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Infrastructure Development of Railway in Cambodia: A Long Term Strategy

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Abstract

Infrastructure development means for the making of living environment, transport and communications, disaster prevention and national land conservation, agriculture, forestry and fisheries, and energy production and supply. Transport infrastructure development in Cambodia involved with (1) road, (2) railway, (3) port, inland-water way and (4) aviation.

All model of transport infrastructure have special different kinds of importance. Railway is different from other base important of railways are transport passengers and traffic freight especially transport for heavy goods in huge capacity and in long distance by safer and faster. Transport in Cambodia for traffic freight export import base from Thailand and other via Sisophon and Shihanoukvill port. Traffic is increasing rapidly during nowadays railway condition in adequate of demand required. This is why

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Railway is selected as the topic of this paper to prevent monopoly of road transport.

This paper, does review about infrastructure development plan for Railway in Cambodia as a long term strategy by review and analysis forecast on the previous performance of Royal Railways of Cambodia (RRC) transport traffic involved with condition of infrastructure development of railway in Cambodia. And also review the plan of development RRC but just only detail a plan of rehabilitation that is immediately needed. Suggest some recommendation at the last part. As Cambodia is a member country of ASEAN and also Mekong sub-region. For make sure that transport networks work effectively with a progress of economic integration, we make clear what is important for infrastructure development of railway in Cambodia from the standpoint of the development plan of Mekong sub-region.

This paper is organized by 4 sections. Section 1 review about Infrastructure Development of Railway in Cambodia (IDRC) Historical Background, Follow by Section 2 will review the Current Situation of IDRC and some analysis of transport performance from previous years, Then Section 3 review of the focusing on traffic transport of RRC in the future, Section 4 review Infrastructure Development of Railway in Cambodia Future plans in long term; at last conclusion and recommendation.

In section 1 does review history background of RRC from the rail first begun. But why is needed to review? Because of history background is involved infrastructure development of RRC in present time. History background made big gaps constraint and obstacle for socioeconomic development and poverty reduction, also left Cambodia with tragedy and left developed behind. After that remain infrastructure development needs huge fund and long time for restoration, reconstruction, rehabilitation and development into new technology as most of world practice.

Keywords: Asia, developing counries, service sector, networks
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I . INTRODUCTION

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Ⅱ. BACKGROUND OF CAMBODIAN RAILWAYS

2.1. History

Railways of Cambodia has the formal names is Royal Railways of Cambodia (RRC), or Cermins de Fer Royaux du Cambodge (in French). RRC have two rail lines, main both lines originating in Phnom Penh, totaling of 650 kilometers (in the past time 750 km including branch 100 km) of single railway tracks with a narrow track gauge of 1000 millimeter track gauge. In the concept of siding, traffic freight, carry passenger, or serving ballast quarries. However the main purpose rail links the Cambodian population with cultural, agricultural, forest areas and industrial center. During 1660s the profitable of rail transport RRC got the high remark of the people as the prosperous of the population.

2.2. Before 1970

The first line or "Old" line track was constructed between 1929 and 1942. The French built, which runs from Phnom Penh to Poipet on the Thailand-Cambodia border via Posat, Battambang, total the length of 386 km. Northern Line was built with 30 kg/m rails on steel sleepers. The track was built to bear with axle loads of 13 tons to 15 tons. The minimum curve radius is 300 m and the ruling gradient is 5%**0**. There are 174 bridges (Steel bridge: 93 of length 2,272 meters and Concrete Bridge: 31 of length 1,354 meters), and culvert and culvert-boxes 242. There are 49 stations in Northern Line. The 48 km from Sisophon to Poipet at Thailand and Cambodia border had connected railway Phnom Penh to Bangkok during the period of 1942-1961.

The South Line or "New" line takes off at a bifurcation 9.4 km from Phnom Penh station to the port of Sihanoukville at 265 km via Takeo and Kampot (PP-Takeo 75 km, Takeo -Kampot 92 km, and Kampot - Sihanoukport 98 km). The line was built between 1960 and 1969 with assistance from France, West Germany and China. The Southern Line was built with 43 kg/m rails on untreated wooden sleepers. There are 94 bridges (7 steel bridges of length 461 meters and 87 concrete bridge of length 2,672 meters), and culvert and culvert-boxes 474. There are 28 stations in Southern line.

In 1969-1970 train operating with 37 trains per day by 74 Locomotives and 928 with all types of wagons, Train speed 60 km/h. HF Radio system is used as emergency backup to the carrier systems in some parts of network. Open wire systems are mainly used for long distance carrier transmission. Paired coppers are used for local communication and signaling. Quad copper cables for carrier and voice frequency transmission are used in some sections.

2.3. After 1970

After 1970 Cambodia became into political trouble and fell into civil war. Especially in 1975-1979 whole Cambodia under a brutal rule of Khmer Rough regime, Led Cambodia worked to death made Cambodia down to zero. At that time Trains main used for army

and military purpose only.

2.4. From 1979-untill now

Even though civil strife, Landmine, and environment threaten still remaining, but transport is in needed during 1979-1999. Railway of Cambodia run in poor condition through dangerously of landmine and civil strife following 20 years, the railway in both line were severely damaged with some parts entirely destroyed. Rails service from early 1980s. Train operating 7 trains per day in 2002, and 852 trains in 2006 in 2000 (424 trains by the North line, it mean 2 to 3 trains per day and 428 trains per year of the South (1 to 2 trains per day) by South line, maximum speed of 15 km 30 km per hour.

Diesel Locomotive in used 22, shunting Locomotive 7 with 284 all kind of wagons and 48 tank wagons. Physical infrastructure of railways are old and damaged, repairs have been carried out since the original track remains. The line has never been renewed or improved and designing for an axle load limit of only 10 tons. Most of the track is about 60 years old or more, which was the last of years of the western ended being some 50 years old. There are 174 bridges, and culvert and culvert-boxes 242 on the Northern lines in poor condition.

The speeds are restricted to 10-15 km/h at the bridge sites. Physical Infrastructure on the Southern Line is also in poor condition. These have received temporary repairs. The line was built to accommodate axle loads up to 20 tons, but in present conditions a limit of 15 tons is applied in practice. In present time could say that RRC is able to operate those trains without signaling system, operating only by radio transmitter equipped at major stations.

The main types of products transport by rail are: Petroleum, Cement, Fertilizer, Container, Construction Material, Agriculture product, Rice product, Sugar, Miscellaneous, Service and others. The agencies are as show on Table 1.

Table 1 Current Transport Agencies of RRC

No	Name of Company	Type of Transport
1	SOKIMEX	Petroleum
2	CALTEX	Petroleum
3	RTC	Cement
4	Hour Hout	Heavy-Duty Cargo
5	Lim Hour	Cement
6	Master Railway Transport	Container
7	Lim	Agriculture products

(Source: Royal Railway of Cambodia)

With the main type of products and agencies above, next section will review the previous action of rail traffic performance.

Ⅲ. CURRENT SITUATION OF CAMBODIAN RAILWAYS

The infrastructure development of Railways of Cambodia from the first start building until present time physical railways infrastructure not yet improve and develop. The North line is over 60 years old from 1940s until now, and also the South line as the same condition. It was devastated, rail service ceased during the war, but resumed in the early 1980s. Guerrilla activities, however, continued to disrupt the service.

The North Line: the 48 km stretch, Poipet- Sisophon, linking Cambodia to Thailand. Bridges were blown[1] out and locomotives and wagons burnt. 200 km equal 52% of railways infrastructure in the North and 47 (96%) stations were damaged by land mines. 48 bridges (28%) of about 1,159 meters long and 38 (16%) culverts of about 226 meters were destroyer. Signaling and telecommunication systems on the network wear completely damaged. Normal service was restored in the early 1980's until get peace full at last of 1990s.

While the South Line, 110 km (41.50 % of the total South line) of railways infrastructure was damaged by war, land mine and flooding, 70% sleeper need to replace, 16 bridges (17.02%) and culvert of 566.56 meters long were destroyed by the flooding and sea water, 24 stations (85.71%) were damaged by war, Signaling and telecommunication systems on the network were completely damaged, HF Radio transmitter is used for telecommunication. Rolling stock is old and inadequately maintained 16 diesel locomotives, 6 diesel shunting locomotives, Steam locomotive 10, passenger Coach 28 and 248 all kind of freight wagon are used in present operating.

Since the rails remain in a poor state of repair, the maximum operating speed is 20 to 30 kilometers per hour. As the systems of signals and communications are inadequate, the service consists of only one train a day on each line. The traffic volume is therefore much lower than pre-war levels, and the RRC has long been in deficit. The RRC is a state-owned enterprise under the supervision of the Ministry of Public Works and Transport (MPWT). However, the RRC is not an autonomous body.

Although physical infrastructure in very poor condition by war such as land mine civil strife or natural disaster, during that condition railway run serve the service from early in 1980s.

Due to railway infrastructure in poor condition, what had done during the poor condition? In the following section will review about rail transport performance from recently previous annual report.

3.1. Railways Transport from 1969-2005

[1] Mine explosion damage was inflicted on a 200 km stretch of the Northern Line, and a 110 km stretch on the Southern line; and 64 bridges and 71 stations were destroyed.

Before 1970, Railway of Cambodia in very good condition, especially in 1969-1970, the Cambodian railway[2] system was at its peak operating 37 trains per day, with 69 locomotives, more than 900 wagons of all types, carrying 2.4 million passenger and 360,000 tons, largely on the North line (273,000 tons) as the Sihanoukville Port had just been completed and was still receiving only limited cargo. However, the service from Bangkok to Battambang was suspended on December, 1961. In Table 2 show Overall Traffic of RRC from 1969-2005.

Table 2 RRC Overall Traffic (Tonnes) from 1969-2005

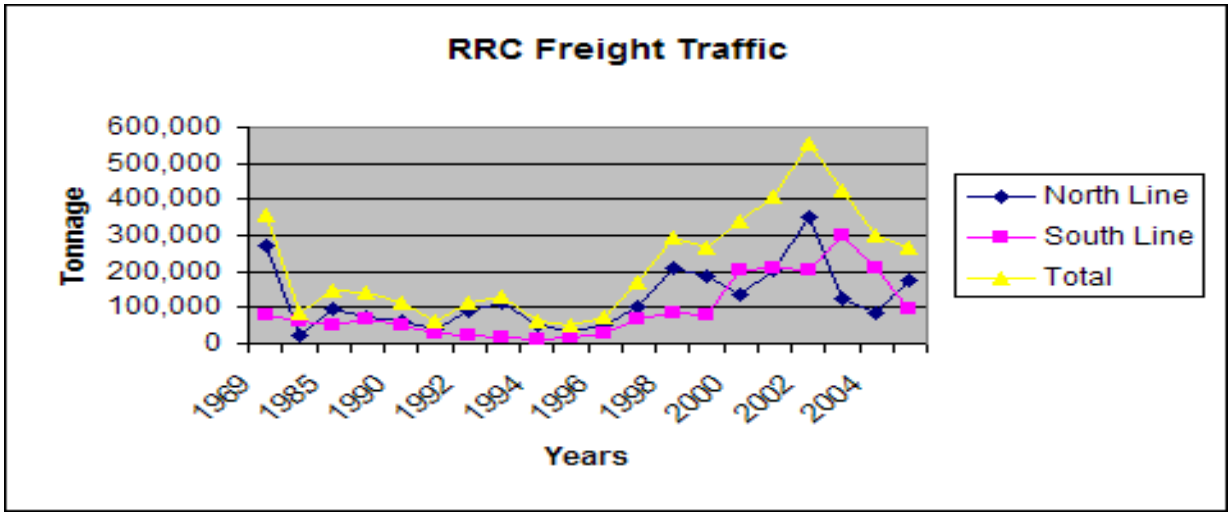
Year	North Line	South Line	Total	Year	North Line	South Line	Total
1969	273,000	81,000	354,000	**1996**	50,180	25,807	75,987
1981	21,200	62,600	83,800	**1997**	102,334	67,419	169,753
1985	95,400	53,400	148,800	**1998**	208,010	86,441	294,451
1989	74,000	65,600	139,600	**1999**	189,270	79,122	268,392
1990	64,300	51,000	115,300	**2000**	137,484	202,672	340,156
1991	38,000	26,400	64,400	**2001**	201,452	208,251	409,703
1992	90,800	23,700	114,500	**2002**	353,654	203,653	557,307
1993	114,200	15,600	129,800	**2003**	122,508	300,192	422,700
1994	48,200	12,600	60,800	**2004**	85,352	211,865	297,217
1995	33,290	16,500	49,790	**2005**	174,005	94,795	268,800

(Source: Royal Railway of Cambodia)

From the previous time of 1969-2005 in Table 2, in 1969 the North Line was carrying 273,000 tons but declined substantially thereafter. Traffic has been regaining some strength on the North Line after 1997. But growth has not been continuous with substantial fluctuations taking place. From 1999 onwards, the South Line showed substantial growth until 2003, growing from approximately 80,000 tons to 300,000 tons. This railway expansion was in accordance with the expansion at the Sihanoukville Port. After 2003 the decline in the South Line traffic was due to the drop in the non-containerized traffic at the Sihanoukville Port.

[2] RRC had a staff of 3,400 employees, 69 locomotives and 928 wagons of all types, an average of 37 trains a day were running at an average speed of 60 km/h;

Figure 1 RRC Overall Freight Traffic (tons) FY 1969-2005



(Source: Royal Railway of Cambodia)

3.2. Railway Freight Traffic (1998-2005)

Railway freight traffic from 1998 to 2005 shown on Table 3 had the top of its traffic at 2001 to 2003. Freight traffic on the North Line with 354,000 (metric) tons was at its maximum in 2002 and started declining thereafter. On the South line, traffic was at 200,000 tons and above from year 2000 to 2003, starting to decline thereafter. Reasons for the decline on both lines are analyzed below.

3.2.1. Traffic by Commodity

3.2.1.1 Cement: Cement is the most commodity transport by railway all both line. In 1998, 1999 cement traffic as near the top of the North 184,065 tons in 1998 and 157,080 tons in 1999. But 2000 and 2001 figure down to 26,625 and 78,525 down 130,455 from 1999-2000, during this South Lines up from 52,360 in 1999 to 151,490 in 2000 up 99,130 tons. It means that nearly the same of the North lost as same gain in the South Line. The top of cement traffic the North Line by 2002 how ever the South line got the top of cement traffic by 2003.

3.2.1.2. Petroleum: The oil terminal was completed in 1996 in the Sihanoukville area and this has meant that more petroleum products have been transited through this terminal up to 2003. Traditionally 25 to 30 % of the diesel oil was transported by rail for the Phnom Penh and Battambang markets.

Table 3 gives for the period of 1998-2005 the railway freight traffic broken down by major commodity. RRC was already in 1998 a very specialized railway transporting essentially

cement and diesel (90 %). The specialization[3] has increased recently with these two commodities accounting for 98 % of the total freight traffic in 2005.

Traffic is concentrated in two commodities each of which is subject to large annual fluctuations. The high level of fluctuations shows that the railway users are very sensitive to changes in market forces and changes in the price differential between road and rail. After all this is not surprising as they are both railways and road transporters.

Table 3 Railway Freight Traffic (1998-2005)

Commodities	Fiscal Year (Metric Tons)							
	1998	1999	2000	2001	2002	2003	2004	2005
I - North Line Phnom Penh - Battambang – Sisophon								
Petroleum Product	18,785	12,950	11,593	27,227	23,475	18,945	15,160	9,240
Cement	184,065	157,080	26,625	78,525	230,566	43,674	48,140	159,430
Others	5,160	19,238	99,266	95,700	99,613	59,889	22,052	5,335
Total	**208,010**	**189,268**	**137,484**	**201,452**	**353,654**	**122,508**	**85,352**	**174,005**
II - South Line Phnom Penh – Sihanoukville								
Petroleum Product	20,080	14,000	12,874	35,095	80,815	114,894	117,971	69,880
Cement	40,746	52,360	151,490	156,553	96,975	175,662	87,836	24,915
Others	25,325	12,762	28,308	16,603	25,863	10,136	6,058	m
Total	**86,151**	**79,122**	**202,672**	**208,251**	**203,653**	**300,692**	**211,865**	**94,795**
Both Lines								
Petroleum Product	38,865	26,950	24,467	62,322	104,290	133,839	133,131	79,120
Cement	224,811	209,440	188,115	23,5078	327,541	219,336	135,976	184,345
Others	30,485	32,000	127,574	112,303	125,476	70,025	28,110	5,335
Total	**294,161**	**268,390**	**340,156**	**409,703**	**557,307**	**423,200**	**297,217**	**268,800**

(Source: Royal Railway of Cambodia)

3.2.2. Reasons for the Decline in Freight Traffic

By the transport performance on overall traffic at the present from 1998-2005

[3] The only exception is during the 2000-2002 period where Cambodia was receiving rice from the UN food program and also importing rice from Thailand. Domestic supply has now improved and the country does not face anymore an excess demand situation.

shown 2002 railways got the top of its transport performance at the year of 2001, 2002 and 2003, and then decline from year to year. The North Line from 2002 to 2005 lost 176,649 tons and the South Line 108,683 tons total 285,332 tons. An analysis of the decline by commodities is revealing (see Table 4 below).

Cambodia has improved its rice production and has become almost entirely self-sufficient except when severe droughts occur. Therefore this traffic from Thailand on the North and South Line has disappeared. Sugar was imported from Thailand apparently to be sold to Vietnam where excess demand was prevailing. This situation has changed as Vietnam has built sugar refineries.

By far the greatest part (50 %) of the overall drop in traffic comes from less cement being transported by rail. On the North Line, with the completion of the rehabilitation of Highway 5 (from Sisophon to Phnom Penh), much traffic has switched to the road. In short, most of the reasons behind the decline are market related. However, RRC has not been able to improve its service when competition from the highways became stronger. There is also a perception that extensive overloading prevails on Highway 5 from Thailand.

Table 4 Decline in Traffic from 2002 to 2005

Goods	Decline (T) on South Line	Decline (T) on North Line	Total Decline (T)
Cement	72,060	71,136	143,196
Diesel	10,935	14,235	25,170
Rice	11,033	42,384	53,417
Sugar	M	23,128	23,128
Service	14,655	12,681	27,336
Miscellaneous	M	12,845	12,845
Other	M	240	240
Total	**108,683**	**176,649**	**285,332**

(Source: Business Case Analysis of the Railway Operating Company, Ministry of Public Work and Transport and Canarail Consultant)

Through this decline, railway agents and users have always complained of the poor reliability and frequent derailments following experiences limited. The lack of maintenance caused of funding and financial limited. So derailments always happen that these make the gaps and obstacles in meeting buyers' or user's demand in time.

Otherwise a huge amount of cement and Petroleum are presently being imported from

Thailand by road. Railway market share of cement traffic from the north is only 20 % and is declining. Some railway users such as Caltex have drastically reduced their amount transported by rail.

3.2.2.1 Road Competition

This section is simply to illustrate the extent of the traffic increase on road when road network improved and developed. NR 5 parallel with railway the North line and NR 2 NR3 and NR 4 parallel with railway the South line.

- NR 5 or Highway 5 was emergency repair by UNDP fund 1992-1993 and also had fully rehabilitated from 1992-1993 by assistance of Thailand's Fund and USAID's also assistance fund for reconstruction Bridge on road 5 and 6 during 1992-1996, ADB also support for rehabilitation NR 5 during 2006-2008.
- NR 2, assistant from Japan fund have rehabilitation from 2002-20034.
- NR 3 road rehabilitation from 2002-2004 by WB and NR 4 road rehabilitation 1994-1996. Nowadays NR 4 on contracted of BOT. Some parts of road have been expanded from 2 lanes to 4 lanes.
- Below, road traffic information5 on Highway 5 is presented for the period of 1994-2004. The road was in the past in very poor condition and was finally fully rehabilitated in year 2004.

It is clear that traffic has been growing significantly since the road rehabilitation. The traffic has tripled between 2001 and 2005, accounting for an average annual compound growth of 31 %. For trucks only, the increase was of the order of 2.3 times or a 23 % average annual compounded growth. Of course the increase has been more significant from 2004 to 2005 when the road was finally completed (a 50 % increase for trucks).

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[4] ADB project number 37269, November 2006, Annex 3 Table A3-1

[5] Comparing road traffic data over a period of time is not easy. Firstly, traffic data usually come from different sources implying that traffic counts have been made at different stations and at different times of the year. Furthermore, some traffic counts are 7 days 24 hours traffic counts when others are simple 12 hours - one day traffic counts. Correcting for these variations is simply not possible and one has therefore to be aware of the inherent limitation of the comparison.

Table 5　Road Traffic Comparison on Highway 5 (1994-2005)

	1993 (b)	1997 ©	2001 (d)	2004 (e)	2005 (f)
AADT(a)	1,250	1,700	1,484	3,364	4,431
Heavy Trucks/day	90	87	118	182	272

(a) AADT: Average Annual Daily Traffic.

(b) Source: MPWT, October 1993 - 12 hours survey - PK 175 South of Pursat.

(c) Source: MPWT and JOC - 12 hours - Average of 2 stations: Battambang-Pursat and Pursat-Kg Chhnang.

(d) Source: SMEC Report - 24 hours - December 2001, PK 184, before Pursat.

(e) Source: Average of 5 stations on Highway 5 - 24 hours - 7 days survey by JICA - 24-30/06/2004.

(f) Source: Average of 3 stations on Highway 5 - 12 hours - 28/04/2005 to 30/05/2005.

12 hours traffic have been transformed to 24 hours traffic using 1.2 as expansion factor.

(Source: Business Case Analysis of the Railway Operating Company, Ministry of Public Work and Transport and Canarail Consultant)

3.2.2.2 Poor Condition of Locomotives and Workshops

Royal Railways of Cambodia has two workshops, one for locomotives and one for wagons and coaches. These workshops were constructed about 1929 when the railway was begun, which are separated by half a kilometer of distance along the line to Phnom Penh Station. The locomotive workshop was established for repairing steam locomotives up to and including general rebuilding. When diesels were introduced some specialized equipment was installed in the same shops to maintain them and test them, but in the main, the workshop continues to be configured for steam locomotive operations, and, assuming materials were on hand, could do so today, according to management. Unfortunately, use of steam locomotives was officially discontinued in 1995-6, although 8 to 10 were prudently stored.

The lack of out-sources substantial amounts of electrical and mechanical work to private sector contractors and the absence of in-depth capacity in Cambodia for diesel repairs either within or outside of the RRC, places the railway in the position of complete reliance on the original equipment diesel manufacturers for spare parts and services. France has fairly consistently provided assistance to RRC so that the fleet of Alstom main line locomotives has remained in service for the most part.

IV. ANALYSIS AND FOCUS OF FUTURE TRAFFIC BY COMMODITY

There are many categories of railway traffic could be considered in the future. The best three major categories appear attractive for rails are: cement, petroleum and Container. Below key freight commodities are analyzed in detail to assess their real potential as future railway traffic related to:

- Normal growth with GDP;
- Diverted traffic from roads: Number 4 (Phnom Penh-Sihanoukville), Number 3 (Kampot-Phnom Penh) and Number 5 (Poipet-Phnom Penh);
- Diverted traffic from sea (container traffic from Thailand diverted from sea to rail;
- Generated traffic from new major economic development projects (e.g. Kampot cement plant).

Market conditions, however, are changing and the forecast of traffic commodities must be carried out within the following context:

- The establishment of two new cement factories near Kampot will modify the whole transportation pattern of cement in Cambodia;
- Highway infrastructure will continue to improve, reducing the net transport cost for truck operators, however;
- There is a place for container traffic in railway operations.

4.1. Cement

4.1.1. Domestic Production of Cement

Cambodia currently has no cement factory and almost all the cement consumed is imported from Thailand. It is estimated[6] that the overall consumption of cement in the country was 1.2 million tons in 2005. Since 1998, cement consumption has been growing at a fast rate, approximately twice as fast as GDP growth. Growth of 7% to 10% implies cement consumption from 1.7 million tons to 2 million tons in 2010.

South line, there are three of cement manufacturing are going to establish soon. Before 2002, the majority of cement was entered Cambodia from Thailand by sea (small vessel) and also through Sihanoukville Port. After 2002, with improved road conditions on highway 5 to Thailand, the balance shifted to the north (60 %). This included a switch to using the Northern line for which RRC was not well prepared. In the south, the opening of two private ports (Srae Ambel and Oknya Mong Port) also may have contributed to the

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[6] This is a conservative estimate. Customs data suggest 1.15 million tons while other estimate (Business Press Number 87, 30 Jan - 5 February 2006) mentions a figure of 1.5 million tons.

temporary decline[7] in the volume of cement transiting through the Sihanoukville Port and moving by rail to Phnom Penh.

4.1.1.1. Siam Cement

Siam cement of Thailand is located approximately 6 km from the South Line, with its local partner company Kampot Cement (currently the largest distributor of cement in the country - 42 % of the total market share) is constructing a cement factory in Kampot province's Touk Meas district this new dry-process cement plant with an initial installed capacity of 1 million tons per year. The Connection to the site by a branch line will be required. The plant at start-up to be required annual raw materials inputs of 100,000 tons of coal, 50,000 tons of gypsum, 100,000 tons of biomass and 20,000 tons of heavy fuel oil. The plant is planned to come on stream progressively from June 2007. The output from the plant is primarily destined for transport to Phnom Penh, for distribution to the market there and to the north, as well as for export to the Mekong Delta region via the inland waters of the Mekong rivers system. The raw materials for the plant are contemplated to be sourced through the port of Sihanoukville and, as regards the biomass, from the Seam Reap area via the river port of Phnom Penh or via the northern railway line.

4.1.1.2. Giant Lafarge

Lafarge Group, a building material maker of French, and AZ Group, a Cambodian company set the re-establishment of a previous production site, at Kampot Switch, some 50 Km farther south on the South Line. The plant site was formerly connected to, and is located approximately 11km from the South Line. This plant,a dry-process cement plant with an installed capacity of 1million tons per year of cement, is being planned in which the largest cement production group in the world. The plant site and the local limestone deposit are controlled by the AZ Group, which is understood to be negotiating a joint venture with Lafarge. Connection by a branch line along the former railway alignment will be required. Apart from the local limestone, the plant is understood at start-up to require annual raw materials inputs of 250,000 tons of coal and 60,000 tons of gypsum. The plant is planned to come on stream by late 2008 or early 2009. The output from the plant is primarily destined for transport to Phnom Penh, for distribution to the market there and to the north as well as to the Mekong Delta region via the inland waters of the Mekong rivers system. The raw materials for the plant are contemplated to be sourced through the port at Sihanoukville.

4.1.1.3. Thai Boon Roong Cement

Thai Boon Roong Cement another cement plant located 5.5 Km along the same

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[7] In 2001 cement throughput in Sihanoukville Port was 600,000 tons, falling to 65,850 tons in 2005, however current shipments (now mainly by truck) show a strong rebound for SHVP.

branch line, has announced plans for a third cement plant for the future; which is a diversified Cambodian company with interests in trucking shipping and hotel ownership/operation and is now proceeding with the construction of a cement factory about 13 km northeast of the old cement factory. Discussions with this company concluded with a strong indication that it was most unlikely to be a user of rail, especially given the owner's trucking interests, scepticism about rail service improvements and recent investment in a large cement road tanker fleet. Planned capacity is understood to be 400,000 tones per year and production is expected to start around the last quarter of 2008.

Taking a proportion of the Kampot and Lafarge plants into account, the traffic available to rail is as follows:

Table 6　Cement Production Forecast

(Thousand Ton, %)

Plant	2007	2008	2009	2010	2015	2020
Est.Consumption Low	1,819	1,946	2,083	2,228	3,125	4,384
Est.Consumption High	1,904	2,132	2,346	2,627	4,630	8,160
Kampot Production	456	1,132	1,300	1,500	2,000	2,500
Rail Share	50%	60%	80%	80%	80%	80%
Rail Tons	2,28	6,79	1,040	1,200	1,600	2,000
Lafarge Production		500	1,000	1,200	1,700	2,200
Rail Share		50%	70%	80%	80%	80%
Rail Tons		250	700	960	1,360	1,760
Total Rail Tons	228	929	1,740	2,160	2,960	3,780

(Source: Business Case Analysis of the Railway Operating Company, Ministry of Public Work and Transport and Canarail Consultant)

Cement products is in considering the potential rail traffic from the cement plants (and potential inbound traffic to the cement plants discussed in the following section) that rail access to all three cement plants will require the construction or reconstruction of branch lines to connect the plants with the South Line. The construction of these branch

lines is not included with in the rehabilitation project to be funded by the ADB, and consequently do not form part of the Cambodian Rail System to be concessioned. The concessionaire will be responsible for working with the cement companies to reach a business arrangement which will permit the inbound and outbound traffic of these plants to move by rail.

4.1.2. Cement Inputs

Most of the raw material for the cement production limestone will come from quarries adjacent to the cement factories. Other raw materials needed are coal from Indonesia as fuel for the kiln and gypsum from Thailand to be mixed with clinker to get the powdered cement. The Kampot process will also use heavy fuel oil and biomass. The Kampot process will require coal equivalent to 8.8% of cement production by tonnage; heavy fuel oil equal to 1.8% of cement production by tonnage, and gypsum equivalent to 4.4% of cement production by tonnage. The Lafarge plant will require coal equal to 25% of cement production by tonnage, and gypsum equal to 6% of cement production by tonnage.

Taking the data from the companies and the factors of production, yields the following tons forecast for inputs.

Table 7 Cement Raw Materials Inputs

(Thousand Ton)

Input	2007	2008	2009	2010	2015	2020
Coal	40	225	365	433	602	771
HFO	8	20	23	27	35	44
Gypsum	20	80	117	138	190	242

(Source: Business Case Analysis of the Railway Operating Company, Ministry of Public Work and Transport and Canarail Consultant)

These inputs will be imported for the foreseeable future, therefore good port facilities will be important. Sihanoukville, 92 Km distant from Lafarge and 136 from Kampot, is the favoured port because of its proximity, however, another contender could be the private Oknha Mong port which is approximately 44 km farther.. The railway would be advantaged by a choice of Sihanoukville as the port of import for the cement inputs, and arrangements are advancing for using that port. However, financial estimates might also contemplate Oknha Mong as an alternate case, with a required branch line to connect that port to the South Line.

4.1.3. Truck Competition

For a number of reasons rail would be the preferred mode for cement transportation if it functioned reliably. Even in its present deteriorated state the railway controls some 15-20% of import cement tonnage. It is worth noting that all cement travels as bagged

product today.

Road transport is limited by both road and vehicle capacity:

- The volumes of cement discussed above net of import volumes they displace would result in the need for significant truck capacity additions/realignments. Economics favour semi-trailers but the present domestic fleet consists mostly of "straight jobs" having a much lower carrying capacity for heavy, dense products such as cement because they have fewer axles. If axle loading limits were observed, and a major thrust will be made in that direction, the limited capacity of these trucks would severely limit use of road transport for long distances cement cargoes as opposed to local deliveries.
- The southern part of Cambodia is served by Route 4 a new toll road from Phnom Penh to Sihanoukville with tolls and weight limits and Route 3 an old road east of Route 4 connecting Kampot with Phnom Penh. This road is 2 lanes and in deplorable condition but would afford the most direct connection to Phnom Penh for the cement plants.
- The current distribution method for cement breaks down most inbound cargoes, and most are warehoused and subsequently delivered in local trucks so that the ability of trucks moving direct from the cement plant to serve worksites directly has less competitive significance today.[8] Warehousing appears to be part of the optimum distribution model until bulk distribution becomes more prevalent.
- The railway currently uses retired 40 foot containers mounted on flat wagons for transporting bagged cement. The containers perform the function of both transport vehicle and temporary warehouse and are thus much favoured, but even so wagon equipment turnover is rapid. The plan advanced for future cement transport by rail would continue this practice.

Even given the theoretical effect of earning a repositioning credit on empty containers returned to Phnom Penh with cement loads,[9] the proposed rail tariff produces a very clear economic advantage, all other things being equal.

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[8] However, the more progressive cement companies are moving toward bulk distribution and Kampot Cement is planning for this at its plant.

[9] Such a credit is highly improbable unless the container were thoroughly washed out because liner companies would soon object to returned containers with cement residue.

Table 8 Truck Operating Costs for Cement

Item	Truck Operating Cost per Ton[10]	
	w/o Reposition 72%	w. Reposition 28%
Variable Costs	4.71	4.71
Fixed Costs	1.05	1.05
Total Costs	5.76	5.76
Repositioning Credit $100		4.00
Total	5.76	1.76
Wtd, Average Cost	4.64	
Rail Tariff	3.25	
Percent Discount	30%	

(Source: Business Case Analysis of the Railway Operating Company, Ministry of Public Work and Transport and Canarail Consultant)

4.1.4. Offsetting Loss of Inbound Cement

Of course the motivation for establishing cement plants in Cambodia is to displace cement which today is imported from Thailand at a high cost to serve an exploding domestic market for cement as the Cambodian economy takes off. While formerly the railway enjoyed a large fraction of imported cement movements, today it enjoys only a small fraction of the traffic. As a consequence, the railway has "everything to gain and little to lose" from the substitution of domestic production for imported cement.

Table 9 Cement Rail Traffic: Import and Domestic Production

(Thousand Ton)

Item	2006	2007	2008	2009	2010	2015	2020
Est. Dom. Production	0	458	1,700	2,000	2,200	4,400	5,600
Import South Line	69	55	9	2	2	2	12
Import North Line	318	255	40	11	17	20	130
Import By Rail Tot.	387	310	49	13	19	22	142
Dom. Prod. By Rail		228	929	1,740	2,160	2,960	3,760
Net Tot. Rail	387	538	978	1,753	2,179	2,982	3,902

(Source: Business Case Analysis of the Railway Operating Company, Ministry of Public Work and Transport and Canarail Consultant)

[10] Economic assessment of Road Vehicle Operating Costs, JARTS draft Final Report, 26 June 2006, Phnom Penh, section 6.

The following table illustrates the effect of gains from domestic production as offset by import losses.

As can be seen above, if the ROC acts swiftly to capture local production of cement it will be greatly advantaged, even though because of proximity to consumption it will not receive the same length of haul as it does with imports. High efficiency shuttle trains can produce very significant profits for the ROC with the tonnages indicated.

4.2. Petroleum Products

Currently Cambodia has no refinery; therefore, all petroleum products are imported. Imported petroleum products come from three different sources: Malaysia, Singapore and Thailand by sea via the Sihanoukville oil terminal in the south, from Thailand by road in the north, and via Vietnam by road or through the Mekong river system in the east

Traditionally, petroleum products have been a mainstay of railway traffic. Poor roads and government safety concerns combine to make the railway the mode of choice. Gradually, as the railway has deteriorated and roads improved, the pendulum has swung toward trucks, even though there remains a strong preference for rail among government officials and petroleum companies.

There are two players in the rail petroleum market, SOKIMEX, the local petroleum company, and the Caltex division of Chevron Oil Company. SOKIMEX, with about a one-third of the local market, is already set-up for rail and is using rail for 23% of its traffic versus inland water for 25% and road for 52%. This reflects a decrease for rail and an increase for road transport. This could turn around quickly with an upgrading of the South Line.

Caltex, with about 10% market share, used rail until a serious and costly derailment occurred several years ago. 2004 was the last year for its traffic. Within the organization, however, a strong preference for rail exists, if the rail is rehabilitated. With this in mind, Caltex has retained some tank wagons. It is believed that when the South Line is rehabilitated this traffic will be available.

Offshore oil and gas discoveries in Cambodia are promising. In the high traffic scenario it is assumed that in year 2015 an oil refinery[11] has been constructed in the south and starts production with 750,000 tons of diesel and 750,000 tons of gasoline per year. The diesel production will be for the domestic market, while large volume of the gasoline production will be exported. It is assumed the oil refinery will be connected to the railroad and 80 % of its production will be sent by rail.

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[11] Petroleum Authority of Cambodia is conducting a feasibility study on the establishment of an oil refinery in the south. Alternative locations are being studied and engineering design is being prepared. Chevron is conducting offshore oil and gas exploration.

With a rehabilitated railway infrastructure, other flammable petroleum products could be transported by rail. In the high traffic scenario, gasoline is also transported by rail. Jet fuel could eventually be a candidate. PTT brings LPG products by sea to Cambodia via the oil terminal in Sihanoukville and by truck through Poipet. The LPG market is too small and scattered and therefore does not offer a good prospect for rail transportation.

4.2.1. Truck and Water Competition for Petroleum Products

Comparing net transport costs of alternative routes for petroleum products is, therefore, an important exercise (see Table 10 below).

Table 10 Net Transport Cost ($/T) of Diesel to Phnom Penh

	(a) Thailand: Vessel Cambodia: Road	(b) Thailand: Vessel Cambodia: Rail	(C) Thailand: Road Cambodia: Road	(d) Thailand: Rail Cambodia: Rail
Distance (km)	654	689	658	648
Duration (hours)	42	44	13	19
Total Cost ($/T)	17.6	12.6	27.6	18.4
Cambodia Cost ($/T)	12	7	18	10

Note: Info comes from PTT, Sokimex and RRC; diesel is assumed to be delivered in Phnom Penh.
(a) Based on diesel coming by PTT from Thailand to SHV oil terminal and continuing by truck.
(b) Based on diesel coming by PTT from Thailand to SHV oil terminal and continuing by rail.
(c) Based on PTT cost of sending diesel by road to Cambodia and continuing by truck.
(d) Based on PTT cost of sending diesel by rail from Thailand to Phnom Penh.

(Source: Business Case Analysis of the Railway Operating Company, Ministry of Public Work and Transport and Canarail Consultant)

From the above table, it is clear that bringing diesel by rail from the Sihanoukville oil terminal offers the best cost advantage. Bringing fuel by rail from Thailand does not offer any cost advantage and was not mentioned as an interesting alternative[12] by PTT. Once the rail line is rehabilitated, except for the southernmost market, most of the fuel going to Phnom Penh could be carried by rail. Petroleum product consumption is assumed to grow with GDP, i.e. at 4 % in the low scenario and 7 % with the high scenario. The following table summarizes the rail traffic history and potential by year.

[12] The alternative does not present any cost advantage, though there is some time saving. An additional reason for not considering such alternative is that SRT is presently facing a shortage of tankers and this is affecting negatively PTT.

Table 11　Rail Petroleum Product Movements History and Potential

(Thousand Ton)

	2004	2005	2006	2007	2008	2009	2010
CAM Total	1,000	1,000	1,040	1,082	1,125	1,170	1,217
SOKIMEX	330	300	312	324	337	351	365
SOK Rail	70	70	83	87	90	94	167
CALTEX	100	100	104	108	112	117	122
CAL Rail	8	m	0	M	61	66	70

(Source: Business Case Analysis of the Railway Operating Company, Ministry of Public Work and Transport and Canarail Consultant)

4.3. Containers

RRC did carry container traffic from Sihanoukville Port from 1999 until now. The experience was a failure because RRC could not offer reliable service. Container traffic is definitely a potential traffic. Estimating this potential, however, requires conducting the analysis market segment by market segment. Containers are classified between export and import containers and between “garment containers” and “non garment containers”.

Currently, most containers move through Sihanoukville Port (87 %) with the remaining container traffic coming to Phnom Penh Port using the Mekong River. The Mekong route is increasing rapidly for certain types of traffic, but the current Phnom Penh Port is small and constrained to about 100,000 annual TEU's. The container traffic in both ports is quite imbalanced. Most of the import containers are full (laden containers) while 50 % of Sihanoukville Port container exports are empty and 75 % for Phnom Penh Port.

The garment industry is definitely the prime user of container service in Cambodia. At Sihanoukville Port, 80 % of the containerized exports are garment products while 45 % of the containerized imports are destined to the garment industry. Material for the garment industry comes mostly from China, while exports are destined to USA and Europe via Singapore or Malaysia. The garment industry has managed to survive and even grow after the termination of the quota period. Under the low scenario, garment industry output (and containers) is growing at the same pace as GDP. For the high scenario, garment industry output is assumed to grow at 10 % per annum.

There is a whole variety of products which come under the classification “Non garment containers” or “Other containers”. They consist mostly of construction material, household products, aluminium empty cans and food products. The average weight of these containers is heavier than for the garment industry.

Comparing alternative transport costs (see below) permits one to conclude that, once the missing link with Thailand is re-established, there is a cost advantage to bringing Thai containers to and from Cambodia by rail instead of by sea.

Table 12 Net Transport Cost ($/TEU) of Thai Containers to Phnom Penh

	(a)	(b)	(C)	(d)
	Thailand: Cambodia:	Thailand: Cambodia: Rail	Thailand: Road Cambodia:	Thailand: Rail Cambodia: Rail
Distance (km)	828	813	648	696
Duration (hours)	270	272	13	19.5
Total Cost ($/TEU)	983	953	404	317.5
($/T)	22	19	17	13
Note: Info comes from Lat Krabang ICD (Thailand), SRT, RRC and SHVP. (a) Thai containers are coming from Laem Chabang but they go to Singapore first. (b) Thai containers are coming from Laem Chabang but they go to Singapore first. (c) Thai containers come from Laem Chabang/Lat Krabang by road to Phnom Penh. (d) Thai containers come from Laem Chabang/Lat Krabang by rail to Phnom Penh.				

(Source: Business Case Analysis of the Railway Operating Company, Ministry of Public Work and Transport and Canarail Consultant)

From the above table (column d) there is a clear advantage (cost and time) of moving Thai containers to Cambodia by rail. The main reason is the absence of a direct container service line between Bangkok Laem Chabang and Sihanoukville Port.

It is estimated that containers originating from Thailand constitute approximately 20 % of the container traffic of Sihanoukville Port. This traffic has, therefore, been removed from the total container traffic of the Port in assessing the potential rail container business at Sihanoukville Port.

Another step in assessing the potential rail container business at Sihanoukville Port consists in splitting the potential container traffic among Sihanoukville Port, Oknha Mong Port, and Phnom Penh Port. Phnom Penh Port container traffic will continue to grow faster than Sihanoukville Port traffic until it reaches a maximum of 100,000 TEU per year. Even so, this maximum capacity will be reached only if the Phnom Penh Port manages to operate efficiently its ICD, which is under construction at the outskirts of Phnom Penh along highway 5.

There is significant potential for immediate capture of the container transport of imported raw materials and the export of finished products for the Cambodian garments industry, which is centered around Phnom Penh. This is reported to currently generate around 12,000 TEU movements per month. The Port of Sihanoukville is the primary entry

port source of raw materials and the logical export port if reliable and safe transport can be assured. Due to poor reliability in the past, the railway lost this market to road and air freight transport competition. The ADB has agreed to finance the reconnection of the South Line to the port and the rehabilitation of the railway tracks inside the port. Improved direct access by rail to container staging yards and vessels and a new common user bulk raw materials handling facility with stockpiles area adjacent to the railway network has been negotiated by the Transaction Advisor with the Port Authority. This improved access should enhance the competitive position of rail in the traffic through Sihanoukville Port.

Bringing containers by rail from Sihanoukville can be a cost effective proposition with the full rehabilitation of the South Line. The forecasted traffic at O.Mong Port may justify construction of the 40 km branch expected to be in operation in 2015.

Above all, the rail container traffic from Sihanoukville Port will be facilitated by the completion of the Phnom Penh container yard (ICD type) at Km 15 of the railway in Phnom Penh. As part of the rehabilitation project, the ADB has agreed to finance a spur line extension from the southern railway line to a seven hectare Dry Port with bonded warehouse and customs facilities located 14 kilometres south of Phnom Penh on National Highway 4 and close to the Ring Road, which provides an alternative connection to Phnom Penh. The Bonded Dry Port is owned and operated by the Sihanoukville Port Authority. This location offers an excellent potential for inter-modal connections and a base for the consolidation and distribution of container cargoes for the garments industry. A new Special Economic Zone is located diagonally opposite the Dry Port.

In addition to improved rail access to the Sihanoukville Port and new rail access to the Phnom Penh dry port, as part of the rehabilitation project, the ADB has agreed to finance the rehabilitation of the commercial spur line which extends for 7 km from Phnom Penh Railway Station to the original site of Phnom Penh Port, which is now known as the Green Trade Warehouse, which includes numerous warehouse facilities in varying stages of disrepair. The GTW has marshalling yards totalling 3.5 km in length, which will also be rehabilitated. The spur line also connects to the Sokimex Fuel Storage Depot at the Port. The Phnom Penh Port Authority is constructing an Inland Container Depot immediately adjacent to the spur line to the Sokimex facility. This rehabilitation work will enable a direct rail connection to inland water transport facilities at the GTW. At present these comprise an unused and probably unusable pier dating from French colonial times and informal vessel to shore transfer arrangements which will need to be regularized.

The following table shows the Low and High container scenarios in TEU for the

railway.[13]

Item	2005	2006	2007	2008	2009	2010	2015	2020	2030
Avg. wt.Garment export TEU (T)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Avg. wt. Garment import TEU (T)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Avg. wt. of import TEU SHV (T)	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Avg wt. of export TEU SHV (T)	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
SHVP Garment export TEU low	44,892	46,299	47,430	48,584	50,285	51,502	63,656	78,593	119,390
SHVP Garment export TEU high	44,892	49,206	53,575	58,325	64,157	69,838	108,922	147,787	224,501
SHVP Garment import TEU low	47,475	49,294	50,476	51,681	53,490	54,761	67,586	83,318	130,926
SHVP Garment import TEU high	47,475	52,390	57,016	62,043	68,247	74,256	115,647	156,671	246,194
Total TEU Garments	**184,734**	**197,188**	**208,497**	**220,633**	**236,179**	**250,356**	**355,811**	**466,370**	**721,011**
SHVP other container export TEU low	7,922	8,172	8,893	8,597	8,375	4,384	2,485	682	376
SHVP other container export TEU high	7,922	9,001	10,760	11,544	12,539	9,936	17,291	30,354	44,399
SHVP other container import TEU low	38,559	40,487	42,511	43,492	44,465	28,341	27,834	23,933	42,333
SHVP other container import TEU high	38,559	42,415	46,656	50,006	53,559	40,403	61,221	94,467	194,670
Total TEU Other	**92,962**	**100,074**	**108,821**	**113,640**	**118,937**	**83,064**	**108,832**	**149,436**	**281,777**
Import from Thailand TEU-North	11,000	12,100	13,310	14,641	16,105	17,716	28,531	45,950	74,847
Export to Thailand TEU (laden)-North	2,750	2,943	3,148	3,369	3,605	3,857	4,937	6,319	10,174
Export to Thailand of empty TEU-North	8,250	9,158	10,162	11,272	12,500	13,859	23,594	39,630	64,673
Thailand Total	**22,000**	**24,200**	**26,620**	**29,282**	**32,210**	**35,431**	**57,062**	**91,899**	**149,695**
Railway Southern Line High Traffic in TEU's									
SHV import garment TEU high	0	0	0	0	0	11,138	34,694	47,001	73,858
SHV import other container TEU high	0	0	0	0	0	6,060	18,366	28,340	58,401
OM import garment high	0	0	0	0	0	0	1,314	2,580	3,603
OM import other container TEU high	0	0	0	0	0	0	2,052	4,131	5,383
Total SL to PP high	**0**	**0**	**0**	**0**	**0**	**17,199**	**56,427**	**82,053**	**141,245**
South Line - PP-SHV									
SHV empty TEU high	0	0	0	0	0	45,511	125,841	188,890	279,868
SHV other TEU export high	0	0	0	0	0	1,490	3,458	6,071	8,880
OM empty TEU high	0	0	0	0	0	0	37,500	75,000	150,000
Total SL from PP to SHV high	**0**	**0**	**0**	**0**	**0**	**47,001**	**166,799**	**269,961**	**438,748**
Railway Southern Line Low Traffic in TEU's									
SHV import garment TEU low	0	0	0	0	0	8,214	20,276	24,995	39,278
SHV import other container TEU low	0	0	0	0	0	4,251	8,350	7,180	12,700
OM import garment low	0	0	0	0	0	0	768	1,372	1,916
OM import other container TEU low	0	0	0	0	0	0	1,289	2,056	2,679
Total SL to PP low	**0**	**0**	**0**	**0**	**0**	**12,465**	**30,683**	**35,603**	**56,573**
South Line - PP-SHV									
SHV empty TEU low	0	0	0	0	0	33,846	68,364	74,715	99,725
SHV other TEU export low	0	0	0	0	0	658	497	136	75
OM empty TEU low	0	0	0	0	0	0	25,000	37,500	75,000
Total SL from PP to SHV low	0	0	0	0	0	34,504	93,861	112,351	174,800
Total SL from PP to SHV low	**0**	**0**	**0**	**0**	**0**	**69,007**	**187,723**	**224,702**	**349,599**
Railway Northern Line Traffic in TEU's									
Import TEU	0	0	0	0	0	14,172	22,825	36,760	59,878
Export TEU	0	0	0	0	0	3,086	3,950	5,055	8,139
Export empty containers	0	0	0	0	0	13,859	23,594	39,630	64,673

Table 13 Traffic Estimates for Containers (in TEU)

(Source: Business Case Analysis of the Railway Operating Company, Ministry of Public Work

[13] Backup data and assumptions are found in Appendix B of the Traffic Forecast and Financial Analysis Report, April 2006, Canarail Consultants

and Transport and Canarail Consultant)

4.4. Passenger Traffic Forecasts

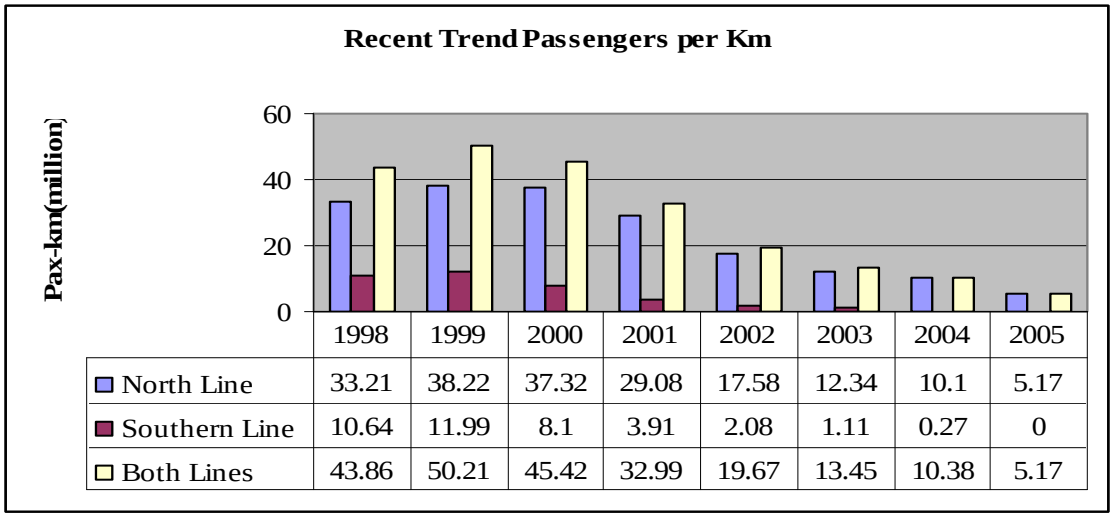
4.4.1. Recent Rail Passenger Traffic Trends

Passenger Traffic for of RRC from 1998 to 2005 as the top by 1998 and after then down from year to year. It can calculate that declined at a rate of about 27 per cent per year. The decline was more pronounced on the Southern Line than on the Northern Line, although the number of passengers travelling on the latter still fell rapidly (declining over the same period by about 23 per cent per year).

On the Northern Line, passenger services was reduced from one train daily to one train per week (running from Phnom Penh to Battambang on Saturdays, returning to Phnom Penh next day) with average train speed to only 17 km per hour, with the result that the trip duration from Phnom Penh to Battambang (273 km) is now about 16 hours. By 2005, the number of passengers carried on the remaining service had declined to only 48,000. The average rail passenger journey is now only 108 km, having reduced from about 150 km in 2000. While it might be argued that the railway continues to provide vital transport services to communities which have limited alternatives available to them, it is highly likely that the secondary road system has absorbed the passengers who recently ceased to use rail. It may be noted that the declining patronage of railway passenger services has continued unabated despite rail fares being considerably cheaper than the competing minibus services, suggesting that frequency of service and shorter travel times may be more important than price in influencing passenger modal choice. The trends in passenger trips and passenger-km for the best part of this decade are shown in Figure 2 and 3.

Figure 2 Passenger Traffic from 1998-2005 tons per km

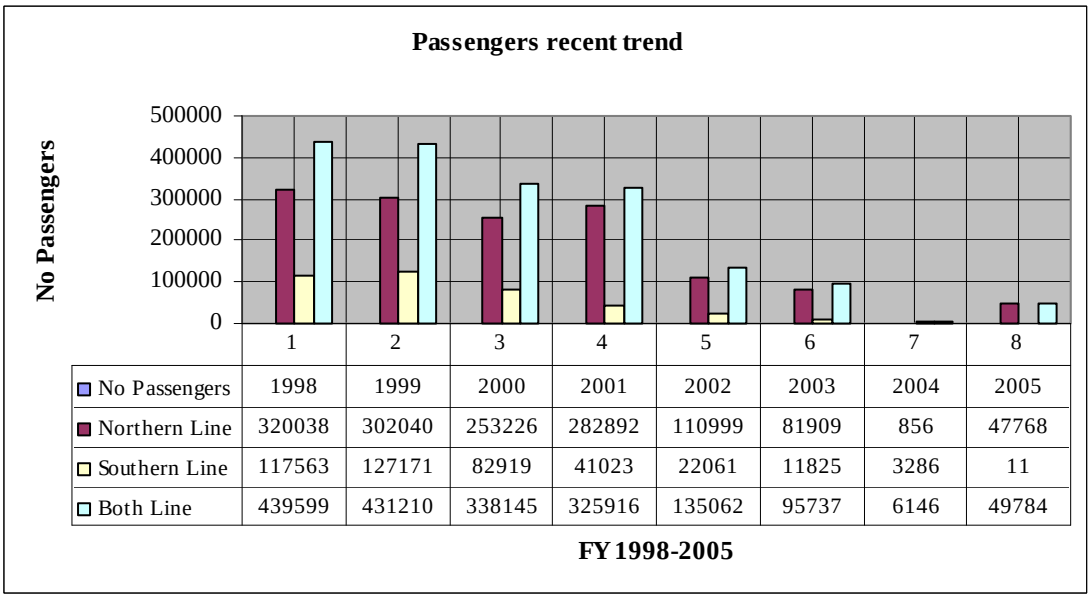
(million ton)



	1998	1999	2000	2001	2002	2003	2004	2005
North Line	33.21	38.22	37.32	29.08	17.58	12.34	10.1	5.17
Southern Line	10.64	11.99	8.1	3.91	2.08	1.11	0.27	0
Both Lines	43.86	50.21	45.42	32.99	19.67	13.45	10.38	5.17

(Source: Royal Railways of Cambodia, 2006)

Figure 3 Passengers Traffic 1998-2005



No Passengers	1998	1999	2000	2001	2002	2003	2004	2005
Northern Line	320038	302040	253226	282892	110999	81909	856	47768
Southern Line	117563	127171	82919	41023	22061	11825	3286	11
Both Line	439599	431210	338145	325916	135062	95737	6146	49784

(Source: Royal Railways of Cambodia, 2006)

4.4.2. Reasons of Decline

As the above review of the Road Condition, the national road system provides an alternative to rail via three national roads which run parallel to the railway alignment. These are: NR 3, from an intersection with NR 4 near Sihanoukville to Phnom Penh, via Kampot; NR 4, from Sihanoukville to Phnom Penh and NR 5 from Phnom Penh to the border with Thailand at Poipet. In addition, NR 2 provides an important means of

transport for passengers to and from Takeo, which is also located on the railway, Assistance in rehabilitation by Japanese Fund.

Much of this parallel road network, with the main exception of NR 3, has been improved over the past decade and further improvements are on-going. NR 4 now provides a high standard asphalt cement(AC) surface for its entire length and future improvement work will involve the widening of some sections (from 2 to 4 lanes) under BOT contracts. Within the past two years major rehabilitation, involving the laying of DBST (Double Bituminous Surface Treatment) pavement has been completed along the entire length of NR 5, except for the final section of 48 km from Sisophon to Poipet, which is currently in progress. Longer term plans (for the period 2011-2020) specify the conversion of NR 5 to AC pavement. On NR 3, limited improvement (including surface improvements and the widening of road shoulders) has been carried out under the maintenance program.

A travel speed survey undertaken in road surface condition is the dominant factor governing travel speed outside of urban areas, it is clear that road users are now benefiting from the progressive improvement of the primary road system.

Nevertheless, after peace was achieved, Cambodia launched an initiative to rehabilitate and reconstruct the country. The percentage of spending on infrastructure development in relation to both total expenditures and to the GDP are high, and much of the funding for such expenditures comes from abroad – foreign governments and international credit organizations.

On assessment of future passenger service, of The Final Report Volum 1 November 2006 of ADB TA6256-REG. the basis for this assessment is a forecast of passenger traffic on the core network comprising the Southern and Northern Lines (the latter including the existing line connecting Phnom Penh with Sisophon and the reconstructed “Missing Link” between Sisophon and Poipet). These forecasts were prepared by the Transport Economist engaged for the rehabilitation project and address the Terms of Reference. By the recent rail passenger traffic trends, the report Passenger traffic forecasts on: road net work development, available of passenger transport alternative, fare competition and other assumption underlying passenger forecasts and also forecast on financial analysis of future passenger traffic including: outline passenger service plan, passenger revenue forecast, passenger relating expenditure and estimates of the passenger revenue gap.

The result of forecast, overall the revenue available from passenger fares is likely to be sufficient to cover only 50 per cent of the operating expenditures (including locomotive and rolling stock depreciation) attributable to future passenger traffic, resulting in a revenue shortfall increasing from US$ 0.61 million in the first year of operation to US$ 3.10 million by 2030. Comparable estimates for the Northern Line show a revenue shortfall increasing in real terms from US$ 0.39 million in 2010 to US$ 2.30 million in

2030. The Northern line may be expected to account for some 75 per cent of the overall financial deficit on passenger services, partly as a result of the proportionately greater rolling stock investment which would be required on this line.

Ⅴ. INFRASTRUCTURE DEVELOPMENT FUTURE PLAN

5.1. Assistance on Railways Infrastructure Rehabilitation

By the transportation plays an important role in Socioeconomic Development under taken of Government and the Ministry of Public Work and Transport, Railways of Cambodia met the assistance for rehabilitation of both lines has been started since 1993 and while finance support from France government with assistance from ADB. The project name Special Rehabilitation Assistance Project, Project Implementation in Transport Sector, ADB Loan No 1199-CAM. Project started 1993 and end 1995 on the remark Emergency rehabilitation to the track sections in both lines, bridges and drainage systems along those lines, repair to wagons and renovation of Phnom Penh rail terminal station. The both lines have been only temporary rehabilitated for the present time service. Much more work has been needed not only the immediate needs assistance for rehabilitation, but also the needed for longer-term for making stronger and efficient for transport from the very outset. This means Rail transport can compete with road transport in local as well as in the ASEAN and in regions to push the country's socioeconomic development fast in growth.

By the ways of efficient and competitive of transport is important Royal Government of Cambodia (RGC) implemented an action plan to reform, restore and develop the railway infrastructure. This plan includes structural reforms, the rehabilitation of the existing lines and construction of new railway lines. By ADB technical assistant project started in January 2006 and is expected to be completed in March 2008. Loan agreement is signed on March 5, 2007 by RGC in cooperation with OPEC and ADB in cost of 73 million us dollar for the rehabilitation of RRC. ADB will support 42 million us dollar, follow by OPEC 13 million us dollar, RGC us$ 15.2, and government of Malaysia 2.8 "used track"), Total US$ 73 us Dollar million. The project is expected to be finished in 2010. The loan is already effectiveness with conditional agreement in 30 years with a private rail operator in selected through an international competitive bidding process.

From this assistance, what is important point necessary to rehabilitate and develop railway infrastructure? The above analysis and focus will be important in development infrastructure of railway.

5.2. Infrastructure Development Future Plan: Strategy for Long Term

In this section mention about the future project plan for development of railways infrastructure in Cambodia means for a long term strategy. Only review the detail of project scope of project plan of TA of ADB for rehabilitation of rail way in Cambodia and only some review of project propose new link.

- Rehabilitation, restore, reconstruct,
- Propose New Rail Link

In this section does only review the scope of project plan of TA of ADB for rehabilitation of rail way in Cambodia. The rehabilitation for the existing line including the reconstruction of 48 Km connection from Sisophon-Poipet with Cambodia-Thailand border. It is as the strategy in long term for Royal Railways of Cambodia going to be part of the Railway ASEAN Singapore Kunming Railway Link.

5.2.1. Rehabilitation of Railway in Cambodia

Because of Cambodia in long time lest improvement and development, because of war and civil strife in the past time made physical railways infrastructure get in poor condition. The needed and the increase of transport from present and in the future will have big obstacle and gap for transport model. For filling this obstacle and gap the first step in making efficient of plan is restructuring and rehabilitation of the existing rail infrastructure, then improve and develop rail transport material such as locomotive, signaling and telecommunication in the modernize or these should start with the new link connecting.

By TA of ADB, plan for restructuring show in 4 parts as follow:

The CTSSS (Cambodia Transport Sector Strategy Study) concluded that the railway in Cambodia is worn-out and requires extensive physical and institutional rehabilitation to regain financial and technical sustainability. The railway is currently incurring losses and neither the RGC nor the railway can finance the rehabilitation from its own resources. According to a Loan Agreement (GMS Rehabilitation of the Railway in Cambodia) between the Kingdom of Cambodia and ADB, dated on March 5th, 2007, the on-going project's objective is to facilitate sub-regional trade and economic growth in Cambodia by providing cost-effective and efficient railway transport. The scope of the project consists of:

Part A: Rehabilitation of the Southern Line

- Rehabilitation of the southern line from Phnom Penh to Sihanoukville (about 254 km), including major repairs to embankments, replacement of worn-out and unserviceable sleepers, fittings and ballasting, and rehabilitation or reconstruction of structures, including bridges, culverts, buildings and drains;
- Construction of a new passing loop;
- Tamping of track to restore operational speed of 50 km/hour;
- Rehabilitation of the rail link in the Sihanoukville Port and extension into the Container Port in Sihanoukville; and
- Carrying out ancillary works at level crossings.

Part B: Rehabilitation of the Northern Line

- Rehabilitation of the northern line from Phnom Penh to Sisophon (about 335 km), including major repairs to embankment, ballasting and installation of missing fittings;
- Rehabilitation or reconstruction of structures, including bridges, culverts, buildings and drains;
- Tamping of track to restore operational speed of 50 km/hour;
- Rehabilitation of an existing spur line to Phnom Penh Port; and
- Carrying out ancillary works at level crossings.

Part C: Reconstruction of the Missing Rail Link

- Reconstruction of the missing rail link from Sisophon to Poipet or Thai border (about 48 km) and re-establishment of the railway connection across the border to Thailand, including major repairs to embankment, preparation of track bed and ballasting, reconstruction of track and rehabilitation or reconstruction of structures, including bridges, culverts, buildings and drains;
- Construction of ancillary facilities at level crossings;
- Construction of passing loops and a station in Poipet with facilities for border crossing.

Part D: Restructuring of the Railways

- Provision of mitigation measures through compensation for future income losses of the redundant railway employees;
- Provision of mitigation measures through compensation for lost pension rights of the railway employees whether made redundant or re-hired by the future PPP (Public-Private Partnership) Railway Operator;
- Provision of counselling and retraining of railway employees to secure their livelihood after restructuring.

The railway link through Cambodia is also an integral part of the GMS southern economic corridor, which is one of 11 flagship programs under the GMS sub-regional economic cooperation. The CTSSS, which was completed in December 2002, concluded that, as a result of many years of war, the railway was in poor condition and would need to be rehabilitated before the full benefits from rail traffic could be realized. Moreover, a rehabilitated railway would be economically beneficial to Cambodia and could possibly become a profitable operation.[14]

[14] ADB, (2005), "Proposed Technical Assistance to the Kingdom of Cambodia for the Restructuring of the Railway in Cambodia (Financed by the Government of France)".

At the official broke ground on Monday, February 18, 2008, the authorities have officially inaugurated the restoration site for a railroad line. The restoration will involve 652 km of railway, a $73 million railway project, beginning a plan to repair the ailing existing rails network of the 650-kilometer rehabilitation is to connect Poipet to Phnom Penh and Phnom Penh to Sihanoukville. Rehabilitation project is expected to be completed in 23 months, by 2010. The first stretch will be the 48 kilometers from Poipet to Sisophon.

5.2.2. Propose New Rail Line

This section will review the long term plans for Cambodia Railway preparing model of transport to make efficient transport competitive although take part in socioeconomic growth and reduce poverty in the country and also take part with regional.

The plans propose as follow:

- Connect Rail link: Batt Doeun-Loc Ninh 255 km with Cambodia-Vietnam border
- Connect Rail link: Sisophon-Siem Reap 105 km potential for tourism
- Connect Rail link: Siem Reap-Skun: 239 km
- Connect Rail link: Snoul-Stung Treng –Cambodia border -Laos 273 km

The Singapore-Kunming Rail Link (SKRL) project was proposed at the Fifth ASEAN Summit in December 1995. The SKRL is a flagship project of the ASEAN-Mekong Basin Development Cooperation (AMBDC). A feasibility study of SKRL examining six alternative routes to link Singapore to Kunming, China, was completed in August 1999. All six routes have a common sector from Singapore to Bangkok via Kuala Lumpur. Rail Link Phnom Penh – Locninh (Vietnam border) is a part of SKRL.

Railways in Cambodia are expected to be part of the Asian Railway Network through linkage with the railway network in Thailand and Vietnam. To this end, it is necessary to link Sisophon with Poipet, and Phnom Penh with the Vietnam/Cambodia border. For Sisophon-Poipet rail link the part of ABD project for rehabilitation of railway of Cambodia. Now project on processing expected finish in 2010 and project have breakstone ceremony at Sisophon on 18 February 2008 by Cambodian PM and ADB President by the project cost $ 73 million, Sisophon-Poipet has priority project start first. At that time of break stone ceremony, rail line Batt Doeun-Loc Ninh to be completed in 2015 respectively.

For any other projects forecast on tourist economic by own special locations according to increase of tourist arrived.

New Railway Link from Sisophon to Siem Reap: A proposal for this new line, which has significant for tourist potential was submitted by the Flagship Superconductivity Group of Cambodia. The length of the proposed new railway link is 105 km. The project is stand on the potential of tourism economics.

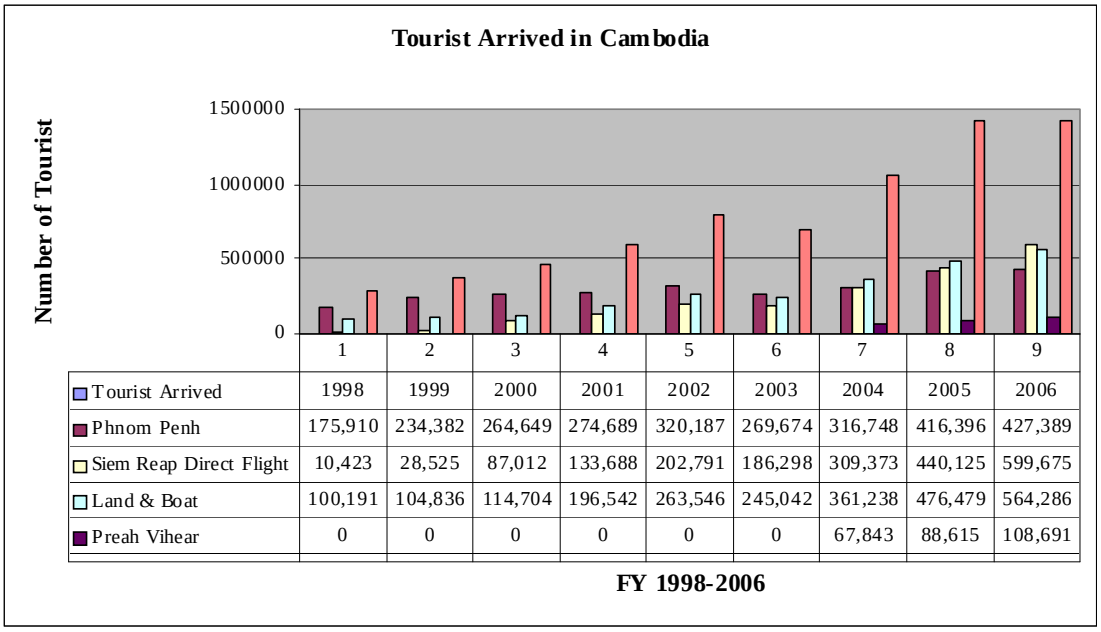
According to the statistics of Ministry of Tourist, the tourists arriving to Cambodia is increasing rapidly. Figure below show the number of the tourist arrive Cambodia by all means of transport growth up rapidly especially tourist arrived Siem Reap direct by flight. The change from year to year is up from 10,423 in 1998 to 28,525 in 1999 change 18,102 percent change 273.67%. The rate change was heist from year 1999 to year 2000 tourist arrived from 28,525 to 87,012 number of change is 58,487 percent change is 305.04%. to 58,587 and up 69,103 from 2002-2003.

Table 14 Visitor Arrival in Cambodia in 1998-2004

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Phnom Penh	175,910	234,382	264,649	274,689	320,187	269,674	316,748	416,396	427,389
S.Reap Direct Flight	10,423	28,525	87,012	133,688	202,791	186,298	309,373	440,125	599,675
Sub-Total by Air	**186,333**	**262,907**	**351,661**	**408,377**	**522,978**	**455,972**	**626,121**	**856,521**	**1,027,064**
Land & Boat	100,191	104,836	114,704	196,542	263,546	245,042	361,238	476,479	564,286
Preah Vihear	-	-	-	-	-	-	67,843	88,615	108,691
Sub-Total By Land & Boat	**100,191**	**104,836**	**114,704**	**196,542**	**263,546**	**245,042**	**429,081**	**1,365,194**	**672,977**
Grand Total	**286,524**	**367,743**	**466,365**	**604,919**	**786,524**	**701,014**	**1,055,202**	**1,421,615**	**1,700,041**

(Source: Ministry of Tourist)

Figure 4 Tourist Arrival in Cambodia 1998-2006



Tourist Arrived	1998	1999	2000	2001	2002	2003	2004	2005	2006
Phnom Penh	175,910	234,382	264,649	274,689	320,187	269,674	316,748	416,396	427,389
Siem Reap Direct Flight	10,423	28,525	87,012	133,688	202,791	186,298	309,373	440,125	599,675
Land & Boat	100,191	104,836	114,704	196,542	263,546	245,042	361,238	476,479	564,286
Preah Vihear	0	0	0	0	0	0	67,843	88,615	108,691

For any other plans such as propose rail link such as: Connect Rail link: Batt Doeun-Loc Ninh 255 km with Cambodia-Vietnam border; Connect Rail link: Siem Reap-Skun: 239 km and Connect Rail link: Snoul-Stung Treng –Cambodia border -Laos 273 km doe not detail in this paper only as future plans for IDRC.

5.3. Problem on Railway Infrastructure Development

Issues on infrastructure development, especially in the transport sector, are described below:

(i) Transport infrastructure is generally inadequate due to damage resulting from the civil war and lack of maintenance during that cause of funding problem needed assistant from government with participation of private partnership.

(ii) Railway infrastructure is so outdated that it cannot effectively cope with the transport demand of today.

(iii) Lack of maintenance and out dated of infrastructure cause of lack of security. Accident happened cause of derailment in 2006 number of wagon derailment 552 and number derail loco motive of 18 times[15].

(iv) To prevent security; so the operating train in low speed become time delay not satisfy to the users and make affect the users.

(v) Railway the need to meet the immediately improve and development make sure that model of transport could supply and compete in service

[15] Source: Royal Railway of Cambodia

demand internal country and in the regions.

(vi) Transport service operators cannot provide services that meet the requirements of users since their management system is inconsistent with a market economy.

By the NR road have been improve and develop form unpaved to paved it is the great competitive and challenge that have to rail passenger down from day today and at last the shown by the south line. This mean immediately railway done by rehabilitation and improve develop make safer and faster.

5.4. Railway Transport Face to Challenges

- Rail traffic has to face of competition with road network well rehabilitation and improved that cause of decline of rail traffic not only passenger but also freight.
- NR 2 and NR 3 parallel with Rail Southern line. NR 4 and NR 5 parallel with railway North line has been fully rehabilitation and on going improve. They make facilitate of user and travel agents.
- Increasing of vehicles on road such as buses, mini buses, vans, pickups, or private taxi. They can load as much as they can and they can depart as fast as they fill.
- Railway transport a part of model to compete with road prevent monopoly of transportation.
- The dilapidated Railway service has not capability enough support traffic transport in the country while the country in part of ASEAN members Great Mekong subregion. Integration economic development in the region will need more works of transport across border.

5.5. General Policy on Infrastructure Development

5.5.1. Government Policy on Infrastructure Development

Infrastructure development in this case is primarily designed to contribute to socioeconomic development in Cambodia. According to the first five-year Socioeconomic Development Plan for 1996-2000, Cambodia's general policy on transport infrastructure sets out the following objectives:

(i) To establish a transport network aimed at securing national integration and maintaining law and order, as the top priority after the civil war.

(ii) To secure transport networks and national land conservation for the development of the provinces, especially rural areas. The provinces, which account for most of the national land and requirements for improvement in the living standards of local farmers, are the key to Cambodia's stability and development.

(iii) To form a transport network and gateways designed to foster export-related industries, and to improve living conditions in urban areas for the subsequent overall economic development of Cambodia.

(iv) To form a transport network and gateways designed to develop tourism, an efficient industry in terms of earning foreign currency and creating jobs; and to develop infrastructure to make use of tourist attractions, including parks and beaches.

(v) To develop a transport network and gateways that make use of Cambodia's geographical advantage at the center of Indochina, and to enables Cambodia to serve as the region's hub by promoting economic development that takes advantage of its location. The buildup of the information infrastructure aimed at promoting industries and strengthening institutional capacity has recently emerged as a new pillar of overall infrastructure development. Above all, the development of telecommunications infrastructure is indispensable as it constitutes the linchpin of this information infrastructure buildup.

By the above policy, RGC recently has setup the grogram of "Public Investment Program (PIP) 2008-2010" Ministry of planning (MOP) RGC has been prepared through extensive one to one consultations between MOP and line ministries and agencies on public sector amount of $ 2,325,000,000 m include transport sector of about $ 641,144,000 m (25.14% of amount of sectors) after Social sector (32.85 %). In amount of transport sector program shared by road 74%, Rail 11.52%, Port & waterway 7.81% and last Aviation 6.58%)[16].

5.5.2. Ministry of Public Work and Transport

The Ministry of Public Work and Transport (MPWT) has general policy into two parts:

Part A: Summary Statement General transport policy summary statements Commitments and aims

The Government is committed to:

1. Continue construction of new transport infrastructure
2. Strengthen transport management
3. Improve availability of year round affordable transport services for individual and commercial users
4. Improve transport services safety and security
5. Increase access to transport facilities for the poor and provide more work

[16] RGC Public Investment Program 2008-2010, Ministry of Planning

opportunities in the regions

6. Rationalize its transport institutions and develop human resources
7. Encourage the development of the private sector
8. Provide more information to the population about transport

Part B: Rational

Sharing of transport responsibilities:

The Ministry of Public Works and Transport (MPWT) is the overall responsible for transport in Cambodia. It however shares specific responsibilities with the Ministry of Rural Development which is responsible for rural roads and rural waterways, the State Secretariat of Civil Aviation which is responsible for civil aviation and the cities which are responsible for urban transport.

Related policies

This policy is complemented by additional specific policies in Air, Rail, Road, Urban and Water transport.

1) New transport infrastructure construction

Given the importance in providing basic transport facilities to all provinces of the country, the Royal Government Cambodia is committed to pursue its investments in infrastructure construction. Road rehabilitation and construction of new bridges will continue on the secondary road network until the regional centers are linked to the national network. Existing port facilities will be expanded and existing railroads will be rehabilitated. Opportunities for new infrastructure projects will be considered in all transport means, and prioritized according to national development policies using sound socio-economic evaluation criteria and methods.

2) Availability of affordable transport services

The Royal Government of Cambodia is committed to improve its planning and management activities in all fields of transport. The government is committed to strengthen its planning methods in order to harmonize the development of the transport infrastructures and increase the socio-economic benefits of the projects. Similarly measures will be introduced to improve the efficiency of compliance inspections and of maintenance activities. The government is also committed to increase resources allocated to infrastructure maintenance to improve the durability of new investments.

3) Availability of affordable transport services

The Royal Government of Cambodia is committed to implement measures that will improve the availability of year round affordable transport services for individual and commercial users everywhere in the country. This will be done by encouraging private services where the demand is high and sufficient for

profitability and by using subsidized services in remote areas, where demand is too low for profitability.

4) Safety and security

The Royal Government of Cambodia is committed to improving safety and security for all means of transport. The Government will continue to develop a better regulatory environment by introducing new laws and regulations and by strengthening the existing enforcement mechanisms. Implementation programs will be devised to facilitate the introduction of these new laws and regulations.

5) Access for the poor and more work in the regions

To empower the regions and reduce rural poverty, the Royal Government of Cambodia is committed to continue its decentralization of transport services and of small infrastructure maintenance activities, and to increase the number of all-weather roads and of small wharf facilities in all provinces.

6) Rationalization of institutions and development of human resources

The Royal Government of Cambodia is committed to rationalize its transport institutions and strengthen its human resources in order to provide better quality transport services to the population. Rationalization will be done through re-organizations and reforms activities. The Government is also committed to the continuous improvement of its human resources. These improvements will be made possible by introducing new recruitment procedures, new personnel databases, new motivation programs, new performance-based work programs and procedures, comprehensive training programs for all involved in transport.

7) Private sector

The Royal Government of Cambodia will continue to encourage private sector participation for all means of transport. Private sector participation enables to accelerate the country's development by introducing foreign capital and resources. The Government will also develop an adequate regulatory and monitoring framework to ensure that private services follow national standards and interests. Competitive and transparent procurement procedures will be adopted for all major concessions. Where the private services are introduced, the government will terminate equivalent public services.

8) Dissemination of information

The Royal Government of Cambodia is committed to disseminate information about transport regulations and about its development and reform activities. The population will be invited to participate to the preparation of all major infrastructure projects through a local consultation process. Information about regulations, projects and reforms will be made available at the relevant

ministries and on the internet.

The MPWT is currently preparing a revised strategy for future development of the transport sector based on the Cambodia *Transport Sector Strategy Study* (footnote 3), financed by ADB and completed in December 2002. In terms of transport sector development and operation, the draft strategy is likely to emphasize the following objectives and goals:[17]

(i) **Support sustained economic growth and promote external trade and foreign direct investment.** Transport is an integral part of the production of nearly all goods and services. Good transport infrastructure and cost-effective transport is a precondition for Cambodia's export drive and for successful development of its tourism potential, and is also a major factor in containing the cost of living and improving rural livelihoods. Increased diversity in transport supply and improved transport logistics using multimodal transport chains are needed to improve Cambodia's international competitiveness and its attractiveness to direct foreign investors.

(ii) **Support poverty reduction and integration of the country.** By enabling new productive activities in areas not previously open to economic exchange, transport creates the foundations for more inclusive and pro-poor economic growth. Transport achieves this by providing cost-effective and reliable access to economic opportunities and social services, thereby enabling the poor to participate more fully in society. Accessible and dependable transport networks, especially provincial roads, are needed to link the provinces and to integrate rural areas into the mainstream economy.

(iii) **Streamline and focus sector institutions and expand private sector involvement in infrastructure provision.** The Government emphasizes strengthening sector institutions, especially the creation of clear mandates for their activities, as the basis for institutional reform and strengthening. The Government recognizes that given the human resources constraint, reform requires flexibility in implementation with the focus on efficiency, transparency, and—whenever efficient—reliance on the private sector. In the past, the Government has shown a readiness to involve foreign and domestic investors in

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[17] ADB Report and Recommendation of the President
to the Board of Directors, Project Number: 3726 November 2006

the financing, development, and management of transport infrastructure. The Government intends to pursue this avenue further, and also strongly supports the development of national contractors to undertake infrastructure construction and maintenance services.

(iv) **Secure the sustainability of transport.** Fuel taxation is a major source of revenue for the Government, and charging for the use of infrastructure has been introduced in most subsectors, but with a few exceptions, the scope for charging full user costs is limited by low traffic loads. As the scope for direct Government funding is equally limited, meeting the funding requirements for infrastructure development and maintenance in the short to medium term will require supplementary funding from the private sector and development partners.

(v) **Improve safety and enforcement.** The Government is aware of the rapidly growing social and economic costs of poor traffic safety and recognizes that inefficient enforcement because of a weak legal foundation, inadequate resources, and corrupt practices is a root cause of the problem

VI. Conclusion

According to the present time of the poor condition of the RRC, and policy of the RGC and Ministry of Public Work and Transport, RRC needs immediately meet the fully rehabilitation of the existing physical infrastructure in the both lines for make sure that railway infrastructure have been rehabilitated and has capability strong enough in traffic required. Railway can face with other model and make efficient of transport, encourage the diversity of multimodal transport service available to users; and encourage competition, preventing of the formation of monopolies in the transport sector.

The lack of maintenance since then made the gaps seriously obstacle in socio-economic and economic growth in country. The fully rehabilitation of rail transport, make railway stronger in its transport in the country and also make facilitated in connected railway ASEAN Singapore Kunming Rail Link. Then expect a result is narrowing the gaps of both sustainable economic growth and poverty reduction. It is necessary for national integration and maintaining balanced development among internal and also crucial for facilitating Cambodia's regional and international integration.

Recommendation

The South Line has a special priority can be competitive with other modes of transportation in carrying oil, cement, containers, and other large-volume freight. RRC needs immediately to take a number of actions to improve the south line, including repairing or reconstructuring or new construction branch lines in previous stations especially branch lines connecting to the cement plants and reinforcing sections that have been left unattended during the restoration work, linking the line with freight shipping facilities and dry ports, restoring switches to allow and could save rail service at least for daily service. And this also need the repairing or reconstruction branch lies in the North line.

By the TA ADB project of rehabilitation of RRC in the above review expected that project will be finished 2010. If the project is on processing and finish at the schedule, so RRC have resolved from the poor condition into fully rehabilitation. In the means time of RRC after completed rehabilitation main concern of the poor Signaling and telecommunication of RRC seem not to be in part of ADB project of rehabilitation. Train will be increase from time to time. The operation will be busy and very busy also.

To avoid the any problem by chance or human error, signaling system and telecommunication expected be set up or install in some of the main stations in the same time of rehabilitation. For the single line or single track and single train run on operation, Tablet Signaling is expected be important used the very simple signaling operation not to use so much material and equipment and fund. It is better and necessary to establish Tablet System in RRC before the needed any new modern system like Automatic Block

System will need time to detail design such as station section with track circuit, point machine, axle counter and also need too much fund, training staff also. For some kind of modern signaling awaiting in using in near future when train increase, from now it sees not suitable for RRC in some following reasons:

- Electricity is not available at any times,
- The system is now not utilize as the cost,
- It takes time to educate staff and workers. Etc.

By the field trip of experience of Japanese Railway to Kururi Line(32.2km, with 14 stations, 4 stations using tablet operating train), in Chiba, in using the old simple system is "Tablet System". This type be a comment of needed using the simple type of signaling system for safety is the priority in the operation of RRC.

As an example of adopting a tablet closing system, Kururi line in Chiba, Japan, may be useful.

The length of the single line is 32.2km and the number of station is 14. The tablet closing system is used in four stations. Two of them are in both edges of the line, which is Kisarazu station and Kazusa-Kameyama station, and the rests are in the middle of the line, which is Yokota station and Kururi station. It takes 9.3km from Kisarazu station to Yokota station, 12.3km from Yokota station to Kururi station, and 9.6km from Kururi station to Kazusa-Kameyama station. In each station, one train arrived in an hour from one direction. The operation of tablet closing system is very simple. Suppose that there are three stations in the line, we call them as north station, central station and south station for simplicity. We can follow the order of operating tablet system in Kururi line as follows:

1. When train left from north station, station attendant in north station push a button of tablet machine three times for ringing a bell three times in central station.
2. After bell rang three times in a tablet machine connected with north and central station, station attendant in central station push a button three times for ringing a bell three times in north station.
3. In both station, station attendants take a receiver on tablet machine.
4. Station attendant in north station say: Train number xxx go from north to central station.
5. Station attendant in central station say I understand that.
6. The same operation is done between central and south station after train left from south station.
7. The token for the segment between north and central station is in a train which is moving from north station to central station.

8. The token for the segment between south and central station is in a train which is moving from south station to central station.
9. At central station, trains arrive almost the same time.
10. Station attendant in central station run to a train, and then receives a token for the segment between central and south station from near side line.
11. The station attendant run to the other train, and then exchange the token with the other token for the segment between central and north station in a train on a far side line.
12. A train starts to move from central station to south station with a token for the segment between central and south station.
13. A station attendant in central station pass the token for the segment between north and central station to the remaining train, and then the train starts to mover from central station to north station.
14. The station attendant push tablet three times to notice that the train is moving from central station to south station (the same operation mentioned above).
15. The station attendant push tablet three times to notice that the train is moving from central station to north station.

As a result, Cambodian railway can use the system only with telephones, bells and one token for one segment.

By setting these equipment at three main stations (Takeo, Kampot and Shihanoukvill) at the South line. And three main stations (Posat, Battambang, and Sisophon) also one set at Phnom Penh Station. The system would be work to improve the safety of Cambodian railway if the number of operation increases.

Ⅶ. REFERENCES

ADB, 2005, "Proposed Technical Assistance to the Kingdom of Cambodia for the Restructuring of the Railway in Cambodia (Financed by the Government of France)".

ADB, 2006, "Proposed Loan and Administration of Loan Kingdom of Cambodia: Greater Mekong Subregion: Rehabilitation of the Railway in Cambodia Project*", ADB Report and Recommendation of the President to the Board of Directors*, Project Number 37269

ADB TA Consultant, 2006, "Cambodia: Preparing the Greater Mekong Subregion: Rehabilitation of the Railway in Cambodia", Project Number 37269

Economic Institute of Cambodia, 2007, "Rural Infrastructure Development", Cambodia

GMS Rehabilitation of the Railway in Cambodia, 2007, *"Loan Agreement between the Kingdom of Cambodia and ADB"*

Government of Cambodia, 1996, *First Socio-Economic Development Plan 1996-2000*

Kaneko, Akira and Hayao Adachi, 2002 "Infrastructure Development" In *the Kingdom of Cambodia - from Reconstruction to Sustainable Development*, ed. Institute for International Cooperation Japan International Cooperation Agency.

Ministry of Public Works and Transport and Canarail Consultants, "Business Case Analysis for the Railway Operating Company"

Ministry of Public Works and Transport, *GENERAL TRANSPORT POLICY*

National Institute of Statistics, 2007, *Statistical Year Book 2006*, Cambodia.

Royal Government of Cambodia, *Public Investment (2001-2003), Ministry of Planning*.

Royal Government of Cambodia, 2006, *National Strategic Development Plan (2006-2010)*, Cambodia.

Royal Government of Cambodia, 2006, *Second Five Year Socioeconomic development Plan 2001-2005*, Cambodia.

Royal Government of Cambodia, 2007, *Annual Progress Report 2006 on National Strategic Development Plan (2006-2010)*, Cambodia.

Royal Railway of Cambodia

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