

CHAPTER A-6 TRAFFIC SURVEY AND ANALYSIS

6.1 Traffic Survey

Series of traffic surveys were conducted in nationwide by using the local consultant in order to grasp the current road traffic condition in Cambodia. Three types of traffic surveys were conducted as follows:

- (1) Roadside Traffic Count Survey (60 stations)
- (2) Origin and Destination (OD) Interview Survey (41 stations)
- (3) Travel Time Survey (21 routes)

Table 6.1 shows the detailed schedule of the survey. In addition, the training of traffic count survey and OD interview survey were conducted to the staffs of provincial Department of Public Works and Transport (DPWT) from the view point of technical transfer. The data collected from these surveys are utilized for the traffic demand forecast, and planning of road network development and road maintenance.

6.2 Survey Results and Identification of Traffic Characteristics

(1) Traffic Count Survey: **Figure 6.1** shows the 24 hours traffic volume at survey stations. The observed traffic volume on 2-Digit national road is considerably smaller than that on 1-Digit national road. The average daily traffic volume on 2-Digit national road is 1,312 only, though that on 1-Digit national road is 7,330. As seen in **Table 6.2** traffic volume on 1-Digit road around a big city, such as NR.1 near Phnom Penh and NR.6 near Phnom Penh, exceeds a capacity of a two lanes road, therefore, a bypass or widening to 4 traffic lanes might be necessary in the near future.

(2) OD Interview Survey: Total sampling rate of OD interview survey was 7.3% though the lowest sampling rate was 2.3% at Station No.1. The sampling data can be judged enough to analyze and use in future traffic demand forecast from statistical point of view.

(3) Travel Speed Survey: The results of travel speed survey by sections. In Cambodia, road surface condition is the dominant factor of travel speed except for Phnom Penh area and the center of some large cities.

6.3 Present OD Table

- (1) Calculation of Annual Average Daily Traffic

In this Study, the traffic volume, as an Annual Average Daily Traffic (AADT), has been computed as an average of nationwide traffic, by using the traffic data obtained through the traffic survey. The way of calculating the volume is: AADT were computed from the weekly variation, that has been calculated based upon the continuous traffic survey for a week at the survey point of No.23 on the National Road No.6A, and the monthly variation that is calculated based upon the number of boarded vehicles on a ferry, crossing the Mekong River, at Neak Loueng. Three categories of

OD tables for Motorcycles (MC), Light Vehicles (LV) and Heavy Vehicles (HV) have been made. The Zoning system has been prepared on a basis of district (197) and provincial (36).

(2) Desired Line

The result of the OD survey indicated that connection of trips to/from Phnom Penh (zone12) and its surrounding area is overwhelming. In particularly, trip volume between Phnom Penh and Kandal province (zone 8) is several times larger than anywhere in Cambodia, as shown in **Figure 6.3**.

MC is overwhelmingly striking in and around Phnom Penh, when compared to other modes. Main cities in provinces, such as the Battambang Province (zone 2), the Siemreap Province (zone 17), the Kampong Cham Province (zone 3) and the Kampot Province (zone7), have the same characteristic that zones adjacent to provincial centers have majority of the share. Moreover, there are trips greater than 8,000 vehicles/day between Svay Rieng Province (zone 20) and Viet Nam (Zone 31), which indicates that cross-border traffic of people and goods uses NR.1.

LV, as well as MC, have more trips in between Phnom Penh and its adjacent zones. However, there are also medium distance zone trips such as between Phnom Penh and Sihanoukville (zone 18) or Battambang (zone 2), which have direct relation with Phnom Penh in distribution of industry.

HV trip volume is highest between Phnom Penh and Kandal Province, followed by Takeo (zone 21), and Sihanoukville provinces. Long distance zone trips linking Phnom Penh with other provinces are striking, but not in between provinces not passing through Phnom Penh, This indicates that distribution of agricultural products is still concentrated in Phnom Penh.

6.4 Present traffic bottleneck and issues

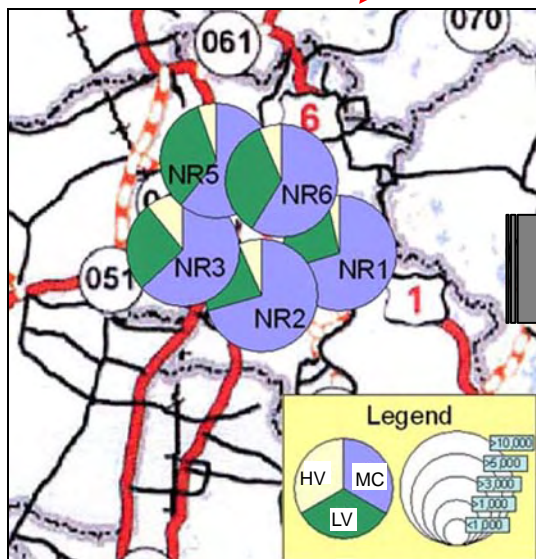
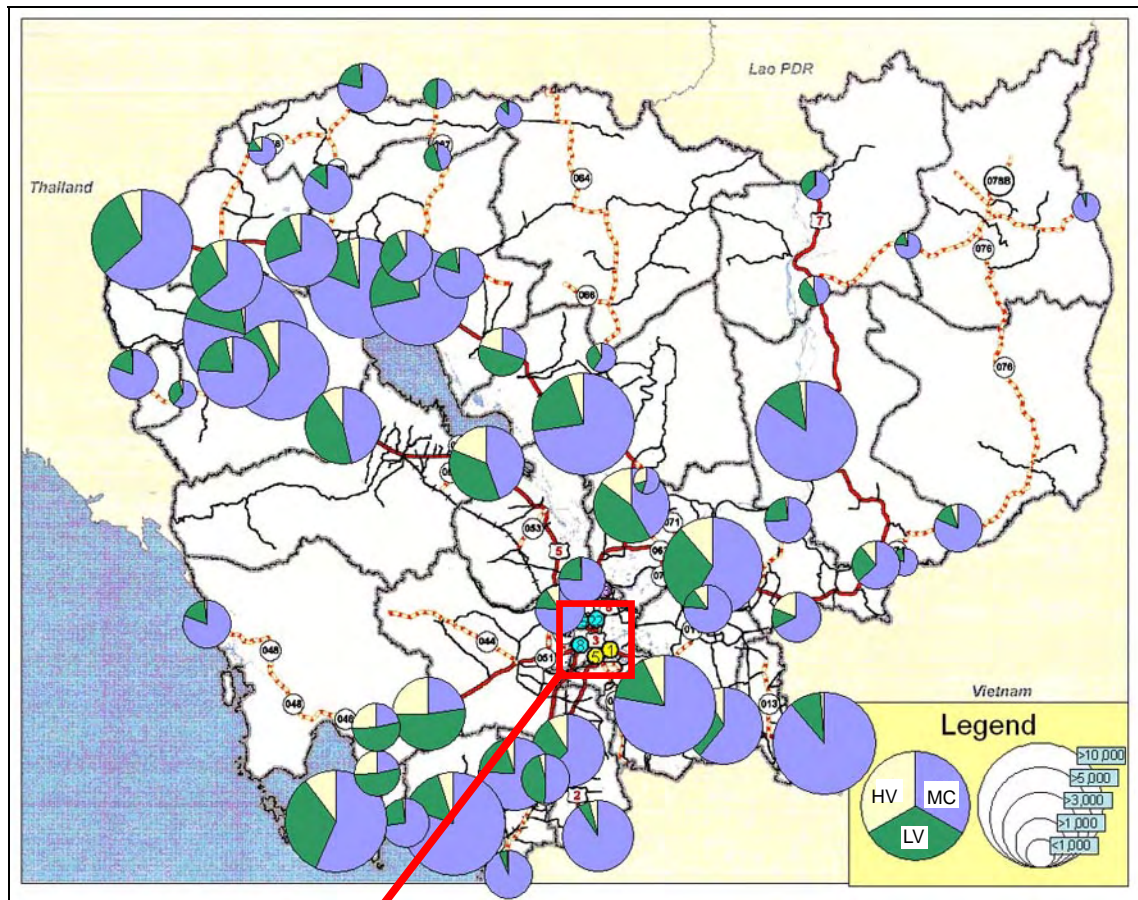
The present traffic bottleneck and issues in Cambodian national roads can be summarized as:

- (1) Traffic Composition: mixed composition of slow and fast-moving vehicles have contributed to traffic congestion in urban centers and other areas.
- (2) Markets Along Roads: markets and parked vehicles occupying most of the shoulders narrows down the effective lane width causing through traffic to slow down and build up along these areas.
- (3) Traffic Control and Safety Facilities: lack of traffic signal lights and warning signs on major intersections has been observed to be a cause of traffic bottlenecks.
- (4) Capacity Overflow: national roads between Phnom Penh and Kandal province and other city centers including Siem Reap and Battambang are observed to have reached or are approaching its traffic capacity causing congestions in these areas during peak hour periods.
- (5) Road User Behavior: major cause of traffic accident and congestion in Cambodia is road user behavior, including misuse of lanes, traffic violations, over speeding, disregard of traffic rules and regulations, use of shoulders for parking, overloading, etc.

Table 6.1 Outline of the Traffic Survey

Survey Title	Objectives	Method	Survey Coverage	Survey Date
Roadside Traffic Count Survey	To understand traffic volumes and vehicle types on the major road sections	Traffic count (vehicles) 24/12 hours	<ul style="list-style-type: none"> ■ Survey stations and survey period (Total of 60 stations) <ul style="list-style-type: none"> - 12 hrs x 1 day (42 stations) - 24 hrs x 1 day (5 stations) - 24 hrs x 7 days (1 station) - Operating hours of international borders (12 stations) ■ Vehicle Classification (Total of 8 types) <ul style="list-style-type: none"> - Motorcycle x 2 types - Light Vehicle x 3 types - Heavy Vehicle x 3 types 	Tuesday, Wednesday and Thursday between April 20 and May 14, 2005 (Except for 24hrs x 7 days survey)
OD Interview Survey	To capture trip information for the vehicles on the major road sections	Direct interview of drivers at roadsides 24/12 hours	<ul style="list-style-type: none"> ■ Survey stations and survey period (Total of 41 stations) <ul style="list-style-type: none"> - 12 hrs x 1 day (24 stations) - 24 hrs x 1 day (12 stations) - Operating hours of international borders (5 stations) ■ Vehicle Classification (total of 8 types) <ul style="list-style-type: none"> - The same as the Traffic Count Survey ■ Interviewed Items <ul style="list-style-type: none"> - Origin and destination of travel - Objective of travel - Seating capacity and number of passengers - Commodity and its load - Estimated travel time - Vehicle registration 	Tuesday, Wednesday and Thursday between April 20 and May 11, 2005
Travel Time Survey	To understand travel speeds on major routes by road section	“Floating car” method 1 round trip per route	<ul style="list-style-type: none"> ■ Surveyed routes (Total of 21 routes) <ul style="list-style-type: none"> - 7 routes of 1-Digit national roads - 14 routes of 2-Digit national roads 	Tuesday, Wednesday and Thursday between April 20 and May 11, 2005

6.1.2 Traffic Count and OD Interview Surveys



24 hrs Traffic Volume around Phnom Penh

ST No. (Road No.)	Motor cycle	Light Vehicle	Heavy Vehicle	Total
ST1 (NR1)	27,916	10,358	1,462	39,736
ST5 (NR2)	8,560	2,771	798	12,129
ST8 (NR3)	6,311	2,624	1,082	10,017
ST15 (NR5)	8,486	4,738	724	13,948
ST22 (NR6)	15,372	9,161	1,681	26,214

Source: JICA Study Team

Figure 6.1 24 hours Traffic Volume

Table 6.2 Present Traffic Volume on 1-Digit Road

Road No.	Urban area		Rural area	Border	
	Location	Traffic Volume	Traffic Volume	Location	Traffic Volume
1	P.P. border	39,700	3,600-8,000	Vietnam	8,500
2	P.P. border	12,100	3,800	Vietnam	3,600
3	P.P. border	10,000	4,300-5,500	-	-
4	Sihanoukville	5,100	2,100-2,800	-	-
5	P.P. border	13,900	3,300-4,400	Thailand	8,000
	Batambang	18,500	5,800(inner province)		
6	P.P. border	26,200	1,500-3,700	-	-
	Siemreap	6,200-8,600			
7	Kampong Cham	8,800	1,800	Laos	100
	Kratie	5,100			

Note : Traffic Volume: vehicles per day

P.P. border: Phnom Penh- Kandal

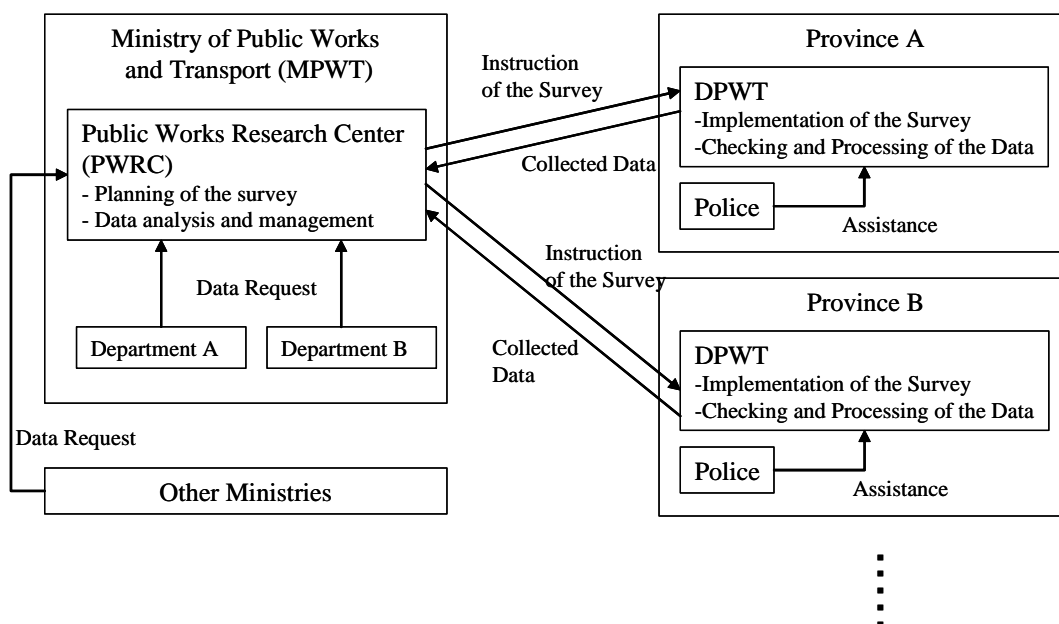


Figure 6.2 Recommended Organization Chart for Traffic Survey and Data Management

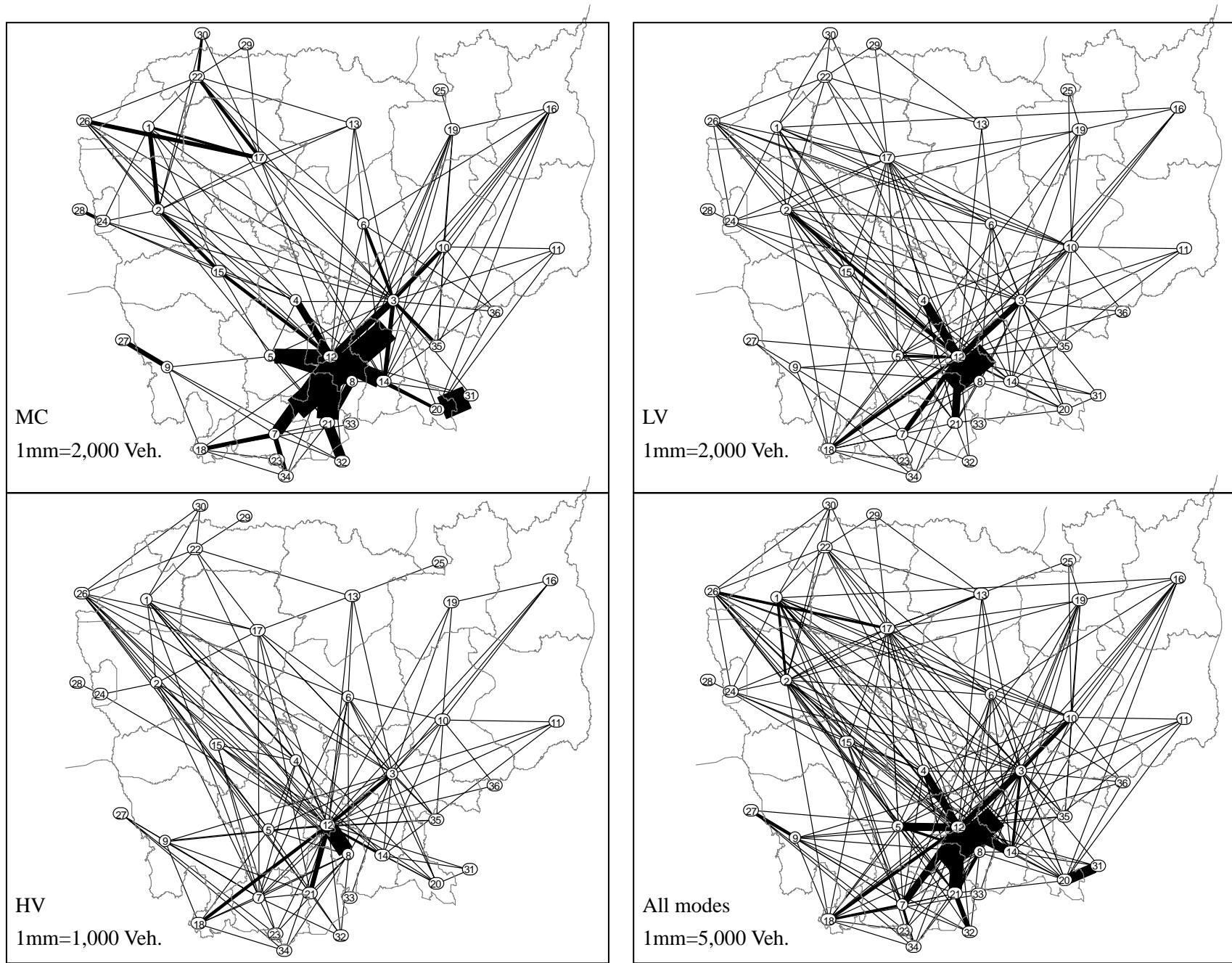


Figure 6.3 Desire Line in 2005

CHAPTER A-7 FUTURE SOCIO-ECONOMIC FRAMEWORK

7.1 Present Socio-Economic Condition in Cambodia

In this sub-chapter, the present socio-economic condition of Cambodia will be studied in order to understand the real lives of people living in both rural and urban areas.

Although the socio-economic information is side data, there are important points to be considered in i) the benchmark of the present condition, ii) the demand projection of traffic and iii) the prioritization of the potential projects in the first stage. **Figure 7.1** illustrates the steps to utilize the socio-economic indicators for the Road Network Master Plan.

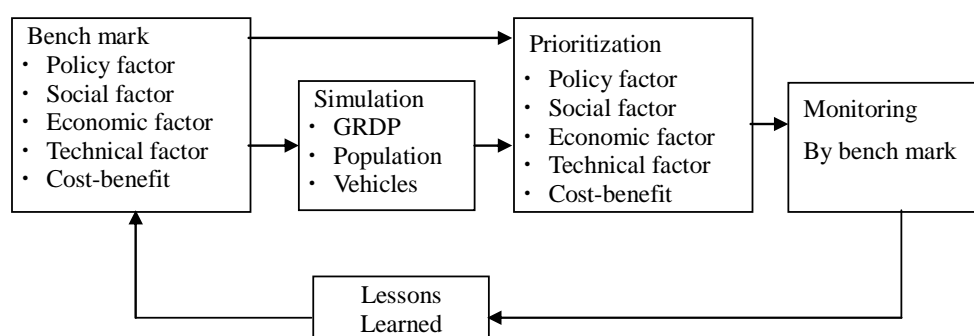


Figure 7.1 Reasons for including the socio-economic indicators

(1) Social Conditions of the Districts

The policy of regional development including the road network plan and the investment plan would be the one of significant policy to distribute the national property. By establishing the road network and promoting the investments, socio-economic activities will be promoted.

According to the rural development database conducted by the Seila program, the illiteracy ratio of adults over the age of 15 years in Cambodia was 17.6% in 2003. From the viewpoint of gender, the female illiteracy ratio is higher, at 19.5% in comparison to 15.5% for males. Accessibility to schools in rural areas is not yet ideal, but many rural roads have been rehabilitated since 2000 by the lead of Ministry of Rural Development with support by the international fund. Still, the issue of maintaining the laterite pavement needs to be addressed.

There are six national hospitals, five military hospitals and six national programs in Cambodia according to the latest information released by the NIS and Ministry of Health. According to interviews with villagers in rural areas, access to health care facilities is one of the highest priorities when thinking about the rural road network, as well as access to schools.

(2) Economic Condition of the Districts

Thatch roof is one of the indicators to assess the degree of improvement of living conditions. The poverty districts are identified by the dark color. According to the Rural Development Database

of the Seila Program, the TV set can represent not only an indicator of wealth but also of electrification, which is regarded as the one of the important public infrastructures.

There are two types of electrification systems, 'On Grid' and 'Off Grid.' On Grid is the facility established mainly by MIME and linked from power plants to the site by power lines and distribution lines to end users. Off Grid instead consists of private power stations, i.e. using diesel to make electricity and connecting to end users having contracts or charging batteries to consumers. The electrification projects should be taken into account when the synergy effect of economic development is considered.

Accessibility of markets is one of the indicators of the advantages of living conveniences when assessing fairness or equal opportunity.

7.2 Projection of Socio-Economy

(1) Population Projection

These figures are adopted as a base of population forecast.

Table 7.1 Projected Annual Rate of Growth by Province (%)

Year	1999-2000	2004-2005	2009-2010	2014-2015	2019-2020
Cambodia	1.79	1.93	2.06	2.07	1.93
Banteay Meanchey	2.84	2.71	2.73	2.65	2.46
Battambang	1.57	1.82	2.07	2.13	2.00
Kampong Cham	1.21	1.45	1.60	1.64	1.54
Kampong Chhnang	2.13	2.31	2.52	2.60	2.50
Kampong Speu	2.05	2.16	2.31	2.32	2.15
Kampong Thom	1.80	1.90	1.97	1.96	1.80
Kampot	0.95	1.27	1.52	1.62	1.53
Kandal	1.28	1.47	1.62	1.67	1.55
Koh Kong	5.61	4.17	3.72	3.40	3.11
Kracheh	2.75	2.63	2.53	2.42	2.27
Mondul Kiri	3.11	2.90	2.84	2.90	2.91
Phnom Penh	3.56	3.21	2.92	2.62	2.34
Preah Vihear	2.70	2.64	2.58	2.56	2.43
Prey Veng	0.50	0.84	1.05	1.12	1.03
Pursat	1.17	1.56	1.98	2.16	2.05
Ratanak Kiri	2.77	2.82	2.90	2.95	2.89
Siem Reap	2.25	2.34	2.42	2.39	2.24
Sihanoukville	3.66	3.42	3.27	3.08	2.84
Stung Treng	2.84	2.73	2.67	2.62	2.47
Svay Rieng	0.86	1.07	1.27	1.34	1.21
Takeo	0.99	1.24	1.46	1.57	1.47
Otdar Meanchey	2.48	2.48	2.60	2.65	2.48
Kep	3.29	3.21	3.16	3.07	2.81
Krong Pailin	6.39	3.89	3.55	3.34	3.08

Source: First Revision Populations for Cambodia 1998-2020, NIS

For the purpose of an estimation of population growth in 185 Districts, the Study Team referred to the Rural Development Database that comprises the latest available data of the districts' population released by the Ministry of Planning and the Seila Program. The population in 2003 was 12,503,401 according to the database. Since the projected population for the year 2003 by the

NIS is 13,287,053, which is about 7 million more than the actual, the Study Team used the Database for adjustment of the reality. Projected populations in 2005, 2010, 2015 and 2020 were calculated using the growth rate shown in **Table 7.2**.

Table 7.2 Projection Based on the Actual Data of 2003

Year	Actual	Projection			
	2003*	2005	2010	2015	2020
Population (1,000)	12,503	13,350	14,732	16,261	17,945
Increase ratio			2.1%	2.1%	1.9%

Source: JICA Study Team estimation using data from “First Revision Populations for Cambodia 1998-2020, NIS” and “Rural Development Database 2003, Seila program”

(2) Projection of Gross Regional Domestic Products

In order to formulate the projection of GRDP, two alternatives were compared, namely (i) Trend scenario (high growth) and (ii) MEF scenario (low growth). Since the gap between the trend scenario and the MEF scenario is very large, the Study team estimated the third scenario as shown below:

Proposed Scenario (medium growth)

In terms of the growth rate of the primary sector, the projected rate is also assumed stable, at 3.8%, because the agriculture sector is usually not expected to achieve a high constant growth rate even if the irrigation system is introduced.

On the other hand, new investment of electricity encouraging development of factories and education is expected in the industrial, or secondary, sector, the so that 8% and 10% are considered appropriate growth rates in 2014-15 and 2019-20, respectively.

The last sector, the tertiary sector of the service industry, is assumed to grow in conjunction with the growth of the secondary sector. The Study Team fixed it at 8.0% in both 2014-15 and 2019-20 as shown in **Table 7.3**.

Table 7.3 GDP Projection based on the

Sector	GDP growth rate				Projected GDP			
	2004-05 (Actual)	2009-10	2014-15	2019-20	2005 (Actual)	2010	2015	2020
Trend Scenario	7.7%	8.2%	9.4%	10.6%	18,490	27,839	43,702	72,460
MEF Scenario	7.7%	6.0%	6.4%	6.4%	18,490	24,873	33,699	45,884
Proposed Scenario	7.7%	6.0%	6.9%	7.8%	18,490	24,873	34,653	50,401
Primary Sector	-2.0%	3.8%	3.8%	3.8%	5,967	7,163	8,631	10,401
Secondary Sector	16.1%	7.2%	8.0%	10.0%	5,857	8,510	12,504	20,138
Tertiary Sector	9.2%	7.1%	8.0%	8.0%	6,664	9,200	13,517	19,861

(3) Projection of Number of Vehicles and Motorcycles

In principal, the number of vehicles/motorcycles is influenced by the GDP, in other words income levels. Therefore, the Study Team identified the correlation and regression formula between GDP and the number of households having vehicles and motorcycles in 2003.

Table 7.4 and Figure 7.2 describes the projected number of vehicles and motorcycles in 2005, 2010, 2015, and 2020, which are calculated by formulas. The provincial GRDP is growing according to the proportion of the sector growth rate with the prior condition that the proportion of sector employment would not change until 2020.

Table 7.4 Projection of Numbers of Vehicle and Motorbike

Year	Projection			
	2005	2006~2010	2011~2015	2016~2020
Vehicles	285,125	6.0 %	6.9 %	7.8 %
Motorbikes	687,960	5.8 %	6.6 %	7.4 %

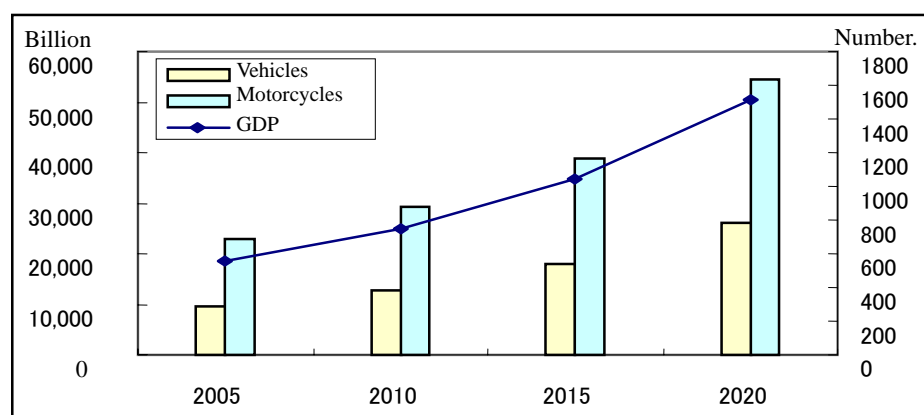


Figure 7.2 Projection of Number of Vehicles and Motorbikes

7.3 Formulation of Socio-Economic Frame

7.3.1 Results of Socio-Economic Projection

The socio-economic frame from 2005 until 2020 in steps of 5 years is tentatively formulated as follows in **Table 7.5**.

Table 7.5 Socio-Economic Framework in 2005, 2010, 2015 and 2020

	2005 (Base Year)		2010		2015		2020	
Population ('000)	13,350	1.00	14,732	1.10	16,261	1.10	17,945	1.11
GDP (Million Riel)	18,490	1.00	24,873	1.35	34,653	1.39	50,401	1.45
Vehicles	285125	1.00	384.847	1.35	537,578	1.39	783,528	1.45
Motorbikes	687,960	1.00	876,955	1.27	1,166,429	1.33	1,632,580	1.40

Source: JICA Study Team

CHAPTER A-8 TRAFFIC DEMAND FORECAST

8.1 Methodology and Calculation Method for Traffic Demand Forecast

Based on the current OD tables, containing the traffic count and OD interview survey data as well as the future socio-economic frame-work presented in previous chapter, future OD tables were forecasted through the use of a trip generation and attraction model for inter-zonal trips. Generated and attracted trips were then distributed on a zonal basis and intra-zonal trips were estimated for each zone for traffic assignment purposes. The magnitude of potential future traffic problems was identified in order to establish the transport improvement components for the master plan projects up to the target year of 2020.

8.2 Estimation of Generation and Attracted Traffic

The objective of trip generation and attraction model is to forecast the number of vehicles that will start and arrive in each traffic zone within the study area. The linear regression model by vehicle categorize are adopted in the study.

Table 8.1 (1) Trip generation and attraction by vehicle type in 2005

(Unit: Vehicle/day)

Zone No	Province	Trip Generation in 2005			Trip Attraction in 2005		
		Motor cycles	Light Vehicles	Heavy Vehicles	Motor cycles	Light Vehicles	Heavy Vehicles
1	Banteay Meanchey	3,867	1,892	219	4,016	1,706	207
2	Battambang	14,587	2,687	236	14,609	2,754	240
3	Kampong Cham	5,970	3,387	781	5,887	3,417	699
4	Kampong Chhnang	1,564	1,861	121	1,525	1,365	87
5	Kampong Speu	3,451	696	316	4,994	1,147	341
6	Kampong Thom	5,228	711	322	5,188	1,006	343
7	Kampot	6,562	974	314	6,579	1,022	318
8	Kandal	30,250	10,615	1,639	28,456	10,386	1,707
9	Koh Kong	1,821	299	109	1,845	477	95
10	Kratie	4,434	654	175	4,598	590	171
11	Mondul Kiri	855	96	27	880	96	28
12	Phnom Penh	43,852	19,027	3,640	44,691	18,761	3,533
13	Preah Vihear	261	70	14	263	63	15
14	Prey Veng	8,446	610	547	7,998	608	616
15	Pursat	1,174	262	180	1,172	237	166
16	Ratanak Kiri	991	88	16	989	89	16
17	Siemreap	8,403	2,017	342	8,262	2,122	362
18	Sihanoukville	3,878	1,045	324	3,788	1,045	326
19	Stung Treng	155	98	22	155	94	24
20	Svay Rieng	1,170	294	142	1,217	463	153
21	Takeo	5,425	1,833	450	5,372	1,817	488
22	Oddar Meanchey	1,154	149	37	1,015	167	31
23	Kep	16	70	19	15	6	26
24	Pailin	352	137	13	352	134	13
	Total	153,866	49,572	10,005	153,866	49,572	10,005

Table 8.1 (2) Trip generation and attraction by vehicle type in 2020

(Unit: Vehicle/day)

Zone No	Province	Trip Generation in 2020			Trip Attraction in 2020		
		Motor cycles	Light Vehicles	Heavy Vehicles	Motor cycles	Light Vehicles	Heavy Vehicles
1	Banteay Meanchey	7,830	3,881	455	8,082	3,496	433
2	Battambang	21,004	5,520	514	21,320	5,628	523
3	Kampong Cham	33,432	12,614	2,865	30,874	12,668	2,589
4	Kampong Chhnang	4,984	6,315	393	4,636	4,605	287
5	Kampong Speu	12,196	2,579	1,151	17,229	4,243	1,261
6	Kampong Thom	16,589	2,389	1,002	15,685	3,325	1,092
7	Kampot	8,287	1,965	648	8,403	2,056	653
8	Kandal	52,813	20,789	3,327	50,297	20,239	3,433
9	Koh Kong	5,227	883	320	5,264	1,394	285
10	Kratie	5,936	915	246	6,191	812	243
11	Mondul Kiri	2,429	389	99	2,281	385	107
12	Phnom Penh	112,184	46,689	9,082	116,654	45,795	8,786
13	Preah Vihear	458	147	25	437	131	28
14	Prey Veng	10,982	1,220	1,133	10,525	1,205	1,269
15	Pursat	12,895	3,035	1,816	11,909	2,764	1,761
16	Ratanak Kiri	1,445	116	22	1,470	112	22
17	Siemreap	27,629	6,998	1,188	26,696	7,309	1,262
18	Sihanoukville	14,625	3,754	1,132	14,365	3,720	1,153
19	Stung Treng	199	123	28	195	116	31
20	Svay Rieng	2,903	950	419	2,769	1,492	478
21	Takeo	17,811	6,402	1,503	16,888	6,314	1,655
22	Oddar Meanchey	2,193	307	80	1,880	354	65
23	Kep	32	192	50	27	15	83
24	Pailin	435	213	22	441	207	21
	Total	374,518	128,385	27,520	374,518	128,385	27,520

8.3 Estimation of Future Traffic Distribution

Trip distribution is the second major step in the travel demand modeling process. Trip production provided methodology for estimating trip generations and attractions for each purpose within each zone. Trip distribution is the process that links the generations to attractions for each zone pair. Based on the trip distribution in 2005 and 2020, the desired line by OD, which the trip distribution and interaction among zone pair are illustrated in **Figure 8.1**.

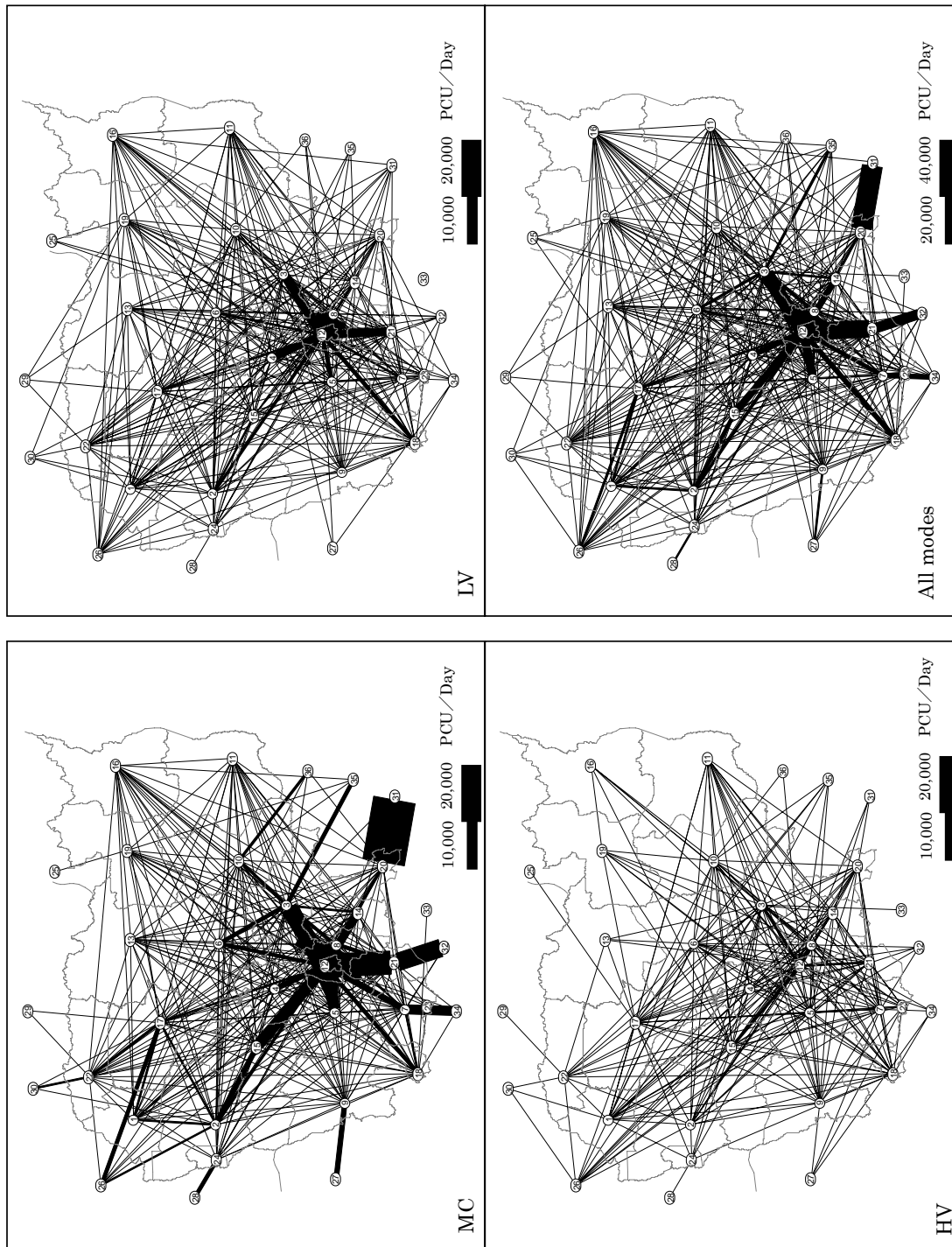


Figure 8.1 Desire Line for 2020

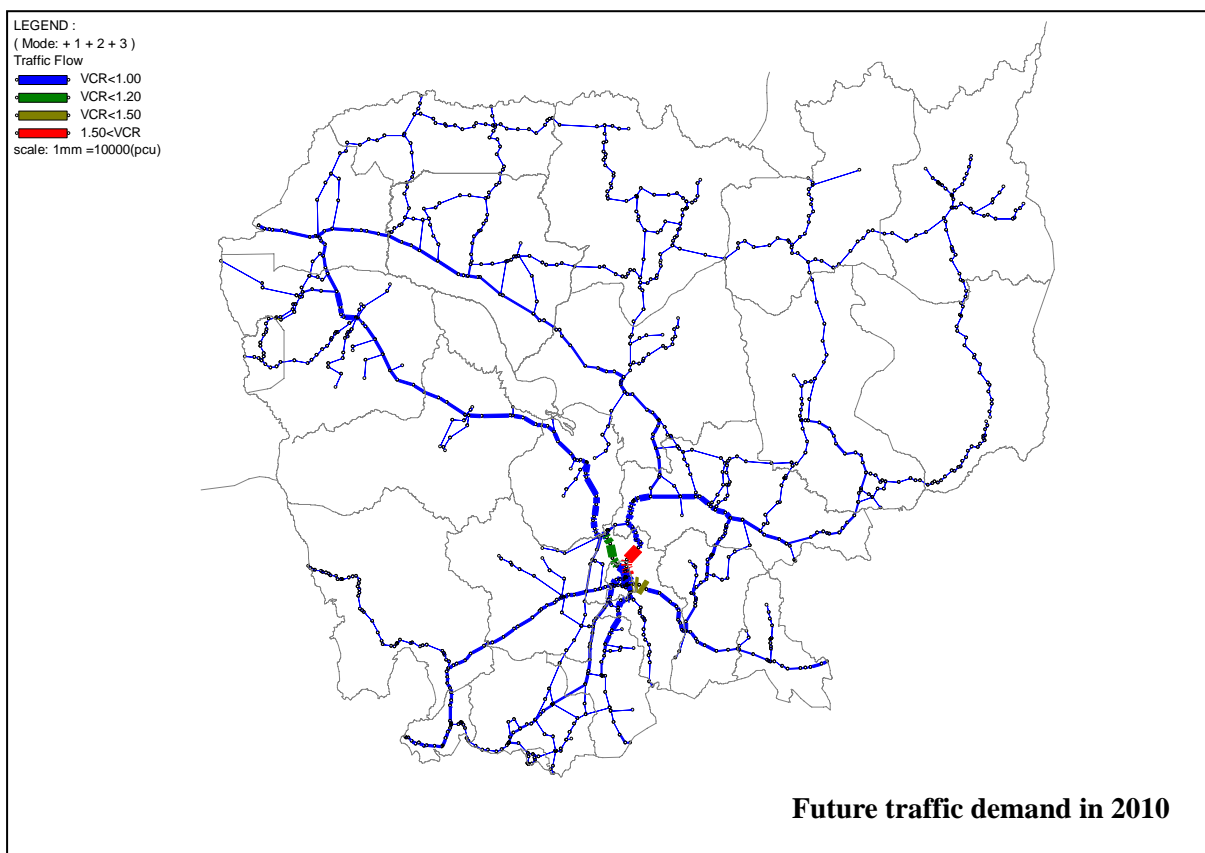
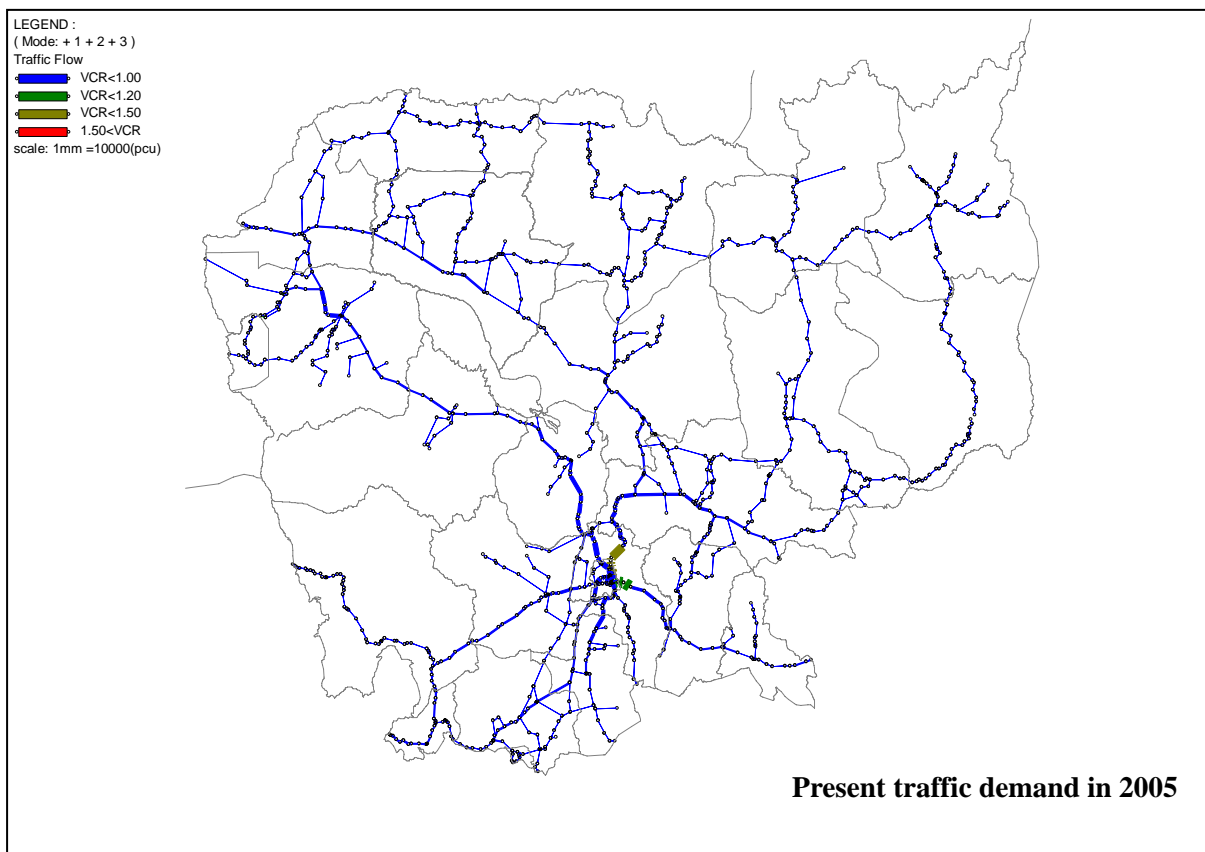
8.4 Traffic Assignment on Road Network

The traffic assignment process allocates vehicle traffic to road network links.

Table 8.2 Result of Future Traffic Volume by Traffic Count Stations

(unit: PCU)

Station No.	Road No.	Year			
		2005	2010	2015	2020
1	1	29,340	39,842	55,668	73,347
2	1	6,180	10,524	20,734	31,314
3	1	3,362	5,421	8,035	13,634
4	1	3,788	6,403	11,785	16,912
5	2	9,486	15,293	18,258	19,781
6	2	3,476	5,403	8,304	11,829
7	2	1,755	2,986	5,467	8,839
8	3	9,754	12,840	19,987	31,412
9	3	2,942	4,234	5,575	11,464
10	3	3,509	4,715	5,737	9,411
11	3	1,269	2,088	2,759	6,019
12	4	4,792	7,333	12,617	17,487
13	4	3,777	6,512	10,243	13,604
14	4	5,127	7,990	12,270	18,398
15	5	13,165	23,764	29,652	43,176
16	5	4,619	9,578	16,361	25,462
17	5	4,031	7,868	12,496	17,429
18	5	4,235	8,046	12,636	17,589
19	5	8,987	12,830	17,607	21,289
20	5	3,196	6,779	10,887	15,717
21	5	5,509	7,884	10,498	13,605
22	6A	23,323	29,034	34,246	47,978
23	6A	8,915	12,270	14,534	23,103
24	6	3,445	6,839	11,885	23,431
25	6	3,843	6,488	10,749	25,481
26	6	1,683	3,645	6,831	19,472
27	6	3,735	6,122	9,961	21,754
28	6	4,321	7,593	12,109	22,096
29	6	2,560	5,577	9,444	17,091
30	7	7,938	13,035	22,750	36,151
31	7	1,639	2,960	3,878	8,051
32	7	2,289	2,498	2,661	2,760
33	7	450	570	681	2,373
34	7	72	125	188	253
35	11	3,367	5,528	13,077	20,224
36	31	1,158	1,487	1,970	2,728
37	33	713	1,204	2,231	4,127
38	48	1,771	2,064	3,478	5,341
39	48	1,070	1,599	2,440	2,941
40	51	1,481	2,669	11,107	19,962
41	56	306	419	595	1,320
42	57	1,731	2,163	2,594	4,555
43	57	475	544	612	2,198
44	57	569	834	1,287	2,397
45	61	681	5,266	8,918	18,053
46	62	226	297	375	1,807
47	66	506	727	1,111	1,637
48	64	1,687	2,534	3,882	7,068
49	64	194	275	403	1,962
50	64	267	394	604	1,217
51	68	580	704	1,003	1,389
52	68	494	676	1,138	1,575
53	71	932	1,267	1,791	8,077
54	72	1,257	2,127	3,914	6,020
55	73	791	1,075	1,336	1,710
56	74	190	329	595	1,167
57	76	541	1,187	1,622	2,961
58	78	274	306	383	701
59	78	240	243	277	326
60	274	150	157	177	181



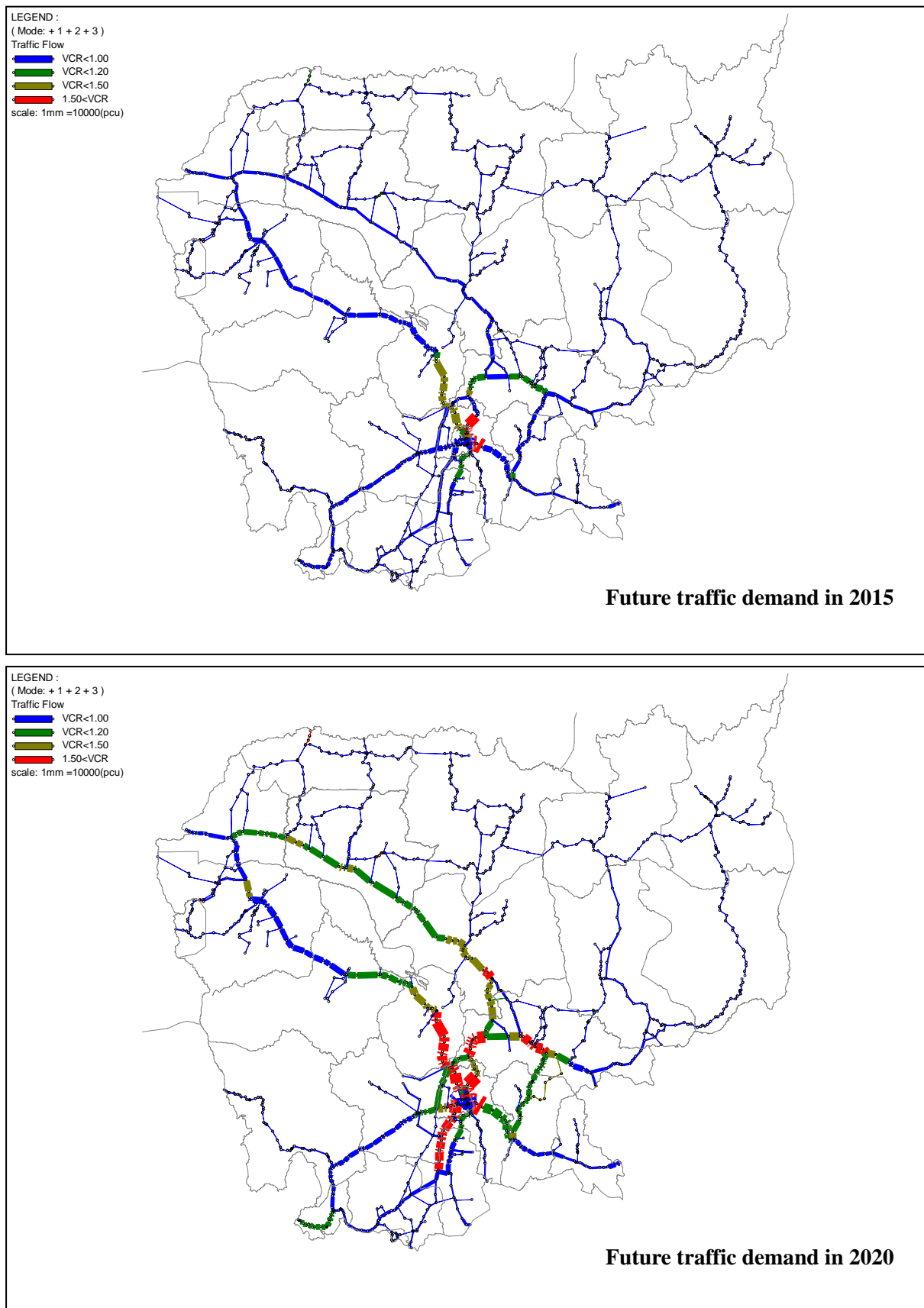


Figure 8.2 Traffic Assignment Results

CHAPTER A-9 DEVELOPMENT CONCEPT AND STRATEGIES

9.1 Current Development Frame

9.1.1 National Development Plan

In order to ensure the efficiency and sustainability of socio-economic development and poverty reduction, the Royal Government of Cambodia has worked out intensively to formulate and implement key national strategic policy frameworks, which focus on the governance action plan and improving people's quality of the life.

The Government has prepared two development guidelines in the past, consisting of:

- Socio-Economic Development Plan II (2001-2005), and
- National Poverty Reduction Strategy 2003-2005 (NPRS)

In 2004, the GOC handed down a new socio-economic development vision i.e. "Rectangular Strategy" with emphasis on economic growth, employment opportunity, equity and efficient government. In addition, it consolidated guidelines into one entitled "National Strategic Development Plan: 2006-2010 (NSDP), which was approved by the Government of Cambodia in January 2006.

It is noteworthy that its policy focus has shifted from "rehabilitation" to "economic development" that the Cambodia is now at a stage to make a new foundation of growth by aligning all the development participants domestically and internationally.



Figure 9.1 GMS Economic Corridor

In addition to the national economic development, poverty reduction is one of the most important issues. Poverty especially in the rural areas is much more serious. Poverty reduction has been tackled based on NPRS.

9.2 Development Issues

9.2.1 Imbalanced Development caused by Single Growth Pole

Economic growth is concentrated on Phnom Penh. GRDP in Phnom Penh makes up 24.1% of GDP as shown in the following table. While Rectangular Strategy aims equity, social justice and efficiency of the public sector. In this context, imbalanced economic structure between Phnom Penh and other provinces should be corrected so as to achieve balanced economic development.

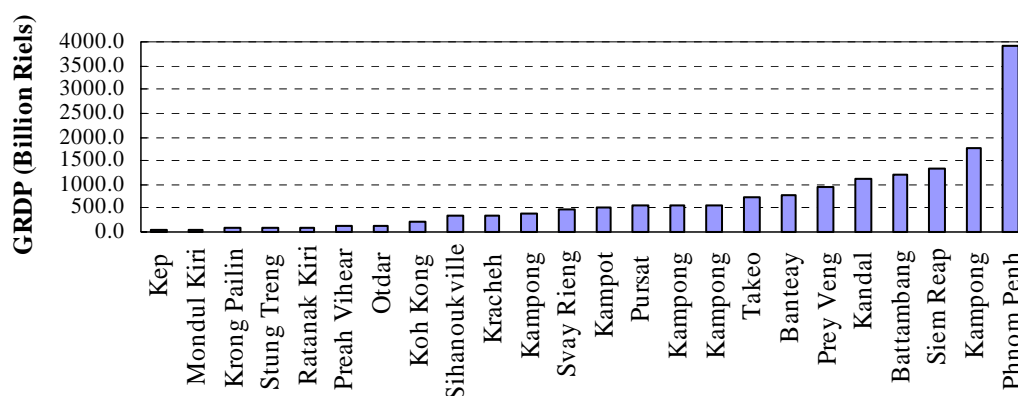


Figure 9.2 GRDP by Province (2003)

In terms of road network development, one digit national roads connecting to Phnom Penh has been developed mostly while development of two digit national roads, provincial roads and rural roads is behind. Road network development, which contributes to the balanced development and correct the single development pole structure, is required.

9.2.2 Encroachment of neighboring socio-economy

Cambodia shares borders with Thailand, Vietnam and Laos. Among these three (3) countries, Thailand and Vietnam have a strong economic connection with Cambodia. These two (2) countries are placed within the tenth of both import and export of Cambodian international trade. The balance of trade for Cambodia, however, 745.2 mil. US\$ and 105.2 mil. US\$ in the red to Thailand and Vietnam, respectively. These trade defects might encourage illegal export of illegal logged woods¹.

While in Koh Kong, Pailin, Oddar Meanchey, Preah Vihear and Banteay Meanchey, where share borders with Thailand, Thai baht of Thai currency is circulated and Thai products are distributed widely. Even though Vietnam currency is not circulated in the border areas in Mondul Kiri and Ratana Kiri, where share borders with Vietnam, products made in Vietnam are oversupplied. In such border areas, neighboring economy is encroaching.

In terms of road network conditions connecting to these areas, it is difficult to drive from these provincial capitals with borders to one digit national roads as a national backbone in the rainy season because these roads are not connected with all weather condition pavement. In addition to these conditions, it is much easier to trade with neighboring countries than provincial capital or other provinces because roads from the border areas to border areas in the neighboring countries are well developed and in better condition rather than roads to the provincial capitals.

Therefore socio-economy in these border areas is encroached by the neighboring countries. The encroachment is disincentive for the Cambodian economic development. Due to the vulnerable

¹ Interview in the border area in Mondul Kili Province (JST)

road network, central administrative services are not distributed well. The socio-economic encroachment and stronger connection with the neighboring countries in the border areas make a problem in terms of governance.

In this connection, road development issue is to secure stable traffic access to these isolated areas near the borders in all year so as to strengthen the governance by providing administrative service, and to enhance economy and international competitiveness by strengthening industrial and economic coordination with other areas in other provinces.

Table 9.1 Trading Partners (Year 2003)

(unit: Million US \$)

	Exports			Imports		
	total	2,031.8	100%	total	2,802.4	100%
1	US	1,214.3	59.8%	Thailand	756.5	27.0%
2	Germany	211.3	10.4%	Hong Kong	411.2	14.7%
3	UK	150.3	7.4%	Singapore	338.2	12.1%
4	Japan	80.1	3.9%	China	324.1	11.6%
5	Singapore	67.8	3.3%	Korea	144.6	5.2%
6	France	40.5	2.0%	Vietnam	135.5	4.8%
7	Vietnam	30.3	1.5%	Indonesia	84.5	3.0%
8	Netherlands	25.6	1.3%	Malaysia	68.9	2.5%
9	China	23.6	1.2%	Japan	67.3	2.4%
10	Thailand	11.3	0.6%	France	53.6	1.9%

Source: ADB, Key Indicators 2003: Education for Global Participation

9.2.3 Insufficient International Corridor

Cambodia has border with Thailand, Vietnam and Laos. International corridors are expected an important role of international cross border traffic in the Mekong/Indochina region such as south corridor and north-south corridor of the GMS Economic Corridors, and Asian Highway. As Cambodian economic is developed more and the international competitiveness is stronger in the future, Cambodia can be developed more by international trade with these neighboring countries.

Roads from the capitals of the provinces with border to the crossing border are not developed well. These roads might be an obstacle to the international trade, which is expected in the future.

Therefore road development issues are to develop international corridors and improve access roads to the border areas so that international trade contributes to the future economic growth.

9.2.4 Difficult Access to Development Potential Areas

In preparing national road network, most influential items are development potentials in the future. Various factors can function as constrains and also supporting forces. Here, eight factors are reviewed, and make themselves give outline of future development potentials. And it gives outline for national development strategy and road development concepts.

Eight (8) items, that is Geography, Population, GRDP, Agriculture, Manufacture, Tourism/Service, Mining resources and Environmental conservation are considered and as a result, **Figure 9.3** summarizes various development potential areas on one map i.e. tourism, manufacturing sector, agriculture, and those potential areas are spreading isolated areas, far from Phnom Penh, the center of the Cambodia where a self-sustainable growth has already initiated.



Figure 9.3 Development Potential Areas

Development for these potential areas is crucial for balanced development to reduce the gap between rural and the center.

Roads in and access to these potential areas are, however, not developed well. Therefore there are a lot of development potentials which have not been functioned yet, for example, Angkor ruins which cannot be accessed due to the undeveloped access roads.

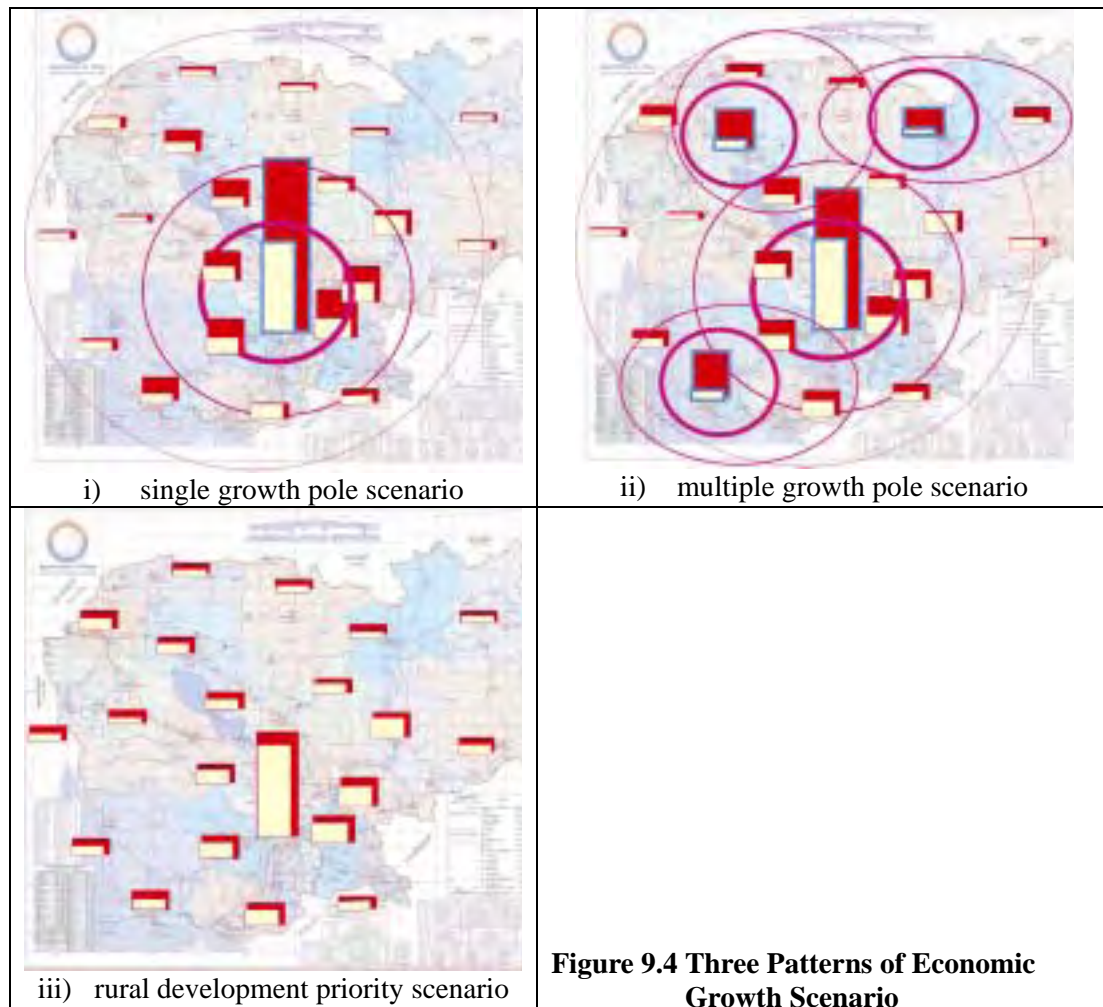
The road development issues are to improve accessibility to the development potential areas so that development potentials can be utilized and maximized, hence balanced development in the rural area.

9.2.5 Insufficient Community Roads (Provincial/Rural Roads)

Provincial and rural roads are essential for community life, such as access to schools, hospitals, other public facilities, working place and market. Most of these roads are, however, not developed or not maintained properly. As a result, these insufficient community roads make community life difficult due to an obstruction to safe and smooth traffic and disconnection in the rainy season.

It can be that development and maintenance of provincial and rural roads as community roads are crucial issue so that community roads contribute to improvement for transport of farm crops and market access, hence poverty reduction in the poverty rural areas.

9.3 Economic Growth Patterns and Vision



Three patterns of economic growth scenario shown in **Figure 9.4** are assessed:

In this study, ii) scenario is found to be most suitable in this country.

Taking into consideration of the national and regional development frames as well as the development potential, the following future vision and philosophies are proposed in terms of national economic development and poverty reduction in order to formulate national road development master plan:

Proposed Vision: “rehabilitation” to “economic development”

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

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

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

9.4 Development Strategies

To achieve the above vision, five (5) development strategies have been established based on the philosophies:

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

Strategy 1: Multi Growth Pole Development

Strategy 2: National Integration

Strategy 3: Development of International Corridor

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

Strategy 4: Enhancement of Rural Economic Development

Strategy 5: Regional Development for Poverty Reduction

9.5 Objectives and Target of each Development Strategy

(1) Strategy 1: Multi Growth Pole Development

Objectives: To contribute to multi core national development instead of that of sole initiative by Phnom Penh

Target: Expansion to 4 lanes on the 1-Digit national roads connecting to Phnom Penh and introduction of Ring Road and by-pass construction at major regional cities such as Siem Reap and Kapong Chnang.

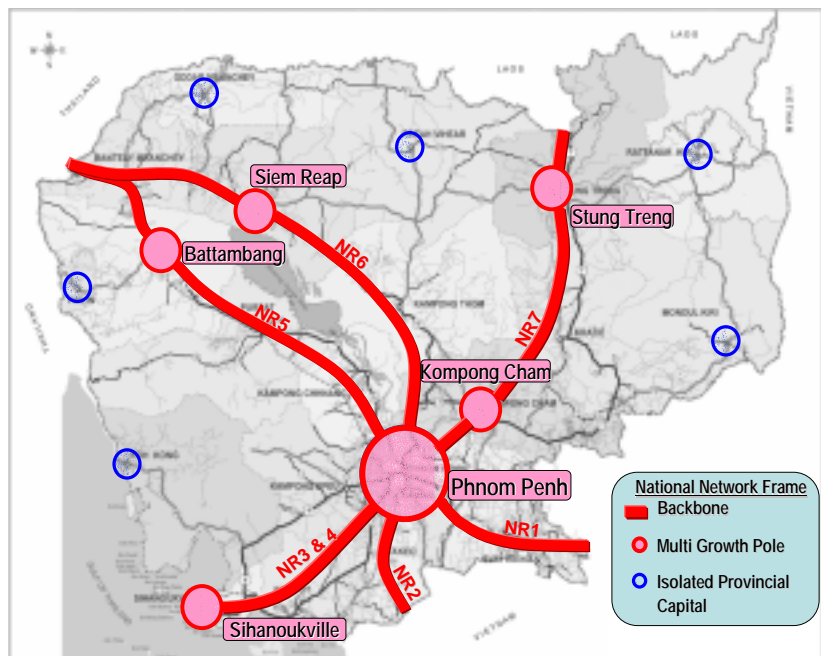


Figure 9.5 Strategy 1: Multi Growth Pole Development

(2) Strategy 2: National Integration

Objectives: To contribute to a national integrity and administration with remote areas where road access is very limited.

Target: Improvement into all-weather roads at the sections of 2-Digit national roads so as to realize easy connection to Phnom Penh even in the rainy season.

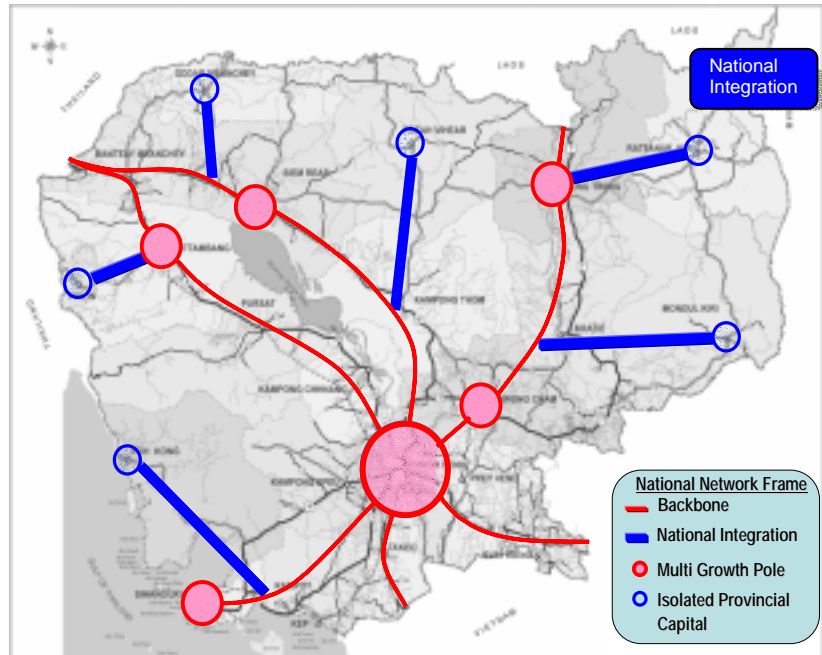


Figure 9.6 Strategy 2: National Integration

(3) Strategy 3: Development of International Corridor

Objectives: To contribute to an expansion of trade and commodity flows to and from neighboring countries

Target: Functional strengthening of 1-Digit and 2-Digit roads, improvement of 2-Digit roads in the area adjacent to borders, improvement of accessibility to rail, waterway and distribution centers.

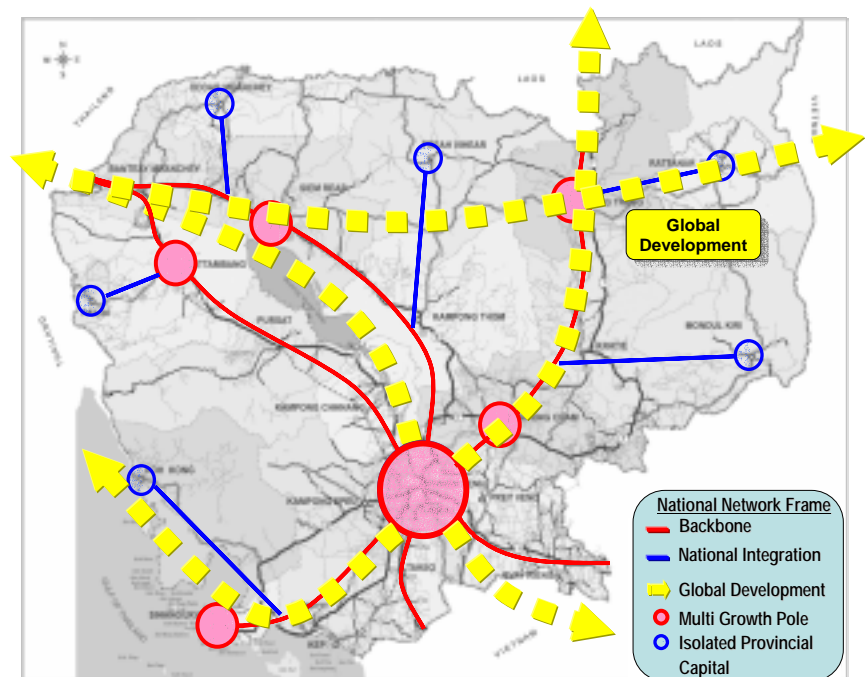


Figure 9.7 Strategy 3: Development of International Corridor

(4) Strategy 4: Enhancement of Rural Economic Development

Objectives: To contribute to a promotion of regional industries, a expansion of investment and an increase in employment

Target: Enhancement of road access, especially by 2-Digit roads, to high potential areas of tourism, agriculture and manufacturing.



Figure 9.8 Strategy 4: Enhancement of Rural Economic Development

(5) Strategy 5: Regional Development for Poverty Reduction

Objectives: To contribute to an enhancement of Basic Human Needs (BHN), employment, education, safety and health.

Target: Improvement of provincial roads and rural roads located in strategically selected areas including CLV border area for poverty reduction by strengthened road maintenance work

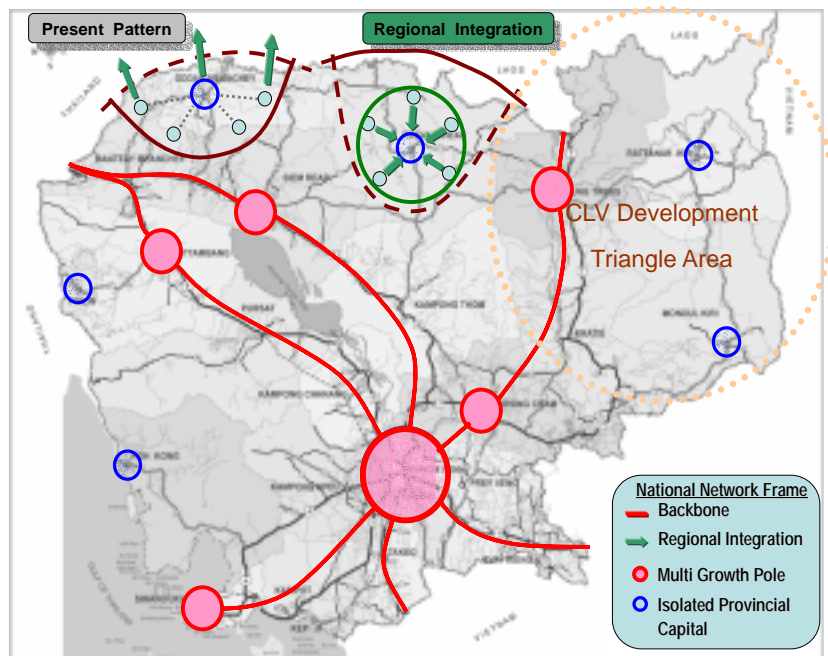


Figure 9.9 Strategy 5: Regional Development for Poverty Reduction

CHAPTER A-10 ROAD NETWORK DEVELOPMENT PLAN

10.1 Road Development Principle

As identified in the existing road condition survey, road network system in Cambodia has sufficient coverage from the perspectives of road density and network, however, many of important roads are not functioning well mainly due to poor surface condition as well as narrow and poor temporary bridges with limited loading capacity. Based on the existing road condition stated above, the Study team establishes the following road development principle;

- (1) Improvement of Existing Road Network
 - * Use existing road network as much as possible
 - * Improvement of existing road network
 - Pavement up-grade for 1 digit and 2 digit roads
 - Maintenance for 3 digit and rural roads
- (2) Strengthening of Road Network and Capacity
 - * 4 lane widening, Ring Road and Bypass
- (3) Reinforcement of Road Network
 - * Provision of alternative routes

10.2 Target of Road Network Development

Based on the above road development principle as well as the 5 strategies developed in the previous chapter, the following target of road network development was established:

Strategy 1: Multi Growth Pole Development

- Target:
- (1) Widening and upgrading of 1 digit road
 - (2) Construction of Bypass around major cities
 - (3) Reinforcement of road network around Phnom Penh City by Ring Road

Strategy 2: National Integration

- Target:
- (1) Improvement of accessibility to provincial capital
 - (2) Reinforcement of main 2 digit roads

Strategy 3: Development of International Corridor

- Target:
- (1) Strengthening of international highway (GMS and Asian Highway)
 - (2) Improvement of access to the border to neighboring countries

Strategy 4: Enhancement of Rural Economic Development

- Target: (1) Tourism development, (2) Manufacturing Development, (3) Agricultural Development

Strategy 5: Regional Development for Poverty Reduction

- Target: Improvement of rural roads by road maintenance

10.3 Proposed Roads to be Improved

To achieve the target mentioned above, the following roads are selected to be improved.

Table 10.1 Summary of Proposed Roads to be Improved

Target of Road Network Development	Proposed Roads to be Improved						
Support for Strategy 1: Multi Growth Pole Development							
(1) Widening and Upgrading of 1 Digit National Road	NR1	NR2	NR3	NR4	NR5	NR6	NR7
	NR8	2 nd Mekong Br					
(2) Construction of Bypass around Main Cities	Siem Reap, Battambang and Kampong Chhanang Bypass						
(3) Reinforcement of Road Network around PP by Ring Road	PP Ring Rd. including 2 nd Monibong Br. and 2 nd Chrucy Chanbvar Br.						
Support for Strategy 2: National Integration							
(1) Improvement of Accessibility to Provincial Capitals	NR11	NR31	NR33	NR48	NR56	NR57	NR62
	NR68	NR76	NR78				
(2) Reinforcement of Main Routes	NR11	NR13	NR22	NR33	NR51	NR61	NR71
	PR104	PR111	PR114	PR127	PR128	PR308	PR319
	Kratie-Kamp. Thom						
(3) For Access Road to Provincial Capitals	NR59	NR65	NR66	NR76	PR148	PR160	PR210
	PR305						
Support for Strategy 3: Development of International Corridor							
(1) International Highway (GMS and Asian Highway)	NR1	NR3	NR4	NR5	NR7	NR33	NR48
	NR66	NR78					
(2) Access to the Border	NR2	NR21	NR33	NR48	NR57	NR62	NR64
	NR68	NR72	NR74	NR78			
(3) Improvement of Access to Railway and Inland Waterway	- Linkage to Railway Facility						
	NR31	NR33	NR42	NR51	NR53	NR55	PR114
	- Linkage to Inland waterway Facility						
	NR52	NR54	NR63	NR70			
- Linkage to Seaport Facility							
Support for Strategy 4: Enhancement of Rural Economic Development							
(1) Tourism Development	- Eco-Tourism Area (Northeast Region)						
	NR7	NR76	NR78	NR78 A	NR78 B	PR301	PR305
	- Siem Reap and Wider Tourism Area (North Region)						
	NR6	NR62	NR63	NR64	NR65	PR210	PR212
- PP Gate Town and Sihanoukville and Coastal Area							
PR213	PR214	PR274	Siem Reap Bypass				
PP Ring Rd.		NR4	NR48				
(2) Manufacturing Development	- Special Economic Zone near Vietnam Border						
	NR1						
	- Sihanoukville - PP Growth Corridor						
NR4	NR48	NR51	PR104	PR127	PR128		
(3) Agricultural Development	- Northeast Region						
	NR78	NR78A	NR78B	PR301			
	- North Region						
	NR64	NR65	NR68	PR274			
	- Middle East Region						
	NR71	NR73					
- West Region							
NR57	NR59						
- South Region							
NR44	NR48	PR148					
Support for Strategy 5: Regional Development of Poverty Reduction							
(1) Rural area	NR76	NR78	NR78A	PR301	PR305		
(2) Rural area	3 digit roads and rural roads						

Note: Existing NR64 and NR67 was changed in 2005 to the number of NR62 and NR64 respectively.

1. Support for Development of Multi Growth Pole Scenario

(1) Widening and upgrading of 1 Digit National Road



Figure 10.1 Proposed Widening Section

(2) Construction of Bypass Around Main Cities

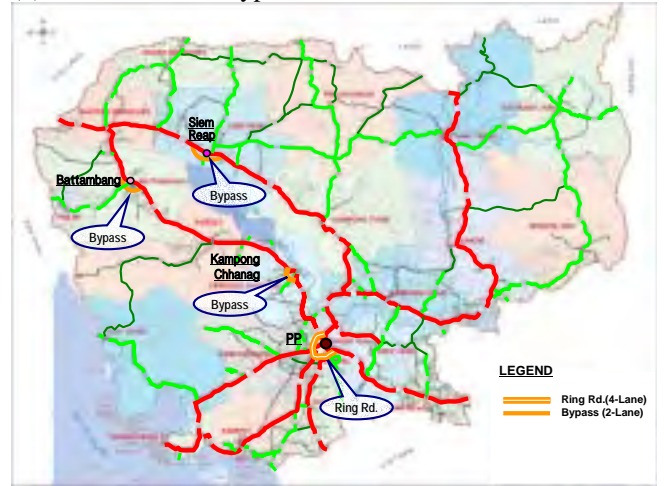


Figure 10.2 New Bypass

(3) Reinforcement of Road Network around Phnom Penh City

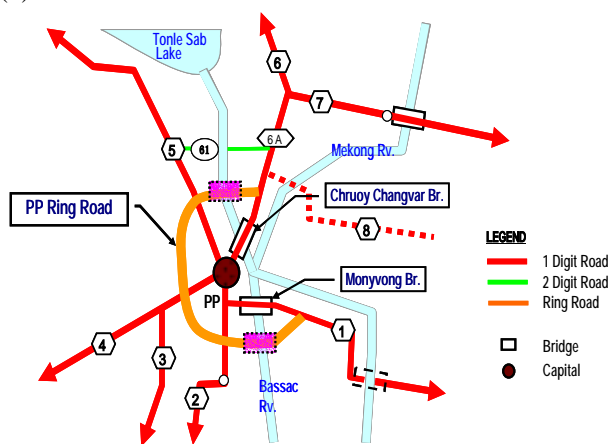


Figure 10.3 Phnom Penh Ring Road

2. Support for Public Administration Services

(1) Improvement of Accessibility to Provincial Capitals

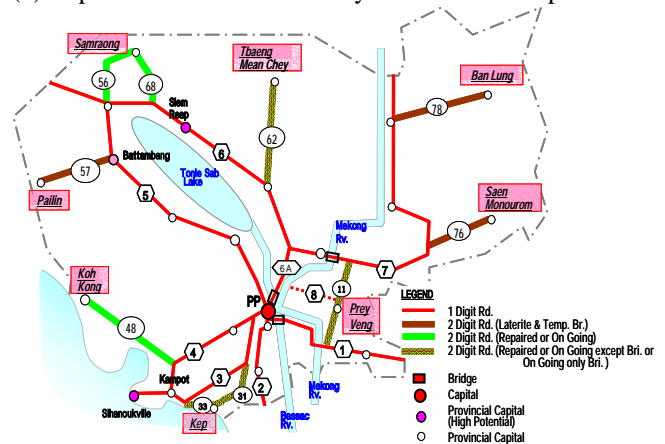


Figure 10.4 2 Digit National Roads access to 8 Provincial Capitals

(2) Reinforcement of main routes

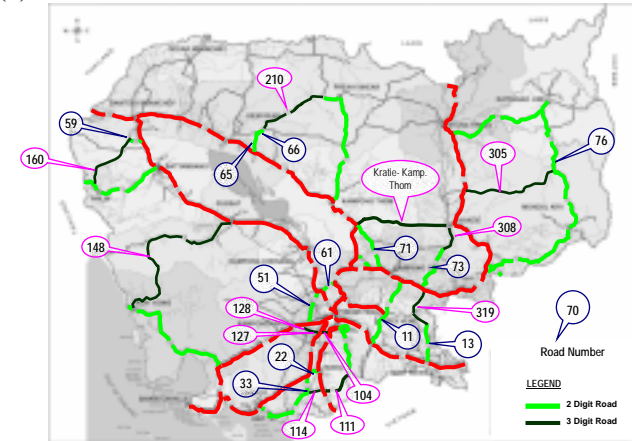


Figure 10.5 Reinforcement Roads of Main Routes

3. Support for International/Internal Trade and Transportation

(1) International Highway (GMS and Asian Highway)

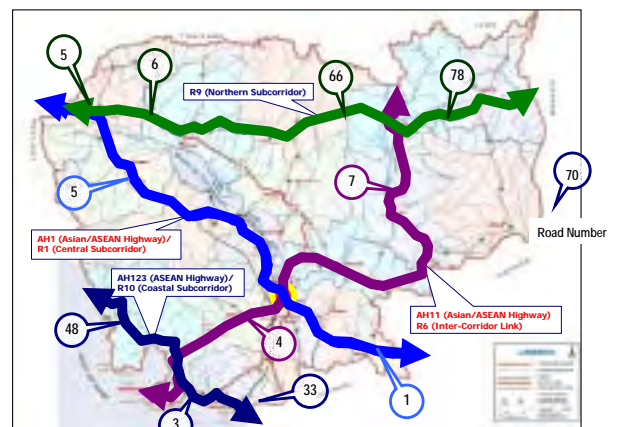


Figure 10.6 International Highway Routes

(2) Access to the Border

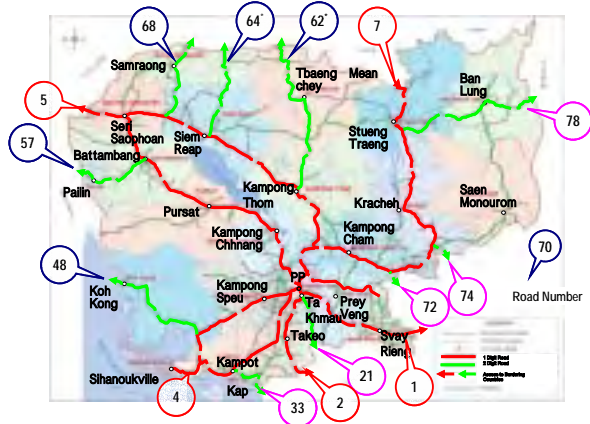


Figure 10.7 Access Roads to Border

(3) Improvement of Access to Railway and Inland Waterway



Figure 10.8 Access Roads to Railway and Waterway

4. Support for Regional Economy in Potential Development Area

(1) Tourism Development

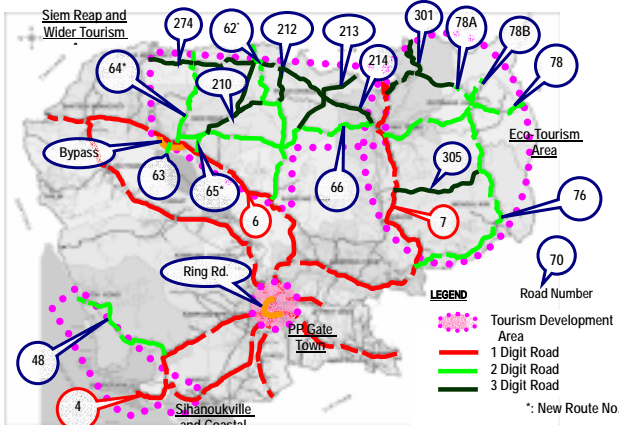


Figure 10.9 Supporting Roads in Tourism Development

(2) Manufacturing Development

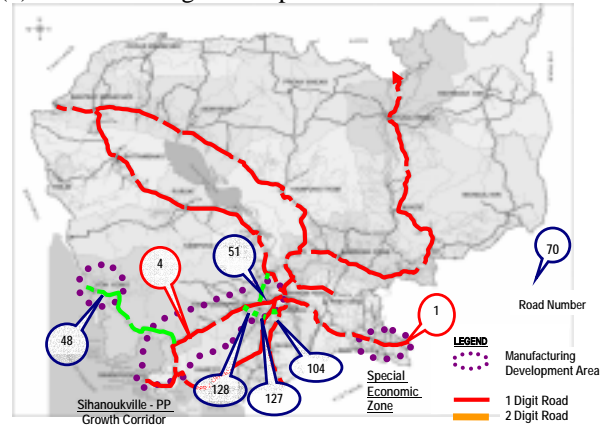


Figure 10.10 Supporting Roads in Manufacturing Development

(3) Agricultural Development

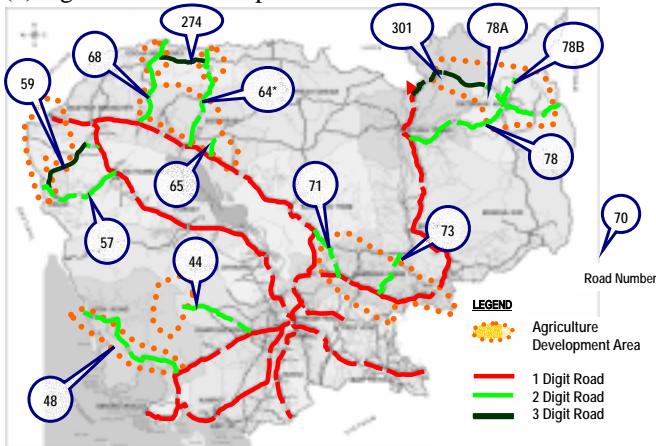


Figure 10.11 Supporting Roads in Agriculture Development

5. Support for Poverty Reduction

(1) Development Triangle recommended in CLV and Japan Summit

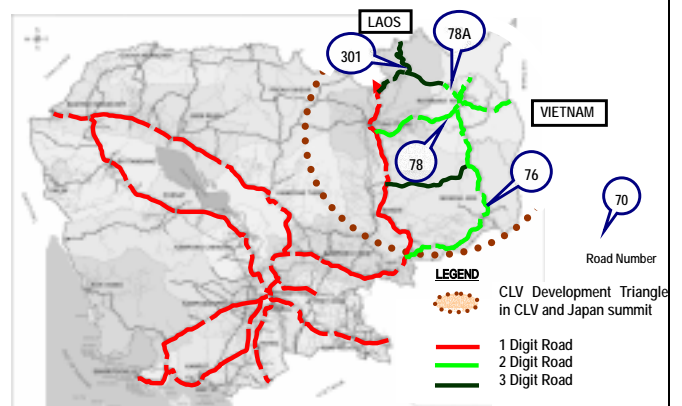


Figure 10.12 Access Roads at Remote Areas for Poverty Reduction