

PART II

TRAFFIC DEMAND FORECAST

CHAPTER 10

FUTURE SOCIOECONOMIC FRAMEWORK

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Socioeconomic framework constitutes the basis for the traffic demand forecast, which, in turn, serve as the basis for formulating the transport master plan. The detailed procedures of traffic demand forecast are described in Chapter 11. The major factors of socioeconomic framework used in traffic demand forecast include car ownership, number of household, employment and students. This chapter describes the assumptions, procedures and the outcome of the work to establish the future socioeconomic framework to be used in the Study.

10.1 PROCEDURE

The overall work procedure discussed in this chapter, presented in Figure 10.1-1, is for the future socioeconomic framework formulated by projecting economic framework, population, household, employment and student characteristics along with the future land use and vehicle ownership in the Study Area.

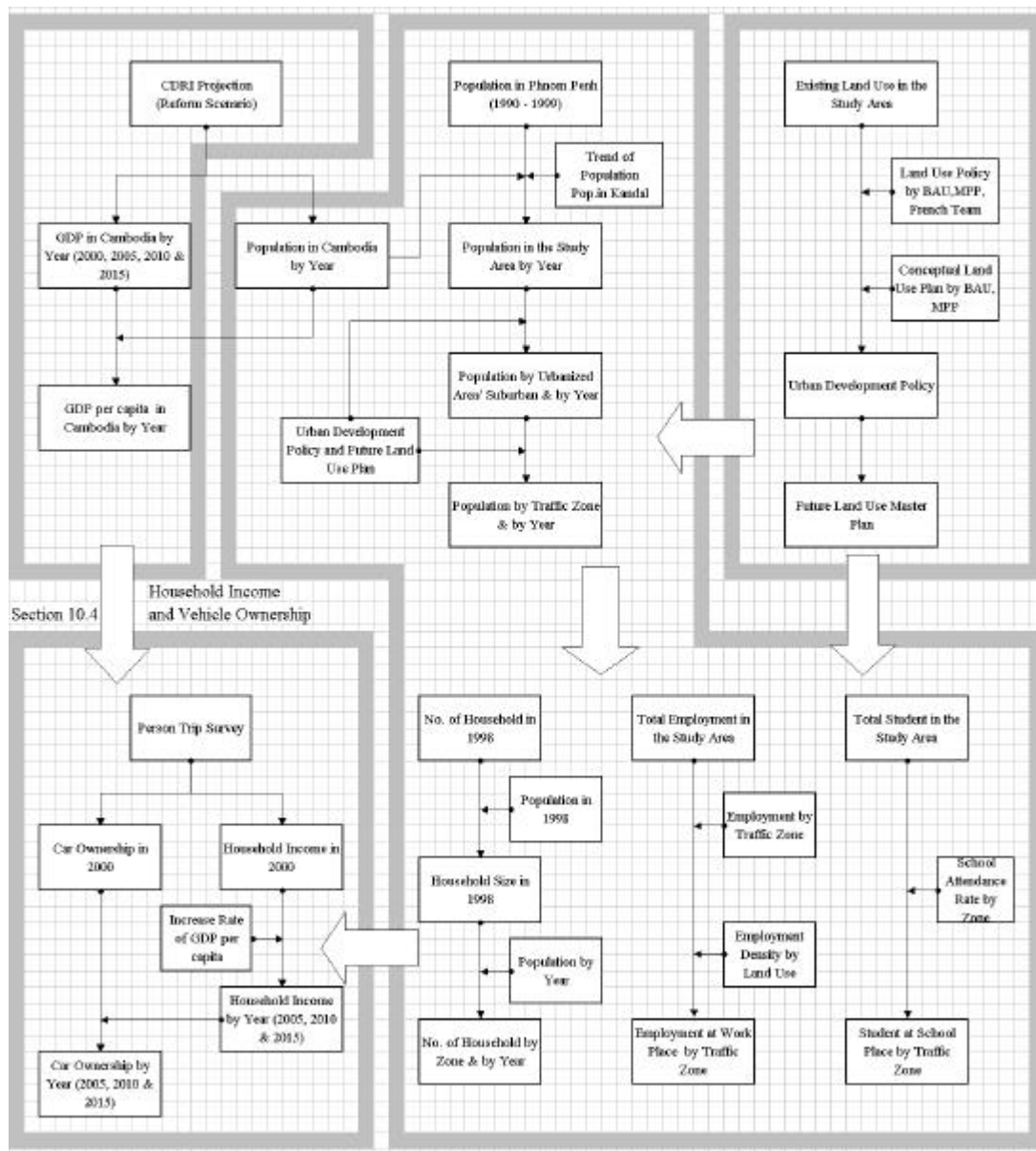


Figure 10.1-1 Overall Work Procedure in Chapter 10

10.2 ECONOMIC FRAMEWORK

10.2.1 National Framework

The Government of Cambodia is pursuing drastic measures to boost the economic growth and to achieve sustainable development, one of which is to reform governance. A report on "Cambodia: Enhancing Governance for Sustainable Development", 2000, has been prepared with the assistance of international agencies. The report presents the national framework for two scenarios. One is "Reform Scenario" and the other is "No-Reform Scenario". The report is understood to include the latest national framework, which is presented in Table 10.2-1. Figure 10.2-1 graphically compares the main indices of "Reform Scenario" and "No Reform Scenario". In due consultation with officials of the Municipality of Phnom Penh and other relevant agencies and authorities, the Study adopted "Reform Scenario (RSC)" for the national framework considering the following.

- (i) RSC assumes a higher rate of economic growth leading to a higher growth rate in traffic volume and other factors used in formulating the Transport Master Plan. Thus, adoption of RSC gives "conservative" values of such factors resulting in the Master Plan with "safety margin".
- (ii) RSC is the scenario that the Government of Cambodia is trying to achieve. The efforts of the Government are directed towards the achievement of RSC. Adoption of any other scenario other than RSC may be regarded as doubting such efforts of the Government.

It should be noted that there is a possibility that RSC overestimates the economic growth or the real economic growth remains below that which is targeted in RSC and the Master Plan may therefore result in over-investment. In the case that the real economic growth is lower than that of RSC and the growth in traffic demand is less than that estimated in the Master Plan, the Government can adjust the Plan by delaying the implementation of the projects.

(The influence of deviation from RSC which may happen in reality is examined through the sensitivity analysis of the Master Plan described in Chapter 13.)

Table 10.2-1 Impact of Reform on Cambodia's Economy

Year	Reform Scenario						No Reform Scenario					
	1995	2000	2005	2010	2015	2020	1995	2000	2005	2010	2015	2020
GDP (current price: Million US\$)	2923	3302	5713	10263	17631	28718	2903	3275	3867	3966	4402	4953
GDP per capita (current price: US\$)	284	274	420	671	1034	1522	284	272	284	259	258	262
GDP per capita (1993 price: US\$)	212	215	267	350	447	542	212	213	230	213	214	219
Real GDP growth (%)	7.6	4.3	7.7	8.4	6.8	5.5	7.6	3.4	2.8	1.2	2.3	2.6
Inflation (final quarter basis: %)	3.5	4.1	3.6	3.4	3.5	3.8	3.5	4.1	11.1	11.9	11.6	11.6
Exchange rate (Riel/ US\$: end of period)	2560	3975	4000	4000	4000	4000	2560	3975	7992	16071	32321	65007
Public expenditure (% of GDP)	8.9	11.3	14.0	15.4	16.6	17.5	8.9	11.4	12.2	12.9	13.8	14.8
Public expenditure (% of GDP)	16.7	15.7	18.6	18.8	19.0	19.2	16.7	15.8	14.8	14.4	14.1	14.8
Current public deficit (% of GDP)	-0.8	1.3	2.5	4.4	5.1	5.2	-0.8	1.3	1.1	1.4	2.2	3.1
Overall public deficit (% of GDP)	-7.7	-4.4	-4.6	-3.5	-2.4	-1.6	-7.7	-4.4	-2.6	-1.5	-0.3	-0.1
Exports of goods (% of GDP)	12.0	20.0	22.2	29.9	39.2	45.7	12.0	20.2	25.8	20.8	21.4	21.2
Imports of goods (% of GDP)	23.9	34.1	38.2	39.7	41.1	41.3	23.9	33.9	32.7	34.1	33.8	34.2
Trade balance (% of GDP)	-12.0	-14.1	-16.0	-9.8	-2.0	4.4	-12.0	-13.8	-6.9	-13.3	-12.4	-13.0
Current account (% of GDP)	-12.9	-12.7	-13.6	-6.6	-1.2	5.3	-12.9	-12.3	-4.1	-8.2	-5.9	-4.5
External contribution to the economy (% of GDP)	21.0	15.7	15.4	11.7	9.1	7.0	21.0	15.2	9.6	8.1	6.8	6.1
Total savings (% of GDP)	21.0	21.5	27.2	29.6	28.7	26.8	21.0	21.0	17.7	16.6	15.3	15.7
External debts (% of GDP)	4.0	14.0	37.0	42.0	42.0	40.0	4.0	14.0	36.0	42.0	40.0	36.0
Population (million)	10.3	12.0	13.6	15.3	17.1	18.9	10.3	12.0	13.6	15.3	17.1	18.9
Unemployment (% of labor force)	1.7	4.2	5.5	4.8	4.1	3.8	1.7	4.3	6.2	8.8	11.2	13.4

Source: Cambodia Development Research Institute (CDRI), Cambodia: Enhancing Governance for Sustainable Development.

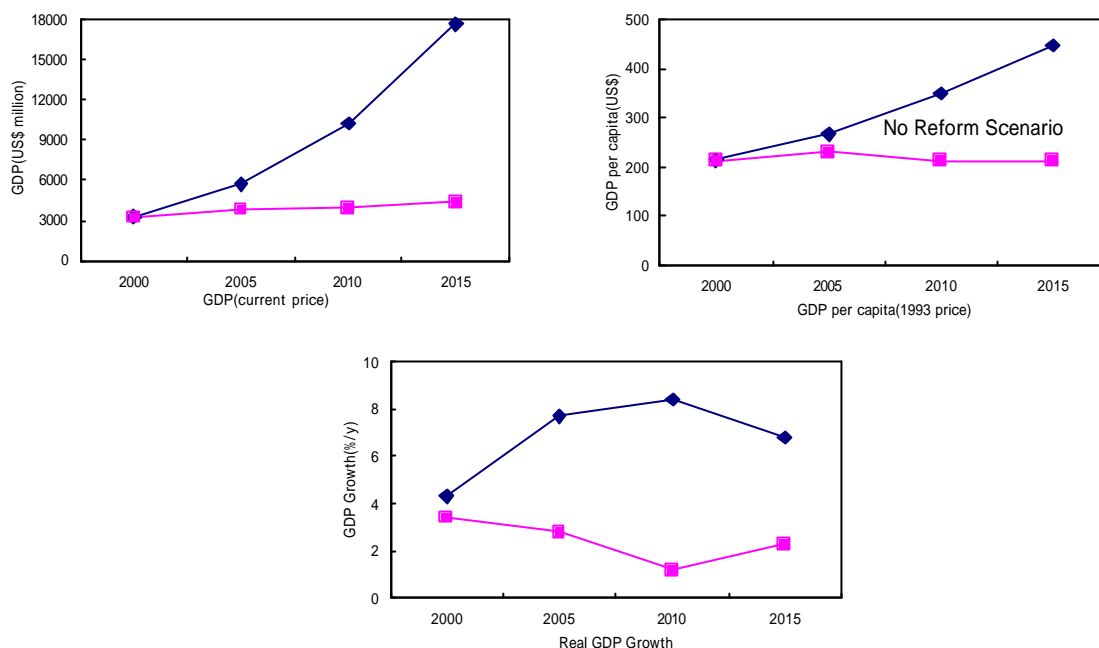


Figure 10.2-1 Graphic Comparisons of Main Indices of Reform Scenario and No Reform Scenario

10.2.2 Economic Framework of the Study Area

Basically, there are no available data on the regional economic indices for the sectoral economic outputs. In this Study, the economic framework of the Study Area is established to follow the national economic framework as presented in Table 10.2.2.

Table 10.2-2 Economic Framework of the Study Area

	2000	2005	2010	2015
Real GRDP Growth Rate (%)	4.3	7.7	8.4	6.8
Real GRDP Growth (Year 2000 as 1.00)	1.00	1.45	2.17	3.01
Inflation (%)	4.1	3.6	3.4	3.5
Unemployment (% of labor force)	4.2	5.5	4.8	4.1

Source: CDRI

10.3 POPULATION

10.3.1 Population of Cambodia and the Study Area

(1) Population of Cambodia

The population census was undertaken in 1998 and precise population data are available only for that year. The population data of previous years were collected from the Ministry of Planning for the years of 1986, 1993, 1995, 1996 and 1999.

As for the future population of Cambodia, there are projection done by the CDRI for the years of 2000, 2005, 2010, and 2015.

Table 10.3-1 Population Projection of Cambodia

	2000	2005	2010	2015
Population Projection by CDRI				
. Population in Thousand	12,000	13,600	15,300	17,100
. Population Growth Rate (%)	-	2.53	2.38	2.25

(2) Population of the Study Area

In addition to the Population Census in 1998, available population data for the past years were collected from the Department of Planning, the Municipality of Phnom Penh. As there is no future population estimate for the Study Area, a regression model, based on the past trend, was applied for the population projection of the Municipality of Phnom Penh (Figure 10.3-1). The population projection incorporates the population of a part of Kandal Province that is included in the Study Area. The results are summarized in Table 10.3-2. The projection results shows that population growth rates in the Study Area are higher than the national rates. The national growth rate of the whole country is considered to give the natural increase in the Study Area, while the difference between the growth rate of and that of the Study Area provides the social increase due to migration, etc.

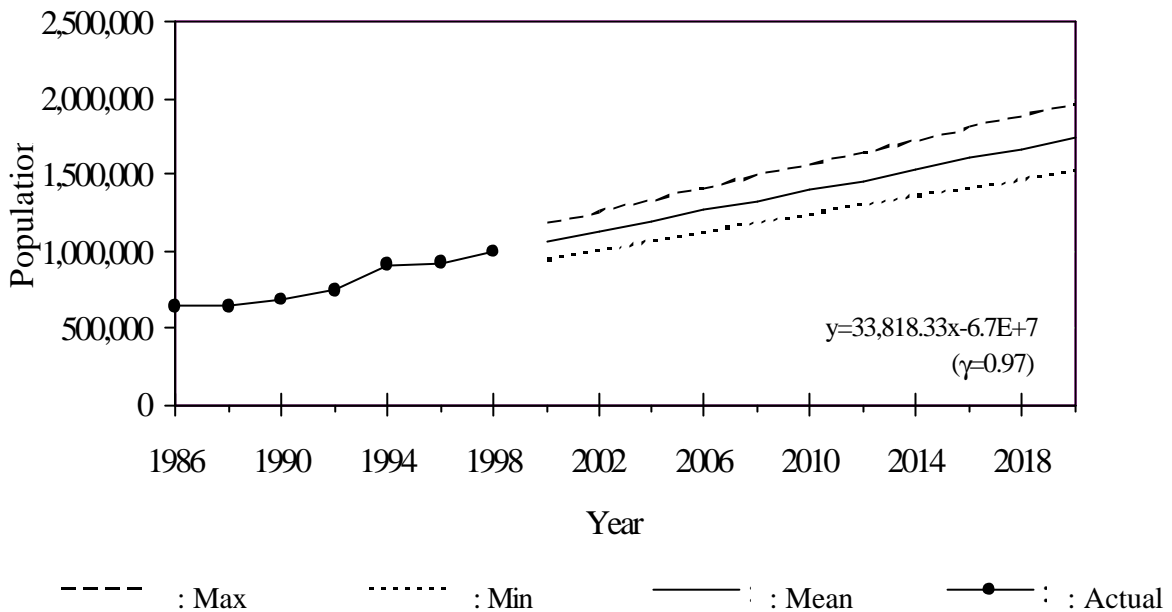


Figure 10.3-1 Population Projection of Municipality of Phnom Penh

Table 10.3-2 Population of the Study Area

	2000	2005	2010	2015
Population of Phnom Penh (in Thousand)	1,082	1,289	1,511	1,702
Population of Kandal included in the Study Area (in Thousand)	70	84	100	118
Study Area (in Thousand)	1,152	1,373	1,611	1,820
Population Growth Rate (%)	-	3.57	3.25	2.47
Population Growth (year 2000 as 1.00)	1.00	1.19	1.40	1.58
Population Increase from year 2000 (in Thousand)	-	221	459	668
Natural Increase	-	175	334	494
Social Increase	-	46	125	174

10.3.2 Population Breakdown into Traffic Zone

The estimated population for the urbanized area and the suburban area is summarized in Table 10.3-3 and illustrated in Figure 10.3-3.

Table 10.3-3 Estimated Population for Urbanized Area and Suburban Area

	2000	2005	2010	2015
Urbanized Area Population (in 1,000)	591	655	718	750
Suburban Area Population (in 1,000)	561	718	893	1,070
Study Area Population (in 1,000)	1,152	1,373	1,611	1,820
Population Growth Rate (%)				
• Urbanized Area	-	2.08	1.85	0.87
• Suburban Area	-	5.06	4.46	3.68
• Study Area	-	3.57	3.25	2.47
Population Growth (year of 2000 as 1.00)				
• Urbanized Area	1.00	1.11	1.21	1.27
• Suburban Area	1.00	1.28	1.59	1.91
• Study Area	1.00	1.19	1.40	1.58
Population Increase from year 2000 (in 1,000)				
• Urbanized Area	-	64	127	159
• Suburban Area	-	157	332	509
• Study Area	-	221	459	668
Population to be Induced from Urbanized Area to Suburban Area				
• Population Increase by Present Trend	-	112	236	343
• Population Increase under Population Control Policy	-	64	127	159
• Population to be Induced to Suburban Area	-	48	109	184

Allocation of Population by Traffic Zone

The total increase of population in the Study Area from year 2000 to year 2015 is estimated at 343,000 based on the present trend. Out of 343,000, the population growth in the urbanized area is estimated to be limited to 159,000 (46.3% of 343,000) by adoption of the population control policy for the urbanized area as described in Section 10.4.3. Accordingly, the remaining 184,000 of population growth is assumed to be displaced to the suburban area supplementing the population increase based on present trend. (See Figure 10.3-2). The estimated population for the urbanized area and the suburban area were allocated in due consideration of the following:

Urbanized Area

- Existing floor area of residential building and their occupancy rate;
- Additional floor areas, which can be built within the limit of building regulation, proposed by the French team.

Suburban Area

- Natural increase of population of each traffic zone as described in Chapter 4.
- Characteristics of zone, such as rural and urban, with or without development projects, area by land use and vicinity to transport facilities, etc.

The population in the suburban area will sharply increase with high population growth rates ranging from 5.06% (in year 2005) to 3.68% (in year 2015). In order to cope with high population growth in the suburban area, sound urbanization must be achieved with the proper support of the transport system.

Figure 10.3-3 shows the population of each traffic zone for the year of 2000 to 2015.

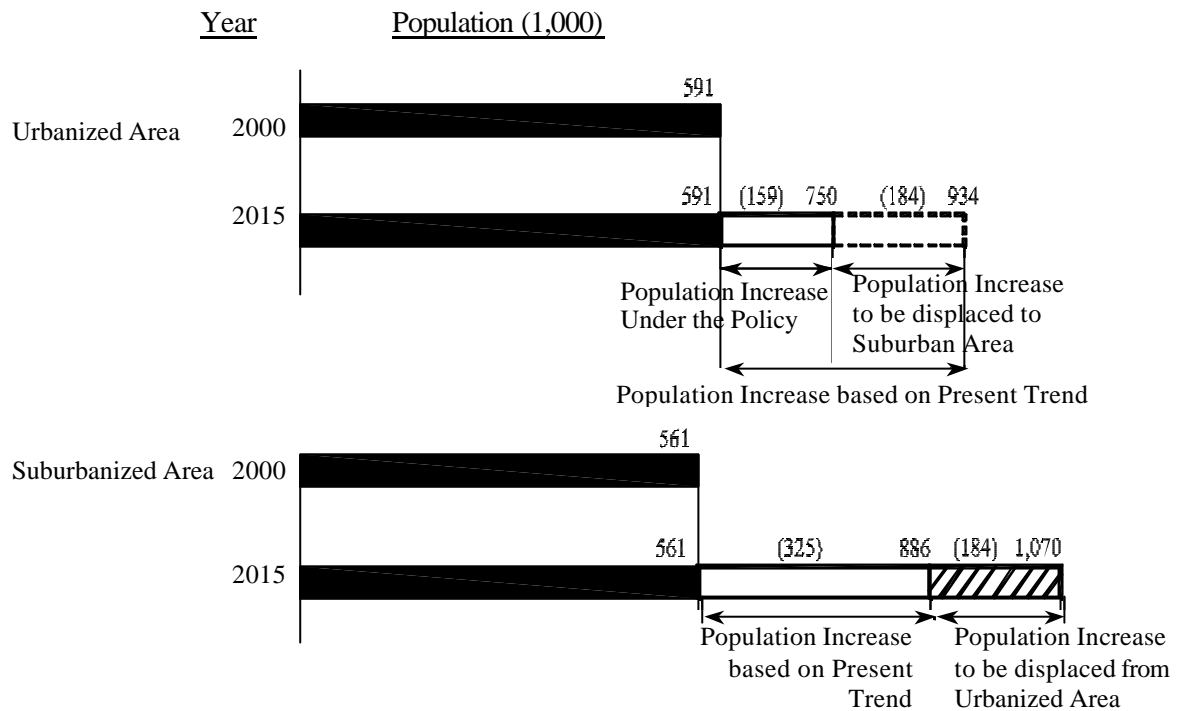


Figure 10.3-2 Population Increase in Urbanized Area and Suburban Area

10.3.3 Number of Households

The data on the household size, and number of households, were obtained from the population census in 1998 and the household statistics prepared by the Municipality of Phnom Penh in 2000. The characteristics of the household size were analyzed in accordance with their relationship to the urbanized area, land use and proximity to arterial roads. The future household size of each traffic zone was estimated based on the results of the analysis. Table 10.3-4 shows the summary of the number of households. Detailed data on household size population and other data by traffic zones and Districts are shown in Appendix 10-1.

Table 10.3-4 Summary of Number of Household

	2000	2005	2010	2015
Study Area				
·Population (in 1,000)	1,152	1,373	1,611	1,820
·Household Size	5.70	5.63	5.57	5.56
·Number of Households (in 1,000)	202	244	289	327
Urbanized Area				
·Population (in 1,000)	591	655	718	750
·Household Size	5.79	5.65	5.52	5.47
·Number of Households (in 1,000)	102	116	130	137
Suburban Area				
·Population (in 1,000)	561	718	893	1,070
·Household Size	5.61	5.61	5.62	5.63
·Number of Households (in 1,000)	100	128	159	190

10.3.4 Employment at Work Place

(1) Procedure

The procedure to estimate employment at work place is shown in Figure 10.3-4.

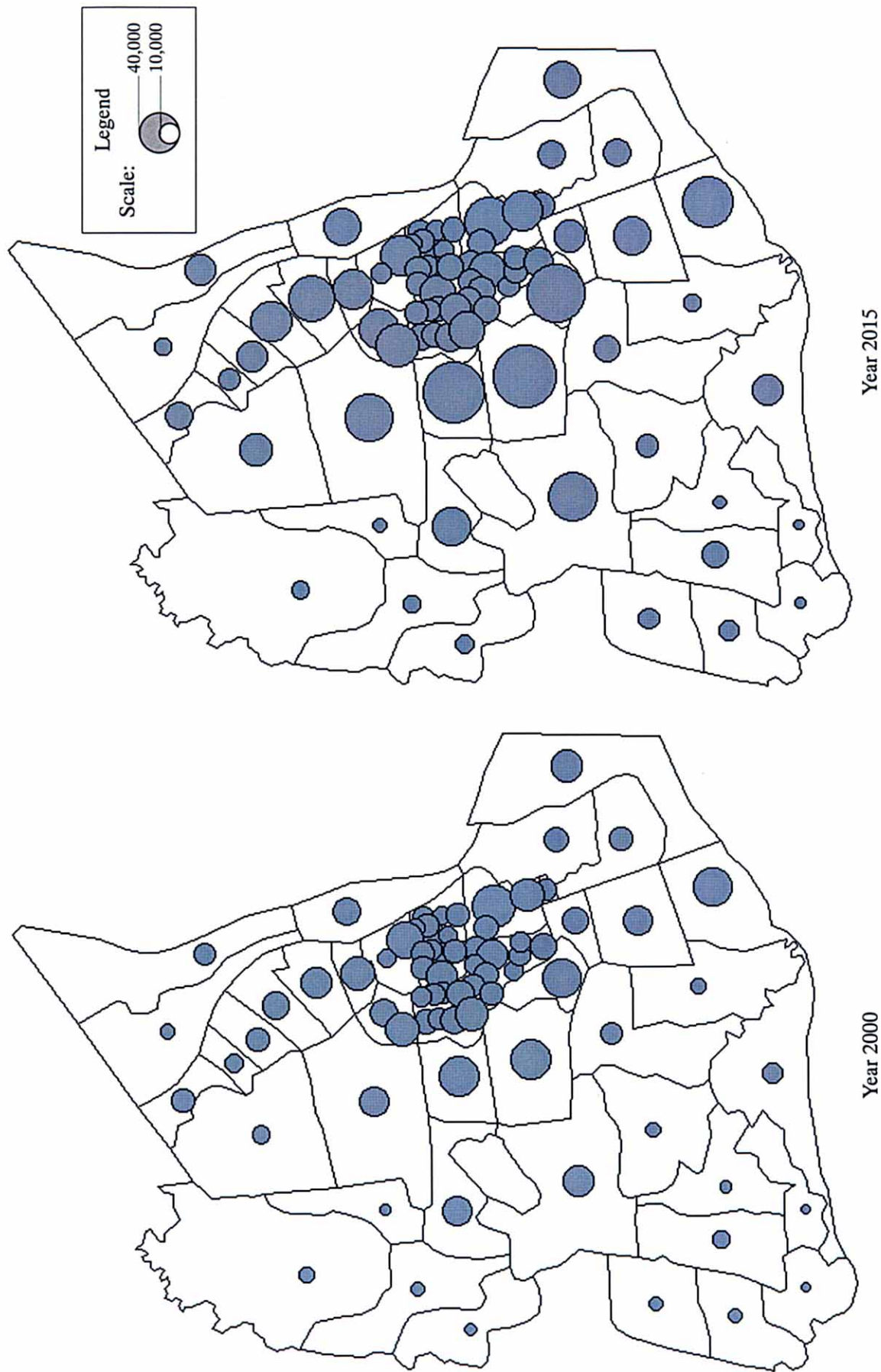


Figure 10.3-3 Population by Zone in Year 2000 and 2015

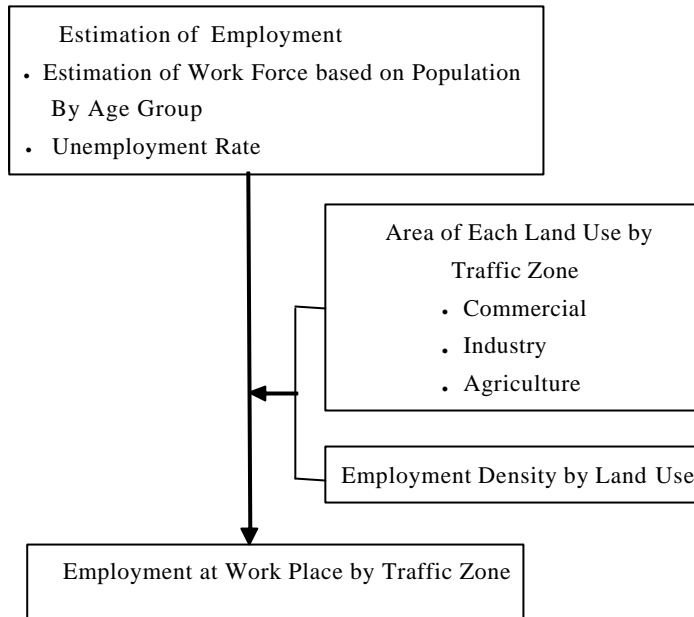


Figure 10.3-4 Estimation Procedure of Employment by Traffic Zone

(2) Estimation of Employment

The available work force was estimated from the age group of the population. The unemployment rate established in the economic framework was applied to obtain total employment. The results of the estimation are shown in Table 10.3-5.

Table 10.3-5 Total Employment

	2000	2005	2010	2015
Study Area				
· Population (in 1,000)	1,152	1,373	1,611	1,820
· Work Force (in 1,000)	612	747	872	1,049
· Unemployment Rate (%)	4.2	5.5	4.8	4.1
· Employment (in 1,000)	586	706	830	1,006
· Employment Growth	1.00	1.20	1.42	1.72
Urbanized Area				
· Population (in 1,000)	591	655	718	750
· Work Force (in 1,000)	265	302	331	344
· Unemployment Rate (%)	4.2	5.5	4.8	4.1
· Employment (in 1,000)	254	285	315	330
· Employment Growth	1.00	1.12	1.24	1.30
Suburban Area				
· Population (in 1,000)	561	718	893	1,007
· Work Force (in 1,000)	346	446	541	705
· Unemployment Rate (%)	4.2	5.5	4.8	4.1
· Employment (in 1,000)	332	421	515	676
· Employment Growth	1.00	1.27	1.55	2.04

10.3.5 Number of Students at School Locations

(1) Procedure to Estimate Number of Students at School Locations (Figure 10.3-5).

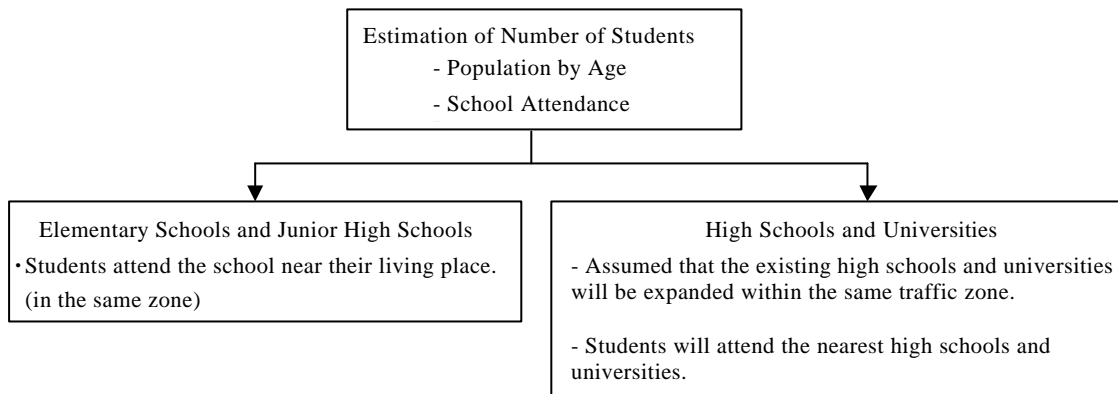


Figure 10.3-5 Procedure to Estimate Number of Students at School Locations

(2) Estimation of Number of Students

The school attendance ratio for the year of 1999 was obtained from the Department of Education (DOE). The Study Team discussed the future school attendance ratio with DOE and obtained their future plan as shown below:

Based on population by age group and school attendance ratio, the number of students was estimated as shown in Table 10.3-6.

Table 10.3-6 Number of Students

	2000	2005	2010	2015
Study Area				
· Number of Students (in1,000)	324	373	415	476
· Student Growth (2000 as 1.00)	1.00	1.15	1.28	1.47
Urbanized Area				
· Number of Students (in1,000)	186	203	211	233
· Student Growth (2000 as 1.00)	1.00	1.09	1.13	1.25
Suburban Area				
· Number of Students (in1,000)	138	170	204	243
· Student Growth (2000 as 1.00)	1.00	1.23	1.48	1.76

10.4 LAND USE PLAN

10.4.1 Procedure

The future land use plan was formulated in accordance with the procedure shown in Figure 10.4-1.

10.4.2 Present Land Use

The present land use map is shown in Figure 10.4-2. The Study Area can be classified into two areas. One is the inner city area, or the urbanized area, and the other is the outside area of inner city, or the suburban area. The characteristics of the urbanized area are described as the center of political, commercial, business and education. Socioeconomic activities are concentrated in the urbanized area. Furthermore, the urbanized area is expanding to the neighboring districts. The present land use is summarized in Table 10.4-1.

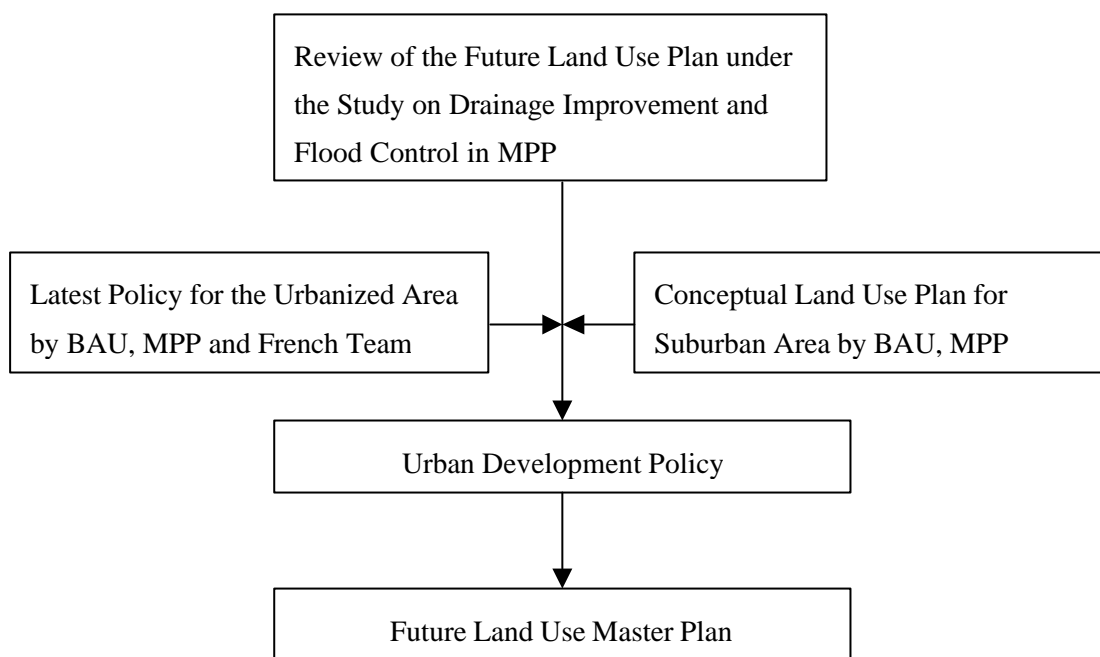


Figure 10.4-1 Procedure of Land Use Master Plan Formulation

Table 10.4-1 Present Land Use

Land Use	Urbanized Area		Suburban Area		Study Area	
	ha	%	ha	%	ha	%
Area	2,708	6.2	41,184	93.8	43,892	100
Residential	1,314	48.5	8,307.5	20.2	9,621.5	21.9
Commercial	792	29.3	649.5	1.6	1,441.5	3.2
Industrial	80	3.0	2,059	5.0	2,139	4.9
Institution	192	7.1	636	1.6	828	1.9
Agriculture	14	0.5	18,627	45.2	18,641	42.5
Parks & Open Space	36	1.3	712	1.7	748	1.7
Swamp Area	-		5,657	13.7	5,657	12.9
Water Surface	280	10.3	4,536	11.0	4,816	11.0
Total	2,708	100.0	41,184	100.0	43,892	100.0

10.4.3 Review of Relevant Plans and Concepts

- (1) Review of Future Land Use Plan under the Study on Drainage Improvement and Flood Control in MPP.

The future land use plan for the Municipality of Phnom Penh was prepared in 1999 under the Study on Drainage Improvement and Flood Control in the Municipality of Phnom Penh conducted by JICA. The Study Team reviewed the plan and discussed it with the Bureau of Urban Affairs, Municipality of Phnom Penh (BAU, MPP) and established the following:

- The basic concept of the plan is to expand the existing urban areas.
- After the formulation of this plan, BAU, MPP in coordination with the French Team established a policy to control population of the urbanized area (the inner city area) by restricting building height. This plan is to be applied on the urbanized area, and the new land use plan is required to be formulated, particularly in the suburban area with due consideration of the new policy.

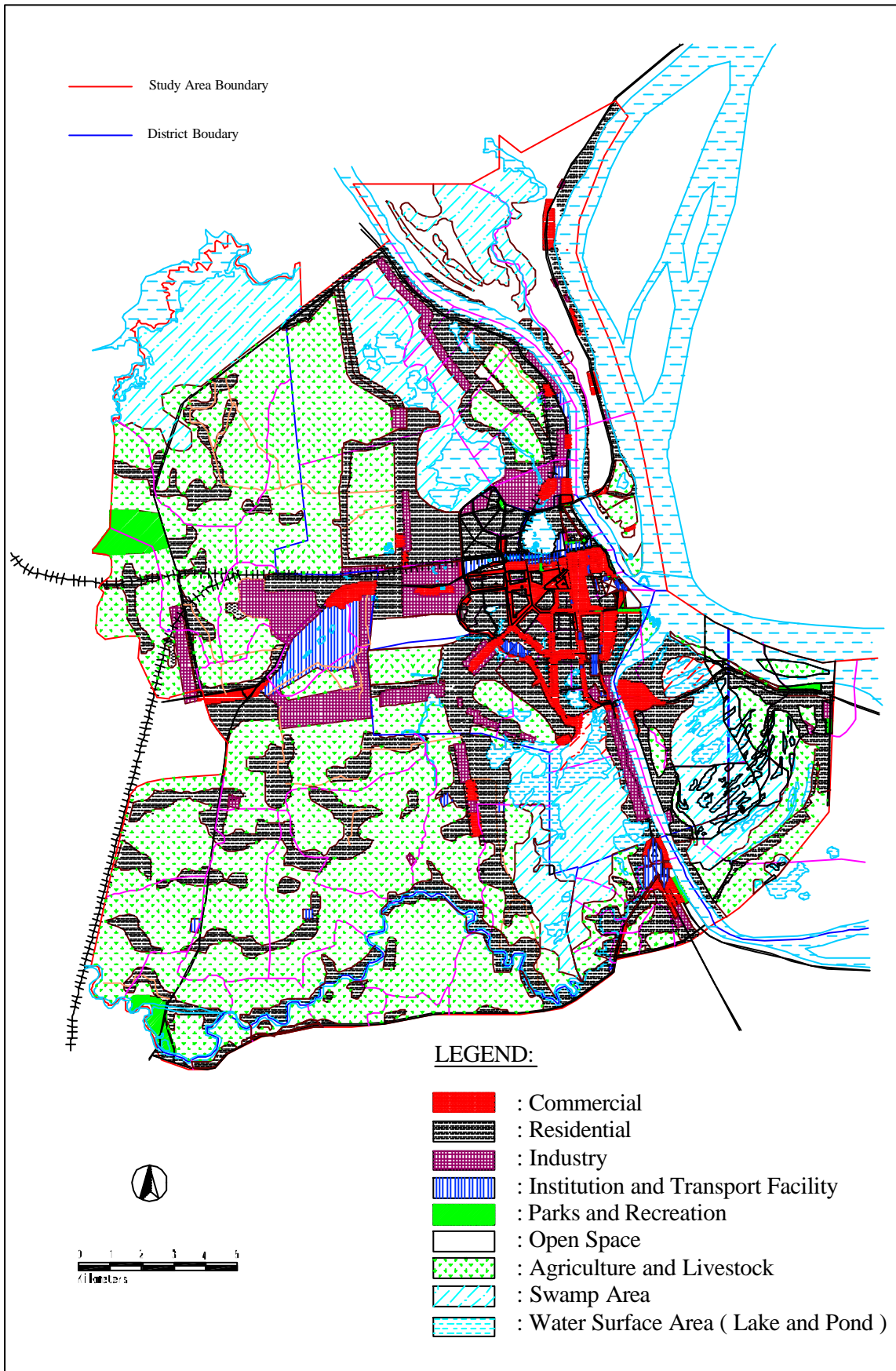


Figure 10.4-2 Present Land Use

(2) Latest Policy and Land Use Plan for the Urbanized Area

The latest development policies for the urbanized area formulated by BAU, MPP and the French Team are as follows:

- To preserve urban landscape, cultural heritage and environment;
- To ease concentration of population in urbanized area by regulating building height.

The urbanized area is divided into four zones as follows (Figure 10.4-3).

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

BAU, MPP and the Study Team agreed to adopt this plan for the urbanized area.

(3) Conceptual Land Use Plan for Suburban Area Proposed by BAU, MPP

In compliance with the request of the Study Team, BAU, MPP prepared the conceptual land use master plan comprising three staged development, namely a short term plan up to 2010, a medium term plan up to 2020 and a long term plan beyond 2020 incorporating all development projects as shown in Figure 10.4.4.

The major features of the plans are as follows:

Short-Term Plan (Up to Year 2010)

- The developments that are currently occurring in the suburban area are expected to progress further, and the area of these development areas are designated according to the type of development.

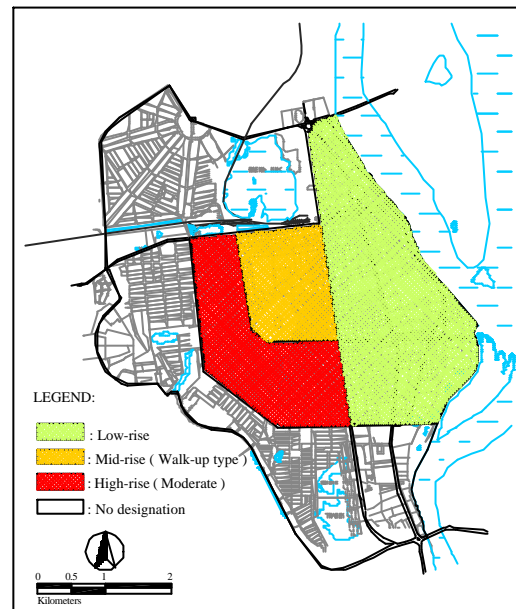
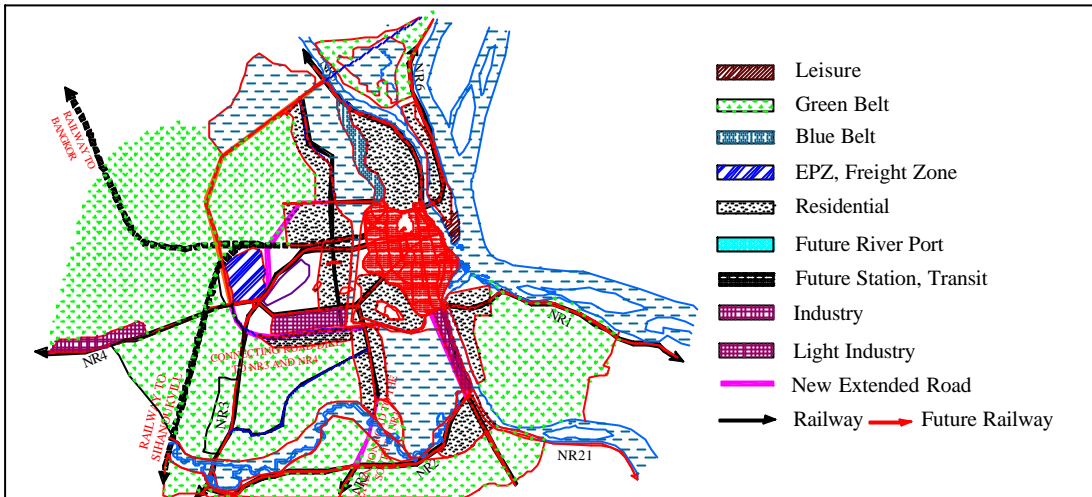


Figure 10.4-3 Height Limitation of Building in the Urbanized Area Proposed by BAU, MPP and French Team

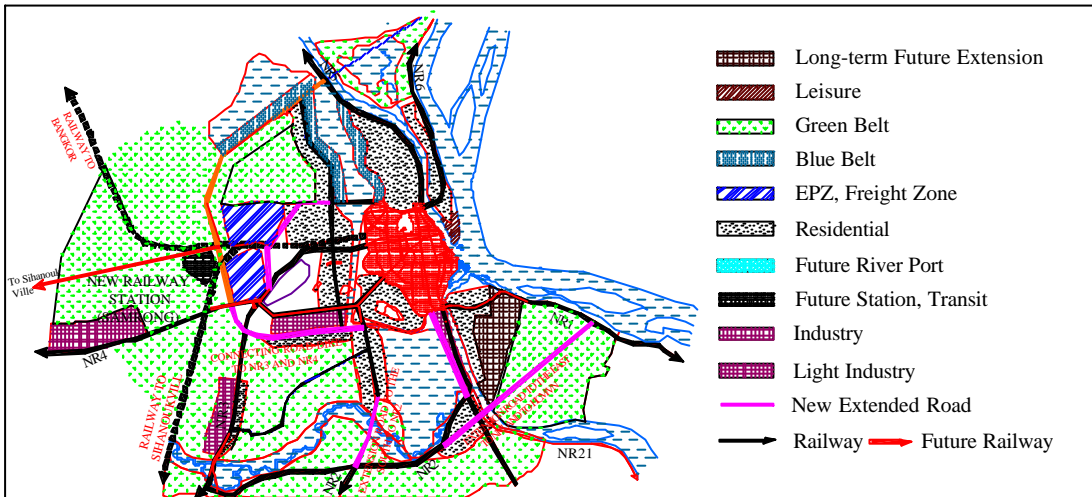
- These development areas include;
 - (i) light industry areas along NR4, BOT Road in the south of Pochentong Airport, NR2,
 - (ii) residential areas adjacent to the present urbanized area,
 - (iii) Export Processing Zone (EPZ) and Freight Zone on the south side of the branching-out point of the existing railroad.
- Construction/improvement of roads serving to the development areas.

Mid-Term Plan (Up to Year 2020)

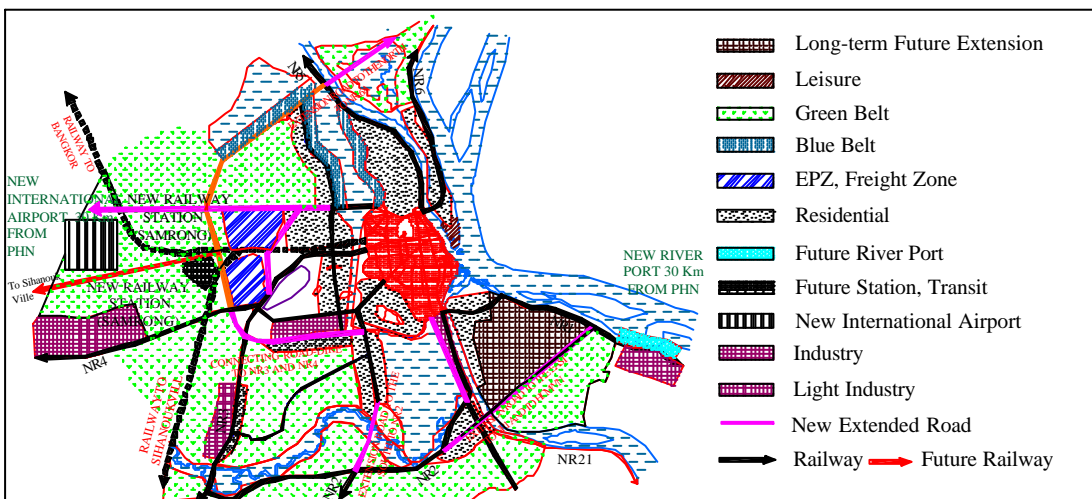
- A new light industry area is developed along NR3, and the existing light industry area are developed further.
- A new railroad station and related facilities are developed on the west side of the “branch-out” point of the existing railroad.



(a) Short Term



(b) Mid-term



(c) Long Term

Source: Bureau for Urban Affairs of Phnom Penh Municipality, BAU/MPP

Figure 10.4-4 Master Plan prepared by Municipality of Phnom Penh

- A new railroad connecting Phnom Penh and Sihanoukville is constructed.
- Leisure areas are developed along Kab Srov Dike (Outer Ring Road) and around the lakes on the west side of Russey Kaev area.
- Extension of Outer Ring Road.

Long-Term Plan (Beyond Year 2020)

- A new international airport is constructed within 30 km from the present urbanized area in its west.
- A new riverport is constructed along NR1 (along Mekong River) within 30 km from the present urbanized area.
- An industrial zone is developed adjacent to the New River Port.
- Further development of EPZ towards north.
- Completion of Outer Ring Road.

10.4.4 Urban Development Policies

Through discussion on the urbanized area plan and the conceptual plans with BAU, MPP officials, the urban development policies were established as follows:

Urbanized Area

- To restrict the population growth to ease concentration of population;
- To preserve urban landscape, historical, cultural heritage and environment as well as promotion of tourism.

Suburban Area

- To achieve spatial distribution of urban activities;
- To create a progressive region with urban structure, high development potentiality and amenity;
- To accommodate the expected population growth.

10.4.5 Future Land Use Plan

The future land use plans are shown in Figure 10.4-5 and 6, which were developed based on the discussions with BAU, MPP officials and the urban development policies.

The major features of the future land use are as follows:

- (i) Development of residential area in a controlled and desirable form (with appropriate infrastructures, amenity, etc.) in the areas where such development is currently progressing in a rather uncontrolled manner. These planned residential areas include those areas as;
 - To the west of, and adjacent to, the present urbanized area,
 - Along Cheung Aek Road (see Figure 5.1-1 for the location of Cheung Aek Road),
 - Around Tumpun Lake (presently, there are large numbers of squatters), and
 - Russey Kaev (currently being developed as a residential area)
- (ii) Development of industrial areas and EPZ as described in Section 10.4.3
- (iii) Construction of New International Airport and other transport facilities as described in Section 10.4.3.

The land use in the urbanized area in 2015 was assumed to be same as the land use in 2000. The land use in year 2015 for the suburban area is shown in Table 10.4-2.

Land Use	2000	2015	
	(ha)	(ha)	Growth
Area	41,184	41,184	
Residential	8,307.5	12,000	1.44
Commercial	649.5	1,100	1.69
Industrial	2,059	3,496	1.70
Institution	636	650	1.02
Agriculture	18,627	13,170	0.71
Parks & Open Space	712	830	1.17
Swamp Area	5,657	5,402	0.95
Water Surface	4,536	4,536	1.00
Total	41,184	41,184	1.00

10.5 HOUSEHOLD INCOME AND VEHICLE OWNERSHIP

10.5.1 Household Income

The average household income obtained by the person trip survey was US\$79/month. The future household income was assumed to increase at the same rate as the GDP per capita.

Table 10.5-1 Future Household Income

	2000	2005	2010	2015
GDP per capita (US\$) <1>	215 (1.00)	267 (1.24)	350 (1.63)	447 (2.08)
Average Household Income (US\$/month) <2>	79 (1.00)	98 (1.24)	129 (1.63)	164 (2.08)

Note: <1> Estimate by CDRI, (1993 Price)

<2> Study Team

10.5.2 Vehicle Ownership

(1) Estimation of Vehicle Ownership Rate

The private car and motorcycle ownership rates per household at the present time were estimated from the result of person trip survey. According to the survey, private car and motorcycle ownership rates were closely related to the household income level (Figure 10.5-1).

The results from the regression analysis between the ownership rate and the household income level by using the logistic curves are shown in Figure 10.5-2.

By using the above analysis, the future ownership rates were estimated as shown in Table 10.5-2.

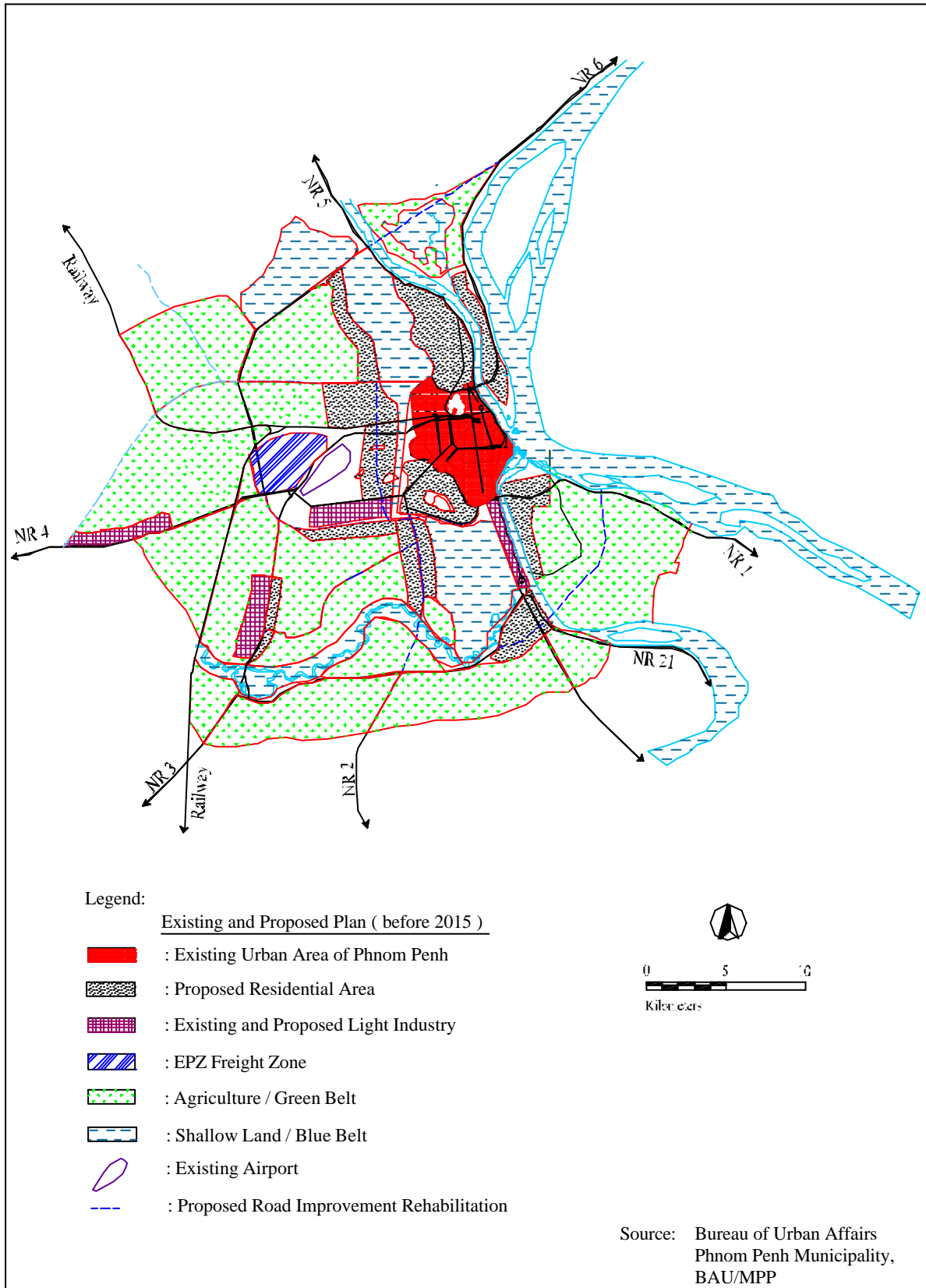


Figure 10.4-5 Land Use Plan (2015)

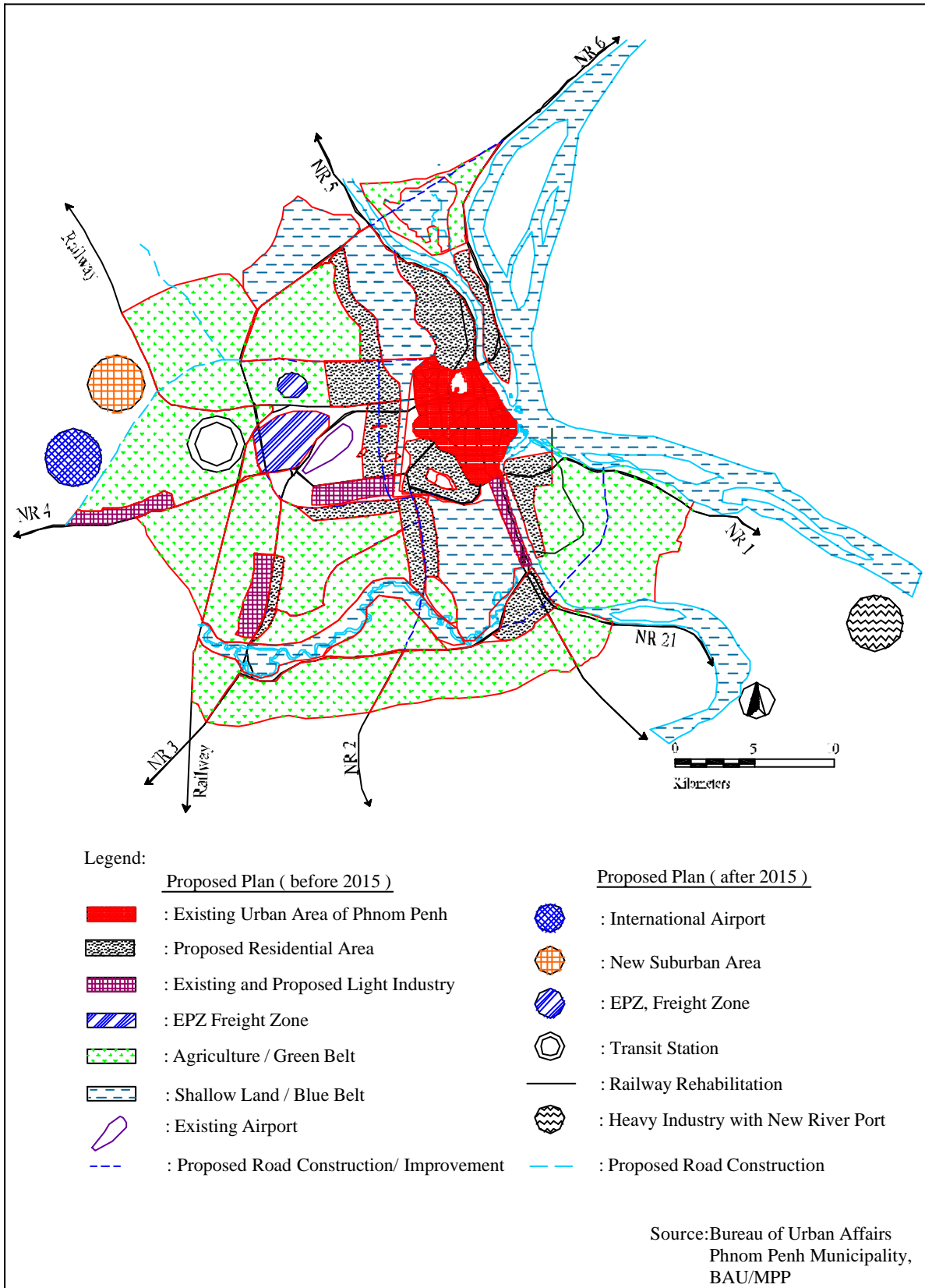


Figure 10.4-6 Master Plan for Future Development of Phnom Penh (beyond 2015)

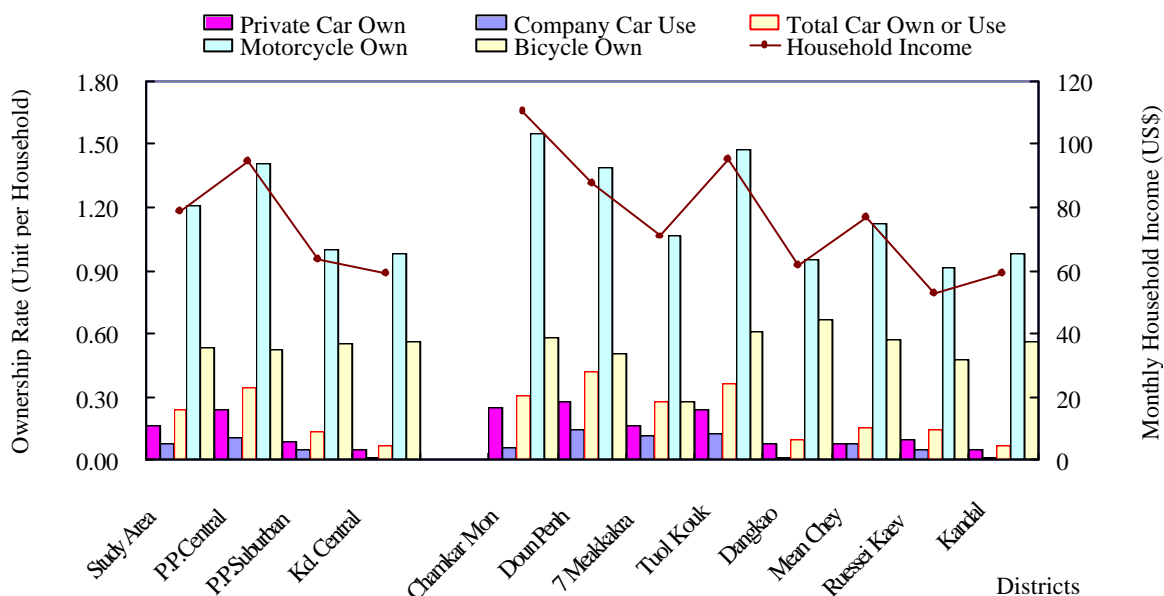


Figure 10.5-1 Household Income Level & Vehicle Ownership by Districts

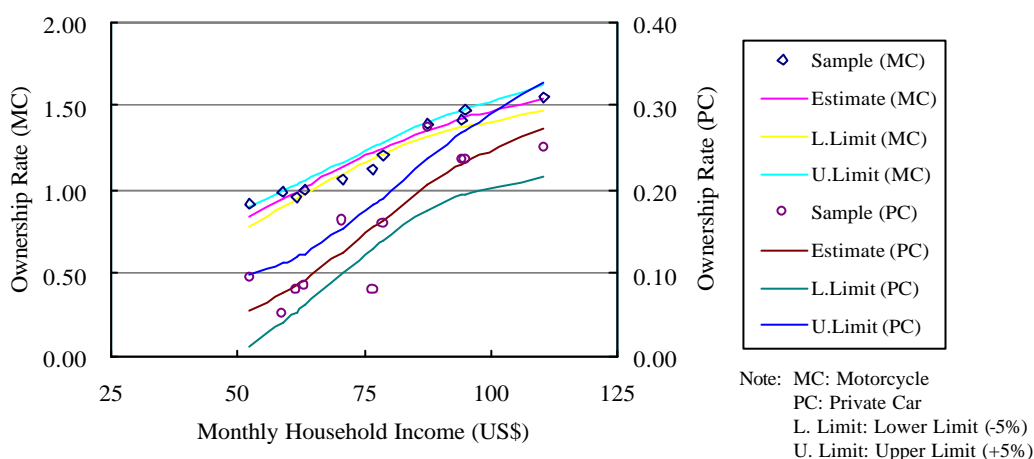


Figure 10.5.2 Household Income Level & Vehicle Ownership Rates

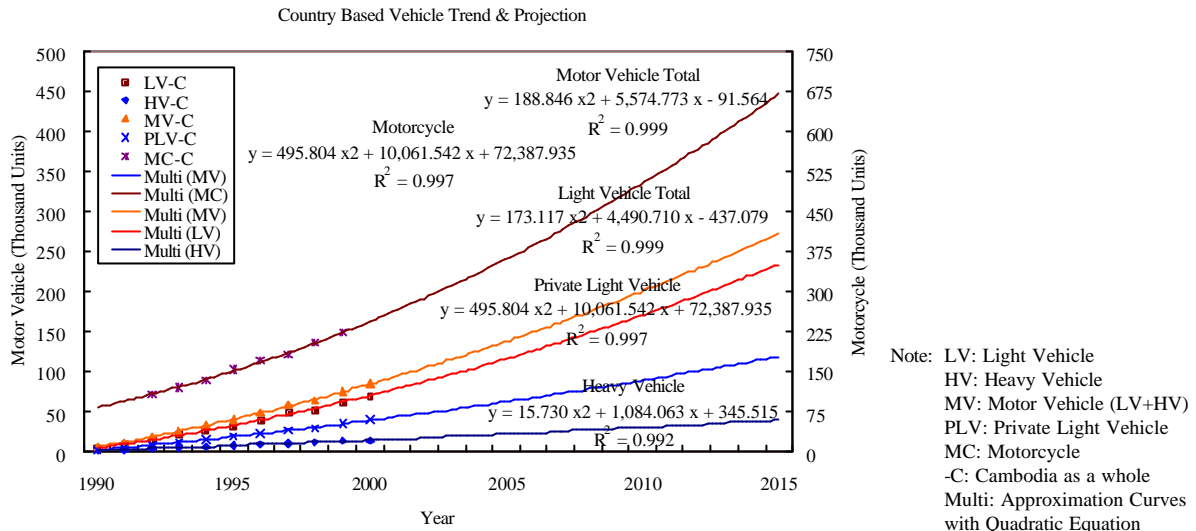
Table 10.5-2 Vehicle Ownership Forecast (Restrained Case)

Year	2000	2005	2010	2015
GDP per Capita (US\$)	215	267	350	447
Average Household Income (US\$)	79	98	129	164
Car Ownership Rate	0.16	0.23	0.29	0.30
Motorcycle Ownership Rate	1.25	1.43	1.61	1.68

Source: GDP per Capita was projected by CDRI
Average Household Income & Ownership Rate are estimated by the Study Team

(2) Estimation of Number of Vehicles

On the basis of registered number of vehicles from 1990 to 2000 provided by MPWT, the number of motor vehicles up to year 2015 was estimated adopting various formulas. Figure 10.5.3 shows the number of motor vehicles estimated based on the past trend and gives details of the formulas adapted for each vehicle type.



With these formula, estimated values by logistic curve for both automobile and motorcycle show slightly higher values than the median of other values estimated by five different formulae for almost all years up to year 2015. The logistic curve itself is widely used for forecasting this kind of economic index; therefore, estimation by using logistic curves shall be applied for further analysis.

Different formula was applied to forecast such economic index, and the logistic formula provided the best fitting for all the vehicle categories.

The number of motor vehicle estimated by logistic curve up to year 2015 that were adopted for the study are summarized in Table 10.5-3.

Table 10.5-3 Estimated Number of Motor Vehicles

	2000	2005	2010	2015
Car	48,132 (1.00)	77,000 (1.60)	120,000 (2.49)	166,000 (3.45)
Motorcycle	247,507 (1.00)	342,000 (1.38)	458,000 (1.85)	570,000 (2.30)