CHAPTER A-11 ROAD IMPROVEMENT PLAN

11.1 Basic Policy of Road Improvement Plan

As the result of road inventory survey, it has been revealed that road network length is sufficient but road design level and quality of pavement and bridges is quite poor. The Study team established the following design policy for the improvement of road.

(1) Design Policy for Road Improvement

Road Classification	Policy of Road Design
1-Digit National Roads	To improve the road level to be all weather condition with sufficient capacity and standard for international corridor
2-Digit National Roads	To improve the road to be highway class function under all weather condition by asphalt concrete pavement or DBST
Provincial Roads & Rural Roads	To maintain the road function level to be trafficable in accordance with traffic demand by strengthening the road maintenance system

(2) Design Policy for Rehabilitation for Existing Bridge

Road Classification	Policy of Bridge Design
Bridges in 1-Digit Roads	To improve all temporary bridges remained in the completed section and bridges with low standard (less 7m width and 20 ton loads) to be a permanent bridge in accordance with the standard of 1-Digit road
Bridges in 2-Digit Roads	(1) Bridges in 2-Digit road connecting provincial capital or international border: To improve all temporary bridges or dangerous bridges to be a permanent bridge with appropriate standard of road classification (2) Bridges in a road except the above; To utilize existing bridges as it is as much as possible except the bridge in dangerous condition, wooden bridge or causeway
Bridges in Provincial Roads & Rural Road	To maintain the road to be trafficable in accordance with traffic demand by strengthening the road maintenance system

11.2 Definition of Improvement Works

Road Network and Road Condition Problems

The road network and road condition problems are summarized in **Table 11.1** below while the existing pavement types and conditions are shown in **Figure 11.1**.

Table 11.1 Problems on Existing Road

Road Condition Problems	Road Network Problems
• Poor pavement condition • Insufficient road width • Insufficient level for international route • Insufficient geometric design • Insufficient road slope protection against flood • Temporary and narrow bridges • Bridges in poor condition • Insufficient culvert capacity	• Insufficient bridge links crossing major rivers • Missing road links • Low paved road ratio • Vulnerability to flood • Traffic congestion in major cities/areas

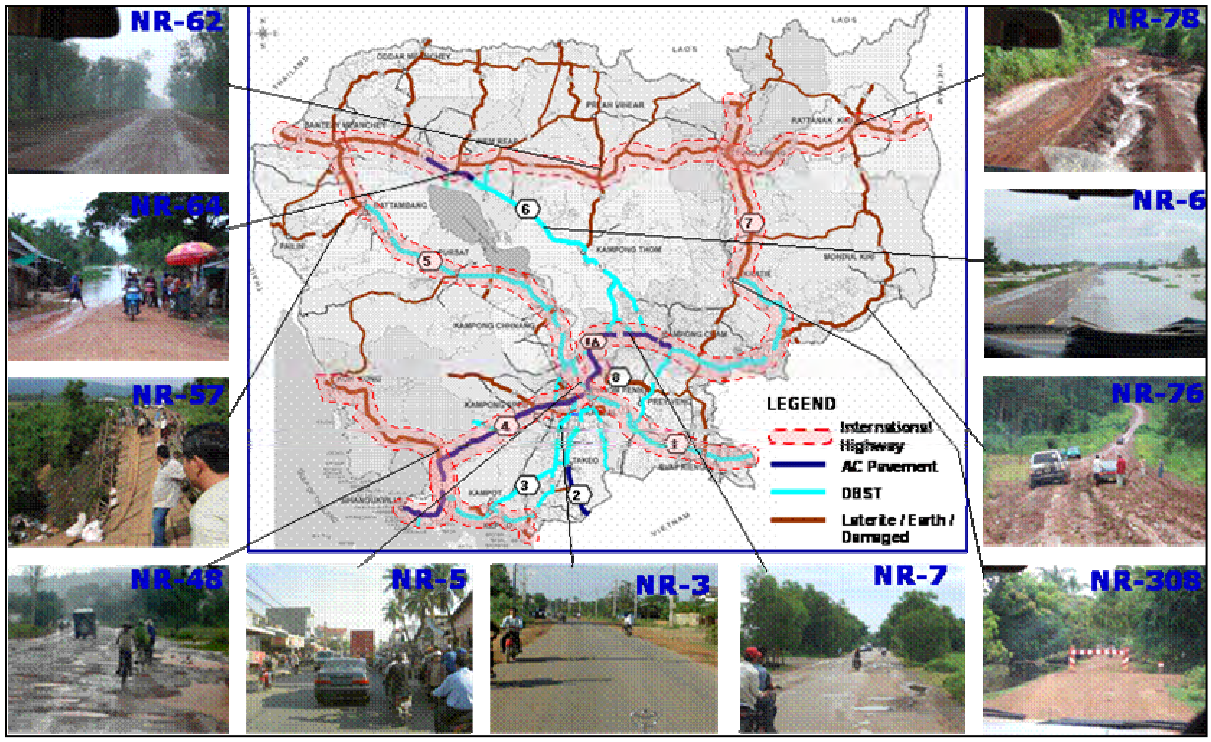


Figure 11.1 Existing Road Pavement Type and Condition

Traffic Congestion and Traffic Demand

Traffic congestion is building up in some built-up areas and major cities especially in commercial areas and markets. Future traffic demand is projected until 2020 and shown in **Figure 11.2**.

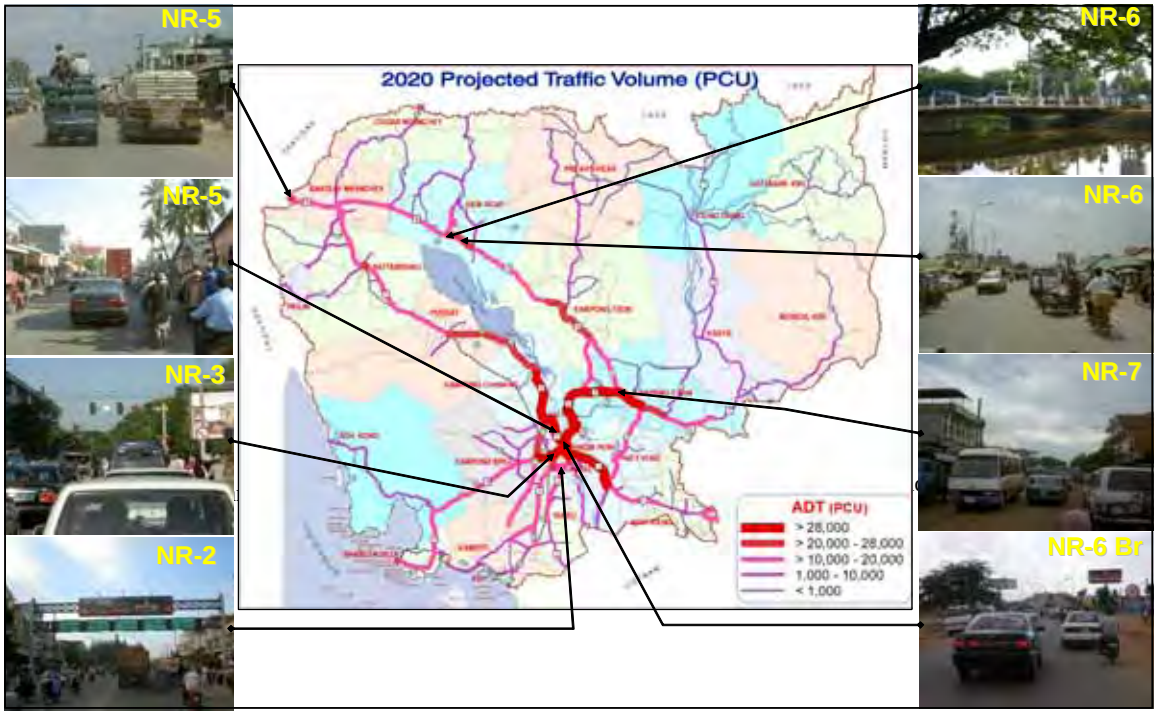


Figure 11.2 Conditions of Some Road Section and Projected Traffic in 2020

Identification of Improvement Measures

The types of improvement works for the proposed road network are identified based on the existing road condition and the need to maintain the required service level of each road category. **Table 11.2** presents the improvement works identification based on the present road condition and problems.

Table 11.2 Improvement Works Identification

PRESENT CONDITON / PROBLEMS	PROPOSED IMPROVEMENT MEASURES
1. Insufficient Road Traffic Capacity • Traffic Congestion • Future Traffic Demand	➡ **• Road Capacity Improvement** • New Road/Bypass • Widening (Additional Lanes)
2. Missing Links on Road Network • Missing Road Links • Lack of Bridge Connection	➡ **• Road Network Improvement** • Road Link Completion • New Bridge Construction
3. Road Condition Below Required Standard • International/Asian Highway • Cambodian Road Design Standard	➡ **• Road Upgrading to Required Standard** • Cross-section Improvement • Geometric Improvement • Pavement Structure Improvement (New Pavement/Replacement)
4. Road and Bridge in Poor Service Condition • Pavement Damage/Deterioration • Poor Drainage Condition • Embankment Slope Damaged • Temporary Bridge • Bridge Heavily Damaged	➡ **• Road and Bridge Rehabilitation** • Pavement Rehabilitation • Drainage Rehabilitation • Slope Protection • Bridge Rehabilitation • Urgent Bridge Rehabilitation Program
5. Road Maintenance Problem	➡ **• Road Maintenance Works** • Minor Repairs • Markings/Cleaning/Painting

11.3 Design Standard and Typical Cross-Sections

Design Standards

The design standards for the proposed improvement works are based on the road functional category which is basically covered by the Asian Highway Standard (AHS) for roads classified as international highways and the Cambodian Road Design Standard (CRDS) for roads classified as national, provincial and district roads. **Table 11.3** presents the proposed design standard.

Table 11.3 Proposed Design Standard

Road Category / Classification	International Highway*	Highway / Arterial	Highway / Minor Arterial	Provincial / Collector	District / Local
General					
Road Class/Number Digit	AH/1-Digit	1-Digit	2-Digit	2/3-Digit	Rural
Number of Lanes	4	2 - 4	2	2	2
Design Standard	Asian Highway / CRDS** (R5)	CRDS (R5)	CRDS (R5/R4)	CRDS (R4/R3)	CRDS (R2/R1)
Design Speed (km/hr)	80 -110	60 - 100	60 - 90	50 - 70	20 - 60
Cross-section					
Cross-Section Type	A & B	A & B	B	C	D & E
Right-of-Way (m)	60	60	50	40	30
Vehicle Lane (m)	3.50	3.50	3.25 - 3.50	3.00	2.50 - 2.75
Shoulder (m)	3.00	3.00	3.00	2.50	1.50 - 2.00
Traffic Volume					
Design Traffic Volume (ADT in pcu)	>10,000	>10,000	3,000-10,000	1,000-3,000	150-1,000 /<150
Pavement Structure					
Surface Type	Asphalt Concrete	Asphalt Concrete	Asphalt Concrete	Asphalt Concrete or DBST	DBST or Laterite

*Asian Highway Standard
** CRDS – Cambodian Road Design Standard

Standard Road Sections

Five types of typical road sections based on the functional categories are proposed as shown in **Figure 11.3**.

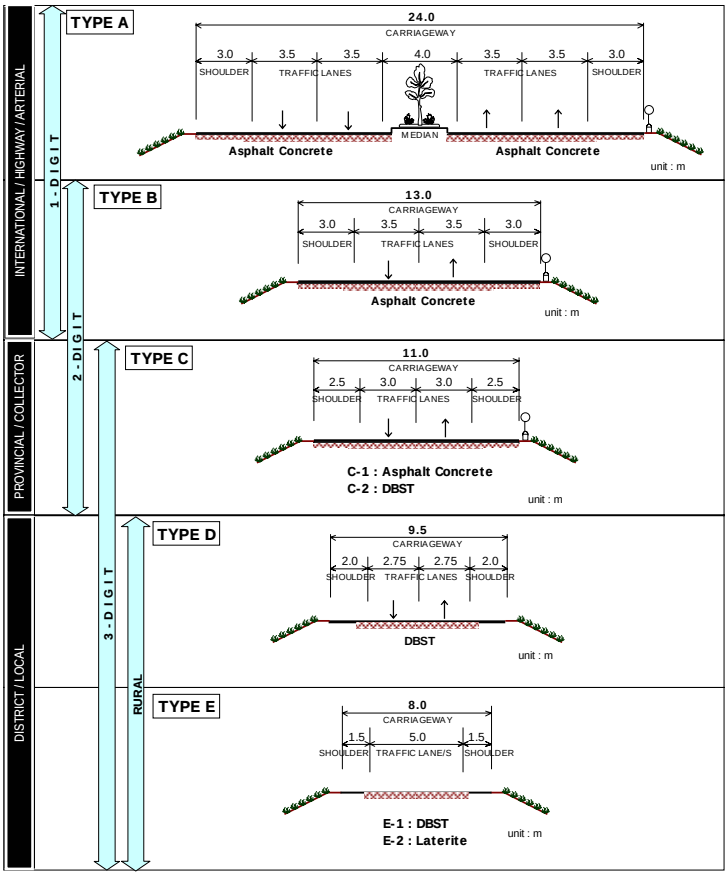


Figure 11.3 Typical Road Cross-Sections

11.4 Improvement Measures

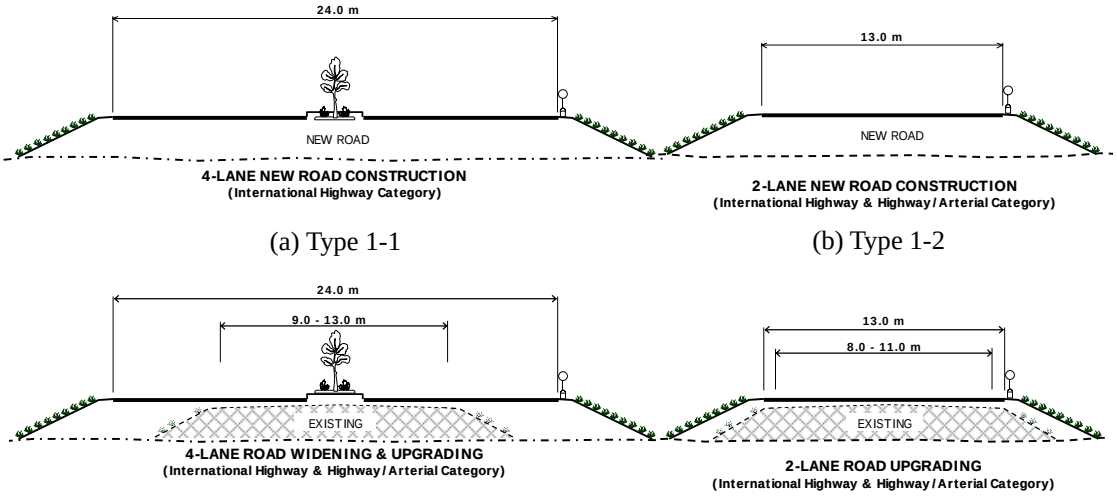
Selection of Improvement Measures

The type of improvement measures for each road section was identified based on: (a) road function/category, (b) existing road structure and condition, (c) present and future traffic demand, and (d) requirements of the master plan.

Improvement Plan for 1-Digit Roads

The types of improvement works for 1-Digit roads (as illustrated in **Figure 11.4**) consist of:

- new road and bridge construction (2-lanes and 4-lanes)
- road widening to 4-lanes
- road upgrading to AHS and CRDS standards



(a) Type 1-1 (b) Type 1-2

(c) Type 1-4 (d) Type 1-5

*Note: Type 1-3 is New Bridge Construction

Figure 11.4 Types of Improvement Measures for 1-Digit Roads

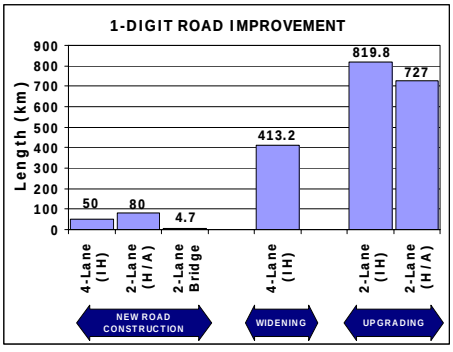


Figure 11.5 1-Digit Road Improvement Measures

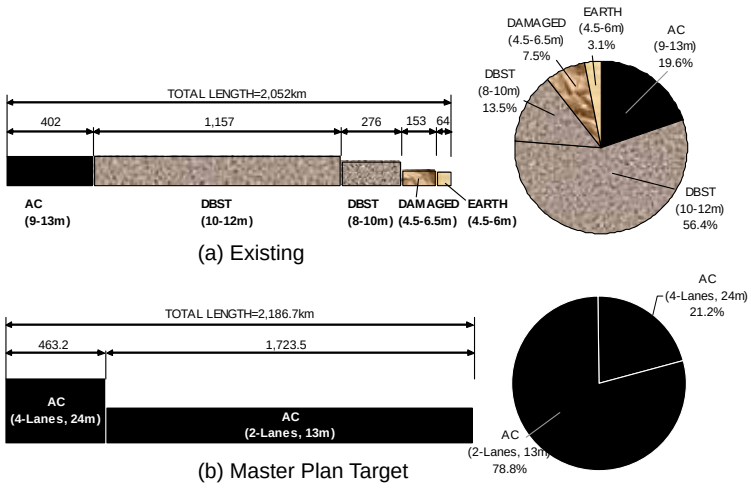
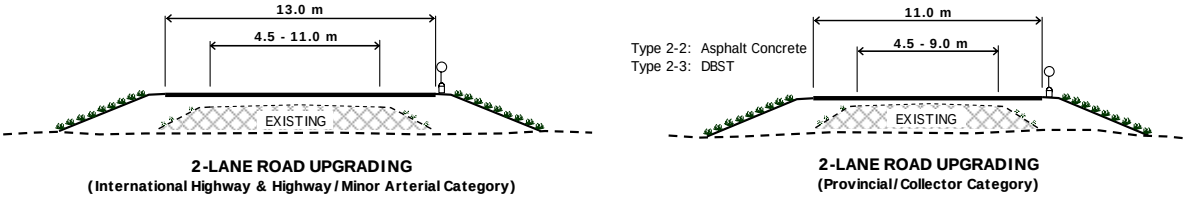


Figure 11.6 1-Digit Road Pavement Structure

Improvement Plan for 2-Digit Roads

Most of the 2-Digit roads fall below the designated standard so that improvement works cover mostly upgrading to either the CRDS for national and provincial roads or AHS for international roads.



(a) Type 2-1 (b) Type 2-2 & 2-3

Figure 11.7 Typical Improvement Measures for 2-Digit Roads

The distribution of 2-Digit road upgrading into international highway, national minor arterial highway and provincial road is presented in **Figure 11.8**. Of the total 2,643.2 km of 2-Digit roads, the international highway upgrading will cover 26% while the minor arterial highway upgrading will cover 42% and the rest at 32% will be provincial roads. It is recommended that asphalt concrete be used as pavement structure for international highway and minor arterial highway. On the other hand, DBST is recommended for roads designated as provincial or collector roads. See **Figure 11.4.6** for the existing and master plan target pavement structures.

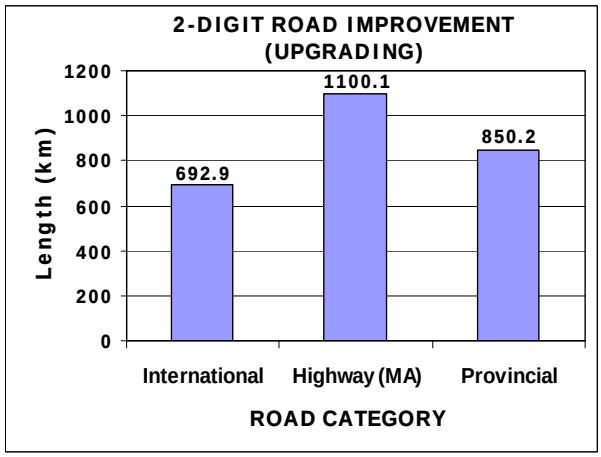


Figure 11.8 2-Digit Road Improvement Measure

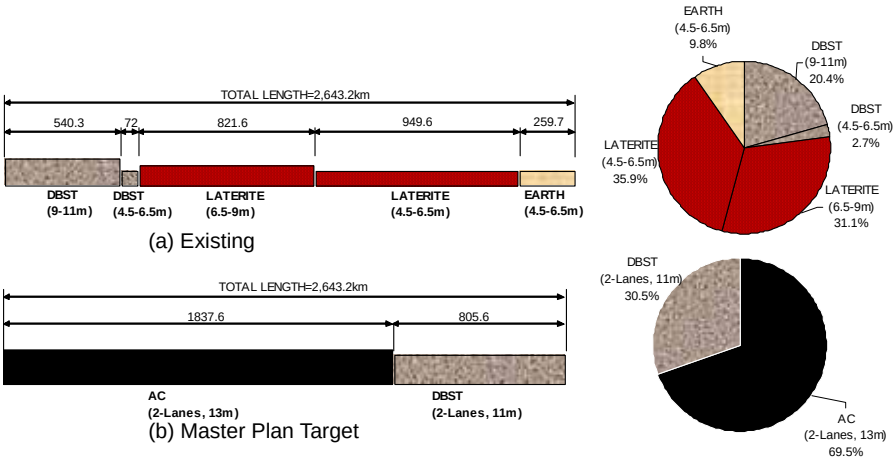
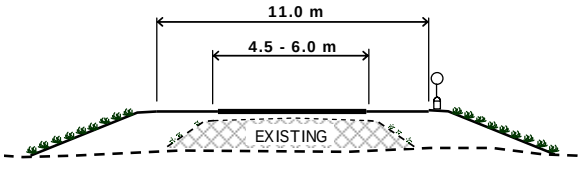


Figure 11.9 2-Digit Road Pavement Structure

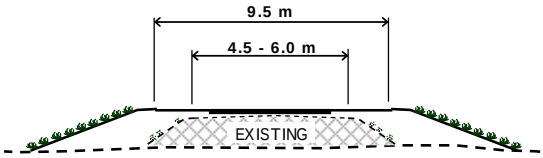
Provincial Roads and Maintenance

The improvement measures for provincial roads basically cover upgrading to the functional standard required for provincial or collector roads (**Figure 11.10**). Although much of the road network especially for provincial roads will have to be developed, the master plan focuses only on provincial roads that should be developed until year 2020 to support the developmental objectives. The pavement structures recommended for these roads should be at least DBST and in some areas where traffic demand volume is low, narrow road sections are recommended.

Routine maintenance is recommended for other provincial road sections and for rural road.



(a) Type 3-1



(b) Type 3-2

Figure 11.10 Typical Improvement Measures for Provincial Roads

11.5 Summary of Improvement Plan

The master plan target improvement works by year 2020 is presented in **Figure 11.5.1**.

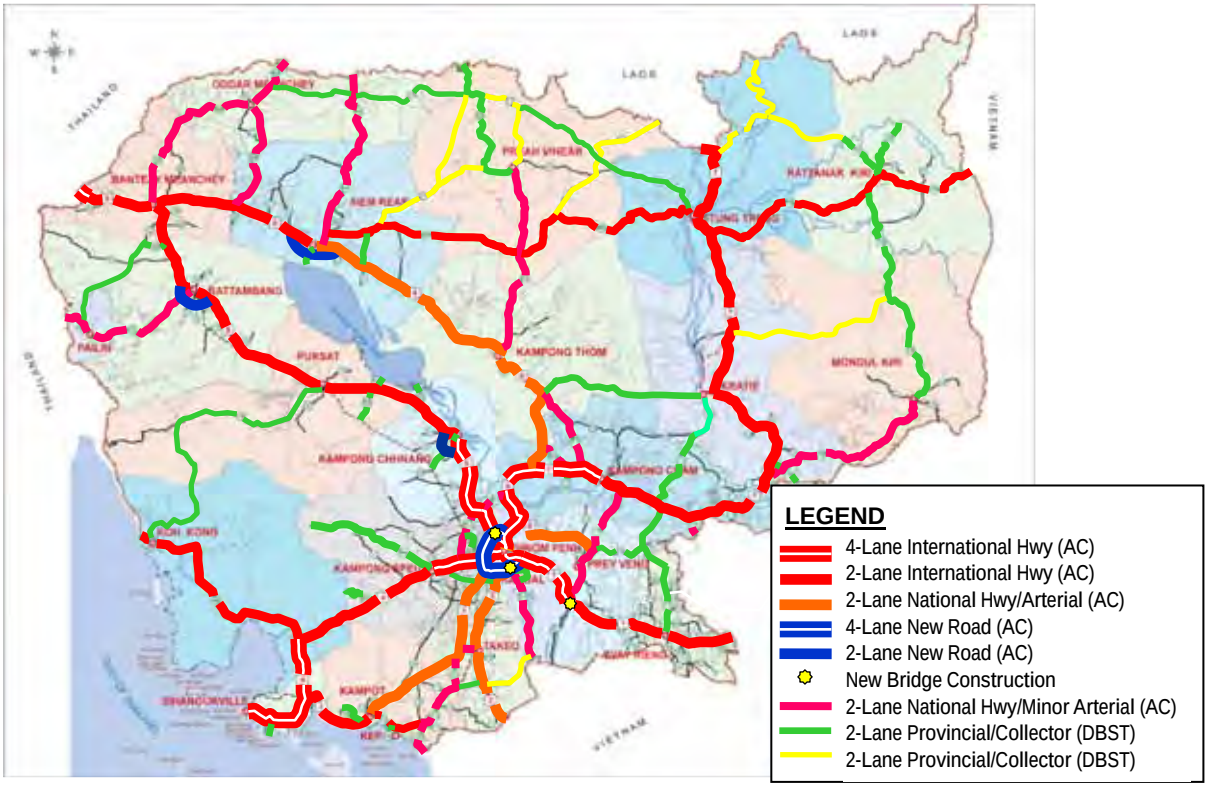


Figure 11.11 Improvement Measures for the Road Development Master Plan

11.6 Road Maintenance Work

Road maintenance works is defined as shown in the following table.

Table 11.4 Road Maintenance

Road Reference	Road Class*	Length (km)	Maintenance		
			Scope	No. of Lanes	Pavement
1 - DIGIT	IH, H/A	2,052	Routine Maintenance	2 – 4	AC/DBST
2 - DIGIT	H/MA ,P/C	2,643	Routine Maintenance	2	AC/DBST
PROVINCIAL	P/C	6,615	Routine Maintenance	2	DBST/Laterite
RURAL	RURAL	18,154	Routine Maintenance	1 – 2	Laterite/Earth

*IH – International Highway
H/A – Highway/Arterial
H/MA – Highway/Minor Arterial
P/C – Provincial/Collector
AC – Asphalt Concrete
DBST – Double Bituminous Surface Treatment

11.7 Cost Estimate of Improvement Works

In order to determine the financial requirements of the master plan, the civil works cost of the different road sections are estimated based on the necessary road improvement and the corresponding improvement measure type.

Unit Costs Applied in the Master Plan

For budgetary purposes, the project costs of the different road sections in the master plan were derived based on the project costs of the different on-going and completed road rehabilitation projects.

The unit costs (per km) of the road type used in the master plan for the different road improvement measure types are presented in **Table 11.5** below.

Table 11.5 Unit Cost of Road Improvement Measures

Road Classification	Type of Improvement Measure	Road Section Type	No. of Lanes	Carriageway Width (m)	Pavement Type	Unit Cost (US$/km)
1-Digit National Road Including New Road	1 – 1	A	4	24	AC	2,000,000
	1 – 2	B	2	13	AC	760,000
	1 – 3	B	2	13	AC	35,000,000
	1 – 4	A	4	24	AC	660,000
	1 – 5	B	2	13	AC	340,000
2-Digit National Road	2 – 1	B	2	13	AC	290,000
	2 – 2	C-1	2	11	AC	240,000
	2 – 3	C-2	2	11	DBST	190,000
Provincial Road	3 – 1	C-2	2	11	DBST	150,000
	3 – 2	D	2	9.5	DBST	110,000

*The Unit Cost includes earthwork, pavement, drainage, slope protection and minor bridges.

Table 11.6 Routine Maintenance Cost

Road Classification	Total Road Length (km)	Maintenance Cost per Year (US$ million)	Implementation Cost (US$ million)			
			Short-Term (2006-2010)	Short-Term (2011-2015)	Short-Term (2016-2020)	Total
1-Digit National Road	2,052.0	6.12	30.6	30.6	30.6	91.8
2-Digit National Road	2,643.2	5.81	23.9	34.1	29.1	87.1
Provincial Road	6,615.0	18.66	54.9	97.0	128.0	279.9
Rural Road	18,154.0	1.45	3.6	7.2	10.9	21.7
Total Maintenance Cost			**113.0**	**168.9**	**198.6**	**480.5**

The civil works costs of improvement measures and the maintenance cost of the different road classifications are presented in **Table 11.7** below.

Table 11.7 Summary of Civil Works and Maintenance Cost

Road Classification		Total Road Length (km)	Civil Works Improvement Cost (US$ million)	Maintenance Cost (US$ million)	Total Cost (US$ million)
1-Digit National Road	Existing	2,052	901	92	993
	New	133	256	-	256
2-Digit National Road		2,643	676	87	763
Provincial Road		6,615	202	280	482
Rural Road		18,948	-	22	22
Total		30,391	2,035	481	2,516

CHAPTER A-12 PROJECT EVALUATION

12.1 Evaluation Procedure

Evaluation of the projects is done by scoring and ranking method. The Road Projects are classified into three (3), namely a) 1 Digit Road, b) 2 Digit Road, and c) Provincial Road.

Prioritization criteria and factors are employed two (2) criteria and six (6) factors as shown in the figure on the right side:

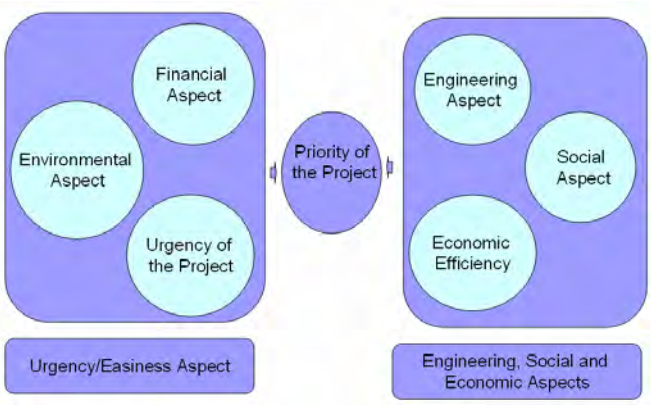


Figure 12.1 Criteria and Factors for Prioritization

Each criteria are further subdivided into eight (8) items in the social and economic aspect and seven (7) items in the project implementation aspect. Each item of the factor is given to score to magnitude of impacts.

Table 12.1 Prioritization Factors and Indicators under Social and Economic Criteria

Factor	Engineering Aspect	Social Aspect	Economic Aspect
1-Digit NR	Max. 10	Max. 30	Max. 60
2-Digit NR	Max. 10	Max. 40	Max. 50
PR	Max. 20	Max. 60	Max. 20
Indicator	■ Road Function ■ Traffic Volume	■Influenced Population by Project Road ■ Public Administrative Service ■ Poverty Reduction	■ National & Regional Development Aspect - Growth Pole Development - Tourism Development - Industrial Development - Agricultural Development - Logistic Industry Development ■ Economic Indicator - EIRR - B/C Ratio - NPV ■ International Trade

Table 12.2 Prioritization Factors and Indicators under Urgency / Easiness Criteria

Factor	Financial Aspect	Negative Impacts for Project Implementation	Urgency for Project Implementation
1-Digit NR	Max. 50	Max. 20	Max. 30
2-Digit NR	Max. 50	Max. 20	Max. 30
Indicator	■ Scale of the Project ■ Realization of the Project	■ Difficulty of Land Acquisition ■ Natural Environmental Impact ■ UXO and Landmine	■ Passable during rainy season ■ Urgent improvement from present road condition

The project scores were determined from the scores for the criteria and factors using the following equations:

$$SC_i = SC^1_i + SC^2_i + SC^3_i + SC^4_i + \text{-------} + SC^f_i + \text{----------} = \sum_{i=1}^{n} SC^f_i$$

Where :

SC_i : Total score on road i

SC^f_i : Scores of factor f of the project road i

The total sums of the scores for each project were categorized into three groups, those are "1st Priority", "2nd Priority" or "3rd Priority" based on the following ranking.

Table 12.3 Ranking of Scores for the Project Roads

			Easiness of Project Implementation		
			Easy	Moderate	Difficult
			Rate>80	80>Rate>50	Rate<50
Engineering, Economic and Social Impacts	Large	Rate>80	**1st Priority**	**2nd Priority**	**3rd Priority**
	Moderate	50<Rate<80	**2nd Priority**	**2nd Priority**	**3rd Priority**
	Small	Rate<50	**3rd Priority**	**3rd Priority**	**3rd Priority**

12.2 Overall Evaluation Results

Economic feasibility of the projects is very important factors among social and economic aspects. Therefore preliminary economic analysis of the projects is made in the study. Economic analysis is made by comparative analysis of the improvement costs and benefits with and without projects. In the benefit calculation, vehicle operating cost and travel time cost are taken into account. Special considerations are taken into account rainy season factors.

The following tables shows the results of project evaluation.

Table 12.4 Evaluation of the Projects (1-Digit Roads)

National Road	Location	Length (km)	Lane Nos	Construction Cost	A. Urgency/Easiness Aspect					B. Engineering, Social and Economic Aspect					Present Situation	Overall Evaluation			Recommended Projects to be done by the year 2020
					A.1	A.2	A.3	A	A	B.1	B.2	B.3	B	B		1st Priority	2nd Priority	3rd Priority	
					Financial Aspect	Negative Impacts	Urgency of Improvement	Total	Ranking	Engineering Aspect	Social Aspect	Economic Aspect	Total	Ranking					
					Max. 50	Max. 20	Max. 30	Max 100		Max. 10	Max 30	Max. 60	Max 100						
NR. No.1	**Phnom Penh - Vietnam Border**	**166.0**		209,000															
1-1	Phnom Penh -Neak Luong	60.0	4	103,000	35	20	30	85	A	10	22	55	87	A	On-Going & Widening	◎			On-going project & Widening to 4-lane
1-2	Second Mekong River Bridge on Route 1	(2.0)	2	70,000	20	20	30	70	B	10	22	55	87	A	Under studying	◎			Under Study by Japan
1-3	Neak Leuong -Vietnam Border	104.6	2	36,000	15	20	7	42	C	10	24	50	84	A	Completed by DBST			△	Overlay to Asphalt concrete by 2020
NR. No.2	**Phnom Penh - Phnom Den**	**120.0**	2	35,000															
2-1	Thakmao-Takeo	63.0	2	23,000	20	20	7	47	C	8	22	40	70	B	Completed by DBST			△	Overlay to Asphalt concrete by 2020
2-2	Takeo-Phnom Den	57.0	2	12,000	45	15	20	80	A	6	18	45	69	B	On-going	◎			Rehabilitation under going
NR. No.3	**Phnom Penh -Veal Lean**	**202.0**	2	67,500															
3-1	Phnom Penh - Kampot	148.0	2	50,000	10	20	7	37	C	6	16	30	52	C	Completed by DBST			△	Overlay to Asphalt concrete by 2020
3-2	Kampot - Veal Rinh	54.0	2	17,500	45	20	7	72	B	6	24	50	80	A	On-Going	◎			
NR. No.4	**Phnom Penh -Sihanoukville**	**213.0**	4	81,000													○		
4-1	PhnomPenh- Kampong Speu	35.0	4	24,000	25	20	30	75	B	10	24	50	84	A	Widening	◎			Widening to 4 lanes
4-2	Kampong Speu-NR 48	92.0	2	0	0	0	0	0	-	0	0	0	0	-					
4-3	NR 48- Sihanoukville	86.0	4	57,000	10	20	12	42	C	10	24	50	84	A	Widening		○		Widening to 4 lanes
NR. No.5	**Phnom Penh -Thai Border(Poipet)**	**359.0**		162,600															
5-1	Phnom Penh -Penh Odongk	37.0	4	24,000	25	12	30	67	B	10	22	55	87	A	Widening	◎			Widening to 4 lanes
5-2	Penh Odongk -Kampong Chhnang	53.0	4	35,000	15	20	12	47	C	10	26	45	81	A	Completed by DBST			△	Widening to 4 lanes
5-3	Kampong Chhnang- Buttambang	205.0	2	70,000	10	20	7	37	C	10	22	45	77	B	Completed by DBST			△	Permanent bridge
5-4	Battambang-Sisophon	64.0	2	22,000	25	16	7	48	C	10	22	45	77	B	Completed by DBST			△	Overlay to Asphalt concrete by 2020
5-5	Sisophon - Poipet	47.0	2	11,600	45	20	20	85	A	10	22	45	77	B	On-going	◎			Rehabilitation under going
NR. No.6	**Phnom Penh - Sisophone**	**416.0**		162,400															
6-1	Phnom Penh -KM 20	20.0	4	13,000	25	12	30	67	B	10	18	50	78	B	Widening		○		Widening to 4 lanes
6-2	KM 20-Skun	55.0	4	36,000	20	16	30	66	B	10	22	50	82	A	Widening		○		Widening to 4 lanes
6-3	Skun-Siem Reap	235.0	2	83,000	10	20	12	42	C	10	22	45	77	B	Completed by DBST			△	Overlay to Asphalt concrete by 2020
6-4	Siem Reap - Sisophone	106.0	2	30,400	40	20	20	80	A	10	22	45	77	B	On-going	◎			Rehabilitation under going
NR. No.7	**Skun - Laos Border**	**459.0**		161,000															
7-1	Skun - Kampong Cham	43.0	4	40,000	25	20	7	52	C	10	22	50	82	A	Completed			△	Widening to 4 lanes
7-2	Kampong Cham-Kratie	216.0	2	71,000	10	20	7	37	C	8	26	50	84	A	Completed			△	Overlay to Asphalt concrete by 2020
7-3	Kratie - Stroeng Treng	136.0	2	50,000	45	20	20	85	A	6	22	40	68	B	On-going	◎			Rehabilitation under going
7-4	Stroeng Treng-Laos Border	64.0	2		45	20	20	85	A	6	22	40	68	B	On-going	◎			Rehabilitation under going
NR. No.8	**Ktoch Saeuch -NR13**	**64.0**	2	22,000	20	20	30	70	B	4	14	15	33	C				△	Upgrade to 1 Digit Standard
New	Phnom Penh Ring Road	50.0	4	100,000	15	12	30	57	B	10	22	55	87	A	New Construction		○		
	2nd Chruoy Changvar Bridge crossing Tonlesap River	1.5	2	53,000	15	16	30	61	B	10	22	55	87	A	New Construction		○		
	2nd Monibong Bridge crossing Bassac River	1.2	2	42,000	20	16	30	66	B	10	22	55	87	A	New Construction		○		
	Battambang Bypass	30.0	2	23,000	20	16	20	56	C	8	26	50	84	A	New Construction			△	
	Siem Reap Bypass	30.0	2	23,000	20	20	20	60	B	8	26	50	84	A	New Construction		○		
	Kampong Chhnang Bypass	20.0	2	15,000	20	16	20	56	C	8	26	50	84	A	New Construction			△	
Total		**2,165.0**		1,156,500															

Table 12.5 Evaluation of the Projects (2-Digit Road)

No.	2 Digit National Road	Road No. connected	Length (km)	Project Cost(US $'000)	A. Urgency/Easiness Aspect					B. Engineering, Social and Economic Aspect					Present Situation	Overall Evaluation			Recommended Projects to be done by the year 2020
					A.1 Financial Aspect	A.2 Negative Impacts	A.3 Urgency of Improvement	A Total	A Ranking	B.1 Engineering Aspect	B.2 Social Aspect	B.3 Economic Aspect	B Total	B Ranking		1st Priority	2nd Priority	3rd Priority	
					Max. 50	Max. 20	Max. 30	Max 100		Max. 10	Max 40	Max 50	Max 100						
1	NR. 11	NR. 1	90.4	26,000	20	18	8	46	C	8	26	23	57	C	Completed by DBST			△	
2	NR. 13		44.6	8,000	25	18	20	63	B	4	32	23	59	C				△	Upgrade to 1 Digit Standard, On-going
3	NR. 21	NR. 2	65.6	19,000	20	18	8	46	C	6	26	33	65	B	Completed by DBST			△	
4	NR. 21A		20.1	4,000	30	18	12	60	C	6	12	15	33	C				△	
5	NR 22		9.6	3,000	30	18	12	60	B	8	22	32	62	B			○		Overlay to Asphalt concrete by 2020
6	NR. 31	NR. 3	54.8	16,000	20	18	8	46	C	4	22	24	50	C	Completed by DBST			△	Rehabilitation under going
7	NR. 32		33.3	6,000	25	18	20	63	B	2	19	7	28	C				△	
8	NR. 33-1		35.3	10,000	20	16	8	44	C	4	28	34	66	B				△	
9	NR. 33-2		17.0	5,000	50	16	22	88	A	4	28	34	66	B	On-going	◎			
	NR 33A		19.7	4,000	50	16	22	88	A	4	28	15	47	C				△	
10	NR. 41	NR. 4	9.3	2,000	25	11	8	44	C	4	12	15	31	C				△	Overlay to Asphalt concrete
11	NR. 42		24.3	5,000	25	11	20	56	C	8	17	32	57	C				△	
12	NR. 44		84.8	16,000	25	18	20	63	B	2	28	24	54	C				△	Widening to 4 lanes
13	NR. 46		27.0	5,000	30	16	8	54	C	2	14	16	32	C				△	Rehabilitation under going
14	NR. 48		161.3	29,700	45	20	20	85	A	6	28	50	84	A	To be financed by Thai Gov.	◎			Permanent bridge
15	NR. 51	NR. 5	44.9	13,000	35	13	12	60	B	8	21	40	69	B	Completed by DBST		○		
16	NR. 52		8.0	2,000	30	20	20	70	B	2	14	16	32	C				△	Rehabilitation under going
17	NR. 53		27.3	5,000	30	20	20	70	B	4	28	15	47	C				△	
18	NR. 54		4.9	1,000	30	20	20	70	B	2	14	16	32	C				△	
19	NR. 55		22.3	4,000	30	20	20	70	B	2	14	24	40	C				△	Widening to 4 lanes
20	NR. 56		113.6	33,000	35	18	20	73	B	4	28	34	66	B	To be financed by ADB	◎			Overlay to Asphalt concrete by year 2020
21	NR. 57		103.3	45,000	35	16	20	71	B	6	32	42	80	A		◎			
22	NR. 59		16.3	3,000	30	18	20	68	B	2	18	16	36	C				△	
23	NR. 60	NR. 6	19.9	6,000	40	18	20	78	B	4	12	15	31	C				△	
24	NR. 61		15.9	5,000	50	18	8	76	B	8	12	23	43	C	On-going			△	
25	NR. 62-1		128.4	37,000	35	14	20	69	B	4	36	26	66	B		◎			
	NR. 62-2		114.3	22,000	35	14	30	79	B	4	36	34	74	B		◎			
26	NR. 63		14.3	3,000	25	16	8	49	C	4	28	24	56	C				△	
27	NR. 64		134.0	27,800	45	12	20	77	A	4	36	50	90	A	To be financed by Thai Gov.	◎			Overlay to Asphalt concrete by year 2020
28	NR. 65		21.5	4,000	50	18	20	88	A	2	36	24	62	B		◎			
29	NR. 66-1		139.9	41,000	35	18	20	73	B	4	36	24	64	B	To be financed by WB		○		Rehabilitation under going
	NR. 66-2		145.4	42,000	35	18	30	83	A	4	22	24	50	C	To be financed by WB			△	Upgrade to 1 Digit Standard
30	NR. 68		117.7	34,000	35	20	20	75	B	6	36	34	76	B	To be financed bt Thai Gov.		○		
31	NR. 70	NR 7	13.5	3,000	25	20	20	65	B	2	12	24	38	C				△	
32	NR. 71		57.8	17,000	45	18	8	71	B	8	26	32	66	B	ADB section completed WB section to be completed by 2007	◎			
33	NR. 72		13.5	4,000	40	18	22	80	B	6	12	33	51	C		◎			
34	NR. 73		57.4	11,000	25	18	20	63	B	2	16	24	42	C			○		
35	NR. 74		17.9	3,000	30	18	20	68	B	4	22	17	43	C				△	
36	NR. 76-1		130.7	38,000	25	20	20	65	B	4	32	24	60	B		◎			
	NR. 76-2		193.5	37,000	25	20	20	65	B	4	32	16	52	C				△	
37	NR. 78-1		124.0	36,000	35	16	20	71	B	4	32	34	70	B			○		
	NR. 78-2		70.0	26,000	25	16	20	61	B	4	32	34	70	B	To be financed by Vietnam Gov partially	◎			
38	NR. 78A		36.9	7,000	25	16	20	61	B	2	32	18	52	C				△	
	NR. 78B		39.0	7,000	25	16	20	61	B	2	32	18	52	C				△	
		TOTAL	2,643.2	675,500															

Table 12.6 Evaluation of the Projects (Provincial Roads)

SQ No.	Road No.	Province	Length	Project Cost	Engineering Aspect			Social Aspect				Economic Indicator	Total	Overall Evaluation		
					Pavement	Road Width	S-Total	Population	Poverty	Natural Environment	S-Total			1st Priority	2nd Priority	3rd Priority
					10	10	20	30	20	10	60	20	100			
1	104	Kandal	9.6	1,400	10	6	16	30	4	10	44	12	72		○	
2	111+Connection to NR 21	Takeo	41.0	5,000	6	6	12	18	8	10	36	12	60			△
3	114	Kampot / Takeo	16.4	2,000	6	6	12	18	8	10	36	20	68		○	
4	127	Kampong Speu	15.0	2,000	6	6	12	18	12	10	40	20	72		○	
5	PR 2082+2081+2076	Battanbang/Pailin	101.0	15,000	6	10	16	18	12	10	40	4	60			△
6	Stung Treng - Cham Khsan	Preah Vihear	135.0	20,000	6	6	12	6	20	1	27	4	43			△
7	Kampong Thom - Kratie	Kampong Thum	102.0	15,000	6	6	12	6	12	10	28	4	44			△
8	210	Siemreap/Preah Vihear	91.7	10,000	6	10	16	12	20	10	42	4	62		○	
8-1	210 A	Siemreap/Preah Vihear	70.0	8,000	6	10	16	6	20	10	36	4	56			△
9	212	Preah Vihear	77.0	8,000	10	10	20	6	20	1	27	4	51			△
10	213	Preah Vihear	112.4	12,000	6	10	16	6	20	10	36	4	56			△
11	274	Preah Vihear / Otdar Meanchey	132.0	20,000	10	6	16	6	20	10	36	4	56			△
12	301	Stung Treng	47.4	5,000	10	6	16	6	20	10	36	4	56			△
12-1	301-1	Stung Treng	59.0	6,000	10	6	16	6	20	10	36	4	56			△
12-2	301-2	Stung Treng	59.0	6,000	6	10	16	6	20	10	36	4	56			△
13	305	Kratie	120.0	13,000	6	6	12	6	12	10	28	4	44			△
14	308	Kampong Cham	34.6	5,000	6	10	16	18	4	10	32	4	52			△
15	316	Svey Rieng / Prey Veng	35.0	5,000	6	6	12	6	8	10	24	20	56			△
16	NR 148	Pousat	114.0	17,000	6	6	12	12	12	10	34	12	58			△
16-1	NR 148 A	Pousat	120.0	18,000	6	6	12	12	12	10	34	12	58			△
17	New Road Connecting to NR 13 and NR 7	Svey Rieng / Prey Veng	61.4	9,000	6	6	12	18	4	10	32	12	56			△
		Total	1,553.5	202,400												

Table 12.7 Overall Prioritization Results

	1-Digit National Road	2-Digit National Road	Provincial Road
1st Priority Projects	NR.1-1 (Phnom Pen – Neak Leoung) NR.1-2 (2nd Mekong Bridge) NR.2-2 (Takeo – VN Boarder) NR.3-2 (Kampot – Veal Rinh) NR.4-1 (Phnom Penh - Kompong Speu) NR.5-1 (Phnom Penh – Penh Odongk) NR.5-5 (Ssophon - Poipet) NR.6-4 (Siem Reap - Sisophone) NR.7-3 & 4 (Kratie – Laos Border)	NR.33-2 (Kampong Trach – Loak) NR.48 (Chamker – Thai Boarder.) NR.56 (Banteay – Oddar Meanchey) NR.57 (Battambang – Thai Boarder) NR.62-1 (Thnal Baek - Tbeng Meanchey) NR.62-1 (Tbeng Meanchey – Peah Parasat Viear) NR.64 (Siem Reap – Dang Rek) NR.65 (Dam Deck – Trapeang Prey) NR.71 (Treung – Peam Chikong) NR.72 (Kreak Tboung – Smach) NR.76-1 (Srei Char – Mondi Kiri) NR.78-2 (Bamg Lung – Vietnam Boarder)	Maintenance works only
2nd Priority Projects	NR.4-3 (NR.48 - Sihanoukville) NR.5-4 (Battanbang - Sisophon) NR.6-1 (Phnom Penh – KM20) NR.6-2 (KM 20 - Skun) Phnom Penh Ring Road 2nd Chruoy Changvar Bridge 2nd Monibong Bridge Siem Reap Bypass	NR.22 (Ou Chambok – Ang Tasom) NR.66-1 (Trach Chrum – Phnom Deak) NR.68 (Kralanh – Osmacth) NR.73 (Pratheat – Chhloung) NR.78-1 (Ou Pong Moan - Bang Lung) NR.78A (Rattanak Kiri – Veun Sai) NR.78B (Thrang Svay – Ta Veng)	PR.104 PR.114 PR.127 PR.210
3rd Priority Projects	NR.1-1 Widening (Phnom Pen – Neak Leoung) NR.1-3 (Neak Leoung - VT Boarder) NR.2-1 (Thakmao - Takeo) NR.3-1 (Phnom Penh - Kampot) NR.5-2 (Penh Odongk - Kampong Chhnang) NR.5-3 (Kampong Chhnang - Battambang) NR.6-3 (Skun - Siem Reap) NR.7-1 (Skun - Kampong Cham) NR.7-2 (Kampong Cham - Kratie) NR.8 (Ktoch Saeuch - NR.13) Battambang Bypass Kampong Chhnang Bypass	NR.11 (Neak Leoung - Thnal Toteoung) NR.13 (Svay Rieng - Traok) NR.21 (Takhmao - Chey Thom) NR.21A (Takhmao - Wat Chhoung Leab) NR.31 (Thnal Bek Koas - Kampong Trach) NR.32 (Road to Bokor - Bokor Top) NR.33-1 & NR.33A (Kampot - Kampot Trach - Loak) NR.41 (Kong Keng - Ream) NR.42 (Bek Chan – Doeng) NR.44 (Chba Morn - Khtes Village) NR.46 (Treg Tre Yeung - Thai Boarder) NR.51 (Veang Chass – Wet Ang Metrey) NR.52 (Ponley - Chhnang Trou) NR.53 (Kampong Chhnang - Teuk Phos) NR.54 (Krakor - Tonle Sap) NR.55 (Anlong Thnaot - Kam Reng) NR.59 (Thma Kom - Khoum Lvea) NR.60 (Sambor Chey - Prey Toteng) NR.61 (Prek Kdam - Thnal Keik) NR.63 (Siem Reap - Chong Khnaes) NR.66-2 (Phnom Deak - Thalabarivat) NR.70 (Prey Toteung - Peam Chikong) NR.74 (Snuol - Khum Thnu (Vietnam B)) NR.76-2 (Mondori Kiri – Ta Ang) NR.78A (Rattanak Kiri – Veun Sai) NR.78B (Thrang Svay – Ta Veng)	PR.111 + Connecting to NR.21 PR.2081, PR.2082, PR.2076, PR.2076 (NR.59, PR.160) Stung Treng – Cham Khsan Kampong Thom - Kratie PR.210 A PR.212 PR.213 PR.274 PR.301, PR.301-1, PR.301-2 PR.305 PR.308 PR.316 PR.148 & 148 A New Road connecting NR.13 and NR.7

CHAPTER A-13 FINANCIAL PROCUREMENT PLAN

13.1 Expected Resources of Funds

A present financial status of Cambodian government is tight and is not enough to serve a necessary construction fund. However, as stated in the Chapter B-4 "Financial Procurement for Road Maintenance" of this study, the problem of road maintenance works in Cambodia is not lying in the shortage of fund but in usage of available fund ever established. Moreover, there are great amount of leakage in tax revenue due to prevailing smuggling of petrol products.

Therefore, the Study team advises to secure necessary funds through improvement of defaults in terms of levying, operation and disbursement method as follows:

(i) To allocate a full amount of added tax (2 cent/litter on gasoline and 4 cent/litter on diesel) to funds for road construction and maintenance works and raise the rates of tax in the long term with an economic development of the nation

(ii) To allocate a part of road user tax (car registration tax, car holding tax, etc) to the resource for road construction and maintenance works

(iii) To take action against smuggling of petrol products and improve the system of cash flow oriented in disconcerted communication among MEF, MPWT and MRD and authorities concerned

13.2 Procurement Plan

Road financing proposals are studied on the basis of recent statistics of domestic fund and external assistance provided for road sectors. Three alternatives are examined as shown in **Table 13.1** and **Figure 13.1**.

Table 13.1 Alternatives of Financial Plan

Alternatives	Financial Plan	Total Amount of Expected Fund for 15 years period (2006-2020)	Prospect
Case 1: Present Pattern	[Pessimistic pattern] Foreign funds retain as same level as the present conditions for next 15 years. Domestic funds increase in proportion to growth of GDP.	US$1,660 M (US$110M/year)	A construction fund is considerably short byUS$770M, and a vision of Master Plan is unachieved. Some improvement measures proposed in a long-term plan should be postponed or cancelled.
Case 2: Growth Pattern	[Moderate pattern] Foreign funds are assumed to be same as Case 1. Domestic funds increase more than Case 1 by raise of Added tax after 2015 as well as levying from oil smuggled.	US$2,270 M (US$150M/year)	A construction fund will be short by some extent but not so much (US$160M). It would be covered by introducing BOT system and new taxation, such as heavy vehicles tax.
Case 3: Growth Accelerating Pattern	[Positive pattern] Both foreign and domestic funds are assumed to increase in proportion to growth of GDP.	US$2,980 M (US$200M/year)	A more splendid road network can be achieved owing to a sufficient fund. But, this pattern has a risk because return of a foreign fund extremely increases.

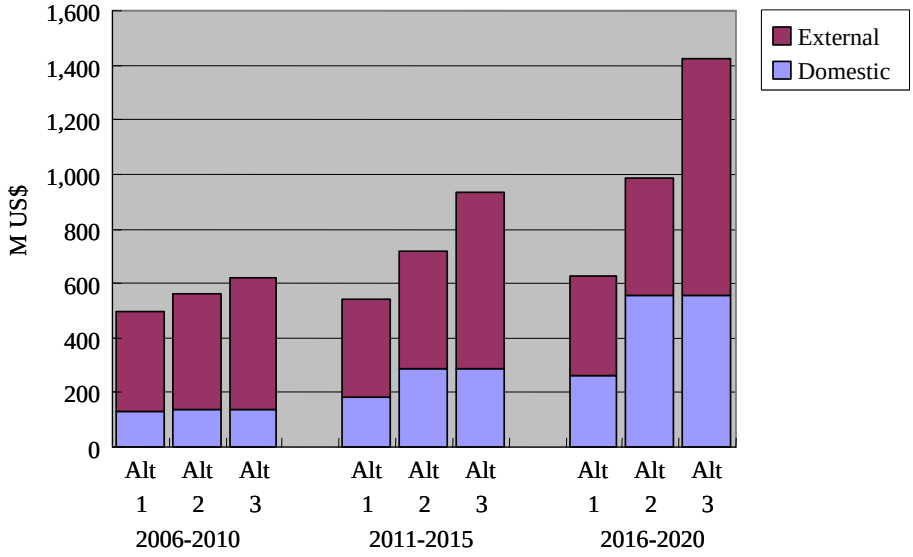


Figure 13.1 Resources of Funds by Alternative

13.2 Recommended Financial Plan

Alternative 2 is recommended to be most practical and optimal plan for following reasons;

- According to a study report by the World Bank, bench mark value of road investment as a ratio to magnitude of national economy in developing countries is set out at 3.5% of GDP, whilst that in Cambodia at present is as small as 2.4% of her GDP. Further investment on road sector has to be carried on.
- However, further accumulation of external debt has to be controlled with less application of external loans on road sector in Cambodia.

CHAPTER A-14 IMPLEMENTATION PROGRAM

14.1 Concept for the Implementation Program

In order to establish a realistic and effective implementation program, the Study Team adopted a basic concept for the implementation program for the Master Plan as follows:

(1) On-going projects should be completed in the short-term plan

National roads, especially 1-Digit and 2-Digit roads are very important as they form the basis of the national and regional economy. Therefore, all of the on-going rehabilitation projects relating to 1-Digit and 2-Digit roads being implemented or committed by international funding agencies and donors shall be completed in the short-term plan.

(2) Access to the provincial capital should be improved as soon as possible

Taking into consideration the importance of governmental administration services in the rural areas, 2-Digit roads linking to the provincial capitals that are in poor condition should be improved as early as possible either in the short-term or medium-term plan.

(3) Implementation of the Urgent Bridge Rehabilitation Program

Although most of the 1-Digit and some important 2-Digit roads have already been rehabilitated, many temporary bridges still remain in narrow and poor condition within the completed sections of the 1-Digit and 2-Digit roads. The rehabilitation of these temporary bridges is included as a part of the upgrading works in the master plan; however, the upgrading of these roads is planned in the medium-term of long-term plan. As the collapse of a bridge on a major road would have an adverse impact on local socio-economic activities, the Study Team recommends that these bridges should be improved as soon as possible and implemented under the "Urgent Bridge Rehabilitation Program".

Based on the above concepts, the Study Team set the targets for the implementation program in the short-term, medium-term and long-term by type of road as shown below:

Table 14.1.1 Targets for the Implementation Program

<table>
<tr><th>Short Term Plan
(2006-2010)</th><th>Medium Term Plan
(2011-2015)</th><th>Long Term Plan
(2016-2020)</th></tr>
<tr><td>All the on-going rehabilitation projects by international funding agencies and donors shall be completed.</td><td colspan="2">All 1-Digit Roads become an all weather conditions road having a high design standards with a asphaltic concrete and sufficient traffic capacity.</td><td rowspan="3"></td></tr>
<tr><td colspan="3">Urgent Bridge Rehabilitation Program</td></tr>
<tr><td>Phase I (South-east Blk)</td><td>Phase II (North-west Blk)</td><td>Phase III (South-west Blk)</td><td>Phase IV(North-east Blk)</td></tr>
<tr><td colspan="3">All 2-Digit Roads linking to a provincial capital will be improved to a paved road with asphalt concrete resisting a disaster in rainy season.</td><td rowspan="3">Remaining 2-Digit Roads will be improved to become a paved road with asphalt concrete or DBST.</td></tr>
<tr><td colspan="3">Urgent Bridge Rehabilitation Program</td></tr>
<tr><td>Phase I (South-east Blk)</td><td>Phase II (North-west Blk)</td><td>Phase III (South-west Blk)</td><td>Phase IV(North-east Blk)</td></tr>
<tr><td colspan="2">Among 3-Digit Roads and Rural Roads, 40% of roads will be passable in wet season owing to the proper maintenance work.</td><td>Among 3-Digit Roads and Rural Roads, 60% of roads will be passable in wet season owing to the proper maintenance work.</td><td>Among 3-Digit Roads and Rural Roads, 80% of roads will be passable in wet season owing to the proper maintenance work.</td></tr>
</table>

14.2 Implementation Program in the Short-term, Medium-term and Long-term

The implementation program has been examined taking into consideration the results of the project evaluation and the available funds based on the financial study. **Figure 14.2.1** shows the routes to be improved in the short-term, medium-term and long-term plans and **Table 14.2.1 (1)**, **Table 14.2.1 (2)**, **Table 14.2.1 (3)** are the implementation programs by type of roads, including national roads and provincial roads.

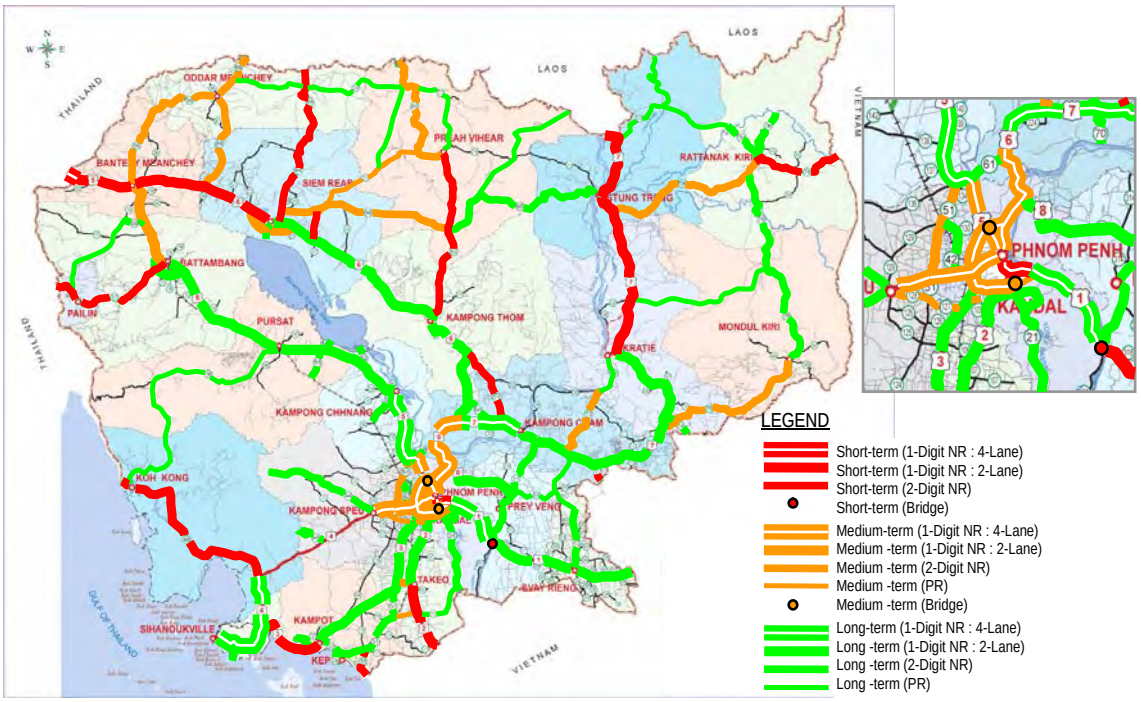


Figure 14.2.1 Road Implementation Program in the Short, Medium and Long-Term

The following projects in **Table 14.2.1(4)** are selected as high priority projects to be implemented in the short-term plan (2006-2010).

Table 14.2.1(4) Summary of High Priority Projects

Road Classification	Short-term Plan (2006 – 2010)
1-Digit Road	NR.1(1-1,1-2)*, NR.2(2-2)*, NR.3(3-2)*, NR.5(5-5)*, NR.6(6-4)*, NR7.(7-3,7-4)*
2-Digit Road	NR.33-2*, NR.48*, **NR.57**, NR.62-1*, NR.64-1*, NR.64-2*, NR.65*, NR.71*, NR.72*,NR.78-2*

Note (1): The figures in brackets ( ) show the number of sub-sections on each 1-Digit road.
(2): The road numbers with an asterisk (*) are on-going projects or projects committed to by donors.

Table 14.2.1 (1) Implementation Program for 1-Digit Roads

1 Digit Road Section	Location	Existing Road	Improvement Measures						Implementation Program			Remarks
		Length (km)	Scope	Lane Nos.	Pavement	Typical Cross Section	Future Traffic Volume (PCU)	Amount (Million US$)	Short Term (2006-2010)	Medium Term (2011-2015)	Long Term (2015-2020)	
NR 1	**Phnom Penh - Vietnam Border**	**166.0**						**209.0**				
1-1	Phnom Penh - Neak Leuong	60.0	On-going	4Lanes	AC	Type A	41,090	** 103.0	* 65.0		38.0	On-going Project is 2-lane road which will be widend to 4-lane AC in the long-term
1-2	Neak Leuong Ferry	(2)	Construction of 2nd Mekong Bridge	2 Lanes	AC	Type B	28,570	70.0	20.0	50.0		Under Study by Japan
1-3	Neak Leuong - Bavet (Vietnam Border)	106.0	Road Upgrading (from DBST to AC)	2Lanes	AC	Type B	12,410	36.0			36.0	
NR 2	**Takhmao - Phnom Den (VN Border)**	**120.0**						**35.0**				
2-1	Takhmao - Takeo	68.0	Road Upgrading (from DBST to AC)	2 Lanes	AC	Type B	15,190	23.0			23.0	
2-2	Takeo - Phnom Den (VN Border)	52.0	On-going	2 Lanes	AC	Type B	4,490	* 12.0	12.0			On-going Project. Road structure to be upgraded based on traffic demand (AC)
NR 3	**Phnom Penh - Veal Rinh**	**202.0**						**67.5**				
3-1	Phnom Penh - Kampot	148.0	Road Upgrading (from DBST to AC)	2 Lanes	AC	Type B	13,890	50.0			50.0	
3-2	**Kampot- Veal Rinh**	54.0	On-going	2 Lanes	AC	Type B	7,210	* 17.5	17.5			(32.5 Km) On-going Project. Road structure to be upgraded based on traffic demand (DBST)
NR 4	**Phnom Penh - Sihanoukville**	**214.0**						**81.0**				
4-1	Phnom Penh - Kampong Speu	36.0	Widening of Existing 2 lane road to 4 lanes	4 Lanes	AC	Type A	18,170	24.0		24.0		BOT Road
4-2	Kampong Speu - NR-48	92.0		2 Lanes	AC							
4-3	NR.48 - Sihanoukville	86.0		4 Lanes	AC	Type A		57.0			57.0	BOT Road
NR 5	**Phnom Penh - Poi Pet**	**406.0**						**162.6**				
5-1	Phnom Penh - Odongk	37.0	Widening of Existing 2 lane road to 4 lanes	4 Lanes	AC	Type A	34,410	24.0	⇨	24.0		
5-2	Odongk - Kompong Chhnang	53.0	Widening of Existing 2 lane road to 4 lanes	4 Lanes	AC	Type A	37,850	35.0			35.0	
5-3	Kompong Chhnang - Battambang	205.0	Road Upgrading	2 Lanes	AC	Type B	22,000	70.0			70.0	
5-4	Battambang - Sisophon	64.0	Road Upgrading	2 Lanes	AC	Type B	16,510	22.0		22.0		
5-5	Sisophon - Poi Pet	47.0	On-going	2-4 Lanes	AC	Type B	17,460	* 11.6	11.6			On-going Project. Road structure to be upgraded based on traffic demand (AC)
NR .6	**Phnom Penh - Sisophon**	**416.0**						**162.4**				
6-1	Phnom Penh - KM20	20.0	Widening of Existing 2 lane road to 4 lanes	4 Lanes	AC	Type A	50,880	13.0		13.0		
6-2	KM20 - Skun	55.0	Widening of Existing 2 lane road to 4 lanes	4 Lanes	AC	Type A	35,210	36.0		36.0		
6-3	Skun - Siem Reap	243.0	Road Upgrading	2 Lanes	AC	Type B	20,650	83.0			83.0	
6-4	Siem Reap - Sisophon	98.0	On-going	2 Lanes	AC	Type B	16,050	* 30.4	30.4			On-going Project. Road structure to be upgraded based on traffic demand (AC)
NR 7	**Skun - Doung Krolor (Laos Border)**	**464.0**						**161.0**				
7-1	Skun - NR-11	61.0	Widening of Existing 2 lane road to 4 lanes	4 Lanes	AC	Type A	33,270	40.0			40.0	
7-2	NR-11 - Kratie	210.0	Road Upgrading	2 Lanes	AC	Type B	8,950	71.0			71.0	
7-3	Kratie - Stoeung Treng	137.0	On-going	2 Lanes	AC	Type B	1,530	* 50.0	50.0			On-going Project. Road structure to be upgraded based on traffic demand (DBST)
7-4	Stoeung Treng - Laos border	56.0	On-going	2 Lanes	AC	Type B	2,570					
NR 8	**Preak Tameak - NR13**	**64.0**	Road Upgrading	2 Lanes	AC	Type B		**22.0**			22.0	
Total of 1 Digit Road (Existing)		**2,052.0**						**900.5**	**206.5**	**169.0**	**525.0**	**900.5**
New Construction	**Phnom Penh Ring Road**	**50.0**	Construction of New Road	4 Lanes	AC	Type A		100.0		50.0	50.0	
	2nd Chruoy Changvar Bridge crossing Tonle Sap	**1.5**	Construction of New Bridge	2 Lanes	AC	Type B		53.0		53.0		
	2nd Monivong Bridge crossing Bassac	**1.2**	Construction of New Bridge	2 Lanes	AC	Type B		42.0		42.0		
	Battambang Bypass	**30.0**	Construction of New Road	2 Lanes	AC	Type B		23.0			23.0	
	Siem Reap Bypass	**30.0**	Construction of New Road	2 Lanes	AC	Type B		23.0		23.0		
	Kampong Chhnang Bypass	**20.0**	Construction of New Road	2 Lanes	AC	Type B		15.0			15.0	
Total of Bypass (New)		**133.0**						**256.0**	0.0	168.0	88.0	
Total of Improvement cost		**2,185.0**						**1,156.5**	**206.5**	**337.0**	**613.0**	
Total of Maintenance cost		**2,052.0**						**91.8**	**30.6**	**30.6**	**30.6**	
TOTAL COST FOR 1 DIGIT ROAD								**1,248.3**	**237.1**	**367.6**	**643.6**	

⇨ : Projects to be shifted to the Subsequent Term due to financial constraints

* Contract Amount of On-going Project

** Improvement Works Plus Contract Amount of On-going Project

Table 14.2 1 (2) Implementation Program for 2-Digit Roads

2 Digit Road Section	Location	Existing Road	Improvement Measures						Implementation Program			Remarks
		Length (km)	Scope	Lane Nos.	Pavement	Typical Cross Section	Future Traffic Volume (PCU)	Amount (Million US$)	Short Term (2006-2010)	Medium Term (2011-2015)	Long Term (2015-2020)	
NR 11	Neak Leoung-Thnal Toteoung	90.4	Road Upgrading	2 Lanes	AC	Type B	17,430	26.0			26.0	
NR 13	Svay Rieng - Traok	44.6	Road Upgrading	2 Lanes	DBST	Type C-2	170	8.0			8.0	
NR 21	Takhmao - Chrey Thom	65.6	Road Upgrading	2 Lanes	AC	Type B	4,400	19.0			23.0	
NR 21A	Takhmao - Wat Chhoung Leab	20.1	Road Upgrading	2 Lanes	DBST	Type C-2		4.0				
NR 22	Ou Chambok - Ang Tasom	9.6	Road Upgrading	2 Lanes	AC	Type B	14,710	3.0		3.0		
NR 31	Thnal Bek Koas - Kampong Trach	54.8	Road Upgrading	2 Lanes	AC	Type B	2,680	16.0			16.0	
NR 32	Road to Bokor - Bokor top	33.3	Road Upgrading	2 Lanes	DBST	Type C-2		6.0			6.0	
NR 33-1	Kampot - Kampong Trach	35.3	Road Upgrading	2 Lanes	AC	Type B	2,090	10.0			10.0	
NR 33-2	Kampong Trach - Lork	17.0	Road Upgrading	2 Lanes	AC	Type B	2,090	5.0	5.0			(17.0 Km) Committed Project
NR 33A	See Sor (Keb) - Krong Keb	19.7	Road Upgrading	2 Lanes	DBST	Type C-2		4.0			4.0	
NR 41	Korng Keng - Ream	9.3	Road Upgrading	2 Lanes	DBST	Type C-2		2.0			2.0	
NR 42	Bek Chan - Bat Doeng	24.3	Road Upgrading	2 Lanes	DBST	Type C-2	14,340	5.0			5.0	
NR 44	Chba Morn - Khtes Village	84.8	Road Upgrading	2 Lanes	DBST	Type C-2	2,140	16.0			16.0	
NR 46	Treng Tro Yeung - Kirirom Mount - Thai Border	27.0	Road Upgrading	2 Lanes	DBST	Type C-2		5.0			5.0	
NR 48	Chamker Loung - Thai Border	161.3	On-going	2 Lanes	AC	Type B	3,260	* 29.7	29.7			On-going Project. Road structure to be upgraded based on traffic demand (DBST)
NR 51	Veang Chass - Wat Ang Metrey	44.9	Road Upgrading	2 Lanes	AC	Type B	19,550	13.0		13.0		
NR 52	Ponley - Chhnang Trou	8.0	Road Upgrading	2 Lanes	DBST	Type C-2		2.0			2.0	
NR 53	Kampong Chhnang - Teuk Phos	27.3	Road Upgrading	2 Lanes	DBST	Type C-2	470	5.0			5.0	
NR 54	Krakor - Tonle Sap	4.9	Road Upgrading	2 Lanes	DBST	Type C-2		1.0			1.0	
NR 55	Anlong Thnaot - Kam Reng	22.3	Road Upgrading	2 Lanes	DBST	Type C-2		4.0			4.0	
NR 56	Banteay Mean - Oddar Mean Chey	113.6	Road Upgrading	2 Lanes	AC	Type B	1,240	33.0	⇨	33.0		Committed Project
NR 57	Battamborng - Ou Prum - Thai Border	103.3	Road Upgrading	2 Lanes	AC	Type B	3,710	45.0	45.0			
NR 59	Thma Kom - Khoum Lvea	16.3	Road Upgrading	2 Lanes	DBST	Type C-2	510	3.0			3.0	
NR 60	Sambor Chey - Prey Toteng	19.9	Road Upgrading	2 Lanes	AC	Type B	3,460	6.0			6.0	
NR 61	Prek Kdam - Thnal Keik	15.9	Road Upgrading	2 Lanes	AC	Type B	17,800	5.0			5.0	
NR 62-1	Thnal Baek - Tbeng Meanchey	128.4	On-going	2 Lanes	AC	Type B	2,420	37.0	37.0			On-going Project. Road structure to be upgraded based on traffic demand (DBST)
NR 62-2	Tbeng Meanchey - Prasat Peah Viear	114.3	Road Upgrading	2 Lanes	DBST	Type C-2	1,010	22.0	⇨	22.0		
NR 63	Siem Reap - Chong Khnaes	14.3	Road Upgrading	2 Lanes	DBST	Type C-2		3.0			3.0	
NR 64-1	Svay Thom (NR6) - 18km	18.0	On-going	2 Lanes	AC	Type B	5,130	* 2.2	2.2			(18.0Km) On-going Project. Road structure to be upgraded based on traffic demand (DBST).
NR 64-2	18km - Dang Rek	116.0	Road Upgrading	2 Lanes	AC	Type B	5,130	* 25.6	25.6			Committed Project
NR 65	Dam Deck (NR67) - Trapeang Prey	21.5	On-going	2 Lanes	DBST	Type C-2	1,740	4.0	4.0			On-going Project. Road structure to be upgraded based on traffic demand (DBST)
NR 66-1	Trach Chrum(NR67) - Phnom Deak	139.9	Road Upgrading	2 Lanes	AC	Type B	1,740	41.0		41.0		
NR 66-2	Phnom Deak - Thalabarivat	145.4	Road Upgrading	2 Lanes	AC	Type B	460	42.0			42.0	
NR 68	Kralanh - Osmacth (T-B)	117.7	Road Upgrading	2 Lanes	AC	Type B	3,120	34.0		34.0		Committed Project
NR 70	Prey Toteung - Peam Chikong	13.5	Road Upgrading	2 Lanes	DBST	Type C-2	2,650	3.0			3.0	
NR 71	Treung (NR7) - Kompong Thmar (NR6)	57.8	On-going/Road Upgrading	2 Lanes	AC	Type B	13,790	17.0	17.0			(15.5 Km) On-going Project. Road structure to be upgraded based on traffic demand (DBST).
NR 72	Kreak Tboung (NR7) - Smach	13.5	Road Upgrading	2 Lanes	AC	Type B	6,030	4.0	4.0			Committed Project
NR 73	Pratheat - Chhloung	57.4	Road Upgrading	2 Lanes	DBST	Type C-2	2,480	11.0		11.0		
NR 74	Snuol - Khum Thnu (Vietnam B)	17.9	Road Upgrading	2 Lanes	DBST	Type C-2	940	3.0			3.0	
NR 76-1	Srei Char (NR7) - Mondlikiri	130.7	Road Upgrading	2 Lanes	AC	Type B	2,590	38.0	⇨	38.0		
NR 76-2	Mondorikiri - Ta Ang (NR78)	193.5	Road Upgrading	2 Lanes	DBST	Type C-2	260	37.0			37.0	
NR 78-1	Ou Pong Moan - Bang Lung	124.0	Road Upgrading	2 Lanes	AC	Type B	810	36.0		36.0		
NR 78-2	Bang Lung - Vietnam B	70.0	Road Upgrading	2 Lanes	AC	Type B	810	* 26.0	26.0			(70.0 Km) Committed Project.
NR 78A	Rattanak Kiri - Veun Sai	36.9	Road Upgrading	2 Lanes	DBST	Type C-2		7.0		⇨	7.0	
NR 78B	Thrang Svay - Ta Veng	39.0	Road Upgrading	2 Lanes	DBST	Type C-2		7.0		⇨	7.0	
Total of Improvement cost		**2,643.2**						**675.5**	**195.5**	**231.0**	**249.0**	
Total of Maintenance cost		**2,643.2**						**87.1**	**23.9**	**34.1**	**29.1**	
TOTAL COST FOR 2 DIGIT ROAD								**762.6**	**219.4**	**265.1**	**278.1**	

⇨ : Projects to be shifted to the Subsequent Term due to financial constraints

* Contract Amount of On-going Project

Table 14.2.1 (3) Implementation Program for 3-Digit Roads and Rural Roads

3 Digit Road and Name of Province	Existing Road	Improvement Measures						Implementation Program			Remarks
	Length (km)	Type of Improvement Measures	Road Category	Lane Nos.	Pavement	Typical Cross Section	Amount (Million US$)	Short Term (2006-2010)	Medium Term (2011-2015)	Long Term (2015-2020)	
PR 104	9.6	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	1.4		1.4		
PR 111+Connection to NR-21	41.0	TYPE 3-2	Provincial / Collector	2	DBST	Type D	5.0			5.0	
PR 114	16.4	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	2.0		2.0		
PR 127	15.0	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	2.0		2.0		
PR 2082+2081+2076 (NR 59)	101.0	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	15.0			15.0	NR-59 Extension
Stung Treng-Cham Khsan	135.0	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	20.0			20.0	
Kampong Thom-Kratie	102.0	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	15.0			15.0	
PR 210	91.7	TYPE 3-2	Provincial / Collector	2	DBST	Type D	10.0		10.0		
PR 210A	70.0	TYPE 3-2	Provincial / Collector	2	DBST	Type D	8.0			8.0	
PR 212	77.0	TYPE 3-2	Provincial / Collector	2	DBST	Type D	8.0			8.0	
PR 213	112.4	TYPE 3-2	Provincial / Collector	2	DBST	Type D	12.0			12.0	
PR 274	132.0	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	20.0			20.0	
PR 301	47.4	TYPE 3-2	Provincial / Collector	2	DBST	Type D	5.0			5.0	
PR 301-1	59.0	TYPE 3-2	Provincial / Collector	2	DBST	Type D	6.0			6.0	
PR 301-2	59.0	TYPE 3-2	Provincial / Collector	2	DBST	Type D	6.0			6.0	
PR 305	120.0	TYPE 3-2	Provincial / Collector	2	DBST	Type D	13.0			13.0	
PR 308	34.6	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	5.0			5.0	
PR 316	35.0	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	5.0			5.0	
PR 148	114.0	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	17.0			17.0	
PR 148A	120.0	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	18.0			18.0	
Road connecting NR13 to NR 7	61.4	TYPE 3-1	Provincial / Collector	2	DBST	Type C-2	9.0			9.0	
Total of Improvement cost	**1,553.5**						**202.4**	**0.0**	**15.4**	**187.0**	**202.4**
Banteay Meanchey	443.0		Provincial / Collector	NA	NA	NA	10.2	3.4	3.4	3.4	
Siem Reap	535.0		Provincial / Collector	NA	NA	NA	12.3	4.1	4.1	4.1	
Kandal	306.0		Provincial / Collector	NA	NA	NA	7.0	2.3	2.3	2.3	
Kep	18.0		Provincial / Collector	NA	NA	NA	0.4	0.1	0.1	0.1	
Koh Kong	5.0		Provincial / Collector	NA	NA	NA	0.1	0.0	0.0	0.0	
Kompong Chhnang	167.0		Provincial / Collector	NA	NA	NA	3.8	1.3	1.3	1.3	
Kompong Speu	355.0		Provincial / Collector	NA	NA	NA	8.2	2.7	2.7	2.7	
Kompong Thom	413.0		Provincial / Collector	NA	NA	NA	9.5	3.2	3.2	3.2	
Kompot	354.0		Provincial / Collector	NA	NA	NA	8.1	2.7	2.7	2.7	
Kratie	149.0		Provincial / Collector	NA	NA	NA	3.4	1.1	1.1	1.1	
Mondulkiri	103.0		Provincial / Collector	NA	NA	NA	2.4	0.8	0.8	0.8	
Kompong Cham	749.0		Provincial / Collector	NA	NA	NA	17.2	5.7	5.7	5.7	
Odor Meanchey	199.0		Provincial / Collector	NA	NA	NA	4.6	1.5	1.5	1.5	
Pailin	18.0		Provincial / Collector	NA	NA	NA	0.4	0.1	0.1	0.1	
Battambang	410.0		Provincial / Collector	NA	NA	NA	9.4	3.1	3.1	3.1	
Peach Vihear	344.0		Provincial / Collector	NA	NA	NA	7.9	2.6	2.6	2.6	
Prey Veng	464.0		Provincial / Collector	NA	NA	NA	10.7	3.6	3.6	3.6	
Pursat	517.0		Provincial / Collector	NA	NA	NA	11.9	4.0	4.0	4.0	
Rattanakiri	172.0		Provincial / Collector	NA	NA	NA	4.0	1.3	1.3	1.3	
Stung Treng	112.0		Provincial / Collector	NA	NA	NA	2.6	0.9	0.9	0.9	
Svay Rieng	478.0		Provincial / Collector	NA	NA	NA	11.0	3.7	3.7	3.7	
Takeo	300.0		Provincial / Collector	NA	NA	NA	6.9	2.3	2.3	2.3	
Sihanoukville	0.0		Provincial / Collector	NA	NA	NA	0.0	0.0	0.0	0.0	
Phom Penh	4.0		Provincial / Collector	NA	NA	NA	0.1	0.0	0.0	0.0	
Total of Maintenance cost	**6,615.0**						**152.1**	**50.7**	**50.7**	**50.7**	**152.1**
TOTAL COST FOR 3 DIGIT ROAD							**279.9**	**54.9**	**97.0**	**128.0**	**279.9**

Rural Road	Existing Road	Improvement Measures						Implementation Program			Remarks
	Length (km)	Type of Improvement Measures	Road Category	Lane Nos.	Pavement	Typical Cross Section	Amount (Million US$)	Short Term (2006-2010)	Medium Term (2011-2015)	Long Term (2015-2020)	
Total of Maintenance cost	**18,948.0**	NA	NA	NA	NA	NA	**21.7**	**3.6**	**7.2**	**10.9**	
TOTAL COST FOR RURAL ROAD							**21.7**	**3.6**	**7.2**	**10.9**	

14.3 Investment Allocation Plan

The following is a summary of the investment allocation plan required to achieve the targets of the master plan.

Table 14.3.1 Investment Allocation Plan

Description	Total Amount ($ million)	Short-term 2006 - 2010	Medium-term 2011 - 2015	Long-term 2016 - 2020	Remarks
A. Required Cost					
(1) Road Improvement/Rehabilitation Project					
1-Digit Roads	1,157	207	337	613	NR1, 2nd Mekong Bridge, NR2, NR3, NR4, NR5, NR6, NR7, NR8
2-Digit Roads	676	196	231	249	NR11, NR21, NR33, NR48, NR57, NR62, NR64, NR68, NR78, and other 28 routes
3-Digit Roads	202	0	15	187	PR104, PR114 and other 16 routes
Urgent Bridge Rehabilitation Program	(40)	(20)	(20)	(0)	Short-term: Phase I (South-east BL) and Phase II (North-west BL) Medium-term: Phase III (South-west BL) and Phase IV (North-east BL)
Total (1)	**2,035**	**403**	**583**	**1,049**	
(2) Road Maintenance Works					
1 digit, 2 digit, 3 digit and rural roads	481	113	169	199	daily and routine maintenance only
Total (2)	**481**	**113**	**169**	**199**	
Total (B)=(1)+(2)	**2,516**	**516**	**752**	**1,248**	
B. Fund to be Procured					Financial procurement plan of Case 2
International fun Total (3)	1,284	428	428	428	Support by International Banks, Bilateral Loans, Grant Aids
Domestic fund Total (4)	982	135	288	559	Allocation of Added Tax and Road Use Tax to Road Sector
Total (B)=(3)+(4)	2,266	563	716	987	
Difference (surplus/▲shortage)	▲ 250	47	▲ 36	▲ 261	Surplus in the short-term shall be transferred to medium-term.
Additional fund required	**250**	**0**	**0**	**250**	To be procured by introduction of BOT system or 3rd private sector

14.4 Improvement of Traffic Control and Administration

In Cambodia, the traffic accident death rate stands out in comparison to neighboring countries. It is a characteristic of Cambodia that there is a high rate of motorcycle accidents. The improvement of the regulations and education for road users is necessary, together with the improvement of infrastructure such as the provision of an exclusive traffic lane for motorcycles and a traffic light facilities.

Improvement of road safety / management:

* The introduction of a driver's license system for motorcycles is required as well as; the reinforcement of the registration system, introduction of a car inspection system, expansion of the insurance regime and riding regulations for cow carriages within cities.

* Provision of traffic lanes on suburban roads for exclusive use by motorcycles, reinforcement of the traffic signal system, full-size vehicle regulations within cities, and the establishment of a sustainable public transport system including bus operation.

* Road and traffic safety through daily inspection and repair of roads, educating road users through the media and schools.

14.5 Effects of Road Development

14.5.1 Economic Benefits derived from Road Network Development

The economic effect in both 2010 and 2020 was calculated in Chapter 13 assuming that all of the road projects were carried out in accordance with the master plan. The assumptions used in the calculation, such as the timing of construction, construction periods and construction costs were very rough and the results of the calculation should be considered as approximate values only.

The economic benefits were determined from the sum of the VOC and TTC for the cases of with/without the project. The resulting economic benefit was $221 million in 2010 and $515 million in 2020 as shown in **Table 14.5.1**. The cumulative economic benefit over 15 years is estimated to be approximately $3,800 million-$4,200 million, and the benefit ratio becomes B/C=1.62, which can be judged as a comparatively good road investment.

Table 14.5.1 Summary of Economic Benefits

(Unit: US$ Million)

Items		2010			2020		
		W/O Master Plan	W/ Master Plan	Benefits	W/O Master Plan	W/ Master Plan	Benefits
1-Digit Roads	VOC	751	601	150	1,610	1,302	308
	TTC	78	46	31	196	121	75
	Total	829	647	181	1,806	1,423	383
2-Digit Roads	VOC	127	95	32	410	308	102
	TTC	12	7	4	45	28	17
	Total	138	102	36	455	337	118
Major Provincial Roads	VOC	7	5	3	30	19	10
	TTC	1	0	1	5	2	4
	Total	9	5	3	35	21	14
Total	VOC	885	700	185	2,050	1,630	420
	TTC	90	54	36	247	151	95
	Total	975	754	221	2,297	1,781	515

14.5.2 Improvement of Pavement Conditions

In 2020, when the long-term project has been completed, all of the 1-Digit roads will be constructed of asphalt pavement that is resilient in the rainy season and under heavy vehicle loadings. In addition, all of the provincial capitals will be linked by asphalt pavement or DBST paved national roads. In 2020, 80% of the 3-digit and rural roads will be passable in the rainy season.

Figure 14.5.1 shows the improvements to the pavement structure in the short-term, medium-term and long-term by type of national road.

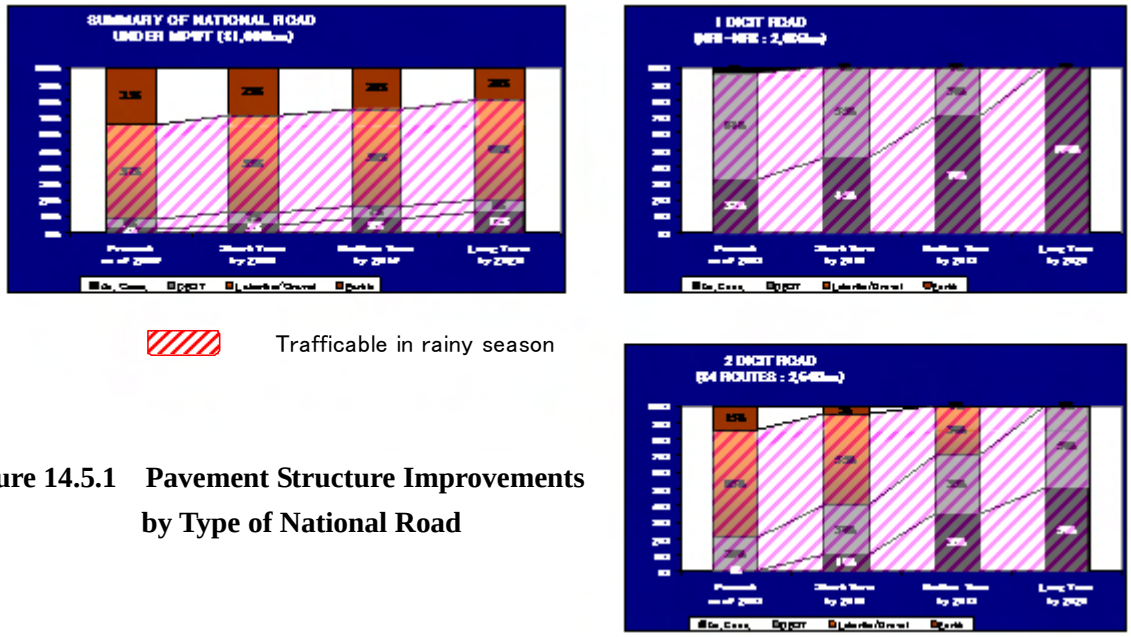


Figure 14.5.1 Pavement Structure Improvements by Type of National Road

14.5.3 Improvement in Travel Times

Out of the 24 provinces in the country of Cambodia, 16 of the provincial capitals are connected to the capital Phnom Penh by paved 1-Digit roads and the remaining eight capitals are connected to Phnom Penh indirectly through 2-Digit roads. However, 2-Digit roads to connect with six provinces of capitals among eight provinces are unpaved roads of a minimum standard that frequently become impassable in the rainy season.

Figure 14.5.2 shows the travel times when these 2-Digit roads have been paved with asphalt or DBST. As seen in the figure, the travel time from the provincial capital of Ratnakiri to Phnom Penh can be shortened from 13 hours to 8 hours in rainy season. This decrease in travel time is expected to have a significant impact on social and economic activities in rural areas.

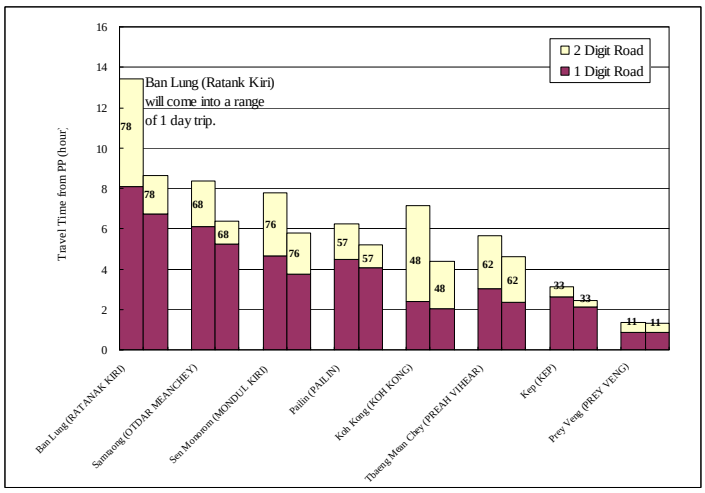


Figure 14.5.2 Improvement in Travel Time from Phnom Penh to Provincial Capitals

CHAPTER A-15 INITIAL ENVIRONMENTAL EXAMINATION

15.1 Review of Existing Environmental and Social Considerations

15.1.1 Legal Framework on Natural Environment and Social Environment

(1) Environmental Impact Assessment (EIA)

It is difficult for MOE to examine IEIA/EIA report because there are neither enough and definite environmental criteria/guidelines nor enough experiences of both MOE and local consultant for PO. There are definite environmental criteria/guidelines only for water quality, solid waste, air pollution and noise pollution. In addition, there is no monitoring system. Legal framework, such as technical standard and guideline, should be established. The law enforcement including monitoring system should be strengthened together with the capacity development of governmental agencies concerned.

(2) Natural Environment

There are several laws and regulations on natural environment in Cambodia. There are 23 protected areas in four (4) categories stipulated by MOE and eight (8) protected forests stipulated by the Ministry of Agriculture, Forestry and Fishery (MAFF). There is, however, no guideline, regulation and standard. For example, what kind of activities can be allowed or prohibited in these protected areas. The legal framework regarding road development, there is no regulation on vibration. This regulation should be established. The monitoring is insufficient as well.

(3) Social Environment

One of the major issues on the social environment related to road development in Cambodia is resettlement/compensation. There is no written policy on resettlement as a state policy. IRC, however, has a kind of guideline on resettlement; this includes a procedure, and unit price and formula of compensation.

15.2 Issues to be considered

15.2.1 General Considerations for Road Development

(1) Resettlement

Resettlement is one of the most critical issues on road development. The legal regulations should be established as soon as possible so that IRC can implement in the common manner even in a national budget project. Public consultation, grievance mechanism and monitoring mechanism are necessary as well so as to ensure proper implementation. Monitoring mechanism can ensure not only proper implementation but also the rehabilitation of PAPs' lives after the project implementation. It is recommended that NGO can be a monitor entrusted by the government if the NGO have good communication with people and well understanding of road project and governmental system. It is desirable to establish a good partnership between the government and such qualified NGOs for the future road development.

(2) Fauna and Flora (Natural Environment)

In case the roads are necessary to be developed, mitigation measures and environmental management plan (EMP) should be required. Before taking these measures and plan, a basic survey is necessary to understand fauna and flora including rare species and ecosystem as a base line. In addition, the types and characteristics of the protected should be confirmed. For example, Samlaut multiple use are is categorized in the multiple use area.

(3) Air Pollution, Noise and Vibration

Major affected areas by air pollution, noise and vibration are densely population areas and large traffic volume areas. One of the mitigation measures against these impacts during construction is to apply construction methods within minimized noise and vibration. Anti-noise measures such as noise barrier fence can be applicable in case of deterioration more than the criteria in the sub-decree. Inspection of vehicle emission is one of the mitigation measures against air pollution. There are no legal criteria on vibration. Establishment of legal criteria on vibration is necessary for the first step.

(4) Other Necessary Measures

Even though these measures are important, however, baseline survey and monitoring are essential. Baseline survey is necessary to compare between and after projects. If the baseline data do not exist, it is impossible to identify the cause of impacts and difficult to take necessary measures as well. Monitoring is very important as well to supervise the project implementation and construction, and to inspect the project at the completion and after the operation. The methodology and manner of monitoring should be formulated.

15.3 Further Issues

(1) ROW Management

One of the further issues should be tackled in the future is ROW management. There was a dispute on ROW in the previous project. The point of the dispute was who could be compensated in terms of two (2) judgments concerned with the declaration (Prakas), 1999 on the measure of eliminating illegal land encroachment. In any judgments, however, new squatters in ROW have to be prevented in terms of the declaration and new land law (2001). Therefore the prevention measures of ROW management to identify the people at this moment should be taken as soon as possible so that new squatters after the measures can be identified. Otherwise, PAPs will be increased and then the compensation cost will be huge.

(2) Indirect Impact

Existing road improvement project may not cause serious impact directly, such as destruction of forest, except for resettlement problems, however, might cause indirect impact. An indirect impact causes another impact, and the impact will cause another

impact as a negative spiral chain.

15.4 Conclusion of IEE for M/P

(1) Existing Road Improvement

Almost all the roads, which development plans are formulated in this M/P, are existing road. Therefore development of these roads is improvement such as pavement and widening and not new road construction. The social and environmental impacts caused directly by these kinds of road improvement might not be huge except for resettlement impact. Therefore these direct impacts can be avoided or minimized if proper measures and considerations are made as described above. While it is difficult for MPWT, the project owner, to take measures under the jurisdiction of MPWT against indirect impacts. For the measures, it is desirable for MPWT to cooperate with governmental agencies concerned and NGOs which work for the issues might be caused by road development both directly and indirectly.

(2) New Road Construction and 4-Lane Widening

New road construction and 4-lane widening upgraded from 2-lane have possibilities to cause large impacts, especially social impacts by resettlement. In addition to the ordinary measures and considerations, careful considerations are necessary for these roads because large scale of resettlement can be estimated. In such case, consensus building among PAPs is essential and very important. The road project which causes a huge impact, such as the Phnom Penh ring road, has to be paid much more careful considerations. In such case, social consensus building among not only PAPs but also the citizen is necessary because the project might bring impacts not only to the PAPs who have to be resettled directly but also to the citizen both directly and indirectly. At the same time, positive impacts and benefits brought by the project should be considered in parallel with the considerations against negative impacts. In this context, such project should be formulated in the urban planning as well, not only in the individual road project plan. In the urban planning, the necessity of the project should be examined with assessing both positive and negative impacts.

15.5 Recommendations

(1) Proper Implementation

Proper implementation is the most important thing for social and environmental considerations because the proper implementation becomes the result of the project directly. In this connection, implementation capacity of both individual staff and organization concerned will be fostered so that proper implementation can be ensured. Capacity development program can be considerable.

(2) Strengthening Legal Frameworks

Strengthening legal frameworks is recommended including guidelines and technical

manuals so that minimum requirement will be secured for every project.

(3) Strengthening Law Enforcement and Monitoring

Strengthening law enforcement and monitoring are recommended. The monitoring is crucial for law enforcement. Monitoring mechanism for resettlement should be established as well.

(4) Land Issues

Land issues are crucial for road development. Strengthening land administration is necessary for MLMUPC, such as land registration, land transaction control, squatter control. Land use control is necessary as well, such as development permission and land use plan made by MLMUPC and other relevant agencies concerned, e.g. MAFF for agricultural development, and MRD for rural development, etc.

(5) Coordination and Cooperation

Coordination and cooperation with other relevant governmental agencies are important so as to take integrated measures against various types of indirect impacts. In addition, cooperation with NGOs can be effective. Some NGOs have projects in the fields where road projects are implemented. They have good relationship with the community. In this connection, coordination and cooperation with NGOs are important.

(6) Facilitating Environmental Improvement with Road Development

Social and environmental considerations can be paid not only against negative impacts but also for environmental improvement. Road development together with other improvement planning can facilitate integrated environmental improvement.

(7) Balanced Development

If only road development is planned without other related plan, only road level becomes advanced other than the other sector's development. As a result, the balance of development will be got off. Due to the weakness of legal frameworks, governmental capacity and law enforcement in every sector and every Ministry, the advantage of road development has impacts to the other sectors or other jurisdictions of other Ministries in terms of both positive and negative views. Thus the road development has both positive and negative impacts directly and indirectly. The view point of national or regional development is crucial for road development in terms of balance development so that road development can maximize the benefit and minimize the negative impacts

CHAPTER A-16 CONCLUSIONS AND RECOMMENDATIONS

16.1 Conclusions

16.1.1 Role of Master Plan

The Study Team recommends that the Cambodian government use the findings of the road network master plan as the basis for the long-term national development program and anticipates that the projects proposed in the study will be successfully completed by 2020.

The Study Team also recommends that the members of IRITWG utilize the results of the master plan study in order to avoid repetition of support efforts and discrepancies between the opinions of different supporting groups regarding project implementation.

16.1.2 Coordination between the Road Development Plan and the Road Management Plan

The Study Team examined the proposed improvement measures for 1-Digit, 2-Digit and major provincial roads under Part A (Road Network Development Plan) and for minor provincial roads and rural roads with small traffic volumes under Part B (Road Maintenance Plan).

Both of these plans complement the proposed master plan, and the implementation of the road network improvement measures and road maintenance should be progressed in parallel with the timing targets in the master plan.

16.1.3 Road Network System in the Year 2020

The master plan target improvement works by the year 2020 are presented below.

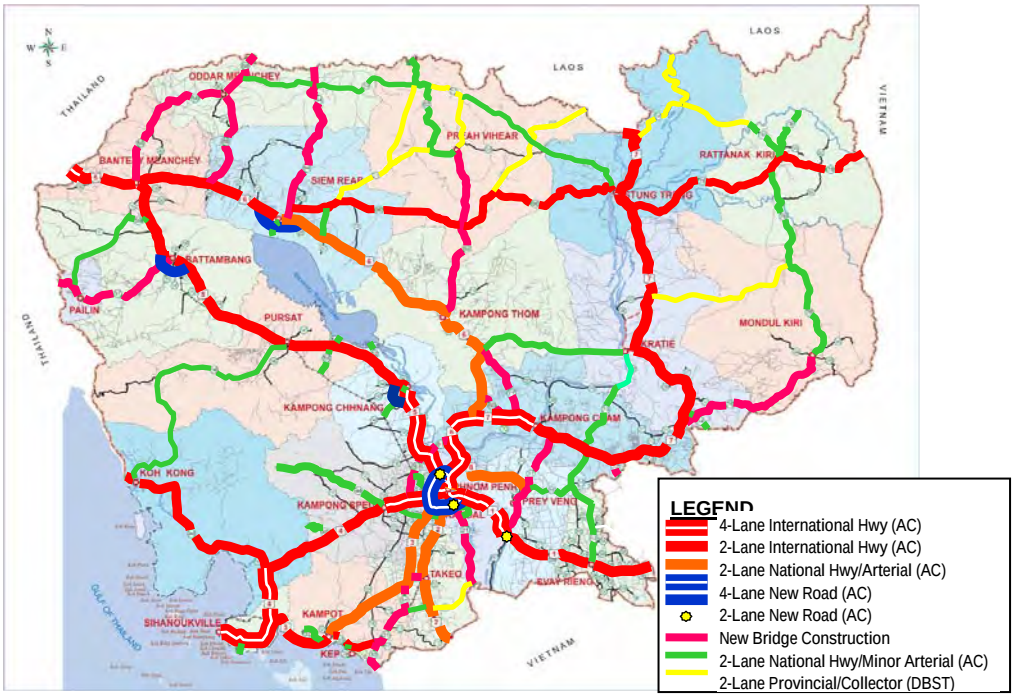


Figure 16.1.1 Road Network in the Year 2020

16.1.4 Total Project Cost Proposed in the Master Plan

The total cost of improvement measures and maintenance costs are as shown below:

Table 16.1.1 Total Project Costs

Road Classification		Total Road Length (km)	Civil Works Improvement Cost (US$ million)	Maintenance Cost (US$ million)	Total Cost (US$ million)
1-Digit National Road	Existing	2,052	901	92	993
	New	133	256	-	256
2-Digit National Road		2,643	676	87	763
Provincial Road		6,615	202	280	482
Rural Road		18,948	-	22	22
Total		30,391	2,035	481	2,516

16.1.5 Expected Economic Effect derived from the Implementation of the Master Plan

The economic benefit, based on the VOC and TTC, derived from the implementation of the master plan is expected to be between $3,800 million and $4,200 million in total over 15 years and the B/C ratio based on a project cost of $2,516 million will be 1.62, which indicates that the project is feasible and viable.

Total project costs	: US$ 2,516 million
Accumulated benefit (Period: 25 years from the year 2010)	: US$ 15,952
B/C Ratio (Discount Factor 12 %)	: 1.62

16.1.6 Implementation Program (Short-term, Medium-term and Long-term)

The upgrading and widening works are divided into the short-term, medium-term and long-term plans as shown below:

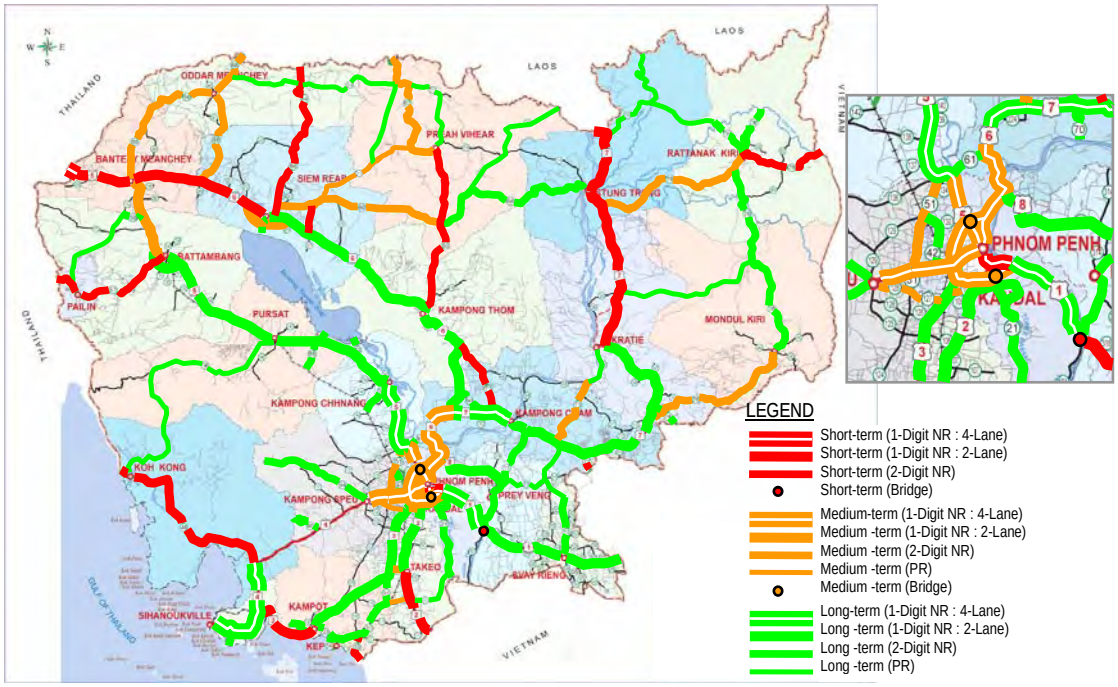


Figure 16.1.2 Implementation Program (Short-term, Medium-term and Long-term)

16.1.7 Investment Plan

The following is a summary of the investment allocation plan for the short-term, medium-term and long-term objectives in the master plan study.

Table 16.1.2 Investment Plan

Description	Total Amount ($ million)	Short-term 2006 - 2010	Medium-term 2011 - 2015	Long-term 2016 - 2020	Remarks
A. Required Cost					
(1) Road Improvement/Rehabilitation Project					
1-Digit Roads	1,157	207	337	613	NR1, 2nd Mekong Bridge, NR2, NR3, NR4, NR5, NR6, NR7, NR8
2-Digit Roads	676	196	231	249	NR11, NR21, NR33, NR48, NR57, NR62, NR64, NR68, NR78, and other 28 routes
3-Digit Roads	202	0	15	187	PR104, PR114 and other 16 routes
Urgent Bridge Rehabilitation Program	(40)	(20)	(20)	(0)	Short-term: Phase I (South-east BL) and Phase II (North-west BL) Medium-term: Phase III (South-west BL) and Phase IV (North-east BL)
Total (1)	**2,035**	**403**	**583**	**1,049**	
(2) Road Maintenance Works					
1 digit, 2 digit, 3 digit and rural roads	481	113	169	199	daily and routine maintenance only
Total (2)	**481**	**113**	**169**	**199**	
Total (B)=(1)+(2)	**2,516**	**516**	**752**	**1,248**	
B. Fund to be Procured					Financial procurement plan of Case 2
International fun Total (3)	1,284	428	428	428	Support by International Banks, Bilateral Loans, Grant Aids
Domestic fund Total (4)	982	135	288	559	Allocation of Added Tax and Road Use Tax to Road Sector
Total (B)=(3)+(4)	2,266	563	716	987	
Difference (surplus/▲shortage)	▲ 250	47	▲ 36	▲ 261	Surplus in the short-term shall be transferred to medium-term.
Additional fund required	**250**	**0**	**0**	**250**	To be procured by introduction of BOT system or 3rd private sector

16.1.8 High Priority Projects in the Short-term Plan

The projects proposed in the short-term plan (2006 -2010) are listed below:

Table 16.1.3 Projects proposed in the Short-term Plan

Projects Proposed in the Short Term		Length (km)	Improvement Measures	Project Status (as of July, 2006)	Project Cost (US$ M)
1-Digit NR	NR.1 (1-1, PP-Neak Leuong)	60.0	Road upgrading	Under construction	65.0
	NR.1 (1-2, Neak Leuong Bridge)	2.0	New bridge construction	F/S completed by Japan	70.0
	NR.2 (2-2, Takeo-VN Border)	57.0	Road upgrading	Completed in 2006	12.0
	NR.3 (3-2, Kampot-Veal Rinh)	54.0	Road upgrading	Under construction	17.5
	NR.5 (5-5, Sisophon -Thai Border)	47.0	Road upgrading	Under construction	11.6
	NR.6 (6-4, Siem Reap - Sisophone)	48.0	Road upgrading	Under construction	30.4
	NR.7 (7-3,4 Kratie-Laos Border)	193.0	Road upgrading	Under construction	50.0
2-Digit NR	NR.33 (33-1, Kampong Trach-Lork)	17.0	Road upgrading	Committed by ADB	5.0
	NR.48 (Chamker Loung-Thai Border)	161.0	Road upgrading	Under construction	29.7
	NR.57 (Battambang-Pailin-Thai Border)	103.0	Road upgrading	Pre-F/S completed by Japan	45.0
	NR.62 (62-1, Thanal Baek - Tbeng Meanchey)	243.0	Road upgrading	Under construction	37.0
	NR.64 (Svay Thom - Dang Rek)	134.0	Road upgrading	Committed by Thai	27.8
	NR.65 (Dam Deck - Trapeang Prey)	21.0	Road upgrading	Under construction	4.0
	NR.71 (Treung -Kompong Thmar	58.0	Road upgrading	Under construction	17.0
	NR.72 (Kreat Tboung - Smach)	14.0	Road upgrading	Completed by DPWT	4.0
	NR.78 (78-2, Bang Lung - Vietnam Border)	70.0	Road upgrading	Committed by Vietnam Gov.	26.0
Urgent Bridge Rehabilitation Program					
	Phase I: South-east Block	-	Bridge rehabilitation	Requested to Japanese Gov.	12.0
	Phase II: North-west Block	-	Bridge rehabilitation	Undecided	12.0

Note) Marked Projects are not yet executed nor committed.

16.2 Recommendations

16.2.1 Investment Allocation Plan

At present, the financial status of the Cambodian government is very tight and there are many problems and issues to be resolved in order to secure the necessary funds planned in the Study. The following improvement measures are recommended by the Study Team:

(i) The allocation of full amount of added tax (2 cents/liter on gasoline and 4 cents/liter on diesel) to funds for road construction and maintenance works and to use the fund that does not accept multipurpose diversion, only limited to road maintenance.

(ii) To correct the yield of taxes that are currently lost due to the smuggling of petrol products.

(iii) To use private funds from a third sector or introduce BOT.

16.2.2 Follow-up on the Master Plan Study

(1) Periodic Review of the Master Plan (every five years)

The master plan has been formulated by the Study Team taking into consideration the socio-economy and technical requirements. Therefore, it is expected that the government of Cambodia will use the findings of the master plan study as a base for the long-term national development program. However, at the same time, the MPWT is advised that projects suggested in the study should be monitored and reviewed in relation to changes in domestic and international affairs at an interval of every five years.

(2) Nationwide Traffic Surveys (at three to five year intervals)

The first national level traffic investigation in Cambodia was conducted by the Study Team and the traffic data obtained through this survey will be important basic data for the development plan for this country in the future. The Study Team recommends that the MPWT continue with the traffic surveys using the same methods and the same locations at the following intervals:

(i) Traffic count survey at roadside : every three years

(ii) OD survey : every five years (at the same time as the master plan review)

At present, no departments are responsible for the implementation of the traffic surveys and data management. It is recommended that the Public Works Research Center (PWRC) of the MPWT is made responsible for all of the traffic surveys and data management. The recommended organization chart is shown below:

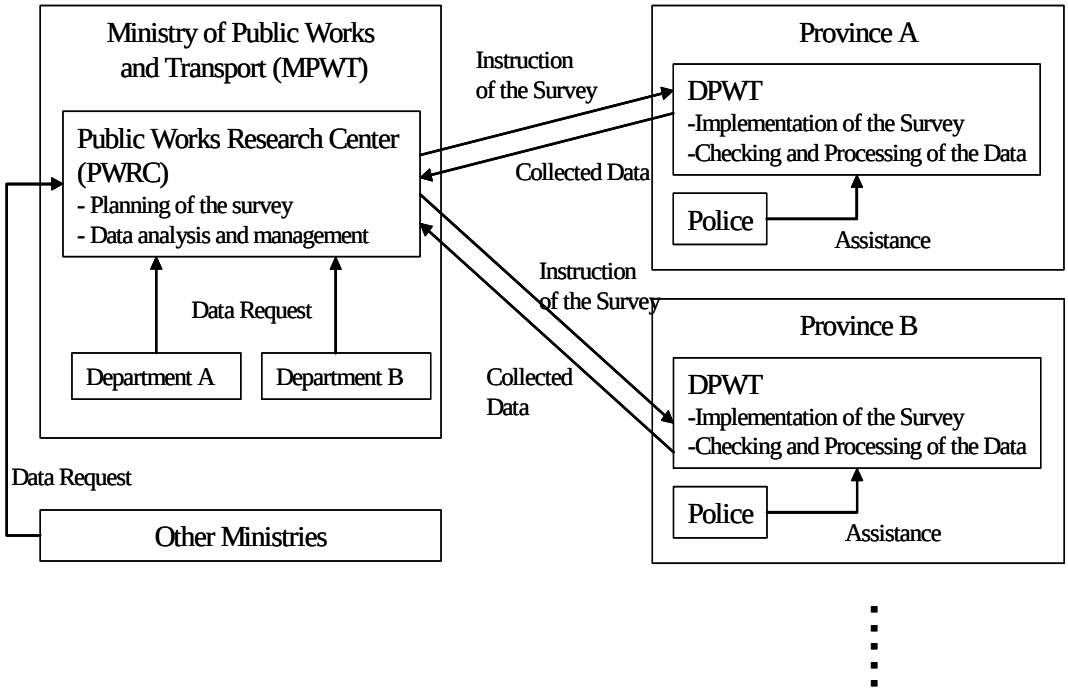


Figure 16.2.1 Proposed System for Traffic Surveys

(3) Updating of Road Inventory (Annually)

A road inventory is indispensable for the annual budget planning process of the MPWT. This data must be reviewed and updated at the end of every financial year for future planning. It is necessary to undertake the following measures to effectively update the inventory effectively.

(i) Installation of distance posts at one km intervals on the 1-Digit, 2-Digit and major provincial roads.

(ii) Installation of markings, showing the road number and distance (km), on the 1-Digit, 2-Digit and major provincial roads, at both ends of each route.

(iii) Establishment of a destination mark at the main crossings.

(4) Cooperation with NGOs

NGOs could become monitoring bodies entrusted by the government if the NGOs have good communication skills with the public and an adequate understanding of road projects and governmental systems. It is desirable to establish a good partnership between the government and such qualified NGOs for future road development.

(5) Continuous training for CP

It is desirable that the staff of the MPWT or other relevant ministries receive continual training from the viewpoint of effective technology transfer.

PART B

INSTITUTIONAL DEVELOPMENT OF ROAD MAINTENANCE

CHAPTER B-1 BACKGROUND AND BASIC STANCE

1.1 Basic Stance

After the long civil war in Cambodia, road policy has focused mainly on the recovery of 1 and 2-Digit national roads and associated facilities destroyed during the period, as an urgent issue. As for road maintenance, the government gave it low priority and put it aside and duly no budget being allocated. This caused many areas isolated during the rainy season and presented significant negative impact to the socio-economic activities in the area. Among the roads already recovered, observed are the issues of road deterioration, and lack of safety measure etc. that are brought from inappropriate maintenance.

It is the most important for road authorities to develop the appropriate road maintenance management mechanism through project cycle, which consists of budget planning, secure fund, timely procurement, implementation, quality control and post evaluation as urgent assignment.

In this regards, the Study Team will propose the concept of intuitional development by 2020 which consists of these 4 (four) factors and as shown in **Figure 1.1** to improve present issues.

1.2 Present Issues

At present 60% of 1-Digit national roads, 40% of 2-Digit national roads and 10% of provincial (3 & 4-Digit) roads are paved roads. These conditions may be further enhanced with the completion of road improvement work being undertaken by foreign donors at present.

However, the system of road maintenance activity by MPWT, major executing agency of road maintenance in Cambodia, is substandard and not effectively functioning. The strengthening of road maintenance capability with the establishment of mechanism with international standard is very important and critical matter.

At present, road maintenance works are undertaken either by force account base or contract out method with the initiative of DPWT and RCC. However, these undertakings and done under no clear-cut demarcation at work, unclear criteria of evaluation and sporadic system of inspection.

It is inevitable to establish standardized method of road maintenance work with the review of existing system, organization, relevant law so as to realize efficient and transparent method of road maintenance activities.

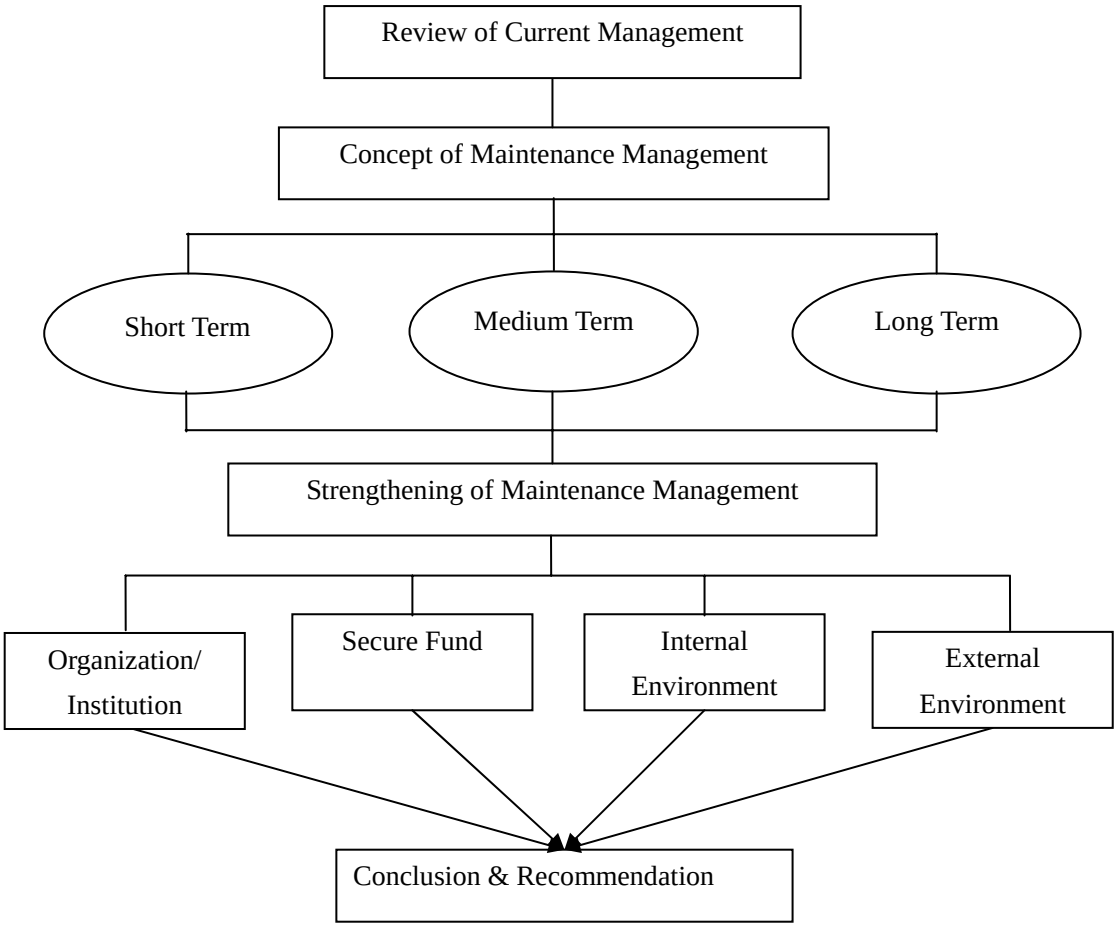


Figure 1.1 Study Flow for Institutional Development of Road Maintenance

CHAPTER B-2 PRESENT SITUATION OF ROAD ADMINISTORATION AND ORGANIZATION

2.1 Organization

MPWT is responsible for road development of national and provincial roads and provides the directions for the maintenance program. MRD manages an extensive rural road and provides the policy of rural roads. **Figure 2.1** shows the flow of project cycle from the beginning of planning stage to the end of implementation stage. Presently, both MPWT and DPWT are carrying out maintenance activities in claptrap manner. As a result, the authorities those are responsible for maintaining the road in Province/Municipality are facing the problems at each flow stage, and project flow is not functioning substantively.

In addition to the above MPWT faces problems in terms of request/approval for annual budget and disbursement by MEF who is responsible for national budget. Specific issues relating to them are as follows and as illustrated in **Figure 2.2**.

(1) Insufficient capability of MPWT at Planning Stage

(2) Un-efficient procurement manner by MPWT at procurement stage

(3) Delay of disbursement by MEF

(4) Poor quality control by MPWT

2.2 Legislation

Road administration; there are generally three (4) essential matters to be stipulated by law or similar rule:

(1) Responsibilities, obligations, rights and interests of the state on road,

(2) Definition of roads to be constructed rehabilitated and maintained by the road authorities,

(3) Application and enforcement of traffic rules, and

(4) Compliance with rule in terms of Road User Special Tax.

In terms of (1) and (2) the draft of road law should be introduced by the government and brought into effect as earlier as possible so that the authority's responsibility and ownership in road infrastructure may become clearer. The revision of traffic law should be as well so as to educate road users and to conduct better traffic flow all over the country of (3). In addition, Road User Special Tax has stipulated in the law, however, the application is not clear. Road authorities shall be encouraged to discuss its application with MEF to solve the issue (4).

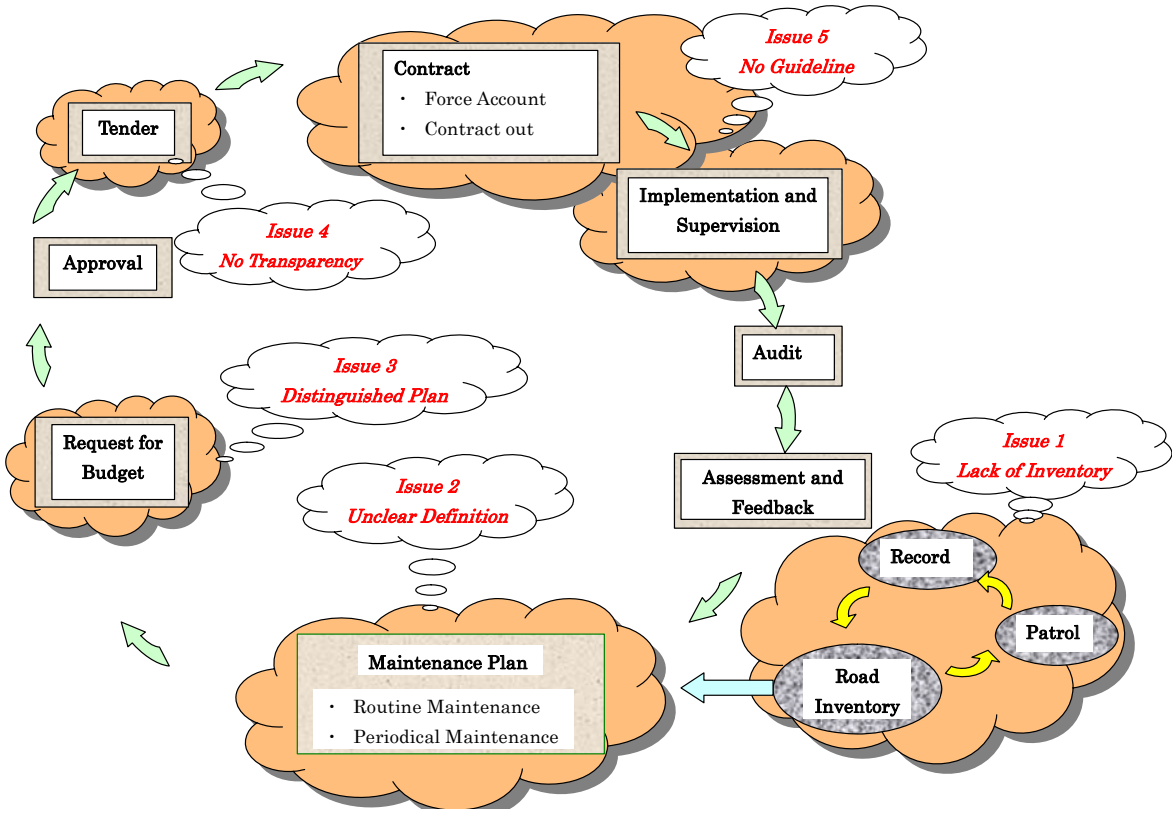
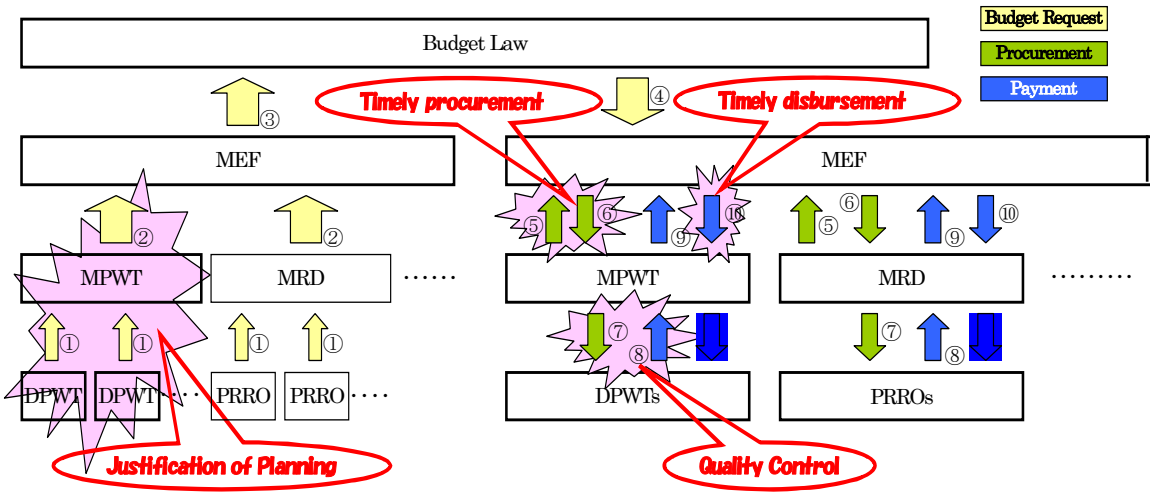


Figure 2.1 Flow of Project Cycle



① Provincial offices request ministry of next year's budget
② Line miniseries request MEF of next year's budget which are coordinated by the ministries
③ MEF drafts the budget law and get the approval of NA
④ Management of the budget
⑤ Request of procurement, making contract (Contract by contract)
⑥ Approval for contract
⑦ Making contract and instruction of works
⑧ Request of Payment (Payment by payment)
⑨ Request of Payment with clearance
⑩ Payment

Figure 2.2 Current Disbursement Procedure and Problems

CHAPTER B-3 CONCEPT OF ROAD MAINTENANCE MANAGEMENT

3.1 Establishment of Sustainable Road Maintenance Mechanism

With reference to **Figure 3.1** and **Table 3.1**, visions and goal in each term is summarized as follows;

Short Term (2006～2010) : Development of Standardized Mechanism Framework

Medium Term (2011～2015) : Establishment of Sustainable Mechanism

Long Term (2016～2020) : Independent Road Maintenance Mechanism

To achieve the above the new organization named National Road Maintenance Committee (NRMC) shall be established and six guidelines shall be prepared to strengthen the road maintenance activities.

(1) Short Term: "Development of Standardized Mechanism Framework"

MPWT has started to prepare the standard guideline for maintenance activities which consist of Budget planning, Procurement, Payment request, Accounting, Preparation of Maintenance Works and Quality Control. The object of guideline is to promote MPWT/DPWT to have substantial understanding about project cycle and content of road management.

Establishment of NRMC is required for institutional management for road maintenance. The advantage of the establishment is to get timely budget disbursement and to simplify the procedure at planning stage, to carry out equitable and transparency of maintenance works at implementation stage and to secure quality assurance at completion stage. MPWT shall insist to establish one standard guideline and to train staffs by either on-the-job or off-the-job in short term.

(2) Medium Term: "Establishment of Sustainable Mechanism"

This guideline may be improved in order within short term. It is necessary that there should be a feed back from the field, especially DPWT staffs. Then, MPWT should prepare a sustainable maintenance management framework as to following items;

1) Training program (Transfer from MPWT to DPWT),
2) Quality management system, and
3) Implementation management by regional office.

The sustainable framework may be applied to maintenance works on the roads with good or fair condition. Most of maintenance works must be carried out by local contactors. The growth of construction industries shall make a large contribution toward economic growth.

(3) Long Term: "Independent Road Maintenance Mechanism"

Maintenance management framework may be established and performed effectively by MPWT by 2020. The condition on national roads should be maintained fair and trafficable at most of the road sections so that MPWT may take over NRMC's functions completely.

Road maintenance management shall be improved to higher stages called asset management method. In 2020 maintenance works shall be implemented effectively with appropriate cost.

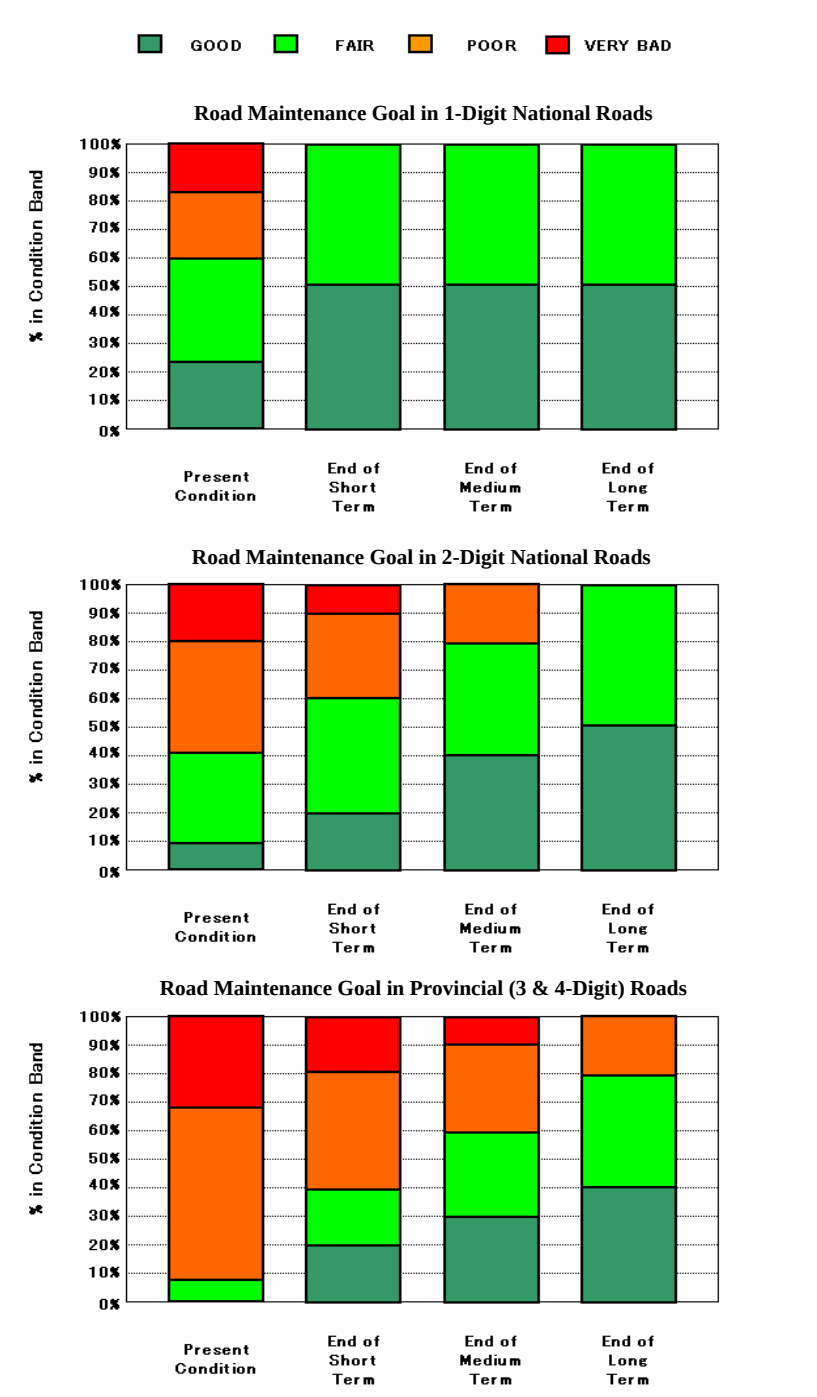


Figure 3.1 Target of Maintenance by Whole View

Table 3.1 Concept for Road Maintenance Management

		Short Term	Medium Term	Long Term
Vision		Development of Standardized System Framework	Establishment of Sustainable System	Independent Road Maintenance System
Goal		・ Trafficable 100% (1-Digit National) 60% (2-Digit National) 40% (Provincial) ・ Application of guideline for Project Cycle management ・ Establishment of NRMC	・ Trafficable 100% (1-Digit National) 80% (2-Digit National) 60% (Provincial) ・ Mobilization of Human Resources (Establishment of Regional Center) ・ Train to Local Contractor	・ Trafficable 100% (1-Digit National) 100% (2-Digit National) 80% (Provincial) ・ Decentralization
Institutional Management		・ Introduction of management by NRMC ・ Application of Road Law	・ Sustainable System Management by NRMC ・ Achieve Quality Assurance (QA)	・ Establishment of Management by MPWT ・ NRMC transfer management to Road Development & Improvement Planning
Organization	Planning	MPWT DOR, PWRC/DPWT	MPWT DOR, PWRC/DPWT	MPWT DOR, PWRC/DPWT
	Implementation	DPWT Force Account/Contract Out	DPWT Force Account/Contract Out	Contract Out
	Assessment	NRMC/MPWT DOR, PWRC	MPWT DOR, PWRC/NRMC	DPWT/MPWT DOR, PWRC
Finance		Earmarked Fund (Added Tax)/Foreign Assistance	Earmarked Fund (Added Tax)	Earmarked Fund (Added Tax)
Human & Organization Development		・ Formulation of National Program ・ Improving individual ability using guideline	・ Developing ability for leaders course ・ Quality Management System ・ Strengthening of Private sector	・ Method of Asset Management

3.2 Strengthening of Maintenance Structure

How MPWT shall strengthen maintenance activities to achieve the goals. Strengthening of Maintenance Structure consists of these 4 (four) factors as shown in **Figure 3.2**. It is helpful for MPWT to monitor the progress by adopting an evaluation system and indicator as its structure**.**

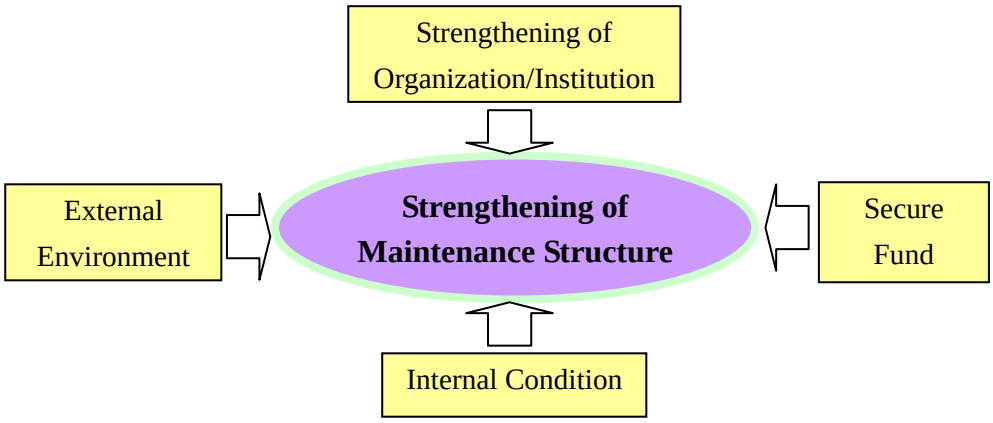


Figure 3.2 Strengthening of Maintenance Structure

(1) Strengthening of Organization and Institution

1) Establishment of National Road Maintenance Committee (NRMC) as described Chapter B-6,
2) Establishment of standardized project cycle management which consist of planning, procurement, implementation and assessment,
3) Development of responsible department for road maintenance in MPWT,
4) Mobilization of human resources to DPWT for maintenance management, and
5) Supporting to privatization (Road sector Reform)

(2) Secure the maintenance Fund

1) Clear the legal status for existing earmarked fund (Road Development Special Tax),
2) Efficient management of earmarked fund by NRMC,
3) Seeking the earmarked fund other than Road Development Special Tax, and
4) Introduction of possible execution fund from private sector.

(3) Tackling of Internal Environment

1) Capacity Development,
2) Availability of management information, and
3) Preparation of guideline for quality management system.

(4) Expected External Environment

1) Growth of Macro Economy,
2) Promotion of private construction sector,
3) Procurement of substantial physical assets (ex. Plant, equipment, facility and etc.), and
4) Removal of land mine and UXO.

CHAPTER B-4 FINANCIAL PROCUREMENT FOR ROAD MAINTENANCE

4.1 Present Situation of Maintenance Budget

The national budget of Cambodia in 2004 was $752 million, in which the budgets of MPWT and MRD were $37.82 mi and $18.89, respectively. These are only about 5% and 2.5% of the national budget respectively.

The road maintenance budgets for MPWT and MRD in the same year were $3.8 mil and $3.9 mil, respectively. These amounts share 10% of MPWT's budget and 21% of MRD's, respectively.

4.2 Present Situation of Maintenance Budget

Financial frame-work for road maintenance work in Cambodia has been established with the introduction of Added Tax (Road User Special Tax) in 2002. However, the operation is far behind the satisfactory level as it is not efficiently managed.

(1) Road User Special Tax (Added Tax)

In the Prakas in 2002, it is notified that the Added Tax, 2 cent/litter on gasoline and 4 cent/litter on diesel, is to be appropriated for road maintenance undertakings. The estimated amount of the tax in 2004 was about $21.1million that was enough amounts to cater to all the road maintenance works to be undertaken by the executing agencies consisting of MPWT, MRD and Governor's Office, should all the levied tax be exclusively appropriated for road maintenance works in the same year.

(2) Road User Tax

The tax was introduced in 2002. 100,000 Riel ($25) is being charged per annum. This tax is not special fund for road maintenance at present but is most directly related to road users.

(3) Issues

However, as to the tax there are many defaults in terms of levying, operation, application and disbursement methods as described below;

1) Lack in smooth cash flow originated in disconcerted communication among MEF, MPWT, MRD and authorities in charge,

2) Imperfect application and usage of this resource due to incapability in road budgeting on the side of executing agencies of road maintenance,

3) Transfer of the resource to other purpose of expenditures that are deemed more urgent/important in the Government of Cambodia, and

4) Great amount of leakage in tax revenue due to prevailing smuggling of petrol products.

4.3 Amount of Road Maintenance Fund to Realize Road Development

The targets of road maintenance plan by planning horizon (short, medium and long) are set out as shown in **Table 4.1** and **Table 4.2**.

Table 4.1 Road Maintenance Goal by Road Condition

(Unit: %)

	1-Digit National Roads				2-Digit National Roads				Provincial (3 & 4-Digit) Roads			
Road Condition	Present 2006	Short 2010	Medium 2015	Long 2020	Present 2006	Short 2010	Medium 2015	Long 2020	Present 2006	Short 2010	Medium 2015	Long 2020
Good	25.0	50.0	50.0	50.0	10.0	20.0	40.0	50.0	0.0	20.0	30.0	40.0
Fair	35.0	50.0	50.0	50.0	30.0	40.0	40.0	50.0	7.5	20.0	30.0	40.0
Poor	25.0	0.0	0.0	0.0	40.0	30.0	20.0	0.0	62.5	40.0	30.0	20.0
Very Poor	15.0	0.0	0.0	0.0	20.0	10.0	0.0	0.0	30.0	20.0	10.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4.2 Road Maintenance Goal by Road Surface

(Unit: %)

	1-Digit National Roads				2-Digit National Roads				Provincial (3 & 4-Digit) Roads			
Surface Condition	Present 2006	Short 2010	Medium 2015	Long 2020	Present 2006	Short 2010	Medium 2015	Long 2020	Present 2006	Short 2010	Medium 2015	Long 2020
Paved	75.0	80.0	90.0	100.0	20.0	40.0	60.0	100.0	2.0	8.0	14.0	20.0
Unpaved	25.0	20.0	10.0	0.0	80.0	60.0	40.0	0.0	98.0	92.0	86.0	80.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total km	2,052				2,643				6,615			

The amount of road maintenance costs required for the realization of the goals including rural roads are estimated to be $480.5 mil ($113.0 mil for short term, $168.9 mil for medium term and $198.6 mil for long term), applying unit maintenance cost set out by activity of road maintenance work to the required amount of works.

The required term-wise maintenance costs are less than the estimated revenues from Road User Special Tax at any of the corresponding planning periods, as shown in **Table 4.3**.

Table 4.3 Estimation of Road Maintenance Cost

Road Class	Work Content	Maintenance Cost ($ mil/ 5 year)		
		Short Term	Medium Term	Long Term
1-Digit National Roads	Patrol/Clean up	3.9	3.9	3.9
	Patching/Sealing FA	4.4	4.4	4.4
	Patching/Sealing CO	22.2	22.2	22.2
	Grading FA	0.0	0.0	0.0
	Grading CO	0.0	0.0	0.0
	Total	30.6	30.6	30.6
2-Digit National Roads	Patrol/Clean up	1.3	2.5	3.8
	Patching FA	0.5	2.0	3.8
	Patching CO	11.4	17.2	21.5
	Grading FA	1.0	2.7	0.0
	Grading CO	9.7	9.7	0.0
	Total	23.9	34.1	29.1
Provincial (3 & 4-Digit) Roads	Patrol/Clean up	3.2	6.4	9.5
	Patching FA	0.5	1.5	3.0
	Patching CO	10.1	17.6	22.6
	Grading FA	3.7	10.8	20.0
	Grading CO	37.4	60.7	72.8
	Total	54.9	97.0	128.0
Rural Roads		3.6	7.2	10.9
Total		113.0	168.9	198.6

4.4 Expected Revenue and Expenditure of Road Maintenance

As far as Cambodia road maintenance is concerned, fundamental procurement method for budget has been established with the enactment of Road User Special Tax catered by the revenue from the added tax on gasoline and diesel. The prospect of future magnitude of the revenue from this tax is estimated expected expenditure for road maintenance is estimated as shown in **Table 4.4**.

Table 4.4 Road Maintenance Expenditure and Road User Special Fund

(Unit: $ mil)

	2006-2010	2011-2015	2016-2020
(1) Expected Expenditure for Road Maintenance	113.0	168.9	198.6
Annual Average Expenditure during the above period	22.6	33.8	39.7
(2) Estimated Revenue from Road User Special Tax (Present Pattern; Gasoline 2 cent, Diesel 4 cent)	133.7	183.6	264.1
Annual Average Tax Revenue during the above period	26.7	36.7	52.8
(3) (=(1)/(2)) Share of Expenditure in the Tax Revenue	84.5%	92.0%	75.2%

4.5 Proposal for Improvement of Present Financial Issues in Road Maintenance

Present issues in road maintenance financing originates mostly in its inefficient administrative/operational manner, due to lack in experience, managing capability, and long inherited bureaucracy, outdated office equipment and lack in tools for planning and financing procedure that have long been neglected by the prolonged internal turmoil of the nation.

Improvement measures and expected effects, corresponding to present issues and targets of improvement, are set out as shown in **Table 4.5**.

Table 4.5 Improvement Measures for Road Financing

Category of Issues	Present Issues		Target of Improvement	Responsible Bodies	Procedure for Improvement	Effect on Improved Procurement of Road Maintenance Fund
Institutional	(1)	Non-transparency in Flow of Special Tax & Road Maintenance Fund	Publicity/Accountability of Budget	Financing Agency	Publicity in Tax Revenue/Disbursement	Concerted Management of Fund among Agencies involved
	(2)	Imperfect Utilazation of Special Tax as against Regulation Subscribed in Decree	Exclusive Application of Revenues from Special Tax for Rd. Maintenance Purpose	Financing Agency	Conformity to Legal Subscription (Decree)	Expansion of Available Fund for Rd. maintenance
	(3)	Excessive Administration of Road Maintenance Budget/Fund by MEF	Distribution of Administration Partially to MEF, MRD and P/C Gvnr. Offices	All the ministries in Charge of Rd. Maint.	Demarcation of Responsibilities among MEF and Rd. Maint. Ministries	Streamlined Cash Flow
	(4)	Complicated Procedure/ Long Process in Budgeting	Streamlined Budgeting System	Financing Agency	Revision of Budget Law & Road Law	Prompt Disbursement of Fund
	(5)	Indirect Control of Road Fund by Executing Ministries/Agencies of Rd. Maintenance	Distribution of Administration Partially to MEF, MRD and P/C Gvnr. Offices	All the ministries in Charge of Rd. Maint.	Establishment of self-reliant Rd. Maint. Activities with Self-accounting	Procurement of Fund for Consistent Implementation of Rd. Maintenance
Operational	(1)	Substandard Project Management	Improve in Management of Revenue, Expenditu ,Tendering/Progress Monitor System	Rd. Maint.Executing Ministries/ Agencies	-Introduction of Management Guideline -Capacity Building	Promotion of Mutual Trust between Financing body and Executing Bodies
	(2)	Substandard Budget/Cost/Revenue/ Expenditure Management	Establishment of Standardized Accounting System	Rd. Maint.Executing Ministries/ Agencies	-Introduction of Accounting Guideline -Capacity Building	Streamlined Cash Flow due to Enhanced Accountability
	(3)	Lack in Communication among Ministries /Office Responsible for Road Maintenance	Establishment of Concerted Body for rd. maint.	All the ministries in Charge of Rd. Maint.	Establishment of Road Board	Efficient Fund Management due to Easy Consensus among Ministries in Charge
	(4)	Less Strict Inspection and Auditing on Accounting/Engineering Output	Strengthening of Auditing Function	National Audit RB to be established	-Establishment of Road Board and Endowment of Inspecting Obligation	Cost Effective Financing
	(5)	Functional Disintegration among Sections in Rd. Maintenance Executing Ministries	Improvement of Fragmental Management of Rd in a series of Maintenance Activities	Rd. Maint.Executing Ministries/ Agencies	Restructuring of Existing Function withi Executing Ministries	Efficient Fund Management due to Easy Consensus among Parties (Sections) in Charge
	(6)	Fragile Function of Financial/Accounting Sections of Rd. Maint. Executing Ministries	Strengthening of Financing/Accounting Function	Rd. Maint.Executing Ministries/ Agencies	-Recruitment/ Capacity Building of Financial Expert	Sound Revenue/Expenditure Planning
Technical	(1)	Lack in Standard on Document Necessary for Application of Rd. Maintenance Fund	To improve the content/requisite of items in Budget Application Form.	Rd. Maint.Executing Ministries/ Agencies	Introduction of Technical Guideline	Prompt Disbursement of Fund due to Enhanced Accountability of Rd. Maint. Activities
	(2)	Lack in Base Data for Preparation of reasonat Maintenance Program/Budget Document	Submission of Scientifically persuasive Budget Application Form	Rd. Maint.Executing Ministries/ Agencies	-Capacity Building -Set out of Guide Line	Prompt Disbursement of Fund due to Submission of Self-sufficient Fund Application Form
	(3)	Deficit in Planning/Execution/Follow Up standing on PCM/PDM	Formulation of Rd. Maintenance Program with Consistency and Sustainable	All the ministries in Charge of Rd. Maint.	-Recruitment/ Capacity Building of Planners	Cost Effective Financing with Long-term View on Project Cycle
	(4)	Loose Quality Control on Output	-Strengthening of Auditing Function -Introduction of Quality Standard	All the ministries in Charge of Rd. Maint.	-Introduction of Quality Standard	Cost Effective Financing

CHAPTER B-5 IMPROVEMENT OF ROAD MAINTENANCE SYSTEM AND PROPOSAL ON ESTABLISHMENT OF NRMC

5.1 Capacity Development on MPWT and DPWT

(1) Fundamental Tool to Improve the Ability of MPWT/DPWT Staffs

Prepare and provide the following 6 (six) guidelines to all MPWT and DPWT staffs.

1) Guideline for Budget Planning,
2) Guideline for Procurement,
3) Guideline for Request and Disbursement,
4) Guideline for Accounting,
5) Guideline for Preparation of Maintenance Works, and
6) Guideline for Quality Control.

(2) Measures to Improve DPWT

1) Provide data keeping and transmission equipment such as computers and allow free access to data-base in MPWT,
2) Appoint qualified directors who hold diploma in civil engineer and skill to maneuver computer with age younger than 40 years old,
3) The director should be responsible for training their staffs regarding Guidelines,
4) Japanese side is recommended to provide technical assistance program collaborating with MPWT, such as planning and supervision to enhance their capability at least for 3 (three) years old, and
5) Japan side is recommended to provide maintenance equipment such as motor grader, wheel-type back hoe, vibration roller, asphalt sprayer and 4-tons truck with crane to 24-city and provinces, and carry out the “on the job maintenance training”.

(3) Measures to Improve MPWT

1) Establish Road Maintenance Unit (tentative name) in Road Department which shall be solely responsible for the road maintenance,
2) Establish intra-net system in MPWT and allow the free access from the staffs,
3) Soak up Road Construction Center and involve in Heavy Equipment Center,
4) Abolish Bridge Construction Unit and mobilize the surplus work force to each DPWT, and
5) Accelerate the privatization.

5.2 Establishment of National Road Maintenance Committee

The current road maintenance activity is slow for the reasons described in the above. In order to cut-off this negative chain, the Study Team shall strongly recommend the followings matters;

- Capacity development on MPWT/DPWT Staffs, and

- Timely Budget Disbursement by MEF.

In order to realize the above the Study Team suggests establishment of the National Road Maintenance Committee (NRMC) as described in **Figure 5.1**.

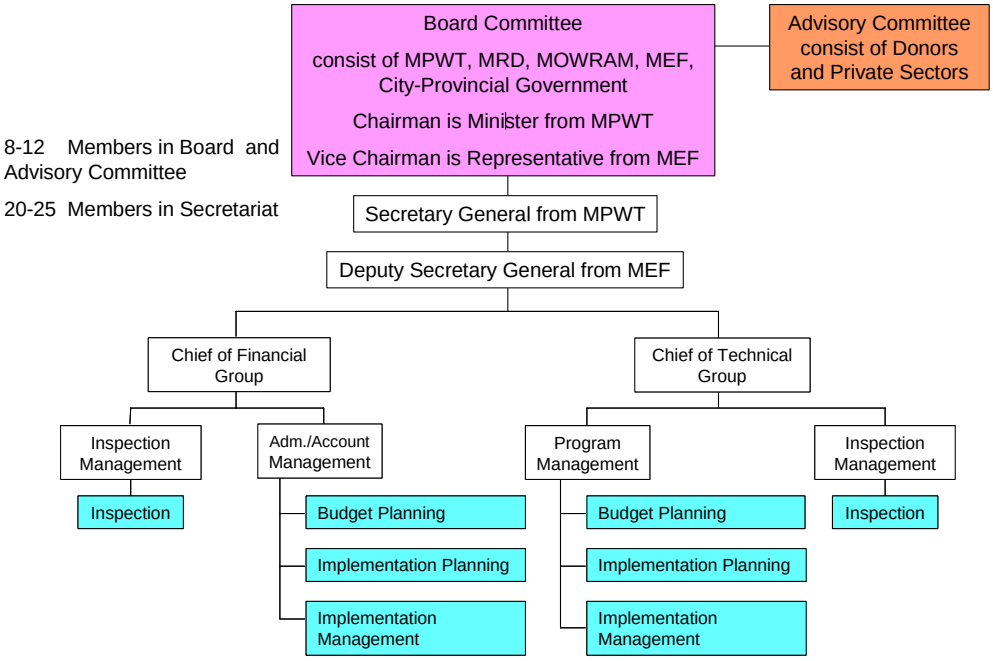


Figure 5.1 Organization of NRMC (draft)

Both MPWT and MEF shall delegate one of their roles to NRMC non-permanent basis. The officials from the Ministries may work together discussing about the better road maintenance. They will have same goals to improve; such as road management administration/techniques and this will promote a mutual understanding and better trust. As a result it is expected that the timely budget disbursement, transparency on maintenance activity and quality of field work shall be achieved. NRMC will be dissolved when the capacity of MPWT/DPWT staffs is improved to the level that in which direct negotiation with MEF become possible.

With regard to the key role of national road management, Chairman of the Board is from MPWT and Vice Chairman from MEF. Member of Advisory Committee consists of foreign donors and public accountant, ISO qualified auditor and representative oil importer/others to support/audit NRMC from administrative and technical point of view. Under this Committee, preparation for requesting road maintenance budget, guarantee of necessary maintenance budget amount, timely budget allocation and disbursement, justification on the project, understanding on project cycle, post evaluation on the project can be achieved substantially.

However, MEF has opposed to the establishment of National Road Maintenance Committee (NRMC) as NRMC has to manage and disburse the fund for road maintenance revolving around

added tax. MEF also pointed out that NRMC is more complicated organization which is composed various parties and will be spent the additional cost. Meanwhile, MEF proposes to establish the Inter-Ministerial Committee (IMC) for evaluation of maintenance program and smooth maintenance activities. The points of emphasis by NRMC and IMC are shown in **Table 5.1** in comparison.

Road authorities will adopt the maintenance management in either organization, it is necessary to promote the mutual understanding among concerned Ministries for the early realization of sustainable maintenance management mechanism.

Table 5.1 Comparison between NRMC and IMC

	NRMC (Proposed by Study Team)	IMC (Proposed by MEF)	
Personnel Organization	Road authorities, MEF, MOI (on behalf of provinces), and private sector	MPWT and MEF	
Management of Maintenance Fund	By MEF	By MEF	
Role at Budgeting Process	To prepare the annual maintenance program including cost which is based on budget plan prepared by MPWT/DPWT	To discuss and get concensus on annual maintenance program which is submitted by MPWT. (Decision of budget will be committed by minutes of discussions between MPWT and MEF)	
Role in Implementation Stage	To approve the implementation plan To participate contract negotiation To approve the contract To secure the quality control	To response for random inspection (To approve the contract by procurement committee)	
Role in Payment Stage	To certify and submit for disbursement to MEF To inspect/review payment request To certify the request for payment submitted by MPWT	No activities for IMC (To evaluate progress by MEF) (Direct payment from MEF to DPWT/contractors)	
Time Frame for Disbursement	4 trenches of disbursement both routine and periodical works	MEF policy (Routine works) 3 trenches of disbursement (Periodical works)	
		Force account	Contract out
		Advance payment Progress payment Retained till warrantee period	Subject to prior evaluation

CHAPTER B-6 ISSUES ON ORGANIZATION OF MRD AND COUNTERMEASURES

6.1 Existing Road Maintenance in MRD

(1) Rural Road Management

Ministry of Rural Development (MRD) was established with immediate tasks to provide the basic needs of all impoverished Cambodians and to safeguard the rights of the rural people to participate in plans affecting their future. Department of Rural Roads (DRR) is assigned to carry out the management of the rural roads in compliance with Rural Road Policy.

This policy objective is that MRD is responsible for facilitating improvement of rural social and economic conditions. DRR will contribute to this goal by enhance rural access through the cost-effective investment in the maintenance and development of rural roads, routes and transport infrastructure.

Present rural roads network is approximately 28,000 km (18,726.13 km finished construction), under MRD, which is responsible for the rural tertiary and sub-tertiary roads. Much of that network is currently in good or fair condition only at small sections when accessibility is guaranteed with provision of maintenance road. The remaining roads have mainly reverted to earth standard and are in poor or bad condition, where rehabilitation is awaiting. Most of these roads are inaccessible and un-maintainable at present.

(2) Procurement, Budget Request and Allocation of Maintenance Works

Current procedure of requesting for maintenance budget seems to be a kind of “bottom up method”, but this is the only preparation method of request by provincials. MEF has been disbursing annual maintenance budget to MRD on one-sidedly. Requesting amount from PDRD is much bigger than actual disbursement. But maintenance budget has not been increased and extended to the trafficable rural road even rural area is developing rapidly. This is not only due to system for budget request but to lack in preparation of road inventory.

Table 6.1 Maintenance Budget for MRD

(Unit: million Riel)

Year	2000	2001	2002	2003	2004	2005
Package Budget	200	2,200	5,600	6,000	8,000	7,000
Actual expenditure	199	2,191	5,000	5,100	5,217	6,990
Routine Maint. (km)	-	-	-	297.3	998.8	609.0
Periodic Maint. (km)	8.0	45.0	81.3	151.5	124.0	235.5

(3) Identification of Issues

1) Insufficient allocation of Maintenance Budget,

2) No availability of inventory system for rural roads, and

3) Not enough knowledge and skill for maintenance works.

6.2 Improvement of Road Maintenance

Management for rural roads in MRD is done by limited staffs in comparison with MPWT and role of functions is not clear in its policy. Besides, all of the undertakings have been managed by foreign donors which resulted in insufficient and non-effective self operation.

In case MRD may run out of fund from donors, MRD should manage rural roads network by themselves with national budget. NRMC shall assist MRD to prepare budget planning. At same time MRD should approach each issue from every angle for rural development. One of purposes of establishment of NRMC is to identify “project cycle”, which consists of maintenance preparation, implementation, operation and evaluation. Each component is essential to promote efficient development of rural roads.

Moreover, collaboration with MPWT/DPWT in technical and physical aspects of road maintenance is recommended. By this method, all authorities responsible for managing the road network in Cambodia can work together with common recognition. This will promote the realization of smooth domestic transportation and contribute to rural development.

CHAPTER B-7 CONCLUSIONS AND RECOMMENDATIONS

The Study Team has pointed out problems and issues for road maintenance in each Chapter. These problems are not only caused by absolutely lack of funds but by inefficiently implementation and operation relating to institutional, traditional and technical backwardness for road administration.

In this regards, the Study Team will recommend the following items for elimination of problems;

1) Preparation of guideline for road maintenance management,

2) Implementation with Project Cycle Management,

3) Capacity development for local contractors,

4) Achievement of provincial capacity development and decentralization,

5) Transparency on the process of prioritizing the project planning,

6) Capacity development for road authorities,

7) Smooth cash flow originated in disconcerted communication among relating ministries, and

8) Strengthening of financial auditing to realize sound budget/expenditure management

9) Strengthening of technical auditing to observe quality standard on the output of maintenance

It is important to establish of NRMC for appropriate maintenance and identification of all standards, design methods and quality control.

PART C

CAPACITY DEVELOPMENT

CHAPTER C CAPACITY DEVELOPMENT

1. Capacity Development through the Master Plan Study

The JICA Study Team gave priority to knowledge and technology transfer throughout the one-year implementation of the Study (See Figure below). The technology transfer was aimed at capacity development of the counterpart members of the related Ministries, primarily in the Ministry of Public Works and Transportation, in researching, planning, designing, and presenting skills as governmental officers. The related agencies of road network administration, which are MEF, MOE and MRD, have been targeted as well.

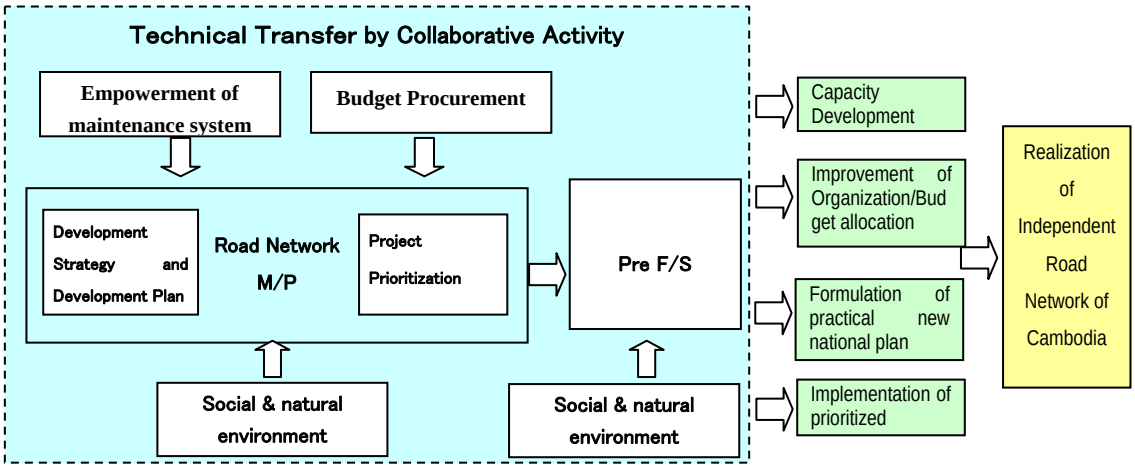


Figure 1.1 Capacity Developments Throughout the Master Plan Study

The Study Team requested one counterpart for one Japanese expert in principle, and collaborated with not only MPWT but also MRD, MEF and MOE to exchange the skills and knowledge. The major events implemented during the Study (18 months) are shown in the next table.

Table 1.1 Major Events of Capacity Development Program

Capacity Development Program	targets/ participants	period/ times	Remarks
On-the-job Training	CP 11 person	18 months	Data correction and site visit
Periodical Workshop	20-60	5 times	Periodically carried out
Workshop with NGO	30	2 times	Explanation of Master Plan
Seminar	60-70 participants /time	3times	After critical Steering Committees Meeting (2005.8, 2006.3, 2006.7)
Group Training Coarse in Japan	CP 2 person	1-2 months	-Urban Environment and Transportation -Regulation and Type Approval System for Safety and Environmental Protection of Motor Vehicle

The figure below illustrates the Structure of Capacity Development to enhance the administrative capability of governments.

The target level of capacity development is separated into two (2) stages. One is consultancy

services to the top management in consensus building and decision making. The second stage is the technical transfer and training of the potential officers in developing the appropriate plans and persuading stakeholders through presentations and reports. The Study Team established four (4) Taskforce Teams in accordance with the subjects.

The members of the Steering Committee are nominated from the related agencies of the road network policy: MPWT, MEF, ME, MWR and MRD. The main function of the Steering Committee had been supervising the Master Plan Study. At the same time, the Study Team expected and encouraged them to exchange the opinions of each Ministry and reach a harmonized network of policy making through the Master Plan Study.

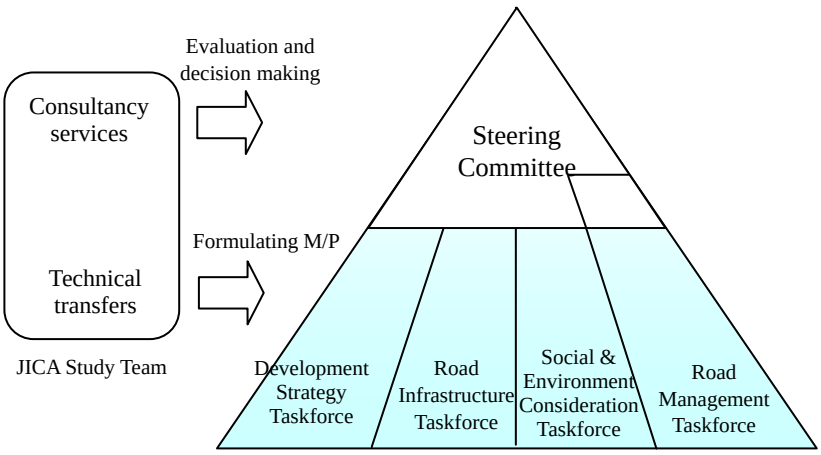


Figure 1.2 Enhancement of the Administrative Capabilities of Governments

The Steering Committee members nominated potential staff to support the Study Team as counterparts. The Committee expected all to learn the methodology of the formulation of M/P and to provide necessary information as required. Through this method, the counterparts learned the following skills: 1) Use of positive attitude to improve situations, 2) Managerial and leadership skills, 3) Presentation skills, 4) Documentation/Reporting skills and 5) PC skills.

2 Findings from the Viewpoint of Capacity Development

In studying Capacity Development concerning the road network administration, the following problems were observed.

(1) Inconsistent training
(2) Lack of follow-up and support from top management
(3) Concentration of information
(4) Lack of "OJT" system
(5) Lectures and workshops but fewer site visits
(6) Unclear promotion system

3 Recommendations

In order to realize the appropriate road network administration suggested by the Master Plan Study, the Ministry needs a consistent vision for Capacity Development. At the same time, a strategic system and mechanism should be designed in order to disseminate the capacity development efficiently. The key points of the strategic program guided by the analysis of the above-mentioned

problems are listed below.

- **Top management** should utilize the Strategic Capacity Development for the purpose of enhancing the organization responsible for the road network administration
- A consistency training program should be organized **according to the levels**
- **A mechanism** for the rapid dissemination of results should be designed
- **On-the-Job Training** from seniors to juniors should be a function of the Ministry
- **Site visits** should be utilized together with lectures for deeper understanding
- A motivation system including **promotion and payment** should be reviewed

By formulating a strategic capacity development program, the individual seminars and workshops will become more effective.

Table 3.1 Strategic Capacity Development

Target	Issues to be learned
Carrier of central government	Road Administration, Budgeting, Procurement of financial resource, Project Planning, Project Evaluation
Staff working for regional office	Implementation of road project (tender, contract, supervision etc.), project budget control
Local staff	Quality control, schedule and process control

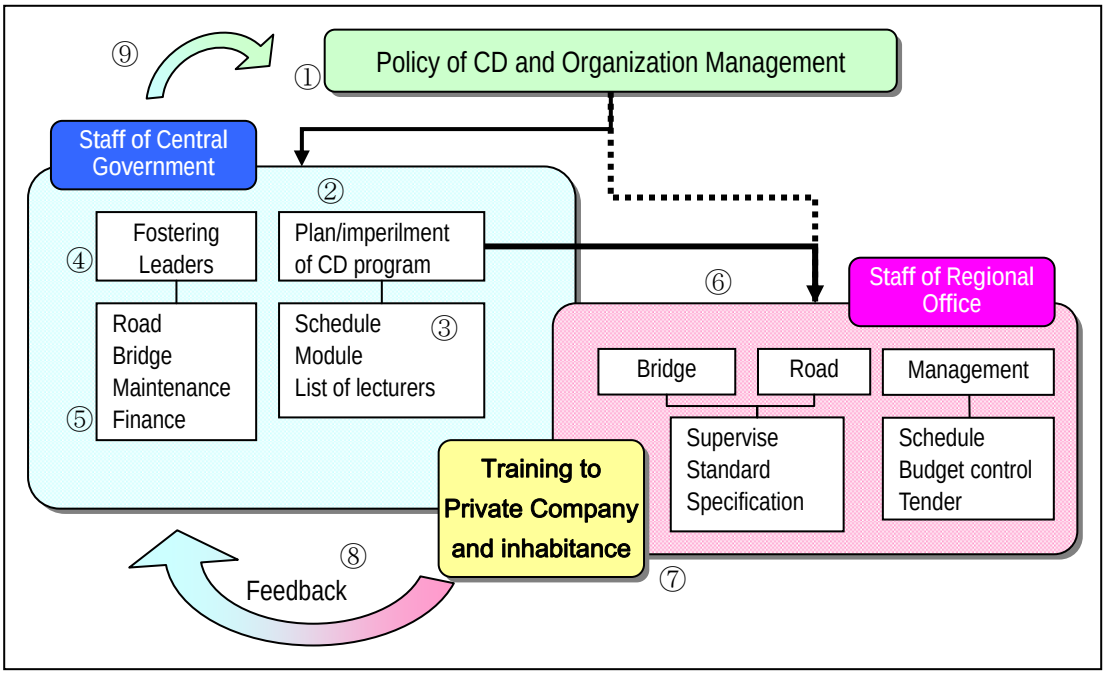


Figure 3.1 Dissemination Model of Capacity Development