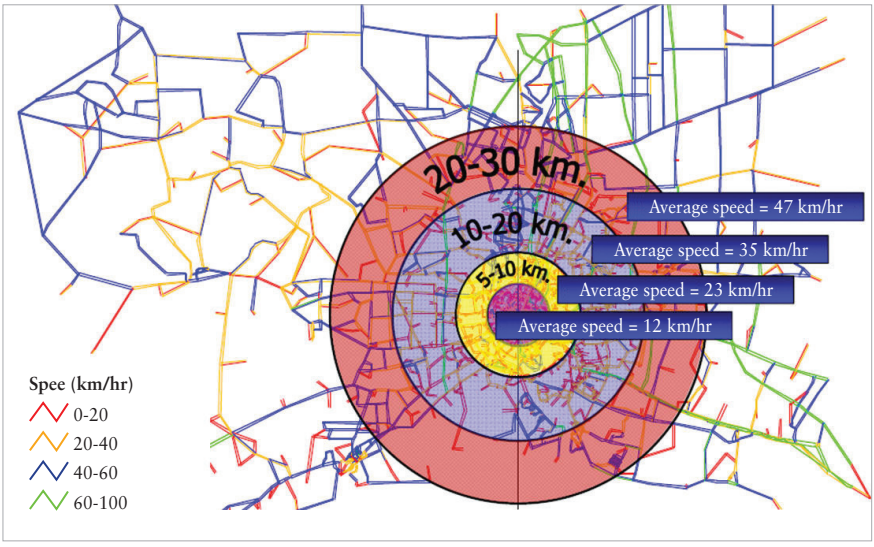


Figure 2.1.14 *Average travel speed of private cars in CBD*

Source: Office of Transport and Traffic Policy and Planning.

Figure 2.1.15 *Traffic congestion in Bangkok*

The severity of the traffic congestion in Bangkok is a well-known problem that the city has to contend with. According to an article from the BBC written in 2012, Bangkok is among the top 10 cities with the worst traffic jams in the world.

The average travel speed of private cars in the Central Business District (CBD) of Bangkok is 12 km/hr, 23 km/hr, 35 km/hr, and 47 km/hr, respectively, in the range of 0-5 km, 5-10 km, 10-20 km, 20-30 km from the center of the district. During rush hour in the morning, the average travel speed is 16.3 km/hr, while during the evening rush hour speeds rise to 23.5 km/hr. The average speed of the MRT system, which includes the BTS and the subway, amounts to a much faster 40 km/hr (Padet, 2014).

1.12 Organizations of Public Transport Administration

1.12.1 Bangkok Mass Transit Authority (BMTA)

The Ministry of Transport of Thailand is composed of two separate entities. These are government administrations and state enterprises. The government administrations body oversees a total of seven government departments, as well as the office of the minister. The state enterprises are a varied group that are responsible for overseeing and taking note of the country's transportation needs. One of these state enterprises is the Bangkok Mass Transit Authority (BMTA).

The BMTA, founded in 1976, is a state enterprise that retains operational control of the public bus system in the Bangkok metropolitan area and its surrounding provinces, Nonthaburi, Samut Prakan, Pathum Thani, Nakhon Pathom and Samut Sakhon. The BMTA, as of August 2011, handled a total of 3,509 buses and carried an estimated 1.05 million passengers per day across 108 individual routes.

The BMTA has several well-defined roles and charges. The enterprise is charged with producing a bus network to meet the challenge of the day in Bangkok, transportation demand. The BMTA has expansive plans to enhance the bus network to make it more extensive and efficient in order to meet the ever-growing demand. Along with expanding the bus network, the BMTA is also seeking to expand its own services in order to cater the ever-changing needs and demands of transportation users and even to one day install itself as a support act to the tourism industry in Thailand. Another role that the BMTA is charged with is attempting to stimulate interest among private firms and enterprises to operate local bus services. The BMTA would retain a supervisory role once the goal of monitoring whether these firms' operations meet the required standards and criteria is reached. Furthermore, the enterprise is also attempting to maintain affordable fares for its services while also taking environmental issues into consideration; this represents a direct coordination with government policies on both counts.

1.12.2 Office of Transport and Traffic Policy and Planning (OTP)

One of the government departments that fall under the government administrations body of the Ministry of Transport is the Office of Transport and Traffic Policy and Planning, or the OTP. The OTP maintains

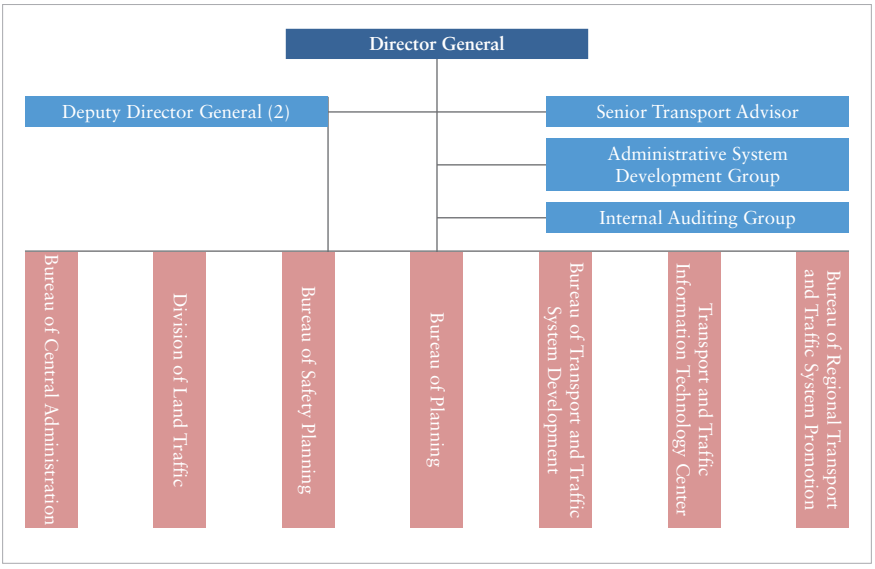


Figure 2.1.16 *Organization chart of the OTP*

Source: Thailand Transport Portal. (2014). "Ministry Transport." <http://vigportal.mot.go.th/portal/site/PortalMOTEN/about/otp-en/> (Accessed on 1 Sept. 2014).

a tri-fold responsibility when acting on its charges and roles. The OTP submits policies, formulates both transportation and traffic plans, and designs transportation safety procedures that are congruous with the country's national plans regarding the same issues. The need for congruence is to simply create an integrated and united transportation policy between the national and local actors. The overarching vision of the OTP is "to be the leading organization in setting the direction for the development of the country's transport and traffic systems."

The OTP, like the BMTA, has several varied charges and roles. The OTP is leading the charge on several fronts with missions such as designing and proposing specific policy acts and transportation and development measures, or even leading the way in undertaking research, conducting studies and creating new innovative technologies to enhance the transportation and traffic scenes. The variation in its roles does not, however, end there with the OTP. Like the BMTA, it advocates for improved safety and environmental measures in transportation. The government department is also in charge of promoting and implementing policy measures and plans into effect while also conducting human resource management.

1.12.3 Bureau of Planning

The Bureau of Planning is the planning office of the OTP, which formed the 2013-2020 Infrastructure Development Plan. In addition, the Bureau of Planning has developed a Summary Report for 2013 and developments in the monitoring and evaluation of the OTP Strategic Plan 2013-2016 and other traffic and transport projects.

1.12.4 Bureau of Transport and Traffic Systems Development

The Bureau of Transport and Traffic Systems Development has worked towards improving mobility within and around the Bangkok Metropolitan Region through the expansion of mass rapid transit, a study on development of a travel connection system and a bicycle way development proposal.

Study on Travel Connection System Development at the Phaholyothin Transportation Center

To provide greater mobility in the Phaholyothin area, the Ministry of Transport assigned the OTP to conduct a study on the development of travel connectivity at the Phaholyothin Transportation Center. The approach included the preparation of an area development model scheme, a feasibility study on minor-scale mass transit system development, improvement of the footpath and road network for travelling convenience, and passengers' attraction to use public transport. The following are the travel connection concepts that are studied at the Phaholyothin Transportation Center.[1]

- Provision of minor-scale mass transit systems to connect important routes to Bang Sue Central Station, such as monorail, tram or BRT
- Development of a pedestrian-only route to connect local travel nearby Bang Sue Central Station through tunnels or raised paths
- Development of travel routes and road networks by expanding the traffic lanes of existing roads to increase traffic flow
- Provision of connections between local roads and expressways to allow convenient and rapid access to nearby areas and to Bang Sue Central

1 Performance Summary of Bicycle Way Development, King Mongkut's Institute of Technology Ladkrabang (KMITL) – Ladkrabang Airport Rail Link Station (ARL Ladkrabang).

Station, and to relieve the traffic volume from ground-level roads
- Management of traffic on the local road network by providing a traffic signal system to control local traffic

In investigating ways to promote the accessibility of Airport Rail Link stations, the OTP has coordinated with the Department of Highways (DOH), Thai Cycling Club (TCC) and King Mongkut's Institute of Technology Ladkrabang (KMITL) in order to design a bicycle way along the highway between Ladkrabang Airport Rail Link Station with KMITL, a total distance of 5 km. Coordination among the various agencies involved resulted in a plan to build cycling infrastructure in addition to facilities such as changing rooms and showers. The plan takes into account cyclist's safety through tree-lined buffers, clear and legible signs and separate crossing bridges for cyclists.

1.13 Public Transport and Traffic Planning

1.13.1 Infrastructure Development 2013-2020

After being rated lower than its neighbor countries in infrastructure development in the World Bank's Logistic Performance Index in 2012, the government of Thailand proposed an infrastructure development plan in making policies and becoming a nationwide strategic move of the country. These included policies to expand transport infrastructure around the country through several methods: To develop cost-reducing and energy-saving transportation systems, to continue investment in different transport facilities for facilitation of exports, to develop the Rail Transport System by investing in a high-tech rail system, to accelerate the construction of 10 electric train routes in Bangkok and surrounding provinces, to develop water transportation, and to develop international and regional airports, in part, for the progress of the Thai aviation industry.

1.13.2 10-Line Mass Rapid Transit (MRT) Project

The OTP has coordinated with the State Railway of Thailand (SRT) and the Mass Rapid Transit Authority of Thailand (MRTA) to develop a plan for a 10-line mass rapid transit project. This is part of the national strategy for the development of the railways. The basic goal is to utilize the high

capacity of the railway transport modes and to increase the traffic on railways to relieve Bangkok of some of its heavy congestion. The master plan includes 10 lines of the MRT in total, including some feeder lines to improve the connectivity of the whole public transportation network.

The 410-km mass rapid transit network in the Bangkok Metropolitan Region is expected to be open by 2019, and extended by an additional 54 km after that. The fare will be a flat rate of 20 Baht across the system, and an integrated ticket system across the different public transportation modes will be implemented for the convenience of the passengers. Low-income housing will be developed near the transit stations in order to increase lower income peoples' access to low-price, low-rent housing that is within reach of the public transportation system. The net present value of the Master Plan is expected to be 413,000 million Baht, with an economic internal rate of return of 20.89%.

2. Bandar Seri Begawan

Young-in KWON and Wonjae KIM

2.1 National and City Statistics

As shown in the Table 2.2.1, Brunei has a land area of approximately 5,765 km^2. The country is a sovereign state located on the north coast of the island of Borneo in Southeast Asia. Apart from its coastline on the South China Sea, Brunei is completely surrounded by the state of Sarawak, Malaysia, and it is separated into two parts by the Sarawak district of Limbang. It is the only sovereign state on the island of Borneo; as the remainder of the island's territory is divided between the nations of Malaysia and Indonesia. The primary language of Brunei is Malay and Bandar Seri Begawan is its capital city. The currency used is the Brunei Dollar (BND) with US$1.00 being worth about BN$1.25. The population of Brunei, as of 2013, was 417,800, and the GDP in 2013 was estimated at US$16.11 billion.

Table 2.2.1 Basic facts about Brunei

Contents	Status
Land area (thousands km^2)	5,765
Population (July 2014 est.)	422,675
Major language	Malay
Capital city	Bandar Seri Begawan
Currency	Brunei dollar (BND)
GDP (US$ billion, 2013 est.)	16.56
GDP per capita (US$, 2013 est.)	$54,800

Source: Central Intelligence Agency. (2014). "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/id.html> (Accessed on 23 Oct. 2014).

Table 2.2.2 shows an overview of Bandar Seri Begawan, Brunei's capital city. As for demographic conditions, the total population of the capital, as of 2010 was around 140,000, and 33% of the total population of Brunei lived there. The land area is about 100.36 km^2 and it surrounded by regions. Due to the extension of the borders of Bandar Seri Begawan in 2007, the capital city now encompasses a greater land area and so has a much greater population than it had prior to 2007.

Table 2.2.2 Overview of Bandar Seri Begawan

Contents	Status
Total population of city city (2011)	241,000
Population growth (% annual)	–
Population density (per km^2)	272
Population by day (million)	–
City's pop. compared to the entire country (%)	–
Total number of households (persons)	–
Land area (km^2)	100.36
GDP per capita (US$)	–
Total budget (billion, US$)	–

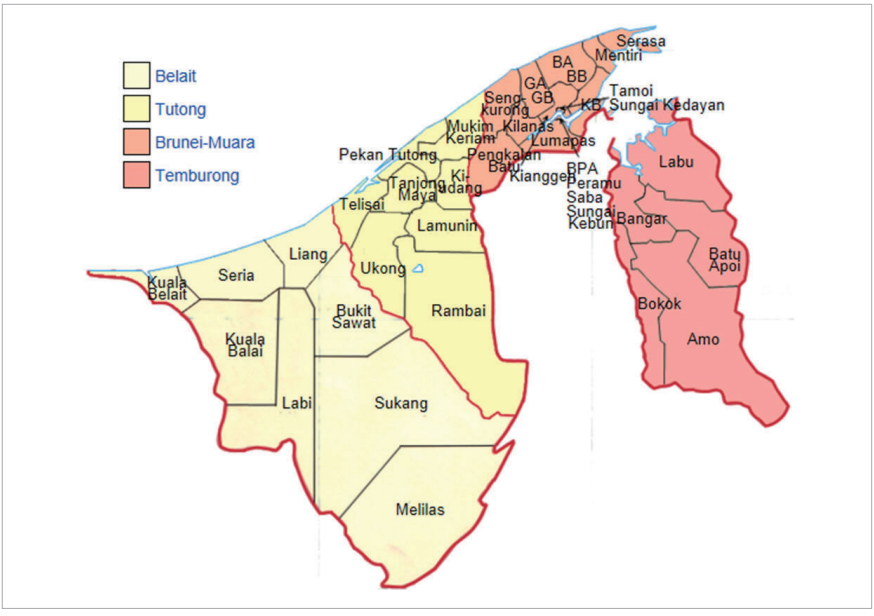


Figure 2.2.1 Map of Brunei

Source: Wikipedia. (2014). "Brunei." <http://en.wikipedia.org/wiki/Brunei> (Accessed on 23 Oct. 2014).

2.2 Public Transit Levels of Service

2.2.1 A Low Share of Public Transport and High Rate of Private Cars

The following table shows the various types of vehicle and their share in the urban transport system. It is evident that the most prevalent form of transport is the private car.

Table 2.2.3 Modal share of transportation vehicles

Contents	Status
Private car	92.0%
Bus	4.0%
Goods vehicles	3.7%
Motorcycle	0.2%
Taxi	>0.1%
Bicycle	>0.1%
Other	>0.1%
Total	100.0%

Source: Hamid, Fadzila Abdul. (2013). "Public Transportation in Brunei Darussalam: Brunei Muara Franchise Buses and Taxis." In *Proceedings of ASEAN-Korea Capacity Building Program*. 17-26 February. Seoul, Korea: The Korea Transport Institute. p. 208.

2.2.2 Comparison of Motor Vehicles Per Capita

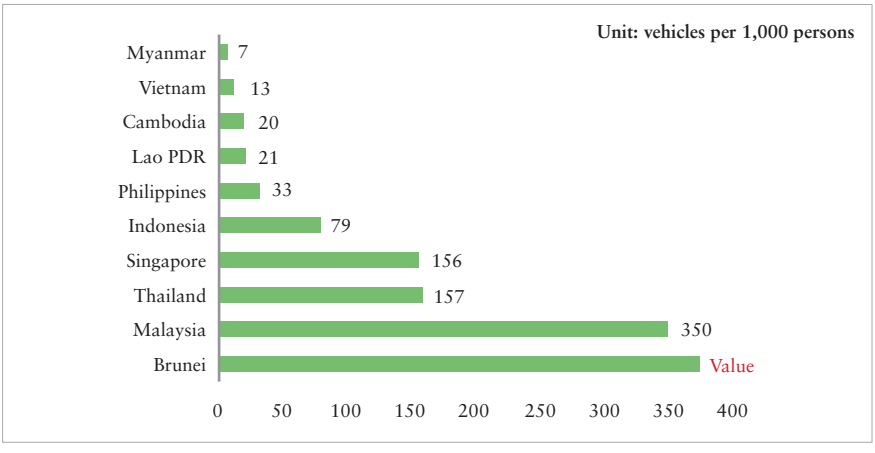


Figure 2.2.2 Comparison of motor vehicles per capita across Southeast Asian countries

Source: Hamid, Fadzila Abdul. (2013). p. 208.

Figure 2.2.2 shows the Southeast Asian countries' motor vehicle levels per 1,000 persons. With 375 motor vehicles per 1,000 persons, Brunei has the highest level among the countries in Southeast Asia.

2.2.3 Satisfaction Levels of Public Transport Services

A survey was conducted with the aim of assessing the levels of satisfaction of public transportation users with the current services provided by a franchise called the Purple buses. The results of the survey are shown in the Table 2.2.4.

Table 2.2.4 Level of satisfaction with public transport services

Service types	Satisfied	Neither	Dissatisfied
Journey time	45%	20%	35%
Convenience	45%	30%	25%
Frequency	28%	28%	44%
Reliability	40%	20%	40%
Information	40%	25%	35%
Cost	60%	30%	20%

Source: Hamid, Fadzila Abdul. (2013). p. 214.

The survey revealed some rather interesting results; it showed that while 44% of public transport users were dissatisfied with the current service's frequency rates, 60% were highly satisfied with the cost of the services. The survey also showed that 45% of the users were satisfied with both the convenience and journey times of the transport services. This result would suggest that even though the users were dissatisfied with frequency rates, they found the services convenient and were less critical about journey times because of the satisfaction with cost that is expressed through this survey.

2.2.4 Bus Routes and Operation Frequency

A new public bus route map, released in 2013, shows the new routes around the Brunei-Muara District. The public bus system would greatly help to reduce the traffic levels and petrol consumption if it could entice more users to use the system whenever and wherever possible. Figure 2.2.3 presents a diagram of city bus routes illustrating the extent of routes for Bandar Seri Begawan. Figure 2.2.4 shows intercity bus routes, and Figure

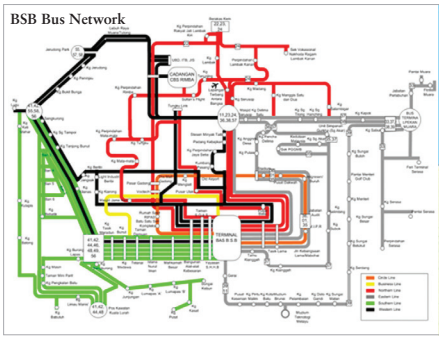


Figure 2.2.3 *City bus route map*

Source: Hamid, Fadzila Abdul. (2013). p. 222.

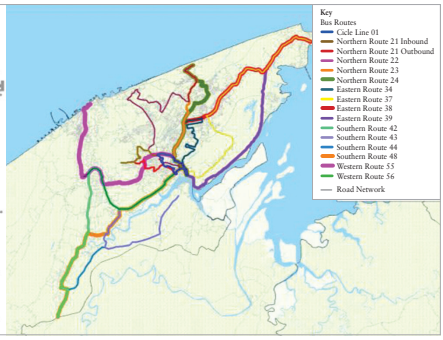


Figure 2.2.4 *Intercity bus route map*

Source: Hamid, Fadzila Abdul. (2013). p. 213.

2.2.5 presents the frequency rates of Brunei's bus operations. These figures suggest that while Brunei has rather extensive city bus route and inter-city systems, the frequencies as shown by Figure 2.2.5, however, are quite low, meaning that the extensive bus system is not being operated well.

In 2011, Brunei Darussalam embarked on a study to develop a National Master Plan for a Sustainable Land Transport System. According to a report by SQW China Ltd. (2013), a consultant appointed to undertake the study, the initial findings revealed that there has been a general 32% drop in ridership from 2005 to 2011.

According to the transport surveys undertaken as part of the study, the following issues are areas that require improvement and need to be addressed immediately to combat the falling ridership figures:

- Unreliable services;
- Poor conditions of buses;
- Poor bus stop accessibility;
- Lack of public subsidies;
- Short and inconvenient operating hours;
- Social separation separation (a concern of foreign workers who take buses); and,
- Limited information available to the public.

2.2.5 Water Transport

The main modes of water public transportation in Brunei Darussalam are water taxis, speed boats and ferries. Water taxis (usually wooden boats with a capacity of fewer than 12 passengers) provide daily express services

Line	No.	Route	Average frequency (minute)	Frequency over an hour
Circle	1	TBBSB - Gdong Circula (both ways)	14	
Business-central	20	TBBSB - Gadong - Jn Batu Bersurat	29	
Northern	21	TBBSB - Kg Mata - Mata	111	∨
	22	TBBSB - TB - Berekas Kem	65	∨
	23	TBBSB - PB Airport - TB Berekas Kem	37	
	24	TBBSB - TB Berekas Kem	111	∨
Eastern	33	Pekan Muara Local	N/A	
	Eastern	TBBSB - Airport	130	∨
	Southern	TBBSB - Immigration	60	∨
	Western	TBBSB - PB Airport	37	
	37	TBBSB - TB Pekan Muara	78	∨
	38	TBBSB - PB Airport - TB Pekan Muara	49	
	39	TBBSB - PB Muzium Tek - TB Pekan Muara	49	
Southern	42	TBBSB - PB Pos Sengkurong - PB Kuala Lurah	25	
	44	TBBSB - PB Kuala Lurah	116*	∨
	45	TBBSB - PB Sengkurong	20	
	48	TBBSB - PB Kuala Lurah	60	∨
Western	55	TBBSB - Sengkurong - Jerudong Park	20	
	56	TBBSB - PB Sengkurong	31	
	57	TBBSB - [Airport] - Jerudong Park	111	∨
	58	TBBSB - Empire Hotel (Jerudong)	98	∨
TBBSB		Bandar Seri Begawan (BSB) bus terminal		
PB		Local bus terminal		

Figure 2.2.5 *Frequency of bus operations*

TBBSB: Bandar Seri Begawan (BSB) bus terminal
PB: Local Bus Terminal
Note: *4 Departure was observed on 11 October 2012 from 7 a.m. to 3 p.m. but no departure was observed on 26 November 2012
Source: Hamid, Fadzila Abdul. (2013). p. 214.

to locals and tourists travelling to and from the mainland and Kampong Ayer (a historic residential area with houses built on stilts above the Brunei River situated at the heart of the BSB).

Speed boats (with a maximum capacity of 30 passengers) are used to travel to Temburong District, one of the four Brunei Darussalam districts that are separated by Limbang, a town in the state of Sarawak, East Malaysia. For international passengers, travelers can opt to utilize the passenger ferries (that hold 100 to 234 passengers) or the car ferries (30-40

vehicles) to Labuan, Malaysia which depart daily from the Serasa Passenger and Car Ferry Terminal. There are also scheduled speed boat services (with a maximum capacity of 30 passengers) to Lawas, Sarawak, Malaysia.

Tourists and private individuals can opt for private boats and ferries to travel around the Brunei waterways. The Serasa Passenger and Car Ferry Terminal come under the purview of the Ports Department, while licenses to operate the above-mentioned water transportation services are issued by the Marine Department.

2.3 Transportation Infrastructure Investment and Financing

Brunei Darussalam has experienced sustainable growth for the past 12 years, with population and population density increasing by 23.09% and 23.21%, respectively, over the past 12 years. Along with this population

Table 2.2.5 Population, national accounts and expenditures of Brunei Darussalam

Item	2000	2002	2004	2006	2008	2010	2012	% Increase*
Population								
Total population (thousand; as of July 1)	324.8	340.1	352.3	364.5	375	386.8	399.8	23.09%
Population density (persons per km^2)	56	59	61	63	65	67	69	23.21%
National Accounts at current prices (million Brunei dollars; calendar year)								
GDP by industrial origin at current market prices	10,346	10,463	13,306	18,226	20,398	16,867	21,185	104.77%
Transport and communications	394	425	454	504	534	576	682	73.10%
Share of GDP (%)	3.81	4.06	3.41	2.77	2.62	3.41	3.22	-15.47%
Expenditure by Function, Central Government								
Total	3,503	3,074	3,338	3,746	3,830	4,041	–	15.36%**
Economic services	1,723	1,399	889	–	–	–	–	-48.40%***
Transport and communications	115	97	102	56	61	68	–	-40.87%**
Share of economic services (%)	6.67	6.93	11.47	–	–	–	–	71.90%***
Share of expenditure (%)	3.28	3.16	3.06	1.49	1.59	1.68	–	-48.74%**

*Percent increase from 2000 to 2012, unless specified otherwise
**Percent increase from 2000 to 2010, due to insufficient data
***Percent increase from 2000 to 2004, due to insufficient data

growth, the national GDP has also experienced sustainable growth. The share of the transport and communications sector in the total GDP has been around 3-4%.

Meanwhile, the central government's expenditures on transport and communications accounted for 115 million Brunei dollars in 2000, but the expenditures in this sector have shown a depreciating trend. By 2010, expenditures in transport and communications had decreased to 68 million Brunei dollars. The share of the central government's total expenditures accounted for by the transport and communications sector decreased from 3.28% in 2000 to 1.68% in 2010.

2.4 Ownership, Operation, and Regulations of Public Transport

2.4.1 Bus System

The Muara Franchise Bus system, called the Purple bus for their distinctive color, was introduced in Brunei Darussalam in 1995. However, the franchise bus services only started operating in 1996 with the appointment of six different companies to operate the six different routes in the Brunei Muara District and one company to operate the services in the Belait District in 2000.

The first term of the contract for the Brunei Muara Franchise Bus service ended in 2003 and was retendered, then awarded to the previous operators and began operation again in 2004. The second term of the contract was supposed to expire in 2010, but has been extended annually pending a newly proposed bus franchise system.

The Brunei Muara Purple bus operates across 22 routes, which are divided into six lines: Central, Circle, Northern, Eastern, Southern and Western, as shown in Figure 2.2.5. There are two types of buses, one with 22 seats and another with 45 seats. The hours of operation are from 6 am to 7 pm. The fares for the general public, irrespective of distance of travel, are $1 per trip, and $0.50 per trip for senior citizens and school children.

2.4.2 Taxis

Taxis have been operating in Brunei Darussalam since the 1960s. With various government and private sector intiatives to promote the use of public transport, the taxi system has evolved greatly over the last six years:

Table 2.2.6 Taxi system of Brunei

Period	Types	Features
1960s	Individual	
	City Transport Service (CTS)	Fleet operator Affordable - US$3 per trip for city areas only
	Perkhidmatan Pengangkutan Pelangi (PPP)	Individual taxis operating like CTS concept
2008 - present	Individual (including Aiport Taxi Service (ATS)	Non-metered. A meter was introduced in 1992 but failed. No taxi signs
Upcoming	Proposed taxi franchsie	Extended hours, taxi box signs, taxi meter radio or telephone call service, improved safety features, priority to use environmentally friendly vehicles

Source: Hamid, Fadzila Abdul. (2013). pp. 223-224.

The report by SQW China Ltd. (2013) revealed the following issues with the taxi modus operandi:

- There are very few registered taxis (estimated to be around 50 from the survey);
- Nominal license fee;
- No financing facility;
- Lack of cooperation among taxis;
- Competes with other modes;
- Car rental with chauffeur; and,
- Unlicensed taxi services.

2.5 Road Infrastructure

The density of road infrastructure in Brunei has fluctuated throughout the last few years, as indicated in the Table 2.2.7. While road density fluctuated from 2004 to 2011, it can be seen that overall, the percentage of paved roads and the total length of roads increased during that time period.

Table 2.2.7 Road infrastructure statistics

Year	Road density (km of road per 100 km^2 of land area)*	Roads, paved (% of total roads)*	Length of road (km)**
2004	58.38	79.10	–
2005	59.38	78.41	–
2006	60.21	78.03	–
2007	51.38	80.06	2,964.7
2008	51.51	81.12	2,972.1
2009	53.10	79.91	3,063.6
2010	52.48	80.40	3,028.1
2011	54.20	82.34	3,127.4
2012	–	–	3,122.7
2013	–	–	3,166.9

*World Development Indicators, World Bank
**Brunei Darussalam Key Indicators 2013 (Release 2)

2.6 Vehicle Statistics, Modal Share of Transportation

2.6.1 Vehicle Statistics

According to the Brunei Darussalam Key Indicators of 2013, the number of newly registered vehicles increased from 15,900 in 2011, 18,651 in 2012 and to 18,950 in 2013. The following table shows the breakdown of the different types of newly registered vehicles. The table shows that private cars accounted for a huge majority of the newly registered cars for 2011-2013, but more interestingly, the number of motorcycles decreased by approximately 76.5% between 2012 and 2013. This notable decrease could be due to the slowing down of the growth in newly registered vehicles numbers.

Table 2.2.8 Newly registered vehicles 2011-2013

Year	Total number of newly registered vehicles	Private cars	Goods vehicles	Motorcycles/ scooters	Others
2011	15,900	14,690	491	599	120
2012	18,651	17,412	427	658	154
2013	18,950	17,883	423	154	104

Source: Brunei Darussalam Key Indicators 2013.

2.6.2 Modal Share of Transportation

Public monthly bus ridership levels in Brunei have steadily declined since 2011. The following table indicates the average monthly bus ridership per year from 2005 to 2011. On average, public transportation only accounts for 2% of the total transportation modal share.

Table 2.2.9 Average bus ridership per month (passengers)

Year	2005	2007	2009	2011
Average bus ridership per month (passengers)	300,800	270,400	250,000	230,000

Brunei has one of the lowest public transport trips per passenger rates per year among the countries and cities compared in the following figure:

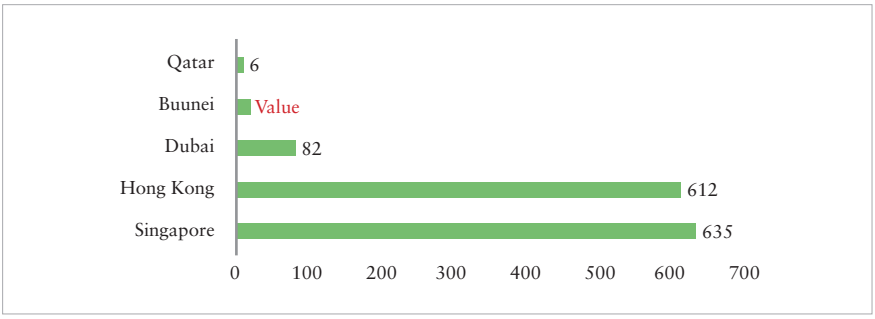


Figure 2.2.6 Public transport trips per passenger per year (2011)

2.7 Traffic Safety Indicators

2.7.1 Traffic Safety Statistics

Even though the population of Brunei has steadily increased in the last few years, as shown in Figures 2.2.1, 2.2.2 and 2.2.3, the number of vehicles has fluctuated from year to year.. However, the number of accidents has also gradually increased at an average rate of 7% per year. This was a cause of major concern for the Ministry of Communications and the Brunei National Road Safety Council, as the number of fatalities has drastically increased to 47 in 2011. However, the number of fatalities decreased by about 50% to 23 in 2012.

Table 2.2.10 Traffic safety statistics

Year	2007	2008	2009	2010	2011	2012
Population	370,000	375,000	380,100	386,800	393,372	–
Total vehicles	191,832	205,621	165,849	113,655	148,186	–
Accidents	2,674	2,775	3,110	3,414	3,598	3,301
Fatalities	54	29	38	26	47	23

Source: Tinggal, Muhammad Adzly Haji. (2013). "Brunei Decade of Action for Road Safety 2011-2020." In *Proceedings of ASEAN-Korea Capacity Building Program*. 17-26 February. Seoul, Korea: The Korea Transport Institute. p. 335.

2.7.2 Brunei Decade of Road Safety (2011-2020)

The Brunei National Road Safety Council's Decade of Action for Road Safety (2011-2020) has set its vision as "Towards Safer Mobility and Safety on the Road." Its goal is "to reduce and minimize deaths and injuries related to road traffic accidents on Brunei roads."

The program takes a psychological, technological ("psycho-techno") and integrated approach towards road traffic accident injury reduction on Brunei's roads. It is composed of the "5Es": "Engineering, Education, Enforcement, Environment (roads and events due to climate change) and Emergency (improving rapid response time to fatal and injury-related accidents on-site and post-crash rehabilitation services)." Its main focus is to address and emphasize the following five aspects: "Speeding, enforcement, driver impairment, road user education and the creation of a safer road environment."

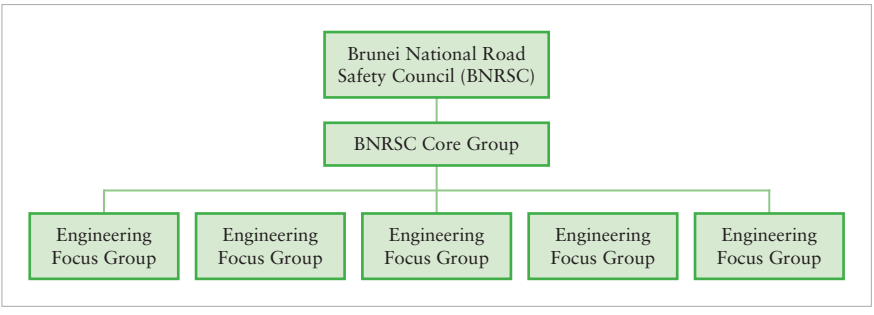


Figure 2.2.7 Brunei National Road Safety Council organization chart

Source: Tinggal, Muhammad Adzly Haji. (2013). p. 338.

2.8 Travel Behavior

2.8.1 School Congestion

A large portion of parents drive their children to and from school, which further exacerbates traffic congestion for a short period of time during the day. School buses only provide transportation for children traveling more than 7 kilometers, and there is a limited amount of off-street parking near school areas for those going by car. There is a desperate need to revamp the school bus system in order to turn it into an attractive and acceptable alternative mode of transportation, in addition to the provision of improved pedestrian facilities and off-street parking by the PTA.

2.8.2 Increasing Public Transport Use

The results of the BSB Development Master Plan Survey on Transportation indicate that 47.4% of respondents would like to see a reduction in fuel subsidies so that subsidies supporting public transport could therefore be

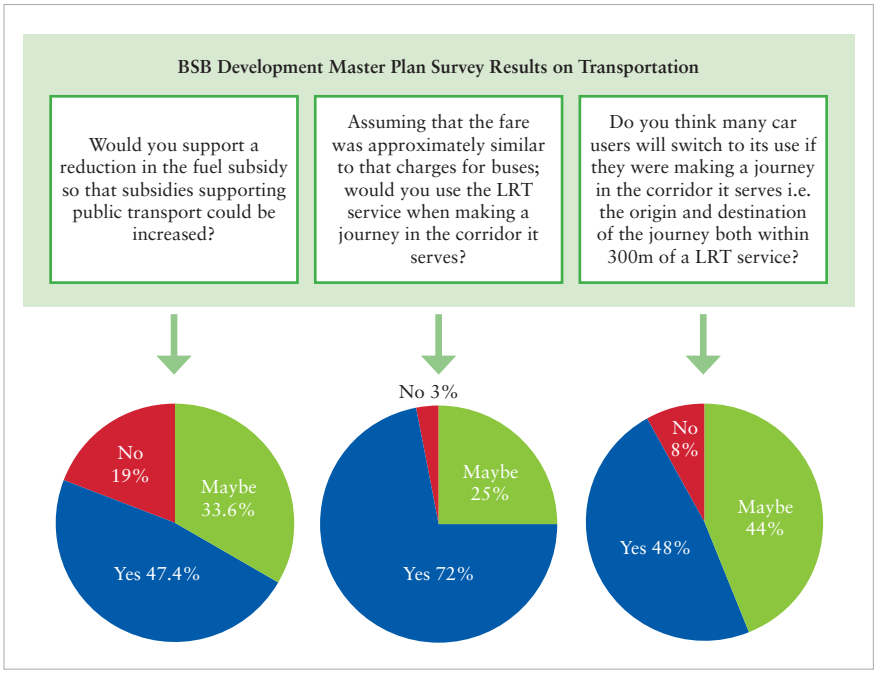


Figure 2.2.8 BSB Development Master Plan survey results on transportation

increased. A vast majority of respondents, 72.1%, expressed interest in an LRT service with similar fares as the current bus system. Additionally, 48.3% of respondents believed that car users would switch to using the LRT service if their journeys were accommodated within the LRT corridor, and if the origin and destination were both within 300 meters of an LRT station. The following is a diagram of the survey results.

2.9 Government Initiatives for Public Transport

The government of Brunei Darussalam has taken several initiatives to upgrade and promote the increased usage of public transportation. These initiatives include:

- Current bus franchise operators upgrading the condition of their buses and services according to a five-year road map;
- A proposed new bus franchise with improved features;
- A proposed new taxi franchise with improved features;
- Regular dialogues between the relevant authorities and operators;
- Consultations with potential investors to invest in public transportation;
- Improved facilities for public transport, e.g., a proposed new central bus terminal and more bus stops;
- A study to develop a National Master Plan for a Sustainable Land Transport System in Brunei Darussalam (to be completed by July 2013); and,
- Creation of a proposed Brunei Darussalam Land Transport Authority (LTA).

2.10 Public Transport Administration Organizations

The public transport system of Brunei Darussalam is both planned and supervised by the Land Transport Department of Ministry of Communication of Brunei. The department was established on January 1, 1962, and its mission is to provide transportation infrastructure and services for the mobility of goods and people within Brunei Darussalam and from neighboring countries.

The main functions of the Land Transport Department include enhancing traffic safety, coordinating the planning of roads and traffic

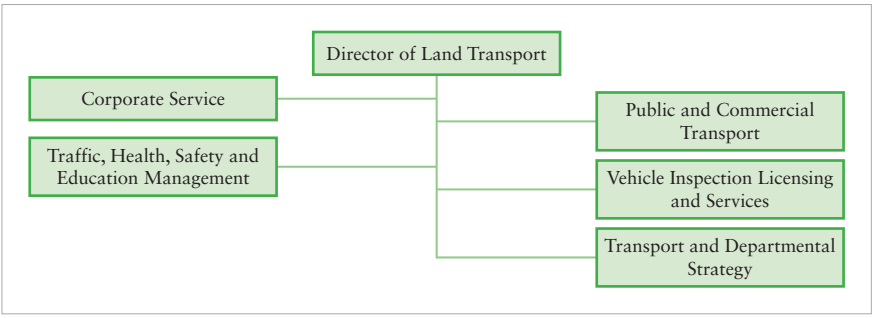


Figure 2.2.9 *Organization chart of the Land Transport Department*

management, the planning and control of public and goods transportation, law and regulation enforcement of road traffic and revenue collection (i.e., road and other services fees). The department oversees the standardization, driving tests and licensing of drivers, in addition to the standardization, road worthiness and technical inspection of motor vehicles and trailers, as well as their registration and licensing.

Much like its main functions in terms of public transportation, the department's main tasks are the planning, monitoring and supervision of public transport services. The following is the organizational chart of the Land Transport Department.

The Public and Commercial Transport section is responsible for the sustainable development of the public transport system, the promotion of widespread usage of the modes of transport, and the assurance that the public transport service operators will provide a more integrated, efficient, safe and reasonably priced public transportation system.

2.11 National Transport Planning

In its Vision 2035, Brunei Darussalam aims to optimize its future economic and social development, which requires a national effort that is multidisciplinary and needs to be tackled from all angles. Strategies from Vision 2035 include infrastructural, economic, educational, and small business development, and institutional strengthening.

With plans for regional growth and the upcoming conclusion of several free trade agreements, Brunei Darussalam recognizes the importance and impact of an integrated and sustainable transport system that it would obtain by achieving the Vision 2035 goals. The identification of

transportation as a key enabler and beneficiary in realizing the goals to increase trade, investment and tourism has also played a pivotal role in directing national policies on transportation issues. Therefore, Brunei Darussalam is now looking at a more holistic approach towards the national land transport system that will integrate efficiency and sustainability in the transportation network.

2.11.1 Functions and Powers

The institutional structure responsible for transportation networks is divided between different agencies within the government of Brunei Darussalam, and these different agencies are outlined below:

Table 2.2.11 Institutional structure for transportation networks

	Strategic planning	Preliminary design	Detailed design	Delivery	Operation	Funding
Roads	MinCom/MoD/ JKR	JKR	JKR	JKR	JKR/Royal Brunei Police	Ministry of Finance/JKR
Public transport	Land Transport Department (LTD)/MoD	LTD/Marine Department (MD)	LTD/JKR/MD	JKR/MD	Private Operators	Private Operators
Transport and environment	Energy Department (EDPMO)	Climate Change Unit	Climate Change Unit	MinCom	–	MinCom
Regional Cconnections	MinCom	JKR	JKR	JKR	–	Ministry of Finance
School transport	Ministry of Education	Schools	Schools	Schools	Schools	Schools

There is a certain degree of overlap and duplication in the functions of the various agencies responsible for Brunei Darussalam's transportation network which has led, in some instances, to conflicting policies or programs. This has made it more difficult to formulate policies for public and private transportation that are consistent and integrated.

Fixing these overlapping roles is paramount in moving forward in the creation of a more fluid and integrated transport network. Therefore, a national land transportation master plan is being developed that will streamline cooperation between ministries and revamp the institutional set-up to speed up developments.

2.11.2 National Land Transport Master Plan

The National Land Transportation Master Plan is aimed at coming up with solutions for an integrated quality, efficient, safe and sustainable transport service network to support the goals of the Vision 2035 plan. The study will take 12 months to complete and will be conducted by SQW China. The study will involve all forms of inland transportation, including private and commercial vehicles, public transport over land, waterways, bicycles and pedestrian walkways, both domestically and cross-border.

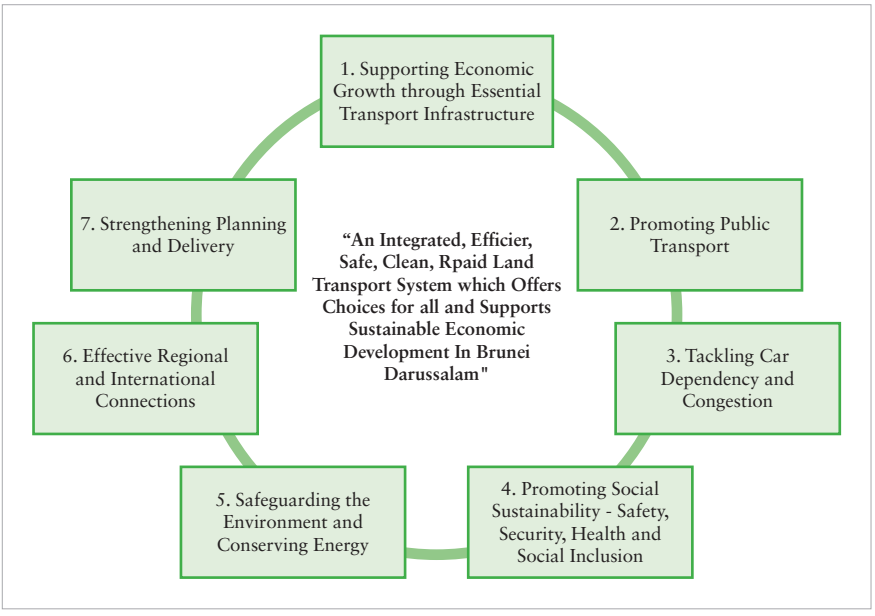


Figure 2.2.10 *Goals of Vision 2035*

Source: Consultant Presentation.

The study's emphasis on improving the connectivity across borders correlates to a series of major projects and initiatives that Brunei Darussalam has in place for providing quick and easy mobility options within cities, between cities and across borders.

The implementation of a well-designed land transportation master plan will help to increase efficiency in the movement of people and commodities while also improving the economic growth and overall productivity of the country as a whole.

3. Hanoi

Changhwan MO, Bo Young KIM, Young Seok PARK, Arie KIM, and Ryan HUNTER

3.1 National and City Statistics

Table 2.3.1 Basic facts about Vietnam

Contents	Status
Land Area (km^2)	330,958
Population (thousand, 2012)	88,770
Major language	Vietnamese
Capital city	Hanoi
Currency	Vietnamese Dong, (VND)
GDP(US$ billion)	170
GDP per capita(US$)	1,895

Source: Tuan, Ngo Quang. (2013). "Transport Planning in Viet Nam." In *Proceedings of ASEAN-Korea Capacity Building Program in Korea.* 17-26 February. Goyang, Korea: The Korea Transport Institute. p. 172.

Vietnam, whose official name is the Socialist Republic of Vietnam, is an S-shaped country in Southeast Asia on the eastern part of the Indochinese Peninsula, with population of about 89 million. Vietnam's total land area is around 330,958 km, which is composed of 1,700 km from north to south, 3,200 km of coastline and 23% of cultivated zones. The Eastern Sea borders Vietnam to the east, the Pacific Ocean to the southeast, Cambodia and Laos to the west, and China to the north. Around 31.9% of the country's population lives in urban areas and the remaining 68.1% live in non-urban areas. Vietnam's population distribution by age skews heavily towards the young. Additionally, Vietnamese is the country's major language, and the capital city is Hanoi, which is the second-most populous city in Vietnam. The country became independent from France on September 2, 1945.

Table 2.3.2 *Overview of Hanoi (2013)*

Contents	Status
Population of total city (thousand)	7,100
Land area (municipality, km^2)	3,329
GDP per capita (US$)	2,750
GDP (billion, US$)	19.5

Source: Wikipedia. (2014). "Hanoi." <http://en.wikipedia.org/wiki/Hanoi> (Accessed on 17 Oct. 2014).

In Hanoi, the level of economic development is relatively lower than in Ho Chi Minh City, which is located in the south of Vietnam. However, because one of the main goals of Vietnam is to maintain the balance of growth between the southern and northern parts of the country, Hanoi, in the north, has grown rapidly alongside the city of Haiphong. After Ha Tay was incorporated into Hanoi in 2008, both the city's population and land area were greatly increased. Furthermore, since public institutions and the headquarters of state-owned enterprises are concentrated in the capital, many large-scale projects and business expansions require the cooperation of several government agencies. The land area of Hanoi is about 3,329 km^2 and it is composed of 10 districts, one town and 18 suburban districts. The GDP per capita was around US$2,750 in 2013, with a GDP of US$19.5 billion.

The population of the city was approximately 7,100,000 as of 2013. The decadal population growth rate has seen two periods of notable growth, from 1989 to 1999 and 1999 to 2009, as the population increased by around 1.24 times. The normal decadal population growth rate of over 35% can be seen in the statistics below.

Table 2.3.3 *Decadal population growth rate in Hanoi*

Year	Total	Urban population	% Urban
1979	2,456,928	897,500	36.5
1989	3,056,146	1,089,760	35.7
1999	2,672,122	1,553,866	58.2
2009	6,448,837	2,632,087	40.8

Source: Central Population and Housing Census Steering Committee. (2010). *The 2009 Vietnam Population and Housing Census, Major Findings*. Hanoi, Vietnam: Ministry of Planning and Investment General Statistics Office. p. 66.

3.2 Public Transit Level of Service

3.2.1 Types of Public Transportation

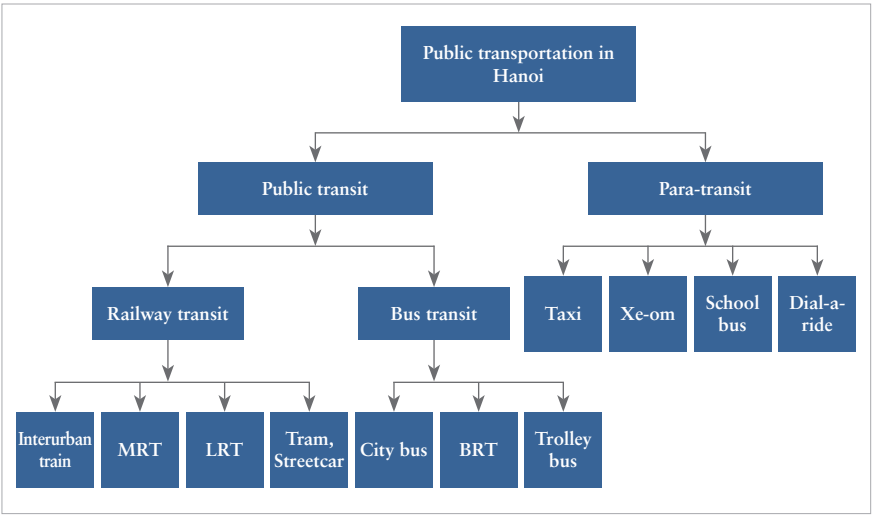


Figure 2.3.1 Public land transportation

Source: Phuong, Nguyen Viet, Vu Hoai Nam, and Dinh Van Hiep. (2014). "Public Transport Problems and Solutions in Hanoi." In *Proceedings of 2nd ASEAN-Korea Public Transport Workshop*. 4-6 August. Jakarta, Indonesia: The Korea Transport Institute. p. 107.

According to the Hanoi Capital Construction Master Plan, which extends until 2030, public land transportation in Hanoi is going to be constructed. The public transportation system in Hanoi is separated into public and paratransit. Public transit is government subsidized, and includes railway and bus transportation. Public railway transit includes interurban trains, MRT, LRT and streetcar transportation. The MRT and LRT are currently being constructed, while the interurban trains and trams are currently in operation. The MRT is due to be ready by 2016. Eight railway lines have been suggested to be constructed in Hanoi. Two urban railway lines have been constructed by China and France. The bus transit includes regular city buses, Bus Rapid Transit (BRT) and trolley buses. The BRT is currently being constructed by the Japan International Cooperation Agency (JICA). Paratransit includes private vehicles such as taxis, motorcycle taxis, school buses and dial-a-ride vehicles. People in Hanoi mostly use their own motorbikes and cars for transportation rather than taking the available modes of public transportation.

Buses & Minibuses

There are several main long-distance bus stations in Hanoi. They have quite a well-organized system, which includes ticket offices, fixed prices and printed schedules. For longer distances, tickets should be bought a day beforehand. The bus network, which has been used since 1992, has 13 lines. Hanoi plans to expand the network until 2014 by adding 89 new bus lines, which would handle in excess of 1.5 million passengers per day. The buses are 100% air-conditioned, and from six to 20 buses run an hour for 14 to 16 hours a day (Phuong et al., 2014; Hiep and Hai, 2014).

The bus network covers wide areas of Hanoi. Bus priority lanes are now under construction as a part of the JICA pilot projects. In addition, although the BRT's exclusive lanes have been completed, its priority traffic lights, vehicles, bus stations and control centers remain under construction (Hiep and Hai, 2014). Hanoi's city buses present fairly attractive ticket prices, categorized by trips, by period of use (monthly), and by the age of the traveler. The usual price for a one-time single trip is VND 5,000, and for a monthly ticket it is VND 90,000 (one route) and VND 140,000 (multiple routes). However, their outdated technology and low fares could be considered inappropriate in light of the current conditions and modus operandi of the bus network.

Rail

The current railway system is not used as an urban transportation mode. The system is mostly for interurban connections. The main Hanoi train station (Ga Hang Co, Le Duan) is at the western end of Pho Tran Hung Dao. The place for purchasing tickets is, rather inconveniently, not necessarily where the train departs. It is, however, possible to buy the tickets in advance at another nearby train station. The average speed of a cargo train is about 50 km/h. Even though rail transportation is cheaper for enterprises than truck transportation, it takes much more time. Therefore, container transportation by rail is quite rare due to the importance of speed and convenience in this domain.

Taxis and 'Xe om'

There are numerous taxis available at cheaper prices compared to those of neighboring countries. Xe oms are private motorbike taxis, which are an easy way to get to a passenger's destination. It costs between 50 to 70 cents per kilometer. It is ideal for short-distance travel within two miles. Helmets are required equipment for riding on a Xe om vehicle. Both motorbikes and

normal taxis are very convenient and useful modes of transportation for short distances. In addition, there are bicycle rickshaws available in Hanoi, called cyclos. Passengers ride in the front of the cab, while the driver sits behind the passengers. Only two passengers can fit in a cyclo, and it is ideal for exploring short distances within the center of the city. It is a slow mode of travel that costs about US$5 for an hour's ride (Aquino, 2014).

3.2.2 Service Level of Public Transport

Recently, the quality and capacity of the Hanoi bus system has been significantly improved. Air-conditioned buses run every 10 minutes or so throughout the city to for citizens' convenience. However, the efficiency of this mode has yet to catch up with that of the developed countries. The high level of congestion in Hanoi and its lagging operating conditions hinder the smooth running of the current service operation and the process of introducing new services. The Hanoi authorities are seeking to improve bus operations through the implementation of the BRT system, which is equipped with bus priority lanes to ensure the effective use of the fleet.

3.3 Transportation Infrastructure Investment and Financing

3.3.1 Outline

Limited financial resources are made available from the government of Vietnam and the Hanoi People's Committee for the improvement of Hanoi's transportation system. Subsequently, the implementation of key transport infrastructure projects, as well as institutional strengthening, is heavily dependent on foreign financial resources. It has been estimated that planned transport projects will require an annual capital investment between US$100 and US$150 over at least the next five years. Based on the Metro Line 3 Project, donors could be asked to contribute up to 85 percent of the costs. This compares with a total capital expenditure by Hanoi of US$880 million in 2010. (The World Bank, 2007, p. 92) Public transportation fares cover about 60 percent of the operating costs and require a subsidy in the region of US$15 million per year (The World Bank, 2007, p. 93).

3.3.2 Cost of Main Components

In the following Table 2.3.4 the cost of the main projects such as the BRT system, road infrastructure and institutional development are summarized. There are three main project components: development of the BRT System, road infrastructure and sustainable urban planning, and institutional development. The project with the biggest budget is road infrastructure and sustainable urban planning, and the second-biggest budget is for the development of the BRT System.

Table 2.3.4 Project costs by component

(Unit: US$ million)

Component	Financed component by GOV*	IDA	GEF	Total
1. Development of the BRT system				
BRT system civil works and equipment	11.76	84.12	1.40	97.28
Pedestrian and NMT access at BRT stations	0.00	0.00	1.30	1.30
BRT consultation, communications and media strategy	0.00	0.00	1.30	1.30
2. Road infrastructure and sustainable urban planning				
Second ring road between Cau Giay and Nhat Tan	124.28	46.47	0.00	170.75
Resettlement site CT1	3.64	18.18	0.00	21.83
Integrated sustainable urban land development & transport planning	0.00	0.00	1.75	1.75
3. Institutional development				
Air quality management	0.00	1.65	0.00	1.65
Traffic safety	0.00	1.92	0.00	1.92
Public transport authority strengthening & policy development	0.00	2.20	2.70	4.90
National and regional replication	0.00	0.00	0.90	0.90
Project management and results management support	0.00	0.67	0.45	1.12
Total cost (including taxes)	0.00	155.21	9.8	304.7

Note: IDA Credit: International Development Association Credit; GEF Grant: Global Environment Facility Grant
Source: The World Bank. (2007). "Vietnam: Hanoi Urban Transport Development Project." <http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2008/05/05/000160016_20080505151313/Rendered/PDF/43457081271 07.pdf> (Accessed on 18 Oct. 2014).

3.3.3 BRT

The second-largest project of the Hanoi Urban Transport Development

project was approved by the Hanoi People's Committee in Decision 1837/QD-UBND dated May 10, 2007. The Hanoi BRT is funded by the World Bank and is classified as an Official Development Assistance (ODA) project. It is considered a significant step in improving the city's urban transportation network and strengthening the overarching public transportation capacity. A grand total of US$99.88 million has been appropriated to be spent on the development of the BRT network to provide 37 km of exclusive bus lanes, 9 km of bus priority lanes, BRT stops, interchange stations, terminals, maintenance facilities, 130 units of vehicles and a management system, such as bus ticketing and financial controls (Hiep and Hai, 2014).

3.3.4 Road Infrastructure and Sustainable Urban Planning

A total budget of US$194.33 million has been assigned to the construction of the Second Ring Road section between Nhat Tan Bridge and Cau Giay. The budget includes resettlement costs for people displaced due to the proposed road, together with support for sustainable urban land development and transportation planning in Hanoi.

3.3.5 Institutional Development

An institutional development budget of US$10.49 million will be used for equipment acquisition and technical assistance. The main purpose of this project is to strengthen air quality management. The project will also support the establishment and strengthening of a new Public Transport Authority, transport planning and policy development. The budget will also support the project management for the Global Environment Facility Grants' priority project, which is designing finance replication. This project supports project management for the GEF project and the enhancement of project monitoring skills.

3.4 Ownership, Operation and Regulations of Public Transportation

Table 2.3.5 shows Vietnam's institutional arrangement in the transportation sector, including roads, railways and air transportation, and the departments in charge. The table has separate categories for functions and

Table 2.3.5 *Institutional arrangement in the transportation sector in Vietnam (1)*

Division	Roads	Railways	Air transportation
Planning and Policy			
Multimodal	MOT		
Sectorial	General Road Administration (GRA), reports to MOT	Vietnam Railways Corporation (VRC), reports to MOT	Civil Aviation Administration of Vietnam (CAAV), reports to MOT
Regulation: Technical			
Safety, Standards	GRA	VRC	CAAV
Licensing	Drivers licensing by Traffic Police	Train/Locomotive Operator, by VRC	Pilots and aircraft technicians licensed by CAAV
Registration	Motor vehicles registered by Traffic Police	Vietnam Railway Administration	CAAV registers & inspects aircraft
Regulation: Economic			
Entry &Competition	VEC for Toll roads, LGU's for bus operators	Monopoly: VRC	CAAV
Pricing	Fares on public transport set by respective Peoples Committees (PCs)	VRC sets fares subject to Ministry of Finance (MOF) approval	Fees, domestic economy airfares, charges subject to MOF approval
Program Management			
Investment	MOT, MPI	MOT, MPI, MOF	
Programming	MOF		

Source: The World Bank. (2011). *Vietnam Urbanization Review.* Hanoi, Vietnam: The World Bank. pp. 109-110.

Table 2.3.6 *Institutional arrangement in the transportation sector in Vietnam (2)*

Planning and policy	Roads	Railways	Air transportation
Service delivery			
Public Users	Private cars, trucks, motorbikes	None	Private aircraft
Basic Law	MOT Decision No.3525/1998/ QDBGTVT4No.3030-4 QD-BGTVT	Vietnam Railway Law No.35/2005/QH11	PM Decision No.267/2003/QD-TTg On19 Dec-2003; No.08/2006/L-CTN (July2006)
Enforcement	Traffic Police	VNRA/VRC	Vietnam Air Traffic Management under CAAV
Infrastructure delivery			
Construction	PMU's under MOT and under GRA	Track infrastructure, to be spun off to VNRA	By 3 Regional Airport Corporations, under CAAV
Concessioning	Vietnam Expressway Corp. (VEC)	In theory, VRC	By 3 Regional Airport Authorities

Source: The World Bank. (2011). pp. 109-110.

roles, which are largely planning and policy making, technical regulation handling, economic regulation handling, program management, and other contents of service and infrastructural delivery.

The role of planning and policy regarding transportation in Vietnam is handled by the Ministry of Transport (MOT). Additionally, the General Road Administration (GRA), the Vietnam Railways Corporation (VRC) and the Civil Aviation Administration of Vietnam (CAAV) take charge of planning and policy making and report to the MOT. The function of the VRC and the CAAV pertains to all aspects of regulations in rail and air transportation. However, the GRA's role is limited to setting overall standards and safety regulations; this is probably due to roads being the most widely distributed and the most accessible transportation method. For road transportation, other government agencies that handle regulations include the Traffic Police and other local government bodies.

3.4.1 Public Buses

An inner city service is provided by Tramoc, which is under the Hanoi People's Committee. There is currently a fleet of 1,146 vehicles in the city, operated by eight companies: TCty Vậçn tải HN, Đông Anh, Bắc Hà, Bả o Yến, CP ô-tôkhách Hà Tây, CP ô-tôtải Hà Tây, Bảo Châu, and Hải Vân. The network system includes 84 bus lines, which consist of 65 subsidized lines, 12 regular lines and seven nearby lines. The BRT system is being implemented as a part of the JICA pilot project. Most of the line operators are under the authority of Transerco, which falls under the Hanoi Transport & Service Corporation, which includes nine subsidiaries (Hiep and Hai, 2014). The development of the bus system began in 2000, when the Hanoi People's Committee, the main government body of Hanoi, chose to focus on the development of its public transportation network. Since then, Tramoc, a transport authority, was created and took control of a wide range of transport operators in Hanoi. Three pilot lines were established through Asia Trans[1], a European program, and the whole system of transportation, as a result, took

1 Ile-de-France region and Germany helped Hanoi set up the transportation network.

2 http://www.atransociety.com/2014/pdf/5thSymposiumDownloadable/FullPaper/2B/SCS12-002.pdf (Aug 10, 2014); http://www.afd.fr/webdav/shared/pays/codatu_EN_version_ecran.pdf

a form similar to European systems. Transerco is responsible for the system of bus operations and bus crews, while Tramoc is responsible for issuing tickets and creating policies. Transerco includes nine subsidiaries and has 8,257 officers working for it. The main sources of income are bus fares and advertisement fees for buses and bus stops[2].

3.4.2 Paratransit

The operation of paratransit services such as taxis, cyclos and xe oms are mostly provided by individual private operators and enterprises. However, a public enterprise called Hanoi Tourist Car Company owns and operates more than half of the taxis in the city.

3.4.3 Trains

The Vietnam National Railways has several train lines originating from inner Hanoi, but the government prohibits daytime operations throughout the inner city in the hope of preventing congestion at intersections on local roads.

Train operations are handled by the Hanoi Metropolitan Railway Management Board (MRB). The MRB is a public body under the Hanoi People's Committee. It was set up on February 22, 2012 when the Hanoi People's Committee passed a decision under the decree of 925/QD-UB-ND. The MRB assists the committee as a project manager in the operation of urban rail network projects, from the planning stages to the final opening of services, and manages, operates and maintains the urban rail network in Hanoi. In other words, the MRB is in charge of research, development and all operational aspects of the urban rail system in the city. The MRB also has the responsibility of handling international investment issues and getting funding from international agencies in the urban railway network construction and expansion projects (Allaire, 2012).

3.5 Road Infrastructure

Table 2.3.7 Urban and rural road infrastructure

Contents	Status
Urban roads (km)	1,816
Rural roads (km)	2,450
Urban area ratio compared to the total area (%)	6-7

There are 1,816 km of urban roads and 2,450 km of rural roads. The proportion of the land area for transportation occupies 6% to7% of the total urban area. Sidewalks are available, but they are usually used as parking spaces for motorcycles due to a shortage of available parking spaces (Hiep and Hai, 2014, p. 78).

3.5. 1 Radial Road Network

The Hanoi Metropolitan area is at the convergence of strategic national highways that establish a network of radial linkages between Hanoi and other commercial and residential hubs. Over the last few years, there have been a number of projects aimed at renovating and upgrading the Hanoi road network and its surrounding provinces. The following picture shows Hanoi's transportation network system from the Hanoi Master Plan 2020 by the Japan Bank of International Cooperation (JBIC).

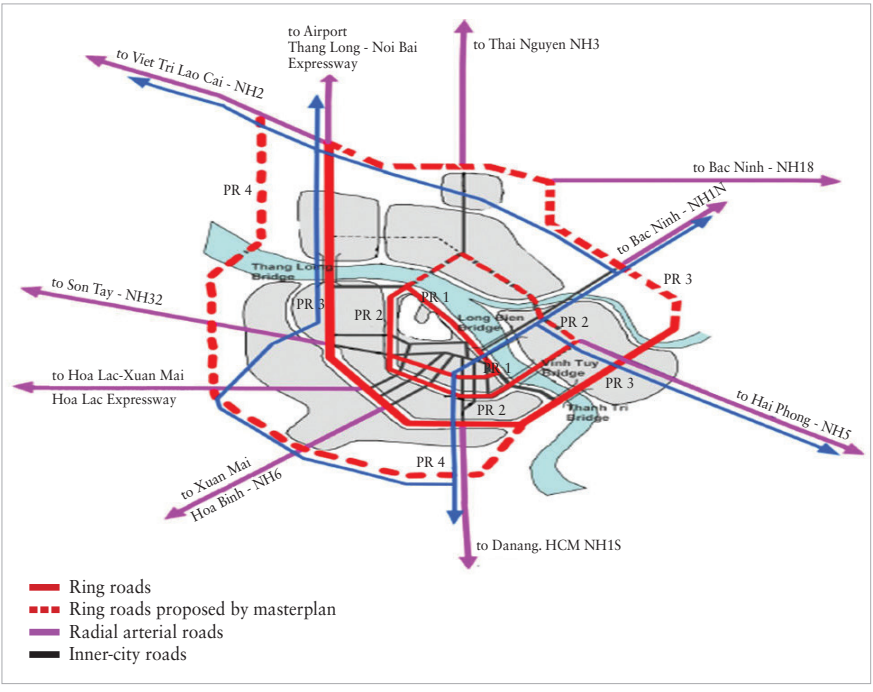


Figure 2.3.2 Hanoi's transportation network system

Source: JBIC(Japan Bank of International Cooperation). (1999). *Urban Public Transportation in Viet Nam*. Tokyo, Japan: Japan Bank of International Cooperation. p. 4. <http://jica-ri.jica.go.jp/IFIC_and_JBICI-Studies/jica-ri/publication/archives/jbic/report/paper/pdf/rp04_e.pdf> (Accessed on 5 June 2014).

3.6 Railway Infrastructure

Table 2.3.8 Railway routes connected to Hanoi

Rail route	Gauge (mm)	Length (km)	Beginning date of construction	Opened
Hanoi-Haiphong	1,000	90	1901	1902
Hanoi-Lang Son (Lang Son–Pingxiang)	Dual	163	1889	1903
	–	–	–	1955
Hanoi-Lao Caie	1,000	294	1901	1906
Hanoi-Ho Chi Minh	1,000	1,726	1900	–
Hanoi-Thai Nguyen	Dual	75	1959	1960
Hanoi Nguyen-Bac Giang	1,435	69	1970	–
Bac Giang-Ha Longe	Dual	106	1970	–

Nguyen, Binh Giang. (2011). "Development of Industrial Estates, Ports and Metropolitan and Alternative Roads in the Greater Hanoi Area." *Intra- and Inter-City Connectivity in the Mekong Region*. Bangkok, Thailand: Bangkok Research Center. p. 310.

While there is no urban rail transportation available yet, there are a number of rail routes connecting Hanoi to other major cities in the country. The above table gives information about the railway routes of Hanoi. A track gauge is the space measured between each rail on a railway track. There are four types of railway track gauges, categorized by size as minimum, narrow, standard and broad. In Hanoi the railway tracks are set up with either a meter gauge, a subsection of the narrow gauge category, with gauge measurements of 1,000 mm or with dual track gauges, which simply means that these tracks can accommodate two separate gauge sizes. However, the Hanoi Nguyen-Bac Giang route has 1,435 mm gauges, which means that this line must have its own separate train fleet, as the trains for this line cannot be used on the other lines. The total length of the rail route is about 2,523 km and most of the routes opened during the early to mid-1900s. It can be said that most of the rails and their pertinent structures are outdated.

Although all the steam locomotives have been replaced with diesel trains, the corresponding railways have not been accordingly upgraded over the past 20 years. There are a number of problems such as shortages of facilities for handling cargo in railway stations, procedure complications, narrow station yards and a lack of railroad cars for containers. The main stations are located downtown at the heart of the cities of the Hanoi region. Recently, however, the 128-km Yn Vien-Cai Lan Rail Route project

was started with the sole purpose of transporting goods from the Hanoi region to Cai Lan Port. The operation began in February 2007.

3.7 Vehicle Statistics and Modal Share of Public Transportation

The total number of vehicles is rapidly increasing, especially in the two major cities, Hanoi and Ho Chi Minh. Vehicle fleets and the number of motorcycles have grown by 11.8% and 14.9%, respectively, between 1992 and 2001. Before 1980, approximately 80–90% of the population in the city used bicycles; nowadays, a similar percentage of people travel by motorbike. The rate of motorbike usage is up almost 400% from 1996 to 2006, and these rates are consistently increasing every year. These increasing rates have had a significant effect on air pollution levels in Hanoi (VCAP and CAI-Asia, 2008).

Table 2.3.9 Hanoi transport modal split in 2008

Mode	Modal split	
Buses	10.7	%
Tourist buses	1.8	%
Cars and mini vans	4.0	%
Motorbikes	80.8	%
Bicycles	2.5	%
Light trucks	0.2	%

Source: The World Bank Group. (2014). "Vietnam Urbanization Review Technical Assistance Report." <https://openknowledge.worldbank.org/bitstream/handle/10986/2826/669160ESW0P1130Review000Full0report.txt?sequence=2> (Accessed on 16 Oct. 2014).

Of all of the trips taken in Hanoi in 2008, motorbikes accounted for around 81% of them. Motorbikes have been an efficient means of transportation since the beginning of the economic takeoff phase of the city. Motorbikes are able to access traditional residential areas where there is not an adequate vehicular road network. Cars and minivans made up 4% of trips, and 11% of trips were by public transportation, a very low rate, especially when compared to the level occupied by motorbikes.

The trend of the increasing modal share of motorcycle usage has continued through to 2010. The overall public transportation usage has decreased by about 5%, while the usage rates of private cars and motorcycles have increased by around 10%.

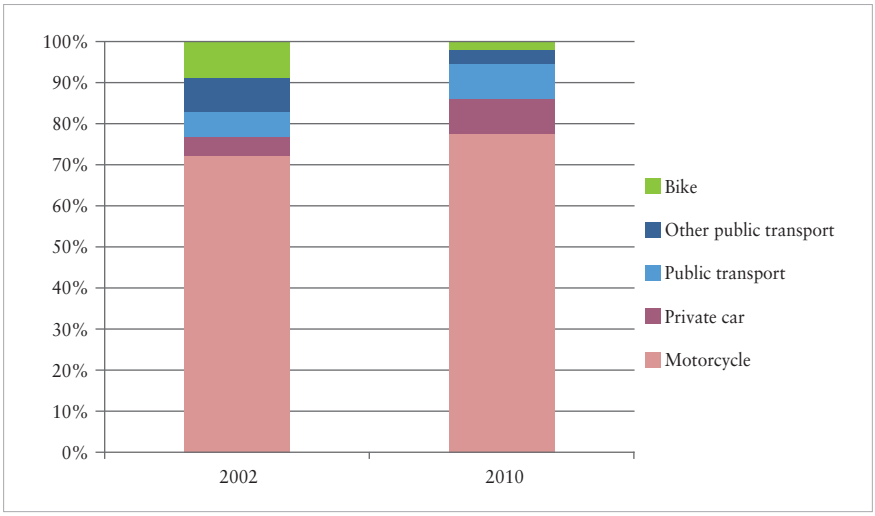


Figure 2.3.3 *Modal share in Hanoi (for mechanized modes)*

Source: Agence Francaise & Development. (2012). *Management and Operation of Hanoi's Mass Transport System.* Lyon, France: CODATU.

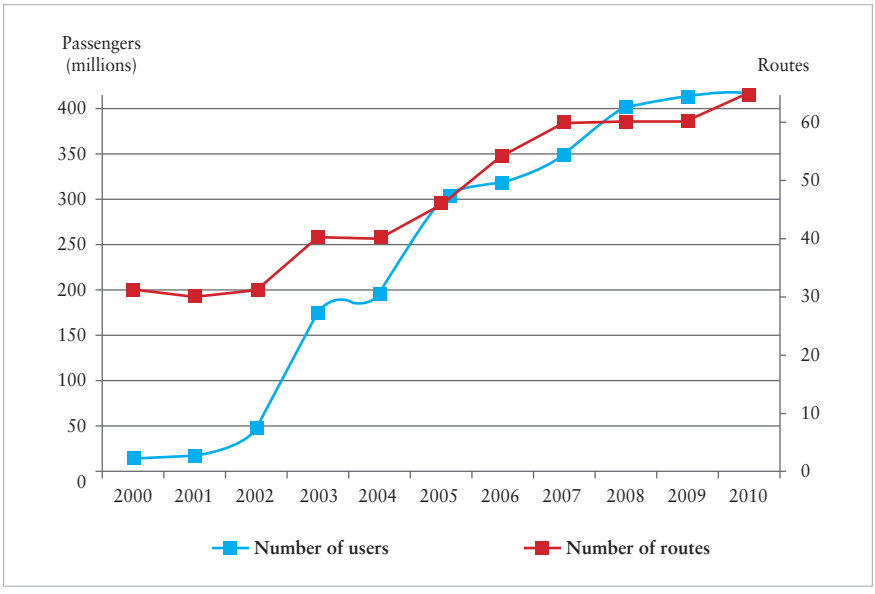


Figure 2.3.4 *Number of users and routes of mass transportation in Hanoi*

Source: Agence Francaise & Development. (2012). p. 11.

As you can see in the graph above, the number of mass transportation users has been increasing in Hanoi, but the rate of increase is, however,

slowing down. Since 2008, the number of people using public transportation has remained steady. Meanwhile, the number of routes has also been on an increasing trend. The numbers have also kept relatively steady since 2007, with an increase of about five to 10 routes during 2009. There are now about 70 routes in Hanoi.

The increase in routes is the result of the Tramoc transport authority and operators developing transit routes. Since 2000, they have sought and managed to improve the service by various methods such as combining and creating new lines, reorganizing the network, and increasing the rate of frequency and range of lines in new urban hubs. The service quality, pricing and traveler information have also been improved. This has had a striking effect on public transportation. The number of mass transportation trips has greatly multiplied in eight years, from 12 million in 2000 to in excess of 400 million in 2009, an increase of more than 3,000%.

3.8 Traffic Safety Indicators

Among road traffic accidents in Hanoi from 2005 to 2011, 40% occurred to people between 20 and 29 years old. In addition, the number of motorcycle accidents reached around 63% of the total number of accidents in the city, particularly due to the accident level during two peak times of the day: 12pm–4 pm and 8 pm–12am. The main places where accidents happened were on the main highways (measured by kernel density estimation).

Table 2.3.10 Road traffic accidents in Hanoi (2005-2011)

(Unit: persons)

Year	Accidents	Fatalities	Injuries	Total
2005	1,122	539	817	2,478
2006	1,017	522	734	2,273
2007	852	497	544	1,893
2008	1,113	868	438	2,419
2009	1,207	856	531	2,594
2010	1,109	807	478	2,394
2011	1,027	749	443	2,219

Source: International Development Center of Japan Inc. (2012). *Traffic Safety Human Resources Development in Hanoi.* Tokyo, Japan: International Development Center of Japan Inc. p. 14.

The number of road accidents did not change much between 2005 and 2011. The number of accidents in 2005 was 1,122, while in 2011 it was 1,027. Another source suggested that there were high levels of motorcycle-related accidents. However, their impact has been reduced in recent years by the success of safety-promotional campaigns to encourage wearing helmets while riding on motorcycles. It is now rare to see motorcycle drivers and passengers in Hanoi who are not wearing helmets. Although the most recent information is not available for this report, from the decreasing rate of accidents, fatalities and injuries on the road since 2009 and Hanoi's continued effort to uphold its citizens' safety as one of the priorities, it could be estimated that the number of accidents has continued on its downward trend.

3.9 Travel Behavior

People who live in Hanoi face heavy congestion during peak hours of the day while traveling by road. Most passengers are urban students, officers and staffers who work in the major industrial zones and travel with monthly tickets. The rest of the travelers are tourists and people traveling within the inner city. The bus passengers for nearby routes are mostly locals, while there are also tourists traveling between the city center and the provinces or districts neighboring resorts. During the seasonal festivals and tourist seasons, the number of bus passengers increases (Trung, 2014, p. 119).

3.10 Air Pollution and Vehicle Maintenance Standards

Hanoi has a significant air quality problem[3]. A study in 2006 (NTF-PSI 2006) estimated that vehicular emissions accounted for up to 40% of the particulate matter and oxides of nitrogen. However, due to the fragmented management of monitoring stations, there is no city-wide monitoring network or recent emission inventory to provide reliable data, especially for decision making. Projects are currently in progress to address these issues.

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3 Hung, Ngo Tho. (2010). *Urban Air Quality Modelling and Management in Hanoi, Vietnam*. Aarhus University, Denmark: National Environmental Research Institute.

Table 2.3.11 Fuel quality and vehicle emission standards

Division	Contents and standards	
Sulphur (Max, ppm)	Diesel	500
	Petrol	500
Fuel quality comments	Lead was phased out in 2001 Euro 4-equivalent fuels (50 ppm) by January 2016 Euro 5-equivalent fuels (10-15 ppm) by 2021	
Vehicle import restrictions*	Importation of used passenger vehicles is banned	
Vehicle fleets	530,000 vehicles registered (CAI-Asia); 45 two-wheelers per 1,000 people in 1990	
Vehicle standards & Inspection and Maintenance (I/M)	Roadworthy registration centers in Vietnam: 71 Vehicle emission standards for new vehicles: Euro 2; Euro 4; Euro 5; Euro 3 for motorcycles. Standards for in-use vehicles: None	

Source: UNEP. (2012). "Status of Fuel Quality and Vehicle Emission Standards in Asia-Pacific." <http://www.lead.org.au/PCFV/Lead_Matrix_AP_201206.pdf> (Accessed on 17 Oct. 2014).

The restrictions on diesel and petroleum are set at 500 ppm. The standards are in compliance with Euro 4 and 5 equivalent fuels as per the fuel quality comments. The import of used cars is restricted and a total of 530,000 vehicles are registered from CAI-Asia resources.

Regarding the vehicle standards, inspections and maintenance in the country, there are 71 roadworthy registration centers. Additionally, new vehicles have new up-to-date vehicle emission standards such as the Euro 2 from 2005, Euro 4 by January 2017, Euro 5 by 2022 and Euro 3 for motorcycles by 2017. However, there are no provisions for the standards of used cars.

3.11 Traffic Congestion and Traffic Demand Management

3.11.1 Traffic Congestion in Hanoi

With rapid urbanization and the consequential fast growth in the number of private vehicles, Hanoi is now congested with 3.7 million motorcycles and 380,000 cars, which account for one-eighth and one-sixth, respectively, of the total vehicles in Vietnam. The number of vehicle registrations increases every year at a rate of 12 to 13 % for motorcycles and 9 to 13% for cars. Additionally, even with the restriction on excessive land use by the city, the land for traffic is only 6.4%, while the standard is 20%. All these figures show that traffic is going to be more serious of a problem in

the future, and the symptoms are already showing on the streets. There is heavy congestion during rush hours in the city centers. The hectic road status contributes to the high number of accidents in Hanoi, as yet again contributing to more congestion. These various road conditions are putting great pressure on urban transport infrastructure for improvement. The air quality is worsening from the center of the city as one of the negative effects of the bad traffic conditions in Hanoi. Furthermore, the traffic congestion is problematic not only because of the environmental issues, but is also an issue due to its economic effects. Slow transport means the slow delivery of goods and services, which could result in the city losing its economic competitive edge. In response to this, there have been efforts by the city to carry out tasks to improve transport conditions. At the end of 2012, there were 67 main traffic-jam spots left in Hanoi, which decreased by 46% from the figure in 2011.

3.11.2 TDM in Hanoi, Vietnam

With the metro system implementation delayed to 2015 and traffic congestion becoming worse, the Hanoi city government has executed several TDM measures to relieve some of the congestion. The main TDM measures include a restriction on cyclos on the streets, changing work and school schedules to disperse the amount of road traffic during rush hours and executing a prohibition on sidewalk parking. As a result, only tourists are allowed to get on cyclos in Hanoi, and school hours have been diversified. But the sidewalks have not remained clear despite of enforcement of the parking prohibition.

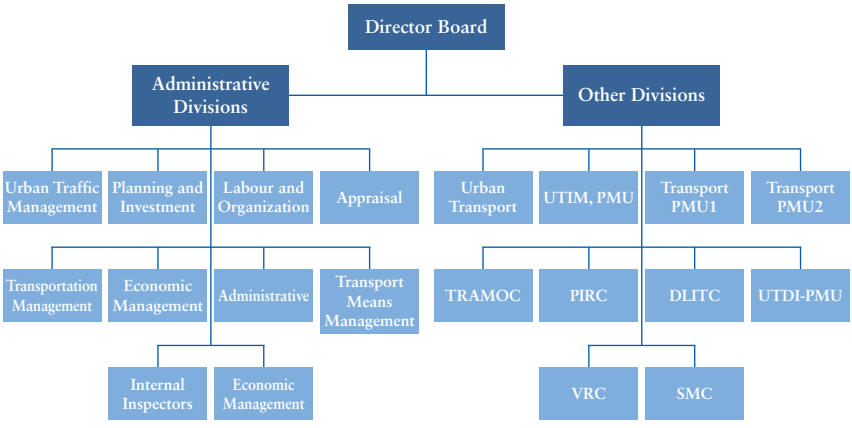
There are still arguments in Hanoi among the various members of different organizations about the effectiveness of the TDM. The restricted use of cyclos, for example, might cause more congestion due to careless rides by tourists without the regard to Vietnamese laws. Also, since the changes of scheduling during the rush hours have mostly focused on school schedule changes, some say that it would not have much effect on traffic since most private car users, who contribute to the majority of the traffic congestion, are working adults rather than students who use public transport.

In addition to the traffic alterations, the city of Hanoi is starting to incorporate IT systems as a traffic management technique. The bus schedules and systematic explanation of bus usage has opened to public through the Internet, and LED boards that inform the current position

buses are being installed at some bus stops. There are smartcards for the bus system that keep records of the passengers and provide more convenience to them as well. A traffic monitoring and information system has been installed for the traffic police to better track current road situations through CCTVs on the main streets. A new ITS center opened on October 11, 2013 and a control center room is being constructed.

3.12 Organizations of Public Transport Administration

The organization of the public transport administration in Hanoi is divided into administrative and other divisions. The former is responsible for ongoing government functions and the latter is responsible for business enterprises and units responsible for management of projects, most of which are donor-funded.



Notes: UTIM-PMU: Urban Transport Infrastructure – Project Management Unit
PIRC: Planning and Investment Research Center
DLITC: Driver License Issuing Testing Center
UTDI-PMU: Urban Transport Development and Investment Project Management Unit
VRC: Vehicle Registrations Center
SMC: Station Management Center

Figure 2.3.5 Organizational units of the Department of Transportation

Source : Phin, Doan Thi and Dotson, Edward. (2013). "Urban Transport Institutions and Governance and Integrated Land Use and Transport, Hanoi, Viet Nam." *Global Report on Human Settlements 2013*. Nairobi, Kenya: UN-HABITAT. p. 9.

Table 2.3.12 Roles and responsibilities in urban transport (1)

Department	Main functions
Ministry of Transport (MoT)	Prepares regional/national transport strategy/policy including urban transport. Provides DoT with technical guidelines and direction. Implementation of various projects outside of Ring Road No. 3. Involved in Urban Transport Plan reviewing and appraisal.
Ministry of Construction (MoC)	Participates in the review of the urban transport strategy/policy before approval. Reviews construction standards of the urban technical infrastructure, including transport infrastructure.
Ministry of Planning and Investment (MPI)	Prepares national socioeconomic long term plans. Participates in the review of urban transport strategy/policy before approval.
Ministry of Natural Resources and Environment (MoNRE)	Participates in the review of urban transport strategy/policy before approval.

Source: Phin and Dotson. (2013). p. 7.

Table 2.3.12 shows a summary of the roles and responsibilities of departments in urban transportation. The table shows the government bodies in charge of approving and reviewing the specific plans created by the sub-divisional administrative organizations in Vietnam as a whole.

Table 2.3.13 Roles and responsibilities in urban transport (2)

Department	Main functions
Department Of Transport (DoT)	Prepares and submits to HPC long-term, five-year and annual programs for important projects in the transport sector for approval. Implements the above approved program/projects. Runs transport management boards, maintenance organization/units and business enterprises, including bus transport management and operation center (Tramoc) and other centers. Manages the construction of transport facilities.
TRAMOC (under DoT)	Manages the bus network (routes, bus stops and terminal). Sets up the development plan of a public transport network. Formulates development strategies for public transport, appropriate for each stage of urban development in order to meet travel demand and the urban environment. Manages infrastructure related to public transport. Signs and manages contracts with the private sector for the supply of public transport services. Coordinates government subsidies for Hanoi.
Hanoi Railway Management Board (HRB)	Advises on overall rail network development in the long and short term. Proposes measures for mobilizing and management of resources for Hanoi railway development investment. Coordinates with other city departments/ units by preparing and implementing the Hanoi railway development plan.

Source: Phin and Dotson. (2013). p. 8.

The above table outlines the government organizations that fall under the Hanoi People's Committee, and lays out what each organization is responsible for. In addition, other departments also have key roles in urban transportation in Hanoi. The Hanoi Authority for Planning and Investment (HAPI) is responsible for the allocation of funding to major transport programs and projects. The Department of Natural Resources Environment and Land (DONRE) is responsible for the preparation of land use plans. The responsibility for verifying that the transportation infrastructure designs are in accord with the Master Plan and Land Use Plans falls to the Hanoi Authority for Urban Planning and Architecture (HAUPA). The Department of Construction (DoC) is in charge of transport infrastructure construction standards. Finally, the Traffic Police of the Hanoi Police Authority is responsible for the enforcement of moving traffic, road safety, and on-street parking regulations.

3.13 Public Transport and Traffic Planning

3.13.1 Outline

Public transportation meets only a small percentage of the overall travel demand in Hanoi, despite the modest income levels of the residents and the affordable rates of public transportation. The modal share of public transportation has increased from 2 % of all trips in the late 1990s (The World Bank, 2007, p. 17) to 6.7 % in 2006 with concerted efforts to improve the coverage and quality of the bus services.

The only existing railway in Hanoi is the Viet Nam Railways inter-city line, which runs roughly from the north to the south of the city, but it does not provide any urban rail services. Hanoi targets an ambitious public transport modal share of 35 to 45 percent by 2020. To achieve the target, the authorities are speeding up the construction of the Urban Mass Rail Transit (UMRT) lines in the Transport Master Plan recommended in the HAIDEP Study. The Hanoi Capital Construction Master Plan to 2030 and Vision to 2050 were approved by the prime minister in July 2011 (Decision No. 1259-TTg dated 26/07/2011). As a part of this plan, there is a proposal to upgrade the current rail line system onto a twin track viaduct, and to operate urban rail services as UMRT Line 1.

Another proposal is to review the bus route plan in order to make its operations more effective. The BRT system is also being implemented

according to the Hanoi Urban Transport Development Project approved by the Hanoi People's Committee on May 10, 2007. Alongside the grand projects, minor projects are currently being implemented as well.

3.13.2 BRT in Hanoi

The first BRT line in Hanoi will run between the Kim Ma and Yen Nghia stations, with 23 stops, including two major stations. As of June 20, 2014, the exclusive lane has been completed; however, the priority traffic light, the vehicles, bus stations and control centers remain under construction.

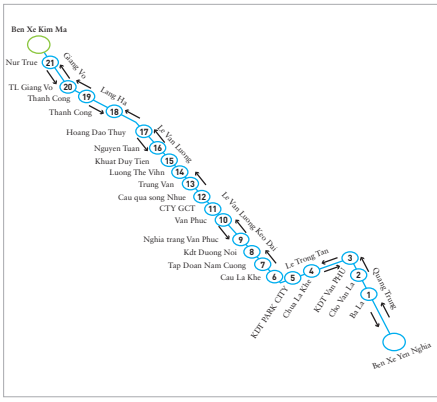


Figure 2.3.6 BRT itinerary in Hanoi

Figure 2.3.7 Construction site of BRT station in Hanoi

3.13.3 Urban Railways

Table 2.3.14 Details of MRT plan

Line number	Route	Length of rail	Status
Line 1	NgọcHồi–YênViên	38.7 km	
Line 2	NộiBài –ThươngĐình	35.2 km	
Line 2A	Cat Linh –Hà Đông	14 km	Under construction
Line 3	Trôi -Nhổn –YênSở	21 km	Under construction
Line 4	Liên Hà –BắcThăng Long	53.1 km	
Line 5	Nam Hồ Tây-HòaLạc	34.5 km	
Line 6	NộiBài –NgọcHồi	47 km	
Line 7	MêLinh –NgọcHồi	35 km	
Line 8	Cổ Nhuế –TrâuQuỳ	28 km	

Source: Hiep and Hai. (2014). p. 86.

According to the Hanoi Capital Construction Master Plan to 2030 and Vision to 2050, the city will eventually have eight UMRT lines, as shown in the following table. Currently, lines 2A and 3 are under construction.

Line 2A: Cat Linh – Ha Dong

The MRT line 2A, 12.88 km in length, is currently under construction. The total investment will be US$553 million, with US$420 million coming from China. The substructure has almost been completed. There have been some issues on land acquisition and clearance, resulting in the project being delayed.

Line 3: Nhon – Hanoi Station

Line No. 3 from Nhon to Ha Noi Station is 21 km in length and includes nine sections. The depot and auxiliaries construction for the fourth section started in 2010.

3.13.4 Hanoi Master Plan from 1998 to 2005, Vision to 2020

Decision No.108/1998/QD-TTg presented specific criteria and goals for Hanoi to bear in mind when creating its urban transportation system and network in order to render it extensive enough to meet the challenge of the day: high transportation demand. These goals primarily focused on the city building an urban rail track network for its public transportation system. The process was rigorous and protracted; it took approximately 10 years for the government to officially ratify the proposed goals for Hanoi's urban transportation. The ratification was delivered through the prime minister's Decision No 90/2008/QD-TTg, which outlined Hanoi's urban development program (called the HAIDEP project) and proposed potential future strategies the city could adopt to further its urban development after achieving the preapproved goals for its urban transportation network. The HAIDEP project was conducted by the JICA from 2005 to 2007. This project took into consideration several proposals and strategies, but the proposal that rose above the rest and received most of the JICA's attention was the Urban Mass Rapid Transit (UMRT) project.

The HAIDEP project founded an overarching master plan for the strategy that Hanoi should proceed with when approaching its future urban development processes. The project was extensive due to the fact that it not only created an urban development strategy master plan, but also oversaw several pilot projects, one of which was focused on the northern

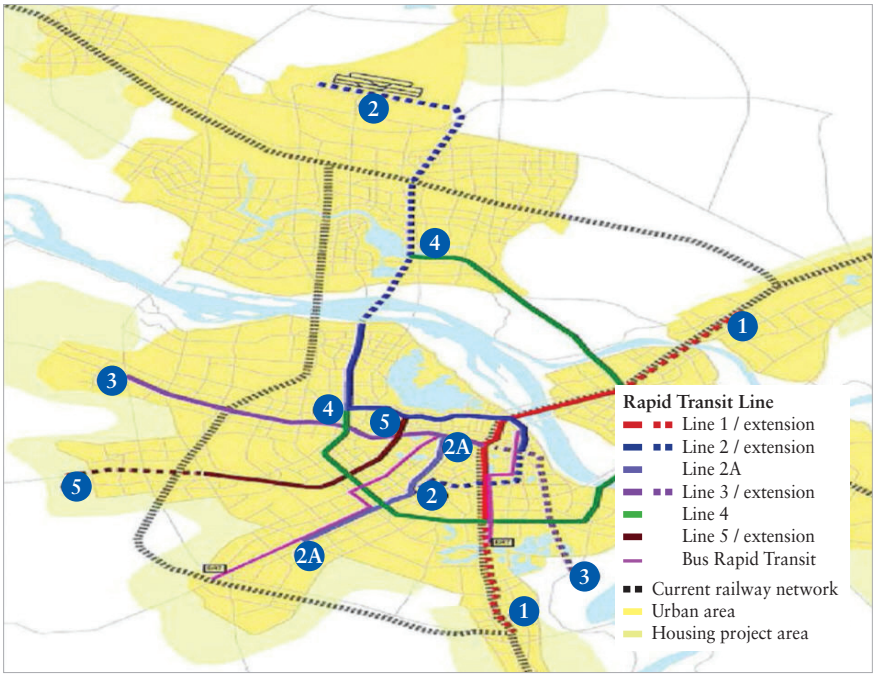


Figure 2.3.8 Rapid transit network until 2020 based on decision No. 90/2008/QD-TTg

Source: Musil, Clement and Molt, Christiane. (2014). "Building a Public Transportation System in Hanoi: Between Emergency and Constraints." p. 12. <http://www.paddi.vn/IMG/pdf/Musil_and_Molt_Building_a_Public_Transport_System_in_Hanoi_2010.pdf> (Accessed on 17 Oct. 2014).

sector of Hanoi, and devised, exclusively for that area, an exhaustive development plan detailing the creation of a new downtown area. In spite of the exhaustive nature of this project, it failed to provide any tangible visions or potential mechanisms to establish a district development plan with UMRT as its nucleus. Furthermore, the pilot project did not consider developing areas near the stations, nor did it propose methods to supervise and shepherd local neighborhood development.

3.13.5 Clean Technology Fund (CTF) Project

Strengthening Sustainable Urban Transport for the Hanoi Metro Line 3 Project

The overall objective of this project was to develop a multimodal system (VTHKCC). The goal was to make an environmentally friendly transport system that appealed to passengers to lure them away from personal vehicles. Such a move away from personal vehicles would allow a resulting

increase in VTHKCC usage, reducing greenhouse gas emissions and toxic emissions harmful to the environment. The overarching goal of the project was to develop a vision for Hanoi that incorporates the urban ecology into a modern civilization.

3.13.6 Project Preparatory Technical Assistance (PPTA)

The objective of this project was to improve access to stations to ensure an effective connectivity between the other forms of transportation and the urban railway No. 3 in Hanoi when it was eventually put into operation. The policy proposal encourages the use of public transportation and limits personal vehicles for systems of public transportation that are environmentally friendly and which also, as mentioned before, appeal to passengers.

Land Use in Urban Transport Planning for Hanoi City

Table 2.3.15 Main targets of the master plan for urban transport development by 2020

Targets	Decision No. 108/QD-Ttg	Recommended revisions
Population - Entire Hanoi - Urban area	 3.9 mil. persons 2.8 mil. persons	 4.5 mil. persons 4.5 mil. persons
Average GDP per capita	USD 1337	USD 1337
Road length (km)	138	183
Road density (km/km^2)	4.42	5.9
Old/New Inner city	10.3/6.3	18.1/10.6
Suburbs	4.1%	7.5%
Terminals and parking area (static transport)	3-5%	3%
Total land area for urban transport	≥25%	20-25%
Public transport share (%)	2020: 50%	2010: 30% 2020: 55- 60%

Source: Ministry of Transport of Vietnam. (2013). "Report on Vietnam Expressway Development Plan." <http://www.unescap.org/sites/default/files/VietNam_0.pdf> (Accessed on 17 Oct. 2014).

In 1998, the prime minister approved the Master Plan for Ha Noi Capital in Decision No. 108/QD-Ttg. In accordance with this, the Ministry of Transport (MOT) made a detailed Master Plan for Urban Transport Development in Hanoi, which is being submitted for appraisal.

The Study on Hanoi Regional Planning conducted by the Ministry of Construction, and proposals for revising the Hanoi Integrated Development

and Environmental Program (HAIDEP) funded by the JICA, have provided scientific and practical recommendations on land use, as shown in the following table.

Based on the above-mentioned targets, the Master Plan for the Urban Transport Development in Hanoi City has to obtain two basic objectives. First, it has to eliminate traffic congestion in the urban area by 2020. Second, it has to meet the standards of the other Southeast Asian capitals in terms of both transportation infrastructure and public transportation systems.

Projected Urban Mass Rapid Transit (UMRT) and New High Rise Buildings in 2009 (Projected Completion in 2030)

Figure 2.3.9 *Infrastructure perspective bus hallway Long Bien*

In transportation terms, dense polycentric cities have both greater advantages and obvious drawbacks compared to monocentric cities with dense centers and low-density suburbs. One advantage is that they are more compact, and therefore transportation distances are shorter. However, one drawback is that they are uniformly dense, and thus most transit lines are more expensive and have to be built either below or above ground. A high-density, polycentric spatial structure implies low land consumption and therefore a small footprint, with high floor area ratios and a transit and road network that is grid-like rather than radial. If Hanoi is to make a successful transition to a dense polycentric city, land use regulations and infrastructure will have to be drastically adapted and dramatically enhanced to accommodate for the evolving spatial structure.

4. Jakarta

Changhwan MO, Young Seok PARK, Arie KIM and Ryan HUNTER

4.1 National and City Statistics

Table 2.4.1 Basic facts about Indonesia

Contents	Status
Land area (km^2)	1,811,569
Population (million, July 2014 est.)	253.6
Main language	Indonesian
Capital city	Jakarta
Currency	Rupiah
GDP (US$ billion, 2013 est.)	868.3
GDP per capita (US$, 2013 est.)	5,200

Source: Central Intelligence Agency. (2014). "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/id.html> (Accessed on 17 Oct. 2014).

As shown in Table 2.4.1, Indonesia has a land area of 1,811,569 km^2. The country is an archipelago and is positioned between the Australian continent and Asia and between the Pacific and Indian Oceans. Indonesia consists of 15,000 small islands and five big islands, which are Sumatera, Java, Borneo, Sulawesi, and Papua.

With a population of 253.6 million, Indonesia is the fifth most populous country in the world. The primary language of the country is Indonesian, and Jakarta is the capital city of the country. The currency used in Indonesia is the Rupiah; one U.S. Dollar is equivalent to around 11,364 Rupiah as of August 2014. The country's GDP in 2013 was approximately US$868.3 billion, making it the tenth-largest economy in the world.

This section attempts to describe the current situation of urban

transportation in the capital city area of Indonesia. Greater Jakarta, which includes Jakarta, Bogor, Depok, Tangerang and Bekasi, is referred to Jabodetabek, while Bodetabek is the area of Jabodetabek without Jakarta.

***Table 2.4.2** Overview of Jakarta and Bodetabek*

Contents	Status
Total population of Jakarta (million, 2011 est.)	9.8
Total population of Jabodetabek (million, 2008)	25.0
Population growth (%, annual)	2.60
No. of daily commuters (Jabodetabek, million)	11
Land area (km^2)	651

Source: Central Intelligence Agency. (2014). "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/id.html> (Accessed on 17 Oct. 2014).

Table 2.4.2 gives an overview of the demographic, geographic and economic characteristics of Jakarta. The total population of Jakarta was estimated at 9.8 million or more. The city has grown rapidly, and the population growth is around 2.6% per annum. The population density is more than 14,000 persons/km,2 and in some areas, such as the Tambora

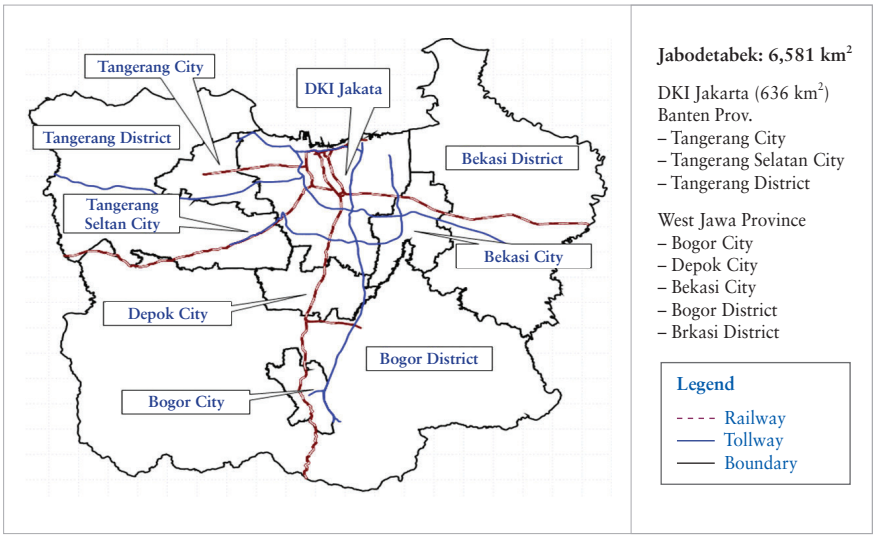


***Figure 2.4.1** Greater Jakarta (Jabodetabek)*

Source: Setiono, Tonny Agus. (2014). "JABODETABEK Public Transportation Policy and Implementation Strategy in the Republic of Indonesia." In *Proceedings of 1st ASEAN-Korea Public Transport Workshop*. 5-7 March. Manila, the Philippines: The Korea Transport Institute. pp. 196.

District, reaches almost 49,368 persons/km^2.

The land area of Jakarta by itself is about 651 km^2 and the surrounding regions are Bogor, Depok, Bekasi, and Tangerang. The total population of Jabodetabek, including Jakarta, is around 2.5 million.

The GDP per capita of Jakarta is US$10,222, and the total budget is US$3.1 billion. Although Jakarta's population makes up 11.8% of the country's population, 25% of the national GDP came from Jabodetabek as of 2008. Moreover, Jabodetabek is the growth engine of Indonesia and a key area where almost 40% of investment comes from foreign investors.

As illustrated by the above map, the Greater Jakarta is divided into several areas. Jabodetabek has a 6,581 km^2 area and is largely made up of three main areas, DKI Jakarta, which accounts for 636 km^2, Banten Province and West Jawa Province.

Table 2.4.3 Summary of characteristics of districts in Jakarta

District	Characteristics
North Jakarta	Area: 7,134 km^2 (sea: 6,979 km^2 and land: 154 km^2)
The Thousand Islands	Location: To the north of Jakarta Bay and the Java Sea. The northernmost island, Sebira, is located around 100 miles off Jakarta Bay.
South Jakarta	Divided into five cities by the decree of the governor. It laid the foundation for the establishment of the City Administrative Area of South Jakarta.
West Jakarta	West Jakarta gets a second-level municipality.
East Jakarta	It has 10 sub-districts, 65 wards, 673 citizens associations, 7,513 neighborhood associations, and a population of 1,959,022.
Central Jakarta	It originated with Ciliwung River in the 5th century as a simple port. The first Europeans were the Portuguese.

Source: Jakarta Capital City Government. (2014). "Jakarta's Geography." <http://www.jakarta.go.id/eng/news/2011/03/jakartas-geography> (Accessed on 1 Sept. 2014).

Table 2.4.3 summarizes the characteristics of each of the respective regions that make up Jakarta. The municipality of North Jakarta has an area of approximately 7,134 km^2, which consists of 154 km^2 of land and 6,980 km^2 of sea. Following a decree by the governor of the Jakarta Capital City Government, the city was divided into five districts and established the basis for the City Administrative Area of South Jakarta. East Jakarta is divided into 10 sub-districts, 65 wards, 673 citizens associations and 7,513 neighborhood associations. The population of East Jakarta is about two million. Jakarta started out as a small port in the 5th century by the Ciliwung River. The first Europeans to arrive in Jakarta were Portuguese.

4.2 Level of Service in Public Transit

4.2.1 Types of Public Transportation

Table 2.4.4 Types of public transport services in Jakarta

Transportation	**Service**	**Rate** (Rp.)
Taxis	Several taxi companies operate, but the Blue Bird taxi is most popular since it provides reliable services with unambiguous fares.	Base: 6,000 (Highway: +10,000)
Intercity buses	There are four long-distance bus terminals.	–
Trains (Kereta Api)	This is useful for travel downtown and to other Java regions.	–
Trans Jakarta	This is a comprehensive BRT System in Jakarta.	3,500
Bajai	This can pick up two passengers in a small converted motorcycle taxi and goes short distances outside of the city.	5,000
Bemo	This is a kind of small bongo bus. Indonesian people often use this.	2,500
Ojek	This is a motorcycle taxi that is fast and easily available.	4,000

Source: Raya, Jaya. (July 2011). "Transportation in Jakarta." pp. 1-40. <http://www.asianhumannet.org/db/datas/9_transport/transport_jakarta_en.pdf> (Accessed on 16 Oct. 2014).

As is illustrated in Table 2.4.4, there are many types of public transportation services available in Jakarta. The BRT uses exclusive bus lanes, and you can transfer as often as you want when you purchase a single ticket.

The Blue Taxies from the Blue Bird Taxi Company are mainly used because they provide good services with a state-regulated fee system. Since Jakarta and Java have a wide area consisting of nearly 132,700 km^2, long-distance bus routes have been developed. There are four long-distance bus terminals in Jakarta.

Indonesia's state-run railway company is called Kereta Api, and is very useful when you travel downtown or to other parts of the country. Due to its wide-ranging network, it provides a convenient mode of transportation for passengers traveling to the main districts.

4.2.2 Urban Public Transport Fleets

There are various types of road-based public transportation systems operated in Jabodetabek. The number of urban public transport fleets in Greater Jakarta varies.

Table 2.4.5 Number of urban public transport fleets in Greater Jakarta (2010)

Type of mode	Fleet number (unit)
TransJakarta BRT	668
Regular Single large buses	4,507
Medium buses	4,960
Micro buses	14,130
Regular taxis	23,396
Executive taxis	1,093
Trucks	19,726
Tourist, Rental buses	5,048
City buses	3,340

Source: Iryantomo, Felix. (2013). "Public Transport Status of Greater Jakarta -Indonesia." In *Proceedings of ASEAN-Korea Capacity Building Program in Korea: Education Program*. 17-26 February. Goyang, Korea: The Korea Transport Institute. p. 232.

4.2.3 Service Levels of Public Transport

Regular large buses have a seating capacity of 50 and a maximum of 85 passengers with standing ones. Medium buses have a seating capacity of 24 and allow for a maximum of up to 40 passengers with standing ones. The small and micro buses, sometimes referred to as Transit Vans, have a capacity for nine to 14 passengers. Generally speaking, all of these transportation modes serve the public daily from 5 a.m. to 11 p.m., and some operate for 24 hours. Unfortunately, the operational system of the public transportation system, excluding the BRT, is not supported by an integration system.

On the TransJakarta Busway, buses run on exclusive lanes, thus lowering

Table 2.4.6 Performance of TransJakarta

Year	Passengers per year	Increase (%)	Travelled per year (km)	increase (%)	Fleet
2004	15,942,423	–	4,647,080	–	Single diesel buses (12 m): 89 Single CNG buses (12 m): 381 Articulated CNG buses: 198
2005	20,798,196	30	5,481,297	18	
2006	38,828,039	87	13,184,848	141	
2007	61,441,667	58	24,502,387	86	
2008	74,619,266	2	30,079,035	23	
2009	82,377,234	10	34,066,970	13	
2010	86,937,488	6	36,361,144	7	
2011	114,769,431	31	45,168,795	24	

Source: TransJakarta Management. (2014).

the potential for traffic congestion. The BRT system can carry up to 30,000 passengers in one direction per hour. According to a survey conducted by the management of the TransJakarta Busway, 14% of the total number of passengers previously used private cars.

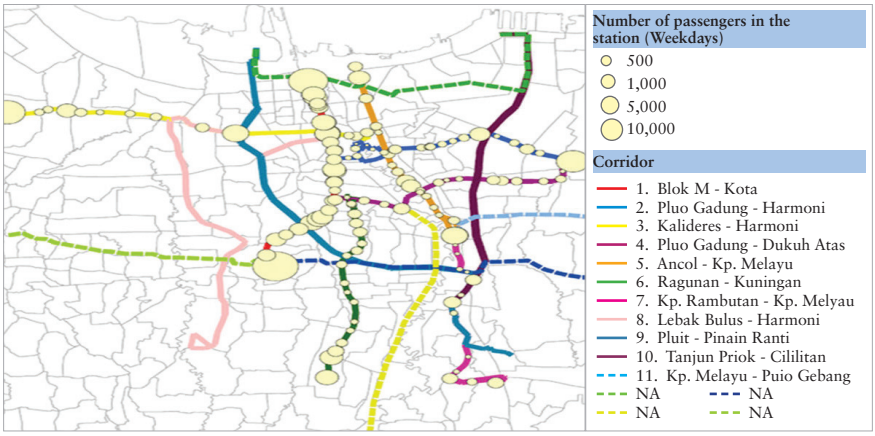


Figure 2.4.2 *Bus routes and number of passengers on the TransJakarta Busway*

Source: Muslihun, Alvinsyah. (2014). "Public Transport Problems and Solutions of Jakarta." In *Proceedings of 1st ASEAN-Korea Public Transport Workshop*. 6 March. Manila, the Philippines: The Korea Transport Institute. p. 217.

Table 2.4.7 *Details of TransJakarta Busway Corridors*

Trans Jakarta corridor		Opened	Length (km)	Number of stops	Average travel time (min.)
1	Block M- Kota	15 Jan. 2004	12.9	20	43
2	PuloGadung – Harmoni	15 Jan. 2006	14.0	23	48
3	Kalideres – Harmoni	15 Jan. 2006	19.0	12	63
4	Pulo Gadung - Dukuh Atas	27 Jan. 2007	11.85	17	38
5	Ancol - Kp. Melayu	27 Jan. 2007	13.5	17	45
6	Ragunan – Kuningan	27 Jan. 2007	13.3	18	44
7	Kp. Rambutan - Kp.Melayu	27 Jan. 2007	12.8	13	43
8	Lebak Bulus- Harmoni	21 Feb. 2009	26.0	22	89
9	Pluit- Pinang Ranti	31 Dec. 2010	28.8	37	96
10	Tanjung Priok- Cililitan PCG	31 Dec. 2010	19.4	21	65
11	Kampung Melayu- Pulo Gebang	28 Dec. 2011	11.76	14	50
12	Pluit-Tanjung Pruik	14 Feb. 2013	26.04	14	–
Total		14 Feb. 2013	209.35	228	–

Source: Iryantomo. (2013). p. 236.

Due to its wide-ranging network, the TransJakarta acts as a de facto subway system, providing easy and convenient travel across its network. In addition, new routes (No. 13-15) are currently in the process of being built. Considering only lines 1-12, it is a total of 209.35 km in length and has 228 stops.

The BRT system provides services with closed stations, air conditioning, CCTV, a bus tracking system (BTS), station locations that are integrated with bus and rail routes, automatic doors, information guides, and e-ticketing, which reduces waiting time and checks sales at a glance.

Figure 2.4.3 Example of TransJakarta services

4.3 Transportation Infrastructure Investment and Financing

4.3.1 BRT

In 2004, Jakarta operated a new public transport system called the TransJakarta Busway. Jakarta has allocated increasing funds for the BRT project, with some US$14 million allocated in 2004 and US$51 million allocated in 2005. The governor proposed that US$87 million be appropriated for the four new Busway corridor projects in 2006.

4.3.2 MRT

The Japan Bank for International Cooperation (JBIC) signed a loan agreement with Indonesia on November 28, 2006 to provide 1,869 million yen to Indonesia to finance the "Engineering Services for the Jakarta MRT System Project."

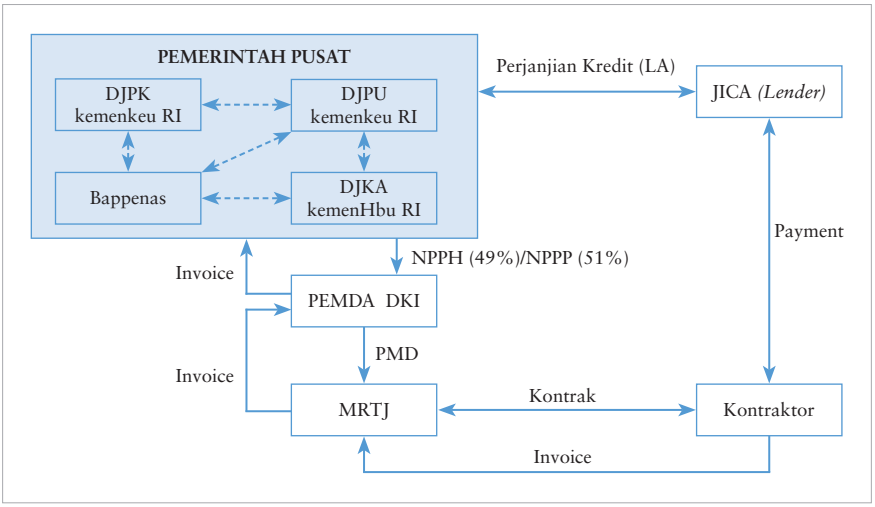


Figure 2.4.4 *Flow chart of the MRT project funding*

Source: MJ MRT Jakarta.

The total project cost was estimated to be around US$1.39 billion, with an eligible loan portion of approximately US$1.15 billion, and the rest funded by the national and city budgets. The project cost will be shared between the national government (42%) and the city government (58%). The fund will then be channelled to the PT MRT Jakarta through the DKI Jakarta as the respective implementer and operator of the project.

As of today, the MJ MRT Jakarta has managed to secure the loan agreement, which is 42% of the eligible loan portion from JICA that is granted to the Provincial Government of DKI Jakarta. In 2009, the JICA also provided a grant to perform a feasibility study on the extension of the MRT corridor from Bundaran HI to Kampung Bandan (Kota), and to also perform a pre-feasibility study on a potential MRT east-west corridor.

4.3.3 Monorail

A monorail project was revived in February 2013 after earlier construction started in 2004 but was abandoned in 2008 due to financial problems and lengthy legal disputes. The project is now being developed by a private corporation, PT Jakarta Monorail. All consortium vendors are local businesses in Indonesia, and Adhi Karya, as a sponsor, will resolve the financial problems through bank loans of 8.4 trillion Rp. and rights issues amounting to 2 trillion Rp.

4.4 Ownership and Operation of Public Transport

4.4.1 Ownership

TransJakarta Busway

The buses that service the corridors are owned by various corridor operators. This holds true for all corridors with the exception of Corridor 1, where the buses are owned by TransJakarta.

Metro Mini Bus (Regular City Buses)

State- and regional-owned enterprises and corporate bodies received ownership of these buses as a result of law No. 22/2009.

MRT Jakarta

The PT MRT Jakarta shareholders are composed of members of the Provincial Government of DKI Jakarta and PD Pasar Jaya, with the percentage of each being 99.5% and 0.5%, respectively.

Urban Railways

The Indonesian National Railways Company, PT Kereta Api Indonesia (PT KAI), owns the railways. The PTKAI Commuter Jabodetabek, commonly known as KRL Jabodetabek, is a mass rapid transit system in the Jakarta metropolitan area. KRL Jabodetabek is an acronym for "Kereta Rel Listrik Jakarta Bogor Depok Tangerang Bekasi," which means "Jabodetabek electrified rail."

4.4.2 Operations

TransJakarta Busway

The operation of the TransJakarta Busway is contracted out for a period of seven years to private operators for each respective corridor. The contract charge is based on the total amount of kilometers that each bus operates in a given corridor. The number of corridors has been increased, and is now run by five different private operators.

On routes 1 to 3, the ticketing and fare collection systems are operated exclusively by two private companies, through five-year contracts. The equipment was provided by the local authority of Jakarta. Fare collection is handled by the TransJakarta management. Road maintenance is undertaken by the Jakarta government, and each operating company performs vehicle

maintenance on their own buses.

Urban Railways

In the past, private enterprises operated the railways, but the government now operates them. The PT KAI Commuter Jabodetabek, a subsidiary of PTKAI, is operating the commuter lines in the Jakarta metropolitan area.

4.5 Road Infrastructure

Table 2.4.8 Road infrastructure construction in Jakarta

Contents	Status
Length of roads	7,650 km
Road area	40.1 km^2
Road area per total area ratio (density)	6.26%
The annual growth rate of road length	± 0.01%

Source: Raya. (2011). p. 5.

The total length of roads in Jakarta as of 2011 was 7,650 km, and the total area of these roads spanned about 40.1 km^2. The road area per total area ratio was only 6.26%, and the annual growth rate of road length was just ± 0.01%. The vehicle population in Jakarta as of 2013 was 38.7 million units[1], a number which, coupled with the extremely insufficient road network, would suggest that traffic congestion in Jakarta is not only a current problem but will remain so for the foreseeable future unless urgent measures are taken to curb vehicle population growth in the city.

4.6 Railway Infrastructure

After the Indonesian government's railways modernization project in 2011, the current system has six integrated commuter lines that serve the Greater Jakarta area. The total length is 236.3 km.

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1 http://en.tempo.co/read/news/2013/07/31/057501221/Jakarta-on-the-Verge-of-Total-Gridlock

Line color	Line	Route	Stations served	Length	Fully operated
Yellow	Jakarta Loopline	Jatinegara to Depok/Bogor	30	71.8 km	1987
Red	Jakarta - Bogor	Jakarta Kota to Depok/Bogor	25	54.6 km	1930
Green	Jakarta - South Tangerang	Tanah Abang to Serpong/Parung Panjang/Maja	19	55.7 km	2013
Blue	Jakarta - Bekasi	Jakarta Kota to Bekasi	18	27.4 km	1987
Brown	Jakarta - Tangerang	Duri to Tangerang	9	18.9 km	1997
Pink	Tanjung Priok Line	Jakarta Kota to Tanjung Priok	4	7.9 km (total) 1.6 km (operated)	Partial service on Jakarta Kota - Kampung Bandan shuttle.

Figure 2.4.5 Jabodetabek commuter railway lines

Source: Wikipedia. (2014). "KA Commuter Jabodetabek." <http://en.wikipedia.org/wiki/KA_Commuter_Jabodetabek> (Accessed on 17 Oct. 2014).

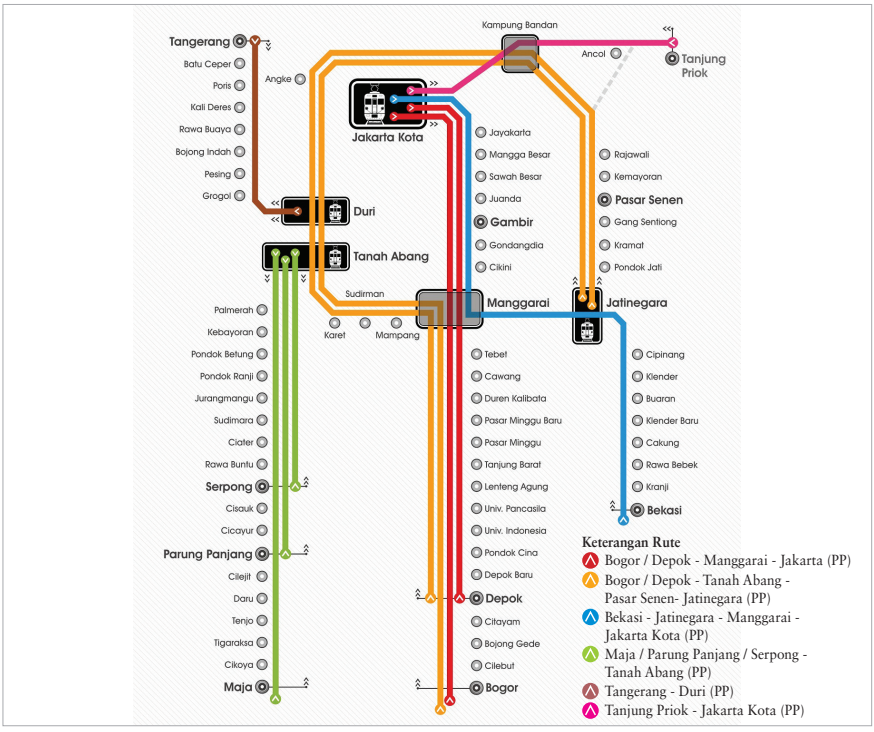


Figure 2.4.6 Railway route map (2013)

Source: Wikipedia. (2014). "KA Commuter Jabodetabek." <http://en.wikipedia.org/wiki/KA_Commuter_Jabodetabek> (Accessed on 17 Oct. 2014).

The number of rail passengers increased from 175 million in 2007 to 194 million in 2008, an increase of 10.9%. The passenger traffic volume has shown an annual average growth rate of 2.4% during a five-year period. Approximately 17 million tons of freight are carried by train annually, and this number has remained substantially consistent.

4.7 Vehicle Statistics, the Modal Share of Public Transportation

Table 2.4.9 Automobile-related statistics of Jakarta for 2011

Item	Figures
Number of daily trips across Jakarta	20.7 (million)
Total number of automobiles in Jakarta	6.7 (million)
Private vehicles	6.6 (million) (98.5% of total vehicles)
Public vehicles	91,082 (unit) (1.5% of total vehicles)
Growth rate (in the last 5 years)	11%
Vehicle growth rate (only Jakarta)	1,172/day (186 motor cars + 986 motor cycles per day)
Jabodetabek (Jakarta, Depok, Tangerang, Bekasi)	Total number of vehicles: 10.5 (million) Growth rate: 2,247/day (288 motor cars + 1,960 motorcycles per day)

Source: Raya. (2011). p. 5.

The number of daily trips in Jakarta in 2001 was 20.7 million. Private vehicles, which made up 44% of the total daily trips, are 98.5% of the total number of vehicles. As a result, only 1.5% of the public vehicles are responsible for carrying the remaining 56% of the total trips[2]. A very small number of public vehicles have to meet more than half of the traffic demand in Jakarta.

4.8 Traffic Safety Indicators

According to a report from the Indonesian National Police released in 2010, Indonesian traffic fatalities totalled 31,234. Figure 2.4.7 means that three to four people died every hour as a result of a vehicular accident. In

2 Including the 3% of daily trips undertaken on the Jabodetabek train service.

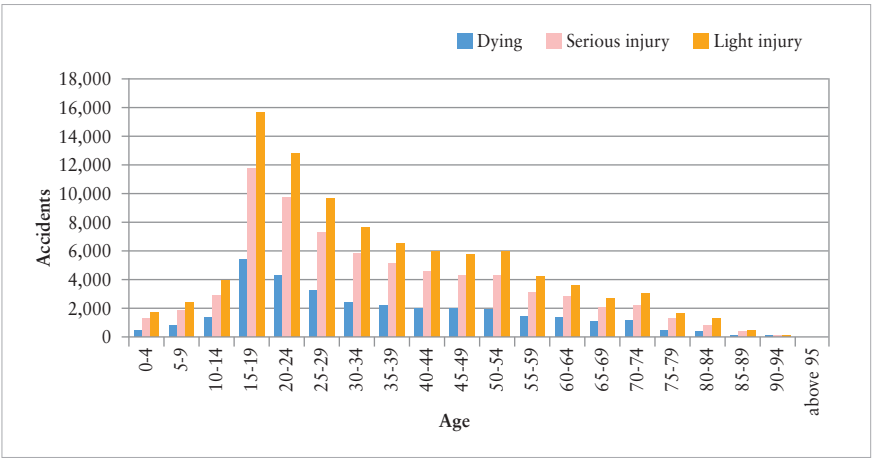


Figure 2.4.7 Age distribution of traffic accidents in Indonesia (2010 Standard)

Source: Bertindak, Saatny. (2012). "Indonesia Road Safety Profile."

the case of children and the elderly, the accident levels are not very high, but for adults over the age of 15 the levels are much higher.

4.9 Travel Behavior

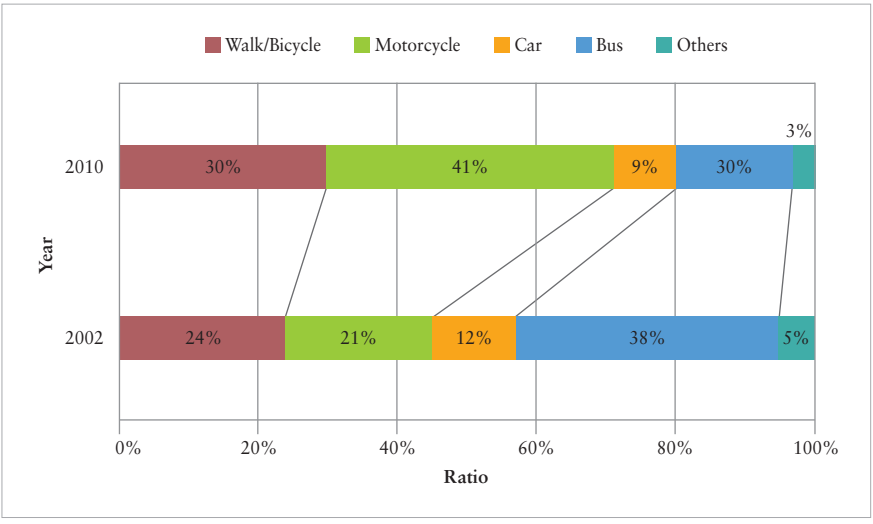
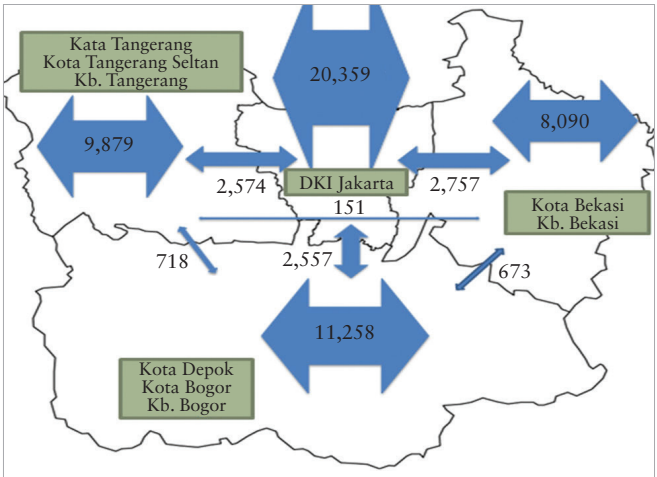


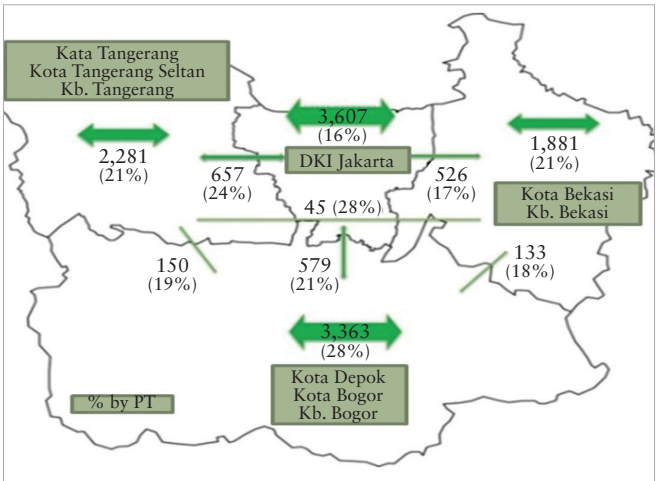
Figure 2.4.8 Mode share ratio of Jabodetabek

Source: JUTPI. (2014).

During an eight-year period from 2002 to 2010, the ratio of motorcycle users increased almost twofold, while the ratio of private vehicle users reduced by 3%, and that of bus utilization severely decreased by 21% between 2002 and 2010. These results suggest an unsustainable pattern of increased usage of private motorcycles at the expense of public vehicles.



(i) Total person daily trips (x 1,000), Total trips=59 million



(ii) Public transport daily trips (x 1,000), Public transport trips=13.2 million (22.5%)

Figure 2.4.9 *Trip patterns in Jabodetabek (2010)*

Source: Muslihun. (2014). p. 216.

The total number of daily trips taken in Jabodetabek as of 2010 was 59 million, and the number of these trips serviced by public transportation was 13.2 million, or 22.5%.

4.10 Air Pollution and Vehicle Maintenance Standards

Table 2.4.10 Fuel quality and vehicle emission standards in Indonesia

Division	Contents and standards	
Sulphur (max, ppm)	Diesel	500: 3,500 (avg.)/500 ppm
	Petrol	500
Fuel quality comment	Lead phased out in 2006. Plan to adopt Euro 3-equivalent fuels (350ppm) in 2016. Source: Ministry of Energy and Mineral Resources, ACFA	
Fuel quality comment	Used vehicles to be banned from 2007 for commercial uses.	
Vehicle standards and inspection and maintenance (I/M)	Euro 2 vehicle emissions came into force in January 2005 for new models and in 2007 for existing models, but sulphur levels are above 4,000ppm.	
Vehicles comment	There is a plan to adopt Euro 4 vehicle emissions in January 2012 for new models and 2014 for existing models.	

Source: UNEP. (2012). "Status of Fuel Quality and Vehicle Emission Standards in Asia-Pacific." <http://www.lead.org.au/PCFV/Lead_Matrix_AP_201206.pdf> (Accessed on 17 Oct. 2014).

Sulphur levels in fuel are above 4,000ppm due to the high level of sulphur imports. Sulphur fuel in Jakarta is only available in small package amounts of 550ppm. Taking into consideration the vehicle import restrictions, the Indonesian government has banned used vehicles for commercial uses.

Emission testing facilities are also available in a number of cities, such as Surabaya and Yogyakarta. Jakarta does have roadworthiness and emissions tests in place for commercial vehicles, something which has not always been the case.

In 2006, the Jakarta provincial government received an Air Quality Management Champion Award from the Clean Air Initiative for Asian Cities. The city was recommended and then awarded for its efforts to improve the environment through its gas fuel program. According to the Institute for Transportation and Development Policy (ITDP) research, 155 tons of NOx were reduced from the total volume of emissions, and the CO^2 emission levels were curtailed by 20,000 tons annually.

Despite all these promising reductions in emission levels, one major problem that has yet to be solved is the insufficient network of gas stations. Improving the gas station network will take time due to the need to restructure the existing routes to develop a feeder bus system.

Figure 2.4.10 *Natural gas buses in Jakarta*

4.11 Traffic Congestion and Traffic Demand Management

4.11.1 Traffic Congestion

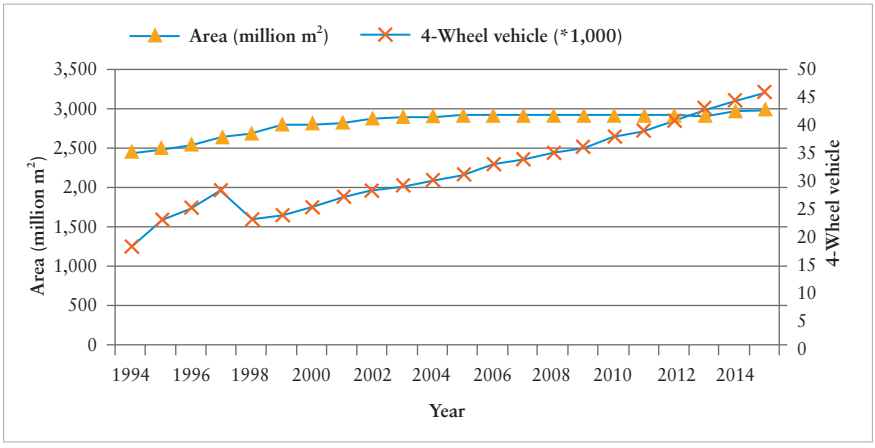


Figure 2.4.11 *Comparison of Jakarta's total road area and private vehicles by year*

Source : Jakarta Local Government. (2014). "Jakarta Urban Transport Problems and Their Environmental Impacts." p.3. <http://www.ui.ac.id/download/apru-awi/jakarta-local-goverment.pdf> (Accessed on 16 Oct. 2014).

The number of motor vehicles in the Greater Jakarta area is growing at an extremely fast rate of 11% per annum. Additionally, 296 new units of four-wheeled motor vehicles are registered on a daily basis. Due to the low

capacity of public transportation, only around 27% of approximately 24 million trips are carried by the public transportation services.

4.11.2 Traffic Demand Management (TDM)

Developing the Bus Rapid Transit (TransJakarta) Network

The BRT can be worked as a kind of TDM since it reduces one lane of urban road per direction. This exclusive lane restricts the excessive use of private automobiles.

(i) TransJakarta BRT System

(ii) Entrance to the 3-in-1 zone in central Jakarta

Figure 2.4.12 BRT system and 3-in-1 zone in Jakarta

Source: Dalkmann, Holger. (2010). *Case Study of a Transport MRV NAMA: TDM Measures in Jakarta, Indonesia.* Jakarta, Indonesia: Asian Development Bank.

Limiting Access to a Part of the Central Business District

Only cars carrying at least three people will be allowed in certain areas of the central business district during peak hours. The intention behind this plan is to encourage more people to ride together in cars and thus decrease the overall number of cars in a prime area of traffic congestion.

Electronic Road Pricing (ERP) System

This is akin to the Singapore-style electronic congestion toll collection and is something that is currently under study. This system charges drivers at the point of use .

Parking Restraints

Parking restraints are done through increasing parking charges and physically restricting the number of parking spaces available.

Further Improvements in Public Transportation

Public transportation, such as the BRT system, has been made more efficient, and this has resulted in lower greenhouse gas emissions per passenger kilometer travelled.

4.12 Organization of Public Transport Administration

4.12.1 Vision of the Jakarta Transport Agency

This vision of the Jakarta Transport Agency is to create a New Jakarta through the provision of transportation services that are reliable, modern and internationally competitive, with public transport as a major service.

4.12.2 Mission

1. Realize transportation services that are run safely, smoothly, safely, comfortably, and are integrated.
2. Realize an informative transportation service based on information technology and communications.
3. Realize environmentally friendly transportation and support accessibility for persons with physical disabilities.
4. Realize affordable transportation costs for the general community.

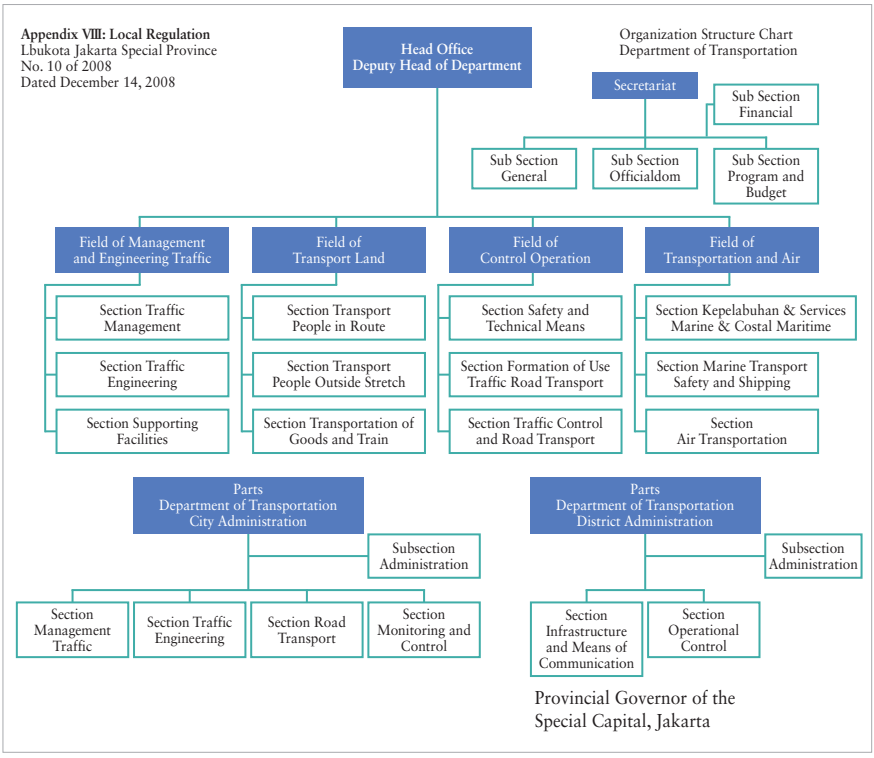


Figure 2.4.13 *Organizational structure of the Department of Transportation in Jakarta*

Source: Raya, Jaya. (2014). "Dinas Perhubungan." <http://dishub.jakarta.go.id/susunanorganisasi> (Accessed on 17 Oct. 2014).

4.13 Public Transport and Traffic Planning

4.13.1 MRT Construction and Planning

The Jakarta government is going to construct three MRT lines — one south-north line and two east-west lines. It is constructing the south-north corridor line from Lebak Bulus to Kampung Bandan. The total length of the line is 23.3 km.

The Jakarta provincial government is going to construct the south-north line in two phases. The first phase is to construct 15.2 km from Lebak Bulu to Bundaran Hi, and the second phase is to construct 8.1 km from Budaran Hi to Kampung Bandan.

The first phase of the south-north line will be completed by 2016, and

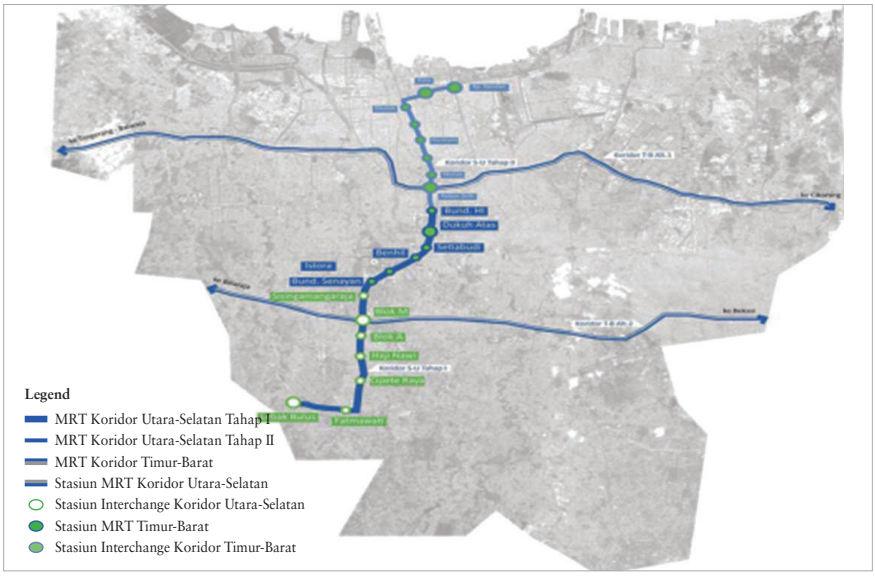


Figure 2.4.14 *Route map of the Jakarta MRT*

Source: MRT Jakarta and the Department of Transportation of Jakarta Capital City Government. (2014). <http://www.jakartamrt.com/informasi-mrt/rencana-rute-mrt-jakarta/> (Accessed on 16 Oct. 2014).

Table 2.4.11 *Construction planning of the Jakarta MRT*

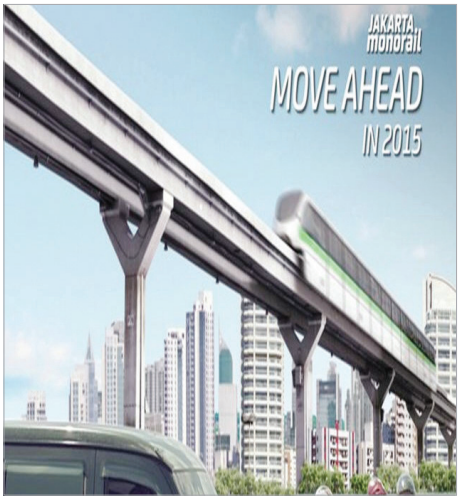
Division	South-North corridor (total length: 23.3 km)	
	1st Phase Lebak Bulus - Bundaran Hi	2nd Phase Bundaran Hi - Kampung Bandan
Length of track	15.2 km (Elevated: 9.2 km, Underground: 6 km)	8.1 km
Stations	13 (Elevated: 7, Underground: 6)	+8 (Elevated: +1, Underground: +7)
Travel time	30 minutes	+22.5 minutes
Distance between Stations	0.5-2 km	0.8-2.4 km
Length of track	5 minutes	5 minutes
Target passenger/day	412,700 (2020, after 3 years in operation)	629,900 (2037)
	Traffic Demand Management (TDM) and Transit Oriented Development (TOD)	
Operation target	2016	2018

Source: MRT Jakarta. (2014). <http://www.jakartamrt.com/> (Accessed on 1 Sept 2014).

the second phase will be completed by 2018. All the stations for the line will be constructed either above ground or underground, and travel time on the line will take about 22.5 to 30 minutes.

The target number of passengers after the completion of the line is 412,700 per day in 2020 and 629,900 per day in 2037. To achieve the target traffic demands, the Jakarta provincial government should implement various traffic demand management techniques and transit-oriented development policies around MRT stations.

4.13.2 Planning and Construction of Monorail



As the following picture and table illustrate, the Jabodetabek monorail system consists of five lines. It started construction on October 16, 2013, and the Green and Blue lines will be opened in 2015 and 2016, respectively. The Green line's length is about 14.3 km and consists of 16 stations. The Blue line has 23.2 km of rail length and a total of 26 stations. A private corporation, PT Jakarta Monorail, is implementing this project.

Figure 2.4.15 Blueprint of monorail

Source: Jet Monorail. (2014). <http://jetmonorel.co.id/rute> (Accessed on 1 Sept 2014).

Table 2.4.12 *Planning of Jabdetabek monorail*

Division	Contents	
Line	Green	Length: 14.3 km, 16 stations
	Blue	Length: 9.7 km, 11 stations (to Tanah Abang) Length: 13.5 km, 15 stations (to Taman Anggrek)
Prologue	Originally a pure private sector venture	
Present	Under construction: 29 km, two-line monorail system Open: 2015	

Source: Raya. (2011). pp. 29-30.

However, there are separate plans for an intercity monorail from a consortium of five state-owned companies to link the greater Jakarta area. It has a plan to develop a 39-km east-west line linking Cibubur, Cawang and Kuningan, and also Bekasi, Cawang, to central Jakarta. This line would also connect with the city monorail Green and Blue lines.

5. Kuala Lumpur[1]

Sangjun PARK and Young Seok PARK

5.1 National and City Statistics

Table 2.5.1 Basic facts about Malaysia (2012)

Contents	Status
Land area (thousands km^2)	329,847
Population (thousands)	29,518
Major language	Bahasa Malaysia
Capital city	Kuala Lumpur
Currency	Ringgit Malaysia (RM)
GDP (US$ billion, 2010)	336.9 billion (2014)

Source: Wikipedia. (2014). "Malaysia." <http://en.wikipedia.org/wiki/Malaysia> (Accessed on 23 Oct. 2014).

Table 2.5.2 Population changes of Malaysia

Contents	2009	2010	2011	2012	2013
Population (thousands)	28,081.5	28,588.6	29,062.0	29,517.7	29,947.6
Population density (per sq. km)	85	86	88	89	90

Source: Department of Statistics Malaysia, Official Portal. (2014). "The Source of Malaysia's Official Statistics." <http://www.statistics.gov.my/> (Accessed on 18 Oct. 2014).

The population of Malaysia is growing continuously, and the capital city, Kuala Lumpur, which plays a key role in the economic development of the nation, shows a similar trend.

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1 This Chapter is summarized from many sources of publications in SPAD, Kuala Lumpur City government, and other web sites, such as wikipedia.

Table 2.5.3 Overview of the city (2012)

Contents	Status
Total population of city (thousand, 2012)	1,710
Population density (per km^2)	7,051
Greater population (thousand)	7,504
Area (km^2)	244

Source: Central Intelligence Agency. (2014). "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/id.html> (Accessed on 18 Oct. 2014).
Source: World Gazetteer. (2014). "Malaysia." <http://archive.today/ACo0> (Accessed on 18 Oct. 2014).

Table 2.5.4 Overview of city and nation by year

Year	GDP (US$ bill.)	Urbanization (%)	Population (persons)	
	Malaysia	Malaysia	Malaysia	Kuala Lumpur
1990	117.31	–	18208562	1145342
2000	356.4	–	23415909	1305792
2010	797.326	70.6	28401017	1627172
2011	884.455	71.7	29062000	1693000
2012	941.237	72.4	29517700	1710100
2013	992.538	–	29947600	1724500

Source: Department of Statistics, Malaysia. (2013). *Compendium of Environment Statistics.* Putrajaya, malaysia: Department of Statistics, Malaysia.

5.2 Public Transit Level of Service

5.2.1 Types of Public Transportation

The main mode of commuting in Kuala Lumpur is by vehicle due to its well-connected road network. As the capital of Malaysia, Kuala Lumpur has a comprehensive road network that leads to the rest of Peninsular Malaysia.

The largest public transportation operator in Kuala Lumpur and the Klang Valley is RapidKL. Since it took over from Intrakota Komposit Sdn Bhd, Rapid KL has redrawn the entire bus network of Kuala Lumpur and the Klang Valley metropolitan area to increase ridership and improve the city's public transportation system. The management of RapidKL has adopted a hub and spoke system to provide greater connectivity, and cut down on the need for more buses. RapidKL is also the operator of two light rail lines in Kuala Lumpur and the Klang Valley, Ampang Line and Kelana

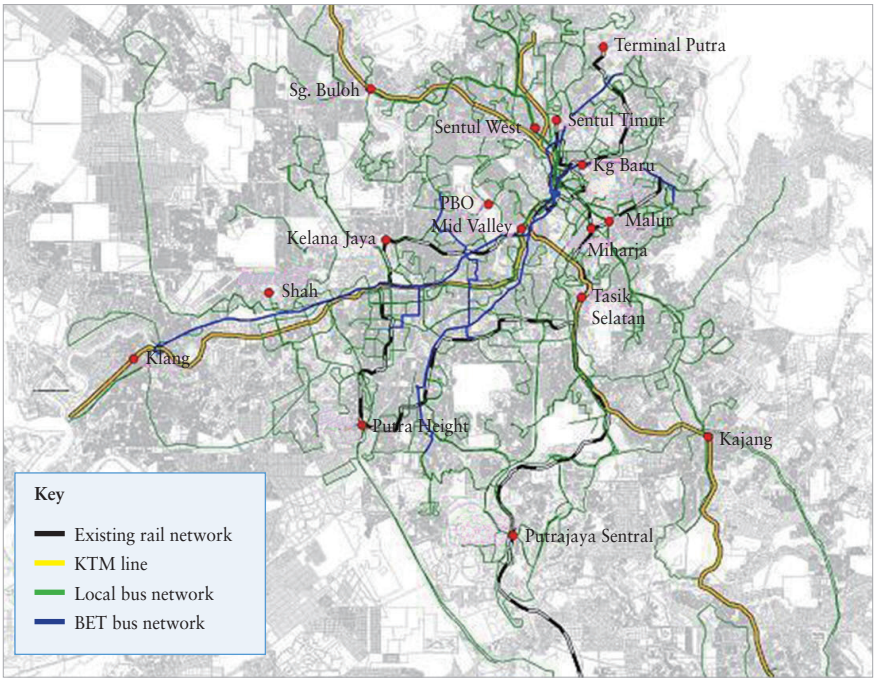


Figure 2.5.1 Land public transport network

Source: Halcrow. (2014). <www.halcrow.com/> (Accessed on 23 Oct. 2014)

Jaya Line. By 2016, the Sungai Buloh – Kajang Line will be completed, providing a faster, more efficient ride to the city center.

Table 2.5.5 Kuala Lumpur integrated transit network average daily commuters

Contents	2001	2002	2003	2004	2005
Rapid KL(Kelana Jaya Line)	143,778	149,105	154,869	160,361	165,695
Rapid KL(Ampang Jaya Line)	88,201	91,702	107,082	120,426	125,208
KTM komuter	57,339	60,504	67,522	74,960	85,733
KL monorail	–	–	23,872	33,837	44,442
Express rail link	–	4,983	7,323	9,990	12,075

Source: Wikipedia. (2014). "Public transport in Kuala Lumpur." <http://en.wikipedia.org/wiki/Public_transport_in_Kuala_Lumpur> (Accessed on 23 Oct. 2014).

Buses

The current bus operation services in the Greater Kuala Lumpur/Klang Valley region have severe service quality, reliability and delivery issues. The

existing delivery of services, perceived lack of integrated or comprehensive bus planning, unpublished timetables, uncoordinated services and distinct lack of enforcement of operating rules indicates that the services are failing to meet the needs of the region.

There is an extensive bus network operated by Rapid KL, Metrobus and a number of smaller operators. The current bus system is provided by 13 main operators, plus a handful of smaller operators who operate on the periphery of the urban areas.

The salient features of bus service provision are as follows: The service pattern focuses on central Kuala Lumpur and is principally concentrated on radial routes emanating from the city, where operators are likely to experience high ridership and high levels of revenues. However, the physical structure of the highway network, combined with the way services are actually operated, means that service accessibility, availability and integration is limited. The lack of coordination or regulation means that oversupply often occurs, and competition between operators is often duplicative rather than adding any new services to the network.

Figure 2.5.2 *Citybus scania operated by Rapid KL*

Source: Wikipedia. (2014). "File:ScaniaK270UB-RapidKL.JPG." <http://en.wikipedia.org/wiki/File:ScaniaK270UB-RapidKL.JPG> (Accessed on 23 Oct. 2014).

Table 2.5.6 Bus services

Indicator	Information	
Number of routes	Rapid KL	162
	Metrobus	40
	Selangor Omnibus	11
	SJ Bus	7
	Len Seng	5
	City Liner	3
	Permata Kiara	3
	Sri Indah	2
	Trinton Commuter	2
	Roadliner	1
	Wawasan Sutera	1
	Sks KL	1
	Causeway Link	1
Average speed	AM peak between 9 and 15 km/hr	
Daily ridership	380,000 (Rapid KL only)	
Bus stops	4,200 (Relatively low for number of route kilometers. Few bus stops display any passenger information)	

Source: The Land Public Transport Commission. "Bus Transformation Plan."

Rail

KL Rail Network

The KTMB Komuter runs on rail corridors that are the oldest in the country. In the early 1990s, freight and passenger railway tracks between Port Klang, Sentul, Rawang and Seremban were upgraded and electrified. It was opened as the KTMB Komuter system in 1995. Since then there have been extensions to Tanjung Malim, Batu Caves and Seremban to Sungai Gadut. The current system is operated by Keretapi Tanah Melayu Berhad (KTMB). The Ampang Line (formerly STAR) was built of grade-separated tracks using a combination of new alignments, and utilizes disused freight rail lines from Pudu to Ampang. The Kuala Lumpur monorail opened in 2003 and links areas within the center of Kuala Lumpur that were not served by the other urban rail systems.

The current daily ridership on the urban rail network is over 464,000 passengers per day, with the Kelana Jaya and Ampang LRT services having the highest passenger loads. KTMB is typically used for longer-distance movements, including to locations outside the Greater Kuala Lumpur/ Klang Valley region such as Seremban. Of the 50 KTMB Komuter stations

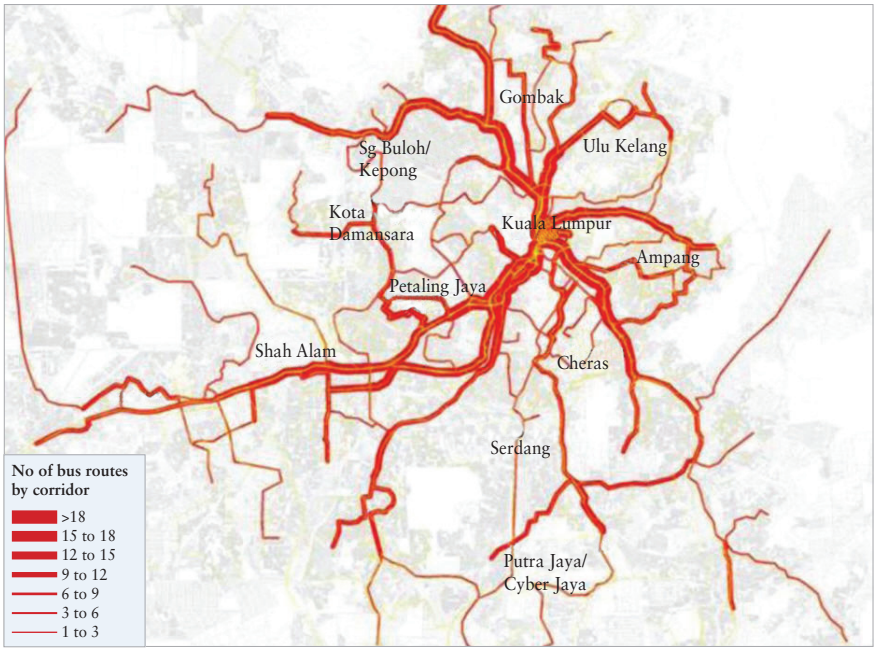


Figure 2.5.3 *Bus route density*

Source: The Land Public Transport Commission. "Bus Transformation Plan."

in the region, 12 have fewer than 250 passengers per day. This reflects its inaccessibility from the surrounding areas as well as the low frequency of trains and slow journey times, and highlights the need for improvements in KTMB's services.

Table 2.5.7 *Rail network*

Rail line	General rail category	Route length (km)	No. of stations	Peak hour headway (min)	Current daily ridership
KTMB Komuter	Suburban rail	157	50	15	95,000
Kelana Jaya (Putra) LRT1	Urban rail/ Metro	29	24	3	160,000
Ampang (star) LRT2	Urban rail/ Metro	27	25	3-6	141,000
Monorail	Urban rail/ Metro	8.6	11	5	57,500
KLIA	Suburban rail / Airport express	57	5	15	11,000
Total		278.6	115		464,500

Source: The Land Public Transport Commission. "Urban Rail Development Plan."

LRT

There are two fully grade-separated light rail transit systems in Kuala Lumpur, the Kelana Jaya Line and the Ampang Line. They are both operated by RapidKL. The Kelana Jaya Line is the most important rail line in Kuala Lumpur, as it links Kelana Jaya and Gombak, which primarily serves the Petaling Jaya region to the south, southwest and central Kuala Lumpur, and Kuala Lumpur City Centre to the center. The Ampang Line is the other rapid transit system, and its branch lines are Ampang (formerly, Ampang line) and Sri Petaling (formerly, Sri Petaling line).

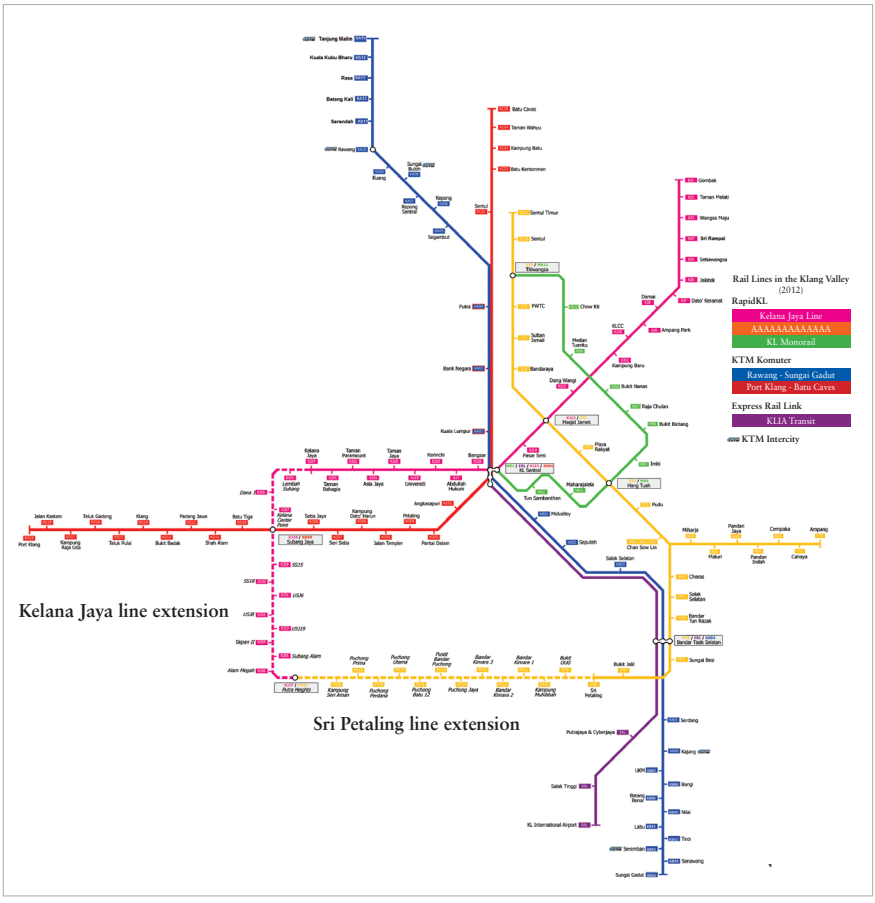


Figure 2.5.4 Rail transport in Kuala Lumpur

Source: Wikipedia. (2014). "Public transport in Kuala Lumpur."

① Kelana Jaya Line (Pink line)

The Kelana Jaya Line is one of the three rail transit lines operated by the Rapid Rail network. It was formerly known as PUTRA LRT, "PUTRA" standing for project Usahasama Transit Ringan Automatik Sdn Bhd, the company that developed and operated it, which is now owned by Syarikat Prasarana Negara Berhad (Prasarana).

② Ampang Line (Yellow line)

Figure 2.5.5 *Kelana Jaya Line train & station*

Source: Wikipedia. (2014). "Kelana Jaya Line." <http://en.wikipedia.org/wiki/Kelana_Jaya_Line> (Accessed on 23 Oct. 2014).

The Ampang Line is an LRT line operated by Rapid Rail. Other rail-based public transport modes in the Kuala Lumpur area include the KTM Komuter and Express Rail Link. The line consists of two branch lines, with one shared major leg:

- Sentul Timur to Chan Sow Lin (shared stations between the two sub-lines)

Figure 2.5.6 *Ampang Line train & station*

Source: Wikipedia. (2014). "Ampang Line." <http://en.wikipedia.org/wiki/Ampang_Line> (Accessed on 23 Oct. 2014).

Table 2.5.8 LRT in Kuala Lumpur

Rail line			
Overview	Overview	Type	Rapid transit
		System	Medium-capacity rail transport system
		Status	Operational
		Locale	Klang Valley
		Termini	KJ1 Gombak
			KJ24 Kelana Jaya
		Stations	24
		Service	Gombak - Kuala Lumpur - Petaling Jaya
Operation	Operation	Opening date	1 Sept. 1998
		Owner	Prasarana
		Operator(s)	Rapid Rail Sdn Bhd
		Depot(s)	Subang
		Rolling stock	Mark II Bombardier ART
Technical	Technical	Line length	29 km (18 mi)
		Track length	0 km (0 mi)
		Track gauge	1,435 mm (4 ft 8 1⁄2 in) standard gauge
		Electrification	Third rail
		Operating speed	60 km/h (37 mph)
Overview	Overview	Type	Rapid transit
		System	Medium-capacity rail transport system
		Status	Operational
		Locale	Klang Valley
		Termini	Ampang
			Sentul Timur & Sri Petaling
		Stations	25
		Service	Sentul - KL – Ampang/Sri Petaling
Operation	Operation	Opening date	16 Sept. 1996
		Owner	Prasarana
		Operator(s)	Rapid Rail
		Depot(s)	Ampang
		Rolling stock	Adtranz
Technical	Technical	Line length	27 km (17 mi)
		Track length	0 km (0 mi)
		Track gauge	1,435 mm (4 ft 8 1⁄2 in) standard gauge
		Electrification	Third rail
		Operating speed	60 km/h (37 mph)

Source: Wikipedia. (2014). "Kelana Jaya Line."
Source: Wikipedia. (2014). "Ampang Line."

- Chan Sow Lin to Ampang
- Chan Sow Lin to Sri Petaling

Further integration with the Monorail Line was achieved in 2012 when the "paid-up" or restricted areas of the Hang Tuah LRT and monorail stations were physically linked up, along with the Titiwangsa LRT and monorail stations, allowing transfers without exiting the system.

Commuter Services

Kuala Lumpur has the most extensive commuter rail system in Malaysia. Commuter rail in in the city is operated by Malayan Railways Limited and Express Rail Link, which run four commuter rail lines: the Sentul-Port Klang Line, the Rawang-Seremban Line, the Rawang-Kuala Kubu Bharu Shuttle Service and KLIA Transit. KLIA Transit is operated by Express Rail Link, whereas the others are operated by Keretapi Tanah Melayu and is called KTM Komuter. All the commuter lines meet at the KL Sentral intermodal transportation hub. The KLIA Transit commuter rail line shares the same track with KLIA Express, which links Kuala Lumpur City Centre and Southern Kuala Lumpur & Klang Valley.

① Port Klang Line

The Port Klang Line, which is in red on the Kuala Lumpur transit map, is one of the two KTM Komuter services provided by Keretapi Tanah Melayu.

KTM Komuter is an electrified commuter train service first introduced in 1995, catering especially to commuters in the city and surrounding suburban areas. It is a popular mode of transportation for commuters working in Kuala Lumpur, as they can travel to the city without the hassle

Figure 2.5.7 *Port Klang Line's train*

Source: Wikipedia. (2014). "Kelana Jaya Line."

of traffic congestion.

② Seremban Line

The Seremban Line is one of the two KTM Komuter services provided by Keretapi Tanah Melayu.

Figure 2.5.8 Seremban Line train

Source: Skyscrapercity. (2014). "Kuala Lumpur Public Transport." <http://www.skyscrapercity.com/showthread.php?p=11719359> (Accessed on 23 Oct. 2014).

Table 2.5.9 Commuter service

Rail line			
Port Klang Line	Overview	Type	Commuter rail
		Status	Operational
		Locale	Selangor and Kuala Lumpur
		Termini	Batu Caves
			Port Klang
		Stations	27
		Sevices	Batu Caves - Port Klang
	Operation	Opening date	14 Aug. 1995
		Owner	Keretapi Tanah Melayu
		Operator(s)	Keretapi Tanah Melayu
		Depot(s)	Sentul
	Technical	Line length	45 km (28 mi)

		Track length	0 km (0 mi)
		Track gauge	1,000 mm (3 ft 3 3⁄8 in) meter gauge
		Electrification	Overhead
		Operating speed	120 km/h (75 mph)
Sungai Gadut Line	Overview	Type	Commuter rail
		Status	Operational
		Locale	Negeri Sembilan, Perak,
		Termini	Selangor and Kuala Lumpur
			Tanjung Malim / Rembau
		Stations	
		Sevices	Main Line: Rawang to Rembau
	Operation	Opening date	14 Aug. 1995
		Owner	Keretapi Tanah Melayu
		Operator(s)	Keretapi Tanah Melayu
		Depot(s)	Sentul
	Technical	Line length	105.15 km (65.34 mi)
		Track length	
		Track gauge	1,000 mm (3 ft 3 3⁄8 in) meter gauge
		Electrification	Overhead
		Operating speed	120 km/h (75 mph)

Source: Wikipedia. (2014). "Port Klang Line." <http://en.wikipedia.org/wiki/Port_Klang_Line> (Accessed on 23 Oct. 2014).
Source: Wikipedia. (2014). "Seremban Line." <http://en.wikipedia.org/wiki/Seremban_Line> (Accessed on 23 Oct. 2014).

Monorail Service

Figure 2.5.9 *Monorail line trains*

Source: Wikipedia. (2014). "KL Monorail." <http://en.wikipedia.org/wiki/KL_Monorail> (Accessed on 23 Oct. 2014).

The Monorail Line is an 8.6-km urban monorail system in Kuala Lumpur. It opened in 2003, runs on two parallel elevated tracks, and has 11 stations. It connects the Kuala Lumpur Sentral transport hub with the "Golden Triangle." It was completed at a cost of MYR 1.18 billion by the KL Infrastructure Group (KL Infra).

KL Infra declared bankruptcy in 2007 after repeatedly missing loan repayments. Syarikat Prasarana Negara Berhad (Prasarana) signed a sale-and-purchase agreement with KL Monorail Systems Sdn Bhd (KLMS). The current operator is Rapid Rail Sdn Bhd (RapidKL), a wholly owned subsidiary of Prasarana.

Table 2.5.10 Monorails in Kuala Lumpur

Rail line			
Monorail line	Overview	Type	Straddle-beam monorail
		Status	Operational
		Locale	Klang Valley
		Termini	KL Sentral
			Titiwangsa
		Stations	11
		Sevices	KL Sentral-Bukit Bintang-Titiwangsa
	Operation	Opening date	31 Aug. 2003
		Owner	Prasarana Malaysia
		Operator(s)	Rapid Rail Sdn Bhd
		Depot(s)	Brickfields
	Technical	Line length	8.6 km (5.3 mi)
		Track length	0 km (0 mi)
		Operating speed	60 km/h (37 mph)

Source: Wikipedia. (2014). "KL Monorail."

5.3 Ownership, Operation and Regulations of Public Transport

5.3.1 Bus Regulations

The current regulatory model is one that lies between quality and quantity licensing. This is a model that sees the free market (operators) controlling the bus network more than the state government. With quantity licensing, the regulator limits the number of operators and vehicles serving a

particular corridor, or places a cap on the total number of operators and vehicles in an area. The current model in Greater Kuala Lumpur/ Klang Valley sees considerable competition, and this is reflected in an uncoordinated approach for the delivery of services with buses competing on heavily concentrated radial routes in and out of central Kuala Lumpur, but gaps in the network existing elsewhere, and patchy coverage at times of lower demand.

While quantity licensing can capably deliver a land public transport service, it can often evolve in one of two ways. If operating margins become tighter, it is possible that a consolidation of operators within the marketplace may occur and eventually result in an effective monopoly. The alternative is that the failure of the state government to regulate adequately may lead to the collapse of the quantity system and potentially lead to an open free-market scenario.

The current regulatory model is unlikely to support the achievement of transformation the bus system needs or address problems that exist within the industry. The process of transformation needs to be managed effectively to ensure that improved planning and integration can take place, but this model does not enable it, thus compounding issues in relation to low quality, network gaps, heavily concentrated bus routes and ineffective coordination.

5.3.2 Bus Fares

There is a zone fare structure within the Greater Kuala Lumpur/Klang Valley region. The lowest fare is RM0.70 within a single zone, to RM3.00 which is charged to travel from Zone 1 to Zone 4. Table 2.5.11 provides the zone structure and fares charged.

Table 2.5.11 Fare Structure of Rapid Bus Service

Bus service	Adult fare	Concession fare
UTAMA (Trunk)	RM 1.00 (0.32 US$) – 1 zone	RM 0.50 (0.16 US$) – 1 zone
	RM 1.90 (0.60 US$) – 2 zones	RM 0.90 (0.28 US$) – 2 zones
	RM 2.50 (0.79 US$) – 3 zones	RM 1.20 (0.38 US$) – 3 zones
	RM 3.00 (0.95 US$) – 4 zones	RM 1.50 (0.47 US$) – 4 zones
BANDAR (City)	RM 1.00 (0.32 US$)	RM 0.50 (0.16 US$)
TEMPATAN (Local)	RM 1.00 (0.32 US$)	RM 0.50 (0.16 US$)
EKSPRES	RM 3.80 (1.20 US$)	RM 1.90 (0.60 US$)

Source: The Land Public Transport Commission. "Bus Transformation Plan."

The first set of fares in the table is charged by all operators other than Selangor and Rapid KL, and the second set is charged by Selangor. The fare paid is determined by the number of zone boundaries crossed. All single zone charges are applied when a passenger travels within a given single zone such as within the city center, and this applies regardless of which zone the journey is in. Two zone charges occur when a passenger travels from one zone to the next, such as from zone 1 to 2 and vice versa. Three zone charges apply when traveling across two zone boundaries, such as from zone 1 to 3, while four zone charges (seldom used) are for travel from the first to the fourth zone, which would be from the city center to remote areas. The ticketing system of Rapid KL buses, however, follows the zone system for single-journey Utama (trunk) services only, while the Bandar (city) and Tempatan (local) routes operate on a fixed-fare structure. The BET services follow the fare structure of the Utama services.

Concession fares are restricted to students in uniform, people above 60 years of age and the disabled. These are made available through an application form. Rapid KL also issues multiple-journey passes for various types of individual or combined services for bus and rail as one-, three-, seven-, 15- and 30-day passes.

5.4 Railway Infrastructure

The total length of railways in Malaysia is 1,849 km nationally, and most of that is narrow gauge, which is 1.000-m gauge. Therefore, the vast part of the railway needs to be electrified for modernization.

Figure 2.5.10 shows the rail network of Kuala Lumpur and Klang Valley. The total length of the rail network is 277.6 km, with 115 stations.

Table 2.5.12 Rail network of Kuala Lumpur

Rail line	General rail category	Route length/No. of stations
KTM Komuter	Suburban Rail	157 km/50 Stations
LRT Ampang Lin	Urban Rail/Metro	27 km/25 Stations
LRT Kelana Jaya Line	Urban Rail/Metro	29 km/24 Stations
Monorail	Urban Rail/Metro	8.6 km/11 Stations
KLIA	Suburban Rail/Airport Express	57 Km/5 stations
Total	–	278.6 km/115 stations

Source: SPAD. (Nov. 2013).

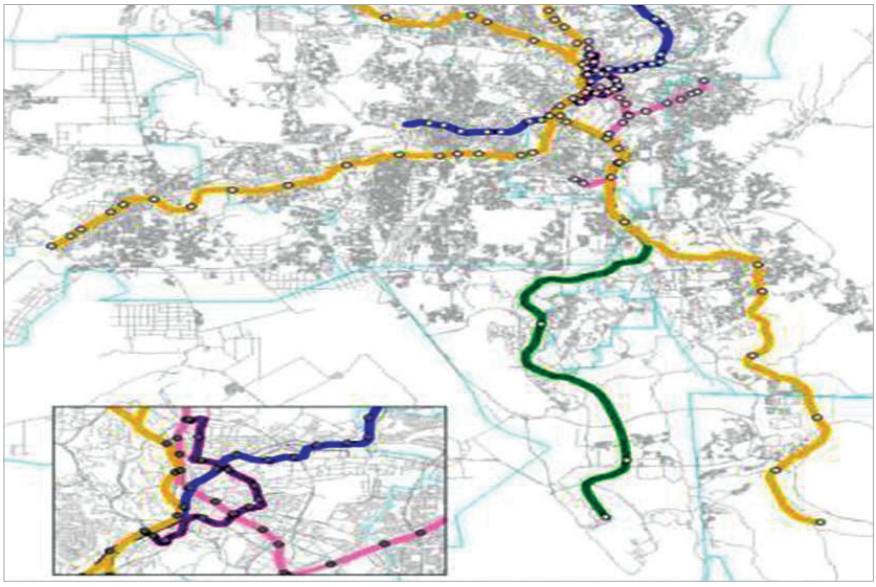


Figure 2.5.10 *KL rail network*

Source: SPAD. (Nov. 2013). "Land Public Transport Master Plan GREATER KUALA LUMPUR / KLNAG VALLEY." <http://eps.mbpj.gov.my/SlideTod/MBPJ_GKLKV_Nov2013_SPAD.pdf> (Accessed on 23 Oct. 2014).

5.5 Vehicle Statistics, the Modal Share of Public Transportation

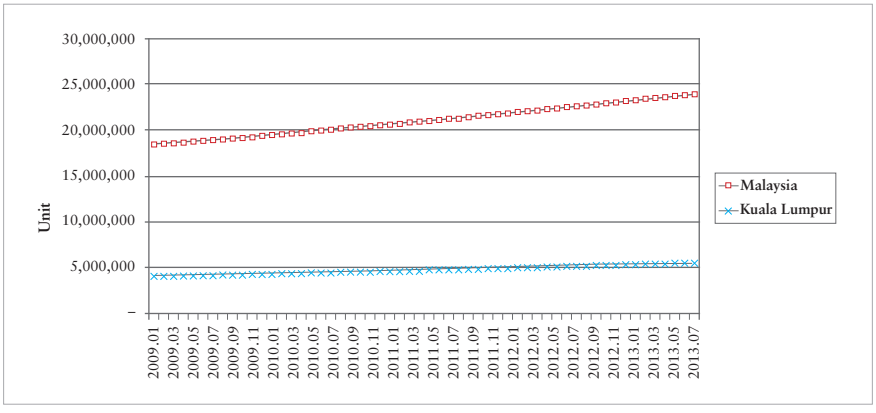


Figure 2.5.11 *Monthly public transit increases*

Source: Department of Statistics Malaysia, Official Portal. (2014). <http://www.statistics.gov.my/main/main.php> (Accessed on 23 Oct. 2014).

Figure 2.5.11 shows that vehicle registrations in Malaysia and Kuala

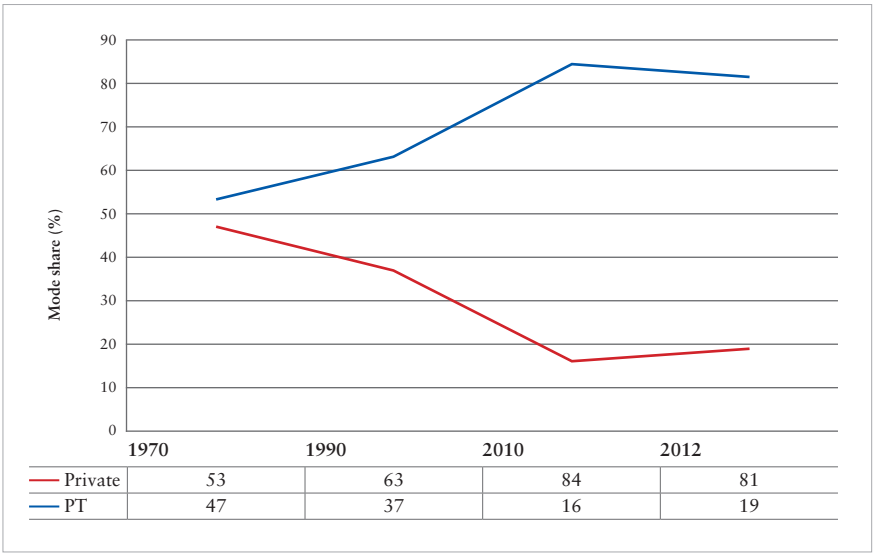


Figure 2.5.12 Mode share rate in Greater Kuala Lumpur

Source: SPAD. (Nov. 2013).

Lumpur are continuously increasing, and the rate of vehicle registration in Kuala Lumpur is higher than that of the nation, at 26.9%.

5.5.1 Mode Share, 1970-2012

The mode share of public transport has been deteriorating since 1970, as transport development has mainly been focused on the road network in Kuala Lumpur. Therefore, the role of the public transport system is not as important as it is in other cities in Western countries.

5.6 Traffic Safety Indicators

5.6.1 Institutional Framework

In a study of the period from 2006 to 2009, 710 road traffic deaths were registered with the Department of Forensic Medicine, HKL. Of these, 40 cases were excluded for analysis, as the post-mortem report details had not been finalized by the attending forensic doctors. The distribution of cases presented to the Department of Forensic Medicine, HKL and analyzed in the study by year is shown in Figure 2.5.13. In general, there was a

declining trend in road traffic deaths, with the highest number recorded in 2006 (209 cases) followed by 2008 and 2009 with 189 and 178 cases, respectively. The large reduction in 2007 cases as compared to earlier and following years was due to no post-mortem data being made available for the months of January and February.

Table 2.5.13 *Institutional framework*

Division	Status
Lead agency	Road Safety Department
Funded in national budget	Yes
National road safety strategy	Yes
Funding to implement strategy	Partially funded
Fatality reduction targets set	Yes (2011–2020)
Fatality reduction target 6% (deaths per 10 000 vehicles, 2011–2012) 5% (number of deaths, 2013–2020)	

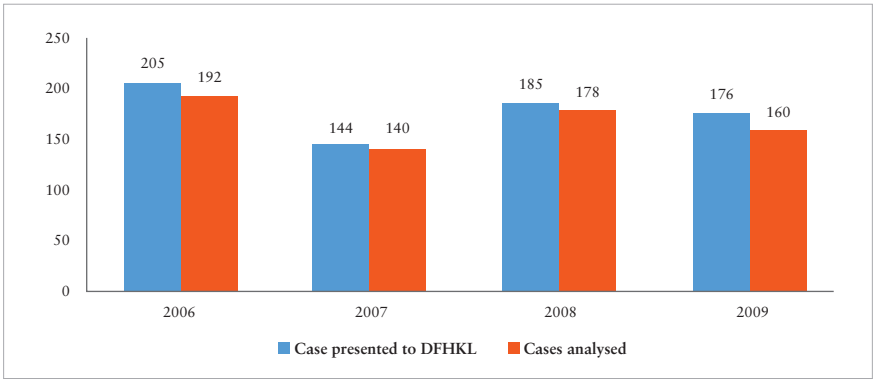


Figure 2.5.13 *Number of road traffic deaths presented to HKL*

Source: Research study by MIROS conducted in Kuala Lumper. (2012).

5.7 Air Pollution and Vehicle Maintenance Standards

Table 2.5.13 shows the vehicle emission standards and vehicle-related facts in Malaysia. The car ownership level is almost 3.94 persons per car, which is quite low compared to developed countries. This means that there will be a high increase in car registration in Malaysia as income levels increase.

Table 2.5.14 Fuel quality and vehicle emission standards

Division	Contents and standards		
Sulphur	–	Diesel	500
(Max, ppm)	–	Petrol	500
50 ppm Target Date	–	2016 Lead phased out in 1999	
Fuel quality Comment	–	In 2005, planned to adopt Euro 4-equivalent fuels (50 ppm) by 2010 and Euro 5-equivalent fuels (10ppm) by 2015; this is now changed to 2016 for Euro 4-equivalent fuel. Source: CAI-Asia, ACFA	
Vehicle import restrictions*	–	Vehicle imports make up less than 5% of market	
Vehicle Fleet	–	139 vehicles per 1000 people (1996 - WRI); 254 Vehicles per 1000 people (2003)	
Vehicle standards & inspection and maintenance (I/M)	–	Proportion of diesel to petrol vehicles; 10:90; half of vehicles are motorcycles; in-use vehicles subject to periodic and roadside inspections, including emissions - outsourced to private company; older commercial vehicles inspected every six months. Euro 2 vehicle emissions standard since 2009	
Vehicles comment	–	There are 23 vehicle assembly plants in Malaysia, which make up 90% of the market	

Source: UNEP. (June 2012). "Status of Fuel Quality and Vehicle Emission Standards in Asia-Pacific." <http://www.lead.org.au/PCFV/Lead_Matrix_AP_201206.pdf> (Accessed on 23 Oct. 2014).

5.8 Organization of Public Transport Administration

Kuala Lumpur has had its own transport administration organization under the Urban Transportation Department since 1987. The department is responsible for delivering the services and facilities of an urban transportation system that is comfortable, safe and of high quality for city residents, consistent with the current rate of development.

The department has six main functions: managing and operating traffic control, managing and operating an integrated transport information system (ITIS), running a traffic management scheme, providing urban transport facilities, managing urban transport facilities, and developing control for proposed new developments.

It has a vision to create modern urban transportation systems, manage traffic efficiently, and build comfortable and safe public transportation facilities that are equivalent to the developed nations of the world. It has also missions to plan and implement strategies toward creating modern transportation systems, building public facilities that are safe and comfortable, as well as managing the city's traffic efficiently for the convenience of its residents.

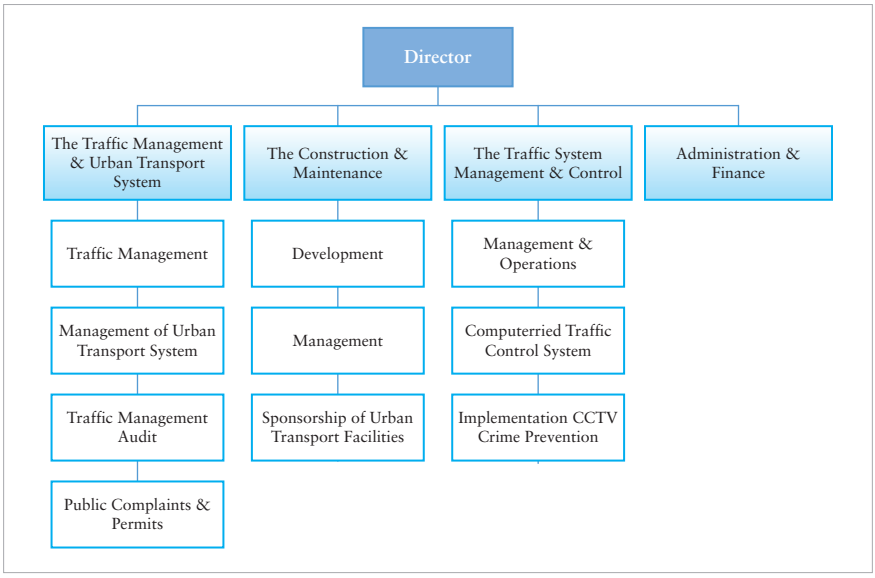


Figure 2.5.14 *Organization of Urban Transportation Department of Kuala Lumpur*

Source: Kuala Lumper City Hall. (2013). <http://www.dbkl.gov.my/index.php?lang=en> (Accessed on 23 Oct. 2014).

6. Manila

Young-in KWON and Wonjae KIM

6.1 National and City Statistics

The Philippines, officially known as the Republic of the Philippines, is a sovereign island country in Southeast Asia situated in the western Pacific Ocean. It consists of 7,107 islands that are categorized broadly into three main geographical divisions: Luzon, Visayas, and Mindanao. The country's capital city is Manila, and its most populous city is Quezon City; both are part of the Metropolitan Manila area.

Table 2.6.1 Basic facts about the Philippines

Contents	Status
Land area (km^2)	298,170
Population (million, 2014 est.)	107.668
Official languages	Filipino, English
Capital city	Manila
Currency	Peso
GDP (US$ billion, 2013 est.)	272.2
GDP per capita (US$, 2013 est.)	US$4,700

Source: Central Intelligence Agency. (2014). "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/id.html> (Accessed on 18 Oct. 2014).

As shown in Table 2.6.1, the Philippines has a land area of approximately 300,000 km^2. The country's population is 107,668,231 as of a July 2014 estimate. The primary official language is Filipino, while English is its secondary official language. The country's currency is the Peso, and 1 U.S. Dollar has an equivalent value of around Pe$43. The Philippines

GDP in 2013 was estimated to be around US$272.2 billion.

Table 2.6.2 Overview of Metro Manila

Contents	Status
Total metro population (2011)	11,862,000
Population density (per km^2)	18,567
Land area (km^2)	638.55
GDP per capita (US$)	6,590

Source: Central Intelligence Agency. (2014). "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/id.html> (Accessed on 18 Oct. 2014).

Metropolitan Manila, commonly known as Metro Manila, the National Capital Region (NCR) of the Philippines, is the seat of government and the most populous region and metropolitan area of the country. It is composed of the City of Manila and the cities of Caloocan, Las Piñas, Makati, Malabon, Mandaluyong, Marikina, Muntinlupa, Navotas, Parañaque, Pasay, Pasig, Quezon City, San Juan, Taguig, and Valenzuela, as well as the Municipality of Pateros.

Table 2.6.3 Overview of Manila

Contents	Status
Total city population (2010)	1,652,171
Population density (per km^2)	43,079
Land area (km^2)	38.55

Table 2.6.3 shows an overview of Manila, the capital and second-largest city of the Philippines. It is one of the sixteen cities which, along with the municipality of Pateros, make up Metro Manila, the NCR, whose overall population is around 12 million.

The city of Manila is located on the eastern shore of Manila Bay and is bordered by the cities of Navotas and Caloocan to the north; Quezon City and San Juan to the northeast; Mandaluyong to the east; Makati to the southeast, and Pasay to the south. It has a total population of 1,652,171 according to a 2010 census and is the second-most populated city in the Philippines, behind Quezon City. The populace inhabits an area of only 2,498 hectares (6,172.69 acres), making Manila arguably the most densely populated city in the world.

Figure 2.6.1 The Philippines

Figure 2.6.2 *Metro Manila and Manila*

Source: Wikipedia. (2014). "Manila." <http://en.wikipedia.org/wiki/Port_Klang_Line> (Accessed on 23 Oct. 2014).

6.2 Public Transit Levels of Service

6.2.1 Types of Public Transportation

Mass Transit

There are three mass transit lines currently operating in Metro Manila: Light Rail Transit (LRT) Line 1, LRT Line 2 and the Mass Rapid Transit (MRT) Line 3. LRT lines 1 and 2 are operated by the Light Rail Transit Authority (LRTA), an agency attached to the Department of Transportation and Communications (DOTC). The MRT Line 3, a project implemented through a public-private-partnership (PPP), is operated by the DOTC.

More rail lines are being planned, including a proposed MRT 7 along Commonwealth Avenue and the proposed extensions of the LRT line 1 (in the south) and the LRT line 2 (in the east) of Metro Manila. The preexisting 34-km commuter line of the Philippine National Railways (PNR) has already been rehabilitated through the Korean Official Development Assistance (ODA). Phase 2 of the project, a 27-km line from Alabang to

Figure 2.6.3 Rail network in Metro Manila

Source: Penafiel, Rafael E. (2013). "Public Transportation in Metro Manila." In *Proceedings of ASEAN-Korea Capacity Building Program*. 17-26 February. Seoul, Korea: The Korea Transport Institute. p. 297.

Calamba, is also being proposed under the Korean ODA.

The existing 52-km network of urban railways, composed of LRT Line 1, LRT Line 2, and MRT Line 3, has a combined daily weekday ridership of about 1.2 million people, which represents around 4% of the total daily personal trips taken in Metro Manila. Figure 2.6.3 outlines the Metro Manila rail network. It is not an extensive network, but as previously mentioned, more rail lines are being proposed.

Public Utility Buses (PUB)

About 30% percent of the total number of buses in the Philippines operates

in Metro Manila. Many of the buses operating on the streets are second-hand buses imported from Japan, which required a conversion from right-hand to left-hand drive. Ninety-one percent of the buses in Metro Manila use diesel for fuel.

Public Utility Jeepneys (PUJ)

The jeepney, which was patterned after the American jeep extensively used during the Second World War, started operating in 1954 and is the most popular mode of transportation in the Philippines, especially in the cities, because of its cheap fares and the convenience it affords to passengers by allowing them to board and alight almost anywhere they want. In many parts of the Philippines, jeepneys provide long-distance transport services and even carry cargo, goods or freight in addition to passengers. Jeepneys in the provinces have also evolved to become significantly larger and tougher than those in the cities and are built to be used on bad roads in all weather conditions. Jeepneys are locally manufactured and utilize surplus or second-hand diesel engines.

Figure 2.6.4 *The Philippine Jeepney*

Source: Penafiel, Rafael E. (2013). p. 298.

Filcab, FX or Asian Utility Vehicles (AUV)

The Filcab or FX (named after the Toyota Tamaraw FX, an Asian Utility Vehicle) is a four-wheeled vehicle with a seating capacity ranging from seven to 11 persons. They operate a door-to-door service within a zone or fixed route of not more than 15 km. Fares are set on a zonal basis or based on distance traveled. The Filcab or FX services evolved from the taxi service as demand for a faster alternative to jeepneys arose in the 1990s.

The fares were higher than those for the jeepneys, but they were eventually considered acceptable since the FX provides better and faster service.

Tricycles and Pedicabs

A tricycle is a motorcycle with a sidecar, while a pedicab is a bicycle with a sidecar. These modes of transportation are very convenient for passengers taking short and feeder trips between residential areas and arterial roads. In the provinces especially, these travel modes play an important role because of insufficient bus and jeepney services. In Metro Manila, the operation of tricycles is restricted partly because they cause traffic congestion. The franchising and supervision of tricycles, including pedicabs, have been devolved to local government units (LGUs).

Taxis

The last few years saw the introduction of new taxicabs. The old, dilapidated taxicabs that are still operating will be phased out in compliance with a DOTC plan. In the larger cities, the meter system is used to determine fares, but in other areas, a negotiation system is still employed. Many taxis now use LPG for fuel, and many LPG stations have sprouted up in Metro Manila to serve the taxis.

6.2.2 Service Level of Public Transport

Carrying Efficiency/Seat Capacities, Fuel Consumption

The carrying and energy efficiencies of the more popular modes of road transport in Metro Manila are shown in Table 2.6.4. As far as seating capacity is concerned, the bus is three times that of the jeepney and approximately six times that of the AUV.

Fuel consumption depends on a number of factors: the size and load of the vehicles, engine type, the topography of the area being served and traffic conditions encountered along the route. Vehicle condition and maintenance and driving habits can also have a considerable effect.

Based on surveys conducted on their operation, buses can run 2.1 km to 2.7 km per liter. A World Bank Technical Report published in 1987 mentioned that the fuel consumption of a well-run bus system should fall within 20 to 25 liters per 100 kilometers (or 2 to 4 km /liter) for regular buses.

The information on the energy efficiency of jeepneys obtained from recent surveys was not reliable, and so the results of a previous study were cited instead.

Table 2.6.4 Seating capacity and fuel consumption of public utility vehicles

Public utility vehicle		Available seating capacity	Fuel consumption (km/liter)
PUB	Aircon	61	2.153
	Ordinary	59	2.696
PUJ	**Diesel**	**20**	**5.5 ***
AUV	Gas Diesel	11	7.03

Note: *Study on Energy Efficiency and Pollution Abatement through Engine Replacement, UPNCTSFI, 2008.
Source: Penafiel, Rafael E. (2013). p. 300.

The unit capacity, fuel consumption and average travel speed of selected transport modes are shown in Table 2.6.5. To save on operating costs, almost all road-based public transport modes in Metro Manila use diesel fuel. Consumption depends on a number of factors such as (1) the size and load of the vehicles, (2) engine type, (3) the topography of the area being served, and (4) traffic conditions encountered along the route. Moreover, vehicle condition and maintenance and driving habits can also have considerable effect on fuel efficiency.

Table 2.6.5 Operational characteristics of public transport

Vehicle	Ave. seating capacity	Fuel consumption (km/liter of diesel)	Average speed (kph), peak period
Bus	60	2.153 (Air-con) 2.696 (Ordinary)	18.43
Jeepney	20	5.50	14.65
FX/ AUV	11	7.03	

Average Bus Travel Time

The overall average speeds for all bus routes and for different time periods are as shown in Table 2.6.6. Note that the average speeds are below 20 kph for all time periods.

Table 2.6.6 Average speeds for all PUB routes

Time period	Ave. speed, kph.
00:00-06:00	19.34
06:00-09:00	18.43
09:00-16:00	16.80
16:00-19:00	16.34
19:00-24:00	16.74

The overall average speeds for all routes of the public utility jeepney (PUJ) for different time periods are shown in Table 2.6.7. The average speeds hardly reached 15kph due to frequent stopping to load and unload passengers. Moreover, refilling of fuel during trips is not uncommon for many jeepneys.

Table 2.6.7 Average speeds for all PUJ routes

Time period	Average travel speed (kph)
00:00-06:00	14.70
06:00-09:00	14.65
09:00-16:00	15.13
16:00-19:00	12.86
19:00-24:00	12.74

The average travel speeds of AUVs are much faster than that for jeepneys and buses, as shown in Table 2.6.8. Average speeds for all time periods exceed 20 kph and come close of 25 kph.

Table 2.6.8 Average speeds for all AUV routes

Time period	Average speed (kph)
0000:0600	24.65
0600:0900	21.58
0900:1600	25.85
1600:1900	24.53
1900:2400	29.25

Average Public Transport Headway

The headways of road public transport vehicles according to their routes are derived from the outcomes of frequency surveys conducted at strategic locations in Metro Manila.

Jeepney Headway

Table 2.6.9 shows the typical estimated headways for jeepneys along selected routes of Aurora Boulevard in Quezon City.

Table 2.6.9 Headways for PUJ routes along Aurora Blvd., westbound (to Cubao)

Route	Headway, minutes per vehicle		
	AM Peak, 7–9 AM	PM Peak, 4–6 PM	Off-peak
Antipolo-Cubao via Marcos Highway	0.91	2.50	2.54
Antipolo-Cubao via Sumulong	5.22	15.00	22.50
Arroceros-Proj. 4 via Espana	120.00	n/a	180.00
Cainta Junction-Cubao via Imelda Ave.	60.00	n/a	n/a
Calumpang-Recto via E. Rodriguez	120.00	n/a	n/a
Calumpang-Stop & Shop via Aurora Blvd.	1.82	7.50	6.92
Cogeo-Cubao via Marcos Highway	0.69	1.18	1.20
Cubao-Angono via Manila Ext. Rd.	3.08	4.44	4.86
Cubao-Padilla	1.13	2.14	2.57
Cubao-Parang via 20th Ave., P. Tuazon	n/a	n/a	n/a
Cubao-Proj. 2&3 via 20th Ave., P. Tuazon	2.40	4.14	3.75
Cubao-Rodriguez Town (Montalban) via San Mateo	1.11	2.73	2.17
Cubao-Silangan (San Mateo) via Marikina	4.29	2.79	4.00
Cubao-SSS Vill. Via 20th Ave., P. Tuazon	24.00	n/a	180.00
Cubao-Taytay/Angono	1.00	1.88	1.84

Note: n/a denotes no PUJ observed at the station

To understand the information provided in the preceding table, we employ an example considering typical commuting. A passenger waiting in the vicinity of a station along Aurora Boulevard who wants to take a jeepney originating from Antipolo to go to Cubao needs only to wait about a minute for one to arrive during the morning peak, two and a half minutes during the afternoon peak, or about the same time (2.54 minutes) during the off-peak period. Meanwhile, a passenger who opts for a jeepney coming from San Mateo/Silangan would have to wait for 4.29 minutes, 2.79 minutes, or 4 minutes, during the AM peak, PM peak, or off-peak period, respectively.

Bus Headways

Table 2.6.10 shows the typical estimated headways for buses along Ortigas Avenue (non-EDSA routes).

Table 2.6.10 Headways for PUB routes along Ortigas, westbound (to Pasig)

Route	Headway, minutes per vehicle		
	AM Peak, 7–9 AM	PM Peak, 4–6 PM	Off-peak
Antipolo- Divisoria via Shaw Blvd., Gov. Forbes	n/a	120.00	n/a
Cainta- Quiapo via Ortigas Ave., Magsaysay Blvd.	6.32	8.00	8.18
Taytay- Quiapo via Ortigas Ave., Magsaysay Blvd.	5.71	8.57	7.50

Note: n/a denotes no PUB observed at the station

In Table 2.6.10, a passenger waiting in the vicinity of a station along Ortigas Avenue who wants to take a bus to Quiapo needs to only wait about 6 minutes for a bus to arrive during the morning peak, 8.3 minutes during afternoon peak, and 7.8 minutes during the off-peak period. The bus would either be a G Liner or an RRCG unit, considering these are the only companies serving this corridor.

6.3 Ownership, Operation, Regulations of Public Transport

6.3.1 Regulations on Public Transportation

The government's responsibility and regulation of carrier operations consist of four basic components: 1) policy setting, 2) plan formulation, 3) plan implementation, and 4) regulation and supervision. The tasks involved in these components are mandated to specific government agencies by the laws which created them.

There are three types of regulations involving carrier service operations: economic, safety and traffic regulations.

Economic regulation refers to the control of the level of the supply of carriers in terms of the number of units to be operated. The control is granted to the authority to operate a service and prescribe the route or area of operation of a service, as well as control over the fare to be charged by the service operator. These functions collectively form the framework of the franchising of public carrier services and fare setting.

Safety regulation refers to the control over which carrier units should be authorized to operate and which individuals should be licensed to handle the movement of a carrier. This pertains to carrier registration and crew licensing regulations.

Traffic regulation refers to the control over the movement of carriers along the travel-way. In the road transport sector, this is called traffic management and enforcement.

6.4 Road Infrastructure

The road network system for Metro Manila is composed of 10 radial roads and six circumferential roads. It was conceptualized right after the Second

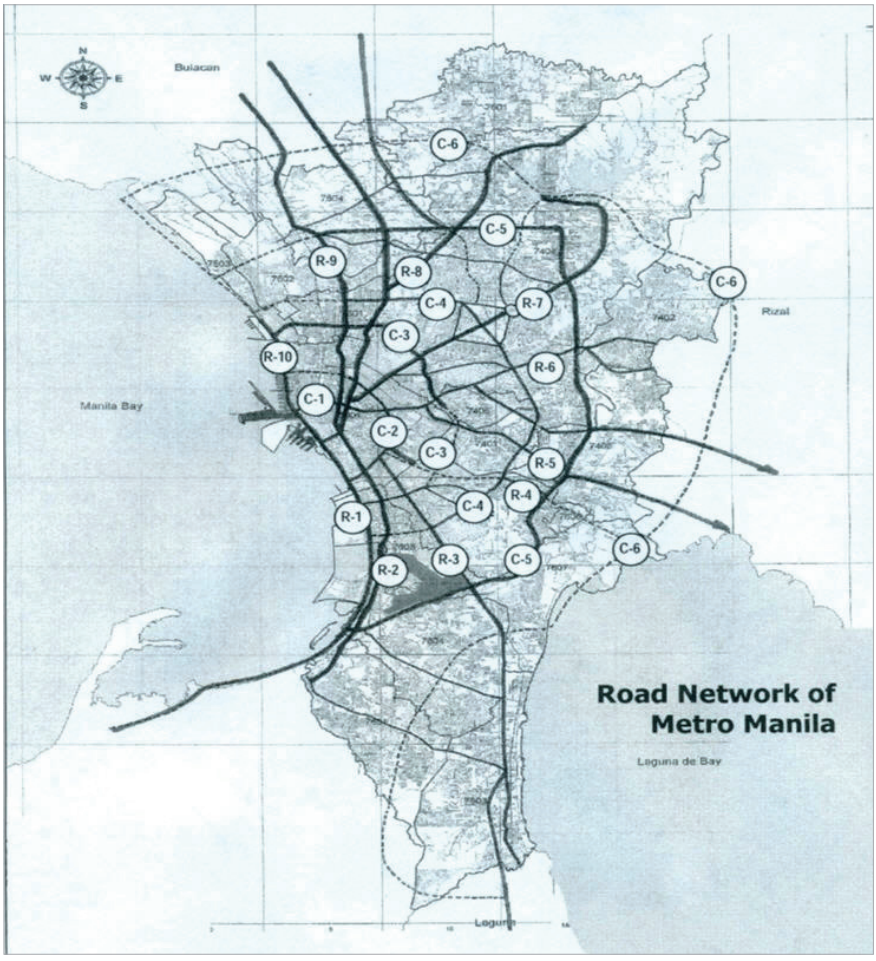


Figure 2.6.5 *Road network in Metro Manila*

Source: Department of Public Works and Highways. "Metro Manila Infrastructure Development." <http://ncts.upd.edu.ph/old/roadsafety/docs/3rd_urpo.pdf> (Accessed on Oct. 23 2014).

World War. All the radial roads are already complete. Circumferential road C-5 is nearing completion, while the development of C-6 is still ongoing.

6.5 Railway Infrastructure

The Manila Light Rail Transit System, popularly known as the LRT, is a metropolitan rail system serving the Metro Manila area in the Philippines. Although referred to as a light rail system because it originally used light rail vehicles, it is more of a rapid transit (metro) system, such as high passenger

Figure 2.6.6 Railway network of Metro Manila

Source: Department of Public Works and Highways. "Metro Manila Infrastructure Development."

throughput, exclusive right-of-way and later use of full metro rolling stock. The system is operated by the Light Rail Transit Authority (LRTA), a government-owned and controlled corporation under the authority of the DOTC. Along with the Manila Metro Rail Transit System (MRT-3, also called the new Yellow Line), and Philippine National Railways' commuter line, the system makes up Metro Manila's rail infrastructure.

Quick and inexpensive to ride, the system serves 2.1 million passengers each day. Its 33.4 kilometers (20.8 mi) of mostly elevated routes form two lines that serve 31 stations in total. LRT Line 1 (LRT-1), also called the Green Line (formerly the Yellow Line), opened in 1984 and travels a north–south route. MRT Line 2 (MRT-2), the Blue Line (formerly the Purple Line), was completed in 2004 and runs east–west. The original LRT-1 was built as a no-frills means of public transport and lacks some features and comforts, but the new MRT-2 has been built with additional standards and criteria in mind like barrier-free access. Security guards at each station conduct inspections and provide assistance. A reusable plastic magnetic ticketing system has replaced the previous token-based system, and the Flash Pass was introduced as a step towards a more integrated transportation system.

Many passengers who ride the system also take various forms of road-based public transport, such as buses, to and from a station to reach their destinations. Although it aims to reduce traffic congestion and travel times in the metropolis, the transportation system has only been partially successful due to the rising number of motor vehicles and rapid urbanization. The network's expansion is set on tackling this problem.

6.6 Vehicle Statistics, the Modal Share of Public Transportation

6.6.1 Vehicle Statistics

As shown in Table 2.6.11, there were more than two million registered vehicles in Metro Manila in the year 2011, an increase of 5.8% from the previous year. This represents 28.2% of all the registered vehicles in the country.

Table 2.6.11 *Vehicle registration in Metro Manila (2011)*

Vehicle type	New	Renewal	Total
Car	48,516	397,590	446,106
Asian utility vehicle/Jeepney	55,479	520,135	575,614
Sports utility vehicle	29,175	127,013	156,188
Truck	8,169	63,952	72,121
Bus	2,133	11,212	13,345
Motorcycle/ Tricycle	200,538	533,927	734,465
Trailer	1,701	15,210	16,911
Total	345,711	1,669,039	2,014,750

Source: Penafiel, Rafael E. (2013). p. 291.

6.6.2 Modal Share

Mode share varies in the different transport corridors in Metro Manila. The average share of different public transport modes, from a recent study undertaken for Commonwealth Avenue, the widest road in the north of Metro Manila, is shown in Table 2.6.12. In EDSA, the number one transport corridor in the metropolis in terms of vehicle volume, jeepneys and tricycles are not allowed to operate.

Table 2.6.12 *Share of personal trips on commonwealth avenue*

	Car	Jeepney	AUV/ FX	Bus	Motorcycle/ Tricycle
Share (%)	25	27	7	38	3

Source: Penafiel, Rafael E. (2013). p. 300.

6.7 Traffic Safety Indicators and Government Initiatives

6.7.1 Traffic Safety Indicators

Traffic accident statistics for the Philippines are shown in Table 2.6.13. The 2009 and 2010 figures are based on a report by the Department of Transportation and Communications to the UNESCAP. The 2011 figures were gathered from a new report quoting figures from complied reports of the Department of Public Works and Highways, Metro Manila Development Authority and the Philippine National Police – Highway Patrol Group.

Table 2.6.13 Philippines traffic accident statistics

	2009 (DOTC)	2010 (DOTC)	2011 (DPWH, MMDA, PNP)
Total number of road fatalities	1,115	1,262	1,833
Number of serious injuries	7,570	6,408	29,000, both seriously and slightly injured
Number of road accidents	20,008	18,810	85,820
Pedestrian deaths/accidents	1,000	No data	No data
Motorcycle deaths/accidents	4,302	No data	No data

Source: Zahari, A. Raof. (2013). "Road Safety in Malaysia." In *Proceedings of ASEAN-Korea Capacity Building Program*. 17 - 26 February. Seoul, Korea: The Korea Transport Institute. p. 391.

Table 2.6.13 show a rising trend of fatalities from road accidents in the past three years. However, the World Health Organization, in its global status report on road safety in 2011, estimated that in 2009 there were 17,557 road deaths in the Philippines. The official figure submitted to WHO was only 1,185. The adjustment was made to compensate for the common incidence of underreporting of traffic accidents among countries.

In the Philippines, accidents of all types, including road traffic –accidents, rank fourth among the causes of mortality in all ages. Traffic accidents constitute the second-leading cause of injury death, with a mortality rate of 7.8/100,000. (Source: Philippine Health Statistics, 2003). The Department of Health cited in 2003 that among children 0-17 years of age, it is the second-leading cause of injury death (with a mortality rate of 5.85/100,000), next to drowning.

Traffic accidents in 2006 mostly involved automobiles (27%), followed by motorcycles (21%), jeepneys (19%) and trucks (11%). (Source: PNP Traffic Management Group, 2007)

6.7.2 Philippine Road Safety and Action Plan (PRSAP) (2011-2020)

On April 28, 2011, Philippine President Benigno Simeon Aquino III issued Proclamation Order No. 159 creating the Philippine Road Safety Action Plan with a view to substantially cut down on road crashes and fatalities in the country. The Order declared 2011 as the launch year of the country's strategies on road safety plans, which incidentally coincided with the global launching of the Decade of Action for Road Safety 2011-2020 by the World Health Organization and the UN Road Safety Collaboration.

The Philippine Road Safety Action Plan is modeled on successful national and local plans implemented in many other countries. It was produced as

part of the ADB/ASEAN Regional Road Safety Project and follows Action Plan Guidelines published by the UN, ADB and the World Bank.

Goal: Reduce Traffic Accident Rate by 50% by 2020

1. Improve Road safety Management
   a. Establishment of coordination and management mechanisms on road safety
   b. Establishment of road crash data system
   c. Establishment of funds for road safety
   d. Traffic legislation
   e. Road safety research
   f. Road crash costs

2. Safer Roads
   a. Improvements of hazardous locations
   b. Safe planning and design of roads

3. Safer Vehicles
   a. Vehicle safety standards

4. Safer Road Users
   a. Road safety education for children
   b. Driver training and testing
   c. Road safety publicity campaigns
   d. Traffic police and law enforcement
   e. Private sector and community involvement

5. Improve Trauma Care and Rehabilitation
   a. Emergency assistance to road crash victims

6.8 Organizations of Public Transport Administration

6.8.1 Department of Transportation and Communications (DOTC)

The DOTC was created by the Ministry of Transportation and Communications (MOTC) in 1979 under EO 546. According to this law, the MOTC was mandated as the primary policy, planning, programming, coordinating, implementing, regulating and administrative entity of the

executive branch of the government in the promotion, development, and regulation of a dependable and coordinated network of transportation and communications. A government reorganization took place by the then newly established Aquino government in 1987, and the MOTC was given the same mandate stated above, under EO 546, with this additional statement: "as well as in the fast, safe, efficient and reliable transportation and communications services."

A division within the DOTC that is closely involved in the regulation of public transport operators, the DOTC Road Transport Planning Division, is tasked to evaluate the franchise applications of existing routes and for developmental routes. This division is responsible for planning the routes of road-based public transport in the country, and reviews applications for new routes from potential operators.

Once the DOTC is satisfied that a proposed new route or developmental route is appropriate within the network structure, it instructs the LTFRB to open the route for applications.

6.8.2 Land Transportation Franchising and Regulatory Board (LTFRB)

Under EO 202, the LTFRB, in connection with its economic regulatory functions, has the following main functions, among several others:

a) To prescribe and regulate routes of service, economically viable capacities and areas of operation of public land transport services in accordance with DOTC transport plans and programs;
b) To issue, amend, revise, suspend or cancel Certificate of Public Convenience (CPC) authorizing the operation of public land transport services and prescribe appropriate terms and conditions thereof;
c) To determine, prescribe, approve and periodically review and adjust reasonable fares, rates or charges related to the operation of public land transport services;
d) To conduct investigations and hearings of complaints for violation of franchising laws and to impose corresponding fines and/or penalties for such violations;
e) To formulate, promulgate, administer, implement and enforce rules and regulations on public land transport services and facilities; and
f) To coordinate and cooperate with the other government agencies and entities concerned with any aspect involving public land transportation services.

The above functions indicate the authority of LTFRB over public land transport services in terms of:

- Routes/areas of operation prescription and regulation in terms of viable route capacities;
- Issuance of CPC (or franchise) to entities worthy to be public transport operators with corresponding franchising terms and conditions;
- Amendment, suspension and cancellation of franchises based on proven facts;
- Prescription of fares/charges on public transport services;
- Promulgation and enforcement of rules and regulations pertaining to public transport service operations; and
- Inter-agency coordination on matters relevant to public transport services.

In line with the above authority, the LTFRB supervises and monitors public land transport service operations and can call on public transport operators to follow its prescribed rules and regulations with the end view of providing the general public with efficient and safe public transport services. In exercising its authority, the LTFRB occasionally issues Memorandum Circulars (MCs) regarding implementation details of specific regulations for the guidance of all concerned, especially public transport operators and government regulatory and enforcement personnel. These MCs are in accordance with DOTC policy guidelines and the basic franchising laws.

6.8.3 Metro Manila Development Authority

The metro-wide services of which MMDA is tasked to administer cover a wide range of concerns, i.e., transport and traffic management, solid waste disposal, flood control, urban renewal with zoning and land use planning, health and sanitation, urban protection and pollution control and public safety. In terms of transportation and traffic management, the MMDA's functions cover the following:

- Formulation, coordination and monitoring of policies, standards, programs and projects to rationalize transport operations, infrastructure requirements, the use of thoroughfares and promotion of safe and convenient movement of persons and goods;
- Provision for the mass transport system and the institution of a system to regulate road users;
- Administration and implementation of all traffic enforcement

operations, traffic engineering services, traffic education programs and institution of a single ticketing system in Metropolitan Manila.

6.8.4 Presidential Anti-Colorum and Kotong Task Force (PACKTAF)

In November 2007, the president issued order A.O. 212, creating the Presidential Anti-Colorum/Kotong Task Force (PACKTAF) to act with resolve and urgency in addressing the issue of extortion and operations of colorum public utility vehicles.

The task force was created to stop the operations of "colorum" vehicles and eradicate the rampant "kotong" activities as soon as possible. The presidential task force is mandated nationwide to proactively and exhaustively promote coordination between and among agencies to effectively and efficiently address the problems of colorum public utility vehicles and the practice of extortion by some unscrupulous government officials and employees.

7. Phnom Penh

Changhwan MO, Youngseok PARK, Arie KIM and Solbee KIM

7.1 National and City Statistics

Table 2.7.1 Basic facts about the Kingdom of Cambodia (2014)

Contents	Status
Land Area (thousands km^2)	181,035
Population (thousands)	15,205
Major language	Khmer
Capital city	Phnom Penh
Currency (note: on average 1 US$= 4,042 Riel)	CR, KHR (Cambodian Riel)
GDP (US$ billion, IMF, 2013)	154
GDP per capita (US$, 2013)	931

Source: Central Intelligence Agency. (2014a). "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/id.html> (Accessed on 18 Oct. 2014).

The Kingdom of Cambodia is a country located in Southeast Asia and is surrounded by Thailand, Laos and Vietnam, with a part of its southwest coast bordering the Gulf of Thailand. It has a land area of 181,000 km^2 and a population of over 15 million people. The main language is Khmer, and the currency is the Cambodian Riel. The GDP of Cambodia was US$154 billion in 2013 according to the IMF, which amounted to a per capita GDP of US$931.

Phnom Penh is the capital and largest city of Cambodia, and is the center of the nation's economy, cultural heritage, politics and diplomacy. With a land area of 679 km^2, it comprises 0.37% of the total area of the country. The population of Phnom Penh is 1.5 million, or 2.3 million in the metropolitan area, which increased from 1.21 million in 2000. The population is projected to be 2.88 million by 2035. It is densely populated

Figure 2.7.1 Map of Cambodia

Source: Ministry of Tourism of Cambodia. (2014). "Cambodia Map." <http://www.tourismcambodia.org/multimedia/detail.php?id=58&cat_id=2> (Accessed on 18 Oct. 2014).

Table 2.7.2 Overview of Phnom Penh (2014)

Contents	Status
Population of metropolitan area (million)	2.3
Population of total city (million)	1.5
Land area (km^2)	679
Population density (persons/km^2)	3,400
GDP per capita (US$, 2011)	2,500

Source: Pheng, Pharinet. (2014). "Current Status of Public Transportation and Strategies in Phnom Penh." In *Proceedings of 2nd ASEAN-Korea Public Transport Workshop.* 4-6 August. Jakarta, Indonesia: The Korea Transport Institute. p. 228.

at 3,400 persons per square kilometer, and the population is growing fast. The area is subdivided into 12 districts called "kahns." The GRP per capita is US$2,500. The climate is hot year-round, with only minor variations. The city's temperature ranges from 18° to 38°C (64° to 100°F). There are two seasons: The dry season lasts from December through May, while the rainy season is from June to November.

The boundaries of the capital have been modified four times. During the first stage, the Dangkor District was added to the districts of Phnom Penh; in the second stage, Khan Russey Keo was created; four villages from Kanthork to Phnom Penh territory were integrated in the third stage; and in the fourth, 20 communes from five districts in Kandal Province, Ponnhear Leu, Mok Kampoul, Khien Svay, Kandal Steung, and Angsnoul, were integrated into Phnom Penh as one province.

7.2 Public Transit Level of Service

7.2.1 Types of Public Transportation

Intra-city transport in Phnom Penh includes paratransit and buses. Since public transport, such as buses and subways, is not well developed in the city, paratransit, including taxis, motos (motorcycle taxis), tuk–tuks (auto rickshaws) and cyclos (pedicabs), is the main mode of travel.

Taxi companies, such as Global and Choice Taxi Company, offer an on-call taxi service, but it is generally difficult to catch these taxis in Phnom Penh. Meter taxis sometimes wait in tourist areas, such as the riverfront and Street 51, while unmetered taxis can be arranged through a hotel or travel agent and can also be found waiting outside major hotels. Motos or "moto-dups" are the fastest and cheapest form of public transportation.

Figure 2.7.2 A cyclo and motorcycles

Figure 2.7.3 *A tuk-tuk*

Figure 2.7.4 *A bus terminal in Phnom Penh*

The best way to travel around town in Phnom Penh is by tuk-tuk, a two-wheeled carriage pulled by a motorcycle. Finally, the humble bicycle rickshaw known locally as the cyclo (from the French "cyclopousse") can be a cheap and practical form of transportation.

City buses have been in operation since the implementation of a trial bus experiment in February and March, 2014. For inter-city connections, there is bus, rail, and water transportation. The city has three bus terminals:

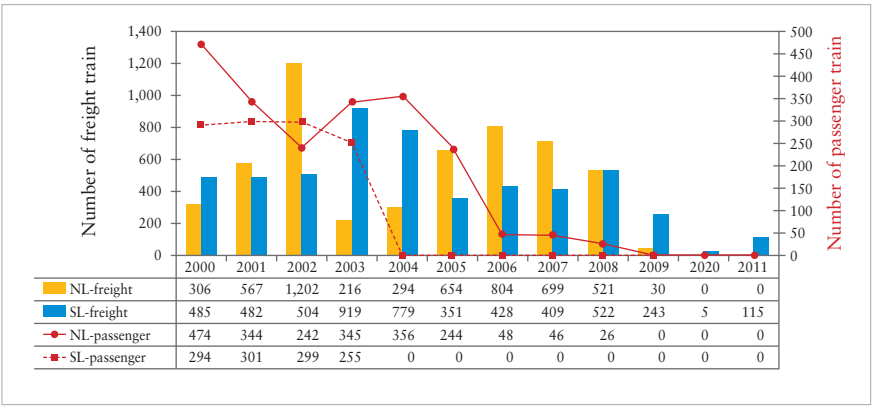
GST Express, Phnom Penh Public Transport, and Sorya Bus Terminal. Bus terminals are located in the middle of the city for inter-city and international buses.

In addition, there are two rail lines, the Northern Line (NL) and Southern Line (SL), which connect to other cities from Phnom Penh, but are mainly for transport of cargo. Water transport also exists for people who live in the eastern part of the city (Pheng, 2014a).

7.2.2 Service Level of Public Transport

Railway Transport

Railway transport is only used for inter-city travel. While there is a train station within the city, passenger train service has ceased operation on the two railway lines, on the SL since 2004 and on the NL since mid-2008. Freight service continues on the SL, but the NL has ceased to operate since 2009.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2020	2011
NL-freight	306	567	1,202	216	294	654	804	699	521	30	0	0
SL-freight	485	482	504	919	779	351	428	409	522	243	5	115
NL-passenger	474	344	242	345	356	244	48	46	26	0	0	0
SL-passenger	294	301	299	255	0	0	0	0	0	0	0	0

Figure 2.7.5 Annual number of trains operated

Source: Infrastructure and Regional Integration Technical Working Group. (2012).

As show in the chart above, the number of trains operated has decreased constantly until now. As of 2010, only the SL operates freight service.

Bus Transport

Buses are the only means of mass public transportation for intra-city travel. There were no systematic bus routes until February 2014, when the JICA supported the launch of trial bus operations in Phnom Penh. The trial bus route extended to approximately 7 km in length and had 36 bus stops.

According to the results of the JICA experiment, the average daily ridership reached 1,546 persons per day, which amounted to 43,278 passengers a month (Pheng, 2014b).

Figure 2.7.6 *City bus*

After the end of the trial run in March, the bus system was continued by Global Trade Development, a Chinese company selected as the city bus operator in March 2014. From April 14, 2014 to the present time (Sept. 20, 2014), the Department of Public Work and Transport (DPWT) under the Phnom Penh city government directly operates the city bus after it terminated the contract with Global Bus since there was a disagreement between the Chinese company and the city government over operations. Although the city government still accepts participation from the private sector as a bus service provider, it plans to directly operate buses and is going to expand the bus routes from one to three. According to the DPWT, the daily passengers per month have increased from 1,049 passengers per day in April to 1,152 in May and 1,266 in June (Phengb, 2014).

The buses used are an old type that have only one door, and they run at irregular intervals. There are few bus stops with shelters, and there are not many ways for passengers to get to the bus stop safely due to a lack of sidewalks and heavy traffic. The fare is fixed at 1,500 Riel (US$0.38). News about the public city bus operation has spread through various media such as TV, newspapers and Internet SNS (Pheng, 2014b).

7.3 Transportation Infrastructure Investment and Financing

There have been a number of transportation infrastructure projects, including public transport experiments and national and urban road improvements. Most of the funds for these came from the aid of international agencies and country such as ADB, KOICA, China, and JICA. The tables show road and bridge infrastructure projects that were supported by international donors.

Table 2.7.3 Road investments from foreign donors

No.	Donor	Cost (US$ mil.)	Length (km)	Section	Year		Fund
					Start	End	
1	Japan	80	56	Phnom Penh-Neak Loeung	2005	–	Grant
2	ADB	–	63	Kbal Thnal-Takeo	2001	–	Loan
3	China	71.5	109	Preak Ta Mak-Anlong Chrey	2007	2010	Loan
4	ADB	13	17	Kampong Trach-Kampot	2007	2010	Loan
5	China	57.8	157	Meanchey-Preah Vihear	2008	2011	Loan
6	China	51.9	127	Snoul-Sen Monorom	2007	2010	Loan

Source: Infrastructure and Regional Integration Technical Working Group. (2010). *Overview on Transport Infrastructure Sector in the Kingdom of Cambodia.* Phnom Penh, Cambodia: JICA. p. 9.

Table 2.7.4 Bridge investments from foreign donors

Name of Bridge	Donor	Cost (US$ mil.)	Length (Km)	Location	Year		Fund
					Start	End	
Kizuna	Japan	57	1.3	Kampong Cham NR7	1996	2001	Grant
Chrouy Changvar	Japan	23	0.7	Phnom Penh NR6A	1992	1994	Grant
Neak Loeung	Japan	131	1.6	Kandal, Svay Rieng NR1	2010	2014	Grant
Preak Ta Mak	China	43.5	1.1	Prey Veng NR8 & NR6A	2007	2011	Loan
Preak Kdam	China	28.9	1	Phnom Penh NR5 & NR61	2007	2011	Loan
Kampong Bai	Korea	–	0.3	Kampot, as a part of NR3	2005	2007	Loan
Se kong	China	–	–	Toeng Treng as a part of NR7	2005	2008	Loan
Koh Kong	Private	7	–	Koh Kong, NR48	2001	–	BOT
New 2nd Chrouy Changvar	China	90	–	Phnom Penh – NR6A	–	–	Loan
Prek Phnov	Private	42	1,543	Phnom Penh – NR6A	–	2010	BOT
Mekong River Bridge in Stung Treng	China	5	1,731	Stung Treng, as a part of NR9	2012	2014	Loan
Koh Thom Bridge	China	25		Kandal Province	2012	2014	Loan

Source: Infrastructure and Regional Integration Technical Working Group. (2010). p. 10.

7.4 Ownership, Operation, and Regulations of Public Transport

7.4.1 Public Transportation Ownership and Operation

City Buses

After a month of trial in 2014, the city's bus operation was outsourced to a private bus company, Global Bus. However, the city government has operated bus service from April 2014 after terminating the contract with the company.

7.4.2 Transportation Regulations

The Law on Road and Law on Land Traffic are stated in Cambodia's laws. However, articles about public transportation do not exist, except regarding safety checkup dates and registration requirements (Ministry of Public Works and Transport, 2014).

7.5 Road Infrastructure

Table 2.7.5 Road Network of Cambodia

Road types	Road length (m)	Paved road (m)	% of paved road
National roads (1 digit)	2,258	2,115	94%
Notional roads (2 digits)	3,342	1,868	56%
Provincial roads	6,607	1,000	15%
Rural roads	40,379	N/A	N/A
Total	52,586	4,983	11%
Road density	0.26 km/km^2		

Note: Road length based on the year 2012. The figures for paved roads are from presentation material from the 2nd ASEAN-Korea Public Transportation Workshop, but they did not give the base date.
Source: Kong, Sophal. (2014). "Cambodian Transport Network Development." In *Proceedings of 2nd ASEAN-Korea Public Transport Workshop*. 4-6 August. Jakarta, Indonesia: The Korea Transport Institute. p. 247.

The road network in Cambodia reaches approximately 52,586 km in length. The national roads extend to 5,600 km and the provincial roads extend 6,607 km. These roads are managed by the Ministry of Public Works and Transport (MPWT), while the rural roads are under the management of the Ministry of Rural Development (MRD). The national road density is estimated to be approximately 0.26 km^2. Most of the national roads with a one-digit title are paved, but the rest are almost bare. Furthermore, most

of the roads in Cambodia are ruined due to the civil war, and many are in a bad condition. Fortunately, with constant financial and technical help from other nations, many of the main roads have been rebuilt and improved.

7.5.1 International Road Network in Cambodia

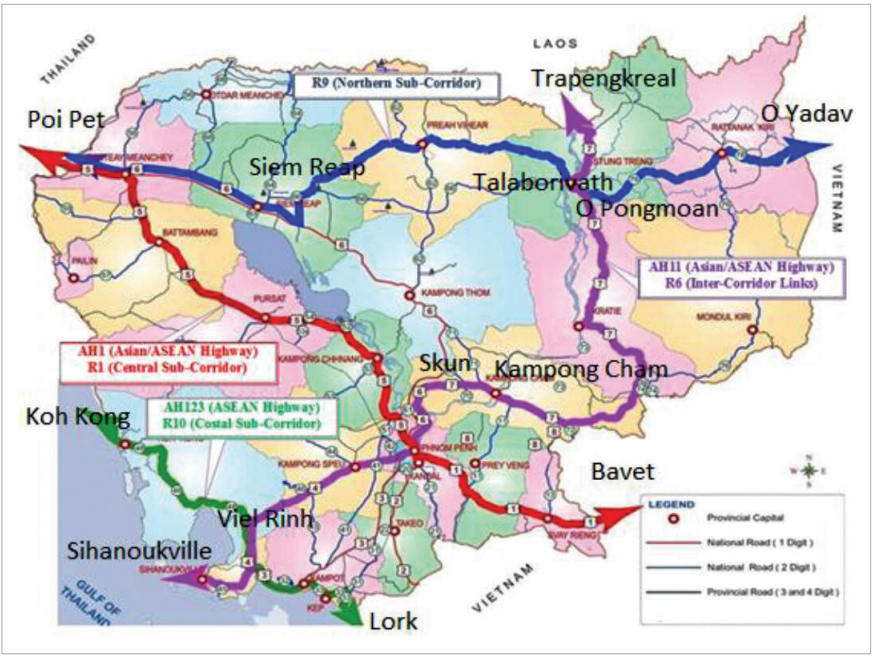


Figure 2.7.7 International road network in SE Asia

Source: Kong, Sophal. (2014). p. 249.

Of the national roads in the road network of Cambodia, four are main international highways connected to neighboring countries. The country's main roads connect Siem Reap (a key tourist town), Battambang (a rice-growing provincial town), Kampong Chhnang (a fishing province) and Phnom Penh (the capital). Phnom Penh is at the cross points of Asian Highway routes No. 1 and No.11, which are the link to all three neighboring countries: Thailand, Vietnam and Lao PDR.

7.5.2 Road Infrastructure in Phnom Penh

The capital has a total of 27 bridges. Their total length is approximately 5.5 km. The total road length in the capital city is shown below.

Table 2.7.6 Roads in Phnom Penh and its districts

(Unit: meters)

Description	AC roads	DBST roads	Concrete roads	Total
Phnom Penh (=total)	215,286.00	279,753.00	206,730.00	1,379,487.00
Daun Penh	29,800.00	12,730.00	1,649.00	43,810.00
Chamkamon	29,521.00	53,646.00	21,377.00	105,528.00
7 Makara	29,800.00	12,730.00	1,649.00	22,264.00
Toul Kork	5,500.00	64,067.00	32,453.00	117,924.00
Mean Cheay	11,980.00	14,720.00	57,953.00	143,490.00
Dangkor	–	38,788.00	22,067.00	451,767.00
Sen Sok	–	3,860.00	7,710.00	105,528.00
Russey Keo	7,020.00	18,409.00	62,241.00	186,528.00

Source: PhnomPenh website. (2010).

There are a total of 1397.5 km of roads, of which 50.8 % are paved. The road status in each district of the Phnom Penh is shown above as well. In addition to the eight districts listed above, four more districts are included in administrative sections of Phnom Penh. Road infrastructure information is not available for those districts.

Urban Transport Development (Ring Roads)

Major urban transport development projects during the last two decades have been focused on the construction of bridges, flyover bridges and road expansions. There have been few development projects for the public transportation system, and most projects focused on national connectivity, which has led to limited road development in the city center and slow road development in the suburban area (Pheng, 2014). In the city of Phnom Penh, ring roads are being planned for implementation. Four ring roads are scheduled for reconstruction or first implementation.

There are three ring roads in the province of Phnom Penh as of 2014. Ring Road Nos. 1, 2 and 3 are under the maintenance of the MPWT, which has been looking for ways to improve the traffic situation in Phnom Penh, mainly to relieve traffic congestion in the city center and promote further economic development of the city. The solution they came up with was to change the routing or extend the current ring roads and newly implement Ring Road No. 4. As a result, Ring Road Nos.1, 2, and 3 are newly constructed for smooth traffic flow in the capital area and Ring Road No. 4 is under consideration. The funds to build Ring Road Nos. 2 and 3 came

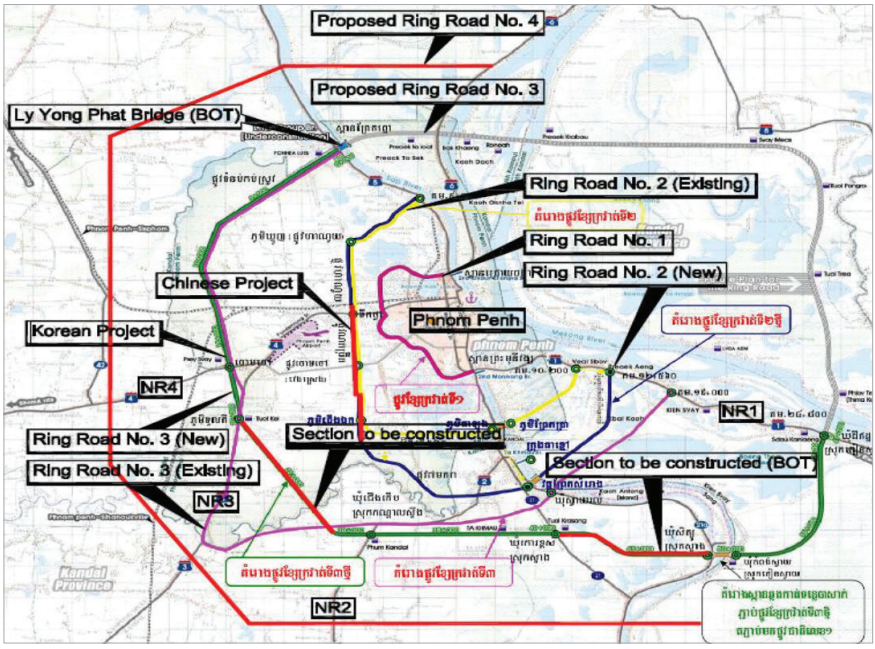


Figure 2.7.8 *Ring road development in Phnom Penh*

Source: Kong, Sophal. (2014). p. 251.

from China and Korea, with help from other donors. However, the city is facing financial problems due to many construction projects under way for the implementation of three more new bridges across the Mekong River and other developments in a swampy area of the Lvear Em district.

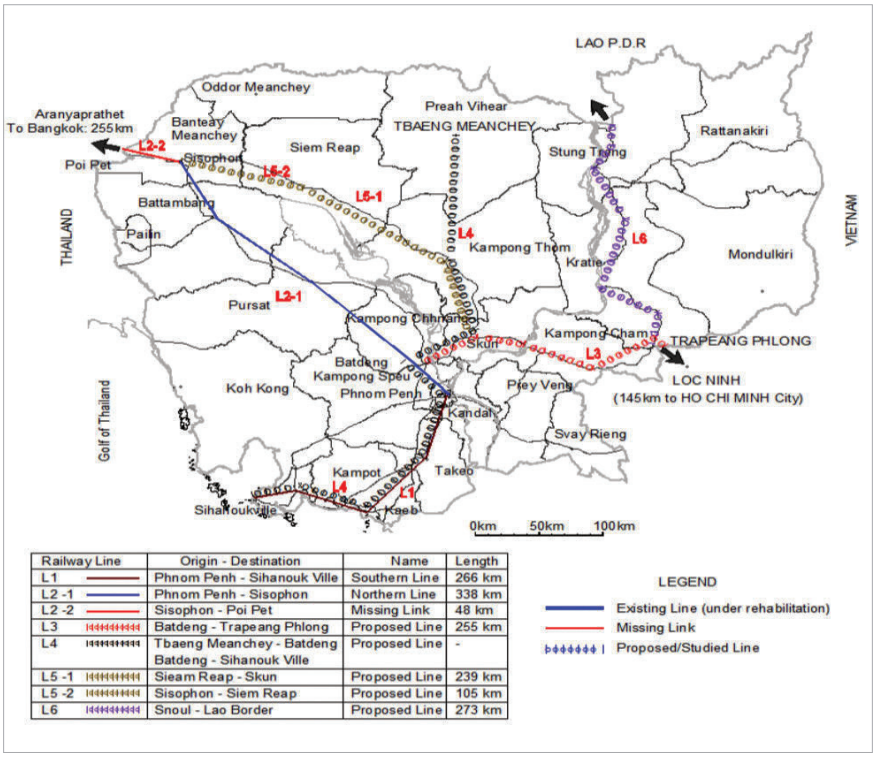
7.6 Railway Infrastructure

There is no railway infrastructure for urban transportation in Phnom Penh. The two rail lines that do exist, the SL and NL, are owned by the Royal Cambodian Railway. The lines were built during the 1960s and earlier.

The NL was part of a great plan to connect Bangkok, Thailand to Saigon, Vietnam. However, the construction of a railway connecting Phnom Penh to Saigon never even started. The NL connects Phnom Penh to the Thai-bordering city of Poipet, and has a length of 386 km. Since 1961, however, the route from Poipet to the Thai city of Aranyaprathet has been disconnected, and because of this, the lines from Sisphone to Poipet stopped being used in the early 1970s. Thus, the NL had been used for carrying

both passenger and freight over 338 km of railways from Phnom Penh to Sisophon until 2009, when it stopped passenger service, and it stopped being used for freight carriage as well in 2010.

The SL is a 264 km line that connects Phnom Penh to the international seaport city of Sihanoukville on the southern coast of Cambodia. It is not in very good condition, and is used for carrying freight only. It stopped carrying passengers in 2004. The SL is currently being rehabilitated by the state. With little traffic using the rail lines, some individuals run their own private "bamboo trains," which are small locally made units for carrying limited passengers and freight.[1]



Railway Line	Origin - Destination	Name	Length
L1	Phnom Penh - Sihanouk Ville	Southern Line	266 km
L2 -1	Phnom Penh - Sisophon	Northern Line	338 km
L2 -2	Sisophon - Poi Pet	Missing Link	48 km
L3	Batdeng - Trapeang Phlong	Proposed Line	255 km
L4	Tbaeng Meanchey - Batdeng Batdeng - Sihanouk Ville	Proposed Line	-
L5 -1	Sieam Reap - Skun	Proposed Line	239 km
L5 -2	Sisophon - Siem Reap	Proposed Line	105 km
L6	Snoul - Lao Border	Proposed Line	273 km

Figure 2.7.9 *Cambodia railway network, including future plans*

Source: Infrastructure and Regional Integration Technical Working Group. (2010). p. 21.

1 Source: The World Bank. "Transport in Cambodia"

The MPWT has announced future plans for the Cambodian railways. They include the extension of the NL and SL, and making new lines and linking missing railways to enhance connectivity in all of Cambodia. The state is currently seeking funds for the project.

7.7 Vehicle Statistics, the Modal Share of Public Transportation

7.7.1 Vehicle Growth

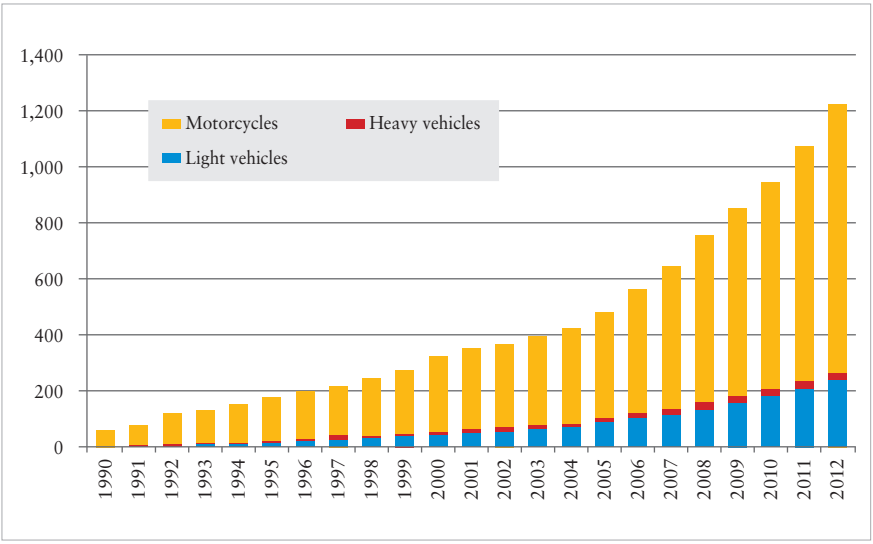


Figure 2.7.10 Vehicle growth in Phnom Penh

Source: Pheng. (2014a). p. 230.

Vehicle registration has been constantly growing since the year 2000. The increase rate of registered vehicles from 2000 to 2012 is 3.7 times. The number of registered vehicles has been increasing at an average rate of about 19% each year, and reached almost 1,900,000 in 2011. Since 2005, the number of registered motorcycles has increased dramatically, more than that of cars, and the rate of increase is approximately 20% each year. Motorcycles represent the biggest share of registered vehicles and accounted for about 80% of all registered vehicles in 2012. Phnom Penh can be said to have a major dependency on private motorcycles. The rapid increase of motorcycles and cars is going to cause big problems, such as serious traffic congestion and air pollution, for the city unless proper measures are taken soon.

7.7.2 Modal Share of Public Transportation

Table 2.7.7 Increases in the number of privately owned vehicles used in the city

(Unit: million)

Mode	2001 (JICA)	%	2011 (SYSTRA)	%
Individual transport				
Private cars	0.2	10%	0.7	20%
Private motorcycles	1.1	65%	2.2	64%
Light public transport (Paratransit)				
Motodops (motorcycle taxis)	0.3	19%	0.3	8%
Tricycles (tuk-tuks) and Other light vehicles	0.1	6%	0.3	9%
Total	1.7	100%	3.5	100%

Source: Pheng. (2014b).

The table above shows the change in modal share of the people in Phnom Penh. The portion of people who use private transportation has increased from 75% to 84%, whereas the percentage of people who use paratransit for public transportation has decreased from 25% to 17%. Since there is a lack of public transportation available in the city, Phnom Penh cannot help but to have an increasing number of people using their own vehicles for everyday ordinary mobility needs.

7.8 Traffic Safety Indicators

According to the National Road Safety Committee, the number of road fatalities in Cambodia amounted to 1,905 in 2011, and there were 13.1 fatalities per 100,000 inhabitants. According to a news outlet, road accidents killed 1,727 people in Cambodia in 11 months of 2013, which was 0.5% down from 2012. Because of the high increase in motorization, the fatality rate of road accidents has greatly increased since 2006. Even though there are some reports regarding decreasing figures of traffic accidents, Cambodia's road accident rates are among the highest of ASEAN countries.

The above chart provides detailed figures regarding traffic accidents in Cambodia in 2010. The fact that Phnom Penh and other provinces had more than 60% of the accidents that involved motorcycles stands out in the chart. Motorbikes are a hazard to road traffic, and there has been a national campaign and efforts to pass national helmet laws. This may

Table 2.7.8 Statistics on traffic accidents in Cambodia (1)

Accident information	2009			2010		
	Phnom Penh	Provinces	Country level	Phnom Penh	Provinces	Country level
Number of crashes	2,116	10,422	12,538	555	6,386	6,941
Number of vehicles involved	3,140	15,270	18,410	1,366	13,813	15,179
Types of vehicles involved						
Bicycles	3%	5%	5%	1%	4%	5%
Motorbikes	73%	69%	70%	65%	62%	66%
Passenger vehicles	15%	15%	15%	22%	20%	17%
Goods vehicles	7%	6%	6%	9%	9%	7%
Agriculture vehicles	0%	3%	2%	1%	3%	3%
Other	2%	2%	2%	2%	2%	3%
During nighttime						
from 6 pm to 5.59 am	66%	35%	44%	58%	30%	32%
Severity of injuries						
Death	7%	8%	8%	10%	10%	10%
Severe injury	26%	34%	33%	35%	37%	37%
Slight injury	63%	55%	56%	50%	50%	50%

Source: RCVIS(Road Crash and Victim Information System). (2010). *Cambodia Road Crash and Victim Information System.* Phnom Penh, Cambodia: National Road Safety Committee and Phnom Penh, Cambodia: Handicap International Belgium. p. 46.

Table 2.7.9 Statistics on traffic accidents in Cambodia (2)

Cause of accident	2009			2010		
	Phnom Penh	Provinces	Country level	Phnom Penh	Provinces	Country level
Human error	99%	97%	97%	98%	97%	97%
High speed	46%	52%	49%	40%	50%	49%
Alcohol abuse	14%	14%	13%	13%	13%	13%
Disrespect of right of way rules	16%	13%	13%	18%	12%	12%
Dangerous overtaking	11%	9%	9%	9%	8%	8%
Non-human error	13%	12%	16%	20%	17%	18%

Source: RCVIS. (2010). p. 46.

explain the huge decrease in the number of crashes occurring around the country. In Phnom Penh alone, the number of crashes decreased from 2,116 to 555. The involvement of motorbikes has also seen a huge decrease of 8%, while that of passenger vehicles increased by 7%. Moreover, the severity

of the crashes has seen an increase, which is probably due to the increasing number of passenger cars.

The main cause of accidents in Cambodia in 2010 was over-speeding, even though this decreased from the rate in 2009. Non-human errors as a cause increased significantly in 2010.

The number of casualties in 2010 saw a huge decrease in accordance with the decrease in crashes. In 2010, the number of casualties in Phnom Penh was 1,735. This reflects the heavy enforcement of the helmet-wearing policy in the city, as the national casualty number did not see as much of a decrease. People in their 20s make up the largest portion of those involved in accidents, and most casualties are from motorbikes, even though the rate is decreasing. The percentage of pedestrian casualties saw a huge increase of 20%, which shows the need for attention by the state regarding pedestrian safety policy.

7.9 Air Pollution and Vehicle Maintenance Standards

Table 2.7.10

Division	Contents and standards	
Sulphur (max, ppm)	Diesel	1,500
	Petrol	No data
Fuel quality comment	Lead was phased out in 2007	
Vehicle fleets	Six vehicles per 1,000 people in 1999-2001, and 30 vehicles per 1,000 in 2003.	
Vehicle standards, inspection and maintenance (I/M)	Formal emission standards for petrol and diesel vehicles exist. Emission standards for two- and four-stroke motorcycles and vehicles are provided for under Cambodian law. Source: CAI-Asia	
Vehicles comment	There was an ADB loan in 2002 for a road safety program, including vehicle testing, but no more information was found.	

Source: UNEP. (2012). "Status of Fuel Quality and Vehicle Emission Standards in Asia-Pacific." <http://www.lead.org.au/PCFV/Lead_Matrix_AP_201206.pdf> (Accessed on 17 Oct. 2014).

There is very little quantitative and up-to-date information available on strategic land use planning and transportation issues for Phnom Penh. A major transportation study was completed by the JICA in 2001, but given the rapid growth of the population, the number of vehicles and rapid suburbanization of the city, the data in that study is out of date. However, the legal restriction on the sulphur amount for diesel is set to 150 ppm max.

7.10 Traffic Congestion and Traffic Demand Management

7.10.1 Overview of Urban Transport

The urban transport infrastructure was severely damaged and neglected during the years of civil war in Cambodia. There are only road-based modes available for urban transportation, and traffic volumes are growing rapidly, especially in Phnom Penh and Siam Reap. Public transport is limited to buses, as there are no subways in the country. Various public transport policies need to be implemented in Cambodia, since they have tremendous impacts on the quality of social life and national competitiveness. Phnom Penh, in particular, with its rapidly growing population and vehicle ownership, has been facing problems of traffic congestion, air pollution, and traffic safety, and the need for a systematic and feasible transport policy is crucial for economic development with little side-effects.

7.10.2 Overview of Traffic Congestion

Cambodia, Phnom Penh as well, has gone through many road improvement projects since 2000. However, the traffic congestion on major roads has not been improved. According to the JICA, as of 2012, the traffic volume on the major roads in Phnom Penh had increased 1.7 times as much as in 2001 (Pheng, 2014a).

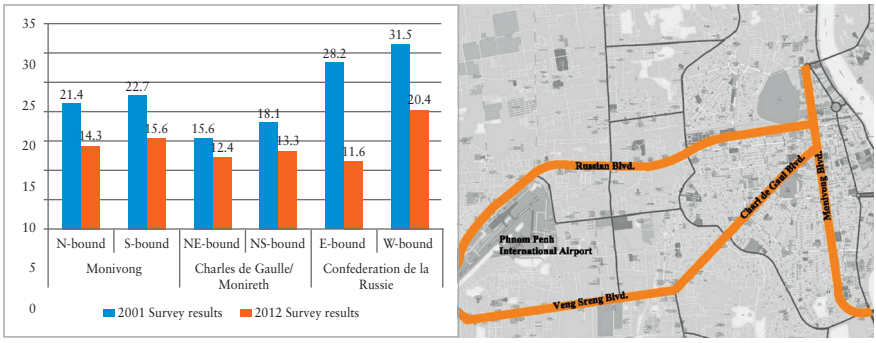


Figure 2.7.11 Changes in average travel speed in the city (unit: km/h)

Source: Pheng. (2014a). p. 232.

The average speed on the main roads was 14.6 km/hr, which, compared to 22.9 km/hr in 2001, was a decrease of about 8 km/hr over 10 years. The

main cause of this result is the rapidly increaing number of vehicles, illegal parking on the roadside due to a lack of parking facilities, insufficient and unreliable public transport services, lack of an integrated traffic management system and illegal construction that does not follow the approved land use plan.

Table 2.7.11 Volume per capacity in Phnom Penh

Area	Existing case	Do nothing case: year 2035	Road improvement: year 2035
Urban	0.87	1.78	1.25
Suburban	0.44	0.77	0.30
Total	0.52	0.95	0.38

Source: Pheng. (2014a). pp. 232-233.

7.10.3 TDM Techniques

There are no specific TDM techniques in implementation. However, in recent years, the installation of traffic signals and improvements to the layout of some major intersections have improved safety and alleviated some of the congestion. There are 56 signalized intersections in the center of the city, but the system is inefficient due to the different signal features and disruptive intersection timing. The JICA's master plan for Phnom Penh is currently being updated under a new technical assistance project that began in late 2010. The transport system in Cambodia is not multimodal or integrated. It is required to change over to a multimodal urbanized transport system in order to lower transport costs and for services to gain a competitive edge. The lack of rail services, limited inland waterway services, and limited docking facilities—especially for container ships—all contribute to high transportation costs.

7.11 Organizations of Public Transport Administration

In the Kingdom of Cambodia, the Ministry of Public Works and Transport is the main government body in charge of managing the operation, planning, and implementation of public works and the transportation sector. The authority is decreed by the Royal Government of Cambodia. Specifically, the authorities of the MPWT are as follows:

(1) Manage the implementation of national policy concerning all

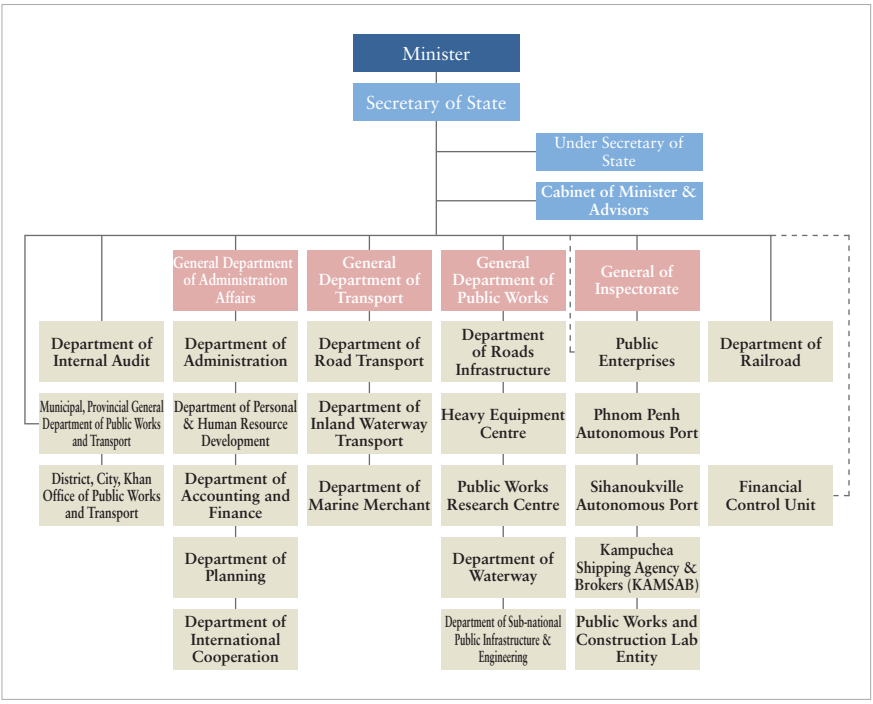


Figure 2.7.12 *Organization chart of the Ministry of Public Works and Transport*

Source: Hong, Sinara. (2013). "Transport Policy and Planning." In *Proceedings of ASEAN-Korea Capacity Building Program*. 17 - 26 February. Goyang, Korea: The Korea Transport Institute. p. 61.

public works construction by establishing the principles of law and cooperate with various organizations to develop the country.

(2) Build, maintain and manage all transportation infrastructure, such as roads, bridges, ports, railways, waterways and buildings.

(3) Establish regulations for the development of road, port, railway and waterway infrastructure.

(4) Establish regulations and control transport by road, railway and waterway.

(5) Participate and cooperate to establish laws, regulations, and diverse standards concerning the construction of transport infrastructure.

(6) Realize the other construction projects that the Royal Government entrusts to it.

(7) Cooperate with the Secretariat of Civil Aviation concerning all airport construction works.

Within the organization of the MPWT, the General Department of

Transport specifically handles tasks relating to transportation. All methods of transportation regarding land, waterway, and sea are managed by the department, and it is in charge of setting up all the regulations to ensure the safe circulation of traffic. The head of the department is the director general, with a deputy-director general supporting him in his duties. The department is separated into three branches, the Department of Land Transport, Department of Inland Waterway Transport and Department of Marine Merchant.

Of the three branches, the Department of Land Transport handles transportation by road, municipal road and railway, which comprises the public transport system of Phnom Penh, as the only public transportation available in the city is the bus system. More specifically, the department is to manage the computerization of licensing, registration and other statistical references, as well as to regulate road transport and circulation for safety on the road. In addition, the department is in charge of the preparation, initiative and management of road transport by such activities as studying and implementing regulations for road transportation, delivering international transport authorizations and advising the provinces on subjects regarding transportation (MPWT, 2014).

7.12 Public Transport and Traffic Planning

7.12.1 National Plan: Expressway Development Plan

Table 2.7.12 Expressway development plan

No.	Route	Length	Time (current situation)	Schedule	Operation
E1	Phnom Penh – Bavet	135 km	1:30(3:30)	Short	2020-
E3	Phnom Penh-Sihanouk Ville	210 km	2:10(4:00_	Short	2020-
E5	Phnom Penh-Poipet	335 km	3:30(10:00)	Medium	2025-
E6	Phnom Penh – Sri Sophon	400 km	4:00	Long	2030-
E7	Phnom Penh-Laos border	335 km	3:30	Long	2030-
E9	Siem Reap – Vietnam border	390 km	4:00	Long	2030-
E10	Krong Kep-Koh Kong	220 km	–	Long	2030-
UE	Phnom Penh Ring Road	155 km	–	Medium	2025
	Total Length	2,200 km			

Source: Kong. (2014). p. 248.

The Cambodian government is considering the implementation of expressway construction in the near future when the GDP per capita reaches US$1,000. The plan, proposed by the JICA, is to use Phnom Penh Ring Road as the feeder line for other expressways that connect to various cities around Cambodia. The construction of expressways is going to reduce the travel time greatly, contributing to fast travel and cutting distribution costs.

7.12.2 Urban Plan for Phnom Penh

There are several plans for Phnom Penh, which include the "Phnom Penh City Ring Road development plan," "Urban Transportation Planning Projects" and "Comprehensive Urban Transport Planning in Phnom Penh." The plan that includes ring roads was introduced in the "Road Infrastructure" section of this report. The following introduces the rest of the plans put forward by the SYSTRA and JICA.

The JICA plan for the city is "Comprehensive Urban Transport Planning in Phnom Penh." The objective of this plan is to formulate a comprehensive urban transport plan up to the year 2035 for the capital city of Cambodia. It focuses on the proper introduction of a public transport system and the planning of an efficient and feasible physical framework for the road network system. It also includes support measures for the overall objective such as an appropriate feeding system, traffic management, a parking system, pedestrian spaces, and network development. The project is now in discussion among the relevant agencies.

The plan by SYSTRA is called "Urban Transportation Planning Projects by International Agencies," and it focuses on the public transport network scheme. It suggests that the tramway line and priority bus line be the center corridors for the overall traffic in Phnom Penh, and introduces regular bus lines as secondary feeders that connect to the main corridors. Studies have been conducted based on multi-criteria analysis, and the results showed that a tramway should be placed on Monivong Street as a priority line that extends about 10 km. It is expected to cost US$240-280 million.

8. Singapore

Sangjun PARK, Mintaek JEON, and Ryan Hunter

8.1 National and City Statistics[1]

Table 2.8.1 *Basic facts about Singapore*

Contents	Status
Land Area (km^2)	697
Population (thousands, 2013)	5,567
Major languages	English, Malay, Mandarin, Tamil
Capital city	Singapore
Currency	Singapore dollar (SGD)
Urbanization rate (%, 2011)	100

Source: Central Intelligence Agency. (2013). *The World Factbook*. <https//www.cia.gov/library/publications/the-world-factbook/geos/id.html> (Accessed on June 20, 2014).

Table 2.8.2 *Population of Singapore*

Year	Total population (thousands)	Average annual growth (%)
1990	3,047	2.3
2000	4,027	2.8
2010	5,076	1.8
2011	5,183	2.1
2012	5,312	2.5

Source: Department of Statistics Singapore. (2014). *Yearbook of Statistics Singapore 2014*. p. 23.

1 This Chapter is summarized from many sources of publications of LTA in Singapore, such as websites and reports.

Table 2.8.3 Economy of Singapore

Contents	Status
GDP (US$ billion, 2013)	287.3
GDP per capita (US$, 2013)	52,917
GNI per capita (US$, 2013)	54,040
GDP growth (%, 2013)	4
Trade (US$ billion, 2011)	7,778
Imports (US$ billion, 2012)	380
Exports (US$ billion, 2012)	408

Source: The World Bank. (2013). *World Economic Outlook Database;* World Trade Organization. (2013). *International Trade Statistics 2013.*

As shown in Table 2.8.1, Singapore has a land area of around 710 km^2 with a population of 5.4 million inhabitants. It also has a high population density, reaching as high as 7.6 thousand persons/km^2.

Singapore's population grew from 4.0 million in 2000 to 5.3 million in 2012. The average population growth has remained relatively stable in the last two decades. In 2013, 12.5 million journeys were made each day across the island. Singapore's economy is also expected to continue to

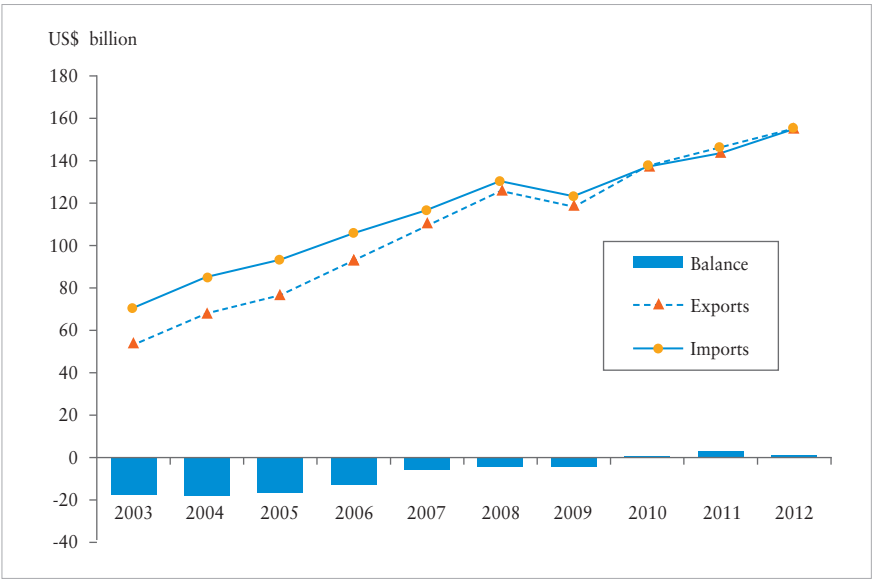


Figure 2.8.1 Singapore services exports, imports and balance (2003-2012)

Source: Department of Statistics Singapore. (2012). *Singapore's International Trade in Services 2012.* p. 1. <http://www.singstat.gov.sg/publications/publications_and_papers/international_accounts/int-trade2012.pdf>.

grow at an average annual rate of 3% to 4% over the next 10 to 15 years. This continued growth means that more people and goods will need to be transported across the country.

Singapore's international trade services are continuously expanding. Both exports and imports of services rose in 2012. The increase in the total level exports of services is largely attributed to increases in business management, financial and transport services, which single-handedly accounted for almost half of the expansion in services receipts. Likewise, total service imports rose 8.2% to US$155.3 billion for 2012, following 5.0% growth recorded in 2011. The increase was mainly driven by rising service payments for transport and travel services.

Singapore's service trade surplus declined from US$2.6 billion to US$0.8 billion in 2012 as the growth in services imports outpaced that of the exports (Figure 2.8.1). The proportion total trade in services in the national Gross Domestic Product (GDP at current market prices) increased from 84.6% in 2011 to 87.6%, reflecting its continued growing importance to Singapore's economy.

8.2 Traffic Management Authority of Singapore

8.2.1 Land Transport Authority (LTA)

The Land Transport Authority (LTA) is a statutory board under the Ministry of Transport of the government of Singapore. The LTA was established on September 1, 1995 and launched by then Prime Minister Goh Chok Tong. The LTA was formed with the merger of several public sector entities, namely the Registry of Vehicles, the Mass Rapid Transit Corporation, the Roads & Transportation Division of the Public Works Department and the Land Transportation Division of the former Ministry of Communications.

The LTA's mission is connecting people and places by enhancing the overall travel experience. By 2020, the LTA expects daily journeys to increase from 8.9 million to around 14.3 million. In order to meet this challenge, the LTA is implementing policies to direct commuters to the most appropriate mode of transportation. Furthermore, its vision is to create a people-centered land transportation system. The LTA aims to make public transport the preferred choice by making it faster, reliable and more frequent. To keep traffic moving smoothly on the roads, the LTA is committed to managing road use by optimizing the road networks and enhancing road safety.

8.3 Status of Public Transport and Service Level of Public Transport

8.3.1 Status of Public Transport

Roads account for 12% of Singapore's land area today, only just a little under housing, which takes up 14% of the total land area. Singapore's road network is expected to grow further, mainly to serve newly developed areas and improve the movement of buses. Singapore will also have to continue to restrain private car travel to have smoother-flowing traffic on their roads. In Singapore, around 63% of all trips during peak periods are made on public transport, up from 59% in 2008. Singapore's government is aiming for 75% of trips during the morning and evening peak hours to be made by public transportation by 2030.

To make public transportation more attractive, Singapore will focus on improving the capacity and reliability of the train and bus services. In the longer term, Singapore will significantly expand the rail network, the backbone of its land transport system. The country will continue to add to and adjust the bus network, not just to facilitate passengers with connecting journeys on the expanded rail system, but also to help them reach more places directly and more conveniently. The country will complement the bus network with more extensive infrastructure for cycling and walking as attractive alternatives to move around and to get to train stations. With these proposed measures, Singapore is seeking to have 85% of journeys that are less than 20 km (the distance from almost all parts of Singapore to the city center), to be taken on public transportation and to be completed within 60 minutes by 2030. This will be an improvement from the 76% of journeys that are taken on public transportation today.

Table 2.8.4 Public transport utilization

	Division	2011	2012
Average daily ridership (`000 passenger trips)	MRT	2,295	2,525
	LRT	111	124
	Bus	3,385	3,481
	Taxi	933	967
Average trip distance	MRT (km/passenger-trip)	10.1	9.6
	LRT (km/passenger-trip)	2.0	2.0
	Bus (km/passenger-trip)	4.5	4.4
	Taxi (km/passenger-trip)	9.6	9.7

Source: Load Transport Authority. (2013). *Singapore Land Transport Statistics in Brief 2013*. <http://www.lta.gov.sg/content/dam/ltaweb/corp/PublicationsResearch/files/FactsandFigures/Stats_in_Brief_2013.pdf> (Accessed on 24 Oct. 2014).

8.3.2 Mass Rapid Transit (MRT)

The MRT system in Singapore is the second-oldest metro system in Southeast Asia after the Manila LRT system. The MRT and LRT system is one of the most popular modes of transport in Singapore, with ridership levels well over two million passengers a day.

There are a host of ticketing schemes based on stored-value smartcards to suit travelers' needs, and these include standard one-time travel tickets and tourist concession passes. Stored value cards, known locally as EZ-Link cards, can be purchased from TransitLink Ticket Offices at selected MRT stations. Standard value tickets can be purchased from general ticketing machines (GTMs) located at all MRT stations. Users may top up their EZ-Link cards at any Transitlink Ticket Office or GTM using cash or NETS. The minimum top-up value is SG$10, and the maximum is SG$100.Users may also choose to buy a standard ticket that can be used up to six times within a 30-day period from the date of purchase.

The MRT is the backbone of the Singapore transportation system. The four main lines move commuters along the North-South, East-West, an North-East Lines, and around the city fringes through the Circle Line.

The SMRT operates the North-South Line, which runs from Marina Bay to Jurong East via Woodlands, the East-West Line, which runs from Pasir Ris to Joo Koon, and the new, fully automated Circle Line that links residential areas at the fringes of Singapore's city center to the Marina Bay

Figure 2.8.2 *MRT train*

Source: FotoLIBRA. (2014). "MRT, Singapore." <http://www.fotolibra.com/gallery/337338/mrt-singapore> (Accessed on 24 Oct. 2014).

area and the city center itself. Singapore's other transportation operators, SBS Transit, runs the North-East Line. This line connects the newest residential areas in Punggol and Sengkang to the city center.

Upon the completion of the fifth main line, the Downtown Line, in 2017, Singapore will be linked by an intricate train system that makes every corner of the island state easily accessible by train.

Table 2.8.5 *Singapore MRT network*

Name	Commencement	Latest extension	Terminal		Stations	Length (km)	Operator
North South Line	7 November 1987	2014	Jurong East	Marina South Pier	26	45	SMRT Trains
East West Line	12 December 1987	2016	Pasir Ris Changi Airport	Tuas Link Tanah Merah	35	57.2	SMRT Trains
Circle Line	28 May 2009	2025	Dhoby Ghaut Marina Bay	Harbour Front Stadium	30	35.4	SMRT Trains
North East Line	20 June 2003	2030	Harbour Front	Punggol	16	20	SBS Transit
Downtown Line	22 December 2013	2025	Bugis	Chinatown	6	4.3	SBS Transit

Source: Wikipedia. (2014). "Mass Rapid Transit(Singapore)." <http://en.wikipedia.org/wiki/Mass_Rapid_Transit_(Singapore)> (Accessed on 24 Oct. 2014).

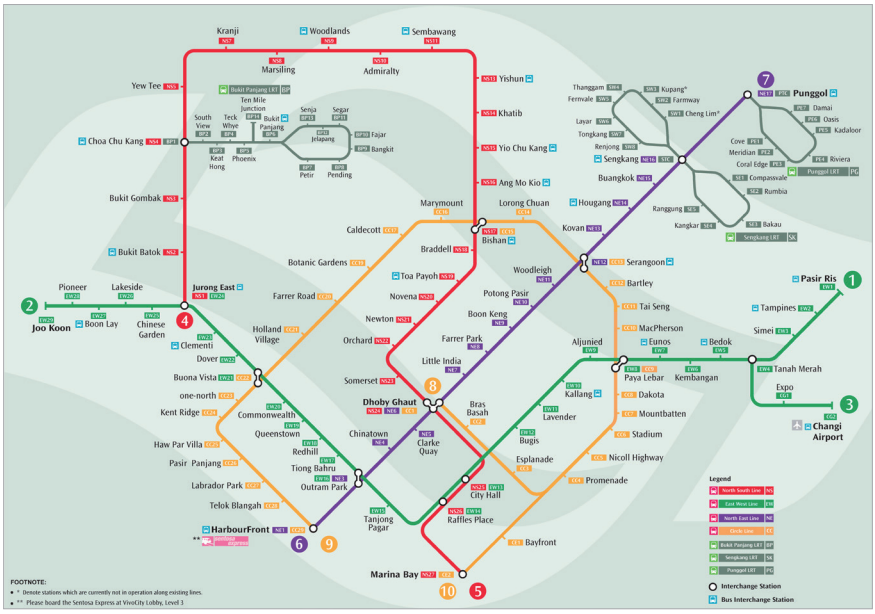


Figure 2.8.3 *Singapore MRT and LRT system map*

Source: SMRT. (2014). <http://www.smrt.com.sg/Trains/NetworkMap.aspx> (Accessed on 24 Oct. 2014).

8.3.3 New MRT Lines

The LTA will be rolling out one new line or line extension almost every year over the next seven years. At the end of 2013, the LTA opened Downtown Line 1, connecting Chinatown to Bugis. In 2014, the LTA will open the Marina South Pier station, an extension of the North-South Line that will bring people directly to the International Cruise Terminal and Gardens by the Bay.

In 2019, three stations on the new Thomson Line will be opened. A year later, the LTA will be adding six more stations in the second phase, and when the final stretch opens in 2021, another 13 new stations will be opened.

In 2013, the LTA announced that it will be building a new 50-km Cross Island Line, a new 20-km Jurong Region Line, and that it will be extending the Circle Line, the North East Line and the Downtown Line by 2030.

When all of the current plans are fully implemented, the number of interchanges will double from 15 to 30, and the rail network will double in length to 360 km, more than seven times the length of the entire island. This massive increase will mean that eight in 10 Singaporean households

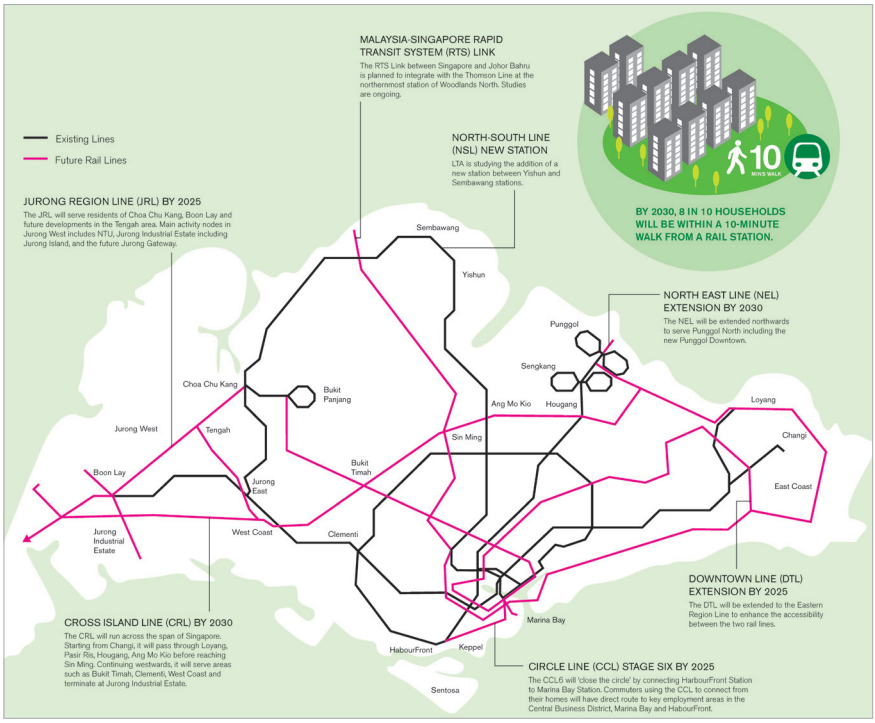


Figure 2.8.4 Singapore new MRT lines

Source: Land Transport Authority. *LTA Annual Report 2012-2013*. pp. 16-17.

will be conveniently within a 10-minute walk from a train station.

8.3.4 Light Rapid Transit (LRT)

The LRTs are shorter trains that connect lines linking major residential areas. All of the stations on the Sengkang LRT and Punggol LRT lines are within walking distance of most apartment blocks in the Sengkang and Punggol New Town areas. Both lines also provide a seamless transfer to the North-East Line.

8.3.5 Bus Services

Public bus services are operated by two main bus operators in Singapore: SBS Transit Ltd (SBST) and SMRT Buses Ltd (SMRTB).

SBS Transit is Singapore's major public bus service operator. It operates convenient bus services all around Singapore, and to destinations that are

Figure 2.8.5 *LRT train*

Source: Wikipedia. (2014). "Light Rail Transit." <http://en.wikipedia.org/wiki/Light_Rail_Transit_(Singapore)#mediaviewer/File:Bukit_Panjang_LRT_Cars.jpg> (Accessed on 24 Oct. 2014).

less accessible, such as areas beyond the city center and the heartlands. Most of their buses are equipped with air conditioning and provide trunk, feeder, Express, Townlink and Premium services.

SMRT runs bus services in the northern parts of Singapore. It shares a duopoly with SBS Transit for Singapore's transportation system. Similar to SBS Transit, it operates feeder, express and premium services. The SMRT

Figure 2.8.6 *Singapore SBS Transit bus*

Source: Epaperbird. (2014). <http://epaperbird.com/life-2/kuala-lumpur-singapore-bus/> (Accessed on 24 Oct. 2014).

also operates the popular NightRider service, which is a safe and affordable alternative transport option for commuters who spend weekends in the city until late hours.

8.3.6 Service Level of Public Transport

The LTA took on the role of central bus planning for Singapore in 2009, and works with local communities and the bus operators SBS Transit (SBST) and SMRT Buses (SMRTB) to identify specific areas where the bus services can be improved and enhanced. To give commuters even more bus options and make it easier to connect to MRT stations and amenities, some bus routes have changed and new services have been added. The LTA has also more than doubled the number of premium bus Services to 91 as of January 2013, up from 42 five years earlier. The length of time spent waiting and crowding density are important service metrics, and the LTA has tightened the overall bus quality of service (QoS) standards to reduce waiting time and crowding. Nowadays, a minimum of four in five bus services run every 10 minutes or less during weekday peak hours, an improvement from every 15 minutes in 2008. The feeder bus services are also more frequent now, with 90% of feeder bus services running at intervals of 10 minutes or less during the weekday peak periods, an increase from the previous 85%.

The LTA, through its annual customer satisfaction surveys to evaluate the service standards set in the license agreements, found that customers expressed dissatisfaction with the frequency of services.

8.4 Public Transport Investment and Funding

8.4.1 Status of Public Transport Investment

The total expenditures of the MOT in FY2014 is projected to be around US$6.17 billion, of which US$638.85 million, or 10.4%, goes toward operating expenditures, and US$5.53 billion, or 89.6%, is for development expenditures. The projected FY2014 expenditure would see an increase of US$227.13 million, or 3.8%, compared with the revised FY2013 expenditure levels.

8.4.2 Operating Expenditures

The operating expenditures in FY2014 are expected to increase by US$66.62 million, or 11.6%, from US$572.23 million to $638.85 million. About 89.3% of the provision, or US$570.75 million, will be for the LTA mainly in the form of its management fees. In addition, US$37.68 million will be set aside to fund two new concession schemes for low-income workers and persons with disabilities commencing in July 2014 as part of the government's efforts to share the cost burden of funding concessions with commuters, and strengthen the government's over-arching social umbrella to help keep public transport fares affordable for these two needy commuter groups. The remaining operating expenditures of US$30.42 million are to meet the running costs of MOT HQ and the Public Transport Council. Overall, the increase in operating expenditures in FY2014 is mainly due to the funding of these two new concession schemes, the one-year pre-peak free travel trial and an increase in the management fee to be allocated to LTA to support the higher maintenance costs for roads and road-related infrastructure.

8.4.3 Development Expenditures

Table 2.8.6 Total expenditure by program

(Unit: US$)

Program		Running costs	Transfers	Operating expenditures	Development expenditures	Total expenditures
2014	Administration	597,912,100	39,367,300	637,279,400	1,529,163,200	2,166,442,600
	Public Transport Council	1,572,100	0	1,572,100	6,900	1,579,000
	Land Transport Authority	0	0	0	4,003,487,600	4,003,487,600
Total		599,484,200	39,367,300	638,851,500	5,532,657,700	6,171,509,200
2013	Administration	559,108,100	1,651,600	560,759,700	1,474,748,800	2,035,508,500
	Public Transport Council	1,472,800	0	1,472,800	20,700	1,493,500
	Land Transport Authority	0	0	0	4,367,983,500	4,367,983,500
Total		560,580,900	1,651,600	562,232,500	5,842,753,000	6,404,985,500
2012	Administration	536,988,900	1,611,300	538,600,200	1,378,373,500	1,916,973,700
	Public Transport Council	1,525,900	0	1,525,900	97,200	1,623,100
	Land Transport Authority	0	0	0	3,368,627,000	3,368,627,000
Total		538,514,800	1,611,300	540,126,100	4,747,097,700	5,287,223,800

Source: Singapore Government. (2014). <http://www.singaporebudget.gov.sg/budget_2014/revenueandexpenditure/REvenueandExpenditureEstimates.aspx> (Accessed on 24 Oct. 2014).

Development expenditures are projected to increase by US$160.51 million, or 3.0%, to US$5.53 billion in FY2014. Of the total FY2014 development expenditures, around US$4.58 billion is earmarked for rail transport projects, with the bulk of it being for the Downtown Line, the Tuas West Extension and the Thomson Line. The remainder, amounting to US$0.95 billion, is for road improvement works, development of bus interchanges and improvement of commuter facilities and traffic management systems.

8.4.4 Funding of Public Transport Investment

Statement of Comprehensive Income

For FY12/13, the Authority achieved a surplus of $35m, after netting off government grants and a contribution to the Consolidated Fund at 17%. The total comprehensive income amounted to $26m after taking into account cash flow hedges of $9m.

Table 2.8.7 Statement of comprehensive income

Division	FY 12/13 US$ million	FY 11/12 US$ million	Increase/(Decrease) US$ million
Operating income	565	552	13
Operating expenditures	(1,113)	(1,049)	64
Operating deficit	(548)	(497)	51
Other gains-net	20	16	4
Deficit before government grants	(528)	(481)	47
Government grants	571	557	14
Surplus before contribution consolidated fund	43	76	(33)
Contribution to consolidated fund	(8)	(13)	(5)
Net surplus	35	63	(28)
Other comprehensive income cash flow hedges	(9)	4	(13)
Total comprehensive income	26	67	(41)

Source: Land Transport Authority. (2014). *LTA Annual Report 2012-2013*. p. 54.

Operating Income

The Authority's total operating income of $565m in FY12/13 is an increase of $13m (2%) over FY11/12's income of $552m, attributable mainly to an increase in management fees from the government. This remains LTA's main source of income, contributing to 80% of total income in FY12/13.

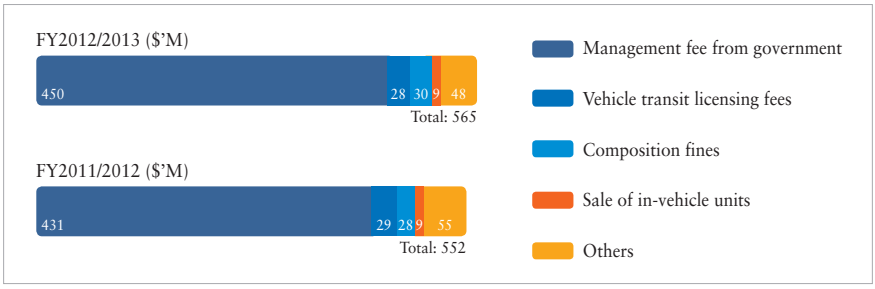


Figure 2.8.7 *Operating income*

Source: Land Transport Authority. (2014). *LTA Annual Report 2012-2013*. p. 54.

Operating Expenditures

The Authority incurred total operating expenditures of $1,113m in FY12/13, an increase of $64m (6%) over FY11/12's expenditures of $1,049m. The increase is mainly attributed to an increase in depreciation of property, plants and equipment arising from the capitalization of completed rail development projects such as the circle Line Stage 4 & 5, the Circle Line Extension project, the North-South Line Extension project, etc. FY12/13's operating expenditure composition remains relatively the same as FY11/12's, with depreciation of property, plants and equipment forming 47% of the expenditure.

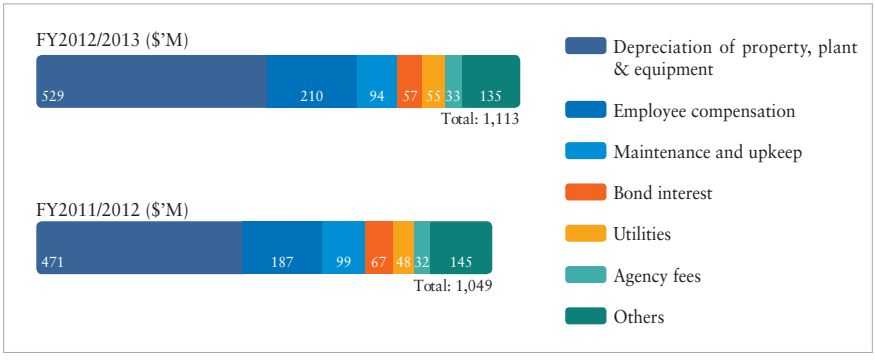


Figure 2.8.8 *Operating income*

Source: Land Transport Authority. (2014). *LTA Annual Report 2012-2013*. p. 55.

Table 2.8.8 Balance sheet

Division	2013 US$ milliom	2012 US$ milliom	Increase/(Decrease) US$ milliom
Property, plants & equipment	25,377	22,578	2,799
Ohter non-current assets	33	36	(3)
Current assets	2,550	2,932	(382)
Assets	27,960	25,546	2,414
Equity	885	835	50
Deferred capital grants	23,450	20,502	2,948
Borrowings (non-current)	1,775	2,075	(300)
Other non-current liabilities	676	568	108
Current liabilities	1,174	1,566	(392)
Equity & liabilities	27,960	25,546	2,414

Source: Land Transport Authority. (2014). *LTA Annual Report 2012-2013*. p. 55.

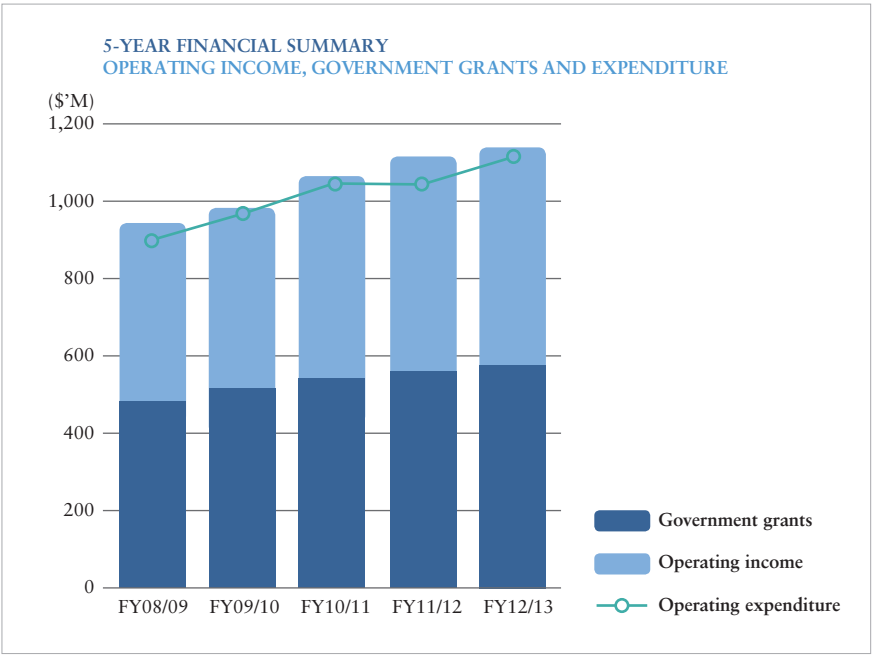


Figure 2.8.9 Five-year financial summary

Source: Land Transport Authority. (2014). *LTA Annual Report 2012-2013*. p. 56.

Figure 2.8.10 *Net surplus/(deficit)*

Source: Land Transport Authority. (2014). *LTA Annual Report 2012-2013*. p. 56.

8.5 Ownership, Operation, Regulations of Public Transport

8.5.1 Bus Service Regulation

Under the industry and regulatory framework, PTC licenses a comprehensive range of bus services to

- Meet the diverse mobility needs of the community.
- Provide an affordable means of transport for commuters to gain easy access to centers of economic, educational, social and recreational activities.

The five main types of bus services are listed below:

Basic Bus Services

Basic public bus services in Singapore are provided by two major operators, SBS Transit Ltd (SBST) and SMRT Buses Ltd (SMRTB). These include trunk, feeder, and intra-town services. The buses deployed must comply with specific vehicle standards set by the LTA.

Both bus operators have been assigned with separate areas of responsibility for bus operations. Each operator is required to

- Meet the mobility needs of commuters within their Area of Responsibility in planning and operating its bus services.
- Comply with the quality of service (QoS) standards and the universal

service obligation (USO). Under the USO, the operators have to provide a comprehensive network of scheduled bus services to within a 400-meter radius of any development where there is at least a minimum level of daily passenger demand. These services must be operated daily, throughout the entire day and at an acceptable headway, even if they are unprofitable.

Basic-Plus Bus Services

Basic-Plus bus services are non-basic services to serve selected niche markets and charge fares that are different from basic bus services. These services are only operated by SBS Transit Ltd and SMRT Buses Ltd. Standees are allowed, and Basic-Plus bus service routings generally fall within the basic bus service operators' Area of Responsibility.

Supplementary Bus Services

Supplementary bus services complement basic bus services by providing additional capacity, primarily during peak hours. These services are provided by private bus operators such as private-hire or school bus operators that operate Scheme B services.

Premium Bus Services

Premium bus services provide a faster and more comfortable journey at fares that are at least 1.5 times higher than the equivalent basic bus/Rapid Transit System (RTS) services. Operated by both private and public bus operators, these services have to be fully air-conditioned with no standees allowed on board. They offer commuters:

- The choice of a faster and more direct journey
- A more comfortable ride and considerable time savings at a differentiated fare that is higher. The revised guidelines for the premium bus service scheme came into effect on 1 February 2007

Shuttle Bus Services

Shuttle bus services are niche services distinct from basic bus services. They cater to the transport needs of local communities by providing better connections to nearby transport nodes, amenities and developments.

Shuttle bus services are required to meet the following requirements:

- The service is allowed up to three intermediate stopping points between the start and end points. Each stopping point could include a group of developments in close proximity

- Within the catchment of its stopping points, the service is allowed to duplicate up to 40% of the connections provided by basic bus or RTS service. The catchment area of a point is defined as one within 200 m of that point
- There will be no restriction on fares

Special Bus Services

Special bus services provide public transport during specific time periods, to specific locations and for special occasions and events. They can be temporary or ad-hoc.

Examples of such services include tourist services, cross-border services, as well as ad-hoc services for special events and during festive periods.

8.5.2 Fare Regulation of Public Transport

Public bus and train services are provided on a commercial basis, within the maximum fares approved by the PTC.

To keep public transport fares affordable for the general public, public transport infrastructure such as the MRT/LRT lines and bus interchanges are funded entirely by the government. In addition, public buses are also exempted from Certificate of Entitlement (COE) payments. The government also pays for the development and software cost of the contactless smartcard system.

In regulating bus and train fares, the PTC carries out its statutory mandate to safeguard public interest by keeping fares affordable while ensuring the long-term financial viability of the public transport operators.

8.5.3 Public Transport Ownership, Operation

MRT

As Singapore's land transport authority, the LTA regulates and oversees all three main modes of public transport (taxis, buses and trains) and ensures that they meet safety and service standards. Apart from building roads and expressways, the LTA constructs rail lines, plans the rail system and integrates it with other existing public transport options. The day-to-day operations of running the MRT train systems are the responsibility of the two main public transport operators in Singapore, SMRT Trains Ltd and SBS Transit. These operators are responsible for the daily operations of trains and their maintenance.

SMRT TRAINS Ltd (SMRT)

Formed in 1987, SMRT began by running Singapore's first MRT route from Yio Chu Kang to Toa Payoh with the Mass Rapid Transit Corporation (MRTC).

SMRT Trains Ltd operates the following lines:

- North-South Line
- East-West Line (including the Changi branch line)
- Circle Line

SBS Transit

Formed in 1973 when three private bus companies merged, the Singapore Bus Service was one of the first major public transport operators in Singapore.

In 1997, Singapore Bus Service restructured and was renamed DelGro Corporation. A fully owned subsidiary called Singapore Bus Services Limited was created to oversee bus operations.

In 2001, Singapore Bus Services Limited was renamed SBS Transit Limited.

SBS Transit operates these lines:

- North East Line
- Downtown Line

Buses

There are two main public transport providers in Singapore:

- SBS Transit Ltd
- SMRT Buses Ltd

Bus operations are regulated by the Public Transport Council (PTC), which keeps tabs on:

- Bus service performance
- Bus service operators
- Ticket payment services
- Bus and MRT fares

The LTA and PTC work closely together to monitor the level of service and performance of bus services in Singapore. This includes monitoring operating performance standards and service provision Standards.

8.5.4 Vehicle Ownership

Singapore has instituted a vehicle quota system (VQS) since May 1990 which has been effective in controlling the growth of the vehicle population at a sustainable rate. The VQS sets a quota on the number of new vehicles that can be registered in Singapore each year. This quota is calculated based on an allowable growth rate in the vehicle population that is sustainable for the long term.

Under the VQS, anyone who wants to register a new vehicle would need to first bid for a Certificate of Entitlement (COE) that entitles them to own and use a vehicle for 10 years. COEs are allocated through a market mechanism, which provides the most efficient and equitable means of allocation.

8.6 Road Infrastructure : Road Extensions, Road Density, Parking Systems

The LTA has made significant investments in road infrastructure over the years. Today, there are 9,046 lane-km of roads in Singapore, which takes up about 12% of the land. For the last 15 years, the rate of road growth has been approximately 1% a year. Over the next 10 to 15 years, road growth is expected to trend down to about half that rate, or about 0.5% per annum.

Nevertheless, there is still a need to build new road infrastructure to cater to the demands of new developments and residential sites. However, the limited land resources means that future major roads will likely be build underground, which will be more expensive.

One such road project that was completed recently is the 12km Kallang-Paya Lebar Expressway (KPE), which features a 9 km stretch that is entirely underground. Construction of the 5km Marina Coastal Expressway (MCE) will be completed by the end of 2013, and the 21km North-South Expressway was also announced in 2011.

8.7 Track Infrastructure Construction : Railways

8.7.1 Rapid Transit System (RTS)

Table 2.8.9 Rapid transit system

		2011	2012
Total rail length built (km)	MRT length (km)	146.5	148.9
	LRT length (km)	28.8	28.8
Number of stations in operation	MRT station	97	99
	LRT station	34	34

Notes: Circle Line extension opened for revenue service in Jan. 2012.
Source: Land Transport Authority. *Singapore Land Transport Statistics in Brief 2013*.

Since 2008, the LTA has increased the length of the rail network from 138km to 178km with the opening of the Boon Lay Extension in 2009, the Circle Line from 2009 to 2011 and the Circle Line Extension in 2012. It has already started work on the Downtown Line, the North-South Line Extension, the Tuas West Extension of the East-West Line, and the Thomson Line.

As part of the Jurong East Modification Project in 2011, the LTA built an additional new platform at Jurong East Interchange Station and added 22 more trains to the North-South and East-West Lines (NSEWL).

8.8 Vehicle-related statistics: Vehicle Registration, Growth, Modal Split

8.8.1 Motor Vehicle Population

Table 2.8.10 Motor vehicle population

	2011	2012
All vehicles	956,704	969,910
Private cars	520,614	535,233
Other cars	85,666	84,778
Taxis	27,051	28,210
Buses	17,046	17,162
Goods & Other vehicles	159,768	160,417
Motorcycles	146,559	144,110

Notes: All categories include tax-exempted vehicles
Source: Land Transport Authority. *Singapore Land Transport Statistics in Brief 2013*.

8.8.2 Annual Average Quota Premium of COE

Table 2.8.11 Annual average quota Premium of COE

	2011	2012
Category A (Cars≤1600cc & taxis)	US$48,206	US$63,898
Category B (Cars>1600cc)	US$64,938	US$84,431
Category C (Goods vehicles & buses)	US$31,885	US$55,150
Category D (Motorcycles)	US$2,098	US$1,836
Category E (Open category)	US$66,067	US$86,001

Notes: The vehicle quota system (VQS) is administered through the Certificates of Entitlement (COE)
Source: Land Transport Authority. *Singapore Land Transport Statistics in Brief 2013*.

8.8.3 Motor Vehicle Registration

Table 2.8.12 Motor vehicle registration

	2011	2012
Number of New vehicles registered	47,885	47,555
Number of vehicles de-registered	36,980	34,349
Total number of vehicles transferred	126,469	142,434

Notes: These numbers exclude taxis, trailers and temporary transfers to dealers
Source: Land Transport Authority. *Singapore Land Transport Statistics in Brief 2013*.

The vehicle population growth rate declined from 3% to 1.5% per annum in 2009, and further reduced in the second half of 2012 to 1% per annum and to 0.5 % from 2013 onwards.

8.8.4 Modal Split

Table 2.8.13 Modal split

	2011
Private transport	29%
Buses	25%
Walking	22%
Rail	19%
Taxis	4%
Cycles	1%

Source: Land Transport Authority. (2014). *Journeys Sharing Urban Transport Solutions 2011*. <http://www.lta.gov.sg/ltaacademy/journeys.htm>.

Table 2.8.14 Public transport modal split

	1997	2004	2008	2012
Public transport mode Share	67%	63%	59%	63%

Source: Land Transport Authority. (2014). <http://www.lta.gov.sg/data/apps/news/press/2013/07-10-2013%20Annex_A_Fig1_Travel_demand_Fig2_PT_mode_share.pdf>.

8.9 Road Safety Indicators: Deaths, Injuries, Pedestrian Accidents, Elderly Accidents

8.9.1 Road Accident Casualties

To enhance pedestrian safety, it has extended a variety of road engineering measures such as pedestrian crossing lines with enhanced dash markings, traffic calming markings and "pedestrian crossing ahead" road markings to more locations from 2009. It has also installed road studs that flash in tandem with a green man crossing signal at more locations to alert motorists to stop for pedestrians in the road. For motorcyclists, it doubled the number of rain shelters on expressways from 32 in 2008 to 64 today so that there are more safe places to take shelter during storms.

Table 2.8.15 Road accident casualties

	2010	2011	2012
Fatalities	193	195	168
Injuries	11,065	9,760	9,106

Notes: 1) Data on journeys is averaged over the period of January-December. A journey refers to a series of consecutive trips on different modes (MRT, LRT, and bus), made by a commuter from his origin to his destination.
2) Traffic volume and speed are averaged over the period of January-December. Daily traffic volume is recorded between 7:30am - 7:00pm on weekdays only. Peak hours refer to 8:00am - 9:00am and 6:00pm - 7:00pm on weekdays.
Source: Land Transport Authority. *Singapore Land Transport Statistics in Brief 2013.*

Table 2.8.16 Road injury deaths

	Pedestrian	Bicyclist	Motorcycle rider	Vehicle occupant	Other
2010 road injury deaths (%)	23	9	40	28	1

Source: The World Bank. (2014). *Transport for Health. p.67.*

8.10 Travel Behavior: Behavior on Roads, Public Transport Usage Patterns

8.10.1 Private Vehicle Annual Mileage

Table 2.8.17 Private vehicle annual mileage

Division		2011	2012
Average annual kilometers	Cars	19,000	18,200
	Private hire buses	52,900	52,600
	School buses	50,000	54,300
Travelled per vehicle	Light goods vehicles (≤3.5 tons)	29,900	29,700
	Heavy goods vehicles (>3.5 tons)	44,100	39,400
	Motorcycles	13,400	13,300

Notes: The average kilometers travelled per vehicle are estimated based on mileage surveys of in-use vehicles conducted at mandatory periodic vehicle inspections
Source: Land Transport Authority. *Singapore Land Transport Statistics in Brief 2013*.

8.10.2 Public Transport Journeys

Table 2.8.18 Public transport journeys

Division	2011	2012
Average daily passenger-journeys (`000)	3,988	4,131
Average journey distance (km)	9.8	9.7

Notes: Data on journeys is averaged over the period of January-December. A journey refers to a series of consecutive trips on different modes (MRT, LRT and bus), made by a commuter from his origin to his destination
Source: Land Transport Authority. *Singapore Land Transport Statistics in Brief 2013*.

8.10.3 Road Traffic Conditions

Table 2.8.19 Road traffic conditions

		2011	2012
Average daily traffic volume entering the city		300,000	292,000
Average speed during	Expressway	62.5	63.1
Peak hours (km/hour)	Arterial roads	28.5	28.6

Notes: Traffic volume and speed are averaged over the period of January-December. Daily traffic volume is recorded between7:30am - 7:00pm on weekdays only. Peak hours refer to 8:00am - 9:00am and 6:00pm - 7:00pm on weekdays
Source: Land Transport Authority. (2014). *Singapore Land Transport Statistics in Brief 2013*.

8.10.4 Public Transport Usage Pattern

Comparing the results of 2012 with 2008, there has been a 13% increase in daily journeys, from 11 million journeys made in 2008 to 12.5 million in 2012. The public transport peak period mode share also increased from 59% in 2008 to 63% in 2012, reversing a downward trend since the survey was first conducted in 1997.

There was a 14% increase in trips made on public transport as a whole, with strong growth in train trips of 35%, from 1.7 million daily train trips in 2008 to 2.3 million in 2012. Daily bus trips also grew, from 3.1 million trips in 2008 to 3.2 million in 2012.

Singapore commuters are also more likely to use public transport if they live nearer to an MRT station. Among those who live within 400m of a station, about 71% would take public transport as their primary commuting option. This compares with 67% for those living about 800m from an MRT station and 55% for those more than 2kms away.

In addition, a denser and more connected rail system has a network effect that will increase the convenience and attractiveness of using public transport, resulting in higher usage rates. For example, those already living close to an MRT station see an increase in the rate of public transport usage, from 65% in 2008 to 71% in 2012. This period coincided with the addition of 40km of rail lines over the last four years, in particular, the opening of the Circle Line, as well as the Circle Line Extension and Boon Lay Extension.

Public transport journeys less than 20km that are completed within 60 minutes have, however, fallen by 3%, to 76%, as compared to 79% in 2008. This is largely due to slower bus speeds on roads. The LTA said it will step up efforts to give buses more priority on roads, as well as facilitate more-efficient bus-rail transfers, such as better feeder services, and together with an expanding rail network, aim to gradually raise this to a long-term target of 85%.

Table 2.8.20 Travel demand by mode of transport

	2008	2012
Goods vehicles (million)	1.1	1.4
Private modes (million)	4.3	4.8
Taxis (million)	0.8	0.8
Buses (million)	3.1	3.2
MRT/LRT (million)	1.7	2.3

Source: Land Transport Authority. <http://www.lta.gov.sg/data/apps/news/press/2013/07-10-2013%20Annex_A_Fig1_Travel_demand_Fig2_PT_mode_share.pdf>.

8.11 Transport Environmental Indicators: Air Pollution, Vehicle Emissions Standards, Vehicle Inspection System

Table 2.8.21 Carbon dioxide emissions and air quality

	2008	2012
CO_2 Emissions from combustions of fossil fuels (ktonnes)	37,933	41,540
Days with "good" air quality (%)	96	93
Days with "moderate" air quality (%)	4	7
Days with "unhealthy or worse" air quality (%)	0	0

Source: Department of Statistics Singapore. *Singapore in Figures 2014. p. 27.*

8.11.1 Noise barriers

Living close to an aboveground train track can mean having trains rumble by. To reduce the level of noise, the LTA will start installing noise barriers along stretches of track with particularly high noise volume. It plans on installing up to 20km of barriers around the island to create quieter neighborhoods. To minimize construction noise, the LTA will coordinate the installation of these barriers with ongoing renewal works on the North-South and East-West Lines, where it is replacing sleepers or upgrading the signaling system.

8.12.2 Reducing Noise Levels

Singapore is more built-up than ever before, and noise pollution in some areas has inevitably increased. To tackle road traffic noise, it is conducting a study together with agencies such as the National Environment Agency (NEA) on possible mitigation measures. As Singapore continues to grow, more and more people will live closer to elevated MRT lines and busy roads.

8.12 Traffic Congestion and Transportation Demand Management Policies

8.12.1 Traffic Congestion

The government will continue to ensure the smooth flow of traffic by erecting new ERP gantries where they are required. In particular, traffic

conditions on the AYE around Clementi have been deteriorating, as speeds have fallen below optimal levels during the morning peak period over the last year.

Three new gantries will manage eastbound traffic for both the morning and evening peak periods, and one gantry is planned to manage westbound traffic for the evening peak period. These gantries will be activated once they are completed by the middle of 2014 if the heavy congestion persists.

8.12.2 Transportation Demand Management Policies

By 2030, it is expected that the daily number of journeys will increase by about 50% as the overall size of the rail network is doubled. Plans for infrastructure to meet this future demand will take 10 years or more from conceptualization to completion.

For travel into the city, the peak hour rail capacity will be increased by 110% with new rail lines, additional trains and upgraded of signaling systems.

8.12.3 ERP

The LTA is developing a next-generation Electronic Road Pricing (ERP) system using global navigation satellite system technology to manage traffic congestion in a more targeted, flexible and fairer way. In the interim, it will implement a few more ERP gantries to tackle heavy congestion and continue to monitor hotspots that may also require congestion pricing.

In 2008, it fine-tuned the criteria for adjusting ERP rates so that motorists could enjoy speeds within an optimal range at least 85% of the time

Adjusting ERP to manage traffic requires the LTA to constantly take into account changing traffic conditions and public feedback. In 2011, it shortened the evening ERP operating hours for gantries along the northbound CTE and southbound Singapore River Line.

8.13 Public Transport Organizations and Public Transportation Administration System Status

8.13.1 Organization of the Public Transport Council

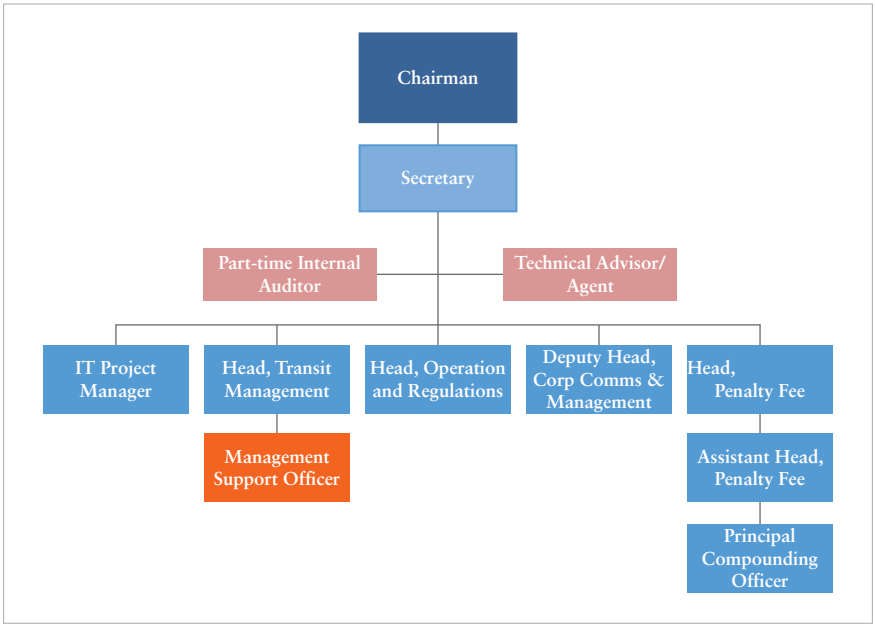


Figure 2.8.11 *Organizational structure*

Source: Public Transport Council. (2014). <http://www.ptc.gov.sg/about/organisationalStructure.htm> (Accessed on 24 Oct. 2014).

The Public Transport Council (PTC) provides policy directions and makes decisions on issues in connection with the regulation of bus services, transit ticket payment services and public transport fares. Decisions are made at regular meetings or via circulation of papers to council members. Where necessary, the chairman appoints committees comprising several council members to analyze major issues in greater detail.

A small full-time staff performs corporate tasks covering the PTC's core functions and provides the secretariat support to the council. The team, headed by the secretariat, works closely with the LTA, which provides technical advice and support to the PTC. The LTA is also delegated with the authority to carry out certain regulatory and enforcement functions.

8.14 Problem Analysis

8.14.1 Moderated vehicle population growth rate

The vehicle population growth rate was reduced from 3% to 1.5% per annum in 2009, and further reduced in the second half of 2012 to 1% per annum and to 0.5% from 2013 onward.

8.14.2 Easing Crowding in Trains

Here is what the LTA is doing to improve commuter journeys to ease crowding, especially during peak hours:

8.14.3 Better Train Service

Since 2011 it has been adding trains to existing lines, and will continue to add trains from 2014 over several years. Just as importantly, it is renewing the NSEWL signaling system to support a higher frequency of train service.

8.14.4 Spreading Travel Demand Outside Peak Periods

Spreading out travel demand will relieve the pressure on the public transport system during the morning peak period. With the Incentives for Singapore's Commuters (INSINC) program, commuters get more chances of winning cash prizes when they shift their commuting time out of the morning peak hour. In June 2013, a one-year program was launched to encourage those who can make changes to their travel schedule to choose to travel before the peak hour into the city area. Under this program, commuters enjoy free travel on the rail network if they end their journeys before 7.45am on weekdays at 16 designated MRT stations within the city area.

8.14.5 More Parallel Bus Services

To offer commuters an alternative to the MRT, a total of 14 parallel bus services connecting major HDB towns to the city area via the expressways will be introduced. To augment the resources of the public transport operators, 10 of these will be City Direct services provided by private operators.

8.14.6 Journey Planning

To help commuters better plan their journeys, information about the crowd density level at each station will be provided routinely throughout the day.

9. Vientiane

Changhwan MO, Bo Young KIM, Young Seok PARK, Arie KIM and Ryan HUNTER

9.1 National and City Statistics

Table 2.9.1 Basic facts about Lao PDR

Contents	Status
Land area (thousands km^2)	236.8
Population (millions)	6.590
Major language	Lao
Capital city	Vientiane
Currency	Kip
GDP (US$ billions)	9,300
GDP per capita (US$)	1,453

Source: Central Intelligence Agency. (2013). "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/id.html> (Accessed on Jan. 10, 2014).

The official name of Lao PDR is the Lao People's Democratic Republic and Vientiane has been its capital city since 1560. Lao PDR, a landlocked country, is located at the 14.1 to 22.3 latitude with a land area of 236.8 thousand km^2. It is bordered by Vietnam to the east, Thailand to the west, Cambodia to the south and China and Myanmar to the north. The average temperature is 28 degrees Celsius and the highest temperatures occur in April, with 38 degrees being the norm, while the minimum is about 15 degrees in December. The rainy season is from May to September, and the average annual rainfall is around 2,045 mm. The dry season is from October to April, and especially during December and January, there is hardly any rain.

The total population was around 6.6 million in 2013, and the population

density is 26 people per km^2, which is the lowest in Southeast Asia. The annual population growth rate on average was 2.2%. Considering the population demographics, 50% of the people were less than 20 years old, followed by 29% between 20 and 39 years old and 20% of 40 years old or older.

The country's GDP has been growing around 8% per year, and the total GDP was approximately US$93 billion in 2013. The GDP per capita was about US$1,453. Based on the exchange rate as of October 2013, US$1 equals 7,883 kip, which is the base currency of Laos.

Table 2.9.2 *Overview of Vientiane*

Contents	Status
Population of total city (thousand, 2013)	>800
Population growth (% annual, 1985-2005)	3.1
Population density (people/km^2)	201
Land area (km^2, 2011)	3,920
GDP per capita (US$, 2011)	1,069
GDP growth rate (%, 2008)	7.6

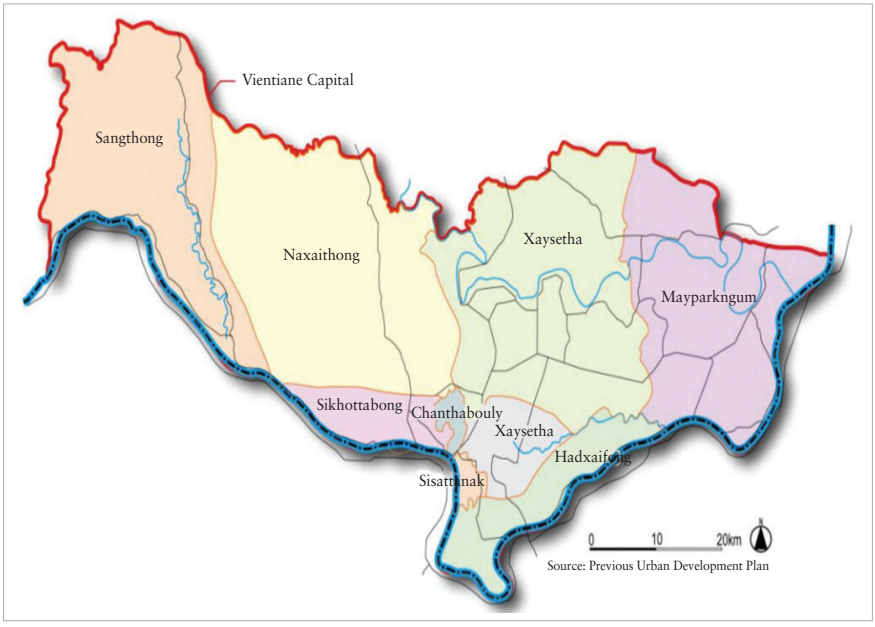


Figure 2.9.1 *Map of Vientiane*

Source: Inthavongsa, Phongsavanh. (2014). "Current Status of Urban Transport System in Vientiane Capital." In *Proceedings of 2nd ASEAN-Korea Public Transport Workshop.* 4-6 August. Jakarta, Indonesia: The Korea Transport Institute. p. 278.

As of 2013, the population of the city was in excess of 800,000, and the average population growth rate from 1985 to 2005 was 3.1%. The population density is 201 people per km^2. Additionally, increasing population levels in the main city have caused environmental problems and a lack of water.

The capital, located on a curve of the Mekong River, consists of nine districts: Chanthabouly, Sikhottabong, Xaysettha, Sisattanak, Naxaithong, Xaythany, Hadxaifong, Sangthong and Pak Ngum. The GDP per capita of the city was US$1,069 in 2011 and its growth rate was 7.6% in 2008. The main contributing sectors to this growth are manufacturing, mining, quarrying and services. The total area is about 3,920 km^2.

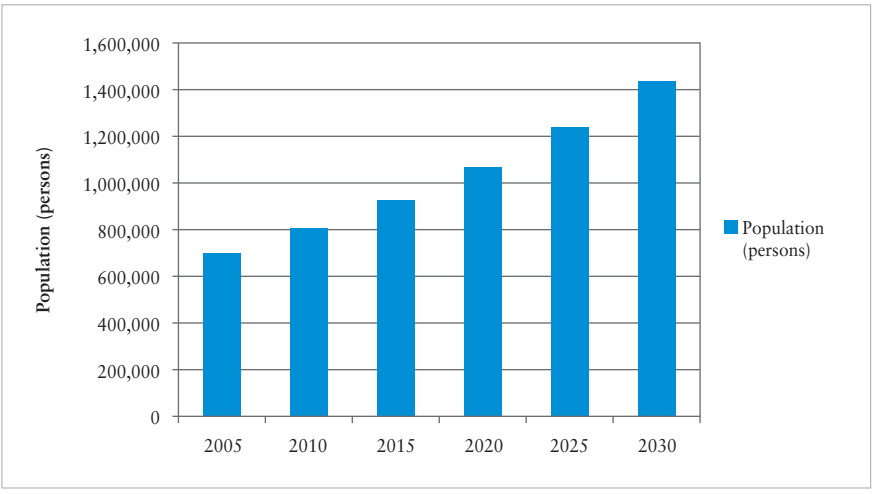


Figure 2.9.2 Population projection for Vientiane

Source: PTI(Public Works and Transport Institute) and JICA(Japan International Cooperation Agency) Study Team. (2011). *Vientiane Capital Urban Development Master Plan*. Vientiane, Lao P.D.R.: JICA. p.4.

As seen in the above graph, the population in 2030 will double from the current population, and there will be an increase in the labor population of 400,000 persons in 20 years. With the additional population, the sanitation and solid waste disposal system will be a public health problem. The annual average growth rate of the Gross Regional Domestic Products (GRDP) was 8.0% in the same period. The growth of the economic sector will be 2.4 times the growth of the primary sector, 6.4 times that of the secondary sector, and 4.3 times that of the tertiary sector.

9.1.1 Types of Public Transportation

The Vientiane public transportation system consists of land-based modes such as buses and coaches. The city also has water transportation such as ferries and boats. A small passenger ferry port is operating from Vientiane. Ferries and boats are used for travel between Lao PDR, China, Myanmar and the Mekong areas of Thailand. Air transportation, such as domestic air travel, is run by the state due to the high operation costs. There is an

Figure 2.9.3 *Motorcycle taxis*

Source: Inthavongsa. (2014). p. 283.

Figure 2.9.4 *Tuk-tuks*

Source: Inthavongsa. (2014). p. 283.

Figure 2.9.5 Sonteos

Source: Inthavongsa. (2014). p. 283.

international airport within the city area and a 3.5 km railway line is being extended through the Friendship Bridge from Thailand to Vientiane.

There are bus systems in Vientiane that cover intra-city, intercity and international routes. In addition, paratransit modes are available such as motorcycle taxis, trucks and taxis. However, despite these modes public transportation, most low-income civilians use motorcycles. Also, access to public transportation is difficult for foreigners and tourists due to the complexity and lack of information about the transport. For long-distance trips within the city, there are luxury buses where passengers can lie back and enjoy air-conditioning for the long service routes. For regular trips, a city bus service is available. The "sonteo," which is one-ton truck converted to carry passengers in the back, runs short-distance trips. The motorcycle taxis, called tuk-tuks or jumbos, and mini buses operate in Vientiane for short trips within the downtown area.

9.1.2 Service Levels of Public Transportation

The main mode of travel in Vientiane that is available as a public transportation service is the city bus. However, bus service levels in the city remain inferior to other modes of transportation. Eleven bus routes are operated by the Vientiane Capital State Bus Enterprise (VCSBE) in addition to 12 minibuses and three electric buses.

Figure 2.9.6 *Vientiane city buses*

In 2012, 42 buses equipped with air-conditioning were provided by the JICA. After the introduction of the buses, bus ridership greatly increased. More buses are necessary, however, to fulfill the transportation needs of the citizens in Vientiane, and the roads need be improved so that there would be less illegal parking and better streets, which would also improve the

Table 2.9.3 *Bus routes run by VCSBE*

No.	Route	Bus	Fare (kip)	CBS departure time and headway
14	CBS – Friendship Bridge	New bus	6,000	5:50 – 18:00, every 15 minutes
20	CBS- Dong Kham xang	Minibus	4,000	6:30 – 17:20, every 25 minutes
23	CBS – SBS - ThaNgon	New bus	5,000	5:45 – 17:30, every 20 – 30 minutes
29	CBS – SBS - Dong Dok	New bus	3,000	6:30 – 18:00, every 15 – 20 minutes
30	CBS – Thongpong	New bus	4,000	6:00 – 17:30, every 20 – 30 minutes
31	CBS – Phontong – Dong Dok	New bus	3,000	6:10 – 17:30, every 20 minutes
32	CBS – Donepamay	Minibus, Electric bus	2,000	6:30 – 17:55, every 15 – 20 minutes
33	CBS – Nongtha – Dongdok	New bus	3,000	6:10 – 17:20, every 30 – 60 minutes
49	CBS – Sikay – Nongtang	Minibus	4,000	6:15 – 17:30, every 35 – 60 minutes
08	CBS – Northern Bus Terminal	New bus	5,000	6:00 – 17:00, every 30 minutes
05	CBS - Namsuamg	Minibus	10,000	10:30, 16:30

Note: CBS (Central Bus Station), SBS (Southern Bus Station) CBS: Central Bus Station, SBS: Southern Bus Station
Source: Inthavongsa, Phongsavanh. (2014). p. 286.

reliable and safe bus operations.

Buses run from the Central Bus Station to various destinations within the city boundaries at intervals that vary between 15 minutes and one hour. The buses usually run from around 6 a.m. to 6 p.m.

9.2 Transport Infrastructure Investment and Financing

A total investment of US$82.37 million for a demonstration project selected by the ADB will be made in the Vientiane Sustainable Urban Transport Project. The technical assistance from the ADB includes institutional and capacity development, a pilot public transportation service and facilities, a parking structure and facilities, and a demonstration traffic management scheme.

Table 2.9.4 Cost by component

Public components	Subcomponents	Cost (US$ million)
Public transport	BRT infrastructure	17.97
	BRT vehicles	13.27
	Fare system and ITS	7.20
	Land and management entity	1.36
Traffic management	Traffic signal system and signage	1.15
	Traffic control center	2.20
Parking system	Parking management / enforcement	4.38
	Electronic vehicle registration	4.19
Non-motorized transport	NMT infrastructure	1.82
Institutional capacity	Technical support and training	1.26
Public administration	PMU in-kind support	0.30
Project supervision	Detailed design and supervision	7.47
Contingencies	Project contingency	17.90
Financing charges	Charges during implementation	1.90
Total		82.37

Source: Onnavong, Bounta. (2014). "Efforts on Sustainable Urban Transport for Vientiane, Lao PDR." In *Proceedings of 2nd ASEAN-Korea Public Transport Workshop*. 4-6 August. Jakarta, Indonesia: The Korea Transport Institute. p. 270.

The main contributor to the project will be the ADB, and the other contributors will be the OPEC Fund for International Development, the European Investment Bank, the Global Environment Facility and the Private Sector Investment and Government of Lao PDR.

Table 2.9.5 Financing sources

Source	Amount (US$ million)	Share of total (%)
Asian Development Bank	35.00	42.4
OPEC Fund for International Development	15.00-20.00	18.2
European Investment Bank	15.00-20.00	18.2
Global Environment Facility	2.00	2.4
Private Sector Investment	8.57	10.4
Government of Lao PDR	7.26	8.8
Total	82.37	100.0

Source: Onnavong. (2014). p. 270.

9.3 Ownership, Operation, and Regulations of Public Transport

9.3.1 Public Transportation Regulations

There are several laws in effect for urban transportation. The names of these laws are:

- Road Law
- Land Transport Law (revised in 2013)
- Traffic Law (revised in 2013)
- Multimodal Transport Law (newly enacted in 2013)
- Regulation No. 849/MPWT on Permissible Gross Weight (PGW), dated 5 March 2002
- Minister Decision No. 2184/MPWT on the increase of PGW on NR 3 and NR 9 to 11 Tons/Axle, dated 3 July 2006

9.3.2 Public Transportation Ownership and Operation

The Vientiane State Bus Company (VSBC) is the main operator of intercity urban transit in Vientiane. However, the three newest stations and some specific routes are operated by private bus corporations. As for paratransit, there are associations for taxis, tuk-tuks and sonteos run by the Department of Public Works and Transport (DPWT) and the Vientiane Capital.

Table 2.9.6 Overview of transportation operations in Vientiane

Item	Vehicle type	No. of passengers	Operation	Min. fare (kip)	Trip type
A. Mass transit vehicles					
1	Big buses	By type	State/private	By distance	Long trips
2	Medium buses	45 seats	State/private	4,000	Short trips
3	Mini buses	25 seats	State	4,000	Short trips
B. Paratransit vehicles					
4	Sonteos	12 Passengers	Private	By distance	–
5	Three-wheel taxis (Tuk-Tuks)	8 Passengers	Private	25,000	Urban trips (Local)
6	Three-wheel taxis (Jumbo)	4-5 Passengers	Private	35,000	Urban trips (Local)
7	Taxis	4-5 Passengers	Private	50,000	Urban trips (Local)
8	Taxis (Vans)	8-15 Passengers	Private	By distance	–
9	Motorbikes	1-2 Passengers	Private	By distance	–
10	Small ferries	20 Passengers	Private	By distance	–

Source: Onnavong, Bounta. (2013). "Public Transportation - Vientiane, Lao PDR." In *Proceedings of ASEAN-Korea Capacity Building Programin Korea: Education Program in Korea*. 17-26 Feb. Goyang, Korea: The Korea Transport Institute. p. 246.

9.4 Road Infrastructure

Roads are classified as National, Provincial, District, Urban, Rural and Special. The types of paving are concrete, asphalt concrete, gravel and earth. Paved and gravel roads occupy highest percentage with a length of 191.78 km and 179.19 km, respectively. The total length of the road network is approximately 587.67 km.

Table 2.9.7 Road network length in Vientiane in 2013

Vientiane capital urban road network	Length (km)
Concrete	72.18
Asphalt concrete	46.34
Paved	191.78
Gravel	179.19
Earth	98.18
Total	587.67

Note: From Department of Roads and MPWT in 2013
Source: Inthavongsa. (2014). p. 279.

While there has been a decrease in the length of paved and earth roads, roads made of concrete, asphalt, and gravel have been extended. This could mean that road conditions are improving by creating more paved roads rather than maintaining the unpaved ones.

9.5 Railway Infrastructure

There is no urban railway infrastructure in Vientiane. The Thanaleng Railway Station is located 20 km east of Vientiane and 4 km north of the border between Laos and Thailand along the Mekong River. The station opened on March 5, 2009, becoming part of the first international railway link serving Laos.

9.6 Vehicle Statistics

Table 2.9.8 Volume, index, structure of passenger transport and passenger traffic for Laos in 2012

Year	Passenger transport (Unit: thousands, persons)				Passenger traffic (Unit: millions, km)			
	Total	By land	By water	By air	Total	By land	By water	By air
2012	50,685.9	47,609.0	2,652.0	424.9	2,849.6	2,618.9	71.8	158.9
1990	13,177.6	12,587.8	469.0	120.8	447.8	383.2	19.1	45.4
Index (1990=100%), 2012 Percentage increase from 1990-2012:								
2012	384.6%	378.2%	565.5%	351.8%	636.4%	683.4%	376.2%	349.8%

Source: Ministry of Public Work and Transportation. (2012).

The volume, index, and structure of passenger transport and passenger traffic are shown in the above table for the whole country as of 2012. According to the MPWT, the number of travelers is about 50,686 for passenger transport, which is 3.8 times more than the number in 1990. For passenger traffic, there was a 60% increase during the same period, and land public transport showed the largest increase.

Table 2.9.9 Number of vehicles by type from provinces in Vientiane in 2012

Provinces	Motorcycle	Wheel car	Sedan	Pickup	Jeep	Van	Truck	Bus	Total
Vientiane	381,700	3,440	28,525	68,483	12,288	22,940	16,918	1,241	535,535

Source: Ministry of Public Work and Transportation. (2012).

According to the MPWT's statistics in 2012, Vientiane had a total of 535,535 transportation vehicles, which accounts for 42% of the total transportation vehicles in the country. Motorcycles make up the outstanding portion of transportation modes, with around 70% of the total transportation in the city, matching the trend of the overall transportation of the country. Buses, as a public transportation ratio, accounted for the lowest proportion.

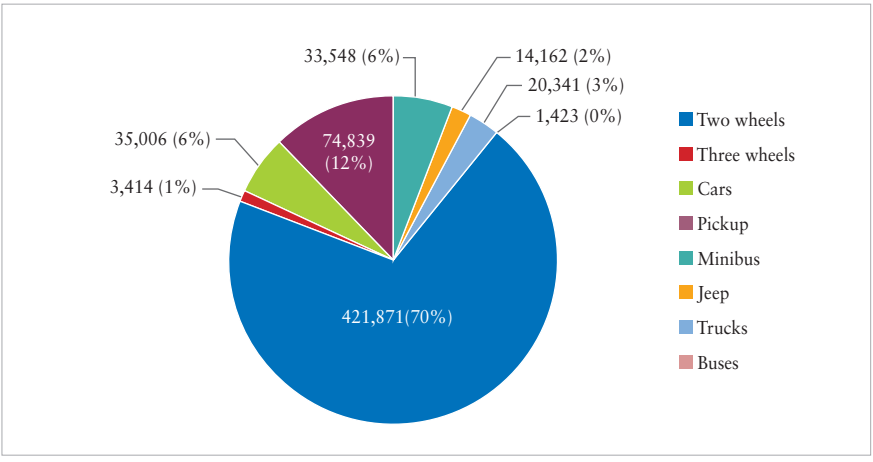


Figure 2.9.7 Number of vehicles in Vientiane by type (2013)

Source: Inthavongsa. (2014). p. 281.

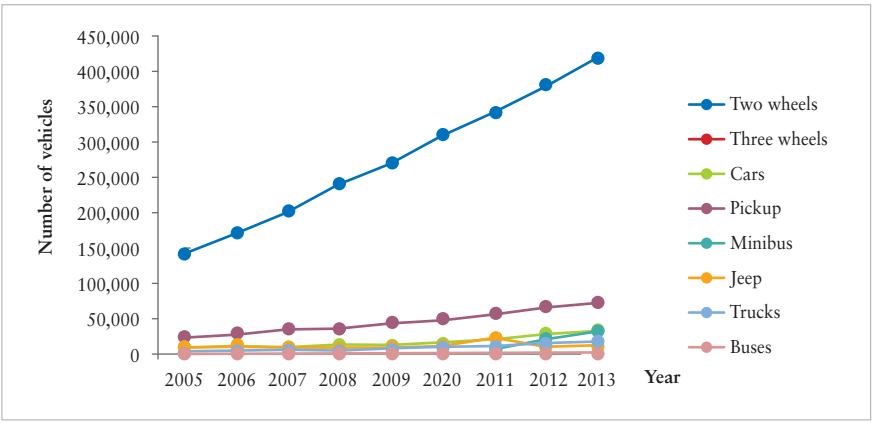


Figure 2.9.8 Annual increase in number of vehicles in Vientiane (2005-2013)

Source: Inthavongsa. (2014). p. 281.

The total number of vehicles officially registered in Vientiane increased about 15 percent from 2005 to 2013 (Inthavongsa, 2014). Motorcycles (with two wheels and three wheels) have the highest share with 70.34%, while light vehicles (cars, pickups, minibuses and jeeps) make up 26.06% and heavy vehicles (trucks and buses) 3.06% (Inthavongsa, 2014). The total number of vehicles registered by 2013 was around 1,439,481.

Notably, most of the transportation was concentrated in the capital city. Vientiane single-handedly accounts for more than 40% of the overall national figure. Such a concentration of vehicles in the urban district corresponds directly with the pressure on its transportation infrastructure and traffic management.

The number of vehicles rapidly increased from 2005 to 2013. This has created a positive impact on national socioeconomic development and has created benefits for the transportation of goods. It also has some negative aspects, including such emerging issues as traffic accidents, more fuel consumption, health problems from vehicle emissions, and noise for people along the roadsides.

9.7 Traffic Safety Indicators

Information on traffic safety is available in the national index as well as in the data collected from Vientiane.

Table 2.9.10 Traffic accident statistics in Lao PDR (1)

Year	Population	Vehicle registration	Fatalities	Accidents
2006	5,747,587	568,290	480	4,620
2007	5,873,016	641,081	608	5,198
2008	6,000,380	768,606	616	5,025
2009	6,127,911	886,348	765	5,233
2010	6,256,197	1,008,788	790	5,638
2011	6,385,057	1,141,858	856	6,462
2012	6,514,432	1,288,700	888	6,146
2013	6,644,009	1,439,481	910	5,931

Source: Inthavongsa. (2014). p. 281.

In 2013, of the 5,931 traffic-related accidents in Laos, there were 910 fatalities. In spite of the fact that the number of accidents has been showing a decreasing trend since 2011, the number of fatalities has clearly been on the rise.

Table 2.9.11 Traffic Accident Statistics in Lao PDR (2)

Year	Road traffic fatality rates		
	Per 100,000 population	Per registered vehicles (10,000 vehicles)	Per accident
2006	8.35	8.45	10.39%
2007	10.35	9.48	11.70%
2008	10.27	8.01	12.26%
2009	12.48	8.63	14.62%
2010	12.63	7.83	14.01%
2011	13.41	7.50	13.25%
2012	13.63	6.89	14.45%
2013	13.70	6.32	15.34%

Source: Inthavongsa. (2014). p. 281.

On average, about 12 people were killed on the road per 100,000 people, and approximately eight people died on the road for every 10,000 vehicles. The death rate per accident equates to 13.25%.

Table 2.9.12 Traffic accident statistics in Vientiane (1)

Year	Population	Vehicle registration	Fatalities	Accidents
2006	711,919	231,869	119	2,091
2007	725,820	275,473	171	2,295
2008	740,010	319,511	165	2,015
2009	754,384	365,903	203	1,857
2010	768,743	419,167	212	1,884
2011	783,032	472,079	191	1,994
2012	797,130	535,535	205	1,644
2013	810,846	604,604	189	1,554

Source: Inthavongsa. (2014). p. 282.

The statistics show a decrease in the number of traffic accidents in the city over a seven-year period from 2006 to 2013. The number of accidents amounted to 2,091 in 2006, while the number decreased significantly to 1,554 in 2013. However, the fatality rate has remained steady at around 200 deaths per year since 2009. The chart shows some fluctuations over the years, but in 2006 there were 119 deaths in the city, a significantly smaller number than in later years. In 2013, the number of fatalities was 189.

Table 2.9.13 Traffic accident statistics in Vientiane (2)

Year	Road traffic fatality rates		
	Per 100,000 population	Per 100,000 population	Per accident
2006	16.72	5.13	5.69%
2007	23.56	6.21	7.45%
2008	22.30	5.16	8.19%
2009	26.91	5.55	10.93%
2010	27.58	5.06	11.25%
2011	24.39	4.05	9.58%
2012	25.72	3.83	12.47%
2013	23.31	3.13	12.16%

Source: Inthavongsa. (2014). p. 281.

The annual traffic accident data show a growing trend of road fatalities in Vientiane. On average, approximately 24 people died per 100,000 people and five people died for every 10,000 vehicles. Also, the death rate per accident amounted to 9.72% on average.

Table 2.9.14 Number of accidents in the provinces of Lao PDR in 2012

Name of province	Injured persons and deaths			
	Minor	Serious	Severe	Death
Vientiane	1,188	957	284	205
national	5,475	3,476	1,240	888

Source: Traffic Police Department, Ministry of Public Security. (2013).

Shown above is partial statistics on the number of accidents in the provinces of Lao PDR acquired from the Traffic Police Department in 2012. The percentage of road injuries and deaths in Vientiane Capital is about 20-25% that of the entire nation. The causes of accident include disregarding road regulations such as speed limits and traffic lights and drunkenness or drowsiness on the road.

According to the Traffic Police Department, there were 4,187 accident cases in Vientiane alone in 2012, comprising 29% of the 14,175 cases nationally, which can be said to be a lot considering that Vientiane comprises only about 1/6th of the nation's population. Most of the accidents were caused by unlicensed driving and drinking and driving.

Table 2.9.15 Number of accidents in the provinces of Lao PDR in 2012

Name of province	Injured persons and deaths			
	Drunk	Aged under16	No driver's license	Other
Vientiane capital	1,101	151	1,291	1,644
National	1,943	752	5,334	6,146

Source: Traffic Police Department, Ministry of Public Security. (2013).

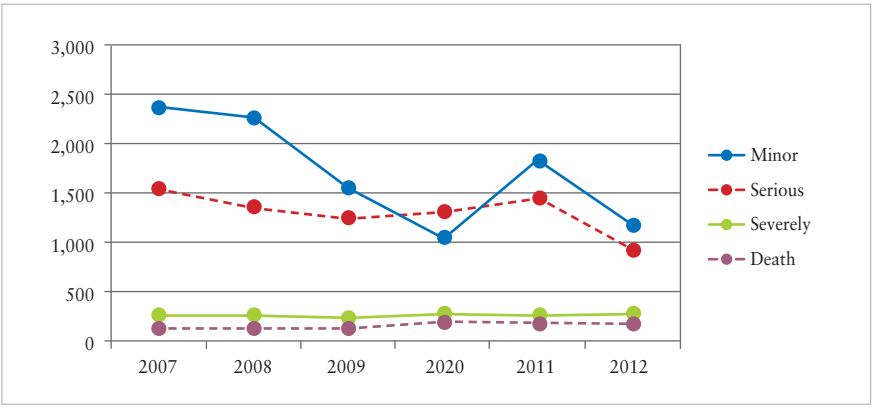


Figure 2.9.9 Seriousness of accidents in Vientiane

Source: Traffic Police Department, Ministry of Public Security. (2013).

The number of severe and fatal injuries has remained steady since 2007, while the number of minor to serious injuries is decreasing.

9.8 Travel Behavior

In 2007, most trips taken in Vientiane were home-related. There were people going to work and school as well. For every type of trip, people used personal vehicles the most and most of them drove motorcycles rather than cars. Motorcycles made up the highest portion of the trips, while public transport was almost not an option. No one took public transportation to go to school. Walking made up a considerable portion of the travel methods as well.

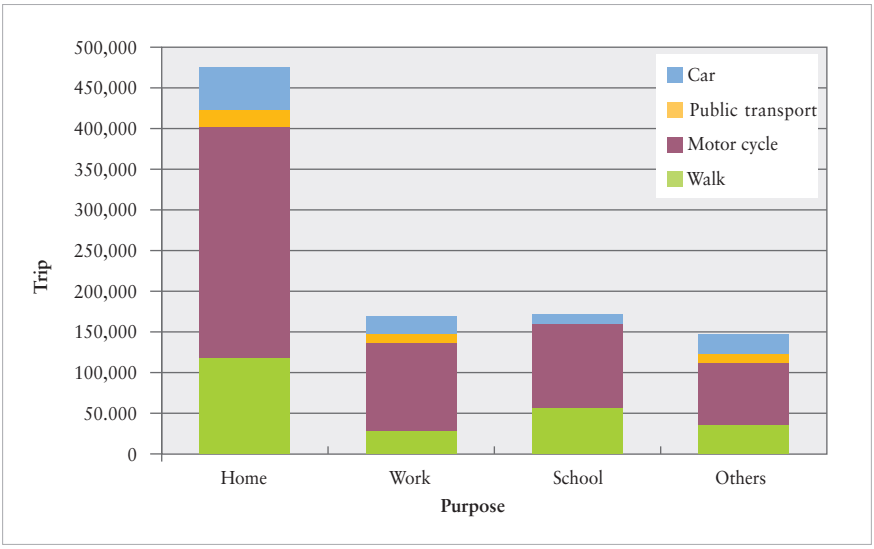


Figure 2.9.10 Trip share in Vientiane (2007)

Source: TodaT. (2008).

9.9 Air Pollution and Vehicle Maintenance Standards

Lao PDR is facing several environmental challenges. Unsustainable exploitation of resources has affected the urban environment and become one of the nation's ecological problems. The degradation of land, combined with declining water quality and increasingly worse urban air quality, is disproportionately affecting the lowest-income group in the country. In particular, second-hand vehicles equipped with two-stroke engines have had an adverse effect on the urban environment over the last decade.

Table 2.9.16 Fuel quality and vehicle emission standards in Lao PDR

Division	Contents and standards
Sulphur (max, ppm)	Diesel: 2,500
Fuel quality comment	Lead information from PCFV workshop. Source: PCFV workshop, 4-5 August, 2008.
Vehicle standards, inspection and maintenance (I/M)	Ratio of diesel to petrol vehicles: 70:30
Vehicle comments	PM10 levels: high (2013) Sulphur and NO_2 levels: low

Source: UNEP. (2012). "Status of Fuel Quality and Vehicle Emission Standards in Asia-Pacific." <http://www.lead.org.au/PCFV/Lead_Matrix_AP_201206.pdf> (Accessed on 17 Oct. 2014).

Fuel quality and vehicle emission standards in Lao PDR are listed in the table above. The maximum amount of sulphur containment is restricted to 2,500ppm for diesel. The proportion of diesel to petroleum in vehicles is 70:30. Air quality testing in 2003 indicated that PM10 levels are high, but sulphur and NO2 levels are low. There are no standards for improving sustainable environment.

9.10 Traffic Congestion

The pressure on urban transport systems has been building up slowly. Since the number of vehicles in Vientiane has been increased in line with national figures, urban infrastructure in the city needs to be upgraded and mass transit systems must be introduced. There are many illegally parked vehicles on the roadsides, and heavy traffic congestion during rush hours is getting worse.

9.11 Organizations of Public Transport Administration

The Ministry of Public Works and Transport (MPWT) is the primary national government body in charge of transportation in the country. It takes care of overall transportation matters such as the development of national and provincial roads, civil aviation, urban transport systems, river wharves and river and road transport. For better implementation, there are Departments of Public Works and Transport (DPWT) in each provincial area and branch offices in districts within the provinces.

The MPWT adopted a delegated, decentralized system for coordination and implementation after a recent reorganization of its institutional structure. It is in charge of overall operations, but has delegated certain project management and maintenance responsibilities to Departments of Public Works and Transport (DPWTs) in each province. The provinces prepare and submit annual implementation plans for transport projects to the MPWT based on five-year master transport plans.

Likewise, the provincial DPWTs have delegated various tasks to offices of public works and transport headed by DPWT staff. The DPWTs report to the provincial governor for budget purposes, but also to the MPWT for compliance with national technical standards. Although the MPWT provides partial budgetary support for routine and periodic maintenance,

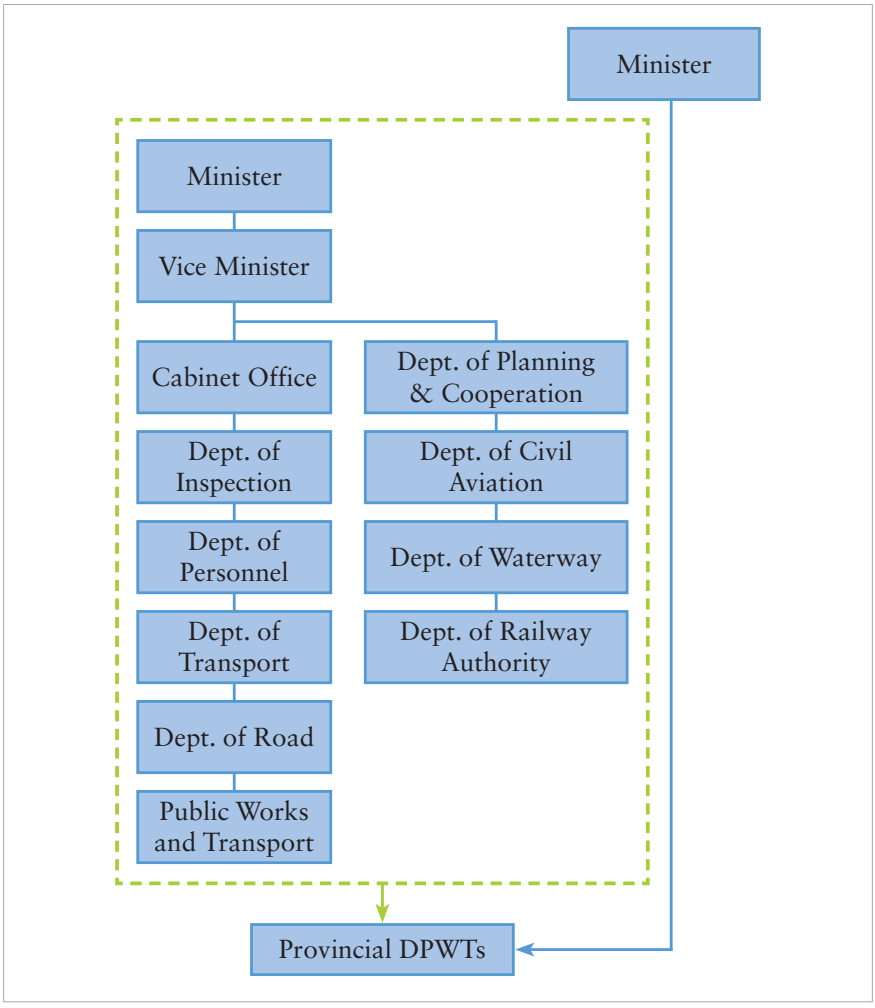


Figure 2.9.11 *Organization chart of MPWT*

implementation is carried out by the DPWTs, which requires adequate technical capacity at the provincial and district levels. (ADB, 2010)

The office of public transport in Vientiane under the Department of Public Works and Transport of Vientiane is in charge of the administration of public transportation. It controls all public transport operators, state and private bus companies and all paratransit operators through each association in services routes. It is also in charge of reviewing transport policy and making suggestions to higher organizations to make the policies fit to national and local standards.

9.12 Public Transport and Planning

9.12.1 Overview of Public Transport Planning

Vientiane was selected by the Asian Development Bank (ADB) as a site for a demonstration project, along with Davao, Philippines and Medan, Indonesia. The project's components include not only a public transport system, but also parking management and enforcement, a traffic management system, public spaces and non-motorized transport and institutional capacity development. For this project, an 84km public transport network is going to be constructed, with 11.5 km of BRT line dedicated to buses only (Onnavong, 2014).

Table 2.9.17 Vientiane sustainable transport project

2014	2015-6	2017-8	2019
• ADB-MPWT fact-finding • PMU (Project Management Unit)/ Management entity decision • PMU begins operating • ADB management review meeting • Recruitment of consultant packages (two recruitments) • ADB Board approval	• Mobilization of international advisors • Mobilization of detailed design consultants • Detailed design • Recruitment of construction firms • Recruitment of management entity personnel	• Construction • Procurement of buses and ITS equipment • Tendering of vehicle operators, station services, ITS and fare system management, clearing-house, parking concession • Establishment of management entity	• Construction completed • Vehicles and equipment delivered • Commencement of public operations

Source: Onnavong. (2014). p. 271.

According to the ADB, The institutional and capacity development component will cover an institutional framework, funding mechanism, and capacity building for a proposed Pilot Environmentally Sustainable Transport (EST) Agency (PEA) to manage the operation and maintenance of the pilot services and eventually extend them to other areas in Lao PDR.

The implementation of a pilot public transport service and facilities will likely consist of two closed-loop routes that will provide public transport bus coverage to essentially the entire city core area. The construction of a parking structure and facilities is necessary to relieve congestion in the core area. The demonstration traffic management scheme is expected to involve the introduction of effective traffic and parking enforcement; education of drivers, other road users, and traffic regulators; and improved coordination and control of new initiatives for development in the Vientiane core area (Miller, 2014).

9.12.2 Bus System, BRT and LRT

Improved Bus System

This development plan is for the availability and improvement of existing facilities and system. Restructuring will be achieved to have flexible routes and a wide range of vehicle capacity. Also, this system will pursue maximum efficiency for priority lanes, signals and intersections, and the operation system and fares.

BRT

A BRT system will be developed to greatly improve the capacity, reliability and travel speed of buses on the roads. Also, exclusive lanes in the CBD and mixed lanes in the suburbs will be made for flexible routing. Minor new facilities will be used to improve the bus system. The capacity will be 150 people per two vehicles.

Figure 2.9.12 *Images of BRT*

Source: Onnavong. (2014). p. 262.

Buses can be seen as the only land public transport in Vientiane, so improving the service is a big issue.

LRT

The BRT and LRT were proposed by the JICA in 2008 to prevent serious traffic problems in the future. For this, research has already taken place, first for an optimal system for the BRT, including five sets of combinations that were evaluated by applying a cost-benefit analysis (Phanthaphap et. al., 2008). Also, short-range transit planning and design was studied with a financial simulation (Sengsavath et al., 2009). Through the introduction of such a system, they will also be able to reduce CO_2 emissions.

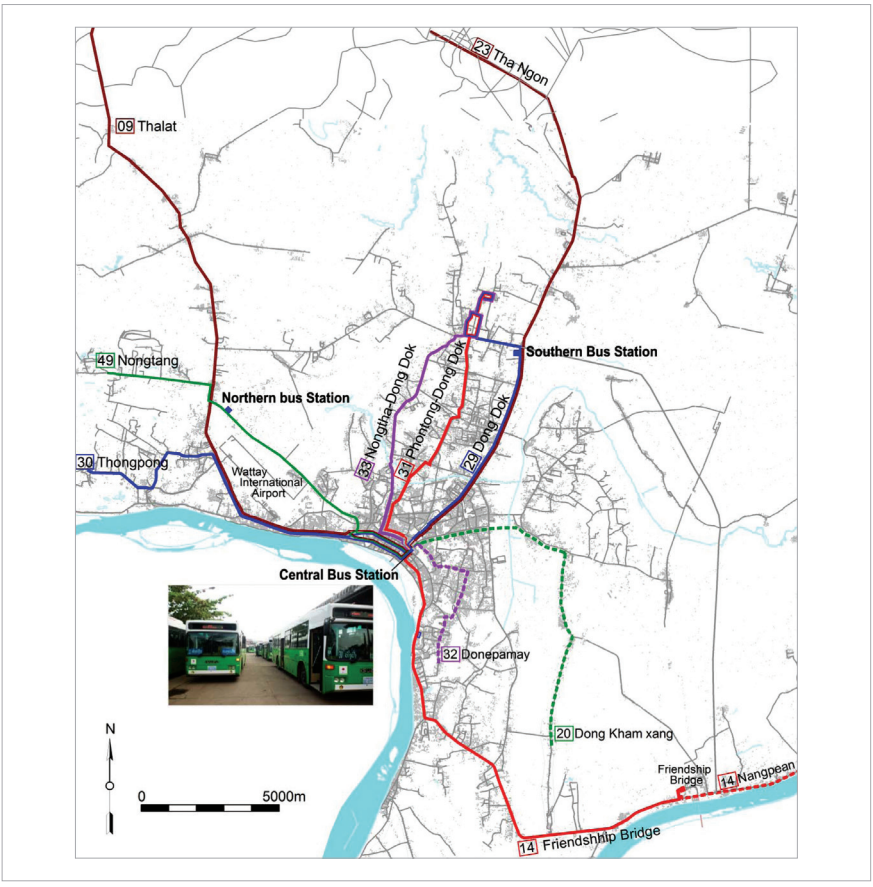
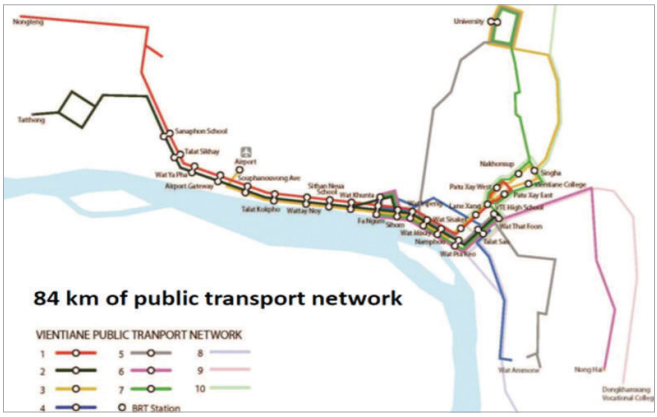


Figure 2.9.13 *Map of bus lines in Vientiane*

Source: JICA. "Vientiane Capital State Bus Enterprise." <http://www.jica.go.jp/project/laos/010/map/> (Accessed on 18 Oct. 2014).

To improve the BRT system, the LRT was also planned. The capacity will be 240 passengers, with three fleets.



(i) Public transport network

(ii) Dedicated busway

Figure 2.9.14 *Public transport network and dedicated busway*

Source: Onnavong, Bounta. (2014). p. 261.

10. Yangon

Changhwan MO, Bo Young KIM, Young Seok PARK, Arie KIM, and Ryan HUNTER

10.1 National and City Statistics

Table 2.10.1 Basic facts about Myanmar

Contents	Status
Land area (thousands km^2)	676,578
Population (thousands)	64,952
Annual population growth (%)	1.9
Major language	Burmese
Capital city	Nay Pyi Taw
Currency	Kyat
GDP (US$ billion, 2012)	53.14

Source: Central Intelligence Agency. (2014). "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/th.html> (Accessed on 17 Oct. 2014).

Myanmar is a country located in Southeast Asia, and borders Bangladesh and India to the west, Thailand and Laos to the east and China to the north. Its land area is 676,578 km^2. Myanmar is divided into seven administrative states and seven administrative divisions. The country has a population of 65 million, thus making it the 23rd most populated country in the world. More than 70% of the people in Myanmar live in rural areas. The country's primary language is Burmese. The currency used in Myanmar is the kyat[1], and the GDP of Myanmar in 2012 was approximately US$53 billion.

1 One U.S. dollar was equivalent to around 964 kyat on Aug. 5, 2014.

Table 2.10.2 Overview of Yangon

Contents	Status
Population of the city (million, 2013)	5.0
Annual population growth (%)	3.0
Population density (per km^2)	6,380
Land area (km^2, 2014)	784

Note: The World Bank (2012) reported the population to be 6.1 million in 2012, the population density to be 10,000 and the land area to be 600 km^2.
Source: Lat, Kyaw. (2014). "Yangon's Challenges in Transportation Sector and Future Plan." In *Proceeding of 2nd ASEAN-Korea Public Transport Workshop*. 4-6 Aug. The Korea Transport Institute, Jakarta, Indonesia. pp. 209-223.

Yangon, the most populated city in Myanmar, has a population of around 5 million according to Lat (2014). Although Nay Pyi Taw is officially the country's capital city, Yangon is the most important and powerful city in Myanmar. It has grown rapidly up until now, and retains a steady population growth of around 3% per annum. The city has a population density greater than 6,380 persons/km^2. Its unique features include Nga Moeyeik Creek, which flows into the center of Yangon City and was the primary reason for boats becoming one of the city's main urban transportation methods.

Yangon could be considered a metropolitan city, as it possesses the necessary characteristics, elevated levels of population and population density of such a city. The city's population accounts for 11% of the total population of Myanmar. The total land area of the Yangon region is

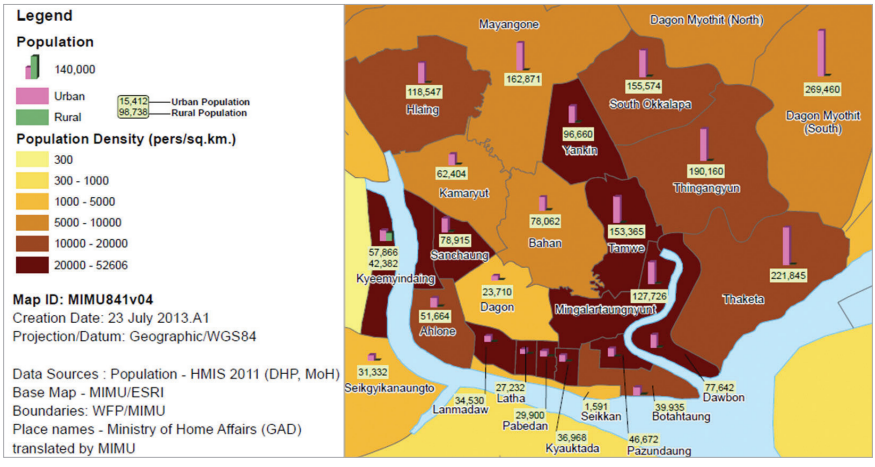


Figure 2.10.1 Population density map of Yangon (2011)

Source: Myanmar Information Management Unit. (2013).

around 784 km^2 and it is surrounded by the Bago East, Bago West, and Ayeyarwady regions. There are two major ports in Yangon, Thilawa Port and Yangon Port, where in excess of 80% of Myanmar's international exchanges are handled.

10.2 Public Transit Level of Service

10.2.1 Overview of Public Transit in Yangon

Table 2.10.3 Types of public transportation service in Yangon

Transportation	Service	Rate (Kyat)
Buses	Ordinary and special buses are available.	200-300 for special bus 50-200 for ordinary bus
Circular trains	These go around the Yangon region in a circle. They are useful for trips to the outskirts of the town, though the trains are very outdated.	1,000
Taxis	These are convenient. Fares are negotiable since there are no government regulations on them.	1,500-2,500
Three-wheeled cycles	This is a tricycle taxi known locally as a "cycar." They are used only for short distances in the center of the city.	200-300
Ferry	It is provided by Inland Water Transport (IWT).	1000-8,000

Source: UNCRD. (2010).

There are various types of public transportation services available in Yangon. The service fare differs depending on the type of vehicle and on whether the passenger is a local resident or a foreigner. Taxis are the most convenient and accessible mode of travel, but fares are sometimes rather exorbitant for foreigners. Buses and trains are an important mode of public transportation for the majority of working-class people. Buses are almost always cheaper and faster than other transportation modes, and most belong to private companies. The circular train runs slowly from the main railway station in Yangon around the various neighborhoods in a circular manner. The Inland Water Transport (IWT) is run by the state and has more than 500 boats that carry around 1.5 million tons of cargo and 14 million people annually. Unlike most other cities in Southeast Asia, Yangon has banned the use of motorcycles in the center of the city since 2003, so it is rare to see motorcycles on the streets of the city.

Buses

Table 2.10.4 Urban bus transport in Yangon (2009)

Bus routes	310 (15 main organizations)
Bus fleet	6,330
Bus trips/day	30,876 trips
Passengers/day	3.14 million

Source: Fourth Regional EST Forum. (2009). "Presentation of Myanmar." p. 7. <http://www.uncrd.or.jp/content/documents/4EST-B1G502.pdf> (Accessed on 18 Oct. 2014).

Regarding the bus transport services in Yangon, there are 310 routes and more than three million people use buses every day. Bus passengers in some buses have been able to use an electronic ticket system since 2012, but it has not been widely utilized by the locals. Furthermore, the level of comfort for the users of public transportation in the city is very low, with people stuffed into small buses and traffic jams being commonplace.

Figure 2.10.2 A bus in Yangon (1)

The Yangon Regional Government is waiting for permission from the Myanmar Investment Commission (MIC) to launch a bus rapid transit (BRT) system in Yangon to relieve the heavy traffic congestion in the city. The BRT system is being planned and implemented as a part of the Greater Yangon Strategic Development Plan, undertaken by the Yangon City Development Committee (YCDC).

Figure 2.10.3 A minibus in Yangon

Rail

Myanmar Railways, the government-owned rail company, operates the railway system. Locomotives in Myanmar are often a hindrance to the rail transportation system because most of them are severely outdated. Despite a maximum speed setting of 70 km per hour, trains maintain an average speed of 40 km per hour on the Yangon-Mandalay railroad, so takes 15 hours to travel the 620 km from Yangon to Mandalay. The first-ever run

Figure 2.10.4 Yangon railway station

of a special express train from Yangon to Kyaikhto commenced at Yangon Railway Station. The express train, imported from Japan, is fully equipped with air-conditioning and toilets, and is able to carry 115 passengers.

There is a well-established circular rail line in Yangon. It runs 21 trains that make 200 trips daily and carry approximately 130,000 passengers. According to the Yangon Central Railway Station, around 100,000 people use the circular train every day, including 200 foreigners. This amounts to around 48 million passengers traveling by rail per year, based on records from 2009. However, this amounts to only 5% of the population using rail transport for their basic transportation needs (Lat, 2014, p.212). The implementation of an e-ticket system on Yangon's circular train will commence in 2014 according to the Ministry of Rail Transportation.

Taxis

As of December 2012, there were about 24,000 registered taxis in Yangon, as shown by government figures. Most of them are imported second-hand vehicles. Although they are the most convenient vehicle for foreigners to use when visiting Myanmar, there is a possibility of conflict since there are no standard prices or meter-gauge requirements set by the government.

10.3 Transportation Infrastructure Investment and Financing

10.3.1 Public Transport System Investments and Financing

Private firms will be financing the Yangon public transportation system. Two local private companies, San Yaung Ni and Forever Green Right, will be joining the Road Transport Administration Department (RTAD) to operate Yangon's public transportation system. The companies will invest 6 billion kyat (US$7 million) and 7 billion kyat (US$8.2 million), respectively. The RTAD has not yet officially announced its share of investment in the project. To get up to pace with the fast economic development of Myanmar, the Ministry of Rail Transportation is increasing its cooperation with private firms to provide better services for passengers.

10.3.2 Circular Railway

As of 2012, the net present values of construction costs, operational costs and ticket revenue were US$367.71 million, US$545.02 million

Table 2.10.5 *Cost and revenue estimates for Yangon circular rail project*

Calculated net present values (US$ million)		
Construction cost	Operation cost	Operating cost
367.71	545.02	579.39

Source: Thida, Moe. Zhu Zhui, Zhou Xiaojing, Muhammad Halley Yudhistira, and Jeff Volinski. (2012). *Yangon Circular Railway Development Project*. Hongo, Bunkyo-Ku, Japan: Graduate School of Public Policy, University of Tokyo. p. 2.

and US$579.39 million, respectively (Thida et al., 2012). Additionally, if ticket prices rise with the inflation level, the net present value of revenue would be US$621.85 million. Without considering the construction costs, the operation of the Yangon Circular Railway would become profitable within 15 years. If the government were to lower the annual inflation rate to 2% in the future, similar to what other Asian countries have done, then there would be a 25% increase in demand, which would in turn make this project financially suitable. Although the results of the financial analysis are not attractive, international aid and commercial plans could cover the financial gap.

Figure 2.10.5 *Interior of a circular rail car*

10.4 Ownership, Operation, and Regulations of Public Transport

10.4.1 Public Transportation Ownership

Rail

The state currently owns Myanmar Railways in the railway sector as a monopoly. However, according to the Ministry of Rail Transportation, the government is planning to privatize some of the state-owned railway lines soon, including the Yangon circular railway system. Many changes have been made in Myanmar's railways since 2011. The authority is currently upgrading the Yangon-Mandalay railroad and the Yangon circular railway system. Buildings under the ministry have been rented out to private companies, and a plan to renovate the Yangon Central Railway Station is also underway. The targets of privatization include the Yangon circular line, Yangon-Mandalay line and Yangon-Myitkyina line. The privatization of the Yangon-Myitkyina rail line is a priority for the project.

Buses

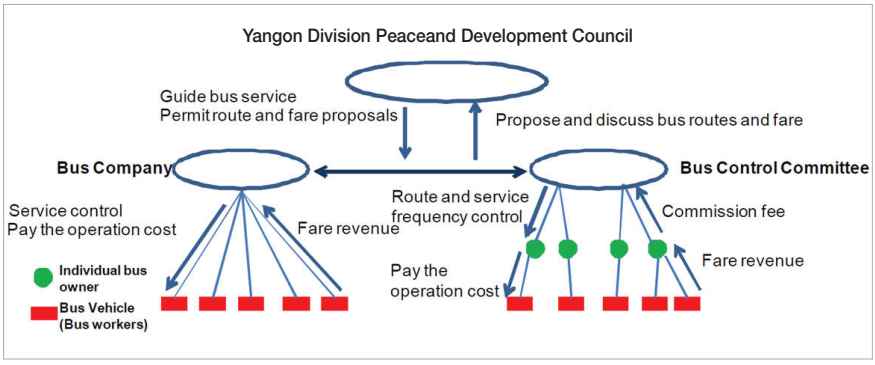


Figure 2.10.6 Relationships among the bus regulator, bus companies, bus control committee and individual bus owners

Source: Kato, Hironori, Akihro Inagi, and Nozomi Saito. (2009). "Institutional System of Urban Bus Transport in Yangon, Myanmar." <http://library.jsce.or.jp/jsce/open00039/200906_no39/pdf/327.pdf> (Accessed on July 5, 2014)

The bus service in Yangon is provided by private large-scale bus companies that own the vehicles, hire drivers and operate urban bus services, while bus control committees (BCCs) provide service by controlling the smaller individual bus owners. An affiliation to a BCC is a requirement for the individual bus owners. The Golden City Link Co. and the union of

Figure 2.10.7 A bus in Yangon (2)

Myanmar Economic Holdings Ltd. are the suppliers for the bus service in Yangon (Kato et al., 2010). Additionally, fares are decided by the Yangon Division Peace and Development Council by communicating with the BCC's and the bus companies.

10.4.2 Public Transportation Regulations

Two laws are in effect to regulate bus transportation in Myanmar: the Road Transport and Inland Water Transport Law 1963, and the Motor Vehicles Law 1964. The Motor Vehicles Law, established in 1964, covers registration, licensing, insurance, safety and illegal activities on roads regarding motor vehicles. These specifically include the registration of motor vehicles; vehicle maintenance; driving licenses; driving training schools; the terms and conditions of hired motor vehicles; and the traffic rules for vehicles, pedestrians and cyclists.

Regarding public transportation, the law Motor Vehicle Rules 1989 was enacted under Section 33 of the Motor Vehicles Law 1964 and prescribed that urban buses are categorized as "hired motor vehicles." The regulations relating to these are in Chapter 6 of the Motor Vehicle Rules 1989 and Section 1 of the Preliminary of Road Transport and Inland Water Transport Law 1963. "Hired motor vehicles" not only include buses and trucks, but also taxis and other small-capacity passenger vehicles. However, it does not include motorcycles, which signifies that passenger services regarding

motorcycles are prohibited in Myanmar. Furthermore, all motor vehicles and motor vessels providing transportation in the commercial sector are required to have business licenses under Section 102 of the Motor Vehicle Rules 1989 and the Road and Inland Water Transport Law 1963. Section 108 of the Motor Vehicle Rules 1989 defines the authorities who determine the rates of transport fares without any official rule in the method toward deciding bus fares.

10.5 Road Infrastructure

Table 2.10.6 Basic facts about roads

Division	Contents
Government agencies	- Ministry of Transport (MOT): Land transport policies. - Ministry of Rail Transportation (MORT): Vehicle / commercial operator registration, licenses, taxes, road regulations, transport planning, international and regional relations. - Ministry of Construction (MOC), Public Works Department: Design, construction and maintenance of main and secondary Roads. - Other agencies, including the Yangon, Mandalay, and Nay Pyi Taw City Development Committees.
Existing operator(s)	- Road Transport Agency, a state-owned company
Total road length	- 150,816 km (33,014 km of paved roads)
Total number of registered road motor vehicles	- 2.33 million registered vehicles: Motorcycles: 1.93 million Passenger cars: 295,000 Trucks: 67,200 Buses: 20,000

Source: KPMG International. (2013). *Infrastructure in Myanmar.* Yangon, Myanmar: KPMG. p.6.

10.5.1 Road Density

Myanmar's road density is only a fifth of the ASEAN average, and almost half of the existing roads are not even navigable during the rainy season. Myanmar is not a small country among the ASEAN nations, but the transport environment, even compared with other countries in the region, is dramatically underdeveloped.

While the road density for the ASEAN nations is about 11km per 1,000 people, it is just 2km per 1,000 in Myanmar. There are around 250-370 vehicles for every 1,000 people in Indonesia and Thailand, but Myanmar averages just 18.

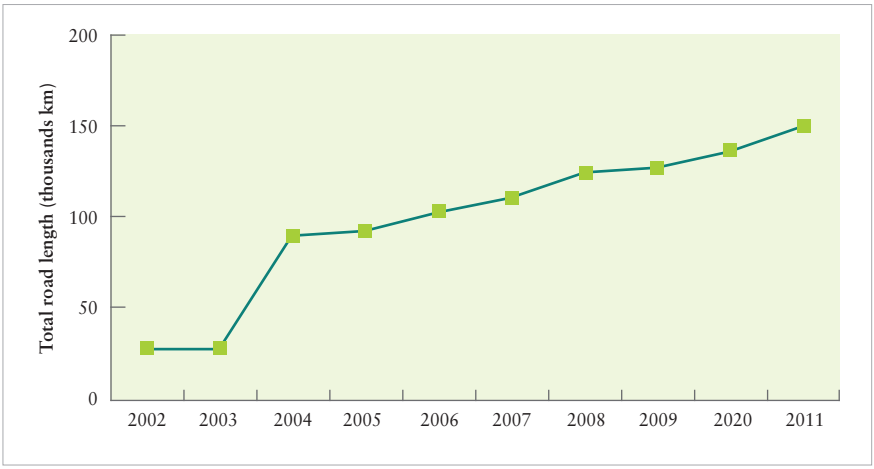


Figure 2.10.8 Growth of roads in Myanmar

Source: KPMG International. (2013). p. 7.

10.5.2 Length of Roads

Roads are the main transport mode in Myanmar. However, the country has a relatively low road density, both in terms of total length and extent of higher-standard roads for the country. Myanmar has around 130,000 km of roads of all types, equivalent to about 2 km of road per 1,000 people in 2012.

10.5.3 Length of Expressway

Table 2.10.7 Yangon-Mandalay expressway length

Particular	Construction period	Distance (mile/furlong)			Length (km)	Opened to public
		From	To	Length		
Yangon-NayPyiTaw	10/2005–3/2009	0/0	202/1	202/1	323.4	25 March 2009
NayPyiTaw-Sakainn	7/2008–12/2010	202/1	352/6	150/5	241	29 Dec. 2010
Sakainn-Tadaoo-Tagundine	1/2011–12/2011	352/6	366/3	13/5	21.8	23 Dec. 2011
Total Length	–	–	–	366/3	586.2	–

Source: Yangon-Mandalay Expressway. <http://ministryofconstruction.org/wp-content/uploads/2013/07/Yangan-Mandalaywebsite.pdf> (Accessed on April 21, 2014).

The total length of the Yangon – Mandalay Expressway reaches 366 miles (531km), including the Sakainn – Tadaoo – Tagundine section divided

Figure 2.10.9 *The Nay Pyi Taw tollgate*

by four-lane concrete roads. The Public Works under the Ministry of Construction, and the Directorate of Military Engineers, under the Ministry of Defense, jointly constructed the entire expressway. The expressway project was launched in 2005 and the section between Yangon and Nay Pyi Taw was partially opened to the public in 2009. The details of the sections are shown in the table below.

10.5.4 Parking Lots

Due to the drastic increase in the number of vehicles, the Yangon City Development Committee (YCDC) is expanding free parking lots in downtown areas. Parking in undesignated zones would be charged, and parking lots in front of buildings is not allowed. Furthermore, the YCDC needs to remove some pedestrian walkways to resolve the lack of parking lots in downtown. Motorists complain about many obstacles and difficulties in some parking lots, such as blocking by lamp posts.

10.5.5 Traffic Lights

The regional government is planning to use intelligent traffic signal controllers to ease traffic jams in Yangon. The intelligent lights turn green automatically when traffic is jammed. A system was tested on an 8-mile junction in December 2013. The city's traffic police said Yangon has more than 160 traffic lights.

10.5.6 Downtown Yangon's Road Infrastructure

Downtown Yangon's road layout follows a grid pattern, based on four types of roads: broad 49-m wide roads running west to east, broad 30-m wide roads running south to north, two narrow 9.1-m wide streets running south to north, and mid-size 15-m wide streets running south to north.

Figure 2.10.10 A Street in Yangon

The east-west grid of downtown Yangon was constructed by British military engineers after the Second Anglo-Burmese War. The city was later developed by the Public Works Department and Bengal Corps of Engineers.

The pattern of the south to north roads is: one 30-m wide broad road, two narrow streets, one mid-size street, two more narrow streets, and then another 30-m wide broad road. This order is repeated from west to east. The narrow streets are numbered; the medium and broad roads are named.

10.5.7 Roundabouts

In Yangon, traffic jams are a regular sight as road infrastructure is not sufficient to catch up with the increasing numbers of cars on the roads. The city's roundabouts are often the reason for cars waiting on all sides, jostling to get around. Therefore, traffic congestion has worsened at the Hanthawady, U Wisara and U Htaun Bo roundabouts after the Hledan flyover opened. Traffic jams are also a daily feature at the U Htaung Bo

roundabout. The North Okkalapa roundabout is also installed traffic lights due to heavy traffic jams.

10.6 Railway Infrastructure

Table 2.10.8 Basic facts about the railway system

Division	Contents
Government agencies	Ministry of Rail Transportation (MORT)
Existing operator(s)	Monopoly by state-owned Myanmar Railways
Railway network	5,844 km

Source: KPMG International. (2013). p. 9.

10.6.1 Railways

In Myanmar, the railway system is operated by the MORT state enterprise, Myanmar Railways. The rail network has been expanded considerably during the past 20 years, to around 3,500 km. Due to the government's policy of national integration, this expansion has been undertaken to provide transport services in remote areas of the country. Because of this, even though urban transportation has not experienced much development, the rail network in Myanmar has been extended considerably.

Most of the new lines are in the mountainous region and were very expensive to construct. The budget for maintaining and improving the core network has been extremely limited, and as a result, the rail network is currently in poor condition. Furthermore, the operating assets, including locomotives, passenger and freight cars, and signaling and communications systems, require huge amounts of investment. In spite of the extensive investment in new rail lines, the relative importance of the subsectors is being ignored by the authorities.

10.6.2 Circular Rail

There is a local commuter rail network serving the Yangon metropolitan area. Myanmar Railways operates a 45.9-km (28.5 mi), 39-station loop system connecting the satellite towns and suburban areas in Yangon. The railway has about 200 coaches, runs 20 times a day and sells between 100,000 and 150,000 tickets daily.

10.7 Vehicle Statistics, the Modal Share of Public Transportation

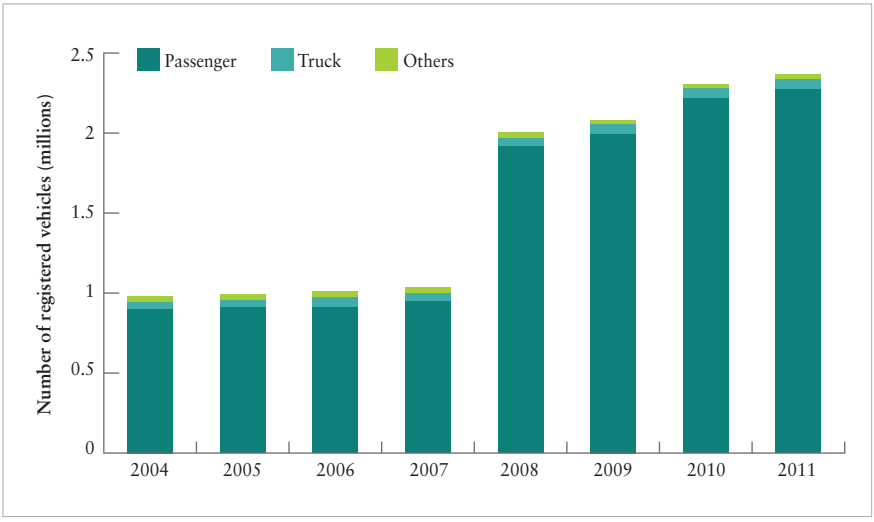


Figure 2.10.11 Number of registered vehicles in Myanmar

Source: KPMG International. (2013). p.7.

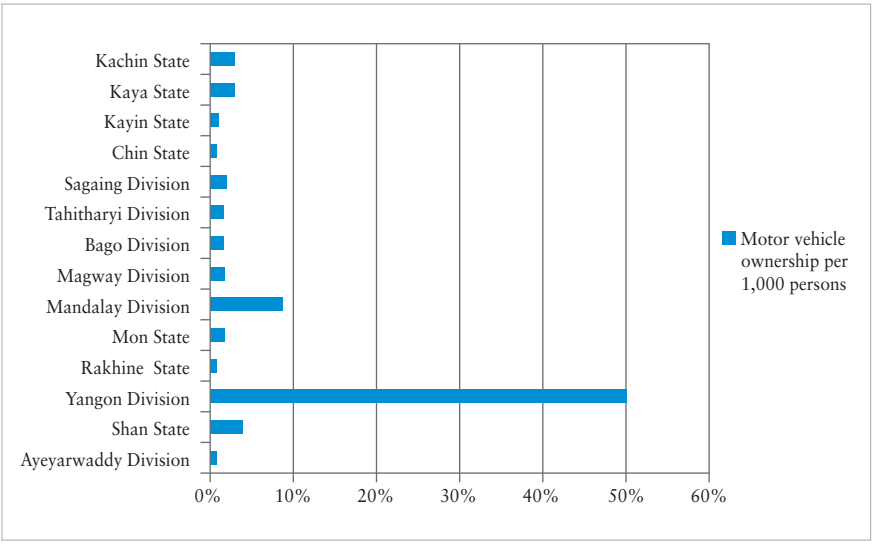


Figure 2.10.12 Distribution of cars in Myanmar's regions

Source: Oo, Thein Han. (2013). "Transport Safety in Myanmar." In *Proceeding of the ASEAN-Korea Capacity Building Program in Korea Workshop Program*. April 22-26. The Korea Transport Institute, Goyang, Korea. pp. 229-242.

There were approximately 2.3 million registered vehicles in Myanmar as of 2011. The total number of vehicles registered in the country, based on statistics from January 2014, was 531,985, of which 351,985 were in the Yangon region. There were 157,265 commercial vehicles in the country, and 109,560 were in the Yangon region.

Of Myanmar's administrative states and divisions, the Yangon Division is still the most critical region in terms of vehicle ownership, and this is exemplified by the fact that this region accounts for 50% of the total number of the nation's cars. Automobile use is concentrated mainly in the Yangon Division, where almost half of the city's population owns a car.

Table 2.10.9 *Business licenses issued (1998-1999 to 2011-2012)*

Year	Motor vehicle	Tractor trailer	Motor vessel	Vessel under 20 HP	Tricycle	Total
1998-1999	96433	1570	3062	22185	–	124250
1999-2000	90044	4914	2449	17742	–	115149
2000-2001	90711	8324	2257	18803	–	120095
2001-2002	93842	15054	1972	24354	–	135222
2002-2003	96228	25607	2055	27931	–	151821
2003-2004	99670	32232	1992	28143	–	162037
2004-2005	103940	38885	2042	24305	109	169280
2005-2006	104975	43822	1903	23543	550	174793
2006-2007	104231	42048	2001	28808	1791	178879
2007-2008	106398	47784	2206	27799	3122	187309
2008-2009	107375	37512	2406	2427	3904	175624
2009-2010	111017	32736	2663	25795	5571	177782
2010-2011	115581	29864	3067	25574	7851	181938
2011-2012	120854	28762	3182	13838	9141	175775

Source: Ministry of Rail Transportation, Myanmar. (2014). <http://www.ministryofrailtransportation.com/index.php?option=com_content&view=section&layout=blog&id=2&Itemid=87&lang=en> (Accessed on 22 April 2014).

Since 1998, there has been a general increase in the number of newly registered vehicles in Myanmar, and since 2005 it has kept steady at about 180,000 a year. The Ministry of Rail Transportation has been keeping records of the number of tricycles as well since 2004. Motor vehicles occupy the largest portion of the newly registered vehicles in the country.

Table 2.10.10 Vehicle statistics

Type of car	Yangon		Average of 18 sections surveyed	National total
	No.	Yangon / total (%)	No.	
Private car	255,406	71.0	19,987	359,772
Passenger car	12,126	57.6	1,169	21,043
Truck (light duty)	40,666	66.7	3,386	60,945
Truck (heavy duty)	15,169	30.5	2,764	49,760
Other	17,310	78.8	1,221	21,978
Two-wheelers	130,997	3.8	189,940	3,418,918
Three-wheelers	1,060	2.1	2,758	49,639
Traw Lergi	1,898	5.6	1,870	33,661
Machinery	331	31.8	58	1,041
Total	474,963	11.8	223,153	4,016,757

Source: Ministry of Rail Transportation, Myanmar. (2014).

Yangon, the most populous city in Myanmar, is the economic center of the nation, and is undergoing rapid urbanization and motorization, with the highest motorization rates in the country.

10.7.1 Modal Share of Public Transportation

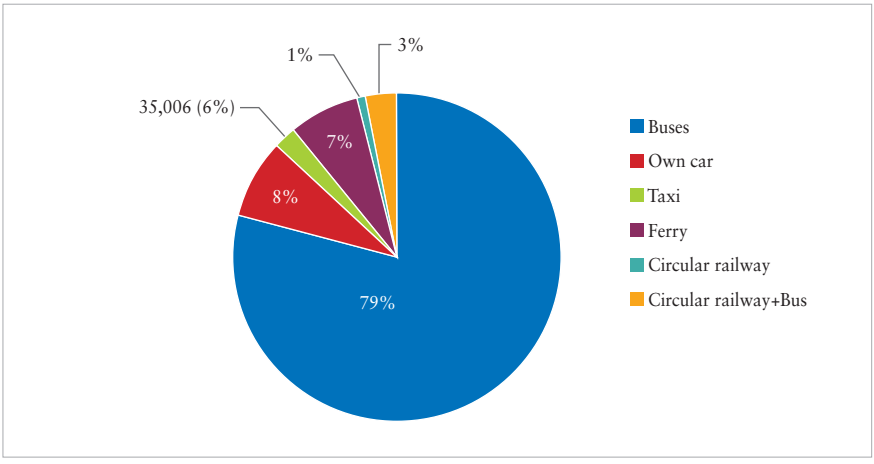


Figure 2.10.13 Modal share in Yangon

Source: Lat, Kyaw. (2014). "Yangon's Challenges in Transportation sector and future plans." In *Proceeding of the 2nd ASEAN-Korea Public Transport Workshop*. 4-6 Aug. The Korea Transport Institute, Jakarta, Indonesia. p.210.

Based on the 1993 Myanmar Comprehensive Transport Study (conducted by the UNDP), 50% of passenger travel was undertaken on roads and 44% by rail. For freight, around 20% was carried by road, 30% by rail, and 40% by inland water transport. However, it is likely that these modal shares have changed somewhat since the study results are outdated and the road sector is now a much more dominant means of transportation.

Transportation modes in Yangon include buses, cars, taxis, ferries, and the circular railway. According to data by Lat (2014), around 90% of the trips around the city were taken on public transportation, and approximately 80% of the entire transportation use was concentrated on buses. The chart shows that only 4% of the people used the circular railway, 7% used the ferry and 8% used their own car for transportation.

10.8 Traffic Safety Indicators

Road accidents are a common danger for people living in the cities of Myanmar. Until now, there have been many victims of careless driving. The number of vehicles in the cities has dramatically increased since the government liberalized auto import policies a few years ago. Yangon's daily traffic jams are now a common sight. More road accidents are occurring these days due to a continued increase in vehicles in the city.

The number of accidents in Myanmar seems to be on a rising path, with steep increases recorded from 2011 to 2012. Traffic safety is becoming a

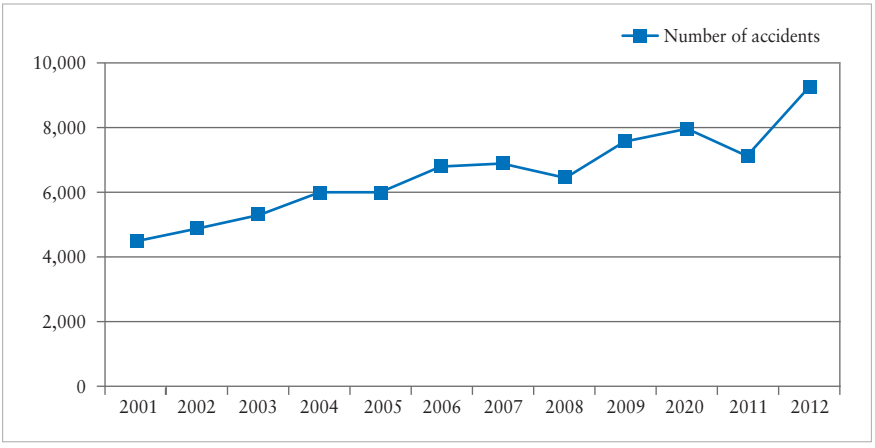


Figure 2.10.14 *Trend of road accidents in Myanmar (2001-2012)*

Source: Ministry of Rail Transportation, Myanmar. (2014).

serious issue in Yangon too. The usual causes for road accidents in the cities are heavy traffic, speeding, overloading and negligent driving. As a result, an improved traffic system, better traffic management and well-trained traffic police are needed to begin reducing the number of road accidents.

Table 2.10.11 Road causalities in each state and division (2012)

No	State/division	Year 2012		
		Accident	Injury	Death
1	Kachin State	294	377	98
2	Kaya State	67	95	22
3	Kayin State	282	463	61
4	Chin State	72	212	26
5	Sagaing Division	580	938	173
6	Tanitharyi Division	273	492	71
7	Bago Division	1,347	2,218	363
8	Magway Division	776	1,469	185
9	Mandalay Division	1,442	2,702	481
10	Mon State	483	749	211
11	Rakhine State	211	295	56
12	Yangon Division	1,645	2,511	334
13	Shan State	773	1,164	249
14	Ayeyarwaddy Division	758	1,317	182

Source: Ministry of Rail Transportation, Myanmar. (2014).

The number of road accident fatalities is significantly increasing, and Yangon now ranks as having the third-highest number of road traffic deaths in Myanmar. The city also has the second-highest number of accident-related injuries in the country. Road traffic accidents are steadily increasing in Yangon in comparison with other regions due to the centralization of the

Table 2.10.12 Road traffic accidents in Yangon and other regions (2012-2013)

State/Region		2013			2012		
		Accident	Injury	Fatality	Accident	Injury	Fatality
Yangon	No.	2,689	3,972	405	1,645	2,511	334
	(%)	23.6	20.6	13.8	17.6	16.0	12.6
Surveyed 17 section average	No.	670	1,133	173	549	925	156
Total		11,383	19,260	2,943	9,339	15,720	2,653

Source: Ministry of Rail Transportation, Myanmar. (2014).

economy and population. This tendency is expected to become even more severe in the future.

The number of traffic accidents in Yangon has greatly increased from 2012 to 2013. The number of accidents rose from 1,645 in 2012 to 2,689 in 2013, and the number of injured people was 3,972 in 2013, while it was 2,511 in 2012. Furthermore, the fatality rate increased by about 20% from 2012 to 2013, with the number rising from 334 to 405. The results show that there is a traffic safety problem in Yangon and that the central government needs to begin attempting to curb what has become a significant issue for the region.

10.9 Travel Behavior

10.9.1 Future Major Movement Patterns at Myanmar's Borders

Yangon and Mandalay will emerge as the main commercial cities of Myanmar due to their advantageous locations, and urbanization will blossom in these cities due to their current focus on economic and commercial activities. These two cities are the largest in the nation, with

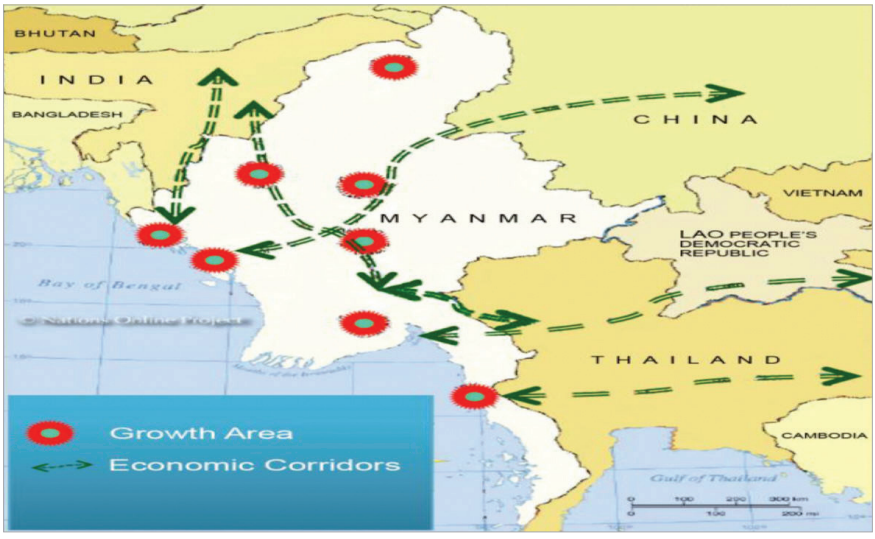


Figure 2.10.15 Relationships among the bus regulator, bus companies, bus control committee and individual bus owners

Source: Ministry of Land, Infrastructure, Transport and Tourism (Japan), Department of Human Settlements and Housing Development, Ministry of Construction (Myanmar).

Yangon being the center of trade for lower Myanmar and Mandalay for the upper region. The new capital, Naypyidaw, will continue to develop as an administrative center and logistical hub for distribution in Myanmar due to its strategic location in the center of the country. Each of the regional capitals is expected to become growth centers.

The vast majority of people rely on bus transportation in Yangon. This is due to difficulties regarding car ownership, low quality of rail service, and heavy regulations for motorbikes and paratransit services in the central business district (Kato, 2010).

10.10 Air Pollution and Vehicle Maintenance Standards

Table 2.10.13 Status of fuel quality and vehicle emission standards in Myanmar (2012)

Lead status	Diesel surplus (Max, ppm)	Vehicle import restrictions	Vehicle fleet	Vehicle standards & inspection and maintenance
Leaded	2,000	Imported used vehicles must be less than 10 years old; vehicles must pass six tests done by an authorized agency	Fewer than one vehicle per 1,000 people	Exhaust checks are done when vehicles are up for registration renewal

Source: UNEP. (2012). "Status of Fuel Quality and Vehicle Emission Standards in Asia-Pacific." <http://www.lead.org.au/PCFV/Lead_Matrix_AP_201206.pdf> (Accessed on 17 Oct 2014).

Vehicles in Myanmar need to be tested for gas emissions qualifications during the registration process. The Road Transport Administration Department has prepared inspection devices to control air pollution from vehicles.

Table 2.10.14 List of CNG stations

Location	Number of stations
Chauk	1
Yenangyaung	2
Yangon	41
Paleik	1
Mandalay	1
Total	46

Source: UNCRD. (2010).

Figure 2.10.16 A CNG station in Yangon

Compressed natural gas (CNG) is one of the cleanest-burning fuels and is something that Myanmar is quite fortunate to be producing in large amounts, especially when compared to other underdeveloped nations regarding green development. The main authority is promoting the use of CNG, which is cheaper than other fuels, for urban transportation in the country. The government of Myanmar started to encourage the use of CNG engines in the bus transport system. In excess of 27,600 passenger cars were converted into natural gas vehicles (NGVs). There were 46 CNG stations in 2012; one in Chauk; two in Yenangyuang; one in Paleik; one in Madalay, and 41 in Yangon.

10.11 Traffic Congestion and Traffic Demand Management

10.11.1 Infrastructure Problems

Yangon has the greatest potential in Myanmar to attract foreign direct investments. However, the current infrastructure is not enough to maintain a stable social and economic environment. Rapid motorization and urbanization has produced some negative outcomes in the city. Road conditions and a road management system for efficient transportation

Figure 2.10.17 Traffic congestion in Yangon

lack the sophistication to follow the development of the city. Lack of both public awareness and systematic car parking facilities has led to many road accidents and heavy traffic congestion, and this has become a major weakness of the city. This situation has also affected the environment of the whole nation.

10.11.2 Unreliable Urban Pubic Transportation System

Although most of the people in Yangon currently rely on public transportation, the system is unreliable because of a lack of planning and rapid motorization, both of which cause severe delays in the system's operation. In addition, planning is done with a focus on automobiles rather than considering human interest. A human-oriented public transport system is needed for sustainable transport.

10.12 Organizations of Public Transport Administration

A complex and fragmented institutional structure is an obstacle for the overall approach to transport planning in Myanmar. Six ministries and several city development committees manage the transport sector: the

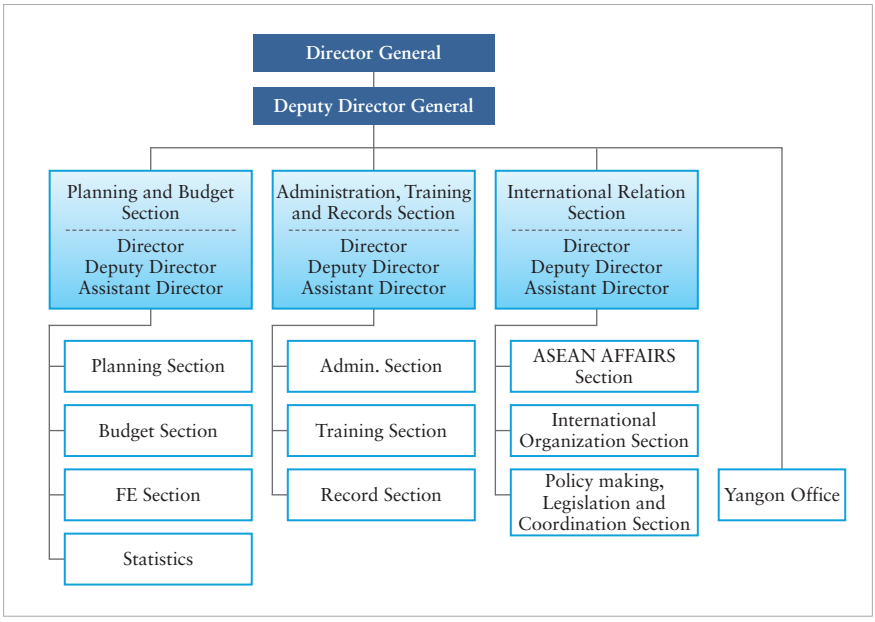


Figure 2.10.18 *Organization of MOT*

Source: Ministry of Rail Transportation, Myanmar. (2014).

Ministry of Transport (MOT); Ministry of Rail Transportation (MORT); Ministry of Construction (MOC); Ministry for Progress of Border Areas and National Races and Development Affairs; Ministry of Defense (MOD); Ministry of Home Affairs; and the Yangon, Mandalay, and Nay Pyi Taw city development committees. Of these, the MOC, the MORT, and the MOT are the most important for the greater part of the country's core transport networks. However, there is no agency with overall responsibility for the transport sector, and therefore no clear lines of responsibility. The MORT and the MOT consist of a mix of departments and state transport enterprises.

The Ministry of Transport in Myanmar is under the Director General of the State, while the Deputy Director General is in charge of actual operation. The department is divided into three sections, each having its own director in charge. The sections are Planning and Budget, Administration, Training and Records, and International Relations. Each section is in charge of separate tasks. The MOT has a separate Yangon Office in charge of the transportation sector of the Yangon region. Yangon City also has a separate government agency called the Yangon City Development Committee (YCDC).

The YCDC, the governing body in control of affairs within Yangon,

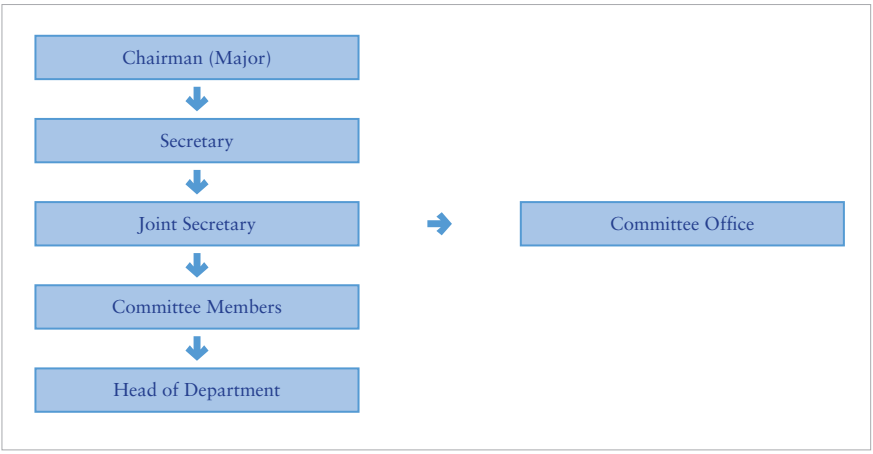


Figure 2.10.19 *Organization chart of the YCDC*

Source: Yangon City Development Committee. (2014). <http://www.ycdc.gov.mm/pages.php?pagename=chart> (Accessed on 18 Aug 2014).

has the mayor, secretary, joint secretary, committee members and heads of department. There is a committee office in charge of all administrative duties. There are 18 departments within the YCDC, and the one specifically in charge of transportation is the Motor Transport & Workshop Department. There is a separate Engineering Department for building roads and bridges, and a City Planning & Land Administration Department for planning the development of the city.

The Motor Transport & Workshop Department has many responsibilities:

- Implementing the public welfare works of the Yangon City Development Committee, fulfilling the needs of the transportation sector and aiding the sector pertaining to the supply of machinery
- Supplying vehicles and machinery to help the work in respective townships for paving and repairing roads, the drainage works, the trash collection and the sewage water cleaning works
- Managing and supplying the vehicles and machinery needed at engineering work sites where work for acquiring drinking water and construction work are being undertaken
- Planning and maintaining the construction vehicles, machinery and equipment needed by the construction sites to be utilized smoothly
- Producing, repairing and storing the machinery, spare parts, hand tools and equipment needed by the other respective departments
- Systematically ordering and using the expendable goods, occupational materials, machine parts and spare parts for vehicles and machinery

- Supervising the use of vehicles and machinery
- Managing the prevention of loss and waste of the materials used
- Administering the cleanliness of the workshop and its compound and security matters
- Making the systematic compilation of records and registers of the vehicles and machinery controlled by the department
- Providing the garbage-container trucks and working machinery needed for carrying out emergency and special cleaning work
- Systematically training the officials and non-gazetted personnel of the department
- Determining and reporting the statistics on the estimated balance sheet of the department
- Providing the vehicles and machinery needed for the committee agricultural and livestock breeding projects directed by the state leader in a timely way
- Providing the necessary vehicles and machinery as guided by the committee for the commemorative days and religious affairs held under the sponsorship of the state

10.13 Public Transport and Traffic Planning

10.13.1 Overview of Urban Transport

The modal share of public transport accounts for more than 90% of total travel made in Yangon City. The leading public transportation mode is bus (over 80%), but the unsafe aspects of the old buses crowded with people is a challenge for the public. The circular train (about 3%) is not functional for people due to the lack of connections to the city's central business districts.

Twenty-five papers related to the 30-year Yangon Concept Plan (Vision 2040) were discussed in a workshop held in September, 2013 with the participation of the government's housing authorities, municipal authorities, port authorities, the Myanmar Engineering Society, the Myanmar Architect Society, the Ministry of Science and Technology consultant scholars, the Yangon Institute of Economics, environmental conservation authorities, and the Yangon Electricity Supply Board. The 30-year plan includes upgrading Yangon in various sectors such as communications, and electricity and water supply, as well as transportation. The funds for this project will be

sought from local private enterprises and banks or directly through foreign investment.

10.13.2 BRT System

A new and improved bus system will be introduced in Yangon to ease daily commuting for passengers. The government has allowed private companies to import cars to be used for the BRT, according to Yangon officials. Some imported cars are already in Yangon port and more will arrive soon. Tenders will be announced for companies that want to import vehicles to be used for the public transportation services.

The BRT system is part of the Greater Yangon Strategic Development Plan, a plan undertaken by the YCDC. The plan includes provisions for upgrading the former capital's major infrastructure, public transportation, roads, water supply and housing projects.

To quote Minister Aung Min, "We have modern buses for the BRT system. The BRT system will not only provide comfort for passengers, but also includes air-conditioning. The bus fares will be fixed at a rate that won't place burdens on the passengers. In order to fix these fares, we told them that CNG will be provided for the buses. Also, the government will invite tenders to private companies that want to operate the BRT project. The government will also specify bus stops and repair traffic lights for the BRT system, and each bus will be run every three minutes. Pyay Rome has been earmarked for this project, and buses will run from Kha Yay Pin Junction to downtown." (Eleven News, 1 Aug. 2013).

10.13.3 Subway System

There are potential plans for a Yangon subway system; however, the map shown below has nothing to do with the ministry since it was made by an outside artist. Minister Aung Min said that the train systems in Bangkok and Beijing were being adopted as models for the planned Yangon system. The Myanmar authorities will grant foreign companies permission to build an overpass and a subway in the country under a build-operate-transfer system. Full foreign investment in the proposed project is expected.

Figure 2.10.20 *Envisioned Yangon subway*

10.13.4 Road Network

The development of a transport network to connect the separated areas is important since the Yangon region is divided by several bodies of water, including the Yangon, Bago and Hlaing rivers. The recent sudden increase of cars is one of the causes of serious traffic jams, especially during peak time, at intersections and road sections. Advanced signal systems, reconfiguration of intersections, road widening, and construction of flyovers are currently required.

10.13.5 Railways

There are eight lines (three main lines and five branch lines, with a length of 148.3 km and 80 stations) in the current railway network in Yangon. This railway infrastructure is not sufficient for the population and for the future urban structure. It is urgently needed to implement an urban mass rapid transit system and to construct new railway lines and feeder lines such as monorails and light railway transit.

10.13.6 Ports and Logistics

It is necessary to expand and modernize the existing port facilities to meet the rapid increase of demand in cargo-handling volume. The stations for

trucks are congested due to the rapid increase of cargo transport demand and the size of the trucks.

10.13.7 Urban Infrastructure Development Strategy

Urban Transport·Road Network·Railways

- Development of a functional road network as an urban backbone
- Development of an effective public transport system led by urban mass rapid transit
- A safe, environmentally friendly, and comfortable transport system
- Development of an appropriate traffic demand management system
- Organizations/institutions and capacity building for creating and maintaining a comprehensive transport system in Greater Yangon

A functional road network serving as an urban backbone, including an outer ring road, is being designed to respond to the road traffic demand arising from a population exceeding 10 million people in the near future. The network now mainly relies on buses, but there are some opinions about the modal share of railway needing to be expanded up to 30% in the future. The introduction of an advanced traffic control system based on an Area Traffic Control System (ATCS) is planned to replace the old unsystematic signals. In setting the target modal share of railways at 30% (only 3% at present), the improvement of existing lines, including the circular railway, and construction of an urban railway will be heavily promoted. A 350-km railway network with eight lines, including five new lines, is planned for 2040.

Ports and Logistics

In response to the increasing cargo volume, the establishment of an efficient port terminal operating system, and reallocation of port terminals are planned in order to alleviate traffic congestion. There are several proposed plans to further improve the ports and logistics system:

- The establishment of safe, punctual, and speedy waterway commuting services.
- The development of a relaxing and scenic waterfront area.
- The development of an environmentally friendly inland waterway transport system.
- The improvement of the waterway transport for rural development.

- Increasing capacity building in port and waterway management.
- The establishment of efficient trucking and logistics facilities.
- The rehabilitation of the railway cargo stations.

Container throughput will be doubled by 2015 from the current 350,000 TEU level (as of 2011) based on a study undertaken by the Yangon City Development Committee and the JICA. The throughput will be further doubled every five years from 2015. The Yangon Main Port and the Thilawa Area Port will be developed to meet this future demand.

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Chapter 3

Characteristics of Public Transport in ASEAN Megacities

Changhwan MO

Morichi and Acharya (2013) pointed out the special characteristics of Asian megacities in terms of urban transportation. Since the Asian megacities they studied are Ho Chi Minh, Bangkok, Manila, Jakarta, Seoul, Tokyo, Taipei and Shanghai, the target cities of their study are not identical with the ASEAN public transport project, except for Bangkok, Manila, and Jakarta. The special characteristics of Asian megacities can be summarized as follows: Rapid economic growth and urbanization, high urban density with monocentric urban development, unprecedented motorization, a higher modal split in public transportation, hierarchically unbalanced transport networks, an increase of motorcycles, widespread use of unconventional modes such as jitneys and tuk-tuks, lack of a metropolitan-level governance system, and weak land use control.

After reviewing the current status of urban transportation in ASEAN megacities, we can conclude that most of the special characteristics of Asian megacities can be applied to ASEAN megacities. However, there are two differences. First, ASEAN megacities are experiencing a decrease of public transportation in modal share. Second, these ASEAN megacities focus on road-based and automobile-oriented transport policies. Among the special characteristics of ASEAN megacities, five should be emphasized: Rapid urbanization and motorization, increase of motorcycles, widespread use of unconventional modes, decrease of public transportation in modal share, and road-based and automobile-oriented transport policies.

These ASEAN megacities have followed a path of urban transport development similar to that in other countries. They have experienced fast

economic growth and have attracted an enormous population from rural areas. As the personal income of city residents has been increasing, the number of private automobiles has increased as well. The rapid increase of cars causes traffic congestion and results in air pollution.

The increase in number of motorcycles is a unique characteristic of urban transportation in ASEAN megacities. For example, in Hanoi before 1980, approximately 80-90% of the population in the city used bicycles. However, in 2008, about 80% of the city's residents were using motorbikes and 2.5% were using bicycles. In Jakarta also, during an eight-year period from 2002 to 2010, the ratio of motorcycle users increased almost twofold, while the percentage of bus utilization severely decreased by 21%. In Phnom Penh, the number of motorcycles has increased dramatically by 20% each year since 2005, and motorbikes represent the biggest share of registered vehicles and accounted for about 80% of all registered vehicles in 2012.

On the other hand, the use of public transit, mainly buses, has been decreasing. For example, while the number of bus users in Bangkok has shown a downward trend since 1992, the number of private modes, cars and motorcycles, has shown an upward trend. Of the total number of privately owned vehicles in Bangkok as of 2013, 3,518,862 were cars and 3,028,153 were motorcycles. In short, economic growth contributes to increasing the ownership of private transport modes. The increase of private modes decreases the use of buses and causes traffic congestion and air pollution.

A road-oriented transport policy is a characteristic of urban transportation in ASEAN megacities. These cities respond to traffic congestion mainly by constructing more roads. For example, Bangkok and Kuala Lumpur have constructed many elevated roads to solve traffic congestion. Large cities, such as Jakarta, Manila, Hanoi, Yangon, Kuala Lumpur, and Bangkok, have a similar pattern of transport development. Bangkok follows the same pattern as Kuala Lumpur, since it seems to

be investing heavily in roads. Accordingly, Hanoi is trying to imitate the transport development pattern of those two cities. Manila also seems to be similar to Kuala Lumpur in the development pattern of transport. This road-oriented policy is easy to take as a method to reduce traffic congestion since it is usually popular with citizens. But sooner or later those cities recognize that a road supply policy does not reduce traffic congestion, but worsens it. Most megacities in ASEAN are experiencing this stage right now.

Accordingly, an automobile-oriented transport policy has been a characteristic of ASEAN megacities. Comparatively small cities, such as Vientiane, Phnom Penh and Bandar Seri Bagawan, have a similar development path, and put a priority on private passenger cars and roads. For example, Phnom Penh did not provide public transport services until 2014. Public buses started operations in April this year, and the government plans to further expand its bus routes. Bandar Seri Bagawan is also an automobile-oriented city, but the Brunei government plans to expand its bus operations, while Vientiane plans to construct a bus rapid transit (BRT) line. Thus, among these three cities, Vientiane is more advanced than other two cities in terms of public transport planning.

These ASEAN megacities now recognize the problems of road-based and auto-oriented transport policies and are starting to pay attention to the development of public transportation, such as BRT, LRT and MRT. Jakarta has been investing heavily into BRT, while Manila and Kuala Lumpur have been investing into LRT systems. Bangkok has constructed LRT, MRT and BRT, while Hanoi is constructing both MRT and BRT. In particular, Singapore has been emphasizing the role of public transportation, such as MRT and buses. It is also known for the implementation of congestion pricing as a transport demand management method.

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Low carbon and green growth are key issues facing urban development today and the growing number of private vehicles in parallel with economic growth in the ASEAN region is of critical problem in terms of environmental sustainability. This project addresses urban transport issues with an objective to promote public transport in the urban areas of ASEAN countries by directly finding the problems of urban public transport in ASEAN cities, consulting ASEAN transport officials about the sustainable strategies of it at two workshops and with two published reports in English, and transferring Korean experiences and technologies of public transport to ASEAN countries so that they can build up a human-oriented and sustainable transport system.

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