

**Kingdom of Cambodia
Phnom Penh Capital Administration**

**Data Collection Survey on Urban Transport
in Phnom Penh**

Final Report

February 2023

Japan International Cooperation Agency (JICA)
Oriental Consultants Global Co., Ltd.
International Development Center of Japan, Inc.
METS Research & Planning, Inc.

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23-002

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List of Abbreviations

Abbreviation	Full Name
ADB	Asian Development Bank
AGT	Automated Guideway Transit
AIIB	Asian Infrastructure Investment Bank
AIMF	International Association of Francophone Mayors
ASCN	ASEAN Smart Cities Network
ASEAN	Association of Southeast Asian Nations
ASFR	Age-specific Fertility Rate
BA	Built Up Area
BCR	Building Cover Ratio
BKK	Bangkok
BRT	Bus Rapid Transit
BRTP	Bureau of Road Traffic Police
BTS	Bangkok Mass Transit System
CA	Control Area
CAGR	Compound Annual Growth Rate
CBA	City Bus Authority
CBD	Central Business District
CBR	Crude Birth Rate
CCCA	Cyclo Conservation and Careers Association
CCDA	Cambodia for Confederation Development Association
CCS	Combined Charging System
CCTV	Closed-Circuit Television
CDB	Commune Data Base
CDC	Council for Development of Cambodia
CFS	Container Freight Station
CLS	Cordon Line Survey
CM	Central Market
CO ₂	Carbon Dioxide
COE	Certificate of Entitlement
COVID-19	Coronavirus Disease 2019
CS	Commuter Survey
CSES	Cambodia Socio-Economic Survey
CTN	Container
CWR	Child Woman Ratio
CY	Container Yard
DPWT	Department of Public Works and Transport
DSA	Debt Sustainability Analysis

Abbreviation	Full Name
EDC	Electricite du Cambodge
ERP	Electronic Road Pricing
EV	Electric Vehicle
F/O	Flyover
F/S	Feasibility Study
FAR	Floor Area Ratio
FCL	Full Container Load
FDI	Foreign Direct Investment
GDP	Gross Domestic Production
GFR	General Fertility Rate
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft fur Internationale Zusammenarbeit
GPC	General Population Census
GPS	Global Positioning System
H/Q	Headquarters
HCM	Ho Chi Minh
HH	Household
HHVO	Household Vehicle Ownership
HTO	Home to Others
HTSc	Home to School Trip
HTSh	Home to Shopping Trip
HTW	Home to Work Trip
IBA	Important Bird Area
ICT	Information and Communication Technology
ID	Identification
IDCJ	International Development Center of Japan
IDEA	Independent Democracy of Informal Economy Association
IMF	International Monetary Fund
IMR	Infant Mortality Rate
IRR	Inner Ring Road
IT	Information Technology
ITS	Intersection Traffic Survey
ITU	International Telecommunication Union
IUTMP	Integrated Urban Transport Management Platform
JICA	Japan International Cooperation Agency
JST	JICA Survey Team
K&R	Kiss and Ride
KHR	Khmer Riel
LCL	Less Container Load

Abbreviation	Full Name
LTAZ	Large Traffic Analysis Zone
M/P	Masterplan
MaaS	Mobility as a Service
MAID	Mobile Advertising ID
MAU	Monthly Active Users
MC	Motorecycle
MEF	Ministry of Economy and Finance
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MM	Mobility Management
MOE	Ministry of Environment
MOI	Ministry of Interior
MPWT	Ministry of Public Works and Transport
MVL	MVLLABS Pte. Ltd.
NCSD	National Council for Sustainable Development
NGO	Non-Government Organization
NHB	Non Home Based Trip
NIS	National Institute of Statistics
NMT	Non-motorized Trip
NOx	Nitrogen Oxides
NR	National Road
NRSC	National Road Safety Committee
NSDP	National Strategic Development Plan
OCG	Oriental Consultants Global
OD	Origin-Destination
OFC	Optical Fiber Cable
P&R	Park and Ride
PAS	Sihanoukville Autonomous Port
PCS	Parking Condition Survey
PCU	Passenger Car Unit
PiBO	Project for Improvement of Public Bus Operation in Phnom Penh
PIS	Passenger Interview Survey
POI	Point of Interest
PP	Phnom Penh
PPAP	Phnom Penh Autonomous Port
PPCA	Phnom Penh Capital Administration
PPCC	Phnom Penh Capital City
PPG	Public and Publicly Guaranteed
PPIA	Phnom Penh International Airport

Abbreviation	Full Name
PPLUMP	Land Use Master Plan 2035 in Phnom Penh Capital City
ppm	parts per million
PPMP	Phnom Penh Municipality Police
PPSCP	Phnom Penh Sustainable City Plan 2018 -2030
PPSEZ	Phnom Penh Special Economic Zone
PPUTMP	Comprehensive Urban Transport Plan in Phnom Penh Capital City
PR	Public Relations
PT Survey	Person Trip Survey
PTOD	Person Trip Origin-Destination
PV	Present Value
QR Code	Quick Response Code
RGC	Royal Government of Cambodia
RHS	Ride-Hailing Service
RMS	Revenue Mobilization Strategy
RR	Ring Road
RS	Rectangular Strategy
RTS	Roadside Traffic Survey
SEZ	Special Economic Zone
SHV	Sihanoukville
SLS	Screen Line Survey
SmartJAMP	Smart City supported by Japan-ASEAN Mutual Partnership
SOx	Sulfur Oxides
SP	Stay Points
SWOT	Strengths, Weaknesses, Opportunities, and Threats
SSIUPTD	Supporting Sustainable Integrated Urban Public Transport Development
TA	Technical Assistance
TAZ	Traffic Analysis Zone
TBD	To be determined
TCC	Traffic Control Center
TDM	Transportation Demand Management
TEU	Twenty-foot Equivalent Units
TFR	Total Fertility Rate
TIS	Truck Interview Survey
TOD	Transit Oriented Development
TSS	Travel Speed Survey
UMR	Under-five Mortality Rate
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

Abbreviation	Full Name
UPS	Uninterruptible Power Supply
USD	US Dollar
V/C	Volume to Capacity Ratio
WHO	World Health Organization

<Executive Summary>

Chapter 1 Background and Objectives

JICA has cooperated to formulate the Comprehensive Urban Transport Plan in Phnom Penh Capital City (hereinafter referred to as "PPUTMP") with the target year of 2035 and consistently supported to improve the traffic condition in Phnom Penh. However, the car-oriented system remains unchanged and traffic congestion is getting worse. The new transport mode, Ride-Hailing Service (hereinafter referred to as "RHS") has been widely expanding in Cambodia. Also, the urban railway project, a key project of PPUTMP, was postponed for the time being due to financial constraints of Cambodia. Based on the above background, the purposes of the Survey are summarised as shown below:

- Updating the traffic data which was surveyed and analysed in PPUTMP in 2014,
- Conducting the interview surveys on new transport mode in Phnom Penh, RHS,
- Identifying the issues on transport sector in Phnom Penh as of today and
- Identifying the direction of cooperation and priority project in urban transport sector in Phnom Penh.

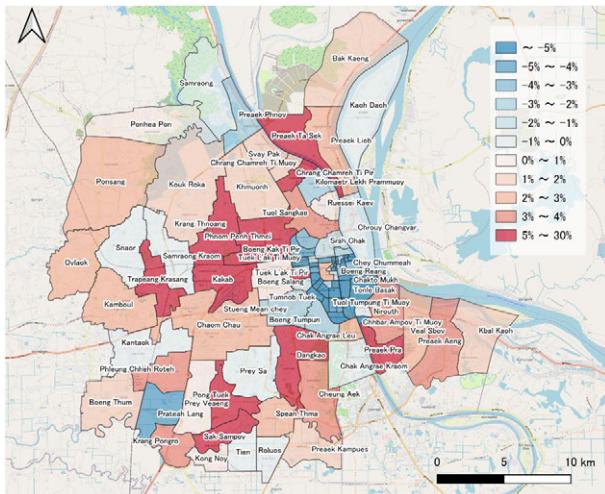
Chapter 2 Socio-economic Condition in Phnom Penh

2.1 Demographic Condition

While the population in the Central Business District (CBD), where the population density is higher than other areas in Phnom Penh, is decreasing at CAGR -3.82%, the population is increasing outside CBD at CAGR 2.43%. The population of about 2.19 million in 2019 is forecasted to increase to about 2.62 million in 2035 in Phnom Penh.

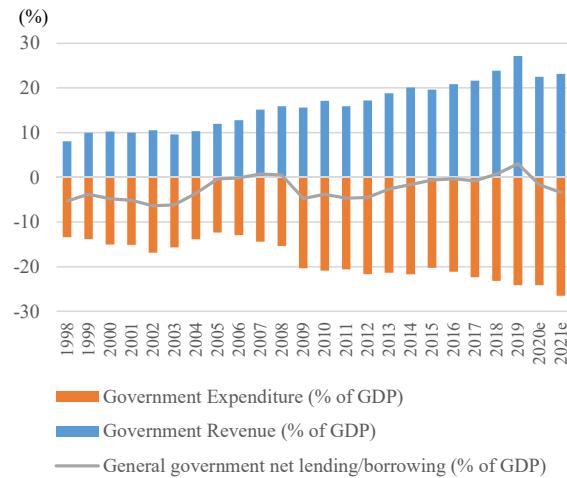
2.2 Economic and Financial Condition

The Cambodian government has maintained the public finance well by keeping the budget deficit below 5% of GDP. The IMF report “Cambodia: Staff Report for the 2021 Article IV Consultation—Debt Sustainability Analysis” concluded that Cambodia remains at a low risk of external debt distress.



Source: JST created based on the population data of Commune data base in 2014 and 2018

Figure I Population Growth Area



Source: IMF World Economic Outlook Database

Figure II Fiscal Balance (1998-2021)

Chapter 3 Existing Condition of Urban Transport Sector in Phnom Penh

3.1 Existing Institution, Legal System and Financial Condition related to Urban Transport Sector

In general, MPWT is responsible for law and endorsement. Besides the function, the demarcation of roles between PPCA and MPWT are intricate. Moreover, there is no agency who establish the comprehensive transport policy and implement it.

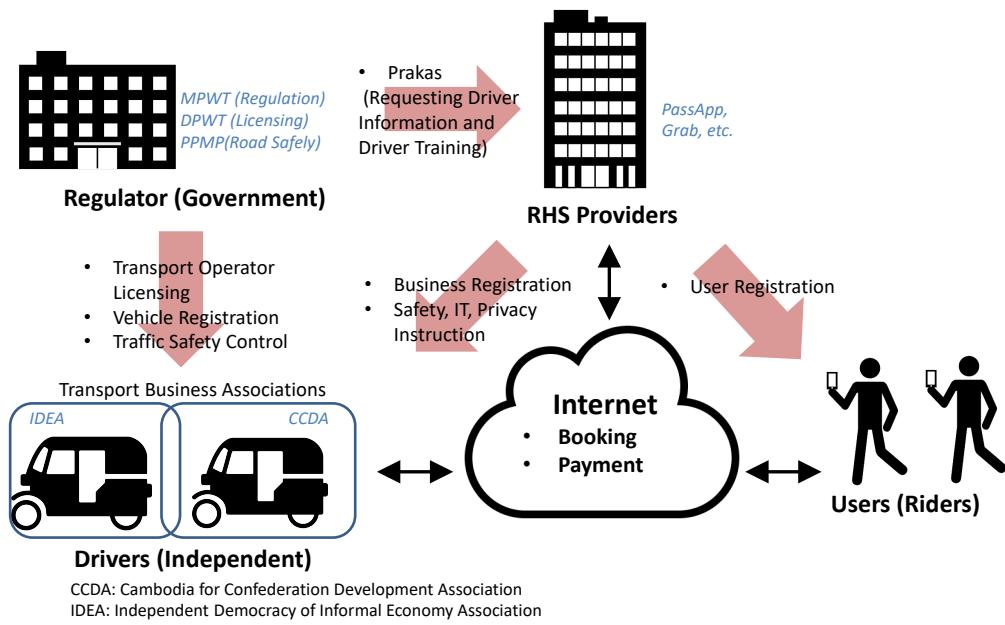
Table I Present Institutional Arrangement for Operation and Management of Urban Transport

Function	Responsible Agency			Instruments
	Public Transport	Highway (Urban)	Traffic Management (Parking)	
Policy and strategy	PPCA (bus), MPWT (rail)	MPWT (arterial), PPCA	Unknown	National Strategic Development Plan (5 year investment plan in all sector), PPUTMP
Law endorsement	MPWT	MPWT	MPWT, MLMUPC*	Road Traffic Law(2017) Land Management Law (1997)
Regulator	MPWT (rail/ bus), PPCA (bus), DPWT (para)		PPCA (off-street)	Sub-decree, Prakas, Certificate & Permit
Implementing Agency (Operator)	CBA (bus), Private (rail, para)	DPWT, PPCA	Private	
Standard	Unknown	MPWT	MLMUPC (off-street)	Road Design Standard (2003) Urbanization of the Capital, Municipalities and Urban Areas (2015)
Public Finance	PPCA, MPWT	MPWT, PPCA		

*MLMUPC: Ministry of Land Management, Urban Planning and Construction

*DPWT: Department of Public Works and Transport, Source: JST

RHS drivers are categorized as passenger transport service provider as well as Khmer Tuk-tuk drivers based on the road traffic law. Most of the drivers are independent drivers.



Source: JST

Figure III Relationship of Driver, Users, App Providers and Regulators on RHS

3.2 Current Status of Infrastructure and Facilities related to the Urban Transport Sector

CBA owns 181 buses. The end/start points of each bus route have bus terminals/parking, for a total of 14 bus terminals. Each bus route operates at around 20 kilometres and takes about 1 to 2 hours travel time to complete the one-way service. As of December 2021, the daily ridership of these routes reached 2,700 passengers, which still has a large gap with the ridership before the COVID-19 pandemic. Several roads were improved such as the widening of Veng Sreng Blvd., Hanoi Blvd., Russian Blve., RR-II South Section, NR-1, NR-3 and NR-5, and the new construction of Hun Sen Blvd. Prior to the introduction of traffic control system by Japan's grant aid, the traffic signals at 69 intersections provided by different donors from seven countries were operated independently. After the introduction of the traffic control system in December 2018, traffic signals at 115 intersections were introduced by Japan. Of this number, 109 intersections connected to the traffic control centre, located in the PPCA compound excluding 6 intersections along NR-1.

Chapter 4 Upstream Policy and Plans related to Urban Transport

Following upstream policy and plans related to urban transport in Phnom Penh were reviewed.

Table II Upstream Policy and Plans

Name	Contents
National Strategic Development Plan (NSDP)	NSDP is a road map for the Royal Government of Cambodia (RGC) to move towards socio-economic development and poverty reduction, and it shall update every five years.
Land Use Master Plan 2035 in Phnom Penh Capital City (PPMP)	PPMP was prepared in 2015 by Phnom Penh Capital Administration (PPCA), PPCA estimated the future population at 2,544,659 in 2035 including Kandal province as a "Greater City".

Name	Contents
Sustainable Development Plan	The National Council for Sustainable Development (NCSD) and the Ministry of Environment (MOE) has developed the development plan, so as to guide and implement the master plans of land use, transport, drainage and waste management in Phnom Penh.
Smart City Plan	The RGC has joined ASEAN Smart Cities Network (ASCN) from the beginning and three cities in Cambodia have been selected as pilot cities, Phnom Penh, Siem Reap and Battambang. Smart Bus Shelters project is on-going in Phnom Penh.
The Comprehensive Urban Transport Plan in Phnom Penh Capital City (PPUTMP)	PPUTMP recommended a balanced decentralised urban structure and modal share between public and private transport, namely the target modals share of the newly introduced rail transit and bus transport is set at 30%, maintaining continuous urban vitality and sustainable urban environment.
2014 Phnom Penh Urban Transport Master Plan revision work (PPUTMP Revision Work)	In the revision work, quantitative transport surveys were not included. It is designed to help PPCA and DPWT officials understand urban transport issues and increase their awareness of the revision of the PPUTMP.
The Project for Improvement of Public Bus Operation in Phnom Penh (PiBO)	Bus operation and management capacity, particularly that in CBA, needs to be improved to ensure proper operation and management of the bus fleets procured under the Japanese Grant Aid scheme. Therefore, GOC requested GOJ to implement technical assistance through the PiBO. The PiBO was implemented by the end of August 2022.
The Project for Development of Traffic Management System in Phnom Penh (Grant Aid)	Traffic signals were installed at 115 intersections in the CBD of Phnom Penh.
Supporting Sustainable Integrated Urban Public Transport Development - Sustainable Integrated Urban Public Transport Development (ADB Study)	The ADB TA identified the Rapid Bus project assigned along 75 kilometre radial road network and traffic improvement programme as the priority urban transport programme, following the mid-term action plan.
Urban Railway	Phnom Penh Post reported on 28 th December 2022 that Senior Minister Sun Chanhol had mentioned the F/S of Skytrain project conducted by JICA and the F/S of monorail and subway projects conducted by Chinese companies have been completed. It was also reported that the state government is expecting private investment on the urban railway since it's difficult to invest huge amount only in Phnom Penh from national budget.

Chapter 5 Transport Survey

5.1 Outline of Transport Surveys

A total of ten (10) items of transport surveys are to be carried out in this survey.

Table III List of Transport Survey

	Survey contents	Objectives and contents	Quantity
1	Person Trip survey	Home-visit interview surveys will be conducted to understand resident's daily activity and travel records, personal attributes such as income and vehicle ownership, and the impact of the COVID-19 pandemic, in order to create a passenger Origin- Destination (OD) matrix.	Approximately 1,000 households
	Commuter Survey	Similar to Person Trip survey, but target respondent is limited to household members who commute and their trip information only.	Approximately 4,000 households
2	Cordon line survey	OD interviews and vehicle count surveys will be conducted to capture the OD traffic volume, cargo type and volume of passengers and cargo from outside the region.	11 points on roads, 1 airport, and 3 ferry terminals
3	Screen line survey	To understand the amount of traffic flowing into the city centre and to verify the reproducibility of the traffic model in its current state, count surveys will be conducted on screen lines.	12 points on roads (3 points are covered by Intersection Traffic Survey)

	Survey contents	Objectives and contents	Quantity
4	Passenger Survey by Mode	For each mode (passenger car, RHS, public / commuter bus, motorcycles), interviews will be conducted at locations where users of each mode gather in order to understand the characteristics of users, their awareness of traffic issues, and the possibility of switching to a new mode.	Approximately 2,000 samples in total
5	Cross-section traffic volume survey	A count survey will be conducted to understand the traffic volume in the city and to verify the reproducibility of the traffic model.	17 points
6	Traffic count survey at intersections	Traffic count surveys will be conducted at major intersections to study intersection improvements and to verify the effectiveness of existing signals and flyovers.	13 points
7	Travel speed survey	Conduct speed survey using GPS loggers to observe travel speed by mode and corridor. Also, the survey result will be used to identify the operation area of RHS.	13 passenger car routes 50 RHS two-wheel vehicles 50 RHS three-wheeled vehicles
8	Parking survey	Conduct interviews and count surveys at facilities and on streets to observe parking capacity, usage, and impact on roadways and sidewalks.	Facilities: 17 locations & On-street
9	RHS status survey	An interview survey will be conducted with drivers to understand the actual status of RHS services, including vehicle kilometres travelled per vehicle (actual and empty), fare revenue, and number of trips.	400 samples
10	Freight vehicle traffic survey	Conduct interviews with companies and drivers, and count surveys at Special Economic Zones (SEZ) and logistics hubs to estimate the percentage of cargo items and intra-regional cargo OD at major cargo hubs.	15 locations

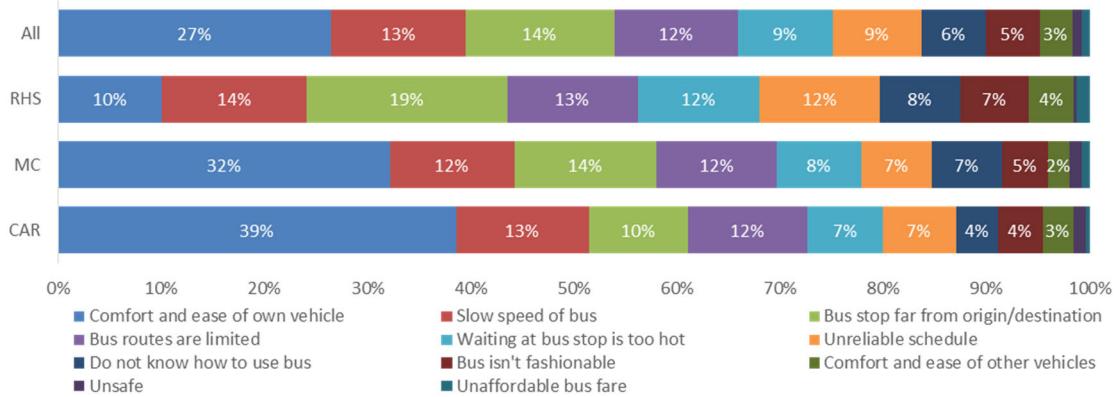
Source: JST

5.2 Consideration for Conducting Transport Surveys under the COVID-19 Pandemic

In order to judge the appropriate time to start the transport surveys, traffic volume has been monitored using CCTV camera data. The results are compared with the traffic volume survey results in 2019 that was conducted by ADB survey team. The recovery index reached 90% in January 2022. Considering the index, transport surveys were initiated consulting with PPCA and Khans.

5.3 Result of Transport Surveys

- The share of car ownership households has increased from 18% in 2012 to 38% in 2022.
- In 2012, the number of trips generated from Phnom Penh metropolitan area was about 4.3 million trips. It increased to about 5.6 million trips in 2022.
- The share of trips between suburban areas increased remarkably to 58% in 2022 from 50% in 2012.
- As the ownership rate of passenger cars and motorcycles increased, the ratio of NMT (Non-motorized Trip: walk and bicycle) decreased, and the ratio of automobiles, motorcycles and tuk-tuk increased to 14.1%, 58.1% and 15.6%, respectively.
- Buses accounted for only 1.4% because the number of operating routes was limited to four due to the COVID-19's pandemic.
- The major reasons not to use city bus are “Comfort and ease of own vehicle” both in Car users (39%) and MC users (32%), followed by “Bus stop far from origin/destination” and “Slow speed of bus”. The major reasons for RHS users are “Bus stop far from origin/destination”, 19% of RHS users.



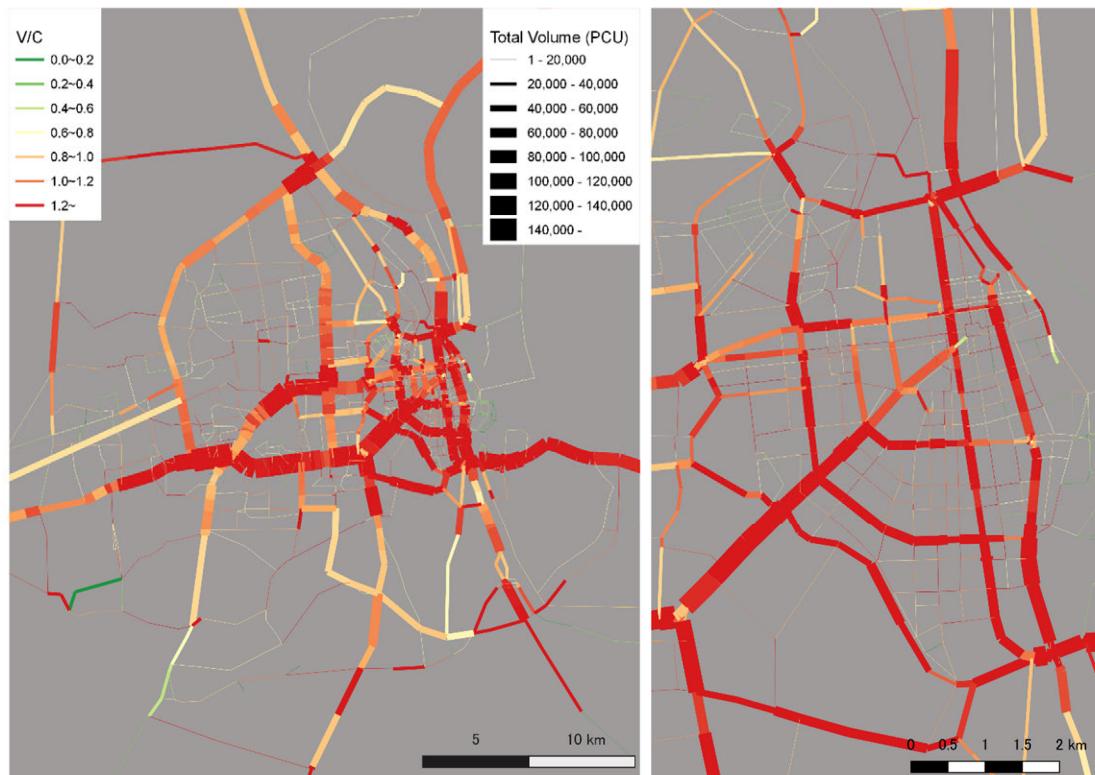
Source: JST

Figure IV Major Reasons Not to Use City Bus by User's Mode

- With regard to the illegal parking, 71% of respondents disagree or won't agree to "current situation is acceptable for convenience" and 90% of respondents agree to "illegal parking should be strictly controlled". These results indicate that they want more control of illegal parking.
- Comparing the parking capacity including off-street and on-street parking in the core area of CBD and the parking demand, it was confirmed that the demand exceeds the capacity of parking facilities.

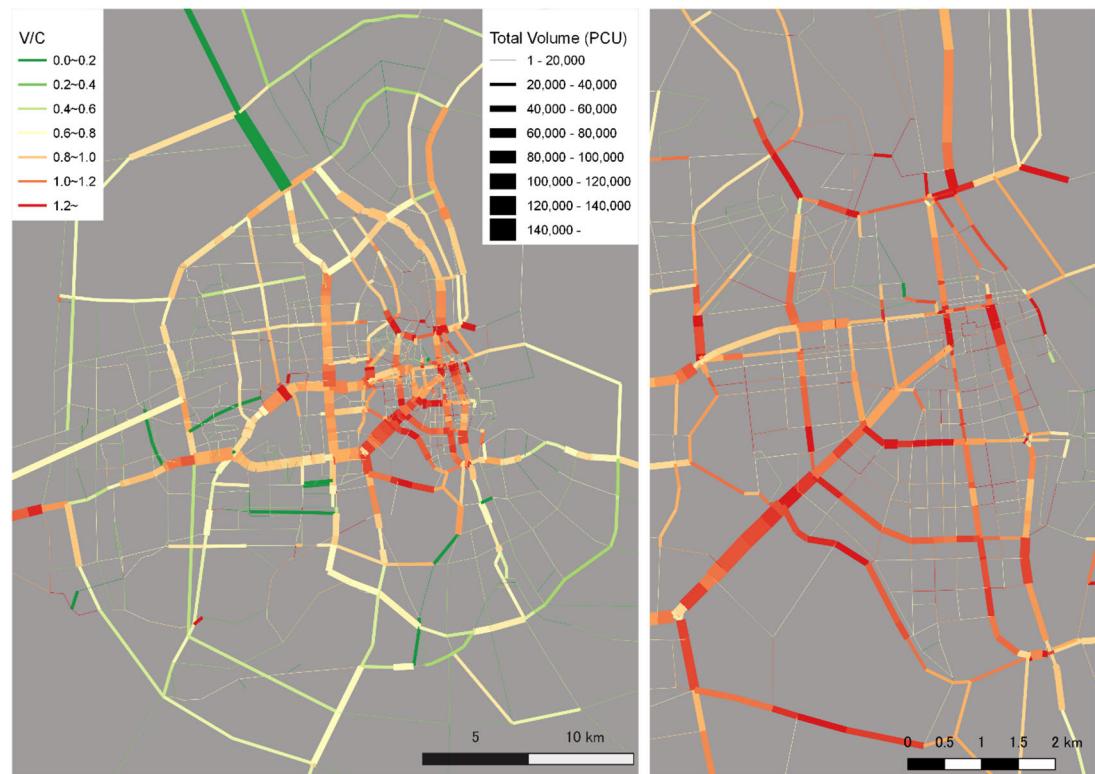
Chapter 6 Transport Demand Forecast

With the result of series of transport surveys, disaggregated four step model was developed to estimate future transport demand. Two scenarios "Do thing" case and "With" project case were set for future road and public transport network. The share of car increased to 14.9% in 2022 from 9.9% in 2012 and the share in 2035 will further increase to 21.7% in "Do Nothing" scenario and 20.2% in "With" scenario. Under the current vehicle ownership and modal choice trends, if population growth and economic growth continue, trips by car in 2035 is projected to be 1.489 million in "Do Nothing" scenario and 1.387 million even in "With" scenario. Trips by motorbike and tuk-tuk is projected to increase slightly, however, the shares of these modes will decrease. The share of public transport is 1.3% in "Do Nothing" scenario where no bus priority lane and urban rail are introduced and 5.4% in "With" scenario. When it is limited to InterTAZ trips only, the modal share of public transport is projected to be 8.6%.



Source: JST

Figure V Road Assignment Result (Do Nothing Scenario in 2035)



Source: JST

Figure VI Road Assignment Result (With Scenario in 2035)

Chapter 7 Identifying Issues on Urban Transport Sector in Phnom Penh

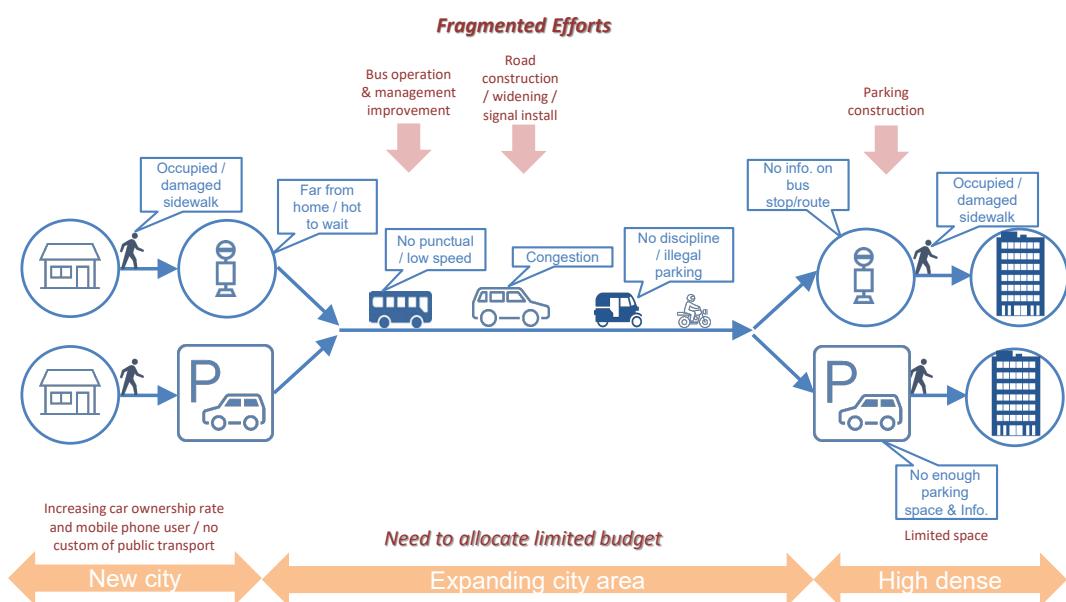
7.1 Progress of PPUTMP Projects/Programme

The number of complete project for public transport sector is limited since most of the railway projects were suspended after the F/S. A major reason of the suspension is budgetary constraint.

7.2 Issues in Urban Transport Sector and Causal Relationship Analysis

7.2.1 Fragmented Efforts to Improve Urban Transport Sectors

To improve the urban transport in Phnom Penh, several efforts such as urban road development and widening, traffic signal instalment, City Bus operation, etc. have been made based on PPUTMP. However, those efforts are fragmented and not effective to change the behaviour of citizens, namely shifting from private vehicle users to public transport users. In order to bring a behaviour change of Phnom Penh citizens, it is necessary to stand from the user's point of view, effectively connect fragmented efforts, and secure a series of comfortable means of transport and space from origin to destination.



Source: JST

Figure VII Past Efforts to Improve Urban Transport and Emerging Issues

7.2.2 Causal Relationship Analysis on Issues to Promote Public Transport

Regarding the City Bus, which plays a major role in public transport in Phnom Penh, the major reasons why car, motorcycle and RHS users do not use the City Bus are “Car is comfortable”, “Bus stop far from origin/destination”, “Slow speed of bus” and “Bus routes are limited”. For improving access to a bus stop, shortening “psychological distance” by improving the environment of pedestrian walkways will be effective as well as shortening “physical distance” by changing the bus stops intervals and expanding the bus network. Furthermore, it is also possible to maximize the coverage of a bus stop by assigning a feeder role for City Bus to RHS and building transfer points between RHS and City Bus.

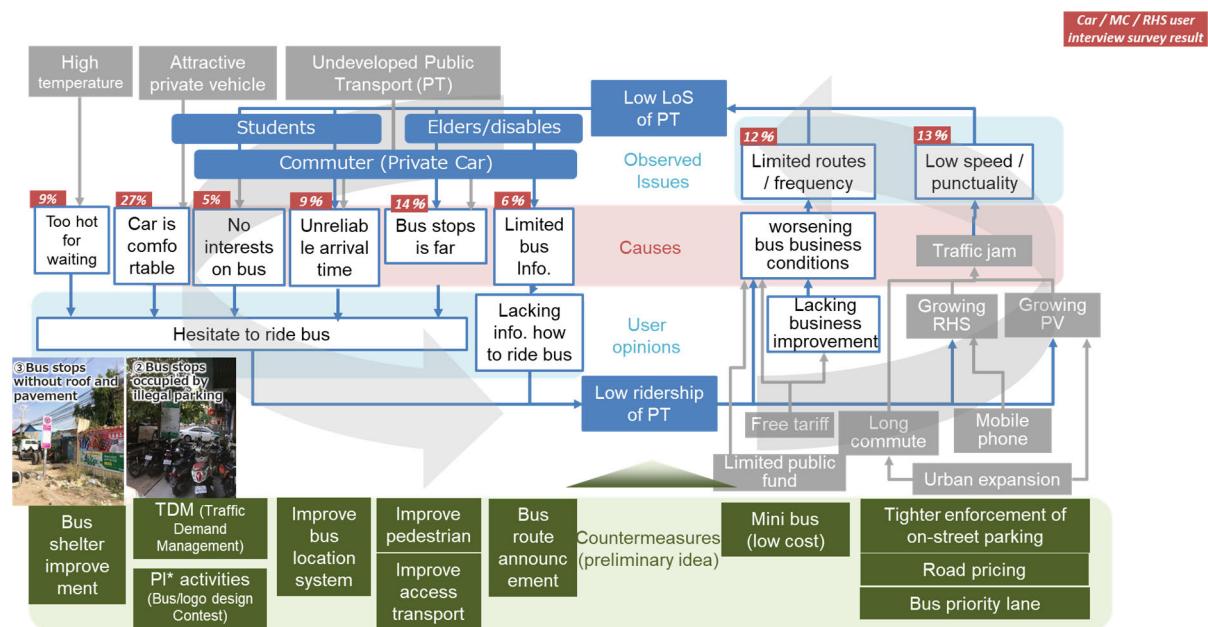
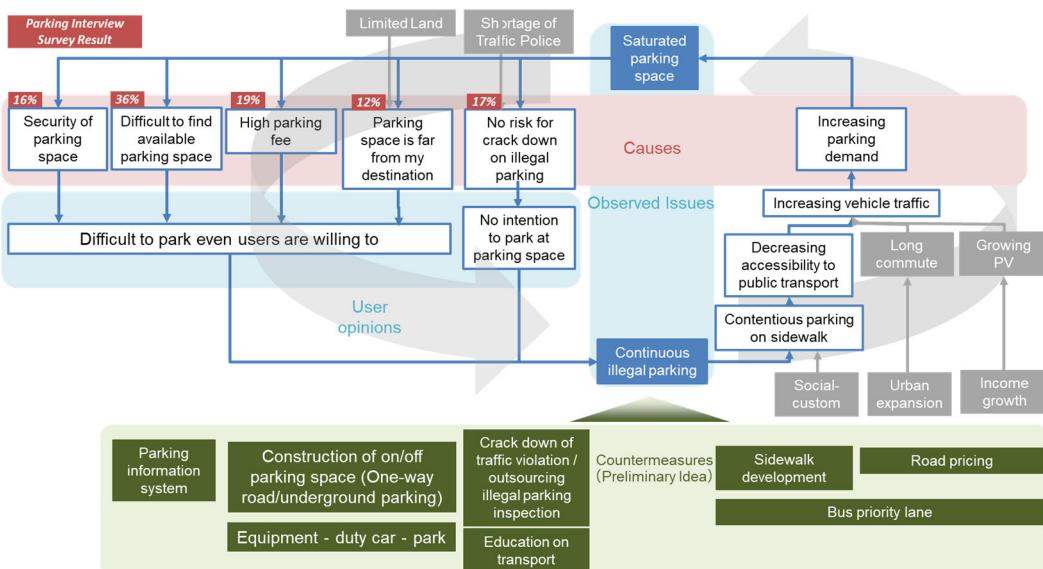


Figure VIII Issues for Achieving Goals of PPUTMP and Causal Relationship

7.2.3 Causal Relationship Analysis on On-street Parking Issues

As the reason for not parking in the parking lot, 36% of the respondents answered the difficulty to find available parking space, followed by 19% of the respondents answered the issue of parking fees, 17% of the respondents who assume there are no risk of crack down and 12 % of respondents who said that there was no parking lot near the destination. In addition to the issue of parking capacity, it is also necessary to provide parking information.

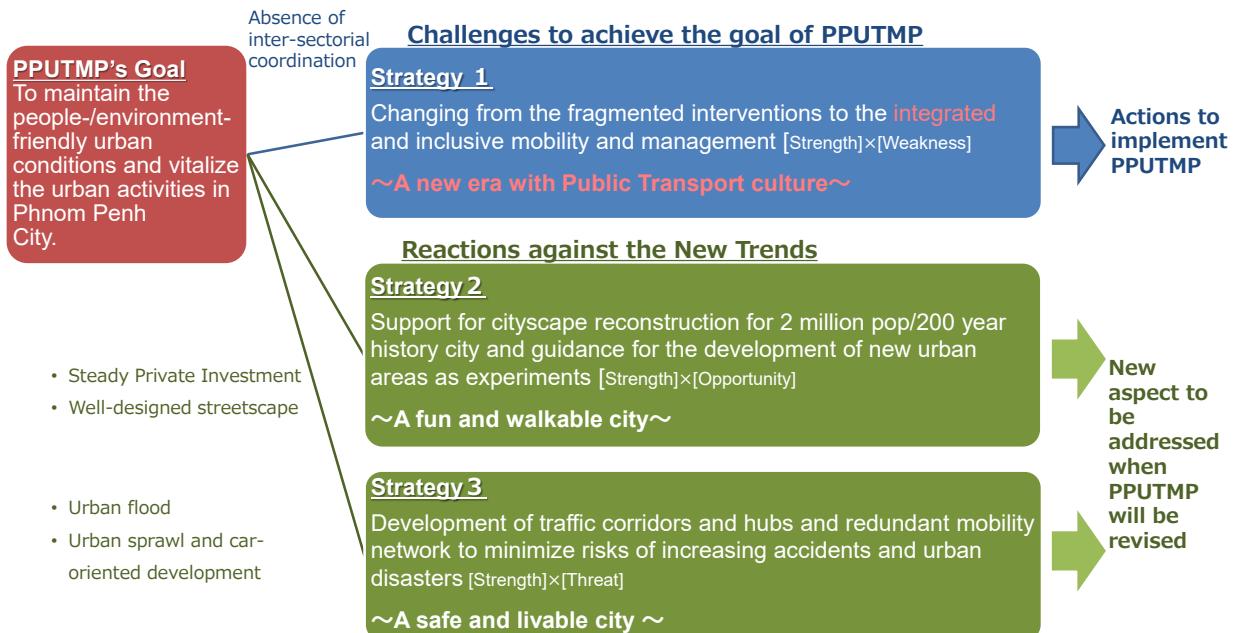


Source: JST

Figure IX Causal Relationship on On-street Parking Issues

Chapter 8 Development Scenario

The draft new conceptual strategy for urban transport based on the analysis of the internal and external factors through SWOT analysis and the perspective of strategic planning based on the pillars of "integrated strategy," "proactive strategy," and "reactive strategies" is shown in the figure below.



Source: JST

Figure X Draft New Conceptual Strategy for Urban Transport

a) Draft Development Scenario to Achieve the Goals of PPUTMP

Currently, major measures against the rapidly increasing traffic demand are road widening and bypass road developments that is relatively inexpensive and fast-acting. But it may promote further car dependency and parking space in future. It will damage the historic cityscape in Phnom Penh. In terms of public transport, Cambodia has a shorter history. To establish a public transport culture, it is necessary to shift from the current car-oriented development to create the public transport culture with punctual bus network and walkable sidewalk. It will continue to the development of mass transit in major corridors in the future.

b) Transport Sector Improvement Programmes and Time Frame to Achieve the Goal of PPUTMP

The following figure shows the transport sector improvement programmes and time frame to achieve the goal of PPUTMP.

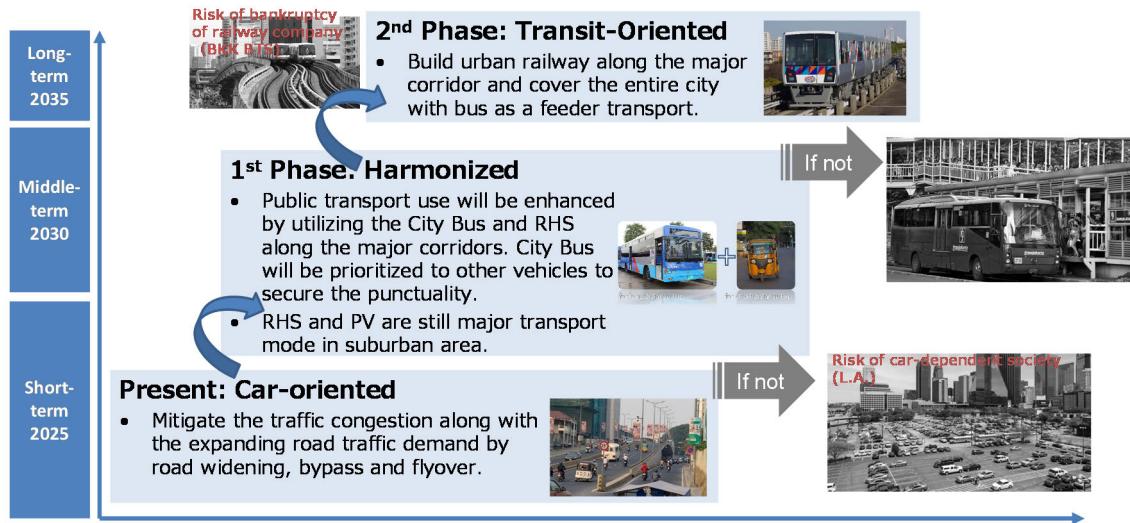


Figure XI Draft Development Scenario to Achieve the Goals of PPUTMP

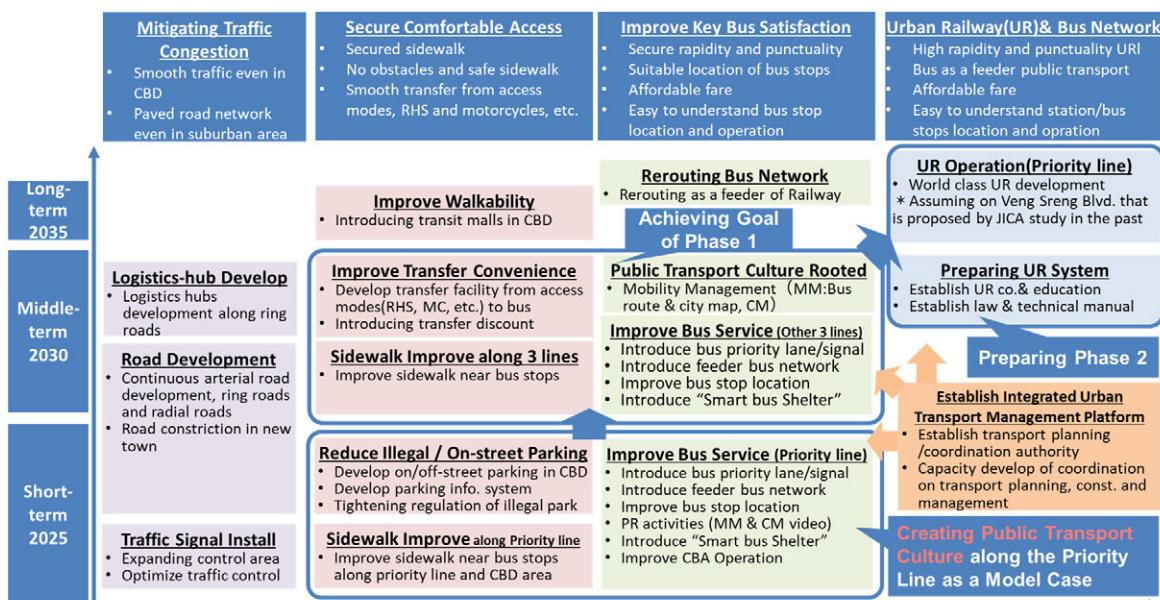


Figure XII Transport Sector Improvement Programmes and Time Frame

Chapter 9 Implementation Plan and Recommendation

JST recommends:

- To implement the proposed priority projects (bus priority lanes, sidewalk improvement, parking management) timely and in an integrated manner;
- To do so, to enhance coordination mechanism among stakeholders through establishment of urban transport platform in PPCA;

- To secure budget for proposed priority projects, the revision and approval of PPUTMP fully utilizing the study outputs;
- To maintain valuable urban transport database developed under this Project and utilize it to realize evidence-based priority projects and support stakeholder consultation process.

Chapter 1 Background and Objectives

1.1 Background

The Japan International Cooperation Agency or JICA has cooperated to conduct the Project for Comprehensive Urban Transport Plan in Phnom Penh Capital City (hereinafter referred to as "PPUTMP") with the target year of 2035 and consistently supported to improve the traffic condition in Phnom Penh. More specifically, many projects include the Project for Improvement of Transportation Capacity of Public Bus in Phnom Penh (Grant Aid), the Project for Improvement of Public Bus Operation in Phnom Penh (PiBO), the Project for Development of Traffic Management System in Phnom Penh (Grant Aid) and the Project for Capacity Development on Comprehensive Traffic Control Centre in Phnom Penh Capital City (Technical Cooperation Project). In addition, other donors such as the Asian Development Bank (ADB) are also providing support such as technical cooperation project, Supporting Sustainable Integrated Urban Public Transport Development (SSIUPTD), for building a transit-oriented network system, which is the basic policy of PPUTMP.

However, the number of new vehicles registered in Phnom Penh (including four-wheeled and two-wheeled vehicles), which was 300,000 in 2013, doubled to 580,000 in 2018; the car-oriented system remains unchanged and traffic congestion is getting worse. Furthermore, there are many issues that have not yet been improved since the formulation of PPUTMP, such as illegal parking on the street and lack of driving manners. In recent years, as Information and Communication Technology (ICT) and the mobile phone penetration rate increase, the Ride-Hailing Service (hereinafter referred to as "RHS") such as "PassApp", a RHS by a Cambodian national company, has been expanding. RHS in Phnom Penh is different from the RHS by automobile like other countries. It is mainly composed of three-wheeled taxis and due to the rapid increase of such vehicles, problems arise as it creates new competition with public transport and further decreases the average speed of main roads. A preparatory survey for Phnom Penh urban railway development project was conducted from 2017 to 2020 toward the introduction of a transit-oriented transport system, which is the key project of PPUTMP, but the project was postponed for the time being due to financial constraints of Cambodia and other reasons.

Based on the above background, Phnom Penh Capital Administration (hereinafter referred to as "PPCA") started the "2014 Phnom Penh Urban Transport Master Plan Revision Work (Data Collection Study)" (hereinafter referred to as "PPCA Survey"). The PPCA Survey started in February 2020 and completed in December 2021. The output will be used for the revision of PPUTMP. However, the PPCA Survey does not include quantitative analysis such as transport surveys and demand forecasts. Therefore, after conducting a quantitative analysis in the "Data Collection Survey on Urban Transport in Phnom Penh" (hereinafter referred to as "the Survey") and sharing the direction to solve the identified issues on urban transport in Phnom Penh with PPCA, the direction of future cooperation from JICA in the urban transport sector in Phnom Penh will be discussed. Furthermore, the quantitative research and analysis in this Survey will be the basis of the quantitative analysis for the future revision of PPUTMP by PPCA.

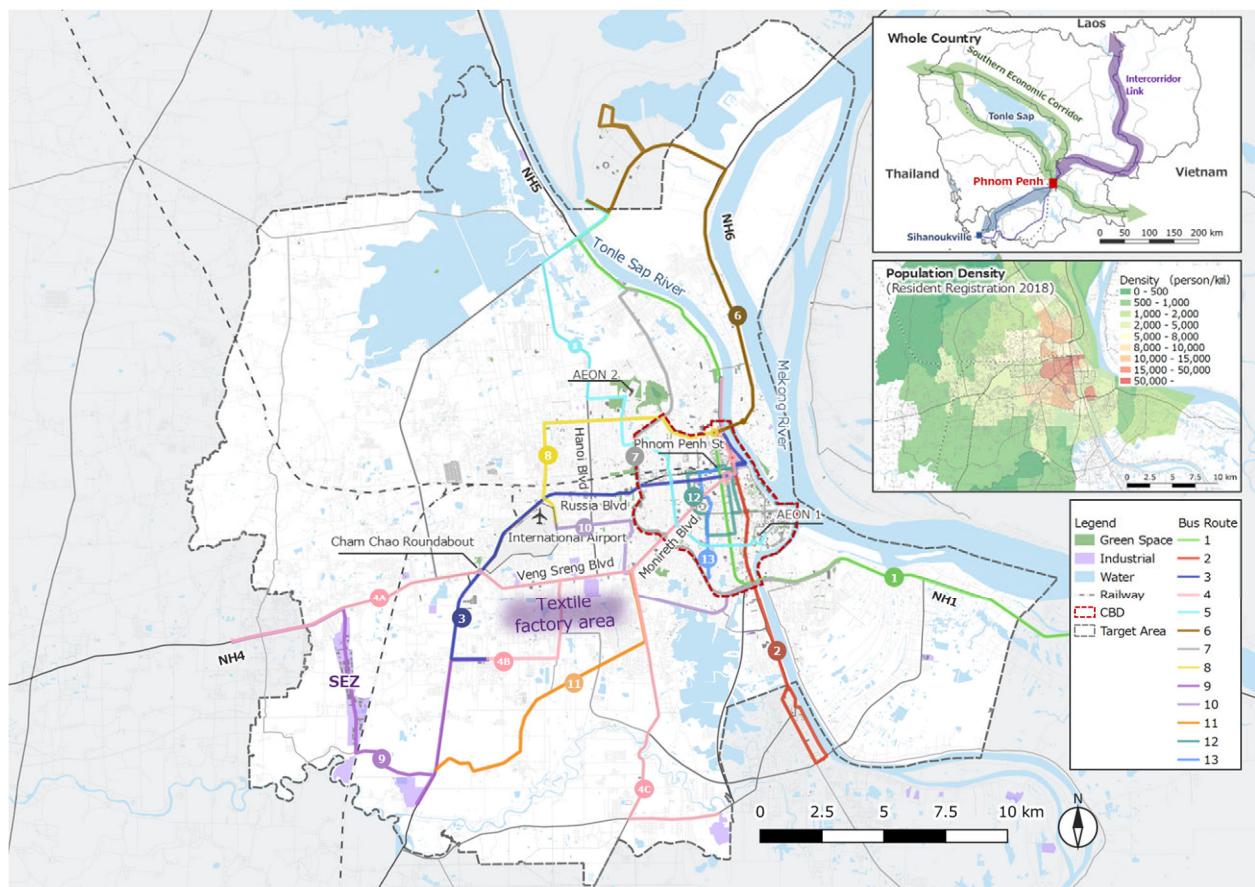
1.2 Objectives

As derived from the understanding of the background of the Survey, the purposes of the Survey are summarised as shown below:

- Updating the traffic data which was surveyed and analysed in PPUTMP in 2014,
- Conducting the interview surveys on new transport mode in Phnom Penh, RHS,
- Identifying the issues on transport sector in Phnom Penh as of today and
- Identifying the direction of cooperation and priority project in urban transport sector in Phnom Penh.

1.3 Target Area

The Survey area is the Phnom Penh Municipality Area as shown in Figure 1.3.1.



Source: JICA Survey Team (JST)

Figure 1.3.1 Target Area

1.4 Structure of Report

Following this Introduction in Chapter 1, Chapter 2 summarises the population and socio-economic condition that will be utilised to prepare inputs for the transport demand forecast and assessing the financial capability of Phnom Penh city on transport sector as well as social environmental conditions such as natural conditions.

Chapter 3 describes the existing condition of the urban transport sector in Phnom Penh, namely: 1) Institution, 2) Legal System 3) Financial Condition and 4) Infrastructure and facilities. Also, the current status of the urban logistics that has impact on passenger traffic is analysed.

Chapter 4 provides a brief introduction of the Upstream Policy/Plans and the status of projects which are implemented by PPCA, ADB and JICA.

Chapter 5 summarises the findings of Transport Surveys. Chapter 6 describes the transport demand forecast based on the result of Transport Surveys.

Chapter 7 describes the identified issues on urban transport sector from the collected information so far. In particular, the causes of failure in increasing public transport use, which is one of the goals of PPUTMP, are discussed based on the result of Transport Surveys as well as the causal relationship analysis.

Chapter 8 proposes the development scenarios to solve and improve the urban transport issues mentioned in Chapter 7.

Chapter 9 describes the next measures to be implemented by PPCA.

Chapter 2 Socio-economic Condition in Phnom Penh

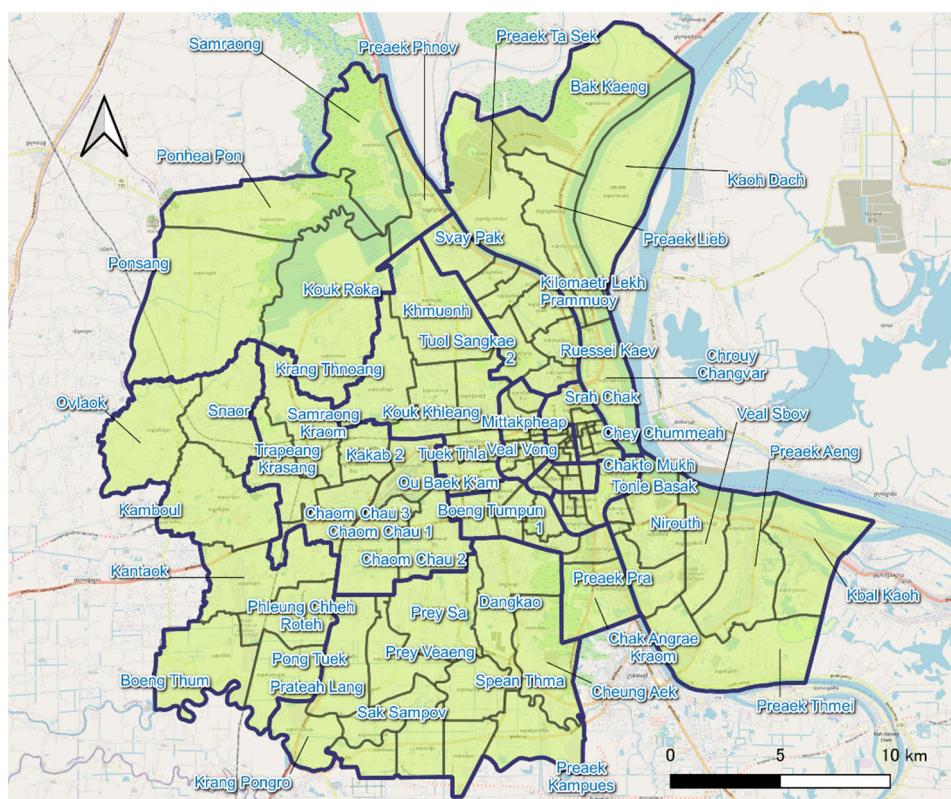
2.1 Demographic Condition

2.1.1 Administrative Division

Cambodia is composed of 24 provinces and one special administrative unit for Phnom Penh Capital City. The area of Phnom Penh Capital City is around 679 km², which is divided into 14 Khans (districts in English). In the Khans of Phnom Penh, there are 105 Sangkats (communes in English) and each Sangkat is further separated into Phums (villages in English). Administrative boundaries have been revised time to time by dividing an existing Khan/Sangkat.

Phnom Penh is fully surrounded by the neighbouring Kandal Province and the boundary with Kandal Province was changed by transferring some villages in Kanadal Province to Phnom Penh. For instance, in November 2016, the jurisdictions of Sangkat Bak Kaeng and Sangkat Preaek Ta Sek in Phnom Penh has expanded by receiving some villages from Kandal Province.

Furthermore, some Sangkats (communes) such as Phnom Penh Thmei and Tuek Thla were divided into two Sangkats. Figure 2.1.1 illustrates the Sangkat boundary in Phnom Penh Capital City as of 2022.



Source: JST

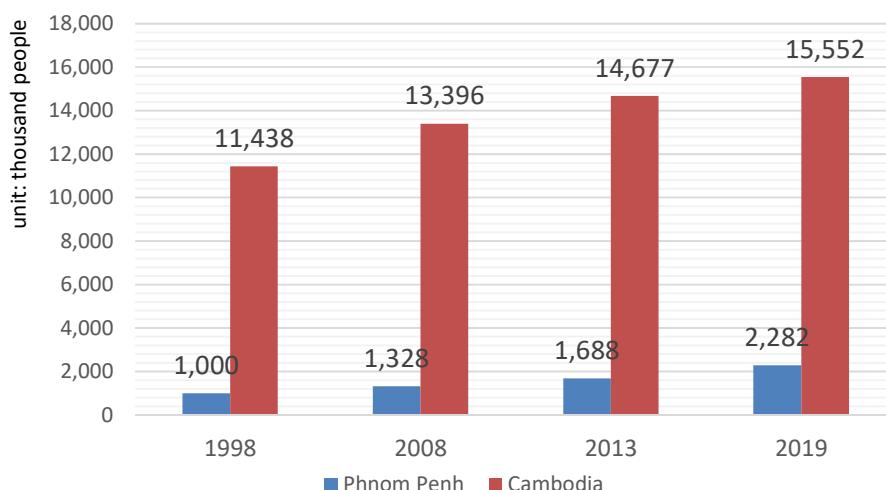
Figure 2.1.1 Sangkat Boundary as of 2022

2.1.2 Existing Population

(1) Trends of Population in Phnom Penh

The general population census was conducted in the Cambodia in 1998, 2008 and 2019. The most recent survey was conducted in 2019 and the final report was published in October 2020. Also, the inter-central population survey was conducted in 2013 sampling households to be surveyed and its accuracy is achieved at the province level. Generally, the population in Cambodia has been steadily increasing over the decades: 11.4 million in 1998 to 15.6 million in 2019 as shown in Figure 2.1.2.

The population of Phnom Penh is increasing in accordance with the large-scale urban development and attracts more citizens from other provinces with its economic importance, abundant employment opportunities and educational institutions. Phnom Penh occupies the highest share in the country's population at the provincial level at 14.7%, which increased from 9.9% in 2008¹. As a result, the population density in Phnom Penh is the highest in the country at 3,361 persons per km² while it is 87 persons per km² for the whole country.



Note: Population other than "Regular or Normal Household" is also included.

Source: General Population Census in 1998, 2008 and 2019 and Inter-censal population survey 2013

Figure 2.1.2 Population Change 1998-2019

As shown in Table 2.1.1, the most regular household in Cambodia is composed of 4 members and the percentage of smaller households as nuclear households became larger in recent years. The household size in Phnom Penh is larger than in other provinces as migrants from other provinces, who move to Phnom Penh because of job opportunities and education, often live with their relatives and friends.

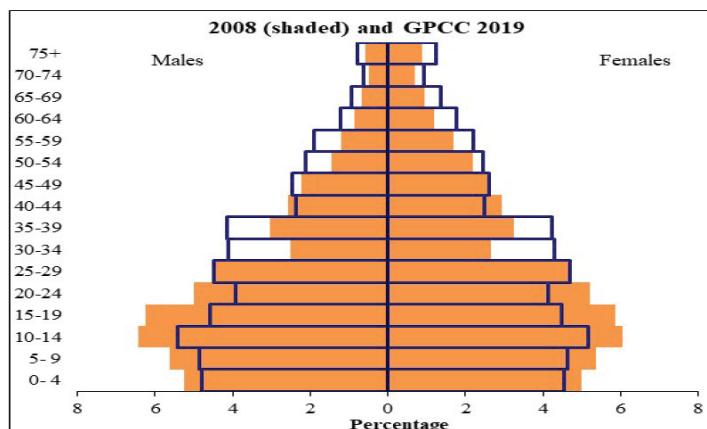
Table 2.1.1 Average Household Size

	1998	2008	2019
Phnom Penh	5.7	5.0	4.4
Cambodia	5.2	4.7	4.3

Source: General Population Census in 1998, 2008 and 2019

¹ Source: General Population Census in 2019

Figure 2.1.3 describes the distribution of population by age groups in 2008 and 2019. The largest age group is still the 10-14 age group, however, the trend of an aging population can be observed.



Source: General Population Census in 2019

Figure 2.1.3 Percent Distribution of Population in Cambodia by Age Group (2008, 2019)

(2) Population Distribution in Phnom Penh

There are five categories for household types in General Population Census, namely, “Regular or Normal Household”, “Institutional Household”, “Homeless Household”, “Boat Household” and “Transient Population”.

Table 2.1.2 Household Category in General Population Census

	Regular or Normal Household	Institutional Household	Homeless	Boat Household	Transient Population	Total
Population in 2019	2,189,460	73,474	1,678	1,096	16,243	2,281,951
Share	95.9%	3.2%	0.1%	0.0%	0.7%	

Note: Institutional Household is defined as household composed of unrelated persons, often seen at boarding houses, messes, hostels, residential hotels, rescue homes, jails and pagodas.

Source: General Population Census in 2019

The table below summarises the population in Phnom Penh by Khans in 2008 and 2019. The Central Business District (CBD) in Phnom Penh is composed of the 4 khans and newly created Khan named “Boeng Keng Kang”, which took 7 Sangkats from Khan Chamkar Mon in January 2019. The population share of CBD dropped from 38% in 2008 to 23% in 2019.

Table 2.1.3 Population Distribution by Khans (2008 and 2019)

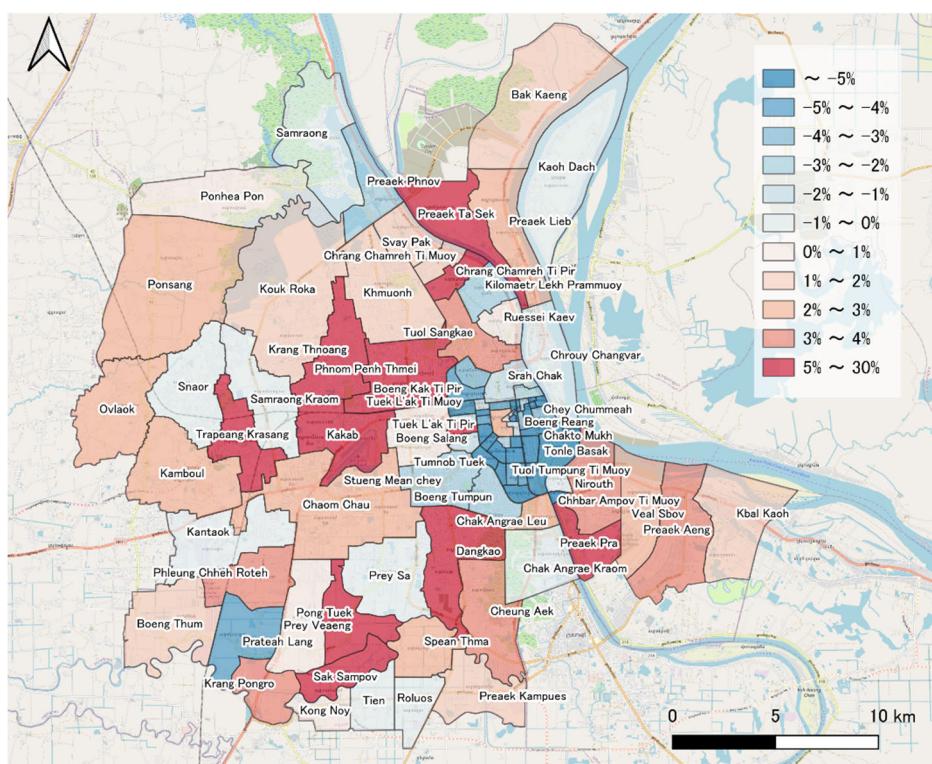
Khans	Population (1,000 people)		Remarks
	2008	2019	
CBD	1 Chamkar Mon	182	71
	2 Doun Penh	127	155
	3 Prampir Meakkra	92	71
	4 Tuol Kouk	171	146
	13 Boeng Keng Kang		67 This khan was created in January 2019 by taking 7 Sangkats from Chamkar Mon.
	Sub-total	572	510

Khans		Population (1,000 people)		Remarks
		2008	2019	
Other Area	5	Dangkao	73	160
	6	Mean Chey	195	248
	7	Ruessei Kaev	135	275
	8	Saensokh	126	183
	9	Pou Saenchey	159	227
	10	Chrouy Changvar	61	159
	11	Preæk Phnov	47	188
	12	Chhbar Ampov	133	164
	14	Kambol		76 It used to be a part of Kandal Province. Integrated into Phnom Penh in January 2019.
	Sub-total		930	1,680
Total		1,502	2,190	
Population Share of CBD		38%	23%	

Note: The figures include “Regular or Normal Household” population only.

Source: General Population Census in 2008 and 2019

Figure 2.1.4 describes the compound annual growth rate (CAGR) of the population of Khans from 2014 to 2018. While the population in the Central Business District (CBD)², where the population density is higher than other areas in Phnom Penh, is decreasing at CAGR -3.82%, the population is increasing outside CBD at CAGR 2.43%. The population in Sangkats outside IRR (Inner Ring Road) such as Sangkat Krang Thnoang, Sangkat Kakab and Sangkat Dangkao marked high growth rate.



Note: The Sangkats boundaries are not the latest for comparing population in different years.

Source: JST created based on the population data of Commune data base in 2014 and 2018

Figure 2.1.4 Compound Annual Growth Rate of Population by Sangkats

² CBD: 5 districts of Chamkar Mon, Doun Penh, Prampi Makara, Tuol Kouk and Boeng Keng Kang.

(3) Demographic Indicators

Basic demographic indicators are collected from the result of General Population Census 2019. Those are key indicators for forecasting the future population.

Fertility Rate

The age-specific fertility rate (ASFR) and the total fertility rate (TFR) in Cambodia are shown in Table 2.1.4. The TFR in 2019 was around 2.5, which has decreased from around 2.7 in 2008.

Table 2.1.4 Estimated ASFR and TFR by Area in Cambodia (2019)

	Total	Urban	Rural
Age-Specific Fertility Rate (ASFR)			
15-19	0.03215	0.02299	0.03800
20-24	0.12595	0.09591	0.15108
25-29	0.13661	0.12315	0.15224
30-34	0.10811	0.10630	0.11432
35-39	0.06192	0.06053	0.06546
40-44	0.02800	0.02632	0.02963
45-49	0.00962	0.00859	0.01034
Total Fertility Rate (TFR)	2.51	2.22	2.81
Crude Birth Rate (CBR)	37.73	31.81	41.83
General Fertility Rate (GFR)	52.15	41.74	59.32
Child Woman Ratio (CWR)	341.16	287.15	379.70

ASFR: The number of births to women of a given age group divided by the number of women in that age group.

TFR: The average number of children that would be born to a woman by the time she ended childbearing, if she were to pass through all her childbearing years conforming to the age-specific fertility rates of a given year.

CBR: The number of live births per 1,000 population in a given year.

GFR: The number of live births per 1,000 women ages 15 to 49 in a given year.

CWR: The number of children under age 5, per 1,000 women of childbearing age in a given year.

Source: General Population Census in 2019

Mortality

The infant mortality rate (IMR) for both sexes was 17.6 in Cambodia, which is not relatively high compared to other ASEAN countries. For instance, the IMR of Indonesia, Lao and Malaysia are 16, 33 and 5³. The reasons of the slightly higher IMR in rural areas are considered to be the access to hygienic facilities and the educations level of parents, which are also generally the case in other countries.

Table 2.1.5 Estimates of Early-age Mortality and Life Expectancy in Cambodia (2019)

Sex and Area	Infant Mortality Rate (IMR)	Under-Five Mortality Rate (UMR)	Life Expectancy at Birth
Total			
Both Sexes	17.6	28.1	75.5
Male	20.6	31.7	74.3
Female	14.6	24.3	76.8

IMR: The number of deaths of infants under age 1 per 1,000 live births in a given year.

UMR: The probability of death from birth to age 5.

Source: General Population Census in 2019

³ Source in General Population Census in 2019: United Nations 2019

Migration

As shown in Table 2.1.6, the migration to another province occupies higher share in 2019 compared to 2008. The most common reason for migrations in 2008 and 2019 was “to move with their families”, which is considered to be associated with “transfer to workplace” and “in search of employment and marriage”. This suggests that Phnom Penh will attract more migrants from other provinces with its rich job opportunities and educational institutions.

Table 2.1.6 Distribution of Migrants by Previous Residence in Cambodia (2008-2019)

Previous Residence	Both Sexes		Male		Female	
	2008	2019	2008	2019	2008	2019
Number of migrants	3,552,173	3,318,402	1,792,519	1,742,311	1,759,654	1,576,091
Within the province of Enumeration (%)	51.3%	37.1%	52.3%	38.0%	50.4%	36.1%
In another province (%)	46.0%	58.8%	45.0%	57.6%	47.0%	60.2%
Outside Cambodia (%)	2.7%	4.1%	2.7%	4.4%	2.6%	3.7%

Note: Excluding migrants whose previous residence was not classified.

Source: General Population Census in 2019

Employed Population and Number of Students in Phnom Penh

According to the General Population Census in 2019, the employed population and the number of students in Phnom Penh are 1.2 million and 0.5 million respectively as shown in Table 2.1.7. Table 2.1.8 summarises the employed population and the number of students in 2008 and 2019.

Table 2.1.7 Population by Main Activities during the Last Year (Phnom Penh)

District		Employed	Un-employed	Never Employed	Home Maker	Student	Dependent	Income Recipient	Other	
CBD	1	Chamkar Mon	40,120	67	254	6,724	15,135	3,032	1,337	49
	2	Doun Penh	85,592	260	835	15,571	34,471	5,451	3,484	99
	3	Prampir Meakkakra	39,222	207	710	7,580	16,220	2,712	872	41
	4	Tuol Kouk	77,842	263	1,343	14,726	34,604	4,935	2,709	51
	13	Boeng Keng Kang	36,182	77	331	6,403	14,742	3,320	1,617	35
Non-CBD	5	Dangkao	82,663	269	1,613	17,207	34,981	6,290	1,394	166
	6	Mean Chey	139,423	294	825	22,820	54,866	9,686	1,926	94
	7	Ruessei Kaev	145,176	528	1,786	29,695	61,594	10,036	2,383	105
	8	Saen Sokh	91,662	172	595	19,845	46,209	7,582	1,688	439
	9	Pou Saenchey	142,599	320	1,258	18,420	40,134	6,169	948	40
	10	Chrouy Changvar	81,762	249	1,247	14,062	38,558	8,562	1,190	56
	11	Preah Phnov	99,552	173	1,324	14,617	45,198	9,631	754	56
	12	Chhbar Ampov	82,148	341	1,221	18,745	37,876	7,257	2,627	111
	14	Kambol	44,597	131	326	5,702	14,776	2,630	407	7
	Total		1,188,540	3,351	13,668	212,117	489,364	87,293	23,336	1,349

Unit: People

Note: Exclude persons less than 5 years old and persons with no answers. Include only “Regular and Normal Household”

Note: “Employed” includes “Employer”, “Paid employee”, “Own-account worker” and “Unpaid family worker”.

Source: JST tabulated the General Population Census (2019)

Table 2.1.8 Employed Population and Number of Students in 2008 and 2019 (Phnom Penh)

District			Employed Population (Unit: 1000)		Number of Students (Unit: 1000)		Remarks
			2008	2019	2008	2019	
CBD	1	Chamkar Mon	84	40	51	15	Boeng Keng Kang was created taking 7 Sangkats from Chamkar Mon in January 2019.
	2	Doun Penh	59	86	34	34	
	3	Prampir Meakkakra	42	39	26	16	
	4	Tuol Kouk	77	78	50	35	
	13	Boeng Keng Kang	N/A	36	N/A	15	This khan was created in January 2019 by taking 7 Sangkats from Chamkar Mon.
Non-CBD	5	Dangkao	38	83	18	35	
	6	Mean Chey	113	139	42	55	
	7	Ruessei Kaev	55	145	25	62	
	8	Saensokh	59	92	31	46	
	9	Pou Saenchey	91	143	33	40	
	10	Chrouy Changvar	31	82	14	39	
	11	Preæk Phnov	24	100	11	45	
	12	Chhbar Ampov	61	82	33	38	
	14	Kambol	N/A	45	N/A	15	It used to be a part of Kandal Province. Integrated into Phnom Penh in January 2019.
	Total		734	1,189	369	489	

Source (2008): JST for “Preparatory Survey for Phnom Penh Urban Railway Development Project” estimated based on General Population Census (2008)

Source (2019): JST tabulated the General Population Census (2019). Only “Regular or Normal Households” are included.

Ownership of Cars and Motorcycles in Phnom Penh

Table 2.1.9 describes the average number of vehicles per household in Phnom Penh. On average, each household owns 0.35 cars and 1.57 motorcycles. As shown in Table 2.1.10, the percentage of households that own cars increased in Phnom Penh.

Table 2.1.9 Average Number of Vehicles Owned by Household (Phnom Penh)

	District		Car	Motorcycle
CBD	01	Chamkar Mon	0.51	1.62
	02	Doun Penh	0.46	1.65
	03	Prampir Meakkakra	0.35	1.59
	04	Tuol Kouk	0.58	1.84
	13	Boeng Keng Kang	0.64	1.80
Non-CBD	05	Dangkao	0.36	1.62
	06	Mean Chey	0.29	1.59
	07	Ruessei Kaev	0.37	1.55
	08	Saensokh	0.42	1.67
	09	Pou Saenchey	0.18	1.23
	10	Chrouy Changvar	0.34	1.61
	11	Preæk Phnov	0.24	1.59
	12	Chhbar Ampov	0.34	1.68
	14	Kambol	0.22	1.38
Phnom Penh			0.35	1.57

Source: JST tabulated the General Population Census (2019). Include only “Regular or Normal Household”.

Table 2.1.10 Distribution of Vehicle Ownership per Household (Phnom Penh)

Vehicle Ownership	Year: 2012 (PPUTMP based on Person Trip Survey)		Year: 2019 (General Population Census 2019)	
	Number of Households	Percentage	Number of Households	Percentage
No Vehicles	29,300	7.8%	53,947	10.8%
1 Motorcycle	131,400	35.0%	181,426	36.3%
2 Motorcycles or more	145,700	38.8%	132,116	26.5%
Car	69,300	18.4%	131,810	26.4%
Total	375,700	100.0%	499,299	100.0%

Note: “Car” includes households with cars only and households with cars and motorcycles.

Source (2012): PPUTMP (estimated based on home interview survey)

Source (2019): Tabulated by JST based on General Population Census (2019). Include only “Regular or Normal Household”.

2.1.3 Future Population

(1) Future Population in Phnom Penh

The National Institute of Statistics (NIS) estimates population projections in each province from 2008 to 2030. This data is shared with the Ministry of Land Management, Urban Planning and Construction (MLMUPC) to prepare an Urban Master Plan in each city encouraged by National Strategic Development Plan (NSDP) 2019-2023. For taking account of such circumstances, JST respects the population projection by NIS. Based on the Compound Annual Growth Rate (CAGR) of the population projection and the “Regular or Normal Household” population in 2019, the future population is calculated as shown in Table 2.1.11. As a result, the population of about 2.19 million in 2019 is forecasted to increase to about 2.62 million in 2035 in Phnom Penh.

Table 2.1.11 Population Estimates in Phnom Penh

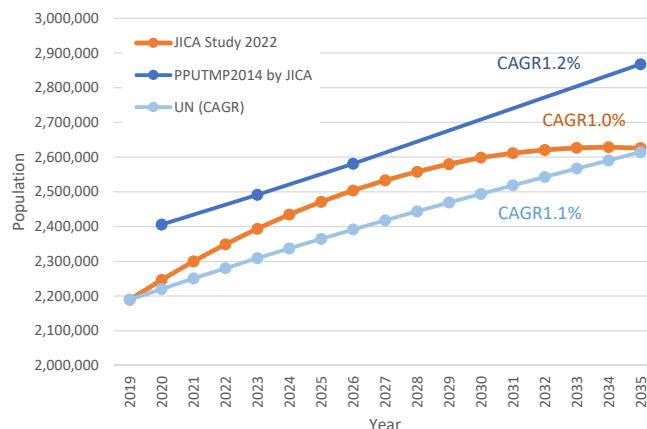
Year	2019	2020	2025	2030	2035
Phnom Penh	2,189.5	2,189.5	2,471.1	2,598.7	2,626.3

Unit: 1000 people

Note: Population is above 5 years old

Source: The population (2019) refers to General Population Census (2019) and the others are estimated by JST

Figure 2.1.5 compares three population estimates by JST, PPUTMP, and the data estimated using the CAGR of World Population Prospects by UN and General Population Census (2019). There is a difference of about 0.24 million population from PPUTMP because it covers the entire population in Phnom Penh. Meanwhile, JST targets on “Regular or Normal Household” population only. Since, in terms of CAGR, there is no significant difference, the estimated number by JST is appropriate and could be utilized for future traffic demand analyses.



Source: "JICA Study 2022" refers to General Population Census (2019) and the estimation by JST
 "PPUTMP 2014 by JICA" refers to the result of PPUTMP
 "UN (CAGR)" calculated with a basis of the CAGR (Medium) by UN World Population Prospect 2019 and General Population Census (2019)

Figure 2.1.5 Comparison of Population Estimates

Based on the future framework, the existing and future populations are distributed into TAZ. The distribution calculation accounted for several TAZ-base data, such as CAGR, population density, urbanization situation and development speed, and future urban development project plans in Phnom Penh. As discussed before, the population in CBD decreased from 2008 to 2019, according to the General Population Census (2019). Most of the land has been developed in CBD, and the average population density marked very high compared to other areas, say 374 per./ha in 2019. Furthermore, 99.5% of the land has already been developed⁴.

Meanwhile, outside CBD still has spaces for urban development since the urbanized land occupies 62.6% of the total land⁵. From such circumstance, the population is anticipated to increase outside CBD in the future in accordance with the urbanization trend. The following figures illustrate the population density by TAZ in 2019 and 2035. According to the estimation, the population is expected to increase along with North, South, and West directions from CBD.

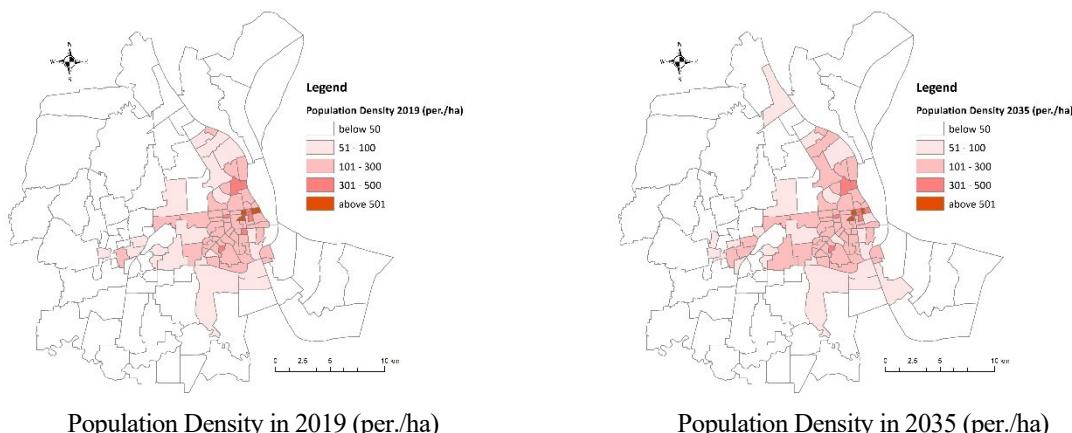


Figure 2.1.6 Population Density by TAZ in 2019 and 2035 in Phnom Penh

⁴ The data is 2020 and the source is JST based on the data of PPUTMP

⁵ The data is 2020 and the source is JST based on the data of PPUTMP

(2) Number of Employed Population and Student in Phnom Penh

Table 2.1.12 shows the estimated number of employed population and student who is over five years old in Phnom Penh from 2019 to 2035. The number of employees and students will increase steadily as the population grows. Concerning employment in Phnom Penh, the impact of the COVID-19 pandemic has already been recovered. Because the unemployment rate in Phnom Penh was 1.3% based on the Person Trip Survey (PT) / Commuter Survey (CS) in 2022, which is a similar rate before the pandemic, 1.4% in 2019.

Table 2.1.12 Future Estimation of Employed Population and Student in Phnom Penh

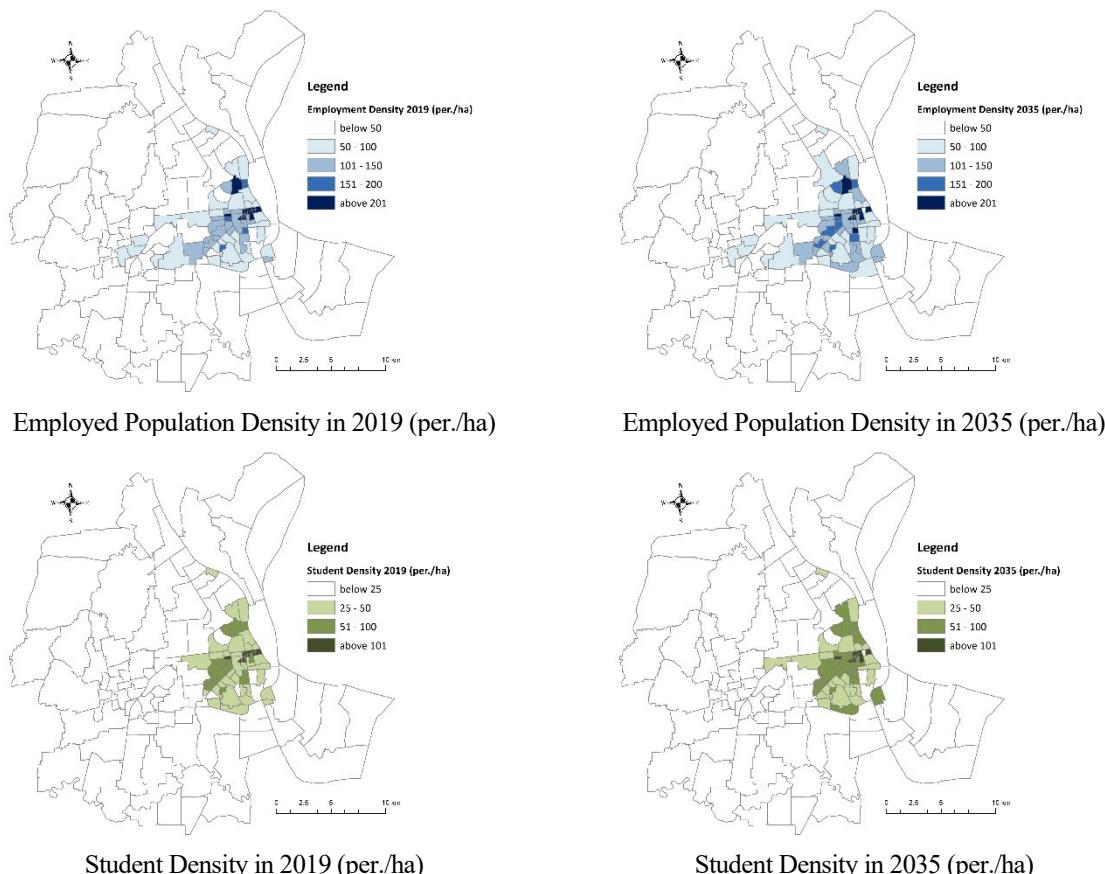
Year	2019	2020	2025	2030	2035
Employed Population	1,189	1,219	1,341	1,411	1,426
Number of Student	489	502	552	581	587

Unit: 1000 people

Note: Employed population and student are above 5 years old

Source: The population (2019) refers to General Population Census (2019) and the others are estimated by JST

Based on the future perspectives and the population growth, the distribution of the employed population and students over 5 years old are illustrated as follows. Same as for the population, the employed population and students are estimated to increase along with North, South, and West directions from the CBD.



Note: Employed population and student are above 5 years old
Source: JST

Figure 2.1.7 Density of Employed Population and Student by TAZ in 2019 and 2035 in Phnom Penh

2.2 Economic and Financial Condition

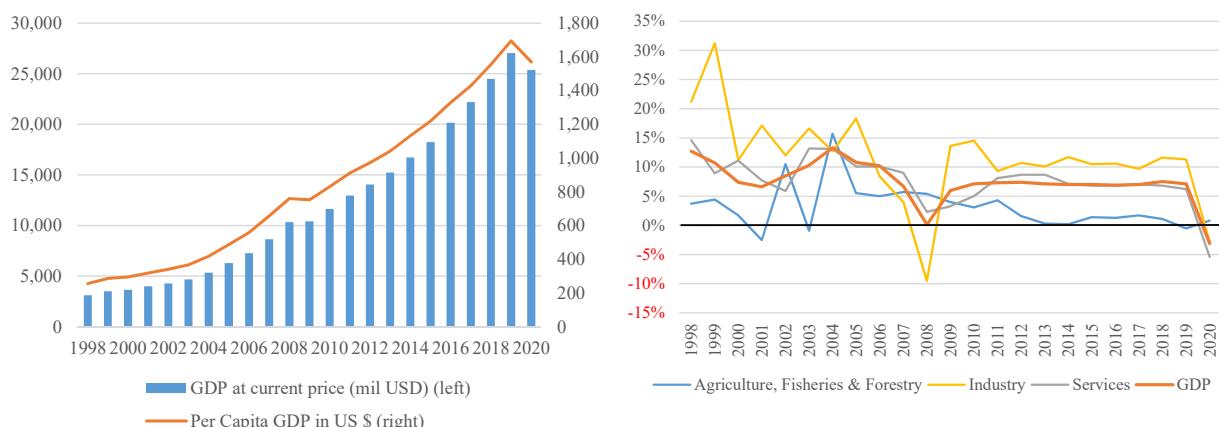
2.2.1 Economic Condition

(1) GDP

The Cambodian economy has achieved a steady economic growth until 2019, with the average annual growth rate of 7.1% from 2015 to 2019. The nominal GDP in 2020 has reached USD 25.383 billion, and the per capita income was USD 1,570, after transforming from a low-income country to officially a lower middle-income status in 2015 (Figure 2.2.1).

The sectoral growth shows that industrial and service sectors have led the steady growth from 2015 to 2019, with the average growth rate of 10.7% and 6.7% respectively. The sub sectors of the industrial sector include construction, real estate and manufacturing. Notably, the garment sector has led the robust growth. Meanwhile, the agriculture sector achieved slow growth at 1.0% during the same period (Figure 2.2.2).

The COVID-19 pandemic hit the Cambodian economy with a collapse in external demand in 2020 and community spread of the virus in 2021. The lockdowns and temporary factory closures hit production in the garments, travel goods and the footwear sectors. The growth has contracted by 3.1% in 2020 despite extensive government support. The services sector recorded a negative growth of 5.4%, and the industrial sector of negative 2.8%. Contrary, the agriculture sector has managed to maintain a positive growth of 0.8%.



Source: 1998-2015: National Institute of Statistics, 2016-2020: Economic and Monetary Statistics, National Bank of Cambodia, July 2021

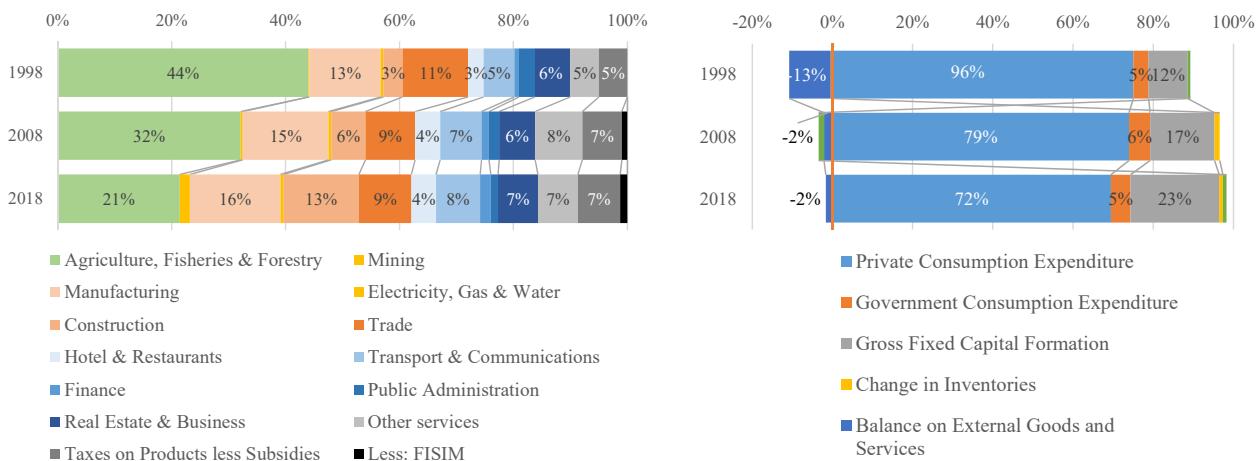
Figure 2.2.1 GDP at Current Price in Million USD and per Capita GDP (1998-2020)

Figure 2.2.2 GDP Growth by Sector (1998-2020)

The transition of the GDP by sector in Figure 2.2.3 shows a growing presence of industrial and service sectors over agriculture. The contribution of agriculture, industrial and service sectors to GDP in 2018 was 21.4%, 29.7% and 29.2%, respectively. Manufacturing and construction sub sectors are the main drivers of the industrial sector, and transport & communications and real estate & business in the service sub sector are also expanding.

In terms of GDP by expenditure, private consumption expenditure composed 72% in 2018, while the share of gross fixed capital formation increased to 23%. The shares of government consumption expenditure and change in inventories are small, and the balance of external goods and services show negative figures due to trade deficits (Figure 2.2.4).

As the average gross fixed capital formation (% of GDP) in East Asia & Pacific countries was 31% in 2018 (i.e., China; 43%, Indonesia; 32% and Lao PDR; 29%) (World Bank national accounts data), which is higher than Cambodia, there would be room to expand the capital investment in infrastructure, factories or office buildings to support the future growth.



Source: National Institute of Statistics

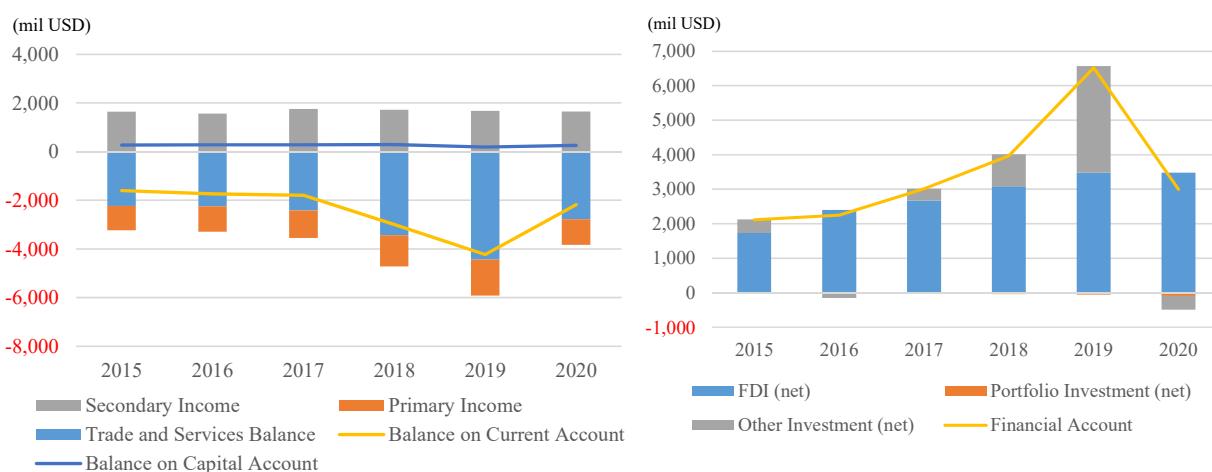
Figure 2.2.3 GDP by Sector (1998, 2008, 2018)

Figure 2.2.4 GDP by Expenditure (1998, 2008, 2018)

(2) Balance of Payments

1) Current and Capital Account

The current account has been in a deficit due to the deficits in trade and services balance. The current account deficits amounted to 15.7% of GDP (USD 4.2 billion) in 2019, and it narrowed to 8.6% of GDP (USD 2.2 billion) in 2020 due to the decline in import volume and increase in export volume, resulting in improvement of the current account. The balance on the capital account has been in surplus, showing a steady inflow of international capital transfers (Figure 2.2.5).

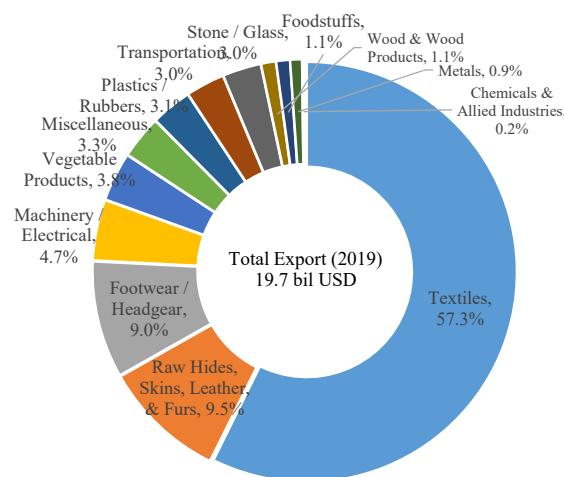


Source: National Bank of Cambodia

Figure 2.2.5 Current and Capital Account (2015-2020)

Figure 2.2.6 Financial Account (2015-2020)

The increasing import of raw material and machinery for export production is a main factor of the trade deficit. Cambodia imports raw materials and machinery from Asian countries such as China, Thailand and Vietnam, and exports textiles, wire harness and footwear to the U.S., Singapore, China, Japan, Germany, etc. In export products in 2019, textiles, wire harness and footwear were the majority which accounted for 75.7% of total exports (Figure 2.2.7). The important import products were fabrics, fibres, fuels, machinery, electric equipment and vehicles (Figure 2.2.8). While electrical machinery was only 4.7% of export in 2019, product diversification into the high value chain will make the manufacturing sector more competitive and contribute to the reduction of trade deficits.



Source: UNCOMTRADE

Figure 2.2.7 Export Products (2019)

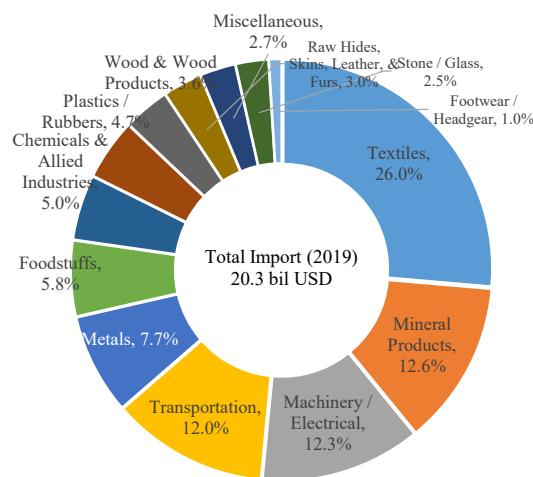


Figure 2.2.8 Import Products (2019)

2) Financial Account

A small open economy with strong inflows of foreign direct investment (FDI) has led to the surplus in the financial account (Figure 2.2.6). The FDI inflows accounted for 13.7% of GDP in 2020 compared to 12.9% in 2019, supported by FDI in banking, construction, real estate and tourism sectors. Meanwhile the investment in the manufacturing, garment and footwear sectors remain the largest share. According to the Council for the Development of Cambodia (CDC), China has been the leading foreign direct investor for five consecutive years from 2013-2017, pumping in FDI worth USD 5.3 billion.

(3) Economy in Phnom Penh

While the available data related to the economic activities of Phnom Penh is limited, the following data describes the economic trends of Phnom Penh.

1) Disposal Income

The Cambodia Socio-Economic Survey (CSES) published by NIS covers the indicators of household income and liabilities, household consumption, economic activities, etc. Figure 2.2.9 shows the average monthly disposable income per capita by area. In 2019/20, per capita disposal income in Phnom Penh was 903 thousand KHR (Cambodian Riel), 1.7 times of the per capita disposal income in Cambodia in general of 523 thousand KHR. The annual average growth rate of per capita disposal income in Phnom Penh between 2009 and 2019/20 was 9.96%, lower than other rural areas. The growth rate of other rural area

(14.78%) was the highest among the category, indicating a narrower economic disparities between Phnom Penh and the rural area.

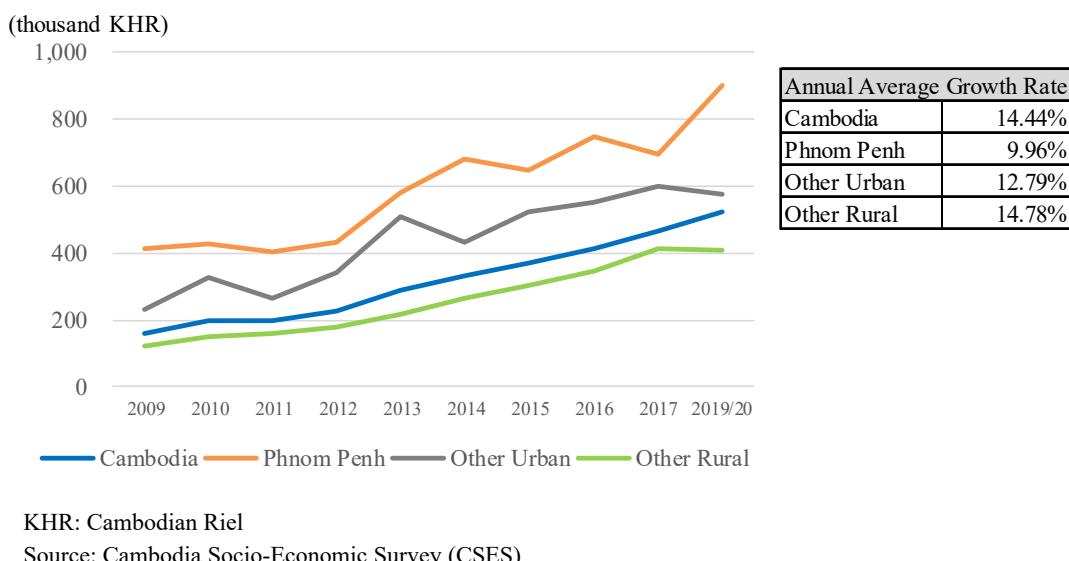


Figure 2.2.9 Average Monthly Disposable Income per Capita by Region (2009-2019/20)

2) Private Entities' Activities

The private entities' activities and economic scale are shown in the Economic Census of Cambodia 2011 and the Cambodian 2014 Inter Censal Economic Survey. The Preliminary Result of the Economic Census of Cambodia 2022 was released in January 2023, however, the performance of business entities was not included. Table 2.2.1 shows the number of entities, amount of annual sales, annual expenses and profit and loss in Cambodia and Phnom Penh. The number of entities in Phnom Penh was only 18.8% in 2011 and 18.9% in 2014, but the number of sales accounted for 55.4% in 2011 and 51.3% in 2014, which implies a higher productivity per entity. In 2011, the productivity per entity in Phnom Penh was three times higher than Cambodia total (USD 75.5 thousand in Phnom Penh and USD 25.5 thousand in Cambodia). In 2014, the productivity gap between Phnom Penh and Cambodia has reduced to 2.7 (USD 119.2 thousand in Phnom Penh and USD 44.0 thousand in Cambodia). The table shows Phnom Penh as the productive economic centre.

Table 2.2.1 Economy in Phnom Penh (2011, 2014)

	2011			2014		
	Cambodia	Phnom Penh	Phnom Penh (%)	Cambodia	Phnom Penh	Phnom Penh (%)
Number of Entities	496,355	93,119	18.8%	513,759	97,200	18.9%
Amount of Annual Sales (mil USD)	12,678	7,027	55.4%	22,612	11,590	51.3%
Amount of Annual Expenses (mil USD)	10,979	6,303	57.4%	18,836	9,976	53.0%
Amount of Annual Profit and Loss (mil USD)	1,699	724	42.6%	3,776	1,614	42.7%
Productivity per Entity (thousand USD)	25.5	75.5		44.0	119.2	

Source: Economic Census of Cambodia 2011, Cambodian 2014 Inter Censal Economic Survey

2.2.2 Financial Condition

(1) National Government

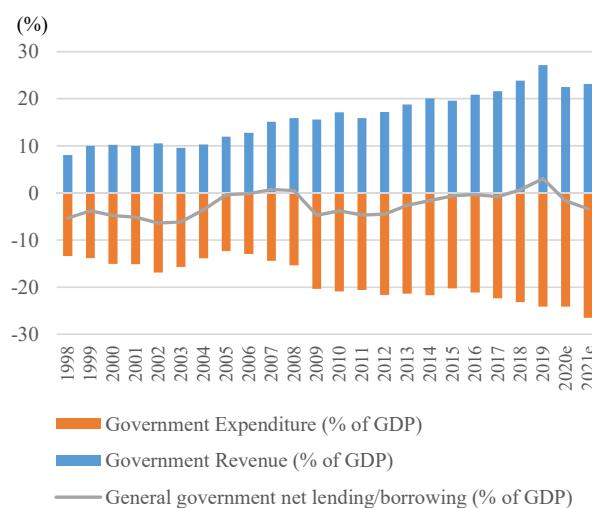
The Cambodian government has maintained the public finance well by keeping the budget deficit below 5% of GDP (Figure 2.2.10). In the implementation of Revenue Mobilization Strategy (RMS) 2014-2018, the vision of “increase the total current revenue by at least 0.5% in addition to the ratio of current revenue to GDP annually” was achieved by collecting the revenue of more than 1.0% of GDP during 2014-2018 on average (1.02% as shown in Table 2.2.2). In response to COVID-19, the tax revenues have suffered with the downturn and demands on healthcare and social assistance have increased in 2020-2021, and the fiscal deficits are expected to widen in a short term.

Meanwhile, based on the public debt management strategy, the public debt has been stable, while it amounted to around USD 9.5 billion (36.2% of GDP) in 2021 due to COVID-19 (Figure 2.2.11). With growth and appropriate policies, fiscal deficits are expected to shrink, containing debt over the medium term.

Table 2.2.2 Trend of Nominal GDP and Revenue in Cambodia (2014-2022)

	2014	2015	2016	2017	2018	2019	2020	2021	2022
Nominal GDP (Billion KHR)	67,436	73,421	81,244	89,753	98,919	110,014	103,512	109,311	118,982
Nominal GDP Growth Rate	10.0%	8.9%	10.7%	10.5%	10.2%	10.5%	-5.9%	5.6%	8.8%
Revenue (Billion KHR)	13,538	14,410	16,913	19,387	23,599	29,461	25,335	24,269	26,784
Revenue Growth Rate	17.7%	6.4%	17.4%	14.6%	21.7%	24.8%	-14.0%	-4.2%	10.4%
Revenue / GDP	20.1%	19.6%	20.8%	21.6%	23.9%	26.8%	24.5%	22.2%	22.5%
Growth Rate of Revenue / GDP	1.3%	-0.4%	1.2%	0.8%	2.3%	3.1%	-2.3%	-2.3%	0.3%
Average Growth Rate of Revenue / GDP (2014-2018)	1.02%								

Source: IMF World Economic Outlook Database



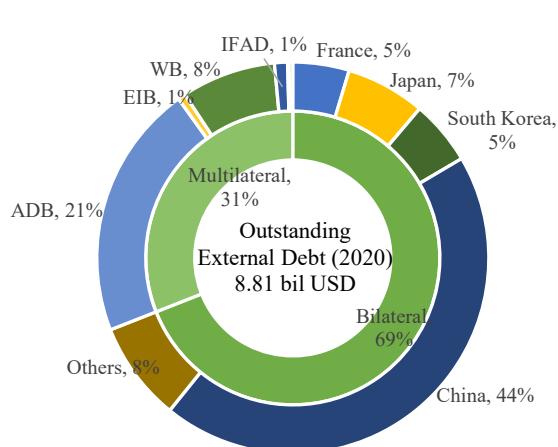
Source: IMF World Economic Outlook Database

Figure 2.2.10 Fiscal Balance (1998-2021)



Figure 2.2.11 Public Debt (% of GDP) (1998-2021)

According to the Cambodian Public Debt Statistical Bulletin, as of year-end 2021, the Cambodian government had a total public debt outstanding of USD 9.49 billion. As the public domestic debt had been fully repaid on 11 February 2020, all of the public debt is considered as public external debt. The outstanding external debt by the creditor is composed of bilateral (69%) and multilateral (31%), of which the largest single creditor is China (44%), followed by ADB (20%), Japan (9%) and World Bank (8%) (Figure 2.2.12). AIIB was added as a creditor for the first time in 2021 (USD 5 million). The redemption profile based on the outstanding external debt as of year-end 2021 shows that the repayment fee of principal, interest and other fees will reach 661 million in 2027, and it will decline gradually (Figure 2.2.13). As the economy progresses with a support of foreign debt, the redemption profile will be updated.



Source: Cambodia Public Debt Statistical Bulletin

Figure 2.2.12 Outstanding External Debt by Creditor (as of year-end 2020)

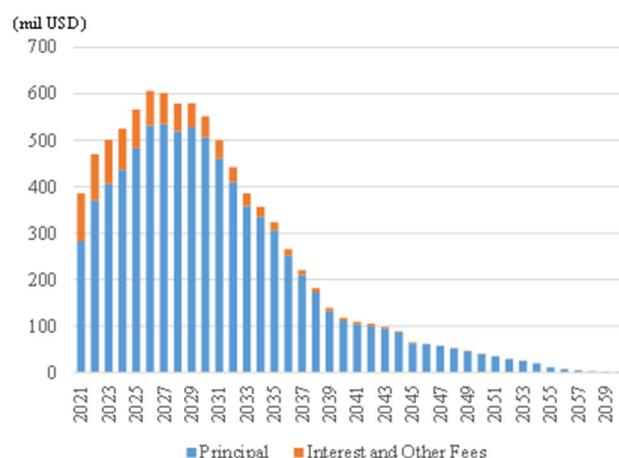


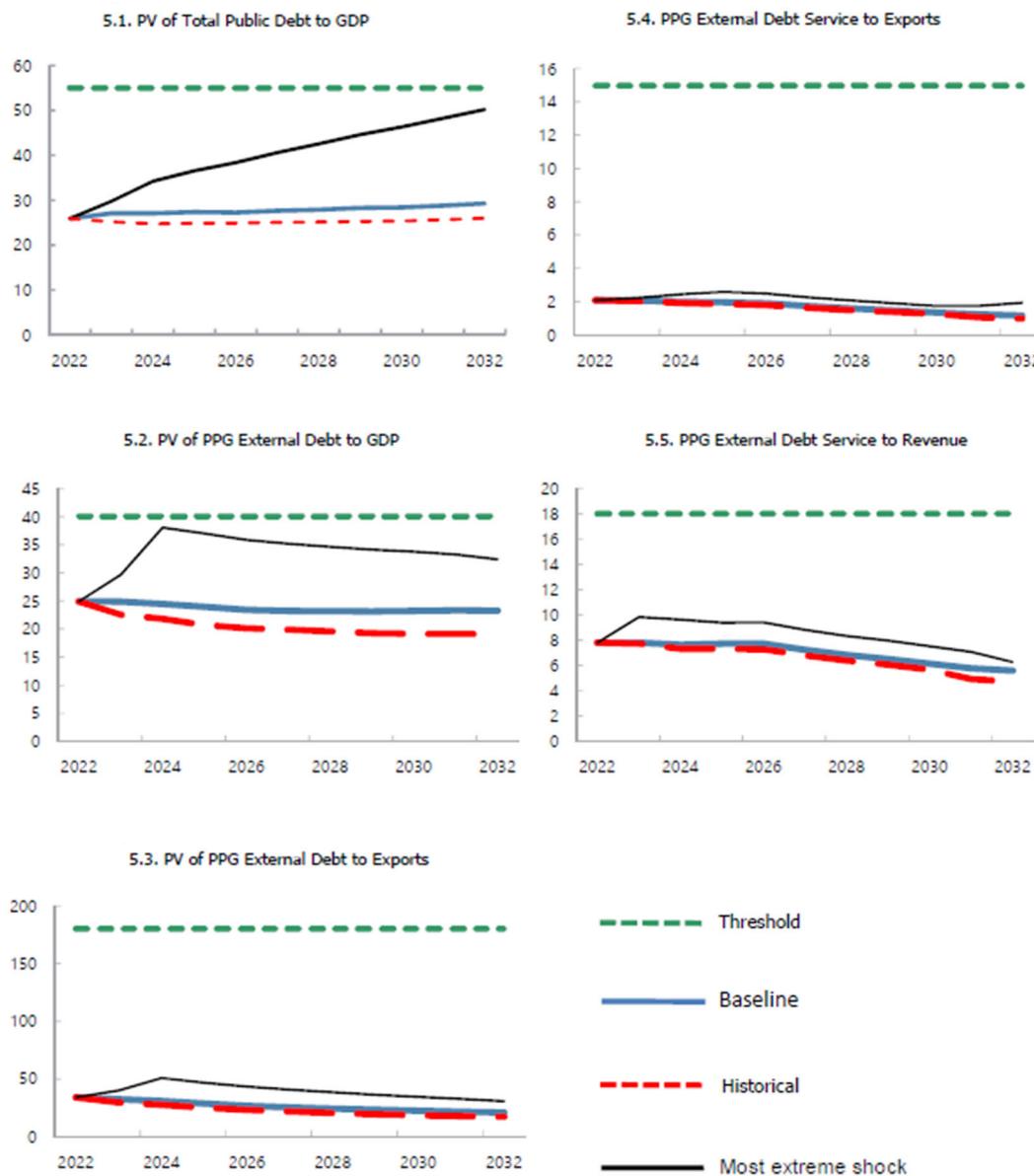
Figure 2.2.13 Redemption Profile based on Outstanding as of Year-end 2020

The International Monetary Fund (IMF) report “Cambodia: Staff Report for the 2022 Article IV Consultation—Debt Sustainability Analysis” concluded that Cambodia remains at a low risk of external debt distress. All debt burden indicators are projected to remain under their indicative thresholds under the baseline and the shock scenarios.

Correspondingly, “Cambodia Public Debt Statistical Bulletin (Date as of Year-end 2021)” published by the Ministry of Economy and Finance, Cambodia states that even with the COVID-19 pandemic, Cambodia's public debt remains “sustainable” and “low risk” of debt distress. The result of Debt Sustainability Analysis (DSA) in Figure 2.2.14 showed that for 2020 all the five key debt indicators are well below the respective indicative thresholds in which 1) Present Value (PV) of Total Public Debt to GDP is 24.4% (threshold 55%), 2) PV of Public and Publicly Guaranteed (PPG)⁶ External Debt to GDP is 24.4% (threshold 40%), 3) PV of Public and Publicly Guaranteed External Debt to Exports is 35.6% (threshold 180%), 4) Public and Publicly Guaranteed External Debt Service to Exports is 2.0% (threshold 15%), and 5) Public and Publicly Guaranteed External Debt Service to Revenue is 7.0% (threshold 18%).

The above results show that Cambodia will be able to invest further in domestic infrastructure development, education, health care, etc.

⁶ The sum of principal repayments and interest actually paid in currency, goods, or services on long-term obligations of public debtors and long-term private obligations guaranteed by a public entity (World Bank, International Debt Statistics).



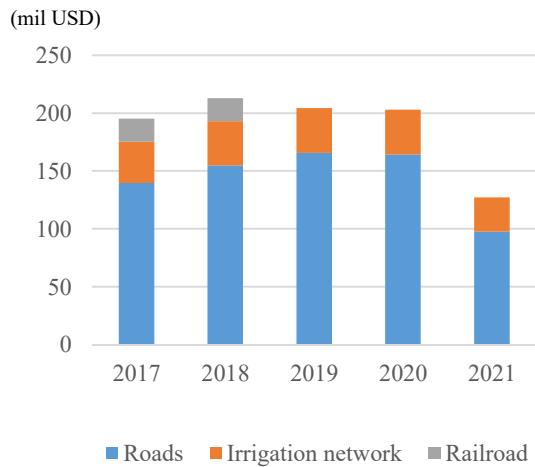
Source: Cambodia Public Debt Statistical Bulletin (Year-end 2021)

Figure 2.2.14 Debt Sustainability Analysis

(2) Infrastructure Investment in Capital Expenditure

The Ministry central administration is responsible for infrastructure investment. While around 12-16% of the total state expenditure is allocated to the provincial department, only the current expenditure is budgeted and the capital expenditure is not covered. Therefore, only the Ministry is responsible for infrastructure investment in capital expenditure. For example, out of the total state expenditure of 30.5 trillion KHR in 2021, 3.5 trillion KHR was budgeted for the current expenditure of provincial line departments.

Looking at the infrastructure investment in capital expenditure, about 800 billion KHR (approximately USD 200 million) has been budgeted annually to road, irrigation network and railroad (Figure 2.2.15). The responsible Ministries are the Ministry of Rural Development for roads, Ministry of Public Works and Transport for roads and railroads and Ministry of Water Resource and Meteorology for irrigation network (Figure 2.2.16).



Source: Cambodian National Budget

Figure 2.2.15 Breakdown of Infrastructure Investment

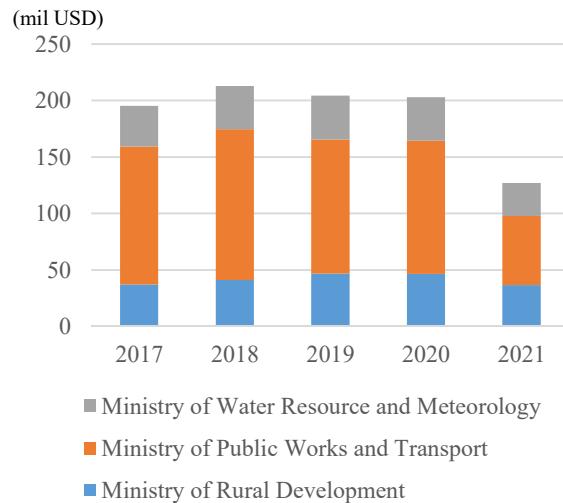
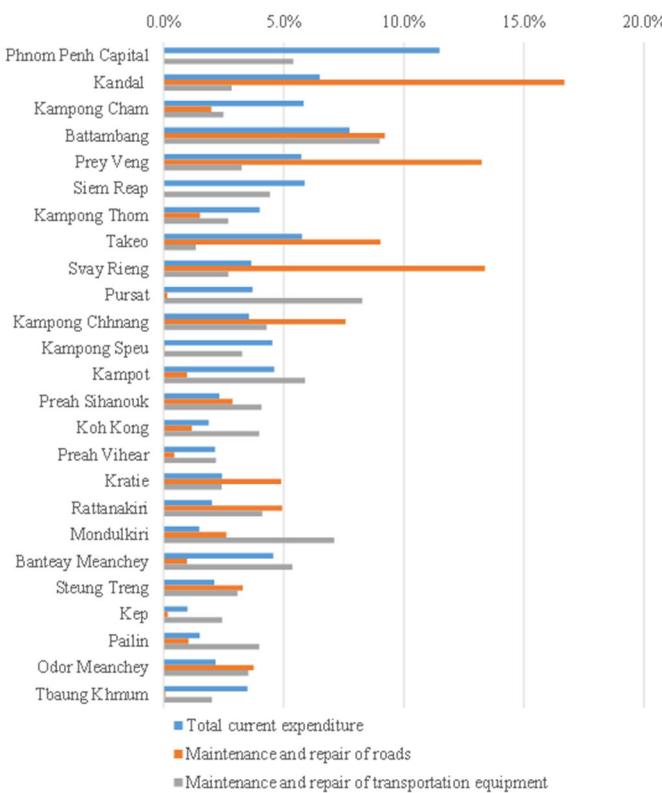


Figure 2.2.16 Infrastructure Investment by Ministry

(3) Current Expenditure by Province

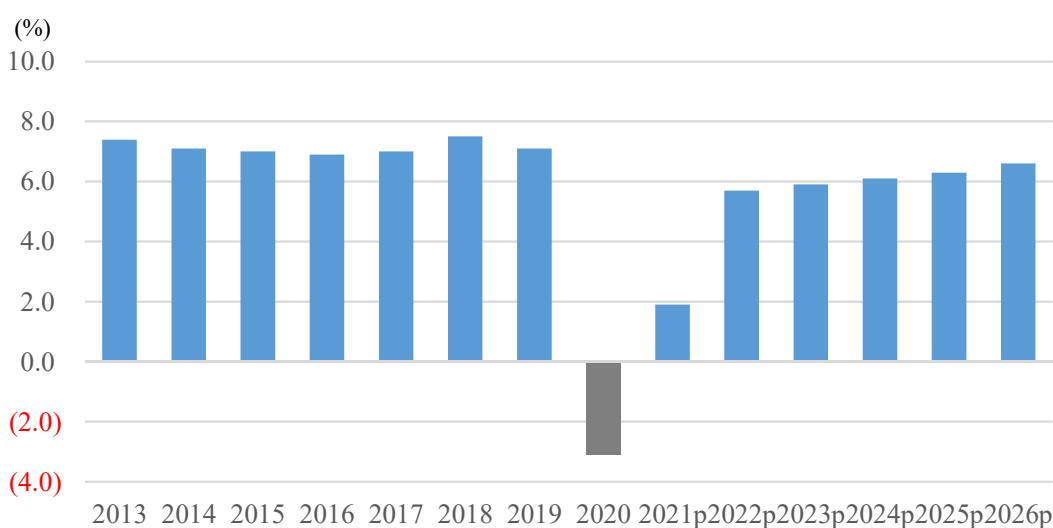
In 2015, the total national expenditure was 20.2 trillion KHR, out of which 2.5 trillion KHR (12.5%) was allocated to the provincial budget. The provincial breakdown shows that Phnom Penh had the largest share in the total current expenditure (11.5%), but the share of maintenance and repair of roads and transport equipment are not significant (0.0% and 5.4% respectively) (Figure 2.2.17). As for the maintenance and repair of roads, Kandal, Prey Veng and Battambang were the main provinces in the budget, and for the maintenance and repair of transport equipment, Battambang, Kampong Chuunang, and Mondul Kiri had larger shares. The results indicate that the requirements in the maintenance and repair of roads and transport equipment are found in the rural provinces.



Source: Cambodian National Budget

Figure 2.2.17 Current Expenditure by Province (2015)

The real GDP growth rate of the Cambodian economy is estimated to have contracted by 3.1% in 2020 after growth of nearly 7% in previous years. Although activity showed signs of picking up toward the end of 2020, the rapid spread of COVID-19 from February 2021 has set the economy back again. As in many other countries, the crisis has strained the ability of households and firms to service loans. A slow recovery is projected, and the World Economic Outlook October 2021 by IMF projects growth of 1.9% in 2021, increasing gradually to pre-crisis rates of 6.6% by 2026 (Figure 2.2.18).



Source: Cambodia Public Debt Statistical Bulletin (August 2021)

Figure 2.2.18 Real GDP Growth Rate

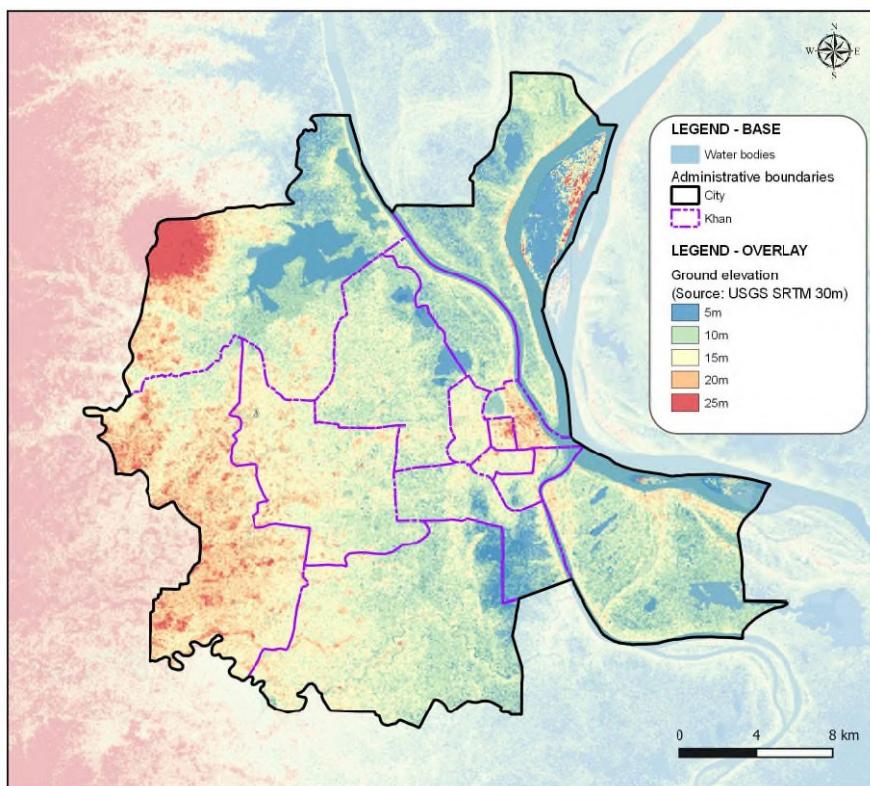
2.3 Social and Environmental Condition

2.3.1 Natural Condition

(1) Topography and Geology

Phnom Penh is in the alluvial plain formed by Tonlé Sap, Bassac and Mekong River and alluvial depositions spread around the Lake Tonlé Sap and Mekong River. The main geological feature around Phnom Penh is lithosols.

The topography of the city is generally flat with a gentle incline from north to south and from west to east. The elevation is highest at the western boundary capital (maximum 25m), and there is a relatively high land area with an elevation of 14 m between the west side and the Phnom Penh International Airport. Floodplain of about 4 m in elevation is found along the Tonlé Sap, Bassac and Mekong Rivers.

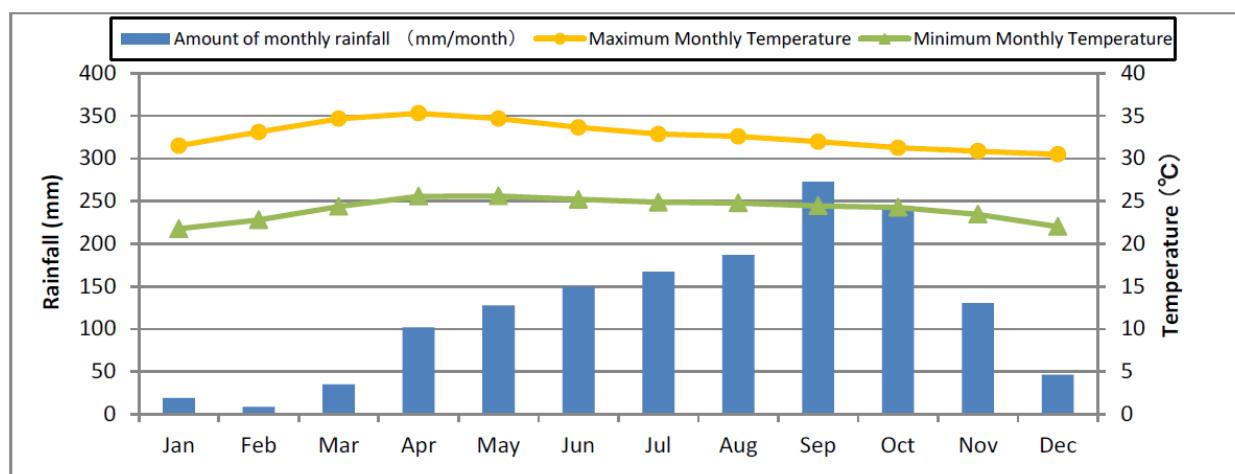


Source: ADB CAM: Improved Sanitation through the Development of Citywide Inclusive Sanitation (CWIS) in Phnom Penh

Figure 2.3.1 Map of Elevations across Phnom Penh

(2) Climate / Temperature

Phnom Penh has a high risk of flooding due to its topographic condition. The climate is categorized as Tropical monsoon climate (Am) with annual rainfall of around 1,400 mm. Most of rainfall is during the rainy season from May to November.



Source: Preparatory survey report on the project for flood protection and drainage improvement in Phnom Penh (phase IV)

Figure 2.3.2 Average Monthly Rainfall, Maximum Monthly Temperature and Minimum Monthly Temperature (2004-2013)

With the climate change model, many researchers project an increase in temperature across Cambodia in future. Fick and Hijmans project that the average annual temperature increases by 2.0°C by 2040.

Similarly, the climate change model presents projections of the number of days above 35°C, which is a measure of potential heat stress conditions. The model indicates that the number of days above 35°C is projected to change from 9 to over 35.

Table 2.3.1 Range of Projected Mean Annual Temperature Changes for Phnom Penh for 2050

	Minimum	Average	Maximum
Changes of Temperature (°C)	1.2	2.0	2.7

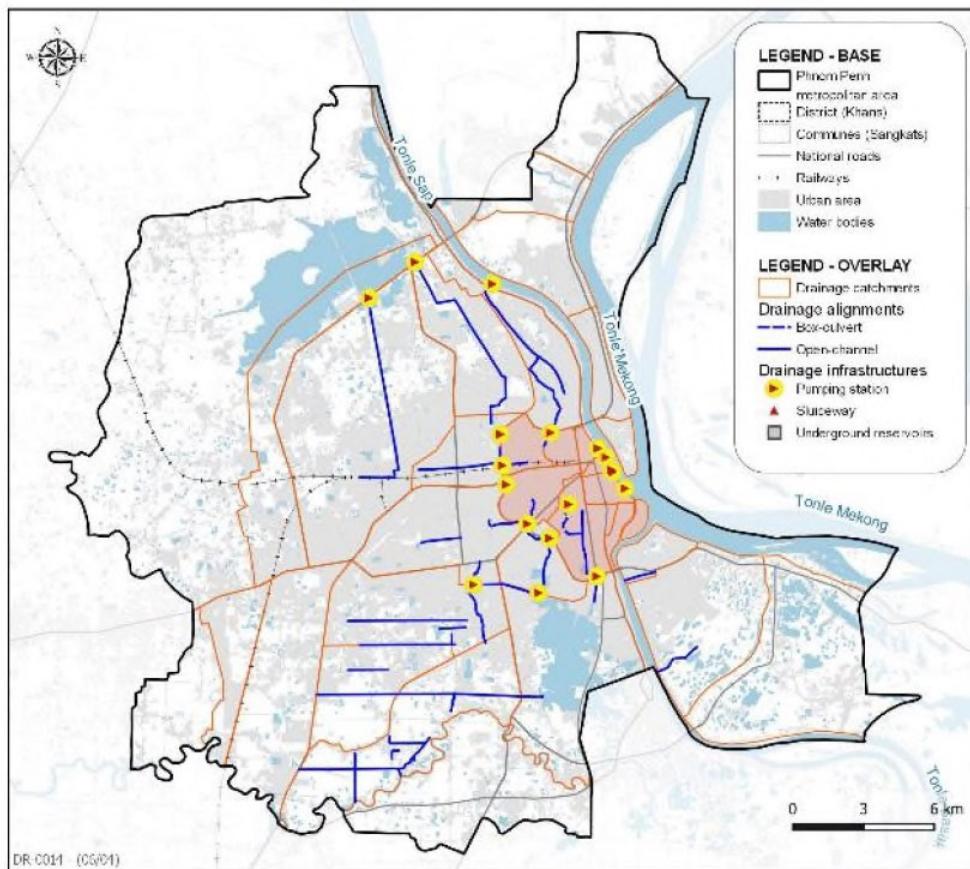
Source: Fick, S.E. and R.J. Hijmans, 2017. WorldClim 2: new 1km spatial resolution climate surfaces for global land areas. International Journal of Climatology

(3) Flood

As above mentioned, Phnom Penh City is ringed by flood dikes, with an Inner ring dike protecting:

- (i) the Inner City area,
- (ii) the larger Kop Srov dike that extends west past the airport,
- (iii) north to the southern boundary of the Tamouk Lake, and
- (iv) south to Tompun Lake and wetlands, protecting the greater city area.

A survey found that floods from the Mekong River of over 10.5 m could potentially overtop the dikes and affect Phnom Penh city.

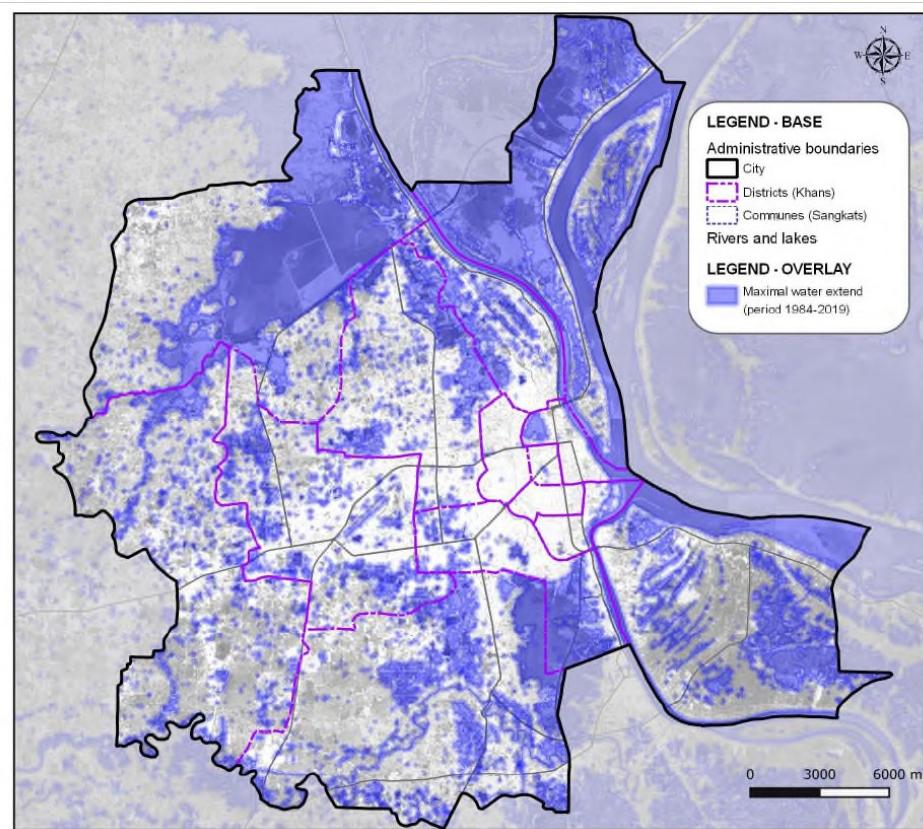


Source: ADB CAM: Improved Sanitation through the Development of Citywide Inclusive Sanitation (CWIS) in Phnom Penh

Figure 2.3.3 Inner Flood Protection Dike and Pumping Stations in Phnom Penh

In 2015, a storm produced a daily rainfall of 103 mm across Phnom Penh, which resulted in widespread flooding leaving stores and homes inundated and roads nearly impassable. In October 2020, localized flooding occurred when the Prek Thnot River, which empties into the Bassac River south of Phnom Penh, overflowed after a tropical storm forced thousands of residents to evacuate from gated communities in southwestern and southern Phnom Penh.

The impacts of the current filling of wetlands and lakes around Phnom Penh for development are a contentious issue. A hydrological study indicates that the filling of the wetlands will contribute to the urban flooding increase.



Source: ADB CAM: Improved Sanitation through the Development of Citywide Inclusive Sanitation (CWIS) in Phnom Penh

Figure 2.3.4 Flood-prone Areas (1984-2019)

Controlling floods has been a major concern for Phnom Penh City and the citizens have been struggling with chronic floods which happen even with small rainfall and in turn deteriorate traffic conditions such as road closure and traffic jams due to flooding.

Furthermore, wetlands in Phnom Penh, which generally mitigates flood damage by storing water, have been destroyed for land development and it makes the capital more vulnerable to such disasters.

In addition to flooding, the damp temperature which stays high all year round as shown in Figure 2.3.2 affects people's trip behaviours such as avoiding walking and use of public transport due to the difficulty for accessing to bus stops.



Source: JST

Figure 2.3.5 Unwalkable Road (Left) and Reduced Road Capacity (Right) due to Heavy Rain

(4) Protected Areas

No areas in Phnom Penh Capital City are designated as protected areas such as national parks by laws or regulations for environmental protection.

(5) Ecosystem

Basset Marsh, located in the northern area of Phnom Penh and Boeung Veal Samnap located in the eastern area of Phnom Penh are designated as Important Bird Area (IBA) by an international conservation NGO named “BirdLife International”. However, there are no laws or regulations that stipulate protection/management of IBA and development in IBA in Cambodia.

As for the water resource including lakes, the “Law on Water Resources Management” enforced in 2007 stipulates 1) Obligation and rights of water users, 2) principals of water resource management and 3) participation of water users in sustainable water resource development.



Source: JST created based on the Final Report of “Preparatory Survey for Phnom Penh Urban Railway Development Project”

Figure 2.3.6 Locations of IBA

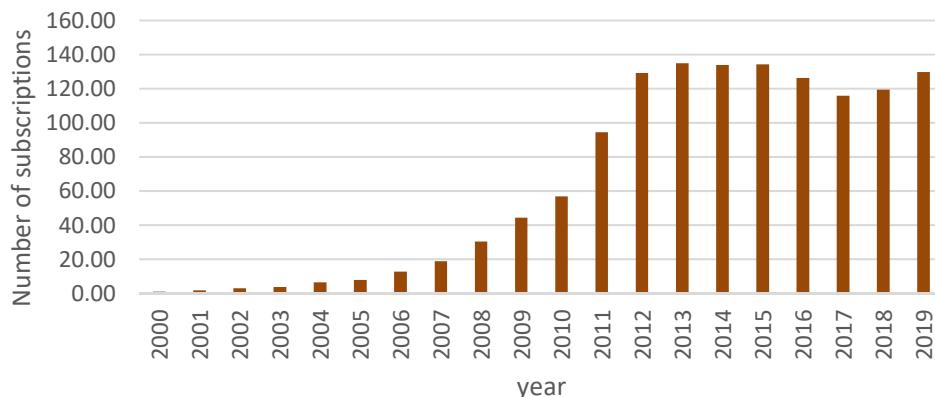
According to the BirdLife International Cambodia, as both IBAs have been deteriorated as bird habitats due to land development, the endangered species are rarely observed in this area in recent years. There is no preservation activities or relevant plans in these IBAs while landfills for agriculture, residential area and other developments are under progress. The overview of IBA and the IBA trigger species and criteria are described in Appendix.

2.3.2 Culture

(1) Mobile Phone Subscriptions

Similar to other ASEAN countries, Cambodia has a very high rate of mobile phone subscriptions at 129.9% in 2019⁷ as described in Figure 2.3.7. This trend accelerates the popularity of Ride-Hailing Service in Phnom Penh.

⁷ Source: ITU World Telecommunication/ICT Indicators Database



Source: ITU World Telecommunication/ ICT Indicators Database

Figure 2.3.7 Mobile-cellular Subscriptions per 100 inhabitants in Cambodia

(2) Durable Goods

The Cambodia Socio-Economic Survey (CSES) 2019/20 surveyed the household ownership of mobile phones, automobiles and motorcycles of the sampled households (Table 2.3.2). In Phnom Penh, 97% of households owned a mobile phone in 2019/20. In Cambodia, the ratio of households with private cars increased from 5% to 10% and those with motorcycles increased from 66% to 83% compared to the 2014 survey. Focusing on Phnom Penh, the ratio of households with motorcycles is 90%, which is unchanged, but those with private cars increased from 20% to 27%.

Table 2.3.2 Percentage of Households with Durable Goods

Items of durable goods	CSES 2014				CSES 2019/20			
	Cambodia	Phnom Penh	Other urban	Other rural	Cambodia	Phnom Penh	Other urban	Other rural
Radio	33	34	28	33	16	17	13	17
Television	66	95	83	59	68	83	75	62
Video tape recorder/	23	34	27	21	3	2	3	3
Stereo	5	19	4	3	2	1	3	2
Cell phone	83	96	90	80	93	97	94	91
Satellite dish	2	0	2	2	8	1	7	10
Bicycle	61	42	60	64	54	36	53	58
Motorcycle	66	90	74	61	83	90	87	80
Car	5	20	9	2	10	27	14	10
Jeep/Van	1	1	1	1	1	1	2	1
PC	6	28	11	2	9	30	9	4

Source: CSES 2019/20, Unit: %

Chapter 3 Existing Condition of Urban Transport Sector in Phnom Penh

3.1 Existing Institution, Legal System and Financial Condition related to Urban Transport Sector

Following table shows the present institutional arrangement by functions by sub-sector of urban transport in Phnom Penh.

In general, Ministry of Public Works and Transport (MPWT) is responsible for law and endorsement. Besides the function, the demarcation of roles between PPCA and MPWT are intricate. Moreover, there are no agency who establish the comprehensive transport policy and implement it.

Table 3.1.1 Present Institutional Arrangement for Operation and Management of Urban Transport

Function	Responsible Agency			Instruments
	Public Transport	Highway (Urban)	Traffic Management* (Parking)	
Policy and strategy	PPCA (bus), MPWT (rail)	MPWT (arterial), PPCA	Unknown	National Strategic Development Plan (5 year investment plan in all sector), PPUTMP (unapproved)
Law endorsement	MPWT	MPWT	MPWT, MLMUPC*	Road Traffic Law(2017) Land Management Law (1997)
Regulator	MPWT (rail/ bus), PPCA (bus), DPWT (para)		PPCA (off-street)	Sub-decree, Prakas ¹ , Certificate & Permit
Implementing Agency (Operator)	CBA (bus), Private (rail, para)	DPWT, PPCA	Private	
Standard	Unknown	MPWT	MLMUPC (off-street)	Road Design Standard (2003) Urbanization of the Capital, Municipalities and Urban Areas (2015)
Public Finance	PPCA, MPWT	MPWT, PPCA		

Note: Traffic management scheme varies, including traffic demand management, and takes an example of parking as typical traffic management issue in Phnom Penh.

*MLMUPC: Ministry of Land Management, Urban Planning and Construction

*DPWT: Department of Public Works and Transport

Source: JST

3.1.1 Public Transport

(1) Overview of Public Transport in Phnom Penh

The definition of “public transport” changes depending on the background of the times and the country. In Japan, railroads, buses, taxis, etc., have been defined as “public transport”.

¹ Prakas is equivalent to “regulation” in Khmer language.

In recent years, with the advent of new technologies and services such as the rapid expansion of the car sharing business, and the spread of special-purpose taxis for welfare and nursing care, car sharing, demand-responsive transport and taxi dispatch services have also been recognized as “public transport”. In addition to these, services that propose optimal movement by combining various transport means including bicycles have become a trend not only in Japan but also worldwide. For example, in Europe, services are evolving mainly in Finland and Germany. With the addition of ride sharing and car sharing, some of the fare payments can be made collectively in case of multi-modality making it more efficient; and these services are called “Mobility as a Service (MaaS)”.

It is no longer an exaggeration to say that transport services provided by businesses that can be easily used at low cost by an unspecified number of people is called “public transport”. In Phnom Penh, mobile phone ride-hailing services such as PassApp and Grab are expanding rapidly, and as shown in Table 3.1.2, the means of transport classified as public transport have diversified in the last 10 years. The details of each mode is described in 3.2.1.

Table 3.1.2 Public Transport in 2012 and in 2020 in PPCA

No.	Mode of Transport	Year 2012	Year 2021	Remarks
1	City Bus		✓ 1) ²⁾	Started in 2014 during Public Experiment in PPUTMP
2	Meter Taxi	✓	✓ 2)	Still operating in 2020 but number of taxis is small
3	Khmer Tuk-tuk	✓	✓ 3)	Still operating in 2020 but number decreases
4	Motodop	✓		Still operating in 2020 but number drastically decreases
5	Cyclo	✓	✓ 4)	Mainly used by tourists and mostly found around local markets
6	Motorumororque	✓		Still operating in 2020 but in suburban areas
7	RHS: Tuk-tuk		✓ 5)	Mainly operated by 2 companies (PassApp and Grab)
8	RHS: Car/Taxi		✓ 6)	Mainly operated by 2 companies (PassApp and Grab)
9	Commuter Truck	✓	✓ 7)	Mainly for commuting of factory workers
10	Water Transport	✓	✓ 8)	Along Mekong River, Tonlé Sap River and Bassac River
11	Existing Railway	✓	✓ 9)	Still operating intercity service in 2020 but train to the airport started in 2018 and stopped in late 2020
12	Intercity Bus	✓	✓ 10)	The number of intercity bus terminals in the city centre is increasing

Note: RHS means Ride-Hailing Service.

Source: JST



Source: JST



Source: JST

Figure 3.1.1 Motorumororque

Figure 3.1.2 Motodop

² 1) to 10) in the table indicate the numbers in Table 3.1.3 on the next page indicating the management agency of each transportation mode.

(2) Institution and Legal Framework

1) Overview

Based on above, the institutional support and legal status of the 10 means of transport services currently operating in Phnom Penh are shown in Table 3.1.3. The motodop and motorumorque are excluded because they are decreasing.

Table 3.1.3 Institutional and Legal Status of Public Transport Modes in Phnom Penh

No.	Mode of Transport	Managing Agency	Legal Basis
1)	City Bus	Business operation: CBA Management: PPCA	
2)	Metered Taxi	General Department of Land Transport, MPWT	- Prakas No. 344 (license of companies of domestic land transport business).
3)	Khmer Tuk-tuk	Individuals	There is no specific regulation to control and manage paratransit services.
4)	Cyclo	Individuals Business association: the Cyclo Conservation and Careers Association (CCCA)	
5)	RHS: Tuk-tuk	<u>RHS company</u> Need to register at MPWT, Ministry of Commerce and Ministry of Post and Telecommunications as a company providing digital technology service for road transport. Business license is issued by MPWT, which requires companies to submit the list of vehicles registered in the company's system.	- Prakas No. 100 (companies providing digital technology service for road transport) - Prakas No. 344 (license of companies of domestic land transport business).
6)	RHS: Car/Taxi	<u>RHS driver</u> No need to register at MPWT in case of an individual driver. The number plate issuance for tuk-tuk is done by Khans (the issuance for cars is done by DPWT). *See "3) RHS" below for further details. *Business Associations: Cambodia for Confederation Development Association (CCDA) and Independent Democracy of Informal Economy Association (IDEA)	- Sub-decree No. 183, 184 (delegating the vehicle registration of Tuk-tuk at districts of the provinces)
7)	Commuter Truck	Individuals (Privately contracted service between a commuter truck driver and individual workers.) *No business registrations	
8)	Water Transport	DPWT	
9)	Existing Railway	Department of Railway, MPWT	
10)	Intercity Bus	General Department of Land Transport, MPWT	-Prakas No. 344 (license of companies of domestic land transport business).

Source: JST

2) City Bus Authority (CBA)

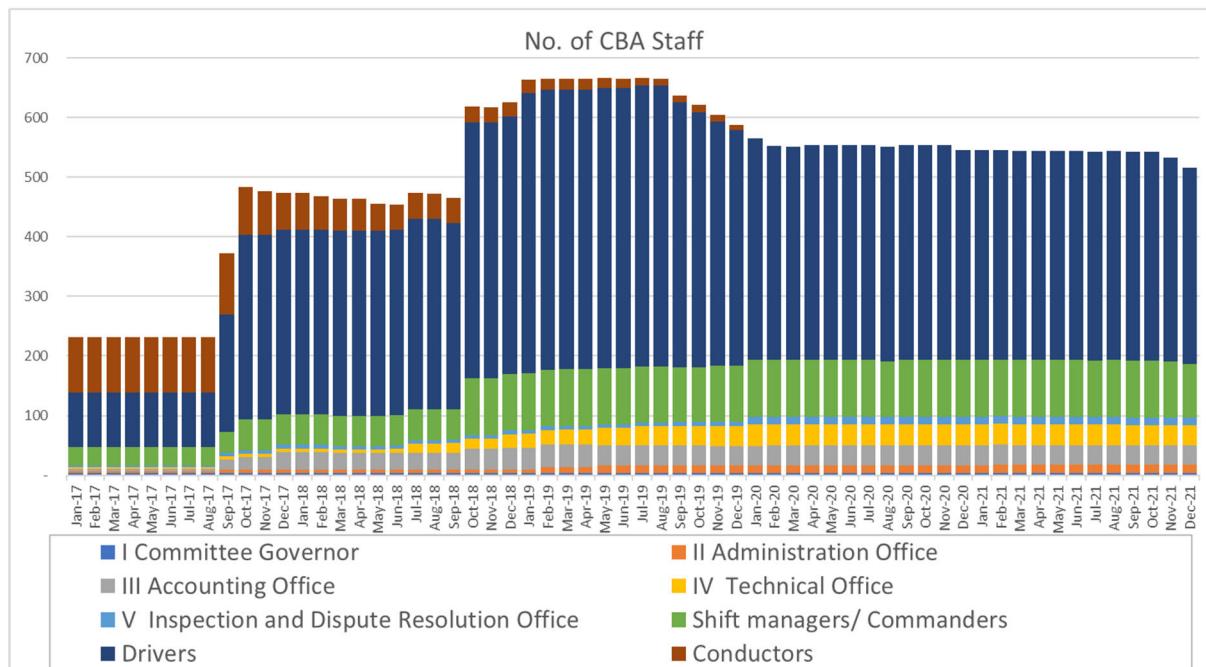
a) Organisation

The City Bus Authority (CBA) is headed by a Governor and managed by 2 Deputy Governors. 4 Departments are responsible for day-to-day operation and management of city buses. The Business Committee is composed of 12 members from PPCA, DPWT and CBA, is chaired by the Governor, which monitors performance of the CBA. The organisation chart of CBA is described in Appendix 3.

b) Number of Staff

As of December 2021, the total number of employees of CBA is 516, including 329 bus drivers. Even after the bus operation was suspended in March 2020, the PPCA had been making the best effort to maintain to hire the drivers/staff in order for a smooth restoration of bus operation. On 2nd November 2021, the bus operation on Line 1, Line 2, Line 3 and Line 4A/4B was resumed.

These staff members are assigned to (i) Committee Governor, (ii) Administration Office, (iii) Accounting Office, (iv) Technical Office, (v) Inspection and Dispute Resolution Office, (vi) Shift managers and (vii) Drivers.



Source: JICA PiBO

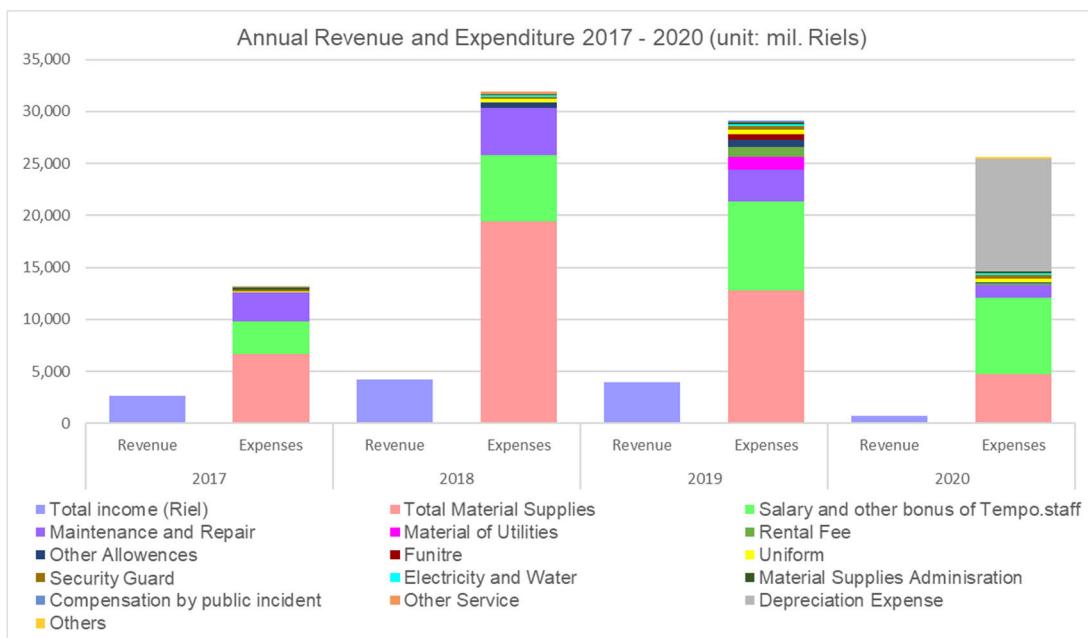
Figure 3.1.3 Number of CBA Staff

c) Annual Revenue and Expenditure

The total expenditure has been significantly increased from 2017 to 2018 and 2019 due to the increase of the bus fleets and expansion of the network and service as well as relocation of the office to the new depot. As a result, the expenditure in 2018 reached 32 billion KHR/annum and around 60% of the expenditure is channelled for material supplies for the new office. In 2019, the amount for material supplies for the office significantly dropped but the expenditure for staff remuneration increases due to an increase in the number of staff members and the total expenditure reached at 29 billion KHR/annum.

On the other hand, the amount of revenue, mainly from fare collection, remained same in 2019 and reached 4 billion KHR/annum and therefore, the CBA lost 25 billion KHR (6 million USD) in 2019.

In 2020, CBA revenue dropped sharply to 700 million KHR due to the COVID-19 pandemic and suspension of bus operation from 26th March 2020. In terms of the CBA expenditure, expenditure related to bus service, including material supplies and maintenance and repair cost, decreased significantly in 2020. On the other hand, the CBA maintained to employ the drivers/staff and retained depreciation expenses for future improvement/replacement of the CBA's assets such as the bus fleets. As a result, the CBA spent around 26 billion KHR in 2020. CBA projects revenue/expenditure of the next financial year by the end of the financial year. CBA applies for budget approval to MEF (Ministry of Economy and Finance) through PPCA and covers the deficit generated in the next financial year with the approved budget. (Any surplus generated will be transferred to the next financial year as the depreciation cost).



Source: JICA PiBO

Figure 3.1.4 Annual Revenue and Expenditure

d) Duties of PPCA and CBA

The following table shows the duties of PPCA and CBA concerning the city bus planning, management and operation.

Besides the operation work, CBA is responsible for planning. PPCA and MEF are responsible for approving and confirmation of those plans.

Table 3.1.4 Duties of PPCA and CBA

Item	PPCA	CBA	Reference
<u>Planning and implementation</u>			
• Mid-term plan	Approval	Planning	
• Annual Budget Plan	Confirmation	Planning	MEF approval
• Revenue and Expenditure Report	Confirmation	Reporting	MEF approval
• Annual Activity Plan and Report	Approval	Planning/Reporting	
• Organizational Structure and Personnel	Approval	Planning	
• Procurement	Approval	Planning/Reporting	

Item	PPCA	CBA	Reference
<u>Management</u> • Work style, fare, etc.	Approval	Planning	
<u>Operation</u> • Vehicle / crew management • Fare collection management	Confirmation Confirmation	Notifying Notifying	

Source: JST

3) Ride-Hailing Services (RHS)

Characteristic of Ride-Hailing Service (RHS) in Phnom Penh

The Ride-Hailing Service (RHS) is becoming dominant and replacing the traditional motodop, Khmer tuk-tuk (remork), and conventional taxis with its convenient platform, the safe service and lower fares in Phnom Penh. Since the ExNet launched the service mainly with taxi type vehicles in June 2016, many start-up companies initiated RHS following ExNet. In 2017 and 2018, 20 RHS applications were in operation³. PassApp was the first company that provided the RHS with tuk-tuk. The major RHS companies in Phnom Penh are PassApp and Grab. Other international giants such as Indonesia's Go-Jek and China's Didi may come to Cambodian market in the future. The vehicles used for RHS are tuk-tuk shown in Figure 3.1.5 as well as passenger car, Khmer tuk-tuk and a small number of motorcycles.



Source: JST

Figure 3.1.5 RHS Vehicles in Phnom Penh

Table 3.1.5 Major RHS Companies in Phnom Penh

Name	Country of Headquarters	Service Start Year	Description
PassApp	Cambodia	2017	Founded in 2017 and started RHS mainly with tuk-tuk.
Grab	Singapore	2017	Entered Cambodia in 2017 and bought the Uber's Southeast Asian operations in 2018.
WeGo	Cambodia	2017	Established in 2015 and officially registered with the Ministry of Commerce in 2017. Received a taxi service licence from MPWT in 2018.
ExNet taxi	Cambodia	2016	The first ever RHS in Cambodia started in 2016.
iTsumo (Phumi)	Cambodia	2017	The application was developed by Cambodian IT engineers in partnership with FIGIX Industry Co. Ltd. based in Japan while other RHS applications were created by other countries.
TADA	Singapore	2019	The world's first block chain based RHS with zero commission for drivers.

Source: JST

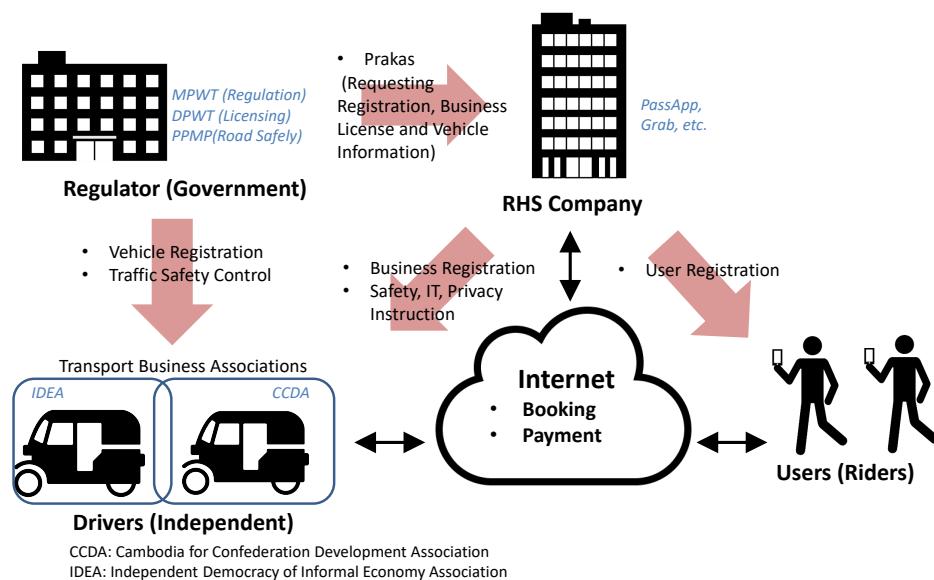
³ Source: Phun, V.K., Masui, R., Yai, T. (2018). Operational characteristics of paratransit services with ride-hailing apps in Asian developing cities: The Phnom Penh case. Journal of Transportation Technologies, 8, 291-311.

In Phnom Penh, the proportion of automobiles that are often seen in RHS in other countries is small, and paratransit (mainly tuk-tuk) accounts for a large proportion. In particular, the number of tuk-tuk, has increased from around 20,000 in 2014 to around 30,000 in 2017⁴.

Role of Related Agencies on RHS

Following figure shows the overview of RHS in Phnom Penh. RHS drivers are categorized as passenger transport service provider as well as Khmer tuk-tuk drivers based on the road traffic law. Most of the drivers are independent drivers. There are two major business associations for tuk-tuk business, Cambodia for Confederation Development Association (CCDA) and Independent Democracy of Informal Economy Association (IDEA). 6.6% of RHS drivers answered that they belonged to both of these associations⁵. These associations manage and facilitate daily operations of drivers. The associations are self-organized and established with internal rules to ensure the fairness, efficiency, and quality of transport service among members. Members are required to pay for a membership fee at around USD 25 per month on average, which will be later used as financial source for the expense of the association activities, including the support for legal issues when there is an traffic accident, and when there is a funeral of the members.

Quality of transport service provided by RHS driver is secured by the government with RHS companies' registrations for the business licence and the daily traffic control by traffic police. Also RHS companies are requested to provide safety instructions to the registered drivers to secure the quality of transport service.



Source: JST

Figure 3.1.6 Relationship of Driver, Users, Companies and Regulators on RHS in Phnom Penh

⁴ Source: Hearing by CCDA and PiBO Study Team in 2017

⁵ Source: Phun, V.K., Masui, R., Yai, T. (2018). Operational characteristics of paratransit services with ride-hailing apps in Asian developing cities: The Phnom Penh case. Journal of Transportation Technologies, 8, 291-311.

Instruction/ Prakas regarding Registration and License

As the number of RHS vehicles increases rapidly in Phnom Penh, the following issues have been pointed out.

- RHS drivers are not well disciplined and deteriorate traffic capacity when they park on roads.
- The number of untheorized RHS companies increases.

MPWT and DPWT are trying to monitor and control the private RHS companies due to the increase of the companies without licences.

MPWT has issued an Instruction No. 367 dated 11 June 2020, which is intended to ensure that all companies and vehicles operating land transport of passengers and goods in Cambodia must obtain a valid and legal licence or certificate. This is to comply with the Prakas No. 343 dated 6th October 2017 on requirements and procedure for license of vehicles used in domestic land transport business, which is not applicable for RHS, and the Prakas No.344 dated 6th October 2017 on requirements and procedure for license of companies of domestic land transport business, which is applicable for RHS.

In accordance with the RHS vehicles/companies increase, MPWT has developed a new Prakas No.100 dated on 21st June 2021 for companies providing digital technology service for road transport of which major points are summarised as below⁶.

- The companies that provide digital technology services for road transport in Cambodia must have the following registration and business licence. (Article 4 and 5)
 - Registration at Ministry of Commerce
 - Registration at Ministry of Post and Telecommunications
 - Registration at MPWT
 - Business License issued by MPWT
- The company and its branch must have training course for their drivers about road traffic law, etiquette, moral, driving manner and customer service. (Article 9)
- The company and its branch require drivers to carry the followings. (Article 9)
 - Driver's licence
 - Vehicle ID and number plate
 - Vehicle technical inspection certificate (except for motorcycle)
 - Vehicle business license (except for motorcycle, three-wheeler and Khmer tuk-tuk)
 - Company logo on the vehicle
 - Company identification card
- The company and its branch must participate in the implementation of action plans of the road safety and the national environment in order to reduce congestions, traffic accident and emissions of greenhouse gases. (Article 10)

In addition, MPWT announces that RHS companies should provide a training course to drivers every 6 months.

⁶ Source: Prakas on Term and procedure of licence issuance for companies to providing digital technology service for domestic road transport

3.1.2 Highway

(1) Institutional Frame

1) Ministry of Public Works and Transport (MPWT)

MPWT is in charge of construction and maintaining the national roads in Cambodia. The General Department of Public Works is in charge of construction and rehabilitation of the national road and bridges. Provincial roads are maintained by the local organisations of MPWT, namely the Provincial Department of Public Works and Transport and the Municipal Department of Public Works and Transport, on behalf of state and municipal governments. The organisation chart of the MPWT is described in Appendix 3.

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

PPCA is governed by the Governor and operated under 11 different departments/offices which are supervised by 7 different Deputy Governors. DPWT was established in 2001 and is responsible for road infrastructure and development projects such as priority lane for Rapid Bus in Phnom Penh under the governor. DPWT is headed by Director and supervised by 6 different Deputy Directors. The organisation chart of PPCA, the chart of DPWT and the number of staff in DPWT are described in Appendix 3.

Currently, the staff in DPWT belong to MPWT and their salary is provided by MPWT. However, the positions lower than Director, including Deputy Directors are assigned by PPCA. The Director is assigned based on the discussion between PPCA and MPWT.

On the other hand, the expenses for road constructions and maintenance costs are allocated with PPCA's budget. PPCA summarises the budgets of all departments including DPWT, and after the discussion between MEF and the Vice Governor of PPCA, the budget of PPCA is approved by the Council of Ministers following MEF's approval.

(2) Legal Frame

1) Road Traffic Law

The road traffic law was adopted by the National Assembly on the 5th of December 2014, approved by the Senate on the 30th of December 2014 and promulgated by PREAH REACH KRAM NS/KRAM/0115/001 date the 9th of January 2015. It was revised in 2016. Road traffic law composed of 12 Chapter and 92 articles as shown in Table 3.1.6.

It should be noted that Prime Minister Hun Sen announced that A1 driving licence was to be eliminated 6th Jan. 2016. This means a driver licence is not required for motorcycle smaller than 125 cc. However, the number of traffic accidents has been rapidly increasing after the lifting of A1 driving license.

To improve the traffic safety, the Government has amended the road traffic laws and changed the fines for traffic violations to increase the effectiveness of the road traffic law in March 2020. For example, the fine for drink driving was changed to 250,000 – 800,000 KHR (USD 60-200). The fine for motorcycle or tuk-tuk drivers and motorbike riders who fail to wear helmets or wear them incorrectly is 60,000 KHR (USD 15). The fine for driver talking on mobile phone is 120,000 KHR (USD 30). The Government tightened regulations on traffic safety comprehensively.

Table 3.1.6 Component of Road Traffic Law

Chapter	Title (Article)	Contents
1	General Provisions (Article 1-4)	Describes the objective scope and terminology of the law
2	Road Signs (Article 5-6)	Describes the traffic signs and priority signs
3	Drivers (Article 7-26)	Describes the drivers driving condition, use of roads, turning left and right, and crossing and parking
4	The use of vehicle lights and horns (Article 27-30)	Describes the use of lights and horns
5	Pedestrians and animal riders/herders (Article 31-33)	Describes pedestrian, animal riders crossing/walking
6	Traffic Accidents (Article 34-38)	Describes the competency of the traffic police, road accidents, and hit and run cases
7	Vehicle and transport management (Article 39-58)	Describes driving licence issues, demerit points, vehicle inspections, over loading and fines
8	National Committee of Road Traffic Safety (Article 59)	Describes establishment of National Committee of Road Traffic corresponding budget allocation
9	Law enforcement agency of the Road Traffic Law (Article 60-70)	Describes the right of detention, competency of the traffic police, small fines and right of complaint
10	The penalty (Article 71-87)	Describes the crime considered for small fines, the responsibility for civil and criminal responses by drivers, and other fines
11	Inter-provisions (Articles 88-91)	Describes the law validity and implementation
12	Final provisions (Articles 92)	Describes the invalid of the road traffic law in 2007

Source: Summarised by JST from the road traffic law

2) Road Law

The Road Law was adopted by the National Assembly on 3rd of April 2014, approved by the Senate on the 11th of April 2014 and promulgated by PREAH REACH KRAM NS/RKM/0514/008 dated the 4th of May 2014. The Road Law is composed of 14 Chapters and 81 articles.

The law describes the competent authorities of road development and maintenance, types of road, contents should be included in the technical standard of road development and maintenance, financial resources of road development and maintenance and so on.

Table 3.1.7 Component of Road Law

Chapter	Title (Article)	Contents
1	General Provisions (Article 1 – 4)	Describes the objectives and scope of the law.
2	Competent Authorities of Road Management (Article 5 – 6)	All roads will be managed by 3 ministries/agencies: <ul style="list-style-type: none"> - Ministry of Public Works and Transport: in charge of Expressway, National Roads and Provincial Roads; - Ministry of Rural Development in charge of Rural Roads and other roads as assigned by the Royal Government and - Sub-national Administration is the competent authority, whose obligation include planning, design, construction, rehabilitation and road maintenance within the capital, cities and provincial towns.
3	Road Types, Name and Classification (Article 7 – 9)	Describes the road types and naming.
4	Road Development and Maintenance (Article 10 – 19)	Describes the role and regulation of road construction and maintenance including private sector.
5	Technique Entity and Road Infrastructure Technical Regulation (Article 20 – 23)	Describes the responsible organization and components of technical regulations for road infrastructures.

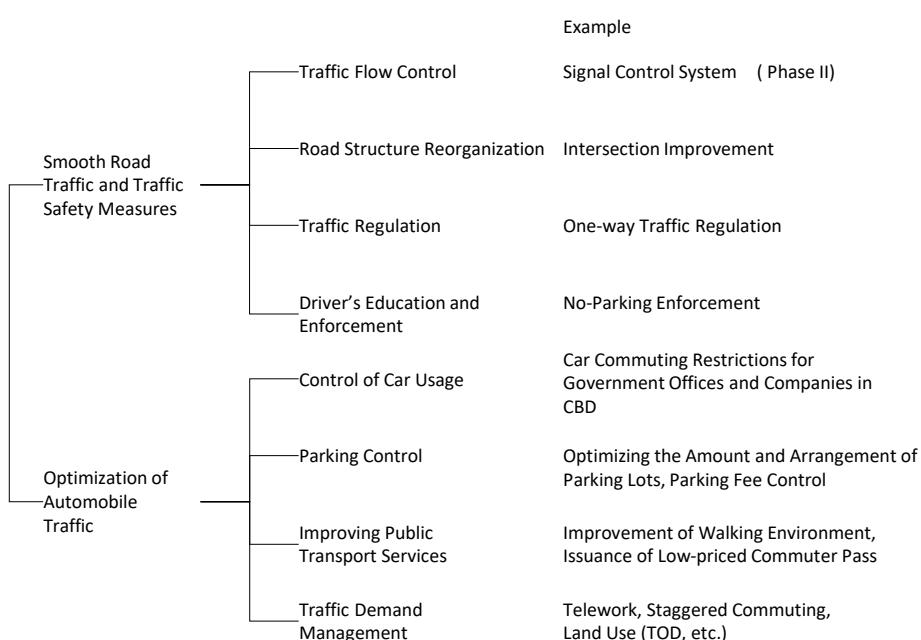
Chapter	Title (Article)	Contents
6	Road use (Article 24 – 34)	Describes the loading limit by types of vehicle and requirement to use roads.
7	Protection of Road Infrastructure (Article 35 – 38)	Describes the responsibility of competent authorities and users to protect road infrastructures.
8	Road Certification (Article 39 – 40)	Describes the necessity of certification for operation on the roads infrastructure, road maintenance, and opening the laboratory for the road sector.
9	Fund for Road Use Maintenance and Development (Article 41 – 42)	Describes the financial source of road maintenance and development.
10	Inspection of Road Infrastructure (Article 43 – 47)	Describes the responsibility and rights of inspectors for road infrastructure.
11	Penalties (Article 48 – 78)	Describes the penalties related to the road construction and maintenance work and the violation of road protections.
12	Final Provisions (Article 79 – 81)	Describes the provisions of the law.

Source: Summarised by JST from the road law

3.1.3 Traffic Management

(1) Overview of Traffic Management in Phnom Penh

Traffic management is the materialization of a safe and efficient urban transport system by combining several methods such as devising ways to use roads and traffic operation methods, rather than by developing and expanding large-scale transport facilities such as new road construction and road widening. Measures of traffic management are roughly divided into two: (1) Facilitation of road traffic and traffic safety measures, and (2) Optimisation of vehicle traffic. The first one includes traffic regulation, restructuring the road facility, traffic flow management and control, driver education, and traffic enforcement. The second one includes control of car usage, parking control, improvement of public transport services, and traffic demand management. These are summarised in Figure 3.1.7.



Source: JST

Figure 3.1.7 Traffic Management Measures by Type in Phnom Penh

(2) Institutional Framework

1) Overview

The status of traffic management measures in Phnom Penh is summarised in Table 3.1.8.

Table 3.1.8 Status of Traffic Management Measures in Phnom Penh

No.	Transport Management	Managing Agency	Legal Basis
1)	Intersection (Signalized/Non-signalized)	PPCA, DPWT, TCC	There is no specific regulation.
2)	One-way System	DPWT	Road Traffic Law
3)	Driver's Education and Traffic Enforcement	Bureau of Road Traffic Police of Phnom Penh Capital	Road Traffic Law
4)	Parking	DPWT, Khan	
5)	Sidewalk Management / Maintenance	DPWT, Khan	
6)	Traffic Demand Management	N/A	

Source: JST

2) Traffic Control Centre (TCC)

The Traffic Control Centre is under the DPWT and responsible for traffic control and monitoring of the CBD area of Phnom Penh. There are 13 experts consisting of 7 exclusive experts, 3 maintenance experts (concurrent post with DPWT) and 3 IT experts (concurrent post with PPCA) (See the Appendix 3 for the organisation structure).

3) Phnom Penh Police Commissariat (PPPC) and Bureau of Road Traffic Police (BRTP)

PPPC is under the Ministry of Interior (MOI). And the BRTP is one of 33 bureaus under the PPPC. BRTP has five sections and number of traffic police is approximately 500 officers and 300 contract staff.

BRTP is responsible for traffic accident investigation, arbitration after accidents and enforce over traffic offenders based on the Road Traffic Law. The office also has a program that delivers road traffic safety education to schools and private companies.

The MOI is responsible for nominating Phnom Penh's traffic police officers. The daily activities such as traffic control and traffic safety education on the main roads in Phnom Penh are under MOI and PPCA's Governor. The office of BRTP is located in the compound of PPPC (St.598).

The staff in PPPC belong to MOI and their salary is provided by MOI. The budget for traffic safety educations is also allocated with MOI budget, but some cases are allocated from with PPCA budget. And the support from the donors such as JICA is also directly accepted.

The organization of BRTP is shown in Table 3.1.9.

Table 3.1.9 Organisation of BRTP

Sections		
1	Traffic Accident Management Section	Subsection 1
		Subsection 2
2	Traffic Investigation Section	Subsection 1
		Subsection 2
3	Traffic Administration Section	

Sections		
4	Traffic Control Section	Subsection 1
		Subsection 2
5	Traffic Advertising Section	

Source: Interview to BRTP by JST

3.1.4 Urban Logistics

(1) Truck Ban Policy

To reduce traffic congestion and traffic accidents, PPCA regulates the time zones and target roads that truck movement is allowed by types of trucks in Phnom Penh based on the following regulations.

- Instruction on Public Orders of Traffics of All Types of Cargo Trucks Entering and Existing Phnom Penh (Phnom Penh Municipality, No. 19 INS.RK, 16 December 2013)
- Notification dated 16 October 2013 on banning the Heavy Cargo Trucks to Travel in and out of Phnom Penh City, Instruction/ Guideline no. 19 INS.RK Dated 16 December 2013 on Banning Heavy Cargo Trucks to Travel in and out of Phnom Penh City.

1) Regulation Area and Contents

The CBD area consisting of five Khans, Chamkar Mon, Doun Penh, Prampir Makara, Toul Kouk and Boeung Keng Kang and the ring road on the outer edge of CBD are covered by the regulations. In this area, truck traffic is basically prohibited during daytime, 5:00 a.m. – 9:00 p.m.. However, trucks with “Trucking Permit” are allowed to pass with following conditions by type of permit:

- Type A to C: Passable at times other than 6:00 a.m. to 9:00 a.m. and 4 p.m. to 8:00 p.m..
- Type D: Passable only from 8:00 p.m. to 6:00 a.m..

In addition to the above mentioned regulations, trucks are not allowed to pass through the following roads anytimes.

- Russian blvd (Norodom blvd – Airport)
- Norodom blvd (Wat Phnom – Kbal Thnol F/O⁷)
- Sisowat Quay (Chuon Nat roundabout - CDC)
- Sihanouk blvd, Nehru blvd, Charles de Gaulle blvd and Kampuchea Krom blvd
- Monivong blvd (Old stadium roundabout – Bokor intersection)
- Mao Tse Toung blvd. (Tep Phan intersection – Deum Kor market)
- Cambodia – Japan Friendship Bridge, Monivong Bridge, Kbal Tnal F/O, 7 Makara F/O, 5 Makara F/O and, Steong Mean Chey F/O (Trucks loading 5 tons and more)

2) Loaded Truck Routes during Daytime

Considering above mentioned regulation, traffic route for loaded trucks during daytime is shown as below.

⁷ F/O: Flyover



Source: Standard on: "Heavy Truck Banned in Phnom Penh" DPWT

Figure 3.1.8 Loaded Truck Routes during Daytime

3.2 Current Status of Infrastructure and Facilities related to the Urban Transport Sector

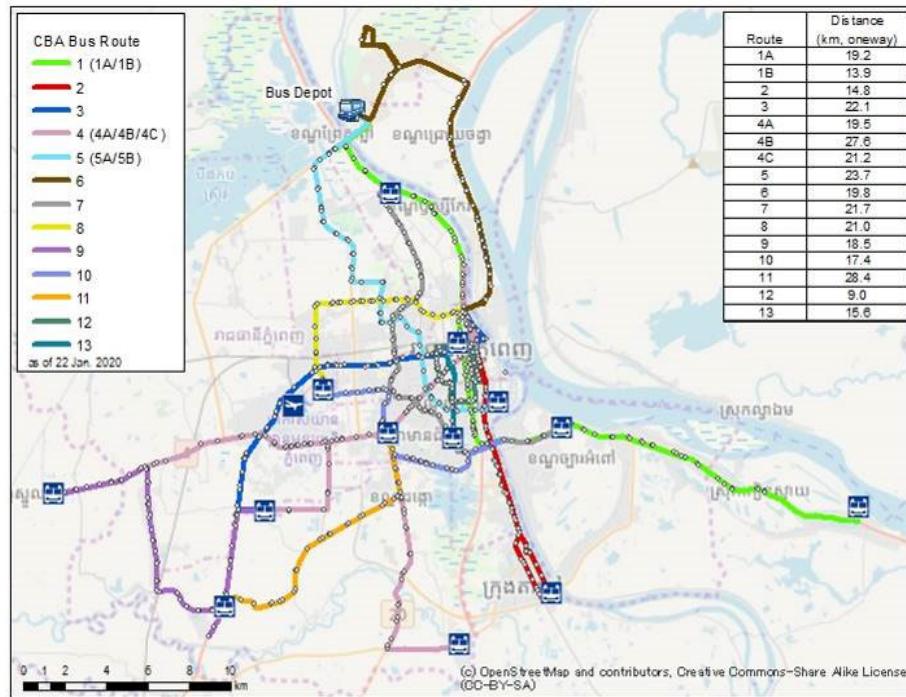
3.2.1 Public Transport

(1) City Bus

1) Number of Bus Route/Terminal and Bus Fleet

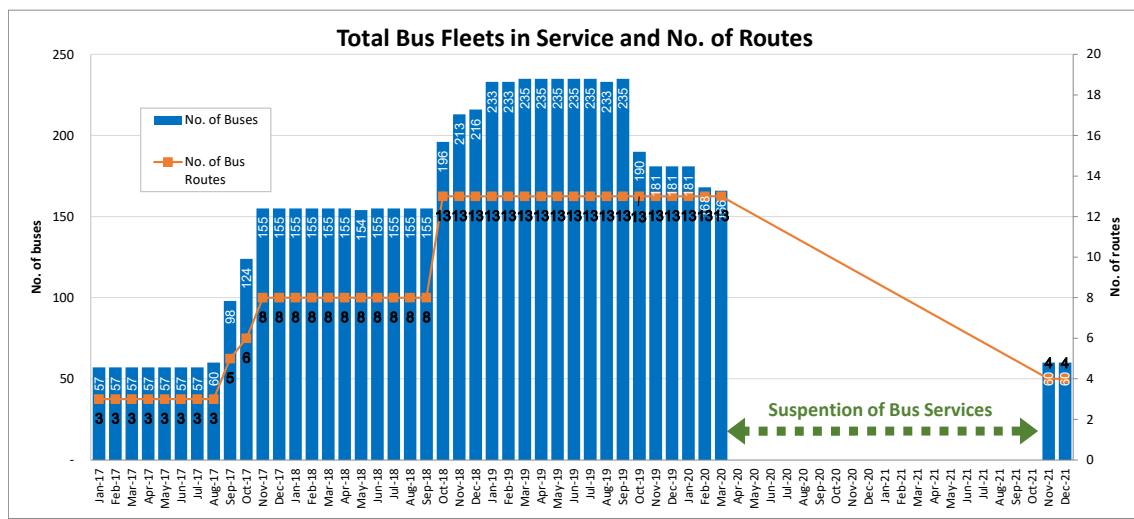
The bus routes operated by CBA started at 3 lines in 2015 with 54 second-hand Korean buses. Since then, the bus route has been steadily expanded to 5 routes in September 2017, 8 routes in November 2017, and 13 routes in October 2018. In September 2019, CBA decided to suspend the use of these routes, due to the high operation and maintenance cost of these Korean buses; CBA owns 181 buses as of April 2021. The end/start points of each bus route have bus terminals/parking, for a total of 14 bus terminals.

On 2nd November 2021, the operation resumed on 4 routes (5 lines) (Line 1A, Line 2, Line 3 and Line 4A/4B).



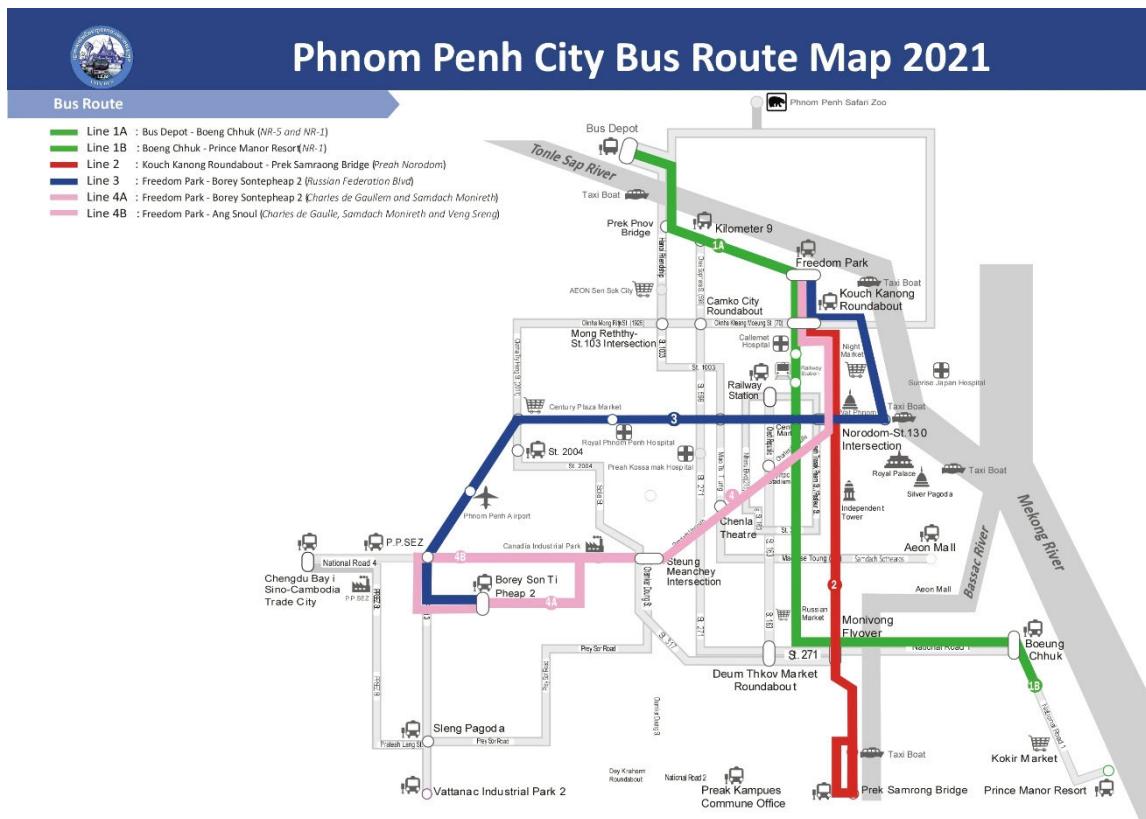
Source: JICA PiBO

Figure 3.2.1 Bus Routes and Terminals



Source: JICA PiBO

Figure 3.2.2 Number of Bus Fleet and Route



Source: JICA PiBO

Figure 3.2.3 Bus Route Map when Operation Resumed in November 2021

2) Service Type and Operation KM

The bus routes are classified into four functions: (i) Trunk Line, (ii) Feeder Line, (iii) Regional Line, and (iv) Circular Line, which determine the route assigned and service frequency. Each bus route operates at around 20 kilometres and takes about 1 to 2 hours travel time to complete the one-way service as it is difficult to have a terminal facilities in the city due to the limited vacant land and publicly owned land.

Table 3.2.1 Service Type and Operation KM of Each Bus Route

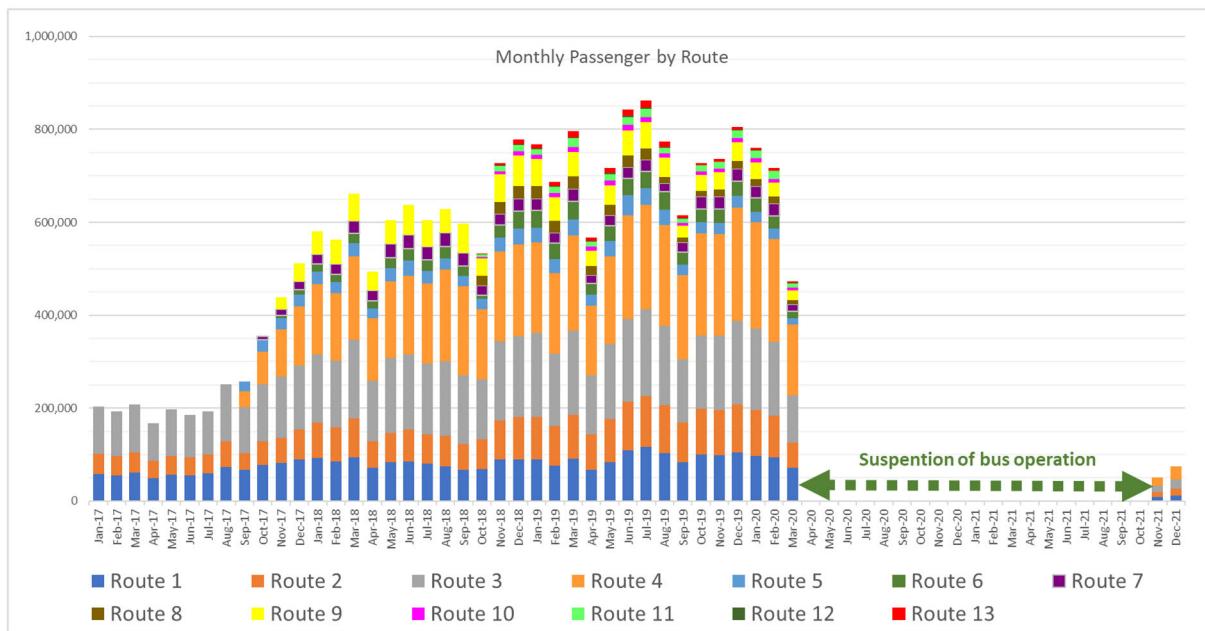
Line	Origin	Destination	Type	Operation Km	Average Speed
				(km)	(km/h)
Line 1A	New Depot	Boeng Chhouk	Trunk	25.1	11.6
Line 1B	Chbar Ampov	Kien Svay Hospital	Regional	24.1	21.4
Line 2	Old Stadium R/A	Takhmao	Trunk	15.0	11.4
Line 3	New Freedom Park	Borey Santepheap 2	Trunk	22.0	11.1
Line 4A	New Freedom Park	Borey Santepheap 2	Trunk	19.6	12.3
Line 4B	New Freedom Park	PPSEZ	Trunk	27.6	10.5
Line 4C	Olympic Stadium	Dei Krahom Roundabout	Feeder-Trunk	24.8	12.3
Line 5A	New Depot	AEON Mall	Feeder (Ring)	24.2	16.4
Line 5B			Feeder (Ring)	22.6	12.4
Line 6	Old Stadium R/A	New Depot	Feeder	25.8	20.5
Line 7	Kilometer 9	Chbar Ampov	Feeder (Ring)	21.6	16.5
Line 8	Old Stadium R/A	Century Plaza	Feeder (Ring)	23.3	13.3
Line 9	PPSEZ	Borey Santepheap 2	Trunk	23.1	18.2
Line 10	Century Plaza	Chbar Ampov	Feeder (Ring)	26.1	13.7
Line 11	Olympic Stadium	Wat Sleng	Regional-Trunk	14.2	18.3
Line 12 (C1)	Olympic Stadium	Olympic Stadium	Circular	16.6	7.8
Line 13 (C2)	Old Stadium R/A	Old Stadium R/A	Circular	10.6	10.5
				366.3	

Source: JICA PiBO

3) Number of Passengers

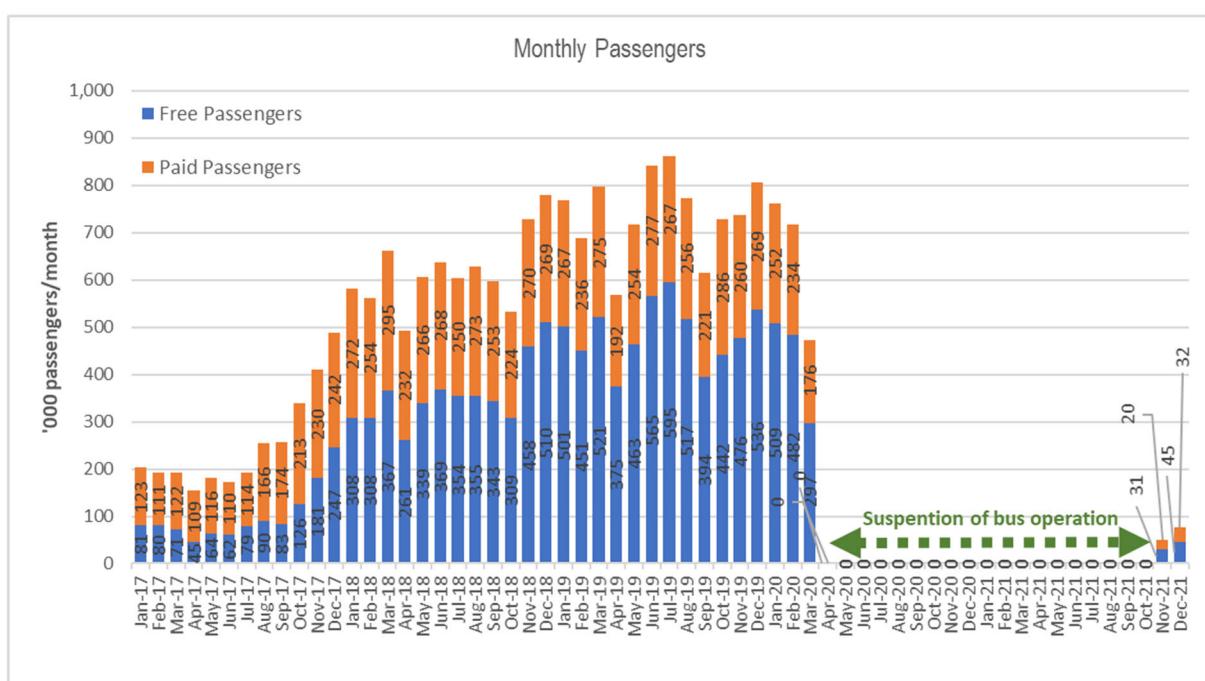
The Routes 1 to 4 run along the radial and trunk road network and collect more than 70% of the total passengers and this tendency remains same from when the CBA expanded the network from 8 to 13 routes. Due to restrictions in social and economic activities and travel caused by the COVID-19 pandemic as well as the temporary termination of City Bus service, the number of passengers was significantly reduced in March 2020. The fare is fixed at 1,500 KHR. Passengers such as elderlyies older than 70 years old and students, who are exempted for fare collection account for around 70%.

On 2nd November 2021, the operation resumed on 4 routes (5 lines) with 60 buses. As of December 2021, the daily ridership of these routes reached 2,700 passengers, which still has a large gap with the ridership of 16,000 passengers before the COVID-19 pandemic.



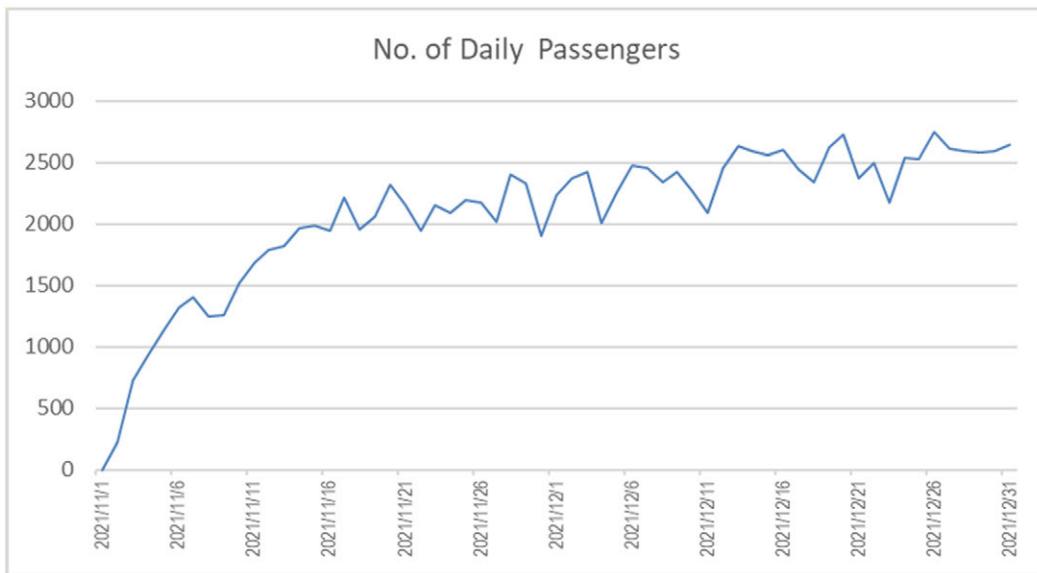
Source: JICA PiBO

Figure 3.2.4 Number of Monthly Passengers by Route



Source: JICA PiBO

Figure 3.2.5 Number of Paid and Free Passengers

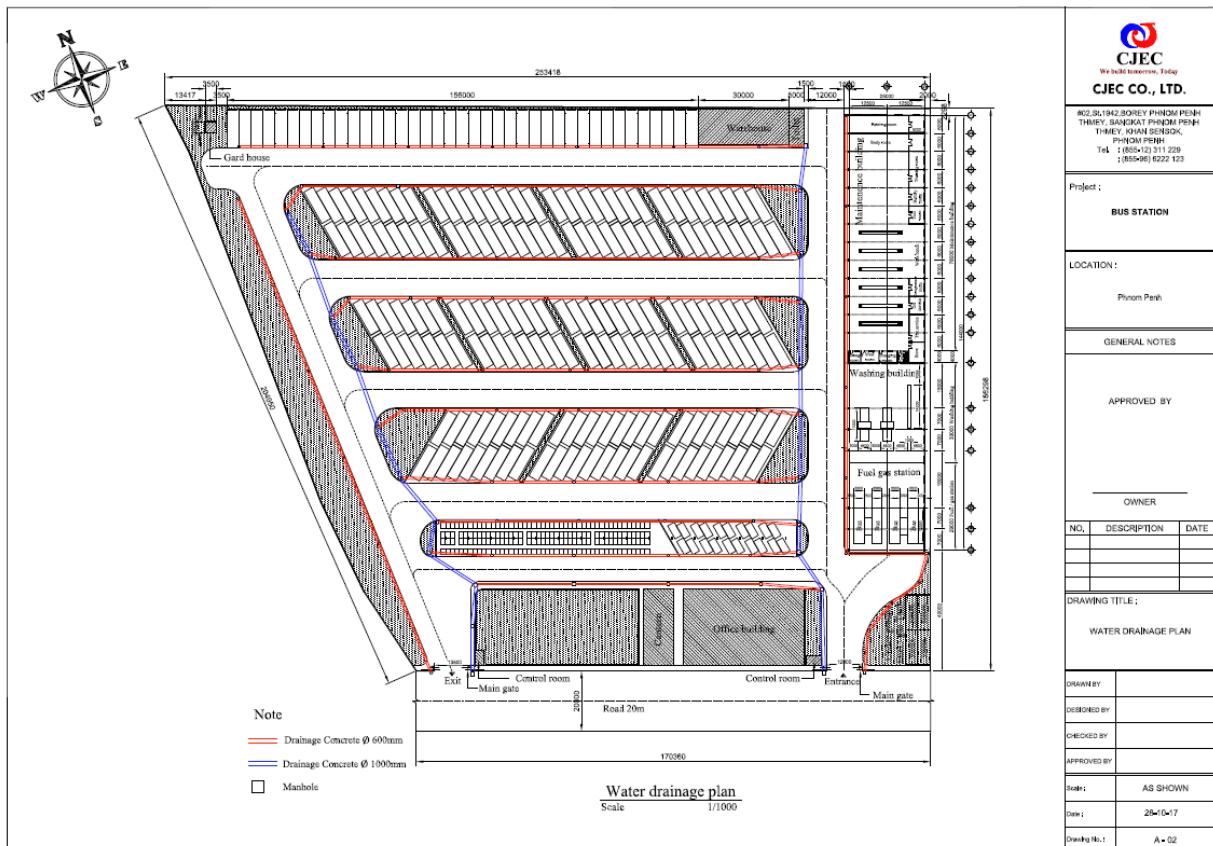


Source: JICA PiBO

Figure 3.2.6 Number of Daily Passengers since 2nd November 2021

4) Bus Facilities: Bus Depot, Bus Terminals and Bus Stops

The CBA developed the 4 hectare bus depot equipped with an administration office, workshop, and parking space and operates this single depot since January 2019. The bus depot is located 15 kilometre north along the National Road (NR) No. 5 across the Prek Pnov Bridge. The CBA also operates 14 bus terminals at the starting/ending points of each bus route and maintains 865 bus stops, which include 270 bus shelters; the rest are bus stands.



Source: City Bus Authority

Figure 3.2.7 Layout Plan of Bus Depot



Source: City Bus Authority

Figure 3.2.8 Parking at Bus Depot

(2) Metered Taxi

Metered taxis were introduced in Cambodia in 2008. Basically, a metered taxi is dispatched by telephone reservation. Because of the rapid expansion of RHS, the number of metered taxis is currently small.

(3) Cyclo

Introduced from France in the early 1960s, these pedal-driven cyclos are currently managed by PPCA. They are often used by tourists around riverside/Royal Palace or by shoppers around the local market for short distance trips. Cyclo drivers earn about USD 85 a month. The average age of the drivers is increasing and currently there are only a few hundred cyclos left.

(4) Khmer Tuk-tuk

The Khmer tuk-tuk is a motorcycle towing a two-wheeled passenger cart, also known as “Remork”. According to the paratransit driver’s interview survey, the average hours of work is 12.3, making 4.1 trips with 10.5 passengers per day, and earning about USD 250 a month. The Khmer tuk-tuk was a typical form of paratransit in urban areas of Phnom Penh, but in recent years it has decreased in number because of the rise of RHS. The base fare is 4,000 KHR and the fare increase by 1,300 KHR per kilometre.

(5) RHS: Tuk-tuk

According to a hearing conducted by the PiBO study team with the Cambodia for Confederation Development Association (CCDA) in 2017, the number of tuk-tuks in Phnom Penh has increased rapidly from 20,000 in 2014 to 30,000 in 2017. Therefore, the condition of vehicles are relatively good. The fare varies depending on companies. For instance, PassApp charges 3,000 KHR for the base fare and additional 1,200 KHR per kilometre.

(6) RHS: Car/Taxi

Each RHS Car/taxi driver (individual business owner) registers and operates under a service represented by PassApp the same as RHS tuk-tuk. The fare varies depending on companies. For instance, PassApp charges 5,000 KHR for the base fare and additional 2,000 KHR per kilometre.

(7) Commuter Truck

The commuter truck serves factory workers in the suburban area. The safety and comfort of commuter trucks is low as passengers ride on the truck bed standing which is exposed to the elements. There is no management agency and each passenger makes their own arrangements about payments with the commuter truck driver, say USD 5/month. On the other hand, some factories in Special Economic Zone (SEZ) provides bus service to their own workers.



Source: Phnom Penh Post

Figure 3.2.9 Commuter Truck



Source: Phnom Penh Post

Figure 3.2.10 Ferry(Russey Keo-Takhmao)

(8) Water Transport

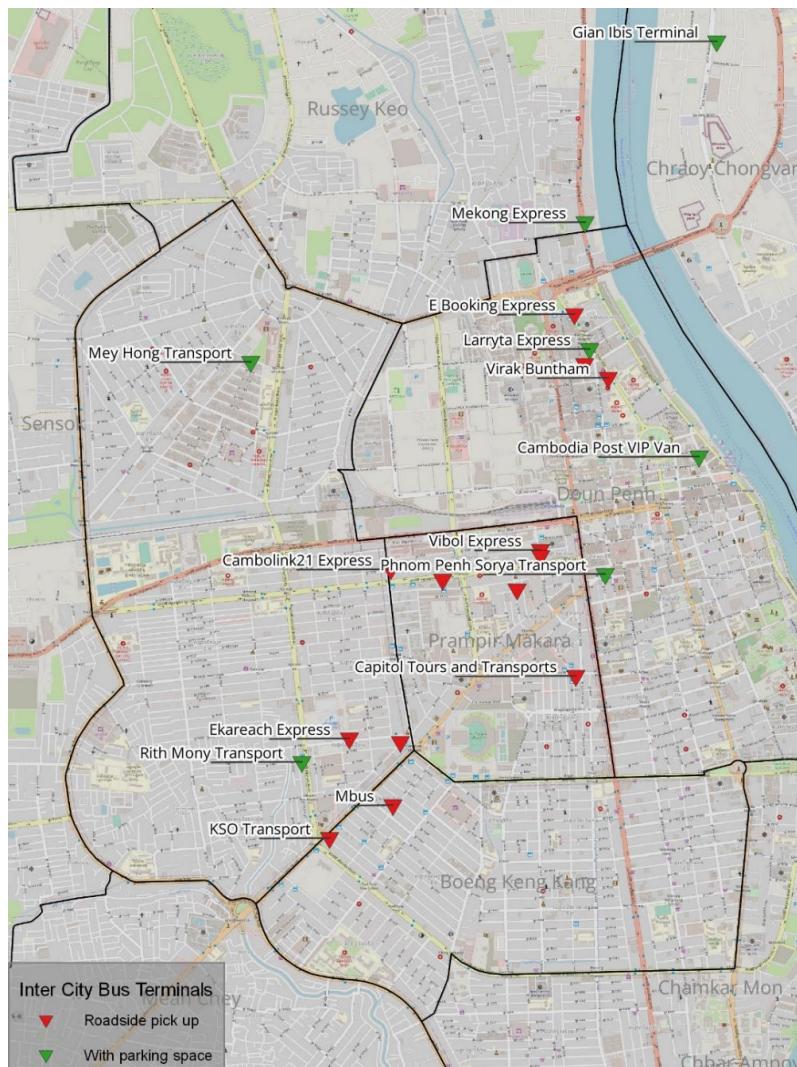
In April 2018, water taxi boats, which connect between Russey Keo Station and Ta Khmau Station, started operation. The number of round trips a day is 8 between 7:00 AM and 17:00 PM, with stops at 5 jetties.

(9) Existing Railway

In April 2018, a shuttle service using the existing railway track between Central Station and Phnom Penh International Airport operated from 6:00 AM to 20:00 PM and the fare was USD 2.5. One railcar train travelled about 10 km for about one (1) hour, which is slow and the second-hand train coach lacked attractiveness and punctuality. There are no stations along the line and it is difficult to use it for local residents, so the number of users was small. Therefore, the service was stopped in 2020.

(10) Intercity Bus

Intercity bus terminals are scattered along the narrow local roads in the CBD and large buses entering/exiting the terminals blocked traffic causing traffic congestion.



Source: JST

Figure 3.2.11 Location of the Inter City Bus Terminals

In total, there are 20 of inter-city bus terminals are observed in Phnom Penh. The inter-city bus terminals are categorized into two different types i.e., the terminals with parking space and roadside pickup. Among them, only 7 terminals are having proper space for bus to park while other 13 terminal are the pickup point or boarding location only. The inter-city bus's routes are depart from Phnom Penh to the provinces such as Siem Reap around 1 – 29 different departure time per day by operator.

Table 3.2.2 Summary of Inter City Bus Destination and Frequency

Type	Operator	Frequency (Trip/day)
To Siem Reap		
With parking space	Cambodia Post VIP Van	3
	Giant ibis Transport	3
	Larryta Express	29
	Mekong Express	5
	Mey Hong Transport	4
	Phnom Penh Sorya Transport	7
	Rith Mony Transport Co., Ltd.	5
Roadside pickup	Cambolink21 Express	6
	Capitol Tours and Transport	8
	E Booking Express	7
	Seila Angkor Khmer	17
	Virak Buntham	13
	Mbus	2
To Sihanoukville		
With parking space	Cambodia Post VIP Van	1
	Giant ibis Transport	1
	Larryta Express	11
	Mekong Express	7
	Phnom Penh Sorya Transport	11
	Rith Mony Transport Co., Ltd.	2
	Capitol Tours and Transport	6
Roadside pickup	Virak Buntham	11
	Mbus	2
To Kampot - Kep		
With parking space	Cambodia Post VIP Van	1
	Giant ibis Transport	2
	Phnom Penh Sorya Transport	5
Roadside pickup	Capitol Tours and Transport	2
	Ekareach Express	3
	Virak Buntham	3
	Kim Seng Express	9
To Koh Kong		
Roadside pickup	Vibol Express	2
	Virak Buntham	2

Source: JST summarized from following sources.

<https://12go.asia/en>, <https://bookmebus.com/en>,
<https://www.canbypublications.com/cambodia/buses.htm>, <https://www.camboticket.com>,
<https://www.giantibus.com/>, <https://vireakbuntham.com/>

Type	Operator	Frequency (Trip/day)
To Battambang		
With parking space	Mekong Express	3
	Phnom Penh Sorya Transport	5
	Rith Mony Transport Co., Ltd.	5
	Capitol Tours and Transport	12
Roadside pickup	Virak Buntham	10
To Soungh/Memot, Kampong Cham		
With parking space	Phnom Penh Sorya Transport	5
	Capitol Tours and Transport	2
	Virak Buntham	5
To Kratie		
With parking space	Phnom Penh Sorya Transport	2
	Roadside pickup	1
To Stung Treng		
With parking space	Phnom Penh Sorya Transport	1
	Roadside pickup	2
To Banlung, Ratanakiri		
Roadside pickup	Heng Sokkhoeun Express	1
	Ratanak Sambath Express	1
	Virak Buntham	3
To Mondulkiri		
Roadside pickup	Ratanak Sambath Express	3
	Rithya Mondulkiri Express	2
	Virak Buntham	5
To Sisophon (Banteay Meanchey)		
With parking space	Phnom Penh Sorya Transport	5
	Capitol Tours and Transport	5
	KSO Transport	12
To Poipet (Thai Border)		
With parking space	Cambodia Post VIP Van	1
	Phnom Penh Sorya Transport	5
	Cambotra Express	5
	Capitol Tours and Transport	5
	KSO Transport	7
	Virak Buntham	6
Roadside pickup		

(11) Electric Vehicle (EV)

Although some auto manufacturers sell electric vehicles (EV) in Cambodia, EVs are still not common in Phnom Penh mainly due to their costs of purchase. A Cambodian company Heng Development launched an electric vehicle named “Angkor” in 2013 but their business short-circuited before the mass production.⁸

⁸ Source: <https://www.khmertimeskh.com/50909807/electric-vehicle-manufactures-poised-to-win-over-kingdoms-highly-petrol-dominated-fleet/>

Onion Mobility Co., Ltd., which is a subsidiary of MVLLABS Pte. Ltd. (MVL), the parent company of TADA, started the pre-contract of the electric Tuk-tuk model called “ONiON T1” that is domestically assembled in Cambodia with the assistance from a South Korean firm late 2021. The model is currently on sale.

Oyika, a Singapore venture-funded company, sells an electric motorcycle named eGo with the free battery swap offer for 2 years. In addition, Oyika rents their electric motorcycles at convenience stores in Phnom Penh with an application named “Go2”.



Source:
<https://www.phnompenhpost.com/business/envoy-enlists-korean-tech-firms-help-ev-assembly>

Figure 3.2.12 Locally-built Electric Vehicle (ONiON T1)



Source:
<https://www.khmertimeskh.com/50750566/easy-going-and-staying-green/>

Figure 3.2.13 Electric Motorcycle Sharing (Go2)

On 5th January 2022, MPWT asked for the support in building 5 EV charging stations in Cambodia to United Nations Development Programme (UNDP). In response to this, UNDP announced that UNDP would support the installation of EV charging station at 4 locations, namely, the headquarters of MPWT, Siem Reap, Battambang and Preah Sihanouk provinces.⁹ Currently, MPWT is working on policies to promote the use of EV with battery stations, charging stations, mechanics, service centres with replacement spare parts, skilled workers and battery disposal facilities in the country. As EVs from various countries such as the United States, China, the United Kingdom and South Korea are sold, MPWT will study which standard's charging station they should build.

Currently, there are 4 major EV charging standards: “CHAdeMO” mainly used in Japan, GB/T in China, “CCS (Combined Charging System)” in Europe and North America and “Tesla”. The plug shapes of CCS in Europe and North America are different each other. Also, Tesla vehicles can be charged with CHAdeMO with an attachment. The charging standards are competitive each other and CHAdeMO is becoming less and less used in Europe and North America. In Japan and China, a faster charging standard called “Chaoji”, which is compatible with other charging systems, is under development and planned to be available in 2022 to 2023.

⁹ Source: <https://cambodianess.com/article/electric-vehicles-charging-stations-on-way>



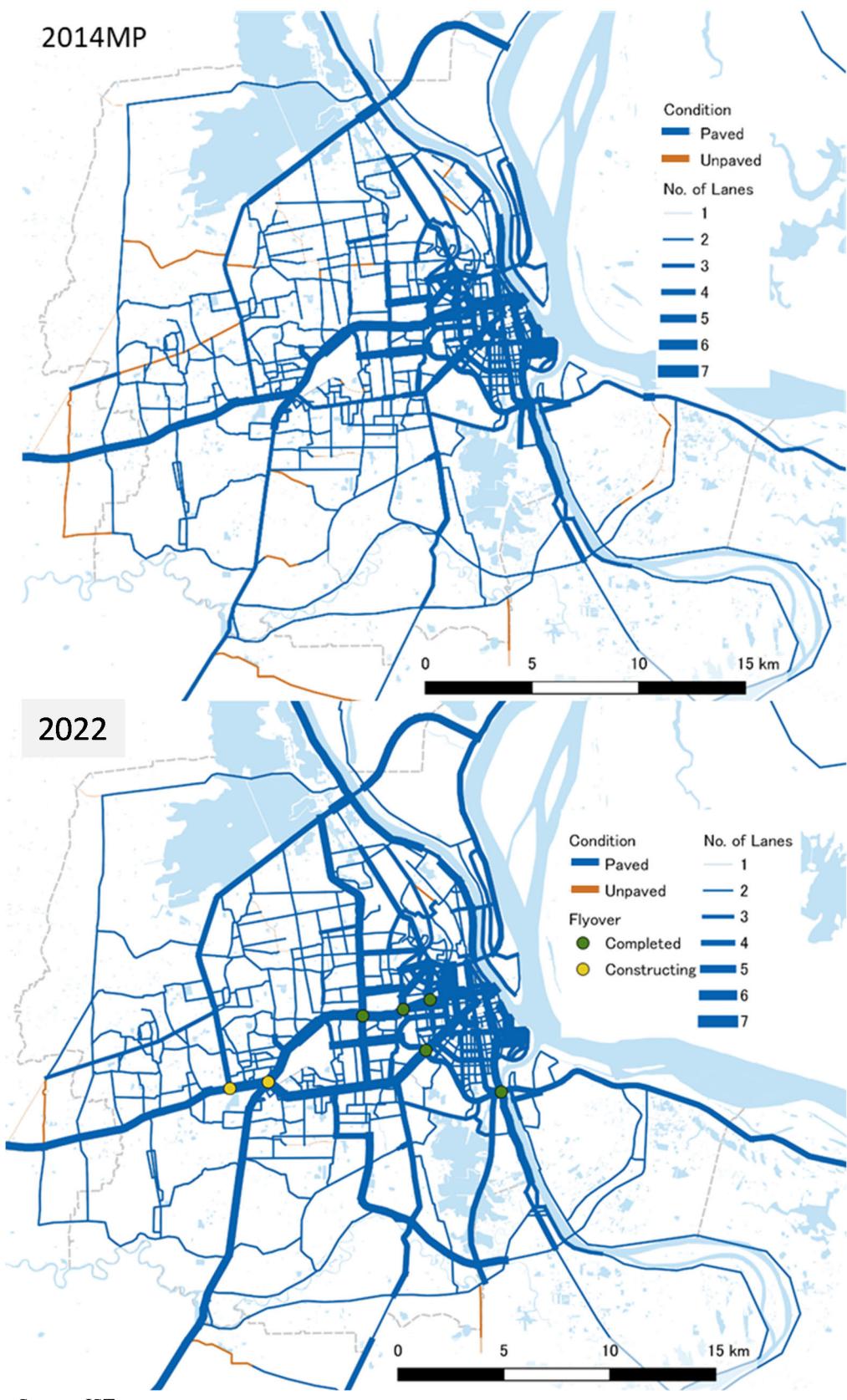
Source: https://evcharging.enelx.com/images/PR/Articles/blog/EMW_plugs_.jpg

Figure 3.2.14 EV Charging Standards

3.2.2 Highway

(1) Number of Lanes and Pavement Condition

Compared to the time of PPUTMP, road condition has been continuously improved by widening and pavement especially in the suburban area. Figure 3.2.15 shows the PPUTMP road network and current network which was observed based on the latest satellite imagery in 2022. Major improvements include the widening of Veng Sreng Blvd., Hanoi Blvd., Russian Blvd., Ring Road (RR)-II South Section, NR-1, NR-3 and NR-5, and the new construction of Hun Sen Blvd. These road improvements allow some part of the traffic to and from the factory area and the though-traffic to pass without passing through the CBD. Compared to suburban area, the large-road capacity increase is limited in CBD area, because it is difficult to carry out large-scale widening within the CBD, which has already been developed with high density.



Source: JST

Figure 3.2.15 Changes in Number of Lanes and Road Conditions

(2) Flyover or Underpass

Flyovers have been completed at three points along Russian Blvd., one point along Ven Sreng Blvd. and one point along NR-1 (Figure 3.2.15). Besides, an underpass is under construction at the Cham Chao roundabout. In addition to this, an overpass is under construction at the intersection of NR-4 and the planned RR-III.

(3) New Airport Access Road

The new airport access road is ancillary to the new airport plan which is planned to be 20 km south of Phnom Penh city centre. The road will connect the new airport and Hun Sen Blvd. and NR-2.

(4) Ring Road II (Eastern Section)

Since the eastern section of Ring Road II passes through Arey Ksat in Kandal Province, which is located on the opposite bank of the Mekong River, a bridge to cross the Mekong River is required. A feasibility study was conducted on this bridge as the Cambodia-South Korea Friendship Bridge with the support of South Korea. The agreement for the construction of the bridge was signed on Dec. 9, 2022 by the Minister of Economy and Finance and the country director of the Korea Economic Development Cooperation Fund (EDCF). The construction cost is estimated around USD 245 million, and the cost will be covered by bilateral loans. Construction is expected to take 47 months and planned to start in mid-2023¹⁰. The project will consist of building the bridge in two sections across the Mekong River and the Tonle Sap River, with one section going from the Night Market Park to the Chroy Changva and the other across the Mekong River to the Arey Ksat area.

(5) Expressway

Based on the request from the local government, JICA conducted the " Data collection survey on the trunk road network planning for strengthening of connectivity through the southern economic corridor" in 2013, and proposed the development of the approximately 2,200 km expressway listed in Table 3.2.3. Of these, the Cambodian government has prioritised to develop three routes: Phnom Penh-Sihanoukville, Phnom Penh-Kandal (part of the Phnom Penh RR-III), and Phnom Penh-Bavet.

1) Phnom Penh-Sihanoukville Expressway

It is the first expressway in Cambodia which connects Phnom Penh and Sihanoukville in the south where the deep sea port is located. The expressway is about 190 km and has total 4 lanes. In the Phnom Penh side, it starts from the Posenchey district and runs to west in parallel with NR-4. It opened in October 2022 and shortened the travel time from 5 to 6 hours on the current road to about 2.5 hours.

2) Phnom Penh-Kandal Expressway

It is a 4 lanes high-standard road that is being constructed as a part of RR-III connecting the Phnom Penh-the Sihanoukville Expressway and the Phnom Penh-Bavet Expressway. The first phase section, which started construction in 2018, is a 53km section that crosses NR-4, NR-3, and NR-2 with grade separation. As a plan for the second phase, it is planned to cross the Mekong River from NR-1 and extend to the starting point of the Phnom Penh-Bavet Expressway.

¹⁰ Source: <https://cambodianess.com/article/the-cambodia-south-korea-friendship-bridge-to-be-built-in-mid-2023>

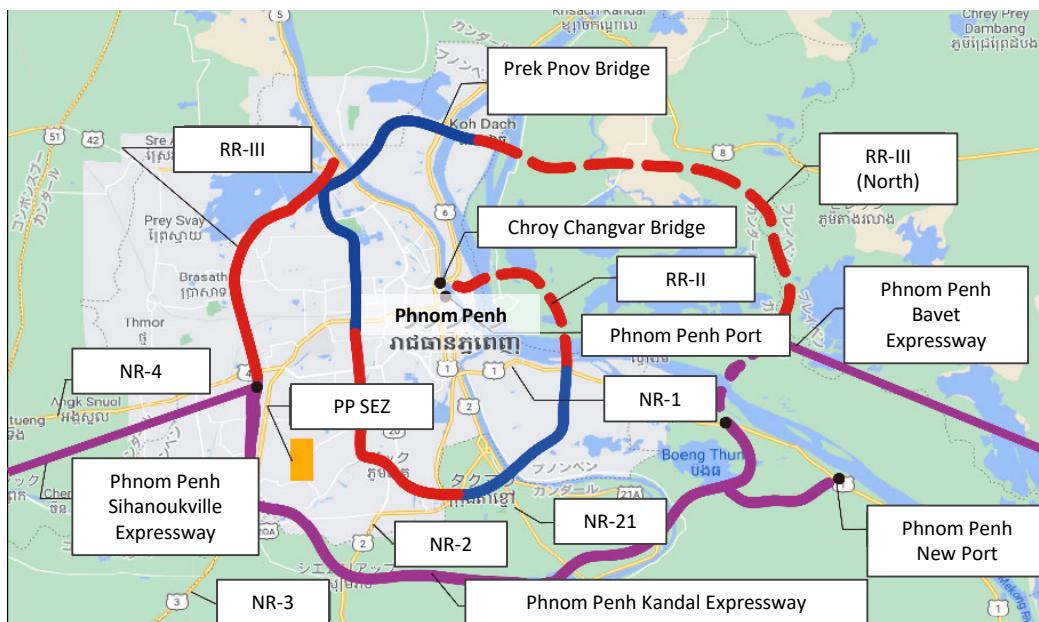
3) Phnom Penh-Bavet Expressway

NR-1, which connects Phnom Penh and Vietnam's border town of Bavet, is an important route to Ho Chi Minh City and Kai Mep Chi Bai Port in Vietnam. Near the border between Cambodia and Vietnam, factories of foreign companies are located in the special economic zone, and NR-1 consists of an important section of the Southern Economic Corridor. JICA conducted a Feasibility Study (F/S) on the Phnom Penh-Bavet Expressway (about 160 km) in December 2018, and then Chinese companies also conducted an F/S on the expressway (135 km) for the same section.

Table 3.2.3 Expressway Plan

No.	Route	Length	Operation
E1	Phnom Penh – Bavet	135 km	2020
E3	Phnom Penh – Sihanoukville	210 km	2020
E5	Phnom Penh – Poipet	355 km	2025
E6	Phnom Penh – Sri Sophon	400 km	2030
E7	Phnom Penh – Laos Border	355 km	2030
E9	Siem Reap – Vietnam Border	390 km	2030
E10	Krong Kep – Koh Kong	220 km	2030
UE	Phnom Penh Ring Road	155 km	2025
		2,200 km	

Source: 6th Meeting of the Working Group on the Asian Highway Network, MPWT 2015



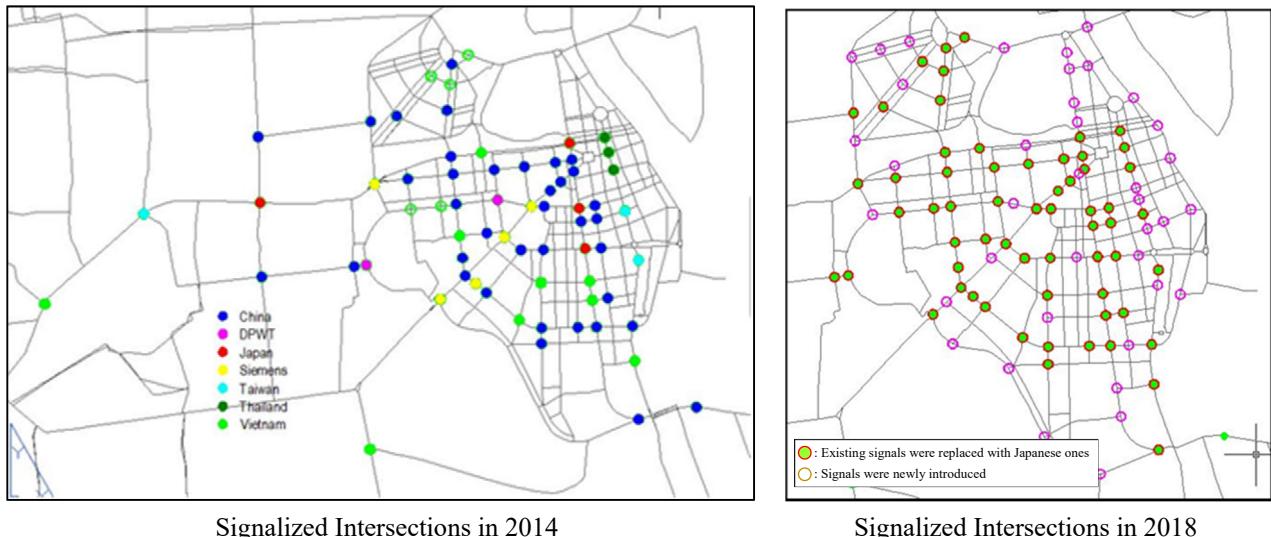
Source: JST

Figure 3.2.16 Prioritised Expressway Plan around Phnom Penh

3.2.3 Traffic Management

(1) Intersection (Signalized/Non-signalized)

Prior to the introduction of traffic control system by Japan's grant aid, the traffic signals at 69 intersections provided by different donors from seven countries were operated independently. After the introduction of the traffic control system in December 2018, traffic signals at 115 intersections were introduced by Japan. Of this number, 109 intersections connected to the traffic control centre, located in the PPCA compound excluding 6 intersections along NR-1. It is operated on flexible signal parameter settings.



Source: JST

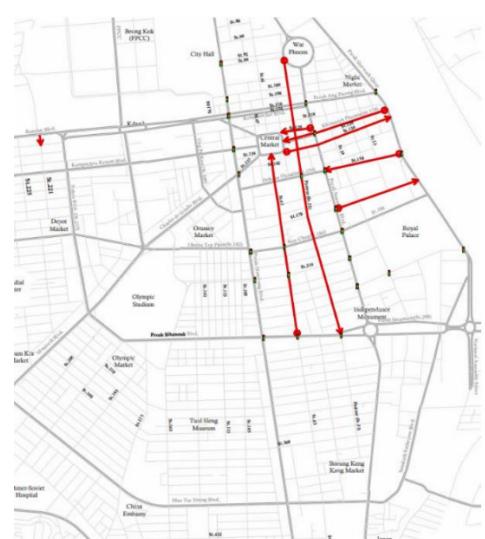
Figure 3.2.17 Location of Signalized Intersections in 2014 and 2018

(2) One-way System

During the public experiment in the PPUTMP, for the purposes of improving the pedestrian environment, increasing road traffic capacity and implementing illegal parking countermeasures, one-way road pairs had been added. There is an extension of the existing one-way road pair (St.130 and St.136) and two new road sections (St.154 and St.178) have been converted to a one-way pair. Consequently, total length of one-way roads in Phnom Penh became 8.4 km.

(3) Driver's Education and Traffic Enforcement

There are drivers who do not follow the traffic signals, traffic signs and road markings prepared by the Project for Development of Traffic Management System in Phnom Penh (Grant Aid). Therefore, it is necessary that the Phnom Penh Municipality Traffic Police officers enforce the road traffic law. However, their number and skill are insufficient, and it is hard to say that the traffic enforcement is sufficiently carried out. The enforcement is carried out when there is financial or technical assistance by donors. In addition, DPWT also has a road safety related department,



Source: JST

Figure 3.2.18 One-way Roads

but it is also hard to say that the road safety activities such as road safety campaigns are sufficient due to budgetary constraints. Due to the budgetary constraints of the related department of DPWT and the Phnom Penh Municipality Traffic Police, it is difficult to properly plan and execute the driver's education and the traffic enforcement.

These enforcement, planning and implementation agencies are struggling with their finance.

(4) Parking

One of the most serious urban transport issues in Phnom Penh is the illegal parking on the carriageways and sidewalks. Several underground parking facilities have been completed such as those in front of Vattanak Tower and the Ministry of Economic and Finance. Another is planned to be installed near night market. Despite these measures, with the number of registered vehicles increasing rapidly, the illegal parking situation will continue to deteriorate.



Source: JST

Figure 3.2.19 Underground Parking

(5) Sidewalk Management / Maintenance

The sidewalk of main roads in central Phnom Penh has a width of about 5 m in many places; however, due to illegal parking and vendors on sidewalks, the walking situation is not safe and can be uncomfortable for the citizens of Phnom Penh. In order to improve public transport services, it is also important to address safety and comfort issues walking to bus stops. Therefore, improvement of the sidewalk environment is an urgent issue in Phnom Penh. The management of sidewalks is under DPWT and Khan; however, owing to the agency's financial problems, the residents themselves had to have damaged sidewalks in front of their houses repaired. Thus, the management of sidewalks is out of control.

(6) Traffic Demand Management

With the COVID-19 pandemic as a trigger, telework started in government offices and private companies. Telework is also effective as an urban transport countermeasure; however, it is unclear whether telework will continue in Phnom Penh in the future.

3.2.4 Urban Logistics

(1) Logistics Facilities

1) Phnom Penh Port

Phnom Penh Port is the second largest port in Cambodia and the largest river port. The port was opened in 1905. Phnom Penh Autonomous Port (PPAP), a state-owned enterprise wholly owned by MEF, was established in 1998 as a management and operation entity. PPAP has been licensed by the governments to operate river ports exclusively in the following "Port Commercial Zone", and anyone who intends to develop a port in this area is required to consult with PPAP in advance. Phnom Penh Port extends over a wide area north and south of the Tonlé Sap and Mekong Rivers. In Phnom Penh, there is a multipurpose terminal (TS3) in Daun Penh. In 2013, a new container terminal (LM17) was constructed and put into

service in Kandal Province, and most of container cargo is handled at the new container terminal except for the limited container handled at multipurpose terminal. Even at the new container terminal, the water depth is 7m. It's not enough to berth large vessels.



Source: PPAP

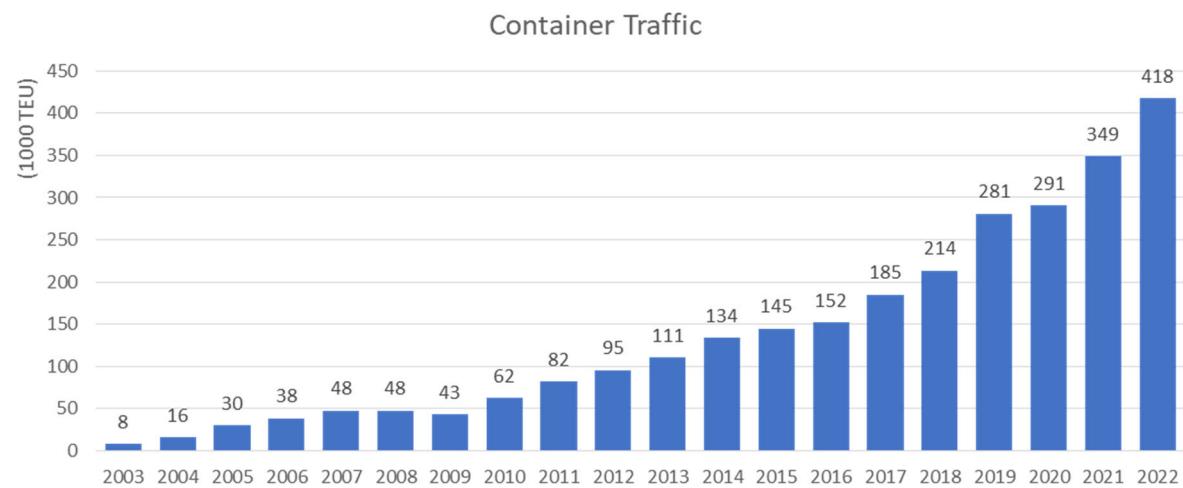
Figure 3.2.20 Phnom Penh Port

Table 3.2.4 Outline of Facilities of Phnom Penh Port

	Terminal	River	Handling Cargo	Berth Facility		
				Length (m)	Width (m)	Depth (m)
TS3	Multipurpose Terminal	Tonlé Sap	General Cargo	300	20	6.3
LM17	New Container Terminal	Lower Mekong	Container	300	22	7

Source: PPAP, "Disclosure Documents for Initial Public Offering of Equity Securities"

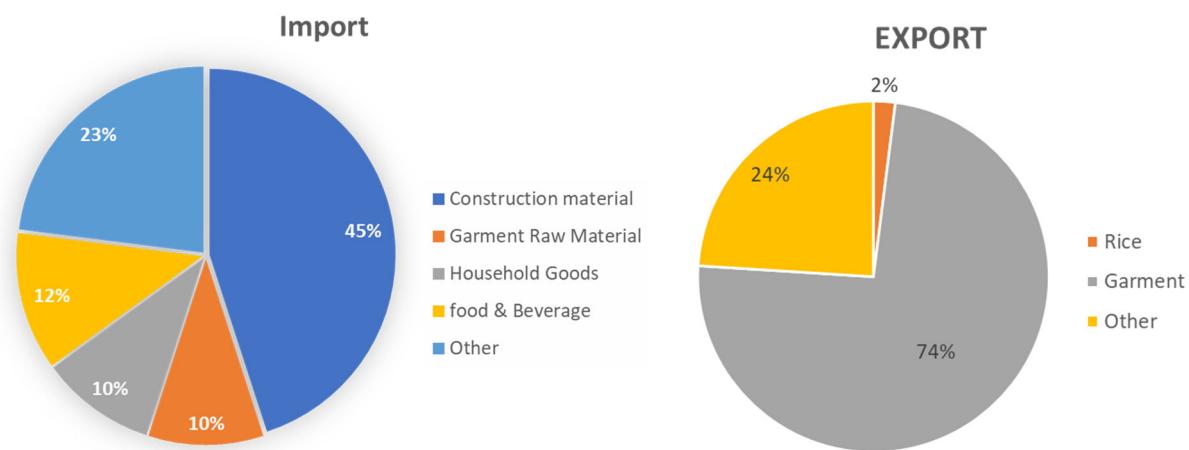
As shown in Figure 3.2.21, container volume handled at Phnom Penh Port has been increased and reached to 418 thousand TEU in 2022.



Source: JST based on PPAP's presentation

Figure 3.2.21 Trend of Handling Container Volume at Phnom Penh Port

Figure 3.2.22 shows the distribution of container cargo commodity. Construction material is the dominant import commodity. Garment products share 74 % of export commodity.



Source: JST based on PPAP's presentation

Figure 3.2.22 Distribution of Container Cargo Commodity Handled at Phnom Penh Port (Yr. 2022, Left: Import, Right: Export)

2) Dry Port

As shown in Table 3.2.5 and Figure 3.2.23, there are at least 10 dry ports in Phnom Penh City. Those are mainly located in south-east area of Phnom Penh.

Dry port has the functions of temporary storage, container yard and container freight station (a place where small cargo is mixed together), and it is not a bonded area or a bonded warehouse, but a place where customs clearance can be done. Therefore, large trucks are generated / attracted to dry port. There is a dry port at the railway station (No. 9: Toll Royal Railway), as well.

Table 3.2.5 List of Dry Port in Phnom Penh

No.	Description	Background	Services	Equipment/Facilities
1	Bok Seng PPSEZ ¹¹ Dry Port Co., Ltd	Another yard in Sihanoukville, located 3km from PAS ¹²	One-stop logistics, container depot, container & conventional Trucking services, project cargo handling, custom clearance services	Lorry crane with capacity ranging 5t to 7t, trucks from 30t to 60t, 50t-crane with suitable lifting gears stacker and 3 warehouses
2	Hong Leng Huor (Transport Imp. Exp & Dry Port) co.,Ltd. (HLH)	Established in 1999 as logistics and transportation company, on 15ha of land, about 3km from PP airport, branches in Bavel, PP	Logistics & freight forwarding, road transport, warehousing and distribution, customs clearance, dry port services	Warehouses: 50,000 sqm, customs office, CAMControl office, CY ¹³ , cargo-handling equipment, warehouse, CFS ¹⁴ & repair workshop
3	Olair Dry Port Worldwide Logistics Co., Ltd	Unknown	Unknown	Unknown
4	SBLL ICD & Transport Co., Ltd.	Unknown	Unknown	Unknown

¹¹ PPSEZ: Phnom Penh Special Economic Zone

¹² PAS: Sihanoukville Autonomous Port

¹³ CY: Container Yard

¹⁴ CFS: Container Freight Station

No.	Description	Background	Services	Equipment/Facilities
5	Sokan Transport Co., Ltd.	Established in 2000, H/Q ¹⁵ in PP ¹⁶ , branches in SHV ¹⁷ , Bavet, Smach and poipet, regional offices in BKK ¹⁸ and HCM ¹⁹ and other countries	Customs clearance & documentation, trucking, sea-freight & forwarding, dry port, warehousing and distribution	Dry port: 29,855 sqm, warehouse: 4,000 sqm, 182 trailers, 6 lorries, 3 forklifts & 4 cranes, 114 truck drivers, 5 standby drivers, 6 lorry drivers and 6 co-drivers, 2 forklift drivers, 4 crane drivers & 4 co-drivers, 5 technicians, 10 technical clerks, 5 staff and 2 team leaders and 25 admin staffs
6	So Nguon Dry Port	Established in 1999, H/Q in PP, branches in SHV, Poipet, Bavet of Svay Sieng and trapeang Plong of Kompong cham	Import-export LCL & FCL cargo clearances, inland transports, warehousing & CY	Dry port in PP: 10ha, Customs office, CAMControl, CTN-handling equipment for 20' & 40' (6cranes), CTN ²⁰ depot up to 7,000 CTN warehouse: 25,000 sqm, 11 elevators, repaire workshop
7	Tec Sun Import Export Transport & Dry port Co., Ltd	Established in 1996, 15 years of trucking experience, 4 branches in SHV, PP, Bavet and Poipet	Customs clearance, depot container storage, sea-freight, transportation, cargo consolidation	5 warehouses: 15,000m ² , 1 dry port:52,000m ² , 12 cranes& stacker 25t to 50t, 12 forklifts:02t to 3.5t, 160 modern trucks: 30t to 40t, 280 trailers, 180 staffs
8	Teng Lay Deport & Dry Port	Established in 1996	Customs clearance, documentation, ocean & air freight, land freight, open storage yard, dedicated container freight station, warehouse management & stock inventory control	Unknown
9	Toll Royal Railway Phnom Penh Dry port/ Toll Cambodia Dry Port	Unknown	Unknown	Unknown
10	Union Imp Exp & Transport/ Dry Port	Established in 2012 on 05ha of land	CY, customs clearance and documentation, trucking, warehousing, shipping, transportation & logistics and bonded warehouse	Warehouses: 7,500 sqm (including bonded warehouse), CFS warehouse & general cargo warehouse, CY: 27,000 sqm (2,500 TEUs ²¹)

Source: The Data Collection Survey on International Logistics Function Strengthening in the Kingdom of Cambodia

¹⁵ H/Q: Headquarters

¹⁶ PP: Phnom Penh

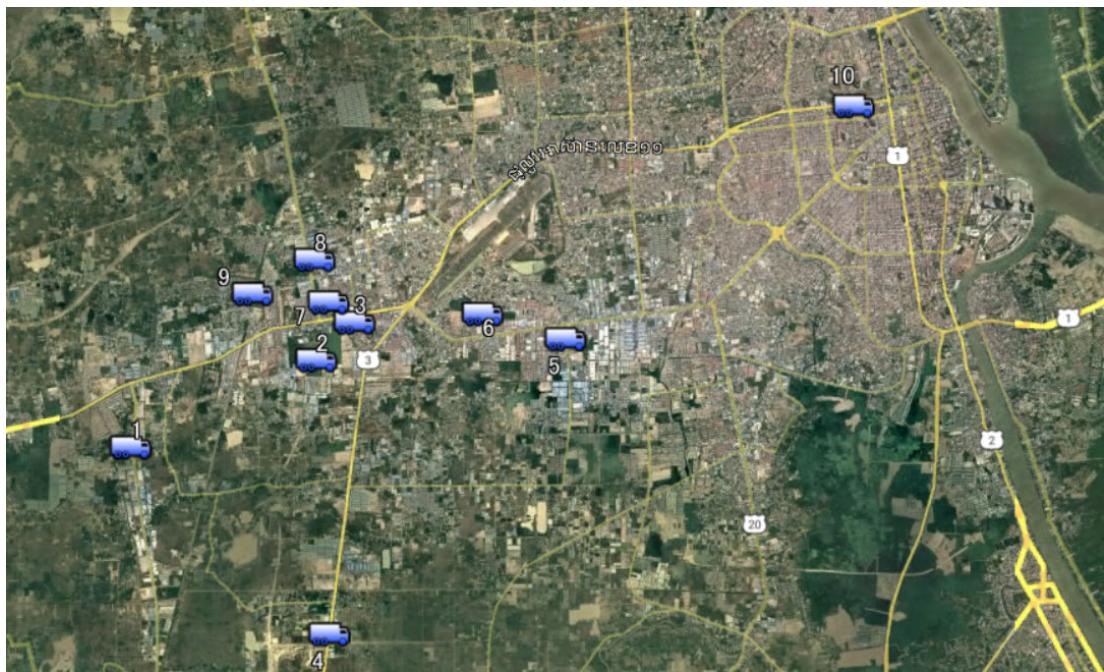
¹⁷ SHV: Sihanoukville

¹⁸ BKK: Bangkok

¹⁹ HCM: Ho Chi Minh

²⁰ CTN: Container

²¹ TEU: Twenty-foot Equivalent Units



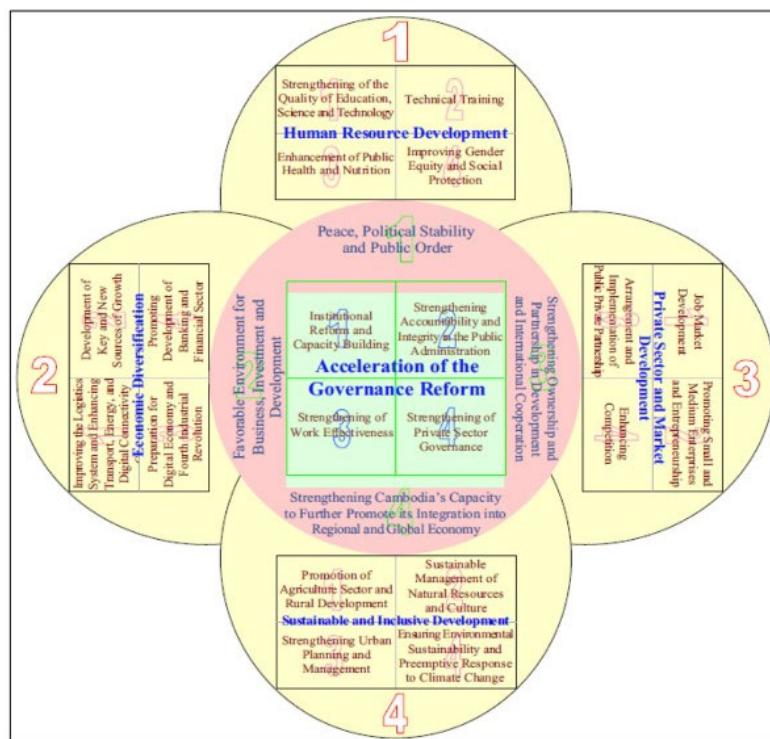
Source: JST

Figure 3.2.23 Location Map of Dry Ports

Chapter 4 Upstream Policy and Plans related to Urban Transport in Phnom Penh

4.1 National Strategic Development Plan

National Strategic Development Plan (NSDP) is a road map for the Royal Government of Cambodia (RGC) to move towards socio-economic development and poverty reduction, and it shall update every five years. The plan has been developed with a basis of “Rectangular Strategy” which has been also revised periodically in line with NSDP. The latest plan, NSDP 2019-2023, was formulated for the implementation of the “Rectangular Strategy Phase IV (RS IV)” which consists of four policies: 1) human resource development, 2) economic diversification, 3) private sector development and employment, and 4) inclusive and sustainable development. The NSDP 2019-2023 and RS IV aim to stimulate development in Cambodia in order to transform the country into a high-middle-income nation by 2030. The RS IV is explained in the following figure.



Source: National Strategic Development Plan 2019-2023, Royal Government of Cambodia

Figure 4.1.1 Rectangular Strategy Phase IV

NSDP set the four major outcomes as follows, in which “over 7% national GDP growth” is expected for future development in Cambodia.

- Resilience of the economy at over 7% growth in GDP

- Employment opportunities with an increasing number from year to year/ ratio of good quality employment
- Income below 10% poverty rate, reduce vulnerability, and low inequality
- Higher capacity of public institutions and good governance

Furthermore, there are several key actions related to urban transport under the “economic diversification” strategy in RS IV in order to improve the logistics system and enhancing transport, energy and digital connectivity. The following points are relevant key actions.

Municipal Public Transport

- Promoting the formulation of national policies, master plans and legal documents related to public transport.
- Promoting the use of smart transport systems and traffic management.
- Continuing to develop the city's streets to avoid heavy transport across the city.
- Continuing to study and solve the traffic jams in Phnom Penh.
- Continuing to study the feasibility of building an automatic train system, and the study of the feasibility of constructing tramway, monorail, and subway in Phnom Penh.

Digital Economy

- Using smart transport system

Road Traffic Safety

- Increasing traffic safety on national roads and in urban areas, and setting up cameras for monitoring the over-speeding vehicles along the national roads
- Carrying out activities and expanding collaboration to achieve the UN's (United Nations) target on road traffic safety, reducing the death rate by 50% by 2020
- Continuing to improve road traffic safety and reducing the number of street deaths to below 5 persons per 10,000 by 2020.
- Continuing to study and monitor the most frequent hazardous areas throughout the country

Railway Development

- Seeking fund to connect railway from Phnom Penh to the new Phnom Penh Autonomous Port

4.2 Land Use and Urban Development Plan

The RGC has issued the Sub-decree No.42 on “Urbanization of the Capital, Municipalities and Urban Areas” in 2015, in order to regulate urbanization within the capital, municipalities, and urban areas in Cambodia. This is similar to city planning acts in other countries. According to the sub-decree, the capital, municipalities and urban areas are required to prepare the following three physical plans: 1) Land Use Master plan/ Master Plan, 2) Land Use Plan, and 3) Urban Detailed Plan. The basic contents of these plans are also guided by this sub-decree. Phnom Penh Capital City prepared its Land Use Master Plan accordingly.

In terms of the zoning system, there are two categories, “Built Up Area (BA)” and “Control Area (CA)”. Under these categories, there are fifteen zones with regulations of maximum building cover ratio (BCR) and floor area ratio (FAR).

Table 4.2.1 Basic Zoning Urbanisation of the Capital, Municipalities and Urban Areas

Category and Zone	Maximum Building Cover Ratio (BCR)	Maximum Floor Area Ratio (FAR)
Built Up Area (BA) Category		
1. Residential zone includes 5 (five) types		
• Detached low-rise residential zone (houses, village, or semi-villages)	50%	1.5
• Linked low-rise residential zone (flats or attached houses)	75%	1.5
• Medium-rise residential zone	60%	3.0
• High-rise residential zone	60%	5.0
• Mixed residential zone	65%	5.0
2. Commercial zone includes 2 (two) types:		
• Commercial zone	75%	12.0
• Mixed commercial zone	70%	10.0
3. Industrial zone includes 3 (three) types:		
• Industrial zone	60%	3.0
• Light industrial zone	60%	3.0
• Mixed industrial zone	60%	3.0
4. Mixed use zone	70%	10.0
5. Transportation zone	60%	3.0
6. Tourism zone	50%	5.0
7. Administration and public service zone	60%	5.0
8. Public space and green area zone	10%	0.3
9. Cultural and religious zone	50%	2.0
10. Miscellaneous zones unique to the geographical features of that particular area	50%	5.0
Control Area (CA) Category		
1. Agricultural zone	30%	1.5
2. Forest zone	--	--
3. Water resource zone	--	--
4. Conservation zone	--	--
5. Miscellaneous zone unique to the geographical characteristics of that particular location	--	--

Definition:

Low-rise buildings are ranged from the ground floor, first floor, and second floor.

Medium-rise buildings are ranged from the third floor to the eleventh floor

High-rise buildings are ranged from twelve floors and above.

Note: “--” means not allowed to build any construction in the zone basically

Source: JST based on Sub-decree No.42 on “Urbanization of the Capital, Municipalities and Urban Areas”

Ministry of Land Management, Urban Planning & Construction (MLMUPC) has responsibility for land use plan, urban plan, and construction in Cambodia. MLMUPC consists of four general departments, bureaus and laboratories. In addition, they have local departments in Phnom Penh and each province in order to control the land. The Sub-decree No.42 has been prepared by MLMUPC.

BOX 1 : History of Urban Planning in Phnom Penh

The modern city of Phnom Penh was formed from urban development during the French colonial period, and this formulates the current urban infrastructure of Phnom Penh. Fujisawa and Shimizu (2021) summarised the history of urban formation of Metropolitan Phnom Penh during this period as follows.

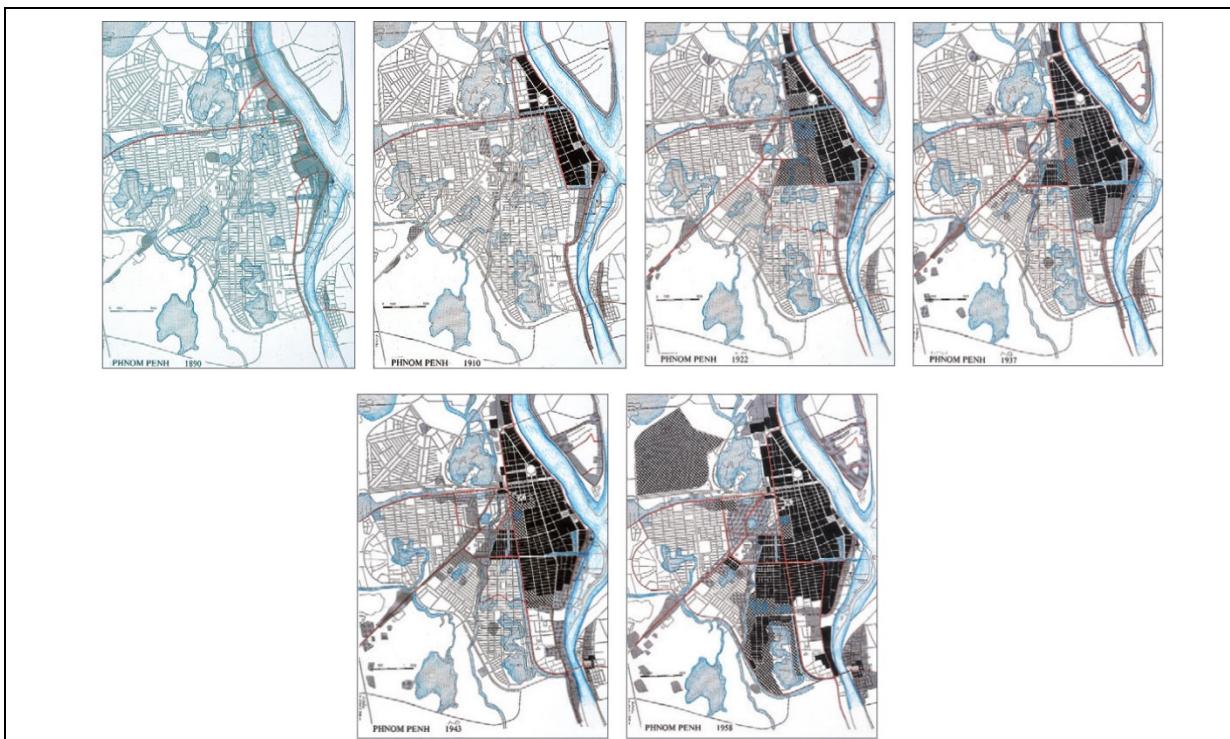
Cambodia government signed a treaty with France government in 1863 to protect its then-invaded neighbours Thailand and Vietnam, and in 1866 moved its capital from Udon to its present location, Phnom Penh. In 1867, Phnom Penh was a city of only stilt houses built along a 4 km stretch of the river with a population of less than 10,000.

Huyn de Verneville, administrator of the French protectorate of Cambodia from 1889 to 1897, had a major influence on urban development, first with the construction of store houses, and second with the segregation of ethnic groups. In 1893, a canal was constructed around the former royal palace in the centre of the city. Many colonial-style buildings, including the central post office, which is still in use today, were constructed in the vicinity. This became a French residential area with a high concentration of government buildings. On the south side of the canal, there existed a market that allowed commercial activities to thrive. This area became a Chinese residential zone consisting of more than a hundred “shophouses” - two storey houses with shops on the first floor.

By 1897, Phnom Penh’s population increased to about 50,000, of which about 400 were French, 22,000 were Chinese, 16,000 were Khmer, and 4,000 were Vietnamese. In 1906, cargo transportation service using the Tonle Sap and Bassac rivers was started. The city expanded not only to the west but also to the east across the river.

Phnom Penh significantly changed in the 1920s with the drainage of the swampy areas of the city. In the beginning of the 19th century, the city centre and other major areas were built with a grid of roads that served as levees. Sediments were pumped from the Tonle Sap and were used to fill waterlogged areas divided by the grid of roads, gradually expanding the buildable area of the city.

In the 1930s and 40s, the Prampir Makara area was divided into smaller lots, and in 1937, the Central Market was constructed. This was a product of the 1925 Phnom Penh city masterplan crafted by Ernest Hébrard which introduced a new radial road around the Central Market. He is the first president of the Indochina Urban Development Board formed in Hanoi in 1923. It was during this period that the city gradually expanded westward and southward starting with the Central Market project. Hébrard, who considered the colony as a kind of "experimental site," also planned the southern end of the Chru Changvar peninsula as an area where only the privileged among the French could live, given the fact that the city could be seen across the river. A new railroad station was also planned contiguous with the radial road and a park was created after reclaiming the waterway that separated the French and Chinese residential areas on the east side. This ensured a view to the Tonle Sap side of the city to the east.



Source: Phnom Penh développement urbain et patrimoine, 1997

Figure 4.2.1 Urban Formation Process of Phnom Penh from 1890 to 1958

Despite this long history, Fujisawa and Shimizu (2021) remarks that the capital city of Phnom Penh has currently been experiencing rapid population growth but poorly planned urban development in recent years. As a result, various problems have arisen, such as deterioration of the urban landscape, destruction of historical buildings, and loss of its characteristic natural topography. They note that, if unregulated development continues, Phnom Penh may become a "city without character", making it difficult to differentiate it from other cities in the world. While development through economic growth is essential, urban development that lacks a long-term perspective will make it extremely difficult to create attractive cities.

Source: A Study of the Urban Formation Process in Phnom Penh, the Capital of Cambodia (Tadamori Fujisawa, Atsushi Shimizu, 2021: Design Studies, Japan Institute of Design)

4.2.1 Land Use Master Plan 2035 in Phnom Penh Capital City

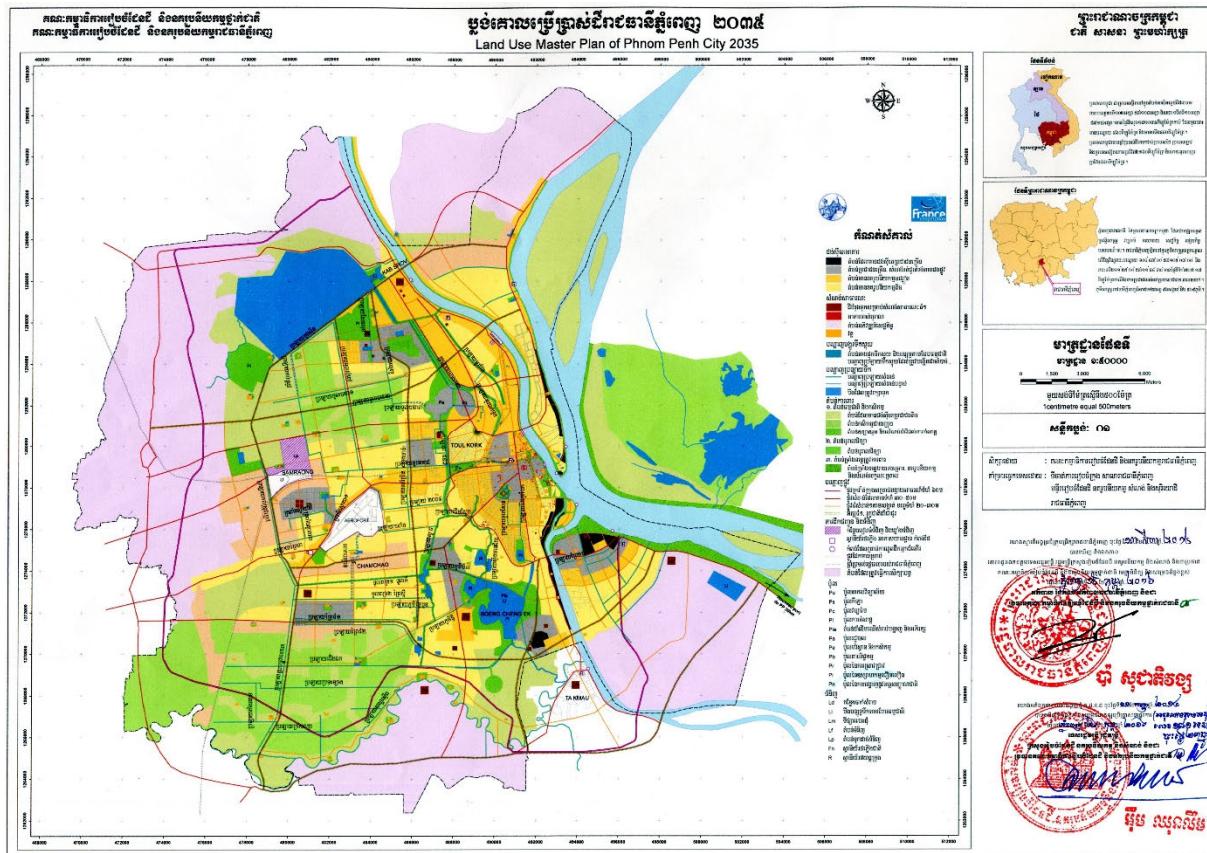
Phnom Penh Land Use Master Plan has been prepared several times since 1950s. The plan has used as guide for urban planning and its relevant regulation as well as large-sized project such as Olympic Stadium and Independence monument in Phnom Penh Capital City.

Phnom Penh Land Use Master Plan 2035 (hereafter called PPLUMP) was prepared in 2015 by Phnom Penh Capital Administration (PPCA) to achieve the objectives as follows:

- Guide to land use and ensure the existing potential value of the capital to be highly effective, sustainable and equitable in supporting socio-economic development, ensure food security, scenery, and environmental quality

- Guide to balanced, equitable and consistent development between Phnom Penh, the country's smaller cities of provinces, and cities of other countries
- Promote the identity of Phnom Penh for regional integration and competing with other cities in the region in terms of development in the context of offering excellent access both in the technical and financial fields

The future land use plan with a scale of 1:50,000 has also developed in PPLUMP as shown in the following figure.



Source: Phnom Penh Capital Hall

Figure 4.2.2 Future Land Master Plan of Phnom Penh City 2035

In PPLUMP, the estimated future population of Phnom Penh Capital City was 1,983,040 in 2035 according to the National Statistics Institute. On the other hand, PPCA estimated the future population at 2,544,659 in 2035 including Kandal Province as a “Greater City”.

Furthermore, based on these future populations, PPLUMP proposed infrastructure development plans in two scales: one is “large-sized plan” which includes Phnom Penh Capital City and Kandal Province, and the other is “city-sized plan” which targets only Phnom Penh Capital City. The following are the development proposals related to the transport sector. These ideas and plans were considered in the Survey for potential future projects.

Large-sized Infrastructure Plan

- Ring Road around Greater City

- Maintaining Port in the City (Phnom Penh Port)
- Restoration of Existing Railways and New Railway Station at the West of the City
- Development of New Airport
- Development of Dry Ports in Suburban Area

City-sized Infrastructure Plan

- Road Network Development
- Multi-Modal Transport System Development
- Green Networks (Parks and Trees) and Blue Networks (Waterway) Development

In addition, the following are ongoing development activities and investments related to the transport sector.

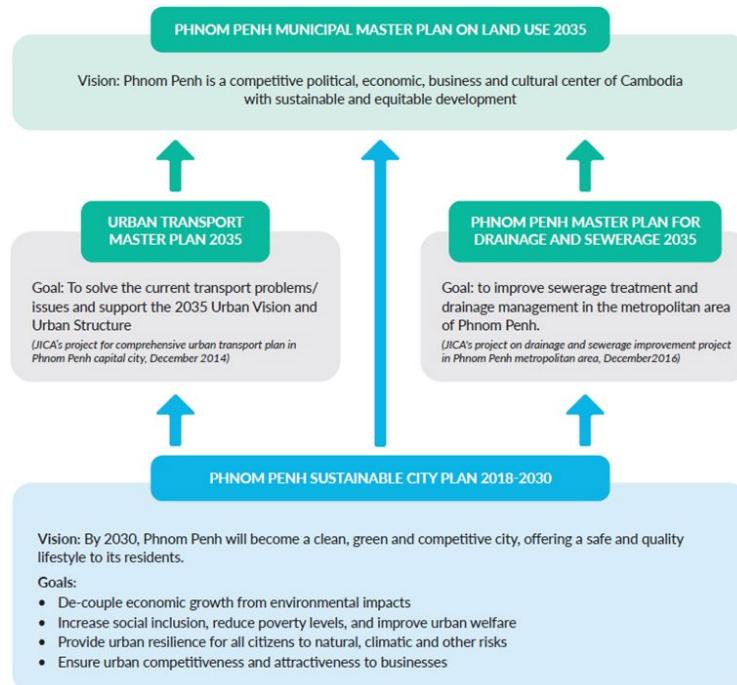
- Ongoing construction and development of satellite cities such as Diamond Island, Chroy Chongvar peninsular, Camko
- Ongoing construction and development of Olympic satellite city at the north of Phnom Penh
- Ongoing construction of roads across Boeng Kak and ongoing development of Boeng Kak area
- Development and construction of dry port and ASEAN station in Samraong area, Khan Po Senchey
- Construction of roads to connect main ring roads from one Khan to another (Russey Keo-Sen Sok-Po Senchey)
- Construction of other roads in line with main roads (NR-1, 2, 3, 4, 5) to relieve traffic into and out of the city
- Construction of overpass at major roundabouts (intersection between city ring roads and roads outside the city to provinces)
- Construction and expansion of roads in suburban areas for equitable development in balance with the city's central area and to help absorb the population growth in the city

PPLUMP has been prepared by PPCA and Capital Committee on Spatial and Urban Planning, then opened for the consultation and public hearing. After the series of process, National Committee on Spatial and Urban Planning reviewed the PPLUMP. Finally it has been approved by Royal Government of Cambodia (RGC). The implementation of PPLUMP has started in December 23, 2015 by issuing the Sub-decree on Phnom Penh Land Use Master Plan for 2035. Currently, the Urban Planning Department of PPCA is updating PPLUMP. The revised future land use plan has formulated by District¹, and a draft was announced at the workshop in December 2022.

4.2.2 Sustainable Development Plan

The National Council for Sustainable Development (NCSD) and the Ministry of Environment (MOE) has developed “Phnom Penh Sustainable City Plan 2018 – 2030” in 2019, so as to guide and implement the master plans of land use, transport, drainage and waste management in Phnom Penh. This plan refers to major plans in Phnom Penh: 1) Phnom Penh Municipal Master Plan on Land Use 2035, 2) Urban Transport Master Plan 2035 and 3) Phnom Penh Master Plan for Drainage and Sewage 2035 as shown in following figure.

¹ <https://www.phnompenhpost.com/national/phnom-penh-2035-master-plan-updated>



Source: Phnom Penh Sustainable City Plan 2018-2030

Figure 4.2.3 Linkage between Phnom Penh Sustainable City Plan and other Major Plans

The plan has eight sectoral objectives including transport sector, in which there are four practical objectives of the transport sector as follows.

Transport Sector Objectives

- Reduce transport sector greenhouse gas emissions (percentage reduction over current baseline)
- Bus-based public transport system in place, covering key transport corridors in the city (percentage of total modal share)
- Reduce traffic accidents (percentage of reduction vs. current yearly baseline)
- Reduce traffic congestion (increase in average vehicle speed vs. current baseline)

The plan proposed priority actions based on the analysis of existing development plans. The priority actions for transport development are listed below.

- Comprehensive and integrated traffic management system in place, adequately resourced and staffed,
- Parking regulations are enforced,
- Introduce sulphur content limits for transport fuel in line with regional standards (in the region of 50 ppm reduced from current 1,000 ppm),
- A system of daily air quality monitoring (increased from the current three monitoring stations) put in place across the city monitoring for key air pollutants (PM10, PM2.5, SOx, NOx , CO and O3),
- Reduce the use of motor vehicles,
- A plan in place to encourage cycle use in the city, including consideration of segregated lanes and cycle paths,
- A system of inducements to encourage the use of low-emission vehicles in place (i.e. those with better emissions performance standards in terms of gCO₂/km or similar, hybrid or electrical vehicles).

However, these actions do not have any concrete ideas nor detailed information.

PPSCP has prepared the department of green economy of NCSD and Global Green Growth Institute (GGGI). The Governor of PPCA approved the plan in November 2018, and the Minister of the Environment in April 2019.

4.2.3 Smart City Plan

ASEAN Smart Cities Network (ASCN) was established in 2018 in order for ASEAN countries to work towards the common goal of smart and sustainable urban development. The primary goal of the ASCN is to improve the lives of ASEAN citizens by using technology. The RGC has joined ASCN from the beginning and three cities in Cambodia have been selected as pilot cities, Phnom Penh, Siem Reap and Battambang. These three cities have action plans for ASCN, and the plan of Phnom Penh is summarised below.

Table 4.2.2 Action Plan of Phnom Penh in ASCN

Vision	<ul style="list-style-type: none"> To improve the urban environment to enhance citizen's quality of life
Focus Areas	<ul style="list-style-type: none"> Build efficient and green infrastructure for current and future growth Adopt best practices in public space design to create a healthy environment and boost economic growth Develop a civic engagement through social media or applications to crowd source suggestions for the improvement of public space and public transport
Strategic Targets	<ul style="list-style-type: none"> Improve pedestrianisation with repurposed walkable paths Redesign public spaces for enhanced public accessibility by people and businesses Improve the efficiency of Phnom Penh Public Bus Services by 50% modal share
Projects	<ul style="list-style-type: none"> Smart City Project 1 11 Sidewalks Rejuvenation Project Smart City Project 2 Improving Efficiency of Phnom Penh Public Transit

Source: ASEAN Smart Cities Network

In the action plan of Phnom Penh, “Smart City Project 2” is strongly related to urban transport improvement. The project mentioned the following three points as main objectives.

- To increase the transport volume of City Bus and to expand the operation routes
- To improve efficiency of City Bus by introducing modernization service such as cashless payment, GPS (Global Positioning System) and infrastructure
- To implement the Comprehensive Urban Transport Plan in Phnom Penh Capital City (PPUTMP)

In 2020, “Smart City supported by Japan-ASEAN Mutual Partnership (Smart JAMP)” has been proposed by the Japanese government and approved in 2nd ASCN High Level Meeting. One of the projects supported by Smart JAMP is “The Smart City Project Formulation Study on Smart Bus Shelters in Phnom Penh City” that was unveiled in August 2021. The project is going to encourage City Bus users by improving and modernizing the bus shelters, and it is expected to reduce traffic congestion, accidents and negative impacts on the environment caused by air pollution and greenhouse gas. In Japanese FY2021, a feasibility study on smart bus shelters was conducted, which examined the installation policy of smart bus shelters, functions to be provided by the shelters, and the use of Japanese technology. Based on the results of the feasibility study, a trial experiment has been conducted in FY2022 at two existing bus stops in the city centre to install smart cameras and touch-panel monitors with information on bus location/arrival time and the surrounding area. The results of the trial are expected to be used to promote the introduction of smart bus shelters and improve the safety and convenience of bus users.

In addition, with the support of the EU, PPCA and the International Association of Mayors of Francophonie (AIMF²) which is one of international cooperation organizations in France prepared the "Smart & Sustainable City Strategic Road Map 2020/2035." The outline is as described below.

Table 4.2.3 Outline of Smart & Sustainable City Strategic Road Map 2020/2035

Vision	<ul style="list-style-type: none"> • Phnom Penh, a Capital City that uses information & technology to better respond sustainably to its community and business needs
Focus Topics and Objectives	<ul style="list-style-type: none"> • Topic 1: Land use • Topic 2: Safety – security <ul style="list-style-type: none"> 1) Pedestrian safety, 2) Vehicle and urban mobility safety, 3) Public space safety, and 4) Maximized monitoring & ensured privacy • Topic 3: Urban Mobility <ul style="list-style-type: none"> 1) Smart parking, 2) (Re) vitalizing driving map, 3) Safe walk, 4) Integrated traffic management, 5) Public transportation, 6) Inter-connected mobility hubs/ platforms, 7) Freight & logistics transport optimization, and 8) Integrated roads pattern development in and around the city • Topic 4: Environment <ul style="list-style-type: none"> 1) Waste management, 2) Environment & wellbeing, and 3) Disaster risks management • Topic 5: Digital Management <ul style="list-style-type: none"> 1) E-governance & inter-active communication, and 2) Soft skills readiness digital awareness & smart people

Source: Smart & Sustainable City Strategic Road Map 2020/2035

Each topic shown in above Table has action plans and priority pilot projects. The actions related to transport are proposed in “Topic 3: Urban Mobility”.

- One map integration (link with Topic 1: Land Use)
- Smart parking integration management
- Mobility mapping / master plan within integrated expected projects developments up to 2035
- Traffic integrated monitoring and real time forecast
- Convenient journeys & One App smart Mobility
- Smart logistic / freight integrated e-management
- Physical infrastructures to partner the optimization

Furthermore, a total of nine projects have been proposed as priority pilot projects, of which the following three are related to transportation.

- Smart bus shelters: optimizing resources
- One App city mobility project
- Intermodal / connectivity hubs & smart parking

These plans related to smart cities described above have been led by the PPCA Deputy Governor, and there is no specific department in charge. The approval process of these plans has not been identified.

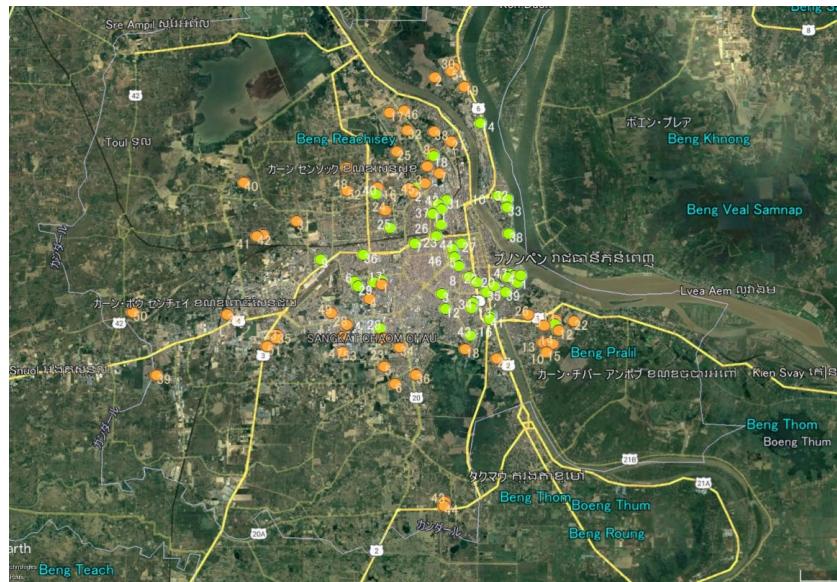
4.2.4 Urban Development Projects

(1) Housing Development

Large-sized housing development projects in Phnom Penh Capital City has been confirmed in “Preparatory Survey for Phnom Penh Urban Railway Development Project in the Kingdom of Cambodia, 2020 (JICA)”.

² Association internationale des maires francophones

In total, 101 housing development projects, consisting of 54 projects for houses and 47 for condominiums, were found in the previous survey as shown in the following figure.

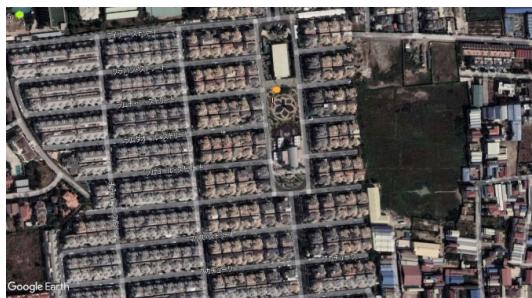


Note: Orange dot means “housing development project” and green dot means “condominium development project”.

Source: JST based on the data by “Preparatory Survey for Phnom Penh Urban Railway Development Project in the Kingdom of Cambodia, 2020 (JICA)” and Google Earth

Figure 4.2.4 Location of Housing and Condominiums Development Projects

In the Survey, the status of these projects is updated by using Google Earth instead of the site surveys. JST evaluated the data of Google Earth as appropriate because the date of images covering the entire Phnom Penh Capital City ranges from February to July 2021. Most of the projects seem to be constructed already, however some are still vacant lots. The followings images show the examples of status.



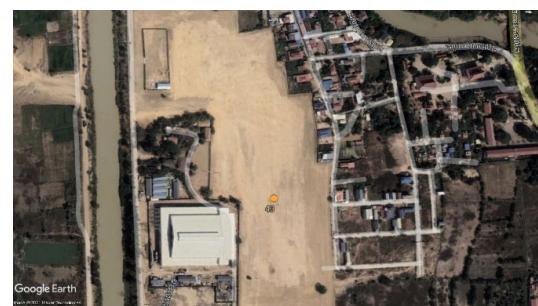
Constructed (Housing Project)



Constructed (Condominium Project)



Under Construction



Vacant Lot

Source: JST based on Google Earth

Figure 4.2.5 Example of Status for Housing and Condominiums Development Projects

The projects without a start have been confirmed in this survey. Then, the population forecast by Traffic Analysis Zone (TAZ) took this updated data into account. The status of housing and condominiums development projects is described in Appendix.

In addition, there are satellite city development projects namely “Koh Norea Project” according to “The Project for Comprehensive Urban Transport Plan in Phnom Penh Capital City, 2020 Revision Report (PPCA)”. The project site are locates at the river mouth of Bassac River and the opposite bank of Koh Pich (Diamond Island) as shown in the following figure.

The project plans to develop the land of 125ha with 50,000 residents and 7,000 job opportunities as well as two bridge constructions by end of 2023.



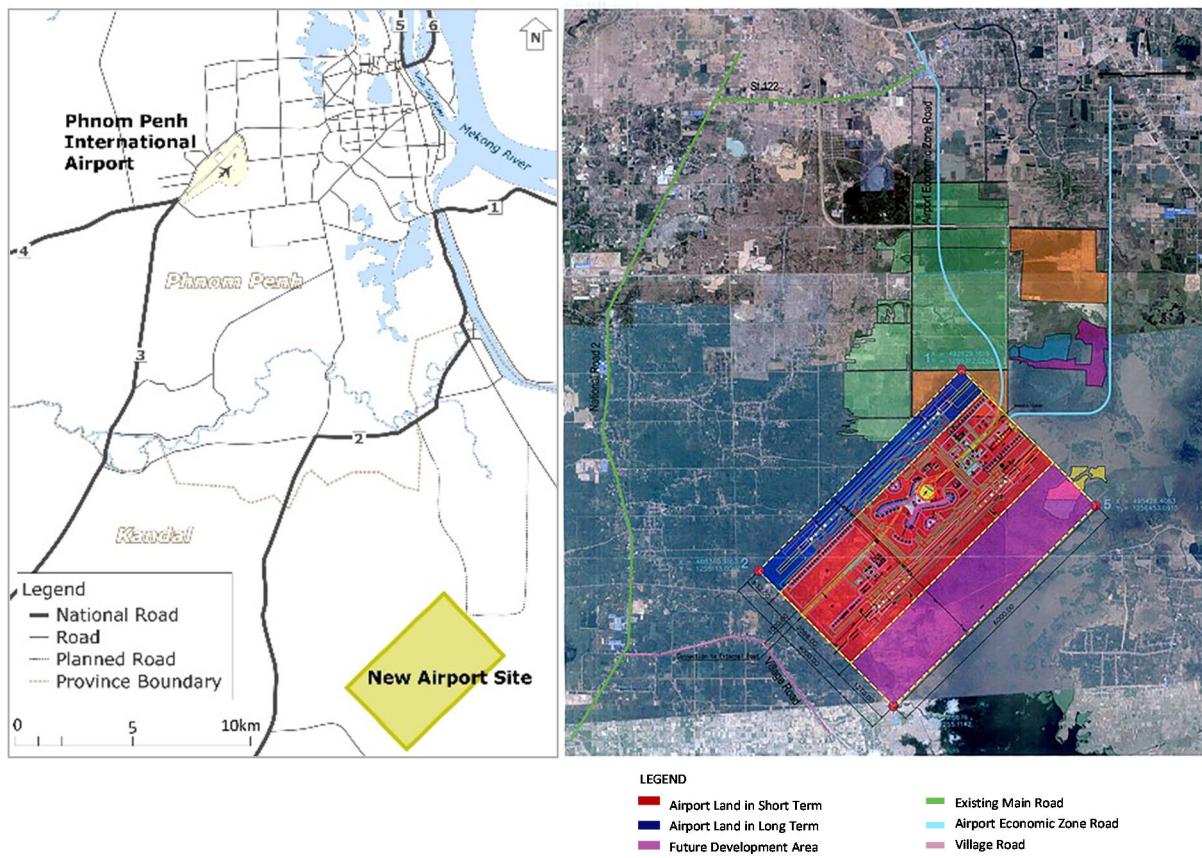
Source: realestate.com.kh

(<https://www.realestate.com.kh/news/koh-norea-30-percent-complete-july-2021/>)

Figure 4.2.6 Koh Norea Satellite City Project

(2) New Phnom Penh International Airport

The development plan of Phnom Penh New International Airport was unveiled by MPWT in “Master Plan on Intermodal Transport Connectivity & Logistics System”, in June 2021. The new airport shall be located in Kandal Province and MPWT plans to develop an access road connecting to Hun Sen Blvd. and NR-2.



Source: MPWT (JST edited the legend)

Figure 4.2.7 Layout of Phnom Penh New International Airport



Source: MPWT

Figure 4.2.8 Image of Phnom Penh New International Airport

According to MPWT, the new airport plans are to be completed during 2020-2024. The runway will be designed at 3,800m long and 60m width, and the terminal will have a capacity of 10 million passengers per year.

The forecasts of passenger and cargo by air transport in Cambodia is disclosed in the following table. Phnom Penh New International Airport will be the primary airport in Cambodia, and the capacity will be dominant. This prediction will be taken into account of the transport plan in the Survey.

Based on the information provided PPCA, the existing airport will be dedicated to VIPs and that all international passenger terminals will be relocated to the new airport.

Table 4.2.4 Future Air Transport Forecast in Cambodia

Year	Passenger Throughput (1,000 persons)				Cargo and Mail throughput (1,000 tons)			
	Domestic	Inter-national	Total	Average Annual Growth Rate	Domestic	Inter-national	Total	Average Annual Growth Rate
2017	715	8,075	8,790	-	76	64	140	-
2023	1,490	15,100	16,590	11.2%	120	120	240	9.4%
2030	2,900	27,500	30,400	10.6%	180	220	400	8.9%

Source: MPWT

4.3 PPUTMP

The Comprehensive Urban Transport Plan in Phnom Penh Capital City (PPUTMP) was established with the support of the Japan International Cooperation Agency (JICA). The target year of the PPUTMP is 2035. The PPUTMP prioritised the development of public transport and traffic management plans and proposed developing a transport system considering environmentally friendliness and modal shift. The PPUTMP established with the back casting method and public involvement approach.

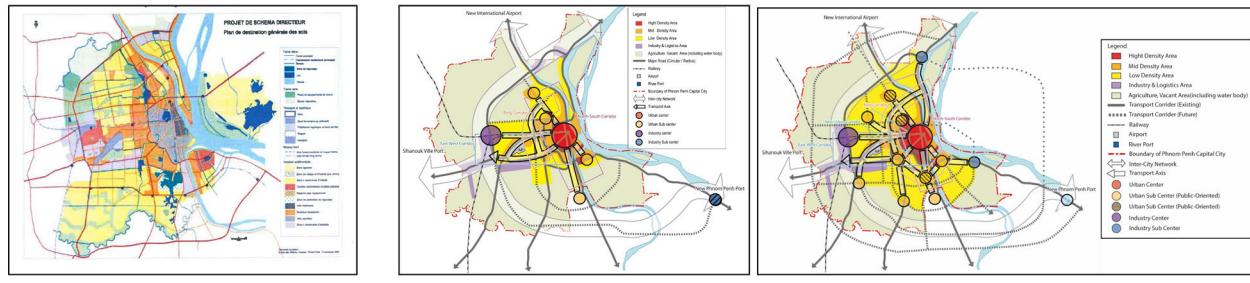
PPUTMP recommended a balanced decentralised urban structure and modal share between public and private transport, namely the target modals share of the newly introduced rail transit and bus transport is set at 30%, maintaining continuous urban vitality and sustainable urban environment.

Main components of the PPUTMP are as follows.

4.3.1 Urban Vision and Urban Structure

Most of the stakeholders of PPUTMP pointed out the necessity of improving the physical functions of PPCA to be a more sophisticated city with high mobility and IT system to progress Cambodia to have a more modern society. Also, environmental friendliness was a primary focus. Finally, the PPUTMP Project Team confirms the following vision which reflects the opinions of the stakeholders:

Phnom Penh – Smart, Mid-Mekong Capital City - is the Economic, Cultural and Political Centre in Cambodia, People and Environment Friendly.



2020 Plan in White Book

2020 Plan in PPUTMP

2035 Plan in PPUTMP

Source: JST

Figure 4.3.1 Urban Vision and Urban Structure of PPUTMP

4.3.2 2035 Urban Transport System

1) Trunk Public Transport

Toward the formulation of policy and environmentally friendly urban transport system with high mobility for the citizens, it is necessary to introduce public transport that is clean, safe, punctual and affordable. It has to be operated throughout the day and with a seamless transfer between modes.

Automated Guideway Transit (AGT)



Source: City Rail Transit System Development

Bus / Bus Rapid Transit (BRT)



Commuter Rail

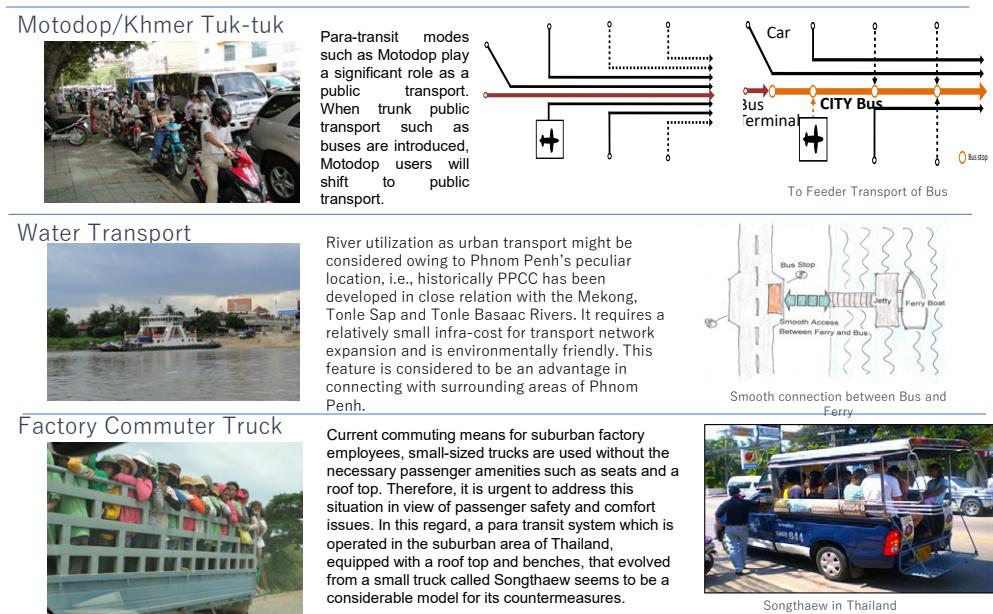


Source: JST

Figure 4.3.2 Trunk Public Transport System Proposed in PPUTMP

2) Other Public Transport System

Not only the trunk public transport but also other public transport modes that have been used for a long time in Phnom Penh such as motodops can be a part of a convenient and efficient transport system that cover the gap of the trunk public transport.

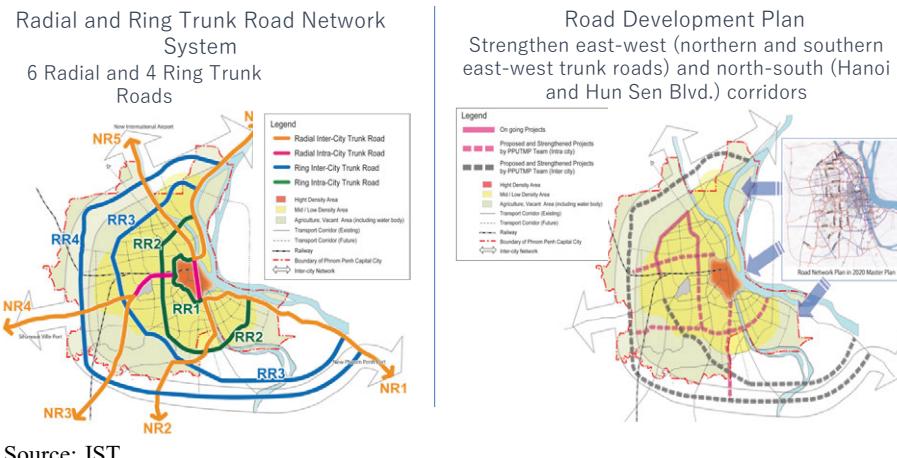


Source: JST

Figure 4.3.3 Other Public Transport Modes Proposed in PPUTMP

3) Road Network

Formulation of the physical framework of the city and creation of smooth connection between major cities in the Mekong Sub-region is another task to achieve the overall vision. The road system development covers such aspects formulating the urban framework, providing the road network with an appropriate distance to the spread of the urbanised area and enabling smooth traffic flow in the Mekong Sub-region while preserving the urban environment through the formulation of a physical framework.



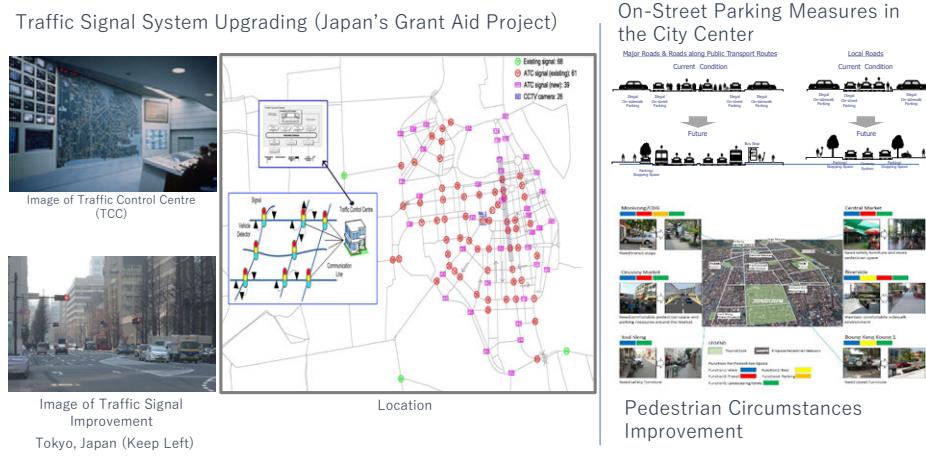
Source: JST

Figure 4.3.4 Road Network Proposed in PPUTMP

4) Traffic Management

Comprehensive traffic management is planned to maximize the use of limited urban road space, to prepare a comfortable pedestrian space and to increase public transport convenience. With a comprehensive traffic management system combining several traffic management schemes, a safe,

comfortable and smooth transport system is expected to be materialised in the dense city centre. In other words, implementation by mutual linkage of the several measures such as traffic signal system upgrading, one-way system, on-street parking measures and sidewalk improvement which are triggered by traffic signal system upgrading, can result in a safe and smooth transport system.



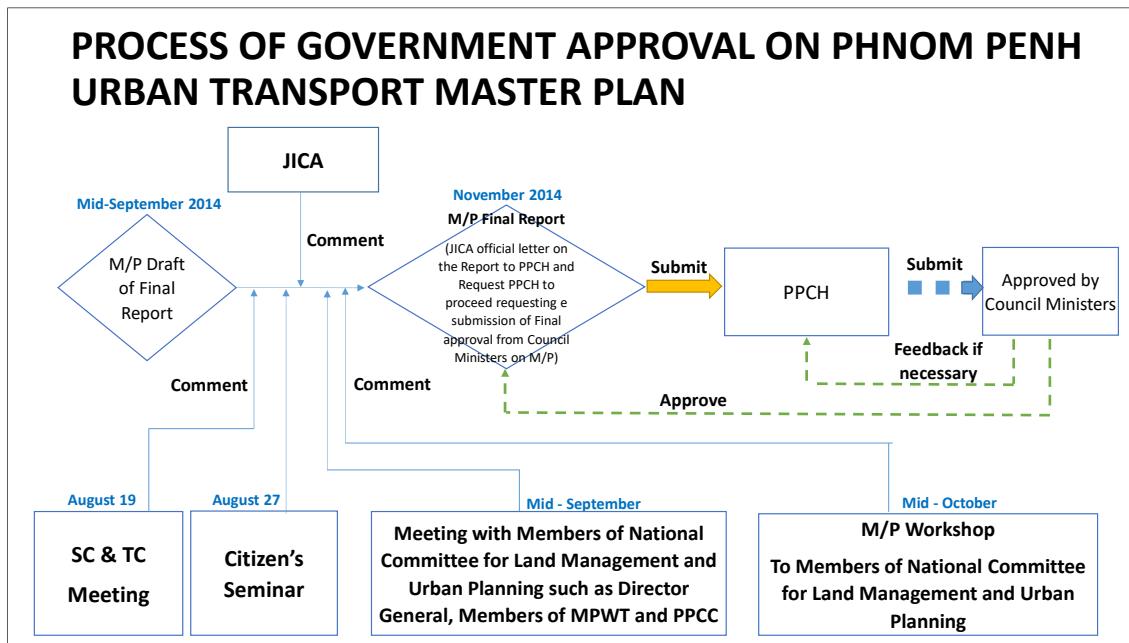
Source: JST

Figure 4.3.5 Traffic Management Proposed in PPUTMP

4.3.3 Discussion for National Approval of PPUTMP

At the finalization stage of PPUTMP, PPCA and the JICA Study Team for PPUTMP conducted a study for national approval of PPUTMP.

Land use plan of major cities in Cambodia is mainly discussed at the National Committee for Land Management and Urban Planning (NCLMUP) of the Ministry of Land Management, Urban Planning and Construction (MLMUPC), and finally was to be approved by the Council Ministers. Considering the approval process of land use plan, JST for PPUTMP proposed an approval process of urban transport master plan as shown in Figure 4.3.6 and series of discussions were made with PPCH, DPWT, MPWT and MLMUPC. However, it was found that there were no experts on urban transport in the NCLMUP members at the time and there were no enough time for approval process after the reappointment of new NCLMUP members by the end of the PPUTMP project. Therefore, it was abandoned to achieve the approval by the end of the PPUTMP project.



Source: Part of the presentation materials for the Phnom Penh Citizens Seminar on August 27, 2014

Note: PPCH in the figure means PPCA

Figure 4.3.6 Process for National Approval of PPUTMP Proposed by JST for PPUTMP

After that, PPCA started the discussion to revise the land use plan target for 2035 with support from France government. Taking the opportunity, PPCA proposed to formulate an integrated master plan with PPUTMP and the revised land use plan targeting for 2035. The revised land use plan, PPLUMP, was approved by national government in 2015. However, the urban planning department in PPCA has continued to revise the plan. Therefore, the proposed integrated master plan of land use plan and PPUTMP is not formulated yet.

4.3.4 Utilization of PPUTMP

Even the PPUTMP has not been approved, it is the only and latest urban transport M/P in Phnom Penh. Therefore, it is referred as an upstream plan for the projects implemented by PPCA, DPWT, etc. However, a mechanism has not been established to prioritize budget allocation for the projects listed in the M/P. In addition, large-scale infrastructure and urban development, such as new airport development, expressway construction and urban development in suburban areas are implemented without PPCA's intervention. Some projects proposed in the PPUTMP aren't compatible with the current situation and it needs to be reviewed.

PPUTMP has proposed 3 project: (1) Conduct of F/S for AGT Implementation, and short-term action plans: (2) Development of City Bus Operation and (3) Development of Traffic Signal System in the CBD of PPCA. And these were proposed as an urgently implemented projects.

These were urgent issues for urban transport in Phnom Penh, so despite the fact that PPUTMP was not approved by the Cambodian Government as an urban transportation M/P, the Cambodian Government has requested supports from Japanese Government. As a result, (1) F/S for urban railway was implemented, and, (2) and (3) were all implemented as grant aid projects.

4.4 Other Plans related to Urban Transport in Phnom Penh

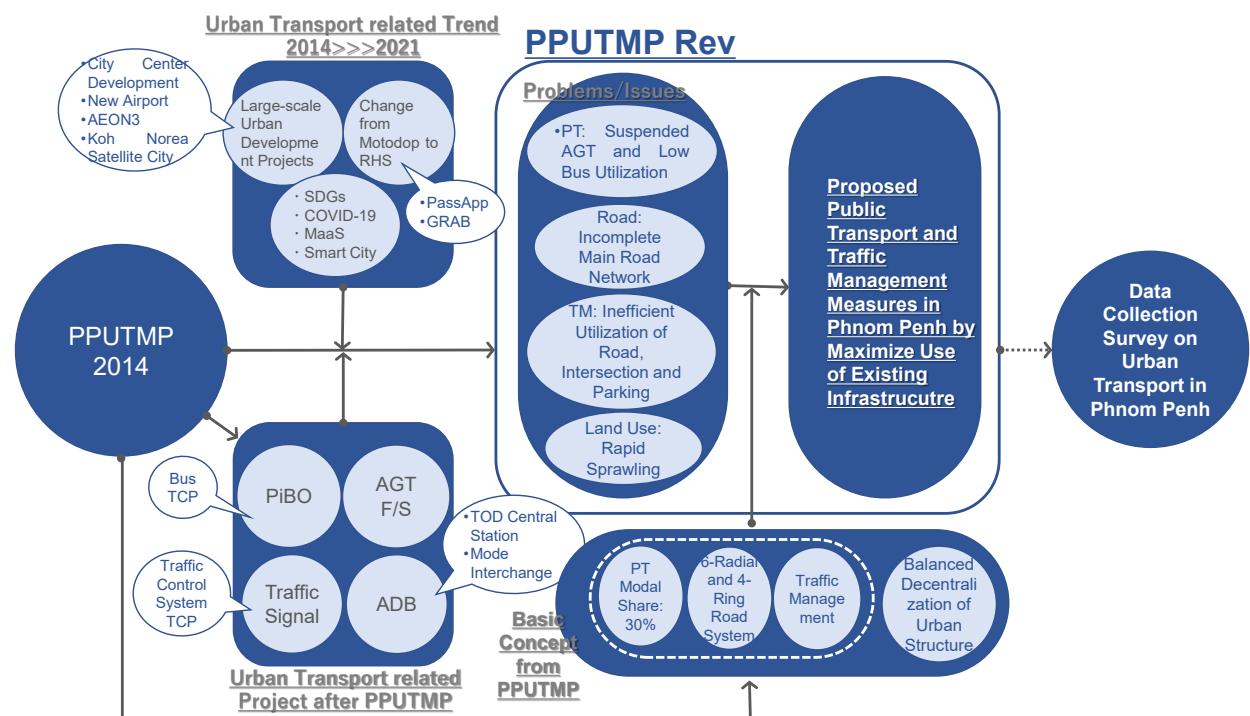
4.4.1 Phnom Penh Urban Transport Master Plan Revision Work (PPUTMP Revision Work)

(1) Outline of the Project

PPUTMP recommended maintaining the continuous urban vitality and sustainable urban environment based on a balanced decentralised urban structure and 30% of transport demand in 2035 shifting to public transport mainly consisting of the Automated Guideway Transit (AGT) and bus transport.

However, the development of AGT by public debt, which is a trunk public transport system, was suspended after the Feasibility Study mainly due to financial issues. Therefore, the urgent urban transport issue in Phnom Penh is how to reconstruct the future urban transport system in the absence of AGT.

Considering the above circumstances, the purposes of the Study are 1) to understand the current urban transport system based on the comparison between the actual situation as of today and the situation planned in PPUTMP as the state of the medium-term target year 2020, and 2) to propose measures that make effective and maximum use of existing urban transport infrastructure and the concept of PPUTMP. This is because these can be a hint for the formulation of future restructuring of the urban transport system in Phnom Penh.



Source: PPUTMP Revision Work Project Team

Figure 4.4.1 Work Flow of PPUTMP Revision Work

(2) Major Findings

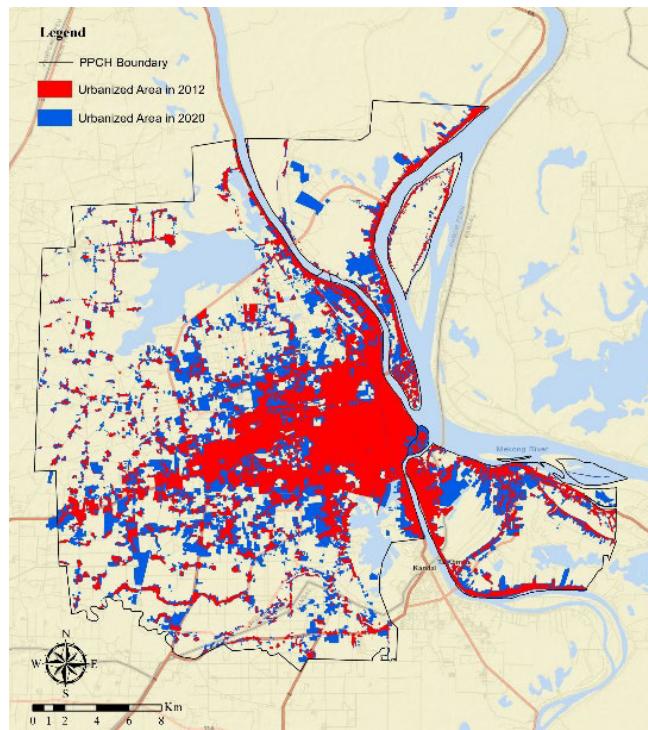
1) Phnom Penh Urban Transport Conditions Comparison between Current Situation and Proposed Mid-term Measures (2020) in PPUTMP

After formulating the PPUTMP, several important proposals such as the feasibility study for rail transit

(AGT), City Bus operation, reuse of existing railway and traffic control for CBD were implemented. While some of the proposed projects in PPUTMP were implemented, there have been new issues raised on the reuse of existing railway and bus operation. Also, there are some projects which have not been implemented. The existing railway is located along one of the major transport corridors in Phnom Penh, but it has not been fully utilised as an urban transport system. The airport access line was operated using existing railway tracks in 2018, but the operation was cancelled due to the lack of passengers, low operating speed, uncomfortable to ride and unattractive second-hand coaches. Regarding City Bus operation, the operation status before the COVID-19 pandemic was 181 bus fleet covering 13 routes. This is almost the same as PPUTMP's proposal. However, the number of daily passengers just before the COVID-19 pandemic was only 25,000 including 70% of passengers receiving free rides. It is important to prepare a convenient, comfortable and safe environment for the bus users. Also, traffic safety is still an issue. Regarding land use issues, despite the efforts of PPCA's Urban Planning Bureau, the sprawl is ongoing due to the strong pressure and speed of private sector development in the suburban area.

Built-up Area in 2012 and in 2020			
Khans	2012	2020	2020-2012
Central 4	26.5	29.4	2.9
Others	116.6	216.5	99.9
Sub-total	143.1	245.9	102.8
Total Area	678.5	678.5	

Unit: km²



Source: PPUTMP Revision Work Project Team

Figure 4.4.2 Urbanisation in Phnom Penh

2) Proposed Urban Transport Measures based on the Concept of PPUTMP and Maximizing the Use of Existing Urban Infrastructure

In considering the future urban transport system in Phnom Penh, it is proposed maximizing/effectively using existing infrastructure based on the concept of PPUTMP. At the same time, Transportation Demand Management (TDM) and land use measures should be actively combined.

Items	PPUTMP in 2035	PPUTMP rev in 2020	PPUTMP rev's Conclusion
Public Transport	<ul style="list-style-type: none"> AGT + Bus Transport + Commuter Train covers 30% of transport demand in 2035 Development of para-transit and water transport Mode interchange area development 	<ul style="list-style-type: none"> AGT plan has been suspended Bus transport has a fleet of 160, 13 routes and 25,000 pax/day Airport Access (reuse of Existing Railway) stopped in 2020 Newly operated RHS competes with bus along main roads Only bus stops are developed as part of bus operation 	<ul style="list-style-type: none"> Assess the urban transport system without rail transit How to increase bus ridership Development of BRT How to Improve the Existing Railway How to collaborate with bus and RHS Needs of development of multimodal interchange area
Road	<ul style="list-style-type: none"> Main Road Network composed of 6-Radial and 4-Ring with Flyovers Development of Collector Road Network for dense suburban area 	<ul style="list-style-type: none"> 6-Radial and 4-Ring + Phnom Penh - Sihanoukville Expressway + New Airport Access + Ring Road Extension to East Bank of Mekong River Development of collector roads mainly private development 	<ul style="list-style-type: none"> Completion of 6-Radial and 4-Ring Main Road Network System including PP - SV Expressway + New Airport Access + Additional Ring Road Development of collector roads for dense sprawled suburban area
Traffic Management	<ul style="list-style-type: none"> Traffic Signal System One-way System Parking Measures Pedestrian Circumstances Improvement Driver Education and Traffic Enforcement Traffic Demand Management (TDM) 	<ul style="list-style-type: none"> Traffic signal system in CBD No progress after PPUTMP Development of underground parking in the parks/opens spaces Still many illegal on-sidewalk parking No need motorcycle driving license under 125cc Not much progress 	<ul style="list-style-type: none"> Traffic signal system in CBD and suburban area Introducing more one-way roads Development of parking not only off-road but also on-road Pedestrian circumstances improvement Strengthening driver's education and traffic enforcement Introduction of TDM, such as telework
Land Use (Urban Structure)	Balanced Decentralization	Balanced Decentralization has not been progressed and sprawl is ongoing	How to realize the Balanced Decentralization?

Source: PPUTMP Rev Project Team

Figure 4.4.3 Proposals in PPUTMP, Current Status as of 2020 and Proposals in PPUTMP Revision Work

It is more effective to implement urban transport measures by combining several measures. Based on Figure 4.4.3, several combinations are drawn up as shown in Table 4.4.1.

Table 4.4.1 Proposed Urban Transport Measures in PPUTMP Revision Work

Combination of Several Measures		
	Combination of Several Measures	Expected Effectiveness
1	Improvement of existing railway + Park & Ride + Transit Oriented Development (TOD)	Car users shift to public transport
2	Traffic Signal + Bus Rapid Transit	Increase of bus operational speed
3	Bus + RHS	Restructuring Bus and Feeder and decrease of traffic jam along main roads
4	Restriction of Car Use to Government and Private Company Staff + Distribution of Affordable Commuter Pass	Car users shift to public transport
5	One-way System + On-street Parking	Increase of traffic volume of local road and transfer to illegal parking along main roads
6	Driver's Education + Traffic Enforcement	Needs to 1 - 5 above

Small but Effective Measures		
	Measures	Expected Effectiveness
1	Telework	If one company introduces telework once a week to all staff, attendees of the company reduce 20%
2	Ban of Selling Second-hand Car on the carriageway/sidewalk in CBD	Reduce of traffic jam in CBD
3	Shift Intercity Bus Terminal from CBD to Urban Fringe	Deduce of traffic jam along local roads in CBD and generates city bus passengers

Source: PPUTMP Rev Project Team

(3) Considerations to this Survey

In the revision work, quantitative transport surveys were not included as it was designed to help PPCA and DPWT officials understand urban transport issues and increase their awareness of participation in the revision of the PPUTMP. Input for the revision of PPUTMP is in conjunction with the Survey. In the

revision work, urban transport measures summarised in Table 4.4.1, were proposed based on the discussion with relevant stakeholders. In this Survey, those proposed measures are considered in the Development Scenario of the Survey.

4.4.2 The Project for Improvement of Public Bus Operation in Phnom Penh (PiBO)

(1) Background of the Project

CBA is still a new organisation, established in 2014, with a fragile organisation structure and delivers a low service level of bus operation, in terms of travel speed and time scheduling. Bus operation and management capacity, particularly that in CBA, needs to be improved to ensure proper operation and management of the bus fleets procured under the Japanese Grant Aid scheme. Therefore, the RGC requested the Government of Japan to implement technical assistance through ‘the Project for Improvement of Public Bus Operation in Phnom Penh’ in line with the said grant aid project.

(2) Duration of the Project

January 2017 to August 2022

(3) Counterparts of the Project

Phnom Penh Capital Administration (PPCA), Phnom Penh City Bus Authority (CBA), Department of Public Works and Transport (DPWT/PPCA)

(4) Project Goal, Purpose and Outputs

1) Project Goal

Bus operation management capacity in Phnom Penh is improved

2) Project Purpose

To promote public transport, city bus, in Phnom Penh, bus operation management capacity is improved through the following activities, 1) improvement of bus operation management capacity of CBA, 2) improvement of bus fleet inspection and maintenance skill, 3) improvement of human resource development system, 4) improvement of management capability, and 5) capacity improvement of DPWT on formulating the public transportation priority policy.

3) Project Outputs

(Output 1) Bus operation capacity of CBA is improved

(Output 2) Maintenance and inspection capacity on bus vehicles of CBA is improved

(Output 3) Training system of bus drivers, drivers' management system for safe driving, and labor management system are established in CBA

(Output 4) CBA's business management capacity is improved

(Output 5) Capacity of CBA and DPWT/PPCA on policy planning for the public transport priority measures is improved

(5) Considerations to this Survey

Due to the COVID-19 pandemic, the bus operation was suspended in March 2020. However, the operation resumed on 2nd November 2021 on 4 routes (5 lines) with 60 buses. Although the duration of the PiBO Project completed in August 2022, some agreed activities and outputs were not attainable during the project period as the full operation on all 13 routes with 181 buses was not achieved. This Survey should review the strategic plan to accomplish the project goal set in the PiBO Project.

4.4.3 The Project for Development of Traffic Management System in Phnom Penh (Grant Aid)

(1) Project Outline

Traffic signals were installed at 115 intersections in the CBD of Phnom Penh. The work at these intersections is divided into three, namely, 1) replacement of existing 64 signalized intersections, 2) installation of traffic signals at 45 intersections, and 3) installation of traffic signals at six (6) intersections along NR-1. The signalized intersections 1) and 2) above, a total of 109, are connected by optical fibre cable to the Traffic Control Centre (TCC), which was built and installed with the necessary equipment to monitor the traffic signals, intersections and roads, and to reduce traffic congestion.

(2) Project Site

CBD in Phnom Penh and Traffic Control Centre on the 9th Floor of the PPCA compound

- Project Site: CBD in Phnom Penh, about 25km²
- Traffic Control Centre: 9th Floor, PPCA compound, about 126 m²
- Generator Room: PPCA compound, about 12m²

(3) Implementing Schedule

- Project Preparatory Survey: 30 May 2014 – 20 February 2015
- Bidding Date: 8 December 2015
- Starting Date: 8 February 2016
- Completion Date: 7 December 2018

Soft Component

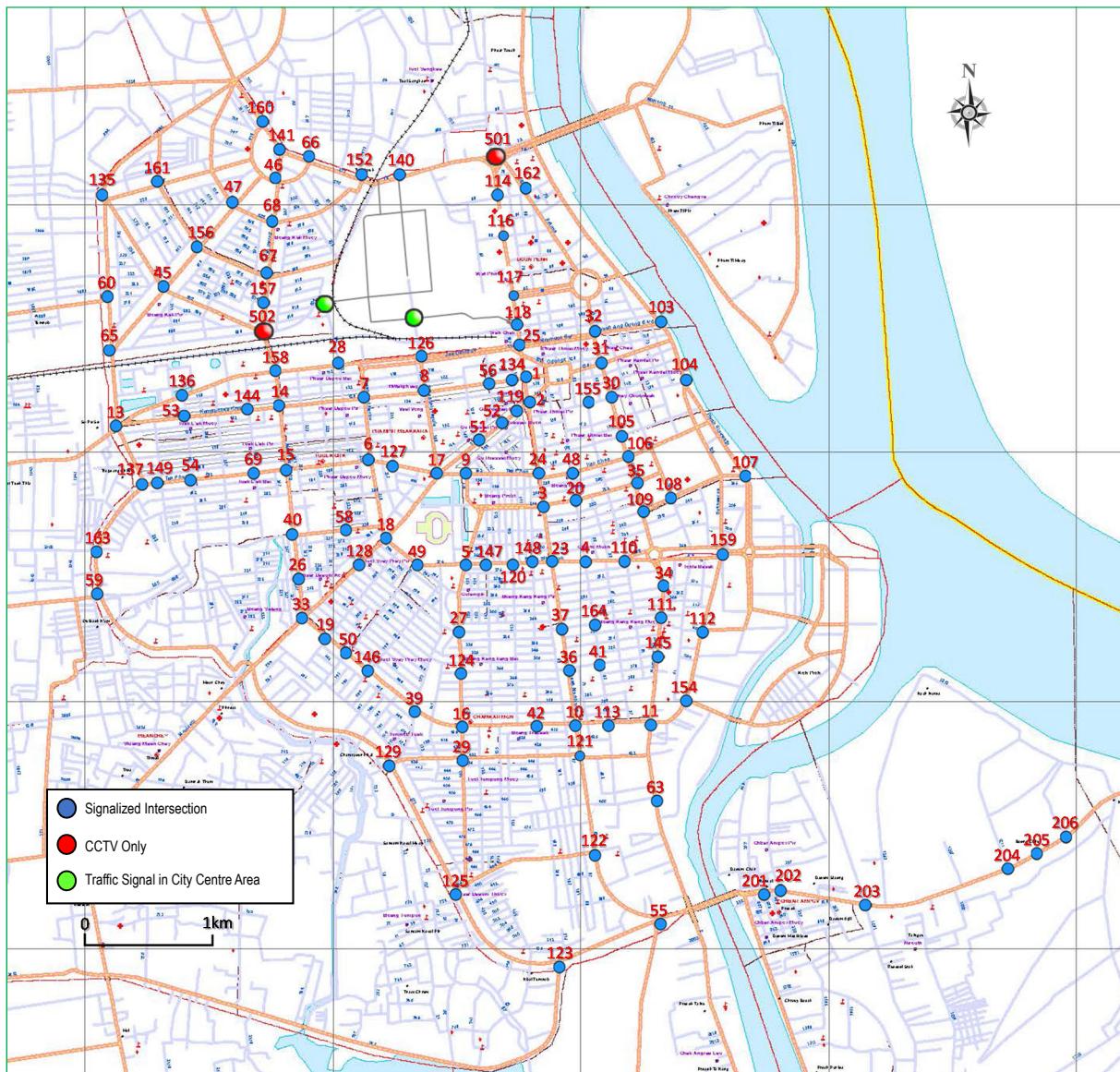
- Conducted from 20 November 2017 to 19 December 2017

(4) Considerations to this Survey

After the project, the improvement of the traffic condition was observed at the signalized intersection in CBD area. Smooth road traffic can improve the punctuality of public transport. It is recommended to expand the signalized area to the suburban area considering the urban sprawl in Phnom Penh.

On the other hand several accidents were observed after the installation, such as cutting Optical Fibre Cable (OFC). Also, several equipment are required to maintain and renovate the system.

It should be noted that TCC has the recorded traffic situation at signalized intersections. In this Survey, video image has been used to monitor the changes of traffic condition against the COVID-19 pandemic. It indicates the traffic data can be used to formulate the future policy of transport in Phnom Penh.



Source: Traffic Signal Project Team

Figure 4.4.4 Location of Project for Development of Traffic Management System in Phnom Penh

4.4.4 Project for Capacity Development on Comprehensive Traffic Management Planning and Traffic Control Centre Operation and Maintenance in Phnom Penh Capital City

(1) Project Outline

It is required to effectively and sustainably utilize the traffic control system that has been introduced in “the Project for Development of Traffic Management System in Phnom Penh (Grant Aid)” as well as to improve the traffic safety measures such as traffic enforcement. This project has commenced in December 2021 with three visions, namely, 1) to maximize the current traffic control system’s resources, 2) toward the second step of PPUTMP implementation through the pilot project and 3) to establish a comprehensive traffic management system for Phnom Penh from TCC that is sustainable and utilises organisational strength, under the project purpose of “Traffic management measures including traffic safety measures in Phnom Penh is improved”.

(2) Duration of the Project

December 2021 to January 2025

(3) Project Outputs

- (Output 1) Maintenance management system of traffic control system is established.
- (Output 2) Capacity of TCC staff on the operation of traffic control system is strengthened.
- (Output 3) Capacity to design traffic signals is strengthened through the implementation of pilot projects for traffic signal improvement.
- (Output 4) Capacity of the relevant staff to traffic control in PPCA, DPWT and TCC staff to develop the expansion plan of traffic control system is strengthened.
- (Output 5) Capacity of urban transport related organizations on traffic management measures is strengthened towards enhancement of the project sustainability

(4) Considerations to this Survey

Expansion of traffic control system is planned in this project. In addition, CCTV camera video image data stored at TCC and other urban transport data will be collected and analysed for solving transport-related issues and utilisation for transport planning.

The Project is also assisting MPWT in developing a parking law (bill to be drafted by June 2023) as part of its capacity building for traffic management measures. The parking law will consist of (1) the definition of parking, (2) designation of parking management areas, (3) management of on-street and setback parking, (4) management of off-street parking, (5) management of mandatory parking in the buildings and properties, and (6) parking fee policies and penalties. The Project also plans to improve the capacity of the PPCA to implement traffic management measures through the trial implementation of the parking law and the accompanying parking planning guidelines.

4.4.5 Supporting Sustainable Integrated Urban Public Transport Development - Sustainable Integrated Urban Public Transport Development (ADB Study)

(1) Background of the Project

The public transport and traffic management components are emerging topics, and the government and PPCA officials require new standards and regulations to consistently plan, design, and implement actions in the PPUTMP medium- and long-term action plans, in support of the development of a sustainable integrated urban public transport system. The development of standards and regulations will allow the officials to coordinate and manage the action plans to (i) improve accessibility from the travel starting point to the urban public transport system; and (ii) improve connectivity or integration among different modes (e.g., private vehicle, paratransit, walking and public transport), and within a mode (e.g., bus to bus).

(2) Objective of the Project

The Technical Assistance (TA) will improve Phnom Penh city's urban public transport system management to achieve a sustainable integrated urban public transport system and promote the use of the system through: (i) developing policy guides and a planning toolkit for relevant public transport authorities; (ii) formulating

candidate integrated urban public transport improvement programmes; and (iii) providing capacity development training to the public transport authorities to improve their system management capacity, and public awareness-raising workshops to promote use of the system.

(3) Title of the Project

TA-9503 CAM: Supporting Sustainable Integrated Urban Public Transport Development - Sustainable Integrated Urban Public Transport Development (51113-001)

(4) Duration of the Project

November 2018 to December 2021

(5) Counterparts of the Project

Ministry of Public Works and Transport (MPWT), Phnom Penh Capital Administration (PPCA)

(6) Project Outputs

Output 1: Sustainable integrated urban public transport policy guides and planning toolkit developed.

Output 2: Candidate integrated urban public transport improvement programmes formulated.

Output 3: Urban public transport management capacity and awareness improved.

(7) Priority Programmes (Tentative)

As a part of the integrated urban public transport improvement programmes, the ADB TA selected the following 3 priority programmes based on the various transport surveys following the longlist of the priority programmes of PPUTMP and conducted the Pre-F/S.

- PTIP-1: Inner City Transport Improvement Plan (Conversion of some streets to transit mall including Sisowath Quay, Re-routing bus routes, Improving pedestrian walkways and On-street/off-street parking management)
- PTIP-2: Building rapid bus network on the 4 major lines
- PTIP-3: Multimodal public transport plan: Improving traffic flow around the Central Station and developing a transit terminal

(8) Considerations to this Survey

The ADB TA identified the Rapid Bus project assigned along 75 kilometre radial road network and traffic improvement programme (including development of transit terminal in front of the Central Station, and installation of walkway and on-street parking facilities in CBA) as the priority urban transport programme, following the PPUTMP's mid-term action plan.

In addition, the urban public transport policy guides and planning toolkit developed in this TA aim for local government planning practitioners to support the development of urban transport policies and improvement programs in urban areas in Cambodia, including Phnom Penh. It is expected that PPCA would utilize the policy guides and toolkits to formulate, plan and implement urban transport policies, including public transport and traffic management, and evaluate them. Therefore, it was considered them as part of the inputs when formulating the JICA's future support program in the Survey.

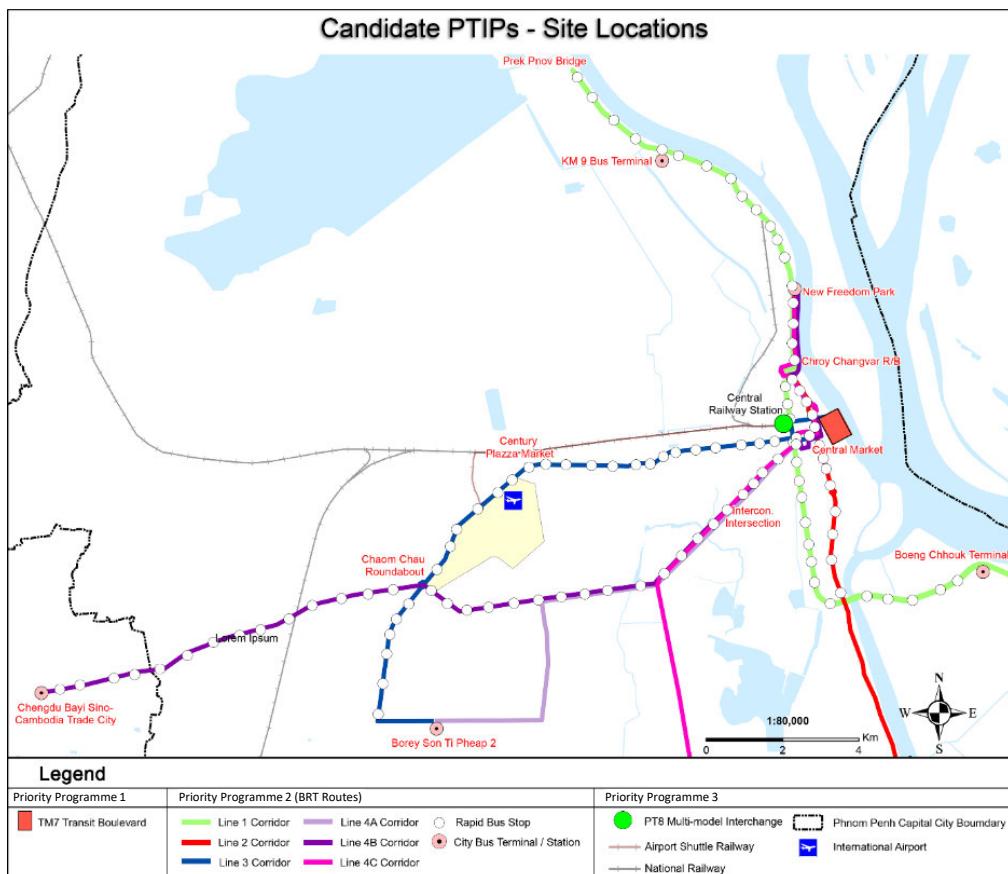
The urban public transport policy guides a planning toolkit are composed of the following contents.

<Urban Public Transport Policy Guide>

1. Background and objectives, 2. Analysis of the current status of urban transport in Phnom Penh, 3. Cross-cutting issues in urban transport, 4. Counter-measures to improve urban mobility, 5. Counter-measures to promote TOD-type development, 6. Measures to cope with climate change, 7. Impact of the COVID-19 on urban transportation and its management scheme

<Planning Toolkit>

1. Urban transport project planning guide, 2. Strategic planning framework for public transport improvements in Phnom Penh, 3. Public transport, bus system and traffic management, 4. Parking management, pedestrian and Transit Mall in the City Centre, 5. Urban development and urban transport integration, 6. Roadmap for public transport development and operation



Source: SSIUPTD (JST modified the legend title.)

Figure 4.4.5 Locations of Priority Programme (1 to 3)

4.4.6 Urban Railway

Phnom Penh Post reported on 28th December 2022 that the F/S of Skytrain project conducted by JICA and the F/S of monorail and subway projects conducted by Chinese companies have been completed. Those F/S report will be delivered to state government after the review. Also, it was reported that Senior Minister Sun

Chanthol had mentioned the state government is expecting private investment on the urban railway projects since it is difficult to invest such a huge amount, approximately 2 billion USD, only in Phnom Penh from national budget.

Chapter 5 Transport Surveys

5.1 Outline of Transport Surveys

A total of ten (10) transport surveys were carried out as follows in order to understand the updated traffic situation and issues and to develop transport models. The transport surveys listed in Table 5.1.1 are generally the same as the transport survey conducted during PPUTMP in 2014. However, in order to grasp the situation of new transport modes, which are City Bus service and RHS tuk-tuk, they are additionally covered under the present transport surveys.

Table 5.1.1 List of Transport Surveys

	Survey contents	Objectives and Contents	Quantity
1	Person Trip Survey	Home-visit interview surveys were conducted to understand resident's daily activity and travel records, personal attributes such as income and vehicle ownership, and the impact of the COVID-19 pandemic, in order to create a passenger Origin-Destination (OD) matrix.	Approximately 1,000 households
	Commuter Survey	Similar to Person Trip survey, but the survey form is more simplified by removing questions regarding daily activities.	Approximately 4,000 households
2	Cordon Line Survey (CLS)	OD interviews and vehicle count surveys were conducted to capture the OD traffic volume, cargo type and volume of passengers and cargo from outside the Survey area.	11 points on roads, 1 airport and 3 ferry terminals
3	Screen Line Survey (SLS)	To understand the amount of traffic flowing into the city centre and to verify the reproducibility of the traffic model in its current state, count surveys were conducted on screen lines.	12 points on roads (3 points are covered by Intersection Traffic Survey)
4	Passenger Interview Survey (PIS)	For each mode (passenger car, RHS, city/commuter bus ¹ , motorcycles), interviews were conducted at locations where users of each mode gathered in order to understand the characteristics of users, their awareness of traffic issues, and the possibility of shifting to a new mode.	Approximately 2,000 samples in total
5	Roadside Traffic Survey (RTS)	Count surveys were conducted to understand the traffic volume in the city and to verify the reproducibility of the traffic model.	17 points
6	Intersection Traffic Survey (ITS)	Traffic count surveys were conducted at major intersections to study intersection improvements and to verify the effectiveness of existing signals and flyovers.	13 points
7	Travel Speed Survey (TSS) ²	Conduct speed surveys using GPS loggers to observe travel speed by mode and corridor. Also, the survey result will be used to identify the operation area of RHS.	13 passenger car routes 50 RHS three-wheeled vehicles 50 commuter buses
8	Parking Condition Survey (PCS)	Conduct interviews and count surveys at facilities and on streets to observe parking capacity, usage, and impact on roadways and sidewalks.	Facilities: 17 locations & On-street

¹ Commuter buses: Buses operated by companies located mainly in the SEZ for commuting of their employees.

² GPS log data for bus travel speed will be obtained via the PiBO.

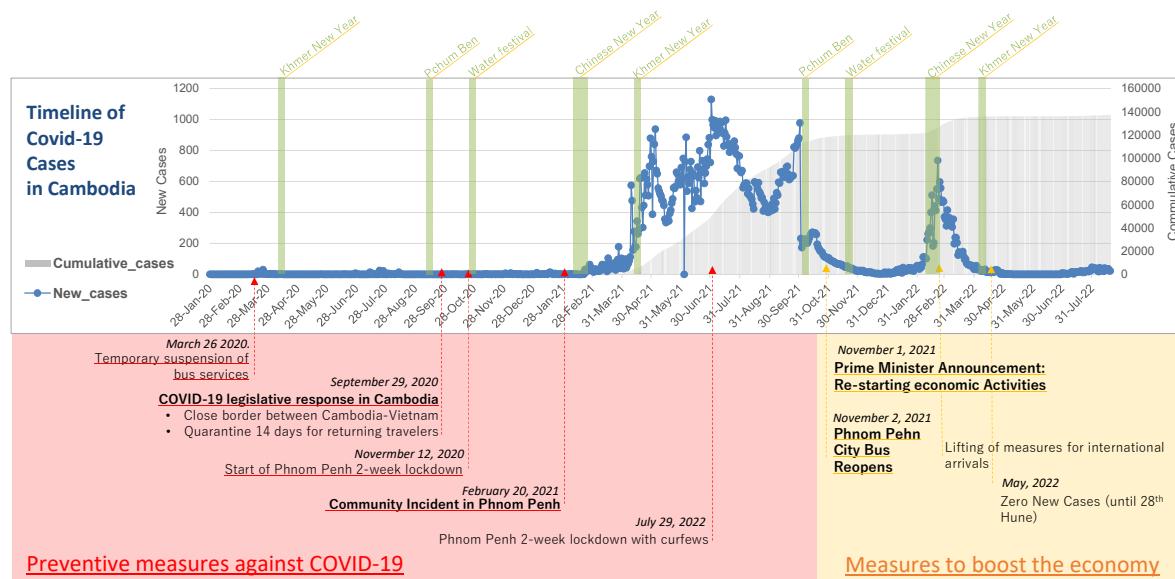
	Survey contents	Objectives and Contents	Quantity
9	RHS Driver Interview Survey	An interview survey was conducted with drivers to understand the actual status of RHS, including vehicle kilometres travelled per vehicle (actual and empty), fare revenue, and number of trips.	400 samples
10	Truck Interview Survey (TIS)	Conduct interviews with companies and drivers, and count surveys at PPSEZ and logistics hubs to estimate the percentage of cargo items and intra-regional cargo OD at major cargo hubs.	15 locations

Source: JST

5.2 Consideration for Conducting Transport Surveys under COVID-19 Pandemic

5.2.1 Monitoring of Effect of COVID-19 on Transport Behaviour in Phnom Penh

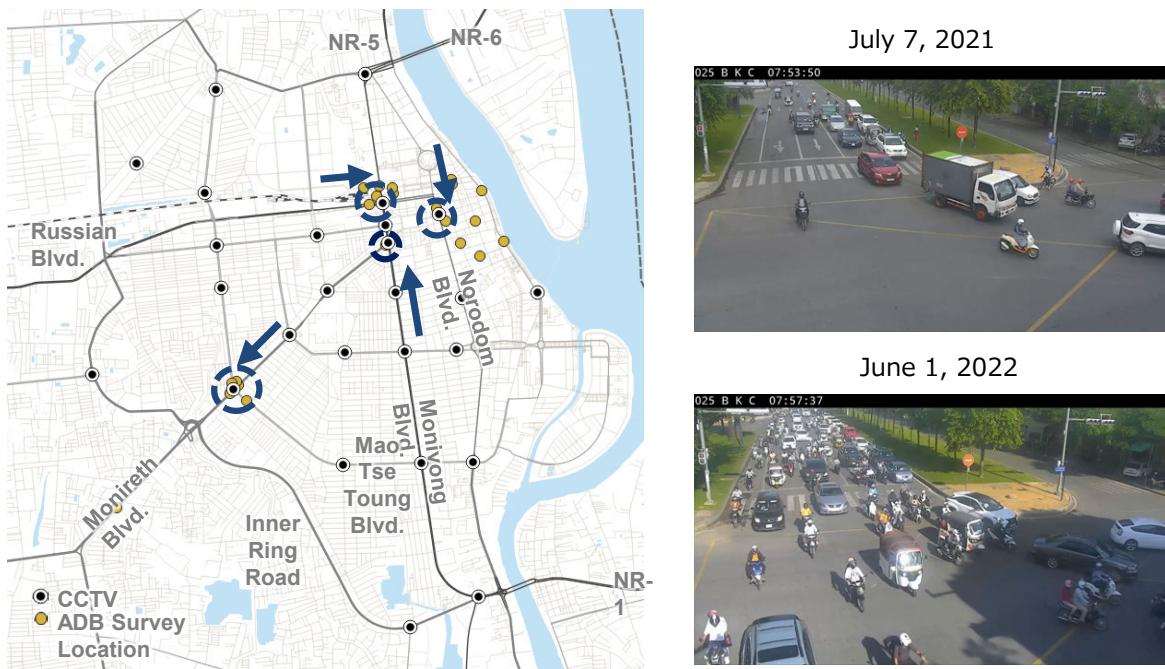
In Cambodia, the number of cases of COVID-19 was limited by February 2021 as shown in Figure 5.2.3. However, it has increased from February 2021 until October 2021. Later in November 2021, the Prime Minister announced the re-activation of the economy and City Bus is also re-started operation immediately after the announcement. The traffic behaviour was highly affected by such daily news of cases and social restrictions such as curfew.



Source: JST based on the information from World Health Organization (WHO) and news articles

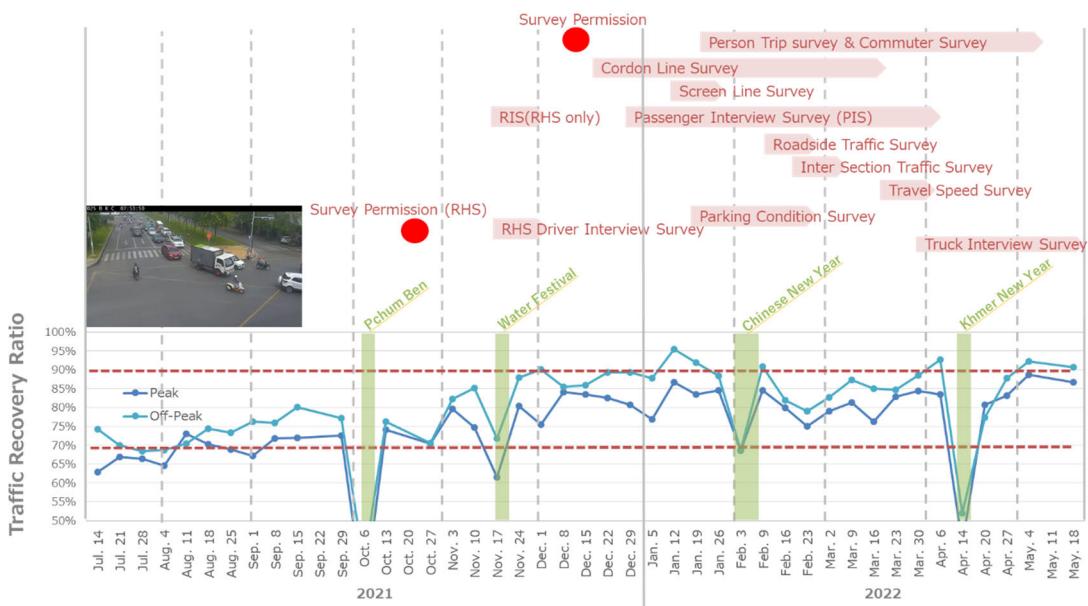
Figure 5.2.1 New Cases of COVID-19 and Counter Measures in Cambodia

In order to judge the appropriate timing to start the transport surveys, traffic volume has been monitored using CCTV camera data as shown in Figure 5.2.2. The results are compared with the traffic volume survey results in 2019 which was conducted by the ADB survey team. Traffic volume has been counted once every other week since July 2021 for one hour each in the morning, noon, and evening, by vehicle type. Figure 5.2.3 shows the recovery rate of traffic volume compared to that in 2019 based on the total PCU (Passenger Car Unit) volume at 4 locations. The recovery index reached 90% in January 2022. Considering the index, transport surveys were initiated after consulting with PPCA and Khans.



Source: JST

Figure 5.2.2 Location of Traffic Monitoring by CCTV and the Captured Traffic Condition

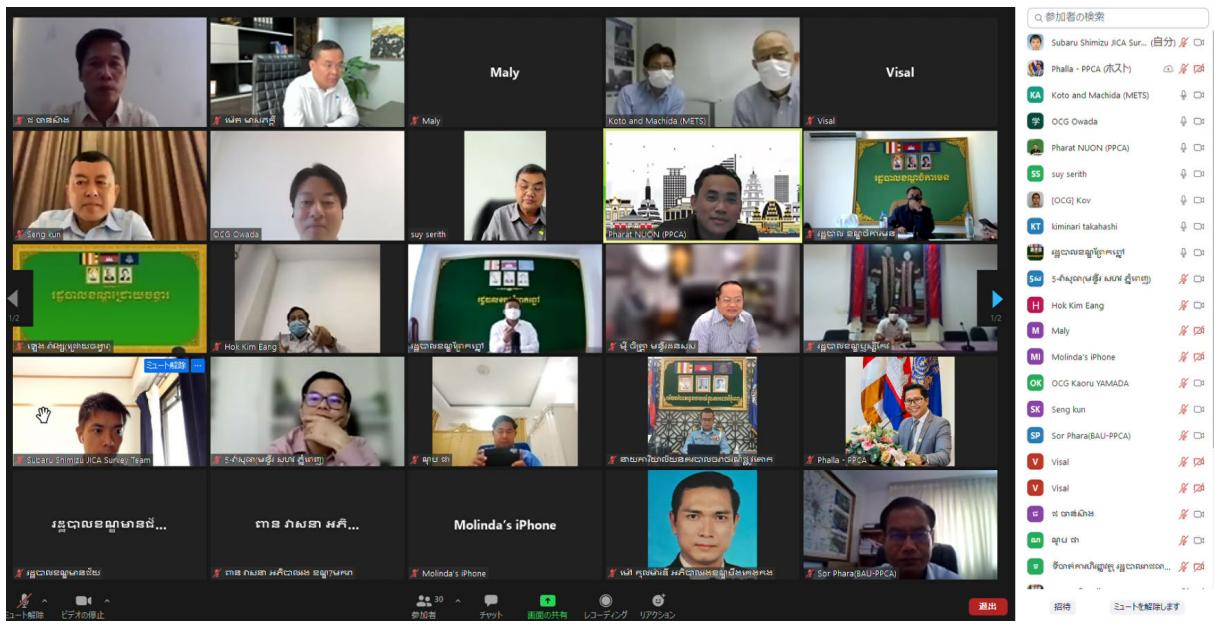


Source: JST

Figure 5.2.3 Traffic Volume Recovery Index at 4 Locations and Schedule of Surveys

5.2.2 Discussions with PPCA

In consideration of the effect of COVID-19, a series of meetings with counterpart officials from PPCA has been made via videoconferences to share the overall progress and to discuss the way forwards with regards to the transport surveys and data/information collection process. On September 10th, 2021, a meeting with related stakeholders, particularly traffic police, all 14 Khan Authorities, and DPWT under the chairmanship of PPCA Deputy Governors was held.



Source: JST

Figure 5.2.4 Stakeholder Meetings for Transport Surveys

(1) Modification of Transport Survey Methodology

Out of the 10 items of transport surveys being planned, there were comments only on the methodology of Person Trip Survey, which can be summarised in 2 points:

- Request to minimize the number of questions and physical contact (i.e. number of home visiting time) to prevent COVID-19 infection;
- Suggestion on utilizing the latest result of Population Census.

In response to the above comments, the JICA Survey Team has proposed to modify from the initial plan of 5,000 households Person Trip Survey to a combination of 1,000 households Person Trip Survey and 4,000 households Commuter Survey. This proposed plan has been shared with PPCA and then approved.

(2) Criteria to Start, Suspend Surveys under COVID-19 Pandemic

Since the transport survey was conducted under the COVID-19 pandemic, the criteria for starting/suspending the transport surveys was prepared using behavioural restrictions and the traffic volume recovery rate as indicators. The criteria was shared with PPCA and was officially agreed.

Table 5.2.1 Criteria to Start, Suspend Survey under COVID-19 Pandemic

	Survey Items	Restrictions	Traffic Volume Recovery
A	RHS driver interview & Passenger interview survey	Common Criteria: <ul style="list-style-type: none"> • Permission of Local Authority • One week after Orange / Yellow zone released 	70% Compared to 2019
B	Mini PT Survey (100 HHs)		
C	Other surveys	<ul style="list-style-type: none"> • Common Criteria + One week after offices open 	90% Compared to 2019
D	PT Survey (900 HHs) Commuter Survey (4,000 HHs)	<ul style="list-style-type: none"> • Common Criteria + One week after schools open 	

HH: Household

PT Survey: Person Trip Survey

Source: JST

5.3 Description/ Result of Transport Surveys

Major findings from transport surveys are described below. Details of each survey result are shown in Appendix 1.

5.3.1 Person Trip Survey/Commuter Survey (PT/CS)

(1) Survey Objectives

The common objectives of the Person Trip Survey and Commuter Survey are:

- To understand the trip characteristics (e.g. origin and destination, mode, travel time, cost etc.) as well as to collect the individual and household socio-economic attributes of the residents in the survey area;
- To obtain the trip rate of the traffic analysis zones in the Survey area; and
- To collect the necessary data for the establishment of base year Person Trip Origin-Destination (PTOD) matrices.

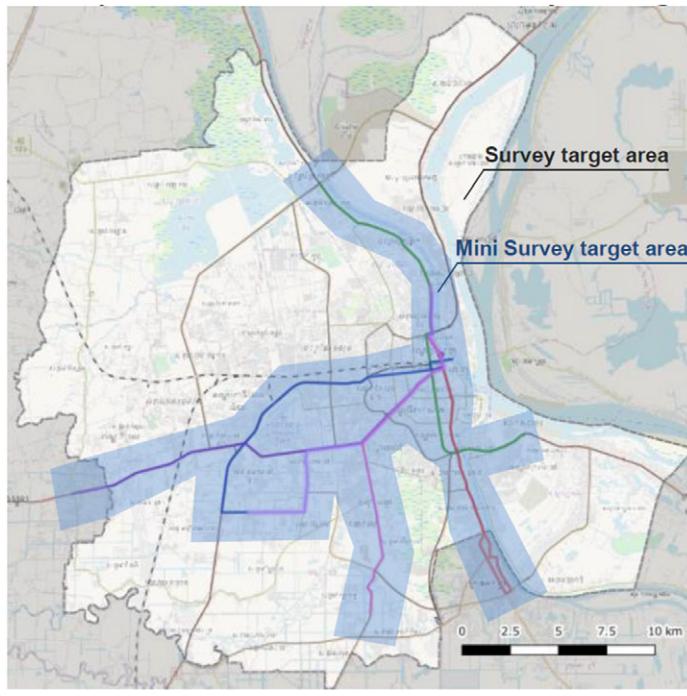
(2) Survey Coverage and Sampling Rate

The survey covers the entire Phnom Penh Capital City, which includes 14 Khans. The effective sampling ratio is set at 1 per cent (1%) of the population of the Survey area and the sample size has been estimated to be approximately 5,000 households.

Following the comments from PPCA as described in sub-section 5.2.2, the JICA Survey Team proposed to divide the simple as follows:

- Person Trip (PT) Survey: 1,000 households
- Commuter Survey: 4,000 households

In addition, due to drop and uncertainty in travel demand during the COVID-19 pandemic, JICA Survey Team has proposed initially conducting a Mini Person Trip Survey targeting only 100 households along the planned transit corridors. The location is shown in Figure 5.3.1.



Source: JST

Figure 5.3.1 Coverage Area of Person Trip Survey and Commuter Survey

(3) Survey Method

The survey will be conducted through the delivery/collection of survey forms method. Surveyors are required to first find the location of the sampled household and then explain about the survey objective and how to fill in the forms to the respondents. Surveyors leave the survey forms, and re-visit the household to collect the completed survey forms after the designated survey date.

(4) Survey Results

The sample data obtained from the Person Trip Survey were expanded to fit the total population of Phnom Penh Capital City by the dis-aggregate four-step modal that is explained in Chapter 6. The summary of survey results after expansion are shown below. The results of the sample-based person-trip survey (before expansion) are shown in Appendix 1.

1) Household Information

a) Household Income Distribution

Table 5.3.1 shows the distribution of household income in 2012 and 2022. In 2012, the household whose income are USD 500 per month or less shares 68% of all household and the share dropped to 21% in 2022. Households whose income are between USD 500 and USD 1,000 per month accounted for 28% in 2012 and the share increased to 49% in 2022. Households whose income are USD 1,000 per month or more increased from 6% in 2012 to 30% in 2022.

Table 5.3.1 Comparison of Household Income Distribution

Monthly Income Group	No. of Household ('000)		Share (%)	
	2012	2022	2012	2022
Under 250 USD	73.3	16	20%	3%
250 - 499 USD	180.0	100	48%	18%
500 - 749 USD	79.0	152	21%	28%
750 - 999 USD	24.8	114	7%	21%
1,000 - 1,499 USD	14.1	103	4%	19%
1,500 - 1,999 USD	2.5	35	1%	6%
Over 2,000 USD	2.1	25	1%	5%
Total	375.7	545.2	100%	100%

Source: JST based on PT/CS survey results and PPUTMP

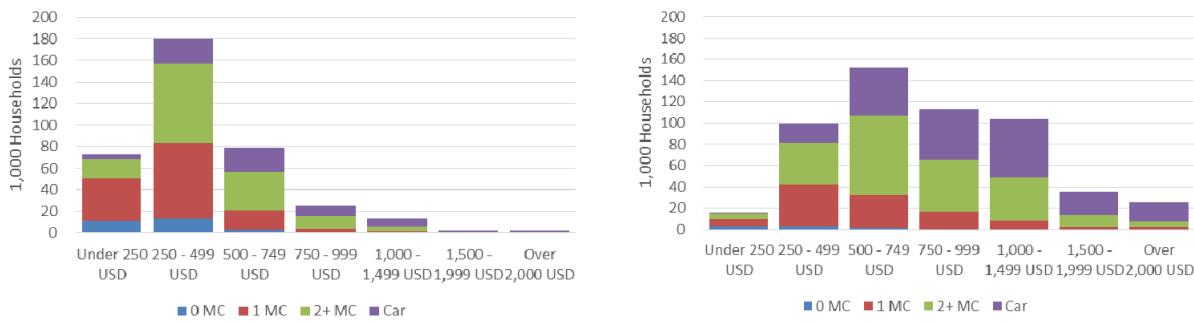


Source: JST based on PT/CS survey results and PPUTMP

Figure 5.3.2 Comparison of Household Income Distribution between 2012 and 2022

b) Vehicle Ownership

Figure 5.3.3 shows a comparison of the number of households by income group and vehicle ownership type in 2012 and 2022. Car ownership rate has been increased due to the income growth as mentioned above. In particular, the number of households with car with a household income of USD 500/month or more increased. In 2012, 8% of households did not have any motorcycles (0 MC in Figure 5.3.3), but the share decreased to 1% in 2022. Similarly, households owning one motorbike (1 MC) decreased from 35% in 2012 to 19% in 2022. On the other hand, households with two or more motorcycles (2+MC) increased from 39% in 2012 to 41% in 2022. The share of car ownership households (Car) increased from 18% in 2012 to 38% in 2022.



Note: “0 MC” represents households with no motorcycles. “1 MC” represents households with one motorcycle. “2+MC” represents households with two or more motorcycles. “Car” represents households with cars. Households that own both motorcycles and cars are classified as car-owning households.

Source: JST

Figure 5.3.3 Comparison of Number of Households by Income Group and Vehicle Ownership Type (left: 2012, right: 2022)

2) Trip Information

a) Trip Generation

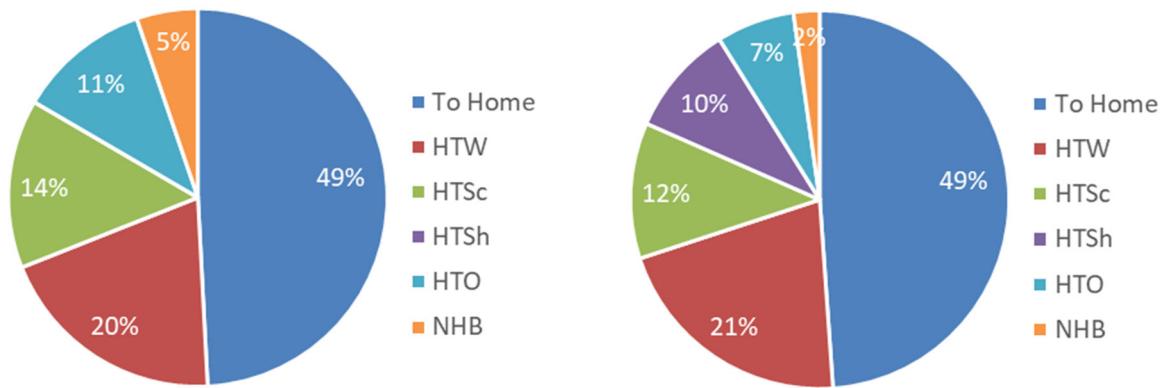
Figure 5.3.2 shows trip generation volume by purpose in 2012 and 2022. In 2012, the number of trips generated from Phnom Penh metropolitan area was about 4.3 million trips. It increased to about 5.6 million trips in 2022. Even the classification of objectives differs slightly between 2012 and 2022, the trends are generally similar. In 2022, “To Home” trip accounts for 49%, followed by HTW (work trip) at 21%, HTSc (school trip) at 12%, HTSh (shopping trip) at 10%, HTO (other trips) accounted for 7% and NHB (non-home based trips) accounted for 2%.

Table 5.3.2 Comparison of Trip Generation by Trip Purpose

Trip Purpose	No. of Trips ('000)		Share (%)	
	2012	2022	2012	2022
To Home	2,111.9	2,738.4	49%	49%
HTW	850.4	1,180.8	20%	21%
HTSc	620.4	651.6	14%	12%
HTSh	-	532.7	0%	10%
HTO	487.6	373.2	11%	7%
NHB	224.4	125.0	5%	2%
Total	4,294.7	5,601.8	100%	100%

Note: In 2012, “Business Trip” in 2012 is categorized into NHB. “Private Trip” is categorized into HTO for comparison.

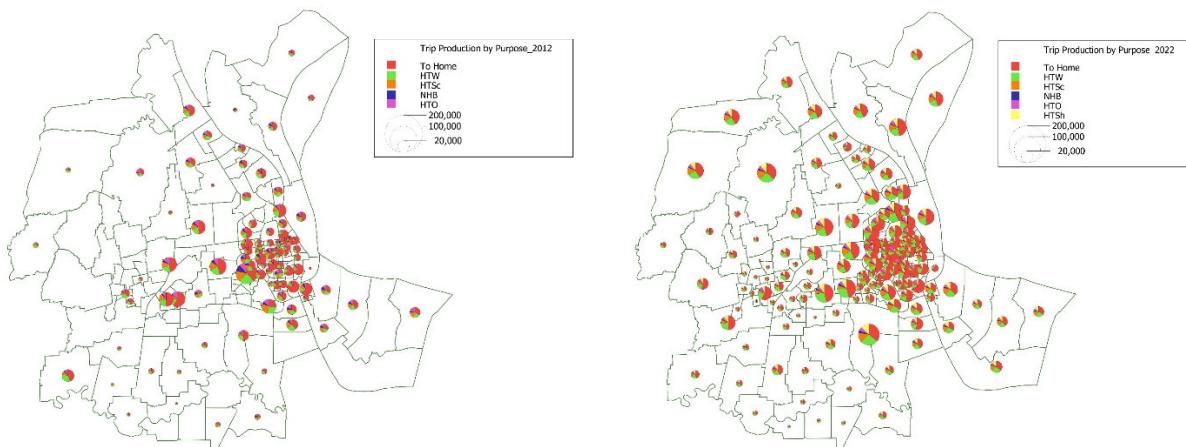
Source: JST and PPUTMP



Note: In 2012, “Business Trip” in 2012 is categorized into NHB. “Private Trip” is categorized into HTO for comparison.
Source: JST and PPUTMP

Figure 5.3.4 Comparison of Share of Trip Generation by Purpose (left: 2012, right: 2022)

Figure 5.3.5 illustrates the comparison of trip generation by purpose by Traffic Analysis Zone (TAZ) in 2012 and 2022. Particularly, the trip generation grew significantly in suburbs in 2022 from 2012.



Source: JST and PPUTMP

Figure 5.3.5 Comparison of Trip Generation by Purpose (left: 2012, right: 2022)

b) Trip Distribution

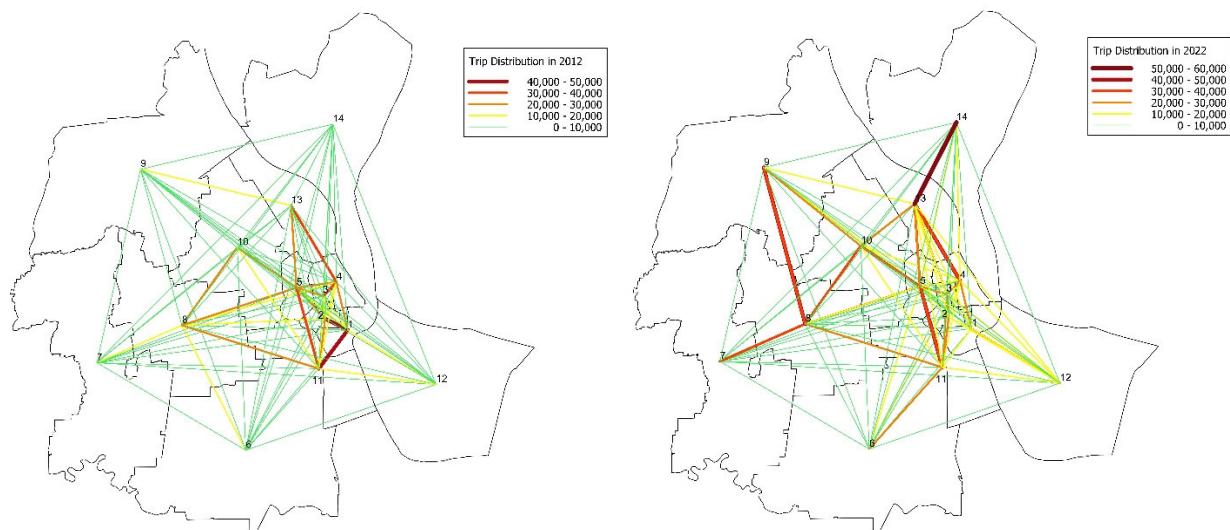
Table 5.3.3 describes the trip distribution in 2012 and 2022. No major change was identified in trips within CBD, amounted to about 1.23 million trips in comparison with 2012. On the other hand, intra-CBD trips accounted for 29% of total trips made in entire Phnom Penh in 2012, the share decreased to 22% in 2022. The share of trips between suburban areas increased remarkably to 58% in 2022 from 50% in 2012.

Table 5.3.3 Comparison of Trip Distribution

Origin	Destination	No. of trips('000)		Share (%)	
		2012	2022	2012	2022
CBD	CBD	1,232	1,231	29.2%	22.0%
CBD	Suburban	433	600	10.3%	10.7%
Suburban	CBD	433	523	10.3%	9.3%
Suburban	Suburban	2,124	3,247	50.3%	58.0%
Total		4,222	5,602	100%	100%

Note: CBD includes districts of Chamkar Mon, Boeng Keng Kang, Doun Penh, Prampir Meakkakra and Tuol Kouk. Suburban refers to the other districts.

Source: JST and PPUTMP



Source: JST and PPUTMP

Figure 5.3.6 Comparison of Trip Distribution (left: 2012, right: 2022)

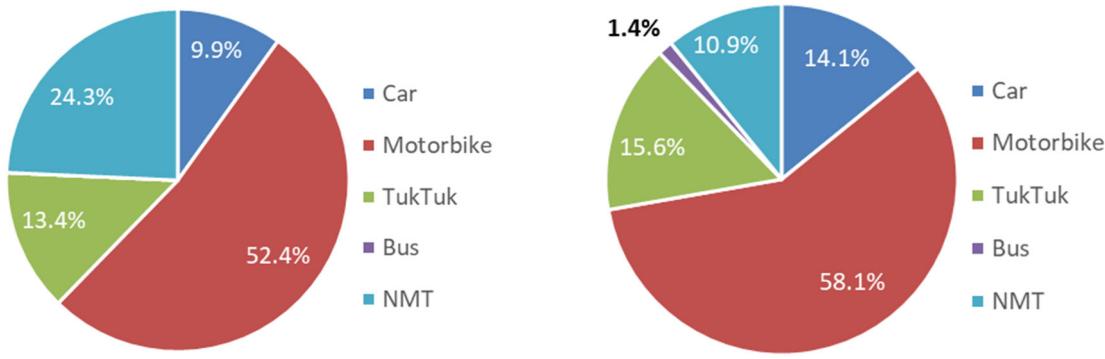
c) Modal Choice

Table 5.3.3 shows trip generation by mode in 2012 and 2022. As the ownership rate of passenger cars and motorcycles increased, the ratio of NMT (Non-motorized Trip: walk and bicycle) decreased, and the ratio of cars, motorbikes and TukTuk increased to 14.1%, 58.1% and 15.6%, respectively. Buses accounted for only 1.4% because the number of operating routes was limited to four due to the COVID-19's pandemic.

Table 5.3.4 Comparison of Trip Generation by Mode

	1,000 Trips		Share	
	2012	2022	2012	2022
Car	421.6	791.3	9.9%	14.1%
Motorbike	2,223.5	3,254.3	52.4%	58.1%
TukTuk	570.5	871.8	13.4%	15.6%
Bus	0.0	76.4	0.0%	1.4%
NMT	1,031.2	608.0	24.3%	10.9%
Total	4,246.8	5601.8	100.0%	100.0%

Source: JST and PPUTMP



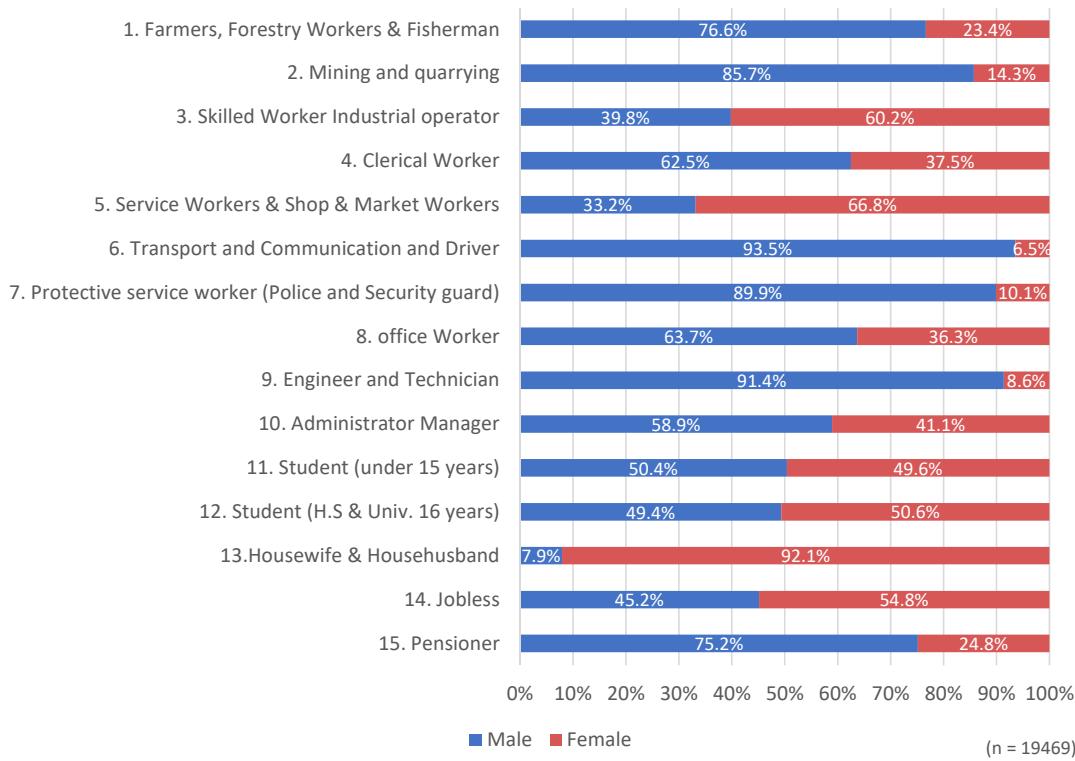
Source: JST and PPUTMP

Figure 5.3.7 Comparison of Modal Share (left: 2012, right: 2022)

BOX 2: Gender Analysis

1. Social Activity and Personal Characteristics

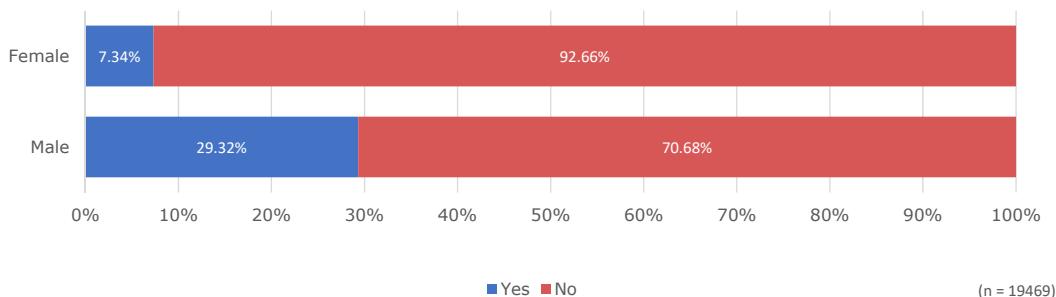
Figure 5.3.8 illustrates the gender distribution in occupation in the result of Person Trip Survey and Commuter Survey (PT/CS). Only 6.5% of female employed in “Transport and Communication and Driver” and 8.6% of female employed in “Engineer and Technician”. Female are tend to employ in the service provide sector such as working in the shop or market, selling goods at home or working in the industrial sector. For example, 66.8% of women employed in the “Service Workers & Shop & Market Workers” and 60.2% of female employed in “Skilled Worker Industrial Operator”. Also, it is highlighted that up to 92.1% of female are housewife which is significantly higher than male.



Source: JST based on PT/CS Result

Figure 5.3.8 Gender Distribution by Occupation

Figure 5.3.9 shows the result of PT/CS on car driving license. Only 7.34% of female respondents hold a car driving license against 29.32% of male respondents hold a driving license.



Source: JST based on PT/CS Result

Figure 5.3.9 Share of Car Driving License Holder

2. Mobility Characteristics

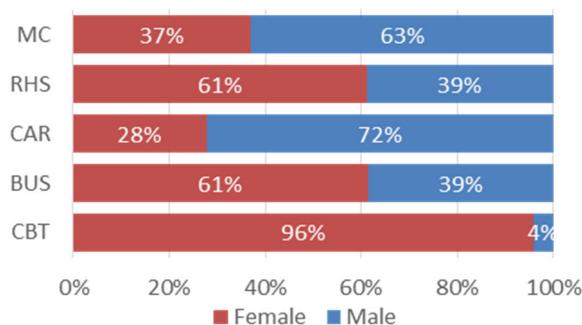
Table 5.3.4 shows the average trip rates by gender by purpose which was estimated by JST based on the result of PT survey. The average trip rate for male are 2.75 trips/day. The rate for female is 2.65 trips/day. The trip rate for male is higher than female. Especially, the trip rate for home-to-work purpose for male is high.

Table 5.3.5 Trip Rates by Gender by Trip Purpose (Trips/day)

	To Home	HTW	HTSc	HTSh	HTO	NHB	Total
Male	1.34	0.72	0.33	0.1	0.2	0.06	2.75
Female	1.28	0.43	0.3	0.4	0.16	0.06	2.62
Total	1.31	0.57	0.31	0.26	0.18	0.06	2.68

Source: JST estimated based on the result of PT Survey

Figure 5.3.10 shows the gender distribution by mode in Passenger Interview Survey result. The share of female user of CBT, Commuter Bus Transport for garment factory workers, is 96%. Additionally, the share of female users of bus and RHS are also higher than male users. On the other hand, the share of male user of private mode such as Car and MC, motorcycle, is higher than female.



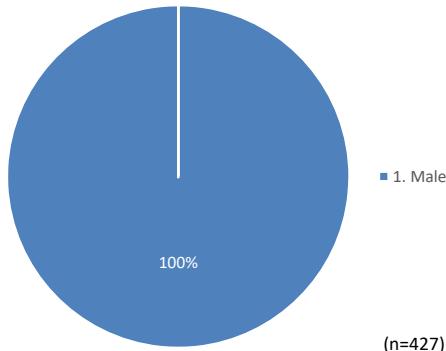
Source: JST based on Passenger Interview Survey Result

Figure 5.3.10 Gender Distribution by Mode

3. Drivers

Huge gender gap was observed on drivers. In the RHS driver interview survey, only any female driver were not observed. Similarly, female bus driver is limited as it is reported in news paper.

As crime prevention measures for female when using RHS and city buses at night, promotion of female drivers, female driver selection functions in the RHS app., and installation of security cameras at bus stops and inside buses are considerable.



Source: JST based on RHS Driver Interview Survey Result

National August 7, 2019
Becoming Phnom Penh's first female public bus driver

Pech Sotheary / Khmer Times /



Horn Sokheang is set to become the capital's first female bus driver. KT/Chor Sokunthea

Source: Phnom Penh Post

Figure 5.3.11 Gender Distribution of RHS Drivers in RHS Driver Interview

Figure 5.3.12 Article on Female Bus Driver

5.3.2 Cordon Line Survey (CLS)

(1) Outline

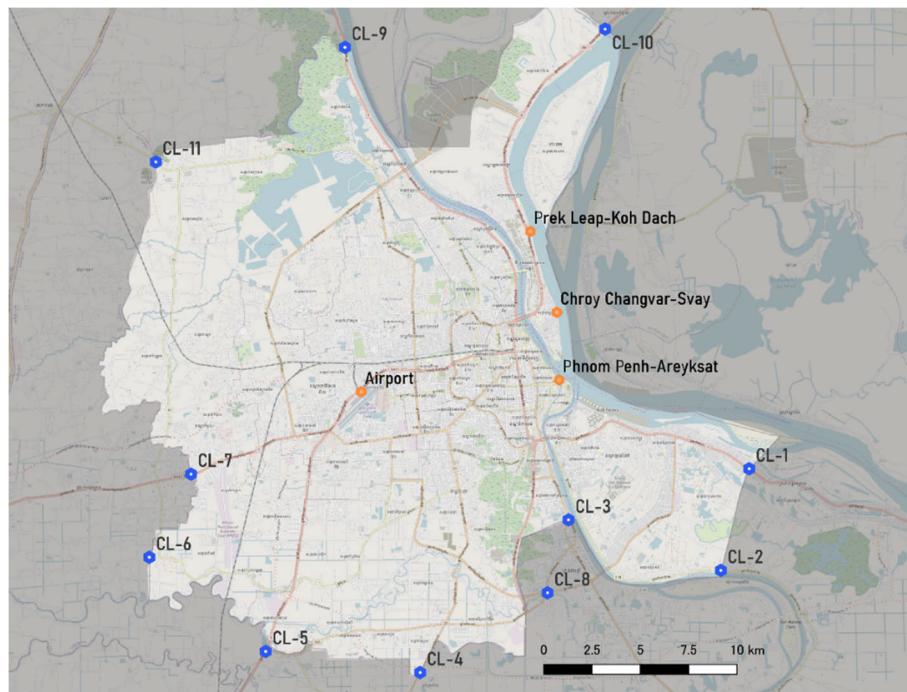
The Person Trip Survey and Commuter Survey collect trip information of the residents in Phnom Penh. On the other hand, there are many non-resident trips within Phnom Penh. To collect the non-resident trip information, the Cordon Line Survey shall be conducted to determine the trips by drivers or passengers coming into and going out of Phnom Penh at several cordon lines. The collected data will be utilised to calibrate the OD matrices obtained from the Person Trip Survey. In order to obtain such data/information, the following survey items shall be conducted:

- Traffic count survey
- Roadside OD interview survey
- Passenger interview at Airport and Ferry ports.

(2) Survey Coverage

Survey Location:

The locations of survey points are shown in Figure 5.3.13. There are eleven (11) road sections, one (1) airport, and three (3) ferry ports. The locations were chosen since they cover the traffic crossing the boundary of Phnom Penh.



Source: JST

Figure 5.3.13 Map of the Cordon Line Survey Location

(3) Survey Results

1) Results of Traffic Count Survey

A summary of the Traffic Count Survey results is shown in Table 5.3.6 and Figure 5.3.14. From these summary results, the following are observed:

- For the national roads which connect cities, about 9,000 - 63,000 PCU were observed.
- The peak rate is 6.8%, and the ratio of 24 hours traffic to 12 hours traffic is 1.34 on average.
- In total, 380,657 PCU/day were observed on road side.
- Comparing with the result in 2012, Compound Annual Growth Rate (CAGR) of total traffic is 10.1%.

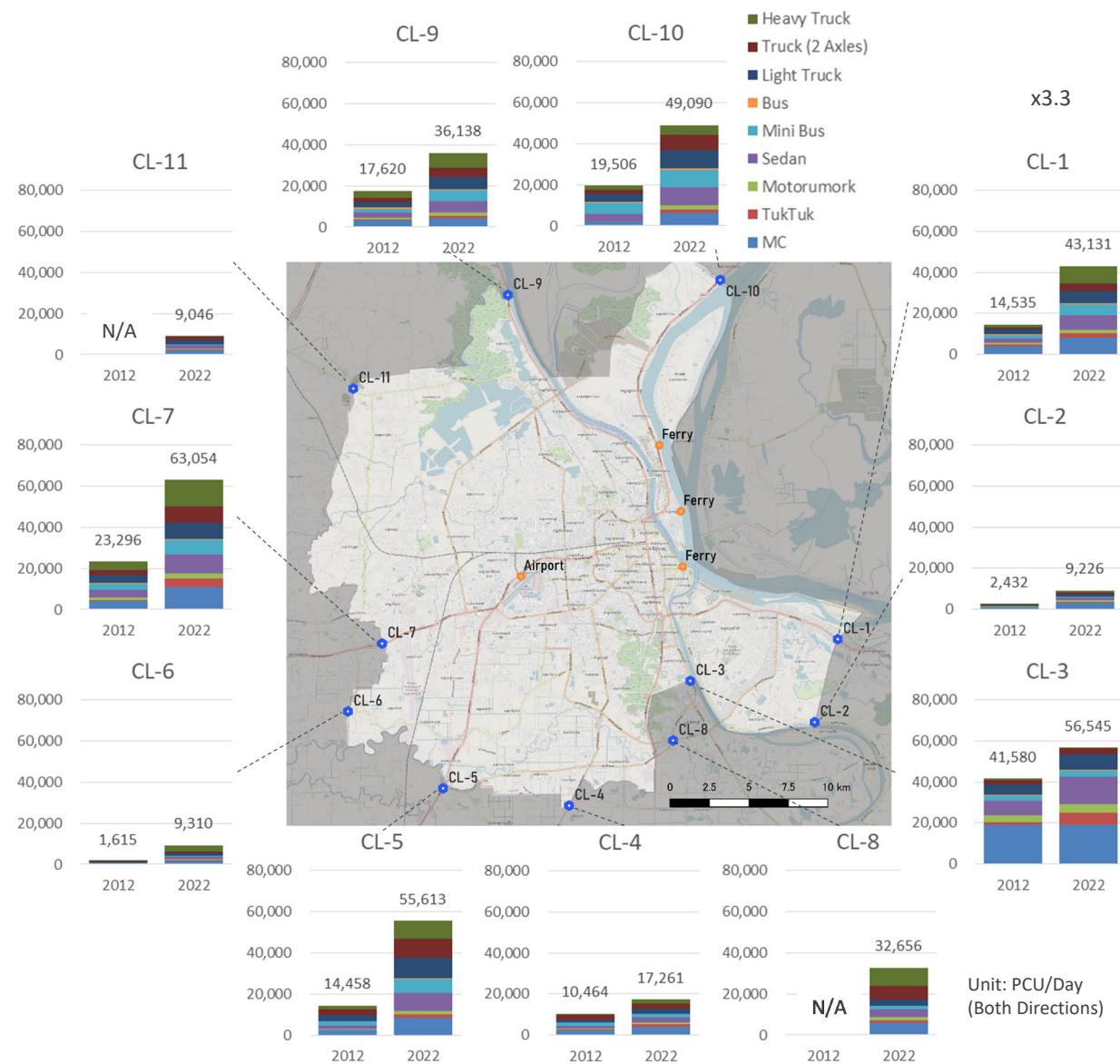
Table 5.3.6 Summary of Traffic Count Survey (vehicle base)

Location	2012	2022					
	Traffic Volume (PCU/day)*1	Traffic Volume (PCU/day)	Peak Ratio	Ratio of Daily Traffic	Motorbike Ratio	Three-Wheeler Ratio	Sedan Ratio
CL-1	14,535	43,131	6.1%	1.58	56%	8%	15%
CL-2	2,432	9,226	9.4%	1.18	74%	8%	7%
CL-3	41,580	56,133	7.5%	1.34	67%	12%	15%
CL-4	10,464	17,261	7.9%	1.25	61%	10%	11%
CL-5	14,458	55,613	8.2%	1.34	51%	6%	15%
CL-6	1,615	9,310	7.9%	1.18	59%	7%	12%
CL-7	23,296	63,054	6.4%	1.38	53%	11%	14%
CL-8	-	32,656	8.0%	1.25	57%	9%	11%
CL-9	17,620	36,138	6.4%	1.41	44%	8%	17%
CL-10	19,506	49,090	7.2%	1.33	45%	8%	19%

Location	2012		2022					
	Traffic Volume (PCU/day)*1	Traffic Volume (PCU/day)	Peak Ratio	Ratio of Daily Traffic	Motorbike Ratio	Three-Wheeler Ratio	Sedan Ratio	
CL-11	-	9,046	7.9%	1.17	63%	6%	15%	
Svay Chrum Ferry	-	5,871	11.0%	1.20	83%	7%	8%	
Arey Kasat Ferry	-	7,505	10.9%	1.21	83%	8%	7%	
Kohdach Ferry	-	2,686	11.6%	1.24	87%	6%	4%	
Total (excluding ferry*)	145,505	380,657	6.8%	1.34	59%	9%	14%	

Note: Peak rate is ratio for 24 hours. 16 hours traffic volume is converted into the 24 hours traffic volume based on the survey result of the 24 hours traffic count survey. Traffic volume of ferry port is not converted into 24 hours. 12 hours traffic volume is from 6:00 to 18:00.

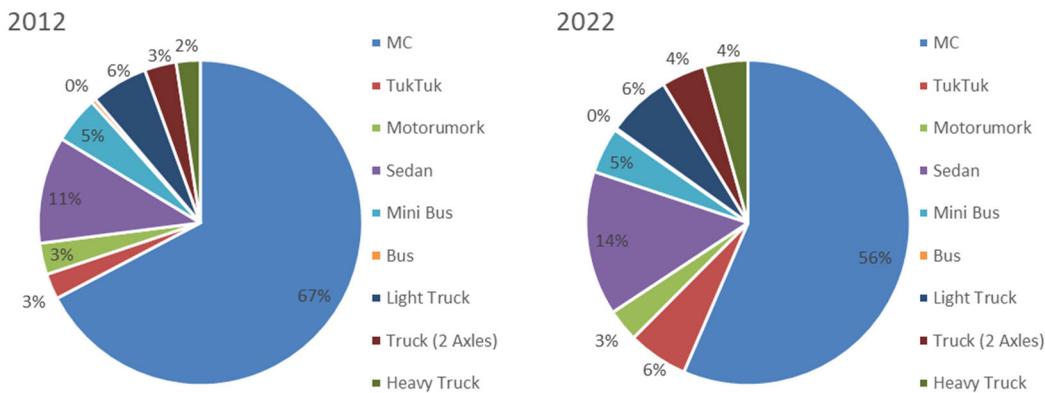
Source: JST



Source: JST

Figure 5.3.14 Cordon Line Traffic Volume in 2012 and 2022 (PCU base)

Vehicle type composition are shown in Figure 5.3.15. Motorcycle has the highest share of 56% on national roads, however its share reduced compared to 67% in 2012. On the other hand, sedan and tuk-tuk increased from 11% to 14% and 3% to 6% respectively.



Source: JST

Figure 5.3.15 Vehicle Type Composition in 2012 and 2022 (vehicle base)

The average passenger occupancy by vehicle classification is shown in Table 5.3.7. These numbers include drivers. Compared to the results in 2012, average passenger occupancy has decreased in all vehicle types.

Table 5.3.7 Average Passenger Occupancy

Year	Motorbike Motodop	Tuk-Tuk	Motorumork	Sedan, Wagon	Taxi	Mini Bus	Bus	Light Truck	Truck (2 Axles)	Heavy Truck and Trailer
2022	1.3	2.1	1.8	2.3	2.0	4.4	12.0	2.4	2.2	1.5
2012	1.5	3.7	4.6	2.8	3.1	8.9	22.4	5.0	2.4	2.0

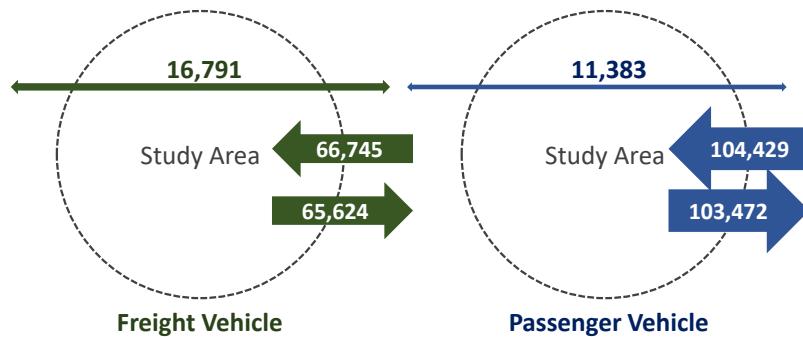
Note: Including driver

Source: JST, PPUTMP

2) Result of OD Interview Survey

Figure 5.3.16 summarises the ratio of external-internal traffic and external-external traffic in PCU. In total, 340,279 PCU come into and go out from the study area, while 28,174 PCU just pass through the study area. The ratio of external-external traffic is higher in freight vehicles.

	PCU/day			Share		
	Truck	Passenger Vehicle	Total	Truck	Passenger Vehicle	Total
In	66,754	104,429	171,183	45%	48%	46%
Out	65,624	103,472	169,096	44%	47%	46%
External-Internal	132,378	207,901	340,279	89%	95%	92%
External-External	16,791	11,383	28,174	11%	5%	8%



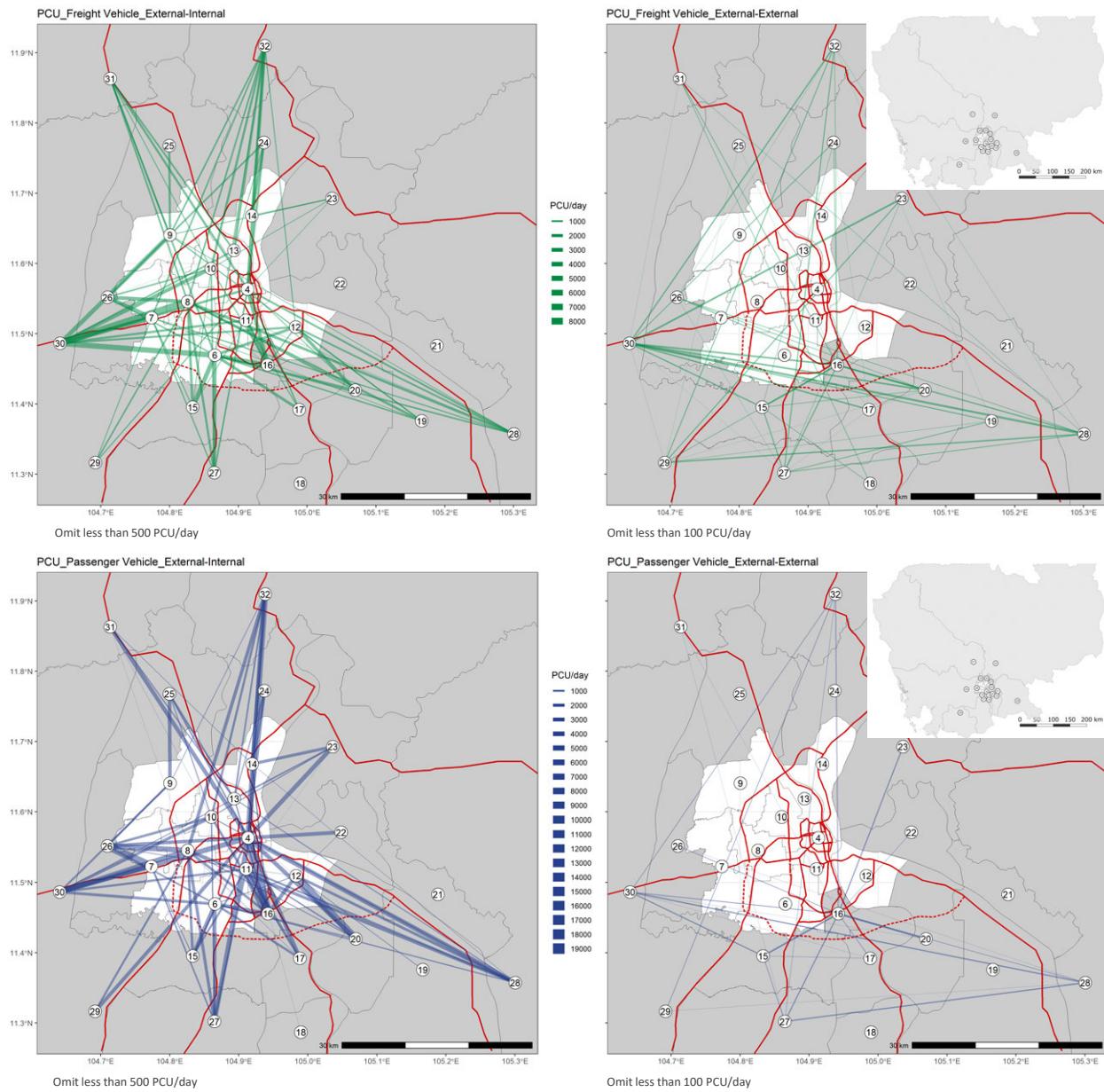
Source: JST

Figure 5.3.16 Ratio of External-Internal and External-External Traffic

Figure 5.3.17 shows the desire line of cordon line OD of freight traffic (green) and passenger traffic (blue). In the graph of external-internal freight traffic, strong lines are observed between NR-4 and the outskirt of west and south-west of Phnom Penh. In the graph of external-external freight traffic, strong lines are observed between NR-4 and NR-1, followed by trips between NR-4 and NR-6. This result indicates that the completion of the south part of (Ring Road-III) RR-III could contribute to the mitigation of traffic congestion along Veng Sreng Blvd. or RR-II. However, freight traffic to/from Large Zone³ 8 will stay on Veng Sreng Blvd. and Russian Blvd. even after the completion of the RR-3.

In the graph of external-internal passenger traffic, strong lines are observed into the Large Zone 4 in CBD, from all directions. Even though Large Zone 6, 8 or 12 attract some amount of cordon passenger traffic, the majority of them concentrate inside CBD. The cordon passenger traffic to/from CBD is large enough to affect the congestion level of the radial arterial roads. In particular, trips between Large Zone 16, 20, 30 (Ta Khmau and areas along NR-4) and Phnom Penh have a large volume. Thus, it is required to consider extending the City Bus routes to outside Phnom Penh. On the other hand, external-external passenger traffic volume is small.

³ Traffic Analysis Zone. See Chapter 6 for the zone categories.



Note: PCU base

Source: JST

Figure 5.3.17 Desire Line of Cordon Line OD (Internal-External Trip and External-External Trip)

5.3.3 Screen Line Survey (SLS)

(1) Survey Objectives

The objective of the Screen Line Survey (SLS) is to grasp the traffic volume crossing the screen line, boundary of the CBD, and gather information for the calibration of the estimated current Origin-Destination (OD) matrices.

(2) Survey Coverage

The survey location is shown in Figure 5.3.18. The survey was conducted at 9 locations on arterial roads crossing the screen line in the study area. Traffic count at another three locations (SL-6, SL-10 and SL-12) was conducted in the Intersection Traffic Survey.

Vehicle occupancy survey was conducted at 4 locations (SL-2, SL-4, SL-5 and SL-7), randomly selecting vehicles at the site and counting the number of passengers in the vehicle including the driver.

Location	Road Name	Hours
SL-1	National Road No.1	24
SL-2	Road No.369	16
SL-3	National Road No.2	24
SL-4	Road Tumnop Thmei	16
SL-5	Road 2004	16
SL-6	Russian Blvd.	16
SL-7	Road 1986	16
SL-8	National Road No.5	24
SL-9	National Road No.6	24
SL-10	Monireth Blvd.	16
SL-11	Hun Sen Blvd.	24
SL-12	Camko Roundabout	16



Note: SL-6, SL-10 and SL-12 were covered in Intersection Traffic Count Survey

Source: JST

Figure 5.3.18 Screen Line Survey Locations Map

(3) Survey Results

Table 5.3.8 shows the summary of the Screen Line survey results. In total, 768,000 PCU/day were observed. Even though there is an additional survey location, Hun Sen Blvd., the observed traffic largely increased compared with the observed traffic in 2012. The Compound Annual Growth Ratio (CAGR) of total traffic is 2.9%.

SL-1 (NR-1), SL-6 (Russian Blvd.), SL-9 (NR-6) and SL-10 (Monireth Blvd.) have about 100,000 PCU/day traffic in both ways. Compared to the results in 2012, traffic volume has increased at most locations. Peak ratio at screen lines varies 7% to 13%.

Table 5.3.8 Summary of Screen Line Survey Results

Location	Road Name	2012		2022				
		Traffic Volume (PCU/day)*1	Traffic Volume (PCU/day)	Peak Ratio*2	Ratio of Daily Traffic*3	Motorbik e Ratio	Three-Wheeler Ratio*4	Sedan Ratio
SL-01	National Road No.1	43,323	95,798	7.0%	1.42	62%	11%	20%
SL-02	Road No.369	14,781	21,865	8.6%	1.35	78%	11%	8%
SL-03	National Road No.2	65,850	48,874	10.7%	1.35	74%	11%	11%
SL-04	Road Tumnop Thmei	26,743	29,603	8.7%	1.41	65%	15%	12%

Location	Road Name	2012		2022					
		Traffic Volume (PCU/day)*1	Traffic Volume (PCU/day)	Peak Ratio*2	Ratio of Daily Traffic*3	Motorbike Ratio	Three-Wheeler Ratio*4	Sedan Ratio	
SL-05	Road 2004	50,408	55,863	8.8%	1.42	65%	15%	15%	
SL-06	Russian Blvd.	84,852	101,402	10.5%	1.34	70%	11%	14%	
SL-07	Road 1986	39,333	50,448	9.8%	1.37	66%	14%	16%	
SL-08	National Road No.5	45,703	56,376	9.1%	1.40	67%	13%	14%	
SL-09	National Road No.6	40,138	105,355	8.2%	1.41	61%	11%	19%	
SL-10	Monireth Blvd.	107,893	108,281	9.3%	1.34	69%	15%	10%	
SL-11	Hun Sen Blvd.	-	43,659	12.7%	1.37	58%	13%	21%	
SL-12	Camko Roundabout	57,352	46,663	9.4%	1.25	58%	11%	22%	
Total		576,376	768,176	9.0%	1.38	66%	13%	15%	

Note: *1 Both direction total

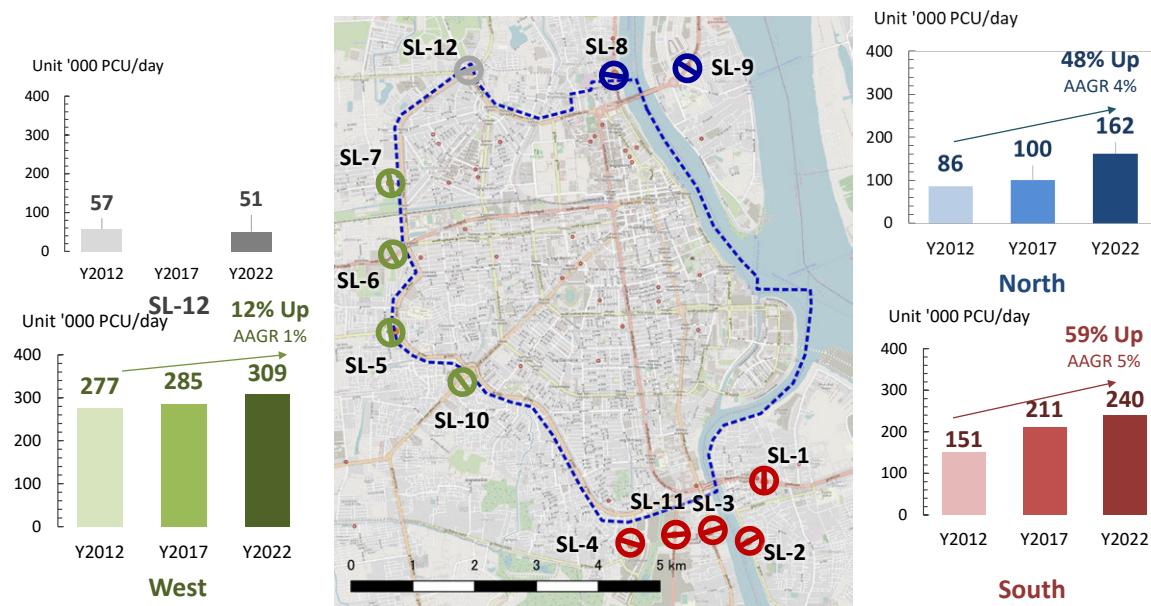
*2 Peak Ratio is for 24 hours. The larger peak ratio in in-bound and out-bound direction is shown here.

*3 24 hours traffic / 12 hours traffic

*4 Tuk-tuk + Motoromo

Source: JST

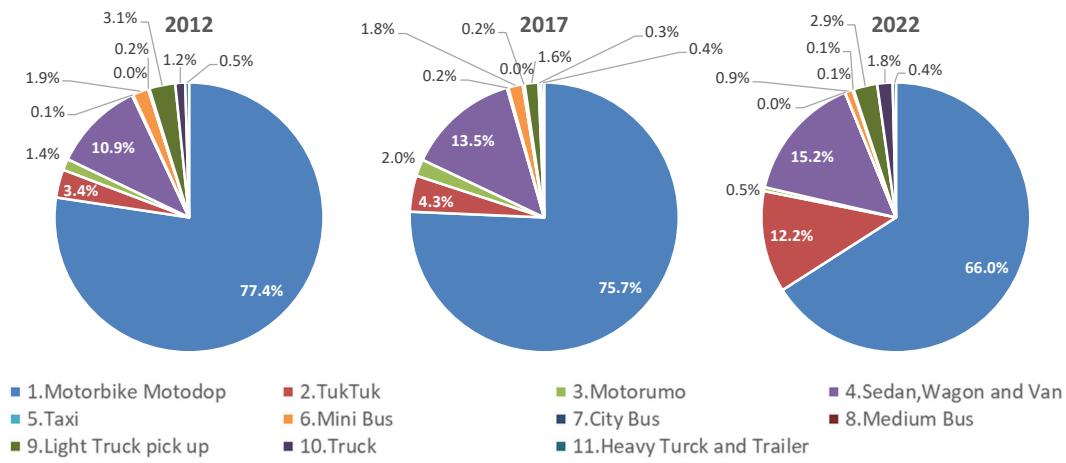
Figure 5.3.19 shows the summarised traffic volume by direction in 2012, 2017 and 2022. The traffic volume from/to the south direction shows the largest increase of 59% (CAGR=5%) in the last 10 years, followed by that of from/to the north direction of 48% (CAGR=4%). Compared to them, the traffic volume from/to the west direction shows a smaller increase of 12% (CAGR=1%), but it has still the largest volume, 309,000 PCU/day.



Source: JST

Figure 5.3.19 Growth of Screen Line Traffic Volume

Figure 5.3.20 shows the composition of vehicle type observed in the screen line survey by year. In 2012, motorcycle occupied 77.4% of the total traffic, but it decreased to 66.0% in 2022. On the other hand, tuk-tuk increased from 3.4% to 12.2% and sedan increased from 10.9% to 15.2% between 2012 and 2022.



Note: vehicle base

Source: JST

Figure 5.3.20 Composition of Vehicle Type by Year at All locations (Screen Line Survey)

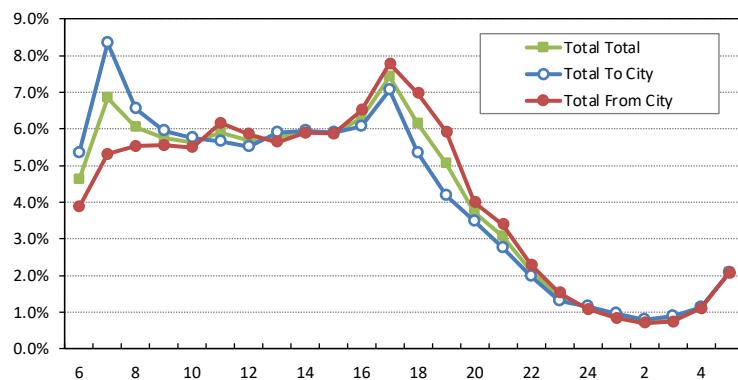
The average passenger occupancy by vehicle classification is shown in Table 5.3.9. These number include drivers.

Table 5.3.9 Average Passenger Occupancy in Screen Line Survey

1. Motorbike Motodop	2. TukTuk	3. Motorumo	4. Sedan, Wagon and Van	5. Taxi	6. Mini Bus	7. City Bus	8. Medium Bus	9. Light Truck pick up	10. Medium Truck	11. Heavy Truck and Trailer
1.54	3.76	4.58	2.76	5.27	8.93	22.42	22.42	5.00	2.38	2.04

Source: JST

Figure 5.3.21 shows the hourly fluctuation of total traffic volume observed at all screen line survey locations. The peak ratio in the morning peak was 8.3% between 7:00~8:00 in the city direction and that the evening peak was 7.8% between 17:00~18:00 from the city direction.



Note: Percentage based on observed and estimated 24 hours traffic volume in PCU
Source: JST

Figure 5.3.21 Hourly Fluctuation

5.3.4 Passenger Interview Survey (PIS)

(1) Survey Objectives

Passenger Interview Survey aims at understanding about personal attributes, preference for selecting transport mode and opinion on the current transport related situation in Phnom Penh. The survey consists of following four (4) surveys targeting passengers of major transport modes.

- 1) Private Car, Motorcycle user (CAR, MC): 519 private car users and 529 motorcycle users
- 2) RHS passenger (RHS): 517 RHS passengers
- 3) Public Bus passenger (BUS): 205 bus users of 4 City Bus lines in operation
- 4) Commuter Bus passenger (CBT): 416 commuter bus passengers

(2) Survey Coverage

Survey Location:

The locations of survey points for the respective survey items are shown in Table 5.3.10.

Table 5.3.10 Survey Locations for Passenger Interview Survey

Survey Items	Abbreviation	Survey Location
Private Mode User Interview Survey (car, motorcycle)	<ul style="list-style-type: none"> • Car: CAR • Motorcycle: MC 	Traffic attraction facilities and their located corridors. <ul style="list-style-type: none"> • Phsar Tauch Market, Chrang Chamreh Market, Noromall, Chbar Ampov Market, Borey Penh Huot Beoung Snor, Pochentong Market, Century Plaza, Derm Kor Market, City Mall, Phnom Penh International University, Olympia Mall
RHS User Interview Survey	<ul style="list-style-type: none"> • RHS: RHS 	Traffic attraction facilities and their located corridors. <ul style="list-style-type: none"> • Chrang Chamreh Market, Phsar Tauch Market, Central Market, Chbar Ampov Market, Steung Mean Chey Thmei Market, Deum Kor Market, Century Plaza, Pochentong Market, AEON Mall 1
City Bus Passenger Interview Survey	<ul style="list-style-type: none"> • City Bus: BUS 	Fou City Bus routes which resumed operation after the COVID-19 pandemic (Line 1, 2, 3 and 4A/4B)
Commuter Bus User Interview Survey	<ul style="list-style-type: none"> • Commuter Bus: CBT 	PPSEZ, Vattanac industrial zone, Phsar Kamboul, Oudem, Trapaing Toul, Veng Sreng

Source: JST

(3) Survey Results

1) User Characteristics by Mode

Figure 5.3.22 shows household motorcycle ownership (left) and car ownership (right). The ownership of motorcycle is very similar in all mode users, owning 1~3 motorcycles, except for BUS users. 16% of BUS users have no motorcycle in their household. Regarding car ownership, CAR users have 1 or 2 cars, while 60~70% of MC, RHS and BUS users don't have a car in their household.

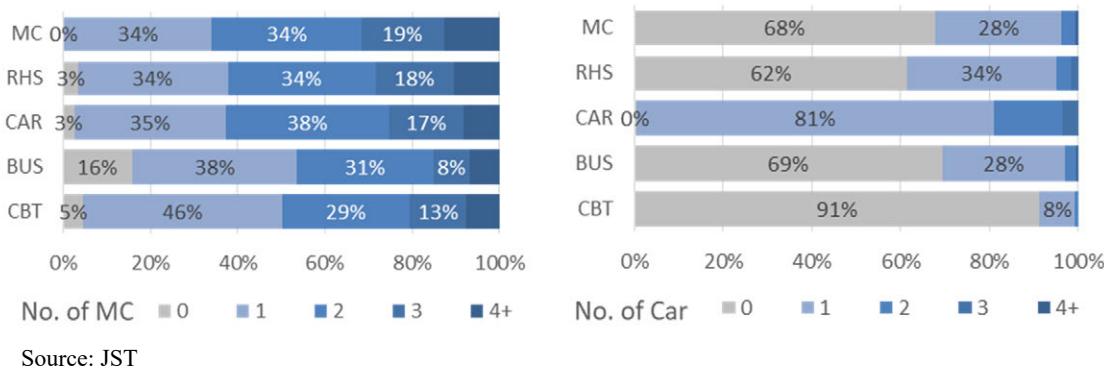


Figure 5.3.22 Household Vehicle Ownership by Mode

Figure 5.3.23 shows the household monthly income level of the users of each mode and the car ownership by household monthly income group. The ratio of high income households is higher in CAR users while that is lower in CBT users. It shows the threshold of car ownership is about 500~1,000 USD/month. Since the price of second hand cars starts at about 6,000 USD and the 3~5 year loan is widely available, car ownership is possible for households with less than 1,000 USD/month income if they spend most part of their income.

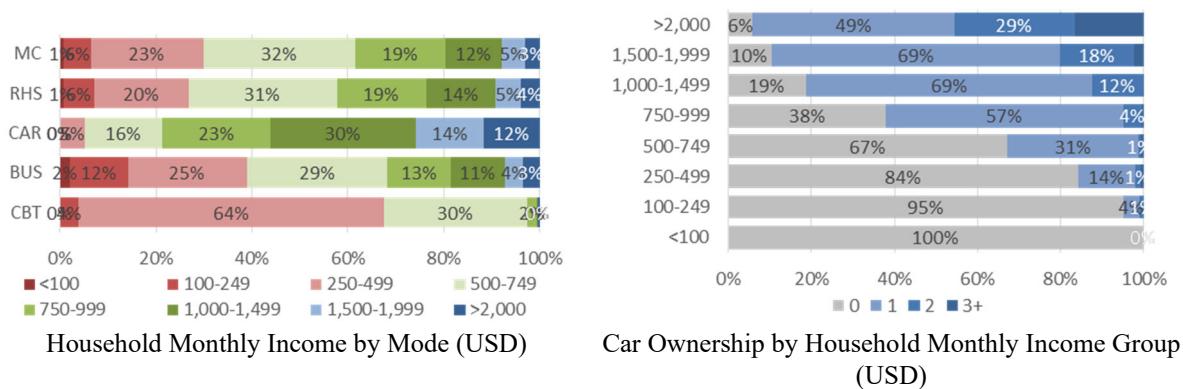


Figure 5.3.23 Household Monthly Income by Mode and Car Ownership

The left side of Figure 5.3.24 shows the travel time and cost of the passengers of each mode. MC tends to be used for short distance trips and BUS and CBT are used for long distance trips. However, it should be noted that this question is highly affected by the location where the surveys for each mode were conducted.

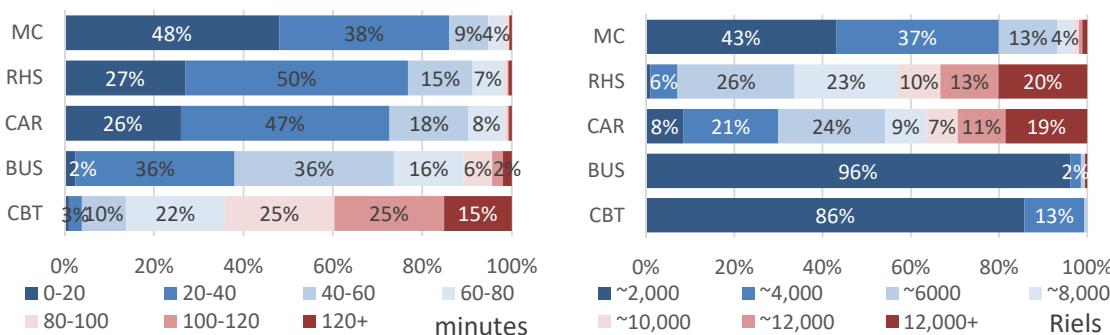
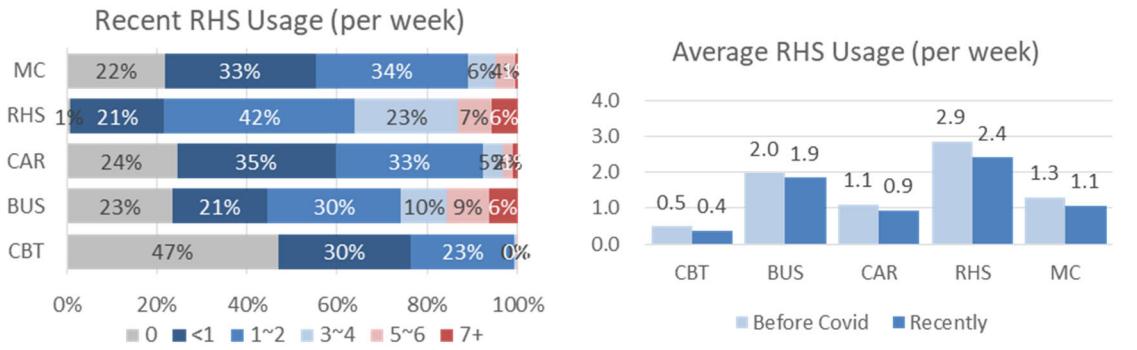


Figure 5.3.24 Travel Time and Cost by Mode

2) Opinion on RHS

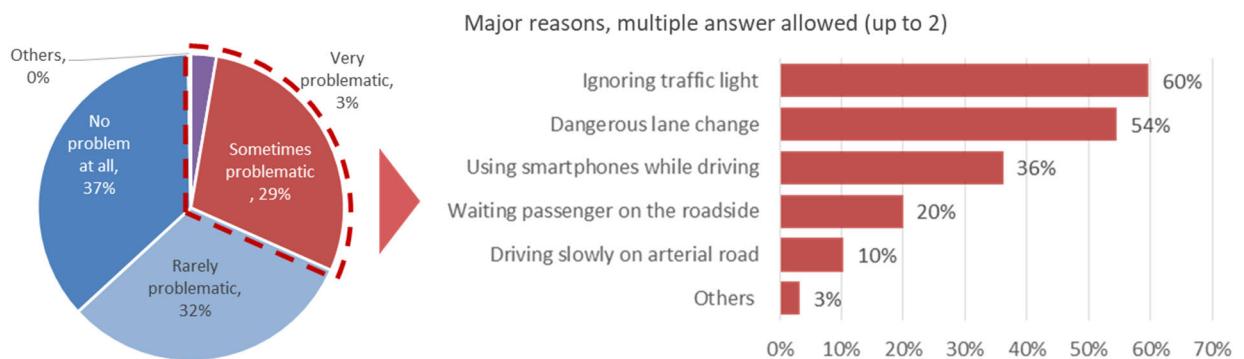
The left side of Figure 5.3.25 shows the frequency of RHS usage by the users of each mode. More than 75% of respondents answered that they use RHS at least 1 time per week, except for CBT users. Though the usage of RHS is less frequent in CBT users, more than 50% of respondents answered they use RHS at least 1 time per week. These results indicate that RHS has become a very popular transport mode for people in all categories.



Source: JST

Figure 5.3.25 Frequency of RHS Usage by Mode

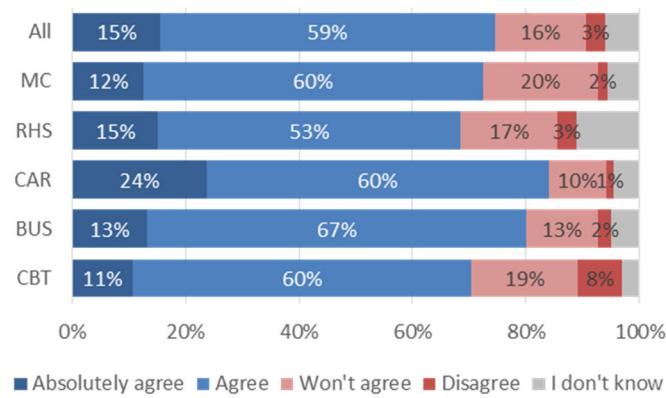
32% of the respondents answered that the driving manner of RHS is very problematic or sometimes problematic (Figure 5.3.26). The major reasons they answered so were “ignoring traffic light” (60%), “dangerous lane change” (54%) and “using smartphones while driving” (36%). There was no significant difference among the respondents of each mode.



Source: JST

Figure 5.3.26 Opinion on Driving Manner of RHS

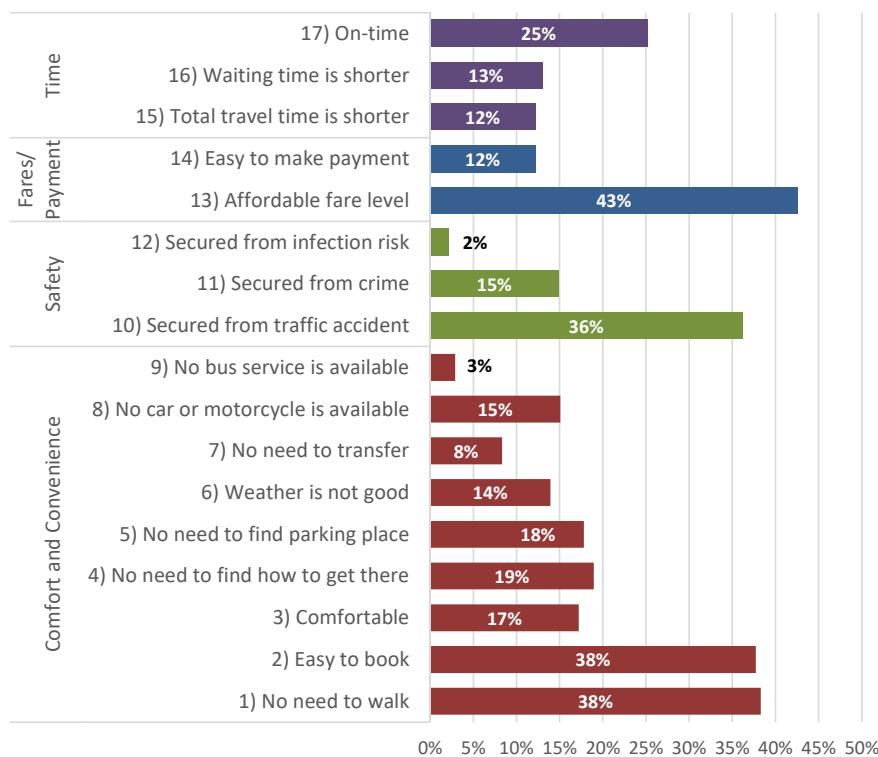
Figure 5.3.27 shows the opinion on no entry policy of RHS on arterial roads. In total, 74% of the respondents answered that they agree with the policy. Especially, CAR users tend to agree with the policy. Even RHS users, 68% of them agreed to the policy.



Source: JST

Figure 5.3.27 Opinion on No Entry Policy of RHS on Arterial Roads

RHS users answered “affordable fare label” "no need to walk" and "easy to book" as the main reasons for using RHS as shown in Figure 5.3.28.

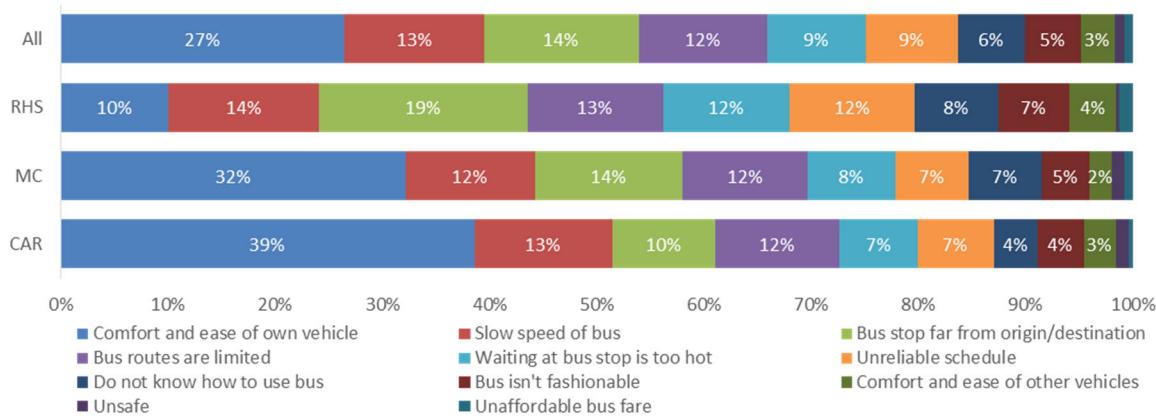


Source: JST

Figure 5.3.28 Major Reason for Using RHS (RHS Users)

3) Opinion on City Bus

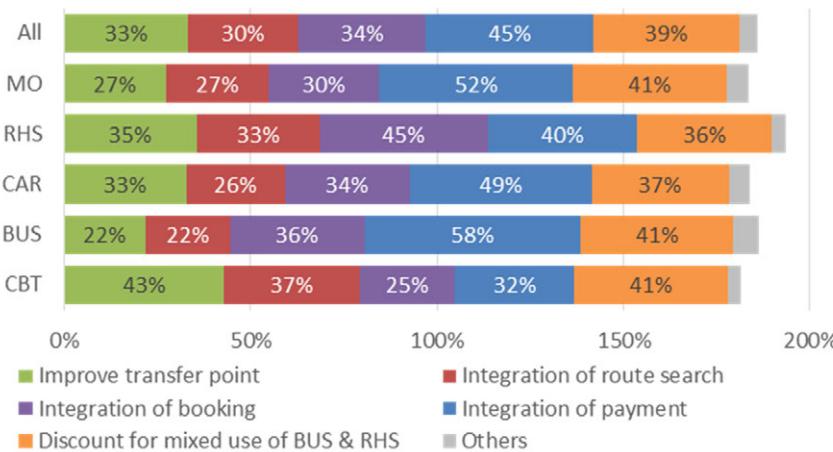
Car users, motorcycle users and RHS users were interviewed about the reasons for not using City Bus. The major reasons are “Comfort and ease of own vehicle” both in Car users (39%) and MC users (32%), followed by “Slow speed of bus”, “Bus stop far from origin/destination”, and “Bus routes are limited”. On the other hand, the major reasons for RHS users are “Bus stop far from origin/destination” raised by 19% of RHS users.



Source: JST

Figure 5.3.29 Major Reasons Not to Use City Bus

In the interview survey, integration of City Bus and RHS was proposed as a possible solution to improve the public transport service. Also, the important measures to realize the integration was asked to the respondents. In general, measures related to payment attracts the largest votes such as “Integration of payment” at 45% and “Discount for mixed use of BUS & RHS” at 39%. Additionally, other measures were also regarded as important measures e.g. “Integration of booking” at 34%, “Improve transfer point” at 33%, and “Integration of route search” at 30%.

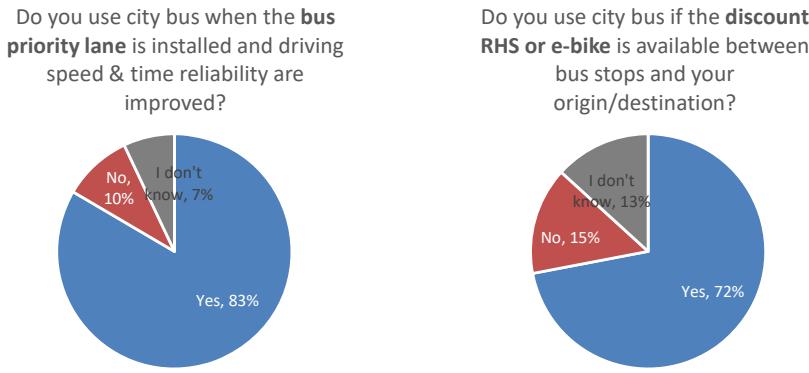


Note: Multiple answers allowed up to 2 choices are allowed. Therefore, total percentage of share exceeds 100%.

Source: JST

Figure 5.3.30 Important Measures to Realize Integration of City Bus & RHS

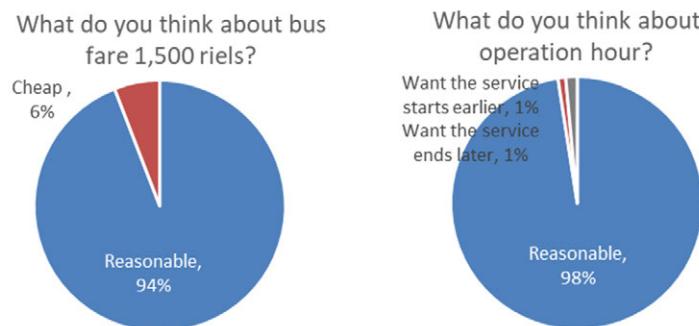
To consider the measures for the modal shift of private mode users to City Bus, willingness of modal shift was asked raising two measures (See Figure 5.3.31). 83% of the respondents answered they would use City Bus when the bus priority lane is installed, and 72% of them would use City Bus when the access discount with RHS or e-bike is available.



Source: JST

Figure 5.3.31 Willingness to Use City Bus When Measures are Implemented (CAR, MC, RHS Users)

The result of City Bus users shows that 94% of the respondents perceive the current fare (1,500 KHR) as a reasonable level and no respondents answered the current fare level is “Expensive”. 98% of the respondents answered the current operation hour is “Reasonable”.

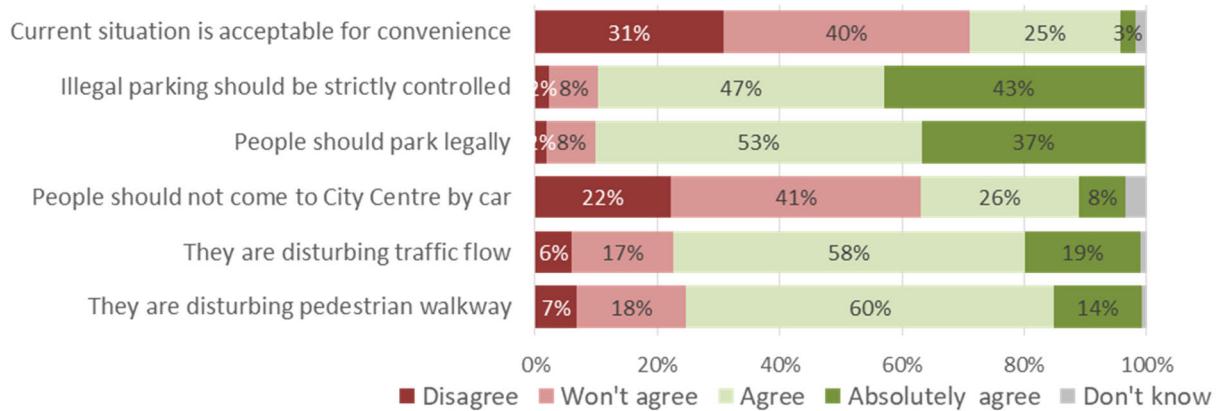


Source: JST

Figure 5.3.32 Opinion on Fare Level and Operation Hour of City Bus

4) Opinion on Illegal Roadside Parking

Figure 5.3.33 shows the opinion on illegal roadside parking. 71% of respondents disagree or won't agree to “current situation is acceptable for convenience” and about 90% of respondents are agreed with “illegal parking should be strictly controlled”. In contrast, 63% of respondents disagree or won't agree with “people should not come to city centre by car”. The respondents consider the current situation is harmful for both traffic flow and pedestrian environment. However, they won't agree with forcing car users to give up on coming to city centre by car. These results indicate that they want more legal parking space and strict control of illegal parking.

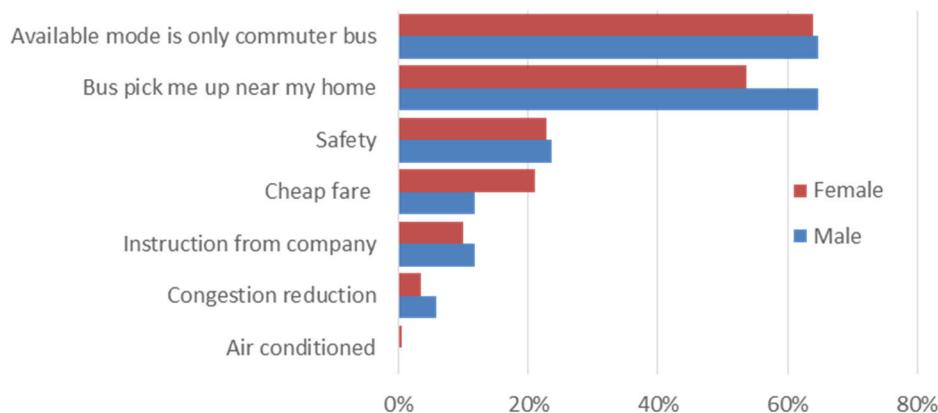


Source: JST

Figure 5.3.33 Opinion on Illegal Roadside Parking

5) Opinion on Commuter Bus

Figure 5.3.34 shows the reason of using the Commuter Bus. The major two reasons which about 60% of the respondents answered were “Available mode is only commuter bus” and “Bus pick me up near my home”. Considering 96% of the commuter bus passengers are female and most of the commuter buses are pickup or truck without a seat.



Note: Multiple answers are allowed (up to 2 reasons)

Source: JST

Figure 5.3.34 Reason for Using Commuter Bus

5.3.5 Roadside Traffic Survey (RTS)

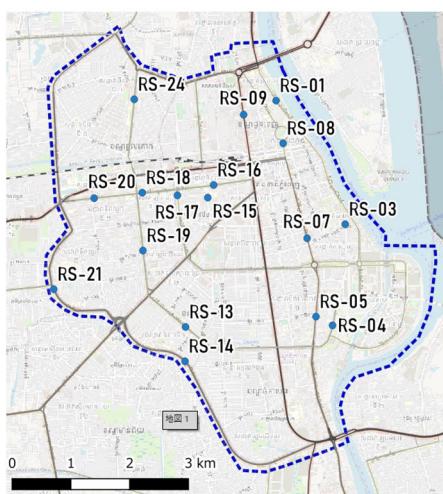
(1) Survey Objectives

The roadside traffic count aims to identify the present condition of traffic at the congested road sections inside the CBD.

(2) Survey Coverage

Survey Location:

The locations of survey points are shown in Figure 5.3.35.



Source: JST

Figure 5.3.35 Map of the Roadside Traffic Survey Location

(3) Survey Results

Table 5.3.11 shows the summary of the Roadside Traffic Count Survey results. Compared to the results in 2012, traffic volume has increased at the boundary of CBD: RS-14, RS-21(Road 271) and RS-1(Sisowat Blvd.). Also, the volume has increased in front of AEON 1, RS-4(Sothechos (Road 3)). Contrarily, the volume decreased near the new flyover, Techno Sky Bridge, at RS-18 (Kampuchea Krom Blvd. (Road 128)) and RS-19 (Mao Tse Toung Blvd. (Road 245)).

Table 5.3.11 Summary of Roadside Traffic Count Results

ID	Road Name	Traffic Volume in 2012 (PCU/24hr)	Traffic Volume in 2022* (PCU/24hr)	Peak Ratio ** (PCU basis)	Ratio of Daily Traffic (PCU basis)	Motorbike Ratio (veh basis)	3-Wheeler Ratio (veh basis)	Sedan Ratio (veh basis)
RS-1	Sisowat Blvd.	32,138	40,018	10%	1.36	67%	14%	14%
RS-3	Sothechos (Rd. 3)*****	N/A	16,044	8%	1.57	71%	16%	11%
RS-4	Sothechos (Rd. 3)	27,387	38,720	7%	1.57	65%	17%	13%
RS-5	Norodom Blvd. (Rd. 41)	37,910	49,487	8%	1.48	64%	11%	20%
RS-7	Norodom Blvd. (Rd. 41)	42,549	43,686	9%	1.50	65%	5%	26%
RS-8	Norodom Blvd. (Rd. 41)	27,550	26,444	8%	1.49	68%	8%	19%
RS-9	Norodom Blvd. (Rd. 93)	66,374	65,901	8%	1.40	62%	15%	16%
RS-13	Mao Tse Toung Blvd. (Rd. 245)	44,831	44,535	8%	1.47	67%	13%	15%
RS-14	Road 271	49,351	71,109	7%	1.50	72%	11%	12%

ID	Road Name	Traffic Volume in 2012 (PCU/24hr)	Traffic Volume in 2022* (PCU/24hr)	Peak Ratio ** (PCU basis)	Ratio of Daily Traffic (PCU basis)	Motorbike Ratio (veh basis)	3-Wheeler Ratio (veh basis)	Sedan Ratio (veh basis)
RS-15	Road Chekoslovaki (Rd. 169)	40,795	43,565	7%	1.46	70%	11%	14%
RS-16	Kampuchea Krom Blvd. (Rd. 128)	33,186	31,316	8%	1.45	62%	16%	17%
RS-17	Nerhu (Rd. 125)	33,100	33,958	8%	1.31	63%	14%	17%
RS-18	Kampuchea Krom Blvd. (Rd. 128)	40,734	34,864	7%	1.49	64%	12%	19%
RS-19	Mao Tse Toung Blvd. (Rd. 245)	52,822	48,036	7%	1.38	69%	10%	16%
RS-20	Kampuchea Krom Blvd. (Rd. 128)	32,910	37,844	8%	1.49	69%	10%	16%
RS-21	Road 271	53,303	66,595	7%	1.51	66%	13%	14%
RS-24	Road 289	34,417	38,350	8%	1.49	62%	10%	23%

* 16 hours traffic volume is converted into the 24 hours traffic volume based on the survey result of the 24 hours traffic count survey.

** Peak rate is ratio for 24 hours.

Source: JST

5.3.6 Intersection Traffic Survey (ITS)

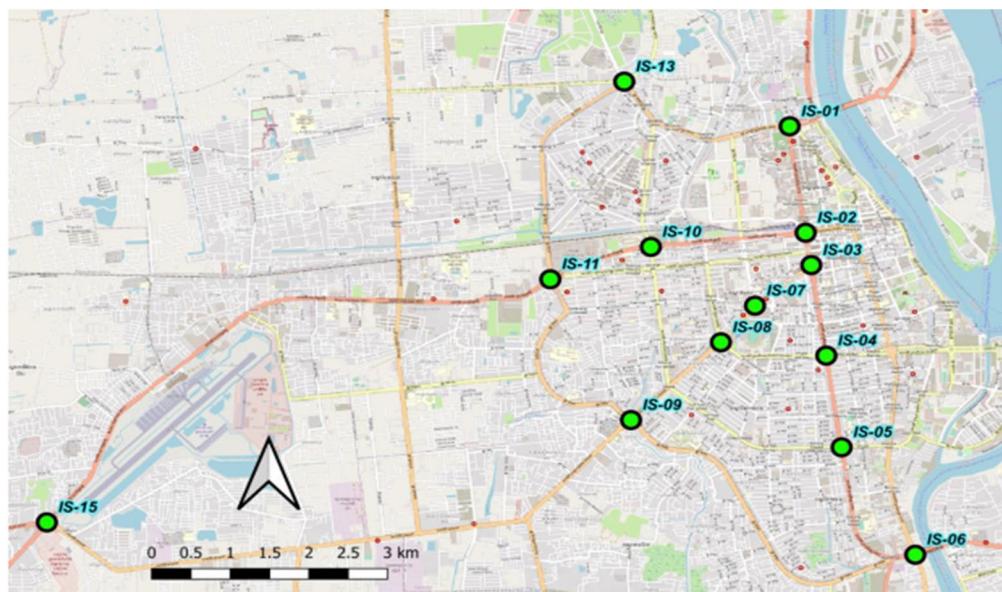
(1) Survey Objectives

The Intersection Traffic Survey aims to identify the locations of congested intersections, time of day of traffic congestion and seriousness of congestion.

(2) Survey Coverage

Survey Location:

The locations of survey points are shown in Figure 5.3.36. There are thirteen (13) major intersections including roundabouts and flyovers.

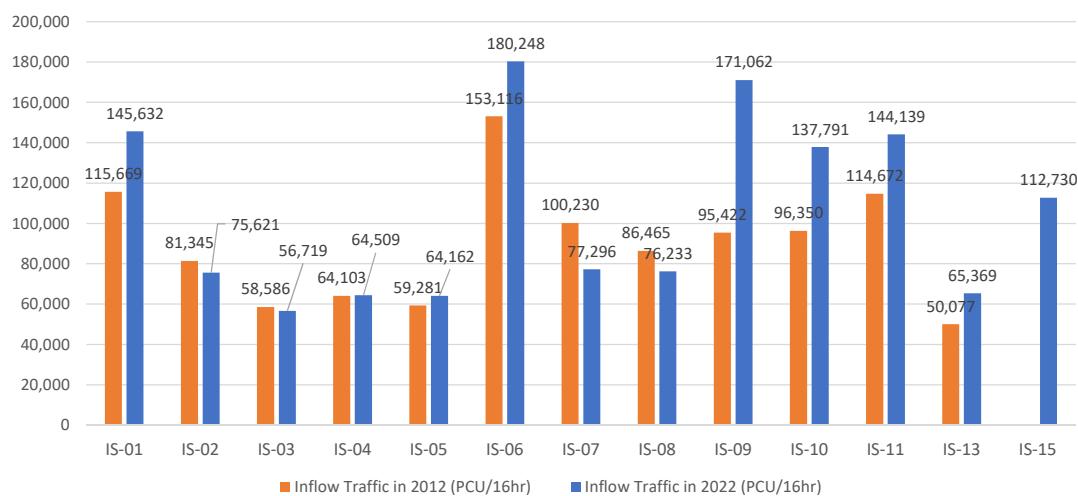


Source: JST

Figure 5.3.36 Map of Intersection Traffic Survey Location

(3) Survey Results

Comparison of the traffic volume at intersections between 2012 and 2022 such as IS-2, IS-3, IS-4, IS-7, and IS-8 (St.271: inside the Inner Ring Road) in the city centre is flat or in a downward trend. On the other hand, an increasing trend is seen at major intersections such as IS-01, IS-06, IS-09, IS-11, and IS-13 on the fringe of the CBD. This clearly shows the sprawl in recent years. In suburban areas where traffic volume is increasing, traffic management such as construction of new signalized intersections and connection of existing signals to the traffic control system is necessary.



Note: Survey was not conducted at IS-15 in 2012.

Source: JST

Figure 5.3.37 Comparison of Inflow Traffic at Intersections (2012 and 2022)

5.3.7 Travel Speed Survey (TSS)

(1) Survey Objectives

The main objective of this survey is to understand the current road traffic situation and to identify congestion bottlenecks on arterial roads in Phnom Penh.

(2) Survey Coverage

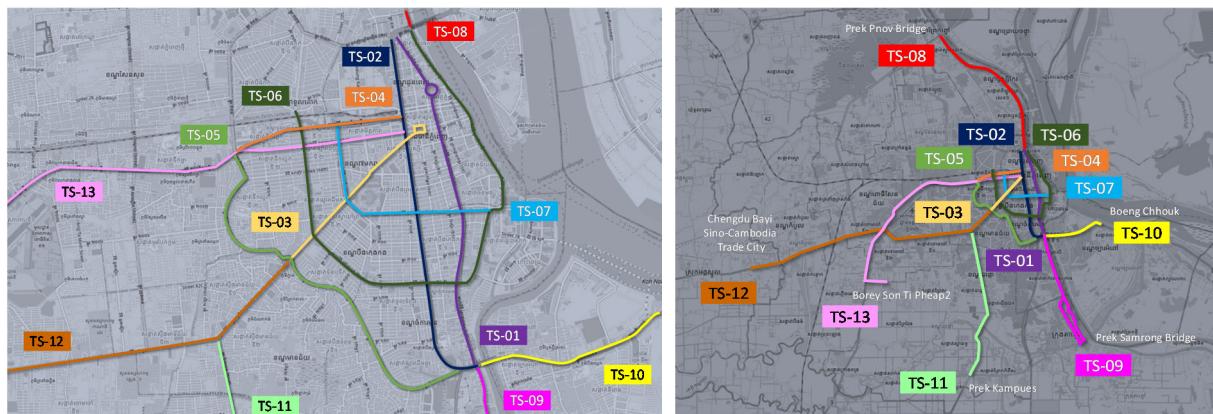
Survey Location and Sample:

The average travel speed will be collected from three (3) different transport modes.

Passenger car: 13 survey routes in the target area (CBD and suburb) as shown in Source: JST

- Figure 5.3.38
- RHS (tuk-tuk): Tuk-tuk with RHS will be selected from 3 locations in CBD and 2 locations in suburb. Target is 50 samples of RHS from the five (5) locations (25 vehicles for 2 days).
- Commuter bus: Commuting bus/truck services operating from city centre to PPSEZ or industrial parks in the suburb. The target is 50 samples of commuter buses (25 routes for 2 days).

It should be noted that travel speed of City Bus was analysed with GPS log data shared by PiBO.



Source: JST

Figure 5.3.38 Travel Speed Survey Routes for Passenger Car

Survey Duration:

In general, the survey was conducted on one (1) weekday between Tuesday and Thursday.

- Passenger car: morning peak hours (07:00-09:00), evening peak hours (17:00-19:00), and off-peak hours (12:00-14:00)
- RHS (tuk-tuk): 12 hours (07:00-19:00). 2-day record is collected for each vehicle
- Commuter bus: morning peak hours (07:00-09:00) and evening peak hours (17:00-19:00). 2-day record is collected for each vehicle
- City bus: vehicle movement were analysed for 5 consecutive days with the GPS record.

(3) Survey Result

The following table describe the average travel speed of passenger car. The average travel speed on most routes in CBD was lower than 15.0 km/h. Travel speed slows down the most in CBD in the evening peak hours to around 14.0 km/h for inbound direction and around 11.5 km/h for outbound on average.

Table 5.3.12 Average Travel Speed (Passenger Car)

Route ID / Street Name	Direction	Average Travel Speed (km/h)		
		Morning 7:00-9:00	Afternoon 12:00-14:00	Evening 17:00-19:00
TS-01 France/ Norodom (Rd 47/41)	Inbound	13.4	20.0	15.1
	Outbound	15.0	19.1	11.3
TS-02 Monivong Blvd.	Inbound	11.4	14.5	15.3
	Outbound	14.1	12.5	11.5
TS-03 Charles De Gaulle/Monireth (Rd 217)	Inbound	9.9	12.1	11.4
	Outbound	14.4	13.4	10.3
TS-04 Russian Blvd.	Inbound	14.1	17.7	15.5
	Outbound	22.8	18.3	9.0
TS-05 Inner Ring Road (Rd 271)	Inbound	14.9	23.3	14.4
	Outbound	13.6	19.9	11.5
TS-06 Sisowath/Sothearos/Mao Tsetung/Kim Il Sung (Rd 1/3/245/289)	Inbound	15.5	14.3	13.2
	Outbound	14.4	18.6	14.3
TS-07 Sihanouk/Nehru Blvd. (Rd 274/215)	Inbound	14.1	14.6	13.4
	Outbound	12.5	14.9	12.7

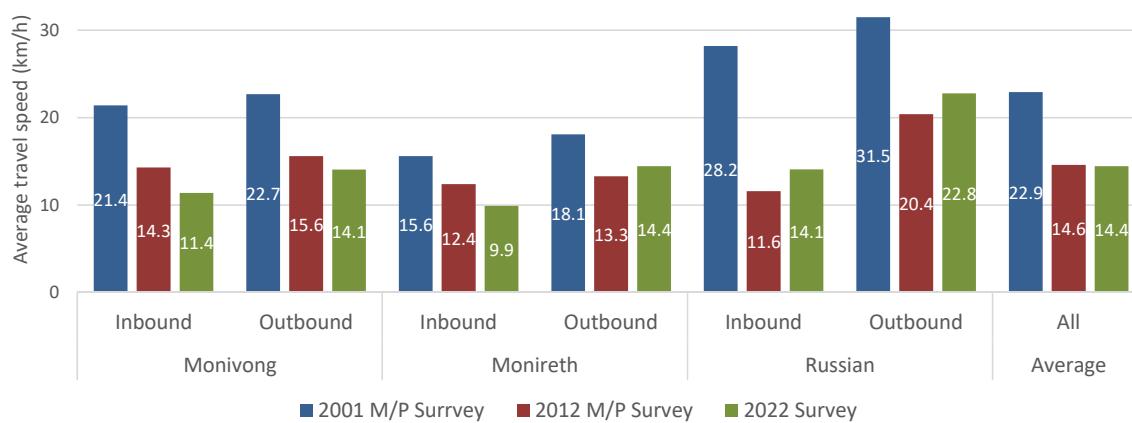
Route ID / Street Name	Direction	Average Travel Speed (km/h)		
		Morning 7:00-9:00	Afternoon 12:00-14:00	Evening 17:00-19:00
TS-08 NR5 (City Bus Line1)	Inbound	23.3	17.2	24.0
	Outbound	30.5	28.8	21.4
TS-09 NR2/ St.211/ St.21A (City Bus Line2)	Inbound	22.5	32.0	27.6
	Outbound	24.6	24.7	16.8
TS-10 NR1 (City Bus Line1)	Inbound	12.6	24.4	24.0
	Outbound	19.5	22.8	11.5
TS-11 Chamkar Doung St. (City Bus Line 4C)	Inbound	26.7	31.4	29.2
	Outbound	26.9	29.2	20.8
TS-12 Monireth/ Veng Sreng/ NR4 (City Bus Line 4)	Inbound	13.2	15.7	19.9
	Outbound	16.2	18.3	14.8
TS-13 Kampuchea Krom/ Russian Blvd./ NR3 (City Bus Line3)	Inbound	17.9	22.3	22.9
	Outbound	20.7	22.9	16.8
Average Travel Speed in CBD (TS-01 to TS-07)		Inbound	13.3	16.7
		Outbound	15.3	16.7
Average Travel Speed outside CBD (TS-08 to TS-13)		Inbound	19.4	23.8
		Outbound	23.1	24.4
				17.0

Note: TS-09's inbound routes and outbound routes are different.

Note: Outbound of circular routes (TS-05, TS-06, TS-07) indicate counter clock wise direction.

Source: JST

Figure 5.3.39 describes the average travel speed on major corridors during morning peak hours. According to the travel speed surveys in 2001, 2012 and 2022, the gradual decline with travel speed can be observed except for Russian Blvd. The improvement on Russian Blvd is considered from the construction of two flyovers: Techno Sky Bridge and Seven Makara Sky Bridge.



Source: JST

Figure 5.3.39 Comparison of Average Travel Speed (Morning Peak) (2001, 2012 and 2022)

Figure 5.3.40 illustrates trajectories of RHS movements. The coverage of RHS is sufficient especially in CBD. On the other hand, many “parking” and “stopping” records were observed in suburban areas where demand forecast is small. In addition, no GPS record was found on a certain section of Norodom, where RHS is prohibited to drive.



RHS Vehicle Movement

Note: Error records are excluded.

Source: JST

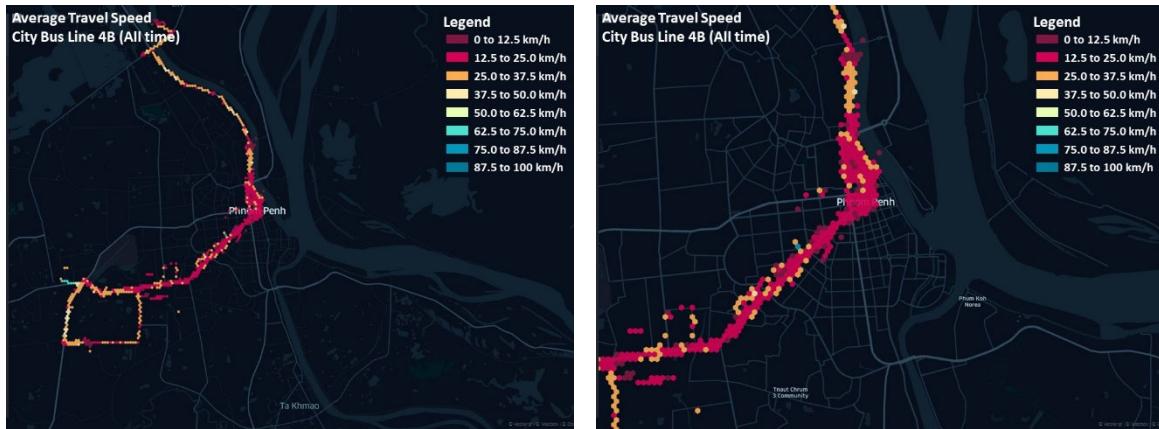
RHS Drivers Stopping/Parking Spots

Note: Error records are excluded.

Note: Less than 2km/h was assumed as stopping/parking.

Figure 5.3.40 RHS Vehicle Movement

Figure 5.3.41 describes the average travel speed of both directions of City Bus line, Line 4B. CBD and Monireth Blvd. / Veng Sreng Blvd., where Line 4A/4B pass, showed a significant drop in the average travel speed.



Note: Records of which travel speed is higher than 100km/h were omitted as errors.

Source: JST

Figure 5.3.41 Average Travel Speed of City Bus (Line 4B) (All Time)

5.3.8 Parking Condition Survey (PCS)

(1) Survey Objectives

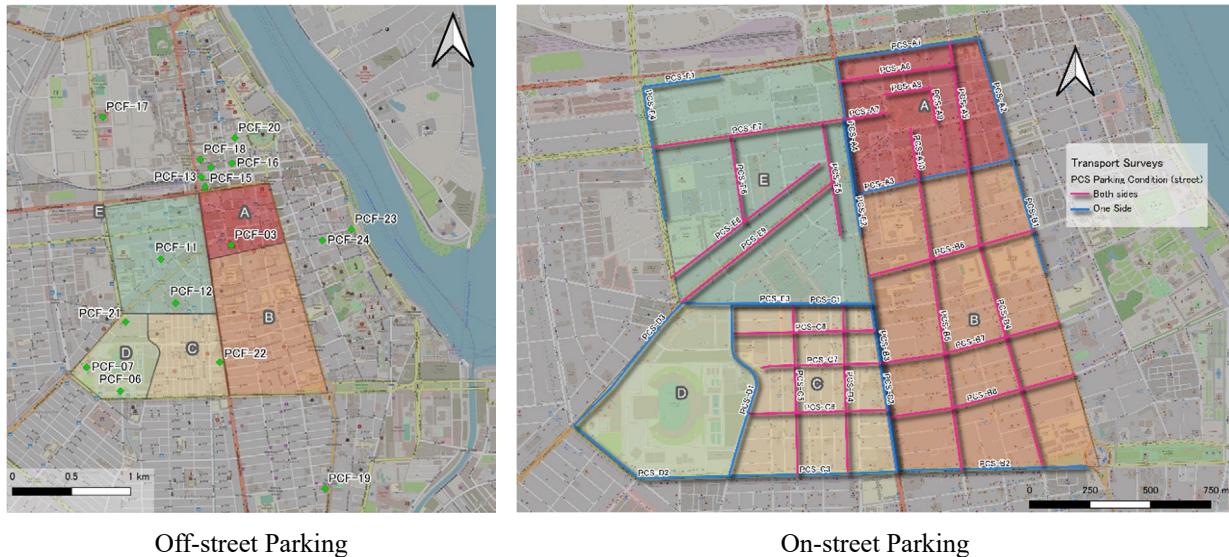
The main purpose of the survey is to obtain updated information about parking facilities and parking conditions in central business and commercial area of Phnom Penh Capital City for better traffic management and transport planning. This survey consists of the following items:

- Inventory Survey
- User Counting Survey
- User Interview Survey

(2) Survey Coverage

Survey Location:

The survey locations are shown in Figure 5.3.42. There are seventeen (17) parking facilities and thirty eight (38) street sections with on-street parking.



Source: JST

Figure 5.3.42 Map of the Parking Condition Survey Location

(3) Survey Method

- Inventory Survey was conducted by site investigation at parking facilities and parking facility name, floor area, operation hour, capacity, fee, etc. were recorded.
- User Counting Survey counted the vehicles parked (legally/illegally) at different observation times and number of entering / exiting vehicles.
- User Interview Survey targeted not less than 20% of parking users to collect the purpose, trip origin, parking duration and user opinions.

The definition of legal/illegal parking is not clearly defined. Thus, the definition in Table 5.3.13 was employed in the survey. Furthermore, the target of each survey contents are summarized in Table 5.3.14.

Table 5.3.13 Definition of Legal and Illegal Parking (On-street)

Type	Description	Sample Photo
Legal-1 (PCS L-1)	L-1: a parking inventory providing legal parking space for motorbikes and other vehicles with red/white/yellow line marking and parking fee. (e.g. Central Market and City Mall on-street parking)	

Type	Description	Sample Photo
Legal-2 (PCS L-2)	L-2: a parking inventory providing legal parking space for motorbikes and vehicles with red/white/yellow line marking and option to pay for parking fee. (e.g. mart, shop, gas station, and bank parking space)	
Illegal-1 (PCS I-1)	I-1: a parking on streets that provides an illegal parking space for motorbikes and vehicles without any line marking and causes inconveniences to the public or traffic congestion on streets.	

Source: JST

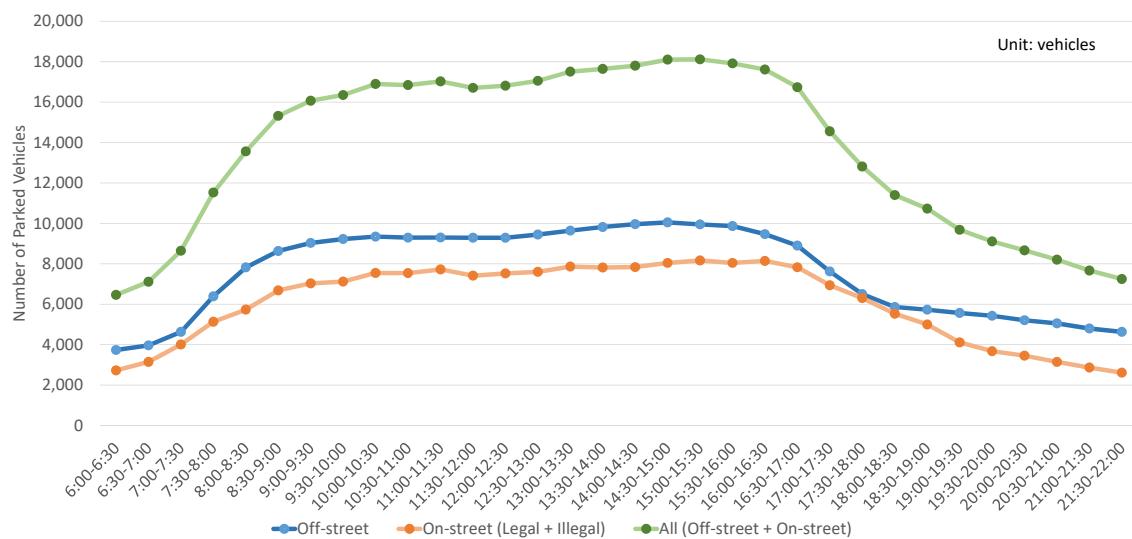
Table 5.3.14 Target of Parking Condition Survey

Type of Parking		Parking Condition Survey		
		Parking Inventory Survey	User Counting Survey	User Interview Survey
Off-street (PCF)	Parking Facility	Surveyed	Surveyed	Surveyed
On-street (PCS)	Legal Parking 1 (L-1)	Surveyed	Surveyed	Surveyed
	Legal Parking 2 (L-2)	Not Surveyed	Surveyed	Surveyed
	Illegal Parking (I-1)	Not Surveyed	Surveyed	Surveyed

Source: JST

(4) Survey Results

Figure 5.3.43 describes the result of user counting survey for off-street parking facilities and on-street parking. The result suggests that the parking demand remains high during daytime and drops at night time.



Note1: Off-street parking indicates “PCF”. Locations outside Block A to E are included as well.

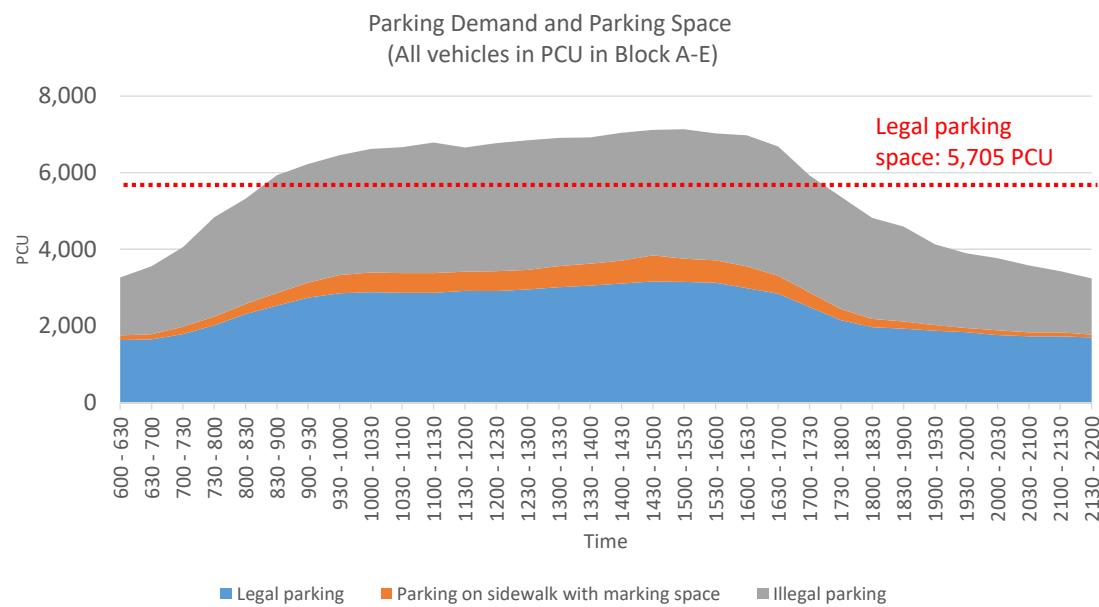
Note2: On-street parking (legal) includes “PCS L-1” and “PCS L-2” in Block A to E.

Note3: On-street parking (illegal) indicates “PCS I-1” in Block A to E.

Source: JST based on Parking User Counting Survey

Figure 5.3.43 Transition of Parking Demand (Off-street and On-street)

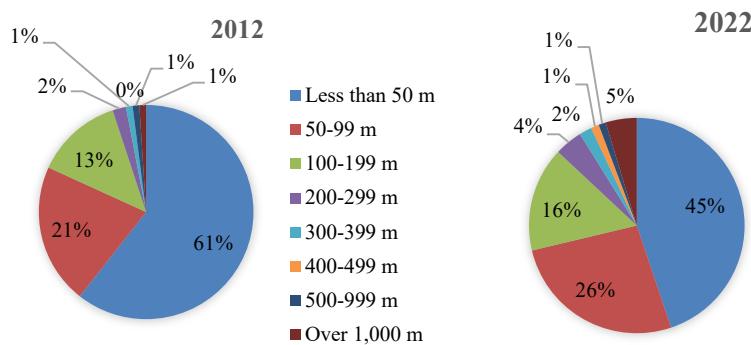
Figure 5.3.44 compares the parking capacity including off-street and on-street parking in Block A to E and the parking demand.



Source: JST

Figure 5.3.44 Comparison between Parking Demand and Parking Capacity (Block A-E)

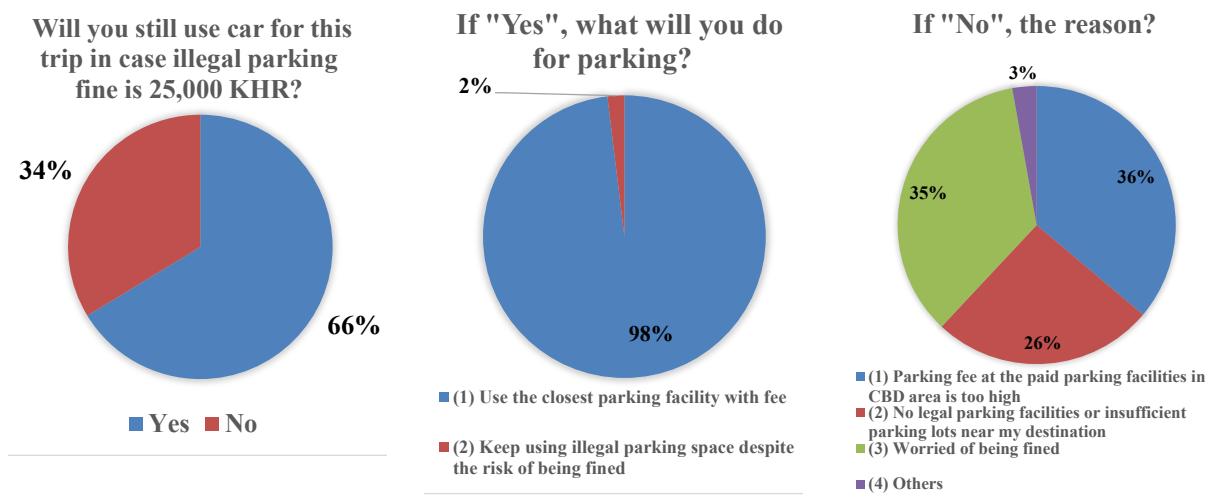
Figure 5.3.45 illustrates the distance from the facility where respondents parked vehicles to their destinations. The trend of walking longer distance is observed compared to the result of PPUTMP in 2012.



Source: JST

Figure 5.3.45 Distance from Parking Facilities to Destinations

Figure 5.3.46 shows the opinion of car users on the strict enforcement for illegal parking in CBD. 66% of respondents answered that they would continue using car for traveling to CBD. In addition, 65% of all respondents, 98% of respondents who answered to continue using car, answered that they would continue using their own cars and use nearby parking facilities with fee. More than half of the users who answered that they would not use private cars in case of strict enforcement cited high parking fees and lack of parking lots.



Source: JST

Figure 5.3.46 Behaviour Change in case of Strict Enforcement for Illegal Parking

5.3.9 RHS Driver Interview Survey

(1) Survey Objectives

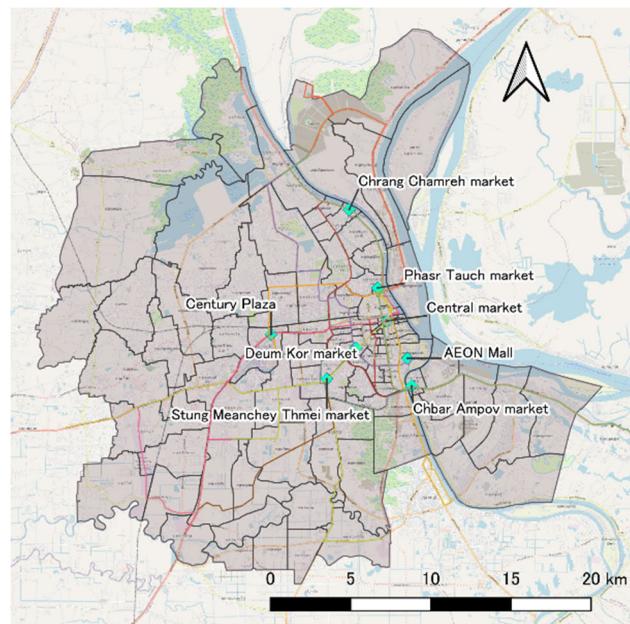
The RHS Driver Interview Survey aims to get the information about actual situation of RHS drivers and to establish the future transport policy in Phnom Penh.

(2) Survey Coverage

Survey Location:

The survey was conducted at the following 8 locations on November 23 and 24, 2021. 427 samples were collected.

- Chrang Chamreh Market
- Phsar Tauch Market
- Central Market
- AEON Mall 1
- Chbar Ampov Market
- Steung Mean Chey Thmei Market
- Deum Kor Market
- Century Plaza or Pochentong Market

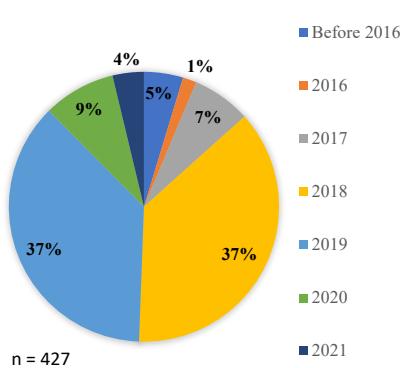


Source: JST

Figure 5.3.47 Map of the RHS Driver Interview Survey Locations

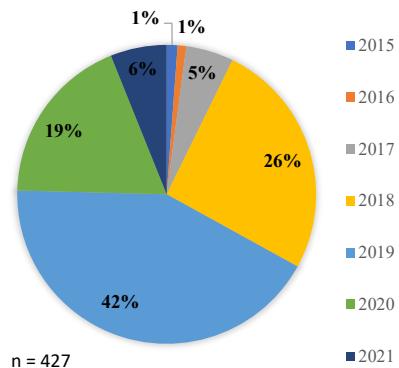
(3) Survey Results

As for driver's age, 25 to 39 years old drivers account for 50% of all interviewed drivers and 40 to 54 years old driver shares 39%. All respondents were male drivers. 83.4% of all respondents were without side business. 79.2% of the drivers work 7 days a week. Many of drivers started using RHS in 2018 to 2019 as shown in Figure 5.3.48 and Figure 5.3.49.



Source: JST

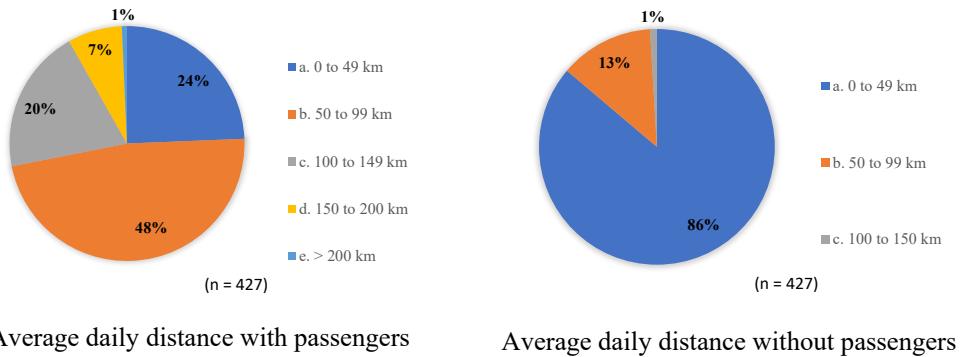
Figure 5.3.48 Year of Starting the Job of Tuk-tuk Driver (RHS Drivers)



Source: JST

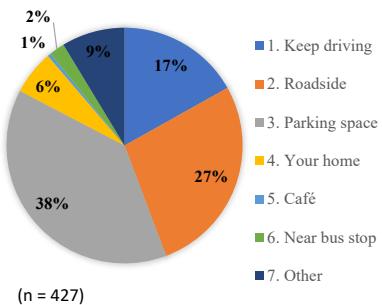
Figure 5.3.49 Year of Starting RHS Application (RHS Drivers)

Daily driving distance with passengers for most drivers is less than 100 km as shown in Figure 5.3.50 and many drivers wait for orders at roadside or parking space.



Source: JST

Figure 5.3.50 Average Daily Driving Distance by RHS Drivers



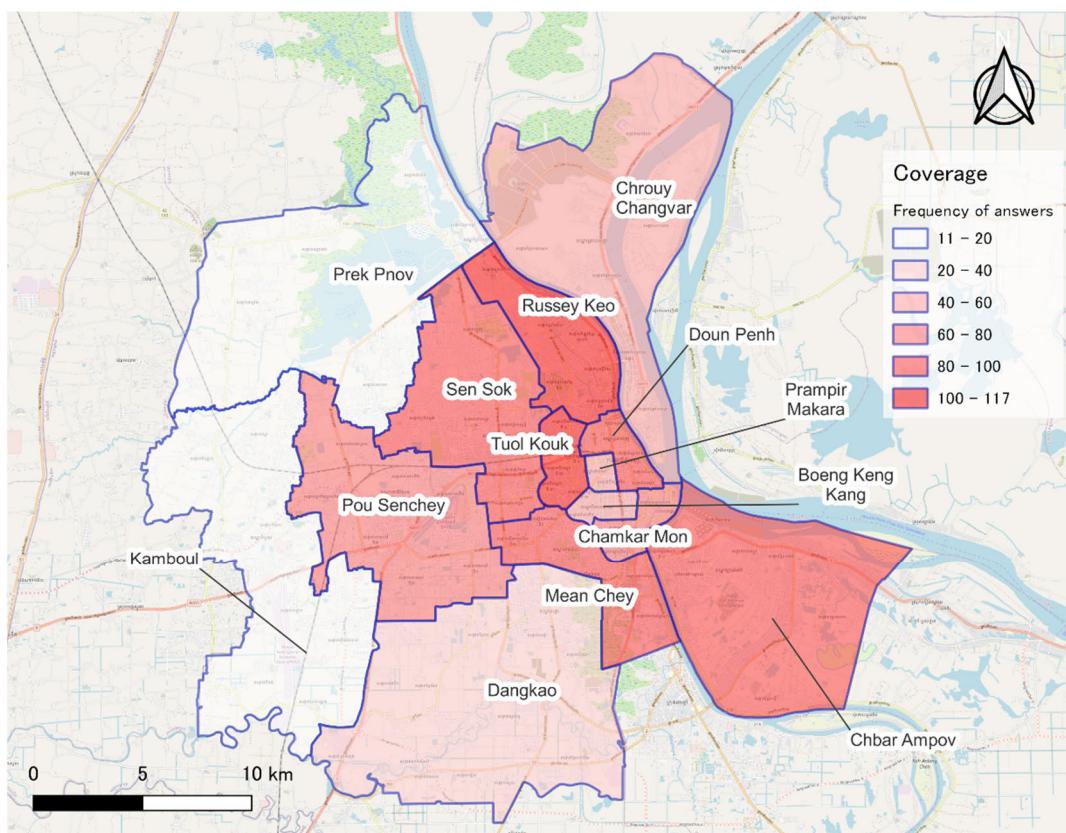
Source: RHS Driver Interview Survey (JST)

Figure 5.3.51 Location when Waiting for Passengers (RHS Drivers)

Figure 5.3.52 illustrates the areas that RHS drivers indicated as their regular coverage of driving service in the RHS Driver Interview Survey. According to the interviews, one RHS driver covers 2.2 districts on average. The city centre is covered by RHS drivers sufficiently while districts in the suburbs are covered by fewer drivers meaning a less convenient situation of RHS.

Drivers perceive “more customers”, “more revenue”, “saving wait time” as the advantage of using RHS while they perceive “app errors”, “commission fee” and “cannot change fare” as the disadvantages. RHS enables passengers to take a ride without a bargain with drivers, which is a significant advantage for passengers. On the other hand, drivers have no discretion on fares, which results in their revenue being affected by decisions of an RHS company.

In addition, 73.3% of respondents register at one RHS company only. The registration percentage for PassApp is 84.8% and that of Grab is 31.1% respectively.



Note: Multiple selections were allowed.

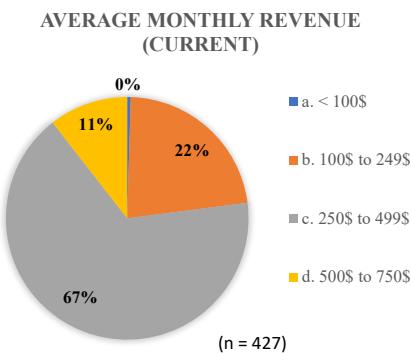
Source: RHS Driver Interview Survey (JST)

Figure 5.3.52 Coverage of Driving Service by RHS Drivers (by Districts)

Revenue of RHS Drivers and Influence by COVID-19 Pandemic

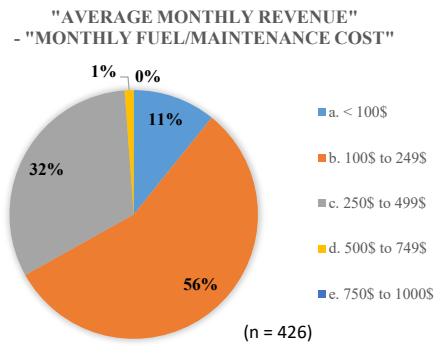
Figure 5.3.53 represents the RHS driver's current revenue received from RHS companies. It should be noted that the current revenue is already affected by the COVID-19 pandemic. The average monthly revenue is USD 315 and the drivers whom revenue varies from USD 250 to USD 499 account for 66.5% of all respondents. Average monthly fuel/ maintenance cost is USD 97 and 60.9% of respondents spend less than USD 100. The RHS driver's actual revenue is estimated by deducting the fuel/maintenance cost from the revenue from RHS companies. The actual revenue is USD 219 on average and the actual revenue of 56.1% of all drivers is in the range of USD 100 to USD 249. Given that the average salary for workers in Phnom Penh is USD 222⁴, the revenue of RHS drivers is relatively lower.

⁴ Source: https://www.jetro.go.jp/world/search/cost_result?countryId%5b%5d=800



Source: JST

Figure 5.3.53 RHS Driver's Revenue (Current)



Note: It is estimated by deducting monthly fuel/maintenance cost from monthly income.

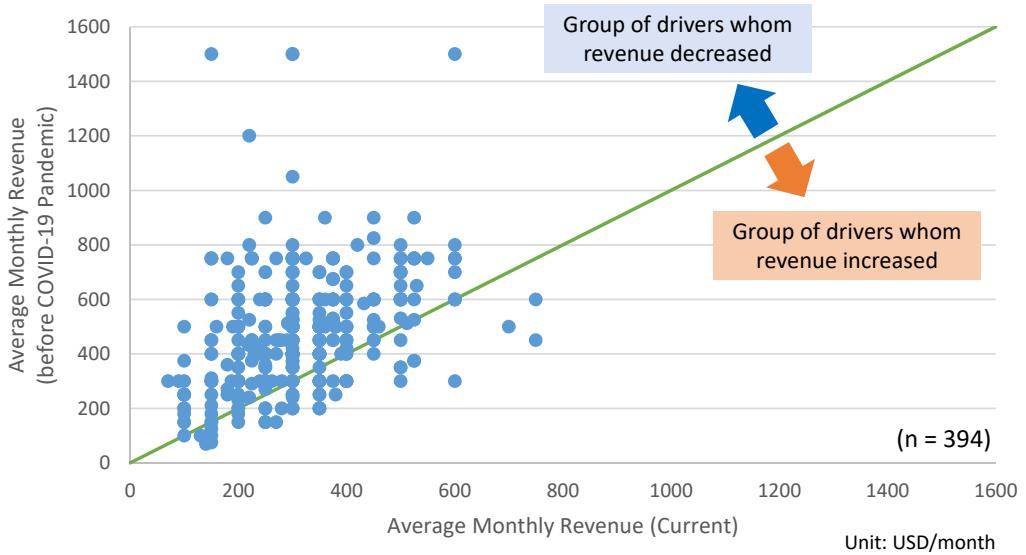
Note: USD 1 = KHR 4100

Source: JST

Figure 5.3.54 RHS Driver's Estimated Actual Revenue

Figure 5.3.55 illustrates the distribution of RHS driver's revenue before/after the COVID-19 pandemic. Before the pandemic, 34.7% drivers used to gain USD 500 to USD 749, however, the percentage dropped to 10.5% after the pandemic. 83.2% of all drivers answered that their revenue decreased after the pandemic.

According to the interview to RHS drivers, the high commission fee by RHS companies (mostly 15%) is a huge burden on RHS drivers. RHS drivers needed to bear some portions of fare discount applied by RHS companies during the pandemic, which is considered to have given a certain impact on drivers. It turned out that there were drivers that stopped using RHS as a result. Therefore, the sustainability of RHS should be considered if RHS is regarded as public transport.



Note: Samples that have no answers for "the revenue before pandemic" are excluded.

Source: JST

Figure 5.3.55 Comparison of RHS Driver's Revenue before/after COVID-19 Pandemic

Although around 80% drivers have already finished the traffic safety education, only 19.0% of drivers

subscribe for insurance for traffic accidents. Improving the insurance subscription rate is required if RHS plays a role in public transport.

5.3.10 Truck Interview Survey (TIS)

(1) Survey Objective

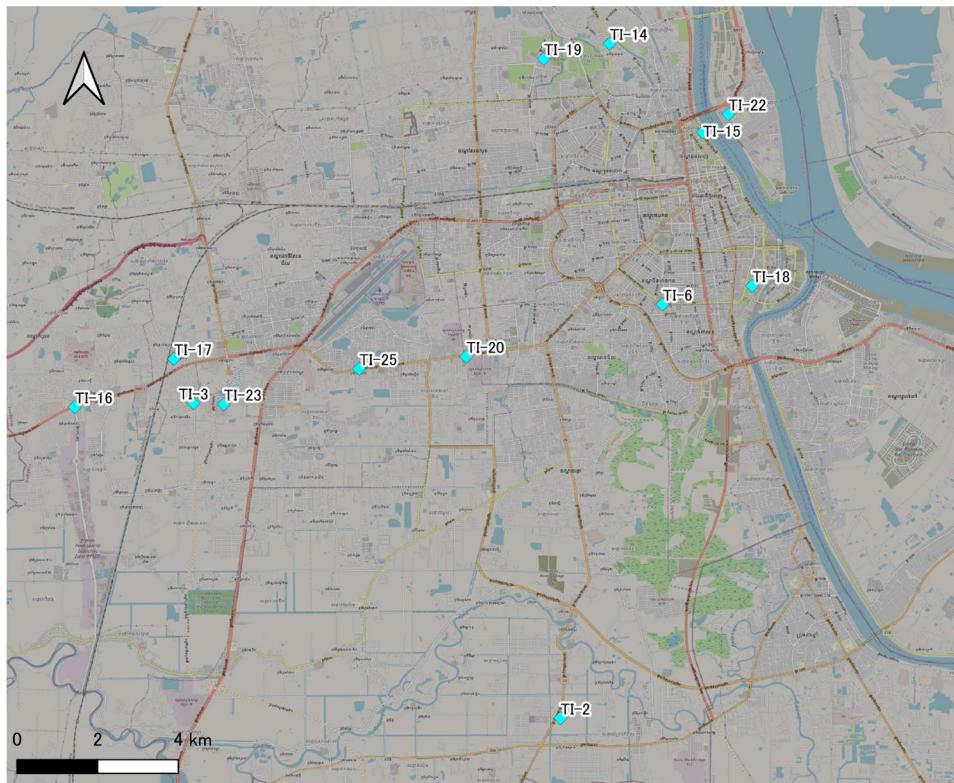
The main objective of Truck Interview Survey is to understand the current trip information of freight transport including the origins and destinations. The following survey items will be conducted.

- Company Interview Survey
- Driver Interview Survey
- Traffic Counting Survey

(2) Survey Coverage

Survey Location:

The target survey locations include 15 major logistics facilities including PPSEZ, industrial parks, factories as well as ports as shown in Figure 5.3.56. To capture the changes of truck movement in 2012 and 2022, JST tried to conduct the survey at the same locations chosen in 2012. However, most of them are no longer exist or rejected to conduct the survey in 2022. On the other hand, new cargo generation points such as AEON 1 and AEON 2 were identified. Therefore, JST conducted the survey at the same location as the survey 2012 as much as possible and as well as the new cargo generation points.



Note: TI-18 (AEON 1) and TI-19 (AEON 2) surveyed. AEON Cambodia operates a supermarket.
AEON Mall operates a specialty store.

Source: JST

Figure 5.3.56 Survey Locations of Truck Interview Survey

(3) Survey Result

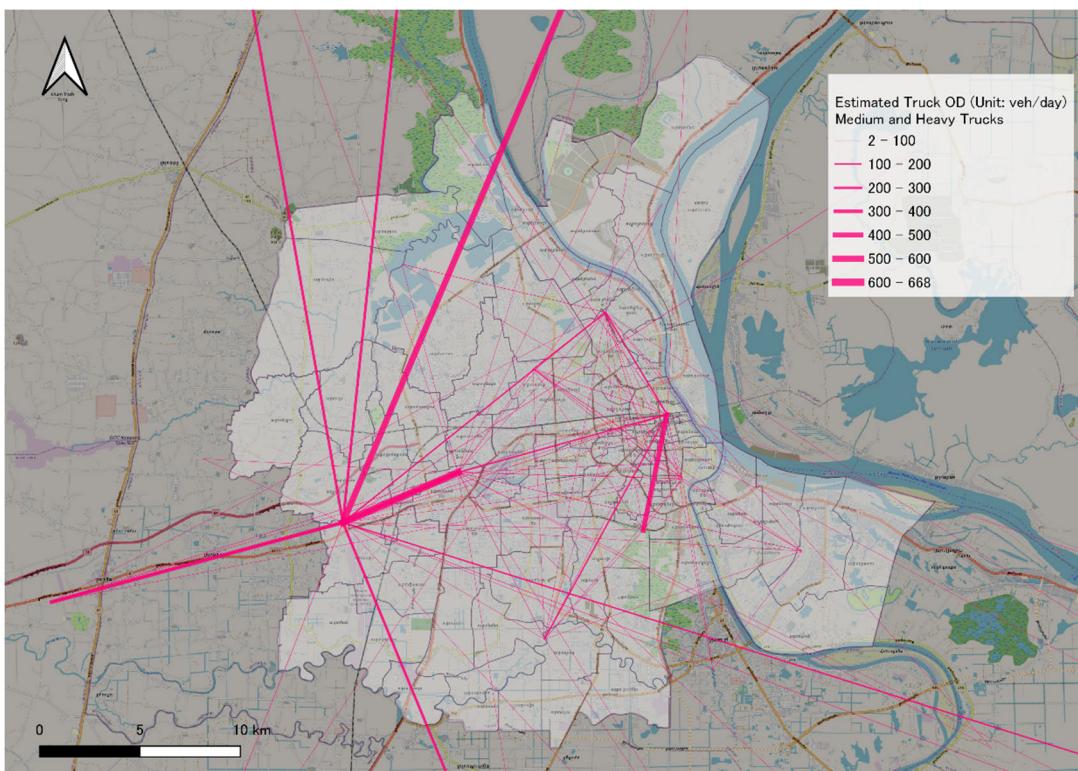
The table below describes the comparison of the survey result between 2012 and 2022. Large number of trucks were observed at PPSEZ and Phnom Penh Port.

Table 5.3.15 Result Comparison of Truck Interview Survey between 2012 and 2022

ID	Company Name	Counted Trucks in 2012 (Veh./day)	Counted Trucks in 2022 (Veh./day)	Interviewed Trucks in 2012 (Veh./day)	Sample Ratio in 2012	Interviewed Trucks in 2022 (Veh./day)	Sample Ratio in 2022	CAGR from 2012 to 2022
TI-2	Cam Paint	-	34	-	-	5	14.7%	-
TI-3	Ming Yung Hung Enterprise (Cambodia) Co.,LTD	-	14	-	-	-	-	-
TI-6	Chip Mong Industries	-	48	37	0.0%	22	45.8%	-
TI-14	N.V.C Corporation Co., Ltd.	24	108	41	170.8%	-	-	16%
TI-15	Phnom Penh Port	170	1,553	66	38.8%	-	-	25%
TI-16	Phnom Penh Special Economic Zone	-	4,570	-	-	138	3.0%	-
TI-17	Toll Royal Railway Phnom Penh Dry Port/ Toll Cambodia Dry Port	-	304	-	-	48	15.8%	-
TI-18-1	AEON 1 (AEON Cambodia)	-	106	-	-	15	14.2%	-
TI-18-2	AEON 1 (AEON Mall)	-	94	-	-	25	26.6%	-
TI-19-1	AEON 2 (AEON Cambodia)	-	30	-	-	8	26.7%	-
TI-19-1	AEON 2 (AEON Mall)	-	41	-	-	8	19.5%	-
TI-20	ISI Steel	-	44	-	-	22	50.0%	-
TI-22	Vireak Buntham Express	-	68	-	-	-	-	-
TI-23	Hong Leng Huor (Transport Imp. Exp & Dry Port) co.,Ltd.	-	54	-	-	-	-	-
TI-25	So Nguon Dry Port	-	141	-	-	-	-	-
		194	7,209	144	-	291	-	-

Source: JST

Based on the survey result in 2022, the expansion factor for each survey location was obtained according to the result of the traffic count and the truck driver interview survey. As shown in Figure 5.3.57, the major truck OD can be observed from Kamboul District to Pou Senchey District at around 670 vehicles per day, followed by from Kamboul District to outside Phnom Penh at around 580 vehicles per day.



Note: The data includes “Truck (two axles)” and “Heavy Truck and Trailer”.

Note: This figure shows the distribution of trucks generated/concentrated from the location where the freight vehicle traffic survey was conducted, and does not show the distribution of trucks in the entire Phnom Penh city.

Source: JST

Figure 5.3.57 Estimated Truck OD Distribution in 2022

BOX 3: Definition and Estimation of Trips by Mobile GPS Probe-data and Possible Replacement of PT Surveys

PT surveys conducted to determine the current transport demand require significant cost, time, and technology and which makes it difficult for developing countries including Cambodia to implement them without technical and financial support from donors including JICA. And it is one of the factors that prevent developing countries from formulating and updating their urban transportation master plans autonomously.

In Japan, studies have been conducted on the use of big data such as GPS probe-data, Wi-Fi access point data, and traffic IC cards as part of comprehensive urban transport surveys, and estimates and definitions of trips have been made using big data. Recently, as a result of these studies, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has published a guidebook on methods to supplement PT surveys using big data, and the use of big data in comprehensive urban transport surveys in Japan is becoming mainstream in the future.

This Project collaborated with Professor Kuniaki Sasaki of Waseda University and Dr. James Goulding of the University of Nottingham (Dr. James participated in the Survey as a member of the JST) to confirm the nature of commercially available location data generally available in developing countries, and to examine the possibility of replacing PT surveys and how to utilise such data for transport planning.

1. Description of GPS probe-data

The GPS probe-data used in this Project was obtained from Lifesight, Inc. The data was obtained from location-aware mobile applications, and logs from multiple applications are centrally managed by the Lifesight, with usage rights sold. These data were obtained for January 2020, just before the new coronavirus outbreak, January 2021, during the coronavirus disaster, and again in March 2022, totaling for a three months period. In addition to the identification ID, 21 other items, including latitude and longitude and time stamps, were obtained.

2. Review of empirical studies

To extract trips from irregular and large GPS probe-data, Ohno et al. 1) group logs that stay more than a certain time within a certain range as Stay Points (SP), and plot between them as trips. They also grouped the nearest stay points into stay areas to improve the accuracy of the trip logs and estimate the travel routes. To infer its purpose from the extracted trips, Furletti et al. 2) and Feng et al. 3) use a database of POIs (Points of Interest) obtained from Open Street Map. In addition to these, numerous other studies have been conducted on trip extraction, trip purpose, and mode estimation. However, the data used in most of these studies were newly obtained for the study and are relatively small in scale; in this Project, trip estimation was conducted using large-scale data commercially available at the above-mentioned Lifesight, Inc.

3. Trip estimation and comparison with PT survey by Prof. Kuniaki Sasaki

3-1) Simple data aggregation

Sasaki et al. used GPS data from January 2020, when the traffic was unaffected by coronavirus, to compare trips estimated from GPS data and trips from the PT survey. The number of logs and IDs for all of Cambodia and the Phnom Penh metropolitan area are shown below.

Table 5.3.16 Number of GPS Data Logs and IDs

	GPS logs	IDs
Cambodia	117,123,391	87,876
Phnom Penh	74,771,575	45,176

Source: JST

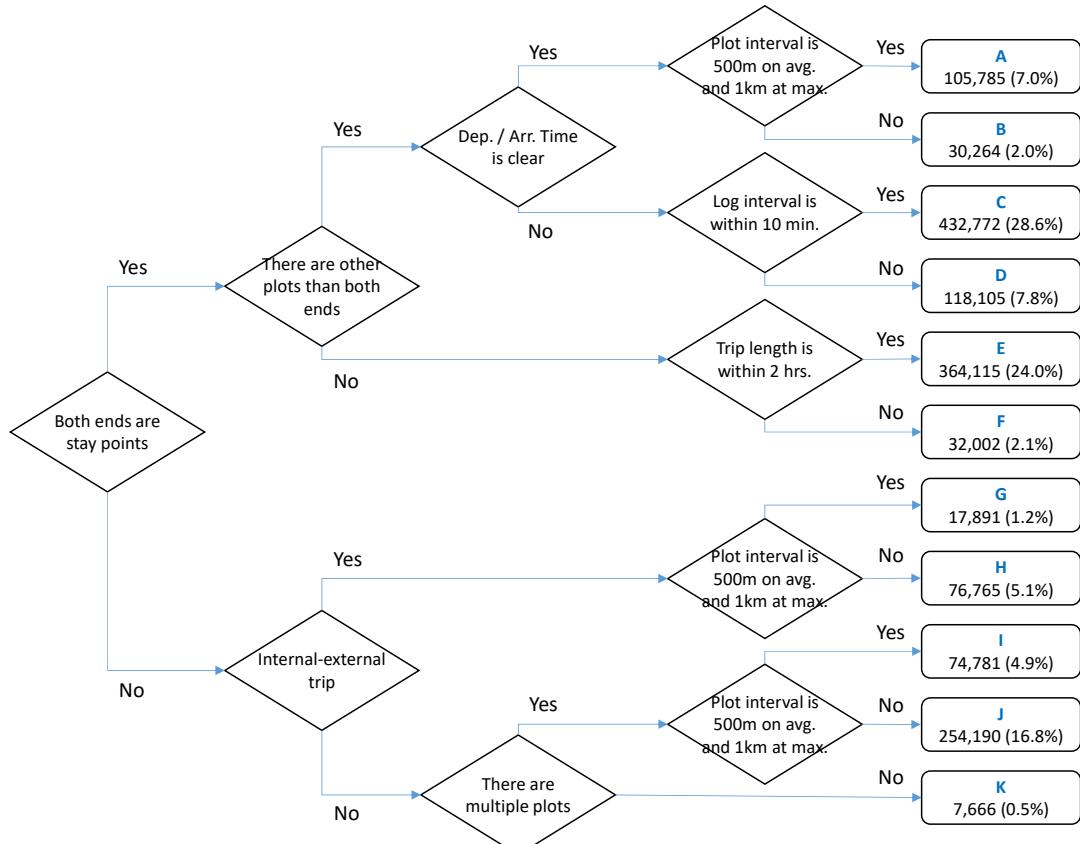
3-2) Define Stay Point (SP)

It is necessary to set conditions on the GPS data to determine which plots are traveling and which are staying. Here, a group of plots that are presumed to be staying are extracted as stay points. Sasaki et al. set two basic conditions, "stay within 50 m for at least 5 minutes" or "stay within 100 m for at least 15 minutes," and defined SP as a group of plots that fit either condition.

3-3) Classification of trips

The GPS data obtained in this survey varied widely in terms of acquisition interval and accuracy, making it necessary to estimate trip ends other than SP. Therefore, Sasaki et al. classified the GPS data according to the conditions shown in the figure below and compared them with the PT survey conducted in

November 2012. As a result, they found that trips meeting conditions "A to I" had the highest accuracy rate (small mean absolute percent error) with the PT survey.



Source: JST

Figure 5.3.58 Classification of GPS Prove-data and Trip

3-4) Estimation of trips by purpose

The locations of the selected SPs were estimated using Points of Interest (POIs), and Open Street Map was utilised to identify the POIs. The POIs within 50 meters of each SP were assigned to the facility category as a place to stay, starting with the closest ones, and categorised into trips for "To home," "To work," "To school," "Business," "Personal matters," and "Other" purposes.

Table 5.3.17 Location Categories and Purpose Groupings by POI

Purpose Group	Facility Category
To home	Home
To work	Office, Administration building, Factory/Warehouse
To school	School
Business	Commercial building
Others	Park/Lake and others

Source: JST

As a result, as for trips of To home, To work, Personal matters, and other trips, the ratios of trip estimates based on GPS data were almost identical to those in the PT survey. On the other hand, the ratio of trip estimates To school tended to be lower than in the PT survey due to the low smartphone ownership rate among students and the fact that some schools do not allow students to have smartphones, suggesting

that trip expansion processing is necessary for estimating trips To school using GPS data. Although the estimated value of Business trips tends to be larger than that of the PT survey, it is possible that many detailed business trips that are not usually answered in the PT survey can be extracted, and in this respect, the accuracy of trip estimation by GPS can be expected to improve the PT survey.

Table 5.3.18 Share of trips by Purpose Estimated from GPS Data vs. PT Survey

Purpose	Estimation by GPS (%)	PT survey (%)
To home	52.78	49.17
To work	15.84	19.80
To school	2.65	14.45
Business	19.17	5.23
Personal matters	5.87	9.16
Others	3.68	2.19

Source: JST

4. Trip estimates by Dr. James, University of Nottingham

4-1) Simple data aggregation

To analyse the impact of novel coronavirus infection on traffic behaviour by GPS data, James et al. analysed data for January 2020, just before the epidemic, January 2021, during the coronavirus disaster, and March 2022, when a further PT survey was conducted and identified 152,248,405 logs and 349,492 IDs throughout Cambodia.

Table 5.3.19 Number of GPS Data Logs and IDs

Month/Year	Data logs	IDs
JAN 2020	96,041,202	84,320
DEC 2020	2,461,833	23,076
JAN 2021	50,093,232	134,927
MAR 2022	3,651,705	144,465
APR 2022	433	128

Source: JST

4-2) Data cleaning

Data cleaning was performed excluding "speed (zero or negative) between GPS logs," "location accuracy (over 2 km)," "speed (over 35 m/s) between GPS logs," "GPS outside Cambodia," etc. As a result, 37,490,979 logs, or 25% of the total, were excluded from the GPS data.

Table 5.3.20 Number of GPS logs cleaned

Cleaning items	Number of GPS Logs Excluded	Share
i. Spurious speeds (negative or null)	17,957,575	11.8%
ii. Insufficient locational accuracy (> 2km)	17,266,401	11.3%
iii. Spurious inter-point speeds (> 35m/s)	2,149,044	1.4%
iv. longitude / latitudes outside of Cambodia	105,471	0.1%
v. Excessive declared speeds (> 35m/s)	12,198	0.0%
vi. Spurious gps accuracies (negative)	290	0.0%

Source: JST

The GPS data was then cleaned by setting conditions to exclude duplicate GPS data, excessive number of logs per individual ID, travel distance and time, and errors in GPS location information.

4-3) Trip definition and estimation of trips by purpose

James et al. defined a trip by setting the following conditions: "two or more events (logs)," "a duration of stay at the event of at least 5 minutes," and "less than 4 hours between events".

The GPS data obtained was accompanied by personal attribute data, which identified the geohash6 (1,200m x 609.4m) of the home and workplace (91% of the personal attribute data identified home and 84% identified work). In order to identify trips for To work, To home, and other purposes, the following conditions were used: "multiple trip ends exist in the same geohash within a month," "daytime hours (10AM to 2PM)," "nighttime hours (7PM to 3AM)," "maximum number of trips of 15 trips (but only 3 trips for airport-related trips)," and "small variation in geohashes identified as home and work by the same individual" were used to estimate trips by purpose.

Table 5.3.21 Share of Trips by Purpose, Estimated from GPS Data

Purpose	ALL DATA	2020	2021
Home to Work	16,598 (44,145*)	12,479 (28,513*)	3,783 (14,780*)
Work to Home	15,704 (43,251*)	11,060 (27,094*)	4,353 (15350*)
Home to Other	145,890	84,488	58,820
Other to Home	147,159	86,418	58,006
Other to Other	300,168	160,140	133,531

Source: JST

4-4) Basic aggregate results for trips in 2020 and 2021

Trips obtained from GPS data in January 2020, prior to the new coronavirus infestation, and estimates of trips in January 2021 during the coronavirus pandemic are summarised below. The results of the analysis for the impact on the trips by the new coronavirus are presented in the main text.

Table 5.3.22 Basic aggregate results of trips estimated from GPS data by year

Feature	ALL DATA	2020	2021
Total Trips Detected	626,318	385,518	224,063
Total MAIDS with Trips	24,335	13,073	10,767
Mean Trips per MAID	25.74	29.49	20.81
Min	1	1	1
Max	448	367	223
Variance of Trips per MAID	1578.36	1410.98	844.50

Note: MAID, Mobile Advertising ID, means the unique ID for each mobile phone.

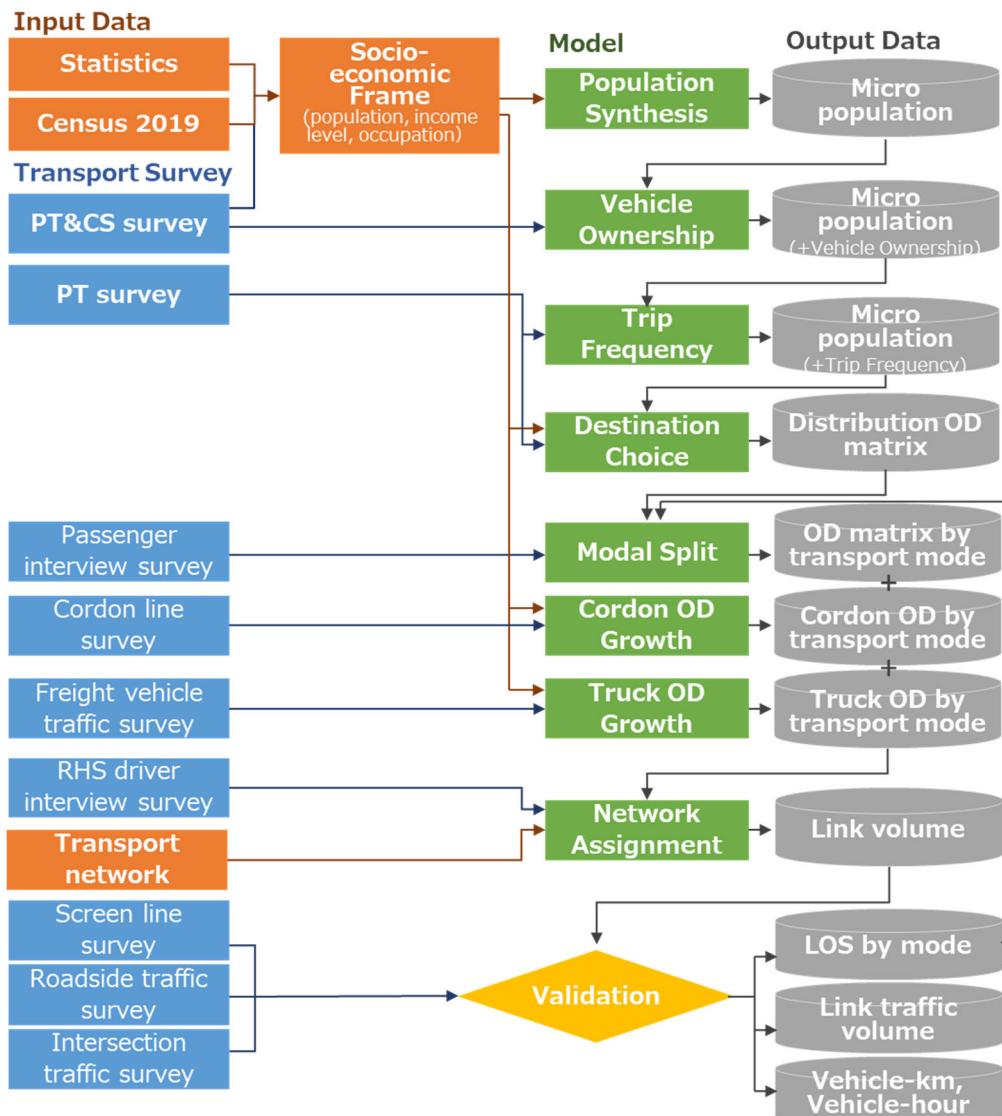
Source: JST

Chapter 6 Transport Demand Forecast

6.1 Transport Demand Forecasting Approach

6.1.1 Outline of Transport Demand Forecasting

Figure 6.1.1 shows the flow of transport demand forecast. At first, a micro population is synthesised based on the socio-economic framework. Then, household vehicle ownership information is added by using a vehicle ownership model. After that, a disaggregated four step model is applied to estimate future transport demand. The detail of each model and estimated parameter is described in Appendix 2.



Source: JST

Figure 6.1.1 Flow of Transport Demand Forecast

6.1.2 Vehicle Classification

Table 6.1.1 shows the vehicle classification for the transport demand forecast. The same classification and PCU (Passenger Car Unit) are applied as PPUTMP. The average occupancy for each vehicle type is shown for the Screen Line Survey and Cordon Line Survey separately.

Table 6.1.1 Vehicle Classification

	Name	PCU	Average Occupancy (SLS)	Average Occupancy (CLS)	Assignment Group
1	Motorcycle	0.30	1.43	1.30	1
2	Tuk Tuk (3 Wheelers)	0.75	1.83	2.10	2
3	Motorumok	1.25	1.67	1.80	2
4	Passenger Car	1.00	1.69	2.30	3
5	Taxi	1.00	1.65	2.00	3
6	Minibus (8-15 seats)	2.00	5.52	4.40	4
7	City Bus	3.00	12.13	-	4
8	Medium & Large Bus (16+ seats)	3.00	8.85	12.00	4
9	Light Truck (<4 Tons) & Pick Up (For Goods Only)	2.00	1.72	2.40	5
10	Medium Truck (>4 tons)	2.50	1.90	2.20	5, 6
11	Heavy Truck and Trailer (Rigid 3 axles or more)	3.00	1.61	1.50	5, 6

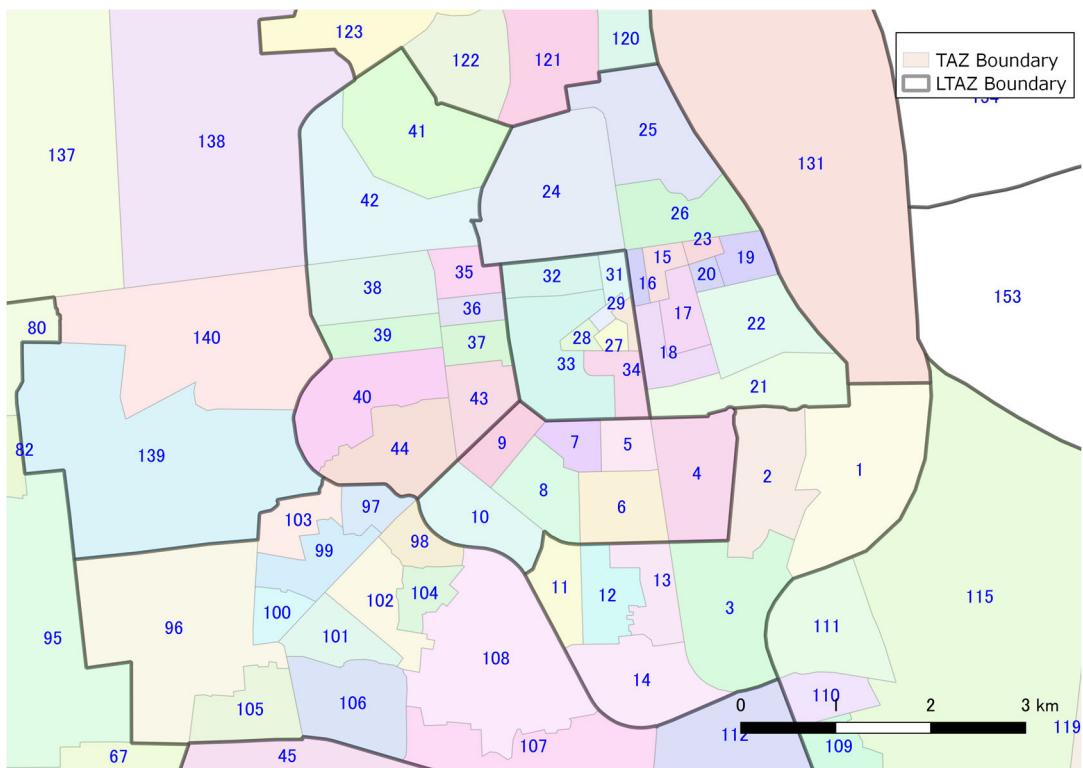
Note: Average Occupancy includes drivers.

Source: JST

6.1.3 Zone System and Target Area

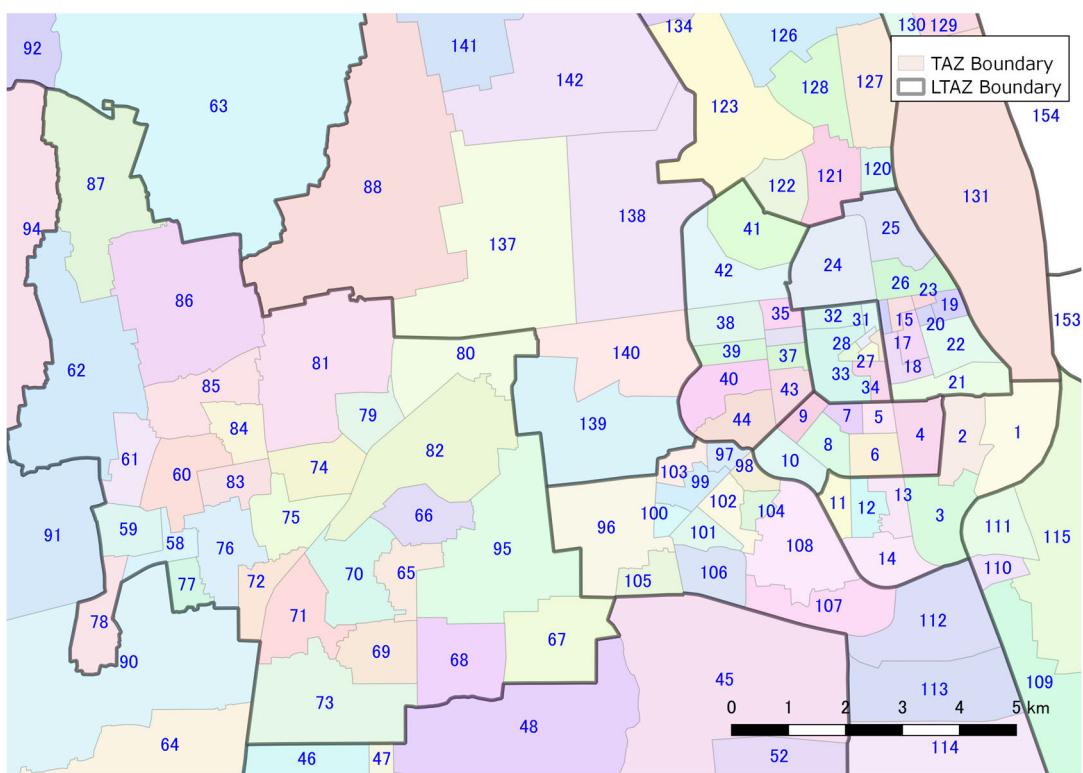
In this study, 163 TAZs (Traffic Analysis Zones) are defined as shown in the figure below. In Phnom Penh, TAZ boundaries are basically defined based on the commune boundaries. For the areas which require a more detailed analysis, a TAZ is divided into multiple TAZs using village boundaries. The area inside Phnom Penh is divided into 145 TAZs. In addition, 14 LTAZ (Large TAZ) were set based on district boundaries in order to analyse medium- and long-distance traffic behaviours.

The TAZs outside Phnom Penh are set using the province boundaries, grouping several provinces into a TAZ by direction. Only Kandal Province, which surrounds Phnom Penh, is divided into several TAZs based on the district boundaries. The LTAZ boundaries outside Phnom Penh are the same as TAZ boundaries.



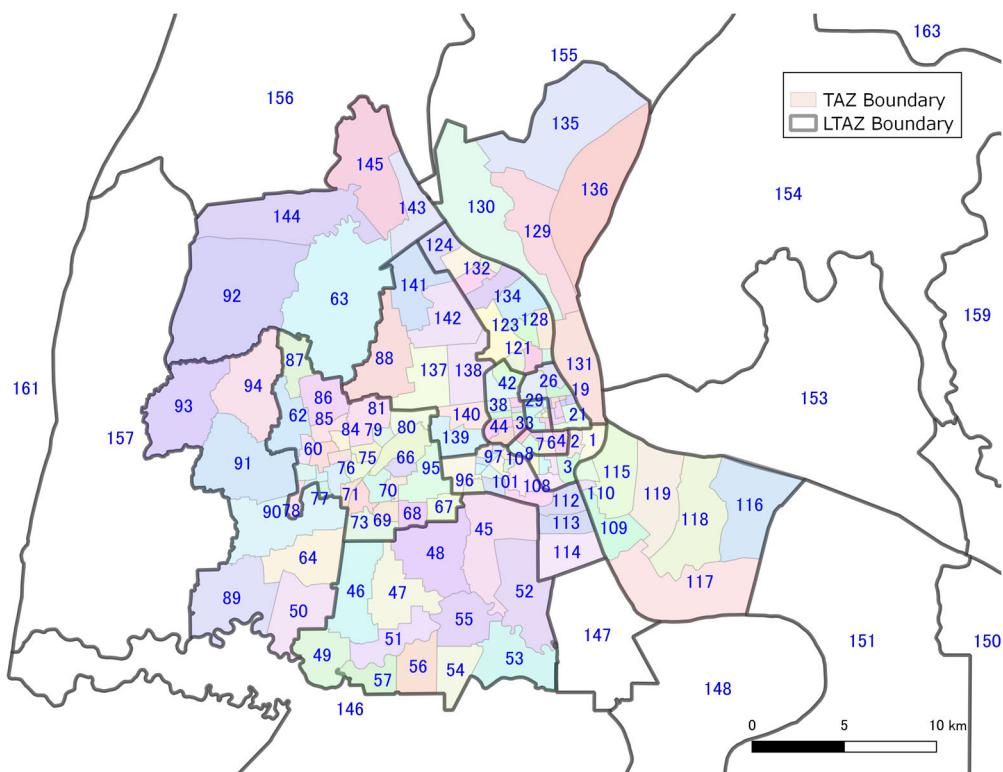
Source: JST

Figure 6.1.2 TAZ Boundary inside CBD



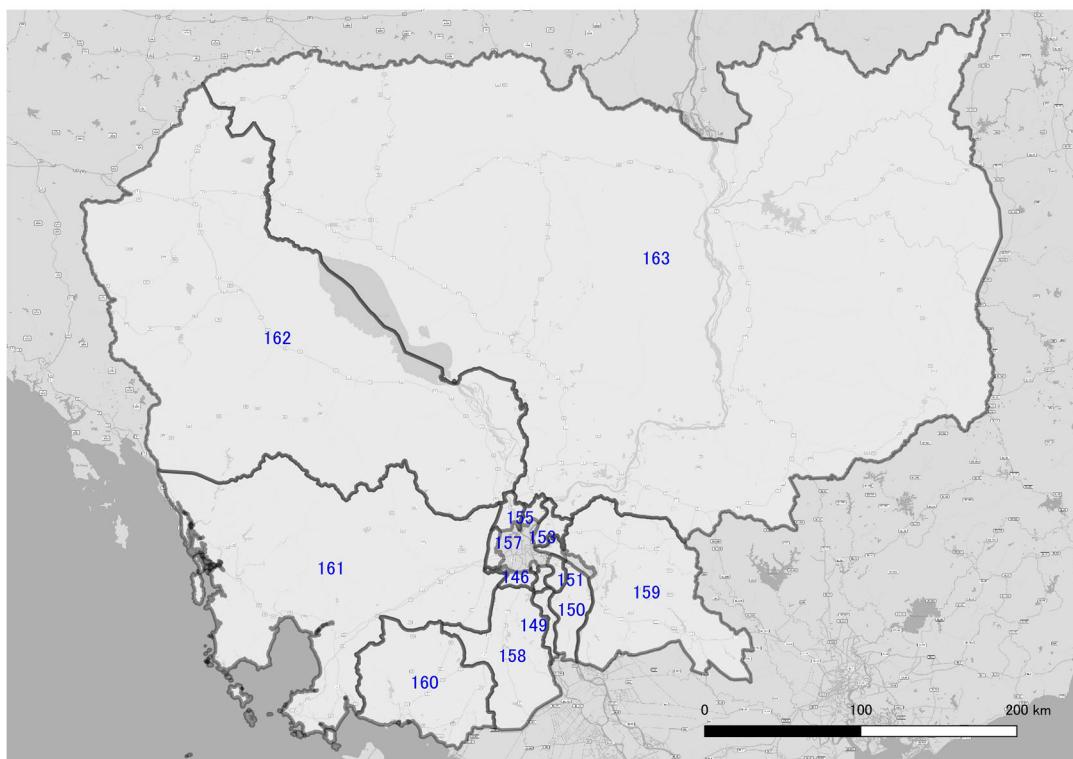
Source: JST

Figure 6.1.3 TAZ Boundary inside CBD and Suburbs



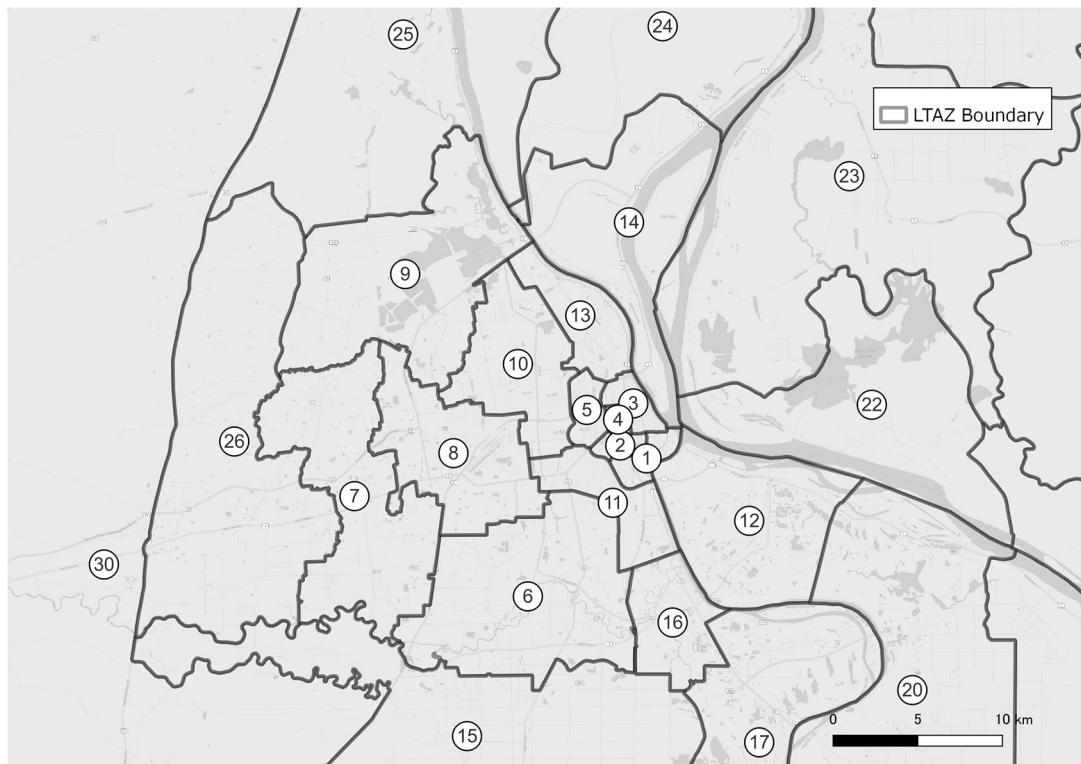
Source: JST

Figure 6.1.4 TAZ Boundary inside Phnom Penh



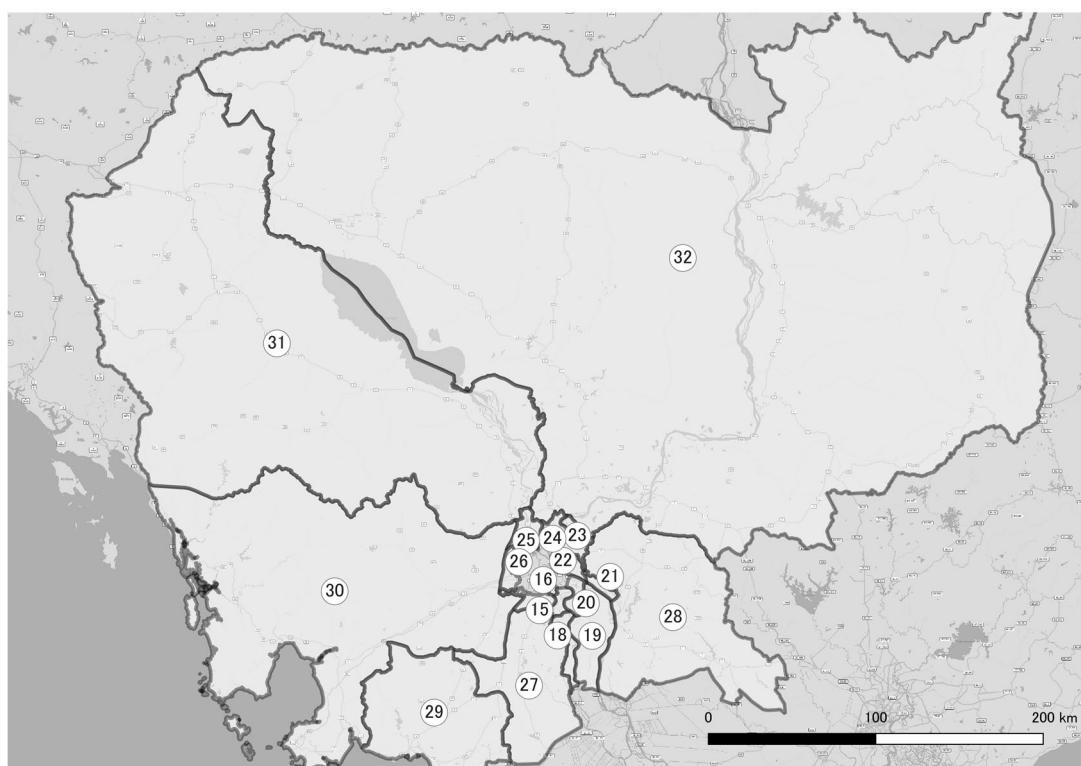
Source: JST

Figure 6.1.5 TAZ Boundary in Whole Cambodia



Source: JST

Figure 6.1.6 Large TAZ (LTAZ) Boundary inside Phnom Penh

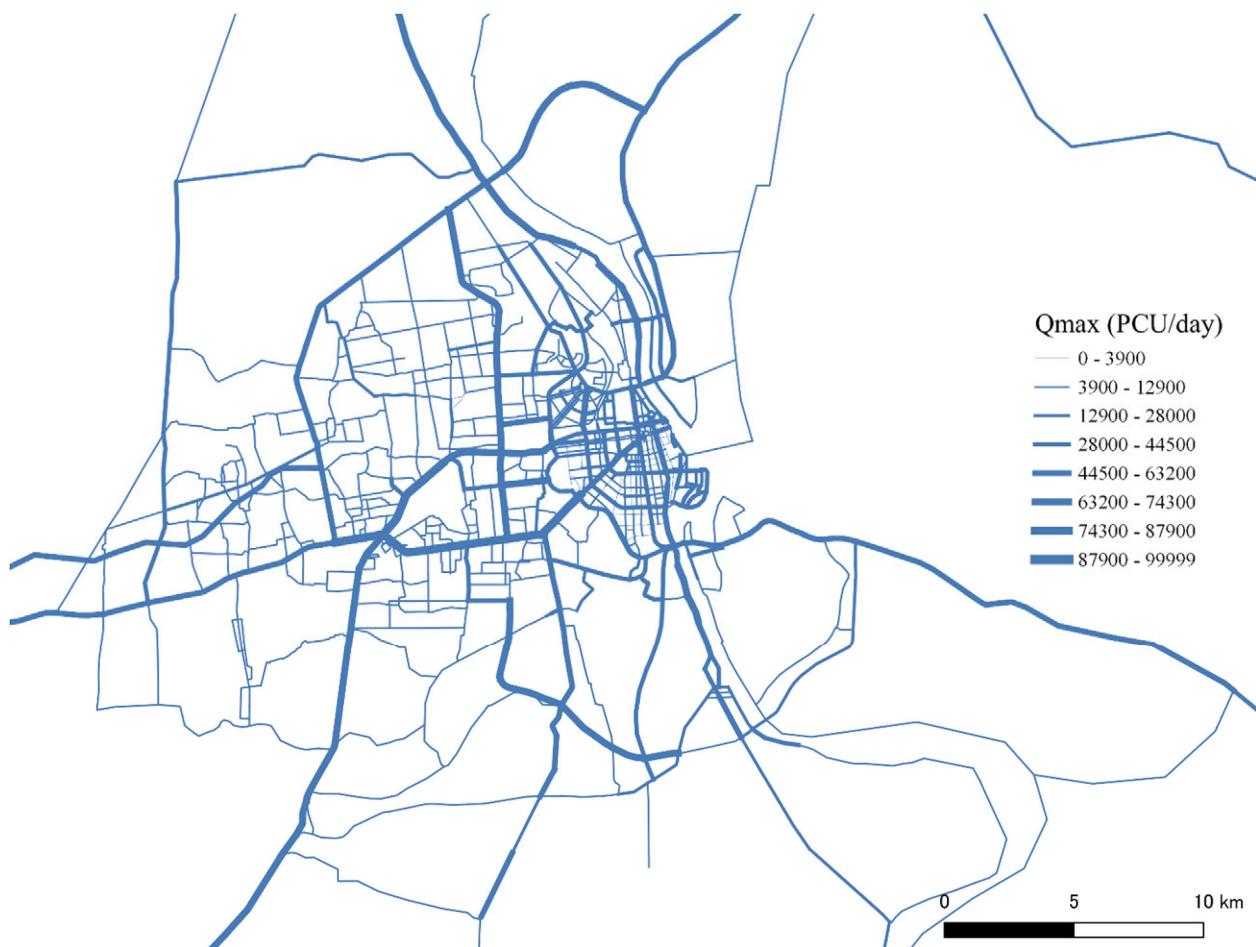


Source: JST

Figure 6.1.7 Large TAZ (LTAZ) Boundary in Whole Cambodia

6.1.4 Road and Public Transport Network

The road network was developed based on the Geographic Information System (GIS) data developed in PPUTMP and road links were added/updated in those cases where it was confirmed with a satellite image that an arterial road was newly constructed or improved. Major changes are road widening of Veng Sreng Blvd., Hanoi Blvd., Russian Blvd., the southern part of RR-II, NR-1, NR-3 and NR-5 and the opening of Hun Sen Blvd. The daily traffic capacity and free flow speed for each road classification are set as the same as PPUTMP (See Table 6.1.2).



Source: JST

Figure 6.1.8 Current Road Network and Capacity

Table 6.1.2 Capacity and Speed by Road Classification

Classification of Road	No. of Lanes	Operation	PPCC						Suburban Area					
			Unpaved		Low Capacity		Standard		Unpaved		Low Capacity		Standard	
			Speed (km/h)	Capacity (pcu/day)	Speed (km/h)	Capacity (pcu/day)	Speed (km/h)	Capacity (pcu/day)	Speed (km/h)	Capacity (pcu/day)	Speed (km/h)	Capacity (pcu/day)	Speed (km/h)	Capacity (pcu/day)
Expressway	2	Two-way					100	30,200						
	4	Two-way					100	60,400						
	6	Two-way					100	90,600						
Arterial Road	2	Two-way			45	8,500	50	10,900			55	12,900	60	15,200
	2	One-way			45	16,400	50	21,000			55	24,700	60	29,300
	3	Two-way			45	24,600	50	31,600			55	37,100	60	43,900
	4	Two-way			45	32,900	50	42,100			55	49,500	60	58,600
	5	Two-way			45	41,100	50	52,600			55	61,900	60	73,200
	6	Two-way			45	49,300	50	63,200			55	74,300	60	87,900
	7	Two-way			45	57,600	50	73,700			55	86,700	60	102,500
Semi-Arterial Road	2	Two-way			35	5,200	40	7,500	10	4,350	45	8,700	50	11,600
	2	One-way			35	10,100	40	14,500	10	8,400	45	16,800	50	22,200
	3	Two-way			35	15,200	40	21,800			45	25,200	50	33,400
	4	Two-way			35	20,200	40	29,100			45	33,600	50	44,500
	5	Two-way			35	25,300	40	36,300					50	55,600
	6	Two-way					40	43,600					50	66,800
Collector Road	1	One-way	10	100	25	200	30	800	10	100	35	200	40	800
	2	Two-way	10	1,950	25	3,900	30	5,300	10	3,850	35	7,200	40	9,000
	2	One-way			25	7,600	30	10,200			35	14,000	40	17,400
	3	Two-way			25	11,400	30	15,300			35	21,000	40	26,100
	4	Two-way			25	15,200	30	20,500			35	28,000	40	34,900
	5	Two-way			25	19,000	30	25,600			35	35,000	40	43,600
	6	Two-way			25	22,800	30	30,700			35	42,000	40	52,300

Note: Unit for road capacity is PCU/day (both directions), PPCC (Phnom Penh Capital City)

Source: JST

6.2 Assumptions for Transport Demand Forecasting

6.2.1 Future Road Network and Public Transport Network

Two scenarios “Do thing” case and “With” project case were set for future road and public transport network. Table 6.2.1 summarises the development status of road network in each scenario. Road projects that were already completed are included in any scenarios. Projects proposed in PPUTMP that are not completed and expressway projects are included in “With” case and not included in “Do Nothing” case. Further detail information is described in Chapter 3.

Table 6.2.2 summarises the development status of the public transport network in each scenario. As of 2022, only four lines of City Bus are in operation due to the COVID-19 pandemic. However, it was assumed that all 13 lines of City Bus will be in operation even in “Do Nothing” case in 2035. In addition to these 13 lines, the introduction of bus priority lanes on Line 1 to 4 including an exclusive bus lane on major sections of Line 1, 3 and 4 and the urban railway along Veng Sreng Blvd. are assumed in “With” case.

Table 6.2.1 Future Road Network Scenario

	2022	2035 Do Nothing	2035 With
Projects proposed in PPUTMP (Completed)*1	○	○	○
Projects proposed in PPUTMP (Not Completed)*2			○
New Airport Access			○
2nd Ring Road (East Section)			○
Phnom Penh-Sihanoukville Expressway	○	○	○
Phnom Penh-Kandal Expressway			○
Phnom Penh-Bavet Expressway			○

Completed *1: 【Completed】 projects and the completed section of 【Partially complete】 projects in Figure 7.1.2.

Not Completed *2: 【Incomplete】 and 【Constructing】 projects and the incomplete section of 【Partially complete】 projects in Figure 7.1.2.

Source: JST

Table 6.2.2 Future Public Transport Network Scenario

	2022	2035 Do Nothing	2035 With
Current City Bus Routes (Line 1 to 4)	○		
All City Bus Routes (Line 1 to 13)		○	○
Bus Priority Lane (Line 1 to 4)			○
Urban Railway (Veng Sreng Blvd.)			○

Source: JST

Table 6.2.3 describes the operation headway of public transport in current and future scenario. The headway in 2022 was set referring to the actual operation in November 2021 with the impact of the COVID-19 pandemic. The headway in “Do Nothing” scenario in 2035 was set as a bus map of these 13 routes in 2020. The headway of bus lines was set higher especially where a bus priority lane is planned to be introduced.

Table 6.2.3 Future Public Transport Operation Headway Scenario

Mode	Line	Headway (min)		
		2022	2035 Do Nothing	2035 With
Bus	1A	20	15	7
Bus	1B	-	30	15
Bus	2	30	15	10
Bus	3	20	15	7
Bus	4A	40	30	15
Bus	4B	20	15	15
Bus	4C	-	30	15
Bus	5A	-	30	15
Bus	5B		20	10
Bus	6	-	20	10
Bus	7	-	30	15
Bus	8	-	30	15
Bus	9	-	20	10
Bus	10	-	30	15
Bus	11	-	30	15
Bus	12	-	30	15
Bus	13	-	30	15
Urban Rail	-	-	-	7

Source: JST

6.2.2 Trips from/to External Zones

(1) Future Trips by Non Phnom Penh Residents

OD matrix of trips by non Phnom Penh residents in the future was estimated based on the result of Cordon Line Survey. The following equation that was developed in the Preparatory Survey for Phnom Penh Urban Railway Development Project was employed for the trip estimation process. The base population, which covers regular or normal households, was obtained from the General Population Census (GPC) in 2019. The population of each TAZ was estimated with the method mentioned in Table 6.2.4.

$$FOD_{ij}^{External} = EOD_{ij}^{External} \times R_i \times R_j$$

$FOD_{ij}^{External}$: Number of trips by non residents between zone i and zone j in the future

$EOD_{ij}^{External}$: Number of trips by non residents between zone i and zone j at present

R_i : Growth rate of population in zone i

R_j : Growth rate of population in zone j

Table 6.2.4 Estimation of TAZ Population

Items	Method
Future Population of Phnom Penh	As mentioned in Chapter 2
Future Provincial Population outside Phnom Penh	<p>Population in 2020 The base population was obtained from the GPC in 2019. The CAGR from 2012 to 2020 of provincial population was computed with the population forecast in 2008 GPC and applied to the population in 2019.</p> <p>Population in 2021 to 2035 In order to forecast population in 2021 to 2035, the forecasted population in 2020 was expanded with the CAGR from 2020 to 2030 of provincial population forecasted in the 2008 GPC.</p>
Population of Districts in Kandal Province	While TAZ in Kandal Province is district basis, the present district boundary does not correspond to TAZ boundaries. Thus, the population of each TAZ was estimated by distributing each district's population proportionally depending on the area in a TAZ that a district accounts for.
Population of Neighbouring Countries	Used population estimates released by World Bank.

Source: JST

Table 6.2.5 describes the population projected in GPC in 2008 and the CAGR of each province. The CAGR was used for future population forecast to expand the population in 2019.

Table 6.2.5 Forecasted Provincial Population by GPC in 2008 and CAGR

	Province	Projected Population in 2008 Population Census			CAGR	
		Y2012	Y2020	Y2030	Y2012 to Y2020	Y2020 to Y2030
1	Banteay Meanchey	760,770	883,494	1,017,936	1.89%	1.43%
2	Battambang	1,148,444	1,327,559	1,519,185	1.83%	1.36%
3	Kampong Cham	1,745,184	1,726,096	1,648,438	-0.14%	-0.46%
4	Kampong Chhnang	520,398	577,366	628,577	1.31%	0.85%

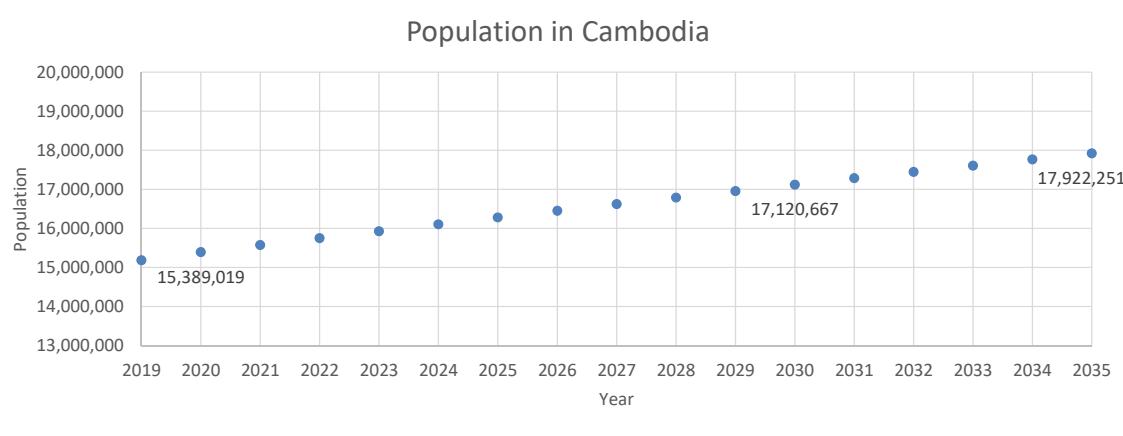
	Province	Projected Population in 2008 Population Census			CAGR	
		Y2012	Y2020	Y2030	Y2012 to Y2020	Y2020 to Y2030
5	Kampong Speu	775,704	831,537	882,184	0.87%	0.59%
6	Kampong Thom	673,247	701,861	724,456	0.52%	0.32%
7	Kampot	615,944	648,799	716,987	0.65%	1.00%
8	Kandal	1,383,298	1,544,180	1,716,290	1.38%	1.06%
9	Koh Kong	137,033	171,920	218,811	2.88%	2.44%
10	Kratie	357,249	408,639	465,960	1.69%	1.32%
11	Mondul Kiri	73,080	94,648	126,725	3.29%	2.96%
12	Phnom Penh	1,637,473	2,126,617	2,450,717	3.32%	1.43%
13	Preah Vihear	188,297	211,488	243,681	1.46%	1.43%
14	Prey Veng	980,811	1,000,313	1,089,316	0.25%	0.86%
15	Pursat	430,837	479,585	553,067	1.35%	1.44%
16	Ratanak Kiri	169,609	196,570	233,141	1.86%	1.72%
17	Siemreap	1,023,990	1,213,200	1,414,727	2.14%	1.55%
18	Preah Sihanouk	253,654	305,149	360,684	2.34%	1.69%
19	Stung Treng	125,166	148,356	187,442	2.15%	2.37%
20	Svay Rieng	500,745	514,333	559,726	0.34%	0.85%
21	Takeo	879,328	909,643	997,025	0.42%	0.92%
22	Otdar Meancheay	227,353	294,030	365,010	3.27%	2.19%
23	Kep	41,420	56,839	88,797	4.04%	4.56%
24	Pailin	92,379	132,932	181,801	4.65%	3.18%
25	Tboung Khmum	N/A	N/A	N/A	-0.14%	-0.46%
Total		14,741,413	16,505,154	18,390,683	1.42%	1.36%

CAGR: Compound Annual Growth Rate

Note: Population includes all population as well as regular or normal household population.

Note: There is no data for Tboung Khmum Province as it was established being separated from Kampong Cham Province in 2013. The CAGR of Kampong Cham Province was used for Tboung Khmum Province alternatively.

Note: Estimated by JST based on GPC 2008



Source: JST

Figure 6.2.1 Forecasted Population of Cambodia

In order to estimate the population in Kandal Province at TAZ level, the area proportion shown in Table 6.2.6 was applied for distributing each district's population proportionally to each TAZ. Also, the population forecast of the surrounding countries is shown in Table 6.2.7.

Table 6.2.6 District Area Proportion by TAZ in Kandal Province

District	TAZ 2022	Area Proportion
Kandal Stueng	146	100%
Kien Svay	150	60%
	151	40%
Khsach Kandal	154	100%
Kaoh Thum	149	36%
	150	64%
Leuk Daek	150	100%
Lvea Aem	152	48%
	153	52%
Mukh Kampul	155	100%
Angk Snuol	157	100%
Popnhea Lueu	156	100%
S'ang	148	26%
	149	29%
	150	29%
	151	16%
Krong Ta Khmau	147	100%

Source: JST

Table 6.2.7 Population Forecast of Surrounding Countries

Country	Y2019	Y2022	Y2025	Y2030	Y2035
Vietnam	96,462,108	98,954,000	101,107,000	104,164,000	106,296,000
Lao PDR	7,169,456	7,481,000	7,775,000	8,226,000	8,626,000
Thailand	69,625,581	70,078,000	70,329,000	70,346,000	69,899,000

Source: Population Estimates and Projections, World Bank (Last updated on 7th January, 2022)

(2) Future Trips of Airport Passengers

Future trips from/to external zones include trips by Phnom Penh International Airport (PPIA) passengers. The methodology of estimating future trips by PPIA passengers are elaborated below.

As mentioned in the report of the Preparatory Survey for Phnom Penh Urban Railway Development Project (2020), the total number of Phnom Penh International Airport passengers is strongly corrected with the national economic growth. In this preparatory survey, the following equation was developed based on the total number of annual airport passengers and the GDP of Cambodia at constant 2000 prices for 10 years of 2006 to 2015. The number of annual passengers can be estimated with the equation and the transition of GDP. 12.46 million annual passengers is estimated in 2035 given that the steady growth continues.

$$T_{air} = -850759 + 351.91 \times GDP$$

T_{air}: Trip of Annual Airport Passengers in Phnom Penh International Airport

GDP: GDP in million USD at constant 2000 price

However, in fact, the number of annual passengers dropped drastically in 2020 at 39.3% of that in 2016 due to the COVID-19 pandemic. As of 2022, it is predicted that the stagnation will continue for a certain period.

Thus, it was assumed in the Survey that this low air traffic trend would continue until 2025 and fully recover to its pre-pandemic level in 2025, which is estimated with the equation above. Table 6.2.8 summarises the estimation method for the number of annual passengers at PPIA.

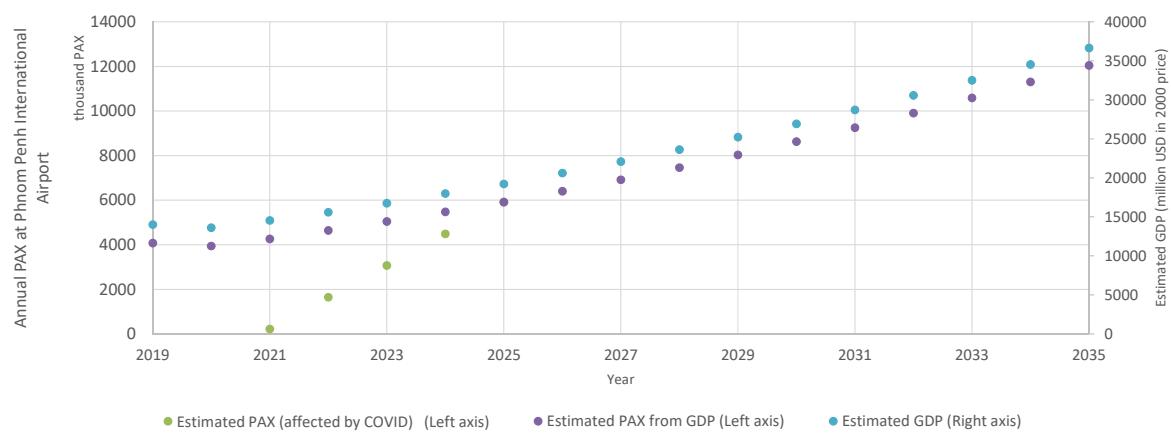
Table 6.2.8 Estimation Method for Number of Annual Passengers at PPIA

Duration	Impact of COVID-19	How to Estimate Number of Annual Passengers
Y2022 to Y2025	With	Y2020: Actual statistics Y2021: Actual statistics except for not published December record Y2025: Estimated with the equation above Y2022 to Y2024: Linear interpolation between 2021 and 2025
After Y2025	Without	Estimated with the equation above

Note: The number of monthly passengers in December 2021 was estimated with the monthly passengers in December 2020 and the ratio of number of monthly passengers in November 2021 to that in November 2020.

Source: JST

Figure 6.2.2 illustrates the forecast of Cambodia's GDP at constant 2000 price, the forecast of the number of the annual passengers at PPIA with the equation above, and the forecast of the number of annual passengers in 2021 to 2025 that is largely affected by the COVID-19 pandemic.



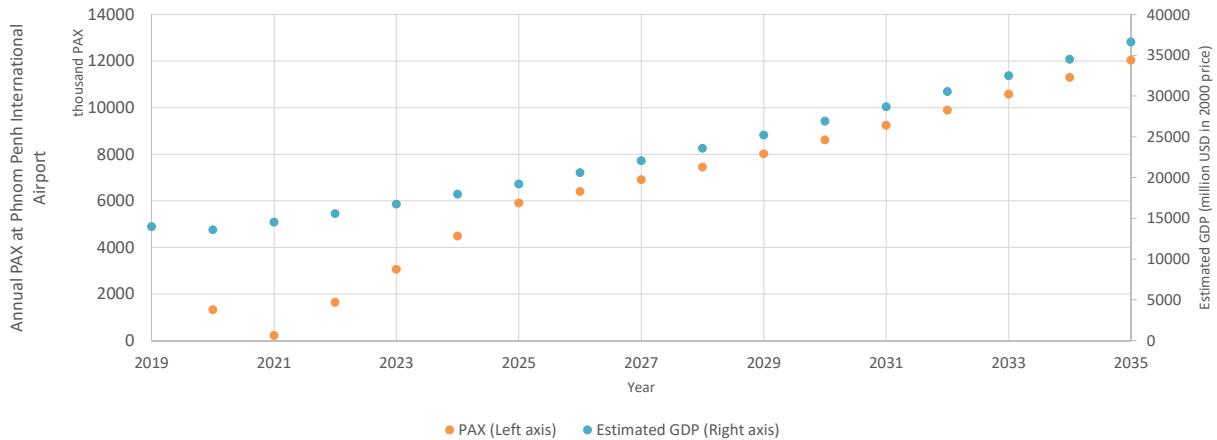
Source (Number of Passengers): Cambodia Airports, Airport Traffic Statistics, November 2022

Source (GDP): NIS and International Monetary Fund, World Economic Outlook Database, October 2020

Source: JST

Figure 6.2.2 Transition of Cambodia's Estimated GDP and Estimated Number of Annual Passengers at PPIA

Figure 6.2.3 describes the number of annual passengers adopted for the estimation of airport passenger trips considering the influence of the COVID-19 pandemic. The number of passengers in Figure 6.2.3 was adopted for estimating future trips by airport passengers.



Source: JST

Figure 6.2.3 Number of Annual Passengers Adopted for Estimation of Airport Passenger Trips

The growth rate of the annual passengers compared to 2022 in Figure 6.2.3 was applied for the estimation of the number of the annual passengers by expanding the number of air passengers' trips in 2022.

Table 6.2.9 Growth Rate of Number of Annual Passengers

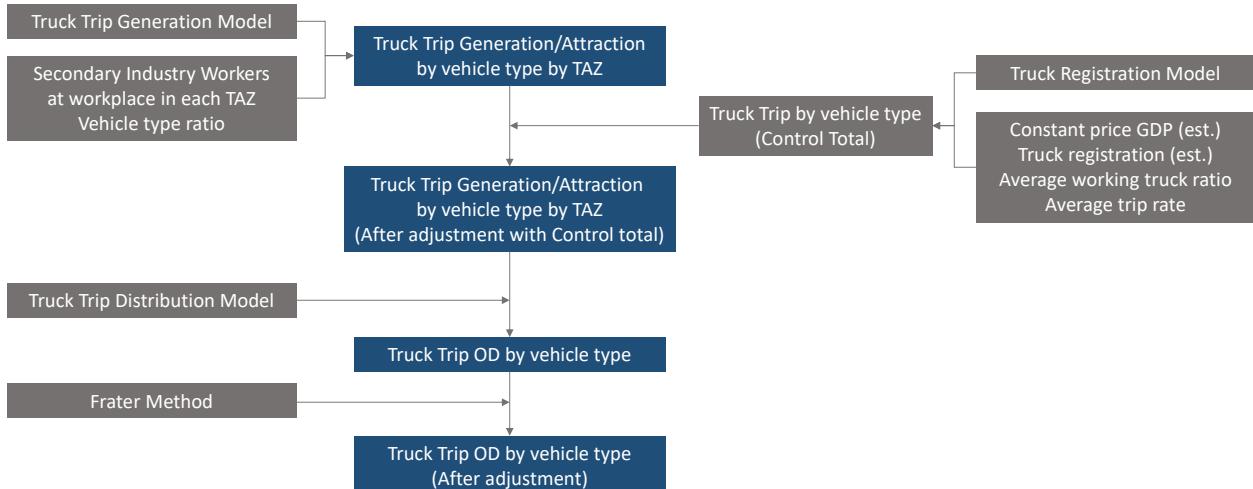
Estimation Year	Growth Rate of Number of Annual Passengers since 2022
Y2025	359%
Y2030	524%
Y2035	732%

Source: JST

(3) Trips by Cargo Truck

1) Flow of Tuck Trip Estimation

The cargo truck OD was estimated based on the flow shown in Figure 6.2.4 using the truck trip generation model and the truck registration model that were developed in PPUTMP.



Source: JST

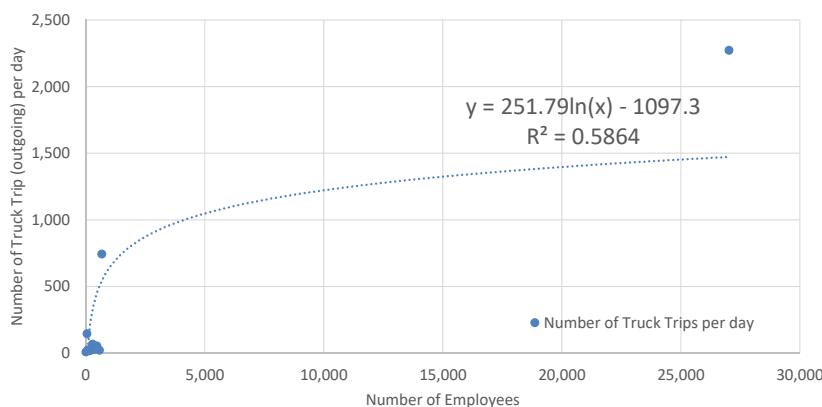
Figure 6.2.4 Truck Trip OD Estimation Flow

2) Truck Trip Estimation by Truck Trip Generation Model

Based on the truck trip generation model developed in PPUTMP, the truck trip generation model used for the Survey was updated with the number of employees and the number of daily truck trips obtained from the Truck Interview Survey in 2022 (see Figure 6.2.5). Truck trip generation by TAZ can be estimated with the model and the number of secondary industry workers at workplace in each TAZ.

In order to estimate the truck trip generation in each TAZ, the total number of workers at workplace in the future was estimated by expanding the total number of workers at workplace in each TAZ in 2022 with the population growth rate. In addition, the number of secondary industry workers at workplace in each TAZ was estimated by multiplying the share of secondary industry workers at workplace in each TAZ by the total number of workers at workplace in each TAZ.

The truck trip generation by TAZ estimated with the generation model was multiplied by the share of truck trip generation observed in PPUTMP for estimating truck trip generation by vehicle type. The share of truck trip generation is described in Table 6.2.10.



Source: JST

Figure 6.2.5 Truck Trip Generation Model

Table 6.2.10 Share of Truck Trip Generation

	Total Trips	Share
Light Truck	25	10.1%
Truck (Medium)	125	50.6%
Heavy Truck & Trailer	97	39.3%

Source: PPUTMP

3) Truck Trip Estimation by Truck Registration Model (Total Control)

The total number of truck trips by vehicle type should be adjusted with the number of truck registrations. The truck registration model, which was developed in PPUTMP, was employed to estimate the number of registered trucks at present and in the future as there is no available statistics data. The total number of truck trips by vehicle type, which is supposed to be used as the control total, was estimated by multiplying the estimated number of registered trucks by vehicle type by the average working ratio and the average trip rate.

$$RT = \alpha + \beta \cdot GDP$$

RT: Number of registered trucks in Phnom Penh

GDP: Gross Domestic Product (GDP) in constant prices 2000 of Cambodia

Table 6.2.11 Parameters for Truck Registration Model

	α	β	Adjusted R ²
Light Truck	-5,377.323	3.672	0.959
Truck (Medium)	460.654	1.714	0.910
Heavy Truck & Trailer	-212.38	0.118	0.863

Source: PPUTMP

Table 6.2.12 Average Truck Working Ratio and Average Trip Rate

	Estimated Number of Registered Trucks in 2012 in Phnom Penh	Ave. Working Truck Ratio	Ave. Trip Rate	Estimated Number of Trips
Light Truck	27,642	100%	2.13	67,300
Truck (Medium)	15,871	95%	2.05	30,800
Heavy Truck & Trailer	852	80%	1.19	800
Total	44,365	-	-	98,900

Source: PPUTMP

4) Adjustment with Control Total

The total numbers of truck trips by vehicle type estimated with the generation model need to be adjusted with the total numbers of trips estimated by the truck registration model as a control total. The adjustment was done in case that the total number of trips of a certain vehicle truck estimated with the generation model exceeds the number estimated with the truck generation model. In such cases, the excess trips are distributed equally to other vehicle types that do not exceed the control total. Table 6.2.13 summarises the estimated truck trips with the generation model and the truck trips after the adjustment with the control total. The truck trip generation was estimated by vehicle type and by TAZ using the truck trips after the adjustment. It was also assumed that the truck trip attraction is equivalent to the generation.

Table 6.2.13 Estimated Truck Trip and Adjustment with Control Total

	Y2022	Y2025	Y2030	Y2035
(1) Estimated Number of Trips with Truck Trip Generation Model				
Light truck	8,057	8,233	8,407	8,444
Truck (medium)	40,283	41,164	42,037	42,220
Heavy Truck	31,260	31,944	32,621	32,763
(2) Estimated Number of Trips with Truck Registration Model (Control Total)				
Light truck	126,145	158,468	227,188	313,879
Truck (medium)	52,975	65,067	90,775	123,205
Heavy Truck	1,550	1,957	2,823	3,914
(3) Adjustment Volume				
Light truck	14,855	14,993	14,899	14,424
Truck (medium)	14,855	14,993	14,899	14,424
Heavy Truck	-29,709	-29,986	-29,798	-28,849

	Y2022	Y2025	Y2030	Y2035
(4) Estimated Number of Trips after Adjustment				
Light truck	22,911	23,226	23,307	22,868
Truck (medium)	55,138	56,158	56,937	56,645
Heavy Truck	1,550	1,957	2,823	3,914
Total	79,600	81,341	83,066	83,427

Note: The excess trips of Heavy truck are distributed to other vehicle types equally.

Source: JST

5) Truck Trip Distribution Model

The truck trip distribution model developed in PPUTMP was employed to estimate the truck OD. Lastly, the OD of each vehicle type was adjusted with the frater method in accordance with the generation/attraction of trips by each vehicle type and by TAZ.

$$T_{ij} = e^{\alpha \cdot TP_i^\beta \cdot TA_j^\gamma \cdot D_{ij}^\delta}$$

T_{ij} : Truck Trip from Zone i to Zone j (per day)

TP_i : Trip Production at Zone i

TA_j : Trip Attraction at Zone j

D_{ij} : Interzonal Inpedance (distance in kilometer)

$\alpha, \beta, \gamma, \delta$: Parameters

Table 6.2.14 Parameters for Truck Trip Distribution

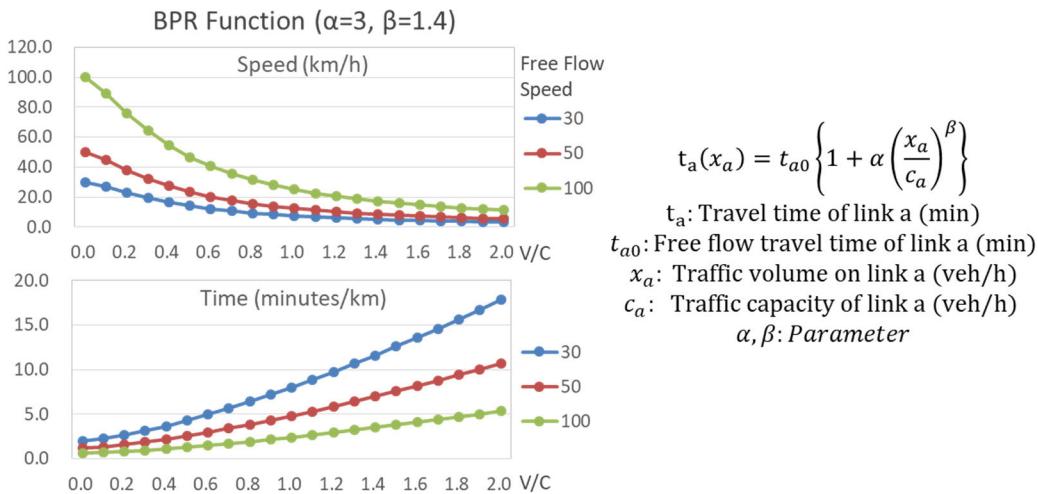
	α	β	γ	δ	Coefficient
Light truck	1.518	0.056	0.123	-0.198	0.249
Truck (medium)	1.200	0.148	0.096	0.000	0.321
Heavy Truck	2.156	0.061	0.038	0.000	0.108

Source: PPUTMP

6.2.3 Parameters for Network Assignment

(1) Link Performance Function

In PPUTMP, the linear QV function is employed for the road link performance function. It was confirmed that the linear link performance function well describes the relationship between traffic and speed where V/C is less than 0.9 while the speed was assumed to be fixed where V/C exceeds 0.9. In current scenario and future scenarios, where V/C of many road links exceed 1.0, the linear link performance function is not suitable to be employed. Thus, the Survey employed BPR function ($\alpha=3$, $\beta=1.4$), which has the similar level of speed reduction rate to the QV function where V/C is less than 0.9 and the speed slows down even where V/C is more than 1.0. The relation between the speed given by BPR function and the V/C are described below.



Source: JST

Figure 6.2.6 Relationship between V/C and Speed/ Travel Time by Link Performance Function

(2) Assumption for Road Network Assignment

Assumptions applied for the road network assignment are as follows.

- Assignment Method: Equilibrium assignment
- Generalized cost in route choice: Only time is considered as there is no toll way in the network
- Link performance function: BPR function ($\alpha=3, \beta=1.4$)
- Traffic restriction: Truck traffic regulation in CBD and One-way traffic (according to current status)

(3) Speed and Cost of Modes

The speed and cost of each mode were set as shown in Table 6.2.15. The speed of modes that use roads was set at the speed after the network assignment except for bus. A factor was applied for the speed of bus considering boarding and alighting time. Fuel fee was assumed for the cost of car and motorbike and parking charge was added to the cost of car further. The cost of RHS was assumed based on the fare system of PassApp. Based on the result of Passenger Interview Survey, the access modes to public transport were assumed to be walk in CBD, where access distance is relatively shorter, kiss&ride by motorbike in suburbs where access distance is longer. Maximum acceptable access time was set 20 minutes based on the survey result.

Table 6.2.15 Assumed Speed and Cost of Modes

Mode	Speed	Cost (Riel)	Cost Remark
Car	Link speed	(4,000x/20 +4,000)/1.69	Fuel + Parking / Occupancy
Motorbike	Link speed	4,000x/40/1.43	Fuel / Occupancy
TukTuk	Link speed	(1,200x +3,000)/1.51	PassApp Cost / Occupancy
Bus	Link speed*0.85	1,500	Flat fare of City Bus
Bus Priority Lane	Link speed*0.95	1,500	Flat fare of City Bus
BRT	17 kmph	1,500	Flat fare of City Bus
Urban Rail	28 kmph	270x + 2,000	Distance based fare
Access Walk (CBD)	4~5 kmph	0	No cost
Access kiss&ride MC (Suburb)	Link speed	4,000x/40*2	Fuel for round trip

Note: x = distance in km, Fuel = 4,000 KHR/l/Fuel consumption

Source: JST

6.2.4 Effect of COVID-19 Pandemic

In the Survey, three approaches were taken to assess the impact of COVID-19 pandemic against passenger traffic: 1) Questions regarding trip frequency before the pandemic and current situation in PT/CS Survey, 2) Traffic volume recovery rate monitoring through CCTV camera video image data, and 3) Trip frequency analysis of before/after the pandemic with Mobile GPS data. The results of these analyses suggest that the impact of the pandemic against passenger traffic was only a few to 10%. The following sub-sections demonstrate the analysis results.

(1) Question of Trip Frequency before the Pandemic and in Current Situation

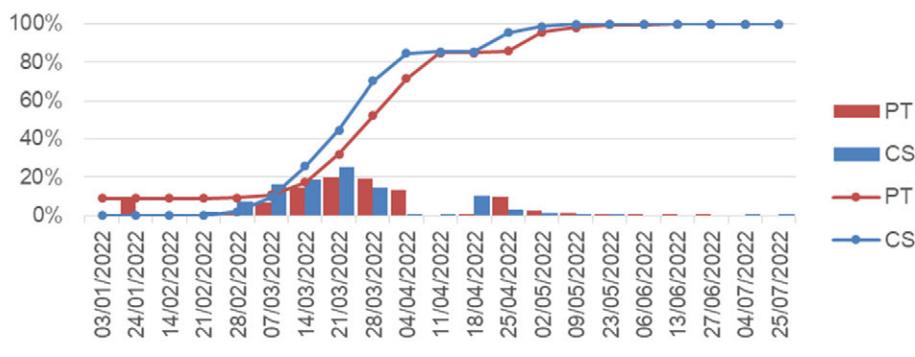
In PT Survey, some questions were added to ask respondents about changes in their frequencies, travel modes and departure/arrival time of their commutes before/after the pandemic. Similarly in CS, additional questions were set to ask respondents about frequency changes in their most frequent trips (commuting, shopping and others) before/after the pandemic (See Appendix 1 for further details).

Table 6.2.16 summarises the respondents' commuting trip frequency before the pandemic and in current situation. The result suggests that the pandemic lowered the students' commuting trip frequency by 3%, while there was no decline observed with workers commuting frequency. As shown in Figure 6.2.7, about 90% of PT/CS samples were collected in March or April 2022 (the survey was suspended during Khmer New Year).

Table 6.2.16 Commuting Trip Frequency Rate before Pandemic / Current Situation in PT/CS

	Current / Before COVID-19	
	CS	PT
Student	0.97	0.97
Worker	1.00	1.00

Source: JST



Source: JST

Figure 6.2.7 Distribution of PT/CS Sample Collection Dates (by weeks, household basis)

(2) Traffic Volume Recovery Rate Monitoring with CCTV Video Image

As mentioned in 5.2.1, the JST continuously monitored the traffic volume in CBD to compare with the traffic volume before the COVID-19 pandemic. Four intersections where the traffic count survey was conducted by ADB Survey Team in 2019 and CCTV cameras are available were selected for monitoring

(See Figure 5.2.2). The traffic in directions indicated with arrows in Figure 5.2.2 was counted by 15 minutes intervals in three different time ranges: 1) Morning peak (7:00-8:00), 2) Off-peak (15:00-16:00) and 3) Evening peak (17:00-18:00) by five vehicle types (Car, MC, Tuk-tuk, Bus, Truck) and they were compared in PCU.

The traffic volume recovery rate in the peak/off-peak time compared to the volume in July 2019 by survey in ADB project was about 70% to 80% in July to October 2021 (See Figure 5.2.3). Since December 2021, the recovery rate transitioned at 85% to 95% except for holiday weeks. The recovery rate during PT Survey was 92% for the off-peak time and 87% for the peak time when computed with weighted average with daily sample size distribution.

(3) Trip Frequency Analysis of before/after Pandemic with Mobile GPS Data

For clarifying the trip frequency change before/after the pandemic, the JST purchased mobile GPS data and analysed it. The detailed analysis result and methodology are elaborated in Appendix 2. Table 6.2.17 summarises the result of Mobile GPS data analysis. The purchased/analysed data was recorded in three different months: 1) January 2020 (before the pandemic), 2) January 2021 (amid the pandemic) 3) March 2022 (when PT/CS Survey was conducted). However, the data in 2022 was incomparable due to the dramatic decline in Monthly Active Users (MAU) and the average number of observation days per month per person. A similar data quality deterioration and record number decline were found with other company's mobile GPS data in 2022 as well.

In comparison between data in 2020 and 2021, the average number of trips per observation day was 3.88 in 2020 and 3.12 in 2021 showing about 20% decline.

Table 6.2.17 Summary of Mobile GPS Data Analysis

	2020 Jan	2021 Jan	2022 Mar
Average No. of trips per observation day	3.88	3.12	1.25
Trip Rate Ratio Before and After Covid-19		0.81	0.32
Average No. of observation days per month	9.98	9.12	2.45
Monthly Active Users	19,933	13,002	3,290
Total Number of observation day	198,970	118,619	8,055
Total Number of trips	771,858	370,454	10,098

Source: JST

6.3 Results of Transport Demand Forecasting

6.3.1 Population Synthesis

In order to generate household/population data that satisfies the macro socio-economic indicators of each TAZ at the same time, micro population synthesis is conducted by using PopGen. PopGen is software developed by Arizona State University and widely used for micro population synthesis in the United States and other countries. Considering calculation efficiency, the population synthesis is conducted for 10% of the total population assuming that each synthesized household represents 10 households.

Table 6.3.1 shows the household and individual attributes used in the population synthesis. As input data, the forecasted socio-economic indicators (see Chapter 2) and the current micro-household/population data from PT/CS survey are used.

Table 6.3.1 Household and Personal Attributes used in Population Synthesis

Type	Attribute	Category
Household	Household Income	1. Under 250 USD 2. 250 - 499 USD 3. 500 - 749 USD 4. 750 - 999 USD 5. 1,000 - 1,499 USD 6. 1,500 - 1,999 USD 7. Over 2,000 USD
Person	Social Status	Worker, Female Worker, Male Student, Female Student, Male Others, Female Others, Male

Source: JST

6.3.2 Vehicle Ownership

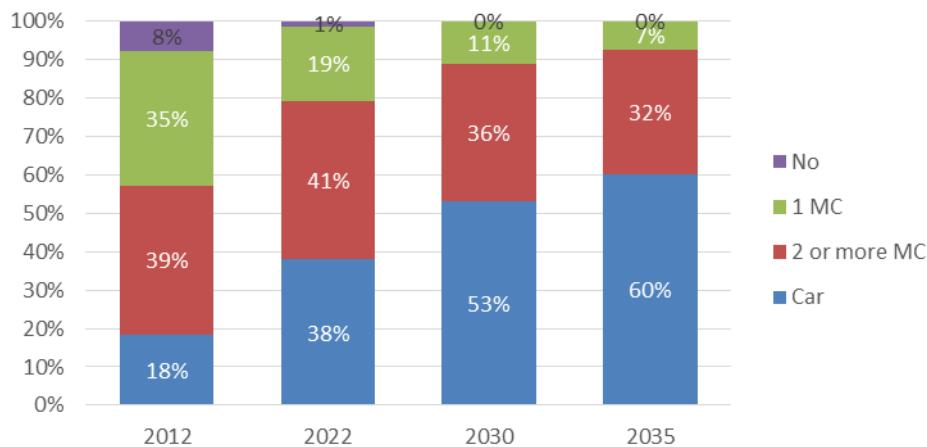
Table 6.3.2 and Table 6.3.2 show the estimated number of households with vehicle ownership and their proportions in the future. These figures were estimated by applying the vehicle ownership model to the future population data. It is projected that the vehicle ownership rate will increase to 53% in 2030 and 60% in 2035 from the current rate of 38% as household income increases. This is faster pace than projected in PPUTMP.

In general, the increase of middle to high class income households and their vehicle ownership rate were observed (See Figure 5.3.3).

Table 6.3.2 Estimates of Vehicle Ownership

HHVO	Type	1,000 Household			1,000 Population		
		2022	2030	2035	2022	2030	2035
1	1 MC	108.51	71.89	51.43	399.80	244.58	168.60
2	2+ MC	225.66	235.04	225.36	857.12	855.81	797.52
3	Car	211.06	346.00	417.97	830.86	1,317.93	1,536.02
	Total	545.23	652.93	694.76	2,087.78	2,418.32	2,502.14

Source: JST



Note: Figures in 2012 and 2022 are based on expansion of survey sample while those in 2030 and 2035 are estimates

Source: JST

Figure 6.3.1 Change in Vehicle Ownership in the Future

6.3.3 Trip Generation in Internal Zones

Table 6.3.3 shows the estimated trip generation by vehicle ownership type and trip purpose in the target area. The trips were estimated by applying the trip frequency model to the population data by vehicle ownership type. It was estimated that the total number of trips increased 22% to 6.85 million trips in 2035 from 5.6 million trips in 2022. The estimated total number of trips in 2035 is comparable to the one estimated in PPUTMP.

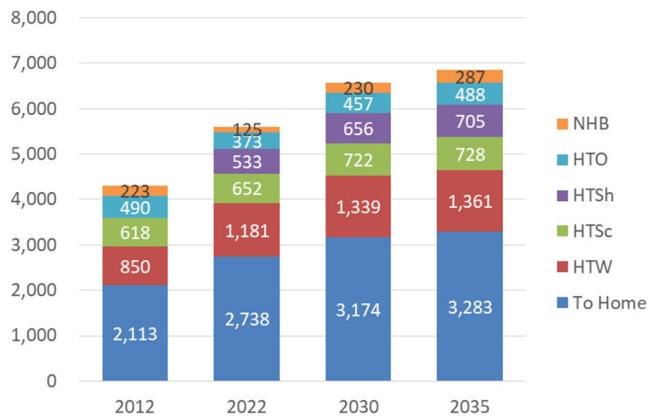
Table 6.3.3 Estimates of Trip Generation by Residents

	HHVO	To Home	HTW	HTSc	HTSh	HTO	NHB	Total
2022	1	523.2	217.0	132.3	102.2	71.6	17.3	1,063.8
	2	1,123.5	481.5	269.6	218.8	153.6	46.6	2,293.6
	3	1,091.7	482.3	249.7	211.6	148.0	61.0	2,244.3
	Total	2,738.4	1,180.8	651.6	532.7	373.2	125.0	5,601.8
	HHVO	To Home	HTW	HTSc	HTSh	HTO	NHB	Total
2035	1	219.1	83.6	48.1	52.3	35.0	10.1	448.2
	2	1,043.6	431.6	224.6	229.8	157.7	76.6	2,163.8
	3	2,020.1	846.0	455.7	422.8	295.7	200.4	4,240.6
	Total	3,282.8	1,361.2	728.4	704.9	488.4	287.0	6,852.6

HTW: Home to Work, HTSc: Home to School, HTSh: Home to Shopping, HTO: Home to Others, NHB: Non-Home based

Unit: 1,000 trips per day

Source: JST



Note: Figures of 2012 was estimated with other models after PT survey samples were expanded.

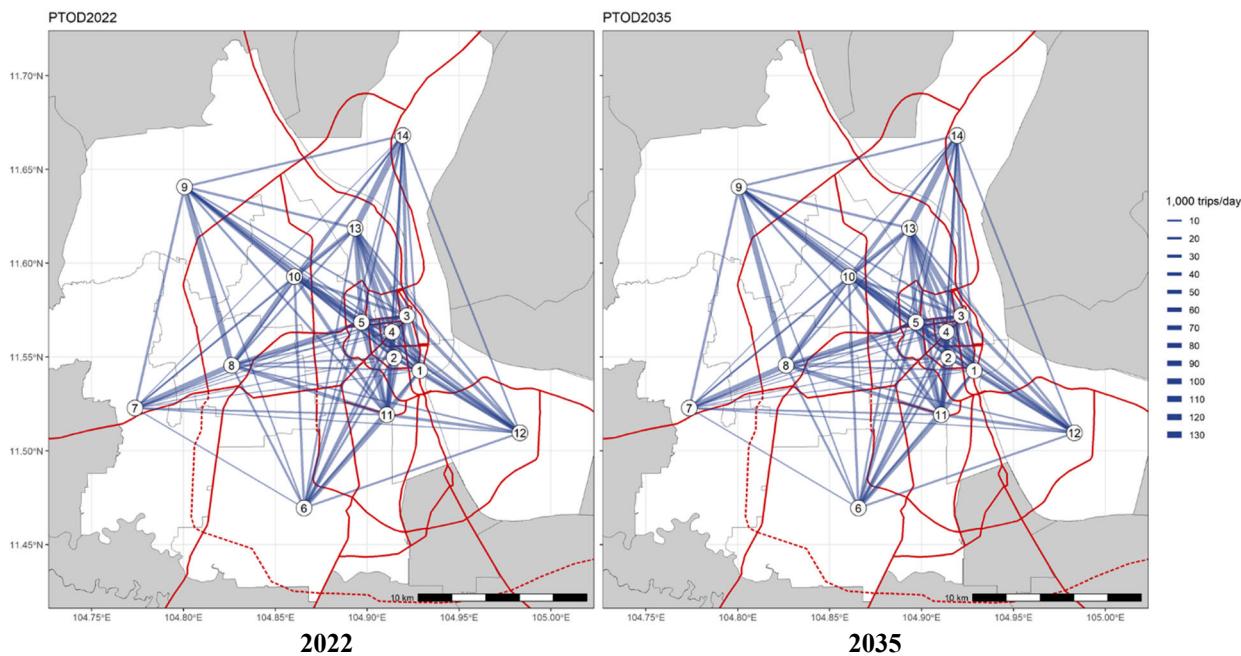
Unit: 1,000 trips per day

Source: JST

Figure 6.3.2 Trip Generation by Trip Purpose

6.3.4 Trip Distribution in Internal Zones

Figure 6.3.3 describes the desire lines of person trip OD at LTAZ level. While the trips from suburbs to the city centre were dominant in 2012, trips between LTAZs in suburbs increased in 2022. The total number trip increase rate is 22% in the 13 years from 2022 to 2035, which is not long enough to show a significant change as shown in the graphs below. The person trip OD was estimated by applying the destination choice model to the trip generation by vehicle ownership type and trip purpose.



Unit: 1,000 trips per day

Source: JST

Figure 6.3.3 Trip Distribution (LTAZ level)

6.3.5 Modal Share in Internal Zones

Table 6.3.4 shows the estimated modal share in internal zones. These figures were estimated by applying the modal choice model to the trip distribution by vehicle ownership type and trip purpose.

The result shows that the share of car increased to 14.1% in 2022 from 9.9% in 2012 and the share in 2035 will further increase to 21.7% in “Do Nothing” scenario and 20.2% in “With” scenario. Under the current vehicle ownership and modal choice trends, if population growth and economic growth continue, trips by car in 2035 is projected to be 1.489 million in “Do Nothing” scenario and 1.387 million even in “With” scenario. Trips by motorbike and tuk-tuk is projected to increase slightly, however, the shares of these modes will decrease.

The share of public transport is 1.3% in “Do Nothing” scenario where no bus priority lane and urban rail are introduced and 5.4% in “With” scenario. When it is limited to InterTAZ trips only, the modal share of public transport is projected to be 8.6%.

Table 6.3.4 Modal Share of Internal Zones (All Trips)

	1,000 Trips				Share			
	2012	2022	2035 Do Nothing	2035 With	2012	2022	2035 Do Nothing	2035 With
CAR	421.6	791.3	1,489.2	1,387.4	9.9%	14.1%	21.7%	20.2%
MC	2,223.5	3,254.3	3,616.2	3,420.3	52.4%	58.1%	52.8%	49.9%
TukTuk	570.5	871.8	949.3	944.1	13.4%	15.6%	13.9%	13.8%
BUS		76.4	91.7	273.3	0.0%	1.4%	1.3%	4.0%
Urban Rail		0.0	0.0	97.0	0.0%	0.0%	0.0%	1.4%
NMT	1,031.2	608.0	706.2	730.5	24.3%	10.9%	10.3%	10.7%
Total	4,246.8	5,601.8	6,852.6	6,852.6	100.0%	100.0%	100.0%	100.0%

Note: Figures of 2012 are estimated with other models after expanding PT Survey samples (including airport-related trips)

Note: Para-transit and tuk-tuk in 2012 were regarded as NMT for comparison

Source: JST

Table 6.3.5 Modal Share of Internal Zones (Inter TAZ Trips only)

	1,000 Trips				Share			
	2012	2022	2035 Do Nothing	2035 With	2012	2022	2035 Do Nothing	2035 With
CAR	339.4	565.9	1,058.8	965.7	13.4%	16.1%	24.5%	22.4%
MC	1,551.7	2,377.1	2,604.0	2,410.2	61.5%	67.5%	60.3%	55.8%
TukTuk	361.3	356.7	388.1	377.4	14.3%	10.1%	9.0%	8.7%
BUS		76.4	91.7	273.3	0.0%	2.2%	2.1%	6.3%
Urban Rail		0.0	0.0	97.0	0.0%	0.0%	0.0%	2.2%
NMT	272.2	147.0	174.5	193.4	10.8%	4.2%	4.0%	4.5%
Total	2,524.6	3,523.1	4,317.1	4,317.1	100.0%	100.0%	100.0%	100.0%

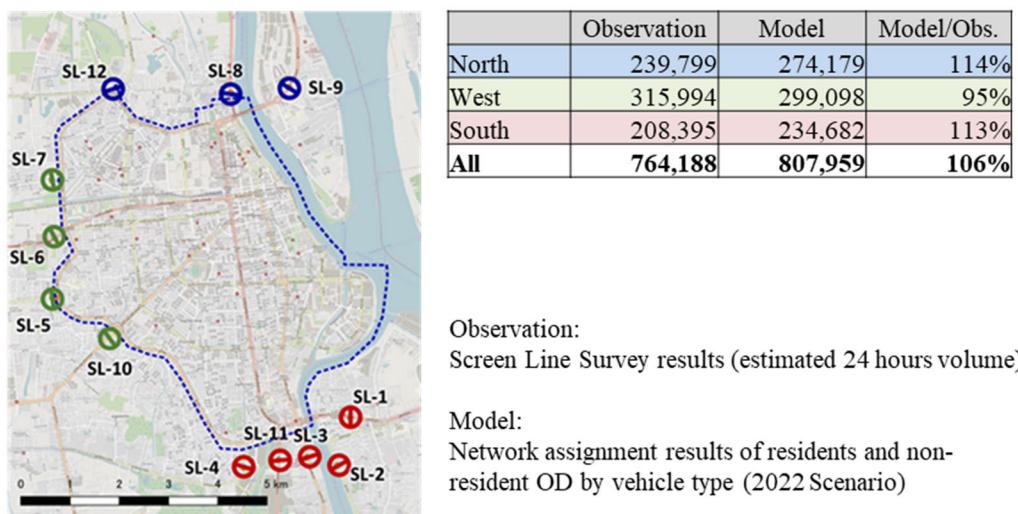
Source: JST

6.3.6 Network Assignment Results

(1) Validation of Base Model

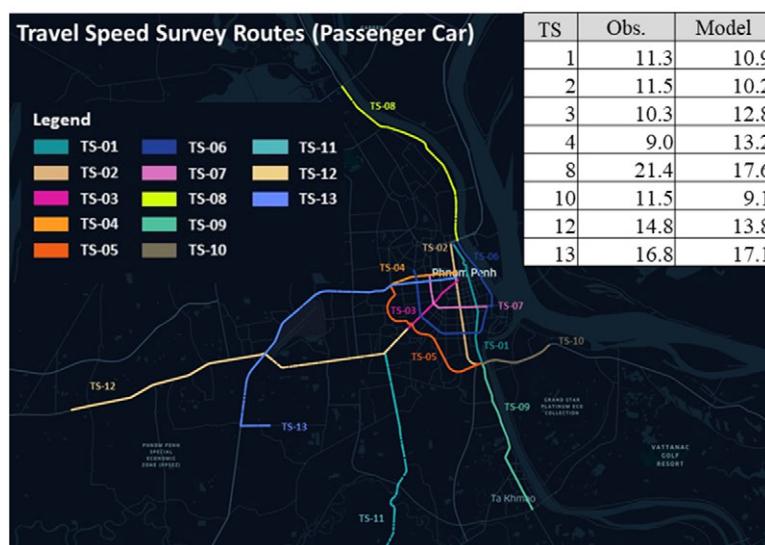
The base model was validated by comparison with the results of Screen Line Survey and Travel Speed Survey. Figure 6.3.4 shows the comparison of daily traffic by direction crossing Screen Line and the network assignment result of 2022. The total traffic volume of all directions is estimated at 808 thousand PCU/day, which is 6% larger than 764 thousand PCU/day observed in Screen Line Survey. North and south traffic is estimated relatively larger whilst west traffic is smaller. Traffic on local streets where the Screen Line Survey was not conducted can be a cause of the excessive traffic estimation.

Figure 6.3.5 compares the travel speed of the base model after the network assignment and travel speed observed in Travel Speed Survey on major routes in the evening peak hours. It was confirmed that the travel speed in the base model is comparable to the Travel Speed Survey.



Source: JST

Figure 6.3.4 Validation of Base Model (Screen Line Survey)



Source: JST

Figure 6.3.5 Validation of Base Model (Travel Speed)

(2) Future Network Assignment Result

Table 6.3.6 to Table 6.3.8 describe the performance index of the road network in the study area based on the assignment result. In the tables below, “urban” represents road links inside Inner Ring Road and Inner Ring Road itself whilst “suburban” represents road links outside Inner Ring Road.

In the base model, the V/C was 0.81 in urban and 0.67 in suburban. Compared to V/C at 0.87 in urban and 0.44 in suburban estimated in PPUTMP, this result indicates the congestion became more severe in suburban areas. V/C increases to 1.05 in urban and 0.90 in suburban in Do Nothing Scenario in 2035, which means the entire road network will become congested. On contrast, V/C in With Scenario in 2035 was estimated lower than the Base Scenario in both urban and suburban, which results in higher average travel speed.

Figure 6.3.9 and Figure 6.3.10 illustrate the public transport assignment result of Do Nothing Scenario in 2035 and With Scenario in 2035 respectively. It was projected that the number of public transport passengers increases on links particularly where a bus priority lane is introduced and it triggers growth of the number of passengers on other lines as well.

Table 6.3.6 Road Network Performance Index (Base Scenario)

	Total Length (km)	Total Capacity Distance (1,000 pcu*km)	Total Travel Distance (1,000 pcu*km)	Volume Capacity Ratio	Total Travel Time(1,000 pcu*h)	Average Travel Speed (km/h)	Peak Travel Speed (km/h)
Urban	188	3,473	3,103	0.81	142	21.88	12.33
Suburban	882	20,998	15,539	0.67	520	29.87	19.23
Total	1,070	24,472	18,642	0.69	662	28.16	23.90

Source: JST

Table 6.3.7 Road Network Performance Index (Do Nothing Scenario in 2035)

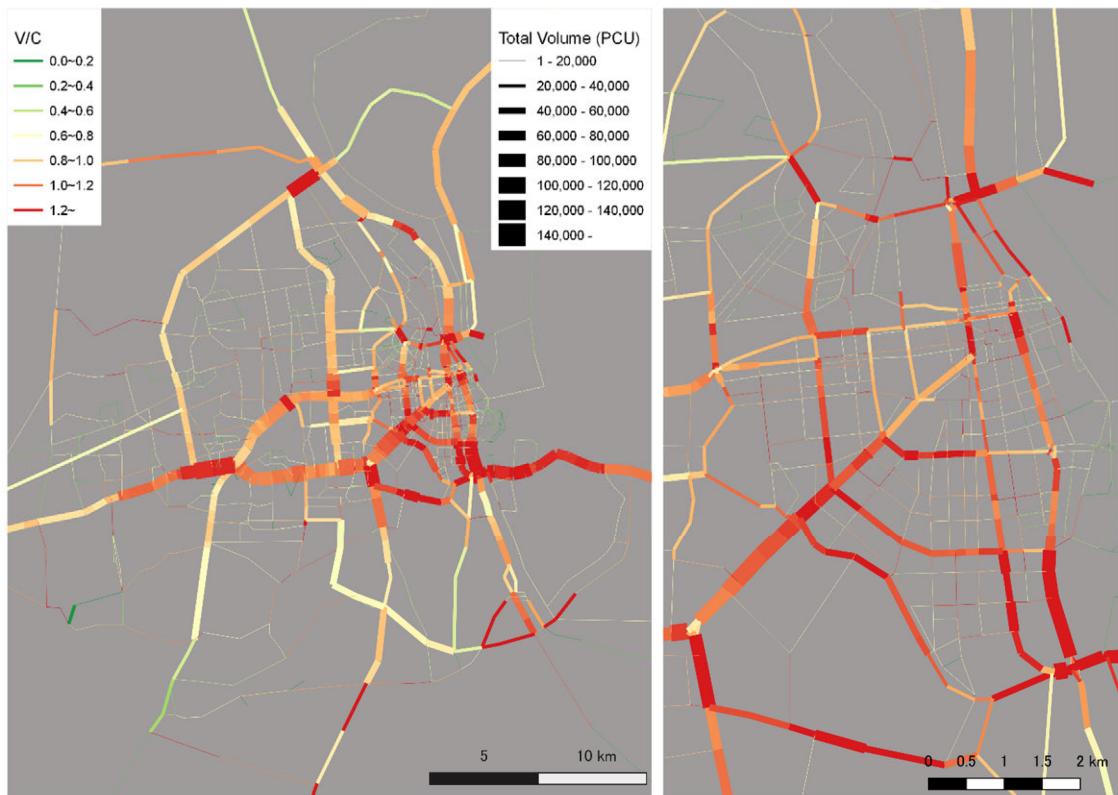
	Total Length (km)	Total Capacity Distance (1,000 pcu*km)	Total Travel Distance (1,000 pcu*km)	Volume Capacity Ratio	Total Travel Time(1,000 pcu*h)	Average Travel Speed (km/h)	Peak Travel Speed (km/h)
Urban	188	3,473	3,987	1.05	209	19.11	9.88
Suburban	882	20,998	20,651	0.90	797	25.92	15.31
Total	1,070	24,472	24,638	0.93	1,005	24.51	18.97

Source: JST

Table 6.3.8 Road Network Performance Index (With Scenario in 2035)

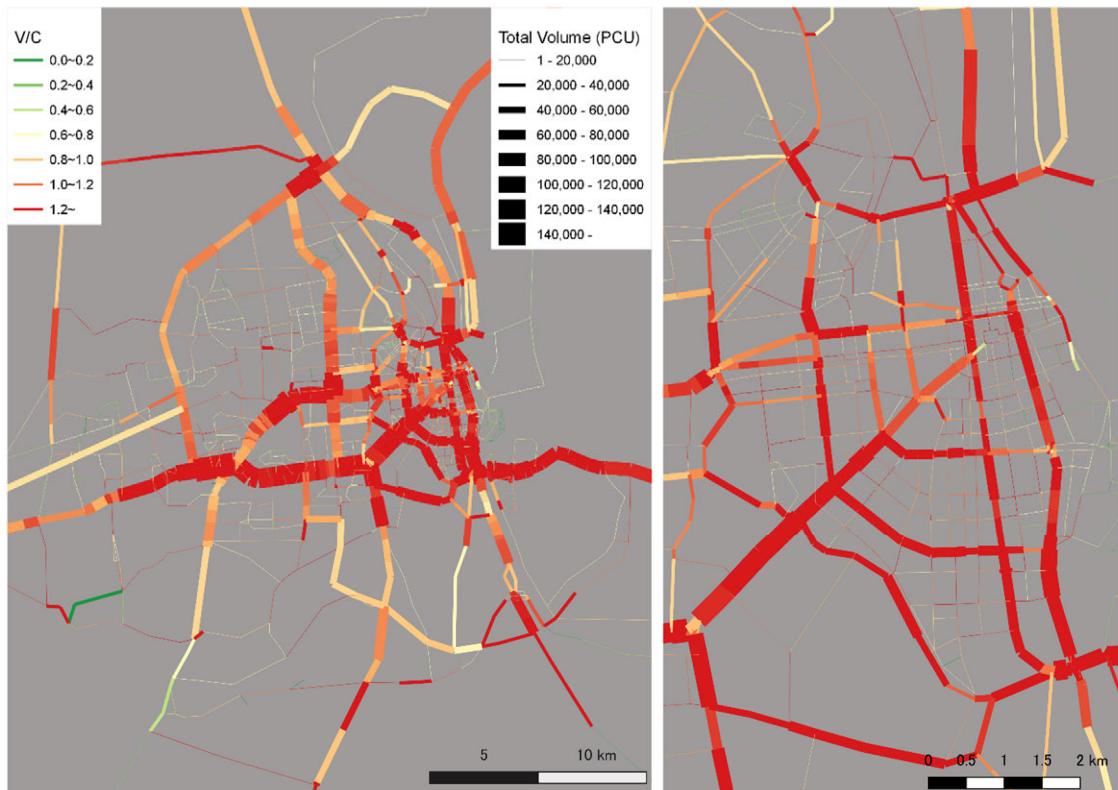
	Total Length (km)	Total Capacity Distance (1,000 pcu*km)	Total Travel Distance (1,000 pcu*km)	Volume Capacity Ratio	Total Travel Time(1,000 pcu*h)	Average Travel Speed (km/h)	Peak Travel Speed (km/h)
Urban	190	3,569	3,153	0.81	136	23.16	12.18
Suburban	1,261	39,211	20,764	0.46	596	34.84	26.98
Total	1,451	42,781	23,917	0.51	732	32.67	34.49

Source: JST



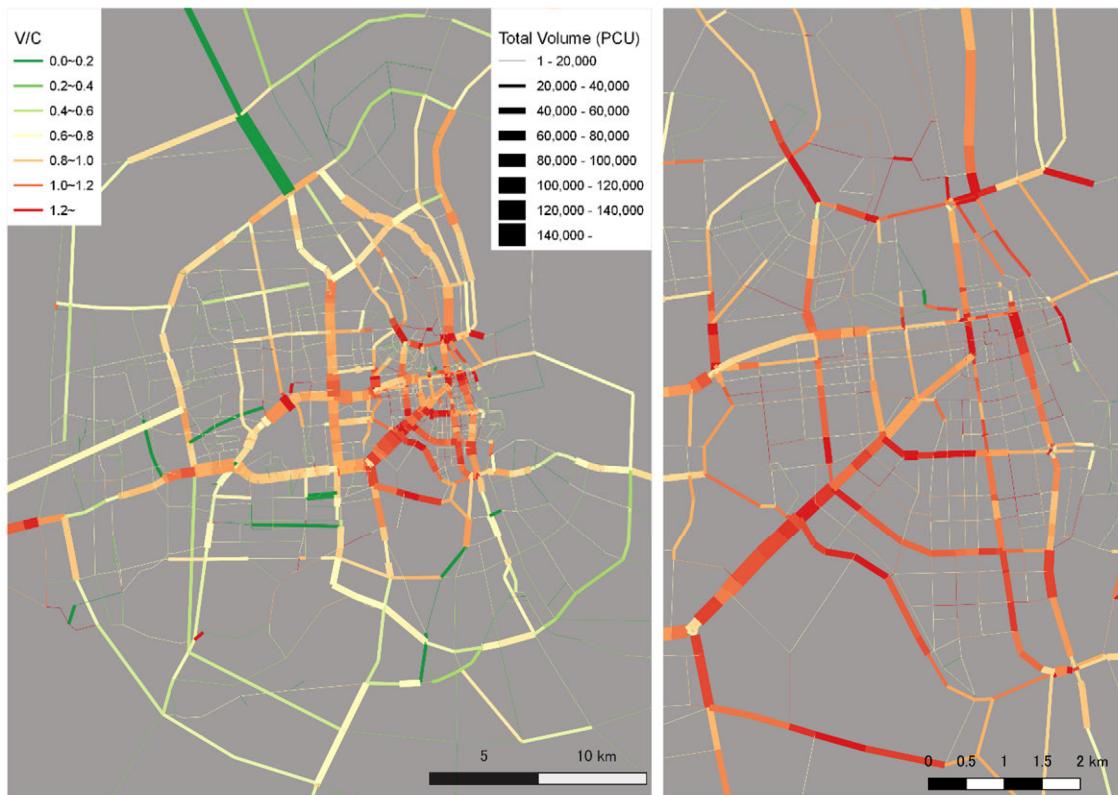
Source: JST

Figure 6.3.6 Road Assignment Result (Base Scenario)



Source: JST

Figure 6.3.7 Road Assignment Result (Do Nothing Scenario in 2035)



Source: JST

Figure 6.3.8 Road Assignment Result (With Scenario in 2035)



Source: JST

Figure 6.3.9 Public Transport Assignment Result (Do Nothing Scenario in 2035)



Source: JST

Figure 6.3.10 Public Transport Assignment Result (Do Nothing Scenario in 2035)

Chapter 7 Identifying Issues on Urban Transport Sector in Phnom Penh

7.1 Progress of PPUTMP Projects/Programme

The progress of the projects proposed in PPUTMP was reviewed and the reasons for the delay of the projects are identified from such viewpoints as financial, environmental, legal and social culture through interviews with concerned agencies.

7.1.1 Public Transport Sector

Twenty-one (21) projects were proposed for the public transport sector in PPUTMP. Out of those, the bus location system project (PT-14) was completed. Most of the projects related to the bus sector were partially completed or on-going. On the other hand, most of the railway projects are incomplete after the Feasibility Study (F/S) due to the lack of budget and the financial feasibility issue as a transport business. The airport railway project and commuter railway projects with the existing rail system were operated once but were suspended due to the financial constraints and the COVID-19 pandemic. The passenger's demand on the quality of transport is increasing in Phnom Penh since the user-friendly new transport mode, RHS, has emerged. Therefore, high quality service is required if a railway is introduced to integrate with other transport modes. Also, it should be noted that the projects related to paratransit may need to be re-considered since the dominant paratransit mode were changed to RHS.

Table 7.1.1 Review of PPUTMP (Public Transport Sector)

Code	Project Name	Details	Progress	Issues			
				Financial	Environmental	Legal	Social Culture
PT-1	Rail Transit (Phase 1)	Chaom Chau – Central Market (CM)	【Suspended】 JICA completed F/S but it was suspended because of mostly financial issue. Another reason is that the PPUTMP is not approved by the Cambodia government or PPCA (Fin.).	✓			
PT-2	Rail Transit (Phase 2)	GPIC to CM and Ta Khmau to CM		✓			
PT-3	Rail Transit Station	No. of stations= 43		✓			
PT-4	Rail Transit Airport Station	No. of stations= 1		✓			
PT-5	Rail Transit Depot	No. of depot= 2		✓			
PT-6	Bus Route	Total length= 426 km	【Complete】 The bus route network proposed by PPUTMP is almost completed in 2020. No. of bus fleet and No. of routes are almost same as PPUTMP.				
PT-7	Bus depot	No. of depot= 2	【Partially complete】 Partially completed in 2020 stage. Due to financial issue (Fin.).	✓			

Code	Project Name	Details	Progress	Issues			
				Financial	Environmental	Legal	Social Culture
PT-8	Multi-modal Interchange Complex	Rail transit + City bus + Intercity bus:4 terminals	【Suspended】 The terminal development is not progress because of suspension of rail transit due to financial issue (Fin.).	✓			
PT-9	Bus Terminal (Type 1)	City bus + Intercity bus	【Incomplete】 Relocation of intercity bus terminal from CBD to fringe of urbanized area is not progressing because of Financial and Legal issue. (Fin., Leg.)	✓		✓	
PT-10	Bus Terminal (Type 2)	City bus terminal	【Partially complete】 A bus terminal has been developed in the Freedom Park (old bus depot site). It also has a mode interchange function between RHS and water transport. However, other terminals are not progressed. (Fin.)	✓			
PT-11	Bus stop	389 stops	【Mostly Complete】 Mostly Completed in 2020 stage				
PT-12	BRT (Bus Rapid Transit)	6 lane roads	【Pre-F/S Completed】 Pre-F/S completed by ADB. F/S is being prepared.				
PT-13	Bus priority measures	4 lane roads	【Incomplete】 Pilot project was conducted in PiBO. Under the discussion on implementation				
PT-14	Bus location system		【Complete】 A smartphone compatible bus location app has been prepared.				
PT-15	Restructuring of the paratransit operation (1)	Zone system for Motodop	【Incomplete】 No. of motodop has been drastically decreased by the convenient RHS (Soc.).				✓
PT-16	Restructuring of the paratransit operation (2)	Exclusive route system for Motorumok modern (tuk-tuk)	【Incomplete】 Compete with bus along the trunk roads. Tuk-tuk operation is prohibited on several trunk roads such as Norodom Blvd (Leg., Soc.).			✓	✓

Code	Project Name	Details	Progress	Issues			
				Financial	Environmental	Legal	Social Culture
PT-17	Restructuring of the paratransit operation (3)	Zone system for Cyclo	【Incomplete】 Not major transport mode anymore, because No. of drivers is decreasing due to the aging of drivers. (Soc.)				✓
PT-18	Restructuring of the paratransit operation (4)	Improvement of commuter trucks for factory worker in suburban areas	【Incomplete】 At least, the roof and benches are required, but implementation is left to the driver (main operator), so it has not been progressed. (Fin, Leg.)	✓		✓	
PT-19	Introduction of commuter rail system	Using existing rail system Central St. - PPSEZ	【Suspended】 The service started in 2018 as the airport access and was cancelled in 2020 due to the uncomfortable riding conditions, low operational speed and no punctuality of operation. Reconstruction is difficult due to illegal occupation of railway and the lack of custom of using railways. (Fin., Env. and Soc.)	✓	✓		✓
PT-20	Commuter Rail Station		【Suspended】 Commuter Stations between Central St. and Airport St. are not developed, because the train is the direct operation between above 2 stations. (Fin., Env.)	✓	✓		
PT-21	Improvement of water transport		【Partially complete】 CBA operates a water taxi between Ta Khmau – Freedom Park. There is a mode interchange function between bus and RHS.				

Source: JST

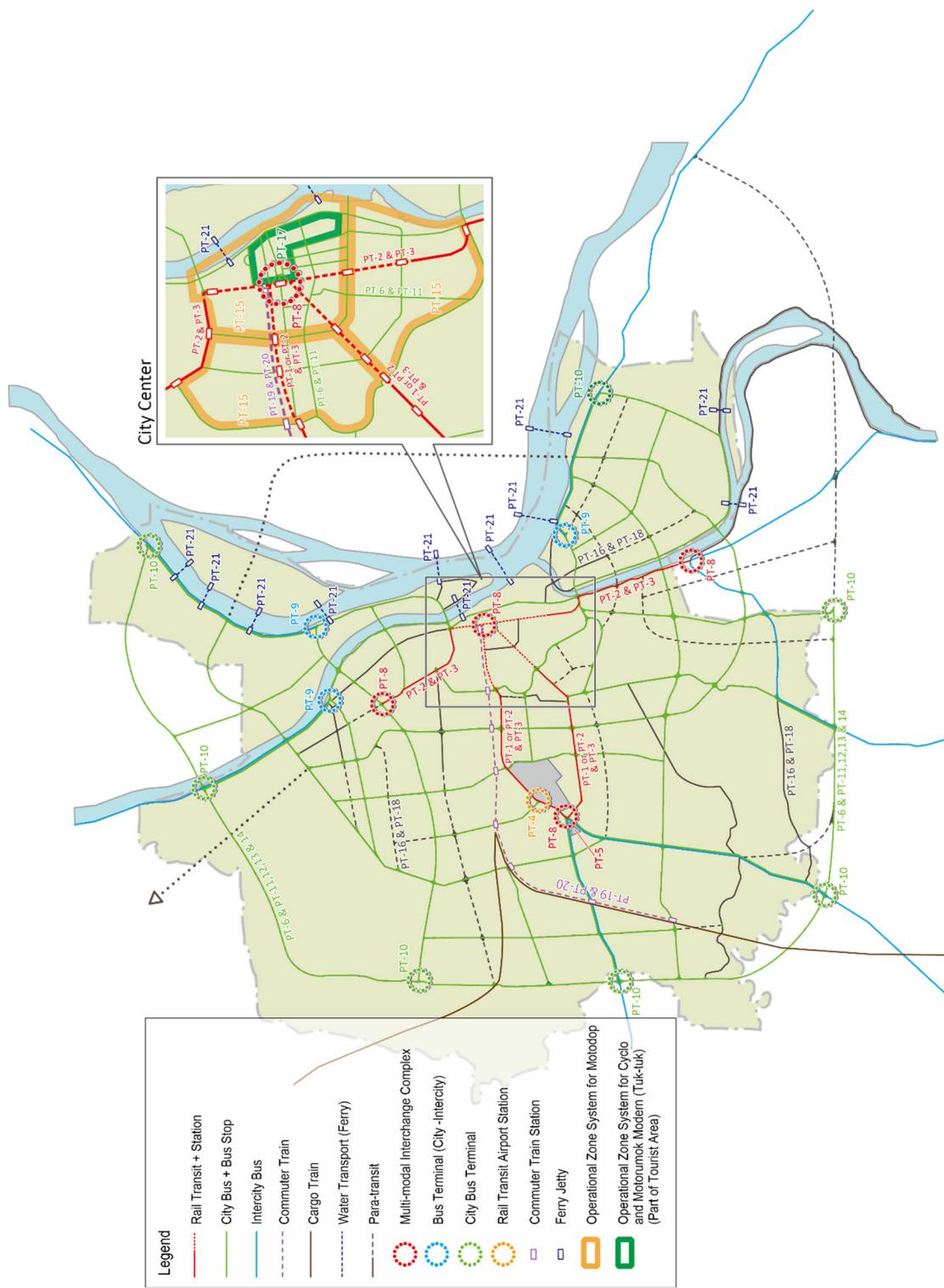


Figure 7.1.1 Location of the Public Transport Projects in PPUTMP

Source: PPUTMP



Source: JST

Figure 7.1.2 City Bus Provided by Japan



Source: JST

Figure 7.1.3 Bus Depot



Source: PiBO

Figure 7.1.4 Bus Location App



Source: JST

Figure 7.1.5 Airport Rail Link (Suspended)

7.1.2 Highway Sector

Thirty-six (36) projects were proposed for the highway sector in PPUTMP. Out of those, 11 projects were completed and most of the projects were partially completed or on-going. Though several projects were completed, the pace of implementation of highway projects severely lags behind to meet the emerging traffic demand and the traffic congestion has been worsening until the COVID-19 pandemic occurred.

Generally, the progress of existing arterial road widening project is relatively going well. On the other hand, constructions of new roads in the suburbs have faced difficulties because of rapid and large-scale housing development. In order to bring out the functions of the planned road network, it is necessary to promote large-scale housing development and arterial road development in an integrated manner, and if it is difficult, consider alternative road development. It is also important to secure lands for new roads whose target year is 2030 or later.

Table 7.1.2 Review of PPUTMP (Highway Sector)

Code	Project Name	Length (km)	Target Year	Progress	Issues			
					Financial	Environment	Legal	Social Culture
RP-1	Widening and Sidewalk of Arterials in Central Area	10.1	2017	【Complete】				
RP-2	Boeng Kok Road	6.5	2026	【Partially complete】 Arterial roads has been constructed for EW and NS direction and the originally planned function has been fulfilled.				
RP-3	Missing Links in Central Area	1.3	2021	【Complete】				
RP-4	Widening of NR-1, Chabar Ampov - New PP Port	25.3	2019	【Complete】				

Code	Project Name	Length (km)	Target Year	Progress	Issues			
					Financial	Environment	Legal	Social Culture
RP-5	New E-W Arterial Road (NR-1 - Cheng Aek Road)	11.5	2023	【Partially Constructing】 Constructing between NR-20 – Ta Khmau.				
RP-6	New E-W Arterial Road (Cheng Aek - RR-IV)	16.1	2031	【Unknown】				
RP-7	New and Widening of RR-II (NR-2 – NR-5)	20.4	2020	【Partially Complete】 Incomplete section through factory area in south of Veng Sreng and section to connect NR-5. (Env.)	✓	✓		
RP-8	Extension of RR-II (NR-5-NR-6)	2.9	2026	【Incomplete】 Construction of a bridge over Tonlé Sap River and adjustment with large scale housing development are required. (Env.)	✓	✓		
RP-9	RR-III (NR-1 - Junction with NR-21)	18.5	2023	【Constructing】 Constructing a bridge over Bassac River.				
RP-10	RR-III(NR-21 – NR-4)	24.5	2023	【Constructing】 Constructing sections including flyovers.				
RP-11	Widening of RR-III(NR-4 - 4km section)	4.1	2015	【Complete】				
RP-12	Widening of RR-III(4km from NR-4 - Preak Pnob Bridge)	10.7	2019	【Complete】				
RP-13	RR-IV (NR-1 – NR-6)	80.8	2035	【Incomplete】	✓			
RP-14	Widening of NR-2 (Junction with NR21 - RR-III)	12.1	2031	【Constructing】				
RP-15	Widening of NR-3 (Junction with RR-III - RR-IV)	9.2	2035	【Complete】				
RP-16	Widening of Chaom Chao Road	8.4	2016	【Complete】				
RP-17	Widening of Russia/NR-4 (IRR - RR-IV)	15.2	2019	【Complete】				
RP-18	New E-W Arterial in Sen Sok(Toul Kok - RR-IV)	15.9	2016	【Partially complete】 Partially Complete about 6km in urban area in 2016. Land acquisition or alignment change is required for sections in west side.	✓	✓		
RP-19	Widening of Hanoi Road (RR-II - RR-III)	4.9	2019	【Complete】				
RP-20	Widening of NR-5 (Chruoy Changvar Bridge - RR-IV)	15	2017	【Complete】				
RP-21	Chban Ampov area Development Road package	18.9	2018	【Incomplete】 Land acquisition or alignment change is required for widening and new construction. (Env.)	✓	✓		
RP-22	Mean Chey District Urban Development road package	27	2028	【Incomplete】 Land acquisition or alignment change is required for widening and new construction. (Env.)	✓	✓		
RP-23	Mean Chey - Diamond Island Connection Rd package	5.8	2031	【Partially complete】 Road widening in high density residential area (Env.) and construction of bridge (Fin.) is not completed.	✓	✓		
RP-24	AZ Green City Development Road package	34.2	2031	【Partially complete】 Section between St. 271 and NR-2 has been almost completed. NS direction is not completed. Land acquisition is required. (Env.)	✓	✓		
RP-25	Chaom Chao South Area Development road package	25.7	2023	【Partially complete】 North part of NS direction completed. ES direction not completed. Land acquisition or alignment change is required for construction in residential area (Env.).	✓	✓		
RP-26	Russia - Chaom Chao Connection & Boeng Tumpun Access	8.5	2021	【Partially complete】 Russian Blvd. - Veng Sreng Blvd. connected. Section to connect Russian Blvd. and St. 2004 is not completed. (Env.)	✓	✓		

Code	Project Name	Length (km)	Target Year	Progress	Issues			
					Financial	Environment	Legal	Social Culture
RP-27	Samraon Kraom Sub-center Development Road package	15.3	2031	【Partially complete】 North part of NS direction and west part of EW direction is not completed. Land acquisition or alignment change is required for some sections in residential area (Env.).	✓	✓		
RP-28	Western Peripheral area development roads	31.2	2035	【Incomplete】 New residential area has been developed. (Env.)	✓	✓		
RP-29	Phnom Penh Thmei district Development package	22.5	2026	【Partially complete】 Partially Complete in urban area. Sections in suburban area are not completed. New residential area has been developed in suburban area. (Env.)	✓	✓		
RP-30	Krang Thnong New Sub-center package	20.8	2035	【Partially complete】 Section of NS direction and 2 sections of EW direction are not completed. Land acquisition is required for NS direction to connect Russian Blvd. (Env.)	✓	✓		
RP-31	Camko/Grand Phnom Penh Development package	9.8	2022	【Partially complete】 Partially Complete in urban area. Widening of sections in undeveloped area are not proceeded.	✓			
RP-32	Ruessei Keo, Kilolekh6 area Development roads	9.3	2026	【Complete】 Alignment was changed from original plan but connected.				
RP-33	Soka, Chruoy Changvar Development roads	9.6	2026	【Constructing】				
RP-34	Garden City Preak Pnob Development roads	37.5	2035	【Constructing】				
RP-35	Flyover or Underpass Project in the Central Area	1.1	2019	【Suspended】	✓			
RP-36	Flyover or Underpass Project	9.3	2035	【Suspended】	✓			

Source: JST



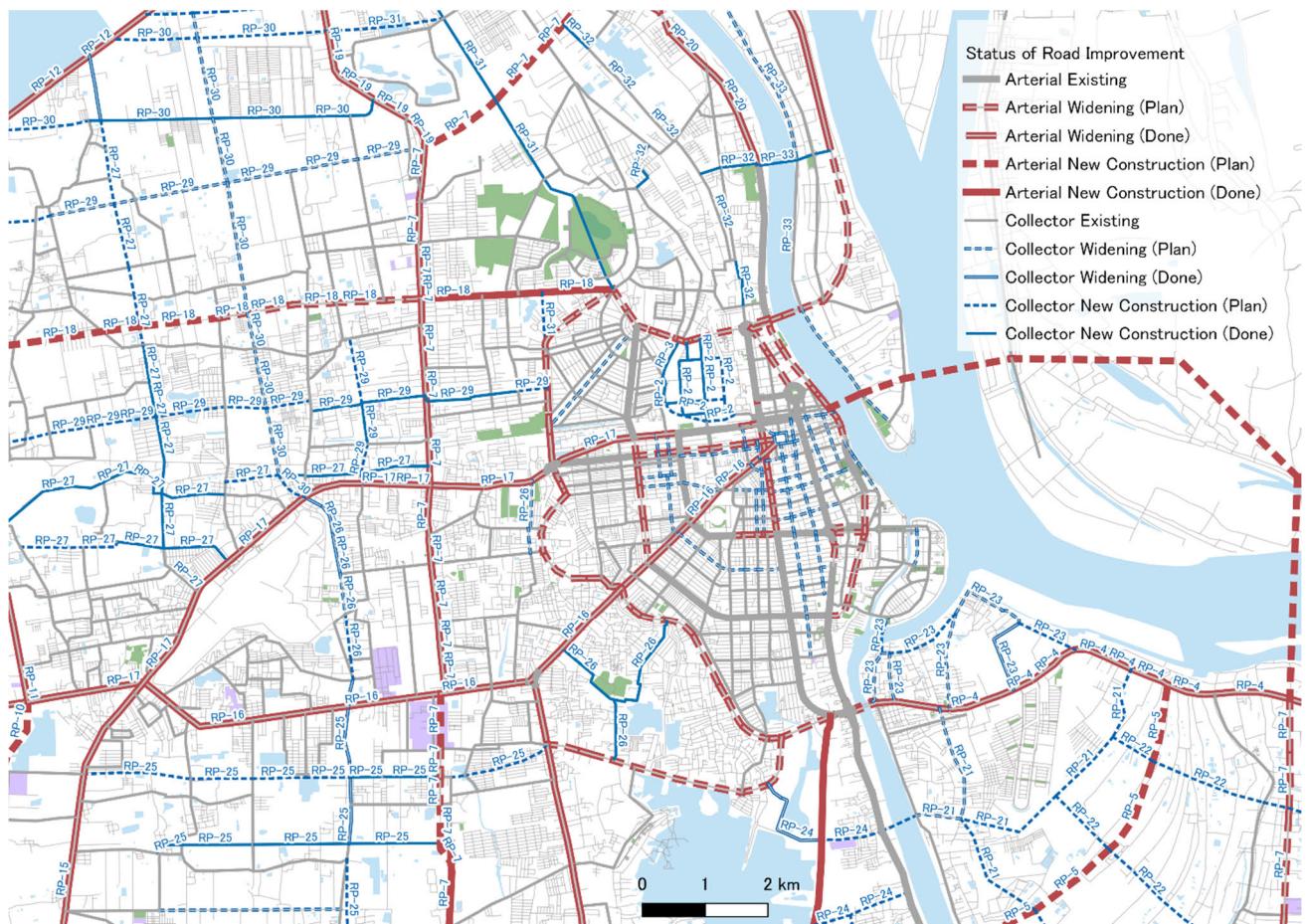
Source: JST

Figure 7.1.6 Widening of RR-III (NR-4 - 4km section)



Source: JST

Figure 7.1.7 Widening of Russia/NR-4 (IRR - RR-IV)

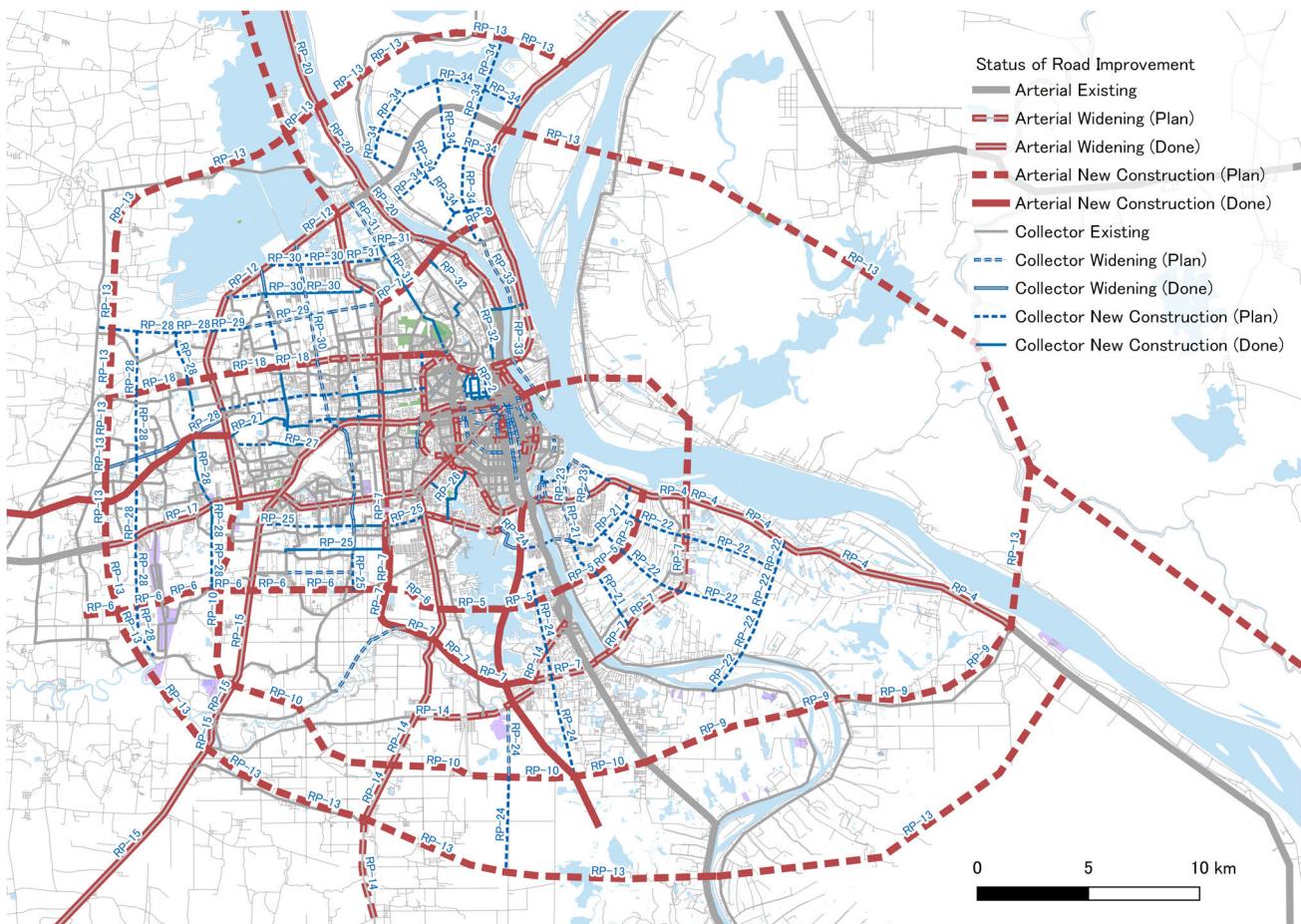


Note: Solid lines in the figure indicate completed projects. Dotted lines indicate uncompleted projects.

Note: RP-1 is not shown in the map since it is a sidewalk widening project in the city centre.

Source: JST

Figure 7.1.8 Location of the Highway Projects in PPTUMP (Detail View)



Note: "Widening (Plan)" includes the sections constructed after PPUTMP had been formulated but it required further widening to reach to the proposed service level in PPUTMP.

Source: JST

Figure 7.1.9 Location of the Highway Projects in PPTUMP (Whole PPCA Area)

7.1.3 Traffic Management Sector

Twelve (12) projects were proposed for the traffic management sector in PPUTMP. Three (3) projects were completed and most of the projects were mostly completed or on-going. Progress of the pedestrian environment, mobility management, parking project is very limited. It should be noted those projects related to pedestrian and parking were closely related to the public transport sector.

Table 7.1.3 Review of PPUTMP (Traffic Management Sector)

Code	Project Name	Details	Progress	Issues			
				Financial	Environmental	Legal	Social Culture
TM-1	Chamkar Morn Intersection	Signal phasing adjustment	【Complete】				
TM-2	Neang Kong Heang Intersection	Revision of traffic regulation	【Complete】				
		Signal phasing adjustment					

Code	Project Name	Details	Progress	Issues			
				Financial	Environmental	Legal	Social Culture
TM-3	Chrouy Changvar Intersection	Underpass	【Suspended】 Not start yet in terms of land acquisition and construction cost. (Fin., Env.)	✓	✓		
TM-4	One-way system	Introduction of one-way system	【Partially complete】 Additional one-way system in the PPUTMP revision work was proposed. But not progressed yet due to lack of consensus with roadside residents is an issue (Soc.)				✓
TM-5	Parking measures	Off-road parking On-road parking Parking information system	【Partially complete】 Several underground parking facilities have been constructed under the public park. On-street parking (charged) is currently difficult to be installed, because it can be parked anywhere for free. Parking information system has not been implemented yet. (Fin., Leg.)	✓		✓	
TM-6	Development of comfortable pedestrian environment	Dissemination to citizens along the roads Guide to remove illegal sidewalk parking, etc. Sidewalk widening	【Partially complete】 Pedestrian network at the intersections was secured by the traffic signal installation, but it is still hindered by illegal parking along the trunk roads. (Soc.)				✓
TM-7	Transit mall		【Studied by ADB】		✓		✓
TM-8	City centre traffic signal improvement project for 100 intersections	Synchronized traffic signal control Area traffic control system Intelligent traffic signal Traffic surveillance system Traffic monitoring system using probe vehicles Traffic information system (Variable message sign system) Transit signal priority system	【Mostly complete】 Even synchronized traffic signal and control centre were installed, traffic monitoring system using probe vehicles, traffic information system, transit signal priority system were not implemented.				

Code	Project Name	Details	Progress	Issues			
				Financial	Environmental	Legal	Social Culture
TM-9	Park and bus ride	Transfer to bus from cars in the suburban area	【Incomplete】 Parking space for P&R ¹ is difficult to develop. Because of financial issue. Basically, No. of P&R users are small, but K&R ² have more possibility than P&R. (Fin., Soc.)	✓			✓
TM-10	Mobility management		【Incomplete】 Even though government offices have introduced telework due to the COVID-19, the PC owned household rate is still low, therefore the introduction of telework, especially private sector is not progressing. (Soc.)				✓
TM-11	Driver's education and traffic enforcement		【Not completely enforced】 Driver education is occasionally conducted with the donor support project and traffic enforcement activity is insufficient because of lack of No. and quality of traffic police officers. (Fin., Soc.)	✓			✓
TM-12	Preparation of parking space for trucks in the city centre		【Incomplete】 Discussed but not yet implemented. (Fin., Leg.)	✓		✓	

Source: JST



Source: JST

Figure 7.1.10 Traffic Signal with CCTV

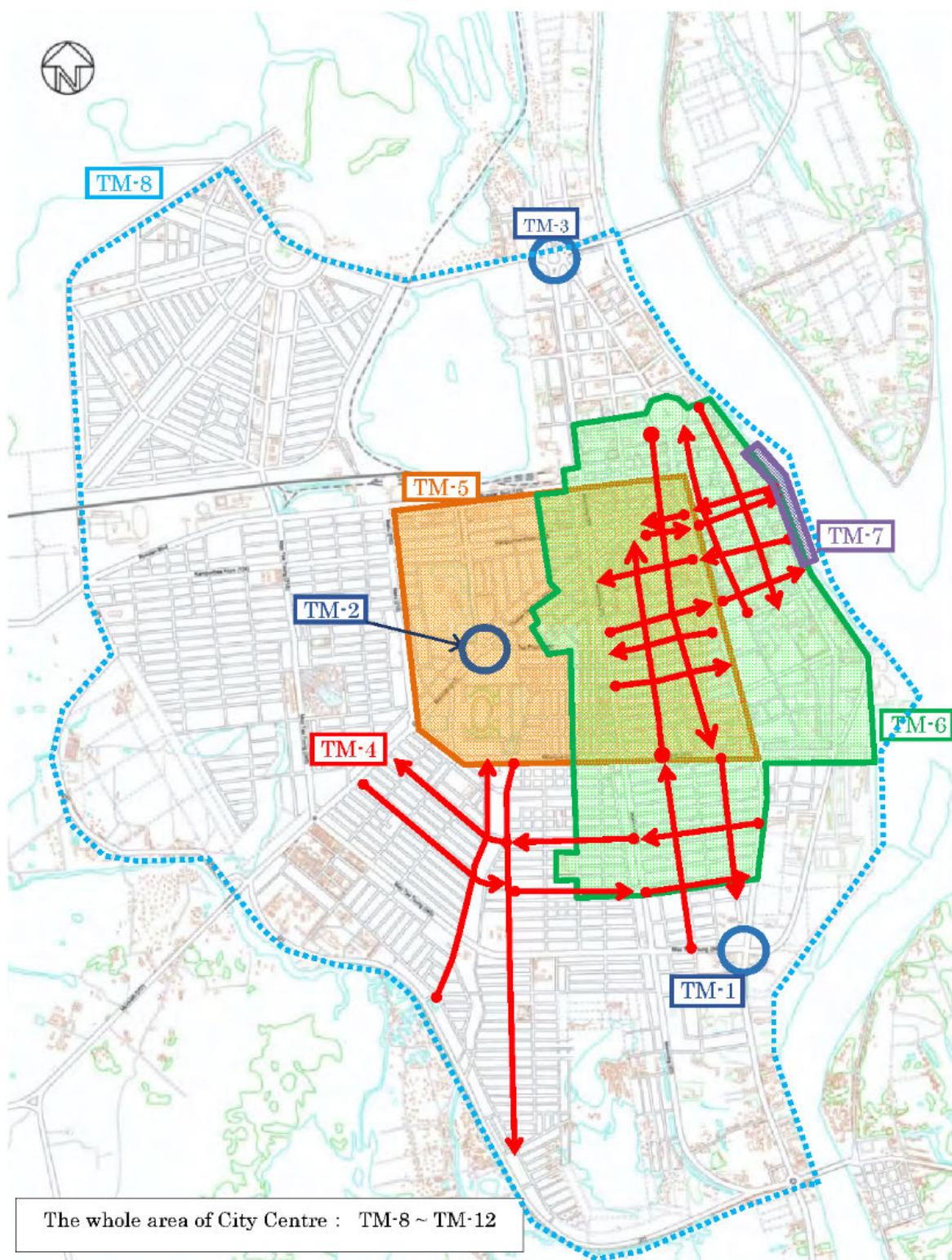


Source: JST

Figure 7.1.11 Traffic Control Centre

¹ P&R: Park and Ride

² K&R: Kiss and Ride



Source: PPUTMP

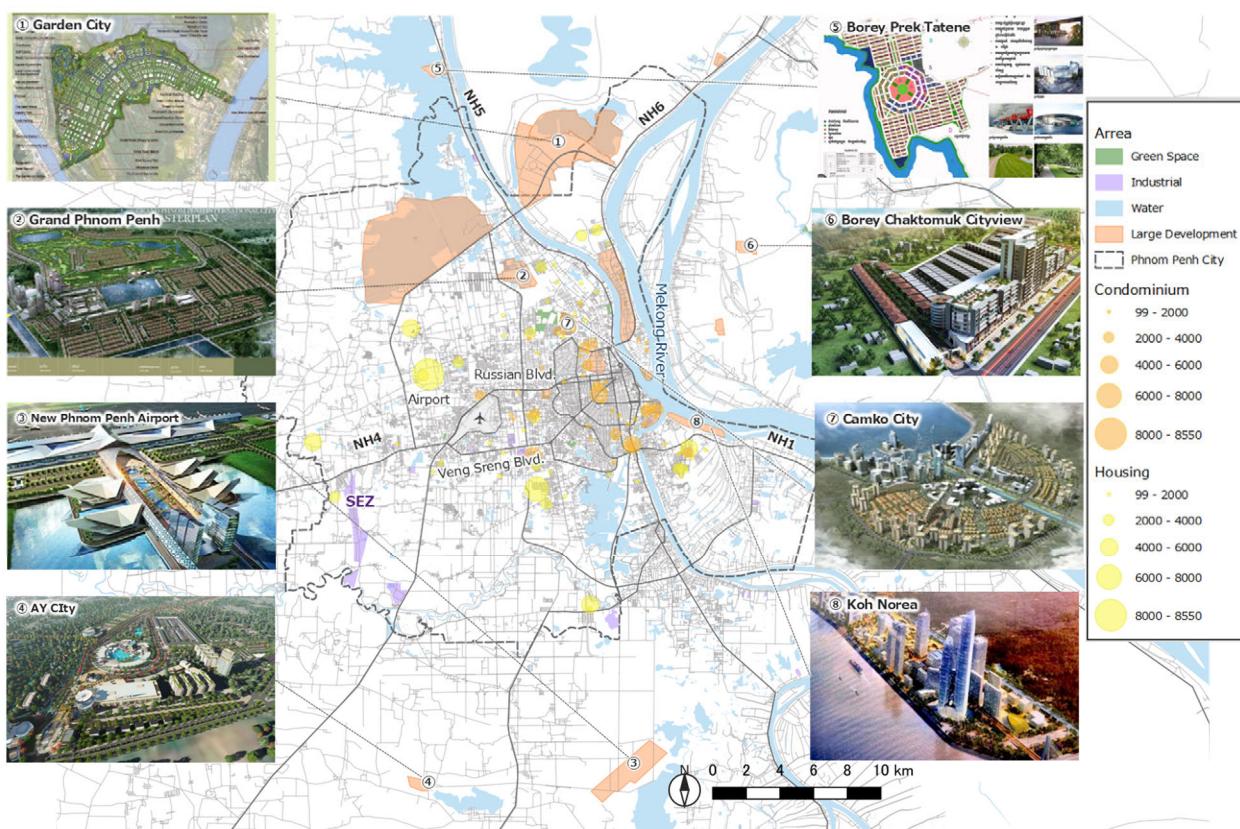
Figure 7.1.12 Location of the Traffic Management Projects in PPUTMP

7.2 Issues in Urban Transport

7.2.1 Impacts Caused by Upper Planning and Urban Transport Project/Programme

(1) Uncontrolled Expansion of Metropolitan Area

Along with the uncontrolled urban sprawl of Phnom Penh Metropolitan Area, some villages in Kandal Province have been transferred to the Phnom Penh municipality. Several mega urban development projects such as Koh Norea, Grand Phnom Penh and Garden City are planned in suburban areas of Phnom Penh. On the other hand, population density in CBD has been decreased due to the rising land price. Land use regulations need to be tightened toward sustainable urban development. The future urban transport infrastructure projects and programmes need to be taken into account for the uncontrolled urban sprawl.



Source: JST based on several brochures and articles

Figure 7.2.1 Location of the Urban Development Projects in Suburbs of Phnom Penh

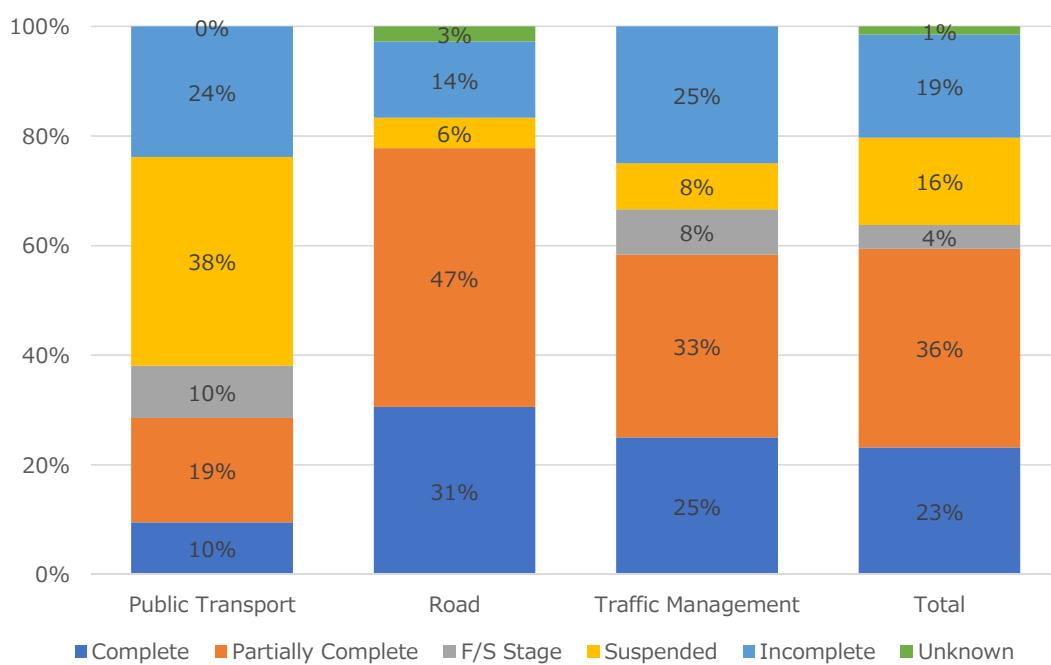
(2) Emerging Mega Projects

A number of mega projects, including those of transport projects, are emerging in Phnom Penh and these projects will adversely impact the urban mobility in Phnom Penh. The Phnom Penh New International Airport and its airport access road, for instance, are planned in Kandal Province, which will significantly generate the passenger travel and change the travel pattern between Phnom Penh and Kandal. On the other hand, the Kandal Provincial Hall is located at Ta Khmau municipality bordering south of Phnom Penh municipality and there are no plan that the area is to be absorbed.

It is expected that frequent commuting and business trip crossing the Phnom Penh municipality area will be generated in the future. Accordingly, further coordination on transport planning and management with Kandal Province and PPCA will be required.

(3) Delayed Implementation of Urban Transport Project

The following figure shows a summary of the project progress in PPUTMP. Comparing with other sectors, the number of complete project for public transport sector is limited since most of the railway projects were suspended after the F/S. A major reason of the suspension is budgetary constraint and the financial feasibility issue as a transport business. The delay of implementation of the public transport project will contribute to leading to the development of Motorised Society. The introduction of a public transport system is essential to achieve the goal of Phnom Penh, a sustainable city. It is required to re-examine a feasible public transport system considering the issues on implementation and constraints.



Source: JST

Figure 7.2.2 Progress of the Projects Proposed in PPTUMP

(4) Social Culture as Key Factor for Success in Implementation and Management of Public Transport and Traffic Management Project/Program

Most of the incomplete projects in the traffic management sector can be said as the complementary projects to increase the accessibility and usability of public transport such as pavement, the parking and bus ride system and mobility management. The progress of those projects is limited due to social culture obstacles. For example, the uncontrolled on-street parking as well as the low quality and unstandardized design of sidewalks which tend to hinder pedestrian's walking environment is a common exercise. Another example is the development of the bus stop which always faces opposition against it by the neighbouring property owners. If the budgetary constraints continue, those complementary projects should be implemented to increase the usability of existing public transport.

7.2.2 Institutional and Organisational Issues in Urban Transport

(1) Absence of Agreed Vision, Strategic Plan and Action Program in Urban Transport

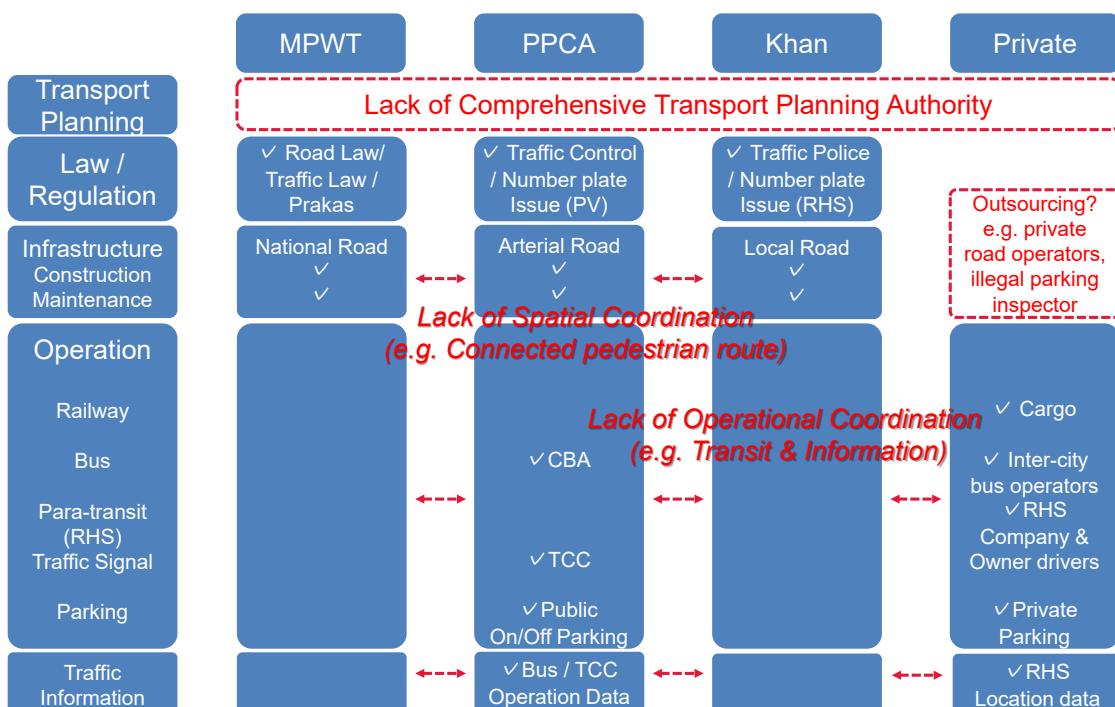
PPUTMP is only the comprehensive transport master plan in Phnom Penh. The implementation of the master plan would be achieved through a number of workshops and seminars to confirm with the related upper and on-going plans/programmes. A number of stakeholders, including decision makers in Phnom Penh and Khan need to agree with the strategic plan and action programme in PPUTMP that are not officially included with the long-term budgetary plan of PPCA and Khan.

(2) Absence of Transport Planning and Management Agency and Lack of Coordination between the Concerned Government Agencies

MPWT is responsible for the development of transport infrastructure at the national level, legislation related to transport, vehicle registration and driver's licence system. DPWT is developing transport infrastructure at the local level, and vehicle registration work has been transferred from MPWT. In addition, traffic police is responsible for ensuring traffic safety, cracking down on traffic violations, investigating traffic accidents and providing traffic safety education.

In addition, the overall planning and management of the urban infrastructure and service are always tasked to three different Deputy Governors of PPCA and there isn't transport planning and management function in PPCA. CBA only functions as a service provider to operate commuter bus service in Phnom Penh.

The duties and responsibilities of development and management of urban transport infrastructure and service are scattered among MPWT, DPWT, traffic police and PPCA. A close coordination among MPWT, DPWT and traffic police should be initiated by PPCA and is required to achieve integrated and effective management in urban transport.



Source: JST

Figure 7.2.3 Absence of Transport Planning and Coordination Agencies

(3) Lack of Management of Private Transport Operators

Recently, private transport operators of RHS are playing a key role in urban transport in Phnom Penh. On the other hand, the government is struggling with monitoring and controlling those private operators since there are no regulation to limit the number of operators and control the quality of services.

In Japan, to start a public transport business, it is necessary to obtain the necessary permits and licences and/or to make a presentation to transport-related authorities in accordance with the following laws: the Road Transport Law (needs permission of public transport business from the Minister of Ministry of Land, Infrastructure, Transport and Tourism), the Road Law (needs permission of road administrator to install bus stops) and Road Traffic Law (needs coordination with traffic police for the public transport routes).

(4) Absence of Enforcement of Road Traffic Law and Related Regulations

All the passenger transport operators are required to acquire the business licence from MPWT based on the Road traffic law. DPWT is responsible for the actual licensing work in each province. When the operators register the business licence, several document such as driver's licence and vehicle technical inspection certificate are required. After the licensing, traffic police monitor the transport operator from the view point of traffic safely. However, the number and the capacity of traffic police are limited and it's difficult to handle increasing RHS operators.

(5) Absence of Urban Transport Management Tool/System

A number of urban transport data is collected from different agencies: Real-time bus operation data (CBA), real-time traffic count and speed at designated intersections (TCC/DPWT), real-time RHS operation data (private App service providers) and so forth, and these urban transport data are not integrated and translated into planning, management and monitoring of urban transport service. To guide the transport policy planners in government and operators, a transport management tool/system which includes integration of those transport data is required.

(6) Absence of Urban Transport Planning and Management Training

Similar to the management tool/system, a training programme for transport policy, makers, planners and operators is not available in any public agencies and the similar training has been conducted in ad-hoc basis mainly under the technical support by different donors. There is also very weak coordination in implementing such training between the public agencies and academic institutes. The capacity building of individual planners and operators is a must to develop evidence-based planning and management of the urban transport system.

(7) Unavailable Sustainable Funding Source

As shown in 7.1, most of the projects and programmes proposed in PPUTMP were incomplete due to the lack of funding sources. In addition, the funding for development and management of urban transport system is always fluctuated due to uncertainties and emergent funding requirement such as that caused by the COVID-19 pandemic. Both lack of funding and unstable funding contribute to unplanned and delay of implementation of urban transport infrastructure and service, therefore sustainable financial mechanism for urban transport sector is required.

7.2.3 Issues on Urban Transport-related Infrastructure and Facilities

(1) City Bus

1) Absence of Terminal Facility in City Centre

As seen in the previous chapter, the average bus operation length of each bus route exceeds 20 kilometres due to the limited availability of bus terminal facilities. The location and space of these bus terminal facilities become part of the determinants of the bus routing/servicing. Efficient operation means that bus runs frequently in the section of high passenger demand and runs low frequent in the section of low demand. However, some bus routes are composed of many kilometres of dead run due to the limited bus terminal facility. Also, the long bus route makes difficult to secure punctuality due to the uncertainty of traffic jam.

2) Further Improvement in Comfort for Bus Users

Bus stops should be located based on passenger demand and accessibility to public facilities such as schools, hospitals, temples and markets. However, due to strong objections by roadside building owners, the CBA faces difficulties to place bus stops at proper locations, which hinders bus users' accessibility to bus stops.

Most of sheltered bus stops are equipped with lighting facilities which at minimum improve the security of bus passengers. These sheltered bus stops are desired to be equipped with additional security tools such as a security camera to maximize the security of bus passengers. The worst cases are seen at stand-type bus stops where there are no proper lighting facilities and security tools.

3) Further Improvement in Spacing and Design of Bus Stop Facilities

Bus stops should be also located considering the impacts to traffic flow. However, due to limited availability of the spaces for bus stops, some bus stops are placed near intersections. The PPCA also encourages placing a number of sheltered bus stops which significantly improve comfortability for bus users. However, these sheltered bus stops are placed without considering spaces for pedestrians and sometimes hinder the flow of pedestrian traffic.

Most bus stops are placed with bus stop markings, however the illegal parking of vehicles and motorcycles is often seen at/near the bus stops. This significantly hinders the safety of the buses and accessibility by bus passengers.

The original bus stop design was not found to be user-friendly: The whole bus network and transfer bus stops were not seen. The bus line information with the bus stops are too detailed and not visible. The bus stop at glance cannot inform the bus line and direction (starting and ending terminals). The bus stop design was gradually improved but should be further improved reflecting users' needs.

The JICA PiBO Project has drafted Bus Stop and Facility Design Guide and bus-related infrastructure and facilities should be designed and planned/placed following this design guide.



Source: JICA PiBO

Figure 7.2.4 Bus Stop Design

4) Underutilised e-Payment System

The CBA launched e-Payment system: smart card by Wing in 2018 and QR-code payment system by Acleda in 2019 and all buses are equipped with these payment systems since then. However, less than 3% of bus passengers use those e-Payment systems before the suspension of bus operation. Fewer number of paid passengers, lack of awareness toward e-Payment system, fixed and lower rate of fare all contribute to lowering the usage of e-Payment system. And these e-Payment systems should be encouraged as part of prevention measures against COVID-19. PPCA also launched an application for City Bus in 2019. The application, which was developed by iTsumo Tec. (a subsidiary company of FIGIX Industry Co., Ltd.), provides the real-time bus location information and bus route network information for users. In addition, there is a plan to integrate other functions such as calling taxis, shopping online and booking bus tickets in the application, however, these functions are still at the demonstration phase.

(2) Paratransit

1) Lack of Terminal/Parking Facilities

The number of RHS users is becoming dominant among public transport passengers and accordingly, the number of registered RHS vehicles has been increasing rapidly. These increased number of RHS users and vehicles contributes to worsening the traffic congestion in Phnom Penh and integration of RHS with mass public transport mode is inevitable to reduce severity of urban traffic congestion.

Based on the result of travel speed of RHS, around 80% of all observations are less than 26 km/h. Many stop records were observed around Chaom Chau Market and Russei Keo Market, which suggests that it is more difficult for drivers to find passengers in suburbs. Most of the RHS vehicles are parked on the road since exclusive parking space for RHS vehicles are limited such as the front of shopping mall, which tends to hinder the traffic flow of both vehicles and pedestrians. Also, there is no proper transit facility to promote the modal transfer between City Bus as mass public transport and RHS.

2) Lack of Centralised and Integrated Information System

RHS companies provides a real-time location system of vehicles by each operator's application. These location system and data currently tend to be utilised only by the RHS passengers and companies and would benefit the public transport agency if fully utilised to monitor the demand and security of RHS passengers and to develop the evidence-based infrastructure and service planning. These data once integrated among different operators and other service providers such as the CBA could also benefit the public transport passengers to integrate the different payment systems, including issuance of discount codes.

3) Lack of Unified e-Payment System

Currently, each public transport service provider has its own payment system: Wing card and QR code by the CBA and credit card and top up charge by RHS companies. Integration of fare payment system may contribute to improving user friendliness to the public transport users and security and safety of the users to prevent from the contact of COVID-19 virus. Sometimes it may also result in increasing the number of public transport users if any fare reduction is introduced such as the monthly subscription payment.

(3) Other Public Transport Modes

1) Safety Issues in Commuter Truck / Motorumorque

Commuter trucks and motorumorques are used by factory workers and students for commuting in suburban areas. The fleets of these trucks and motorumorques tend to be very old and do not meet safety standard. Passengers basically travel by standing on the truck deck bed under the heat of the sun or in the rain. The cost of commuting by truck may be low but passenger safety and comfort are neglected.

2) Limited Service of Taxi Boats

Since three rivers, namely, the Mekong River, the Tonlé Sap River and the Bassac River run across the east side of Phnom Penh, the river crossing boats have been used for long time in Phnom Penh. Following the recommendation by the Minister of Public Works and Transport, DPWT developed piers and purchased 2 units of taxi boats and CBA currently operates these two taxi boats between Ta Khmau and Freedom Park. These taxi boats are expected to function as part of commuter transport mode, however, still collects very few passengers due to limited service frequency.

3) Lack of Terminal/ Parking Facilities for Taxi Boats

Although the service route of taxi boats running between Ta Khmau and Freedom Park meets the travel demand generated in southern Phnom Penh and has potential to increase the ridership, there is no proper terminal and parking facilities available to transfer the taxi boat to/from private car and public transport modes.

4) Dispersed Intercity Bus Terminal

Currently, each intercity bus operator has its own terminal and parking facility mostly located and scattered within the city centre. These intercity buses transport both passengers and small parcels and which always generates a number of trips sending/collecting them. Traffic congestion caused by large

parking buses can be frequently observed at the entrance/exit of the intercity bus terminal located in an area lined with narrow and busy streets in the CBD.

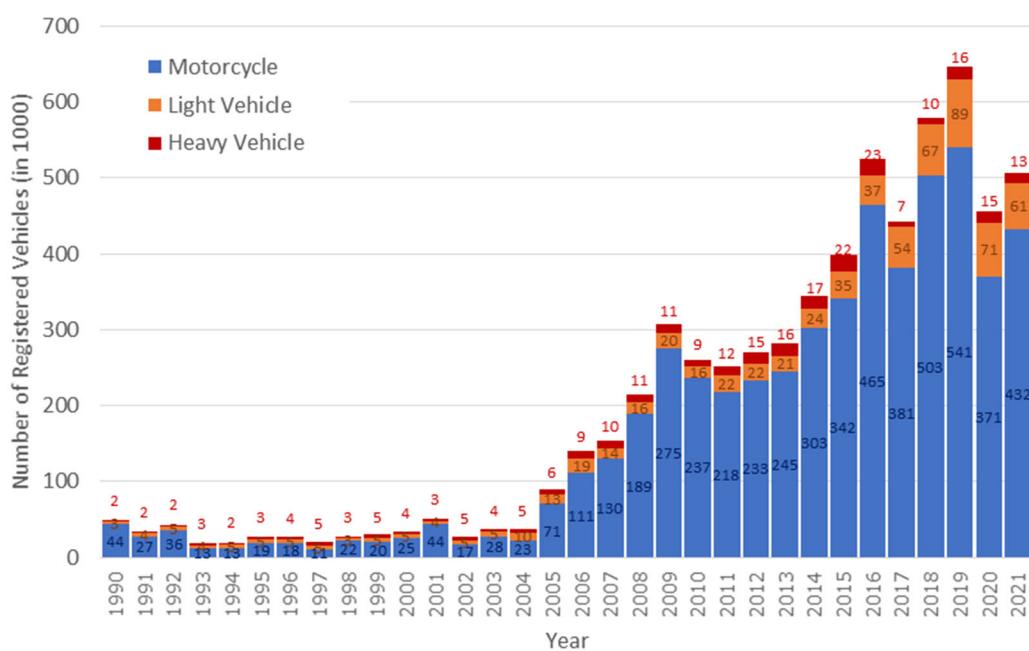
(4) Highway

1) Rapid Increase in Vehicle Ownership and Registered Vehicle

The number of newly registered vehicles in Phnom Penh, which was 282,137 in 2013, has almost doubled to 506,226 in 2021. After 2005, the increasing trend has continued for more than 15 years. Previously, it was possible for residents outside Phnom Penh to register vehicles in Phnom Penh. Since it was banned around 2020, the number of newly registered vehicle has slightly decreased. The breakdown of the number of newly registered vehicles in 2021 was 432,255 motorcycles (85.4%), 60,964 light vehicles (12.0%), and 13,007 heavy vehicles (2.6%).

To purchase a sedan car of 1000cc or less for USD 10,000 in Cambodia, required total amount is USD 17,852.5, namely USD 10,000 for vehicle, USD 3,500 for import tax, USD 2,700 for special duty, USD 1,620 for value added tax, USD 10 for registration tax, and USD 22.5 to obtain a driver's license. As for the operation and maintenance cost, USD 37.5 per year for road tax, USD 5 per year for vehicle inspection fee and fuel cost are required. In order to control the rapidly increasing number of vehicles, countermeasure such as increasing taxes on vehicle purchases and maintenance and allocating them to road development and maintenance costs are also conceivable.

In Cambodia, driver's license doesn't required for motorcycles of 125cc or less. Introduction of a license system for motorcycles of 125cc or less is required not only from the viewpoint of curbing the number of vehicles but also from the viewpoint of traffic safety.

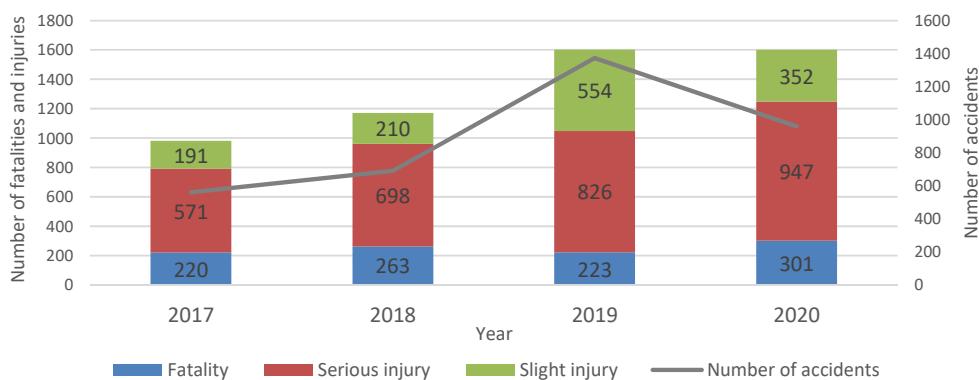


Source: JST based on MPWT

Figure 7.2.5 Number of Newly Registered Vehicles

2) Increase of the Number of Traffic Accidents

Figure 7.2.6 illustrates the transition of the number of traffic accidents, injuries and fatalities in Phnom Penh. According to the increase of registered vehicles, the injuries and fatalities are increasing year by year.



Source: Phnom Penh Municipality Traffic Police

Figure 7.2.6 Number of Traffic Accidents, Injuries and Fatalities

BOX 4 : Traffic Accident Spot Analysis

1. Overview of Traffic Accident Location Data

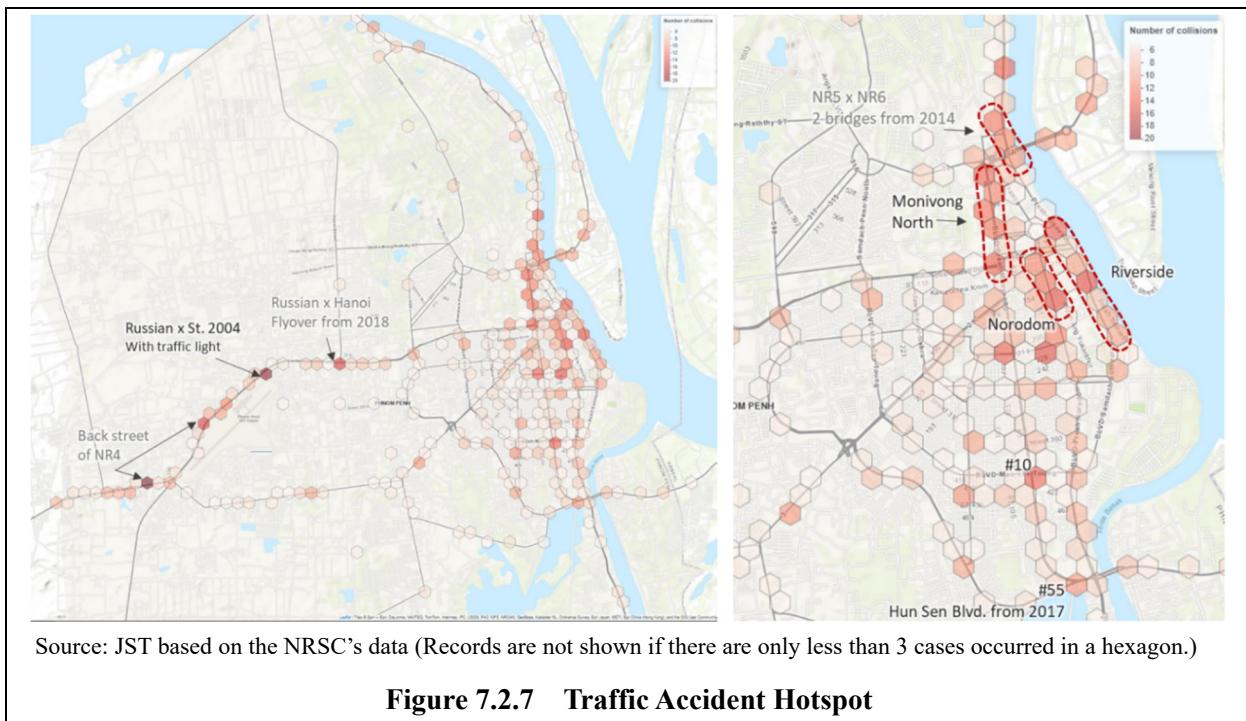
In 2005 to 2016, Traffic Police used to record the location information where traffic accident happened. Currently, the registration system is not functional and the most updated data was not available. Among the available data, 2,714 records with location information are illustrated in a heat map (See Figure 7.2.7).

The location information can be utilised for identifying hotspots even though the information is limited and more than 6 years old.

2. Result of Traffic Accident Spot Analysis

In Phnom Penh, traffic accidents are concentrated on Russian Blvd., Veng Sreng Blvd., NR-1, NR-4, NR-5 and NR-6. On these arterial roads, traffic accidents were identified at any sections not limited to major junctions. The intersection of Russian Blvd. And Hanoi Blvd. was transformed to a flyover in 2018, the current trend may be different. Traffic accidents is likely to decrease at the confluence point of a short cut from NR-4 and Russian Blvd. because of the completion of grade separation at Chaom Chau intersection. On the other hand, there is no plan of grade separation at the intersection between Russian Blvd. and Road 2004. Thus, high traffic accident risk still remains there.

Traffic accidents in CBD are concentrated particularly in the triangle of Chroy Changver Bridge, Central Station and Royal Palace. This area has heavily congested roads and a lot of pedestrians as well. In addition, at-grade intersections on major arterial roads were identified as hotspots.



3) Lagging Improvement of Road Infrastructure against Emerging Traffic Demand

As it is mentioned in the section 7.1, several projects proposed in PPUTMP are in progress. However, some of them are still incomplete due to the lack of budget and land acquisition issues. Considering the above-mentioned increasing number of vehicles, further road development is required. On the other hand, it should be noted the improving highway network further encourages a car oriented culture as well in the future.

(5) Traffic Management

1) Limited Signalized Intersections and Unsignalized Intersection

Among the 115 signalized intersections, there are 109 signalized intersections connected to the Traffic Control Centre (TCC). There are also signalized intersections not connected to the TCC in the large-scale private developments and outside St.271 (Inner Ring Road) in Phnom Penh. Those unconnected signalized intersections were developed by DPTW based on the request from private developers. There are 55 unconnected signalized intersections in Phnom Penh as of the end of 2021. Those are mainly located in suburban area. In addition, there are non-signalized intersections with heavy traffic in the CBD, especially at the intersection between major thoroughfares/small roads. There is a need to increase signalized intersections and expand the covered area of TCC.

2) Deterioration of Traffic Signal Facilities

After the Grant Aid Project, OFC (Optical Fibre Cable) related accidents (disconnection due to OFC accidents, and traffic police disconnect not only the power supply but also the OFC network due to VIP passage) accounted for 40% of all troubles. There were many accidents since the OFC of the traffic control system was mixed with other messy fictitious wiring such as communication cables and thus were accidentally disconnected.

Since more than 3 years have passed after the Grand Aid Project, deterioration has been observed on facilities and equipment such as the uninterruptible power supply (UPS). The fire extinguishing equipment and the power generation equipment which is installed in the dedicated building on the north side of the PPCA Building were installed in the Grant Aid Project. That equipment is not regularly maintained.

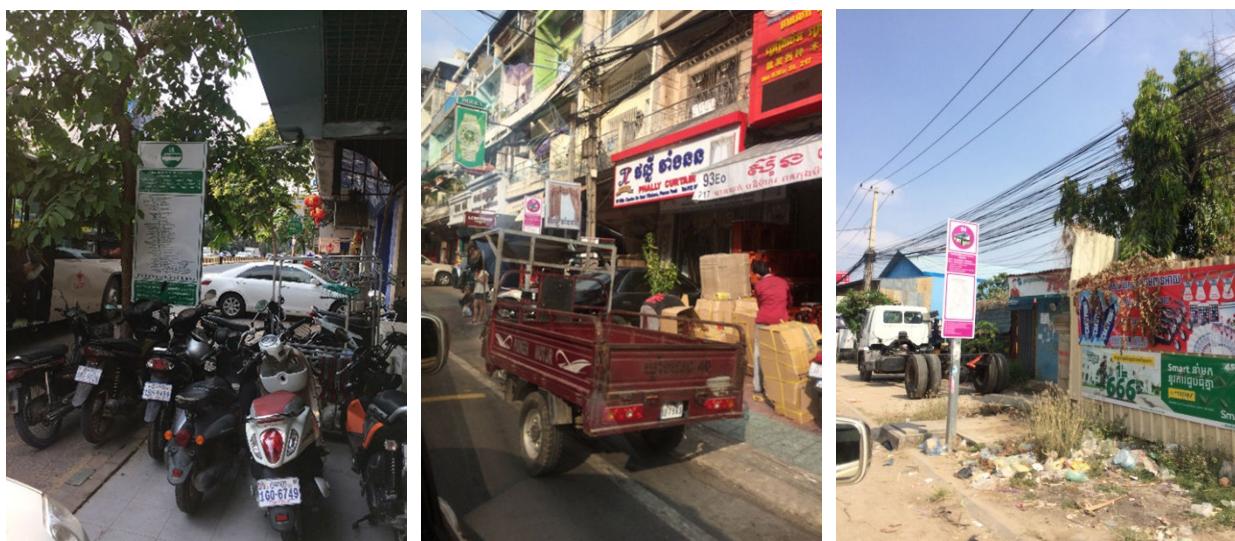
Similarly, five years have passed since the server, which is the basis of the traffic control system, was installed when the Grant Aid Project started. Renewal of the server is required. However, it is expensive to replace the software and countermeasures should be considered.

3) Uncontrolled On-street Parking and Limited Off-street Parking Facilities

Many private vehicles are parked on the street. Traffic police is responsible for crackdown. However, the illegal parking has been overlooked for many years in Cambodia. Based on the result of parking condition survey in CBD, parking occupancy ratio in peak hour was 125%, parking capacity was 7,134 PCU and parking demand was 5,705 PCU. There are not enough parking facilities. PPCA is trying to install off-street underground parking facilities in CBD area. On the other hand, illegal parking ratio was 86% based on the parking condition survey. It is necessary to strengthen crackdowns on illegal parking, even parking facilities are constructed in future.

4) Further Improvement of Pedestrian Environment

The radiant roads that form the main structure of Phnom Penh and the grid roads in the CBD were formed during the French colonial era. Sufficient width of sidewalk is secured and it forms a beautiful cityscape together with some colonial-style buildings that still remain. However, the large sidewalk space is mainly occupied privately as a parking space. In addition, many narrow streets in the suburbs have no sidewalks, or the sidewalks and shoulders are unpaved. Therefore, pedestrians are forced to walk on the road. Safe and comfortable pedestrian environment isn't secured.

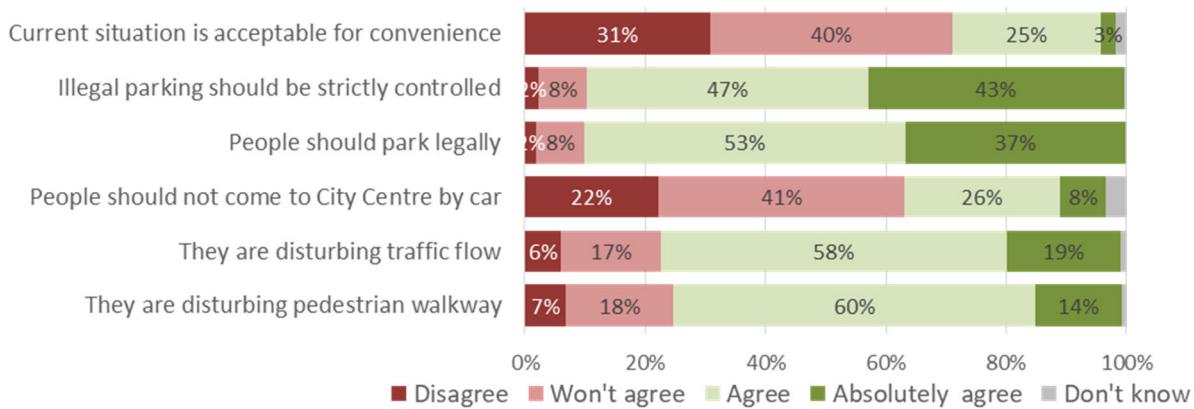


Source: JST

Figure 7.2.8 Privatised Sidewalk and Unwalkable Pedestrian Walkway

Figure 7.2.9 illustrates the opinions on roadside parking collected in the Passenger Interview Survey. 71 % of respondents answered current situation is not acceptable for convenience. There are many users

wish for crackdowns and further improvements. As “Secured from traffic accidents” is raised as a major reason for using RHS, pedestrians are forced to walk on roads since sidewalks are occupied by parked vehicles and kiosks. Improving the pedestrian’s environment is vital for promoting public transport use to improve access to a bus stop.



Source: Passenger Interview Survey (JST)

Figure 7.2.9 Opinions on Roadside Parking

5) Efficient Use of Existing Road Facility

The road spaces in Phnom Penh tend to be occupied by on-street parking, on-street stopping cars/trucks, RHS vehicles waiting for passengers, Kiosks and so forth. Compared with other cities in surrounding countries, the width of major roads is relatively wide in Phnom Penh due to the historical urban development. Therefore, the road capacity will increase if illegal parking and occupancies are excluded.

6) Driver Education and Traffic Enforcement

Disregarding traffic rules and traffic lights/road markings is a long-time habit of Phnom Penh citizens and the amendment to the Road Traffic Law in 2016 that a driver's licence is not required to drive a motorcycle under 125cc has made the situation worse and increased traffic accidents in Phnom Penh.

7) Others

Second-hand cars are sold along a busy carriageway/sidewalk in the CBD reducing traffic capacity.

There is no organisation that manages urban transport as a whole. For example, roads, traffic lights and part of traffic management measures such as one-way system and traffic safety are under DPWT. Although one-way system was introduced on some streets already, new introduction of one-way system is not progressing due to the inadequate organisation structure of DPWT. On the other hand, City Bus operation and parking measures are directly managed by PPCA.

In addition, the legal system that covers the entire urban transport is not sufficient; for example, positioning of paratransit in the road related law.

On the other hand, telework started in Phnom Penh with the COVID-19 pandemic; however, it is unclear whether telework, which is one of the effective traffic demand management measures, will take root as a new work style.

7.2.4 Issues in Urban Transport Service

There are three important indicators to measure the service level of public transport, "population coverage along routes", "transport capacity", and "operating speed". In this section, these 3 indicators are quantitatively evaluated for the current 13 City Bus routes.

(1) City Bus

1) Function of Bus Route

City Bus has been gradually expanded from 3 routes in 2016 to 8 routes and 13 routes by 2018 in line with the provision of Chinese Buses in 2017 and Japanese Buses in 2018, following the 10 bus routes recommended by the PPUTMP. When planning the operation of City Bus, the CBA takes into consideration passenger demand, roadside development status, and transfer between buses, and defines Trunk Line (Line 1A, 2, 3, 4A / B, 9), Feeder Line (Line 4C, 5, 6, 7, 8 and 10), Regional Line (Line 1B and 11), and Circular Line (Line 12 and 13), sets the operation frequency required for each function, formulates an operation plan, and assigns 181 buses into 13 routes.

The number of passengers on the Trunk Line, Feeder Line, and Regional Line was steadily increasing, with an average of 10 passengers per operation on the Trunk Line, an average of 5 passengers on the Feeder Line, and an average of 3 passengers on the Reginal Line. On the other hand, the number of passengers of the Circular Line has not reached the expected number due to the expansion of the RHS services such as PassApp, and the average number of passengers of the Circular Line is less than two passengers per operation.

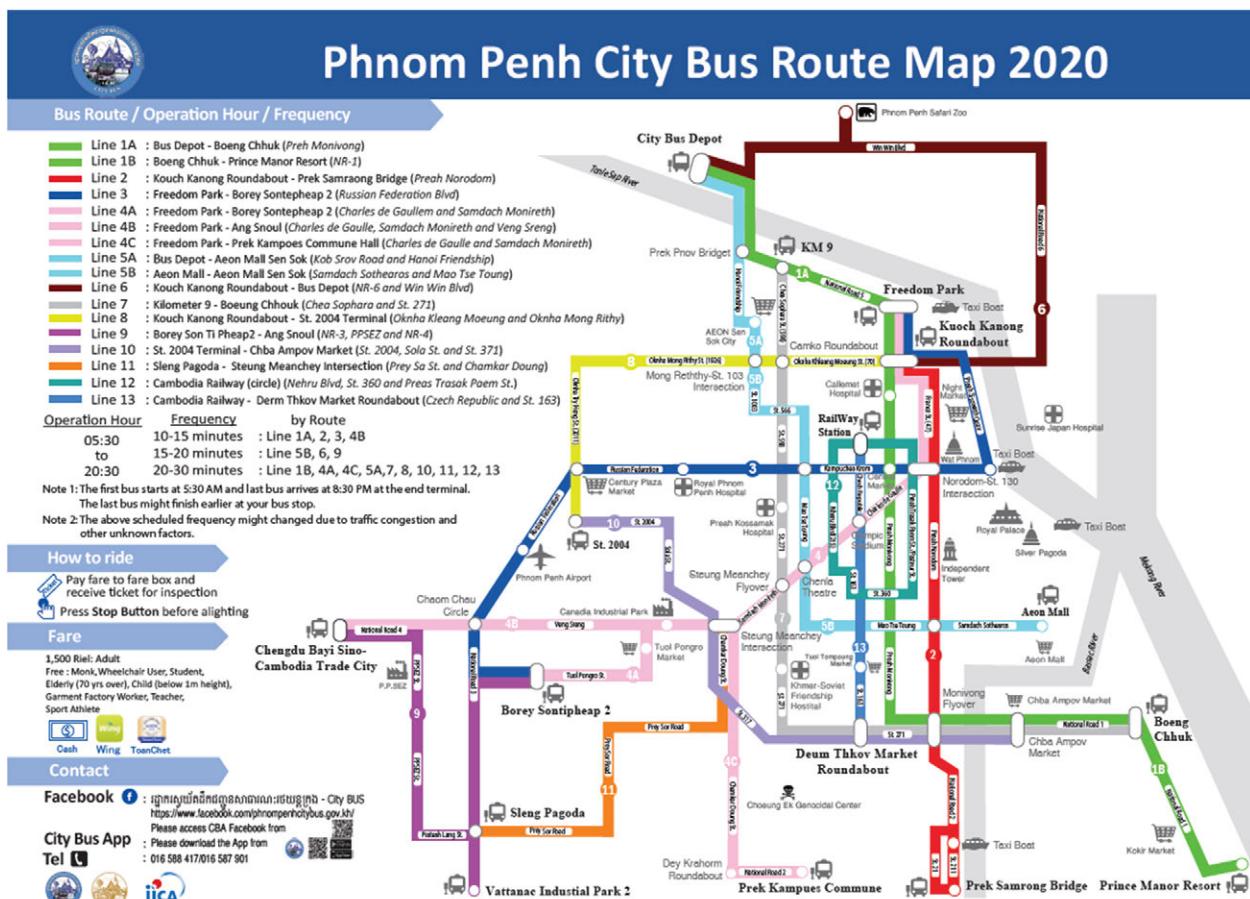
In addition, as the development of urban railway is delayed, ADB is considering to support the development of Bus Lanes along the Truck Lines to replace urban railways as the intermediate measure.

Currently, due to the influence of the new coronavirus, the City Bus service is limited to 4 Lines and 5 routes (1A, 2, 3, 4A / B), but in the short term when expanding the service routes in the post Corona, it is necessary to reorganize bus routes to meet passenger demand, and in the medium term, it is necessary to reorganize routes in line with the development of Bus Lanes and urban railway development, and to assign the number of required bus fleets.

2) Missed Trips caused by Breakdown and Traffic Congestion

The City Bus operation was suspended due to the COVID-19 pandemic in March 2020. However, the operation resumed on 4 routes (5 lines) with 60 buses on 2nd November 2021. Figure 7.2.10 shows the latest bus route map and frequency of operation as of February 2020. Lines 1A, 2, 3 and 4B, which have the largest number of passengers, operate every 10 to 15 minutes, Lines 5B, 6 and 9 operate every 15 to 20 minutes, and the other routes operate every 20 to 30 minutes. However, the actual operation lags behind these pre-set frequencies.

Lines 1A, 2, 3 and 4A/B, which resumed their operation in November 2021, operate every 15 to 20 minutes currently.



Source: Phnom Penh City Bus

Figure 7.2.10 Operation Frequency of City Bus

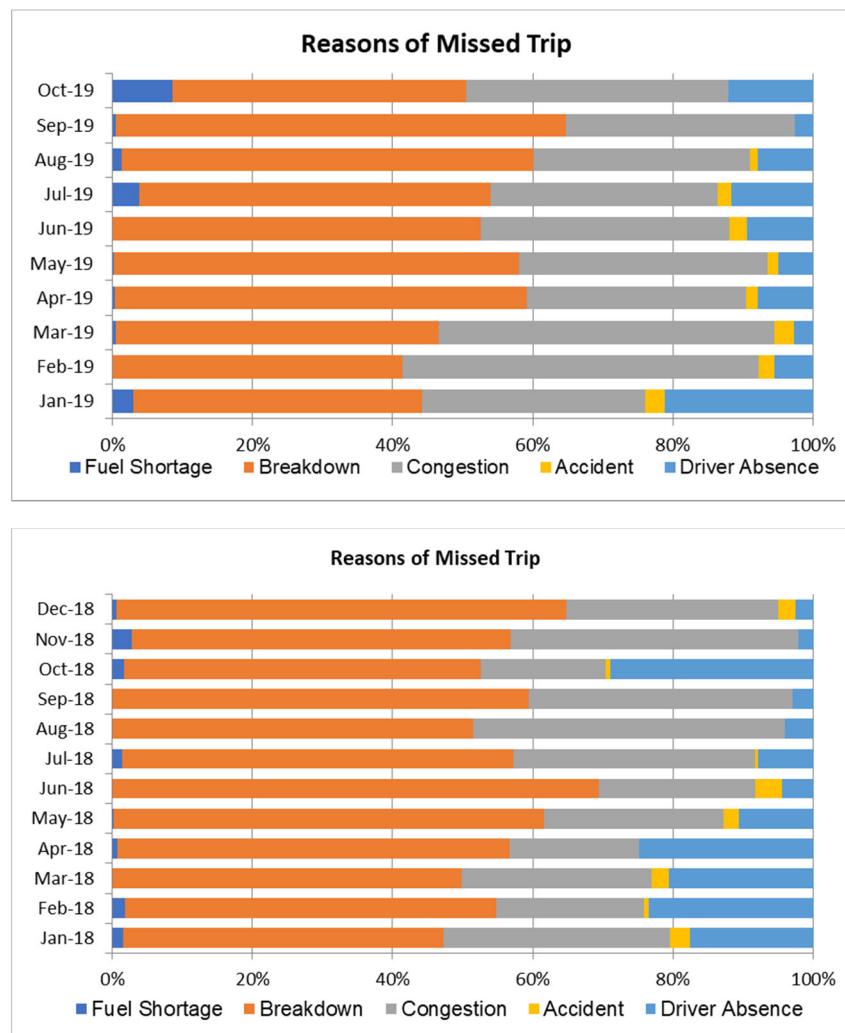
The PiBO Project regularly updates the service level of the City Bus. In 2018, the average percentage of missed trip (Actual number of missed bus trips against planned trips) was recorded at 14.8%, however it worsened by reaching 30.0% on the average in 2019. The PiBO Project also records the reasons of these missed trips: half of missed trips are caused by the urgent breakdown/repair work of the bus fleets and another half of the missed trips are caused by traffic congestion. These urgent breakdown/repair works consist of 1) failure due to clutch wearing, 2) brake failure and 3) painting/sheet metal repair due to small-scale accidents.

Table 7.2.1 Bus Service Level (2018-2019)

Month	Operation								
	No. of Route	Bus Fleet	Expected Trip	Actual Trip	Missed Trip	Bus km per day	Bus km per month	Operation Speed	
	(route)	(veh.)	(round-trip/day)	(round-trip/day)	(%)	(km)	(km)	(km/h)	
Jan-19	13	233	839	652.5	22.2%	25,272	758,163	13.7	
Feb-19	13	233	870	675.0	22.4%	25,681	770,418	13.7	
Mar-19	13	235	889	672.5	24.3%	25,907	777,198	13.8	
Apr-19	13	235	853	604.5	29.1%	23,167	695,001	13.7	
May-19	13	235	902	626.0	30.6%	23,849	715,464	13.0	
Jun-19	13	235	878	605.5	31.0%	22,878	686,337	13.3	
Jul-19	13	235	860	573.5	33.3%	21,961	658,839	12.0	
Aug-19	13	233	865	524.0	39.4%	19,750	592,488	10.8	
Sep-19	13	235	867	519.0	40.1%	20,033	600,993	11.2	
Oct-19	13	190	717	452.0	37.0%	16,644	499,326	11.9	
Nov-19	13	181	644	482.4	28.0%	17,243	517,293	14.6	
Dec-19	13	181	664	500.5	24.6%	18,804	564,123	15.5	
Total in 2019	13	181	820	574	30.0%	21,766	7,835,643	13.1	

Month	Operation								
	No. of Route	Bus Fleet	Expected Trip	Actual Trip	Missed Trip	Bus km per day	Bus km per month	Operation Speed	
	(route)	(veh.)	(round-trip/day)	(round-trip/day)	(%)	(km)	(km)	(km/h)	
Jan-18	8	155	546	494.5	9.3%	18,235	547,050	14.2	
Feb-18	8	155	568	509.0	10.4%	18,818	564,549	14.2	
Mar-18	8	155	570	512.5	10.1%	18,928	567,828	14.0	
Apr-18	8	155	556	501.5	9.7%	18,678	560,334	15.0	
May-18	8	154	545	506.5	7.1%	18,749	562,470	14.1	
Jun-18	8	155	549	488.0	11.0%	18,102	543,072	14.2	
Jul-18	8	155	557	487.0	12.6%	18,344	550,320	15.0	
Aug-18	8	155	592	517.0	12.7%	19,426	582,768	14.1	
Sep-18	8	155	572	471.0	17.7%	17,703	531,102	13.5	
Oct-18	13	196	740	553.0	25.2%	21,498	644,940	13.8	
Nov-18	13	213	755	599.5	20.5%	22,966	688,977	13.3	
Dec-18	13	216	777	604.5	22.2%	23,377	701,307	13.7	
Total in 2018			610	520	14.8%	19,569	7044717	14.1	

Source: JICA PiBO



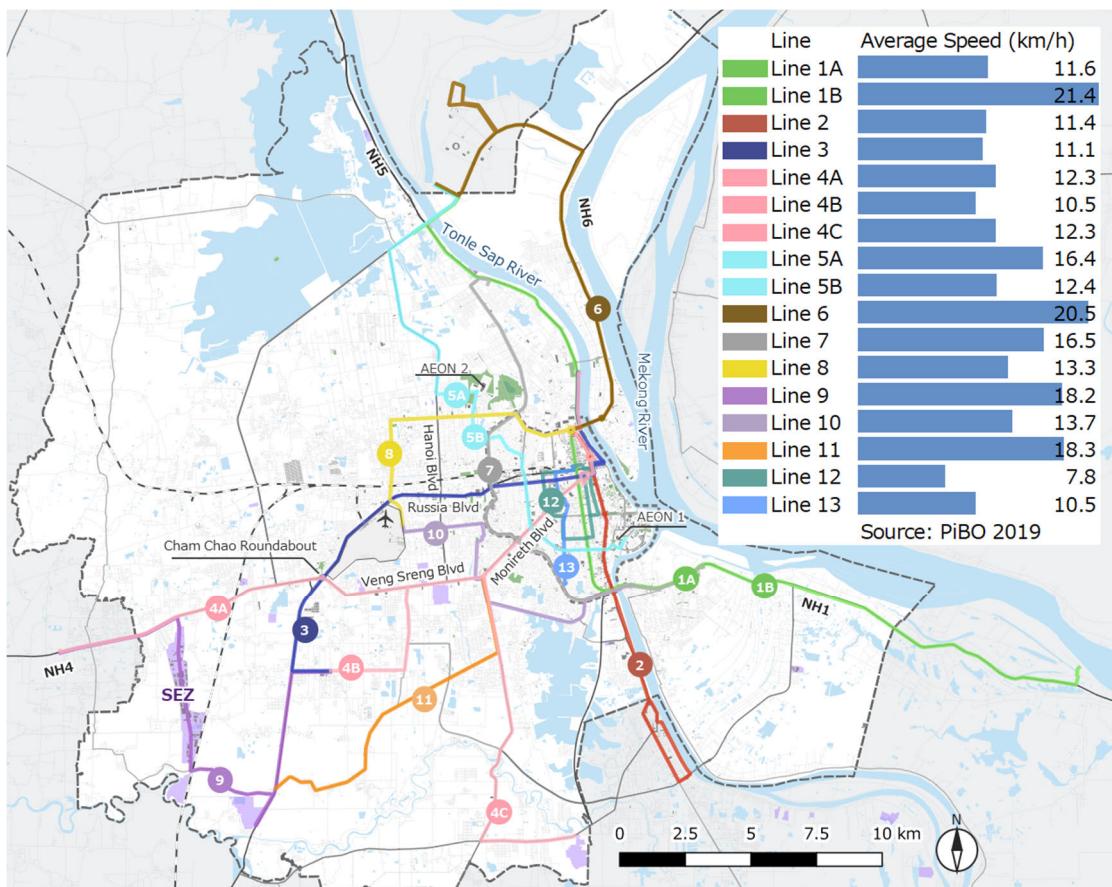
Source: JICA PiBO

Figure 7.2.11 Reason of Missed Trip (2018-2019)

3) Lower and Unstable Operation Speed

The average operating speed of 13 City Bus routes was measured by the PiBO Project in 2019 as shown in Figure 7.2.12. The operating speed of the circular line inside CBD (Lines 12 and 13) was about 8~10 km/h, and that of Lines 1 to 4, connecting the CBD to the suburbs, was about 10~12 km/h. This low speed operation is mainly caused by traffic congestion and more severe slowdown was observed in morning and evening peak hours.

On the other hand, the 4 lines (Line 1 to 4) plying on the major corridors, which resumed the operation on 2nd November 2021, marked the operation speed of 16.9 km/h in November and December 2021 during the COVID-19's pandemic. Figure 7.2.13 shows the travel speed of city bus, line 4A, in April 2022. This implies that the travel speed of bus are delayed due to traffic congestion.



Source: JST based on the analysis made by PiBO

Figure 7.2.12 Operating Speed of City Bus in 2019



Note: Records of which travel speed is higher than 100km/h were omitted as errors.

Source: JST

Source: JST draws the map with the GPS record of city bus provided by CBA

Figure 7.2.13 Operating Speed of City Bus (4A)

4) Low Bus Service Coverage

Figure 7.2.14 shows the results of overlaying the 500 m, 1,000 m, and 1,500 m buffers of 13 City Bus routes on the registered population density map by commune (2018). The bus routes are concentrated in populated areas, especially in CBD, where the most of the area is covered by the 500 m buffer.

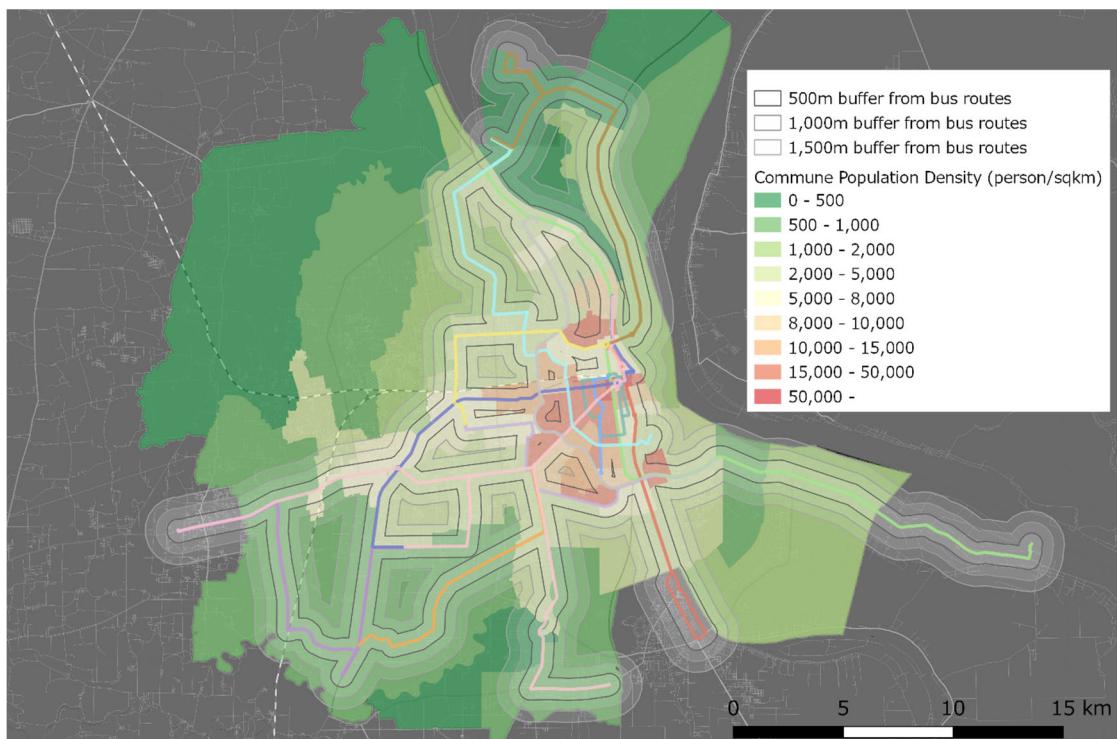
Table 7.2.2 shows the area and population contained in the 500 m, 1,000 m, 1,500 m buffer and the ratio to the area and population of Phnom Penh city. On an area basis, the coverage rate of the 13 City Bus routes is only 26% in 500 m, 44% in 1,000 m, and 55% in 1,500 m buffer areas, but on a population basis, the coverage rate is 57% in 500 m, 77% in 1,000 m and 84% in 1,500 m buffer areas.

The actual practice proves the frequent bus users are still limited to those within 500 m walking distance from the bus stops and therefore the improvement of access and egress environment is a key to increase the coverage area of the bus service and the ridership of the City Bus.

Table 7.2.2 Area and Population inside the City Bus Coverage Area

	Total	500m	1,000m	1,500m
Area (sqkm)	692	181	302	380
Area %	100%	26%	44%	55%
Population	1,495,379	845,392	1,144,497	1,259,468
Population %	100%	57%	77%	84%

Source: JST



Source: JST

Figure 7.2.14 City Bus Coverage Area

(2) Highway

1) Increased Traffic Demand and Lowered Travel Speed

As shown in Figure 5.3.14 and Figure 5.3.34 in Chapter 5, average travel speed on the major roads has been decreased in inverse proportion to the traffic volume except for the roads where flyover was constructed, Russian Blvd. It means the increasing of vehicle traffic demand has exceeded the highway capacity improvement.

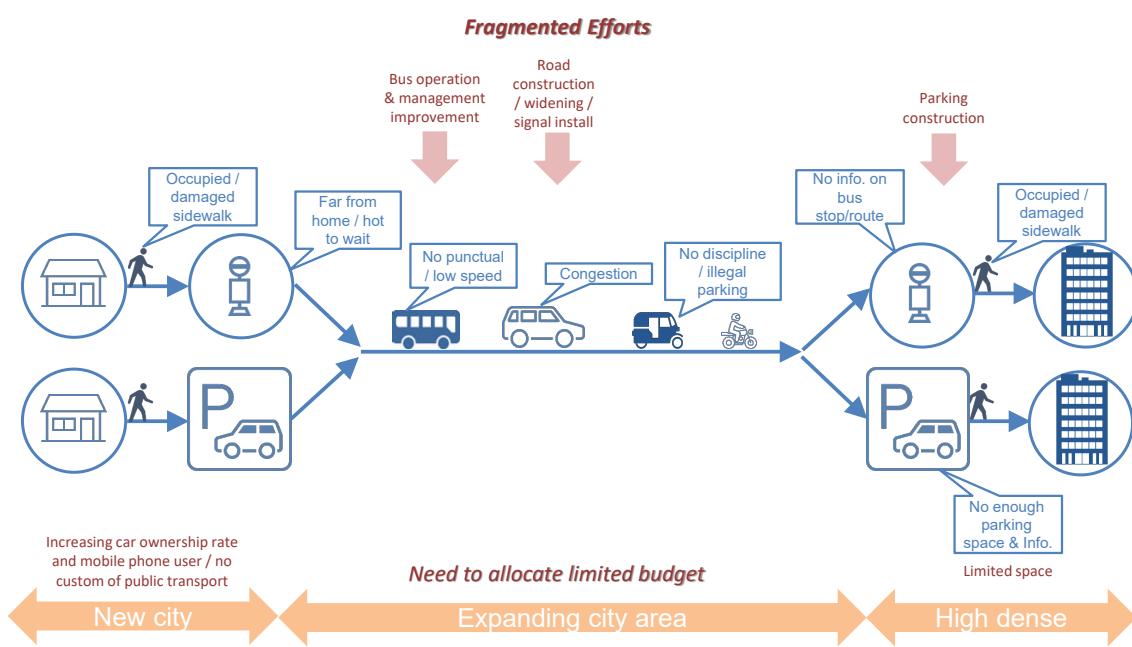
7.3 Issues in Urban Transport Sector and Causal Relationship Analysis

7.3.1 Fragmented Efforts to Improve Urban Transport Sectors

To improve the urban transport in Phnom Penh, several efforts such as urban road development and widening, traffic signal instalment, City Bus operation, etc. have been made based on PPUTMP. However, those efforts are fragmented and not effective to change the behaviour of citizens, namely shifting from private vehicle users to public transport users.

For instance, the City Bus service has been provided. However, it has low punctuality and access route for bus stops are not secured. Also, illegal on-street parking is a social problem since the parking demand is beyond the supply of parking facilities and traffic police doesn't crackdown on illegal parking. Even though several roads are developed, the impact is limited. Although RHS improves the convenience of users, it also has a negative impact on non-RHS users, such as reduced road traffic safety and induction of traffic congestion.

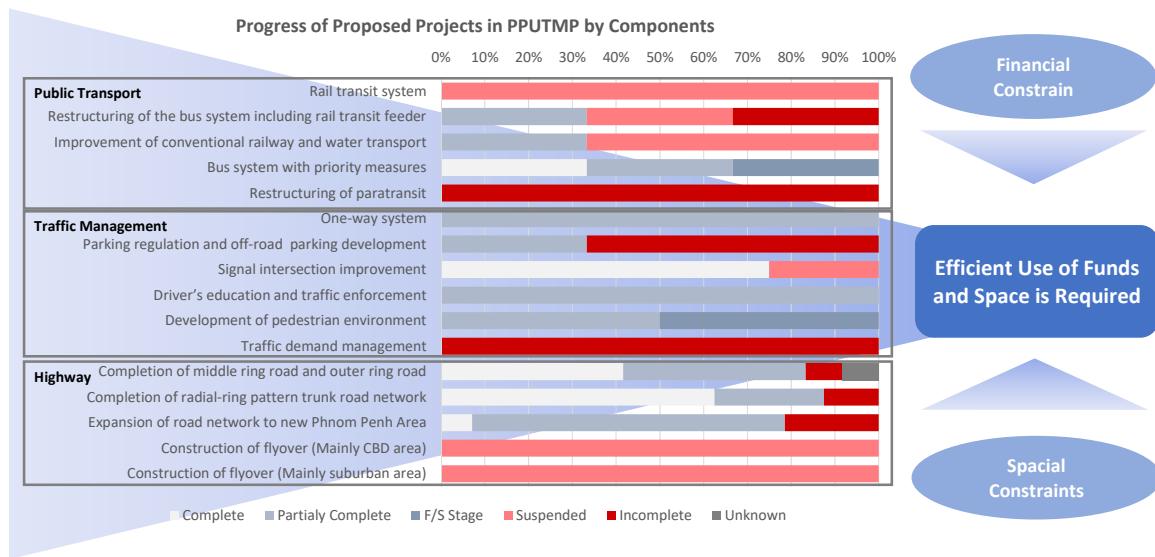
In order to bring a behaviour change to Phnom Penh citizens, it is necessary to stand from the user's point of view, effectively connecting fragmented efforts, and securing a series of comfortable means of transport and space from origin to destination.



Source: JST

Figure 7.3.1 Past Efforts to Improve Urban Transport and Emerging Issues

As shown in 6.1, some projects proposed in PPUTMP, which required large-scale investment and relocation, such as urban railway development and flyover construction in the CBD area, have not been implemented due to financial and social environment constraints. Regarding traffic management measures, although the signalized intersections project was implemented, the progress of traffic management measures that promote public transport, such as sidewalk improvement, traffic demand management and one-way systems is limited. In the future, it will be necessary to make maximum use of existing infrastructure, facilities and space without large-scale investment or large-scale relocation and to improve urban transport by combining appropriate traffic management measures.

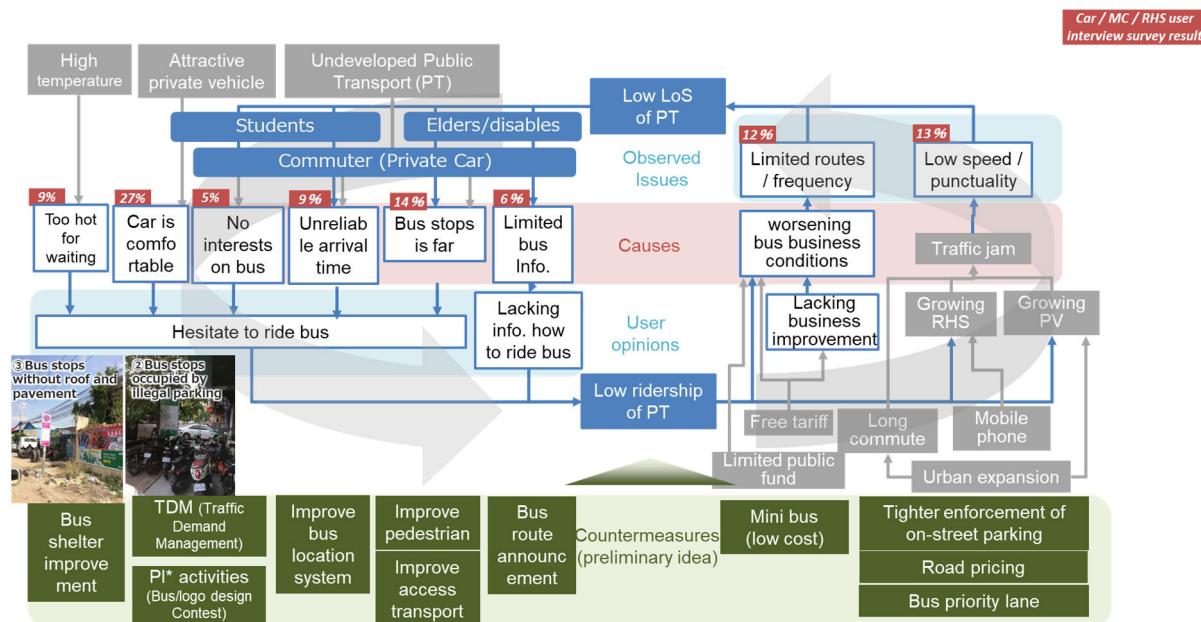


Source: JST

Figure 7.3.2 Progress of Projects Proposed in PPUTMP and Future Direction of Urban Transport Improvement

7.3.2 Causal Relationship Analysis on Issues to Promote Public Transport

The Survey particularly focuses on the causes of the stagnation of public transport use expansion, which is one of the goals of PPUTMP. The following figure illustrates the issues and countermeasures that were identified in the Survey.



Note: PI (Public Involvement)

Source: JST

Figure 7.3.3 Issues for Achieving Goals of PPUTMP and Causal Relationship

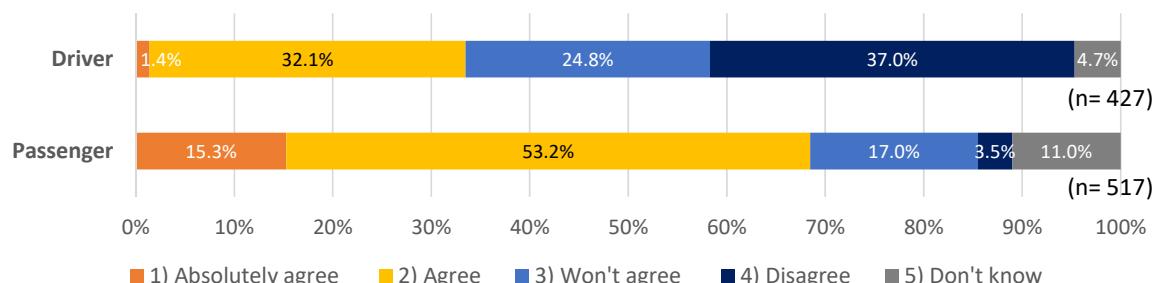
Regarding the City Bus, which plays a major role in public transport in Phnom Penh, the major reasons why car, motorcycle and RHS users do not use the City Bus are “Car is comfortable”, “Bus stop far from

origin/destination”, “Slow speed of bus” and “Bus routes are limited” according to the Passenger Interview Survey conducted by JST as shown in Figure 5.3.24 in Chapter 5.

For improving access to a bus stop, shortening “psychological distance” by improving the environment of pedestrian walkways will be effective as well as shortening “physical distance” by changing the bus stops intervals and expanding the bus network. Furthermore, it is also possible to maximize the coverage of a bus stop by assigning a feeder role for City Bus to RHS and building transfer points between RHS and City Bus.

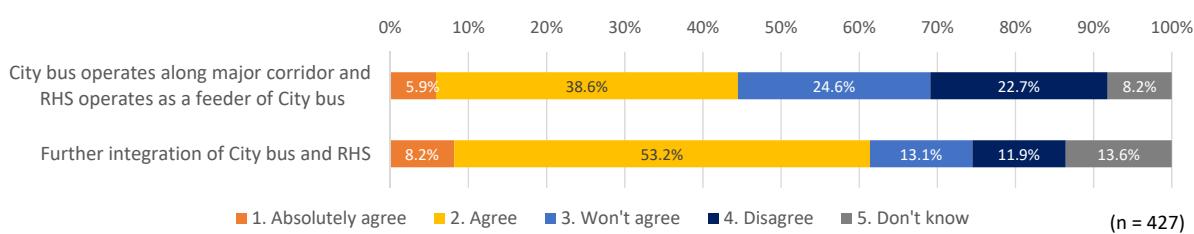
The cause of the issue of “Slow speed of bus” lies in traffic congestion triggered by the increase of private vehicles and RHS vehicles. In order to deal with this issue, the “No Entry Policy” for RHS vehicles on arterial roads and dividing roles of City Bus and RHS clearly in the Urban Transport sector are considered to be effective. Opinions on these policies were collected in the RHS Driver Interview Survey and RHS User Interview Survey.

68.5% of RHS users support the “No Entry Policy” for RHS vehicles on arterial roads while more than 50% of RHS drivers are against it as shown in Figure 7.3.4. Although the relatively large proportion of RHS drivers support the further integration of the City Bus and RHS, there are many drivers who do not support the policy that City Bus is operated along major corridors while RHS is operated as a feeder of the City Bus (Figure 7.3.5). These survey results suggest that it is required to encourage the public transport use thoroughly by realizing the seamless transit between the City Bus and RHS so that the revenue of RHS drivers will not be impaired.



Source: RHS Driver Interview Survey, RHS User Interview Survey (JST)

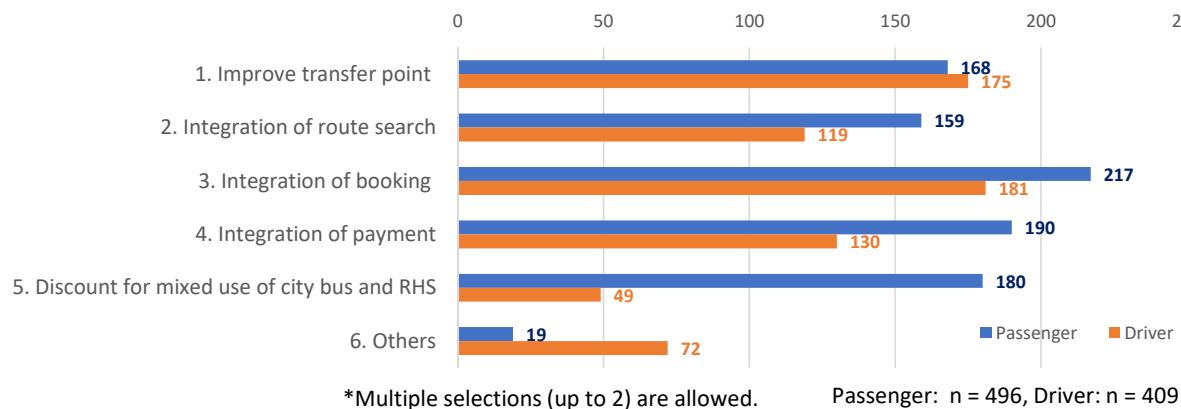
Figure 7.3.4 Opinion on “No Entry Policy” for RHS Vehicles to Arterial Roads (RHS Drivers and RHS Users)



Source: RHS Driver Interview Survey (JST)

Figure 7.3.5 Opinion on Integration of City Bus and RHS (RHS Drivers)

Both RHS drivers and RHS users seek the integration of booking as an item required for the integration of City Bus and RHS. Furthermore, RHS drivers expect improvements of transfer points while RHS users expect the integration of payment and a discount for mixed use of City Bus and RHS.



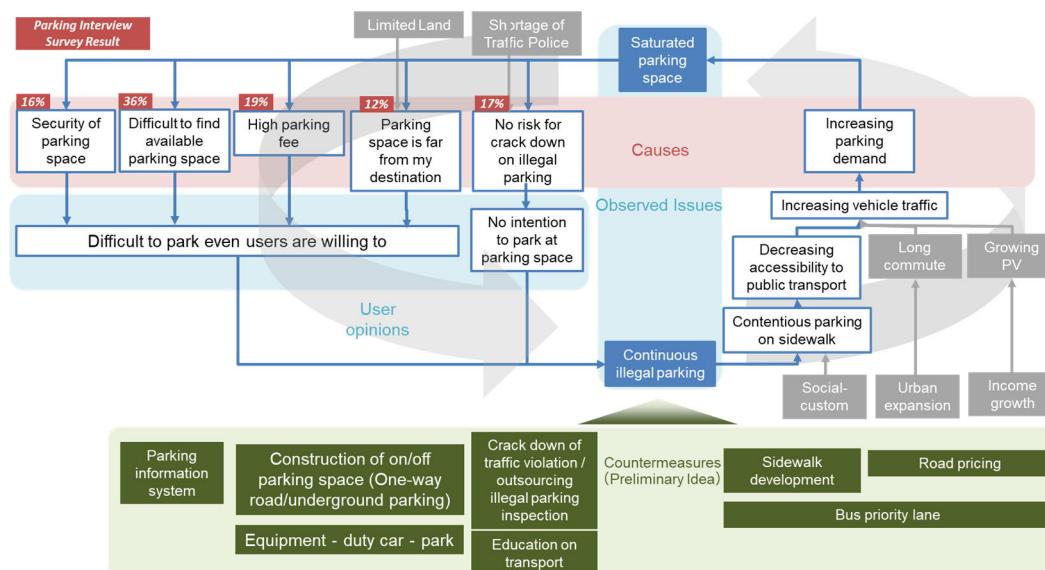
Source: RHS Driver Interview Survey, RHS User Interview Survey (JST)

Figure 7.3.6 Important Items for Integration of City Bus and RHS (RHS Drivers and RHS Users)

7.3.3 Causal Relationship Analysis on On-street Parking Issues

Illegal parking on the sidewalk is one of the reasons why the access environment to the bus stops is not secured. The figure below shows the results of a causal relationship analysis on illegal parking based on the results of a parking condition survey and countermeasures to improve.

As the reason for not parking in the parking lot, 36% of the respondents answered the difficulty in finding an available parking space, followed by 19% of the respondents who answered the issue of parking fees, 17% of the respondents who assume there is no risk of crack down and 12 % of respondents who said that there was no parking lot near the destination. In addition to the issue of parking capacity, it is also necessary to provide parking information. Considering budgetary and land constraint, it is effective to provide parking information since it makes the best use of existing parking facilities.

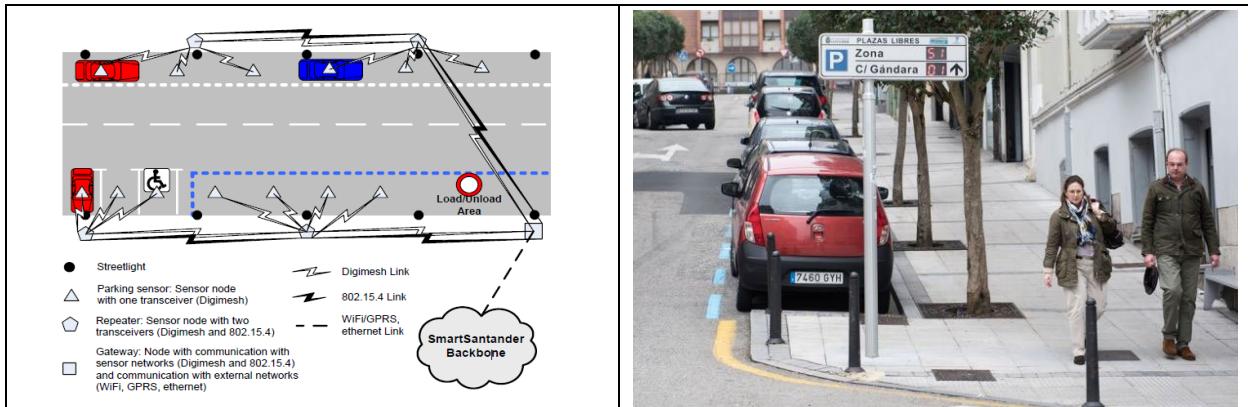


Source: JST

Figure 7.3.7 Causal Relationship on On-street Parking Issues

BOX 5: Smart Parking System in Santander, Spain

A smart parking system installed in a roadside parking space in the city of Santander. A magnetic sensor is embedded in the road surface to collect information on the presence or absence of parking. It is displayed for the driver on the information panel provided on the road. The upper part of the panel shows the entire parking zone, and the lower part shows the availability information of the road to go.



Source: Smart Sandar <https://www.smartsantander.eu/>