Appendix H
Transportation Infrastructure

THE STUDY ON REGIONAL DEVELOPMENT OF THE PHNOM PENH-SIHANOUKVILLE GROWTH CORRIDOR IN THE KINGDOM OF CAMBODIA

AppendixH Transportation Infrastructure

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APPENDIX H TRANSPORTATION INFRASTRUCTURE

This Sector Report reviews the current situation of the transportation infrastructure in the Growth Corridor Region with reference to the surrounding international and domestic contexts. This report primarily intends to provide a solid base to support the Regional Master Plan of the Growth Corridor.

H.1 TRANSPORTATION SYSTEM IN CAMBODIA

H.1.1. Institutional Framework for Transportation

(1) Laws and Regulations

Legal framework on transportation in Cambodia has been developing since the 1990s. The following laws and sub-decrees provide the legal base of transportation in Cambodia.

1) Laws:

- Civil Aviation Law (1994)
- Law on the Establishment of the Ministry of Public Works and Transport (January 1996)
- Law on the Establishment of the State Secretariat of Civil Aviation (January 1996)

2) Anukret (Sub-Decree) and Ministerial Order:

- Anukret on Build-Operate-Transfer (BOT) Contract (February 1998)
- Anukret on the Organization and Functioning of the Ministry of Public Works and Transport (March 1998)
- Anukret on Maximum Weight of Transport Vehicles Circulating on National Roads of the Kingdom of Cambodia (September 1999)
- Sarachor on Sea Shipping Management (October 1999)
- Anukret on the Development of Sihanoukville Autonomous Port (April 2000)
- Prakas (Ministerial Order) on the Regulation of Architectural and Construction Companies and Enterprises (September 2000)
- Sarachor on Means of Water Transport Management (June 2000)

After the establishment of MPWT, important legal settings have been prepared in the forms of Sub-Decrees and Ministerial Orders.

The laws only prepare the outlines. For instance, there are only a few chapters in the Law of the Establishment of MPWT. Accordingly, the actual arrangements have been declared in Ankret and Prakas. Then, the administration can decide the important regulation and arrangement without the discussion in the Parliament.

(2) Administrative Organizations

1) Ministry of Public Works and Transport (MPWT)

The Ministry of Public Works and Transport (MPWT) has an organizational structure shown in Appendix 1. The organizational chart is prepared from the Sub-Decree of Organization and Function of MPWT (March 1998) and adjusted to the current situation from various sources. The organization expresses a clear separation between public works and regulatory bodies at General Directorate level. Under the General Directorates, the departments are basically divided by transportation mode.

Although the Sub-Decree sets only one post of Secretary of State, there are two Secretaries currently.

In addition, the relationship between the central and local governments is vague. The MPWT has no local bureaus but Department of Public Works and Transport (DPWT) under each local government such as province and city are sometimes working as a bureau of the Ministry. The mission of DPWT is different from that of MPWT, but DPWT is funded by national government.

2) State Secretariat of Civil Aviation (SSCA)

The State Secretariat of Civil Aviation (SSCA) was established in 1996 under the Office of Council of Ministers. The SSCA has one Secretary of State and three Undersecretaries of State although SSCA Law defined only one post of undersecretary as a Director General.

The SSCA administers and regulates civil aviation sector in the Kingdom. It is not clear why the aviation subsector has independent organizational setup from MPWT.

The SSCA is a pioneer of privatization and deregulation. It has 13 bilateral Air Service Agreements and Memorandums of Understandings and six International Civil Aviation Organization (ICAO) conventions. Thus, the authority basically has an "Open Sky Policy" with some exceptions and many air carriers are operating international route to Phnom Penh and Siem Reab. Establishment of a new international route to Cambodia is relatively easy.

"Open Sky Policy" is widely accepted by Cambodian and foreigners.

Because Cambodia accepts foreign tourists more than Cambodian international tourists, it is reasonable to open its air to foreign carriers from tourists' origin.

However, it should be noted that "Open Sky" includes certain risk to Cambodian economy under special circumstance. For example, the diplomatic cool-down with Thailand in February 2003 stopped Thai Airways International Flight and Cambodia lost many tourists even they wanted to visit. In addition, because most routes are operated by single carriers, it is likely to be monopolistic.

At the same time, the Secretariat conceded dynamic PFI schemes on the Pochentong and Siem Reab Airports to an international joint venture. Additionally, air traffic control has been also conceded to a company.

3) Ministry of Rural Development

Ministry of Rural Development has jurisdiction to oversee the rural road development (See late chapter for rural roads.). However, the actual rural road development is not so active because of budget constraint. Only one exception is a foreign-funded project for rural roads.

4) Armed Forces

The Engineering Command under the Armed Forces is another important road constructing public body. The Engineering Command constructs new roads by the direct orders from the Prime Minister. The Command has its own construction machineries and engineering staff.

Their construction work is not based on the master plan by MPWT, civilian side, and they have their own budget.

(3) Relevant Plans and Framework

Table H-1 Relevant Plans and Framework for Transportation Sector

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Law/ Policy			MPWT Law	MPWT Anukret	BOT Anukuret							
			SSCA Law									
Development Plans			SEDP I					SEDP II				
								Five-Year Master Plan for Maintenance and Rehabilitation of Road Network				
					Ten Year Civil Aviation Development Framework							
Study / Planning	TRS Transportation Rehabilitation Study							PP M/P	Phnom Penh Urban Transport Master Plan			
									TSS Transport Sector Strategy			
									Growth Corridor Regional M/P			

Source: JICA Study Team.

Table H-1 shows the relevant plans and framework for the transportation sector in Cambodia. The laws/ policy and development plans have binding

powers because they are authorized at policy level. The studies and planning at the bottom have no budgetary set-up.

Among them, this section reviews some important plans, especially long-term development plans related to transportation sector.

1) Socio-Economic Development Plan (SEDP) (1996-2000)

The target period is already over. As the first economic development five-year plan, SEDP left many important transportation elements in the Study Area. Firstly, it specified Phnom Penh and Sihanoukville as "Growth Centers" and stated that "Export Processing Zones" and "dry ports" to be development in Phnom Penh, while port facilities to be development in Sihanoukville.

Road construction received fewer funds than the original plan. However, the road sector completed the following sections:

- Reconstruction of Route 4,
- Reconstruction of Route 6 between Phnom Penh and the junction with Route 7 at Skun, and
- Reconstruction of Route 7 between Skun and Kampong Cham.

In total, 350km of national road were reconstructed to the international standards between 1992 and 2000.

In addition, a number of bridges along Route 6 and several ferry crossings have been improved.

2) Second Socio-Economic Development Plan (SEDP2) (2001-2005)

The Plan was finally approved in July 2002.

a) Road

The road sector of this SEDP II is basically consistent with "Five-year Plan for Maintenance and Rehabilitation of Road Network 2001-2005" prepared by MPWT.

The Plan firstly prioritizes the rehabilitation of 2,800 km of National Road system that connects Phnom Penh to provinces. Then, the second priority is given to an additional 1,900 km of National Road system that more directly links adjacent provinces and connects small communities with towns and cities.

Table H-2 Road Rehabilitation Program 2001-2005

Year	Length (km)	Estimated Cost (mil. $)
2001	992.7	49.635
2002	963.0	48.185
2003	947.6	47.380
2004	896.6	44.800
2005	933.0	46.650
Total	4732.9	236.650

Source: SEDP-II. p.214.

Among the total of US$ 237 million, the RGC will heavily depend on foreign donors.

Additionally, the plan estimates US$ 13 million maintenance cost for the period. However, the cost only includes routine maintenance cost but not periodical maintenance cost. The fund source for it has not been secured.

b) Ports and Inland Waterway

Sihanoukville Port rehabilitation with the JBIC loan is a main project in ports and inland waterway during SEDPII. There is no upgrading project for Phnom Penh Port. Four high priority projects have not been financed.

c) Civil Aviation

As the transformation of SSCA from a direct service provider to a regulatory organization, the public involvement to airport construction is decreasing sharply. The SEDPII prepares a concession project at Siem Reab Airport.

The development and upgrading of existing airports are depending on the BOT-based schemes.

d) Railways

Despite the current poor conditions of railways, there is not clear upgrading project listed on the SEDPII. The Royal Railways of Cambodia had a Strategic Plan but none of the priority programs has not been financed.

3) Public Investment Program (PIP)

Public Investment Program, subject to SEDPII, is another important framework for public administration. The PIP is basically a three-year rolling plan to

define the mid-term expenditure. **Table H-3** shows the budget allocation for the transportation sector.

Table H-3 Budget Allocation by PIP 2001-2003

Sector		Sector		Subsector	
	Subsector	US$'000	%	US$'1000	%
Transport		215,443	15.4%		
	Aviation			26,887	12.5%
	Ports and Waterway			7,788	3.6%
	Rail			8,300	3.9%
	Roads			172,468	80.1%
Others (13 sectors)		1,184,557	84.6%		
Total		1,400,000	100.0%		

Source: Public Investment Program 2001-20003.
Note: Programmed level only.

The transportation sector has 15.4% of total expenditure. Among the sector, road sector, 80%, is dominant.

4) Transport Sector Strategy (TSS)

The Transport Sector Strategy (TSS) was prepared by the consultants with the finance of ADB in 2002. TSS proposed to introduce more private participation in various areas. However, some projects, including railways, are still far to attract private sectors.

(4) Privatization of Transportation Infrastructure

After the introduction of BOT Law in late 1990s, the private participation in transportation infrastructure development became an indispensable part.

Table H-4 Private-involved Transportation Projects

	Divesture of Existing Assets	Concession of Existing Assets	Public-Private Joint Ventures for Existing or New Assets	Greenfield BOO/BOTs Projects	Liberal Entry
Roads		Operation and Maintenance of Highway 4	Vehicle inspection	Two toll roads in Phnom Penh	
Rail					
Civil Avation		Pochentong and Siem Reap Airport Terminals Air traffic control services			Airlines
Ports	Fuel terminal at Sihanoukville		Dry Port at Phnom Penh		Two Dry Ports

Source: Modified from World Bank. Private Solutions for Infrastructure in Cambodia.2002.

BOT based concession is a very common method for private participation.

Because most projects are not open to public tender, there are many invisible aspects about the scheme. Specifically, the MPWT, Ministry of Economy and Finance, and a concessionaire can decide a scheme to utilize existing public goods. In addition, there is no discussion on the demarcation between public and private.

H.1.2 Current Physical Situation of Transportation Infrastructure in Cambodia and Growth Corridor

(1) Strategic Location of Growth Corridor

The Growth Corridor Region is located in the southern part of Cambodia. The transportation system is basically connecting Phnom Penh and Sihanoukville.

A major international corridor is now emerging nearby the region (See Figure H-1 and also 1.1 of this report). It is Ho Chi Minh - Phnom Penh - Bangkok Corridor. The corridor is also called as "Southern Economic Corridor" by Greater Mekong Subregion (GMS) Program of Asian Development Bank or "Asian Highway A-1" by Asian Highway Project. The section of the corridor within Cambodia corresponds National Road No. 5 and No. 1. It reaches to 574 km.

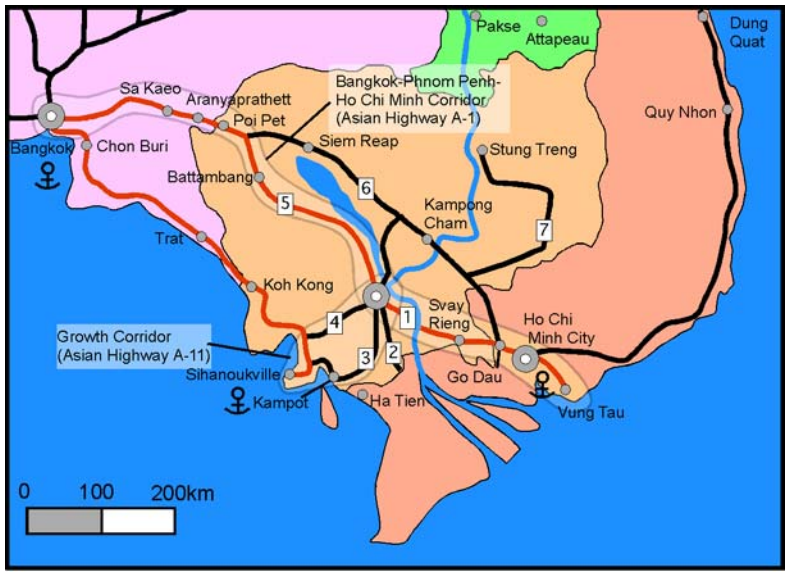


Figure H-1 Southern Economic Corridor and Growth Corridor

The Ministry of Public Works and Transport (MPWT) defines the National Road 4 and 7,761km, as a part of the international route from Sihanoukville to Lao PDR. The route is also designated as A-11 by Asian Highway Project. However, the section between Stung Treng and Pakse in Lao PDR is very difficult to connect by roads.

Then, the Sihanoukville Port will be used for international trade exclusively for Cambodia. In other words, there is and will be no cargoes *in transit* to other countries from Sihanoukville Port. This means that the Growth Corridor is significant only in the context of national development of Cambodia.

The current function of Growth Corridor is considered to face the existing industrial core of Phnom Penh to the outer world. The function can be diversified as the growth of the Corridor. The purpose of transportation infrastructure planning in this Study is to utilize the strategic setting of the Growth Corridor with other sectors development and to propose feasible and viable transportation system for the Corridor.

(2) Inventory of Transportation Infrastructure in Growth Corridor

Figure H-2 and **Table H-5** express the inventory of the transportation infrastructure in the Region. The detail of each infrastructure element is discussed in the later sections.

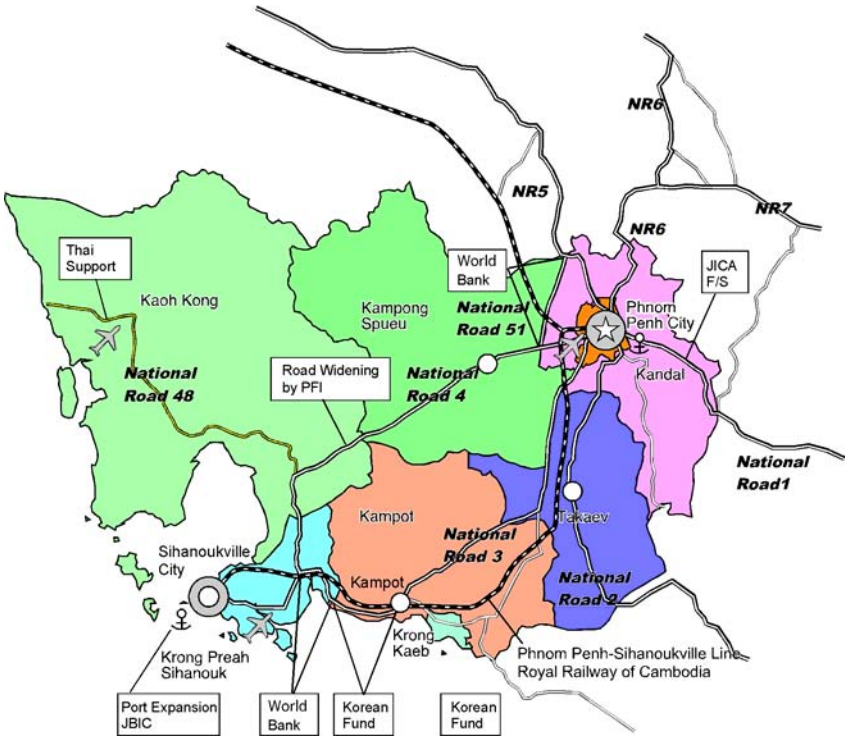


Figure H-2 Transportation Infrastructure in the Region

Table H.5 Outline of Transportation Infrastructure in the Region

Road

Name	Location	Length	Current Condition	Future Plan	To be Completed in	Note
Route 3	Phnom Penh-Kampot-Veal Rinh	202km	Fair except western section	Western sections financed by WB and Korea	2003	
Route 4	Chaom Chau-Kampong Spueu-Sihanoukville	214km	Good	Widening under construction by PFI.	2003	
Route 48	PK142-Kaoh Kong	138km	Mostly completed except bridges	Bridge construction.	2003?	

Railway

Name	Location	Length	Current Condition	Future Plan	To be Completed in	Note
Phnom Penh - Sihanoukville Line	Phnom Penh - Sihanoukville	246km. Single track.	Limited speed due to maintenance problem.	Reassessment of Railway Master Plan.		

Port

Name	Location	Facilities	Current Condition	Future Plan	To be Completed in	Note
Phnom Penh Port	On the Tonlesap River near Friendship Bridge.	300m general berth, oil jetty.	Not efficient for containers.	Container liner will be started.		0.1 mil. t in 2001except fuel.
Sihanoukville Port	2km north from city.	Container berth, general berth, oil jetty.	Good.	Expansion by JBIC loan.	2004	1.4mil.t in 2001 except fuel.

Airport

Name	Location	Runway Length	Current Condition	Future Plan	To be Completed in	Note
Pochentong Airport	7km west from Phnom Penh city center	3,000m	Good. Too short for a 747.	Terminal construction by PFI is ongoing.	2003	856,000 passengers in 2000.
Sihanoukville Airport	15km east on Rt.4 from Sihanoukville city center	1,200m	No scheduled flight.	Runway extension by PFI.	Postponed.	
Koh Kong Airport			No scheduled flight.			2,400 passengers in 2000.

(3) Road

Two urban centers are connected by the Route 3 and 4. The role of road transportation is very important in the region. All national roads are under MPWT and financed by general budget for both development and maintenance. The MPWT has Five Year Master Plan for National Road Rehabilitation and Reconstruction, which has been, also financed many international donors.

1) National Roads

Table H-6 indicates all major national roads (single-digit) in Cambodia and other national roads (double-digit) in the Study Area.

Table H-6 National Roads

Major National Roads

No.	Length (km)	Origin - Terminal	Traffic Volume Estimate (AADT in 2001)
1	167	Phnom Penh - Svay Rieng - Bavet (Vietnamese Border)	2,288
2	121	Ta Khmau - Takaev - Phnum Den (Vietnamese Border)	4,106
3	202	Phnom Penh - Kampot - Veal Rinh	3,822
4	214	Chaomchau - Kampong Spueu - Krong Prea Sihanoukville	6,762
5	407	Phnom Penh - Bat Dambang - Serei Saophoan -Paoypet (Thai Border)	1,876
6	416	Phnom Penh - Kampong Thum - Siem Reab - Serei Saophoan	680
7	461	Skun - Kampong Cham -Kracheh -Stueng Traeng - Voeun Kham (Lao Border)	1,418
Total	1,988		

Other National Roads in the Study Area

No.	Length (km)	Origin - Terminal
21	75	Ta Khmau - Chrey Thum
22	10	Takaev - Angk Tasaom
31	55	Kus - Kg. Trach
32	34	Rolouskia -Bouk Kou
33	52	Kampot - Luxsonn
33a	18	PK 163+090 -Dn.chang oeur
41	10	Kangkeng - Ream
42	22	PK14+000 - Batdoeng
44	84	Kampong Spueu - Roleak Kangcheung
46	28	PK87+877 - Kr. Kirirom
48	138	PK142+350 - Kaoh Kong
51	45	Odongk -Kg. Tram
Total	571	

Source: MPWT.

Traffic Volume Estimate: "*Cambodia Transport Sector Strategy Draft Final Report* " June 2002.

a) Route 3

National Road. 202km. The route connects Phnom Penh and Sihanoukville via southern cities. The section between western end and Kampot is under construction by the World Bank fund and Korean fund. The section between Kampot and Takaev has been in fair condition. Between Takaev and Phnom Penh, not only Route 3, but also Route 2 is connecting the two cities. The area along the route is mostly flat used

for paddy fields. The drainage system for the road is also incomplete and some section of the road is also used as small dams that reduced the lifetime of roads. There are many provincial roads connecting to Route 3.

b) Route 4

National Road. 214 km. The route is working as a major transportation route between Phnom Penh and Sihanoukville. The road is under construction work to widen current two lanes by 1.50m on each side by a PFI scheme under MPWT. The route will be a toll road for maintenance fee collection. US$2 will be charged for a passenger car and US$16 will be charged on a container truck.

Appendix 2 describes more details on Route 4 and forecasts the future traffic volume on Route 4.

c) Route 48

National Road. The road connects Route 4 and Kaoh Kong. The road has been rehabilitated by Thai support. There are four missing bridges on the route. The road will be another important route on the coastal route directly leading the Eastern Seaboard of Thailand (Figure H-3 and **Table H-7**)

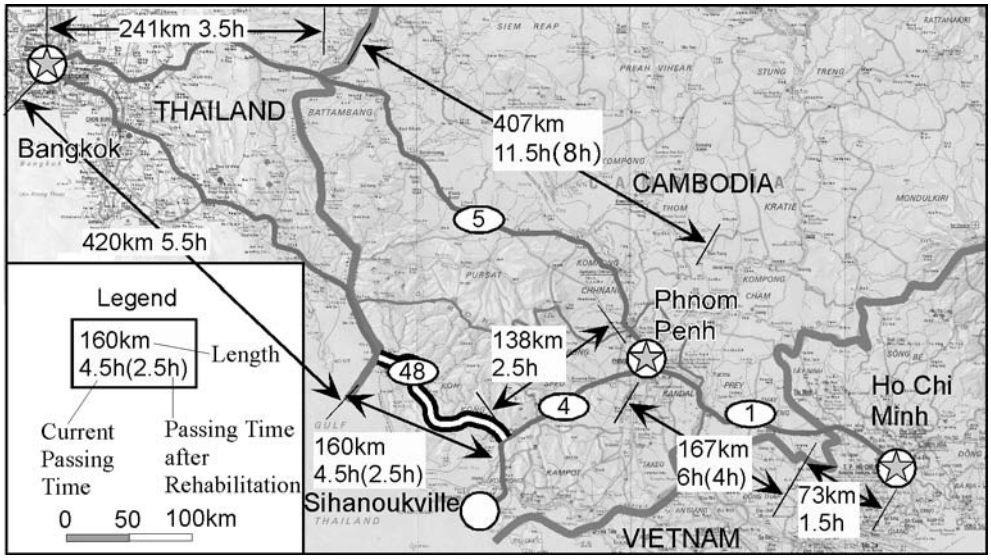


Figure H-3 Southern Corridor and Route 48

Table H-7 Passing Time by Route between Bangkok and Phnom Penh

via	Length (km)	Travel Time (hour)	
		Current	After Rehabilitation
Battambang	648	15.0	11.5
Kaoh Kong	718	12.5	10.5

Source: JICA Study Team.
Note: Route 48 "rehabilitation" includes both asphalt pavement and four bridges.

The whole route has been rehabilitated to laterite pavement by Thai Army by grant base. It has been mostly completed and is to be finished in 2003. Although it became passable, it is still difficult for ordinary passenger car to pass in rainy seasons.

On the request form the Government of Cambodia, Thai Prime Minister pledged additional support for four bridges and asphalt pavement in November 2002. However, it has been frozen since January 2003.

2) Other Roads

In addition to national roads, the provincial roads (triple-digits) in the Study Area are shown in **Table H-8**.

Table H-8 Provincial Roads in the Region

Province	Numbers	Length (km)
Kandal	104,105	16
Takaev	106-114,169,170,204	132
Kampot	113,115-124	151
Kaoh Kong	146,161	90
Kampong Spueu	124	43

a) Provincial and Municipal Roads

Although these roads are under the management of each provincial or municipal government, their actual budgets are provided by the MPWT. The provincial roads are numbered from 100 by MPWT. More than 80% of provincial roads are unpaved.

b) Rural Roads

Smaller roads than provincial roads are classified to rural roads. Rural roads are under the jurisdiction of the Ministry of Rural Development (MRD). No inventory and map on the rural roads are prepared by MRD. Currently, several maintenance projects are in operation in the Region. Especially, the World Food Program (WFP) has been active in Food-for-work typed projects.

(4) Railways

Another important land transportation mode in the corridor is railway. Railways in Cambodia are operated by Royal Railways of Cambodia. The 260 km section between Phnom Penh and Sihanoukville is single truck built between 1965-1969. Originally, the railway transported import and export cargoes from and to the Sihanoukville Port. Currently, internationally traded cargoes are limited to petroleum. The sidetrack to the Port is not in use at present.

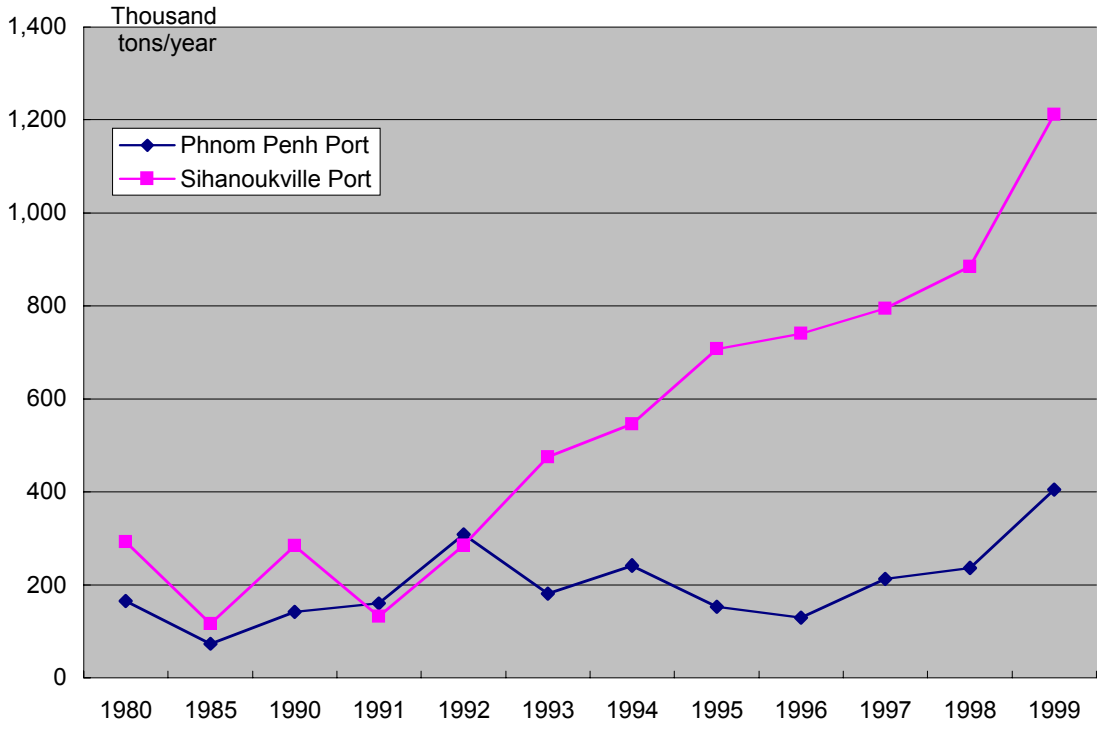
Only 3 to 4 trains (total of both directions) are operating per day on the Southern Line at present. Each train consists of 17 (approx.) number of freight wagons, including open, covered and tank wagons for petroleum. Marine container transport service is not provided now. However, containers loaded on container wagons are used instead of covered wagons. Passenger service is very poor. Most of the passengers are unwillingly traveling by freight wagons due to the shortage of passenger wagons.

The maximum operation speed is 35 km/h approx. The average speed is 25 km/h, depending on the track, bridge and roadbed conditions. Speed limitations (5 to 10 km/h) are given at the destructed bridges having temporarily repaired. It takes 10 hours approx. to connect Phnom Penh and Sihanoukville at present.

The main role of RRC is to transport heavy cargos, such as containers, petroleum, cement, etc. securely and constantly, even though operating speed is low. Due to the long lasted civil war, facilities and rolling stock of RRC are severely damaged. In these circumstances, in order to achieve the abovementioned basic role, urgent track restoration, as the first step, shall be executed. If heavy cargos can be transported by the restored railway system, it can be expected to reduce maintenance expenses of roads which are damaged by overloaded and heavy trucks.

(5) Ports

The region has two major ports. They are Phnom Penh Port and Sihanoukville Port. The role of each port is quite different. The Sihanoukville Port works as an international gateway and Phnom Penh Port works as the hub of inland waterway. As shown in Figure H-4, the cargo volume at Sihanoukville Port is continuously growing. This means that the growing handling volume of Sihanoukville Port has not affected the volume at the Phnom Penh Port due to the different function of two ports.



Source: Cambodia Statistical Yearbook 2000.

Figure H-4 Total Throughput of Two Ports

1) Sihanoukville Port

The Sihanoukville Port is only one deep seaport in Cambodia. Port Authority of Sihanoukville (PAS) under Ministry of Public Works and Transport is responsible for the port operation.

The cargo volume is constantly growing as shown in Figure H-5. Especially, the growth owes to the containerized cargoes. More than 85% of containerized cargoes are carried from and to Phnom Penh City. All container trucks select Route 4.

Sihanoukville Port has the following facilities:

- Container berth (3 vessels, 350 m long, and 7.50 m depth)
- General cargo berth (580 m long and 8.50 m depth)
- Oil berth (53 m long and 4.20 m depth)
- Storage facilities (Warehouses, open area and container yard)

With a JBIC (Japan Bank for International Cooperation) loan, the port is constructing additional 240m terminal (9.50 m depth) to be finished by 2004. Additionally, two gantry cranes and two transfer cranes will be introduced.

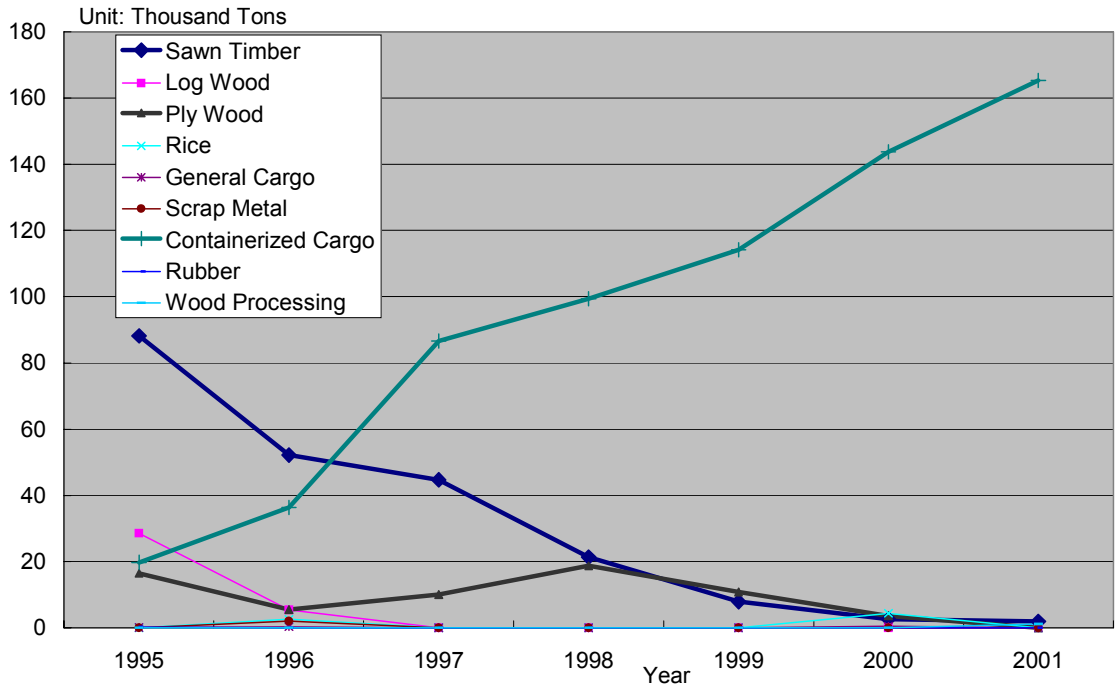


Figure H-5 Exporting Items from Sihanoukville Port

2) Phnom Penh Port

Phnom Penh Port has been working as a hub of river transportation. Phnom Penh Autonomous Port Authority is responsible for the port operation. Maximum draft alongside is 5.2 meters and 4.2 meters in rainy and dry season respectively. So far the port has not handled containers due to the limited draft and its geographical location.

With the past JICA support, the port has a new wharf of 300m long and 30 meters wide.

In addition to the fixed wharf, a floating wharf, which was funded by the World Bank, is located in the downstream of the Tonlesap River to serve local trade.

Around the port area, there are a few passenger terminals for speedboats to Siem Reap and oil jetty along the river.

In mid-2002, a foreign shipping company launched a scheduled container liner service between Phnom Penh and Ho Chi Minh Port. This means that the factories in Phnom Penh have alternate route to export their products in containers. The transportation cost will be more competitive between the two routes. The progress of AFTA and implementation of protocols under "the Agreement for Facilitating the Cross-Border Movement of Goods and

People.[1]" will smoothen the land transportation of containers to Ho Chi Minh.

On the other hand, the capacity of the handling containers is limited to approximately 15,000 TEU at best in a year. Moreover, the Phnom Penh Port does not have sufficient lifting facilities for container service. It is unlikely to increase the cargo volume rapidly at Phnom Penh Port with the current port status.

(6) Civil Aviation

The airline market is very competitive in Cambodia. "The Open Sky Policy" liberated the international flight route to the foreign airlines of the countries with bilateral Air Services Agreements and Memorandums of Understandings. Currently, 10 foreign airlines operate flights to Cambodia.

The RGC, in equity partnership with Malaysian Helicopter Service, established Royal Air Cambodge as a national flag air career in December 1995. However, the airline bankrupted in 2002. Thus, there is no Cambodian airline with international flight routes.

Table H-9 Airlines Operational in Cambodia

Name	Code	Country	Int'l	Domestic
Bangkok Airways	PG	Thailand	X	
China Southern	CZ	China	X	
Dragon Air	KA	Hong Kong	X	
Eva Air	BR	Taiwan	X	
Lao Aviation	QV	Lao PDR	X	
Malaysia Airlines	MH	Malaysia	X	
Mandarin Airlines	AE	Taiwan	X	
Shanghai Airlines	FM	China	X	
Silk Air	MI	Singapore	X	
Thai Airways International	TG	Thailand	X	
Vietnam Airlines	VN	Vietnam	X	
Kampuchea Airlines		Cambodia		
Mekong Airlines				
President Airlines	TO			X
Royal Khmer Airlines				
Royal Phnom Penh Airways	RL		X	X
Siem Reap Airways Int'l	FT			X
Siem Reap Angkor Airways				

Source: SSCA.

There are several domestic airline companies. Among them, five were established in the year of 2000. Each airline company has only a few small aircrafts each and mostly operates the flight routes between Phnom Penh and Siem Reab. Thus, the domestic airline market is open to new entries.

[1] Also called as "Cross Border Agreement." Originally signed among Thailand., Lao PDR and Viet Nam in November 1999. Cambodia joined the Agreement in November 2001.

1) Civil Air Navigation

Civil air navigation system in Cambodia has two route systems. One is international Air Traffic Service (ATS), which controls the area above altitude 19,500 ft. Below 19,500 ft is domestic ATS with seven control zones (Pochentong, Battambang, Stung Treng, Kampong Cham, Siem Reab, Kong Keng and Kao Kong). There are several restricted air spaces for non-civil usage.

In December 2000, the Government and SAMART Corporation agreed to develop and operate the civil air traffic control and air navigation system on a Build, Cooperate and Transfer basis.

2) Flight Routes

Figure H-6 Direct International Flight Routes

Source: SSCA.

As shown in Figure H-6, the international flight routes with Cambodia are very limited. The Bangkok, Ho Chih Minh, and Singapore are the three major gateways. Mostly the routes are limited to the Southeastern Asian countries.

It also includes a potential risk of civil aviation market because of the shortness of flight routes. For example, the distance between Phnom Penh and Ho Chi Minh is 210km. Once the roads are rehabilitated, the land transport will be a serious competitor against civil aviation. The second shortest route is the route between Bangkok and Siem Reab. The route is very important for foreign tourists. Because the distance between the two cities is 375km, it seems difficult to replace the route only by the land transport. Then, the tourists will select air or land mode based on their preferences.

The Study Area has already experienced such a competition between air and

land. The rehabilitation of the Route 4, completed in 1995, decreased the air passenger demand between Phnom Penh and Sihanoukville. Then, the scheduled flight is not available between the two cities now.

3) Airports

In Cambodia, two international airports, Pochentong and Siem Reab Airports, work as major international gateways from Asian countries. The 72% of the total domestic passengers were foreigners in 2000. Growth Corridor has three airports, namely, Pochentong, Sihanoukville and Kaoh Kong Airports (**Table H-10**).

Table H-10 Passenger Arrivals and Departures in 2000

	International	Domestic	Total
Pochentong	647,006	209,296	856,302
Siem Reap	176,499	161,002	337,501
Kaoh Kong		2,415	2,415

Source: State Secretariat of Civil Aviation

4) Pochentong Airport

Pochentong Airport is located 7km west from the Phnom Penh center. It is the largest airport in Cambodia. It accepted 13 airline companies and 856,000 passengers in 2000 (**Table H-10**). The airport conceded all airport operation and a new terminal construction to a French-Malaysian joint venture.

The runway, 3,000m, is too short for a full loaded Boeing 747 to arrive. However, a 747 with its fuel tank half-filled can take off and land to the airport. Consequently, it is enough for the existing market.

There is a plan to extend the current runway to the southwest by 500m but there is a problem in land acquisition. In addition, the demand of 747 flights has not been confirmed by the market research. There is also an idea of new international airport far west from current airport location.

5) Sihanoukville Airport

Sihanoukville Airport, which has 1,200m runway, has no scheduled flight currently. It is located 10km far from the Sihanoukville urban area. The airport is also called as Kang Keng Airport. Ironically, the road rehabilitation of Route 4 decreased the demand of air passengers between Phnom Penh and Sihanoukville. The airport is now extending the runway by a PFI scheme by 100m.

(7) Containerization

Cambodia imports various commodities in containers, but its export is not

active in container numbers. Consequently, the number of import containers exceeds the number of export containers. In 2001, more than half of exporting containers from Sihanoukville Port was empty (Figure H-7).

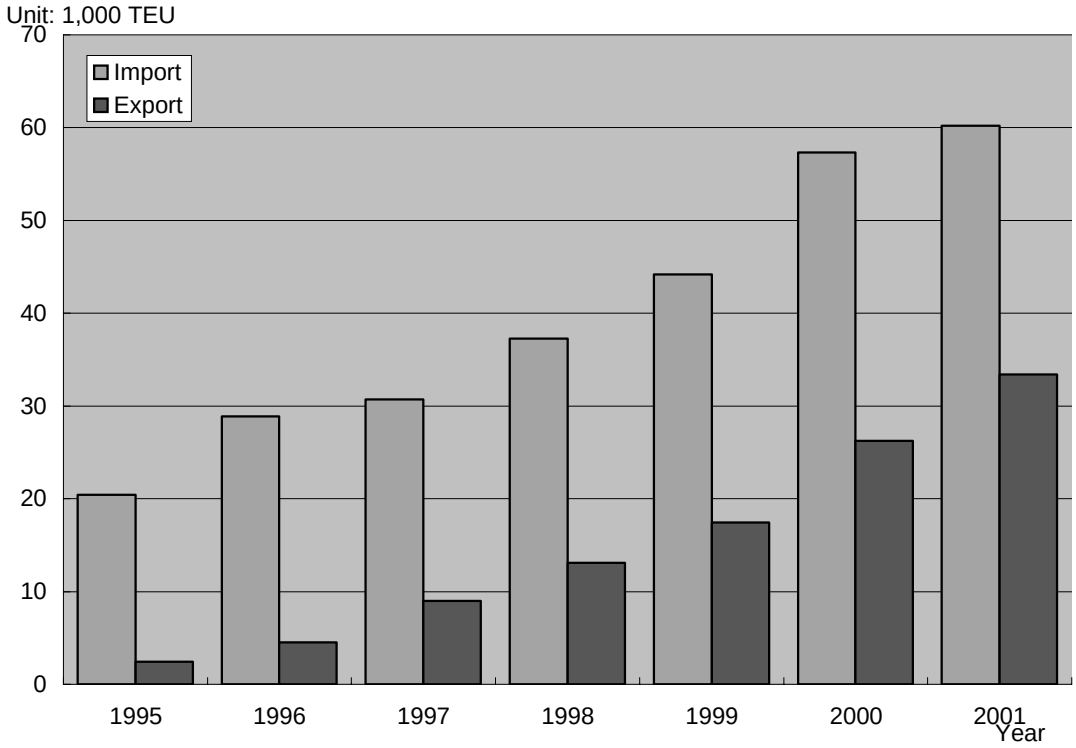


Figure H-7 Container Volume at Sihanoukville Port (Loaded Containers only)
Source: PAS.

Considering current and future main export items, such as garments, the importance of ocean containers is still growing.

Table H-10 Container Tariff to Yokohama from Various Ports

From	To	Tariff (US$)
Phnom Penh	Yokohama	1,800
Sihanoukville	Yokohama	1,600
Bangkok	Yokohama	1,350
Ho Chi Minh	Yokohama	1,500

Source: JETRO, JICA Study Team

Table H-10 shows the international container tariff around the Growth Corridor. The tariff is not simply proportional to the distance. Container ships from Cambodia do not go directly to Yokohama or other ports in US or EU. The containers are transferred at larger container hubs such as Hong Kong or Singapore. The ocean liner routes are decided on market basis and not controllable by a government. However, the land transportation cost of containers from Phnom Penh can be reduced through competition.

Most imported containers from Sihanoukville Port are carried to Phnom Penh on the road. Everyday, almost 200 TEU containers are transported between Sihanoukville and Phnom Penh. All container trucks select Route 4. There are several Inland Container Depots (ICDs), both public and private, around Phnom Penh. The following measures are possible for smoother container operations:

- Better services for container trucks along Route 4 (Road, service area, rest spaces, etc.)
- More sophisticated ICD operation on Phnom Penh side.
- Rail transportation of container (as future plan)

Currently, three Inland Container Depots (ICDs) are operational in Phnom Penh as in **Table H-11**.

Table H-11 Inland Container Depots in Phnom Penh

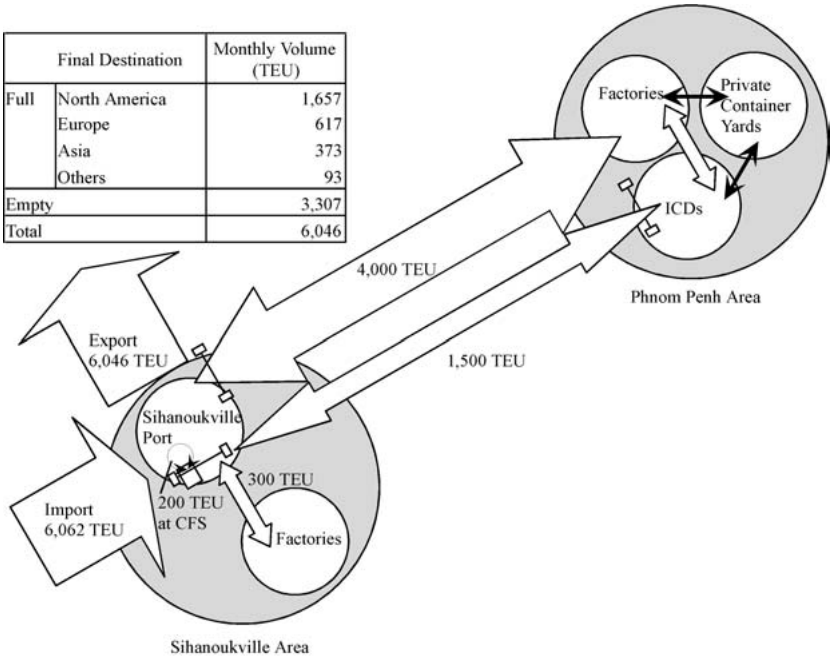
Name	Corporate Type	Started in	Handling Volume (TEU/Month)	Capacity (TEU/Month)	Area (ha)
Cambodia - CWT Dry Port	Private-Public Joint Venture	1996	600	2,500	17.0
KPM-MSE	Private	1998	1,000	2,400*1	7.5
Soung Oun	Private	1999	1,400	3,000*1	5.0

Souce: JICA Study Team.

Note: *1: Assumed to be twice of ground slots.

The Study Team estimated the container flow in the Region as follows.

Final Destination		Monthly Volume (TEU)
Full	North America	1,657
	Europe	617
	Asia	373
	Others	93
Empty		3,307
Total		6,046



Source: JICA Study Team

Figure H-8 Estimated Container Flow in the Region (Monthly Base)

H.2 ISSUES AND GOALS FOR TRANSPORTATION INFRASTRUCTURE DEVELOPMENT

H.2.1 Issues for Transportation Development

(1) More Containerization and Its Diversified Flow

As observed in Chapter 1 of this Sector Report, one of the disadvantages of the Growth Corridor is the long distance between production center and seaport. The distance is now filled by containerized transportation on the road.

Smooth and inexpensive container transportation on Route 4 is of importance to keep the international competitiveness of Cambodia. Although the container export route is currently limited to Route 4, containers should have alternative route such as river transportation from Phnom Penh to Ho Chi Minh Port. It will enhance a competition among route.

Figure 9 illustrates the future transportation network by containers and trucks.

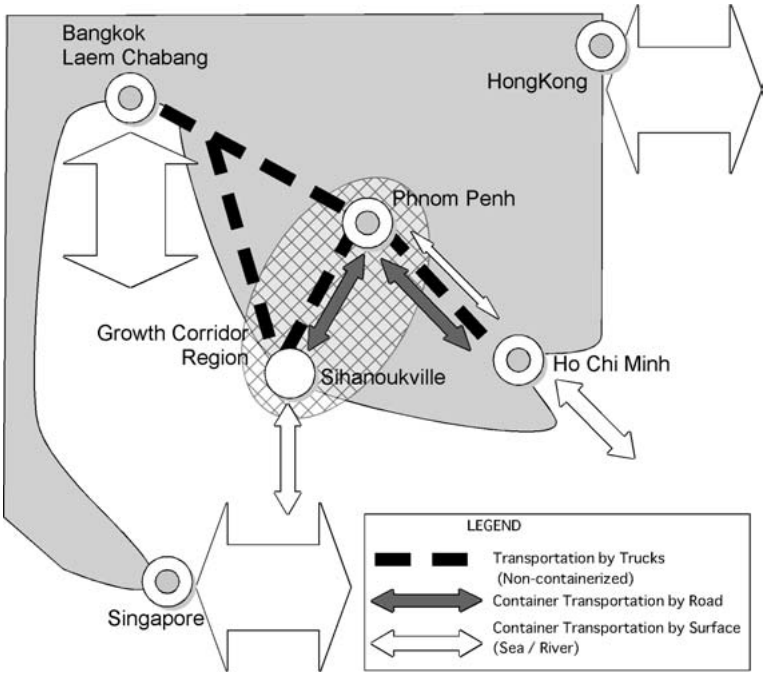


Figure 9 Future Image of Transportation Network and Logistics

(2) Effective Road Maintenance

The current Five Year Master Plan of Road Rehabilitation is only possible with the foreign assistance. Not only rehabilitation, but also road maintenance is becoming an issue of the transportation sector. In the Growth Corridor region, Route 4 is ready for the maintenance expenses by introduction of PFI. The toll from users will be allocated for the maintenance.

On the other hand, the perspective of maintenance for other routes is not promising. Public Investment Plan (PIP) only estimates routine maintenance cost. In addition, the Route 3 and Route 48 are vulnerable for natural disasters such as flooding. Not only counter-disaster program, routine and periodical maintenance are required for the routes. Particularly, it is appropriate to install water drainage system for the road bases.

(3) Meeting International Standard

Because Cambodia is not a geographically isolated country, many transportation modes are required to meet the internationally accepted standard. Maritime and civil aviation are mostly prepared to meet such standard. In the long run, the following matters should be considered to raise the Cambodian transportation sector to meet the international standard.

- Port: Deep seaport with 10m draft for larger vessels
- Airport: 3,500 - 4,000 m runway to accept a long-range Boeing 747s in future.

- Road: Axle load standard, standardized English sign and supporting facilities.

H.2.2 Goal and Strategies

A descriptive goal of transportation sector is presented to express the priority area and the image of transportation development in the region. Overall strategies and area-wise strategies are provided to attain the goal.

(1) Goal

Overall goal of transportation system is stated as follows.

- Efficient transportation system to support export activity and people's life

The main purpose of the regional master plan is to develop the area as an engine of export promotion. Accordingly, the transportation system is set to support export activity. At the same time, the transportation system supports people's daily life in both urban and rural area. Especially, improvement of accessibility is significant.

(2) Overall Strategies

- Appropriate modal share among air, road, river and railways

Current transportation system heavily depends on roads but river and air are also important modes in the region. In addition, railways will be also important in the future. Availability of appropriate modes is important for overall efficiency and people's convenience.

(3) Sihanoukville

1) Support of SPZ by Modern Logistics

The new SPZ and Free Zone will require modern logistics not only the Sihanoukville Port but also in other areas. Basically, the container cargo flow should be separated from passenger transport. In the future, container transport on railways will be an option.

Modern logistics includes container related service and warehouses. Because of tax advantage, importers can save import duty until their cargoes are shipped outside of Free Zone. It creates a new business opportunity in SPZ.

2) Improvement of Urban Life by Better Transport

The urban population in Sihanoukville will be growing rapidly in the coming decade. Because the city's area is widely spread, the role of urban transport will be more important than now along with the development of SPZ. It is necessary to development attractive urban transport system related under a city

master plan.

(4) Phnom Penh Metropolitan Area

1) Suburban Development with Road Network

The suburban area of Phnom Penh is expanding rapidly but it does not have sufficient road network. JICA Phnom Penh Urban Transport Master Plan Study (2001) proposed various projects, including ring road and public transport system. Implementation of the proposed projects is urgently required.

Additionally, the Phnom Penh Industrial Zone (PIZ) will increase the traffic volume on Route 4. Thus, it is necessary to develop western suburbs in conjunction with Route 4 and PIZ.

2) Export Promotion Support by More Containerization

As a hub of the national and international distribution system, Phnom Penh Metropolitan Area has location advantage in air, river and road network. To support existing and future industrial activities, the Area should provide more advanced function. Especially, the ocean container handling facilities are important currently. In the future, an air cargo terminal will be also needed.

(5) Intermediate Area

1) Support of Corridor Function by Road Network

Both Route 3 and 4 will be maintained in good condition in the Intermediate Area. In addition, the Route 48 is becoming alternate corridor between Sihanoukville and Eastern Seaboard in Thailand. Development and maintenance of these three national roads are significant for the Growth Corridor Region.

Contrarily, the provincial and rural roads require large amount of public involvement and the future perspective is unclear. It is necessary to develop rural roads step-by-step with local participation.

2) Improvement of Urban Function in Provincial Cities

Coastal provincial centers such as Kampot and Kaoh Kong require small-scale but reliable port facilities for domestic and international trade. It includes bridges, small ports and urban roads.

Table H-12 Strategies of Transportation Development

Category		Strategy
Overall		- Appropriate modal share among air, road, river and railways
Area-Specific	Sihanoukville	- Support of SPZ by modern logistics - Improvement of urban life by better transport
	Phnom Penh Metropolitan Area	- Suburban development with road network - Export promotion support by more containerization
	Intermediate Area	- Support of corridor function by road network - Improvement of urban function in provincial cities

H.2.3 Approaches for Development

(1) Approach 1: Concentration of Key Infrastructure

The first approach to development infrastructure concentrates the resources on key infrastructure that directly relates to the external trade. The key infrastructure includes two ports, Route 4, and industrial utilities only. This is effective and promising. These infrastructures can offer many attractive PFI schemes for many private companies.

(2) Approach 2: Acceleration of Rural Development

The second approach accelerates the rural development in the Region. This approach emphasizes the infrastructure development such as provincial roads and rural water supply. The governments at both central and provincial level require substantial budget allocation for the implementation of projects, but the direct financial returns from projects are little expected.

This leads to raise the overall level of infrastructure in the rural area. Not only living standard but also the agricultural distribution system will be improved under this approach. Consequently, this leads to reduce rural poverty.

(3) Approach 3: Incremental Cross-Subsidy

The third approach is a combination of the previous two approaches by phase. Initially, the Approach 1 is introduced to provide infrastructure services quickly. While PFI concessionaires are in operation, the Ministries should establish a fund that funnels the revenue from the concessionaires to the infrastructure development in rural area.

For example, a Regional Road Maintenance Fund for provincial and rural roads in the Growth Corridor Region can be introduced from 10% of the revenue of Route 4 maintenance after 2007. If a nationwide funding system from fuel tax is established for national and provincial roads, the system can be an

add-on to this region-specific scheme.

This works as a cross-subsidy from a profitable field to an unprofitable field. Until the time when rural areas reach to the specific standard in terms of all-weather road density or electrification rate, the cross-subsidies are admitted. At that time, the universal service for infrastructure access is expected in all over the region. The time to abolish the cross-subsidy is set for the year 2015.

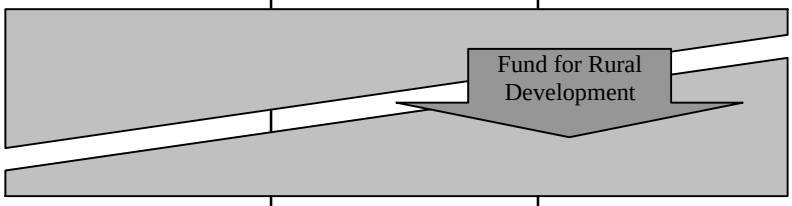
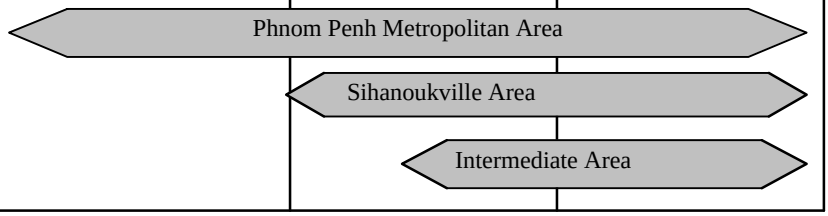
Then, the scenario accepts to abolish the cross-subsidy for infrastructure provision. Rural areas have affordability for their infrastructures. On the other hand, privatized infrastructure can seek for more sophisticated level of service such as access controlled highway or high-speed data communication system at the state-of-the-art.

The following Tables illustrate the approaches.

Table H-13 Three Approaches for Transportation Infrastructure Development

	Cases of Focus Projects	Advantage	Disadvantage
Approach 1 - Concentration on Key Infrastructure	Port, airport, national roads, toll roads	Quick response Secure cost-recovery	Risk to expand regional disparity
Approach 2 - Accelaration of Rural Development	Provincial and rural roads	Regional balance, Poverty reduction	Substantial public involvement. Difficult cost recovery
Approach 3 - Incremental Cross Subsidy	Phased implementation	Natural transition	Difficulty to redistribute the fund.

Table H-14 Approach 3 Phased Implementation

Incremental Cross-subsidy	Urgent 2003-2005	Short Term 2005-2008	Middle and Long Term 2009-2015
Concentration on Key Infrastructure Acceleration of Rural Development			
Area Priority			

H.3 TRANSPORTATION PROJECTS FOR IMPLEMENTATION

H.3.1 Transportation Projects

(1) Project Outline

The Study proposes following transportation projects for the Growth Corridor. Nine projects have been identified in the transportation sector. The common purpose of all projects is to enhance and improve the transportation function of the Growth Corridor. The details of the proposed projects are shown in the project sheets attached in later section. **Table H-15** below lists the eight projects.

Table H-15 Development Projects for Transportation Sector

Project	Objective	Executing Agency
J1: Southern Railway Rehabilitation Project	To utilize the advantage of railway transportation in the Region.	RRC
J2: Container Distribution Center Project	To improve and rationalize container inflows and outflows.	MPWT, PAS, PPAP and concessionaire.
J-3: Container Lane project	To improve access between Srae Ambel and Sihanoukville.	MPWT, PAS and concessionaire.
J-4: Sihanoukville Urban Transport Project	To mitigate the traffic congestion.	MPWT and Sihanoukville City
J-5: New Phnom Penh Port Project	To mitigate traffic congestion caused by the port related traffic in the future.	MPWT, PPAP and concessionaire.
J-6: Phnom Penh Urban Transport Project	To mitigate the traffic congestion.	MPWT and Phnom Penh Municipality.
J-7: Kampot Urban Infrastructure Development Project	To improve various urban facilities of Kampot City.	MPWT and Kampot City
J-8: Rural Road Maintenance System Development Project	To establish a sustainable and effective system and institution especially for low-traffic rural roads. Participation for maintenance work from villagers is the most important element.	MRD, Province and Rural Development Committee.
J-9: Route 48 Upgrading Project	To upgrade the existing Route 48 to all-weather road. Four bridges are included.	MPWT.

(2) Evaluation of Proposed Projects

The proposed projects were scrutinized in view of the 6 evaluation criteria.

- Conformity to Basic Strategy
- Conformity to Regional Strategy
- Relevance to Industrial Development
- Sustainability and use of local resource

- Admissibility of implementation
- Impact on social dimension

Table H-16 summarizes the appraisal.

Table H-16 Evaluation of the Proposed Projects

Project	Conformity to Basic Strategy	Conformity to Regional Strategy	Relevance to Industrial Develop- ment	Sustain-ability and use of local resource	Admissibility of implemen- tation	Impact on social dimension
J1: Southern Railway Rehabilitation Project	C - The role of railways is very limited.	C - The role of railways is very limited.	B - This supports containeriza-ti on.	C - Uncertain sustain-ability.	C – Not Admissible immediate- ly.	B – Limited social impact.
J2: Container Distribution Center Project	A – It enhances the trans-portation function.	A – It reduces the unnecessary traffic in the City.	A – Relevant to support industrial activity.	A - Sustainable.	A – Admissible.	B – Land acquisition required.
J-3: Container Lane project	A – It reduces the trans-portation cost.	B – It mainly focus on PP side users.	B – Relevant to promote industrial development.	A - Sustainable.	A – One half is under construc-tion.	A – Impacts on people on Stuen Have..
J-4: Sihanouk-ville Urban Transport Project	A – It enhances the attractive-ness of the City.	B – Consistent with the regional strategy	B – It supports he industrial levelopment ndirectly.	B - Uncertain.	B – Master plan by F-3 will be required.	B – Uncertain.
J-5: New Phnom Penh Port Project	A – It reduces the center city traffic.	A – Consistent with the regional strategy	A – It supports the industrial develop-ment.	B - Uncertain.	A – Link with F-4 is necessary.	B – Land acquisition required.
J-6: Phnom Penh Urban Transport Project	A – It enhances the attractive-ness of the City.	B – Consistent with the regional strategy	B – It supports the industrial development indirectly.	B - Uncertain.	A– Transport Master Plan was prepared by JICA. A City M/P is to be prepared by F-4.	B – Uncertain.
J-7: Kampot Urban Infrastructure Development Project	A – It enhances the attractive-ness of the City.	B – Consistent with the regional strategy	C – It supports the industrial development indirectly.	C - Uncertain.	B – Master plan will be required.	B – Uncertain.
J-8: Rural Road Maintenance System Development Project	A – Is consistent with the basic strategy	A – Will support the development strategy of Intermediate area.	C – Little relation with industrial development.	A - Local resources are utilized.	B - Project should be carefully designed.	A – Positive social impact.
J-9: Route 48 Upgrading Project	A. Consistent	A - It creates new develop-ment axis.	A. It links with Thai industrial agglomeration.	B. Uncertain.	B: Const-ruction by Thai Government has been frozen	B. Large impact on environment.

(3) Implementation Program

Based on the evaluation of the proposed projects, the implementation program is formulated as shown in **Table H-17**

Table H-17 Implementation Program of Projects

Project	Executing Agency	2003 - 2005	2006-2008	2008-2015
J1: Southern Railway Rehabilitation Project	RRC			
J2: Container Distribution Center Project	MPWT and Kampot City	F/S	Construction	
J3: Container Lane project	MPWT, PAS and concessionaire.		Construction	
J4: Sihanoukville Urban Transport Project	MPWT and Sihanoukville City	F/S,D/D	Construction	
J5: New Phnom Penh Port Project	MPWT, PPAP and concessionaire.	M/P,D/D	Construction	
J6: Phnom Penh Urban Transport Project	MPWT and Phnom Penh Municipality	D/D	Construction	
J7: Kampot Urban Infrastructure Development Project	MPWT and Phnom Penh Municipality.		D/D	Construction
J8: Rural Road Maintenance System Development Project	MRD, Province and Rural Development Committee.		Construction	
J9: Route 48 Upgrading Project	MPWT	D/D	Construction	

Here shortlists three priority projects by the common criteria of this study and the followings are selected.

- J-2 Container Distribution Center Project
- J-6 Phnom Penh Urban Transport Project
- J-9 Route 48 Upgrading Project

Profile is described in the following section.

H.3.2 Priority Project Profile

Project Sheet **J-2**

Project Name	Container Distribution Center Project			
Backgrounds	The exporters around Phnom Penh pay high land transportation costs for containers because of its location. There are several small inland container depots but a larger facility is required.			
Project Purposes	To improve and modernalize container inflows and outflows.			
Target Year (Project Period)	2007			
Beneficiaries (Target Group, Target Area)	Both exporters and importers. Transportation companies.			
Activities	- Bonded Inland Container Depot for both Phnom Penh Port and Sihanoukville Port. - One-stop service for all documentation for export and import including custom clearance. - Electric Data Interchange. - Including a Container Freight Station for cargoes less than a container load.			
Executing Organization	MOC, MPWT, two Port Authorities, and Department of Customs. A private company under PFI contract can operate the yard.			
Outputs(Results)	Rehabilitation of rail beds. Establishment of signal and communication system Introduction of new rolling stocks			
Inputs (Project Cost)	Loan from financial institutions. PFI is also appropriate.			
Finance	Domestic Budget. Soft loan from donors			
Implementation Schedule	**Activity**	**2003**	**2004**	**2005**
	Site Selection	===		
	Feasibility Study		===	
	Detailed Design			===
	Construction			2006-
Evaluation (Including Results of IEE)	See IEE report.			
SW of EIA (if necessary),Mitigation for Impacts				
Location Map				
Project Image Photo etc.				

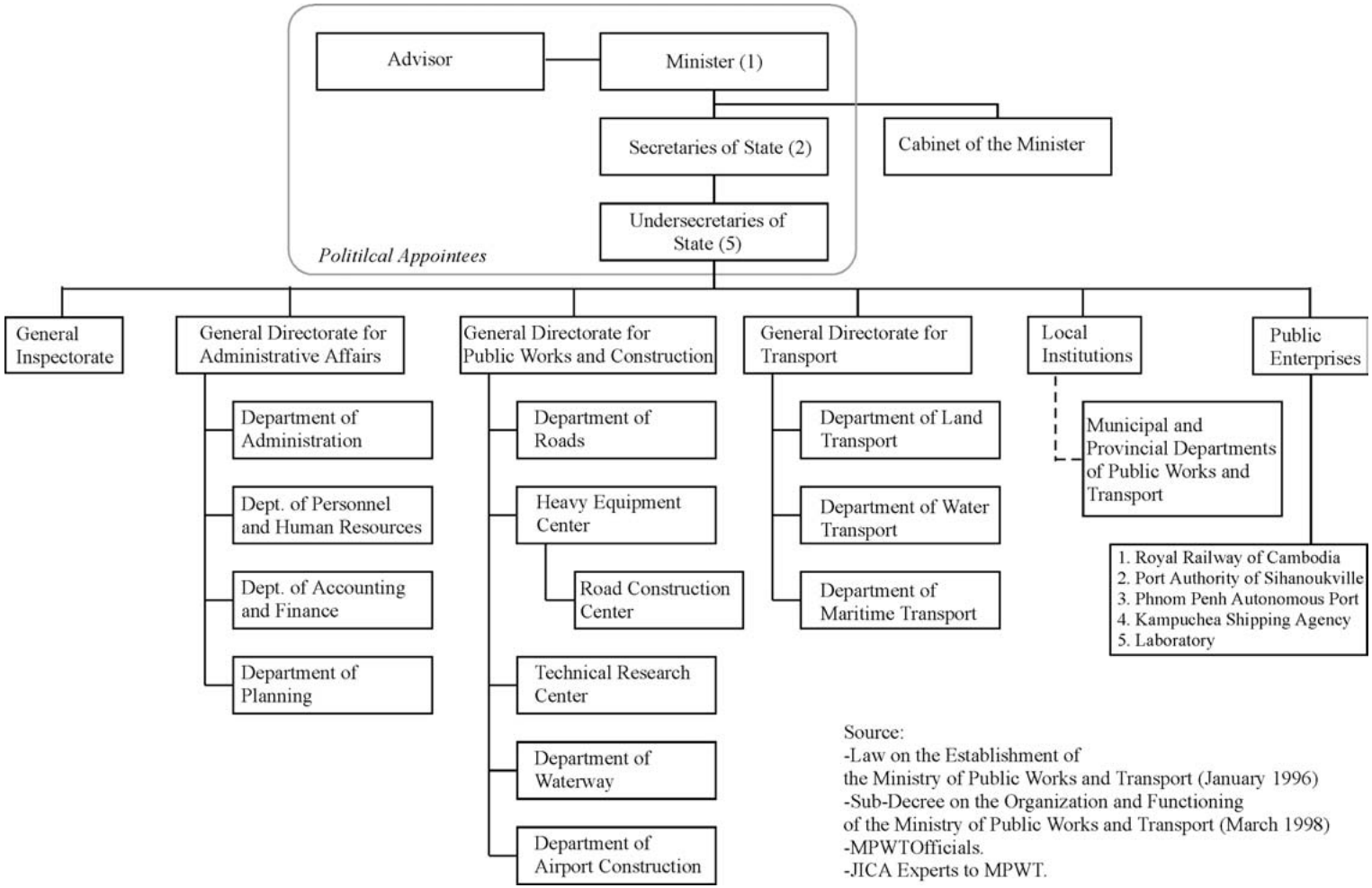
Project Sheet **J-6**

Project Name	Phnom Penh Urban Transport Project			
Backgrounds	Traffic congestion in Phnom Penh is a growing problem and JICA prepared the Urban Transport Master Plan in 2001. It is necessary to implement the proposed projects.			
Project Purposes	To mitigate the traffic congestion. To improve air quality.			
Target Year (Project Period)	2002-2005 Detailed design and financing 2003-2008 Construction			
Beneficiaries (Target Group, Target Area)	Phnom Penh residents. Transportation operators.			
Activities	- Outer Ring Road and Route 4 Bypass construction - Public transportation development - Traffic management improvement			
Executing Organization	MPWT and Phnom Penh Municipality			
Outputs (Results)	Decrease of traffic congestion in inner city.			
Inputs (Project Cost)	Government budget. Loan or grant from various financial institutions. Private Finance Initiative is also appropriate.			
Finance				
Implementation Schedule	**Activity**	**2003**	**2004**	**2005**
	Detailed Design	===	========	========
	Financing Arrangement		====	
	Construction			====
Evaluation (Including Results of IEE)	Effective to promote international trade. See also IEE report.			
SW of EIA (if necessary),Mitigation for Impacts				
Location Map				
Project Image Photo etc.				

Project Sheet **J-9**

Project Name	Route 48 Upgrading Project			
Backgrounds	The National Route 48 is a new coastal route which connects Sihanoukville and Eastern Seaboard in Thailand. It will enhance the industrial linkage between Thailand and Cambodia. The Royal Thai Army almost completed the upgrade to laterite pavement but it is far from stable transportation for all seasons. Thai Prime Minister pledged additional support for four bridges and asphalt pavement in November 2002. However, it has been frozen since January 2003.			
Project Purposes	This project intends to construct four bridges and to pave the whole route to asphalt. In some mountainous area, road geometry is to be improved.			
Target Year (Project Period)	2006			
Beneficiaries (Target Group, Target Area)	Sihanoukville industrial companies. Kaoh Kong residents.			
Activities	Feasibility Study (Traffic Demand Forecast) Detailed Design Construction			
Executing Organization	MPWT.			
Outputs(Results)	Creation of new trading route between Thailand and Cambodia.			
Inputs (Project Cost)	(Rough estimate) US$ 50 million for pavement of 160km. US$ 10 million for four bridges (total length of 1,600m)			
Finance	MPWT budget and donor assistance. Construction by PFI is also possible.			
Implementation Schedule	**Activity**	**2003**	**2004**	**2005**
	Feasibility Study (Demand Forecast)	===		
	Detailed Design		====	
	Construction (-2007)		==	==== =
Evaluation (Including Results of IEE)	This contributes to industrial promotion. IEE is necessary for all aspects.			
SW of EIA (if necessary),Mitigation for Impacts				
Location Map				
Project Image Photo etc.				

APPENDIX H.1. ORGANIZATION CHART OF MINISTRY OF PUBLIC WORKS AND TRANSPORT



Source:
-Law on the Establishment of
the Ministry of Public Works and Transport (January 1996)
-Sub-Decree on the Organization and Functioning
of the Ministry of Public Works and Transport (March 1998)
-MPWTOfficials.
-JICA Experts to MPWT.

H.4 TRAFFIC FORECAST ON ROUTE 4

H.4.1 Introduction

The National Route 4 is the most important transportation route not only to the Growth Corridor but also for the country. It is essential to maintain the Route 4 in a good condition for the development of Cambodia.

The Route 4 has a different background from other national roads. Traditionally, Phnom Penh and Sihanoukville were connected by the seaside route, current Route 3. By the development of Sihanoukville Port, the Route 4 was constructed in the 1960s and then rehabilitated in 1996 by USAID. Other single-digit national roads were constructed in 1920s and 1930s. Therefore, the Route 4 is unique in terms of its road standard and location.

H.4.2 Past Traffic Volume Surveys

Several researches conducted traffic volume surveys on the Route. Because all of them had different approaches and purposes, it is difficult to compare in the same method. The Ministry of Public Works and Transport (MPWT) does not conduct regular traffic survey.

The reliable traffic volume surveys on Route 4 since the UNTAC period are as follows:

- January - June 1997: MPWT and Japan Overseas Consultants (JOC), 1997
- August 30 - September 5, 2000. AZ Distribution.
- May 30, 2000. Phnom Penh Urban Transport Master Plan. JICA. 2001.

This section selects three traffic count points from 1997 MWPT and JOC survey and 2001 JICA Survey as follows:

- City Border; JICA.
- South of Kampong Spueu; MPWT and JOC.
- Viel Rinh Junction; MPWT and JOC.

The locations of points are as shown in Figure H-10.

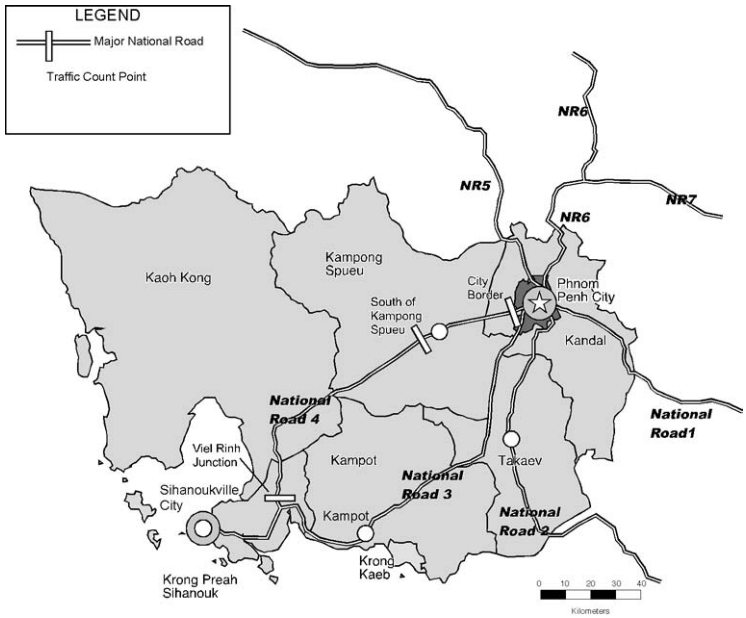


Figure H-10 Three Points for Traffic Count

H.4.3 Current Situation of Route 4

(1) Road Structure

Route 4 has mainly three major types of section as follows.

Table H-18 Road Structure of Route 4

Section	Lane	Estimted Capacity
City Center - Chaom Chou (Route 3)	4x3.5m	5,000 pcu/hr
Chaom Chou (0km)-33km Post	2x3.5m, 2x1.5m	3,700 pcu/hr
33km Post -Sihanoukville	2x3.5m	2,500 pcu/hr

Source: JST.

(2) Maintenance Scheme

The RGC adopted a PFI to maintain the Route 4. The following box shows the outline of concession.

Table H-19 Outline of Route 4 Operation and Maintenance Contract

Concessioner: MPWT and MEF		
Concessionaire: AZ Distribution		
Contract Term: 35 years from 2002		
Contract Contents:		
	Regular Maintenance	
	Periodic Maintenance (US$ 10 million every 8 years)	
	Traffic sign	
	Road painting	
	Parking space	
	Toilets	
Commencement Date:		
Toll:	Passenger car:	US$2
	Large trucks:	US$6
Tollgates:	One at 19 km post	
	One between Viel Rinh and Sihanoukville	
Note: Residents along the stretch of route and official vehicles can be exempt from the toll.		

(3) Characteristics of Traffic Flow

1) Peak Hour Concentration

The peak hour congestion happens between 6:15-7:15 in the morning at City Boundary. The congestion has been already severe and the Level of Service is low enough. The congestion occurs within the City boundary. JICA counted 1,842 PCUs/hour at city boundary.

For the forecast purpose, it is assumed that 10% of daily traffic occurs during the peak hour.

2) Traffic Volume by Vehicle Category

Motorcycles are the common transportation measures. Among the total traffic volume, motorcycles are dominant in number and PCUs especially in suburban areas.

Not only motorcycle, bicycles and motorumos are also commonly used on Route 4. The mixed traffic significantly affects the traffic flow because motorcycles are slower than cars and trucks. Especially, in two-lane section, passenger cars need to change their lane to pass the slower vehicles.

The Route 4 has additional half lanes, 1.5 m width, on both sides between Chaom Chau and 33 km post. The lanes are mostly used for motorcycles and

significantly improve the traffic flow.

Figure H-11 shows the traffic volume by vehicle category.

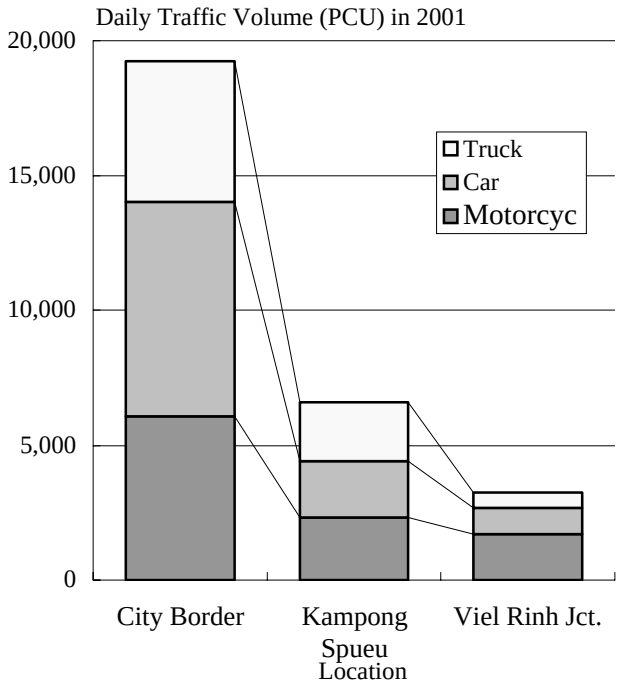


Figure H-11 Traffic Volume by Vehicle Category

3) Container Transportation

Container transportation is the most important function of Route 4. The AZ Distribution counted 177 container trucks per day in average. The number is equivalent to 327 TEU/day. Thus, the average container load is 1.85 TEU per container truck.

Container trucks on Route 4 have a risk of overloading. For example, a twenty-feet container can weigh to 30 ton in gross. It will easily exceed the current limit of weight control.

A tuck weight scale is located on the east end of Route 4. Overloaded truck operators are fined in accordance to the weight but unloading is not necessary.

Current trade structure and the number of import and export containers shows that Cambodia import cargoes more than its export in both financial and physical terms. (See Sector Report for detail) The container transportation is import driven to the largest consumer market, Phnom Penh.

This is an important factor to forecast traffic volume on Route 4. The above trade characteristic suggests the basic traffic volume on Route 4 will change only slightly even if export-oriented industries are re-located in Sihanoukville.

The decreased amount will be proportional to the amount of input materials for the factories in Sihanoukville.

H.4.4 Traffic Forecast on Route 4

(1) Baseline Forecast

Here refers the baseline traffic forecast from the Working Paper No.1: Future Trend in Transportation Demand in Transport Sector Strategy (TSS) Appendix.

Table H-20 Assumption of Growth Rate (Baseline)

Road	2001-2005	2006-2010	2011-2015	Comments
R-3	5%	5%	5%	R2 and R-3 pass through relatively dense area populated areas; agriculture and possibly more industries in Phnom Penh vicinity, growth slightly lower than average GDP.
R-4	15%	10%	10%	Traffic will continue to be strong with the attraction factors of Phnom Penh and Sihanoukville Port; assumes to grow according to growth of vehicles or fuel.

Source: *Future Trends in Transportation Demand* in TSS Appendix (2002).

On the other hand, the GDP growth rates of transportation sector are set as 11.9% in the Study Area in both baseline and intensive case. Because the growth rate of 11.9% is expressed in financial term, the growth rate in physical term (such as PCU or TEU) will be close to it. The difference between financial and monetary units is explained by the competition among operators and the improvement of productivity. Thus, these rates are at reasonable levels and the above growth rates are adopted here.

Figure H-12 shows the baseline forecast based on the above assumption.

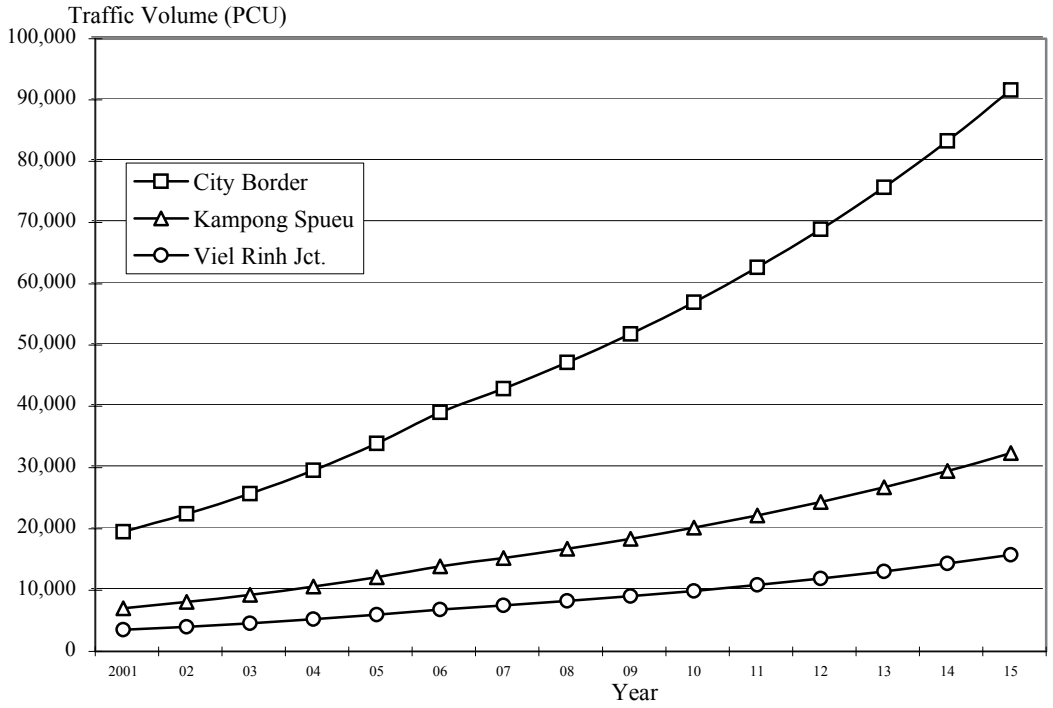


Figure H-12 Traffic Volume Forecast by Baseline

(2) Intensive Case Forecast

Significant Additional Elements Available from Indicative Targets as follows.

1) Population

The Indicative Targets under Intensive Case set the population levels in the Greater Capital Area and Sihanoukville to be 11% and 24% higher than the ones in baseline respectively. The population closely relates to the number of commuters. Here assumes the traffic volumes of motorcycles and cars at three points to accommodate these numbers. The volumes of motorcycles grow at additional 0.70% p.a[2] at Phnom Penh side and 1.44% p.a[3] for Sihanoukville side from baseline forecast.

2) Industrial Sector in Phnom Penh

Although the Indicative Targets set the GDP from the manufacturing sector to be 10% higher than the baseline, most growth are to occur in Sihanoukville.

[2] 1.11^(1/(2015-2004))-1=0.0095=0.95%
[3] 1.24^(1/(2015-2004))-1=0.0197=1.97%

Table H-21 Population Forecast in Urban Area

GDP from Industry	Study Area	Greater Capital	Intermediate Area	Sihanoukville
Present Level (2000)	1,729	1,362	304	63
Baseline Case (2015)	4,814	3,512	1,056	246
Intensive Case (2015)	5,033	3,622	856	555

Unit: Billion Riels (2001 prices)

The difference between the baseline and intensive cases in Greater Capital is 3.1% in 11 years. This equals to 0.27% p.a. Although the difference is negligible compared to the baseline growth rate, here assumes that the truck volume grow with this additional volume on top of the baseline forecast.

3) Influence by SPZ/EPZ in Sihanoukville

The SPZ/EPZ in Sihanoukville will influence little on traffic volume on Route 4 because they import raw materials from abroad and export products directly. The transportation arrangement for EPZ and the port is discussed in the Feasibility Study.

4) Influence by EPZ in Phnom Penh

EPZs in Phnom Penh will increase the traffic volume on Route 4. The total amount is included in the intensive case growth rate.

H.4.5 Traffic Forecast Results

Tables of A2.6 shows the traffic forecast under two cases.

H.4.6 Proposed Countermeasures on Route 4

Based on the forecast by intensive case, the following countermeasures are proposed in this study.

Table H-22 Countermeasures for Traffic Congestion on Route 4

Year	Situation on Route 4	Proposed Countermeasures
2002	Congestion between Chaom Chau (0km) and city center.	-Road widening to 4 lanes or bypass construction to south. (between Angk Snoul and Phnom Penh)
2005	Congestion between Angk Snoul (12km) and city center	
	Difficulty in changing lanes on all routes.	-Half lane expansion on both sides.
2010	Congestion between Kampong Spueu (35km) and city center.	-Bypass for Kampong Spueu centers.
	Congestion in other urban areas.	
2015	Congestion on all routes.	-Heavy cargo transportation by railways. -Expansion to 4+2 half lanes all along route. Or, new route construction.

Based on the forecast, the current Route 4 should be widened in early 2010s. Because the current maintenance scheme only cares maintenance, the road reconstruction is out of the contract. MPWT should finance the new construction or expansion by the concession fee.

Table H-23 Traffic Forecast on Route 4

Growth Rate Assumption

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Baseline Growth Rate	15%	15%	15%	15%	15%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

Additional Growth Rates for Intensive Case

Motorcycles and Cars	City Border and Kg. Spueu				1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	
	Viel Rinh				2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	
Trucks					0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
City Border	Motorcycle	6,091	7,005	8,055	9,264	10,742	12,455	13,819	15,333	17,012	18,876	20,943	23,237	25,783	28,607	31,740
	Car	7,932	9,122	10,490	12,064	13,988	16,220	17,996	19,967	22,155	24,581	27,274	30,261	33,575	37,253	41,333
	Truck	5,226	6,010	6,911	7,948	9,162	10,562	11,648	12,845	14,165	15,621	17,227	18,997	20,950	23,103	25,477
	Total	19,249	22,136	25,457	29,275	33,892	39,237	43,463	48,145	53,332	59,078	65,444	72,495	80,308	88,963	98,551
Kampong Spueu	Motorcycle	2,334	2,684	3,086	3,549	4,115	4,772	5,294	5,874	6,518	7,231	8,024	8,902	9,878	10,959	12,160
	Car	2,095	2,409	2,771	3,186	3,695	4,284	4,753	5,274	5,851	6,492	7,203	7,993	8,868	9,839	10,917
	Truck	2,180	2,507	2,884	3,316	3,823	4,407	4,860	5,359	5,910	6,517	7,187	7,926	8,741	9,639	10,630
	Total	6,609	7,600	8,740	10,051	11,632	13,462	14,907	16,507	18,279	20,241	22,414	24,821	27,486	30,438	33,706
Viel Rinh Jct.	Motorcycle	1,716	1,973	2,269	2,610	3,053	3,571	3,999	4,478	5,014	5,614	6,286	7,039	7,882	8,826	9,883
	Car	966	1,111	1,278	1,469	1,719	2,010	2,251	2,521	2,822	3,160	3,539	3,963	4,437	4,968	5,563
	Truck	576	663	762	876	1,010	1,165	1,284	1,416	1,562	1,723	1,900	2,095	2,310	2,548	2,810
	Total	3,258	3,747	4,309	4,955	5,782	6,746	7,534	8,415	9,398	10,497	11,725	13,097	14,629	16,342	18,256

Peak Hour Traffic Volume	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
City Border	1,925	2,214	2,546	2,928	3,389	3,924	4,346	4,815	5,333	5,908	6,544	7,250	8,031	8,896	9,855
Kampong Spueu	661	760	874	1,005	1,163	1,346	1,491	1,651	1,828	2,024	2,241	2,482	2,749	3,044	3,371
Viel Rinh Jct.	326	375	431	496	578	675	753	841	940	1,050	1,172	1,310	1,463	1,634	1,826

Existing Lane Capacity	0km-33km	2 lanes	+1.5m side lane on both sides	3,700 pcu/hr
	33km-214km	2 lanes		2,500 pcu/hr

V/C Ratio	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
City Border	**52%**	**60%**	**69%**	**79%**	**92%**	**106%**	**117%**	**130%**	**144%**	**160%**	**177%**	**196%**	**217%**	**240%**	**266%**
Kampong Spueu	26%	30%	35%	40%	47%	**54%**	**60%**	**66%**	**73%**	**81%**	**90%**	**99%**	**110%**	**122%**	**135%**
Viel Rinh Jct.	13%	15%	17%	20%	23%	27%	30%	34%	38%	42%	47%	**52%**	**59%**	**65%**	**73%**

Note: Bold numbers of V/C ratios are exceeding 50%, which means significant decrease of Level-of-Service (LOS).