

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)**

**MUNICIPALITY OF PHNOM PENH  
THE KINGDOM OF CAMBODIA**

**THE STUDY  
ON  
THE TRANSPORT MASTER PLAN  
OF  
THE PHNOM PENH METROPOLITAN AREA  
IN  
THE KINGDOM OF CAMBODIA**

**FINAL REPORT**

**VOLUME I**

**EXECUTIVE SUMMARY**

**NOVEMBER 2001**

**KATAHIRA & ENGINEERS INTERNATIONAL**

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US\$1.0 = 3,900 riels  
(June 2001)

## PREFACE

In response to a request from the Government of the Kingdom of Cambodia, the Government of Japan decided to conduct a Study on the Transport Master Plan of the Phnom Penh Metropolitan Area and entrusted the study to Japan International Cooperation Agency (JICA).

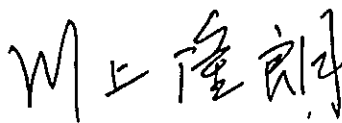
JICA selected and dispatched a study team headed by Mr. Tsuneo Bekki of Katahira & Engineers International four times between April 2000 and October 2001. In addition, JICA set up an advisory committee headed by Dr. Tetsuo Yai, Professor, Tokyo Institute of Technology between April 2000 and November 2001 which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of Cambodia and conducted field surveys in the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Cambodia for their close cooperation extended to the study.

November 2001

Handwritten signature in black ink, consisting of stylized Japanese characters: 川上隆明 (Kawakami Takao).

Takao Kawakami  
President  
Japan International Cooperation Agency

November 2001

Mr. Takao Kawakami  
President  
Japan International cooperation Agency  
Tokyo, Japan

Dear Mr. Kawakami,

### Letter of Transmittal

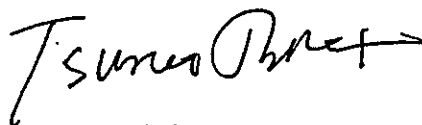
We are pleased to submit to you the report of The Study on Transport Master Plan of The Phnom Penh Metropolitan Area in the Kingdom of Cambodia. The report includes the advice and suggestions of the authorities concerned of the Government of Japan and your Agency. Also included are comments made by the Municipality of Phnom Penh and the authorities concerned of the Royal Government of Cambodia.

This report analyses the present and future demand and conditions of transport in the Phnom Penh Metropolitan Area. It comprehensively covers the issues of transport including road, public transport, traffic management, institution, legislation and financing as well as environment. The report proposes an integrated transport plan to year 2015, including the Short Term Plan for urgent projects to be implemented in years 2001 – 2006. The outcome of the Study concludes that the plans are technically, economically, environmentally and socially feasible and contribute to the development of the Phnom Penh Metropolitan Area.

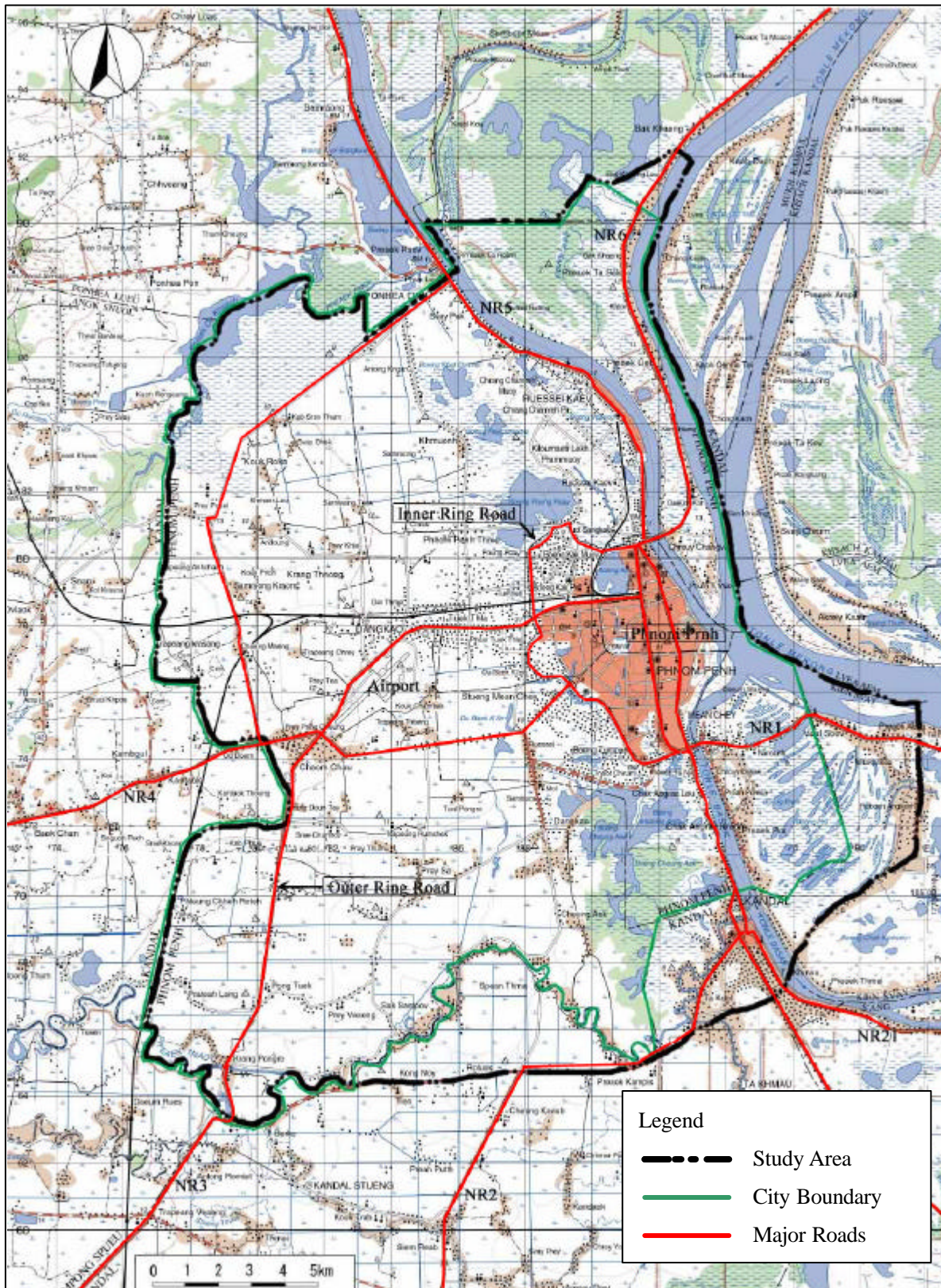
In view of the urgency of development of transport facilities in the Phnom Penh Metropolitan area and socioeconomic development of the Kingdom of Cambodia, we recommend that the Royal Government of Cambodia implement the Projects with top priority.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Land, Infrastructure and Transport. We also wish to express our deep gratitude to the Municipality of Phnom Penh and other authorities concerned of the Royal Government of Cambodia for the close cooperation and assistance extended to us during our course of the Study.

Very truly yours



Tsuneo Bekki  
Team Leader  
The Study on the Transport Master Plan of  
The Phnom Penh Metropolitan Area in  
The Kingdom of Cambodia



Location Map

## SUMMARY

### TRANSPORT MASTER PLAN

#### (1) Background

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

#### (2) Objectives

1. To formulate an Urban Transport Master Plan in order to solve various transport problems and to support sustainable urban development;
2. To conduct Feasibility Studies for priority projects;
3. To carry out technology transfer.

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

#### (3) Master Plan Components and Project Cost

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

To implement the required projects and measures, the institution and human capacity development is in urgent need. The project costs are also listed in view of implementation on the required projects and measures.

#### (4) Master Plan Evaluation

##### Traffic System Performance

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

Comparison of "With Plan" and "Without Plan"

Year	Increase in Average Speed	Decrease in Traffic Cost
2005	1.13	0.76
2010	1.28	0.73
2015	1.47	0.70

##### Direct Benefit

###### • Target Realization

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

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

###### • Economic Analysis

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

##### Indirect Benefit

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

Major Projects, Measures and Project Cost

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

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



SUMMARY

**FEASIBILITY STUDY**

Feasibility studies were conducted on the following projects. These projects should be implemented in combination to fully attain the expected result.

**(1) Bus Service Implementation**

- Major Components
  - Immediate Action Plan; 75 buses for 4 routes  
22,900 passengers/day
  - Short Term Plan; 175 buses for 9 routes  
49,500 passengers/day
- Implementation Agency and Operation
  - MPP as the executing agency is to provide the bus fleet and facilities.
  - PPA as the operating entity is to manage the self-reliance operation.
- Implementation Schedule
  - Immediate Action Plan to be operated in 2004 and Short Term Plan in 2005.
- Project Cost

Unit: US\$ Million

	Immediate Plan	Short-term Plan	Total
Bus Fleet	4.8	6.4	11.2
Bus Facilities	0.9	0.9	1.8
Engineering	0.6	1.2	1.8
Total	6.3	8.5	14.8

- Economic and Financial Evaluation

	NPV (\$Mil)	B/C	E/FIRR (%)
Economic	4.13	1.38	20.4
Financial	-9.45	0.81	1.7

Financial evaluation indicates the non-financial viability as a project. However, the profit and loss flow shows that the operation as an entity is self-reliant and managerial if the bus fleet and facilities are provided by the government.

**(2) Traffic Control System**

- Major Project Components
  - Improvement of existing signal; 21 I.S.
  - Installation of new signal; 12 I.S.
  - Geometric improvement of intersection; 3 I.S.
- Implementation
  - Agency; DPWT of MPP
  - Cost; US\$2.78 Million
  - Schedule; 18 months (2003 ~ 2004)
- Economic Evaluation

EIRR (%)	B/C	NPV (US\$1,000)
44.9	3.4	6,500

**(3) Urban Street Improvement**

- Major Components
  - Reconstruction of pavement; 22.4 km
  - Overlay of existing pavement; 9.4 km
- Implementation
  - Agency; DPWT of MPP
  - Cost; US\$14.51 Million
  - Schedule; 28 months (2002 ~ 2004)
- Economic Evaluation

Item	Length (km)	Cost (\$M)	NPV (\$M)	B/C	EIRR (%)
Construction Cost					
Principal Arterials	5.2	2.57	1.71	1.38	18.0
Minor Arterials	5.6	2.26	0.21	1.07	12.9
Collectors	12.3	4.92	-0.04	0.99	11.9
Local Streets	8.7	2.94	-0.17	0.94	11.3
Total	31.8	12.69	1.71	1.05	12.9
Engineering Cost		1.82			
Total Cost		14.51			

**CONCLUSIONS AND RECOMENDATIONS**

- Plan Authorization; The Transport Master Plan shall be authorized for smooth Implementation of recommended measures.
- Plan Premise; The MPP development policy adopted as the Plan premise shall be taken effect immediately prior to the implementation.
- Effective Organization; The proposed organizational reform plan shall be executed for systematical implementation approach.
- Professional Skill; The recommended human capacity development programs shall be carried out prior to and during the implementation of the Plan.
- Fund Preparation; The fund required for the Plan is recommended to be prepared through the project categorization approach.
- Private Participation; Attraction and encouragement of private participation shall be worked out, in particular for projects with high commercial return.
- Early Implementation of Feasibility Study Projects; The Projects are rationalized to be viable on various aspects for the early implementation.

Implementation Schedule and Financial Requirement for Feasibility Study Projects

	Total	2002	2003	2004
Bus Service Implementation	13.60	0.40	5.84	7.36
Traffic Control System	2.78	-	2.48	0.30
Urban Street Improvement	14.51	0.63	13.58	0.30
Total	30.89	1.03	21.90	7.96

Unit: US\$ Million

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## INTRODUCTION

### BACKGROUND

The transport infrastructure in the Kingdom of Cambodia is in a serious state of disrepair. In particular, the Phnom Penh metropolitan area, as the capital city of the kingdom, is experiencing serious transport problems caused by inadequate transport facilities and management system set against the rapid growth of population and socio-economic activities. This growth is causing a sprawling phenomenon especially in the newly developing zones surrounding the built-up area.

Recently, the population of Phnom Penh has reached over one million (1.4 times increase in 1991-2000 period) under stable domestic conditions after the end of the civil war in 1992. The urbanized area of the capital city, which is approximately 27 km<sup>2</sup>, has rapidly expanded to the surrounding suburban areas of about 412 km<sup>2</sup>. Additionally, motor vehicles show a remarkable increase (2.6 times increase in 1991-2000 period) in terms of the number of registered vehicles with a total of approximately 295,000 motorized vehicles, of which about 247,000 are motorcycles and 48,000 are passenger cars.

Linked with international routes No. 1 and No. 5 of the Asian Highway Network, Phnom Penh has historically been the core city of land transportation in the area. At present, the poor and deteriorated road network is causing an increase of traffic concentration in the urbanized areas of the city.

The traffic flows concentrate into the built-up area and traffic congestion occurs on the arterial roads during morning and evening peak hours. The existing traffic management facilities such as traffic signals, signs and pavement markings are not sufficient. These poor management conditions coupled with shortage of traffic safety facilities and traffic safety education contribute to an increase in traffic accidents. In addition, most of the public transport is served by motorcycle-taxi (motodop), due to the lack of a mass public transport system.

Traffic congestion and poor pavement condition are also imposing environmental pollution with increased emission of noxious gases from the vehicles and dust from unpaved road surface.

It can be stated that the transportation system of the Phnom Penh Metropolitan Area is lacking proper planning as well as facilities and it depends com-

prehensively on motorcycles as the most predominant mode for transportation.

With the rapid growth in population, urbanization and motorization in the city, the problem of traffic congestion has imposed itself to be a major issue for concerned authorities. These authorities decided that in order to solve the transport problems, a comprehensive master plan covering the areas of road network improvement, public transport and traffic management should be developed with a time horizon of 2015.

In response to the request of the Government of the Kingdom of Cambodia, the Government of Japan has decided to conduct "the Study on the Transport Master Plan of the Phnom Penh Metropolitan Area in the Kingdom of Cambodia" (hereinafter referred to as "the Study"), in accordance with the relevant laws and regulations in force in Japan.

The Government of Japan has entrusted the Study to the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical cooperation programs of the Government of Japan, to undertake it in close cooperation with the authorities concerned of the Government of Cambodia. JICA has organized and dispatched a Study Team consisting of the experts of Katahira & Engineers International to Cambodia to commence the Study in April 2000. The Final Report was submitted to the Government of Cambodia in November 2001.

### OBJECTIVES

1. To formulate an Urban Transport Master Plan in order to solve various transport problems and to support sustainable urban development;
2. To conduct Feasibility Studies for priority projects identified under the Master Plan;
3. To carry out technology transfer to the Cambodian counterpart personnel through the implementation of the Study.

### STUDY AREA

The Study covers the Municipality of Phnom Penh and adjoining area surrounded by the proposed Outer Ring Road as shown in Location Map.

## MASTER PLAN FORMULATION

### Objectives

The Transport Master Plan is formulated to develop the future transport system adaptable for the Phnom Penh Metropolitan Area. The Plan aims at providing transport facilities and measures to solve various problems of transport and to support increasing socioeconomic activities and sustainable urban development. The formulation follows the step-by-step process.

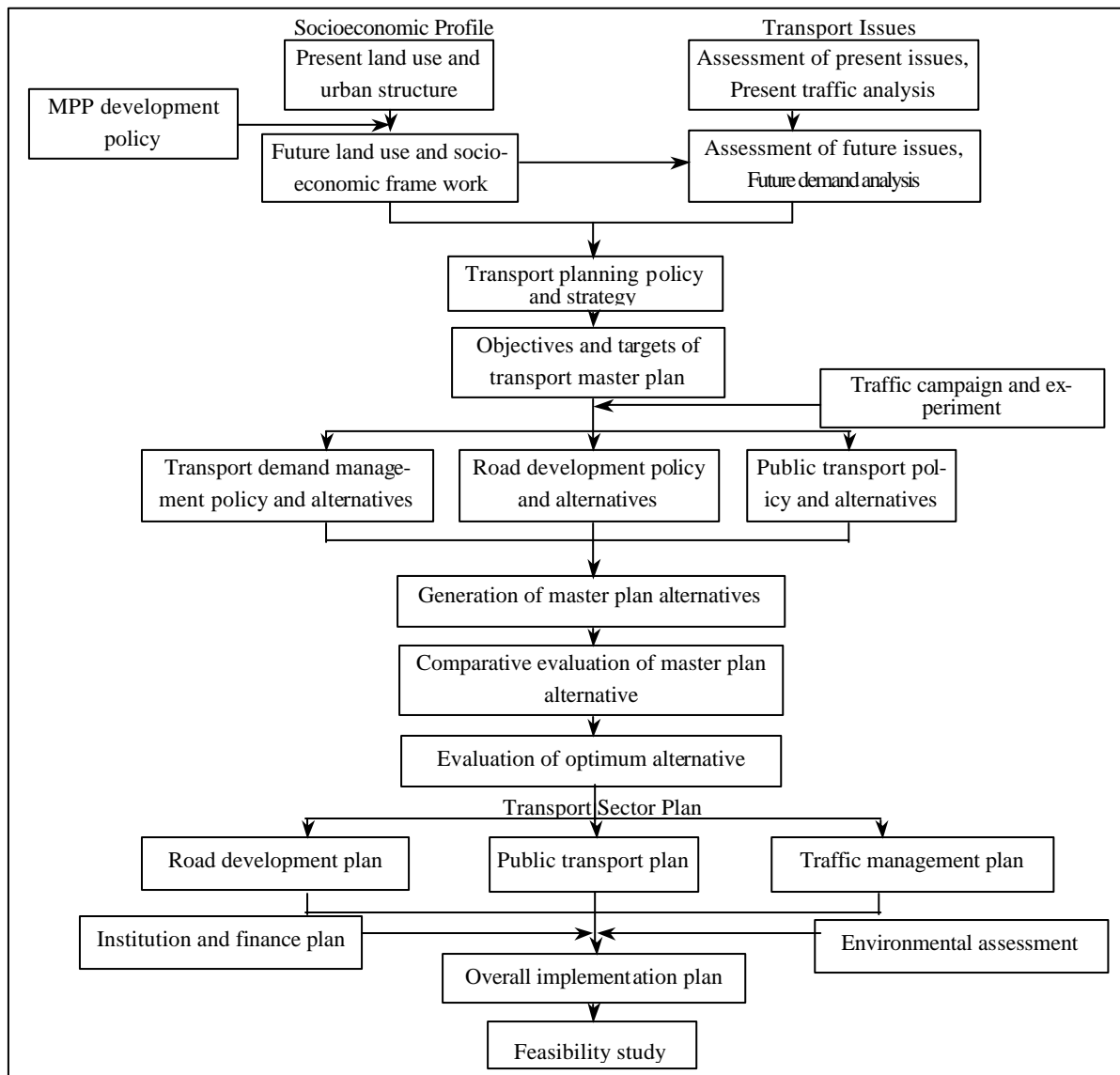
**1<sup>st</sup> Step;** present and future transport issues are identified and evaluated, which provide the fundamental engineering base of the Plan.

Simultaneously, the present socioeconomic profile and future development are estimated based on existing and future land use and MPP development policy.

**2<sup>nd</sup> Step;** the transport planning policy is established to directly response the transport issues and future traffic demand as well as future land use and socioeconomic development. Based on this policy, transport system alternatives are generated and evaluated. The optimum alternative is selected and evaluated in view of network efficiency, benefit, effects as well as environmental assessment.

**3<sup>rd</sup> Step;** the Transport Sector Plan is formulated, namely road, public transport and traffic management.

**4<sup>th</sup> Step;** the overall implementation plan of the Plan is proposed with due consideration of institutional organization, human resource capability and financial restriction.



Procedure of Transport Master Plan Formulation

## TECHNOLOGY TRANSFER

The technology applied to the Study was made available to be transferred to the Cambodian side through the possible methods in all stages of the plan formulation process.

### Steering Committee

The Steering Committee was established by MPP to discuss the methodology and outcome of the Study, especially the Progress Report, the Interim Report, Draft Final Report and other reports of the Study. The Study Team had discussion with many members of the Steering Committee on various topics of the Study.

### Seminar and Workshop

A seminar was held at the time of presentation of the Draft Final Report. The methodology and outcome of the Study was presented and discussed in the Seminar. A workshop was convened at the time of presentation of the Inception Report and active discussion took place among the participants.



Workshop on Inception Report

### On-The-Job Training and Manuals

Six persons of engineers and architects of DPWT were assigned as the counterparts to work with the Study Team on full-time basis. They were given hands-on training throughout the Study. Manuals and formats of questionnaires used in the various surveys of the Study can serve as a reference in similar projects in the future.



On-The-Job Training

### Counterpart Training in Japan

Counterpart training in Japan were held twice: September - November 2000 and September 2001.

### Major Subjects of Technology Transfer

The major subjects of technology transfer included, among others, the following;

- Traffic surveys
- Road survey and inventory
- Land use surveys and data analysis
- Planning and implementation of traffic campaign
- Planning, monitoring and evaluation of bus operation
- Computer skills
- Planning concept and procedures on road, public transport and traffic management



Using CAD

### Contribution by the Cambodian Side

Major contribution by the Cambodian side was made in the following areas:

- Establishment of development policy
- Establishment of future land use with major projects
- Public Experiment
- Traffic Campaign

### Accomplishment

Considerable accomplishment was made in the technology transfer. The capacity of the counterparts has been substantially improved in the following specific areas:

- Traffic surveys and data analysis
- Road condition survey and compilation of road inventory
- CAD operation
- Planning concept and procedure on transport study

The effort and devotion of the counterparts should be noted. The Study Team owes much to their co-operation and assistance.

PRESENT AND FUTURE ISSUES

**1. SOCIO ECONOMIC PROFILE**

**(1) Present Land Use**

The Phnom Penh Metropolitan Area can be classified into two areas; the inner city area enclosed by the Inner Ring Road (the urbanized area) and the outside area surrounded by the Outer Ring Road (the suburban area). The urbanized area is characterized as the center of political, commercial, business and education, with a developed urban landscape. The present development has been rapidly expanding to the suburban area where the high development potential is observed.

Present Land Use		Unit: km <sup>2</sup>	
Land Use	Urbanized Area	Suburban Area	Study Area
Residential	13.14	83.07	96.21
Commercial	7.92	6.49	14.41
Industrial	0.80	20.59	21.39
Institution	1.92	6.36	8.28
Agriculture	0.14	186.27	186.41
Parks & Open Space	0.36	7.12	7.48
Swamp Area	-	56.57	56.57
Water	2.80	45.36	48.16
Total	27.08	411.83	438.91

Source: MPP data.



Amenity in Urbanized Area



On-going Development in Suburban Area

**(2) Population and Employment**

The population was forecasted based on the 1998 census. The projection results show that population growth rate in the Study Area is higher than the national rate because migration to the city.

The employment was estimated based on age group, work force and unemployment rate.

On the basis of registered number of vehicle from 1990 to 2000, the number of motor vehicles was estimated in proportion with GDP per capita growth.

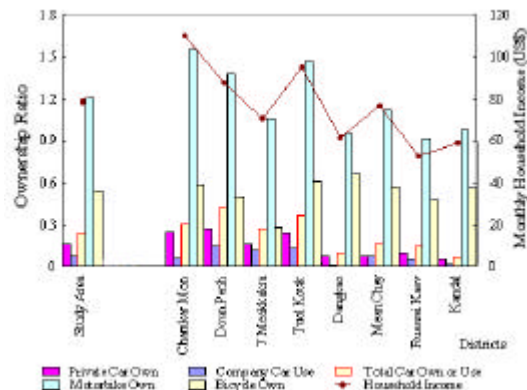
Employment and Motor Vehicle		2000	2005	2010	2015
GDP per capita (\$)		215	267	350	447
Population	To	1,152	1,373	1,611	1,820
	Ur.	591	655	718	750
	Su.	561	718	893	1,070
Employment	To	586	706	830	1,006
	Ur.	254	285	315	330
	Su.	332	421	515	676
Motor Vehicle	To	295,639	419,000	578,000	736,000
	Ca	48,132	77,000	120,000	166,000
	MC.	247,507	342,000	458,000	570,000

Note: GDP in 1993 prices, US\$, To: Total, Ur.: Urbanized Area, Su.: Suburban Area, Ca: Car, MC: Motorcycle

**(3) Income and Vehicle Ownership**

The average household income obtained from the household interview was US\$79/month. The future household income is assumed to be increased in the same rate as the GDP per capita.

The car and motorcycle ownership rates per household were estimated from the household interview. The ownership rates were clearly related to the household income level.



Household Income Level & Vehicle Ownership

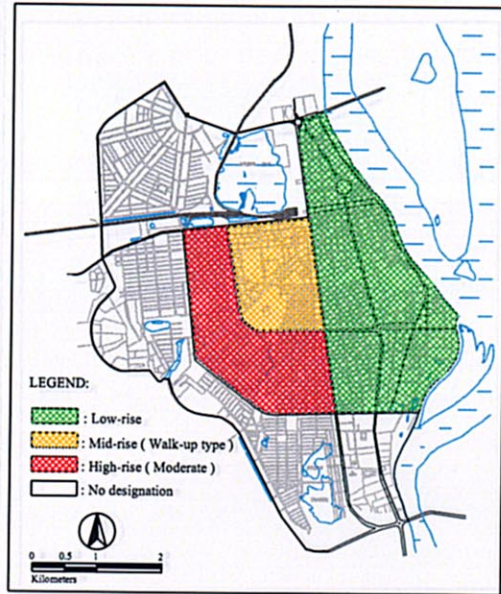


PRESENT AND FUTURE ISSUES

**(4) Development Policy for Urbanized Area**

MPP formulated the development policy for the urbanized area with the objectives of preserving landscape, cultural heritage and environment as well as easing concentration of population in the urbanized area by regulating building height. The urbanized area are divided into four (4) zones. This policy clearly indicates the decisive direction in formulating the transport plan.

- Low-rise zone of up to three-story for historical area
- Mid-rise zone of walk-up type for the central commercial center area
- High-rise zone with moderate height for office and commercial area
- No designation zone for the others.



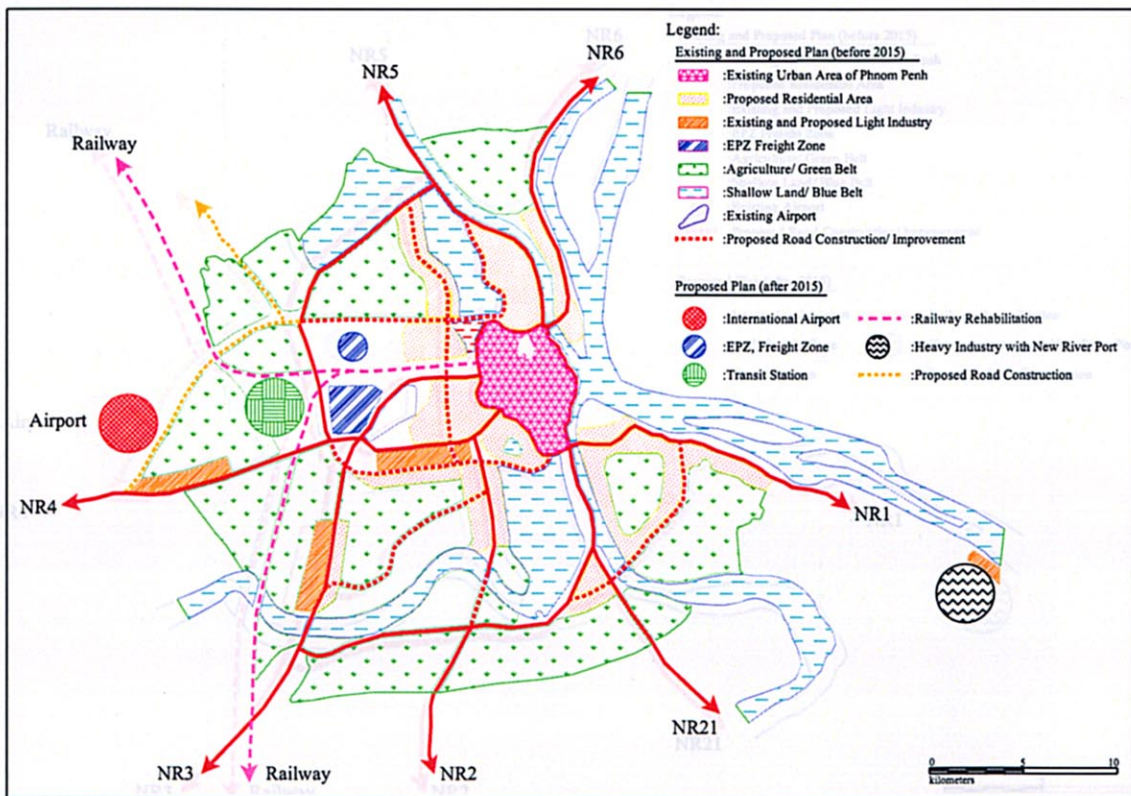
Height Limitation of Building in the Urbanized Area proposed by BUA, MPP

**(5) Future Land Use for Suburban Area**

MPP prepared the conceptual land use master plan before and after Year 2015 for the suburban area with the special policies of achieving spatial distribution of urban activities, creating progressive region with urban structure, high development potential with urban amenity, and achieving the planned population growth.

This plan is central to any proposals for the transport network to be integrated into network.

It is noted that major large development project such as international airport, new suburban area, transit station, etc are included in the plan after Year 2015.



Land Use Plan Before and After 2015, Proposed by MPP