

THE PROJECT FOR COMPREHENSIVE URBAN TRANSPORT PLAN IN PHNOM PENH CAPITAL CITY (PPUTMP)

FINAL REPORT APPENDIX

December 2014

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE KINGDOM OF CAMBODIA
PHNOM PENH CAPITAL CITY
MINISTRY OF PUBLIC WORKS AND TRANSPORT

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ABBREVIATIONS and ACRONYMS

ADB	Asian Development Bank
AusAID	Australian Agency for International Development
BAU	Bureau of Urban Affairs
BCR	Building Coverage Ratio
BD	Board of Directors
BHN	Basic Human Need
BOT	Build, Operate and Transfer
CBD	Central Business District
CLV	Cambodia, Laos and Vietnam
CFS	Container Freight Station
CINTRI	Canadian and Cambodian Joint-Venture
CMDG	Cambodia Millennium Development Goals
CO ₂	Carbon Dioxide
DLMUPCC	Department of Land Management, Urban Planning, Construction and Cadastral
DPWT	Department of Public Works and Transport
DWT	Dead Weight Tonnage
EASTS	Eastern Asia Society for Transportation Studies
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
F/S	Feasibility Study
FAR	Floor Area Ratio
GDP	Gross Domestic Product
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
ICD	Inland Container Depot
IEIA	Initial Environmental Impact Assessment
ILS	Instrument Landing System
IMF	International Monetary Fund
IRI-TWG	Infrastructure and Regional Integration - Technical Working Group
IRR	Inner Ring Road
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JICA 2001MP	Urban Transport Master Plan in 2001
KOICA	Korea International Cooperation Agency
LEPNRM	Law on Environmental Protection and Natural Resources Management
MEF	Ministry of Economics and Finance
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MOE	Ministry of Environment
MOP	Ministry of Planning
MPP	Municipality of Phnom Penh

MPWT	Ministry of Public Works and Transport
MRD	Ministry of Rural Development
NGO	Non-Government Organization
NIP	Neighborhood Improvement Program
NL	Northern Line
NPRS	National Poverty Reduction Strategy
NPV	Net Present Value
NSDP	National Strategic Development Plan
OD	Origin-Destination
PCU	Passenger Car Unit
PDR	People's Democratic Republic
PPCC	Phnom Penh Capital City
PPCH	Phnom Penh City Hall
PPMP	Phnom Penh Municipal Police
PPP	Public-Private Partnership
PPUTMP	Project for Comprehensive Urban Transport Plan in Phnom Penh Capital City
PPWM	Phnom Penh Waste Management
PT	Person Trip
RRC	Royal Railway of Cambodia
RS Phase II	Rectangular Strategy Phase II
SC	Steering Committee
SCA	Société Concessionnaire de l'Aéroport
SEDP II	Socio-Economic Development Plan II
SKRL	Singapore Kuming Railway Link
SL	Southern Line
TCP	Technical Cooperation Project
TEU	Twenty-foot Equivalent Unit
TMOA	Transport and Mobility Organization Authority
TOR	Terms of Reference
TRR	Toll Royal Railway
2020MP	Phnom Penh Urban Planning Master Plan 2020

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1 INTRODUCTION

Supplementary materials contained herein are for five topics, namely, Current conditions of Phnom Penh urban transport, 1st public experiment, 2nd public experiment, Pre-feasibility study and Verification of target public modal share in 2035 based on the SP survey. An outline for each topic is provided below:

a) APPENDIX 1: Current Conditions of Urban Transport

This is the collection and analysis of basic data for the formulation of the urban transport master plan (JICA 2001MP). The contents are related plans such as the national development plan, socio-economic indicators, land use, road, public transport, traffic management, tourism, commodity flow, urban transport-related organizations, environment and citizens' participation. It also contains the results of 11 transport surveys and road inventory including person trip survey.

b) APPENDIX 2: 1st Public Experiment

To test the effectiveness of the one-way system which is proposed as one of the traffic management schemes in this master plan, a public experiment was conducted, implementing a one-way system on four roads (two-pairs) between Norodom and Sisowath Blvd. aimed at not only ensuring smooth traffic flow but also testing the possibility of on-road parking as it relates to better sidewalk environment.

c) APPENDIX 3: 2nd Public Experiment

About the city bus operation which is one of the most serious urban transport issues in Phnom Penh, a one route/one month city bus operation was conducted along Monivong Blvd as a public experiment to test the possibility of a city bus system and its continuous operation by the Department of Public Works and Transport (DPWT) and to give the citizens an understanding of bus operation. At the same time, improvement of signalized intersections at three intersections along Monivong Blvd. was also tested to ensure smooth flow of traffic in the city center.

d) APPENDIX 4: Pre-feasibility Study

This appendix contains the alternatives analysis of the rail transit route for reference in as much as the route that obtained the highest score, the east-west transport corridor (Russian Blvd.), cannot be used due to its designation as the VIP road in Phnom Penh.

The analysis is the output of the pre-feasibility study for the rail transit system, the main public transport system.

e) APPENDIX 5: Verification of Target Public Modal Share in 2035 Based on the SP Survey

This appendix explains the verification of the target public transport modal share (30%) which was set during the master plan formulation be made through the conduct of a survey called Stated Preference (SP) survey.

2 NATIONAL DEVELOPMENT POLICY AND PLAN/ RELEVANT DEVELOPMENT STUDIES, PLANS AND PROJECTS

2.1 Rectangular Strategy Phase II and National Strategic Development Plan Update 2009-2013

The Rectangular Strategy was originally formulated in 2004 as a long-term comprehensive framework for Cambodia's socio-economic development. The Royal Government of Cambodia for the Fourth Legislature was formed in September 2008 and declared its pursuit of the "Rectangular Strategy Phase II (RS Phase II)" as its socio-economic policy. Placing "good governance" as the core of Rectangular Strategy, the four pillars of the strategy are (1) enhancement of agricultural sector; (2) continued rehabilitation and construction of physical infrastructure; (3) private sector growth and employment; and (4) capacity building and human resource development. One component of the strategy pillar (2) is "further rehabilitation and construction of transport infrastructure".

The National Strategic Development Plan (NSDP) 2006-2010 was launched in 2006 as a five-year development policy at the national level. It combines and synthesizes various policy instruments including the National Poverty Reduction Strategy (NPRS) and the Cambodia Millennium Development Goals (CMDG) adopted in 2002 and 2003 respectively. In consideration of consistency with the timeframe of the RS Phase II and the global economic downturn in 2008, the NSDP Update 2009-2013 was prepared with two primary goals; first, to synchronize the time period covered by the NSDP Update with the term of the Fourth Legislature of the Royal Government in order to ensure that the actions, programs and projects of all ministries and agencies are aligned to implement prioritized policies that are outlined in the RS Phase II; second, to ensure that the actions to be laid out by line Ministries and Agencies to implement these prioritized policies are formulated taking into account the potential impact of the global economic downturn on the Cambodian economy.

The goals of the NSDP Update in transport sector were set to mainly improve road pavement condition considering the fact that road is one of the basic infrastructure for economic enhancement (see Table 2.1.1).

Table 2.1-1 Goals of NSDP Update in Transport Sector

Sector	Unit	Target					
		2008	2009	2010	2011	2012	2013
Primary & Secondary Roads	Km	11,494	11,494	11,618	11,618	11,618	11,618
a. Paved Roads	Km	2,342	2,661	2,781	2,800	3,500	4,100
Railways	Km	650	650	650	650	650	650
International Ports	No.	2	2	2	2	2	2
Airports							
a. International Airports	No.	2	2	3	3	3	3
b. Domestic Airports	No.	9	9	8	8	8	8

Source: NSDP Update 2009-2013

The prioritized policies to be implemented for the transportation in urban areas in the Fourth Legislature are listed as follows:

- Strengthen and improve the environmental and urban transportation management;
- Foster the planning of urban and public transportation in major urban centers;
- Foster the preparation of a new master plan and the development of infrastructure for urban transportation including a construction project for commuter light train in order to contribute

to reduction of Carbon Dioxide (CO₂) emission resulting in environmental pollution, global warming, and climate change;

- Foster the efficient, effective, and safe use of public and urban transportation infrastructure and services managed and owned by private sector;
- Put in place additional measures for the management of traffic in order to minimize the extent of traffic congestion; and
- Enforce the Traffic Law and improve road safety.

2.2 Socio-economic Development

2.2.1 Economic Framework

According to the NSDP Update 2009-2013, which was settled on in 2010 after the collapse of Lehman Brothers, the mid- to short-term economic growth is estimated at 6% except in 2009 when the economy was influenced by the collapse of Lehman Brothers (see Table 2.2-1).

About the long-term economic growth, it is premised at around 7% based on the Rectangular Strategy for Growth, Employment, Equity and Efficiency Phase II.

Table 2.2-1 GDP Growth Rate, GDP and GDP per Capita

	2008	2009e	2010p	2011p	2012p	2013p	Long-term
Real GDP growth rate (% , Riels)	6.7	0.1	5.0	6.0	6.5	6.5	around7%
GDP at constant 2000 prices (Billion Riels)	28,668	28,692	30,126	31,941	34,029	36,235	/
GDP per capita (000Riels)	2,998	3,030	3,234	3,528	3,799	4,084	
GDP at constant 2000 prices (Billion US\$)	7,061	6,917	7,268	7,725	8,184	8,704	
GDP per capita (USD)	738	731	792	853	915	981	

Note : GDP= Gross Domestic Product

: Long term=The Rectangular Strategy for Growth, Employment, Equity and Efficiency Phase II (2008)

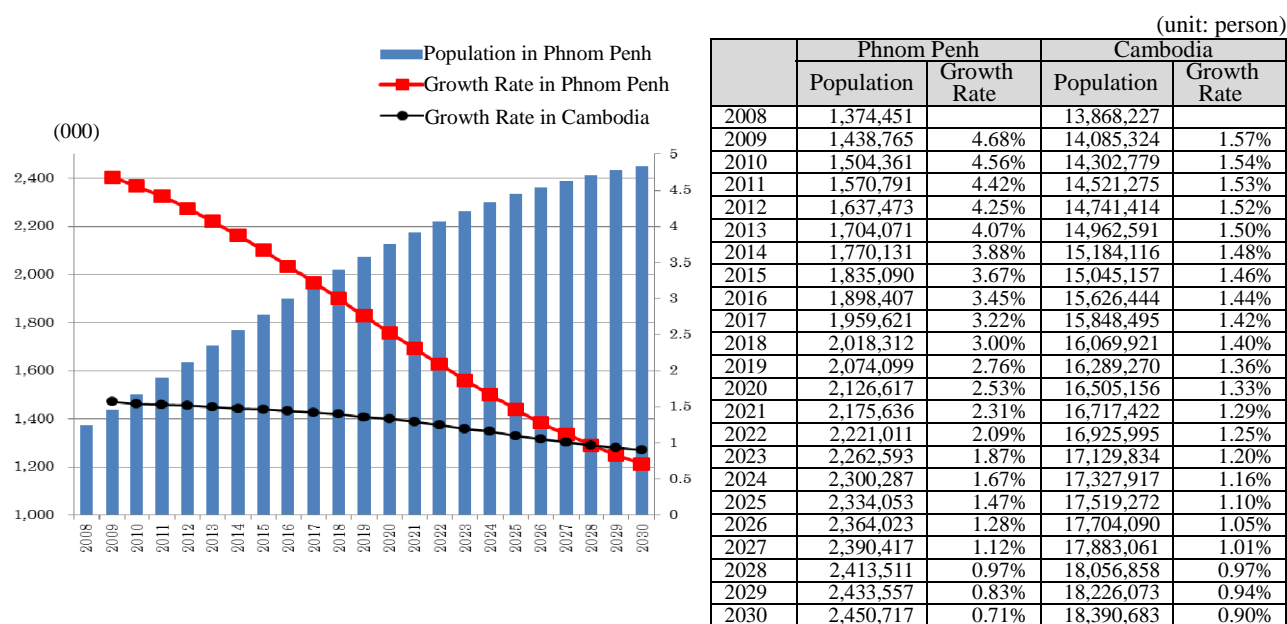
Source: 2008-2013= NSDP 2009-2013 (2010)

2.2.2 Population

(1) Population Projection

According to the population projections of the Ministry of Planning (MOP), Cambodia's population will increase at a rate of 1.57 - 0.9% from 2008 to 2030 with its population reaching 18.39 million, or an increase of almost 4.5 million (see Figure 2.2-1).

On the other hand, the population growth of Phnom Penh (old area) over the same period is estimated to increase at a rate of 4.68 - 0.71% with its 2030 population reaching 2.45 million, or an increase of almost 1.08 million.



Note: In the Census, the population of Phnom Penh in 2008 was 1.3276 million and that of Cambodia was 13.3957 million. The difference with the table above is because MOP's standard population projection month is July while the standard census month is May.

Source: General Population Census of Cambodia 2008 National Report on Final Census Results (2009, MOP)

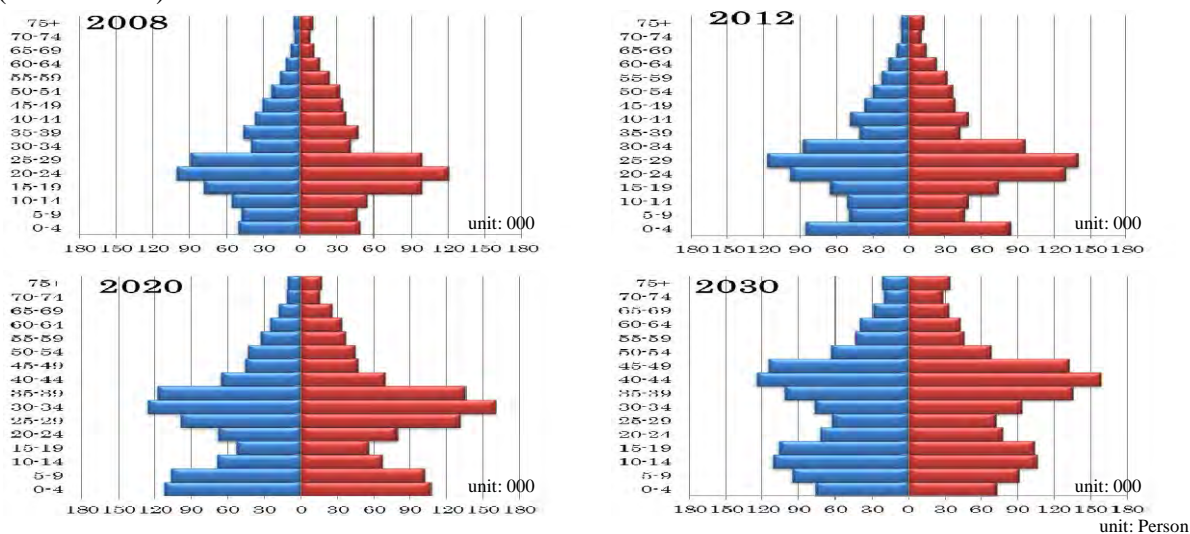
Figure 2.2-1 Population Projection in Phnom Penh (Old Area) by MOP

(2) Population Pyramid

According to the 2008 Population Census, Phnom Penh Capital City (PPCC) had a population swell of the 20 - 24 age group because of social movements and the baby boom. And because of the second baby boom of this age group, the population composition is estimated to be gourd-shaped in 2030.

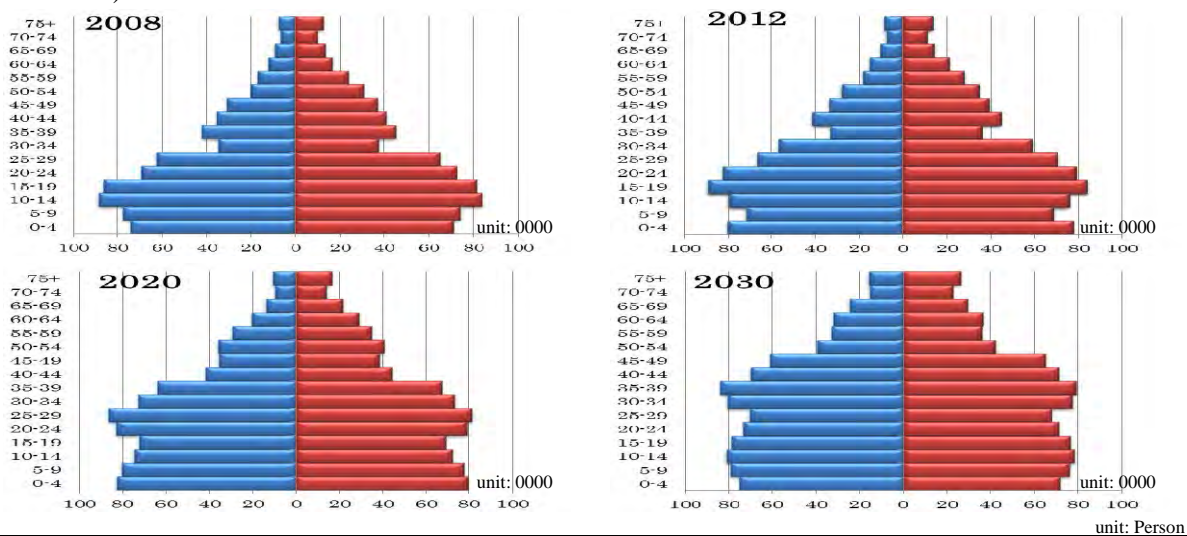
It is estimated that the age composition of the population in 2030 will worsen a little with people belonging to the age group 0 - 14 years comprising 20%, the age group 15 - 64 years, 70% and those over 64 years, around 5%.

(Phnom Penh)



	2008		2012		2020		2030	
0-14	302,977	22.0%	362,911	22.2%	562,145	26.4%	552,089	22.5%
15-64	1,024,374	74.5%	1,216,081	74.3%	1,465,908	68.9%	1,733,046	70.7%
64+	47,101	3.4%	58,482	3.6%	98,561	4.6%	165,580	6.8%
Total	1,374,451	100.0%	1,637,473	100.0%	2,126,617	100.0%	2,450,717	100.0%

(Cambodia)



	2008		2012		2020		2030	
0-14	4,691,570	33.8%	4,523,265	30.7%	4,663,573	28.3%	4,610,308	25.1%
15-64	8,586,397	61.9%	9,574,721	65.0%	10,979,140	66.5%	12,438,779	67.6%
64+	590,260	4.3%	643,428	4.4%	862,443	5.2%	1,341,596	7.3%
Total	13,868,227	100.0%	14,741,414	100.0%	16,505,156	100.0%	18,390,683	100.0%

Source: General Population Census of Cambodia 2008 National Report on Final Census Results (2009, MOP)

Figure 2.2-2 Population Age Pyramids (2008, 2012, 2020 and 2030)

2.3 Phnom Penh Urban Planning Master Plan 2020 (2020MP)

2.3.1 Introduction

The existing rapid urban development of Phnom Penh due to a heavy dynamic of economy and demography needs to be more mastered by urban planning. Phnom Penh Municipality prepared an Urban Planning Master Plan to set the strategy for the future targeted to 2020. In fact, Phnom Penh is following the same large trends observed in other Asian cities. The globalization process is creating the condition for a metropolization of the capital city where contemporary urban forms have to be integrated: international hotels, commercial malls, business towers, condominiums, large facilities (stadium, international fair, international airport, railway station, logistics...) with large-scale urban projects. At the same time, slums relocation policy due to rationalization of the urban management is affecting the poor, and agricultural land is decreasing because of the urban expansion. The recent extension of the administrative limits gives the necessary territory to manage well the future developments. But its development has to be connected with the neighboring province of Kandal and the network of secondary cities in Cambodia.

2.3.2 Setting up legal and institutional tools to organize the city's modernization

In order to transform the individual projects into an asset for development, investments have to be integrated into a global strategy for medium term. This is the condition to make the urbanization a good support for economic and social development and to modernize the city. Partnership between public and private investors could help to finance sustainable infrastructures, a condition that makes Phnom Penh more attractive for international investors. The Cambodian government, with the goal to strengthen the legal framework and upgrade the governance, is setting up legal and institutional tools for a better land management. The Urban Planning Master Plan is one of the main components inside this global process. In that political, economic and cultural context, Phnom Penh municipality defined main options for the urban development through the master plan document that will give the capacity to the capital city to take a stronger and original position in the competition between large cities in the region.

An hydraulic city

Phnom Penh is, first and foremost, a river-front city situated at the confluence of three great rivers known as the Chaktomuk (Four Faces) of the Mekong River: it marks its identity and heritage. Phnom Penh can develop its image as a hydraulic city as a support to its urban renewal. This close link between the city and the river could be strengthened by large-scale projects with skyscraper constructions along the riverside on Mekong River and Bassac River and by the implementation of river transport for passengers. To symbolize this intricate relation, Chrouy Changvar's southern tip could support a landmark facility as a Mekong regional environmental museum, a Buddhist facility, etc. On the other hand, lakes and ponds, which bring to mind the brays in the Angkor, could be considered as a good asset to implement housing in a very high value environmental and ecological landscape. The protection of this unique ecosystem, necessary for flood protection, is a priority and an asset to the city's attractiveness. This symbiosis is expressed in the Master Plan by the Green and Blue Plan and by the land management proposed for the Chaktomuk site.

Urban heritage, sites and landscapes to be preserved

The urban identity is supported not only by new projects but also by the protection and the upgrading of urban heritage and sites that have large social and economic values for tourism and the international image of the city. It is notably proposed to limit the urban pressure on the historical center to preserve the city's architectural heritage and focus on large-scale development of new sites that will be the future urban centers. These projects within skyscraper constructions are unique opportunities to

develop new sites like Boeung Kak, Char Ampoeuv, Boeung Pong Piey or the southern part of Boeung Cheng Ek.

To organize urban development with new multifunctional urban centers

The existing urban development model of Phnom Penh is on the same track as those of Singapore or Kuala Lumpur: new urban development associated with industrial activities and large-scale projects in the suburbs and services in the city center. But public transportation that is necessary to make the link is not yet implemented. The physical organization of the Master Plan is based on multifunctional centers around large facilities. These new satellite cities are creating the new centers: Anlong Kngan, Takmau, Samraong, Chbar Ampoeuv, Beng Cheng Ek, etc. The challenge is to establish close coordination between large-scale development projects and industrial development in order to preserve agricultural and natural areas. This expansion will limit the pressure to the city center and reduce mobility needs. Urban expansion needs a heavy transportation system at the scale of the whole agglomeration. Urban density is linked with the location of new urban centers to limit urban sprawl, to optimize infrastructure and to accommodate future population in better conditions.

Phnom Penh, an ecological city to protect environment

Phnom Penh is a garden city. Its relation with nature implies the need to create more parks, to plant more trees to reduce the warming effect due to constructions and to reduce air-conditioning needs, following the principles of the Kyoto Protocol. The capital city could use its image as an environmental city notably in the energy field, in the preservation of water and land areas and in the natural treatment of waste water.

Decent housing and affordable access for everybody to basic urban services, jobs and leisure areas are a main priority. The Anukret on building permits to be revised could be a good support for more justice in the city, notably by regulating urban services contribution from Borei projects.

2.3.3 Development technical capacities of municipal departments

The city is supporting a very rapid development. Today, the Municipality is only in charge of projects of less than 3,000 m². The decentralization process, implemented since 2010, changed the competencies of the Municipality, and in turn, its duties. With a good coordination with the Ministry of Land Management, Urban Planning and Construction (MLMUPC), the Municipality has to prepare land use regulations and a land registration system and to implement for each sangkat a development plan. It needs to grow stronger technical departments and well-skilled technicians and to decide on the set-up inside the MLMUPC for upgrading the management capacities of its staff.

2.3.4 Implementation of priority projects

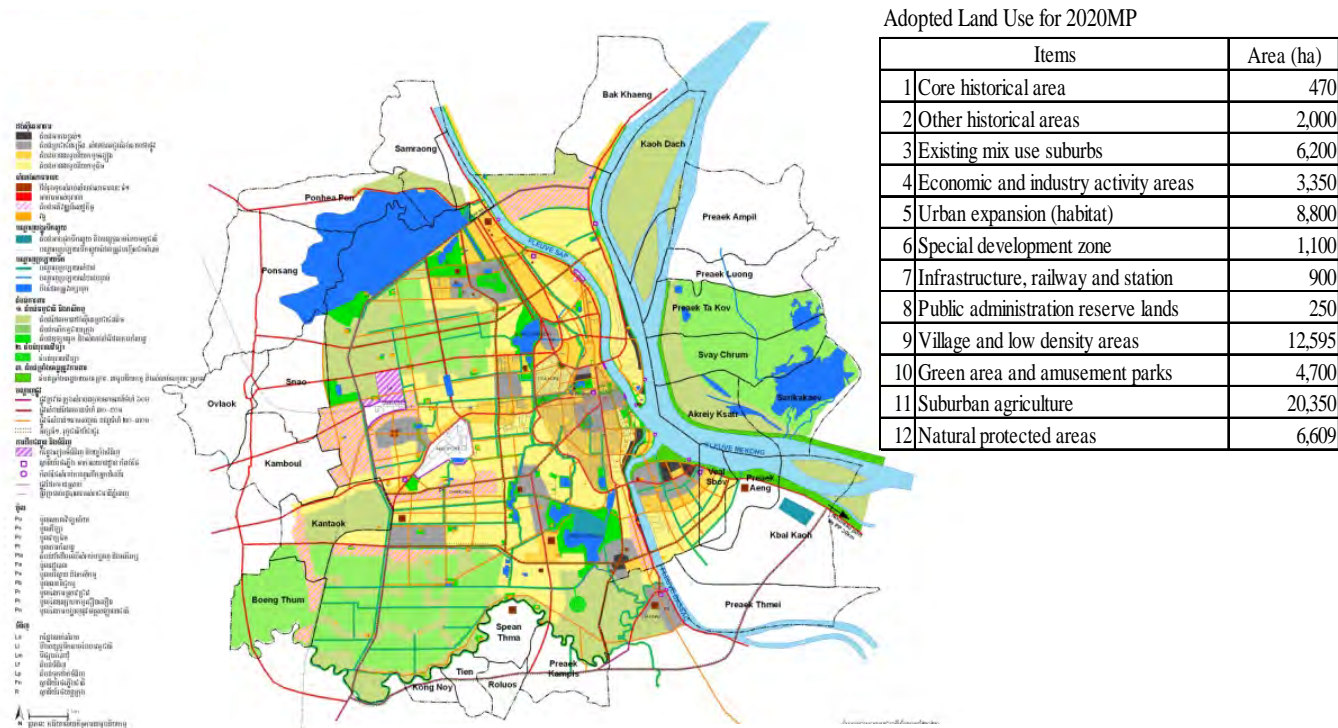
Urban expansion is directed by industrial development and infrastructure. Road, water supply and electricity infrastructure development are the main tools that public authorities can use to orient urban expansion. So, the urban planning master plan proposes priority projects in the fields of roads, water supply, electricity, telecommunication, waste water, transportation, landscaping and drainage. The implementation of these projects is a crucial condition for implementing the 2020MP.

The Anukret prepared for the Council of Ministers gives the main strategic orientation in the master plan for development of PPCC until 2020 as follows:

- Formulate the rehabilitation and enlargement of the existing infrastructure: Airport enlargement, port enlargement, intervention of railway station for transport of goods to suburbs (Sam Rong) and improvement of the railway station at the heart of the city (Boeung Kak development) and the creation of a co-transportation on railway existence in North and

East zones.

- Determine the public space border (pond, canal, road, railway, airport, port, green, greenfield) before making the land measurement and registration
- Prepare the site for economic development including the existing road network development on the main streets and road to support real estate development in the suburbs
- Prepare sites to receive population growth especially for poor people living next to the economic development areas
- Broaden the municipal limits to a distance of 20 km from Wat Phnom (adding 20 sangkats from Kandal province)
- Increase the agreement between investors, bank, real estate agency, big land owner and developer to make more dynamic the real estate market
- Push the quality of iconic location in PPCC, adopt the Landscape Plan and create an important service for the formulation of green spaces including human resources, financial and technical capacities
- Predetermine the zones (high building district, historical center, villa house district, activity zone, dry port, etc.) to reduce difficulties arising from contradictions of land uses (air pollution, noise, traffic) or instability of functional areas (exclusive construction, villa house zone, risk prevention, military zone)
- Strengthen the economic capacity in construction sector, textile, fishery, vegetable cultivating, tourism, transportation, food production, enterprise services, electronic technology, packing technology, mechanic assembly, and training



Source: PPUTMP Project Team

Figure 2.3-1 Phnom Penh Urban Master Plan 2020

2.3.5 Remarks

The Urban Master Plan was modified several times from 2005 due to the consultation process to prepare the Anukret at the Council of Ministers. Today, the satellite image shows that the urbanization trend is completely in line with the urban planning prospects. Most of the infrastructure priority projects have been implemented.

Nevertheless, there have been some important changes/developments that need to be taken into consideration:

- Expansion of the Municipal administrative limits (So the Urban Master Plan needs to integrate these new areas.)
- Delay of the implementation of Samraong railway station and its related industrial and logistic development
- Filling of important lakes (Poung Piey) that will increase the flooding risk in the city
- The filling of Boeung Kak lake and the relocation of the population, giving a great opportunity to create on this location the large business center that Phnom Penh needs
- Construction of new towers inside the city center without considering the urban regulation principles of the Master Plan
- Change of the outer and intermediate rings outlines in the southern suburban area (decision August 2012). This will not change the balance of the master plan, but is modifying the effect for the urbanization in some location.
- Slow development of the Green and Blue Master Plan except in the city center
- No implementation yet of the treatment pond of Boeung Cheung Ek and of Prek Pnevuv, despite the protection of the area for this purpose
- Slow implementation of the Mekong container port and of the construction of Mekong Bridge at Neak Loeung (to be opened soon)
- Large structure enhancing facilities for creating new centers are slow to be implemented.

So it can be considered that most of these changes/developments do not affect the orientation of the Master Plan, but could delay some projects and urban dynamics.

2.4 Urban Transport Master Plan (JICA 2001MP)

2.4.1 Background

The transport system in Phnom Penh is in poor condition, resulting in such problems as congestion, accidents and environmental pollution. With rapid growth in population, urbanization and motorization, the problems are becoming major social issues. To secure sustainable and desirable development, a transport master plan needs to be established.

2.4.2 Objectives

The objectives of the Master Plan are to solve the present and future transport issues in the Phnom Penh Metropolitan Area and to provide transport facilities and measures to support increasing socio-economic activities and sustainable urban development.

2.4.3 Master Plan Components and Project Cost

The Plan integrates the various projects and measures of all subsectors in such a way that they can create a multiplier effect. The pavement improvement and road network development plan were formulated. The bus system with co-existence of motorcycles was proposed as a flexible and comprehensive mode to cope with the future traffic demand. The urgent installation of traffic signals was recommended with emphasis on traffic connection and enforcement.

To implement the required projects and measures, the human and institutional capacity development is in urgent need. The project costs are also listed in view of implementation of the required projects and measures (see Table 2.4-1).

Table 2.4-1 Major Projects, Measures and Project Cost

Sub-Sector	Major Projects and Measures	Total Quantity	Total Cost (USD M.)	Financial Requirement (USD M.)		
				Short	Medium	Long
Road Development	Urbanized: Pavement Improvement	288.5 km	75.3	27.5	47.8	0
	Suburban: Road Improvement	231.1 km	152.4	47.4	44.7	60.3
	Bridge	21 Br.	73.3	4.7	16.1	52.5
	Sub Total	519.6 km	301.0	79.6	108.6	112.8
Public Transport	Bus Fleet	1,306 Units	52.2	17.4	16.5	18.3
	Bus Facility		5.0	1.9	1.0	2.1
	Others		0.2	0.2	0	0
	Sub Total		57.4	19.5	17.6	20.3
Traffic Management	Urbanized: Traffic Signal	117 Nos.	12.9	2.8	2.6	7.5
	Others		2.4	1.7	0.4	0.3
	Sub Total	117 Nos.	15.3	4.5	3.0	7.8
Traffic Legislation	Institution Development	-	0.4	0.4	-	-
	Human Resource Capacity	-	0.5	0.5	-	-
	System and Law	-	1.2	1.2	-	-
	Sub Total	-	2.1	2.1	-	-
Total			375.8	105.7	129.2	140.9

Note: Short (2001 ~ 2005), Medium (2006 ~ 2010), Long (2011 ~ 2015)

Source: PPUTMP Project Team

2.4.4 Master Plan Evaluation

(1) Traffic System Performance

Assessment of the performance of the traffic system of the Plan showed that the Plan will greatly contribute to alleviation of traffic congestion and bring favorable economic results.

Table 2.4-2 Comparison of “With Plan” and “Without Plan”

Year	Increase in Average Speed (km/h)	Decrease in Traffic Cost (USD M.)
2005	1.13	0.76
2010	1.28	0.73
2015	1.47	0.70

Source: PPUTMP Project Team

(2) Direct Benefit

- Target Realization

The Plan greatly contributes to the spatial distribution of urban activities, which is achieved by appropriate allocation of future population and provision of road network integrated with the land use plan in accordance with the Municipality of Phnom Penh (MPP) development policy.

The transport system responsive to future traffic demand is the direct goal, which is realized by implementing the recommended projects and measures.

- Economic Analysis

The economic analysis performed showed a net present value of 114, a benefit/cost ratio greater than 1 and an economic rate of return of 22%.

Table 2.4-3 Result of Economic Analysis

	NPV	B/C	EIRR (%)
Master Plan	114.4	1.62	22.0

Note: NPV= Net Present Value, EIRR= Economic Internal Rate of Return

Source: PPUTMP Project Team

(3) Indirect Benefit

The Plan generates the following indirect benefits:

- Promotion of tourism industry
- Improvement of living environment
- Contribution to poverty reduction

(4) Master Plan Achievement

The proposed components in the JICA 2001MP and their achievement situation as of 2011 are provided below.

- Thirty-two (32) road development components out of the proposed 48 including Outer Ring Road have been completed.
- All 2 public transport components including development of mode interchange area are yet to be completed.
- Nine (9) traffic management components out of 10 including traffic signal installation are either completed or ongoing

2.5 The Study on the Road Network Development in the Kingdom of Cambodia

2.5.1 Background of the Project

In order to ensure the efficiency and sustainability of socio-economic development and poverty reduction, the Royal Government of Cambodia has prepared two development guidelines in the past consisting of the Socio-Economic Development Plan II (SEDP II) (2001 - 2005) and NPRS (2003 - 2005), and a new 5-year national development plan called NSDP (2006 - 2010), which took effect and was enforced in January 2006. Its policy has shifted from “rehabilitation” to “economic development” in which Cambodia is now at the stage to make a new foundation of growth by aligning all the development participants domestically and internationally.

With the assistance from foreign governments and international lending organizations, most of the transport infrastructure of the one-digit national roads has been rehabilitated and reconstructed in the last 15 years. However, majority of the two-digit national roads and the three-digit provincial roads in the regions and countryside still remain in their deteriorated state without any improvement for a long time.

Such condition, together with the expanding economic influence by the neighboring countries in and around the local border and the inability of the government’s administrative services to be extended to the district and rural areas, has led to an increase in the socio-economic gap between Phnom Penh and the rural areas. This situation has become a large problem in Cambodia in terms of governance.

2.5.2 Purpose of the Project

The major objectives of the Project are:

- To formulate a road network development master plan covering the whole country of Cambodia, aiming at the year 2020;
- To carry out a pre-feasibility study for high priority projects selected in the short-term plan (2010); and
- To undertake transfer of knowledge and technology.

2.5.3 Study area and objective roads

The study area covers the entire territory of Cambodia. The objective roads of the Project are one-digit and two-digit national roads and three-digit provincial roads under the Ministry of Public Works and Transport (MPWT) and local roads under the Ministry of Rural Development (MRD).

2.5.4 Target year of the master plan

The target year of the master plan is set at the year 2020, and it consists of short-term (2016 ~2010), medium-term (2011 ~ 2015) and long-term (2016 ~ 2020) planning.

2.5.5 Composition of master plan

The master plan consists of two parts, namely:

- Road Network Development Master Plan, and
- Pre-feasibility Study on the High Priority Projects.

In order to make a reliable and practical road development master plan, it is important to examine not only the physical structure of the road network but also the soft component regarding the institutional development of road maintenance and the capacity building of personnel in charge. Based on the above, the master plan study has three components as follows:

Part A: Infrastructure Development of Road Network

Objective: To establish the road development plan in the long term consisting of road network plan, road improvement plan and implementation plan

Part B: Institutional Development of Road Maintenance

Objective: To prepare the improvement plan of road maintenance system including procurement of budget, operation and administration

Part C: Capacity Building

Objective: To conduct the technology transfer to the counterpart through the Project and prepare the capacity development plan for personnel in charge of road administration

2.5.6 Coordination with stakeholder

With the exception of some sections, the restoration of one-digit roads and some major two-digit roads is almost completed owing to the support of each donor country in the past 15 years. However, differences in opinions among the supporting groups regarding a project's implementation have become remarkable recently, which has caused inconsistency in the execution of project implementation.

Taking into account the above situation, the Project Team pursued the study with the cooperation of an international lending organization and donor countries and participated in the infrastructure working committee (IRI-TWG), which is organized regularly as a lower level donor meeting to avoid repetition of support. Furthermore, the Project Team carried out the study in coordination with ministries and government offices (eight ministries and government offices) through the Steering Committee (SC) together with two Japan International Cooperation Agency (JICA) experts dispatched in MPWT in order to reach an agreement on the issue.

Although it is difficult to identify specific stakeholders at the stage of master plan development, the Project Team held a workshop with the participation of a non-government organization (NGO), considering that information disclosure is necessary, and exchanged opinions about problems in compensation and procedure of resettlement. In the workshop, the Project Team explained the findings of the road master plan to the NGO.

2.5.7 Conclusion and recommendations

The Project Team hopes that the Cambodian government uses the findings of the road master plan study as the base of long-term national development program and recommends that the projects suggested in the Project be conducted and completed successfully by 2020.

2.5.8 Outline of road network master plan

The Project Team established the road network master plan covering the whole country which has been formulated based on the philosophies and strategies as shown below:

Proposed National Vision:

The nation is in the transition from rehabilitation of internal turmoil to development in peace. Therefore, the road network development in Cambodia has to proceed in order to realize sustainable and stable socio-economic development with poverty alleviation of the people and stabilization of daily life, especially in rural areas, as a nation located in the global center of the Greater Mekong Region.

Philosophy 1: Road development which contributes to the national governance and economic development

- Strategy 1: Backbone Development for Multi-Growth Poles
- Strategy 2: National Integration for Strengthening Government Administration Service
- Strategy 3: Global Development for International Trade

Philosophy 2: Road Development which contributes to the regional development and poverty reduction

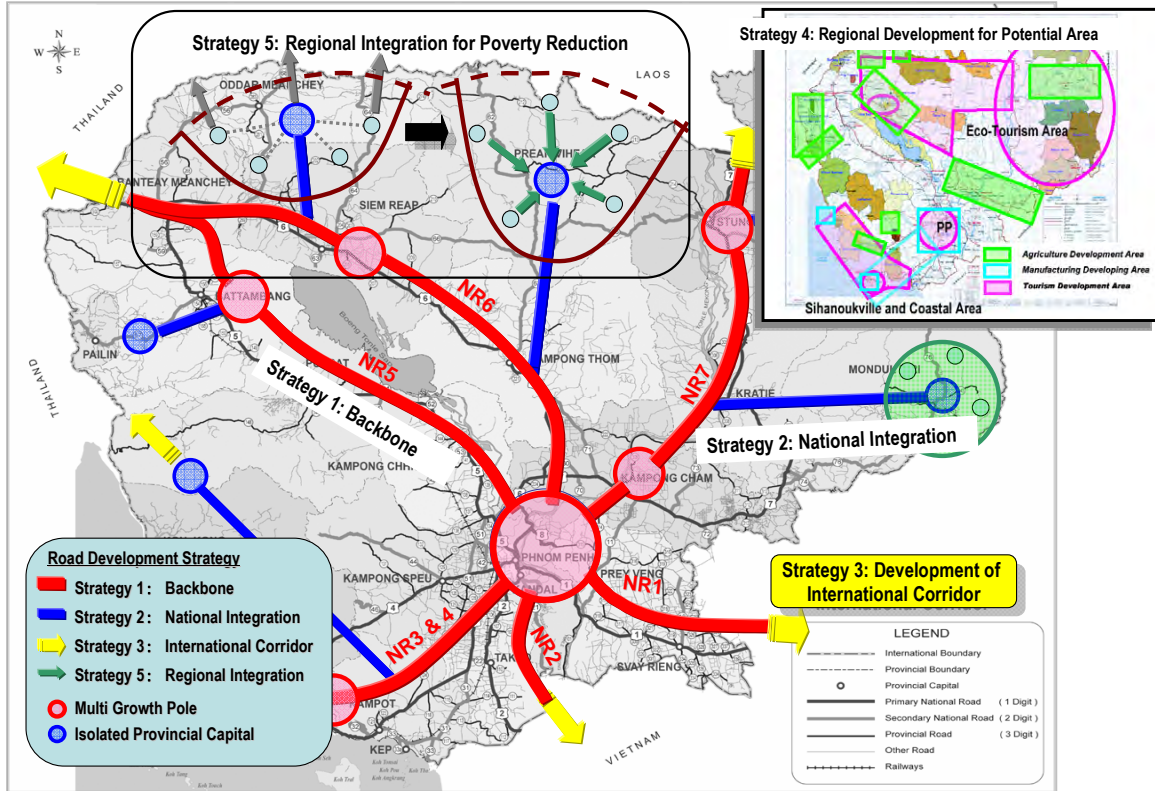
- Strategy 4: Enhancement of Regional Economic Development
- Strategy 5: Regional Development for Poverty Reduction

The concept and image of the above strategies are shown in Table 2.5-1 and Figure 2.5-1, respectively, while the future road network plan in 2020 is shown in Figure 2.5-2.

Table 2.5-1 Road Development Concept

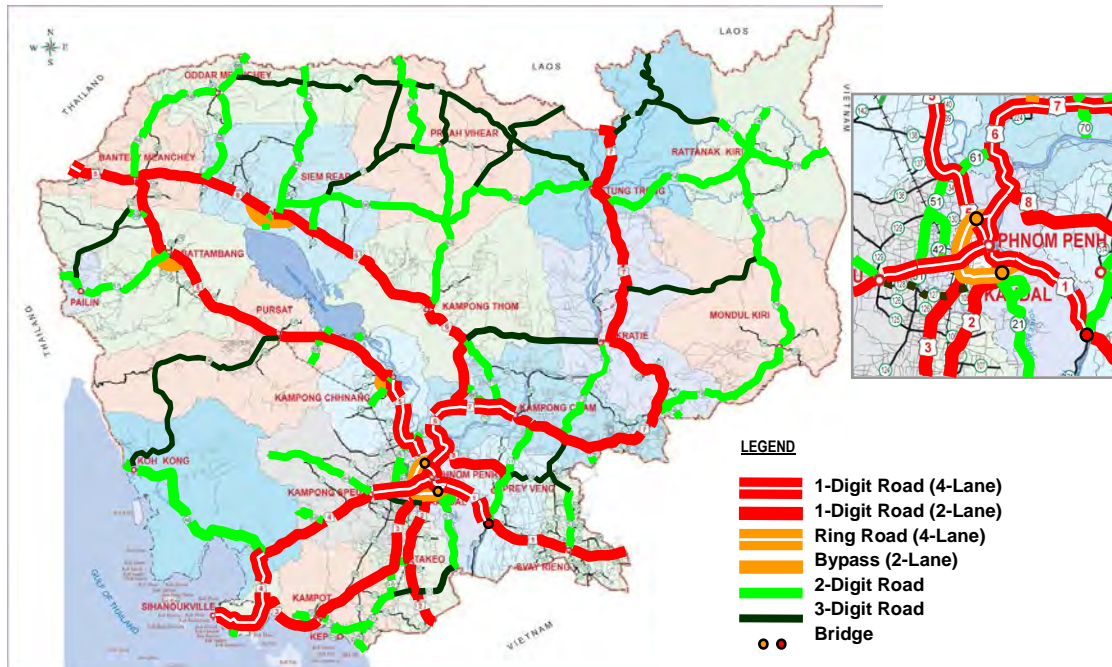
Vision	Philosophy and Strategy	Objectives	Target
<p>The nation is in the transition from rehabilitation of internal turmoil to development in peace. Therefore, the road network development in Cambodia has to proceed in order to realize sustainable and stable socio-economic development with poverty alleviation of the people and stabilization of daily life, especially in rural areas, as a nation located in the global center of the Greater Mekong Region.</p>	<p>Philosophy 1: Road development which contributes to the national governance and economic development</p>		
	<p>Strategy 1: Multi-Growth Poles Development (Contribution to capital city and regional centers)</p>	<p>To contribute to multi-core national development instead of that of sole initiative by Phnom Penh</p>	<p>Expansion to 4 lanes on the national roads connecting to Phnom Penh and introduction of Ring Road, Bypasses construction at major regional cities such as Siem Reap and Kampong Chhnang</p>
	<p>Strategy 2: National Integration (Road network development to expand national administration)</p>	<p>To contribute to national integrity and administration with remote areas where road access is very limited</p>	<p>Improvement into all-weather roads at the sections of two-digit national roads so as to realize easy connection to Phnom Penh even in the rainy season</p>
	<p>Strategy 3: Development of International Corridor (Expansion of trade and commodity flows to and from neighboring countries)</p>	<p>To contribute to expansion of trade with neighboring countries, distribution industry and increase in employment</p>	<p>Functional strengthening of one- and two-digit national roads, improvement of two-digit national roads in the areas adjacent to borders, improvement of accessibility to rails, water ways and distribution centers.</p>
	<p>Philosophy 2: Road development which contributes to the regional development and poverty reduction</p>		
<p>Strategy 4: Enhancement of Regional Economic Development (Road network to support regional economy)</p>	<p>To contribute to promotion of regional industries, expansion of investment and increase in employment</p>	<p>Enhancement of road access, especially by two-digit national roads, to high potential areas of tourism, agriculture and manufacturing</p>	
<p>Strategy 5: Regional Development for Poverty Reduction (Alleviation of poverty and reduction of income disparity)</p>	<p>To contribute to enhancement of Basic Human Needs (BHNs); employment, education, safety and health</p>	<p>Improvement of three-digit national roads and rural roads located in Cambodia, Laos and Vietnam (CLV) border area, northeast corner of Cambodia, strategically selected areas for national development by strengthened road maintenance works</p>	

Source: PPUTMP Project Team



Source: PPUTMP Project Team

Figure 2.5-1 Road Network Development Strategy



Source: PPUTMP Project Team

Figure 2.5-2 Road Network Master Plan (2020)

2.6 Public Transport Plan

Since the last transport master plan in 2000, several public transport plans were formulated toward realization of a practical public transport system in Phnom Penh. They included not only bus transport plan as a short-term solution but also a rail-based system for longer term objectives. In this section, these projects are briefly reviewed and swift consideration is made on what is current project status and why the project did not proceed to next step if it still remains in its initial stage. Table 2.6-1 shows a broad summary of these projects.

So far, no transport plan has materialized to be a practical solution except for the bus operator selection project by MPP, which is considered to be an ongoing project. However, these projects are considered to provide useful information and hints at preparing a more realistic application of transport proposals in the future.

Based on Table 2.6-1, the following opinions are given:

- Demonstrated in this table are two kinds of public transport proposals, i.e., the project for bus system and the project for rail-based system. The former is undertaken in the short term because it reflects current transport needs and requires a relatively small amount of investment while the latter should be undertaken in a long-term perspective because its impact will be huge for transport and urban system in the future; it also needs a large amount of investment cost, comparing with the bus plan. So generally, the plans for rail-based system take a longer study period and require complicated institutional /political procedures.
- Regarding long-term proposals of rail based-system, project justification should be made by four important steps, i.e.: (i) project rationalization; (ii) project identification, including alignment and approach direction; (iii) project evaluation of feasibility; and (iv) project implementation. At present, both referred projects are considered to have reached 2nd step and require further examination for project feasibility.
- As to project status of either suspended or pending, several reasons are considered; however, lack of implementation capacity and lack of available fund schemes are pointed out as most critical reasons.
- For short-term solutions, it is important to improve institutional/financial arrangements. For long-term solutions, it is important to go forward into further examination of project feasibility and project implementation arrangement.

Table 2.6-1 Summary of Previous/Current Project Proposals on Public Transport Plan in Phnom Penh

Category	Bus System		Rail System	
Project name	Bus Operation Experiment	Bus Operator Selection	Sky Train Project	Tramline Project
date	June 2001	January 2012	March 2009	July 2012
Undertaken by	MPWT, MPP, JICA	MPP	JETRO	SYSTRA with understanding from MPP
Project target	Implementation	Program	Preliminary feasibility study for long-term target	Preliminary feasibility study for long-term target
Project outline	First bus trial operation aims for testing viability of bus transport in Phnom Penh as an experimental status. Bus operation serviced 2 routes on Monivong Blvd. and circle links in CBD with 56 bus stops. Trial operation was conducted for one month with a fleet of 23 buses and at the flat fare of 800 riel.	Announcement of private companies that intend to invest on public transport (City Bus) in Phnom Penh. Public bus system should be operated as a common transport authorized by the government.	A transit corridor was proposed along Russian Blvd. based on the future urban structure extending westward from city center. The route and system were selected from viewpoints of offering high mobility, minimum social and environmental impact, requiring less land acquisition, less impact for existing traffic during construction period and possibility of redevelopment near train stations. Required project cost was estimated at around US\$300 million, and construction period required is 5 years.	To seek a Public Transport Long-Term Strategy, the study was conducted, aiming at short- and mid-term actions including an LRT system. It consists of three main phases, i.e., Phase 1(Diagnosis and Perspective), Phase 2 (Public Transport Network and Priority Line's Definition), and Phase 3 (Feasibility Study for a Priority Line). At present, the study has completed until Phase 2.
Main outcome	Total bus passengers during test period reached more than 100 thousand. The experiment was positively accepted and its continuation and expansion are expected by participants. In addition, comments were collected after the experiment from various groups, including claims and complaints.	Establishing initial bus operation scheme by private sector with public assistance.	The project was determined to be economically and financially feasible, presuming that opportunity cost is 12% and fare level per passenger is 2000 riel. As for the project implementation, application of PPP, with role sharing between public (infrastructure) and private sector (operation), is justified. As a major financial resource, application of soft loan is considered to be most important.	Tramway line on Monivong was proposed as a first priority section. The route would be around 10 km long with approximate investment cost of US\$240M to US\$280M. This covers a rolling stock of about 10 to 15 33-meter-long tramways.
Current status	Experiment finished within one month and succeeding ones were to be conducted by MPP. However, due to budget limitation, the experiments were suspended.	After preparing the shortlist of eligible proponents, its screening process is in progress.	Currently, the project remains in preliminary stage requiring further examination of its feasibility.	Based on conclusion by steering committee, Phase 3 project, which covers feasibility study, was executed.

Note: CBD= Central Business District, JETRO= Japan External Trade Organization, PPP= Public-Private Partnership

Source: PPUTMP Project Team

3 URBAN STRUCTURE

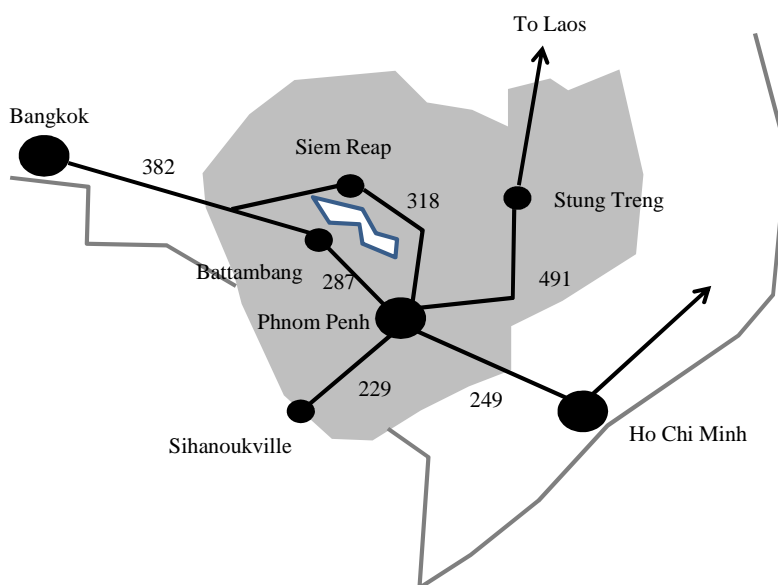
3.1 Overview of Phnom Penh

3.1.1 Phnom Penh Capital City

(1) Location

Phnom Penh Capital City (PPCC) is located at the southern part of the Indochina Peninsula along the Indochina Southern Economic Corridor which runs between Bangkok, Thailand and Ho Chi Minh City, Vietnam. The distance from Bangkok and Ho Chi Minh to Phnom Penh is 669 km and 249 km, respectively. Phnom Penh is located at the southern central part of Cambodia. The distance from major cities such as Sihanoukville, Siem Reap, Battambang and Stung Treng to Phnom Penh is 229 km, 318 km, 287 km and 491 km, respectively (see Figure 3.1-1).

Along with the Southern Economic Corridor, in the southern center of Cambodia and at the river-crossing point of the Mekong River and the Bassac River, Phnom Penh is developed as the capital of Cambodia.



Source: PPUTMP Project Team

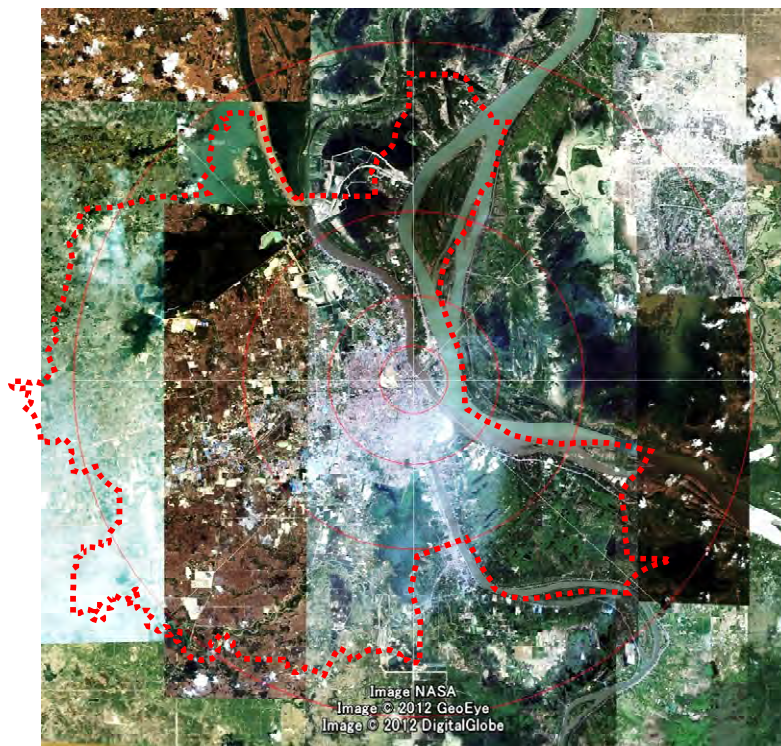
Figure 3.1-1 Location of Phnom Penh

(2) Natural Conditions

Phnom Penh is located beside the Bassac and Mekong Rivers, and it has a very flat plain area with little undulation in the city area. Originally, Phnom Penh has a lot of ponds and swamps due to large rainfall in the rainy season. The area of Phnom Penh has expanded and urbanized with reclamation of ponds and swamps. Due to its flat land with heavy rainfall in the rainy season, Phnom Penh has a serious risk of flooding, which is one of most important issues considering the urban structure and land use of PPCC for the long term.

(3) City Boundary

The boundary of PPCC stretches 678.5 km² with a population of approximately 1.5 million in 2008. PPCC is square-shaped with 36 km in the north-south direction and 34 km in the east-west direction, as shown in Figure 3.1-2.

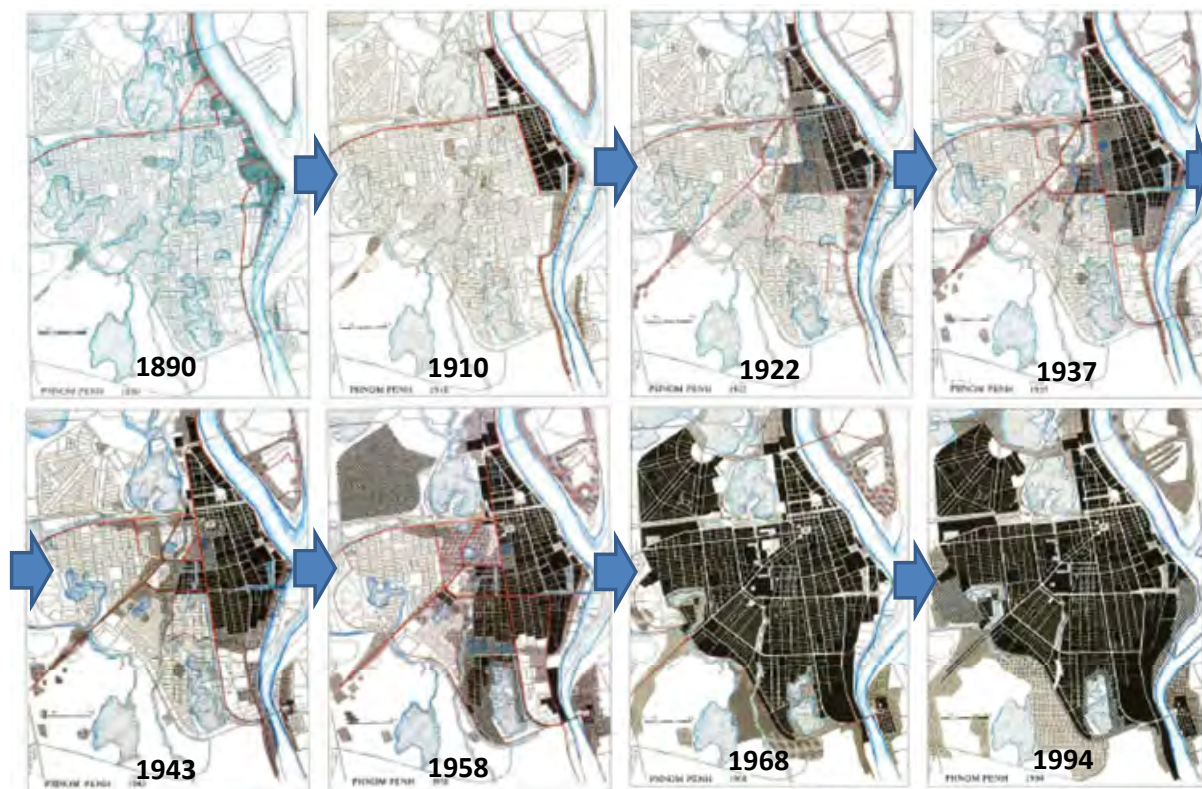


Source: PPUTMP Project Team

Figure 3.1-2 Boundary of PPCC

3.1.2 Development of Urban Area of Phnom Penh

Phnom Penh was originally developed at the river-crossing point of the Mekong River and Bassac River. The accumulation of habitats was firstly seen at the area around the present Wat Phnom, then it expanded along the river in a north-south direction until it gradually shifted to expand in the west direction. This basic direction of urban expansion continues even now due to the difficulty of expanding to the east direction with the existence of rivers and lower land. Figure 3.1-3 traces the expansion of the urban area of Phnom Penh over a period of a hundred years.



Source: Phnom Penh Development, Urbain et Patrimoine, Societe Nouvelle Sicavic à Saint Ouen, April 1994

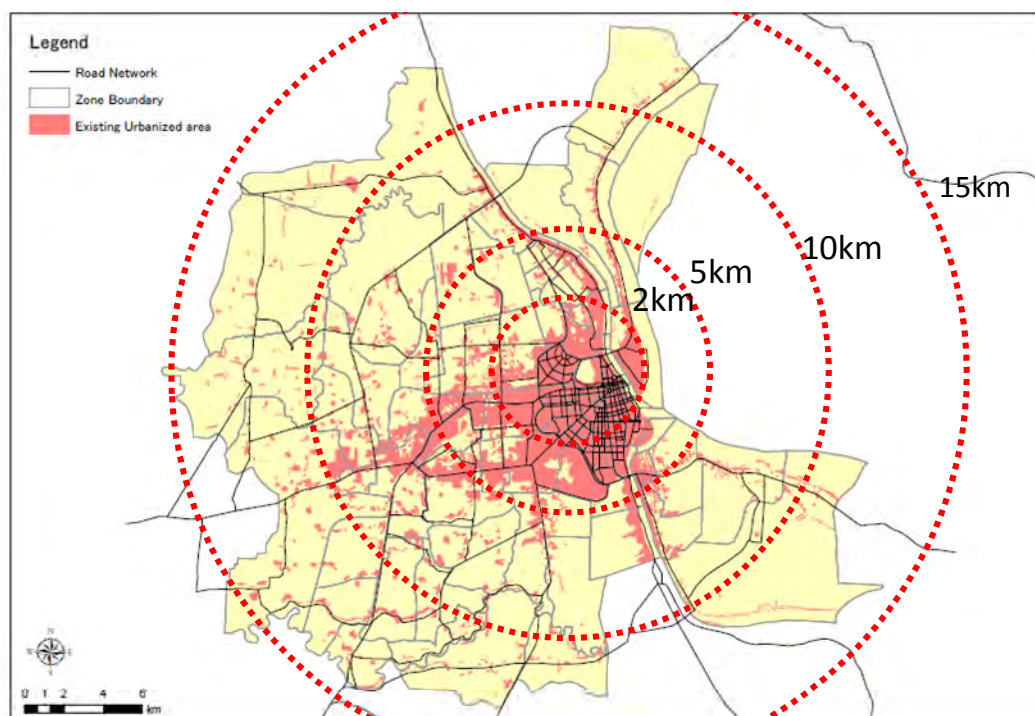
Figure 3.1-3 Historical Expansion of Urban Area of Phnom Penh

3.2 Present Urbanization and Land Use

3.2.1 Urban Area

The current urbanized (built-up) areas of PPCC are shown in Figure 3.2-1. The urban area is mainly expanding to the north, west and south directions. In the west direction, the most urbanized area is approximately 10 km along the National Road No. 4 (NR4); in the south direction, the urban area has a radius of around 5 km; and in the north direction, it reaches around 2 km radius and the urbanization occurs along NR5 and NR6.

This spatial expansion of urban area (or built-up area) can be interpreted from the population data (see Table 3.2-1). The urban central area, which is defined as the area within the inner ring road (C1), is densely populated with more than 200 persons/ha, but has little population growth due to limited space for expansion. While the inner suburban area, which is defined as the area between C1 and the middle ring road (C2), still has a lower population density (24 persons/ha on average), and has seen high population growth in the last 10 years particularly in the north and west directions. The outer suburban area, which is defined as the area between C2 and the outer ring road (C3), has a much lower population density (5 persons/ha on average), but has the highest population growth in the last 10 years in the west direction.



Source: PPUTMP Project Team

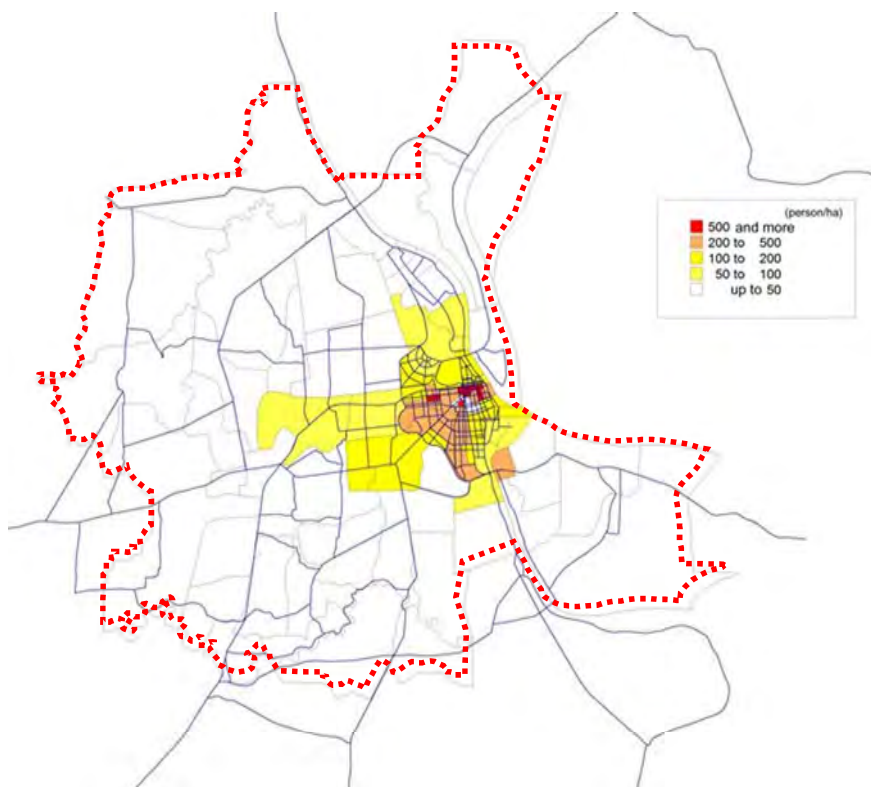
Figure 3.2-1 Urban Area of Phnom Penh, 2012

Table 3.2-1 Population Change by Direction

Zone	Direction	Area (ha)	1998		2008		Change of Poulation		
			Population (person)	Density Person/ha	Population (person)	Density (person/ha)	Number (person)	Change of Density	Growth rate %/year
C1	North	0	0	-	0	-	0	-	-
	East	0	0	-	0	-	0	-	-
	South	1,442	325,607	225.8	325,607	225.8	0	-	0.00%
	West	1,372	244,548	178.3	266,938	194.6	22,390	16.3	0.88%
	Total	2,814	570,155	202.6	592,545	210.6	22,390	8.0	0.39%
C1-C2	North	2,729	88,236	32.3	128,588	47.1	40,352	14.8	3.84%
	East	4,482	27,863	6.2	34,328	7.7	6,465	1.4	2.11%
	South	13,862	162,100	11.7	228,379	16.5	66,279	4.8	3.49%
	West	1,635	64,879	39.7	150,185	91.8	85,306	52.2	8.76%
	Total	22,709	343,078	15.1	541,480	23.8	198,402	8.7	4.67%
C2-C3	North	3,806	34,983	9.2	46,707	12.3	11,724	3.1	2.93%
	East	0	0	-	0	-	0	-	-
	South	3,541	15,275	4.3	24,965	7.0	9,690	2.7	5.04%
	West	11,593	73,484	6.3	178,768	15.4	105,284	9.1	9.30%
	Total	18,941	123,742	6.5	250,440	13.2	126,698	6.7	7.30%
Outside C3	North	7,501	34,965	4.7	41,924	5.6	6,959	0.9	1.83%
	East	0	0	-	0	-	0	-	-
	South	4,379	14,335	3.3	20,269	4.6	5,934	1.4	3.52%
	West	15,307	47,155	3.1	75,963	5.0	28,808	1.9	4.88%
	Total	27,186	96,455	3.5	138,156	5.1	41,701	1.5	3.66%

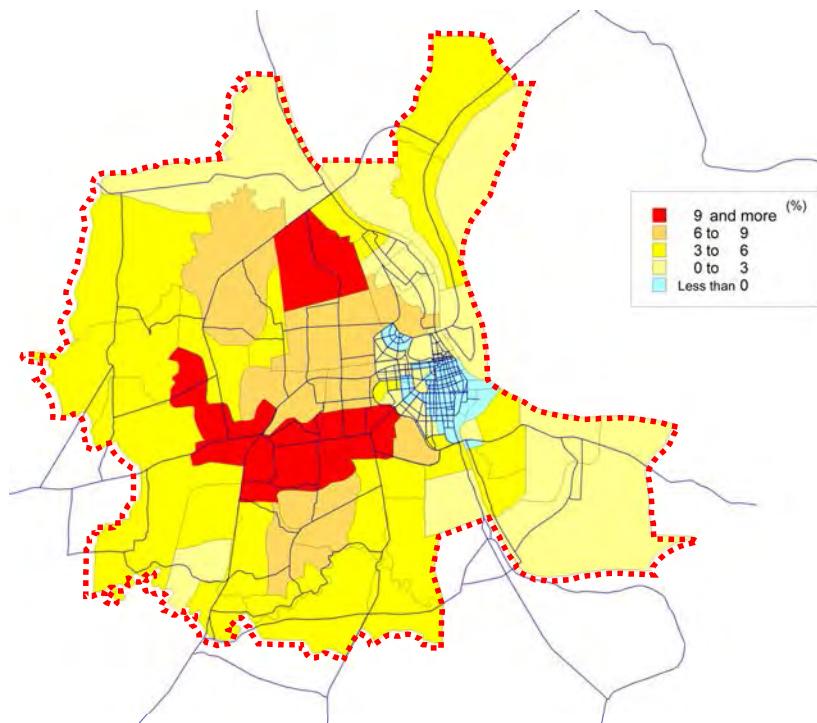
Source: Compiled by PPUTMP Project Team, based on Census Data of 1998 and 2008

Population density in 2008 and population growth between 1998 and 2008 by “Sangkat” (Commune) are shown in Figures 3.2-2 and 3.2-3, respectively.



Source: PPUTMP Project Team

Figure 3.2-2 Population Density by Traffic Zone, 2012



Source: PPUTMP Project Team

Figure 3.2-3 Population Increase Rate by Traffic Zone, 2012

3.2.2 Typical Land Use Pattern

(1) Urban Center Area

The urban center area has been densely built-up with shop-houses that are 4 to 5 stories high. The downtown area, or central commercial area (see Figure 3.2-4) has a building coverage ratio (BCR) of approximately 80% ~ 90% and a floor area ratio (FAR) of around 500%. There are some sangkats with a population density of around 2,000 persons/ha. Road density in the downtown area is very high due to planned development in the past. This area may have a very complicated land and building ownership, which may be one of the constraints for further urban redevelopment.



Source: Google Earth

Figure 3.2-4 Urban Center of PPCC (Central Market Area)

Outside the central commercial area, there are residential areas with mainly low detached houses and a large number of shop-houses with 2 stories (see Figure 3.2-5). The residential area in the urban central area has a population density of 200 ~ 250 persons/ha, BCR of approximately 60% ~ 80%, and FAR of around 200%. Road density here is relatively high. There is generally little remaining space for new development, but renovation and rebuilding of existing houses are active in the residential area.



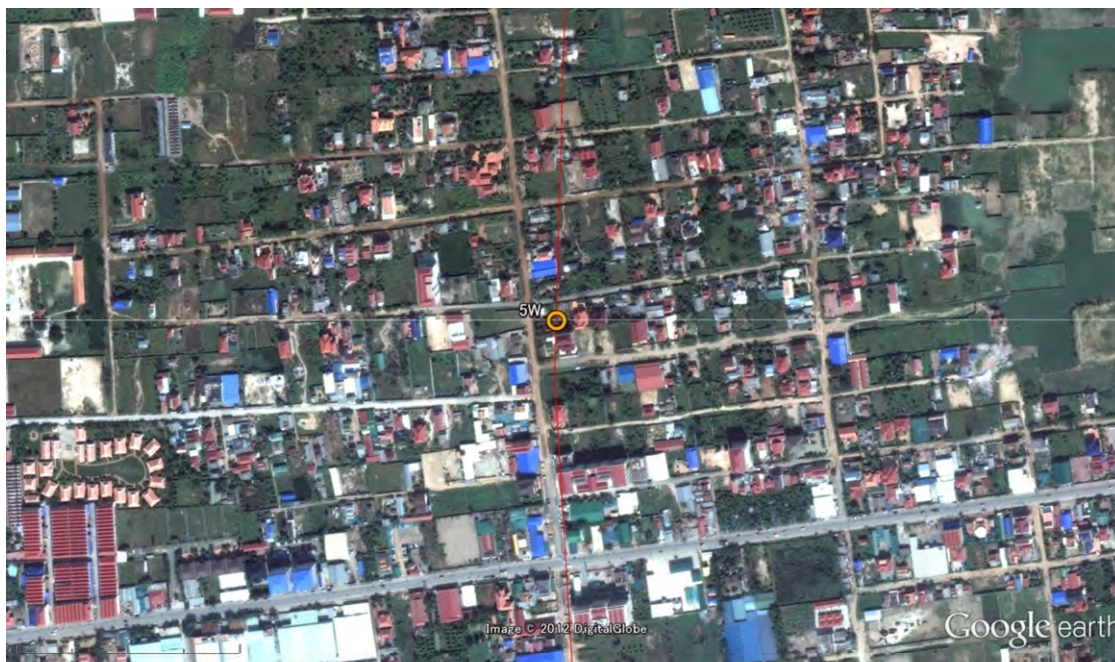
Source: Google Earth

Figure 3.2-5 Residential Area in C1 (Intersection of Monivong and C1)

(2) Inner Suburban Area (Between C1 and C2)

Suburban areas are the frontage of urbanization, where a number of housing developments occur currently. The area consists mainly of shop-houses along the roads, but there is much vacant back land (see Figure 3.2-6). Large residential estate developments are observed here. Population density in the built-up area is around 100 persons/ha in net, but gross population density is not yet so high (25 persons/ha) as there is still a lot of vacant land remaining. Generally speaking, BCR in this area is approximately 60% and FAR is around 100%. The area has a relatively higher road density.

Since most of the undeveloped areas are behind the shop-houses along the roads, provision of access road will be a key to utilize the back land.

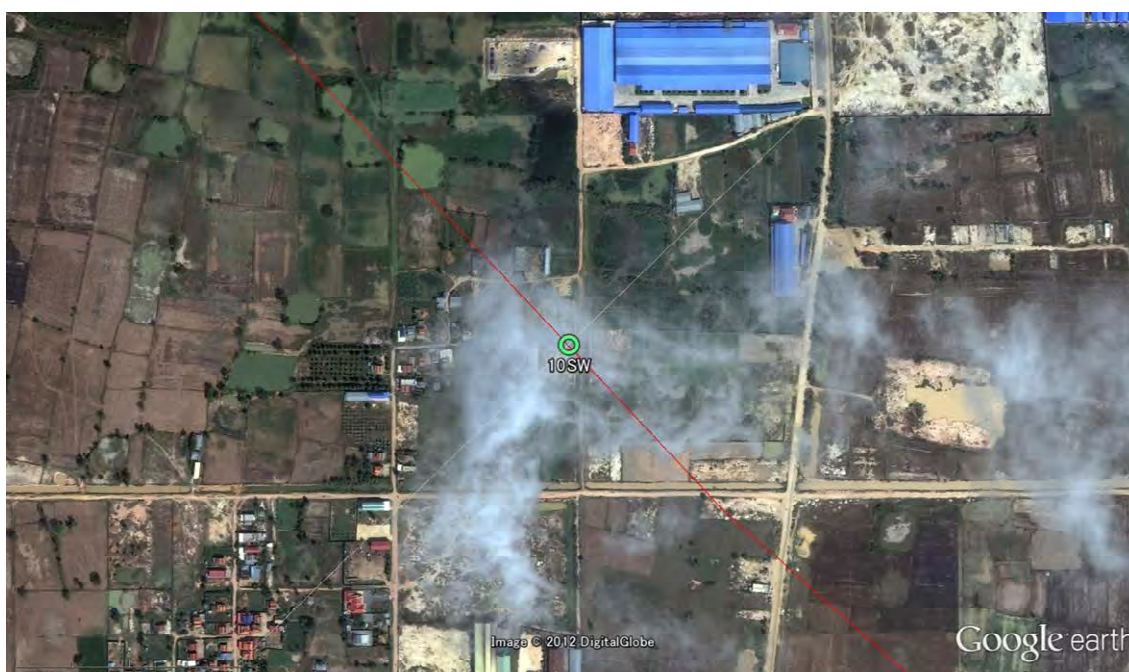


Source: Google Earth

Figure 3.2-6 Inner Suburban Area Between C1 and C2 (North of Airport)

(3) Outer Suburban Area (Between C2 and C3)

The outer suburban area is yet substantially urbanized. There are houses scattered and some large factories along the arterial roads in the area, but there are large vacant lands behind the factories (see Figure 3.2-7). Accordingly, population density is still low (only 5 persons/ha) in this area.



Source: Google Earth

Figure 3.2-7 Outer Suburban Area of C2 (Southern Area of Airport)

3.2.3 Current Urban Structure

(1) Urbanized Area

Phnom Penh is historically developed at the river-crossing points of the Mekong River and Bassac River with a large, fertile hinterland. The township origin of Phnom Penh is around Wat Phnom, which still remains a part of downtown/ city center where business and commercial activities are concentrated. Urban central functions including administration, banking, business and commerce are concentrated in the areas in Sangkat of 7 Makara, Daun Penh along Monivong. The area around the Central Market has the highest density. Urbanization has expanded to the areas along NR2, NR4, NR5 and NR6. Currently, the areas within approximately 1 km radius from Wat Phnom or the area within C1 roads and the suburban areas to the north, west and south along the main roads have been urbanized. It reaches up to 2 km in the north direction, up to 5 km in the south direction and up to 10 km in the west direction. There are many factories located in the west direction or along NR4 and Chaom Chau Road. The areas outside C3 basically have traditional land uses like farmland and ponds, which function as a water retention area of Phnom Penh.

(2) Transport Network

Phnom Penh's urban road network is developed to form a circular and radial system. The radial system is formed with NR1, NR2, NR3, NR4, NR5 and NR6, while the circular system is formed with C1 of 271 Road, C2 of Hanoi Road, and C3 of Kob Srov Dike. From the city center, the radius of C1 is approximately 1 km, C2 is approximately 2 km, and C3 is approximately 5 km.

(3) Land Use

The urban central area in roughly 7 Makara, and Daun Penh Sagats is a high density area with mixed land use consisting of business, commercial and residential areas. The surrounding area of the central area inside C1 is of relatively higher density and is basically residential area of detached houses with shop-houses along the roads. The inner suburban area between C1 and C2 is still of low density with residential area of shop-houses along major roads. There are still many vacant lands behind the shop-houses. The outer suburban area outside C2 is not urbanized yet with very low density. There are some factories and houses in the west direction, but most of the areas are still covered with agricultural land in the other directions.

3.3 Review of Urban Plans

3.3.1 Urban Master Plan in 2020 (by France)

There is an urban master plan for PPCC, namely the "White Book on Development and Planning of Phnom Penh" (hereinafter referred to as "2020MP") prepared by a French consultant team under French assistance and was completed in 2009. The plan delineates the land use plan and urban facilities plan targeting to the year 2020. The Plan is approved by PPCC and currently in the approval process in the national Parliament. Accordingly, it is necessary to acknowledge the plan if anyone considers further urban planning and urban transport planning.

(1) Vision and Mission

The plan first of all recognizes continuous urban growth in terms of population increase and economic growth, and then it emphasizes the importance of supplying more jobs and formal employment in Phnom Penh. To this end, the plan emphasizes the following urban functions of Phnom Penh to be enhanced:

- Intersection of Southern Corridor and Growth Corridor;
- Political and administrative center;
- Service center within 100 km radius; and
- Receiver of foreign investment.

Phnom Penh is required to accommodate the above urban functions by appropriately providing space for economic activities, residential area and efficient transport, so the plan takes into account the following eight strategies:

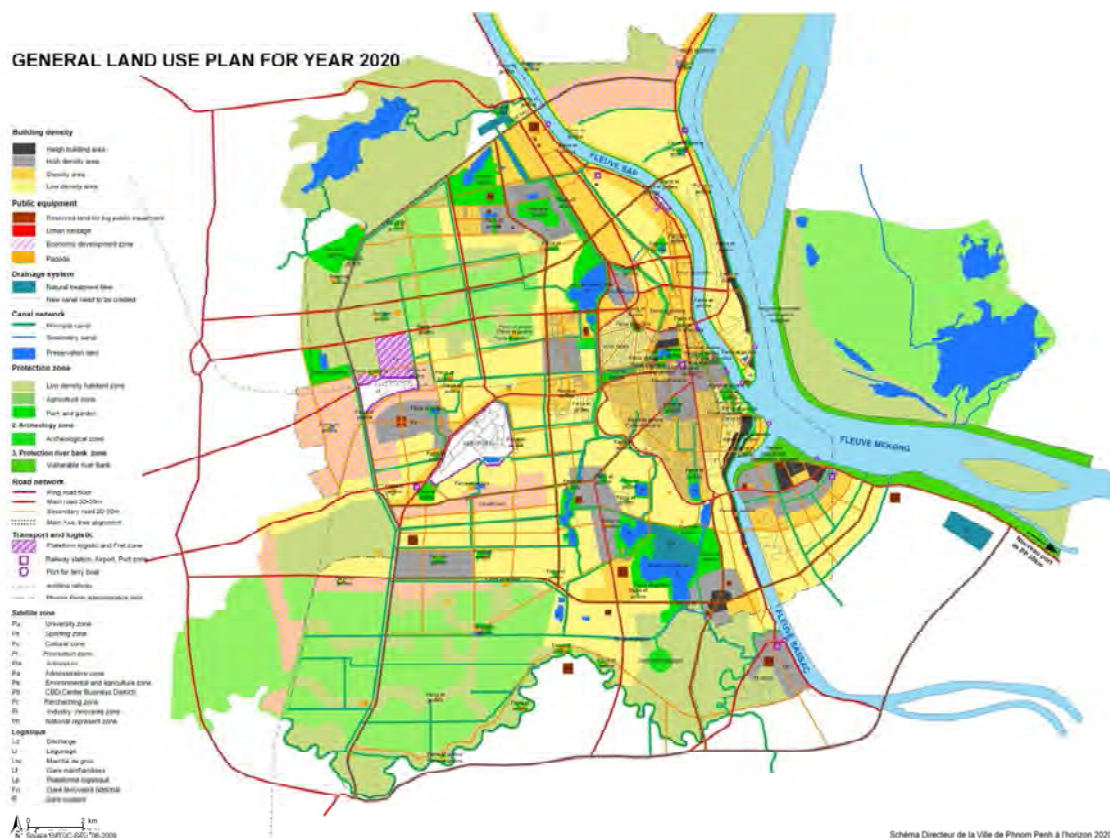
- Pre-condition of existing infrastructure development projects/plan;
- Determination of public space border;
- Preparation of places for economic development and population growth;
- Expansion of city boundary to cover a 20 km radius;
- Coordination of development partner;
- Strengthening of green space;
- Definition of function and development type by area; and
- Strengthening of economic capacity.

(2) Framework

The plan applies 1.98 million persons in 2020 as a population framework of urban planning.

(3) Land Use Plan

The land use plan in the 2020MP is shown in Figure 3.3-1.



Source: White Book on Development and Planning of Phnom Penh, 2009

Figure 3.3-1 Land Use Plan 2020 (by France)

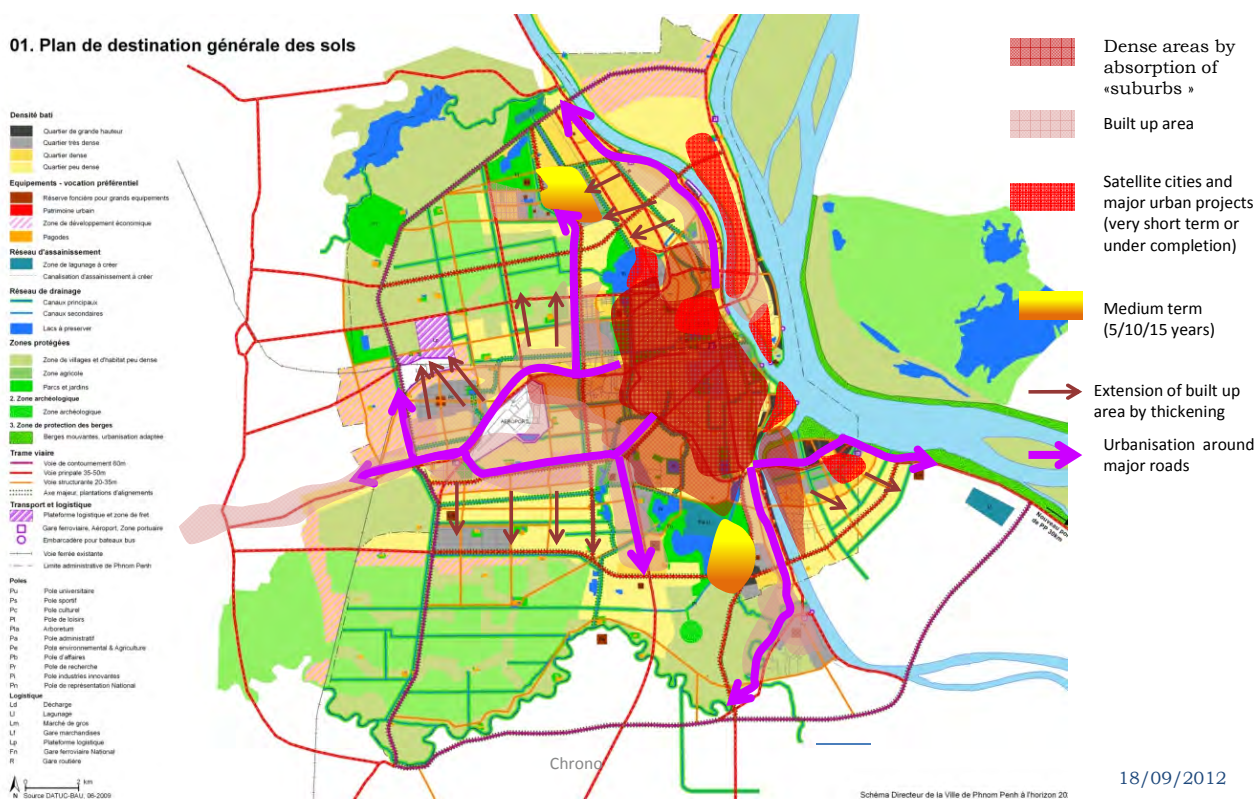
(4) Current Status of the 2020 Urban Master Plan

As earlier mentioned, the current master plan formulated by the French consultant team is now undergoing the approval process in the National Parliament. It seems that it will be approved, although the timing cannot be foreseen at this moment. Accordingly, it is necessary for the future urban structure in 2035 to be consistent with the current urban master plan.

3.3.2 Urban Plan in Tramway Feasibility Study (F/S) by SYSTRA (2012)

A feasibility study (F/S) on introducing a tram system into Phnom Penh, namely “FASEP Phnom Penh N°914, Phase 1 – Diagnosis and Perspective,” was carried out by SYSTRA, a French consultant firm, starting in 2012. The study aims at introducing a tram system as public transport for Phnom Penh. The study is ongoing and the record of discussions is made available to the public. One of them is the review of the land use plan in 2020MP.

Figure 3.3-2 is a tentative land use plan in 2030 developed by SYSTRA, which is a precondition of the traffic modeling and demand forecast of the tram system. This plan follows the land use plan of the French Plan described above, even 10 years later, but it seems to assume more actual urbanized areas in the west direction following current urban expansion.



Source: FASEP Phnom Penh N°914, Phase 1 – Diagnosis and Perspective Edition 1, March 2012, SYSTRA

Figure 3.3-2 Land Use Plan 2030 (by SYSTRA)

3.4 Future Urban Structure

Based on the analysis of current urbanization as well as the review of existing urban plans of PPCC, the PPUTMP Project Team prepared the future urban structure of PPCC for the year 2020 and 2035.

3.4.1 Objectives and Planning Process

(1) Objectives

The urban structure aims to provide future spatial settings for urban transport planning as well as formulate a basis for allocating future population into traffic zones.

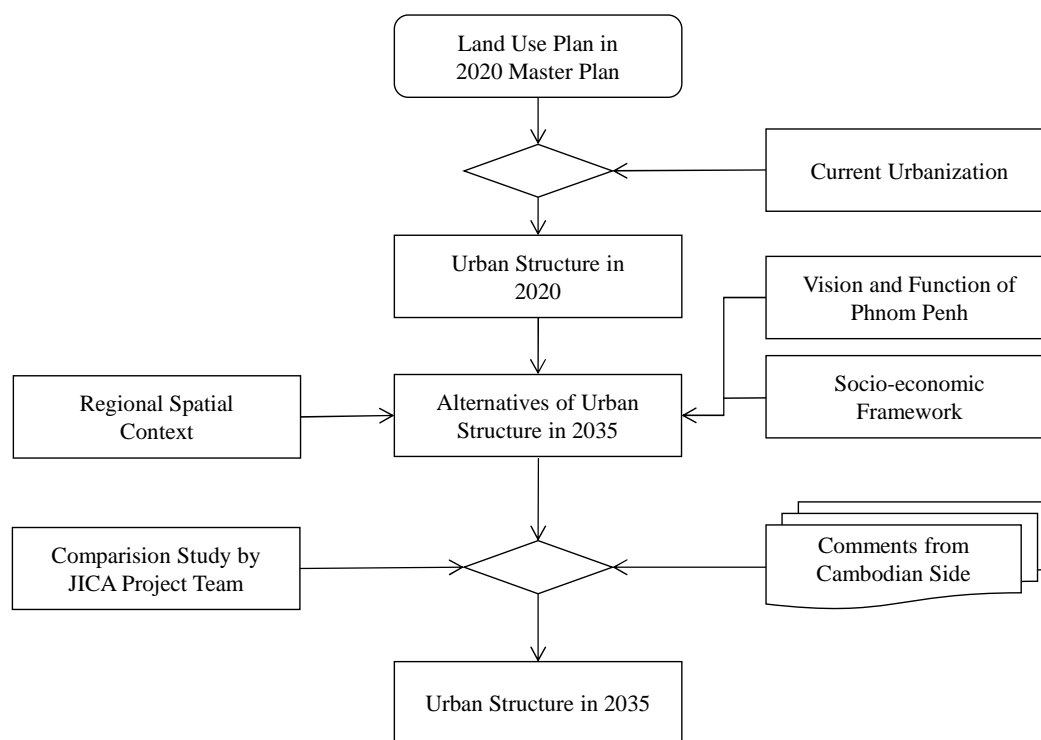
(2) Planning Process

The land use plan in the master plan 2020 will be a basis of the structure plan in 2020 and 2035 because the plan is authorized by PPCC and currently under the approval process in the Parliament. The PPUTMP Project Team (hereinafter referred to as “the Project Team”) formulates the urban structure concept in 2020 through carefully reviewing and evaluating the plan from current urbanization point of view. The urban structure plan in 2035 is developed based on the urban structure plan in 2020 to accommodate development visions and socio-economic framework, reflecting potential urban development after the year 2020.

The Project Team prepares several alternative urban structures in 2035 which anticipate different perspectives of the future. The prominent factors are how to assess private development projects,

public intervention on private development, as well as several constraints like natural conditions and limitation of investment. The Project Team then makes a comparison of the alternatives from several aspects. Based on the comparison, the Cambodian side selects the most preferable alternatives possibly with comments for further modifications. The overall process is shown in Figure 3.4-1.

For this process, the Project Team applies a participatory approach to reflect opinions of stakeholders into the plan as much as possible. Details of the process are available in Chapter 12.



Source: PPUTMP Project Team

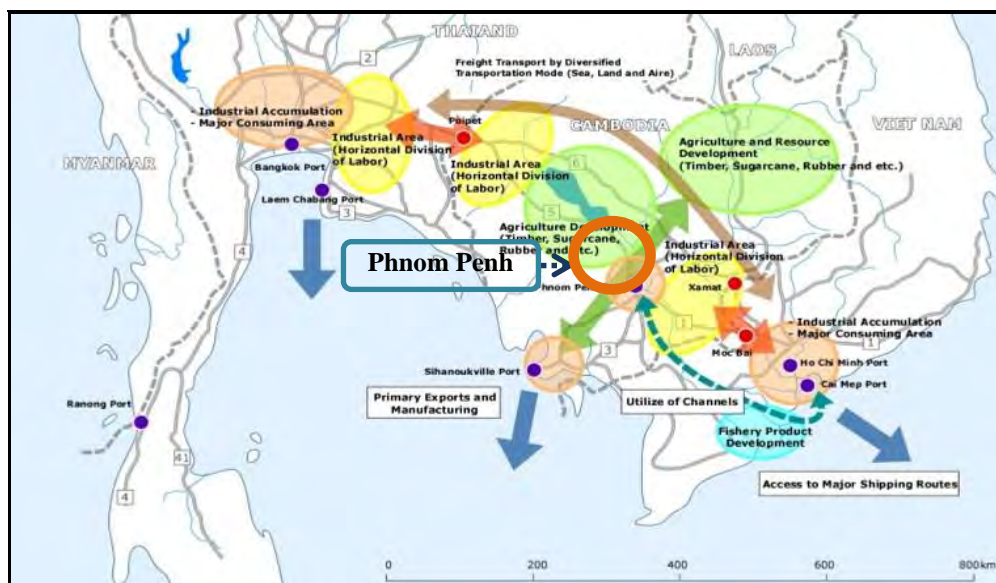
Figure 3.4-1 Planning Process of Urban Structure of Phnom Penh

3.4.2 Future Regional Context of Phnom Penh

(1) Regional Context

Phnom Penh is the capital of Cambodia and it is inhabited by about 10% of the country's population. It is the administrative center as well as the driving force of economic development of the country. From the regional point of view, Phnom Penh is strategically located where the Indochina Southern Corridor and Growth Corridor intersect, as shown in Figure 3.4-2. By fully utilizing such advantageous location, Phnom Penh should accumulate more activities related to:

- Manufacturing under foreign direct investment;
- Service and trade for the area within 100 km radius from Phnom Penh; and
- Administration and public service center.



Source: PPUTMP Project Team

Figure 3.4-2 Strategic Location of PPCC

(2) Regional Transport Network

1) Ring Roads

The Ministry of Public Works and Transport (MPWT) has developed a plan for the overall ring road system in Phnom Penh. The ring road system consists of four ring roads, namely the Inner Ring Road (C1), Middle Ring Road (C2), Outer Ring Road (C3), and Outer-outer Ring Road.

C1 is completed as national route 271, which is located in the built-up area of Phnom Penh to perform as an inner distributor road. C1 is also a boundary of the high-density inner urban area and of the suburban area, which is medium to low density. C2 is relatively newly proposed and is not in any previous studies regarding urban planning and urban transport planning in Phnom Penh like the JICA or French Study, but its importance is currently recognized. The existing Hanoi Road is designated as part of C2. C3 is expected to play an important role as a fringe of the urban expansion with flood protection function and by-pass function of Phnom Penh, to avoid merging through-traffic with urban traffic, and as industrial road to promote industries to locate along the road. Outer-outer Ring Road is also a newly proposed ring road. The JICA Study on Road Network Development Master Plan in 2006 proposed the designation of NR51 as the outer ring road mainly to function as short-cut route connecting Sihanouville (NR4) with the northeastern region (NR6), and the eastern region/ Vietnam (NR1) with the northwestern region (NR5 and NR6). The outer ring road by MPWT is located between NR51 and the 2nd Intermediate Ring Road, and will be constructed to expand the existing provincial road.

Besides C1, the other ring roads are not yet completed. C2 and the outer ring roads are partially completed while the outer-outer ring road is still under planning. There are certain donors who are interested in constructing C2 and C3, which should be considered as a future basic road network in Phnom Penh for delineating the urban structure of Phnom Penh.

2) Railway

There are two railway lines in Cambodia, namely the north line and the south line, and Phnom Penh is

a terminal of both railway lines. Due to the heavy deterioration of the railway lines, a track rehabilitation project has been implemented with funding by the Asian Development Bank (ADB).

The railway rehabilitation project targets both the north and south lines. For the north line, 34 m of the section from Phnom Penh to Battan and 40 km of the section from Poipet to Sisophon are almost completed, while some 300 km of the other section has no exact implementation plan due to shortage of budget at this time. On the other hand, 90% of the southern line is already completed and the remaining 10% will soon finish.

Railway operation is now privatized. It is being run by an Australian company which operates a freight train between Phnom Penh and Kampot once a week primarily to transport salt. The company used to operate a freight train between Phnom Penh and Touk Meas to transport cement, but it has discontinued this service.

Besides the train operation, the Australian company also obtained the concession to construct and manage an Inland Container Depot (ICD) along the railway lines. The ICD is planned to locate in the bifurcation point of the north and south lines along C3. The Australian company is now at the stage of land acquisition.

Consequently, as railway transport, the south line and ICD should be considered as a future basic road network in Phnom Penh for delineating the urban structure of Phnom Penh.

3) Port

Phnom Penh Port is a river port with a capacity of approximately 100 thousand twenty-foot equivalent units (TEU) per year. Although its current annual throughput is 60 thousand TEU, the Phnom Penh Port will soon reach full capacity due to the rapid increase of throughput in accordance with the economic growth of Cambodia.

In response to this situation, the Phnom Penh Port Authority has prepared a new port development plan approximately 20 km south from the existing port along the Mekong River. On the other hand, there is another plan to utilize the old pier located 5 km north from the Phnom Penh Port, which is now under study by Korean assistance.

Since these new port projects are still at the initial stage, there is still a long process to be done such as design, land acquisition, financing plan, management plan and execution. Considering the current situation, a new port might not be necessary to consider in the urban structure in 2020 but probably for the urban structure in 2035.

4) Airport

The existing international airport has been gradually enclosed by built-up areas due to rapid urbanization in the west direction resulting in safety issues and difficulties of future expansion. Thus, there is an idea for a new international airport to be located at Kampong Chhnang around the year 2030 (see Figure 3.4-3). After-use of the current international airport is not yet clear at this moment.

However, it is noted that the existing international airport offers some advantages, as follows:

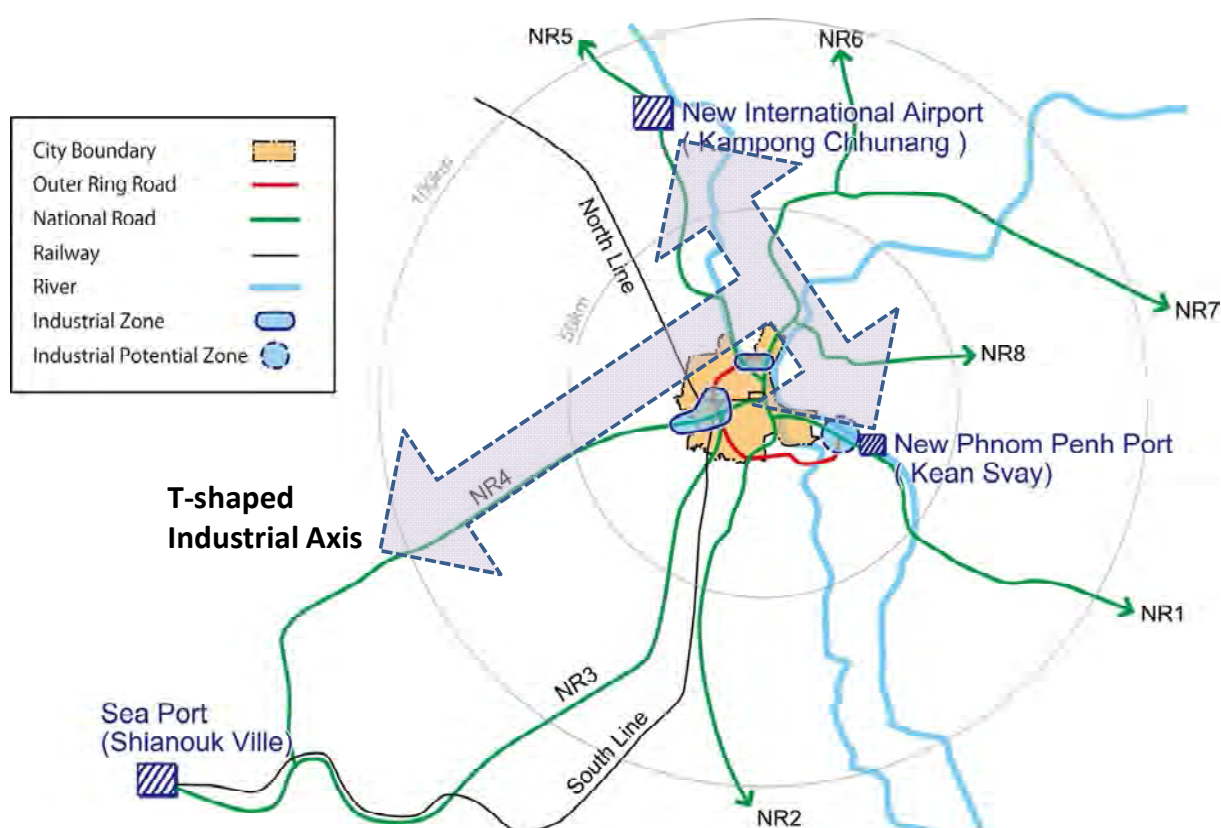
- a) The airport capacity could be increased if the air traffic control system is improved and both parallel taxiway and high speed exit taxiway are constructed. At the same time, it would be necessary to clear the approach zones of the runway such as maintaining them as greenery.
- b) The airport location is convenient to passengers as it is only 7 km away from the city center.

Considering the current situation, a new international airport at Kampong Chhnang should be taken into account in the urban structure in 2035.

(3) Satellite Cities (New Urban Area Development)

There are several ideas on large urban development outside Phnom Penh, such as (1) air city at Kampong Chhnang, (2) new urban area development at the opposite side of Phnom Penh across the Mekong River, and (3) new satellite city at Kandal state. These projects may have a large impact on the urban structure of PPCC in terms of size of population and size and quality of economic activities and transport network. However, there is no sufficient information on these projects since no exact plans are available.

Considering the current situation regarding the proposed satellite cities, there is no way to consider them for the urban structure in both 2020 and 2035.



Source: PPUTMP Project Team

Figure 3.4-3 Regional/Large-scale Infrastructure

3.4.3 Urban Vision

(1) Visions

As mentioned earlier, Phnom Penh is required to keep the position of a driving force in the economic development of Cambodia by utilizing its strategic location, which is the intersection of the Indochina Southern Corridor and Growth Corridor. By fully utilizing such advantageous location, Phnom Penh should accumulate more economic activities. On the other hand, Phnom Penh is the largest city in

Cambodia with a population of 1.8 million. Urbanization is rapidly proceeding, urban area is expanded, high-rise buildings are constructed in the downtown area, and traffic congestion is often observed due to increase of cars and motorcycles, depending upon population increase and economic growth. These problems would be more serious with more economic activities and population increase, so that Phnom Penh is increasingly required to solve/ mitigate such urban problems.

Many stakeholders share the above understanding. Participants in the workshop point out the necessity of improving Phnom Penh's physical functions to make it a more sophisticated city with high mobility and information technology to lead Cambodia as a more modern society. Environmental friendliness is also an aspect that needs attention according to the stakeholders. Considering these, the PPUTMP Project Team then set the future visions into the following three visions which reflect the opinions of the stakeholders:

- Center of Population and Economy;
- Smart and IT City; and
- Environmentally Friendly City.

3.4.4 Preconditions of Urban Planning in Phnom Penh

(1) Population

Phnom Penh's future population is discussed in the following Chapter 4. The summary of results is shown in Table 3.4-1. The population of Phnom Penh will increase to 2.4 million in 2020 and 2.8 million in 2035. Total employment will increase to 1.2 million in 2020 and to 1.4 million in 2035 in accordance with the population increase. This implies that the urban area should be appropriately provided with residential areas to accommodate the increase in population and working places to accommodate employment as well.

Table 3.4-1 Population Framework

	2008	2012	2016	2020	2035
Population (unit:1000)	1,502	1,852	2,147	2,406	2,868
Employment (unit:1000)	733	900	1,050	1,170	1,400
Primary	70	65	60	55	40
Secondary	240	300	360	400	490
Tertiary	423	535	630	715	870

Source: PPUTMP Project Team

The analysis of population density in Section 3.2.2 indicates that 100 persons/ha is the current average in the built-up area of suburban area and this can create a good residential environment in the suburban area. Considering this population density as the future average population density, Phnom Penh will require 5,540 ha of land to be developed between the years 2020 and 2012, and 4,620 ha to be developed between the years 2020 and 2035 (see Table 3.4-2).

Table 3.4-2 Required Urban Area based on Population Projection

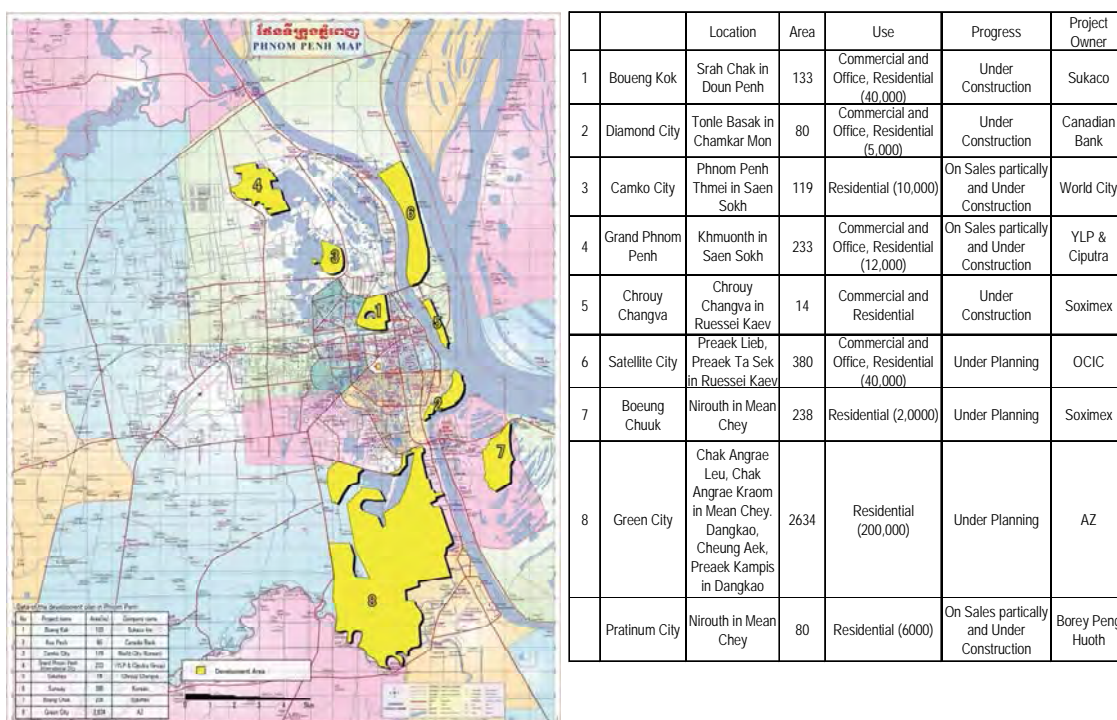
		2012	2020	2035
Population Increase	(Thousand persons)		554	462
Urban Area	(Km ²)	107.7	162.7	208.7
Urban Area Ratio	(%)	15.8	24.0	30.8
Required Urban Area	(Km ²)		55.40	46.20

Source: PPUTMP Project Team

(2) Existing Large Urban Development Projects

Phnom Penh currently has several urban development projects lined up under a favorable economic situation, which are shown in Figure 3.4-4. These are very large projects with residential development, and commercial and office development. These projects are intended to accommodate large populations, and commercial and office spaces. Progress of implementation varies among the projects. Currently, some of them are under construction like the Platinum City Project, Diamond City Project, Kamco City Project and Grand Phnom Penh Project, while the other projects are still in the planning stage such as the Satellite City Project, Boueng Chuk Project and Green City Project.

These projects have large impacts on the future urban structure. Under an assumption of continuous economic growth of Cambodia in the future, it is natural to suppose that these projects would be basically completed in the long term even though there could be delays due to change of situations on certain occasions.



Source: PPUTMP Project Team

Figure 3.4-4 Current Large Urban Development Projects

3.4.5 Urban Structure in 2020

PPCC is required several roles and functions as the capital as well as the economic driving force of Cambodia. The urban structure aims at realizing the visions and missions discussed in several meetings of the Cambodian side like stakeholders meetings, with careful attention to the socio-economic framework and preconditions as well as the future regional context around PPCC.

The urban structure plan should start to confirm the validity of 2020MP from current socio-economic conditions including urbanization, population, etc.

(1) Evaluation of Land Use Plan in 2020MP

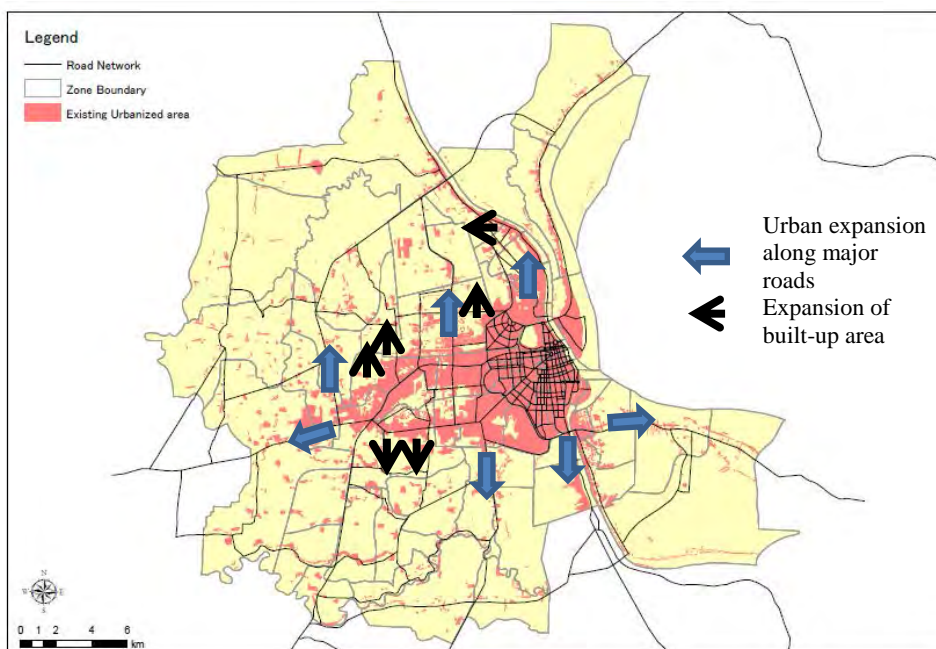
PPCC is currently experiencing rapid economic growth and population increase. This trend seems to be more accelerated recently, so the land use plan in 2020MP is first of all examined from the following viewpoints in order to confirm its validity:

- Conformity of the land use plan with the direction of current urbanization;
- Conformity of urbanized area with the framework;
- Relation to urban development projects with the land use plan; and
- Relation of the ring road system with the land use plan.

1) Conformity of the Land Use Plan with the Direction of Current Urbanization

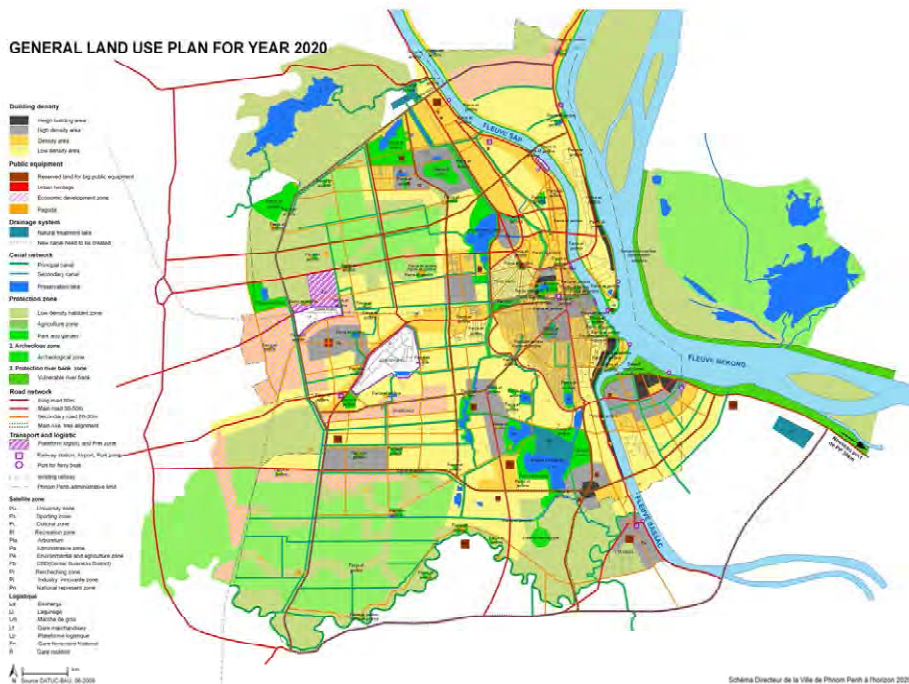
The current urban expansion of PPCC is conceptually illustrated in Figure 3.4-5. Based on the analysis made in Section 3.2.1, the current urban expansion can be understood by dividing it into two movements: urban expansion along the major roads and expansion of built-up areas.

Urbanized areas expand to the west, north and south directions along NR4, NR5 and NR1, respectively, while the existing urbanized areas expand to the areas behind particularly the area in the west direction.

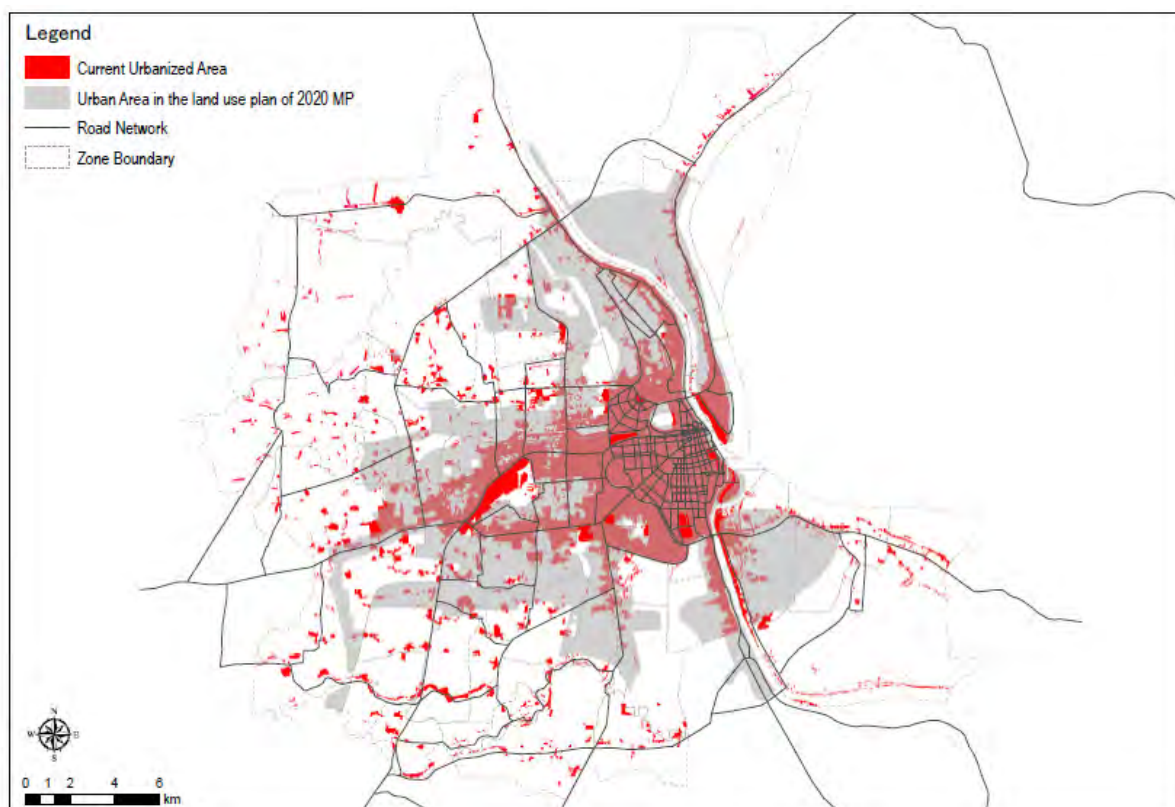


Source: PPUMTP Project Team

Figure 3.4-5 Current Urbanization Directions



(Figure 3.3-2 is re-shown for comparison with the above figure.)



Source: PPUTMP Project Team

Figure 3.4-6 Current Urbanized Area and Urban Area in 2020MP

Figure 3.4-6 shows current urbanized areas (red color) and the land use plan in 2020MP (grey color). The land use plan well designates urban areas which are to be built-up for residential and economic

activities in the same direction of current urbanizing areas such as the west, north and south directions along the national roads. In particular, the land use plan widely designates the urban area in the west direction to cover the development behind the existing built-up area. From this, it can be concluded that the land use plan is still workable under the current urbanization direction.

2) Conformity of Urbanized Area with the Framework

The master plan 2020 by French assistance applies 1.98 million population as a framework of the plan. Since the previous city boundary is smaller than the current city boundary, this is interpreted as about 2.26 million people with the current boundary. On the other hand, the PPUTMP Project Team makes new population projections based on the new city boundary with latest population data from MOP, which are approximately 2.4 million 2020 and approximately 2.9 million in 2035. Comparing both population projections, the future population re-estimated by the PPUTMP Project Team is a little bit higher than that of the 2020MP (see Table 3.4-3).

The 2020MP designates approximately 190 km² of land to be developed in the land use plan, which is large enough to accommodate the future population in 2020.

Table 3.4-3 Required Urban Area from the Framework

			2012	2020	2035
PPUTMP	Population	(Thousand persons)	1,852	2,406	2,868
	Urban Area	(Km ²)	107.7	162.7	208.7
2020MP	Population (estimated with current boundary)	(Thousand persons)	---	1,980 (2,260)	---
	Urban Area	(Km ²)	---	190	---

Source: PPUTMP Project Team

3) Relation of Private Urban Development Projects with the Land Use Plan

There are nine large-scale private urban development projects, as discussed in Section 3.4.3. Some projects have already commenced and some are still in the planning stage, but all projects have obtained official construction permission. Looking into the type of land use in the land use plan by each project location, most of them are located at urban areas with high/ medium population density except for Grand Phnom Penh and Green City. The areas of the Grand Phnom Penh and the Green City projects are both designated as “Park and Garden” area in the land use plan. However, since Grand Phnom Penh is under sales and development stage, while Green City is still in the planning stage, these areas cannot be designated as “park and garden” area.

4) Relation of the Ring Road System with the Land Use Plan

MPWT and PPCC are currently refining the ring road system road network of Phnom Penh, which consists of four ring roads, namely C1, C2, C3 and Outer-Outer Ring Road. The new route concept of the ring road system in Phnom Penh is different from that of the 2020MP. Therefore, it is necessary to coordinate the ring road system proposed by MPWT and by the 2020MP.

5) Conclusion

In general, the current urbanization and population framework basically conform to the land use plan in the 2020MP. Although the 2020MP designates the land to be developed as urban land larger than the land required, it does not directly mean a modification of the land use plan would be required.

However, there are few discrepancies between the current land use and the land use plan, which are caused by current private urban development projects. Hence, it is not necessary to drastically modify/update the land use plan in the 2020MP at this moment, with minimal changes made on the following:

- Ring road system; and
- Land use at areas of some private urban development projects (Green City, Grand Phnom Penh).

(2) Urban Structure

1) Urban Area

Since the PPUTMP Project Team confirmed that the current urbanization basically meets the land use plan in the 2020MP, the Team has adopted the concept of land use plan in the 2020MP, considering a new population framework. More concretely, the Team followed the land use intensity, urban centers, and major transport network of the land use plan; however, the urbanized area will be examined based on the future population of 2020. In this regard, the Team determined the urbanized area with the following considerations:

- Urban expansion along the road will be a major driving force;
- Private development will provide certain new urban areas; and
- Public sector has little power/ measures to guide/ control urbanization until 2020.

Urban expansion constantly continues following the direction of current urbanization, which is along major roads, the expansion of built-up areas to the areas behind the road side, and large-scale private urban development projects (residential complex development).

The total urbanized area will be approximately 160 km² in 2020 to accommodate a population of 2.4 million people.

2) Land Use and Intensity

Urban development will actively continue in accordance with expansion of investment based on the economic growth and population increase. In the area within C1, most of the area is densely built-up. Many urban re-development projects with higher land use intensity currently occur in this area due to higher land price and no vacant space.

In the area outside C1, built-up areas expand along the major roads, and back areas of the built-up area along the major roads will be gradually developed with lower land use intensity. Some areas like the area along Russian Blvd. and private development areas will be developed with medium intensity.

The areas along Cham Chao Road and NR4 currently have an accumulation of factories. This accumulation of factories will continue to expand in the areas along NR4 and C3 following current development:

- Inside C1: high and medium density mixed land use;
- Outside C1: medium density at private development areas and the area along NR4; in the other area, low density;
- Industrial areas along Cham Chao Road, NR4 and C3; and
- Other areas: Green and farm land, water body, vacant land, etc.

3) Urban Centers

The urban center will be more clearly formulated with urban redevelopment projects and private development projects, which will generate denser commercial, business and service facilities. On the other hand, the western area around the existing airport along Cham Chao Road, NR4 and C3 will be a production and logistics center with unique accumulation of factories. Anticipated urban centers with high density areas are as follows:

- Urban Center (Boueng Kok, Monivong, Diamond City);
- 8 Sub-centers (Chbar Ampov, Chak Angrae Kraom, Kandal, Stueng Meanchey, Cheung Aek, Pleung Chheh Roteh, Grand Phnom Penh, Camko City); and
- Production Center (Cham Chao, NR4, C3).

4) Transport Network

Phnom Penh has a radial and circular road network which forms the following major transport corridors:

Major transport node:

- Phnom Penh International Airport, Phnom Penh Port, New Phnom Penh Port

Major transport corridor:

- North-South Transport Corridor, including 3 sub-corridors, supports the urban institutional, business and commercial activities
- East-West Transport Corridor, including 3 sub-corridors, supports the urban industrial and commodity activities
- Ring Transport Corridor (Grand Phnom Penh–Stung Meanchey) supports the urban connectivity

Regional corridor:

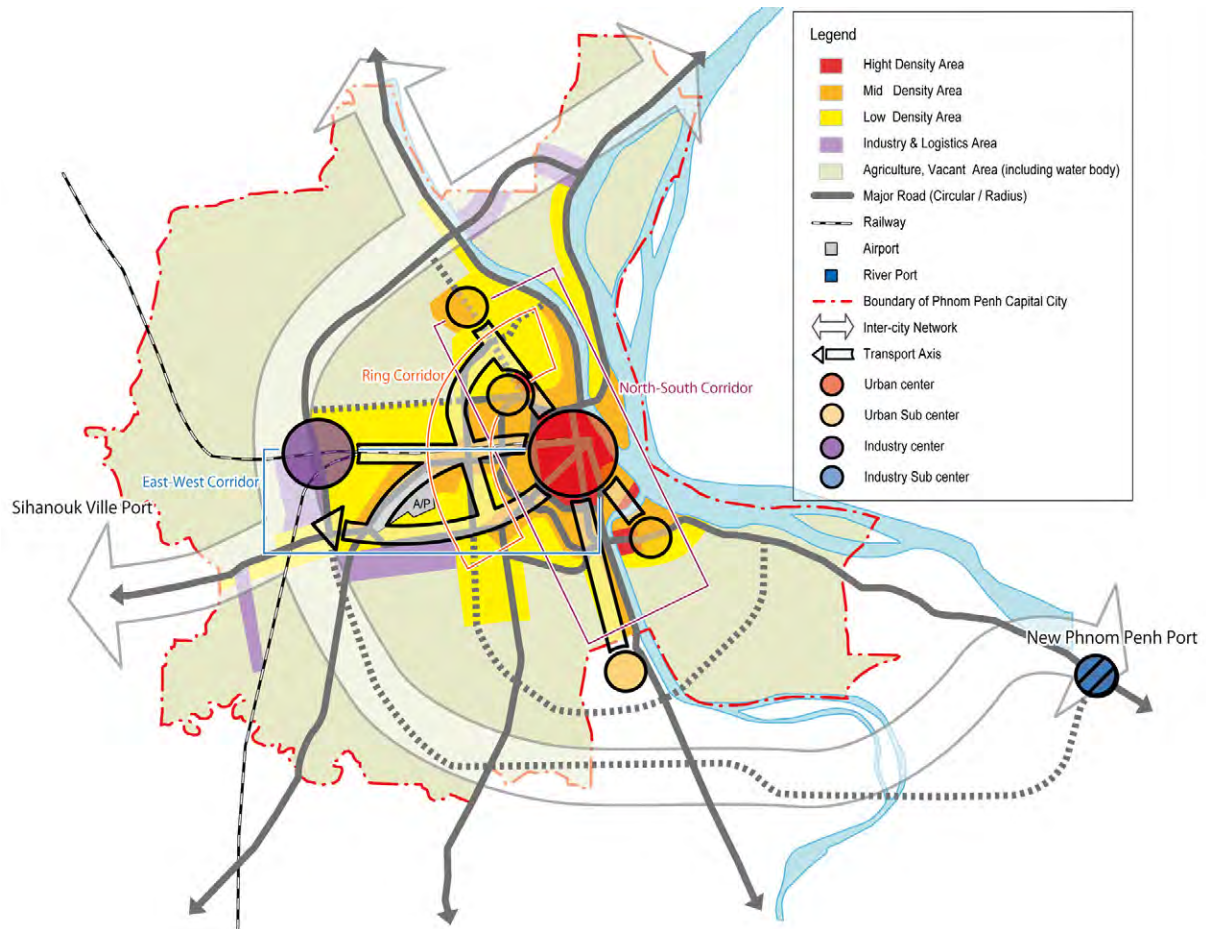
- Growth Corridor and Indochina Central Corridor: Sihanoukville - NR4 - Phnom Penh - NR6
- Indochina Southern Corridor: NR1 - Phnom Penh - NR5

Mode interchange area:

- Both ends and intersection of major transport corridors.

The planned urbanized area in the 2020MP is relatively wider because of the adoption of lower population densities. The planned future urbanized area in this project aims to develop a compact development considering the current urbanization and population density configuration. Therefore, urbanization to the southern area in the urban structure is suppressed, unlike that in the 2020MP.

The abovementioned urban structure is conceptually illustrated in Figure 3.4-7.



Source: PPUTMP Project Team

Figure 3.4-7 Urban Structure in 2020

3.4.6 Urban Structure in 2035

(1) Potential Urban Structure to Accommodate Future Population

1) Urban Area Required in 2035

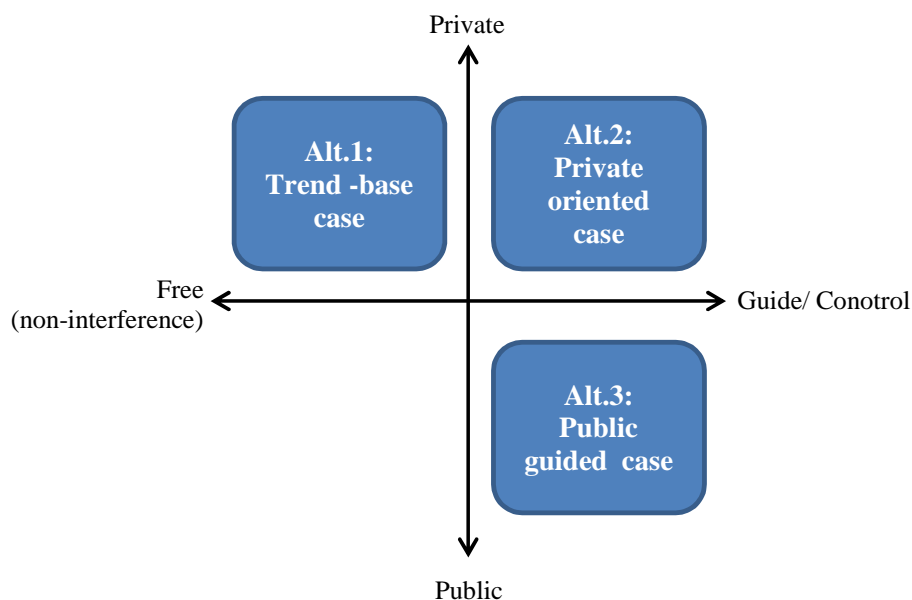
According to the framework, Phnom Penh will have a population of 2.87 million by 2035. It means that the increase in population is approximately 462 thousand people between 2020 and 2035. To accommodate this increased population, Phnom Penh is required to expand the urban area by 46.2 km².

In other words, the urban structure in 2035 will expand to approximately 210 ha with the addition of 46.2 km² of new urban area to its 2020 level.

2) Alternatives

There was little public intervention for guidance/ control of urban development by the urban planning authorities in Phnom Penh. Accordingly, Phnom Penh has been expanded as a result of individual building construction activities. Since areas at the road side are convenient for transport and utility supply, urbanization concentrates along the major roads. Currently, the private sector invests in large-scale urban development projects in Phnom Penh, and the government system and capacity is gradually enhanced to be able to tackle urban problems. Thus, it is important to examine the future urban structure to be able to anticipate the following two axes of determinants of urban development (see Figure 3.4-8):

- Degree of freedom (non-interference) and guidance/control of urban development; and
- Involvement of private and public sectors in development.



Source: PPUTMP Project Team

Figure 3.4-8 Alternatives on Future Urban Structure in 2035

Based on the above figure, the PPUTMP Project Team delineated three typical future land use prospects anticipated, namely:

- Alternative 1: Trend-based case;
- Alternative 2: Private-oriented case; and
- Alternative 3: Public-private collaboration case.

(2) Alternative 1: Trend-based Case

1) Urban Area

Total urbanized area will be approximately 210 km² in 2035 to accommodate some 2.9 million people.

Trend-based case is considered to follow the current urban expansion primarily along the major roads with little governmental interference. Development is made with mainly individual building construction with some private development projects. Urban expansion along the road will be a major driving force. Private development will provide certain new urban areas. The public sector will have limited improvement of institutional, human and financial capacity to guide/ control urbanization even until 2035. Major activities of urban expansion from 2020 to 2035 are as follows:

- Urban area in 2020 continues to expand to the same direction of urbanization until 2020 which occurs along major roads to the north (NR5 and NR6), south (NR1, NR2, NR3) and west (NR4) directions;
- Urban area in 2020 expands built-up areas to the areas behind from the road side; and
- Industrial area is expanded in the west and north directions along NR4 and C3.

2) Land Use and Intensity

In this case, land use intensity will rise from the center to the fringes. The high density area will expand up to Mao Tse Tung Road, and the medium density area will expand over C1 mainly to the west direction. Details are provided below.

- Inside C1: high and medium density mixed land use;
- Outside C1: medium density at private development areas and the area along NR4; the other areas, low density;
- Industrial areas along Cham Chao Road, NR4 and C3;
- Industrial areas at C2/ NR1 and at C3/NR6; and
- Other areas, mainly outside C3: Green and farm land, water body, vacant land, etc.

3) Urban Centers

Economic activities such as services, finance, commerce and trade are more concentrated in the urban centers. On the other hand, the area along C3 and the railway will receive more factories and logistics facilities. Anticipated urban centers with high density areas are the following:

- Urban Center (Boueng Kok, Monivong, Diamond City);
- 8 Sub-centers (Chbar Ampov, Chak Angrae Kraom, Kandal, Stueng Meanchey, Cheung Aek, Pleung Chheh Roteh, Grand Phnom Penh, Camko City);
- Production Center (Cham Chao, NR4, C3); and
- 2 Production Sub-centers (Prek Aeng, Bak Khaeng).

4) Transport Network

The 2035 transport network basically expands the network in 2020 in accordance with urban expansion. The major transport nodes and network are as follows:

Major transport node:

- Phnom Penh Port, New Phnom Penh Port, International Airport (Planned New International Airport located at Kampong Chhnang);

Major transport corridor:

- North-South Transport Corridor, including 5 sub-corridors, supports the urban institutional, business and commercial activities;
- East-West Transport Corridor, including 3 sub-corridors, supports the urban industrial and commodity activities;
- Ring Transport Corridor (Grand Phnom Penh - Stung Meanchey) supports the urban connectivity;

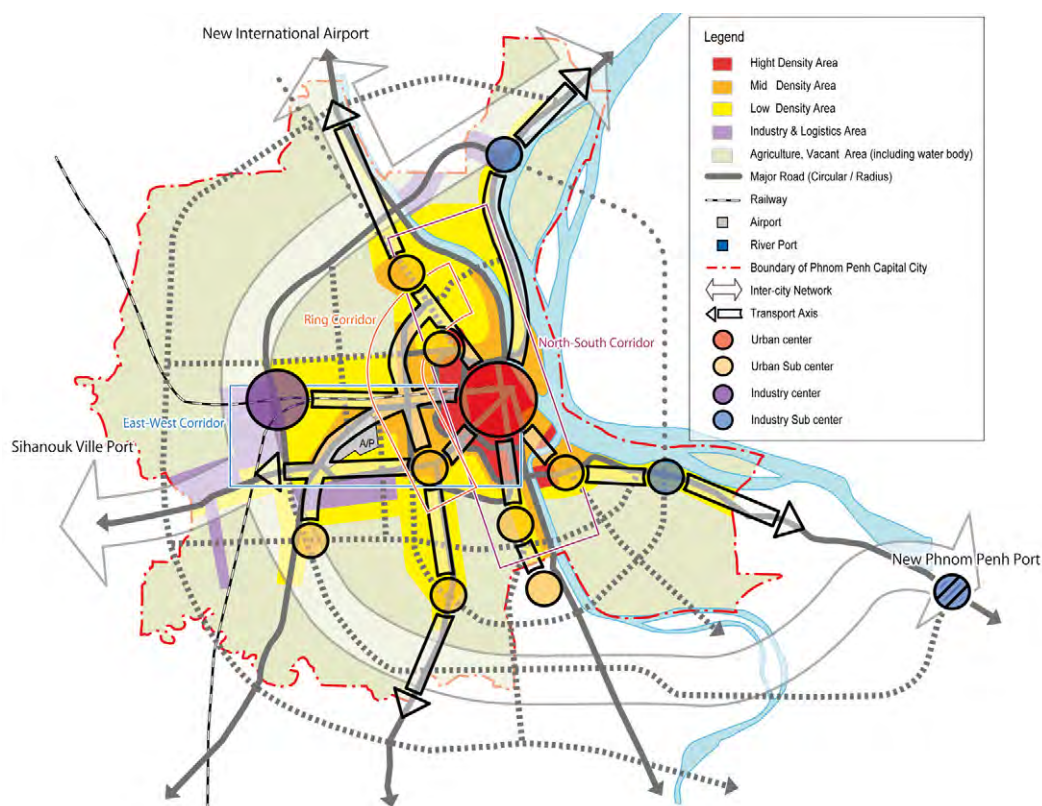
Regional corridor:

- Growth Corridor and Indochina Central Corridor: Sihanoukville - NR4 - Phnom Penh - NR6;
- Indochina Southern Corridor: NR1 - Phnom Penh - NR5;

Mode interchange area:

- Both ends and intersection of major transport corridors.

Figure 3.4-9 is a conceptual illustration of the abovementioned urban structure under Alternative 1.



Source: PPUTMP Project Team

Figure 3.4-9 Alternative 1: Urban Structure in 2035

(3) Alternative 2: Private-oriented Case

1) Urban Area

Total urbanized area will be approximately 210 km² in 2035 to accommodate an estimated population of 2.9 million.

The private-oriented case assumes that more real estate businesses will contribute to form a major part of the urban expansion. Currently, large-sized residential development projects are planned like the Green City, Satellite City and Boueng Chuk area development. If current urban development projects turn out to be successful, it is expected that the real estate business in Phnom Penh will attract more foreign investment under favorable economic conditions and growth in population. The major urban expansion activities from 2020 to 2035 are as follows:

- Large private urban development projects indicated in Figure 3.4-3 are completed and accommodate sufficient population. Other private residential estate development projects are also carried out;
- Urban area in 2020 continues to expand to mainly the west (NR4) direction;
- Urban area in 2020 expands built-up areas to the areas behind from the road side; and
- Industrial area is expanded in the west and north directions along NR4 and C3.

2) Land Use and Intensity

Land use intensity will rise from the center to the fringes. High density areas will expand up to Mao Tse Tung. Medium density areas will expand over C1 mainly to the west direction. The following land use changes are expected:

- Inside C1: high and medium density mixed land use;
- Outside C1: medium density at private development areas and the area along NR4; the other areas, low density;
- Industrial areas along Cham Chao Road, NR4 and C3;
- Industrial areas at C2/ NR1 and at C3/NR6; and
- Other areas, mainly outside C3: Green and farm land, water body, vacant land, etc.

3) Urban Centers

The location of urban centers is the same as that of Alternative 1. Anticipated urban centers with high density areas are as follows:

- Urban Center (Boueng Kok, Monivong, Diamond City);
- 8 Sub-centers (Chbar Ampov, Chak Angrae Kraom, Kandal, Stueng Meanchey, Cheung Aek, Pleung Chheh Roteh, Grand Phnom Penh, Camko City);
- Production Center (Cham Chao, NR4, C3); and
- 2 Production Sub-centers (Prek Aeng, Bak Khaeng).

4) Transport Network

The transport network in 2035 basically expands the network in 2020 in accordance with urban expansion. The network should also be developed to cover the southern direction, where many large urban development projects are to be completed. Major transport nodes and network are as follows:

Major transport node:

- Phnom Penh Port, New Phnom Penh Port, International Airport (Planned New International Airport located at Kampong Chhnang);

Major transport corridor:

- North-South Transport Corridor, including 5 sub-corridors, supports the urban institutional, business and commercial activities;
- East-West Transport Corridor, including 3 sub-corridors, supports the urban industrial and commodity activities;
- Ring Transport Corridor (Grand Phnom Penh - Stung Meanchey) supports the urban connectivity;

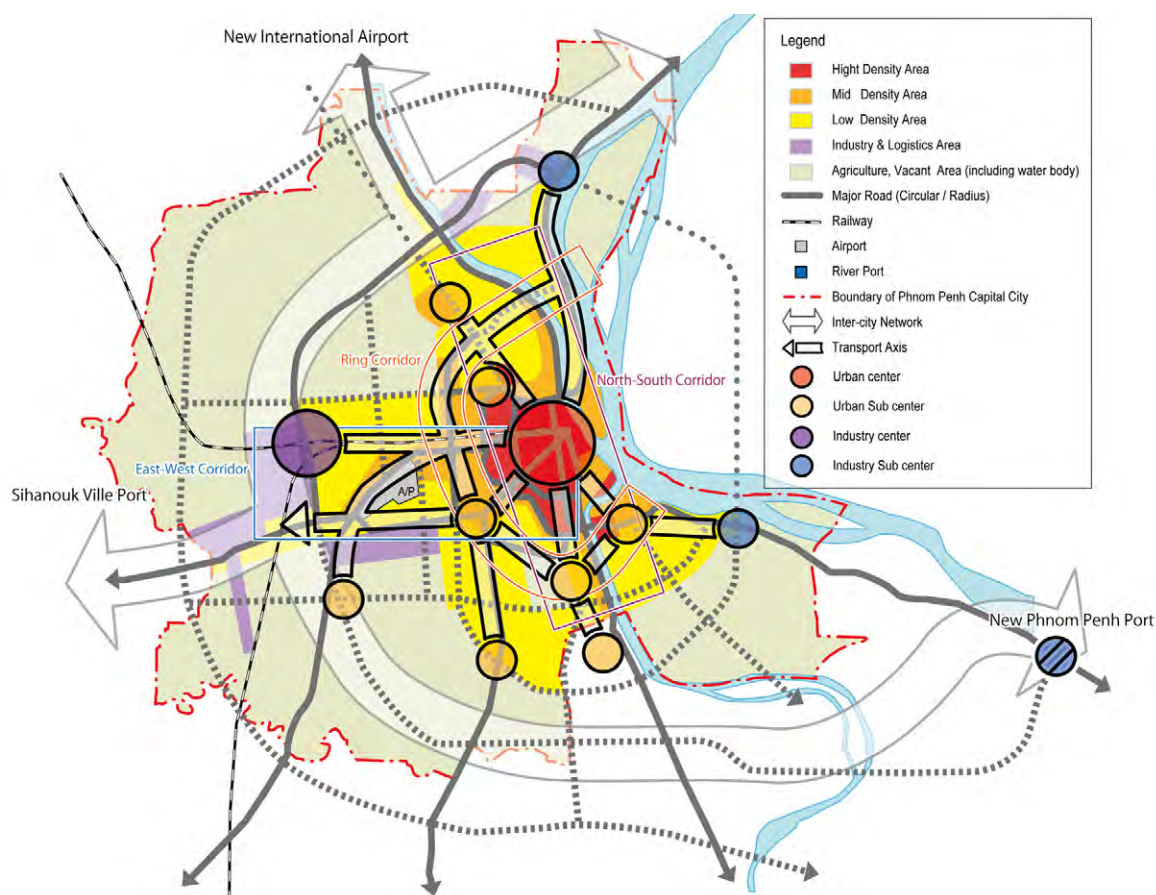
Regional corridor:

- Growth Corridor and Indochina Central Corridor: Sihanoukville - NR4 - Phnom Penh - NR6;
- Indochina Southern Corridor: NR1 - Phnom Penh - NR5;

Mode interchange area:

- Both ends and intersection of major transport corridors.

The urban structure mentioned above is conceptually illustrated in Figure 3.4-10.



Source: PPUTMP Project Team

Figure 3.4-10 Alternative 2: Urban Structure in 2035

(4) Alternative 3: Public-Private Collaboration Case

1) Urban Area

The total urbanized area will be approximately 210 km² in 2035 to accommodate about 2.9 million people.

In this case, the public sector guides private investment to certain areas by institutional control and infrastructure provision. An example of this case in Phnom Penh is the Toul Kouk area, which has a network of ring and radial roads developed under an urban plan and design in the late 1960s. This needs institutional, human and financial capability of public agencies concerned with urban development administration. The Cambodian Government has been gradually enhancing its capacity with foreign assistance, so that there seems to be a potential to prepare certain measures to guide urban development with new town development like the Toul Kouk area. To improve the efficiency and effectiveness of logistics and production, the government designates a special zone for concentrating logistics and industrial activities around the intersection of C3 and the railway line in the south.

Under this alternative, the major directions of urban expansion from 2020 to 2035 are the following:

- Large public investment will be made for constructing transport network and utilities at the north-east area to guide private investment of housing and real estate development. This area will form new urbanized area;
- Urban area in 2020 continues to expand mainly to the west (NR4) direction;
- Urban area in 2020 expands built-up areas to the areas behind from the road side; and
- Logistics and industrial complexes will be formulated by government initiatives to where existing factories and warehouses in the downtown area will be relocated. The area is around the intersection of C3 and the railway southern line.

2) Land Use and Intensity

Land use intensity will rise from the center to the fringes. High density area will expand up to Mao Tse Tung. Medium density areas will expand over C1 mainly to the west direction. Land use will consist of the following:

- Inside C1: high and medium density mixed land use;
- Outside C1: medium density at private development areas and the area along NR4; the other areas, low density;
- Industrial areas along Cham Chao Road, NR4 and C3;
- Industrial areas at C2/ NR1 and at C3/NR6; and
- Other areas mainly outside C3: Green and farm land, water body, vacant land, etc.

3) Urban Centers

In addition to the urban centers which are the same as in Alternatives 1 and 2, Krang Thnong is designated as a sub-center which is a neighboring center of the new urbanized area. Anticipated urban centers with high density or medium density areas are the following:

- Urban Center (Boueng Kok, Monivong, Diamond City);
- 9 Sub-centers (Chbar Ampov, Chak Angrae Kraom, Kandal, Stueng Meanchey, Cheung Aek, Pleung Chheh Roteh, Krang Thnong, Grand Phnom Penh, Camko City);
- Production Center (Cham Chao, NR4, C3); and
- 2 Production Sub-centers (Prek Aeng, Bak Khaeng).

4) Transport Network

The transport network in 2035 basically expands the network in 2020 in accordance with urban expansion. The network should also be developed to cover the southern direction, where many large urban development projects are completed. The major transport nodes and network are as follows:

Major transport node:

- Phnom Penh Port, New Phnom Penh Port, International Airport (Planned New International Airport located at Kampong Chhunang);

Major transport corridor:

- North-South Transport Corridor, including 5 sub-corridors, supports the urban institutional, business and commercial activities;
- East-West Transport Corridor, including 3 sub-corridors, supports the urban industrial and commodity activities;
- New Urban Sub-center Transport Corridor (Urban Center - Krang Thnong) supports the urban activities in the new urban sub-center;
- Ring Transport Corridor (Grand Phnom Penh - Stung Meanchey) supports the urban connectivity;

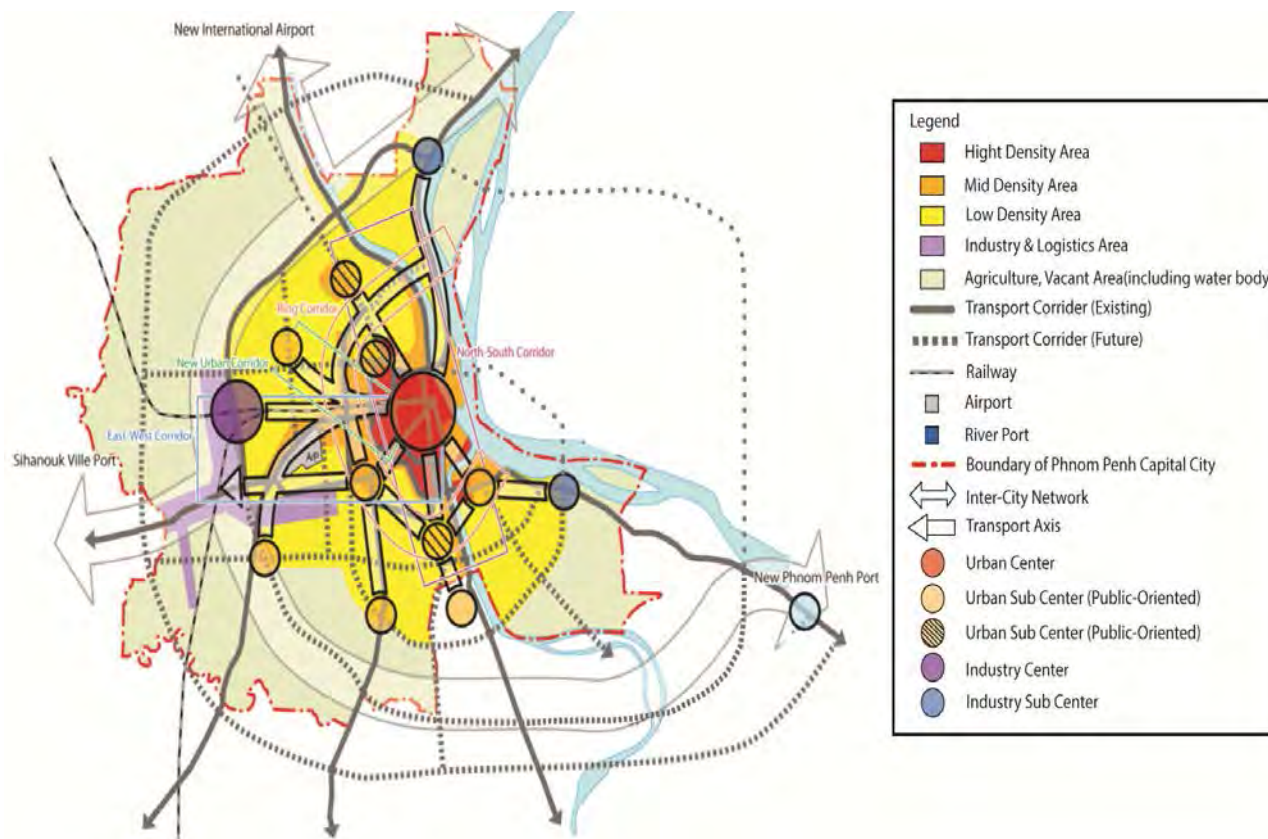
Regional corridor:

- Growth Corridor and Indochina Central Corridor: Sihanoukville - NR4 - Phnom Penh - NR6;
- Indochina Southern Corridor: NR1 - Phnom Penh - NR5;

Mode interchange area:

- Both ends and intersection of major transport corridors.

The concept of the reversed pear structure is shown in Figure 3.4-11.



Source: PPUTMP Project Team

Figure 3.4-11 Alternative 3: Urban Structure in 2035

(5) Evaluation of Alternatives

1) Criteria

The three alternatives discussed in foregoing section could accommodate the requirements of development visions and preconditions. However, there are different advantages and disadvantages among them. The best alternative will be selected based on the following criteria:

- Environment (impacts on further environment improvement projects);
- Traffic (impacts on traffic conditions);
- Cost (to realize the structure by public sector);
- Public enforcement (intervention) for controlling/guiding development (to realize the structure);
- Project risk (dependence on private sector investment); and
- Sub-urban development (to provide the residential area with good accessibility and environment for lower and medium income groups by public intervention).

2) Results of Evaluation

Table 3.4-4 summarizes the results of the evaluation of the three alternatives. The PPUTMP Project Team selected the “Public-private collaboration case” of Alternative 3 which may have more advantages to generate a holistically better environment in the suburban area, compared to others. However it is important to acknowledge that sufficient capacity of the public sector in terms of investment and institutional capacity to guide urbanization and urban development are required to realize this structure.

Table 3.4-4 Evaluation of Alternatives

	Alternative 1: Trend-base Case	Alternative 2: Private-oriented Case	Alternative 3: Public-private collaboration Case
Natural Environment	1 There is no vulnerable fauna and flora in the urban area in Phnom Penh, so that there is little impact on natural environment from urbanization which seems to be negligible difference among the alternatives. Green belt areas, consisting of agricultural land and forest land, surrounding Phnom Penh will be deteriorated with disordered urbanization.	2 There is no vulnerable fauna and flora in the urban area in Phnom Penh, so that there is little impact on natural environment from urbanization which seems to be negligible difference among the alternatives. Green belt areas, consisting of agricultural land and forest land, surrounding Phnom Penh will be affected with development along roads, but it may be limited.	2 There is no vulnerable fauna and flora in the urban area in Phnom Penh, so that there is little impact on natural environment from urbanization which seems to be negligible difference among the alternatives. Green belt areas, consisting of agricultural land and forest land, surrounding Phnom Penh will be affected with development along roads, but it may be limited.
Living Environment	1 Environmental burden on living circumstance can not be released in urban center. Sprawl type of urban area will be generated along the major roads, resulted in expanding insufficient urban environmental areas in the suburban area.	2 Environmental burden on living circumstances can be released in certain degree in urban center by removing businesses to sub-centers. Residential area with better environment shall be expanded with large urban development projects.	3 Environmental burden on living circumstances can be released in certain degree in urban center by removing businesses to sub-centers. Residential area with better environment shall be expanded in the public guided new urbanized area which has sufficient infrastructure and utilities.
Traffic Impact	1 There is a risk to generate heavy traffic congestion in the urban center in future.	3 High mobility can be maintained with distribution of traffic attractions.	3 High mobility can be maintained with distribution of traffic attractions.
Cost	3 Less public investment is required to develop infrastructure and utility in the sub-centers.	2 Certain level of public investment is required to accelerate public investment for housing and real estate businesses.	1 More public investment is required to develop infrastructure and utility to guide private development projects to the new urbanized area.
Enforcement	3 It is possible to manage with current institution and capacity regarding urban development management.	2 It is required to improve urban development and management capacity in urban planning authority.	1 It is required to improve urban development and management capacity in urban planning authority. More capacity is necessary comparing to the alternative 2.
Project Risk	3 Less influence from large urban development projects	1 Urban structure depends totally on large urban development projects by the private investment.	2 Dependence on the public investment and capacity
Suburban Development	1 There is a risk to cause urban sprawl along the major roads in the suburban area. Industrial area will be naturally formed along N0.4 and outer ring roads. Residential area will be formed along the major roads.	2 There is a risk to generate disordered private development without sufficient public control capacity. Industrial area will be naturally formed along N0.4 and outer ring roads. Residential area will be mainly formed at the private initiated large scale urban development areas and certain areas along the major roads (but it much smaller than the Alternative 1).	3 It is possible to improve living environment (conditions) of existing relocation sites in the northeastern part of Phnom Penh with good impacts from development of nearby areas. Industrial area will be intentionally formed mainly tag the intercession area of outer ring road with railway with certain accumulation along No.4 (but it is limited). Residential area will be intentionally located at north-eastern area between C2 and C3 to form a planned urbanized area.
Total	13	14	15

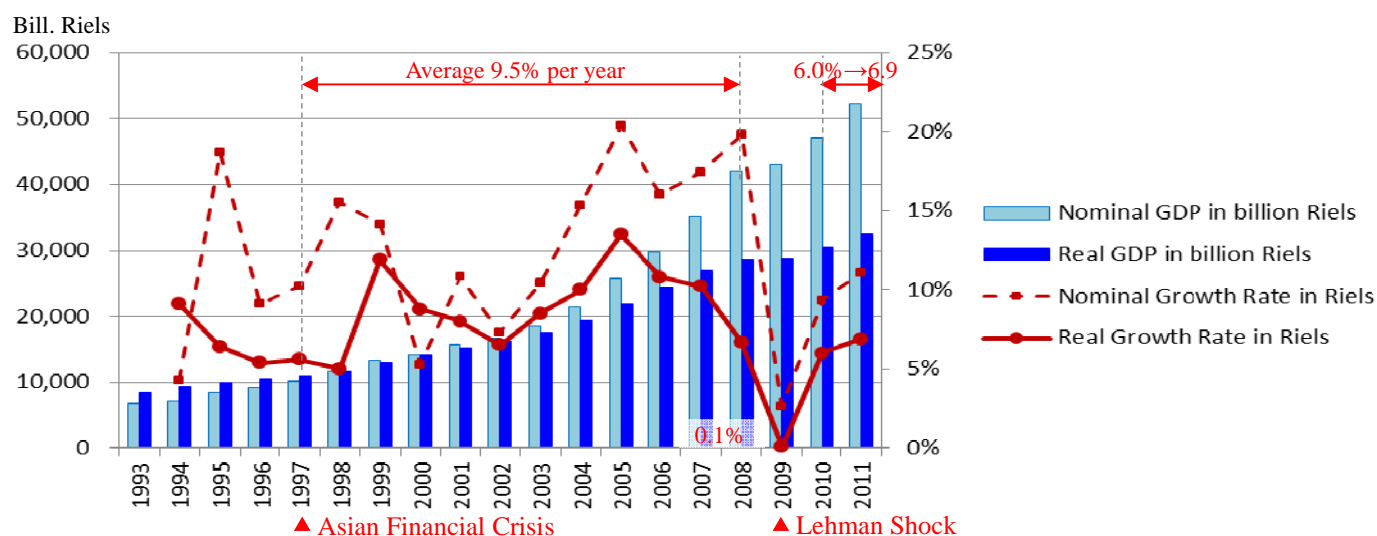
Source: PPUTMP Project Team

4 SOCIO-ECONOMIC PROFILE

4.1 Economic Framework

4.1.1 Trend of Economic Data in Cambodia

The Cambodian economy grew at an average rate of 9.5% per year over a 10-year period from 1998 (the year after the Asian financial crisis) to 2008 (the year of the collapse of Lehman Brothers which triggered the financial crisis in many parts of the world). In 2009, a year after Lehman Brothers collapsed, the Cambodian economy grew no more than 0.1%, then steadily recovered to post a 6.0% growth in 2010 and 6.9% in 2011. This economic trend is shown in Figure 4.1-1 below.



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Nominal GDP in billion Riels	6,813	7,105	8,434	9,202	10,145	11,720	13,376	14,083	15,617	16,756	18,508	21,343	25,693	29,809	35,042	41,968	43,057	47,048	52,254
Nominal Growth Rate in Riels		4.3%	18.7%	9.1%	10.3%	15.5%	14.1%	5.3%	10.9%	7.3%	10.5%	15.3%	20.4%	16.0%	17.4%	19.8%	2.6%	9.3%	11.1%
Real GDP in billion Riels	8,521	9,297	9,896	10,431	11,018	11,570	12,947	14,083	15,215	16,210	17,589	19,351	21,956	24,334	26,870	28,668	28,692	30,406	32,511
Real Growth Rate in Riels		9.1%	6.4%	5.4%	5.6%	5.0%	11.9%	8.8%	8.0%	6.5%	8.5%	10.0%	13.5%	10.8%	10.2%	6.7%	0.1%	6.0%	6.9%
Nominal GDP in million USD	2,480	2,765	3,419	3,486	3,392	3,106	3,507	3,649	3,980	4,273	4,656	5,315	6,278	7,265	8,631	10,337	10,400	11,634	12,874
Real GDP in million USD	3,102	3,617	4,011	3,951	3,684	3,066	3,395	3,649	3,877	4,134	4,425	4,819	5,365	5,931	6,618	7,061	6,931	7,519	8,010
Nominal Per Capita GDP in USD	229	248	297	295	281	253	281	288	309	326	349	392	454	513	575	760	753	830	909
Official Exchange rate(Riels/USD)	2747	2570	2467	2640	2991	3774	3814	3859	3924	3921	3975	4016	4092	4103	4075				

Source: 1993-2006= Statistical Yearbook of Cambodia 2008

: 2007-2011= Economic and Monetary Statistics Series No.218-19th Year (2011, National Bank of Cambodia)

Figure 4.1-1 Trend of Economic Growth Rate in Cambodia, 1993-2011

4.1.2 Projection of Economic Growth

Based on projections by the Cambodian Government and the International Monetary Fund (IMF), the Cambodian economy is estimated to grow from 6% to 7% annually in the short term (2012-2016) and finally settling to grow at around 7% in the long term (2017-2031), as shown in Table 4.1-1.

Table 4.1-1 Assumption of Economic Growth Rate by Cambodian Government and IMF

	2012	2013	2014	2015	2016	2021	2031	Long Term
Rectangular Strategy	-	-	-	-	-	-	-	around7%
NSDP Update 2009-2013	6.5%	6.5%	-	-	-	-	-	-
IMF Country Report No.12/46	6.5%	6.4%	6.8%	7.4%	7.4%	7.6%	7.8%	-

Source: NSDP Update 2009-2013 (2010)

: Rectangular Strategy for Growth, Employment, Equity and Efficiency Phase II (2008)

: IMF Country Report No.12/46, Cambodia 2011 Article IV Consultation (2012, IMF)

4.1.3 Economic Framework of the Study Area

There is not enough data related to Gross Regional Domestic Product (GRDP) of PPCC; therefore, the rate of economic growth of Cambodia is used as the rate of economic growth of Phnom Penh. Referring to the Rectangular Strategy, NSDP Update 2009-2013, and IMF Country Report, the rate of economic growth of Cambodia is established as follows.

Table 4.1-2 Economic Framework

	2008	2012p	2016p	2020p	2035p
Real GDP Growth Rate (%)	6.7%	6.5%	7.5%	7.5%	7.5%

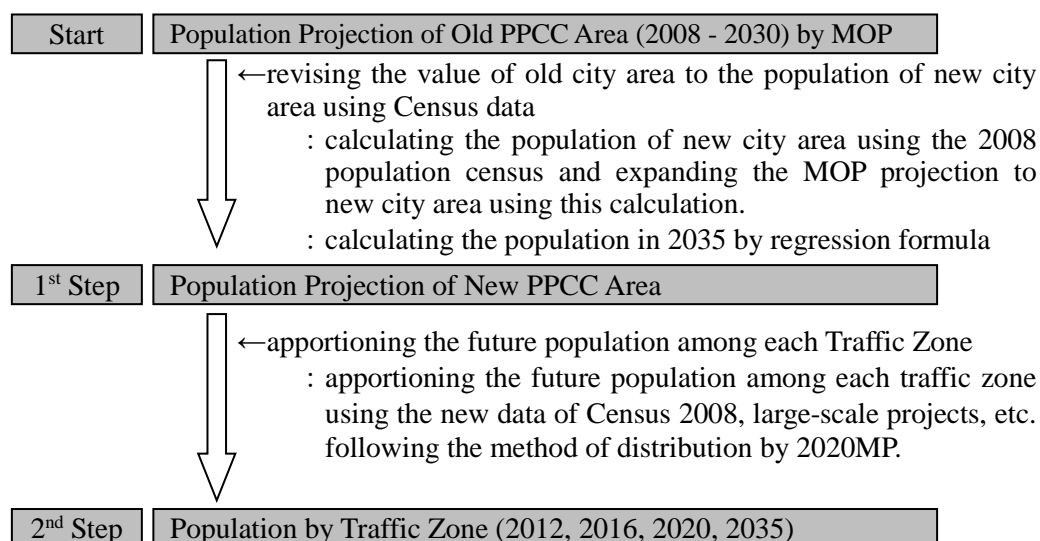
Note: p - projected

Source: PPUTMP Project Team

4.2 Population

4.2.1 Introduction

The future population of Phnom Penh in 2016, 2020 and 2035 is estimated based on the population projection of MOP (2011). However, MOP's population projection is for the old city area; therefore, the population projection for the new city area is estimated using the results of Census 2008. The population by traffic zone is set based on the data of Census 1998, Census 2008, 2020MP, etc. (see Figure 4.2-1)



Source: PPUTMP Project Team

Figure 4.2-1 Procedure in Population Estimate

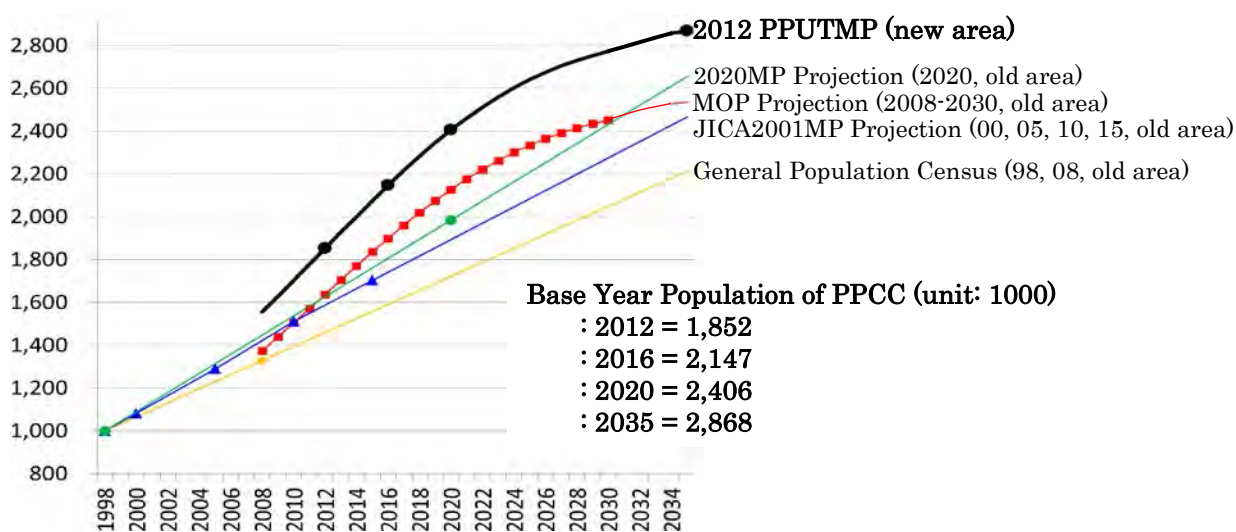
4.2.2 Population of Phnom Penh

The project's base year (2012) population of the PPCC new area) was set at 1.85 million and that of the target year 2035 was set at 2.87 million (see Table 4.2-1 and Figure 4.2-2).

Table 4.2-1 Population Projection of Target Year (unit: '000)

	1998	2008	2012p	2016p	2020p	2035p
Phnom Penh (new area)	1,133.4	1,501.7	1,852.2	2,147.4	2,405.5	2,867.6
Phnom Penh (old area)	999.8	1,327.6	1,637.5	1,898.0	2,126.6	2,535.1
Cambodia	11,437.7	13,395.7	14,741.4	15,626.4	16,505.2	19,166.6

Source: PPUTMP Project Team






Source: PPUTMP Project Team

Figure 4.2-2 Population Change Estimate by this Project, Census, Related Projects, etc.

4.2.3 Breakdown into Traffic Zones

(1) Urban Structure and Population Allocation

The population allocation is set based on Alternative 3, which was supported by most at the stakeholders at the meeting on 6 September 2014 (see Figure 4.2-3). Moreover, the population allocation of Alternative 1, which is based on present trends as a base case without the project, is also being conducted.

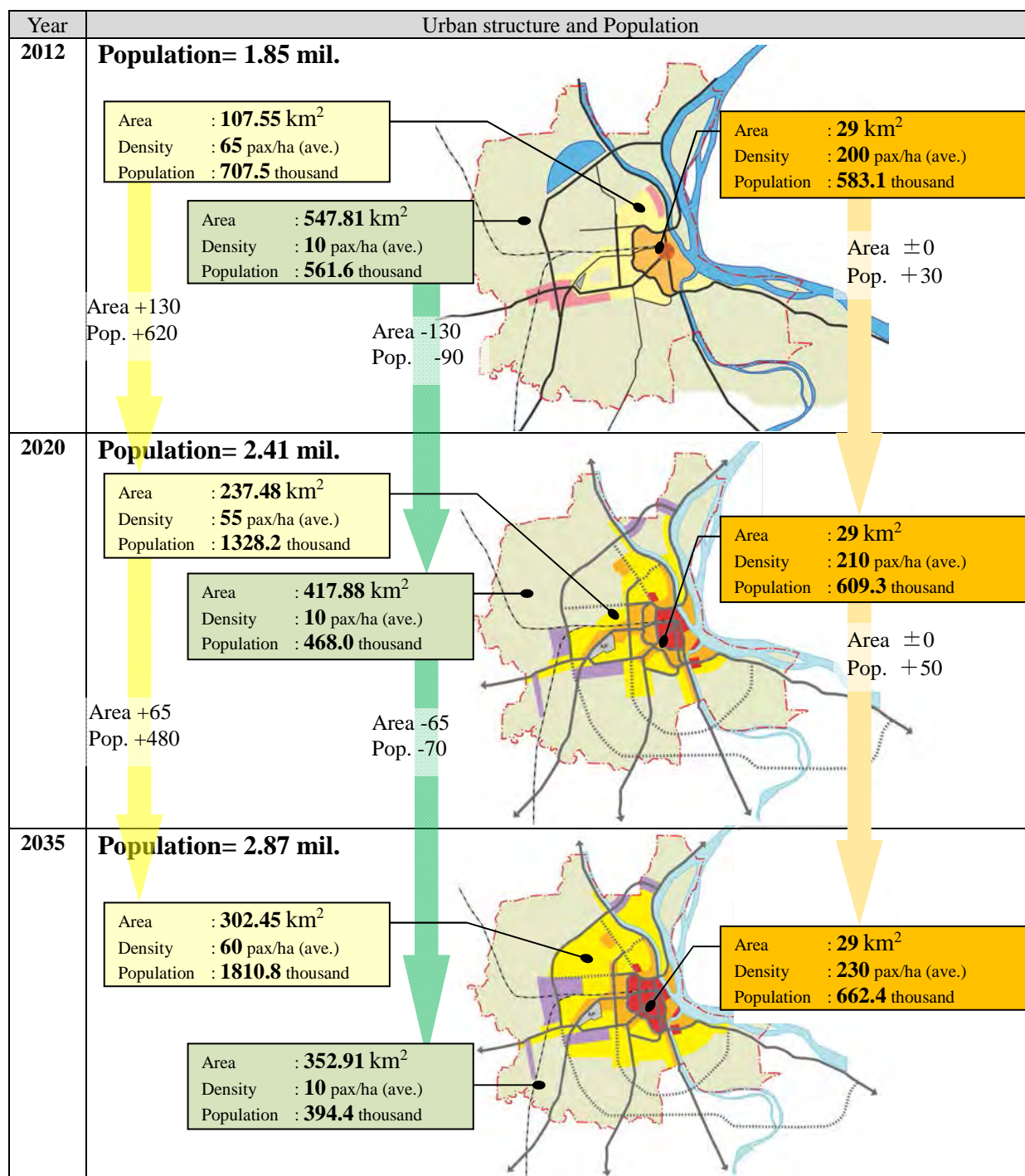
Alternative 1: Trend-based Case	Alternative 2: Private-oriented Case	Alternative 3: Public-Private Collaboration Case
		
<p>Trend-based urban development: present trend plan</p> <p>: population concentrates along the east and west trunk road</p>	<p>Multi-core based on the private large urban development projects: development projects for the radial direction</p> <p>: population concentrates along roads</p>	<p>Multi-core with guided urbanization to northwest direction in suburban area: development projects by roads radiating in all directions</p> <p>: developmental type of 2020MP</p>

Source: PPUTMP Project Team

Figure 4.2-3 Three Urban Structure Plans Indicated at the Stakeholder Workshop (6 September 2014)

(2) The outline of Population Allocation Based on Alternative 3

The population of the Inner Urban Area is estimated to increase by almost 80 thousand people from 2012 to 2035. Meanwhile, over the same period, the area of the Outer Urban Area is estimated to expand by 195 km², and the population is expected to increase by 170 thousand people (see Figure 4.2-4). In the same way, the agricultural area is estimated to decrease by 195 km², and the population is expected to decrease by 170 thousand people.



Note: The Inner Urban Area (orange) corresponds to the Zone 1-44. The Outer Urban Area of 2012 (yellow) corresponds to 9-63, 69-71, 73, 74, 77, 80, 83, 84, 92, 93, the area of 2020 - 46, 56, 59-65, 69-71, 73-75, 77, 79-89, 92-95 and 2035 year - 6, 53, 56-65, 69-71, 73-77, 79-89, 92-95. The rest is Agricultural Area (green).

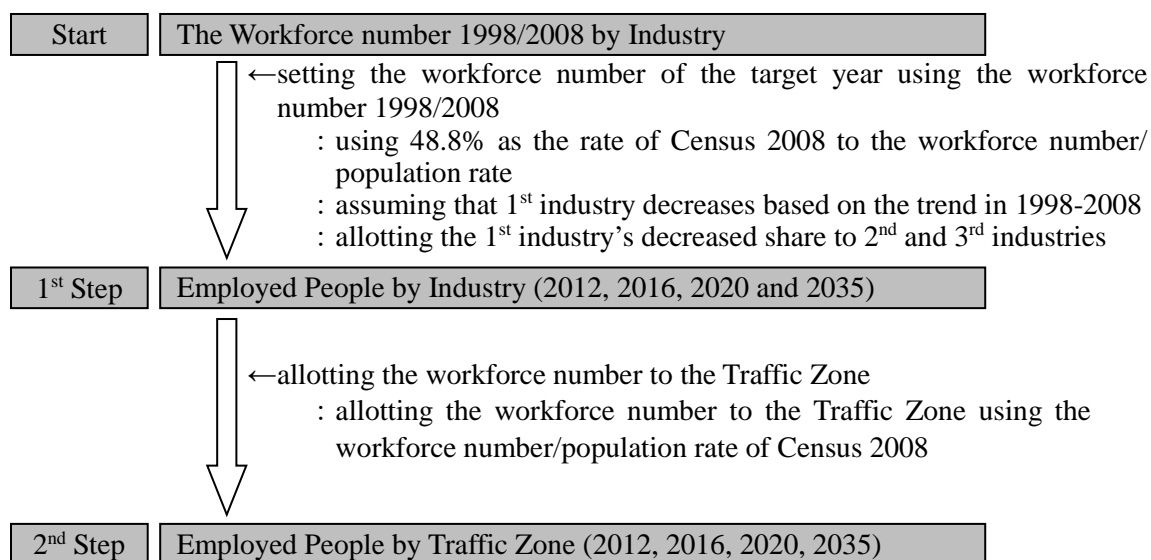
Source: PPUTMP Project Team

Figure 4.2-4 The Way of Thinking about Future Urban Structure and Population Allocation

4.3 Employment

4.3.1 Estimation Procedure

The workforce of PPCC is set in the following order, using the population statistical results of the Census 1998, Census 2008, and this project (see Figure 4.3-1).



Source: PPUTMP Project Team

Figure 4.3-1 Procedure of the Workforce Estimation

4.3.2 Workforce of Target Year

The workforce in the target year 2035 by industry is projected as follows:

Table 4.3-1 Employment Projection in PPCC by Industry (unit: '000)

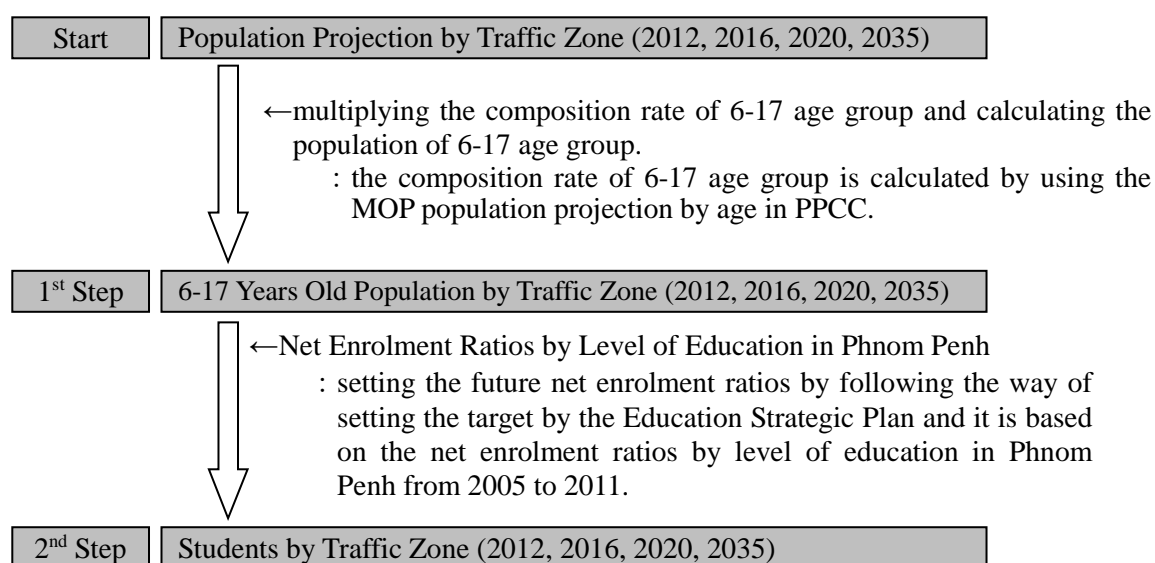
	2008		2012		2016		2020		2035		Difference 2035-2012
	No.	%	No.	%	No.	%	No.	%	No.	%	
Population	1,502	100.0%	1,852	100.0%	2,147	100.0%	2,406	100.0%	2,868	100.0%	+1016
Workforce	733	100.0%	900	100.0%	1,050	100.0%	1,170	100.0%	1,400	100.0%	+500
Primary	70	9.5%	65	7.2%	60	5.8%	55	4.8%	40	2.7%	-25
Secondary	240	32.7%	300	33.5%	360	34.1%	400	34.4%	490	35.2%	+190
Tertiary	423	57.7%	535	59.2%	630	60.1%	715	60.8%	870	62.0%	+335

Source: PPUTMP Project Team

4.4 Student Enrolment

4.4.1 Procedure to Estimate Number of Students

The number of students in PPCC is determined by calculating the population belonging to the age group 6-17 years using the above population by traffic zone and multiplying it by the net enrolment ratios by level of education (see Figure 4.4-1).



Source: PPUTMP Project Team

Figure 4.4-1 Procedure to Estimate Number of Students at School Locations

4.4.2 Net Enrolment Ratios by Level of Education in Phnom Penh

The net enrolment ratios by level of education in Phnom Penh from 2005 to 2011 are shown in Table 4.4-1 below.

Table 4.4-1 Net Enrolment Ratios by Level of Education in Phnom Penh

	Number				Net Enrolment Ratio		
	Primary	L.Sec	U.Sec	Total	Primary	L.Sec	U.Sec
2004/2005	148,784	63,123	38,849	250,756	91.6%	68.1%	27.1%
2005/2006	140,550	64,715	44,895	250,160	93.7%	65.6%	37.0%
2006/2007	131,126	63,617	46,812	241,555	91.3%	68.7%	52.9%
2007/2008	118,980	60,834	51,088	230,902	93.2%	63.5%	52.4%
2008/2009	113,979	53,605	50,736	218,320	87.8%	55.1%	40.1%
2009/2010	113,320	49,639	50,501	213,460	91.8%	50.0%	46.8%
2010/2011	133,113	52,404	48,942	234,459	92.4%	52.4%	39.2%

Note: L.Sec= Lower Secondary School, U.Sec= Upper Secondary School

Source: Education Statistics and Indicators (Ministry of Education, Youth and Sport)

4.4.3 Number of Students in Target Year 2035

The number of students in the target year 2035 is set as follows:

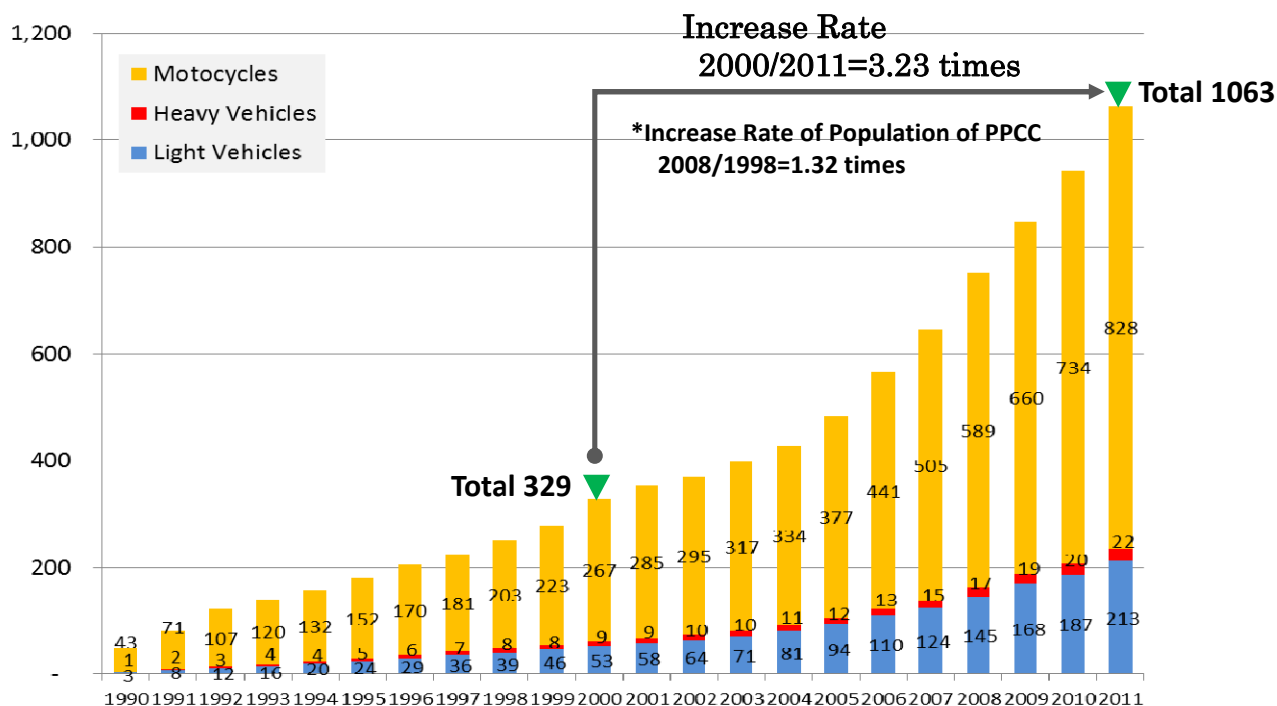
Table 4.4-2 Number of Students in Target Year

	2012	2016	2020	2035
Number	188,600	251,800	368,900	435,500

Source: PPUTMP Project Team

4.5 Number of Registered Vehicles

The number of registered vehicles in PPCC has rapidly increased, from 4 thousand in 1990 to 235 thousand in 2011 (see Figure 4.5-1). During the same period, the number of motorcycles has tremendously increased from 43 thousand to 828 thousand. The total number of registered vehicles including motorcycles from 2000 to 2011 increased 3.23 times. However, this number is just an accumulation from 1990 and does not take into account the scrapped vehicles.



Source: Phnom Penh City Hall (PPCH)

Figure 4.5-1 Number of Registered Vehicles (Accumulated, unit: ‘1000)

5 ROAD NETWORK

5.1 Road Network in Phnom Penh

5.1.1 Network Pattern

The road network in Phnom Penh shows a radial-ring pattern in general, particularly in the central district within C1 (Road No. 271). The main radial roads are composed of Monivong and Norodom in the north-south direction, Russian and Kampuchea Krom in the east-west direction, and Charles de Gaulle/Monireth stretching toward the southwest direction from the Central Market. As for the ring roads, Sihanouk, Mao Tse Toung and C1 are functioning as main roads in the central area. When looking at the road network by district basis, the road network shows rather a grid pattern formed by the district local roads.

The suburban area is linked with the Central District through the two bridges, Chroy Chanvar Bridge (Japan Bridge) in the north and Monivong Bridge in the southeast, and Russian and Monireth in the west and southwest. The road network inside C1 is generally in good condition owing to the overlay and rehabilitation projects carried out during the past decade. Most of the abovementioned arterial roads are 30 m in total width (18 m for the carriageway and 12 m for the sidewalk). However, the actual road widths are substantially reduced due to on-street parking of cars throughout the daytime. Traffic on the roads is growing at a rapid pace and traffic congestions are getting serious, particularly in the morning and evening peak hours. The congested intersections are Steung Mean Chey, Monivong/Russian, Russian/Toul Kok, etc. The congestion at the intersections of Pet Lok Sang and Kbal Thanol seem to have been alleviated because of the recently completed flyover projects.

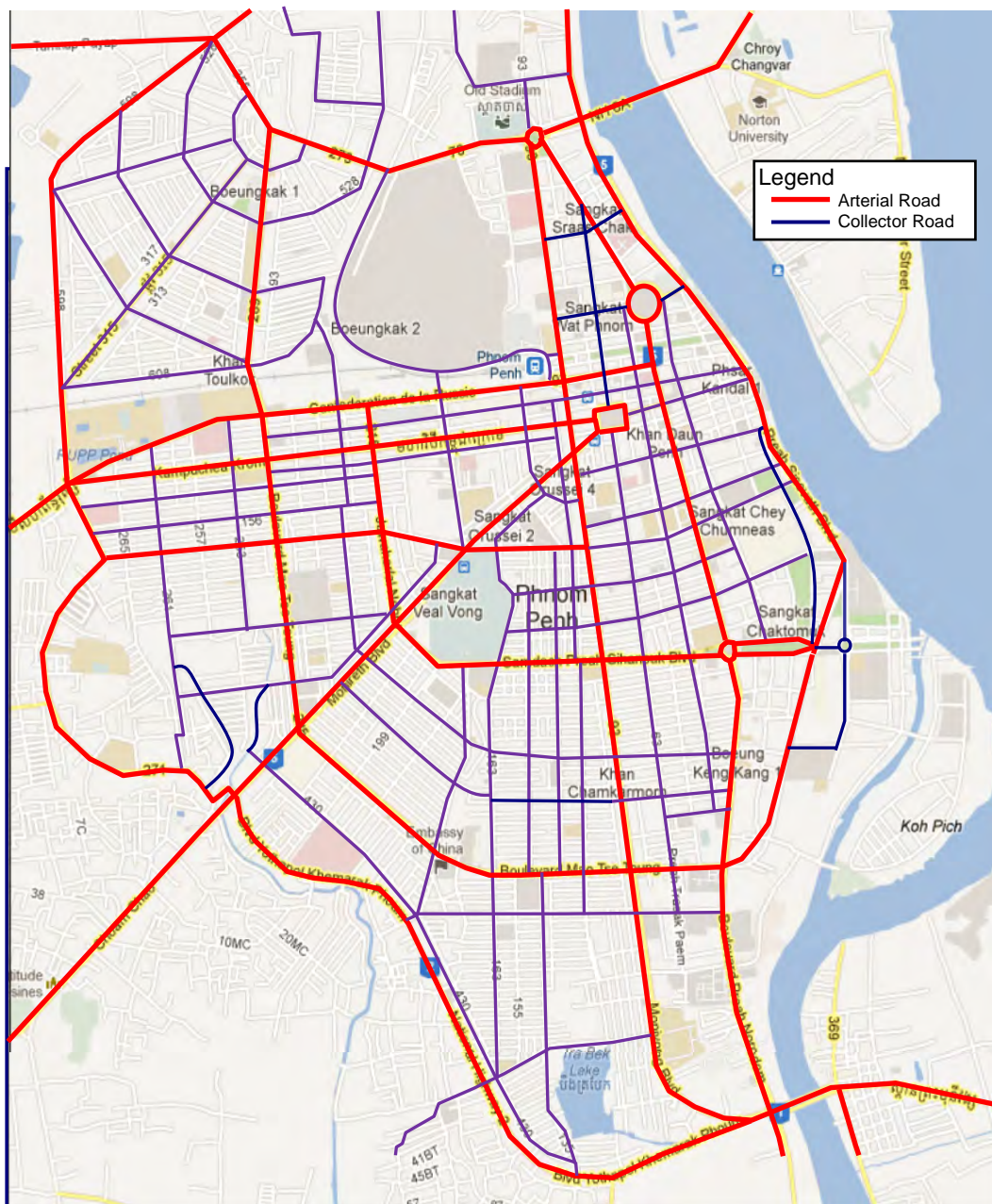
The main road network in the suburban area is composed of Russian, Chaom Chao Road, and their extensions, NR3 and NR4 in the south west direction, NR1 to the East, NR2 and NR21 to southward, and NR5 and NR6 to the North. Kob Srov Road is used as an outer ring road at present.

The roads in Phnom Penh are classified by their function, namely: arterial, collector and local roads (see Figure 5.1-1 and Figure 5.1-2). As shown in Table 5.1-1, the total road length and total road area are 1,379 km and 10,370 km², respectively, as of June 2012, of which about 15% or 212 km are the arterial roads.

Table 5.1-1 Road Length by Function

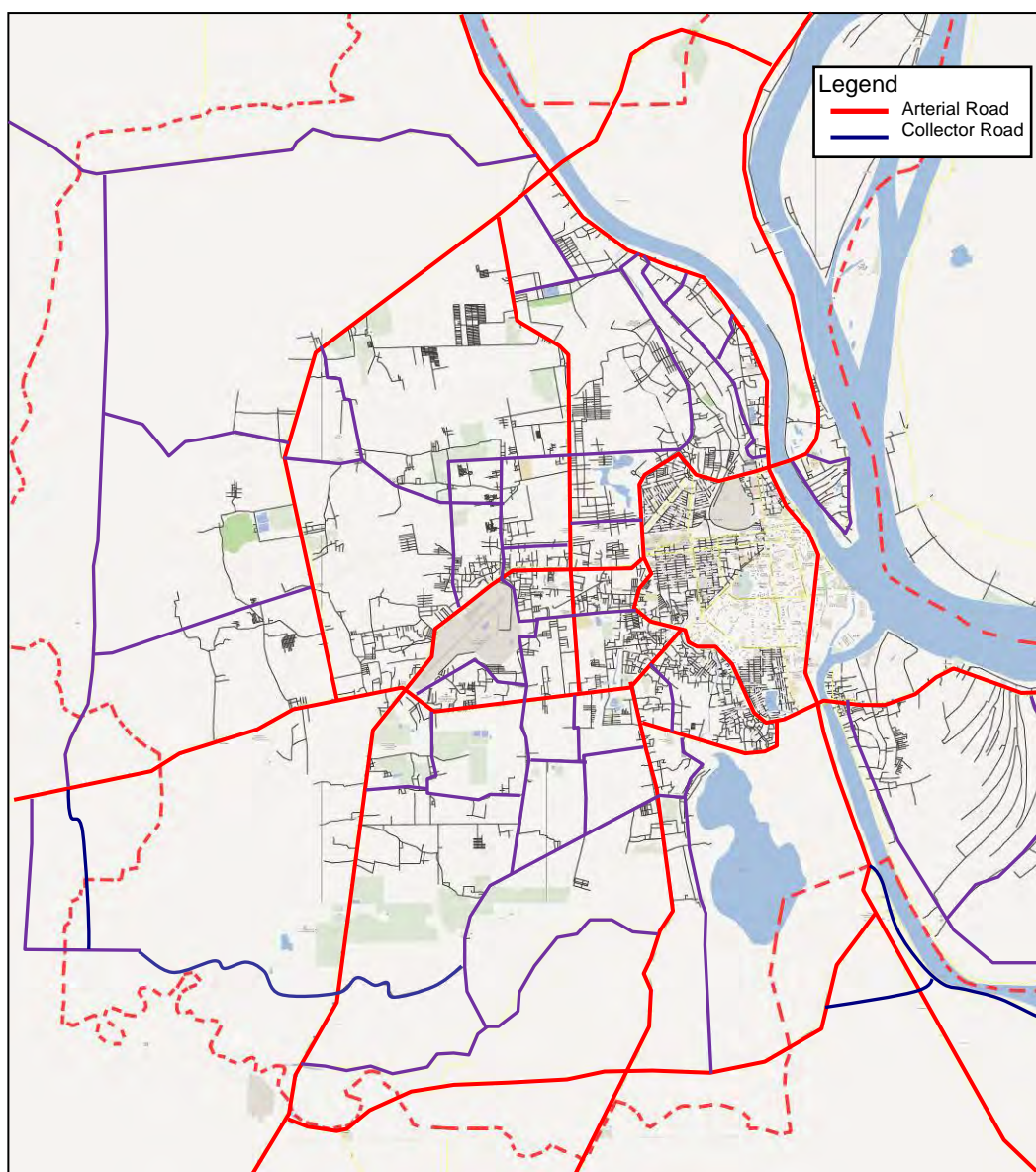
Road Type	Total Length (km)	%	Total Area (km ²)	%
Arterial road	212	15%	2,562	25%
Collector road	283	21%	2,199	21%
Local road	884	64%	5,609	54%
Total	1,379	100%	10,370	100%

Source: DPWT



Source: DPWT

Figure 5.1-1 Road Network in Central Area of Phnom Penh



Source: DPWT

Figure 5.1-2 Road Network in the Suburban Area of Phnom Penh

5.1.2 Inter-regional Road Network

(1) Existing Road Network

Phnom Penh is the starting point of the 1-digit National Roads. NR1, NR5 and NR6 are identified as the main corridors in the east-west direction, while NR2, NR3 and NR4 are the main corridors in the north-south direction (see Figure 5.1-3). Among these, NR1 and NR5 are designated as the ASEAN Highway No.1 connecting Ho Chi Minh and Bangkok. NR4 is also formulating an important corridor connecting Phnom Penh and Sihanoukville Port, the largest port in Cambodia.



Source: MPWT Follow-up Study on the Road Network Master Plan, March 2009

Figure 5.1-3 Inter-regional Road Network Development Plan Related to Phnom Penh

(2) Present Road Conditions and Development Plan

a) NR1

The road improvement project for the section between Phnom Penh and Neak Loueng is ongoing. The project aims to change it to a dike road for protection from flood and at the same time to widen the carriageway from 6.5 m (narrow 2-lane road) to 12 m (2 lanes for vehicles and 2 lanes for motorcycles). The 2nd Mekong Bridge at Neak Loueng is also under construction using Japanese funds and expected to be completed in 2016. The project has been completed except for the 4 km section from Phnom Penh because of the relocation problem. According to the JICA study on “Preparatory Survey on the Project for the Improvement of NR1 (Phnom Penh–Neak Loeng Section) (February 2012), it is concluded that the completion of the 4 km section is important for the further development of Phnom Penh.

b) NR2

Rehabilitation program is ongoing in the section between Takhmao and Takeo using ADB and Korean loans. It is expected to be completed by 2016.

c) NR3

Rehabilitation work has just been completed through financing from the World Bank, ADB and Korean loans. There is a widening plan from 2 to 4 lanes for the section from Phnom Penh to Kampot.

d) NR4

The concessionaire, AZ Group, is responsible for the operation/maintenance and further development of NR4 based on the Build, Operate and Transfer (BOT) scheme. The 36 km section between Phnom Penh and Kampong Speu has been widened already from 2 to 4 lanes.

e) NR5

There is a widening plan from 2 to 4 lanes for the section Phnom Penh-Odongk. MPWT is looking for a source of financing for this project.

f) NR6

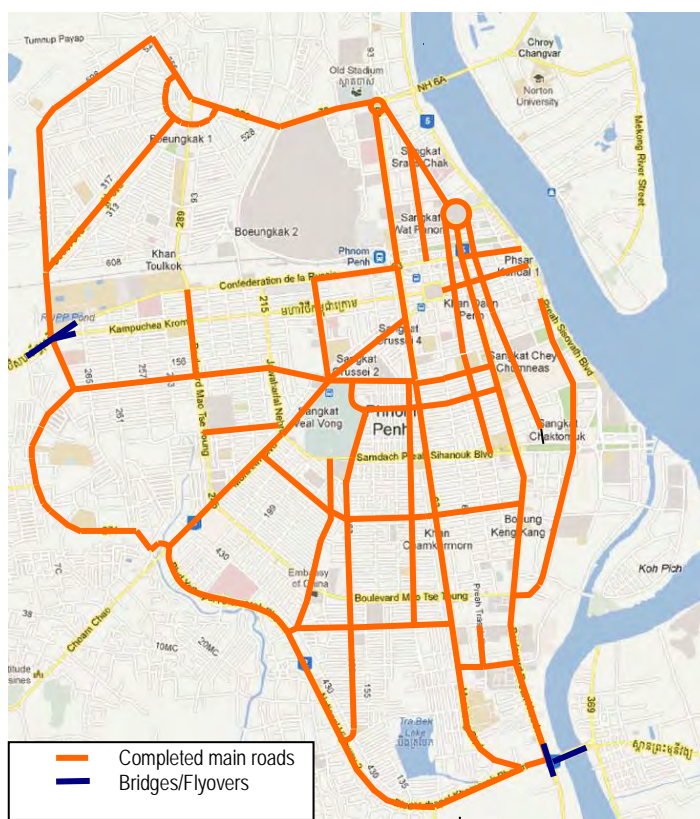
In 2015, the widening project from 2 to 4 lanes has been started for the section from Phnom Penh to the intersection with NR61 using a Chinese loan. The further section from the intersection to Siem Reap is under study.

5.1.3 Progress of Road Network Development Plan

PPCH has steadily developed the road network in Phnom Penh during the past decade. Those efforts are still ongoing at present. The road projects completed and still ongoing are described in this section. The completed projects are illustrated by using the road network development plan proposed in “The Study on the Master Plan of the Phnom Penh Metropolitan Area” in 2001 by JICA (hereinafter referred to as JICA 2001MP).

(1) Urban Area Inside C1

Figure 5.1-4 shows the rehabilitation and improvement projects inside C1, which had either been under construction or proposed in the JICA 2001MP, since all the road conditions were very poor at that time. All the rehabilitation/improvement works of these roads have been completed by now using local funds. In addition, most of the unpaved local district streets have also been paved already. It is also noted that the second Monivong Bridge and two flyovers at Kbal Thanol and Pet Lok Sang have been completed. Only the missing links proposed in the JICA 2001MP have not been completed yet because of problems of relocation of affected houses.



Source: DPWT

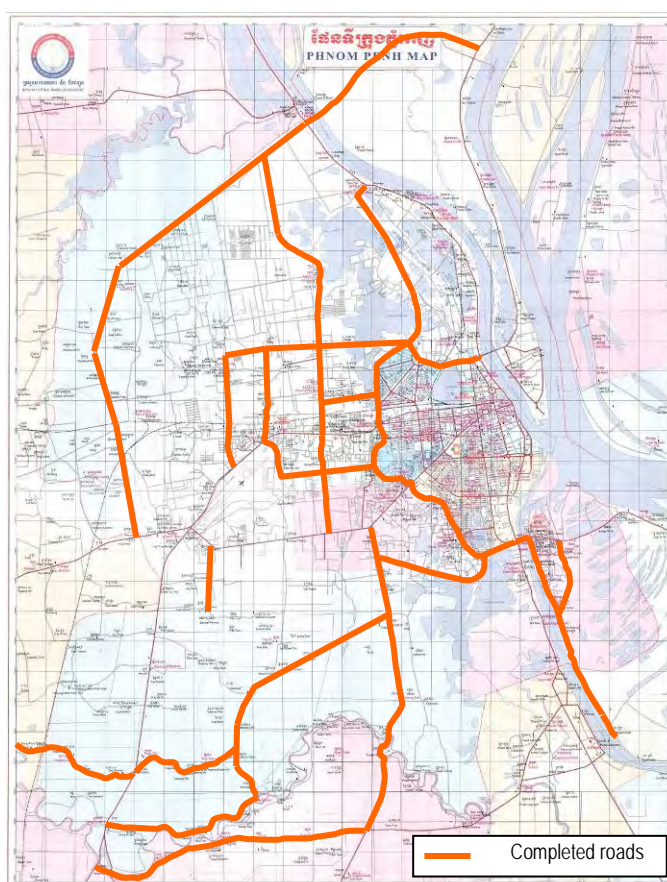
Figure 5.1-4 Progress of the Proposed Roads in the Urban Area

In addition to the rehabilitation/improvement projects proposed in the JICA 2001MP, some roads have been widened using local funds, as follows:

- C1: the entire C1 was widened from 2 lanes to 4 lanes;
- Russian Blvd.: about 300 m section from Monivong was widened at the time of the urban renewal project including the intersection improvement of Russian/Monivong; and
- Tep Phon: about 100 m from Nean Kong Hing intersection was widened at the time of the urban renewal project.

(2) Suburban area

While the road network improvements in the urban area have been prioritized, the road projects in the suburban area proposed in the JICA 2001MP have seen comparatively less progress. The completed projects are shown in Figure 5.1-5.



Source: DPWT

Figure 5.1-5 Progress of Road Projects in the Suburban Area

Among others, the prominent road projects implemented are as follows:

- a) Kob Srov dike road (a part of the Outer Ring) connecting from NR4 to NR6 including Preak Pnob Bridge;
- b) Russei Kaev Bypass (link between C1 and NR5);
- c) Hanoi Road connecting Chaom Chao Road and Kob Srov Road;
- d) Cheung Aek Bypass connecting Choam Chao Road and NR2; and
- e) Airport Access Road (Ou Baek Kaam Road, a part of Kouk Chambak Road).

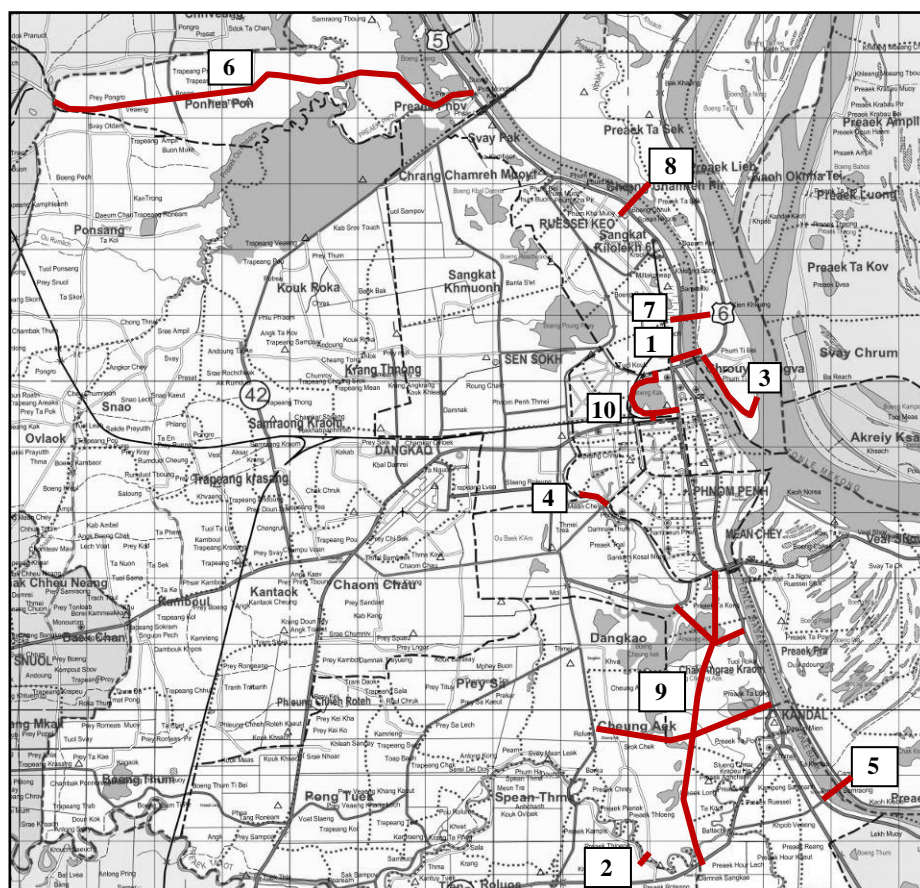
5.1.4 Ongoing Projects

There are a number of road/bridge projects either under construction or under study in Phnom Penh, as follows (see Table 5.1-2, Figure 5.1-6 and Figure 5.1-7):

Table 5.1-2 Ongoing Road and Bridge Projects

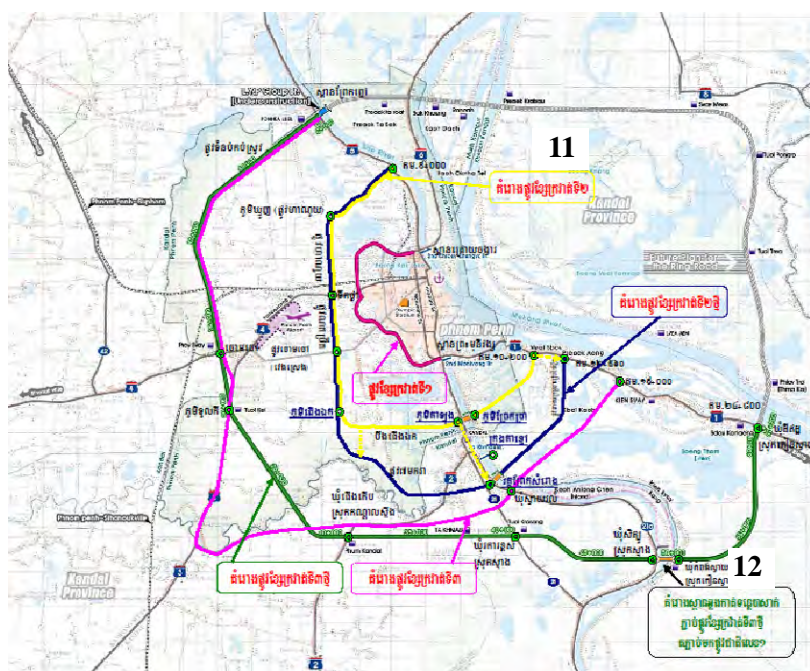
No.	Projects	Length	Current Status	Expected	Finance
				Completion yr	
1	Chroy Changvar 2 nd Bridge	1250m	Under Construction	2014	China Loan
2	Preak Thloeng Bridge	90m	Under Construction	2013	Local Government
3	East River Bank Road in Chroy Chanvar Commune	3km	Under Construction	End of 2012	Sokha Group
4	Stem Mean Chay Flyover	320m	D/D	n.a.	Local Government
5	Thakmao – Prek Samrong Bridge(the Blue Ring)	n.a.	Under Construction	2014	China Loan
6	Local Road in Sensok (Preak Pnob Mkt - Basit Mountain)	12.8km	Under Construction	2013	Local Government
7	Chrang Chamreh – Prekt Tasek Bridge	n.a.	Plan	n.a.	Local Government
8	Km 6 Bridge (Extension of Blue Ring Road)	n.a.	Plan	n.a.	Local Government
9	Hun Sen Road Project	9km	Plan	n.a.	AZ Group
10	Boeng Kak Road	n.a.	Under Construction	n.a.	Sukaco Inc.
11	Ring Road Plan(I)	n.a.	Plan	n.a.	China Loan
12	Ring Road Plan(II)	n.a.	Plan	n.a.	Korea Loan/BOT

Source: DPWT, MPWT



Source: PPUTMP Project Team

Figure 5.1-6 Ongoing Projects (1 - 10)



Source: PPUTMP Project Team

Figure 5.1-7 Ongoing Projects (Ring Road Plan) (11 - 12)

- (1) Chroy Changvar 2nd Bridge
 This bridge is located at the north side of the existing Chroy Changvar Bridge and is under construction under a Chinese loan. After completion, the two bridges will be used as a pair of one-way bridges, like the Monivong Bridges.
- (2) Preak Throeng Bridge
 This is a small bridge on the collector road in Cheung Aek District.
- (3) East River Bank Road in Chroy Changvar Commune
 This road is being constructed to support the urban development in the Chroy Chanvar Commune promoted by Sokha Group.
- (4) Stem Mean Chay Flyover
 This is the third flyover project to be constructed at the intersection of C1 with Monireth. It is now in the design stage.
- (5) Thakmau - Preak Samlong Bridge
 This bridge is already under construction over the Tonle Basac River at the downstream of Monivong Bridge using a Chinese loan. It will be a part of the Ring Road Project described in Project no. (11).
- (6) Local Road in Sensok (Preak Pnob Market - Basit Mountain)
 This road is being constructed to contribute to better access to main roads for the residents in the northwest region of Phnom Penh. The carriageway width will be 7 m.
- (7) Chrang Chamreh - Prekt Tasek Bridge
 This project is a new bridge to be constructed at about 1.5 km north of Chroy Chavar Bridge in order to ease the traffic concentration at the Chroy Chanvar Bridge. The project is still at the planning stage.

(8) KM 6 Bridge

This is the new bridge planned to be constructed between project no. (7) and Prek Pnov Bridge. It will be a part of the Ring Road Project described in Project no. (11), connecting Hanoi Road and NR6, and is expected to contribute to the urban development of CAMKO city and Grand Phnom Penh.

(9) Hun Sen Road Project

This project is the road network development plan in the urban development project, “Green City,” located at the southern part of Phnom Penh. It will connect NR2 with C1 as well as Monivong.

(10) Boeng Kok Road

This project is a road network development in the Boeng Kok area to support the urban development in the Boeng Kok area. The construction work has been started but it seems to have been suspended due to the residents’ relocation issues.

(11) Ring Road Plan (I)

Two ring road projects are planned; the blue ring road in Figure 5.1-7 is the first one. This project is to be undertaken using a Chinese loan. As earlier mentioned, the Bridge at Thakmau–Preak Samlong over the Tonle Basak River is already in the construction stage. Hanoi Road will be used as the western part of the ring road.

(12) Ring Road Plan (II)

The second ring road project is the green line in Figure 5.1-7. The F/S is now being carried out. It is expected to be realized by using a Korean loan and a BOT scheme. The starting point was changed from the PK 25 km to PK 30 km of NR1 because of the location of the new container terminal, which is under construction using a Chinese loan.

5.2 Road Characteristics

5.2.1 Surface Conditions

Table 5.2-1 shows the surface conditions of the existing road network in Phnom Penh as of November 2011. The roads administered by PPCH and the four Kahns (Chakarmon, Dang Penh, Prampir Meakkara and Toul Kok) inside C1 have been completely paved already, as some previously unpaved roads in Toul Kok have also been paved recently. On the other hand, there are considerable lengths of unpaved roads for those administered by the four Kahns (Dangkao, Meanchey, Russei Kaev and Sensok) in the suburban area.

Table 5.2-1 Road Surface Conditions (unit: km)

Surface condition	Total Length (km)	City hall	Kahn									Sub-total
			Chamkarmon	Dang Penh	Prampir Meakkara	Toul Kok	Sub-total	Dangkao	Meanchey	Russei Kaev	Sensok	
AC	215	123	30	30	8	6	74		12	7	0	19
DBST	280	61	54	13	12	64	143	39	14	18	4	75
Concrete	207		21	1	2	32	56	22	58	62	8	150
Laterite	264						0	158		51	55	264
Earth	413		1			16	17	232	59	48	57	396
Total	1,379	184	106	44	22	118	290	452	143	187	124	904

Note: AC= Asphalt Pavement, DBST= Double Bituminous Surface Treatment

Source: DPWT

5.2.2 Road Density

Road density is defined as the road length per administration area. It is usually employed as an indicator for examining the degree of the road network development in the urban area. Table 5.2-2 shows the road density of Phnom Penh in comparison with the other surrounding cities.

Table 5.2-2 Road Density Comparison Between Phnom Penh and Other Asian Cities

Cities	Area (km ²)	Population (million)	Ave.Pop Density (person/km ²)	Road Length (km)	Road Density (km/km ²)	Public transport share (%)	Remarks		
							population (year)	Road (year)	public transp. (year)
Phnom Penh	678	1.5	2,212	1,379	2.03	15	2008	2011	2001
Kuala Lumpur	243	1.6	6,667	1,213	4.99	20	2005	2005	2005
Singapore	693	4.6	6,637	3,234	4.67	63	2005	2005	n.a.
Hong Kong	1,108	7	6,318	2,009	1.81	90	2005	2005	n.a.
Bangkok	1,569	5.7	3,633	4,076	2.60	50	2000	2000	2000
Vientiane	3,920	0.79	202	2,004	0.51	-	2010	2004	2004
Ho Chi Minh	2,095	7.2	3,437	3,670	1.75	-	2009	2009	n.a.
Hiroshima	905	1.2	1,326	4,323	4.78	20	2011	2011	2008
Tokyo	2,187	8.9	4,070	24,342	11.13	66	2010	2010	2009

Note: the public transport share is excluding walk trips.

Source: IMF Economic Outlook Database, ADB Economic Outlook 2010, Current Situation and Development planning for Transportation of Ho Chi Minh City towards 2020, IGI Global :Sustainable Urban infrastructural development in Southeast Asia 2010, An

The average road density of Phnom Penh is approximately 2.0 km/km², which is higher than Vientiane or Ho Chi Minh although the administrative areas of those cities are quite large, formulating a metropolitan area probably involving the surrounding rural areas. Hong Kong also has a lower road density while the high share on the public transport may be offsetting the insufficiency in the road network. When compared to cities of similar area size like Kuala Lumpur, Singapore or Hiroshima, the road density of Phnom Penh seems to be a little low.

Table 5.2-3 shows the road density by district basis. It can be said that the average road density in the central districts is already sufficiently high, at 12.2 km/km², which is comparable to the CBD area of Hiroshima City. On the other hand, those for the other four Kahns outside C1 still remain at a low level, only 1.6 km/km². This indicates that the road network in the suburban area is still insufficient.

Table 5.2-3 Road Density by District

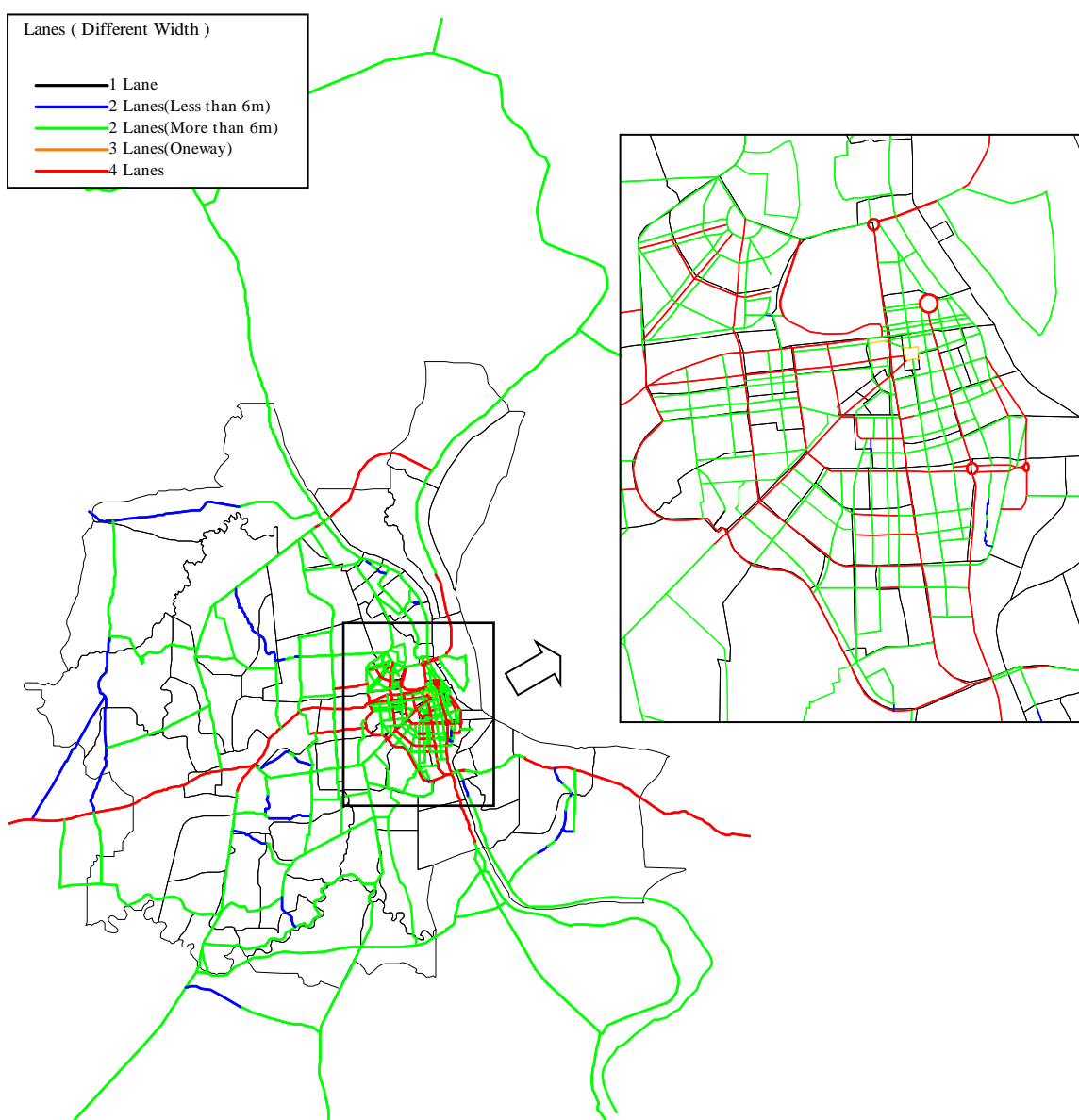
	Name of District	Area (km ²)	Population (2008)	Pop Density person/km ²	Road Length (km)	Road Density (km/km ²)	Road Density (km/km ²)
1	Chamkar Mon	10.4	182,000	17,500	122	11.7	12.2
2	Doun Penh	7.2	126,000	17,500	51	7.1	
3	Prampir Meakkara	2	92,000	46,000	25	12.5	
4	Toul Kouk	7.8	171,000	21,923	136	17.4	
5	Dangkao	340.2	258,000	758	522	1.5	1.6
6	Mean Chey	111.1	328,000	2,952	165	1.5	
7	Russeï Kaev	107.7	196,000	1,820	216	2.0	
8	Sen Sok	92.1	148,000	1,607	143	1.6	
	Total	678.5	1,501,000	2,212	1,380	2.0	
	Hiroshima CBD	15	130,000	8,667	223	14.9	yr :2009
	Tokyo City Area	622	8,900,000	14,309	11,841	19.0	yr :2010

Source: DPWT, Annual Statistics of Hiroshima, Tokyo

5.2.3 Number of Lanes

The number of lanes of the main roads is shown in Figure 5.2-1. The arterial roads in the urban area are mostly expressed as four-lane roads. As mentioned later, the typical carriageway width of arterial road is 18 m, which is composed of four lanes for 4-wheel vehicles and two lanes for motorcycles. However, the roadside is usually occupied by parked cars or street vendors or commercial goods. Accordingly, the actual use for road traffic is assumed as only four lanes.

On the other hand, most of the arterial roads in the suburban area are of two-lane roads, with some exceptions such as NR4 and NR1. Some of the two-lane roads have wider carriageways than ordinary two-lane roads. For instance, some sections of Hanoi Road have more than 12 m width, although such section is limited only for a short stretch, then it is actually used as a two-lane road. The arterial roads should be developed as at least four-lane roads wherever it is possible.



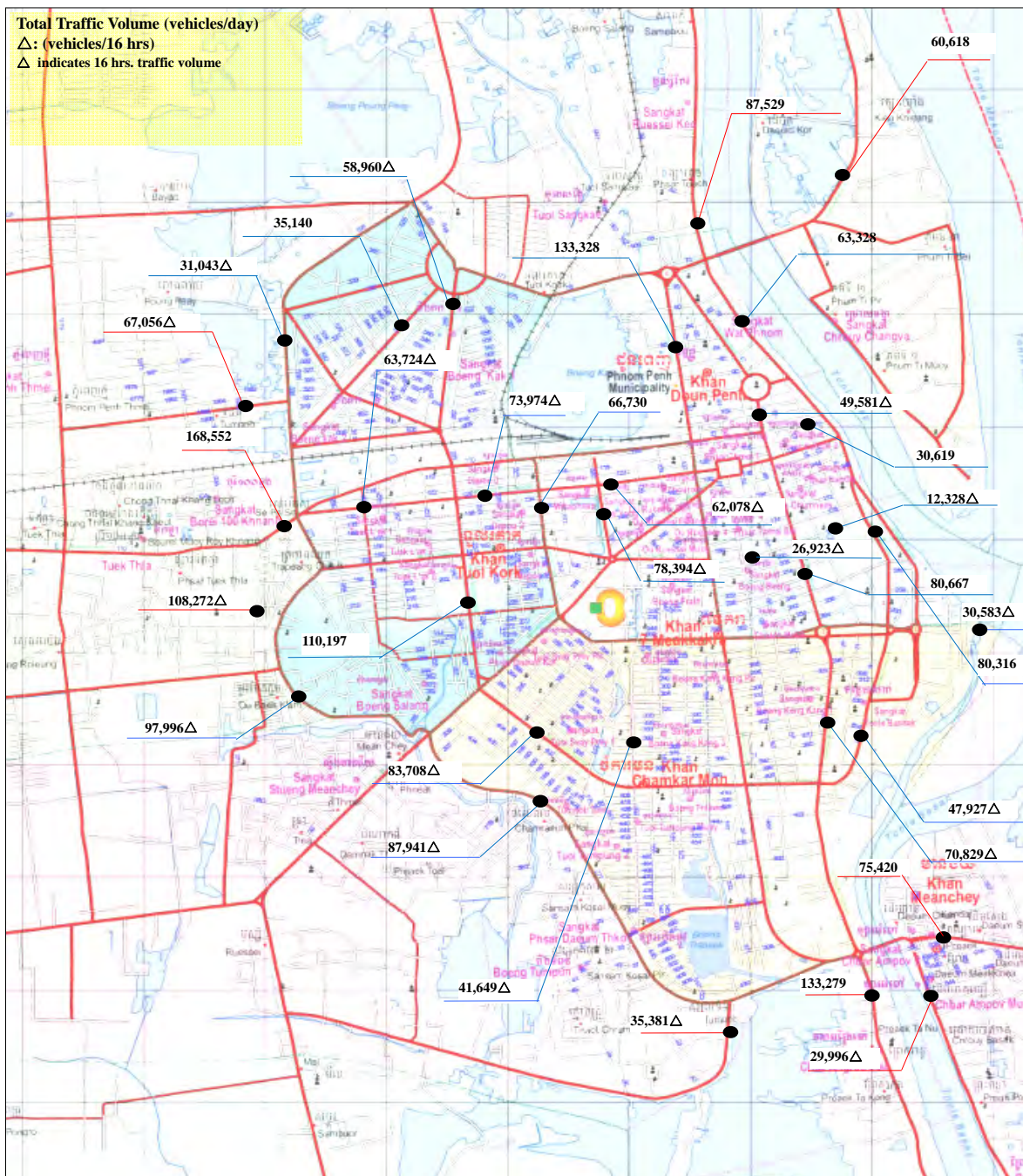
Source: PPUTMP Project Team

Figure 5.2-1 Number of Lanes of Roads in PPCC

5.3 Road Traffic

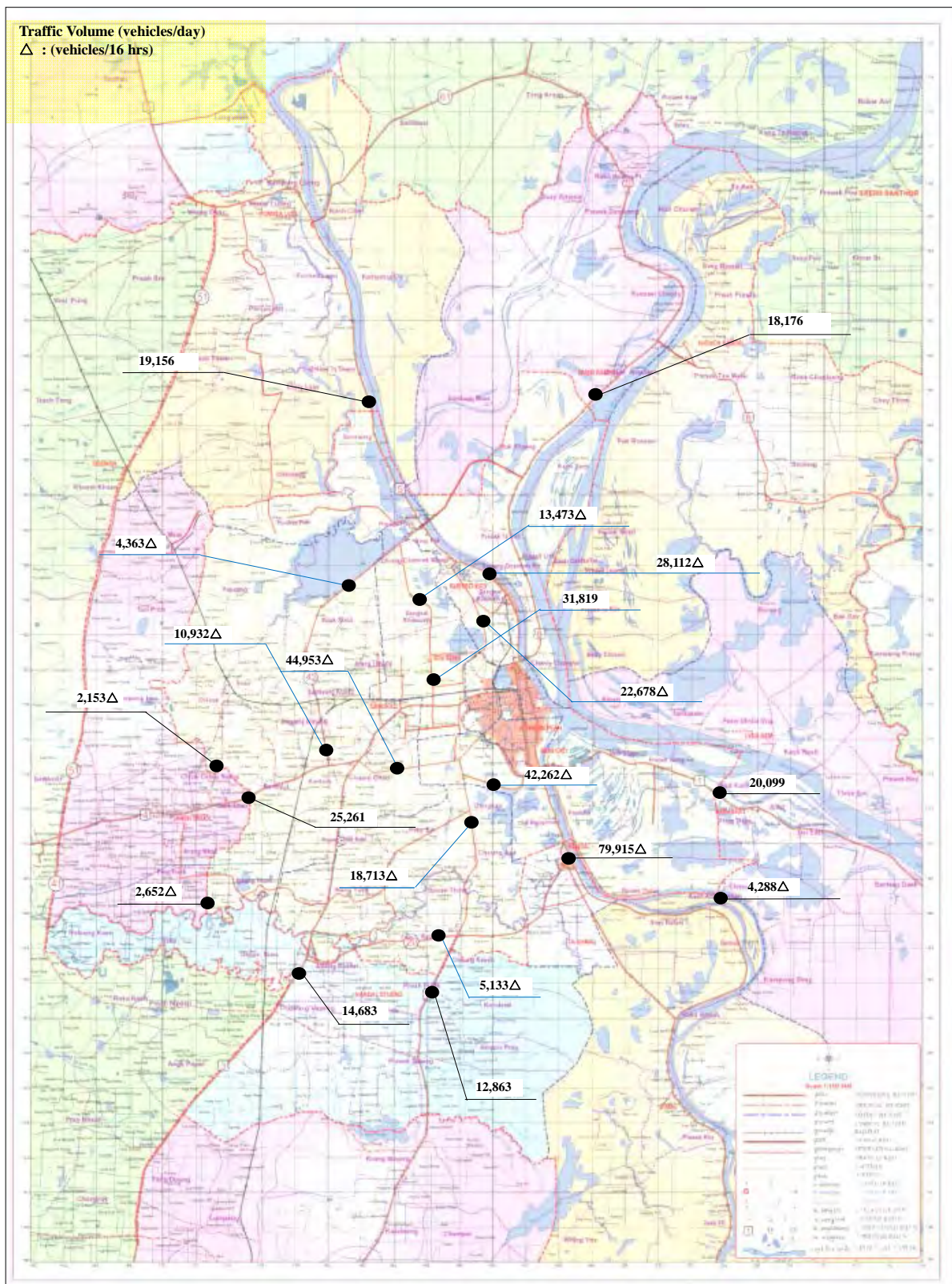
5.3.1 Present Traffic Volume on Main Roads

Figure 5.3-1 and Figure 5.3-2 show the traffic volume obtained through the traffic count survey conducted in July 2012. The results indicate the following features:



Source: PPUTMP Project Team

Figure 5.3-1 Traffic Volume in the Central Area



Source: PPUTMP Project Team

Figure 5.3-2 Traffic Volume in the Suburban Area

(1) Central Area

- a) The highest traffic volume is found at Russian (just outside of C1), accounting for about 169,000 vehicles/day.
- b) The other stations (see Figure 5.3-3).with higher volumes are at the northern part of Monivong and at the south of Kbal Thanol Flyover along NR2, both counting 133,000 vehicles/day.
- c) On the other hand, the traffic volume in the CBD area (inside of Mao Tse Toung and Russian) mostly ranges from 60,000 to 90,000 vehicles/16 hrs.
- d) More or less 80% of the traffic is motorcycles.
- e) In general, traffic volume is higher in the peripheral area along C1 rather than the CBD area. It may be attributed to the changes in the population distribution and the difference in the road network density in the CBD area and peripheral area.

(2) Suburban Area

- a) The highest volume was observed on NR2 at Ta Khmau accounting for about 80,000 vehicles/16 hrs (suggesting that Ta Khmau District has already been absorbed into a part of the Phnom Penh metropolitan region).
- b) It is followed by Chaom Chau Road and Turnpum Dike Road (connection road between C1 and Cheung Aek Bypass) with 42,000 ~ 45,000 vehicles/16 hrs.
- c) In general, the road traffic in the neighborhood area of C1 is relatively higher than the other suburban area of Phnom Penh.

5.3.2 Changes in Traffic Volume and Travel Speed

The changes in traffic volume and travel speed are examined by comparing the traffic data in 2000 based on the JICA 2001MP and the survey results in 2012.

(1) Changes in Traffic Volume

As shown in Table 5.3-1, the following changes are noted:

- a) The highest growth was found on C1, recording 12 times the traffic volume in 2000. This is mainly due to the rehabilitation work and the widening of C1 from 2 to 4 lanes during the period.
- b) The traffic growth on Monivong, Sothearos and Mao Tse Toung is rather moderate, from 1.2 to 1.39 times only. It may be attributed to the development of the road network including local roads in the central area and the changes in the population distribution.
- c) Russian and NR5 show relatively higher growths compared to Monivong and Sothearos. The traffic at the peripheral area of the city center seems to be generally higher than that in the city center, reflecting the expansion of the urbanized area outwards.
- d) In terms of vehicle type, the sedan type generally has higher growth than other vehicles on most roads.

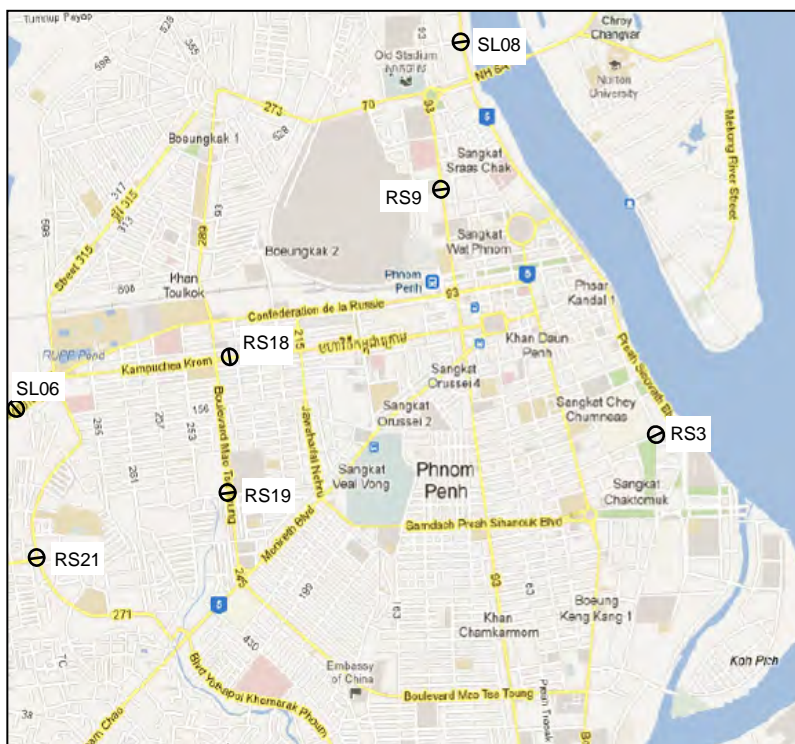
Table 5.3-1 Changes in Traffic Volume

(unit: vehicles)

Road	Year	Car				Motor-cycle	Total	Growth	Sta. No. (2012)
		Sedan	OtherLight	Heavy	Subtotal				
Russia	2000	11,400	8,195	1,019	20,614	59,422	80,035	-	SL-06
	2012	22,661	15,742	680	39,083	129,469	168,552	2.11	
Monivong	2000	12,345	5,960	608	18,914	80,475	99,389	-	RS-09
	2012	18,620	10,763	644	30,027	103,301	133,328	1.34	
Sothearos	2000	6,729	2,744	323	9,795	48,138	57,933	-	RS-03
	2012	10,519	9,649	433	20,601	59,715	80,316	1.39	
Mao Tse Tong	2000	6,031	4,621	1,299	11,951	79,216	91,167	-	RS-19
	2012	13,708	7,813	579	22,100	88,094	110,194	1.21	
Kampuchea Krom	2000	6,321	2,067	218	8,606	32,265	40,871	-	RS-18
	2012	12,516	5,234	205	17,955	54,108	72,063	1.76	
NR No.5	2000	4,201	4,927	465	9,593	33,720	43,312	-	SL-08
	2012	7,590	7,591	1,261	16,442	62,464	78,906	1.82	
Inner Ring Road	2000	811	700	459	1,970	5,887	7,857	-	RS-21
	2012	10,057	7,894	1,258	19,209	77,026	96,235	12.25	

Note: Sedan includes passenger car, taxi.
 Other Light Vehicles includes motor (modern), pick-up, mini-bus.
 Heavy vehicles includes trucks, heavy trucks and buses.
 The traffic volume at Russia, Monivong, Sothearos and Mao Tse Tong: 24hrs
 The traffic volume at Kampuchea Krom, NR No.5 and Inner Ring Road: 15hrs(6:00a.m. – 21:00p.m.)

Source: PPUTMP Project Team



Source: PPUTMP Project Team

Figure 5.3-3 Traffic Volume Counting Stations

(2) Changes in Travel Speed

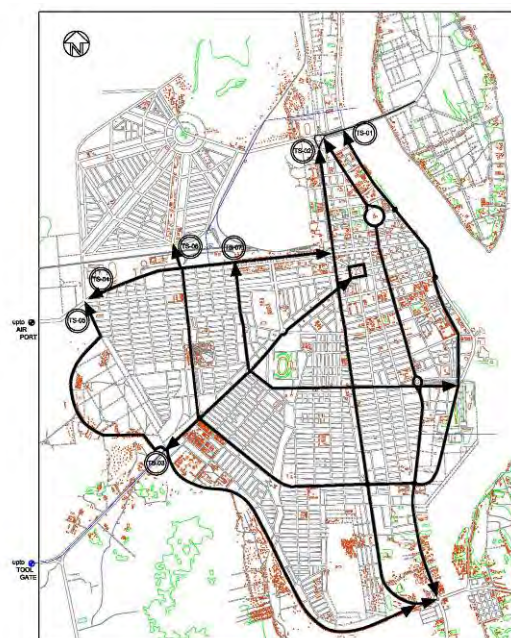
The following changes in travel speed are noted (see Table 5.3-2 and Figure 5.3-4):

- Lower travel speeds were observed in the evening peak hours (17:00 ~ 19:00) along most of the routes compared to the morning peak (7:00 ~ 9:00).
- Travel speeds in 2012 have decreased on all the roads for both directions compared to those in 2000.
- The change in travel speed is remarkable on Russian, Monivong, Charles De Gaulle and Mao Tse Toung, declining to the level of approximately 10 km/hr.
- The results suggest that traffic volumes on these roads seem to have reached their traffic capacities. For comparison, travel speed during peak hours in the Tokyo CBD is 14.4 km/hr. (Road Traffic Census in 2010).

Table 5.3-2 Changes in Travel Speed in Evening Peak

Road	Direction	km/hr	
		2000	2012
Norodom	South bound	22.7	15.4
	North bound	26.1	16.3
Monivong	South bound	22.5	10.7
	North bound	22.3	12.8
Charles De Gaulle / Monireth	SW bound	17.3	10.0
	NE bound	17.0	12.3
Russian	West bound	27.3	11.8
	East bound	28.5	11.4
IRR	S/E bound	20.5	17.3
	W/N bound	20.1	16.5
Mao Tse Tong	S/E/N bound	22.7	11.9
	S/W/N bound	21.7	10.1
Jawaharial Nehru / Sihanouk	W/N bound	18.1	10.6
	S/E bound	20.7	11.8

Source: PPUTMP Project Team

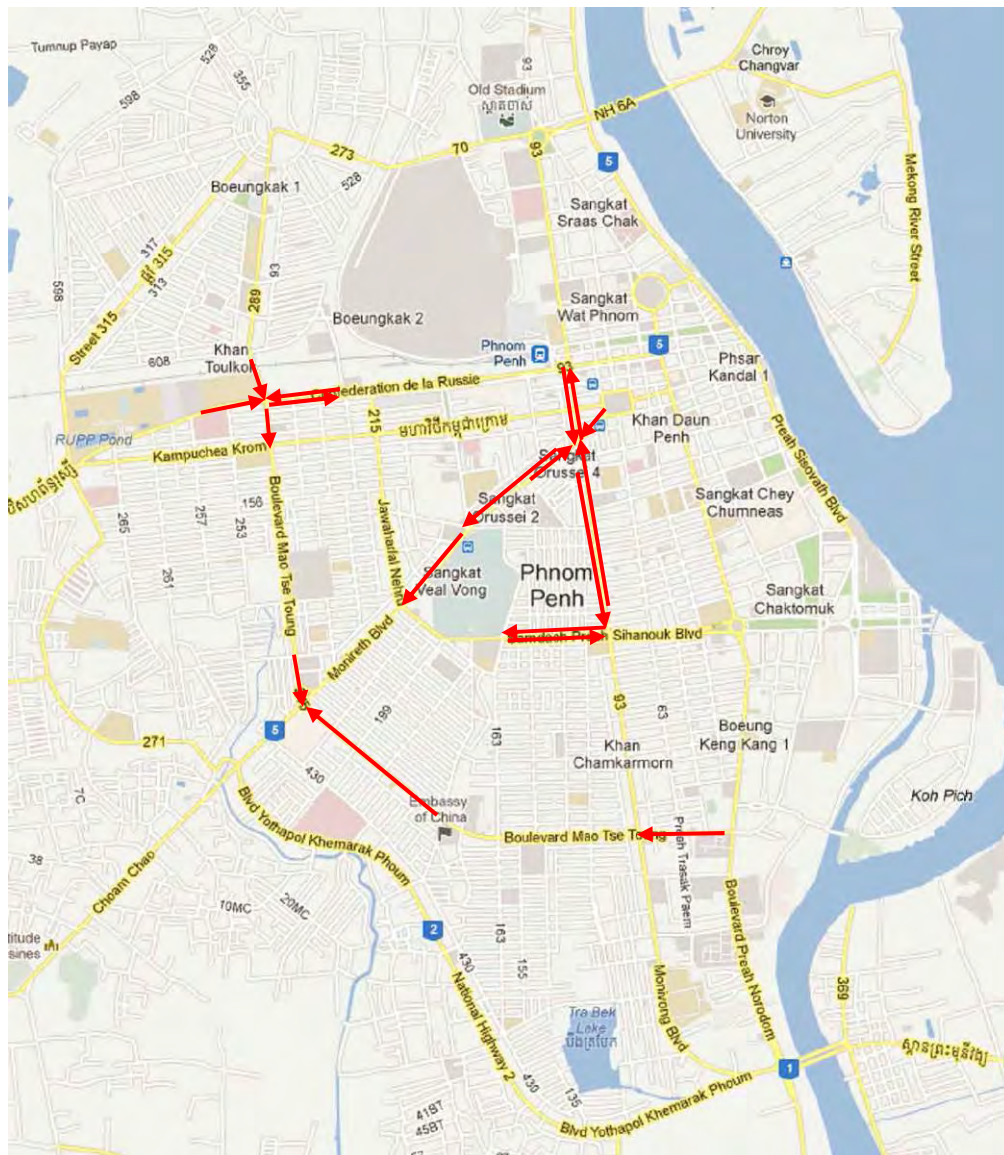


Source: PPUTMP Project Team

Figure 5.3-4 Traffic Congestion Points in the Evening Peak in the Urban Area

Figure 5.3-5 shows the congested road sections during the evening peak hours. The red arrows indicate the average speeds of less than 10 km/hr in the evening peak. The low speed of less than 10 km/hr was observed at the following sections:

- Monivong for both directions between Russian and Sihanouk;
- Charles De Gaulle from Monivong to Sihanouk;
- Russian near Toul Kok intersection;
- Sihanouk for both directions between Monivong and St 163;
- Mao Tse Toung from Norodom to Monivong; and
- Mao Tse Toung at Monireth intersection.



Source: PPUTMP Project Team

Figure 5.3-5 Congested Sections in the Evening Peak

5.4 Engineering Standards

According to the Road Design Standard in Cambodia, urban roads are categorized as follows:

- a) Urban expressway
At present, an urban expressway does not exist in Phnom Penh.
- b) Arterial Road
An arterial road is a continuous road with partial access control for through traffic within urban areas. Basically it conveys traffic from residential areas to the vicinity of the CBD or from a part of the city to another center.

- c) Collector Road
This is a road with partial access control designed to serve the traffic between the arterial and local road systems.
- d) Local Road
This is the basic road network within the neighborhood and provides a direct access to abutting land.

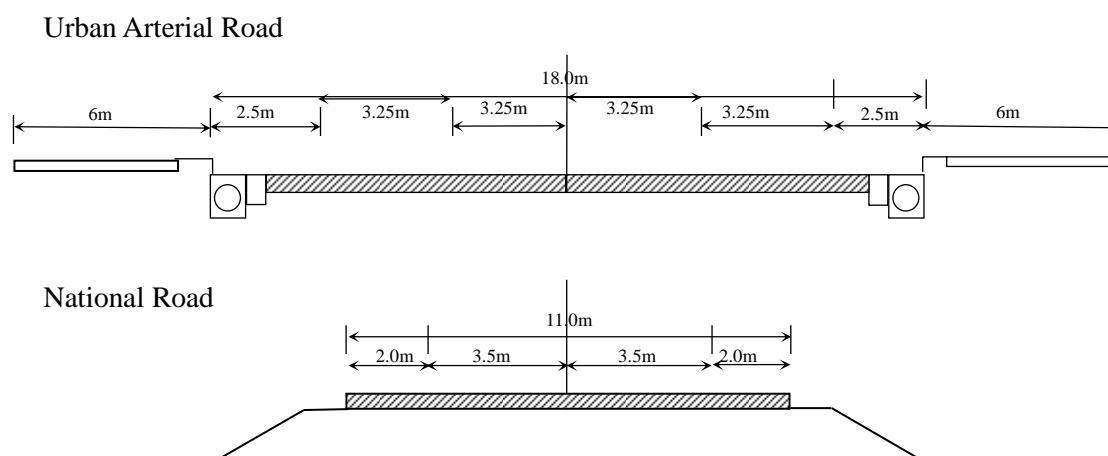
Table 5.4-1 shows the lane width, shoulder and median width set forth by type of road in the Road Design Standard.

Table 5.4-1 Widths of Lane, Shoulder, Median

Type of Road	Lane Width	Shoulder	Median (min)
	(m)	(m)	(m)
Arterial	3.25~3.5	2.0~3.0	1.5~3.0
Collector	3.0~3.25	1.5~3.0	1.0~2.5
Local	2.5~2.75	1.5~2.0	-

Source: PPUTMP Project Team

The typical cross-sections of the arterial road in the central area and the national road in the suburban area are as shown in Figure 5.4-1.



Source: PPUTMP Project Team

Figure 5.4-1 Typical Road Cross-Sections

The arterial road has a right-of-way of about 30 m, of which 18 m is used for the carriageway (i.e., four lanes for 4-wheeled vehicles and two lanes for motorcycles). It is normally equipped with sidewalks of about 6 m width at both sides, but these are mostly occupied by parked cars or street vendors or commercial goods.

Collector roads usually have less carriageway width ranging from 7 m to 10 m. The sidewalk is often unpaved.

As for national roads, their carriageway ranges from approximately 10 m to 18 m depending on the route. In particular, NR4 has a four-lane carriageway, while the others are at various stages of further development into four-lane roads. As a typical cross-section, the case of an 11 m width carriageway with 2 lanes for four-wheeled vehicles and 2 lanes for motorcycles is illustrated in Figure 5.4-1 above.

5.5 Preliminary Identification of Existing Problems on Road Traffic

Since some of the survey results including the person-trip survey are still under processing, the problems identified in this section are still at a preliminary level and, therefore, might be amended in the course of the further study.

5.5.1 Central Area

- a) Although most of streets have been improved, traffic congestion is getting serious on the main streets in the central area. The travel speed in peak hours is approaching marginal level, more or less 10 km/hr, centering on the main intersections such as Russian/Monivong, Monivong/Charles De Gaulle, Nean Kong Hing, and Sihanouk/Monivong.
- b) There are some discontinuous collector roads due to socio-geographical constraints such as rivers or built-up areas (for instance, Street 360, Street 608, etc.).
- c) Road space is normally occupied by on-street parking or private properties of shops and street vendors, reducing the traffic capacity for vehicles and blocking the pedestrians.
- d) There are many road users who have not enough knowledge on traffic rules or just neglect them. This is one of the causes of traffic accidents and congestions.
- e) The new bridge construction projects may create new traffic problems. At the Kbal Thnol Flyover as well as the Monivong Bridge, U-turn traffic is heavy because the left turn has become impossible. This is generating additional traffic demand on the bridge/flyover.
- f) There still exist many intersections where traffic signals have not been installed even though the traffic volume has reached the required level that merit signalization.
- g) There are some districts vulnerable to flood even in the central area, particularly in the southern area where the main road is sometimes inundated. DPWT is now undertaking the redevelopment of the drainage system for mitigating flood damages.

5.5.2 Suburban Area

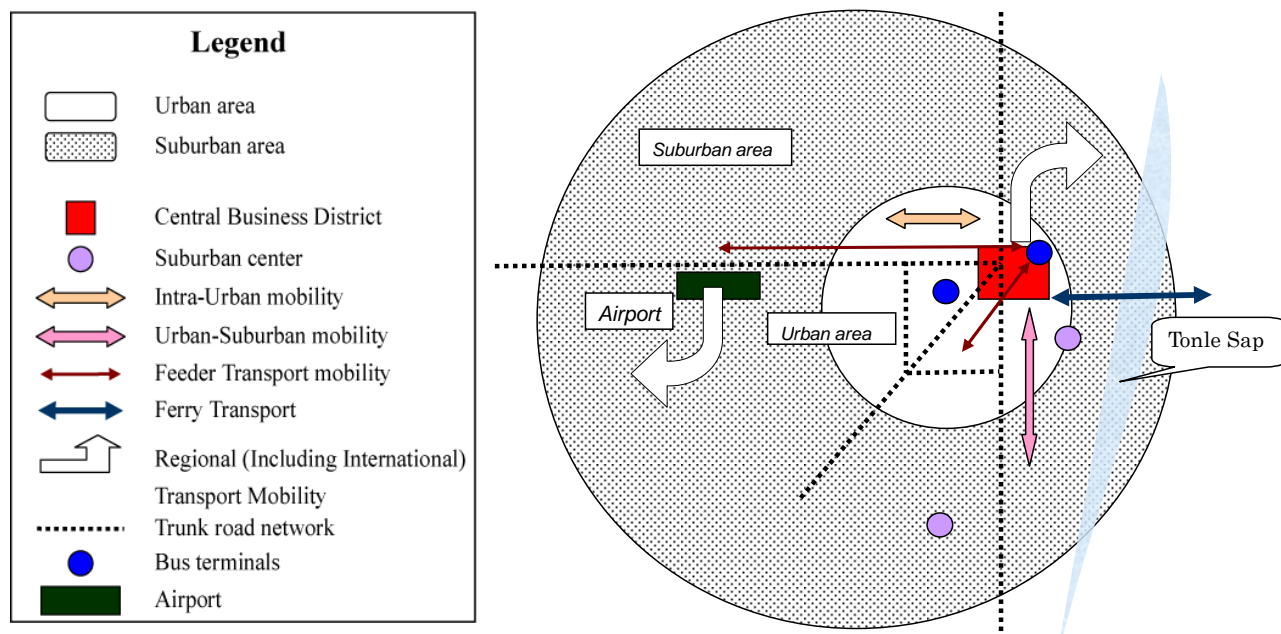
- a) The road network is not sufficient to cover the newly urbanized areas in recent years. Most of the existing secondary roads are not paved and usually discontinuous and their widths are too narrow to pass by each other.
- b) In addition, there are several important roads the alignments of which are not well designed, like a zigzag or L-shaped road. These alignments should be improved before the surrounding area is fully urbanized.
- c) There are missing links along the main roads, such as the section between the Kob Srov Road and NR3, or the section between NR1 and NR20, among others.
- d) Many residential development projects are ongoing in the suburban area. Although the access roads to the main roads are usually planned to be developed, those may have a possibility to create new bottlenecks since the traffic dispersal from the newly developed area is not properly considered.

6 PUBLIC TRANSPORT

6.1 Public Transport Network

From the viewpoint of transport needs and network reach, the public transport network in the urban area is classified into three levels, namely: intra-urban transport network, inter-urban/ regional transport network, and international transport network. Given an urban structure and population distribution pattern, the urban transport network should be well furnished to respond to expected traffic demand and provide smooth and effective transport connectivity. Taking into account the topology, economic conditions and political status of Phnom Penh, the following are pointed out (see Figure 6.1-1):

- Since Phnom Penh is the capital of Cambodia, a gateway function for international traffic is needed. The function as a political center is needed as well.
- Focusing on expanding the urban area in Phnom Penh, network development is expected at a metropolitan transport level such as transport linkage with suburban areas.
- Since Phnom Penh is a typical riverfront city developed on the right bank of Tonle Sap River, river transport is also taken into account.



Source: PPUTMP Project Team

Figure 6.1-1 Schematic Chart of Public Transport Network in Phnom Penh

Based on the above considerations, the current public transport network in Phnom Penh is summarized in Table 6.1-1.

Table 6.1-1 Main Features of Public Transport Network in Phnom Penh

Network Level	Necessary Function	Physical Network Scale	Infrastructure	Main Mode at Present	Current Issues
Intra-urban	<ul style="list-style-type: none"> ✓ Trunk transport for commuting, business, shopping, tourism/leisure. ✓ Feeder transport for linking with intercity transport + international transport hub. ✓ Main axis of specific urban development area 	Within 3-km radius	Arterial and supplementary roads	Motodop Motorumok modern (tuk-tuk) Taxi Other para-transit modes	<ul style="list-style-type: none"> ✓ Formulation of fixed public transport network ✓ Reinforcement of infrastructures ✓ Formation of inter-modal facilities
Urban-Suburban	<ul style="list-style-type: none"> ✓ Trunk transport for commuting trip demand 	Within 10-km radius	Arterial roads		
Intercity	<ul style="list-style-type: none"> ✓ Trunk transport for business trip, private visit trip. 	Around 300 km	National road, railway and water transport	Intercity bus (Railway)	<ul style="list-style-type: none"> ✓ Improvement of national road network, including construction of expressway. ✓ Improvement of railway network
International	<ul style="list-style-type: none"> ✓ Trunk transport for tourism and business trip 		N.A	Air transport	

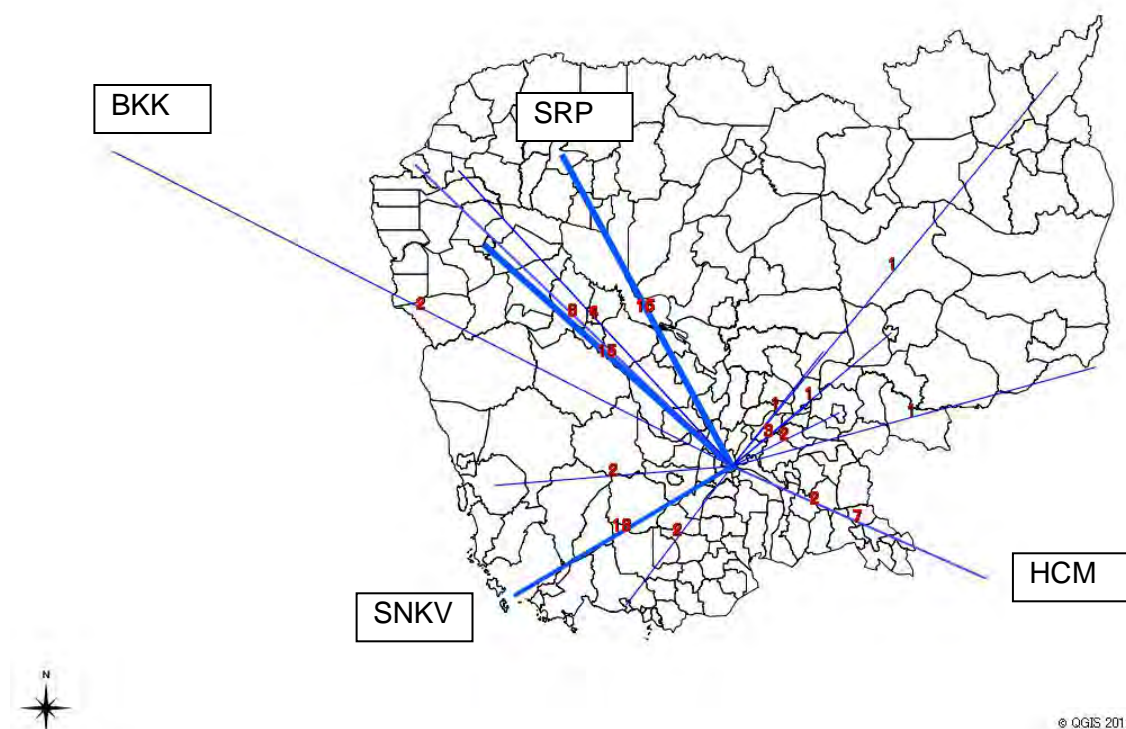
Source: PPUTMP Project Team

6.2 Bus Transport

The transport services covering long distance transport including international transport are provided by air, water and land transport. In land transport, the bus transport system is currently the most dominant transport mode in terms of transport services and number of passengers carried across the national territory.

6.2.1 Intercity Bus Transport Network

At present, many intercity buses are operated from Phnom Penh to major destination points in the country on a daily basis, and they have realized the potential public transport network for long distance travel needs and regional transport demand. This bus network is most commonly used in intercity transport; it is also considered to actually play the most important role in providing stable and economical transport services for people when no other effective transport system exists due to the deterioration of the railway transport services. Intercity bus services are provided on trunk routes, connecting between Phnom Penh and main regional transport hubs such as Siem Reap, Sihanoukville and Battambang, and Bangkok and Ho Chi Minh as international transport links (see Figure 6.2-1).



Source: PPUTMP Project Team

Figure 6-2.1 Regional Transport Network by Intercity Bus Services

6.2.2 Bus Operation

For intercity bus transport, a transport operator wishing to engage in this service is required to obtain a license to operate from the appropriate government authority by route. Currently, in the whole country, there are 21 bus companies registered as intercity bus service providers with their own bus fleet and drivers. Based on the interview of some major bus service providers, a typical profile of a bus service provider is summarized as follows:

- **Company Structure:** Consists of operation division including branch functions, administration and finance division, and marketing division. Number of employees is around 120 persons.
- **Scale of Bus Fleet:** Around 100 buses consisting mostly of large-sized and standard-sized buses.
- **Number of Routes:** 5-10 routes including international transport links.

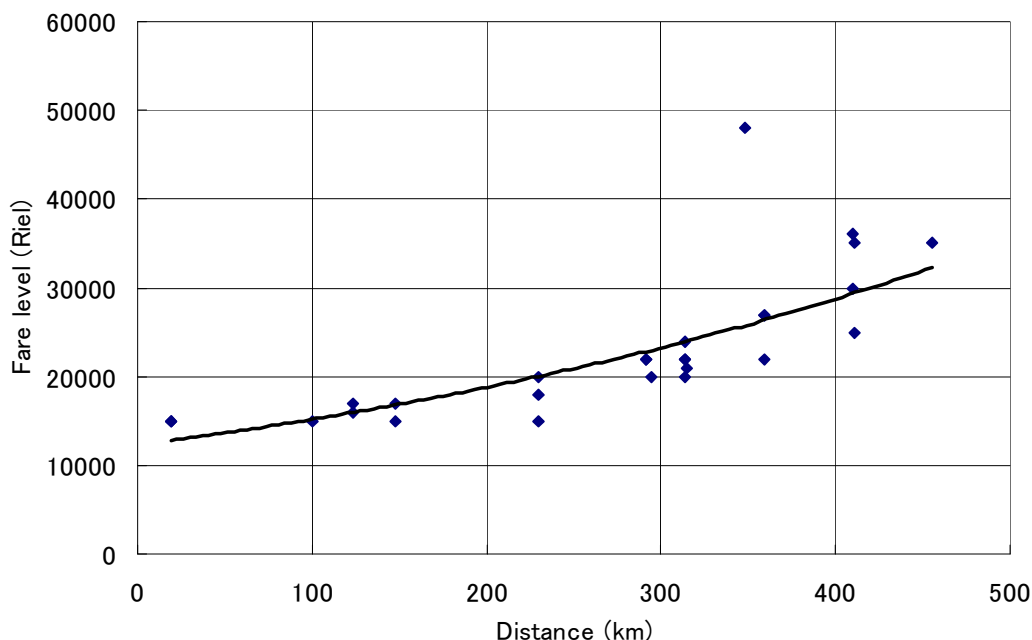
According to MPWT, in addition to the registered bus companies, there are more than a thousand minibus operators whose specific situations have not been monitored by the government because they are mostly informal business operations. However, even if they are small-sized bus operators, they still have to provide their bus services in fixed route basis just like any other bus operator and are obliged to submit a route plan according to government regulation.

6.2.3 Bus Transport Market

In Cambodia, the intercity bus market is basically open to any bus operator and entry and exit from the market is free from government control. Even though a bus company is obliged to apply for a license to operate, government regulation is not so tight, so that some of the bus service providers continue to operate even after their licenses have expired. Regarding the fare/tariff system, this is basically decided by each service provider and there is very little government intervention on this matter. As a result, self-regulatory optimization is expected through free market competition. Furthermore, double tracking for single bus route was applied to more than two bus operators to further intensify market competition.

6.2.4 Fare Level

Current fare level is determined for each bus route by level of service and transport distance. As shown in Figure 6.2-2, fare level tends to increase gradually as travel distance becomes longer.



Source: PPUTMP Project Team

Figure 6-2.2 Current Fare Level Curve by Travel Distance

6.2.5 Comparison to the Bus Operation in 2000

Intercity bus service was operated in 2000 when the previous master plan was conducted. A brief comparison is made below between the present and past operations based on data shown in Table 6.2-1 on the current bus services provided for Phnom Penh by several bus operators, and in Table 6.2-2 on past bus operation in the previous master plan.

- In general, bus transport services seem to be on a growing trend in terms of network coverage, particularly the international bus operation extending toward Vietnam and Thailand.
- Production capability of operators is considered to be almost at the same level judging from their fleet size and number of employees.
- Regarding user cost, the average fare level for the same travel distance seems to have gone up almost twice as much during this decade. This figure implies a 7% annual increase, which is relatively lower than GDP growth.
- Above all, the intercity bus market is well maintained in terms of user cost/benefit even though there is no explicit government intervention and the market is competitive.

Table 6.2-1 Current Intercity Bus Operation Originated at Phnom Penh

Bus operator	Origin	Destination	Distance	Fare	Frequency	Bus fleet size
Caipitol Bus Staff:125 persons	Phnom Penh	Siem Rep	314	22000Riel	9 /day	Large bus:78 Medium bus:5
		Sihanouk Ville	230	20000Riel	7 /day	
		Battambang	291	22000Riel	12 /day	
		Svay Si	359	27000 Riel	4 /day	
		Poipet	411	35000Riel	4 /day	
		Kampong	123	17000 Riel	2 /day	
		Soung	NA	19000Riel	2 /day	
		Bovel	NA	27000Riel	2 /day	
		Kompot	148	17000Riel	2 /day	
		Saigon	234	10US\$	3 /day	
	Chau Doc	NA	21US\$	1 /day		
	Sihanouk Ville	Phnom Penh	230	18000Riel	5 /day	
	Battambang		295	20000Riel	13 /day	
	Bovel		NA	25000Riel	2 /day	
	Svay Sisophon		359	22000Riel	5 /day	
	Poipet		411	25000Riel	3 /day	
	Kampoung		123	16000Riel	2 /day	
	Soung		NA	18000Riel	2 /day	
Kompot	148		15000Riel	2 /day		
Phnom Penh Sorya Transportatio n Staff:120 Person	Phnom Penh	Bakse	690	27US\$	1 /day	Large bus:122 Medium bus:3
		Sihanouk Ville	230	15000R	5 /day	
		Siem Rep	314	22000R	3 /day	
		Battambang	291	22000R	3 /day	
		Poipet	410	30000R	1 /day	
		Bantay Meanchey	359	27000R	1 /day	
		Steung Treng	455	30000- 40000R	1 /day	
		Kratier	315	21000R	1 /day	
		Ratanakiri	348	48000R	1 /day	
		Kampong	NA	15000R	1 /day	
		Hochimen (Vietnam)	234	40000R	3 /day	
Virak Buthan Express Tour & Transport Staff:120 persons	Phnom Penh	Koh Kong		22000R	2 /day	Large bus:122
	Phnom Penh	Siem Rep	314	24000R	3 /day	
	Phnom Penh	Poipet	410	36000R	3 /day	
	Phnom Penh	Sihanouk Ville		24000R	1 /day	
	Phnom Penh	Hochimenh		40000R	1 /day	

Source: Major Bus Operator Interview Survey

Table 6.2-2 Intercity Bus Operation as of Year 2000

Bus Route	Destination	Distance (km)	Fare (riels)	From PP to Province		From Province to PP		Via
				Frequency	No. of pax	Frequency	No. of pax	
Ho Wah Genting Transport Co. (250 staff including 65 drivers)	Route No.4			14				Kampuchea-Russia-RN4
	Sihanoukville	220	10,000	5				
	Kampong Speou	48	4,500	9				
	Route No.6A			21				Monivong-RN6
	Kampong Cham	125	5,000	8				
	Ro Ka Kaung	35	3,000	13				
	Route No.5			26				Monivong-RN5
	Ou Dong	37	2,500	17				
	Kampong Chhnang	91	4,500	9				
	Route No.2			60				Monivong-RN2
	Ta Keo	77	4,500	9				
	Ta Knau		1,200	51				
	Route No.1			35				Monivong-RN1
	Neak Loeng	60	4,000	10				
	Koki Market		2,000	25				
Total				156				
G.S.T. Express Bus (25 staff & 12 drivers)	Route No.6							Monivong
	Kampong Cham	125	5,000	2		2		
	Route No.4							Russia
Sihanoukville	220	10,000	1		1			
Total				3	0	3	0	
D.H. Cambodia Group (15.6)	Route No.4							Russia
	Sihanoukville	220	10,000	1		1		
Total				1	0	1	0	

Source: JICA 2001MP

6.3 Taxi Transport

There are two taxi companies operating metered taxis in Phnom Penh, namely Trans-Choice Cambodia and Global Taxi. In respect of taxi fare, a taxi ride costs passengers KHR4,000 for the first 2 km and additional KHR400 for every 1 km thereafter.

Below is a profile of Trans-Choice Cambodia Taxi Company:

- Number of taxis/ owned vehicles: 80 (will increase to 300 in the next 3 years)
- Number of Drivers: 200



Source: PPUTMP Project Team

Figure 6-3-1 Taxi Transport in Phnom Penh

6.4 Para-transit Modes

6.4.1 Para-transit Vehicle Registration in Phnom Penh

According to DPWT, PPCH does not formally control para-transit operation in Phnom Penh. In particular, motodops are not controlled at all by the government such that the number in operation is not known. The motorumok modern (tuk-tuk) owners/operators are required to register their vehicles with DPWT, and their current numbers are shown in Table 6.4-1.

Table 6.4-1 Number of Motorumok Modern (Tuk-Tuk) Registered in Phnom Penh, 2006-2012

Year	3-Wheeled Type		4-Wheeled Type		Remarks
	Registration	Cumulative	Registration	Cumulative	
2006	29	29	1	1	
2007	249	278	0	1	
2008	41	319	0	1	
2009	198	517	905	906	
2010	306	823	1,494	2,400	
2011	527	1,350	1,400	3,800	
2012	295	1,645	554	4,354	As of July 2012

Source: DPWT

A motorumok modern (tuk-tuk) of 3-wheeled type is more expensive because it is imported, usually from such countries as Thailand, while the 4-wheeled type is supplied domestically. In general, the total number of motorumok modern (tuk-tuk) is estimated at around 6,000.

On the other hand, the number of motodops in operation is difficult to estimate because no official record including license and registration exists and because some drive a motodop only as a secondary source of income. This implies that the potential number of motodops in operation is nearly close to the number of registered motorcycles. The latest figures (as of 2007) on motorcycle registration in the country show that the number of privately owned motorcycles is estimated at more than 500 thousand (see Table 6.4-2).

Table 6.4-2 Number of Registered Motorcycles in Cambodia, 1990-2007

Year	Privately Owned Motorcycles	Cumulative Number
1990	43,733	43,733
1991	27,432	71,165
1992	36,443	107,608
1993	12,544	120,152
1994	12,818	132,970
1995	19,080	152,050
1996	18,422	170,472
1997	10,794	181,266
1998	21,756	203,022
1999	20,147	223,169
2000	24,064	247,233
2001	41,960	289,193

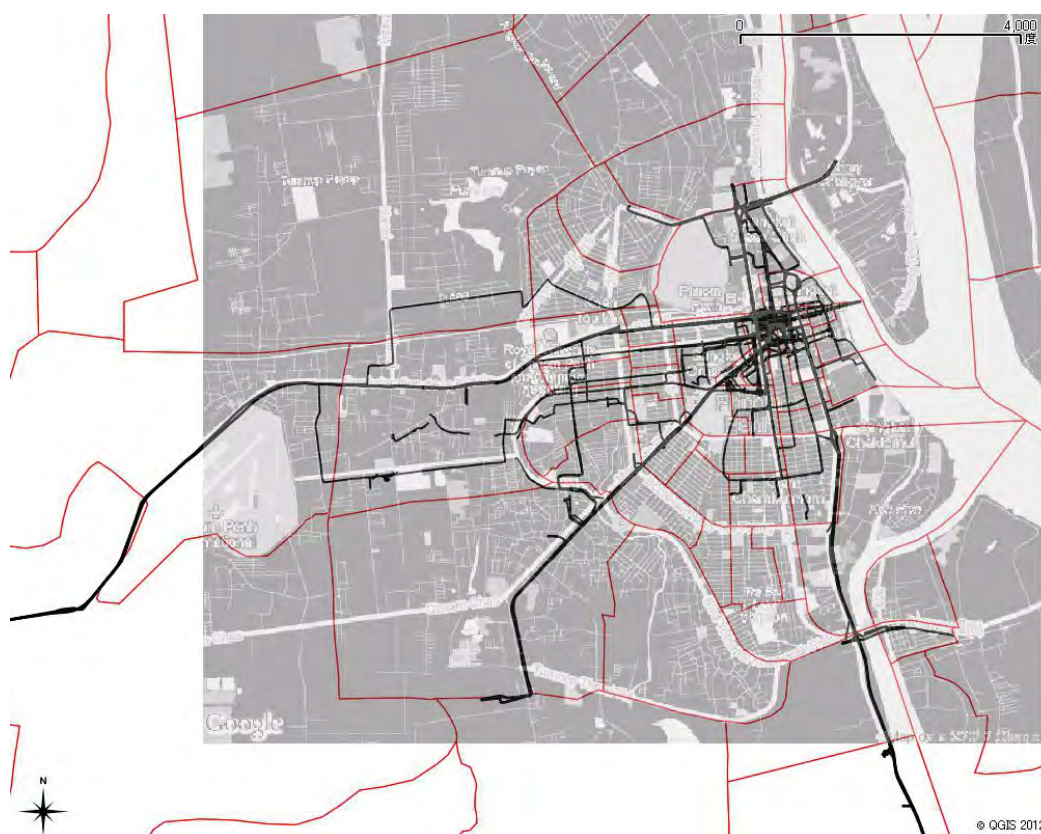
Year	Privately Owned Motorcycles	Cumulative Number
2002	15,675	304,868
2003	26,736	331,604
2004	20,730	352,334
2005	68,689	421,023
2006	39,643	460,666
2007	129,915	590,581

Source: Statistical Yearbook of Cambodia 2008

6.4.2 Daily Movement of Para-transit Modes

In this study, a travel condition survey was conducted in order to look into the actual movement of para-transit vehicles in June 2012. The survey employed on-board Global Positioning System (GPS) equipment encoding the travel log data containing geodetic features (latitude, longitude), time, etc. The survey was conducted at 5 locations, i.e., Central Market, Beung Kang Market, Choam Chao Market, Russian Market, and Russeikeo Market. At each location, 10 samples each for motodop and motorumok modern (tuk-tuk) were selected, and travel log data were collected for a whole day for each sample.

Based on the collected log data, travel movements of para-transit vehicles were analyzed and projected in a map like the example shown in Figure 6.4-1.



Source: PPUTMP Project Team

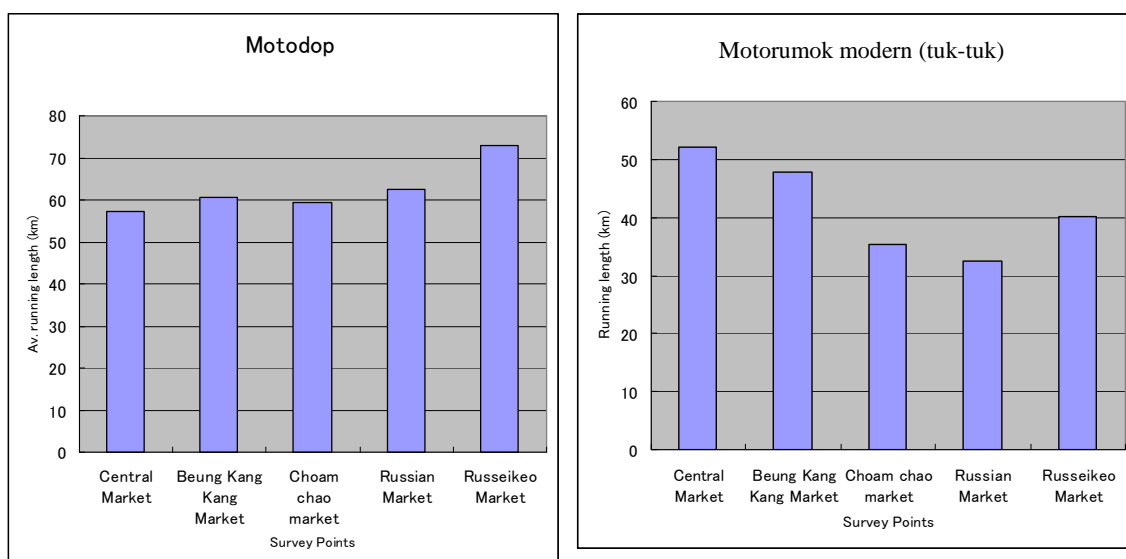
Figure 6.4-1 Example of Visualized Travel Movement of Para-transit Modes

A detailed analysis of the survey results are shown in the Appendix while a summary of major findings is given below.

1) Total Travel Length and Operation Time of Para-transit Modes

Figure 6.4-2 shows the average distance traveled by para-transit modes, observed by survey location. It shows that a motodop runs an average distance of around 60 km, which is relatively greater than the 30 km to 50 km distance traveled by a motorumok modern (tuk-tuk).

Table 6.4-3 shows the survey results on operation time of para-transit vehicles surveyed at each location. In this table, the total time stands for the observed hours the survey was carried out and does not mean actual business hours in which the para-transit provides transport services. Thus, this study assumes that elapsed time for vehicle in motion was the time in service by para-transit. In this regard, actual service operation time is estimated from 2 hours to 3 hours for both the motodop and motorumok modern (tuk-tuk).



Source: PPUTMP Project Team

Figure 6.4-2 Average Distance Traveled by Para-transit Modes by Survey Location

Table 6.4-3 Average Operation Time of Para-transit Modes

Mobility of Motodop		Running length of vehicle (km/day)	Elapsed time by vehicle (H:M)		
			Total	in Service	Idle time
Central Market	Max	115.09	13:30	5:50	9:30
	Min	22.26	10:45	1:45	5:35
	Average	57.22	12:07	3:51	8:16
Beung Kang Kang Market	Max	82.25	11:45	5:20	7:20
	Min	47.49	10:55	4:00	5:50
	Average	60.76	11:23	4:33	6:50
Choam chao market	Max	76.13	15:25	3:45	12:30
	Min	31.19	11:50	1:45	8:15
	Average	59.48	12:25	2:45	9:40
Russian Market	Max	107.07	12:10	6:45	10:00
	Min	23.28	10:35	2:10	4:15
	Average	62.40	11:14	4:31	6:43
Russeikeo Market	Max	100.23	12:40	5:55	9:05
	Min	40.90	10:20	2:55	5:55
	Average	72.83	12:09	4:18	7:51

Mobility of Motorumok modern (tuk-tuk)		Running length of vehicle (km/day)	Elapsed time by vehicle (H:M)		
			Total	in Service	Idle time
Central Market	Max	114.41	12:50	7:10	10:40
	Min	20.36	11:35	1:45	4:50
	Average	52.08	12:01	3:37	8:23
Beung Kang Kang Market	Max	114.52	12:05	7:20	9:55
	Min	14.72	10:45	1:15	3:55
	Average	47.82	11:20	3:34	7:45
Choam chao market	Max	94.50	12:20	4:30	11:45
	Min	8.73	11:55	0:30	7:25
	Average	35.34	12:07	2:01	10:06
Russian Market	Max	67.58	12:35	5:15	10:45
	Min	8.97	10:40	0:40	6:55
	Average	32.46	11:35	2:25	9:09
Russeikeo Market	Max	82.02	13:50	4:25	12:05
	Min	1.00	11:20	0:00	8:10
	Average	40.21	12:15	2:33	9:42

Source: PPUTMP Project Team

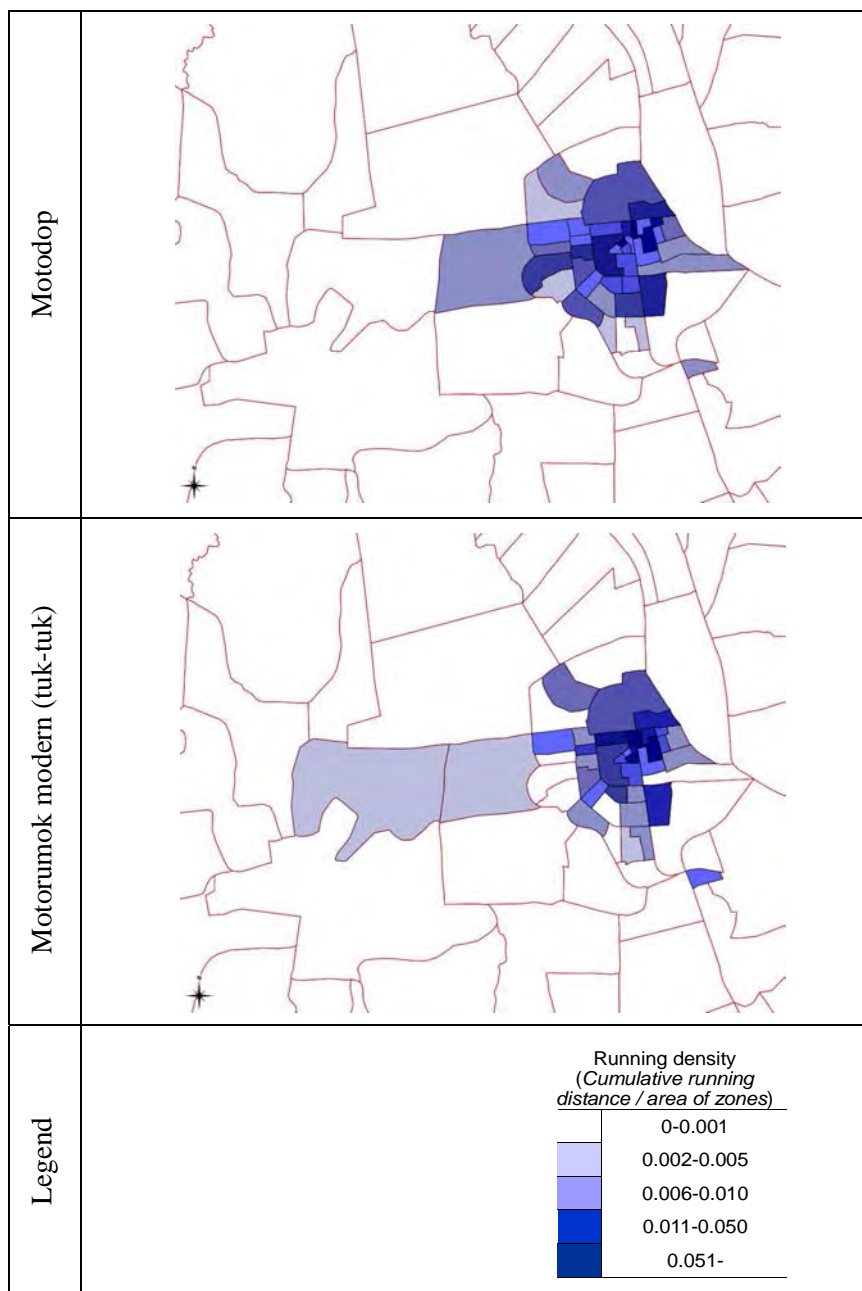
2) Service Coverage of Para-transit Modes

Para-transit is not a formal public transport system that is operated on scheduled routes and, thus, it is quite difficult to find an operation pattern for this type of service. In this study, an approximate operation pattern is analyzed by a form of trip density of the para-transit modes, dividing the accumulated running length of the para-transit vehicles in a zone by area of each zone. Figure 6.4-3 shows the operation density of para-transit modes surveyed at the Central Market. Compared with the motorumok modern (tuk-tuk), the motodop's operation seems to concentrate more in the central district. The motorumok modern (tuk-tuk) has a relatively wider area coverage including the suburban district. This indicates that the motodop is used for shorter trips and more frequently in the downtown area than the motorumok modern (tuk-tuk).

3) Operation Characteristics by Period of Time in a Day

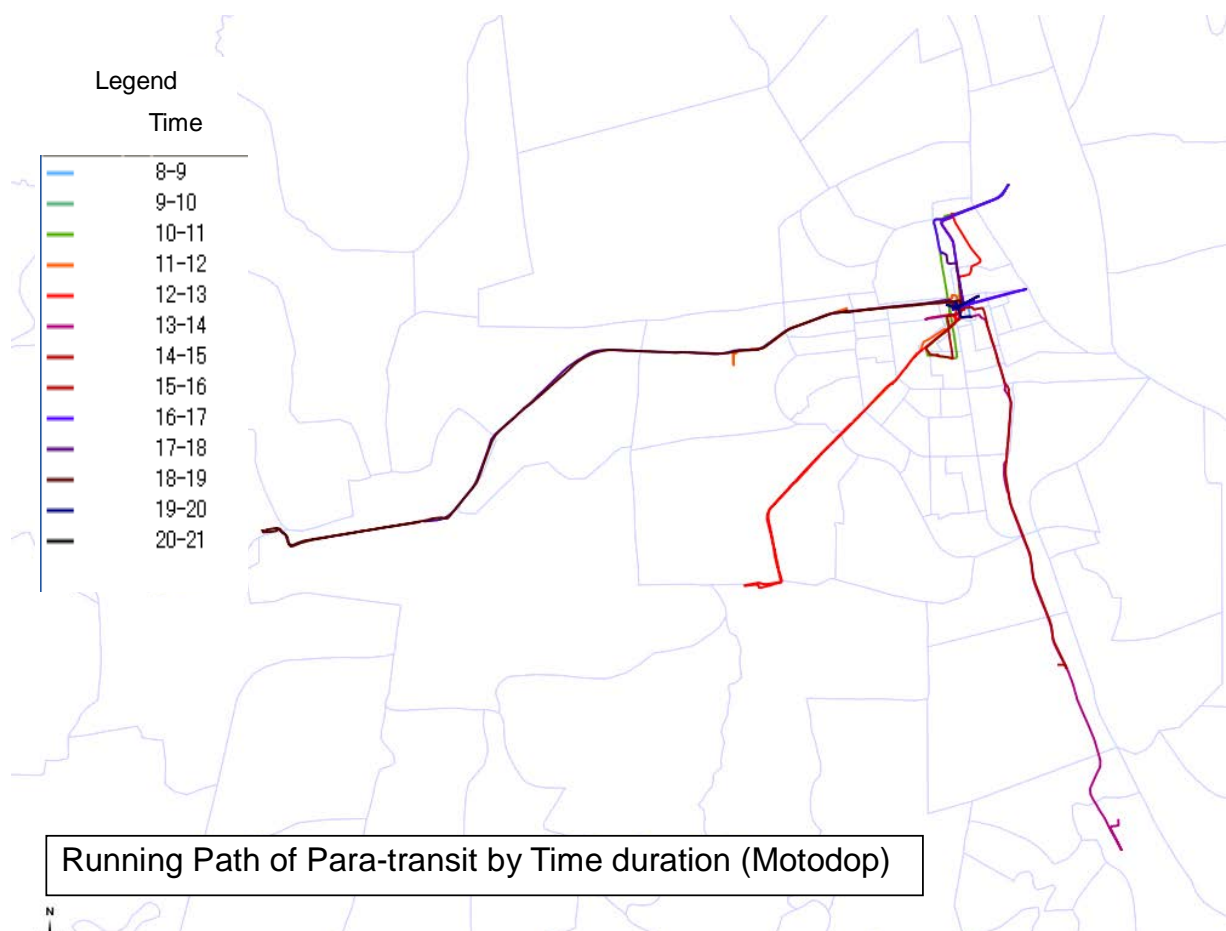
Figures 6.4-4 and 6.4-5 show the running path of para-transit vehicles on an hourly basis for 13 hours. The figures indicate that in the morning peak period from 8:00 to 10:00, both the motodop and the motorumok modern (tuk-tuk) are moving within a relatively narrow area of the central district; conversely, in the noon period (12:00-15:00) and evening period (18:00-21:00), they are used for a wider area including the suburban area.

This indicates that there are two aspects of para-transit services in accommodating transport needs. Firstly, they can serve morning transport demand such as commuting trips but their service coverage is limited to a relatively small area; and secondly, they also cater to long trips between the central district and the suburban area in the daytime and evening time. However, it is pointed out that these transport demands are generated on ad-hoc basis rather than on a regular basis. As a whole, it is concluded that the basic nature of para-transit modes is different from that of a typical public transport system, which is operated based on a regular and cyclical traffic demand such as commuting, and the para-transit's service modality lacks a regular and normative nature as a genuine public transport system.



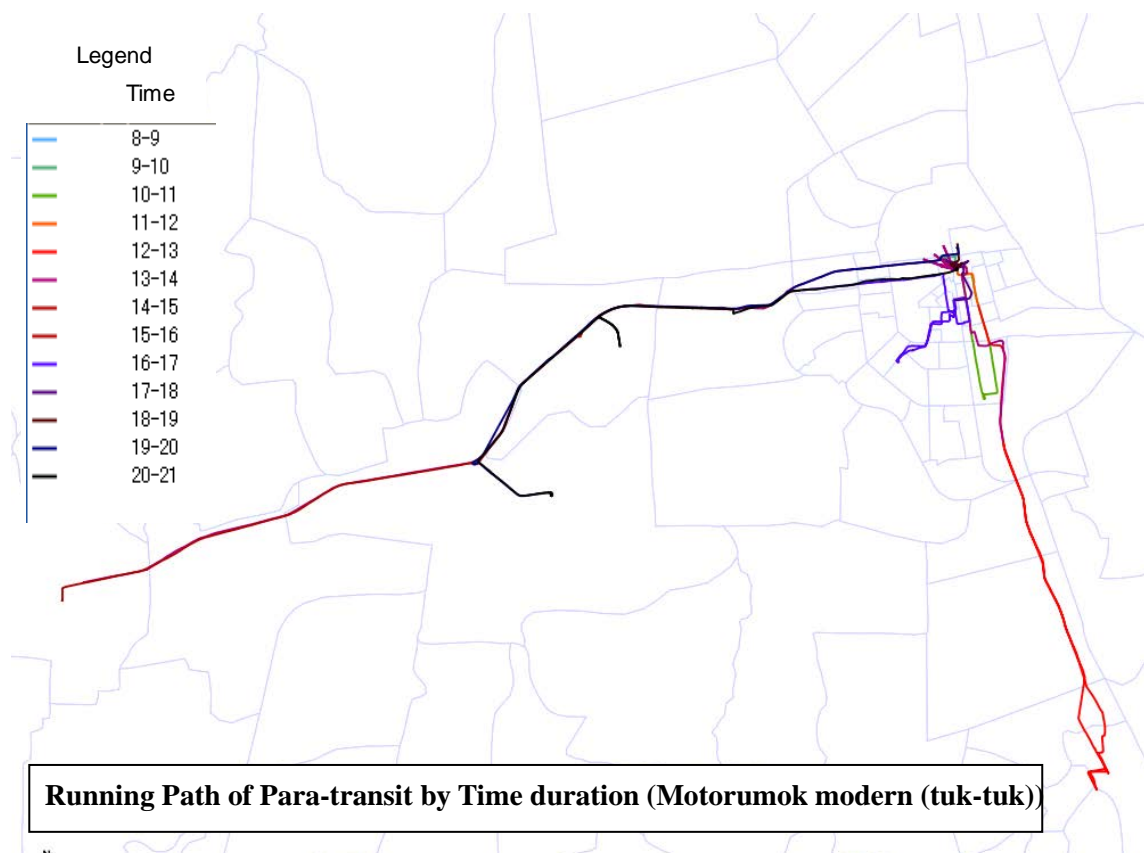
Source: PPUTMP Project Team

Figure 6.4-3 Coverage of Operation Density of Para-transit Modes



Source: PPUTMP Project Team

Figure 6.4-4 Hourly Running Path of Motodop (13 hours)



Source: PPUTMP Project Team

Figure 6.4-5 Hourly Running Path of Motorumok Modern (Tuk-Tuk) (13 hours)

6.4.3 Transport Characteristics of Para-transit Modes

1) Number of Trips and Number of Passengers

Based on the results of the Driver Interview Survey, the number of daily trips produced by type of para-transit and by survey location is shown in Table 6.4-4. Compared to the average of 4 trips made by the motorumok modern (tuk-tuk), the motodop makes around 15 trips a day, which is 3 times that of the former. The cyclo driver makes an average of 12 trips a day from its cyclo station.

Table 6.4-4 Number of Trips of Para-transit Modes by Survey Location

Para-transit	Survey Location							
	Boeung Kenkong Market	Chomchao Market	Chrang Chamreh Market	Central Market	Cyclo Station	Russian Market	Stueng Menchey Market	Total
Motodop	13.2	13.6	21.2	15.3	0.0	14.1	15.4	15.5
Motorumok modern (tuk-tuk)	6.4	3.1	3.0	5.5	0.0	4.2	3.8	4.4
Cyclo	0.0	0.0	8.0	5.0	12.4	0.0	0.0	12.2

Source: Driver Interview Survey 2012

Regarding the number of passengers, the survey results are shown in Table 6.4-5 below.

Table 6.4-5 Average Number of Passengers of Para-transit Modes by Survey Location

Para-transit	Survey Location							
	Boeung Kenkong Market	Chomchao Market	Chrang Chamreh Market	Central Market	Cyclo Station	Russian Market	Stueng Menchey Market	Total
Motodop	1.2	1.2	1.2	1.1	0.0	1.1	1.3	1.2
Motorumok modern (tuk-tuk)	3.1	2.9	2.5	2.0	0.0	2.3	2.4	2.5
Cyclo	0.0	0.0	0.0	2.4	1.4	0.0	0.0	1.4

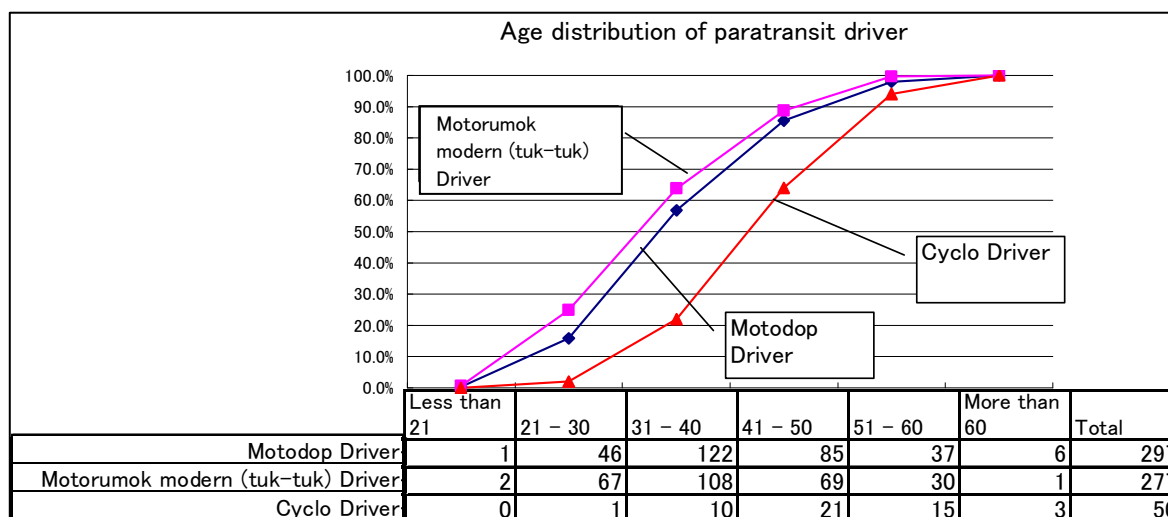
Source: Driver Interview Survey 2012

Because it has a single seat capacity, the motodop’s average occupancy is 1, more or less. The motorumok modern (tuk-tuk) is considered to have a 4-5 seating capacity but its average occupancy is 2-3 passengers.

2) Individual Attributes of Para-transit Drivers

a) Age

The age structure of para-transit drivers, shown in Figure 6.4-6, is based on the results of the Driver Interview Survey. Majority of the motodop and motorumok modern (tuk-tuk) drivers are between 31-40 years old and a significant number are 41-50 years old. Cyclo drivers tend to be older, with most in the 41-60 age bracket.

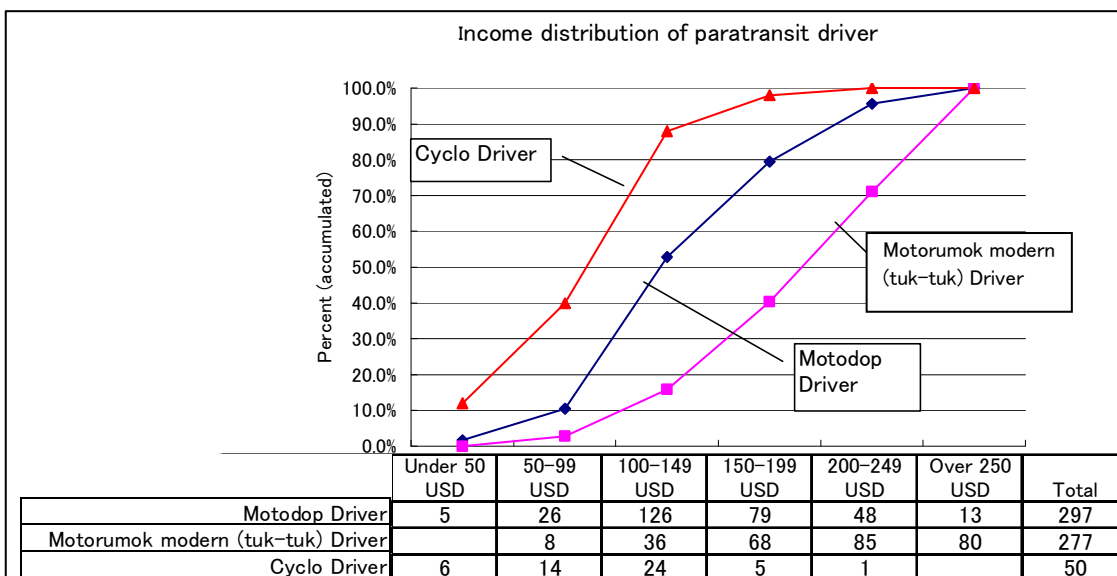


Source: PPUTMP Project Team based on the Driver Interview Survey 2012

Figure 6.4-6 Age Structure of Para-transit Drivers

b) Income

Figure 6.4-7 shows the income distribution of para-transit drivers. Survey results show that with most of them having an average income of 150-249 USD a month, the motorumok modern (tuk-tuk) drivers earn more than the motodop and cyclo drivers, most of whom earn from 100-149 USD.



Source: PPUTMP Project Team based on the Driver Interview Survey 2012

Figure 6.4-7 Income Distribution of Para-transit Drivers

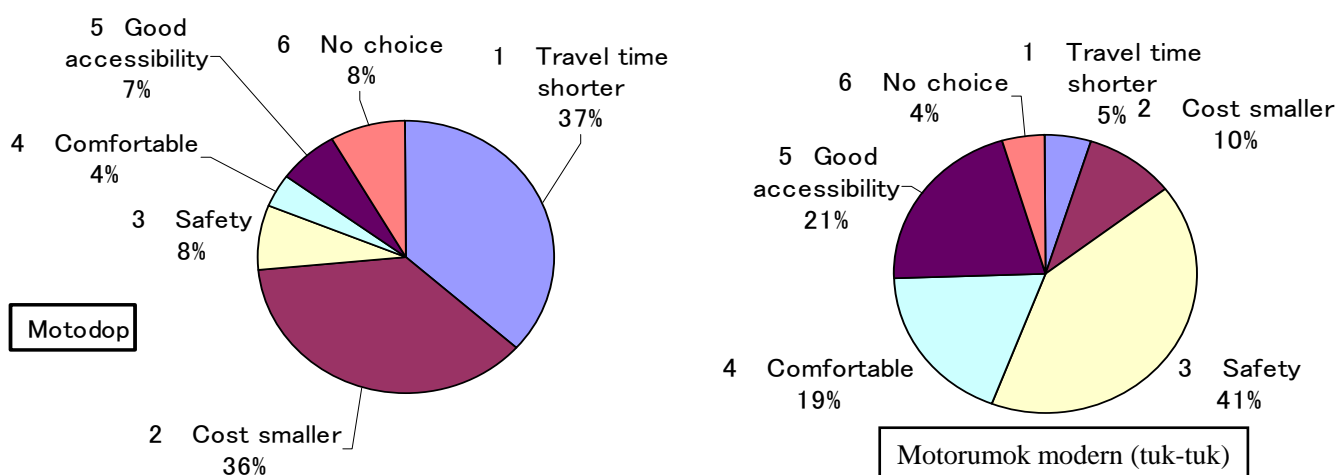
6.4.4 Modal Characteristics of Para-transit Users

Using the results of the Public Transport User Interview Survey, an analysis is conducted on the overall modal choice characteristics of para-transit modes.

1) Reasons for Choosing Para-transit Mode

Figure 6.4-8 shows the percentage shares of the different reasons for choosing either motodop or motorumok modern (tuk-tuk) as a para-transit mode. It is shown that:

- "Travel time" and "cost" are pointed out as the significant reasons why the motodop is selected, having a combined share of around 73%.
- The main reasons for selecting the motorumok modern (tuk-tuk) are "safety" and "comfortable," having a combined share of 60%. Meanwhile, the share of "travel time" and "cost," factors which are significant to motodop users, scored low among motorumok modern (tuk-tuk) users.
- Therefore, it may be said that the motorumok modern (tuk-tuk) is selected because it provides affirmative benefits such as safety and comfort while the motodop is selected for marginal reasons, that is, no other option is available.

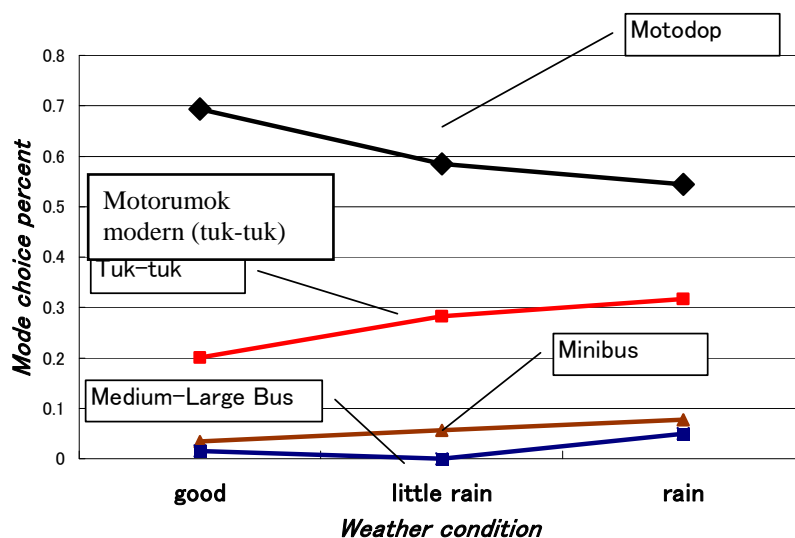


Source: PPUTMP Project Team based on the Public Transport User Interview Survey

Figure 6.4-8 Reasons for Taking Para-transit Mode

2) Variation of Modal Choice Rate by Weather Condition

Figure 6.4-9 shows the difference in mode choice rate of the motodop and the motorumok modern (tuk-tuk) by weather condition on the survey date. On a rainy day, the mode choice rate for the motodop decreases by around 10% compared to that on a fine day. On the contrary, the rate for the motorumok modern (tuk-tuk) on a rainy day increases around 10% over that on a fine day. This seems to support the more safe and comfortable perceptions about the tuk-tuk.



Source: PPUTMP Project Team based on the Public Transport User Interview Survey

Figure 6.4-9 Variation of Modal Choice Behavior by Weather Condition

6.4.5 Comparison of Para-transit Conditions with the Results of JICA 2001MP

Comparing the results of the 2012 Driver Interview Survey and that of JICA 2001MP, shown in Table 6.4-6, it is observed that the average age of drivers has slightly increased and their average income has almost doubled between 2000 and 2012. It is also interesting to note that the average trip length of the motorumok modern (tuk-tuk) has more than tripled while that of the motodop remained almost the same, if not slightly shorter.

Table 6.4-6 Comparison of Para-transit Operational Performance

Items	Year	Unit	Motodop	Motorumok modern (tuk-tuk)	Cyclo
Driver's age	2000	Years	35.6	33.3	37.5
	2012		39.3	37.2	46.5
Average monthly income	2000	Riels 000	296	390	213
	2012	USD (Riels 000 est.)	154 (616)	203 (812)	109 (436)
Income- expenditure	2000	USD	39.0	47.0	30.0
	2012	USD	79.8	113.5	54.5
Average No. of trips	2000	Trips	9.5	5.2	8.7
	2012		15.5	4.4	12.2
Average No. of Pax per trip	2000	Persons	1.4	7.0	1.6
	2012		1.2	2.5	1.4
Average Trip length	2000	Km	4.1	1.8	20.1
	2012	Km	4.0	9.5	-
Average fare /pax/trip	2000	Riels	808	755	945
	2012	Riels	-	-	-

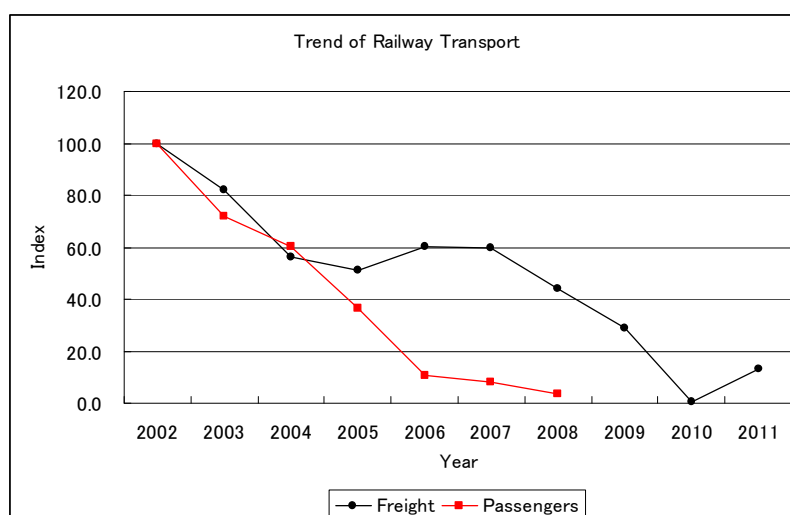
Source: 2000->Master Plan in 2000, 2012->Driver interview survey

6.5 Railway Transport

6.5.1 General

The railway infrastructure in Cambodia was primarily built before World War II. It is 650 km long, consisting of the northern line which connects Phnom Penh to Poipet on the Thai border, and the southern line which connects Phnom Penh and Sihanoukville.

Previously, rail transportation services were provided by the state-owned Royal Railway of Cambodia (RRC), a public enterprise governed under MPWT before 2009. However, due to the poor maintenance and lack of competitiveness compared to other land transport modes such as long distance bus services and truck services, the volume of passengers and freight carried by railway has decreased dramatically (see Figure 6.5-1 and Table 6.5-1).



Source: MPWT

Figure 6.5-1 Trend of Railway Transport Volumes, 2002-2011

Table 6.5-1 Trend of Railway Transport Volumes, 2002-2011

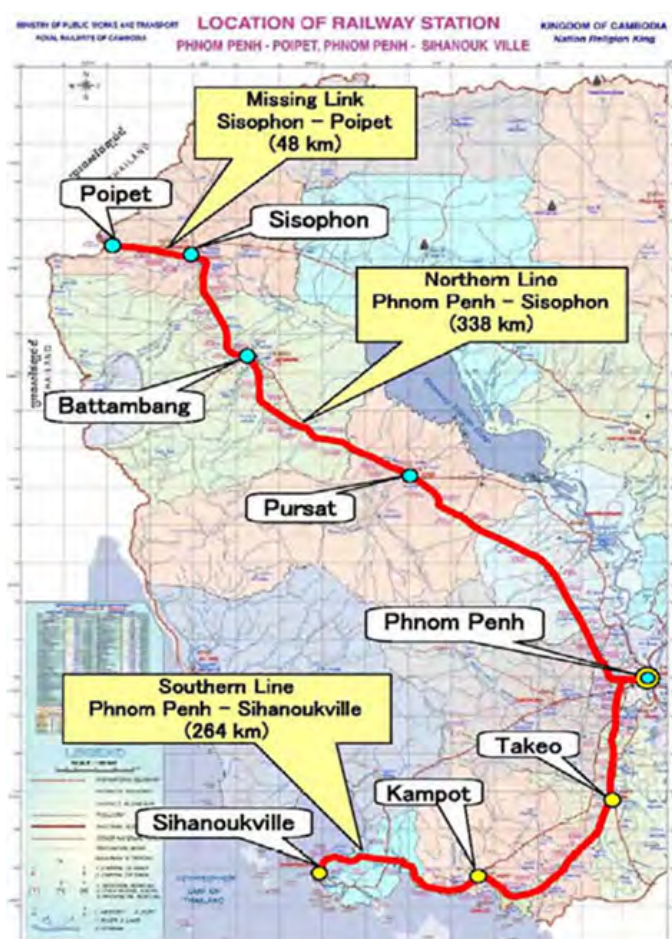
Year	Freight transport		Passengers transport			
	Freight ton	Ton-Km	No. of Passengers	Pass-Km	Luggages	Luggage Ton-Km
2002	527,971	155,276,598	133,060	20,231,512	1,169.21	170,881.55
2003	433,190	100,486,217	95,929	13,440,721	702.64	107,333.34
2004	297,257	77,744,323	80,413	10,175,797	466.39	73,867.41
2005	268,880	80,001,610	48,543	5,320,307	349.87	66,290.42
2006	317,020	92,697,165	14,003	1,416,618	82.54	19,999.99
2007	315,367	88,828,192	10,628	957,965	61.28	11,533.11
2008	233,884	51,397,161	4,924	415,211		
2009	151,152	30,230,400				
2010	3,000	36,000				
2011	68,755	8,250,600				

Source: MPWT

6.5.2 TOLL Royal Railway (TRR)

From 2009, the railway operation in Cambodia has been taken over and managed by the TRR, instead of RRC as a state enterprise. The Government of Cambodia has outsourced the railway operation under a 30-year exclusive concession for Toll (Cambodia) Co., Ltd. (trading as TRR) to operate the Cambodian railway network. The concession is jointly held by TOLL, which has a 55% share and the rest is owned by the Royal Group (Cambodia origin capital).

Its railway operation is envisaged for 2 main corridors, i.e., the south rail section which connects Phnom Penh and Sihanoukville with a railway length of 284 km, and the north rail section which connects Phnom Penh to Sisophon and then to Poipet (Thai border) with a railway length of 386 km (see Figure 6.5-2). A part of the north section from Sisophon to Poipet is not currently existing.



Source: TRR

Figure 6.5-2 Operation Area of TRR

The conceded assets are the railway reserve and the infrastructure and equipment, and all and any part of the rehabilitated or reconstructed railway infrastructure. On railway rehabilitation and reconstruction, ADB and the Australian Agency for International Development (AusAID) take part in the upgrading project for the Southern Line (SL) (254 km) and the Northern Line (NL) (388 km), and the missing link section near the Thai border (48 km). It also includes a provision for a new intermodal

freight terminal on the outskirts of Phnom Penh, at Samrong (see Figure 6.5-3).

The role and responsibilities of TRR in providing railway service are summarized as follows:

- Operating all rail track activities after the track is handed over;
- Providing functional trains and wagons through restoring locomotives and wagons;
- Managing an intermodal freight terminal constructed at Samrong;
- Maintaining infrastructure; and
- Operating depots in Sihanoukville, Kampot, Touk Meas, Samrong, Phnom Penh, Pursat, Battambang, Sisophon and Poipet.



Source: PPUTMP Project Team

Figure 6.5-3 Operation Pattern of TRR

6.5.3 Railway Rehabilitation Project

The railway rehabilitation project was funded by ADB and AusAID. It consists of NL, SL and the 48 km missing line between Poipet and Sisophon. As the rehabilitation work started, all the train operations on NL and SL were suspended from November 2009. In October 2010, part of rehabilitation work for SL between Phnom Penh and Kampot was completed and, thereafter, cargo train service was undertaken to carry cement from Kampot to Phnom Penh. In addition, a new container yard is planned to be built between Sihanoukville Port and the Sihanoukville railway station, in order to meet the requirements of the container transportation by railway.

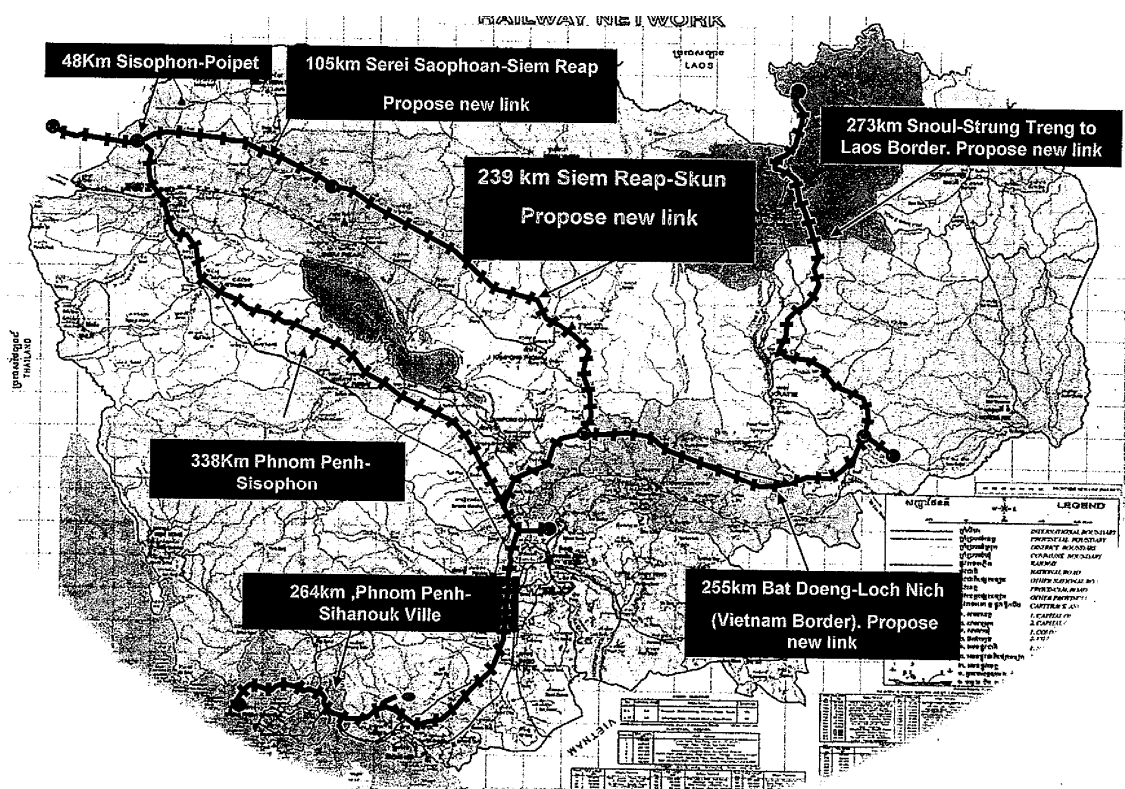
Regarding NL, the rehabilitation work between Phnom Penh and the separating point of NL and SL, located 32 km from Phnom Penh, has been completed.

6.5.4 Future Prospect of Railway Network Development

With regard to future railway development plans, the related master plan and F/S are conducted through foreign technical assistance. Latest information on the progress of the future railway transport plan is as follows:

- A railway master plan for whole area of Cambodia is in progress. It commenced in 2011 and is scheduled to finish in 2013, funded by the Korea International Cooperation Agency (KOICA), an aid agency of Korea.
- An F/S on the Singapore-Kunming Railway Link (SKRL) was carried out by China. It is already completed and awaiting the decision of further project implementation. The planned circular rail link (7,000 km) will connect the capital cities in Cambodia, Lao PDR, Myanmar, Vietnam and Thailand.

The overall development concept of railway in Phnom Penh is shown in Figure 6.5-4.

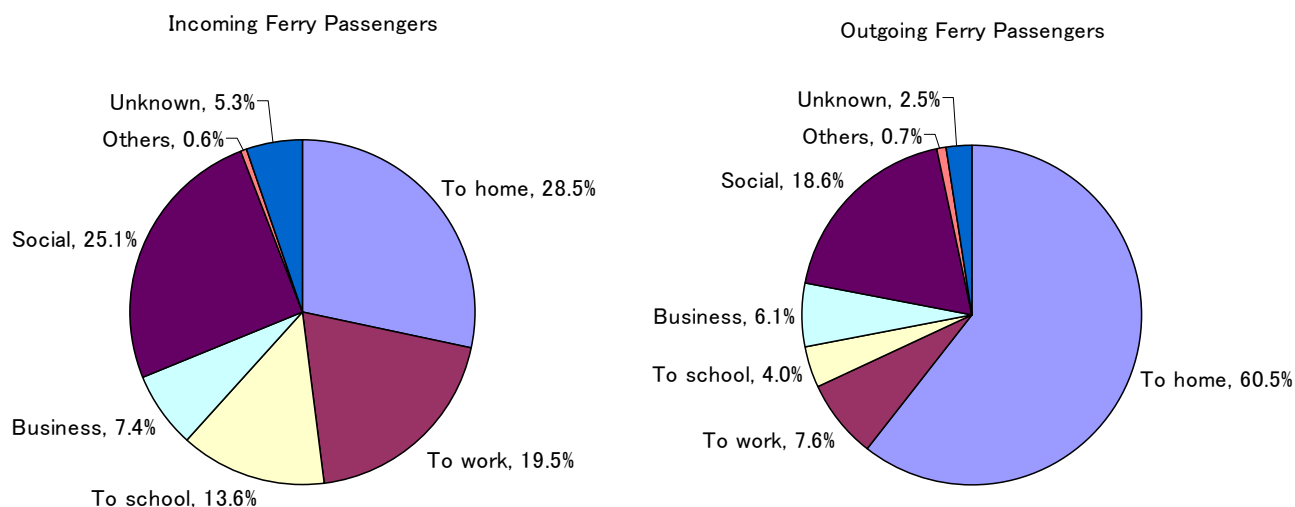


Source: Railway Department

Figure 6.5-4 Schematic Map of Railway Development Concept in Cambodia

6.6 Water Transport

As to the water transport system in Phnom Penh, there are currently several regional ferry transport services from Phnom Penh to Siem Reap, Chau Doc, Kratie and Stung Treng, including speed boat service to Siem Reap for tourist use. The trip purposes of ferry passengers, according to the Ferry Transport Survey, are shown in Figure 6.6-1.

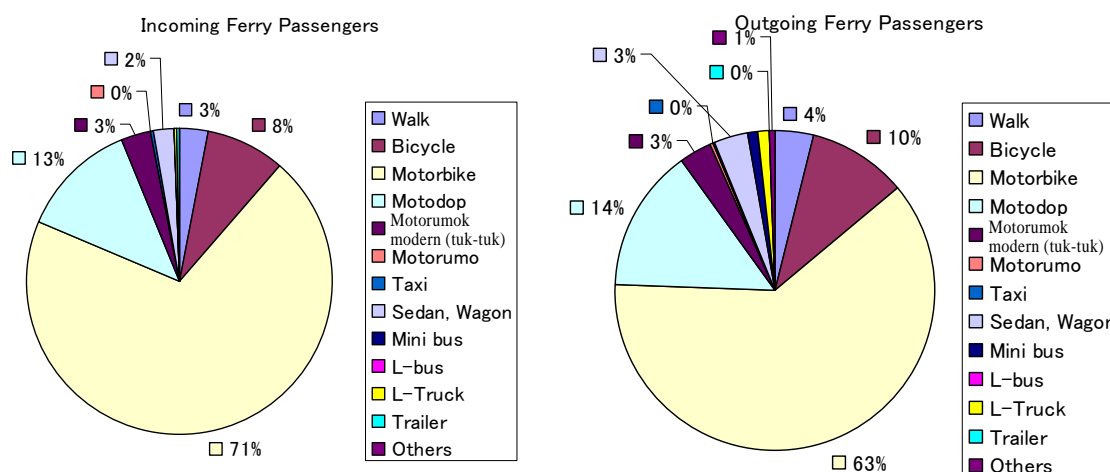


Source: PPUTMP Project Team based on the Ferry Transport Survey

Figure 6.6-1 Trip Purpose Composition of Ferry Passengers

Trips of passengers going to Phnom Penh are mostly for purposes of “to home” (28.5%), “social and shopping” (25.1%) and “to work” (19.5%); conversely, passengers leaving the city for the province do so mainly for purposes of “to home” (60.5%) and “social and shopping” (18.6%).

Regarding feeder transport used from/to the city area to/from the ferry stations, the modal split is calculated from the ferry transport survey results, as shown in Figure 6.6-2. For both incoming and outgoing passengers, their means of transport to/from the ferry stations are mostly 2-wheeled transport, namely motorbikes and motodops, which combined share of total passengers is more than 70%.



Source: PPUTMP Project Team based on the Ferry Transport Survey

Figure 6.6-2 Modal Split of Ferry Passengers

6.7 Air Transport

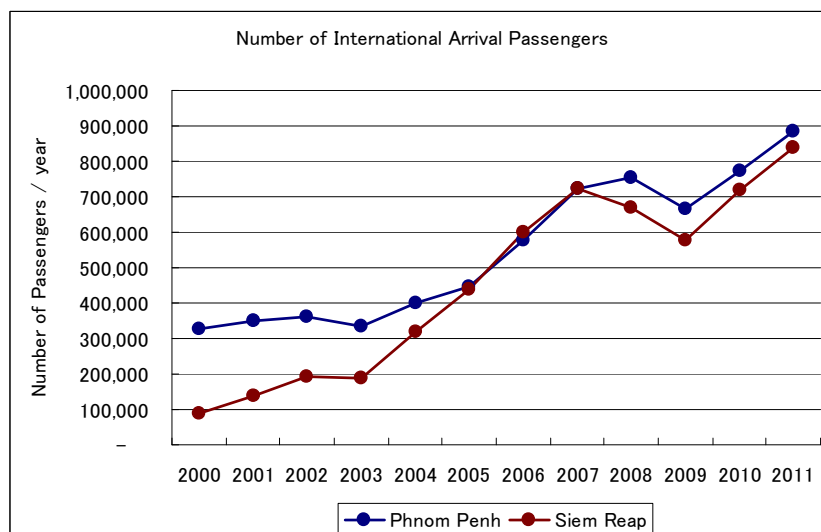
6.7.1 Phnom Penh International Airport

The Phnom Penh International Airport (airport code: PNH, also called Pochentong International Airport) is one of the gateway airports in Cambodia. Since 1995, PNH has been operated by Societe Concessionaire de l' Airport (SCA, a French-Malaysian joint venture company) under a concession agreement with the government. The concessionaire's responsibility covers the airport improvement program, i.e., construction of a new runway, terminal and cargo buildings, hangars, installation of a Cat III level Instrument Landing System (ILS), and associated approach lighting.

The airport is located at an elevation of 40 feet (12 m) above mean sea level. It has a single runway designed 05/23 with an asphalt surface measuring 3,000 by 50 m.

6.7.2 Transport Volume

The comparative annual trends of international arrivals for PNH and Siem Reap International Airport (REP) are shown in Figure 6.7-1. In 2011, the number of arriving passengers at PNH reached around 900 thousand/year, and with the exception of the period 2008-2009 when the global economic crisis took place, the trend of arriving passengers is considered on track to grow for the long term. Passenger volume in REP also exhibits the same growth trend and both airports seem to have identical dips and crests in passenger volumes although their respective functions are different from each other, e.g., Phnom Penh as a business hub airport and Siem Reap as a tourism hub airport.



Note: International passengers

Source: State Secretary of Civil Aviation

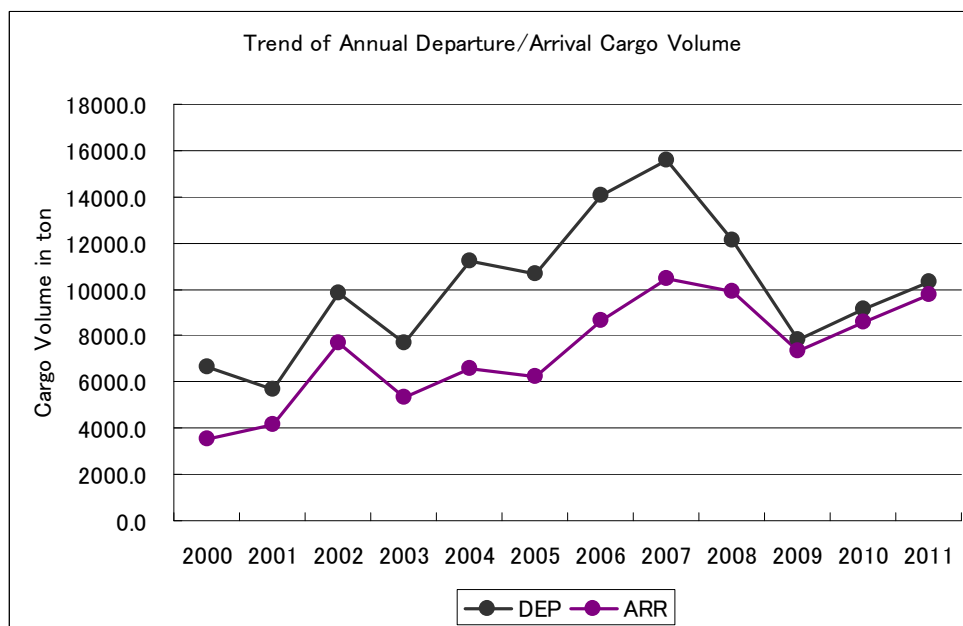
Figure 6.7-1 Volume of International Passengers at Phnom Penh and Siem Reap Airports

Figure 6.7-2 shows the cargo shipment volume of PNH. The cargo handling volume at the airport shows a stable growing trend except for the period of economic downturn (2007-2009).

6.7.3 Airport Access Transport

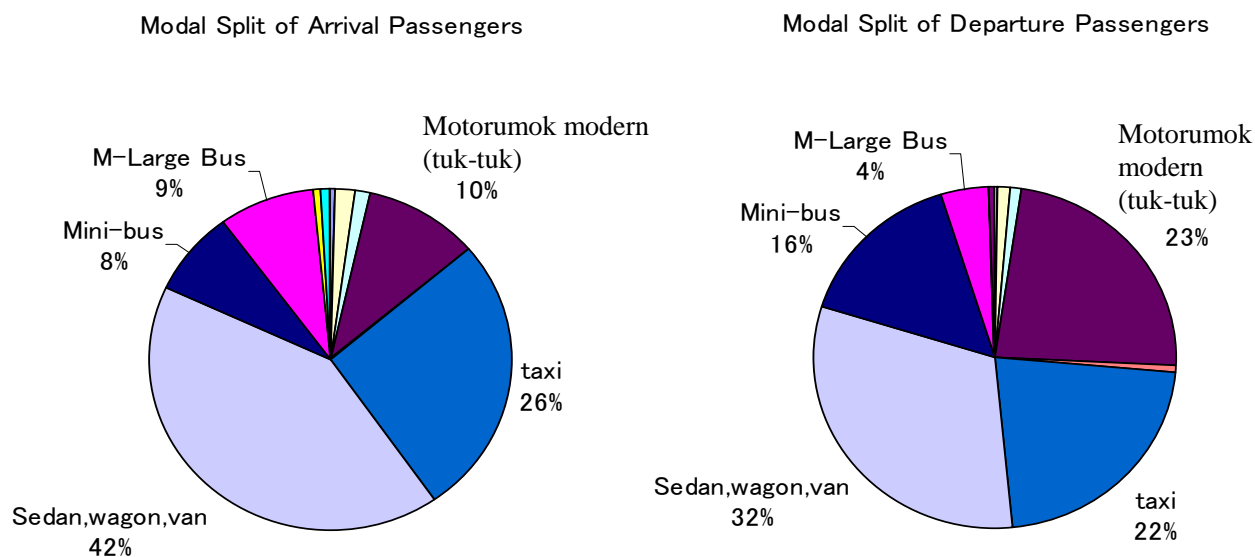
Figure 6.7-3 shows the modal share of feeder transport to the Phnom Penh International Airport, according to the results of the Airport Passenger Interview Survey. Almost 70% of arriving passengers take a relatively expensive feeder transport means such as private cars/taxis. While majority of

departing passengers also take private cars/taxis to the airport, a significant number also prefer the more popular/cheaper transport modes such as the motorumok modern (tuk-tuk) and buses.



Source: Secretary of Civil Aviation

Figure 6.7-2 Cargo Shipment of Phnom Penh Airport



Source: Airport Passenger Interview Survey

Figure 6.7-3 Modal Share of Feeder Transport to/from Phnom Penh Airport

6.8 Identified Problems and Issues

The current situation of the public transport sector in Phnom Penh has been analyzed based on various data sources such as literature/statistical review, interview surveys and others. Based on the analysis, some preliminary findings are discussed below:

- For the intra-urban transport segment, para-transit modes, namely the motodop and the motorumok modern (tuk-tuk), currently play a role as an integral part of public transport. However, both transport modes are basically defined as informal transport rather than formal public transport and their modality is doubtful as a reliable and stable transport system.
- As a capital city, the provision of a principal public transport system is considered to be an essential and urgent issue for Phnom Penh. Study and discussion on how to provide the public transport system in the intra-urban segment should be made, taking into account the disposition of present para-transit modes.
- For the regional transport segment, more upgrading of transport services is expected for long distance transport needs, especially the intercity bus services. As for the railway sector, current conditions show a despairing situation. However, an existing railway sector policy focusing on railway rehabilitation by ADB and the concession scheme of TRR should be maintained at long-term standpoints.
- Together with the provision of a public transport system in each transport segment, improvement of connectivity between intra-urban transport modes and inter-urban transport modes is also an important issue. To cope with this, many study issues are pointed out, e.g., how to arrange feeder transport system from/to city bus terminals, railway station, ferry terminals and airport, and how to keep smooth transferability between principal transport and feeder transport, among others.

7 TRAFFIC MANAGEMENT INCLUDING TRAFFIC SAFETY

7.1 Traffic Rules and Regulations

7.1.1 Outline of Law on Land Traffic

The Land Traffic Law in Cambodia to sustain the smooth and safe road traffic flow was adopted by the National Assembly of the Kingdom of Cambodia on 20 September 2006 and was signed by H.E. Heng Samrin, President of the National Assembly, on 22 September 2006.

This law is composed of 12 chapters, which are listed below, and 95 articles.

Chapter 1	General Provisions	Chapter 7	Vehicle Management and Transportation
Chapter 2	Traffic Signs	Chapter 8	National Road Safety Committee
Chapter 3	Drivers	Chapter 9	Competence of Officers Implementing Traffic Law
Chapter 4	Use of Vehicle Light and Horn	Chapter 10	The Penalty
Chapter 5	Pedestrians and Animal Riders	Chapter 11	Inter-provision
Chapter 6	In Case of Traffic Accident	Chapter 12	Final Provision

ARTICLE 1

The land traffic law governs all road users in the Kingdom of Cambodia.

ARTICLE 2

The law is aimed at:

- Maintaining order and traffic safety on public roads throughout the Kingdom of Cambodia
- Protecting human and animal lives and environment
- Curbing the effect on human health and damage to the state and private properties
- Curbing the offenses stemming from the use of the roads

ARTICLE 3

The road users should have proper respect for the regulations which are determined by this law.

ARTICLE 4

All drivers driving any type of vehicle in the Kingdom of Cambodia should adhere to the right-hand side driving regulation. All vehicles which are moving along the roads MUST have drivers.

The articles of the traffic law pertaining to urban traffic management are as follows:

Article 17: The maximum speed of motorcycles and cars is 30 km/hour and 40 km/hour, respectively.

Article 24: On the two-way road, the drivers of vehicles have to stop or park on the right-hand side in accordance with their traffic direction. On the one-way road, vehicles have to stop and park on the right- or left-hand side along with the traffic direction except in cases where there is a sign indicating that it is allowed to park facing the opposite direction. (Parking on sidewalks is illegal because of this article.)

Article 40: There are 5 types of road driving licenses issued in the Kingdom of Cambodia, namely, a license to drive a motorcycle, a car, a freight vehicle, a bus and a trailer.

Article 41: The minimum age of a person to obtain a driving license is 16 years old for a motorcycle driver's license and 18 years old for a car driver's license.

Article 43: Every driving license must have a score card with 12 marks (or points). Each time a driver is stopped for a traffic violation, a deduction/s shall be made from these points.

Article 88: In the case of non-wearing of seatbelt or safety helmet, a motorcycle driver shall be fined 3,000 riel while a car driver shall be fined 5,000 riel. In the case of repeat violations in parking and stopping, the fine shall be 5,000 riel and 10,000 riel for a motorcycle driver and a car driver, respectively.

Work is currently ongoing to amend the Land Traffic Law to close the gap between the current situation and the articles in the law. It has been five years since the last law proclamation for better road safety circumstance in the country was passed.

As of 15 December 2011, there were already discussions on revising 35 articles and adding 10 new articles in the working group of Land Traffic Law Amendment. The main points of the amendment are as follows:

- a) Addition and revision of terms used in the Law;
- b) Helmet wearing not only by motorcycle drivers but also by passengers;
- c) Reduction of maximum speed;
- d) Introduction of specialized equipment in apprehending traffic violators such as drunk driving and speeding;
- e) Obligation to carry a driving license and vehicle registration card, and to have car number plates;
- f) Strengthening of traffic violation penalties, especially fines. For example, the fine imposed on traffic accidents including injuries and fatalities is ten times higher and minor penalty is about five times more than before; and
- g) Responsibility for a traffic accident falls not only on the person who caused the accident but also on legal entities.

7.2 Present Traffic Control Facilities and Measures

The traffic management and safety furniture in PPCC are discussed in the following sections.

7.2.1 Control Measures at Intersections

(1) Roundabout Control

A roundabout is introduced at major intersections such as Chroy Chamber (see Figure 7.2-1). A roundabout is designed to provide greater traffic efficiency, aside from its added function as a landmark. However, roundabouts cannot service large volumes of traffic.



Source: PPUTMP Project Team

Figure 7.2-1 Chroy Chamber Roundabout

(2) Signal Control (refer to Section 7.4)

(3) Left-Turn Prohibition

This measure is introduced in a few intersections such as St. 221 and Russian Blvd.

7.2.2 Control Measures Along Road Sections

(1) One-Way Operation

This is introduced along a pair of secondary roads, each with one direction.

(2) Entry Restrictions by Vehicle Type

A measure of entry restrictions by vehicle type is introduced along major roads such as Sihanouk and Mao Tse Toung Blvd.

(3) Speed Control

Speed control furniture such as humps (see Figure 7.2-2) are introduced along secondary roads such as Road 178.

(4) On-Street Parking Control

There are on-street parking controls on almost all major roads. However, odd/even on-street parking controls are introduced along many secondary roads in the city center (see Figure 7.2-3).



Source: PPUTMP Project Team

Figure 7.2-2 Speed Hump

**No-parking on
ODD DAYS**



**No-parking on
EVEN DAYS**



Source: PPUTMP Project Team

Figure 7.2-3 Parking Control Sign

7.2.3 Area Restriction for Trucks

(1) Entry Restriction for Trucks in Designated Areas

Large freight truck traffic is banned on Road 271 (C1) from 06:00 to 09:00.

(2) Road Safety Furniture

Traffic safety furniture such as median barriers, guardrails and street lights are installed along roads mainly in the city center (see Figures 7.2-4 to 7.2-6).



Source: PPUTMP Project Team

Figure 7.2-4 Metal Median Barrier



Source: PPUTMP Project Team

Figure 7.2-5 Guardrail



Source: PPUTMP Project Team

Figure 7.2-6 Street Light

7.3 Behavior of Drivers and Pedestrians

7.3.1 Behavior of Drivers

(1) Driving Along Straight Roads

A mixed traffic flow with cars, motorcycles, motorumok modern (tuk-tuk) and bicycles can be observed in the city center and, sometimes, slow-moving bicycles can be seen driving near the median side (see Figure 7.3-1). This causes obstruction to smooth traffic flow so much so that the average travel speed during the peak hour goes down to less than 15 km/hour, even with just a small number of intersections in the city center.



Source: PPUTMP Project Team

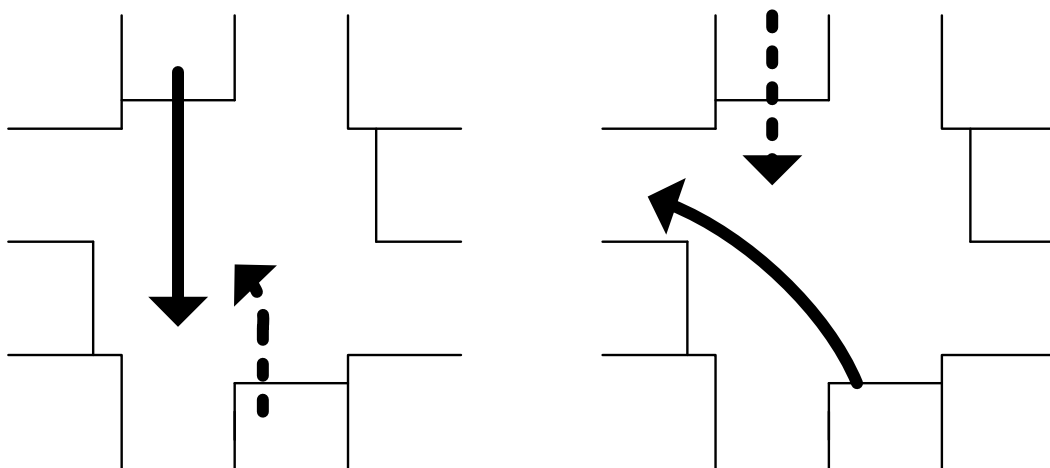
Figure 7.3-1 Bicycles Driving Near Median

(2) Driving at Intersections

One of the typical characteristics of driving at intersections is the left-turn traffic blocking straight traffic, even though the latter has priority over left-turn traffic (see Figure 7.3-2). This driving behavior not only causes disruption to the smooth flow of traffic but it can also lead to serious traffic accidents.

■ Ordinary Left-Turn (Priority to Straight)

■ Typical Left-Turn in Phnom Penh



Source: PPUTMP Project Team

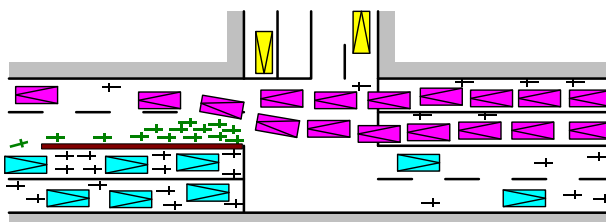
Figure 7.3-2 Driving Left-Turn

Traffic jams at intersections are caused by unauthorized counterflow driving by motorcycles at the opposite lane (see Figure 7.3-3 and Figure 7.3-4). This causes a bottleneck to develop at the opposite lane because of the narrower exit at the intersection.



Source: PPUTMP Project Team

Figure 7.3-3 Counterflow Driving at Opposite Lane by Motorcycles



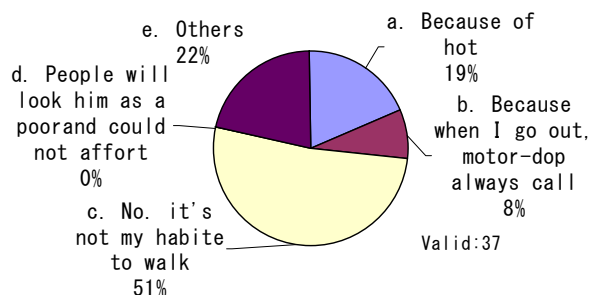
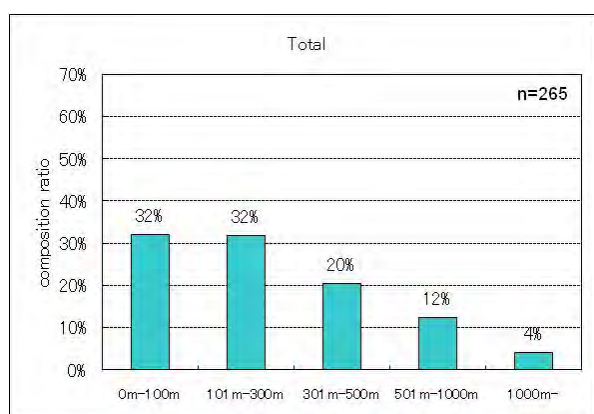
Source: PPUTMP Project Team

Figure 7.3-4 Traffic Jam Caused by Counterflow Driving at Opposite Lane

7.3.2 Pedestrian Behavior

It is very difficult to see pedestrians in the city center except at the market area. According to the results of the survey conducted by the JICA Technical Cooperation Project (TCP) Project, about 60% of trips with a distance over 300 m are accomplished by using some mode of transport (see Figure 7.3-5). The reason usually given is "it is not their custom/habit to walk."

On the other hand, many pedestrians cross the road without pedestrian crossing, including at busy four-lane roads. This is also true for children. The traffic issues for children are the traffic safety education and safety measures of schooling.



Source: The Project for the Traffic Improvement in Phnom Penh City (JICA, 2010)

Figure 7.3-5 Walking Distance and Reasons for Not Walking

7.4 Traffic Signals

7.4.1 Number of Traffic Signals

As of June 2012, there were 56 signalized intersections in the city center, mainly located along radial and major ring roads such as Monivong Blvd. and Mao Tse Toung Blvd. (see Figure 7.4-1).

The number of signalized intersections in Phnom Penh is quite small compared to cities in other countries with almost the same population size. There are also many non-signalized intersections with a large volume of traffic. Traffic police officers control the traffic during morning and evening peak hours at these intersections.

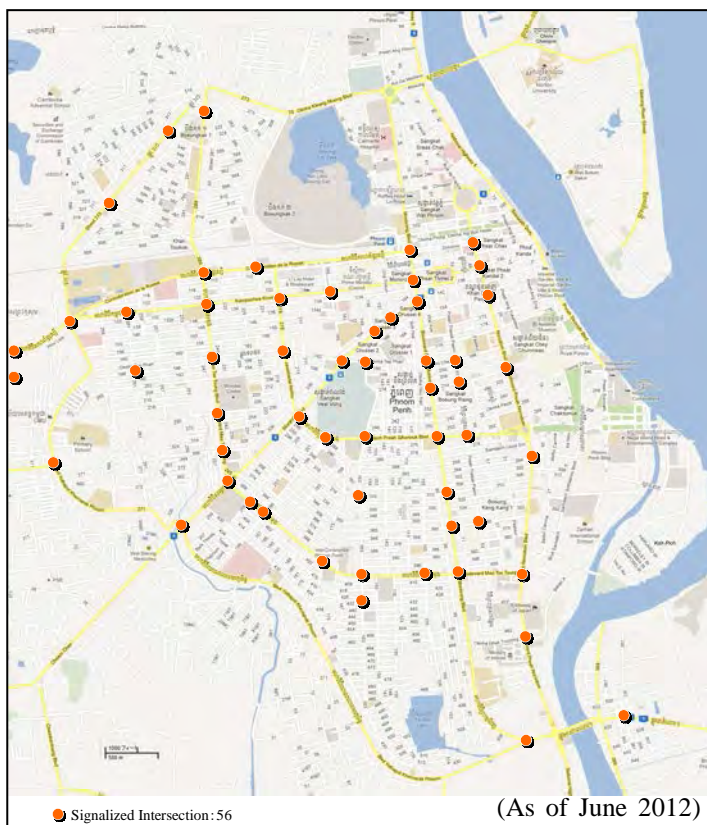
For comparison, the number of traffic signals installed in Hiroshima City in Japan was about 1,500 in 2010 (from the website of Hiroshima City).

7.4.2 Traffic Signal Lights

Many arrow-type traffic signals with countdown displays can be observed in the city center (see Figure 7.4-2). This is the popular traffic signal type in the city center.

7.4.3 Operation

Many traffic signals installed in the city center were donated by different countries. Thus, the equipment (controller and signal display) lacks uniformity and the maintenance work poses many problems. As each traffic signal operates independently, there is a lack of coordination among them causing inconsistency of traffic signal operation. In addition, many traffic signals have only one phasing pattern which, sometimes, does not meet peak hour traffic.



Source: PPUTMP Project Team

Figure 7.4-1 Location of Installed Traffic Signals

■ Arrow Type



Source: PPUTMP Project Team

■ Round Type

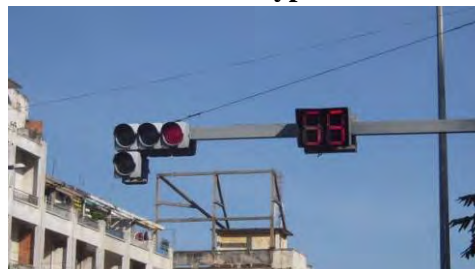












Figure 7.4-2 Types of Traffic Signals

7.5 Traffic Signs and Road Markings

7.5.1 Traffic Signs

The traffic signs in Phnom Penh are categorized into the following 10 types (see Table 7.5-1):

Table 7.5-1 Types of Traffic Signs









Type	Example	Type	Example
(1) Prohibitory Sign		(6) Direction Sign	
(2) Mandatory Sign		(7) Built-up Area Boundary Sign	
(3) Priority Sign		(8) Street Name Sign	
(4) Warning Sign		(9) Informative Sign	
(5) Temporary Sign		(10) Supplementary Sign	

Source: PPUTMP Project Team

7.5.2 Road Markings

Road markings in the city are divided into four types, as shown in Table 7.5-2 below.

Table 7.5-2 Types of Road Markings

Type	Example
Transversal Markings	 STOP LINE  GIVE WAY LINE
Longitudinal Markings	 SINGLE YELLOW BROKEN LINE  DOUBLE YELLOW COMBINATION LINE
Arrow Markings	 STRAIGHT ARROW  TURN RIGHT ARROW
Other Road Markings	 ROAD HUMP MARKING  BUS STOP MARKING

Source: PPUTMP Project Team

7.6 Parking Facilities and Conditions

A parking survey was conducted in the city center area surrounding Russian Blvd., Norodom Blvd. and Sihanouk Blvd., which was divided into 5 blocks as shown in Figure 7.6-1.

7.6.1 Parking Inventory

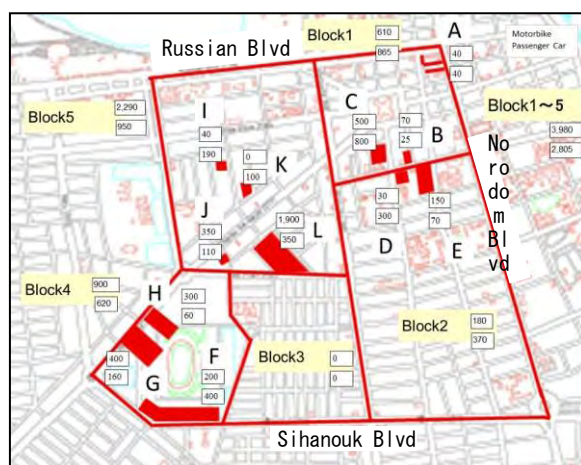
There are 12 off-road parking facilities in the survey area (see Table 7.6-1) and these are outlined below.

- The number of parking slots for motorcycles and cars is about 4,000 and 2,600, respectively. Block 5 has the highest number of parking slots, with Ou Russei Market having the highest number of slots for motorcycles at about 1,900 and Sorya Shopping Center having the highest number of slots for cars at 800.
- The average parking fee for motorcycles and cars is KHR500/hour and KHR2,000/hour, respectively.

Table 7.6-1 Summary of Off-Road Parking Facilities

	Name of parking facility (if any)	Type of parking 1. At grade 2. Under ground	Number Of parking space		Operation hours	Parking fees (1 time) (Riel)		Night time (after 22:00) 1. Open 2. Closed	Type of ownership 1. Public 2. Private 3. Company
			Motobike	Passenger Car		Motobike	Passenger Car		
A	Ang Duong	1	40	40	16	1000/time	3000/time	2	1
B	SN	1	70	25	24	1500/time	4000/time	1	2
C	Sorya Shopping Center	1	500	800	12	500/time	1000/time	2	3
D	Coffee Mondul Kiri	1	30	300	24	1000/time	5000/time	1	2
E	Sorya mall	1	150	70	24	500/ time	4000/time	1	2
F	Underground Parking	2	200	400	18	500/ time	1000/ time	1	3
G	City mall	1 & 2	400	160	12	500/time	1000/time	2	3
H	Olympic Stadium	1	300	60	15	500/time	1000/time	2	3
I	Chey Thavy	1	40	190	24	500/ time	2000/ time	1	2
J	Home Center	1	350	110	24	500/ time	3000/ time	1	3
K	Serey Pheap	1	0	100	24	-	2000/ time	1	2
L	Ou Russei Market	1	1,900	350	13	500/time	2000/time	2	3
Total			3,980	2,605					

Source: PPUTMP Project Team

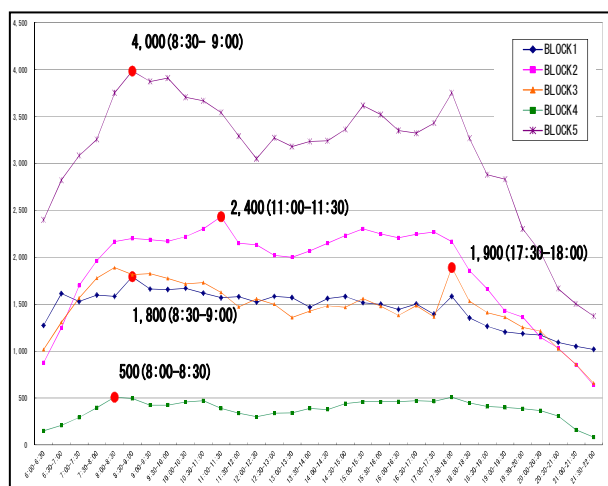


Source: PPUTMP Project Team

Figure 7.6-1 Location of Parking Facilities

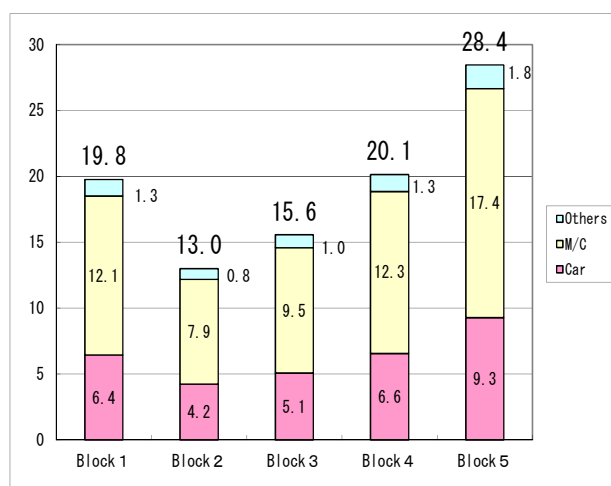
7.6.2 Parking Conditions

The hourly observed on-street parking demand by block does not show much variation and is almost flat at any block even with a small showing of morning peak traffic. For the number of on-street parking per 100 m road length by block, the highest number can be observed in Block 5 (28.4/100 m) where the commercial and business center is located, and the lowest number can be observed in Block 3 (13.0/100 m) where the residential area is situated.



Source: PPUTMP Project Team

Figure 7.6-2 Parking Demand Hourly Variation Signals by Block



Source: PPUTMP Project Team

Figure 7.6-3 Parking Demand/100 m Road by Length

7.6.3 Parking Interview

A parking interview survey was conducted with 100 drivers in the 5 blocks. Following are the results of the survey.

(1) Parking Time

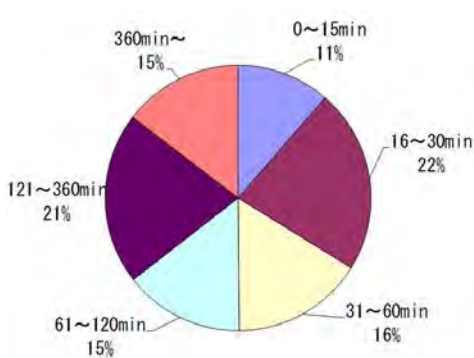
The surveyed drivers who spent a parking time of less than 15 minutes, 16-30 minutes, 31-60 minutes, and over an hour were 11%, 22%, 16% and 51% of the total sample, respectively (see Figure 7.6-4). On the other hand, it is noteworthy that 15% of the drivers had a parking time of more than 6 hours.

(2) Distance to the Destination

More than 80% of drivers of parked vehicles walked less than 100 m to their destinations (see Figure 7.6-5). This indicates a dislike for walking long distances.

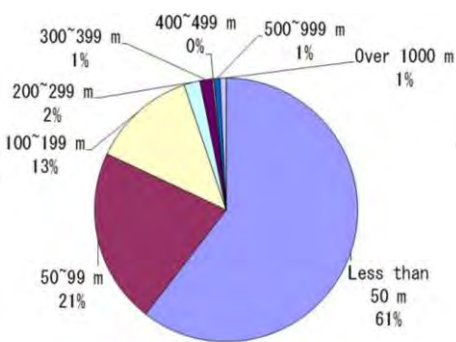
(3) Parking Fee

Parking fees of less than KHR500, KHR500-1,000, and more than KHR1,000 were paid by 15%, 22% and 26% of the drivers, respectively (see Figure 7.6-6).



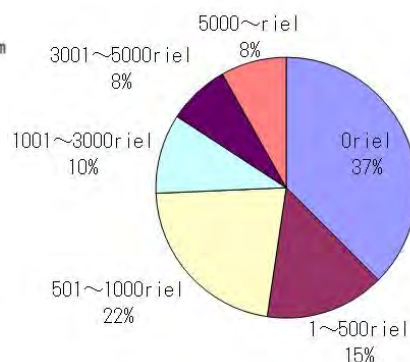
Source: PPUTMP Project Team

Figure 7.6-4 Parking Time



Source: PPUTMP Project Team

Figure 7.6-5 Distance to Destination



Source: PPUTMP Project Team

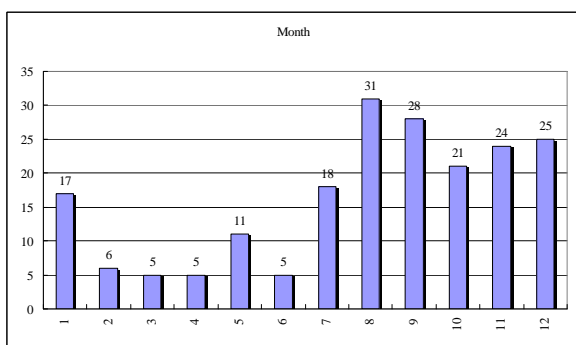
Figure 7.6-6 Parking Fee

7.7 Traffic Accidents

The locations of black spots (places where traffic accidents have historically been concentrated) on Road 271 as of 2007 are shown in Figure 7.7-2, and some important accident statistics are discussed below.

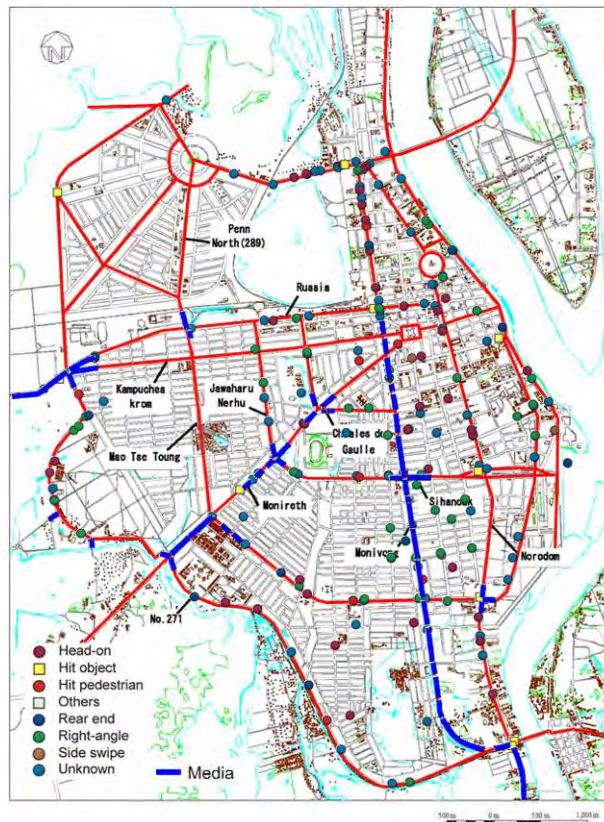
7.7.1 Number of Accidents by Month

The number of accidents in the last half of the year is almost double that in the first half (see Figure 7.7-1). This is because of the many festivals such as the Water Festival that attract many people to the city later in the year.



Source: PPUTMP Project Team

Figure 7.7-1 Number of Accidents by Month



Source: PPUTMP Project Team

Figure 7.7-2 Location of Black Spots in 2007

7.7.2 Number of Accidents by Time

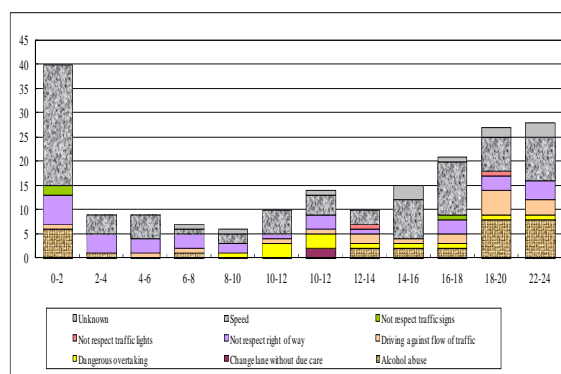
Many accidents occur during the night (see Figure 7.7-3), which are mainly caused by speeding and drunk driving.

7.7.3 Accidents Involving Motorcycles

More than 90% of traffic accidents involve motorcycles (see Figure 7.7-4).

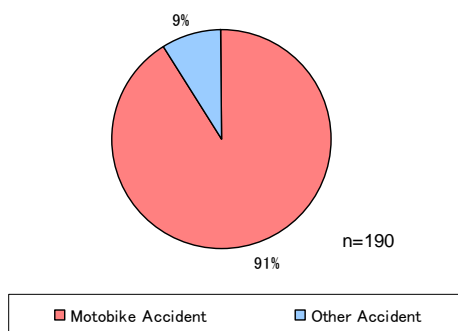
7.7.4 Type of Accidents

Right-angle collision accidents are the leading accident type, followed by head-on collision (see Figure 7.7-5).



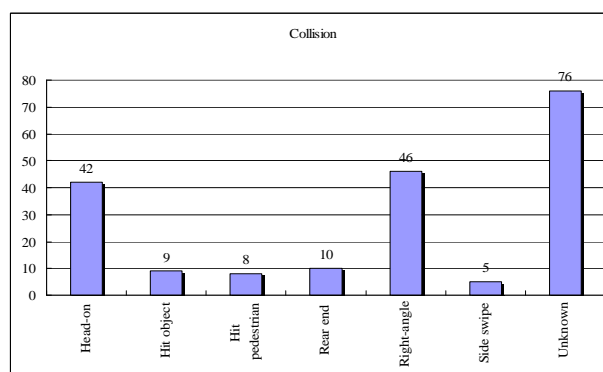
Source: PPUTMP Project Team

Figure 7.7-3 Number of Accidents by Time



Source: PPUTMP Project Team

Figure 7.7-4 Accidents Involving Motorcycles



Source: PPUTMP Project Team

Figure 7.7-5 Type of Accidents

7.8 Traffic Safety Education and Enforcement

7.8.1 Traffic Safety Education

(1) Program for Issuing Motorcycle Driving Licenses

The Driving License System regulates the issuance of driving licenses to persons who pass the examination that includes having the physical ability to drive, knowing the safe driving techniques, and having the knowledge of traffic safety, traffic regulations and rules.



Source: PPUTMP Project Team

Figure 7.8-1 Pamphlets for Traffic Safety

(2) Traffic Safety Campaign

1) Means of Traffic Safety Campaign

For the traffic safety campaign, TV, radio, newspaper, banner, leaflets and flyers are mainly used (see Figure 7.8-1).

2) Activities of the Traffic Safety Campaign

The following traffic safety campaigns were previously conducted in PPCC:

- Traffic Safety Campaign for Water Festival revelers (Phnom Penh);
- Awareness Campaign on non-use of helmet for motorcycle drivers; and
- Cambodia Road Safety Week (before Khmer New Year).

7.8.2 Traffic Enforcement

The traffic enforcement skills of traffic police officers in Phnom Penh were developed through the conduct of the following traffic enforcement activities during the "Project for Traffic Improvement in PPCC."

(1) Contents of Traffic Enforcement

- Driving without license, drunk driving
- Traffic signal and speeding violations
- Illegal parking at intersections and along major roads
- Stop line violation, overloading and driving a not well-maintained vehicle

(2) Enforcement Skills

- Basic activities for the safety of traffic management
- Traffic-related laws and regulations
- Traffic rules and traffic safety furniture
- Traffic enforcement
- Process after traffic accident occurrence



Source: PPUTMP Project Team

Figure 7.8-2 Scene of Traffic Enforcement by Traffic Police

7.9 Identified Problems and Issues

7.9.1 Issues on Traffic Operation

Figure 7.9-1 shows the problems/issues on traffic operation and some examples of future directions and measures to address such issues.

(1) Mixed Traffic

Most of the road traffic in Phnom Penh consists of motorcycles and cars, and more modes can also be observed in the traffic mix such as motorumok modern (tuk-tuk), bicycles and motodops. The smooth and safe flow of traffic can be secured with proper road use, such as faster vehicles using the center lane and slower vehicles keeping to the right side. However, the mixed traffic in PPCC causes a lack of safety and smoothness. Therefore, it is necessary to educate drivers including on the basics of road use.

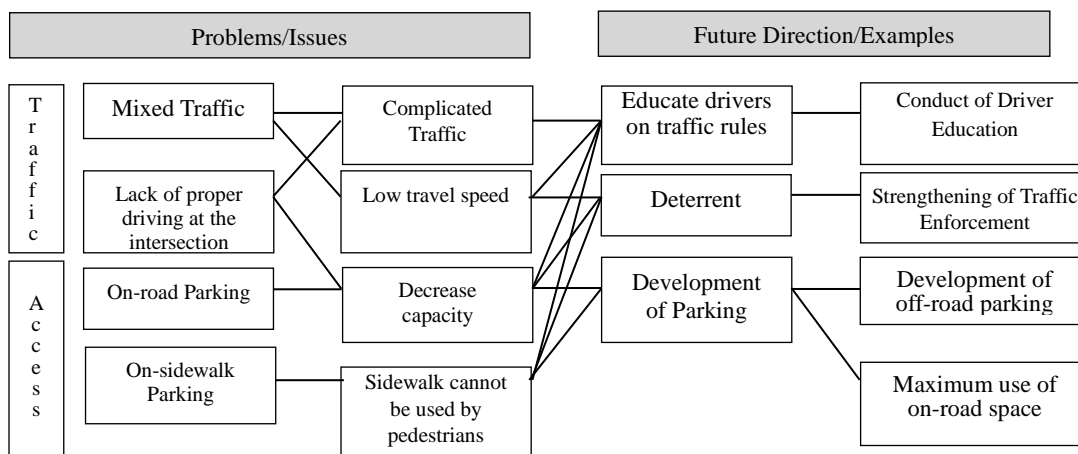
(2) How to Drive at Intersections

The intersection itself is the bottleneck of traffic in the urban roads. The traffic capacity at the intersection is secured by the proper driving followed by direction. In Phnom Penh, traffic jams at

intersections can be observed at many locations because of ignorance on the proper way of driving at the intersections. It is also necessary to strengthen the traffic enforcement together with driver education.

(3) Parking

Illegal on-street parking blocks the driving lane of the road and causes traffic congestion. On the other hand, illegal on-sidewalk parking blocks the pedestrian space and pedestrians are forced to walk on the dangerous carriageway. Therefore, it is necessary to develop multi-story car parks and attempt to maximize use of on-road parking by efficient use of side streets.

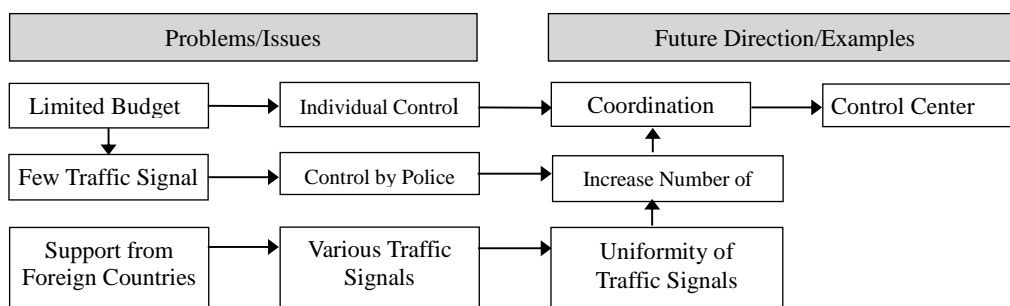


Source: PPUTMP Project Team

Figure 7.9-1 Issues and Future Directions of Traffic Operation

7.9.2 Issues on Traffic Signals

Figure 7.9-2 shows the issues and future directions of the traffic signal system in Phnom Penh. There were only 56 signalized intersections in the city as of July 2012. This number is extremely low compared to other cities with the same area and population size. In addition, almost all traffic signals in Phnom Penh have only one phasing pattern. Since many of these traffic signals were donated by other countries, many types of signal displays can be observed and this causes compatibility and maintenance issues in the signal system. Therefore, it is necessary to increase the number of traffic signals using uniform technology and equipment and to consider the development of a Traffic Control Center for the comprehensive management/operation of the traffic signal system in Phnom Penh.



Source: PPUTMP Project Team

Figure 7.9-2 Issues and Future Directions of Traffic Signal System

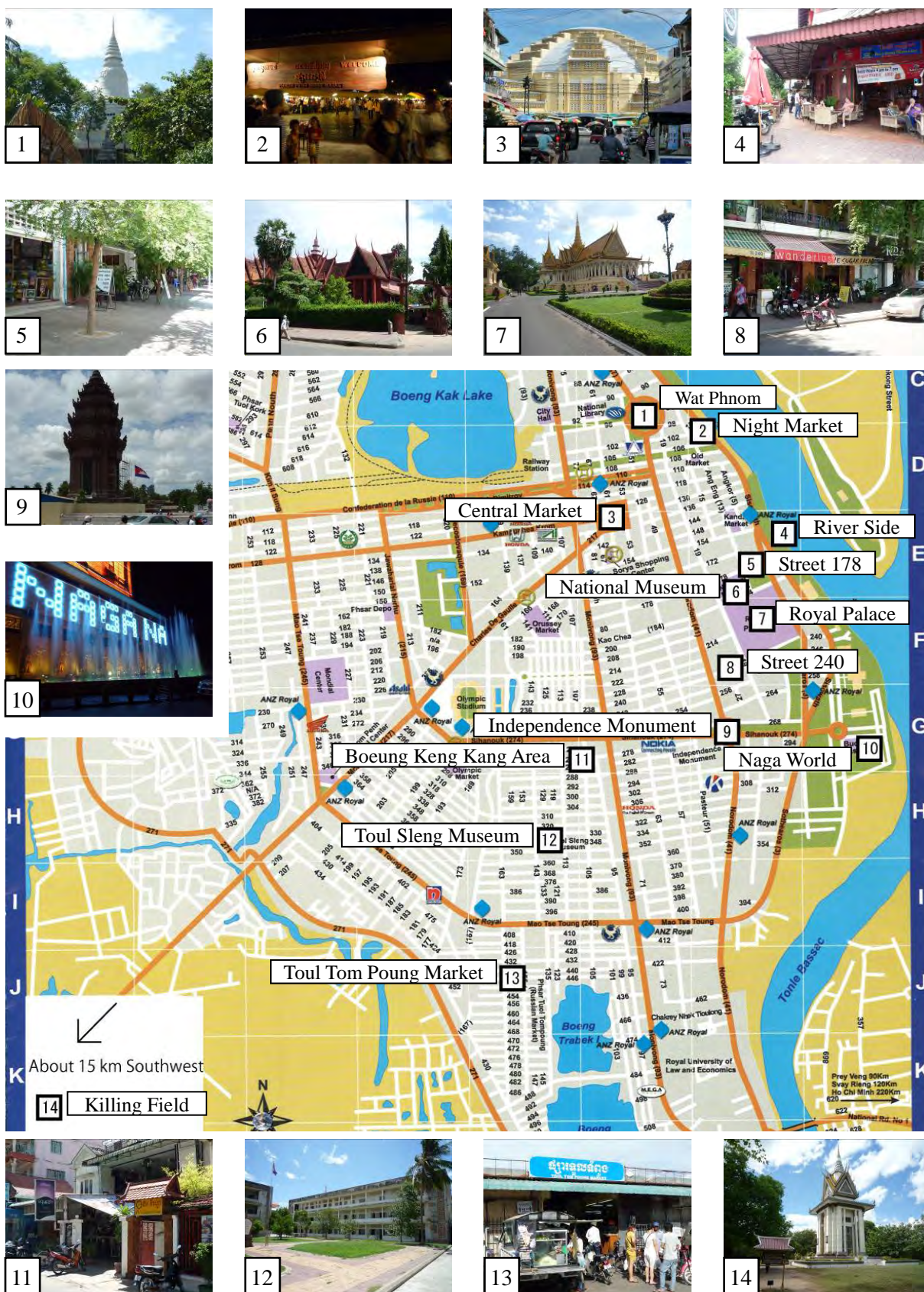
8 TOURISM TRANSPORT

8.1 Tourist Spots Including Potential Areas

Major tourist attractions in PPCC are listed and described in Table 8.1-1 and correspondingly shown in Figure 8.1-1.

Table 8.1-1 Major Tourist Attractions in Phnom Penh

No.	Tourist attraction	Type	Description
1	Wat Phnom	Temple	The capital city Phnom Penh is named after this Buddhist temple, which is the tallest and most important temple in PPCC.
2	Night Market	Market	This is held every weekend in the evening. Souvenir items such as handicrafts and clothing are sold.
3	Central Market	Market	This is the largest and most popular market in Cambodia. It is open every day.
4	River Side	Street/Area	There are many restaurants with open terrace facing Tonle Sap River along Sisowath Quay Blvd. This is one of the most popular tourist spots for foreigners.
5	Street 178	Street/Area	There are many shops selling antiques and modern art along this street
6	National Museum	Museum	This museum was built to imitate the shape of Angkor Wat. Bronze treasures, statues and precious Khmer art are on display.
7	Royal Palace (and Silver Pagoda)	Historical Building	The king of Cambodia resides within the Royal Palace compound, which houses several buildings such as pavilions and pagodas. The Silver Pagoda is located adjacent to the south side of the Royal Palace, and this is the place where royal Buddhism events have been performed.
8	Street 240	Street/Area	There are many stylish bars and restaurants catering to foreigners along this street.
9	Independence Monument	Monument	This tower was built to commemorate Cambodia's independence from France in 1953. When lighted up in the evenings, it presents a fantastic appearance.
10	Naga World	Amusement	This is the only casino authorized by the government in Phnom Penh, and it is very popular with tourists.
11	Boeung Keng Kang Area	Street/Area	This area has recently become a very popular hangout for foreign residents and tourists. Cafes and restaurants with good atmosphere are found along many streets.
12	Toul Sleng Museum	Museum	This is a "genocide museum" exhibiting instruments of torture and photos of the victims of the Khmer Rouge led by Pol Pot.
13	Toul Tom Pong Market (Russian Market)	Market	This market is as well-known as the Russian Market, and there are many antique shops found here. Silk, silver and gold products are more abundant here than at the Central Market.
14	Killing Fields	Historical site	Located about 15 km southwest of PPCC, this is a place of execution during the Pol Pot era. This place was left untouched to convey to posterity the genocide during the Pol Pot Era.



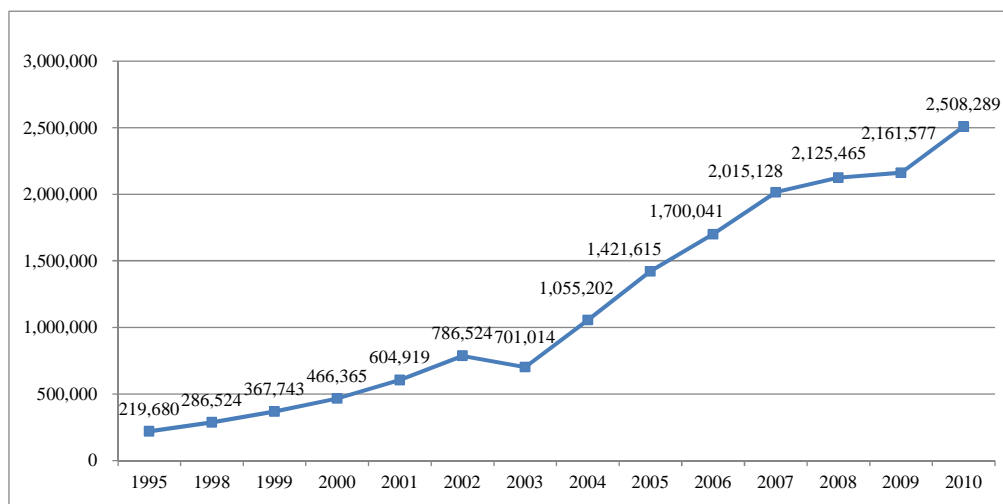
Source: PPUTMP Project Team

Figure 8.1-1 Pictures of the Major Tourist Attractions in Phnom Penh with Location Map

8.2 Number of International Arrivals to Cambodia

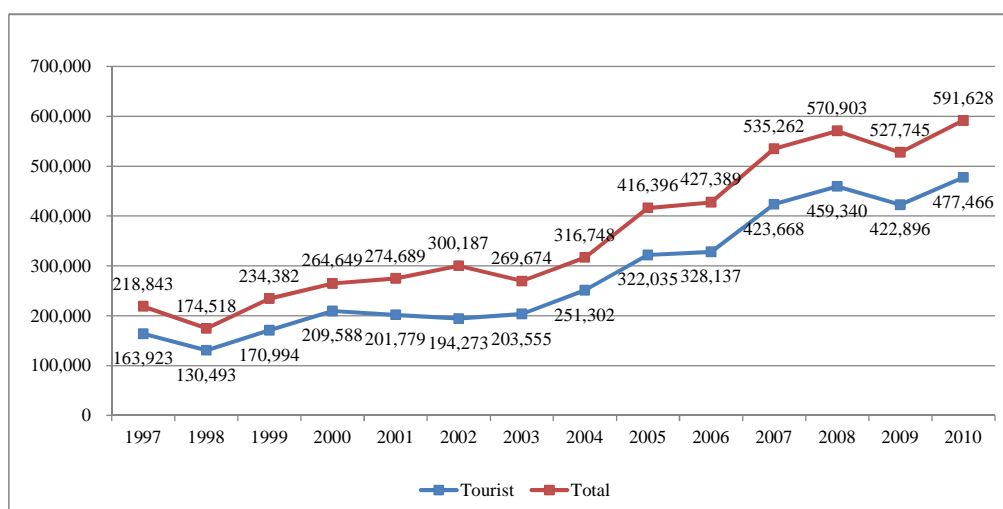
Visitors to Cambodia have been increasing since 1995. In fact, their numbers reached more than 2.5 million in 2010 as shown in Figure 8.2-1 below..

The number of passengers entering Cambodia via Phnom Penh International Airport has been increasing since 1998. Arrivals peaked in 2010 as the number went up to more than 450 thousand. Out of this number, 80% entered Cambodia as tourists (see Figure 8.2-2).



Source: Statistical Yearbook of Cambodia 2008, 2011

Figure 8.2-1 Number of International Visitor Arrivals by All Modes, 1995 - 2010



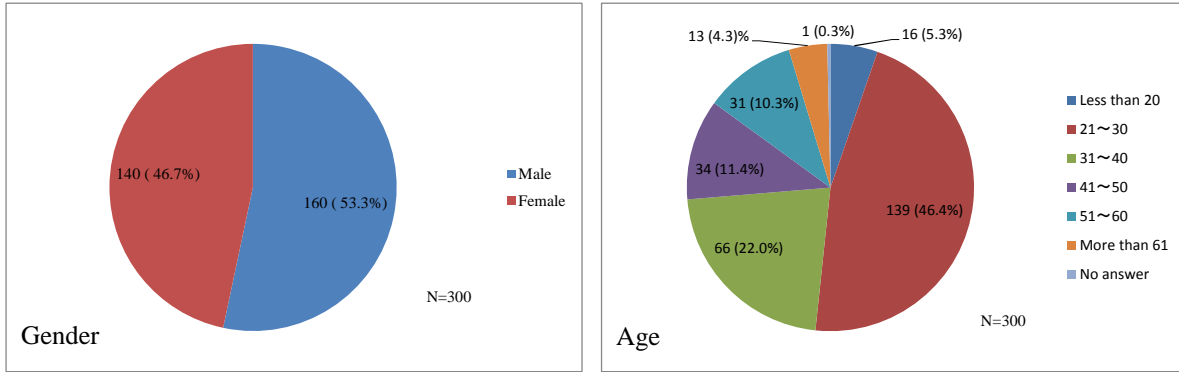
Source: Statistical Yearbook of Cambodia 2008, 2011

Figure 8.2-2 Number of International Visitor Arrivals by Air, 1995 - 2010

8.3 General Profile and Behavioral Pattern of Tourists to Cambodia

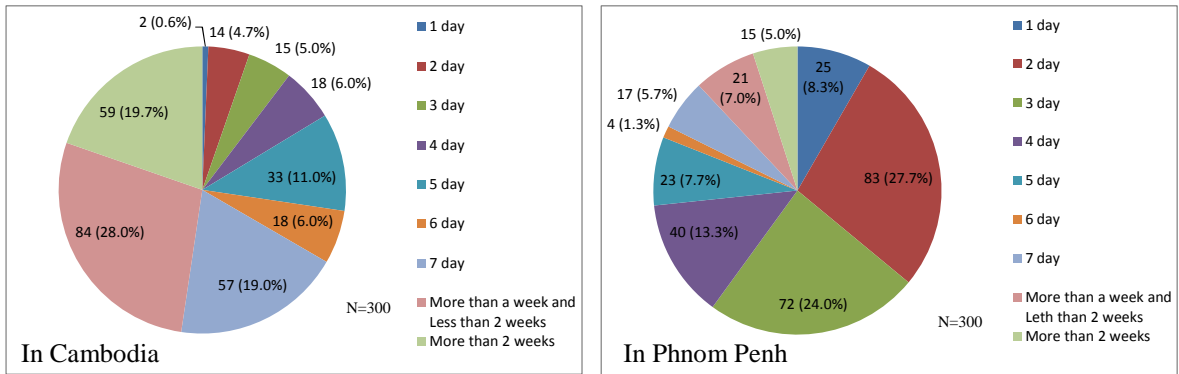
The Tourist Interview Survey, which targeted 300 interviewees, yielded data on the characteristics of tourists to Cambodia, and these are summarized below (see Figures 8.3-1 to 8.3-6).

- Male tourists slightly outnumber female tourists (160 and 140, respectively).
- Local tourists are mainly in the 21 - 30 age group (46%), followed by 31 - 40 years old (22%) and those in their 20s and 30s (75%).
- Their length of stay in Cambodia is usually more than one week but less than two weeks (28%), while others stay more than two weeks (20%) or 7 days (19%).
- Their length of stay in Phnom Penh is usually 2 days (28%) or 3 days (24%). Therefore, 50% of tourists stay only 2 - 3 days in Phnom Penh.
- On a daily basis, tourists spend from 21 to 30 USD (24%) at most, followed by 10 to 20 USD (20%). So about 60% of tourists spend less than 30 USD a day.
- Most tourists to Cambodia travel in pairs, that is, with at least one companion (42%); there are those who travel solo (22%) while others have 2 companions (14%). About 75% of tourists travel solo or with a companion.
- A hotel (48%) is the most favored accommodation when traveling to Cambodia, followed by a guesthouse (26%).
- For their daily accommodation most tourists spend about 11 - 20 USD (36%). There are those who spend less than 10 USD (25%) for accommodation; and others stay in rooms billed at 21 - 30 USD a day (18%). Four-thirds of tourists stay in accommodations under 30 USD.
- Tourism spots that visitors find impressive are Toul Sleng Museum, Wat Phnom, Killing Fields, River Side, Central Market, Royal Palace and National Museum.
- The most popular trip among the above "impressive tourist spots" is "Wat Phnom - Royal Palace", "River Side - Royal Palace", "Toul Sleng Museum - Royal Palace", "Toul Sleng Museum - Killing Field", "Royal Palace - National Museum".
- Among the trips to tourist attractions, the one with the most amount of walking done is the trip between "Royal Palace-National Museum" and "River Side - Royal Palace". This is because there is a wide sidewalk that has been developed along the Tonle Sap River. The motorumok modern (tuk-tuk) is a popular mode of transport between other attractions.
- A tour bus is used for a relatively longer trip such as between Killing Fields and the center of Phnom Penh.



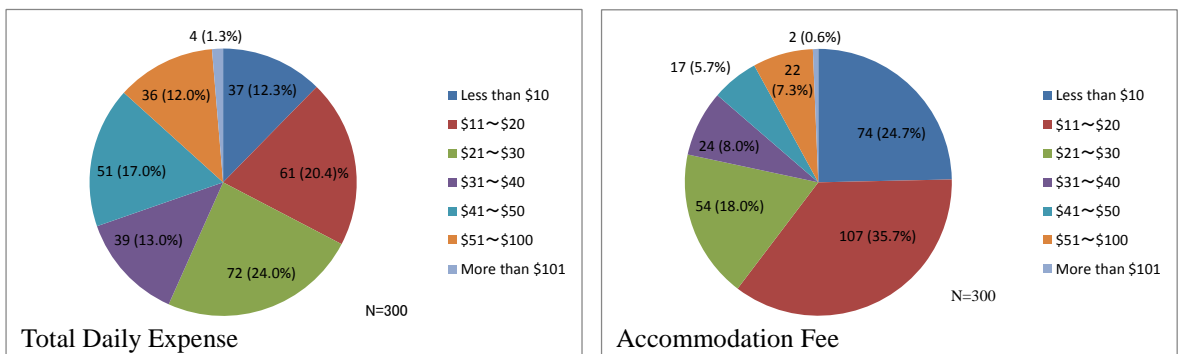
Source: PPUTMP Project Team

Figure 8.3-1 Profile of Tourists that Visit Cambodia



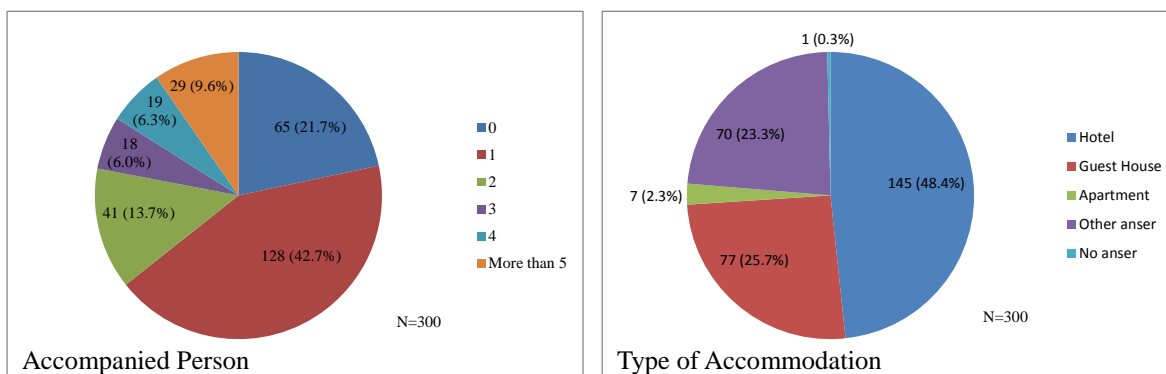
Source: PPUTMP Project Team

Figure 8.3-2 Length of Stay of Tourists



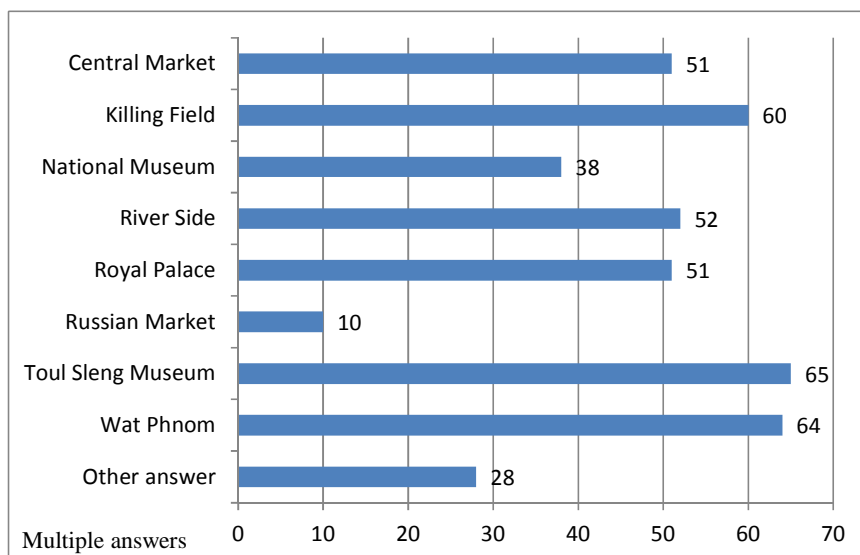
Source: PPUTMP Project Team

Figure 8.3-3 Total Daily Expenses and Accommodation Fees



Source: PPUTMP Project Team

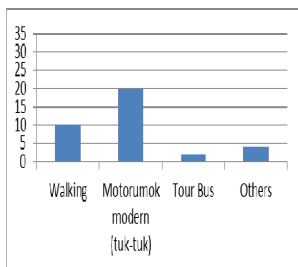
Figure 8.3-4 Traveling Alone or With Companion/s and Type of Accommodation



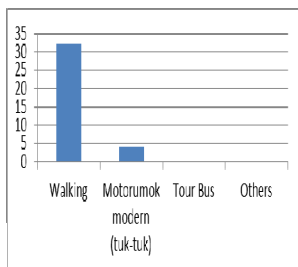
Source: PPUTMP Project Team

Figure 8.3-5 Impressive Tourist Spots in Cambodia

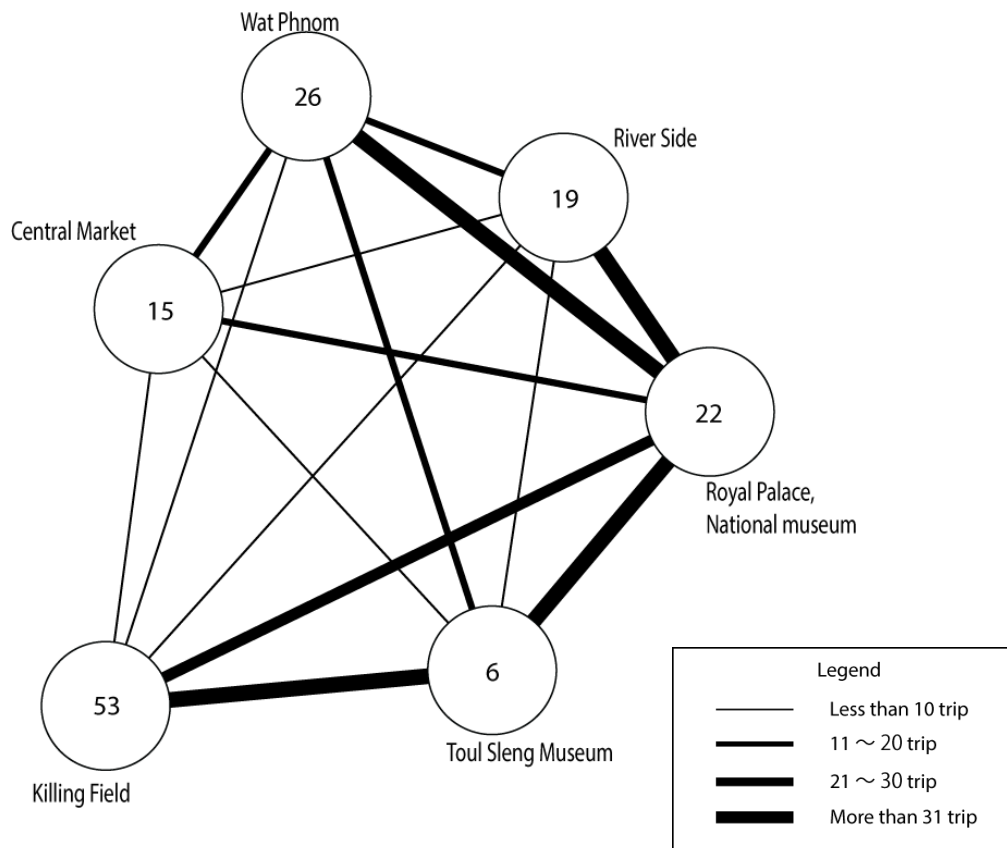
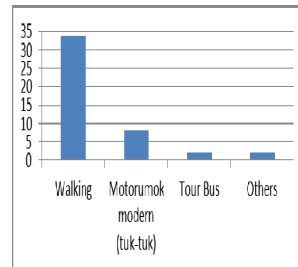
OD: 22-26



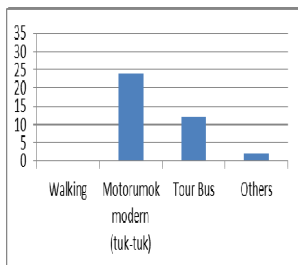
OD: 19-22



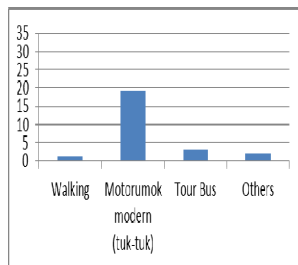
OD: Within 22



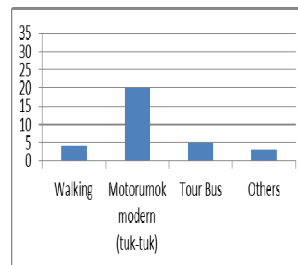
OD: 6-53



OD: 22-53



OD: 6-22



Source: PPUTMP Project Team

Figure 8.3-6 Tourist Behavioral Pattern in Cambodia

8.4 Identified Problems and Issues

The following are identified problems and issues that need to be addressed for the improvement of tourism in Cambodia.

- Tourists visiting Cambodia and Phnom Penh are increasing every year. Based on the results of the survey, it is found that their length of stay in Phnom Penh is only less than 3 days. This is quite short compared to the length of stay of tourists in Cambodia (only 40% of 1 to 2 weeks stay in Cambodia).
- Even though there are many tourist spots in Phnom Penh, tourists visit only one to two places in a day. Thus, the tourism pattern in Phnom Penh is short, what with the limited places visited which is not enough to predict a visiting pattern. It is observed that trips between Wat Phnom, River Side and Royal Palace and trips between Toul Sleng Museum, Killing Fields and Royal Palace are popular, but trips via Central Market are extremely few. The unpopularity of the latter is because there are only few sidewalks left for pedestrian use as most of the sidewalks are used mainly as off-street parking, which is a very serious problem.
- The mode mostly used for short distance trips such as between Royal Palace and National Museum is by foot. Trips between other tourist spots are done by motorumok modern (tuk-tuk) and tour bus. The most popular mode of transport for tourists is the motorumok modern (tuk-tuk).
- Many tourists use the motorumok modern (tuk-tuk) for sightseeing trips, even though its fare is relatively high, because it is convenient and comfortable. Besides, there is no convenient public transport such as city bus in PPCC. However, the motorumok modern (tuk-tuk) is relatively slow, needs almost the same space as a private car on the road and has no fare meter. In addition, this mode of travel prefers to use main roads rather than small streets.
- Considering the above circumstances, the improvement of the network connecting tourist spots and the introduction of a more convenient mode of transport are the key to increase the number of tourists to PPCC.

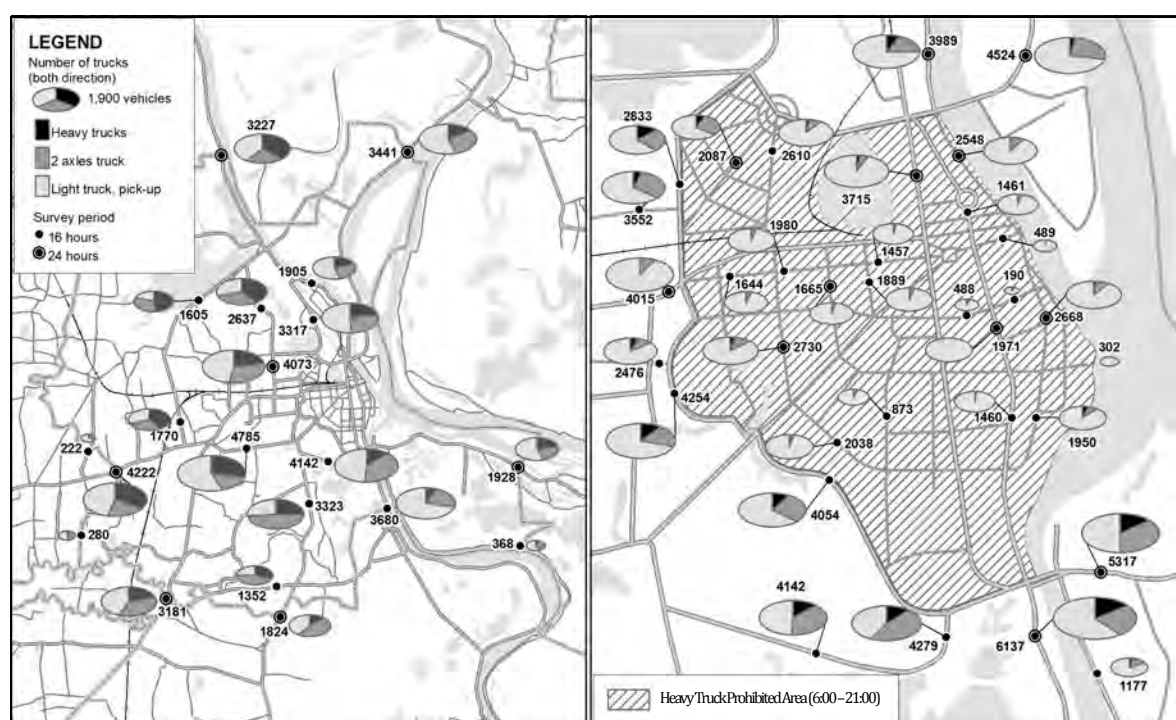
9 FREIGHT TRANSPORT

9.1 Current Freight Transport

9.1.1 Trucks

The results of the traffic count survey at 10 cordon line points on the boundary of Phnom Penh, 9 screen line points on the outskirts of the central area bounded by NR1 and NR6, and 34 major road sections are summarized in Figure 9.1-1 below.

On the outskirts bounded by NR1 and NR6, heavy trucks are prohibited from entering the city center from 6:00 - 21:00; therefore, trucks in the city center are dominated by small trucks such as pick-up and light trucks.



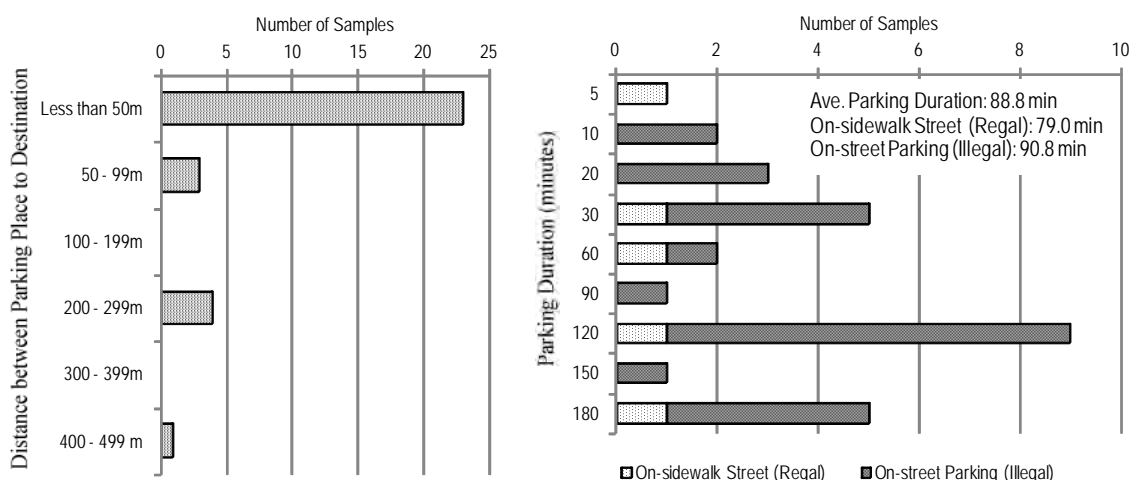
Note: Traffic volume is a total of both directions.

Source: PPUTMP Project Team

Figure 9.1-1 Truck Volume by Traffic Count Survey

To understand parking demand and capacity of parking spaces in the central area of Phnom Penh, a parking vehicle count survey, a parking inventory survey and an interview survey of parking drivers were carried out. Unfortunately, trip purposes such as loading/unloading or delivery were included as “business purpose” in the survey.

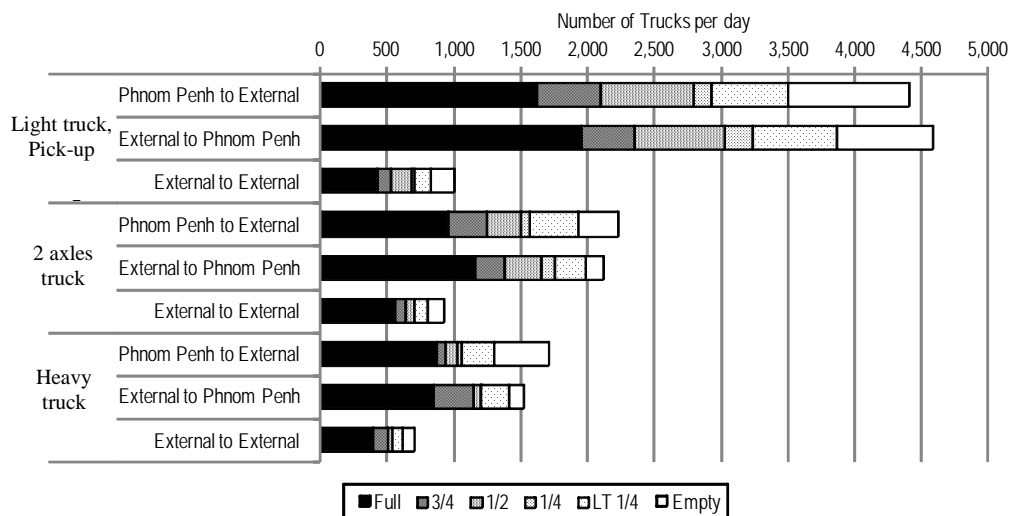
The following figures show the results of parking interview survey only for business purpose trucks. Truck drivers tend to park their trucks within 50 m from their final destination. There are two peaks on parking duration, namely, 30 minutes and 120 minutes.



Note: Analysis on effective sample only (Truck with business purpose).
Source: PPUTMP Project Team

Figure 9.1-2 Parking Trucks for Business Purpose

The following figure shows the number of loaded trucks crossing the boundary of Phnom Penh based on the cordon line survey. A preliminary analysis of the cordon line survey result indicates that empty truck ratio is very low: Only 18% of light trucks, 11% of 2-axle trucks and 15% of heavy trucks are empty. In general, the ratio of empty to loaded trucks indicates efficiency of freight transport by road, for example, the distance traveled based on empty truck ratio in Japan is almost one-fourth of commercial-use trucks and one-half of household-use trucks¹.



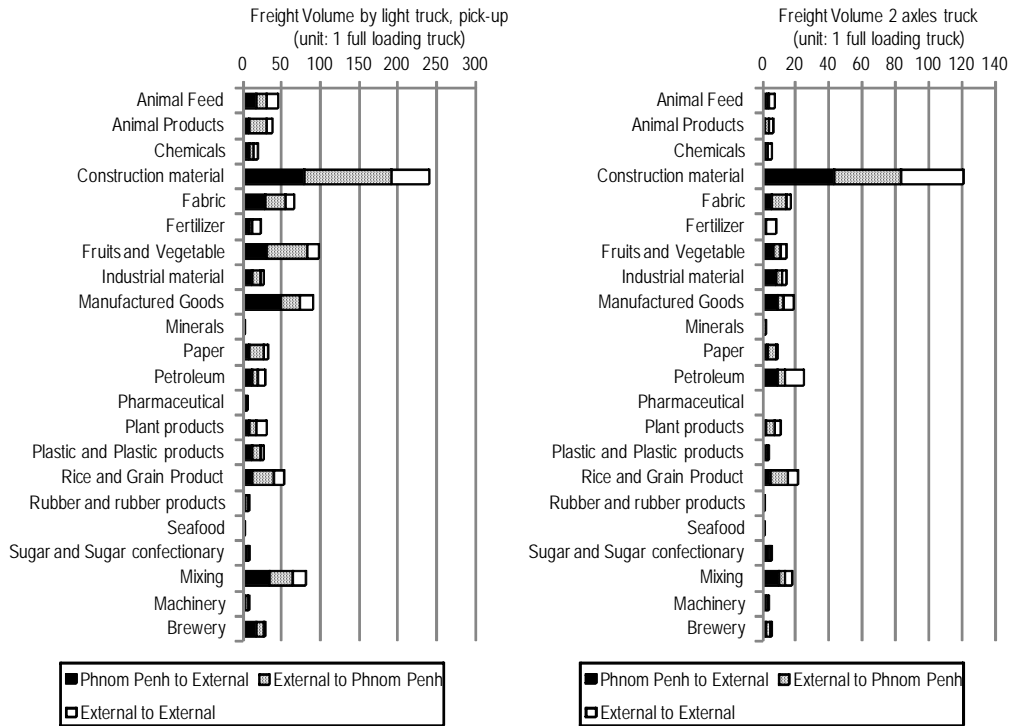
Note: Truck trips from external to external were cut into half to exclude double count.
Source: PPUTMP Project Team

Figure 9.1-3 Truck Traffic Volume Crossing the Cordon Line

Based on the survey, freight volume crossing the cordon line is estimated as shown in the following figures (see Figure 9.1-4). Major commodities transported by light trucks and pick-up are construction materials, followed by manufactured goods, fruits and vegetables. The commodity most transported by

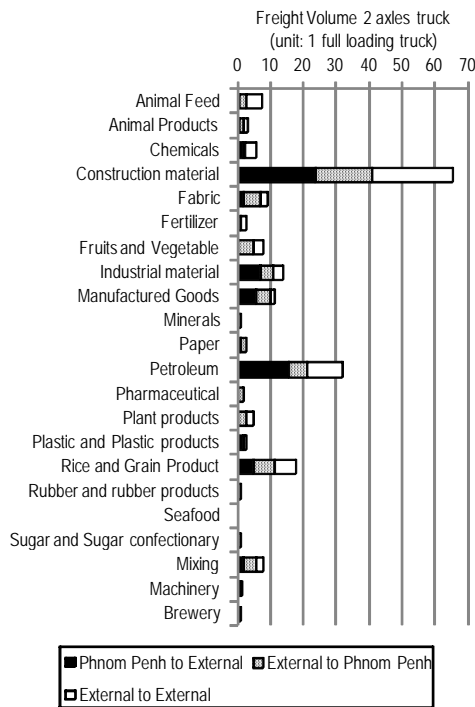
¹ "Survey on Motor Vehicle Transport (2009)" by Ministry of Land, Infrastructure, Transport and Tourism.

2-axle trucks and heavy trucks is construction materials as well.



Source: PPUTMP Project Team

Figure 9.1-4 Estimated Freight Volume Crossing the Cordon Line (Left: Light Trucks and Pick-up; Right: 2-axle Trucks)



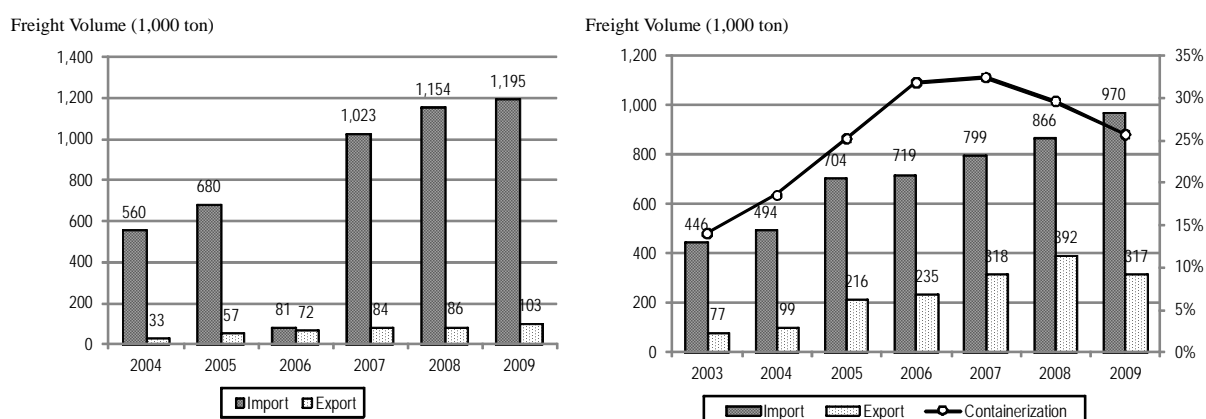
Source: PPUTMP Project Team

Figure 9.1-5 Estimated Freight Volume Crossing the Cordon Line (Heavy Trucks)

9.1.2 Phnom Penh Port

Phnom Penh Port is located on the west bank of the Mekong River and it is used for international and domestic freight and passengers. Vessels of up to 2,000 Dead Weight Tonnage (DWT) are able to use the port without difficulty. The wharf's length is 300 m and two mobile cranes are operated for loading/unloading. The capacity of Phnom Penh Port is estimated at about 100 thousand Twenty-foot Equivalent Units (TEUs) per year; in 2010, the actual number of containers handled at the port was about 60 thousand TEUs. Customs operating hours at Phnom Penh Port are from 8:00 to 17:00 on Monday to Friday.

There is differing cargo volume data for Phnom Penh Port by previous study reports: however, the common factor is that the import cargo volume is larger than the export cargo and that cargo volume has increased since 2007 (see Figure 9.1-6).



Source: Left: Transportation Infrastructure Sector Study in Cambodia (2010, JICA)

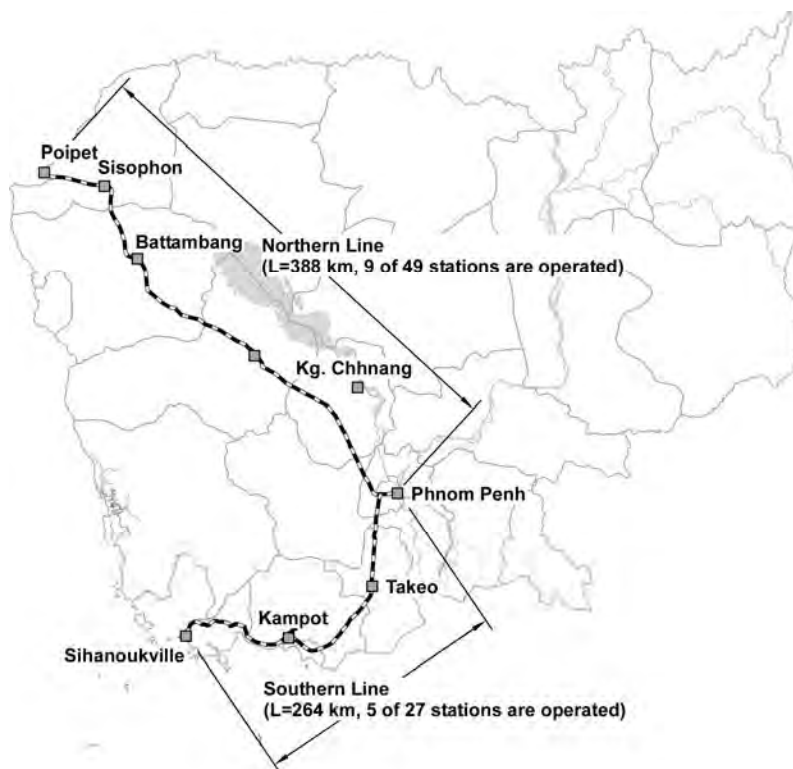
Right: Data Collection Survey on the Integrated Cargo Distribution System (2010, JICA)

Figure 9.1-6 Import and Export Freight Volume at Phnom Penh Port

A new Phnom Penh port construction is planned at 30 km downstream from PPCC supported by the Chinese Government. The capacity of this new port is expected to be 120 - 150 thousand TEUs.

9.1.3 Railway Transport

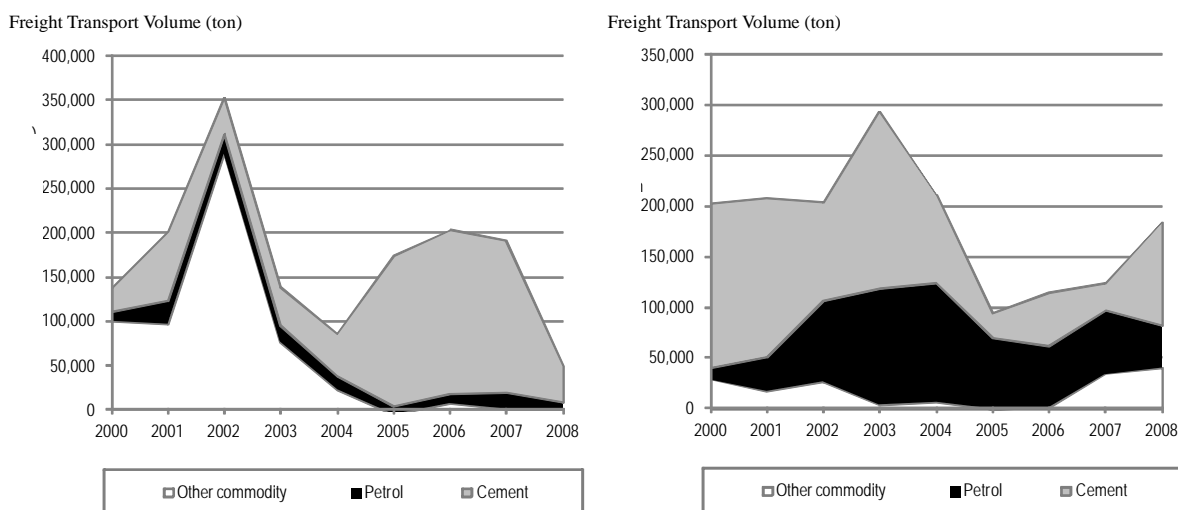
The railway network in Cambodia consists of the north line and the south line as shown in the following figure. The north line (NL) is 388 km between Phnom Penh and Poipet where Cambodia shares a common border with Thailand. The south line (SL), on the other hand, is about 264 km between Phnom Penh and Sihanoukville. Both railway lines are single-track.



Source: PPUTMP Project Team

Figure 9.1-7 Railway Network in Cambodia

Freight transport by railway in Cambodia is dominated by cement and petrol as shown in the following Figure 9.1-8. Freight transport volume by railway has decreased since 2002 - 2003. The decline may be attributed primarily to the increasing competitiveness of road transport and the decreasing level of service of railway transport.



Source: Transportation Infrastructure Sector Study in Cambodia (2010, JICA)

Figure 9.1-8 Freight Transport Volume by Railway (Left: NL; Right: SL)

9.1.4 Factory and Freight Facility

In order to gain an understanding of the features of truck transport relevant to factory and freight transport facilities such as dry ports in Phnom Penh, an interview survey of truck drivers and companies was conducted. The target areas of the interview survey were Phnom Penh Port, 2 transit warehouses, 3 dry ports and 9 factories in Phnom Penh. The number of truck drivers interviewed was 607.

Number of truck trips in Phnom Penh was estimated using the following formula developed based on the results of the interview survey for companies. However, the reliability of this model is not sufficient because there were not enough samples.

$$TG = \alpha + \beta \cdot \text{Employee}$$

where,

TG: Truck trip generation per day (number of all trucks coming and going respectively).

Employee: Number of employees of the facility

α, β : Parameters shown in following table.

Table 9.1-1 Preliminary Truck Trip Generation Model Parameters

Type of facility	α	(t-value)	β	(t-value)	Adjust R2
Factory	37.75	(38.07)	0.0077	(5.98)	0.70
Transit warehouse, Dry Port, Phnom Penh Port	19.73	(2.54)	0.066	(2.32)	0.33

Source: PPUTMP Project Team

The volume of truck trips generated by type of truck is estimated by the results of the company interview survey shown in the following table. At the freight transport facilities such as dry ports and transit warehouses, heavy trucks with more than 3 axles are used mainly. Concerning light industry factories, smaller trucks are preferred than heavy trucks.

Table 9.1-2 Share of Trucks by Facility Type

		Light Truck	2-Axle Truck	Heavy Truck (3 axles and more)	Total
Freight	Transport Facility	0.0%	0.8%	99.2%	100.0%
	Phnom Penh Port	28.8%	0.0%	71.2%	100.0%
	Warehouse, Dry Port	0.0%	0.8%	99.2%	100.0%
Factory		4.8%	50.6%	44.5%	100.0%
	Heavy Industry	9.1%	37.5%	53.4%	100.0%
	Light Industry	0.0%	65.4%	34.6%	100.0%

Source: PPUTMP Project Team

Average actual working ratio of trucks is estimated by the results of the company interview survey as shown in the following table. In Japan, actual working ratio of trucks is about two-thirds of commercial-use trucks and one-third of household-use trucks². Analysis of the company interview survey results show that average actual working ratio is 84%, which is higher than Japan's.

² "Survey on Motor Vehicle Transport (2009)" by Ministry of Land, Infrastructure, Transport and Tourism.

Table 9.1-3 Percentage of Actual Working Ratio

	(A) Number of owned and contracted trucks			(B) Average number of trucks operated per day			(B/A) Average working ratio		
	Cargo Facility	Factory	Total	Cargo Facility	Factory	Total	Cargo Facility	Factory	Total
1. Pickup	0	2	2	0	2	2	-	100%	100%
2. Truck (2 axles)	9	119	128	8	113	121	89%	95%	95%
3. Truck (more than 3 axles)	196	98	294	195	58	253	99%	59%	86%
4. Trailers	121	22	143	78	20	98	64%	91%	69%
5. Light Truck	21	2	23	21	2	23	100%	100%	100%
Total	347	243	590	302	195	497	87%	80%	84%

Source: PPUTMP Project Team

Average trip rate per day is calculated by the results of the truck driver interview survey as shown in the following table. Basically, trip rates of smaller trucks are larger than the trip rate of heavier trucks.

Table 9.1-4 Average Trip Rate per Day

	(A) Number of total trip			(B) Number of samples			(A/B) Ave. trip rate per day		
	Cargo Facility	Factory	Total	Cargo Facility	Factory	Total	Cargo Facility	Factory	Total
2 axles Rigid truck	25	542	594	53	254	279	0.47	2.13	2.13
Rigid truck 3 axles +	32	138	171	33	56	88	0.97	2.47	1.95
Semi-trailer	22	7	45	38	11	33	0.58	0.67	1.37
Full-trailer	155	4	133	129	4	159	1.20	1.07	0.84
Dump truck	1	0	3	3	0	1	0.33	-	3.00
Tanker	0	22	22	0	36	36	-	0.61	0.61
Others	0	20	20	0	11	11	-	1.78	1.78

Source: PPUTMP Project Team

Based on whether the truck is loaded/empty and what is the weight in ton, if loaded (information taken from the truck driver interview survey), estimated maximum loading weight and average loading weight by type of truck and carried commodity are calculated as shown in the following tables.

Table 9.1-5 Estimated Maximum and Average Load in Tons

	Major Commodity	2 axles Rigid truck			Rigid truck 3 axles +			Semi-trailer			Full-trailer		
		Estimated maximum loading (ton)	Ave. Loading Ratio (%)	Ave. Loading (ton)	Estimated maximum loading (ton)	Ave. Loading Ratio (%)	Ave. Loading (ton)	Estimated maximum loading (ton)	Ave. Loading Ratio (%)	Ave. Loading (ton)	Estimated maximum loading (ton)	Ave. Loading Ratio (%)	Ave. Loading (ton)
1	Animal Feeds	4.8	91	4.3	24.3	88	21.2	-	-	-	-	-	-
2	Animal Products	-	-	-	-	-	-	-	-	-	-	-	-
3	Chemicals	-	-	-	26.3	82	21.6	-	-	-	-	-	-
4	Construction materials	5.5	83	4.6	27.3	88	23.8	22.2	75	16.7	32.9	68	22.3
5	Fabrics	8.4	48	4.0	23.8	71	16.8	30.5	75	22.9	22.9	77	17.5
6	Fertilizers	-	-	-	-	-	-	-	-	-	23.1	75	17.3
7	Fruits and Vegetables	-	-	-	-	-	-	-	-	-	16.0	75	12.0
8	Industrial material	9.5	48	4.6	-	-	-	13.3	75	10.0	38.1	59	22.5
9	Manufactured Goods	3.1	79	2.5	-	-	-	19.9	75	14.9	21.4	70	14.9

10	Minerals	-	-	-	-	-	-	-	-	-	-	-	-
11	Paper	4.0	50	2.0	29.0	44	12.7	-	-	-	56.0	13	7.0
12	Petroleum	-	-	-	-	-	-	-	-	-	-	-	-
13	Pharmaceuticals	-	-	-	-	-	-	-	-	-	-	-	-
14	Plant products	-	-	-	-	-	-	-	-	-	22.0	100	22.0
15	Plastic and Plastic Products	-	-	-	-	-	-	-	-	-	-	-	-
16	Rice and Grain Products	13.3	75	10.0	20.5	100	20.5	24.3	94	22.9	29.1	86	25.0
17	Rubber and Rubber Products	-	-	-	-	-	-	-	-	-	15.0	100	15.0
18	Seafood	-	-	-	-	-	-	-	-	-	-	-	-
19	Sugar and Sugar Confectionery	-	-	-	-	-	-	-	-	-	-	-	-
20	Mixing	3.0	59	1.8	21.3	100	21.3	10.0	100	10.0	25.3	72	18.1
21	Machinery	-	-	-	-	-	-	-	-	-	-	-	-
22	Brewery	-	-	-	-	-	-	-	-	-	-	-	-
23	Workers	-	-	-	-	-	-	-	-	-	-	-	-
	Total	4.7	76	3.6	25.3	78	19.8	22.3	85	18.8	28.7	71	20.5

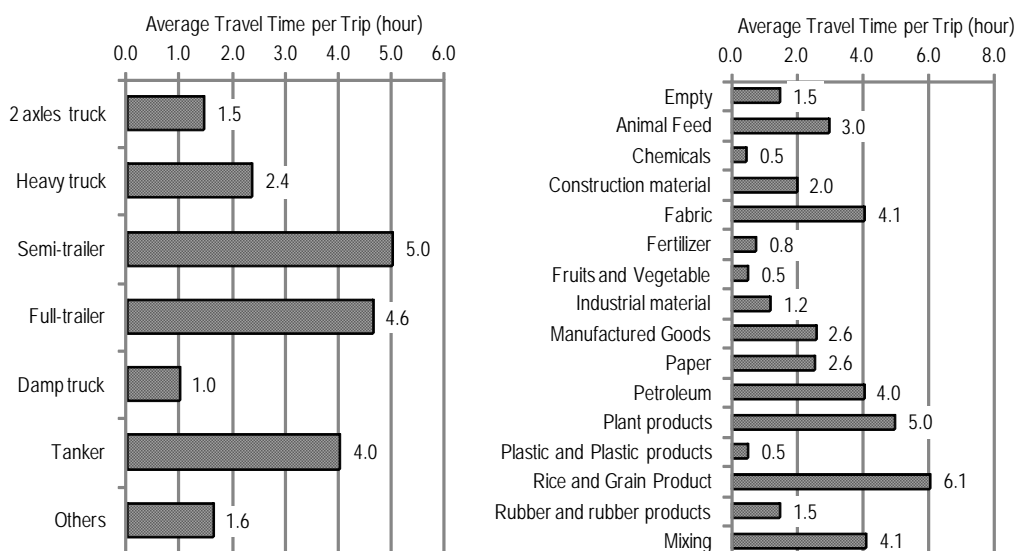
Source: PPUTMP Project Team

Table 9.1-6 Estimated Maximum and Average Load in Tons (Cont'd)

	Major Commodity	Damp truck			Tanker			Others		
		Estimated maximum loading (ton)	Ave. Loading Ratio (%)	Ave. Loading (ton)	Estimated maximum loading (ton)	Ave. Loading Ratio (%)	Ave. Loading (ton)	Estimated maximum loading (ton)	Ave. Loading Ratio (%)	Ave. Loading (ton)
1	Animal Feeds	-	-	-	-	-	-	2.9	94	2.7
2	Animal Products	-	-	-	-	-	-	-	-	-
3	Chemicals	-	-	-	-	-	-	-	-	-
4	Construction materials	-	-	-	-	-	-	-	-	-
5	Fabrics	33.3	75	25.0	-	-	-	-	-	-
6	Fertilizers	-	-	-	-	-	-	-	-	-
7	Fruits and Vegetables	-	-	-	-	-	-	-	-	-
8	Industrial materials	-	-	-	-	-	-	11.3	83	9.4
9	Manufactured Goods	-	-	-	-	-	-	-	-	-
10	Minerals	-	-	-	-	-	-	-	-	-
11	Paper	-	-	-	-	-	-	-	-	-
12	Petroleum	-	-	-	28.6	100	28.6	-	-	-
13	Pharmaceuticals	-	-	-	-	-	-	-	-	-
14	Plant products	-	-	-	-	-	-	-	-	-
15	Plastic and Plastic Products	-	-	-	-	-	-	-	-	-
16	Rice and Grain Products	-	-	-	-	-	-	-	-	-
17	Rubber and Rubber Products	-	-	-	-	-	-	-	-	-
18	Seafood	-	-	-	-	-	-	-	-	-
19	Sugar and Sugar confectionery	-	-	-	-	-	-	-	-	-
20	Mixing	-	-	-	-	-	-	-	-	-
21	Machinery	-	-	-	-	-	-	-	-	-
22	Brewery	-	-	-	-	-	-	-	-	-
23	Workers	-	-	-	-	-	-	-	-	-
	Total	33.3	75	25.0	28.6	100	28.6	13.6	74	10.1

Source: PPUTMP Project Team

Based on the truck driver interview survey at freight transport facilities and factories, average travel time per trip is calculated as shown in Figure 9.1-9 below. Trucks with 2 axles are mainly used for short trips of about 1.5 hours on average. Heavy trucks such as rigid trucks with more than 3 axles are used for longer trips than 2-axle trucks, and average travel time of trailers including semi and full trailers is almost 5 hours per trip.



Source: PPUTMP Project Team

Figure 9.1-9 Average Travel Time per Trip

9.2 Issues

9.2.1 Trucks

In general, major problems in urban transport caused by heavy vehicles such as freight trucks are i) traffic congestion, impact on roadside environment or involvement in traffic accidents, and ii) obstruction to urban traffic by on-street parking of loading/unloading trucks. Based on the results of various traffic surveys, observed traffic volume and number of parking trucks inside NR1 and NR6 are 2.8% and 2.4% of motorized vehicles, respectively. Therefore, the impact of trucks on the urban traffic, road safety and environment in the central area of Phnom Penh is not considerable compared to other private vehicles.

9.2.2 Phnom Penh Port

Most of the existing problems in existing Phnom Penh Port, especially capacity of cargo handling, will be alleviated by the opening of a new Phnom Penh Port in the future. Concerning freight transport by water relevant to Phnom Penh, function sharing between existing and new ports should be considered. Based on respective features and functions of existing and new Phnom Penh port, cargo transport network and facilities should be considered.

9.2.3 Railway Transport

In general, railway transport is economically and environmentally superior to road transport. In Cambodia, however, infrastructure of railway has been damaged during the Cambodian Civil War until

1993 and it has not recovered completely. Therefore, travel speed and loading weight of railway freight transport is restricted with lower than designed speed and weight. Thus, the Cambodian railway system has various problems on infrastructure, rolling stock and capacity of operator which should be improved by a long-term project. To cope with these problems, the railway rehabilitation by ADB and the operation by concession scheme of TRR are ongoing.

9.2.4 Factory and Freight Facility

A dry port (or inland depot/port) is an inland intermodal facility or container freight station (CFS) operating as a center of the transshipment of cargo. A dry port usually has a Customs office in order to reduce time for custom clearance at port and border. In Phnom Penh, 5 - 7 dry ports are developed and operated for alleviating congestion at container yard in Phnom Penh Port. Freight facilities such as existing and newly required dry ports should be considered in accordance with Phnom Penh Port.

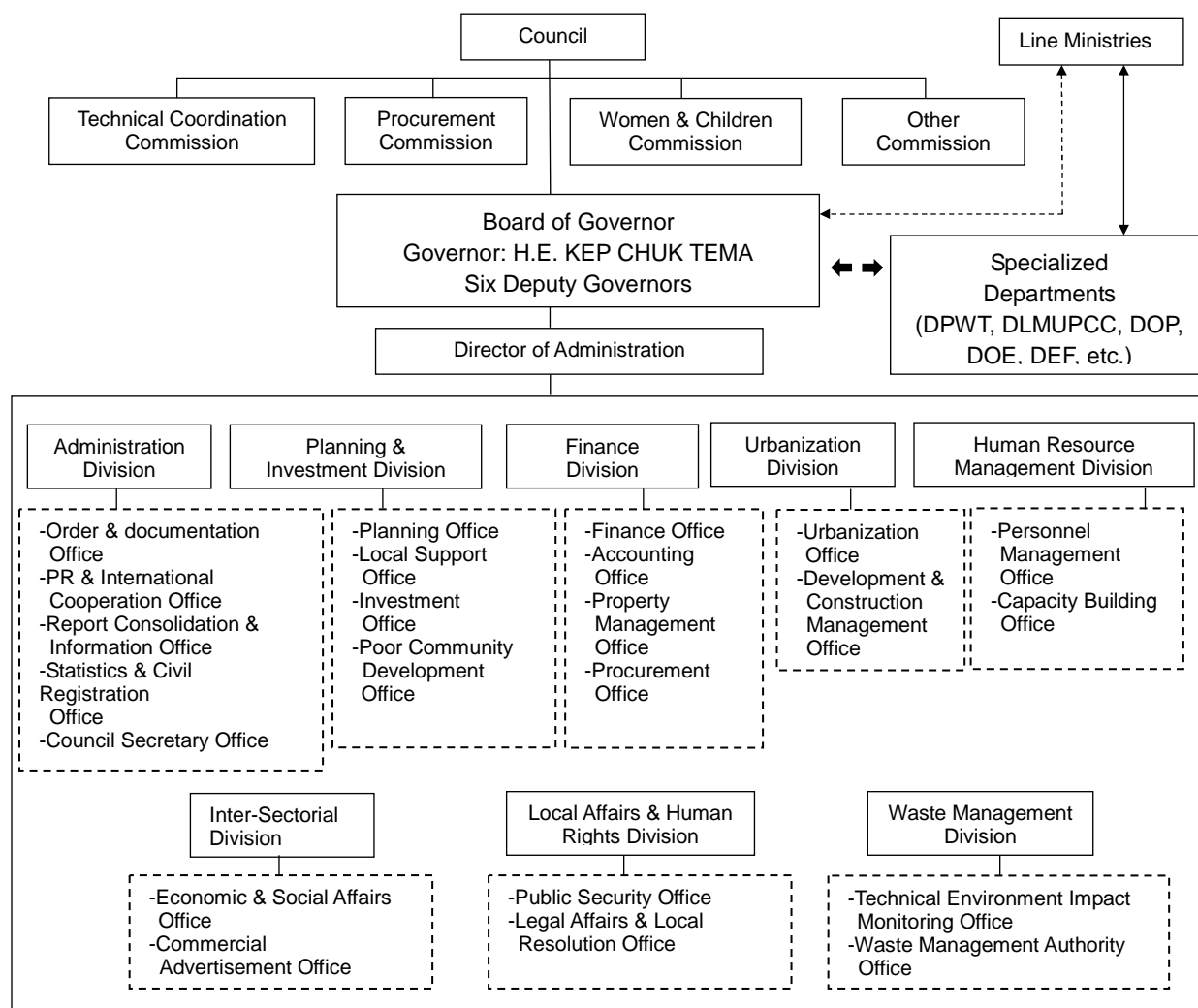
10 ORGANIZATION AND INSTITUTIONS

10.1 Organization and Role of Phnom Penh Capital Hall

Good Governance by means of improving capacities of organization and developing human resources is critical for the future of Phnom Penh Capital Hall (PPCH). In this sense, this chapter discusses briefly the organization from the viewpoint of urban transport and city development. The function and responsibilities of the Municipality are described in this chapter including some problems that have been identified especially concerning management of public transport in Phnom Penh.

10.1.1 Organization of PPCH

Figure 10.1-1 shows the present organizational structure of PPCH according to Sub-Decree. As of December 2010, its officers number 268.



Note: DLMUPCC= Department of Land Management, Urban Planning, Construction and Cadastral

DOP= Department of Planning, DOE= District Office of Education, DEF= Department of Economics and Finance

Source: PPUTMP Project Team

Figure 10.1-1 Organizational Structure of PPCH

The Project Team looked into all sectors of urban transport and city development. A review of the offices under these sectors was made toward future development in PPCH.

There are several offices involved in urban transport and city development. The roles and responsibilities of a few of these offices are briefly explained below.

(1) Urbanization Division

The Urbanization Division was established in 2010 upon request from current various development planning offices in Phnom Penh. The predecessor of the Urbanization Division is the Bureau of Urban Affairs (BAU), which was supported by French agencies. Its main roles and tasks are as follows:

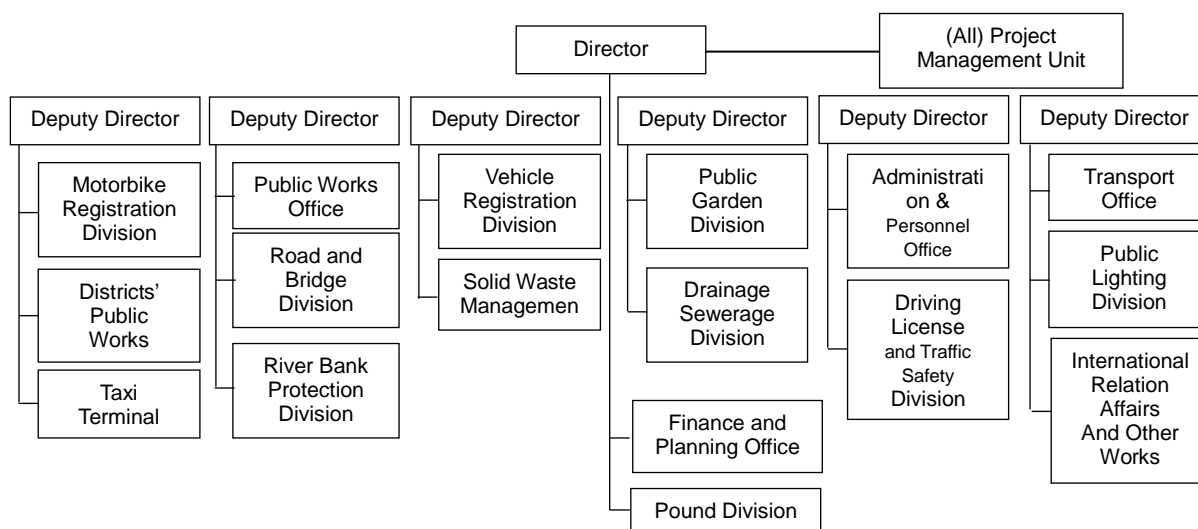
- Cooperation in the formulation of master plan and land use plan
- Handling of works related to land tenure, construction and rehabilitation as well as addressing problems related to violations of construction rules
- Formulation of strategy and development for settlement in PPCH
- Management of old constructions and heritage sites of the Capital
- Development of transportation infrastructure, parks, gardens and public facilities

The Urbanization Division consists of the Urbanization Office and the Development and Construction Management Office.

However, the Department of Land Management, Urban Planning, Construction and Cadastral (DLMUPCC) is also involved in urban development management in PPCH. DLMUPCC is a decentralized department of the Ministry of Land Management, Urban Planning and Construction (MLMUPC), which is also in charge of transport sector with land management plans as well as Master Urban Plans for Phnom Penh. For the needs of these land management plans, DLMUPCC and DPWT may collaborate from time to time on issues relating to roads.

(2) Department of Public Works and Transport (DPWT)

DPWT is corresponding in position under specialized department order from not only PPCH but also MPWT. DPWT is mainly responsible for management of all infrastructure such as roads and bridges and traffic. Thus, it should be one of the main players of transport sector in future practice. Its organizational structure is shown below.



Source: PPUTMP Project Team

Figure 10.1-2 Organizational Structure of DPWT

DPWT's roles and responsibilities are as follows:

- Carry out, on behalf of MPWT, the government's policy in the field of public works and transport in PPCH;
- Manage administrative affairs and develop the plan for its human resources development;
- Manage and control all kinds of transportation modes, bus terminals and construction sites;
- Repair, innovate and assemble all transportation means as defined by MPWT;
- Manage and maintain all kinds of transportation facilities such as roads, bridges, ports, airports, sewerage network, wastewater treatment plants, ferry ports, building and lands, which are under its responsibility;
- Manage and maintain all public sanitation services along the national and provincial roads in PPCH; and
- Study and design all development plans on public works and transport in PPCH.

10.1.2 Proposed New Organization

The Paris City Government conducted the "F/S Regarding the Creation of Transport and Mobility Organization Authority (TMOA)" in September 2009. Table 10.1-1 below shows the proposed functions of TMOA contained in the F/S report by the Paris City Government.

Table 10.1-1 Functions of TMOA

ITEM	CONTENT
NECESSITY	<ol style="list-style-type: none"> 1. Reduce traffic congestion in the center 2. Improve traffic management 3. Create a Public Transport System
DUTY	<ol style="list-style-type: none"> 1. Coordinate the different stakeholders 2. Coordinate transport projects in competition 3. Design the mobility policy framework and tools 4. Better understand urban growth, mobility and transport means 5. Design the transport planning documents 6. Draw up the transport contracts for pay parking lots, traffic lights control station, bus stations, transport lines construction, transport lines operation, and logistic infrastructure 7. Draw up the tariff policy and the subsidies level: pay parking lot price, transport ticket price, discounted fares for students
NEED of TECHNICAL CAPACITY	<ol style="list-style-type: none"> 1. Transport Planning 2. Parking Management 3. Traffic Management 4. Public Transport Design and Management
ISSUE	<ol style="list-style-type: none"> 1. Have a geographical capacity beyond PP borders (integrate Kandal and Kampong Speu neighboring provinces) 2. Command an investment budget to finance infrastructure 3. Have the ability to tender to choose operators 4. Be associated with national rail, port authority and airport projects

Source: PPUTMP Project Team

The Paris City Government also suggested taking the steps outlined below toward the realization of TMOA:

- Anukret shall be announced creating this TMOA and appointment of the members of the Board of Directors (BD). On the basis of the draft Anukret drawn up as part of the F/S (regarding specifying the role), MPWT, jointly with the Ministry of Economics and Finance (MEF), will submit the Anukret to the Prime Minister for signature.
- Without waiting for the members of the BD to be appointed, as soon as the Anukret has been signed, the investment and operating budgets will be put in place to start up TMOA.
- At the same time as the budgets, the human resources will be put in place and the Director, in particular, will be hired.
- The technical support will be set up at the same time as the budgets and the human resources.
- Once the budgets, human resources and technical support are in place, TMOA may become effectively operational. The role of the technical support will particularly involve providing on-site training for TMOA's staff, completed as applicable by internships abroad in similar organizations. At this stage, 14 months is allowed for the technical support but this must be extended as needs dictate.

The function of TMOA as an urban transport-related organization does not rest upon a single local government only because the future urban transport issues in Phnom Penh are more complex and cover a wider area. Therefore, the collaboration between adjoining provinces is the key to the successful establishment of TMOA. This lesson is learned from the European countries.

10.2 Matters to be Observed and Proposed as Next Step

A detailed survey or review was not done on urban planning and transport sector (e.g., actual Terms of Reference (TOR) and competencies of each relevant division) at this time, although it was observed which organizations on transport, road infrastructure and urban development are existing. Therefore, the following matters will be surveyed or reviewed in next step so that PPCH can be a major implementing organization in future activities:

- a) Approval process of each development plan and activities to manage their progress;
Regarding the ongoing development plans by active private investment, what kind of approval PPCH has been issuing and how it has been evaluating the plan will be reviewed.
- b) Observation of human resource development plans and contents of trainings in PPCH
Based on results of studies in current competencies, strengths and weaknesses of PPCH, and training plans, particularly in transport sector, shall be developed.
- c) Which division will supervise the public transport in case it is adopted?
Based on the F/S of TMOA which has been proposed by the Paris City Government, the stance of PPCH (whether it can be a Ministry to supervise it or only an operating body) shall be studied.
- d) Involvement of MPWT to PPCH plan
It is observed which concrete actions MPWT will take in case the time to implement the new transport policies represented by the urban development plan and the public transport is officially decided.
- e) Amend or legislate a new law
In case of adoption of public transport, the Project Team shall review existing laws and regulations in Cambodia relating to transportation of passengers.