Kingdom of Cambodia
Ministry of Public Works and Transport
Sihanoukville Autonomous Port

FINAL REPORT
FOR
THE PROJECT FOR THE STUDY
ON
STRENGTHENING COMPETITIVENESS
AND DEVELOPMENT
OF
SIHANOUKVILLE PORT
IN
THE KINGDOM OF CAMBODIA

Executive Summary

July 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

The Overseas Coastal Area Development Institute of Japan

Oriental Consultants Co., Ltd.

Nippon Koei Co., Ltd.

Ides Inc.

Exchange Rate
1 USD = 80.25 Yen （Average rate during 16-29, February 2012）
1 USD = 4,094 Cambodian Riel (Average rate during 10-17, January 2012)

List of Abbreviations

A	AASHTO	American Association of State Highway and Transportation Officials
	AC	Asphalt concrete
	ACI	American Concrete Institute
	ADB	Asian Development Bank
	AFTA	ASEAN Free Trade Area
	AHTN	ASEAN Harmonized Tariff Nomenclature
	APM	APM Terminals
	ASEAN	Association of South‐East Asian Nations
	ASYCUDA	Automated System for Customs Data
	ASW	ASEAN Single Window
B	BL	Bill of Lading
	BPR	Business Process Re-engineering
	BSAA	Bangkok Shipowners and Agents Association
	BSC	Balanced Scorecard
C	CBT	Cross Border Transport
	CBTA	Cross-border Transport Agreement
	CCTV	Closed Circuit Television
	CD	Capacity Development
	CDC	Council for the Development of Cambodia
	CDIT	Coastal Development Institute of Technology
	CDL	Chart Datum Level
	CEPT	Common Effective Preferential Tariff
	CFS	Container Freight Station
	CHE	Container Handling Equipment
	CIECC	China International Electronic Commerce Center
	CIQ	Customs, Immigration, Quarantine
	CLM	Cambodia, Lao PDR and Myanmar
	CP	Counterpart
	CSF	Critical Success Factor
	CT	Container Terminal
	CTIC	Chao Phaya Terminal International Co., Ltd.
	CTO Dept.	Container Terminal Operation Department
	CY	Container Yard
D	DBST	Double Bituminous Surface Treatment
	DD	Detailed Design
	DDT	Dichloro-diphenyl-trichloroethane
	DPW	DP World
	DWT	Dead Weight Ton
E	ECD	Empty Container Depot
	EDI	Electronic Data Interchange

	EIA	Environmental Impact Assessment
	EIRR	Economic Internal Rate of Return
	EPZ	Export Processing Zone
	ESCAC	Environmental and Social Consideration Advisory Council
	ESDC	Eastern Seaboard Development Committee
	ETA	Estimated Time of Arrival
	ETD	Estimated Time of Departure
	EU	European Union
F	FAO	Food and Agriculture Organization
	FCL	Full Container Load
	FDI	Foreign Direct Investment
	FIRR	Financial Internal Rate of Return
	FOB	Free on Board
	FOC	Flag of Convenience
	F/S	Feasibility Study
	FT	Freight Ton
	FZ	Free Zone
G	GCHO Dept.	General Cargo Handling Operation Department
	GDCE	General Department of Customs and Excise
	GDP	Gross Domestic Product
	GDT	General Department of Transport
	GMAC	Garment Manufacturers Association in Cambodia
	GMS	Greater Mekong Sub-region
	GOJ	Government of Japan
	GSP	Generalized System of Preferences
	GT	Gross Tonnage
H	HP	Horse Power
	HPH	Hutchison Port Holdings
	HWL	Highest Water Level
I	ICD	Inland Container Depot
	IEA	International Energy Agency
	IEE	Initial Environmental Evaluation
	IMF	International Monetary Fund
	IMO	International Maritime Organization
	ISO	International Organization for Standardization
	ISPS	International Ship and Port Facility Security Code
	IT	Information Technology
	IUCN	International Union for Conservation of Nature
	IWD	Inland Waterway Department
J	JASTPRO	Japan Association for Simplification of International Trade Procedures

	JETRO	Japan External Trade Organization
	JICA	Japan International Cooperation Agency
	JPY	Japanese Yen
	JSCE	Japan Society of Civil Engineers
K	KAMSAB	Kampuchea Shipping Agency & Brokers
L	LA	Los Angeles
	LCL	Less than Container Load
	LDC	Low Developed Country
	LLWT	Lowest Low Water Level
	LM Dept	Labor Management Department
	LoLo	Lift-on Lift-off
	LOA	Length Overall
	LPI	Logistic Performance Index
	LSCI	Liner Shipping Connectivity Index
	LWL	Lowest Water Level
M	M/M	Minutes of Meeting
	MAFF	Ministry of Agriculture, Forestry and Fisheries
	MEF	Ministry of Economy and Finance
	MFN	Most-Favored-Nation
	MIC	Ministry of Internal Affairs and Communications
	MLIT	Ministry of Land, Infrastructure, Transport and Tourism
	MMD	Merchant Marine Department
	MOC	Ministry of Commerce
	MOE	Ministry of Environment
	MOU	Memorandum of Understanding
	MoEYS	Ministry of Education, Youth and Sport
	M/P	Master Plan
	MPH	Movement Per Hour
	MPWT	Ministry of Public Works and Transport
	M&R	Maintenance and Repair
	MSL	Mean Sea Level
	MT	Metric Ton
	MTSA	Maritime Transportation Security Act
	NACCS	Nippon Automated Cargo and Port Consolidated System
N	NIS	National Institute of Statistics
	NPM	Net Profit Margin
	NR	National Road
	NSDP	National Strategic Development Plan
	NSW	National Single Window
O	O/D	Origin and destination

	OCDI	Overseas Coastal Area Development Institute of Japan
	ODA	Official Development Assistance
	OKM	Oknha Mong Port
	OSB	Oil (Offshore) Supply Base
P	PAA	The Pan-Asian e-Commerce Alliance
	P2M	Project & Program Management
	PARIS	Port and Airport Research Institute
	PAS	Sihanoukville Autonomous Port
	PAT	Port Authority of Thailand
	P/C	Pre-stressed Concrete
	PCA	Post Clearance Audit
	PCB	Polychlorinated biphenyl
	PCC	Port Clearance Committee
	PCU	Passenger Car Unit
	PDR	People's Democratic Republic
	PENPPAS	Project for Establishment of National Port Policy and Administration System
	PFSP	Port Facilities Security Plan
	PFSO	Port Facility Security Officer
	PIANC	World Association for Waterborne Transport Infrastructure
	PMB	Port Management Body
	PPAP	Phnom Penh Autonomous Port
	PPP	Public Private Partnership
	PR	Provincial Road
	PRC	People's Republic of China
	PSC	Port Security Committee
Q	QGC	Quayside Gantry Crane
R	RC	Reinforced Concrete
	RGC	Royal Government of Cambodia
	ROE	Return of Equity
	RORO	Roll-on Roll-off
	RRC	Royal Railway of Cambodia
	RTG	Rubber Tired Gantry Crane
S	SCOPE	Service Center of Port Engineering
	S/W	Scope of Work
	SEA	Strategic Environmental Assessment
	SEZ	Special Economic Zone
	SHM	Stakeholder Meeting
	SHV	Sihanoukville
	SLS	Serviceability Limit State
	Smax	Spreading Parameter

	SMB	Sverdrup, Munk, Bretschneider
	SME	Small and Medium Enterprise
	SPI	Structural Performance Index
	SPZ	Special Promotion Zone
	SRT	State Railway of Thailand
	SWOT	Strength, Weakness,Opportnunity and Threat
T	TBT	Tributyltin
	TC	Technical Committee
	T&G	Textile and Garment
	TEDMEV	Transferência Electrónica de Dados - Macau EDI VAN, S.A.
	TEU	Twenty-feet Equivalent Unit
	THC	Terminal Handling Charge
	TOC	Total Organic Carbon
	TPT	Thai Prosperity Terminal
	TR	Tomnop Rolok Port
	TRR	TOLL Royal Railway Cambodia
	TSA	Transportation Security Administration
	TWIC	Transport Workers Identification Credential
U	UN	United Nations
	UNCTAD	United Nations Conference on Trade and Development
	UNEP	United Nations Environment Programme
	US	United States
	USA	United States of America
	UTCT	Unithai Container Terminal
	ULS	Ultimate Limit State
V	VAT	Value Added Tax
	VICT	Viet Nam International Container Terminals
	VIWA	Vietnam Inland Waterway Administration
	VTMS	Vessel Traffic Management System
W	WB	World Bank
	WBS	Work Breakdown Structure
	WTO	World Trade Organization

CONTENTS

EXECUTIVE SUMMARY

1. OUTLINE OF THE PROJECT

The objectives of the Project are to clarify the roles of Sihanoukville Port and Phnom Penh Port, and accordingly formulate a future vision of Sihanoukville Port (for the target year of 2030, middle term target year of 2020), and then to formulate the "Strategy for Strengthening Competitiveness of Sihanoukville Port" (a soft strategy with the target year of 2020), and the "Strategic Master Plan for the Development of Sihanoukville Port" (with the target year of 2030) for the purpose of realizing that vision.

2. STATUS QUO AND FUTURE TRENDS OF COMPETITIVE POSITION OF SIHANOUKVILLE PORT

2.1. Socio-economic Trends

2.1.1 Cambodia

1) Demography

The General Population Census in 2008 indicates that the total Cambodian population is 13.4 million. The population pyramid is in transition from a stable pyramid to constrictive pyramid due to a lower birth rate in recent years. According to UN Department of Economic and Social Affairs, the annual increase rate of Cambodian population up to 2030 is forecasted to be 1.1%, whereas that of the last ten years was 1.4%.

2) Economy

The assessment on Cambodian economic performance by IMF is summarized as follows:

- Over the medium term, addressing longstanding structural weaknesses can improve the balance of risks. On the one hand, potential setbacks in efforts to strengthen the business environment and enhance public sector revenues and service delivery constitute major downside risks to growth. A better-than-expected return on medium-term investments in the power sector and rural infrastructure could offer significant upside potential. Under the baseline scenario, growth is expected to gradually return to potential of about 6–7 percent over the medium term.

3) Industry

The tertiary industry is the largest industry in Cambodia in terms of the added value followed by the secondary industry. Although the largest percentage of people works in the agricultural sector, the share of the added value of the primary sector is the smallest. Textile, apparel and footwear industry, which accounts 16.3% of total added value in Cambodia, is the largest sub-sector followed by trade.

4) Trade

Though Cambodia has been running a negative trade balance, it is worth noting that the 2010 exports has made a good recovery from 2009 when the country was once hit by the global recession. As a result, the value of exports has been increasing at the average yearly growth rate of 13.8% throughout the decade from 2000 to 2010.

5) Investment

Predominant source country is China, of which the share is 3.5 times larger than that of the second largest source country of Korea. Tourism sector is by far the largest target sector, accounting for more than 70% of the total investment. Compared with this, the share of manufacturing is rather small.

6) Food and energy

Besides combustible renewables, virtually all sources of energy in Cambodia are imported oil products. Small amount of electricity is also imported from Viet Nam. Around one third of imported oil products are used in power generation and the remaining portion is used mainly in the transport sector and by residents. Energy consumption in industrial sector remains rather small.

Cambodia is self-sufficient in almost all major commodities of foods. All of wheat is imported, though the volume of consumption still remains very small. Cambodia is a potential food exporting country. Because Combodia produced about 50 million tons of cereal and consumed only about 2.7 million tons in 2007.

7) Transport

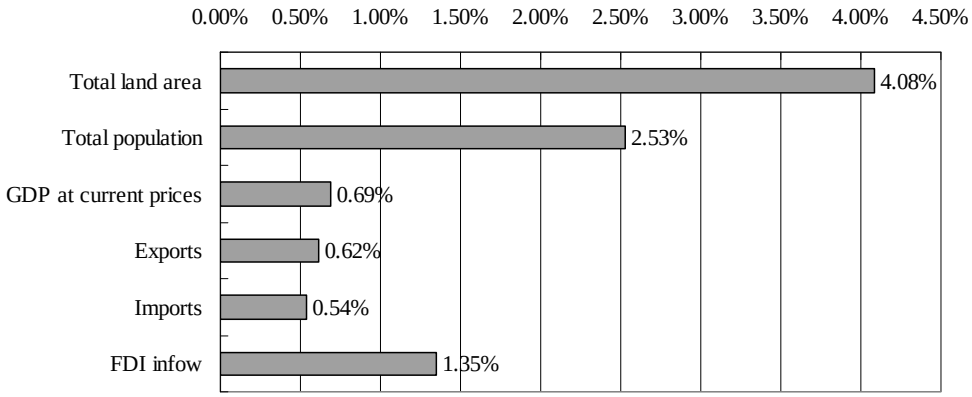
The road network in Cambodia consists of 5,205 km of National Roads (2,119 km are one-digit and 3,086 km are 2-digit), 6,413 km of provincial roads and 33,005 km of rural roads (as of September 2010). The National Roads are mostly primary roads linking Phnom Penh to provincial capitals. The Government plans to have paved road of 4,100 km in 2015.

The railway system comprises the northern line from Phnom Penh to Poipet (386 km) on the border with Thailand and the southern line from Phnom Penh to Sihanoukville port (264 km). The railway in Cambodia forms part of the GMS Southern Economic Corridor. The railway is now being rehabilitated under a series of reforms and investments, with a private concession agreement for operations. Freight service was introduced on part of the railway in October 2010.

Among the ports in Cambodia, only Sihanoukville Port and Phnom Penh Port handle international container cargoes. Other ports besides the two autonomous ports are small sea or river ports. Two commercial sea ports have been constructed and are operated by private companies.

2.1.2 ASEAN

As shown in Figure 2-1-1, Cambodia occupies 4% of land area of ASEAN region and 2.5% of total population of ASEAN countries. However, Cambodia's share of economic indicators such as GDP, external trade and FDI is still much smaller than these figures. Cambodia's share for FDI is larger than those for other economic indicators, though the FDI per capita is still lower than the average of ASEAN region.



Prepared by Project Team (based on the data provided by ASEAN)

Figure 2.1-1 Cambodia's share in ASEAN region

2.2. Position of Sihanoukville Port in the National Policy Framework

2.2.1 Basic policy and institutional framework for Cambodian port sector

(1) Rectangular Strategy II

"Rectangular Strategy" for Growth, Employment, Equity and Efficiency Phase II established

after the General Election in 2008 aiming at achieving national goals described below is the basic policy of RGC.

Although Sihanoukville port is not specifically referred to in the strategy, recognizing that the transport network plays a role as "a Prime Mover of Economic Growth", high priority is put on infrastructure development including port expansion as shown in the box below. The strategy also stresses the importance of private sector participation in transportation services.

Besides contexts which refer infrastructure including ports directly, the strategy provides a lot of policies related with Sihanoukville Port.

(2) NSDP Update 2009-2013

The National Strategic Development Plan Update (NSDP Update) 2009-2013 has been prepared focusing on identifying who is responsible for implementing the priority policy or policies in each area of the Rectangular Strategy II; what specific actions the responsible institution(s) has/have planned to implement the priority policy(ies); and the responsible institution(s) best estimate on how much it will cost to implement the planned actions during 2009-2013.

2.2.2 Policy on the functional demarcation among public ports

The basic port policy of Cambodia is “Open Sea Policy” with open access to all Cambodian ports by all port developers and operators, though it doesn’t appear in the Rectangular Strategy. The policy is referred to in NSDP Update as an existing strategy. Open Sea Policy was advocated by the Ministry of Commerce as an analogy of “Open Sky” in the context of promotion of private investment.

Since the fair competition on the basis of equal footing is the basic principle according to the Open Sea Strategy, RGC has hesitated to put political priority on a specific port whether it is a public port or a private port, even when it seemed necessary for securing the nation’s competitiveness. In this relation, there is no policy paper which clearly defines the demarcation between Sihanoukville Port and Phnom Penh Port.

2.2.3 Role of Sihanoukville Port in achieving the national development targets

The analysis in the context of the Rectangular Strategy II revealed that the port has important roles in achieving all four aspects as well as the core of the strategy as listed below:

- The Core of the Rectangular Strategy: Good Governance
  - Exterminating corruption in Sihanoukville Port by the efforts of PAS and authorities concerned, the port shall be a successful example in combating corruption and enjoying economic prosperity.
  - Under the framework of the national port policy which is to be formulated based on the result of PENPPAS, fully complying with international conventions, national laws and regulations including the Port Act which is also to be established based on the result of PENPPAS, Sihanoukville Port shall be contributing toward achieving well-organized and synergetic development of the port sector in Cambodia, which maximizes the national benefit.
  - By intensifying port security, Sihanoukville Port shall be contributing toward securing social security.
  - By the trade facilitation through the efficiency improvement and the cost reduction of port operation, Sihanoukville Port shall be supporting Cambodia's integration into the region and the World
  - By export promotion through the efficiency improvement and the cost reduction of port operation as well as provision of SEZ, and by tourism promotion through receiving a greater number of cruise vessels, Sihanoukville Port shall be supporting the favorable macro-economic condition.
- Rectangle I: Enhancement of the Agricultural Sector

- By the provision of efficient and low-cost port service, Sihanoukville Port shall be contributing toward the increase of export of agricultural products, especially finished goods, in particular rice.
- By realizing well-harmonized spatial utilization between port and fishery, Sihanoukville Port shall be contributing to the improvement of productivity of fishery and supporting the reform of the sector.

➢ Rectangle II: Further Rehabilitation and Construction of the Physical Infrastructure

- For enabling provision of convenient, stable, safe, economically efficient, lower cost transportation and logistics services network, aiming at trade facilitation, tourism promotion, rural development as well as regional and global economic integration, Sihanoukville Port shall be expanded responding to its traffic demand and paying due attention upon environmental and social impacts.
- Encouragement of private sector participation in the rehabilitation of infrastructure and in the provision of transportation services at Sihanoukville Port shall be studied with due consideration on maximizing benefit to the nation's economy.
- By the provision of efficient coal unloading facility, Sihanoukville Port will be able to contribute to the promotion of thermal power generation aiming at increasing electric supply capacity and reducing tariff to an appropriate level as well as diversifying energy sources.
- By the provision of reliable and efficient supply base, Sihanoukville Port shall be contributing to the production of off-shore oil and gas with minimum impact to the environment.

➢ Rectangular III: Private Sector Development and Employment

- By improving operational efficiency and simplifying port procedures as well as upgrading physical infrastructure, Sihanoukville Port shall be contributing to the reduction of business transaction costs and the improvement of market access.
- For diversifying the economic basis, Sihanoukville Port shall be contributing toward the promotion of agro-processing industry, and assembling industry including electronic and machinery assembly through the efficiency improvement and the cost reduction of port operation as well as provision of SEZ.
- Through the provision of SEZ and the promotion of logistics industry, Sihanoukville Port shall be contributing to job creation.

➢ Rectangle IV: Capacity Building and Human Resources Development

- Sihanoukville Port shall be making continual efforts in improving the quality of technical and vocational training.

2.3. Trends of Logistics in the Hinterlands of Sihanoukville Port and Phnom Penh Port

2.3.1 Business and logistics of the major shippers

(1) Garment and footwear

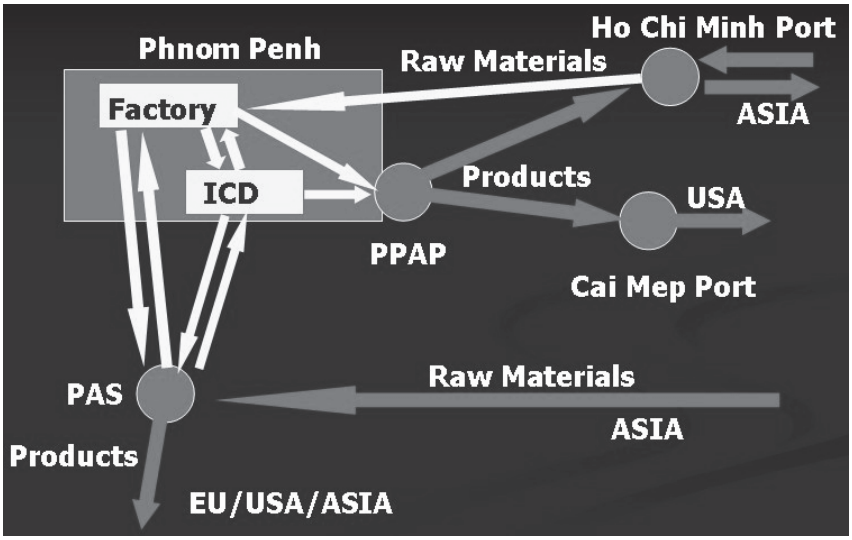
Before the removal of T&G quota, there were discussions whether Cambodian garment industry can survive or not; however, the export of Cambodian garment products has been steadily increasing after the removal of quota in 2005. After the drop due to the global economic crisis in 2009 the garment export started growing again. This proves that Cambodian garment industry is competitive even without preferential quota system.

The majority of garment export is knitted articles, which amount to 85% of total garment export. Though the footwear industry is the important exporting industry in Cambodia, the export is much smaller than garment products in terms of quantity and value.

More than 50% of garment products are exported to USA. EU is also an important trade partner of garment products. As an individual country, China is the second largest trade partner of garment products, since a considerable amount of trade of "rags" exists.

Figure 2.3-1 shows the typical international logistics route for the garment/footwear industry in Phnom Penh. The major part of textiles and other raw material is imported from the East Asian countries and regions such as PRC, Hong Kong and Taiwan. In 2020, around 120 thousand tons of textiles were imported to Cambodia, of which 83% were imported from PRC, Hong Kong and Taiwan. Raw materials are mainly discharged at Ho Chi Minh port where frequent, economical and diversified liner services linking to East Asia are available. Once unloaded at Ho Chi Minh port, raw materials tend to be transported to Phnom Penh by road even though the land transportation is more costly than waterborne transport, since garment/footwear factories want to start production as earlier as possible to meet buyers' strict requirement on the time of delivery and to minimize overtime of their employees. Sihanoukville port also handles a considerable amount of raw materials for garment/footwear industry utilizing its advantage of direct linkage to the East Asian major ports.

As for export of garment products and footwear, Sihanoukville port is the principal gateway to all destinations, handling more than 50% of garment products and footwear exported from Cambodia. Phnom Pen port also handles exported products to Asia via Ho Chi Minh port and to United States via Cai Mep port.



Prepared by Project Team

Figure 2.3-1 Typical international logistics route for garment industry in Phnom Penh

(2) Rice milling

Rice is Cambodia's main crop, accounting for about 50 percent of total crop production and some 7-8 percent of GDP. Rice production in Cambodia has doubled in the last decade due to the increase of harvested area and productivity.

The food balance in Cambodia shows a surplus of rice, and Cambodia exports rice at present. Factoring in domestic consumption and post-harvest losses, more than 3 million tons would be available for exports. However, according to the official statistics, the exported volume is only around 50 thousand tons, suggesting existence of informal export to neighboring countries.

Under the motto, "Rice - White Gold," the government's new rice policy adopted in 2010 is a five year plan that focuses on expanding the production and export of rice. The policy aims to transform Cambodia into a «rice basket» and key milled rice-exporting country in the global market. In this connection, the Royal Government has set the year 2015 as the target year to (1) reach paddy rice surplus of more than 4 million tons and achieve milled rice export of at least 1 million tons; and (2) ensure Cambodian rice to be internationally recognized.

The policy looks at all aspects of the value-chain and has the following key objectives:

- Facilitating trade.

- Raising productivity.
- Addressing land issues.
- Improving the infrastructure including reducing energy costs.

2.3.2 Present status and development plans of SEZs

A sub-decree on the Establishment and Management of Special Economic Zones was adopted in December 2005. RGC has since approved a total of 21 Special Economic Zones (SEZs) located mainly along the border with Thailand and Vietnam and at the port city of Preah Sihanouk.

Businesses within the SEZs benefit from a number of incentives such as up to 9 years tax holiday, 0% VAT, full import duty exemption for raw materials/machinery/equipment, no export tax, employment of expat workers allowed up to 10% of total workforce, permanent visa for families of investors, up to 99-year lease, free repatriation of profit.

In addition, for SEZ located within 20km from the official border including international ports, Special Customs Procedures stipulated in the Prakas No.3841, MEF, September 11, 2008 is applied as follows:

The SEZs offer a 'One-Stop Service' for imports and exports, with government officials stationed on-site providing administrative services.

2.3.3 Business trends of logistics industries

(1) Land transportation companies and freight forwarders

1) Trucking company

The Cambodian Trucking Association (CAMTA) is established, which is now composed of seven trucking companies, five of which have their own dry port:

In the survey carried out in the vicinity of Sihanoukville Port, the percentage of flat-body trailers without any securing devices was found to be 10% of all heavy vehicles carrying containers. Although, there were some cases observed where container is fastened to chassis using chains alike on flat-body, still there are major concerns of accident due to insufficient fastening. Some trucks are found to be in a very dangerous condition without any fixing of containers on the flat-body.

Even on the trailers with container securing device, it is a known fact that some containers do fall off if the twist lock pin is not locked correctly, which may lead to accidents on the road. Besides the risk of accident caused by unsecured containers, there is also the potential for accidents due to the loaded heavy vehicles speeding around the corners. It is important that drivers travel at a safe speed and ensure proper container fixings on the trailer to prevent any further heavy vehicle accidents.

2) Freight forwarder

In Cambodia, a freight forwarder and forwarding agent is a person or company that organizes shipments for individuals or companies and it may also act as a non-vessel operating common carrier. The Cambodia Freight Forwarders Association (CAMFFA) has been established since 2001. It is the official representative of freight forwarder companies in Cambodia.

(2) Waterborne transportation companies

Four barge operators are currently deploying self-propelled container barges between Phnom Penh Port and Cai Mep-Thi Vai Port / Ho Chi Minh Port through Mekon River waterways. Fifteen barges are deployed in total by the 4 companies. Their services are much the same; each barge has 7-day turnaround with the same route and port rotation.

Capacity of barges is in the range between 72 TEUs and 120 TEUs. Every barge has a light draft suitable for navigation on the Mekong River in the dry season.

The bilateral agreement on waterway transportation was concluded between Cambodia and

Vietnam in December 2009. As a result, CIQ procedures for the barges at the border have been simplified from previous 2 stops to single stop.

2.3.4 Hinterland transport of seaborne cargoes handled in Cambodian ports

For both export and import through Sihanoukville Port, more than 90% of containers are to/from Phnom Penh, where a lot of garment factories export their products to USA and EU and import raw materials from East Asia. Export/import cargoes from Preah Sihanouk, which Sihanoukville Port can handle without major competition, is less than 4%.

For export through Phnom Penh Port, more than 90% of containers are from Phnom Penh as observed in the data of Sihanoukville; however, the destination of imported cargoes through Phnom Penh Port is slightly more diversified than those through Sihanoukville Port.

2.3.5 Cross-border cargo transport

- Bavet–Moc Bai route: The total export volume in 2010 was 4,106 tons.
- Poipet- Aranyaprathet route: The total export volume in 2010 was 11,490 tons.
- Koh Kong–Hat Lek: The total export volume in 2010 was 379,803 tons.

2.3.6 Generation of seaborne cargoes in Cambodia

(1) Seaborne cargoes to/from Cambodia

The volume of seaborne cargoes was estimated using the following manner:

- Calculation of total weight (net weight) of imported and exported cargoes using customs' data
- Elimination of the volume of cargoes to/from Vietnam or Thailand, in which non-seaborne cargoes are included from the total weight
- Conversion of net weight data into gross weight data
- Addition of the weight of cargoes transported between Cambodia and Thailand/Viet Nam by sea.

Table 2.3-1 summarizes the estimated volume of seaborne cargoes to/from Cambodia. The estimated import cargo volume is 4.7 times larger than export cargo volume due to large inflow of oil products, construction materials, and consumer goods.

Table 2.3-1 Estimated volume of seaborne cargoes to/from Cambodia in 2010

(1,000tons)

		Import	Export
A	Except Thailand or Viet Nam	1,770	646
B	Thailand or Viet Nam	1,283	2
C	**Total (A+B)**	**3,053**	**648**

Prepared by Project Team

(1) Market share of gateway ports

The Project Team estimated the handling volume of seaborne cargoes at each gateway port as shown in Table 2.3-2.

Table 2.3-2 Estimated handling volume of seaborne cargoes at each gateway port in 2010

(1000 tons)

		Total Seaborne Cargoes	Sihanoukville	Phnom Penh	Provincial Ports	Private Ports	Vietnamese Ports via Roads
Import	Container, Dry Bulk, Break Bulk	2,424	1,176	183	160	686	219
	Liquid Bulk	629	627	2	0	0	0
	Total	3,053	1,803	185	160	686	219
Export		648	415	130	0	8	95
Total		3,701	2,218	315	160	694	314

Prepared by Project Team

2.4. Present Status and Development Plans of the Road and Railway Networks

2.4.1 Existing condition of international roads in Cambodia

NR 1 was specified as a part of Asian Highway No. 1 (AH-1). AH-1 is a main international route connecting Bangkok, Phnom Penh and Ho Chi Minh. Moreover, the southern economic corridor advocated by ADB includes NR 1 in Cambodia and it was one of economic corridors that were approved in the first summit of GMS held in Phnom Penh in 2002. NR 6 composes a part of AH-II which connects Bangkok, Siem Road and Quy Nhon in Vietnam.

2.4.2 Road network in Cambodia

(1) Present condition of major national roads

The rehabilitation and construction of the major national road network, which consists of single digit roads, has been almost completed. The next challenge is to ensure traffic safety and provide proper maintenance of roads over the country in accordance with the National Strategic Development Plan (NSDP) update 2009–2013. The following issues are recognized in the rehabilitation and construction of the roads:

- Roads and bridges deteriorate faster in accordance with the traffic volume increase.
- Roads are damaged by traffic of overloaded vehicles.

1) NR 1

NR 1 is part of the Southern Corridor, which is the main logistics route of countries of the Greater Mekong Subregion (GMS). The route is expected to achieve economic development in Cambodia. The total length of NR 1 is about 162 km, which ends at a jetty where ferries are functioned to cross Mekong River. It was found out that the said 4.0 km section is a bottleneck, which prevents smooth traffic and transport.

For many years, there has been traffic congestion of ferries crossing Mekong River. In order to eliminate this traffic congestion, a construction plan for a bridge across the river had been studied and a groundbreaking ceremony for the construction works has been implemented in February 2011 through a Japanese grant aid. The installation of a weighbridge was planned in order to control overloaded vehicles. In accordance with the NSDP update 2009–2013 and master plan of road network in 2020 provided by the Ministry of Public Works and Transport (MPWT), NR 1 was planned to consist four lanes.

2) NR 3

The section of NR 3 between Phnom Penh and Kampot was rehabilitated by means of a Korean grant aid in 2010 and it is expected as the main route to connect Phnom Penh with Sihanoukville. However, the rehabilitated section will be deteriorated easily by the overloaded vehicles and rain due to pavement with DBST. It was found that the section of NR 3 between Kampot and Trapang Ropaou which was rehabilitated through a Korean grant aid in 2008 has deteriorated.

The total length of NR 3 between Phnom Penh and Veal Rengh is 188 km.

3) NR 4

NR 4 is the main route connecting Phnom Penh and Sihanoukville. Many factories, logistics companies, as well as the Phnom Penh Special Economic Zone (SEZ) are located along NR 4. Also, it is expected as an economic corridor towards the development of Cambodia. NR 4 has a total length of 213 km, and is paved with AC. The operations and maintenance (O&M) of NR 4 is conducted by AZ Investment Co., Ltd., which is a private company. The toll fee, which is collected at the toll gates located at three points, is devoted to the O&M of NR 4.

Heavy vehicles travel along at approximately 35 to 45 km/h in an average. Most vehicles pass through NR 4 when going to Sihanoukville and take about 5 to 6 hours for travelling.

In accordance with the NSDP update 2009–2013, NR 4 will be improved to four lanes. The MPWT has proposed the road network master plan for 2020 in which construction for improvement will be implemented between Sihanoukville and the connection point with NR 48.

The weight limit of most bridges on NR4 is shown to be 25 ton, which can obstruct the transportation of sea containers.

4) NR 5

NR 5, which constitutes a part of the southern economic corridor similar to NR 1 in Cambodia, is expected as an important logistics route between GMS countries to contribute to the economic development of Cambodia. NR 5 is paved with DBST and the existing condition is generally good. Every year, a part of NR 5 is submerged in floodwater due to the rise of water level in Tonle Sap Lake.

In order to control the overloaded vehicles, a weighbridge has been installed in NR 5. In accordance with the NSDP update 2009–2013, NR 5 is planned to have four lanes similar to the future improvement plan of NR 1.

5) NR 48

NR 48 was rehabilitated and paved with DBST in 2007 and four bridges along NR 48 were newly constructed in 2008 through aid from the Kingdom of Thailand. The traffic condition of NR 48, in which there was no option to cross four rivers but by small ferries, has improved since the completion of the rehabilitation and construction. The completion of NR 48’s improvement is expected to contribute towards the economic development of Cambodia as well as interaction between GMS countries as a part of the Southern Coastal Corridor.

(2) Logistics trunk route in Preah Sihanouk

Under the "Master Plan on Integrated Strategy of Coastal Area for Cambodia's Continual Development and Feasibility Study on Sihanoukville Development Master Plan (2010)", the regional industrial and logistical corridor between Phnom Penh to Veal Rengh is currently being proposed. Under this proposal, the corridor extends from Phnom Penh to Veal Rengh on NR 4, and Veal Rengh to Sihanoukville via Stung Hav.

2.4.3 Road access to Cambodian borders from ports in neighboring countries

(1) Cai Mep–Thi Vai International Port

The transport route consists of three national roads, namely, NR 22, NR 1A and NR 51 with a total length of 142 km. Widening of NR 51 has been implemented wherein double lanes and one motorcycle lane will be provided.

At the current stage, there is no dedicated motorway for only four-wheel vehicle in the Ho Chi Minh City, so all kinds of vehicles travel as a whole. Consequently, the traffic congestion in the city is severe, and especially during the morning and afternoon peak hours, the city may halt completely due to the congestion. To ease the city's congestion, some heavy vehicles are not permitted to enter the city during the day. The restriction applies during the hours between 6 am to 9 pm for the vehicles over 2.5 tons, and 6 to 8 am and 4 to 7 pm for the vehicles under 2.5 tons.

(2) Laem Chabang Port

1) Aranyaprathet - Laem Chabang Port route

The cross-border road network through Aranyaprathet is the most important trunk route supporting cross-border trade between Cambodia and Thailand with a total length of 276 km. The Aranyaprathet–Laem Chabang Port route consists of five roads, namely NR 33, Provincial Road (PR) 304, PR 314, NR 7 and the approach road to the port.

2) Hat Lek–Laem Chabang Port route

The cross-border road network through Hat Lek is the second trunk route connecting Cambodia and Thailand with a total length of 353 km. The Hat Lek–Laem Chabang Port route consists of five roads, namely, PR 318, NR 3, NR 36, NR 7 and the approach road to the port.

2.4.4 Railway network

The existing railway network in Cambodia consists of the northern and southern lines. The northern line was constructed during the 1920s and extends to a distance of 388 km from Phnom Penh to Poipet at Cambodia's border with Thailand. The southern line, which has a total length of 264 km, was built in the late 1960s and links Phnom Penh with Sihanoukville. The railway network was destroyed during the civil war, and it has deteriorated due to limited rehabilitation and maintenance. Under such condition, rehabilitation of the railway network has commenced since 2006 with aid from ADB and the Government of Australia. The project aims to reconstruct and repair the railway network, which extends from Cambodia's border with Thailand, through Phnom Penh, and to Sihanoukville where the country's main seaport is located.

2.4.5 Land transport network in the target years

(1) Estimation of transport network for large vehicles

NR1, 4, 5, 7, and 8 are to be widened from 2 to 4 lanes, and also there is a plan to construct new ring roads in Phnom Penh.

(2) Estimation of railway network

The existing railway network in Cambodia has been rehabilitated and expected to be completed in 2013. Moreover, a new railway line was planned to be developed between Cambodia and Vietnam as part of the Singapore–Kunming Railway Line initiative. But, it is thought to be challenging to establish a railway network, mainly because of the enormous construction cost, existing unsolved problem of resettlement over an extensive area, unsecured financial assistance on projects in Vietnam alone, high number of high speed and inter-city railway project plans being proposed in Vietnam other than mentioned above, and also possibly the positively progressing road maintenance linking Cambodia and Vietnam. The completion of a new railway is not able to be expected in the near future.

2.5. Status Quo and Development Trend of Ports in South-eastern Indochina

2.5.1 Phnom Penh Port

Phnom Penh Port is the second largest port in Cambodia. The access distance to the port is about 332 km from the Cuu Tieu entrance mouth of South China Sea, and about 100 km from Kaam Samnar, Cambodia-Vietnam border gate.

Phnom Penh Port is managed and operated by Phnom Penh Autonomous Port (PPAP) which is under the supervision of the MPWT and MEF. PPAP is managed by the Director General, three Deputy Director Generals and eight Directors. The Operation Department will be divided into two departments when the new container terminal commences operation in 2012.

Basically, cargo handling is carried out by employees of PPAP; however floating cranes provided by a barge operator are operated by the company's employees.

The business zone of PPAP covers the 160 km long Mekong basin from Neak Leung to

Kompong Cham province. Prior consultation with PPAP is required when any third parties intend to develop ports in this zone.

Besides above-listed river terminals, PPAP has an ICD. Since the area of river terminal is limited, PPAP promotes the utilization of ICD.

The port faces to NR5, but capacity of the section of NR5 in downtown Phnom Pen is limited. Therefore the port introduced a traffic monitoring system using CCTV cameras in order to alleviate traffic congestion. Railway access is not available at present. PPAP plans to construct an intermodal terminal connecting railway/road transport and waterborne transport in Kilometer 6 Port at a point 6 km from the Chak Tomouk confluence and 4 km from the main port.

Change in the number of vessel calls at the port in the last ten years is rather small. The number of calls of domestic barges showed a continuous decline since 2003 and actually ceased in 2007. The number of calls of international vessel/barge has been increasing; however, the increase rate is rather moderate compared with that of cargo throughput due to increase of vessels' dimensions.

The major cargo of the port is imported liquid bulk (oil products from Viet Nam), which accounts for more than 60% of total cargo throughput and 70% of imported cargoes. The cargo throughput of Phnom Penh Port has been increasing rapidly in line with the development of the Capital City and the growth of the country's industry. In particular, remarkable growth was seen in container traffic. The port was being used mainly for import, but since 2009 export containers have been increasing, and in 2010 more export containers were handled than import containers. This would be due to the diversion of a part of garment export containers for USA from Sihanoukville Port by the commencement of operation of Cai Mep Port and the increase of rice export.

Responding to the rapid growth of container traffic, PPAP is developing a new container terminal in Kien Svay District, Kandal Province, 30 km east of Phnom Penh along the Mekong River and the National Road No. 1. The development project is being implemented in three phases.

The annual handling capacity of the new terminal is 500,000 TEU. In the phase 1 development which will be completed in June 2012, a terminal with the capacity of 120,000 TEU was constructed. The length of the quay is 300m and the port area is 20 ha. Up to 5,000 DWT vessels can be accommodated at the new container berths. In the second phase development the handling capacity of 180,000 TEU will be added and the total capacity will be increased to 300,000 TEU.

The first phase development project is financed by a soft loan from the Government of China. The Chinese soft loan project covers only construction of infrastructure and buildings.

A new bypass road directly linking the new terminal and the National Road No.2 and No.3 is under construction. A railway link is not planned so far.

According to the explanation by PPAP, the new terminal will be operated by PPAP directly.

2.5.2 Provincial and private ports in Cambodia

(1) Provincial ports

There are five provincial seaports in Cambodia, namely Koh Kong Port, Stueng Hav Port, Tomnop Rolok Port, Kampot Port and Kep Port. Generally the scale of provincial seaports is very small and they are furnished with poor facilities such as wooden deck and un-paved yard without modern handling equipment. These ports are used mainly for coastal shipping linking the eastern coast of Thailand.

(2) Oknha Mong Port

Oknha Mong Port is the first private sea port in Cambodia, located at Stung Hav district, Preah Sihanouk Province. The port was inaugurated and commenced its operation in 2004. At present, the port is owned by a joint venture of Cambodian and Thai company. Land area of the port is 64 ha (of which 26 ha is used as a port terminal), total berth length is 1,111m berth with a width of 200 m and the water depth is 5.5 m. The port has 6 warehouses (1 unit of 1,200 m_2, 3 units of 5,600 m2, and

2 units of 7,000 m2) and open storage areas of 3 ha. It has 5 cranes (2 of 25-ton capacity), 5 forklifts and 15 trucks (for operating at the port area) and 2 dredging barges.

Most of the transport is carried out by barges or wooden boats with the capacity of 300 tons, which carry cargoes from Thailand. During a six-month period from October 2010, the port handled 371,860 tons of cargoes (of which 368,258 tons were imported cargoes and 3,602 tons were exported cargoes), and received 541 vessels. Cement and sugar from Thailand are the major commodities of import goods. Crude palm oil is the only export cargo, which is transported to Malaysia.

(3) Sre Ambel Port

Sre Ambel Port is located in Sre Ambel District, Koh Kong Province, 99.69 km from Preah Sihanouk. The privately owned 10 ha port terminal lies along the channel about 12 km from the open sea. Total berth length is 500 m with a width of 30 m and a water depth of 5 m. Without dredging, only boats of a maximum of 180 tons can navigate the channel, however, there is plan to secure a depth of 6m through dredging which will allow the channel to accommodate ships loading from 2,000 to 3,000 tons.

Most of the cargoes come from Thailand. Annual import volume through Sre Ambel Port ranges from 4,000 to 5,000 tons.

(4) Other private ports

A deep water port is planned along the coast of Kampot by a private SEZ developer. Originally it was announced that the new port and SEZ would be completed in 2010, but as of the date of the Project Team's investigation in July 2011, only embankments for the reclamation for the land of SEZ was under construction. Construction of berthing facilities has not commenced.

In the vicinity of Stueng Hav Port, construction of a SEZ with container port is planned by Attwood Investment Group. The planned development area for SEZ and port is 520 ha with 400 ha of basin protected by breakwaters of more than 7.6 km in length. The planned maximum depth of water alongside quays is 12 m. The port facilities constructed in the first phase seem to be designed considering traditional coastal shipping, which would not be convenient for SEZ factories.

2.5.3 Ports in the Gulf of Siam and southern Viet Nam

(1) Cai Mep - Thi Vai International Port

The Government decided to develop a new deepwater port at the mouth of Thi-Vai River in 1999. This area is located about 77 km away from HCMC by roads. This area has a sufficient depth for receiving deep draft container vessels.

Corresponding to the progress of the development project, foreign terminal operators and shipping companies started investment in a container terminal development and port operation and management business by establishing joint venture companies with Vietnamese corporations.

River waterfront spaces are allocated for the development of bulk cargo terminals area and container terminals at Cai-Mep Thi-Vai area Industrial parks are located behind or adjacent to the waterfront area in order to make use of port facilities for their products transport. The width of the river is between 400m and 600m in the vicinity of CTs. The depth is 14m at the down-stream of TCCT/TCIT and 12m at the up-stream.

Road access from HCMC is provided by Route 1 and Route 51, with the total distance of about 77 km. Parts of Road 51 are under improvement for widening the lanes from 4 to 6. Container trucks take about 3 hours from HCMC to Cai-Mep Thi-Vai area.

Barges travel a distance of about 65 km through rivers from HCMC. Currently, 80 % of containers to be loaded on container vessels at the port are transported by barges with carrying capacity of about 50 TEUs.

Public enterprises such as Saigon New Port, Saigon Port and Vinalines operate these

container terminals solely or as a member of joint venture with private terminal operators. Total container handling capacity at Cai-Mep Thi-Vai port after the completion of 2 terminals under construction is expected to reach at least 6.75 million TEUs.

(2) Ports in Ho Chi Minh

Port terminals in Ho Chi Minh are located along the river system in Ho Chi Minh, around 45 nautical miles from the sea.

Cat Lai Terminal operated by the navy-origin Saigon New Port is the largest terminal in Ho Chi Minh as well as in Viet Nam. VICT is the first private container terminal in the port. Saigon Port is operated by Saigon Port Company. Ben Nghe Port located next to VICT mainly handles domestic containers. Hiep Phuoc Terminal is the newest terminal and will be the terminal with deepest berths in Ho Chi Minh. All terminals in Ho Chi Minh except Hiep Phuoc use Long Tau access channel with the draft of 8.5m, whereas Hiep Phuoc Terminal plans to use Soai Rap channel by dredging it up to -9.5m (tidal -12m).

Ho Chi Minh ports handle much greater number of containers than Cai Mep Thi Vai port.

(3) Laem Chabang Port

Laem Chabang Port is in located approx. 130 km southeast of Bangkok. Having been the largest port in the country since its commencement of operation in 1991. In 2010, the port which handled about 5.2 million TEUs now ranked the 21st in the world in container throughput.

The master plan of “Eastern Seaboard Development Programme” including the development of Laem Chabang Port was approved by the cabinet in 1982. Under this master plan, “Eastern Seaboard Development Committee (ESDC)” was formed as a cabinet-level national committee in the recognition that the port should be developed together with the industrial areas in its hinterland and transportation infrastructures to connect the Eastern Seaboard Area with the Bangkok Metropolitan Area.

Private enterprises were invited to join in the operations of the terminals under the overall port governance by Port Authority of Thailand.

Eleven berths surrounding Basin Ⅰ and 4 berths (C0, C1, C2, C3) surrounding Basin Ⅱ are currently in operation. Basin I, constructed as Phase I of the development plan, commenced operation in 1991 with the capacity of 4 million TEUs per annum. In the case of Basin II, planned as Phase II, all civil works were done by Hutchison Port Holdings; the single concessionaire and delivered to the same company as the first case of the port, while 3 berths (D1, D2, D3) are still under construction in spite of the original assumption of the concession contract to inaugurate the full berths within the year of 2011. With the full utilization of Basin II, the total capacity of the port will increase to 10.8 million TEUs per annum.

(4) Bangkok Port

1) General

Although the gateway port function of the country has already moved to Laem Chabang Port, located in the metropolitan area, Bangkok Port still handles a considerable amount of containerized cargoes and bulk cargoes.

Each terminal in Bangkok Port is operated and owned by a different entity. Khlong Toey Port is owned and operated directly by the Port Authority of Thailand (PAT). Other terminals are owned and operated by private companies. The access channel connecting the port with the open sea is maintained by PAT.

PAT terminal is located on the left bank of Chao Phraya River between the kilometer 26.5 and 28.5 in Klong Toey District. The depth of water in the port area varies from 8.5 to 11 m below MSL.

The government owned PAT terminal handles around 80% of total container throughput in

Bangkok Port. However, the share of private terminals has been slightly increasing due to their increased capacity. Since the area of PAT terminal has been fully developed, PAT doesn't have a plan to increase its terminal's capacity.

2.6. Present Status and Future Trends of Maritime Network

2.6.1 Container network

(1) Global trends

The prolonged global recession caused by the succession of Lehman Shock and Euro crisis, the world maritime transport has been enmeshed in difficulties. When looking at the demand side of world maritime transport, the cargo movement has slowly been recovering from the bottom of 2009, mainly led by emerging exports from China and Asian countries and inter-Asia trade, However, as for the supply side, it is observed that the adjustment of vessel tonnage by shipping lines has not been working well. The surplus of vessel tonnage is now causing the serious decline of ocean freight rates, which is further aggravating the shipping lines' economies.

It is observed that the vessel tonnage of container carriers is still much exceeding the demand despite all their attempt to adjust the scale of fleet down to the reduced demand.

Thus the container carriers are now seeking cost-competitiveness more desperately than ever, which may be revealed in the trend to deploy larger vessels to reduce their slot cost, severe selection of ports to call or in the demanding requests to the container terminal operators for the improvement of stevedoring efficiency.

Deployment of mega container vessels has been sought by the major container carriers with the advancement of shipbuilding technology, as enlargement of vessel size has a profound effect on reducing the unit cost (so called "slot cost") of container carriers. The largest container vessel currently in operation has a capacity of 14,000 TEUs. In June 2011, Maersk Line announced that they had placed an order for 20 new vessels (named as "EEE" Class) with 18,000 TEU capacity.

When a larger container vessel replaces the existing smaller vessel in Asia-Europe trade, a "cascading effect" will take place across almost all trades, resulting in a general upsizing in the vessels deployed in each trade lane. Cascading effect can also happen in feeder routes. In September 2011, MCC Transport, Maersk Line's intra-Asia arm, started to operate 5,500 TEU mega feeder vessel on the weekly shuttle between Laem Chabang and Tanjung Pelapas.

Another new trend happening among the major container carriers under the current over tonnage situation is the merger of services by different alliances. Following Maersk Line's launch of "Daily Maersk" in September 2011 which assures daily departures in Asia-Europe trade, Mediterranean Shipping and CMA CGM, the world's second- and third-largest ocean carriers, announced in December, 2011 an agreement of partnership on key trade routes around the world, and on its heel, 6 members of the New World Alliance and Grand Alliance announced to forge a new vessel-sharing alliance (called as G6 Alliance) operating 90 vessels on Asia-Europe trade lanes. CKYH Green Alliance and Evergreen Line also made a cooperation agreement to exchange more slots in Asia-Europe trade.

(2) Trends in south-eastern Indochina

1) Current situations

The salient feature of Cai Mep is that almost all the vessels are deployed for North America and Europe trades and very few vessels are for intra-Asia and feeders. As Ho Chi Minh is characteristic of Intra-Asia and feeders, it can be said that those 2 ports are "dyad" complementing each other.

Bangkok and Ho Chi Minh, as both are the shallow river ports, share the similar feature specialized in intra-Asia and feeders which smaller vessels are deployed under the restriction of draft, while the capacities are rather big owing to the rich cargo sources at their hinterlands.

Kuantan, Songkhla and Sihanoukville also share the same feature composed of the feeders and

some few intra-Asia with the small hinterlands.

Cai Mep is attracting the largest main line vessels with the capacity of 6,200 TEU. The average size of main line vessels calling at Leam Chabang is not so large as that of Cai Mep, as smaller intra-Asia fleet is included. The sizes of main line vessels at Bangkok and Sihanoukille are similar, as the calling vessels are all deployed for intra-Asia only.

The major container carriers will move toward the deployment of larger vessels and accomplishment of hub & spoke systems. In the course of this movement, Cai Mep Port with a competence of proximity to the trunk line will be spotlighted as a hub port of south-eastern Indochina and attract more main line vessels for North America, Europe and intra-Asia.

On the contrary, Laem Chabang will peak out its attractive power toward the main line vessels of North America and Europe in spite of the further continuous growth of its throughput, while there is a possibility to induce more intra-Asia vessels.

In the course of progress above, some changes may come out with the regional maritime network in south-eastern Indochina. The ports surrounding The Gulf of Thailand such as Songkhla, Bangkok, Laem Chabang and Sihanoukville may possibly become the feeder ports of Cai Mep. The number of feeder vessels currently connecting those ports with Singapore will be reduced and shift to Cai Mep though the competence of Singapore will remain viable for the transshipments in west-bound trades such as for Europe, South Asia and Middle East.

(3) Status of Sihanoukville Port in the container transport network

2 main line services are currently available by the slot-charter deployment of MCC Transport/CNC Line and Regional Container Lines (RCL). The intra-Asia service of MCC/CNC covers various ports from Laem Chabang, Ho Chi Minh to China, Taiwan and Japanese ports with 1,600 to 1,700 TEU type vessels. Another intra-Asia service of RCL's covers from Songkhla, Haiphong, Hong Kong upto Taiwanese ports. The most recently inaugurated service is by SITC Shipping, a China-based intra-Asia operator. It was started from September 2011, covering various ports in Thailand, Vietnam, China, Korea and Japan.

The feeder services are operated by 5 shipping lines. Out of those, 4 services are connecting Sihanoukville with Singapore. Currently no feeder services are available to connect with Cai Mep Port.

(4) Forecast of liner services calling at Sihanoukville Port

The Project Team makes a projection on the position of Sihanoukville Port in the regional maritime network for the target years of 2020 and 2030 that:

- There will be little chance that the large trunk line vessels will call at Sinhanoukville Port instead of Cai Mep Port in consideration of the geographical advantage of Cai Mep Port
- By the same reason, it is unlikely that the shipping lines will make Sihanoukville Port a transhipment hub in place of Cai Mep Port.
- The cargoes to/from Sihanoukville Port will continue to be carried by feeder vessels and transshipped at the nearest hub port of Cai Mep in case of the trade lanes of North America and Europe.
- There is a possibility that more intra-Asia vessels with larger size will call at Sihanoukville Port, combined with Laem Chabang Port.
- The possible feeder vessels to connect with Cai Mep are likely to cover Bangkok, Laem Chabang and Sihanoukville Port altogether depending on the cargo volume at each port.
- The maximum size of those feeder vessels may be larger than the existing feeder vessels; possibly reaching close to Panamax size (2,900 TEU by 2020, 4,000 TEU by 2030 depending on the cargo volume at each port of call).

- The maximum size of possible intra-Asia vessels may also be larger than those currently calling at Laem Chabang Port, namely large Panamax size (3,500 TEU by 2020, 4,500 TEU by 2030 depending on the cargo volume at each port of call).

2.6.2 Passenger transport

(1) Overview of the ocean cruise market in The Gulf of Thailand

Currently in the littoral area of Gulf of Thailand, cruise ships are calling at Bangkok, Laem Chabang, Sihanoukville and Ho Chi Minh, very few at Cai Mep at some special occasions. Ho Chi Minh which received 64 calls in 2010 has been most frequently called among those 5 ports. At Sihanoukville Port, number of calls has increased from 5 in 2005 to 11 in 2010.

There is a trend that, the more tourism resources are accessible to the passengers, the longer the ships stay at the port. Ship size varies from luxury 200 pax type to 3,000 more pax type.

The longest stay of 2.1 days is found at Bangkok where the ships of smallest size with 471 pax visited. At Sihanoukville, the average stay of 1.1 days is the shortest among 5 ports. The average ship size of 1,179 pax is larger than the shallow ports of Bangkok and Ho Chi Minh but not so large as Laem Chabang.

At Sihanoukville, almost all the ships come in the dry season in and before April.

(2) The potential of Sihanoukville Port in the cruise market

Sihanoukville may fit the cruise ship passengers' taste and have the potential to be more spotlighted as a likely destination for cruise tourism. In addition, the flying route between Sihanoukville and Siem Reap which resumed operation in December 2011 will also be effective to induce cruise passengers.

Based on above, it is forecasted that the similar size of the ships currently calling at Laem Chabang or some largish can be expected for the year 2020 and 2030; namely 3,100 to 3,500 pax at maximum with average of 1,600 to 2,000 pax.

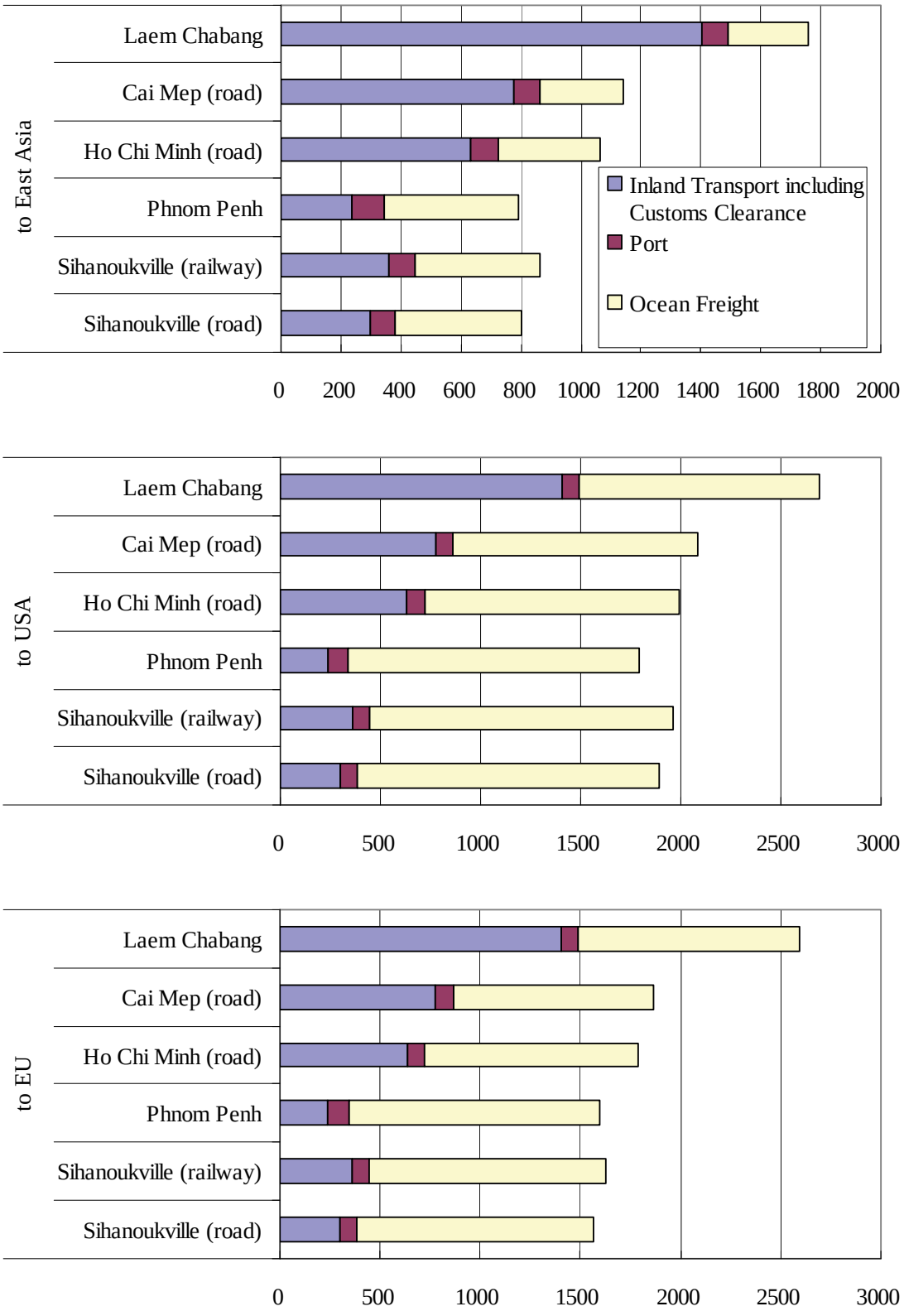
2.7. Competitiveness of Sihanoukville Port

In this sub section, the Project Team investigates/forecasts the current/future figures of costs and transit times for the transportation of container cargoes exported/imported to/from Cambodia by route and destination/origin. The figures of costs and times will be used for the analysis in "2.7.4 Comparative advantage of Sihanoukville Port" and "3.2.1 Cargo Demand Forecast for Containers" of the main part. For this purpose, the costs in this sub section refer to the costs borne by exporters or importers when they select one of the several transportation routes available.

Figure 2.7-1 and Figure 2.7-2 compare the cost for transportation between Phnom Penh and major export destination or import origin via each gateway port. The cost was estimated based on hearing survey; the survey results widely fluctuate since the price highly depends on the transportation market. Therefore it should be noted that a small difference in the estimated cost has little meaning. The following observations can be made based on these figures:

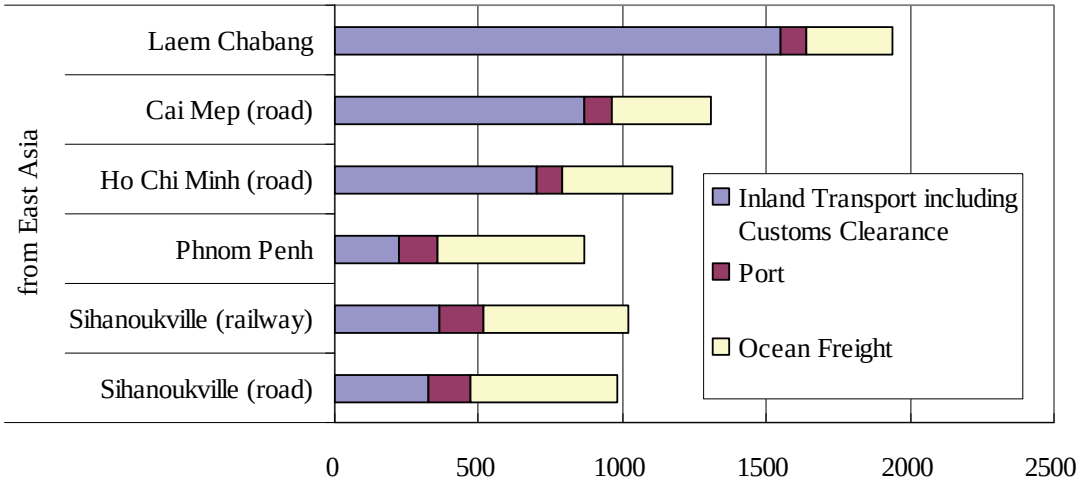
- Due to high land transportation cost, Laem Chabang Port is not competitive in container transportation to/from Phnom Penh for all trade lanes.
- For export to East Asia, the combination of cross-border road transport and Vietnamese ports is less competitive than Cambodian ports due to higher land transportation cost. The cost for Sihanoukville Port and Phnom Penh is almost the same.
- For import from East Asia, Phnom Penh Port provides slightly the most economical route.
- For export to USA, Phnom Penh Port also provides slightly the most economical route. Since the percentage of ocean freight rate in the total cost for cargoes to/from USA is larger than that for cargoes to/from Asia, the competitiveness of the cross-border route which uses Vietnamese ports is higher in transport to/from USA than that in intra-Asian transport.
- For export to EU, the costs for Sihanoukville Port and for Phnom Penh Port are almost the

same.



Prepared by Project Team

Figure 2.7-1 Comparison of cost for export from Phnom Penh to major destinations via each gateway port (unit: USD/TEU)

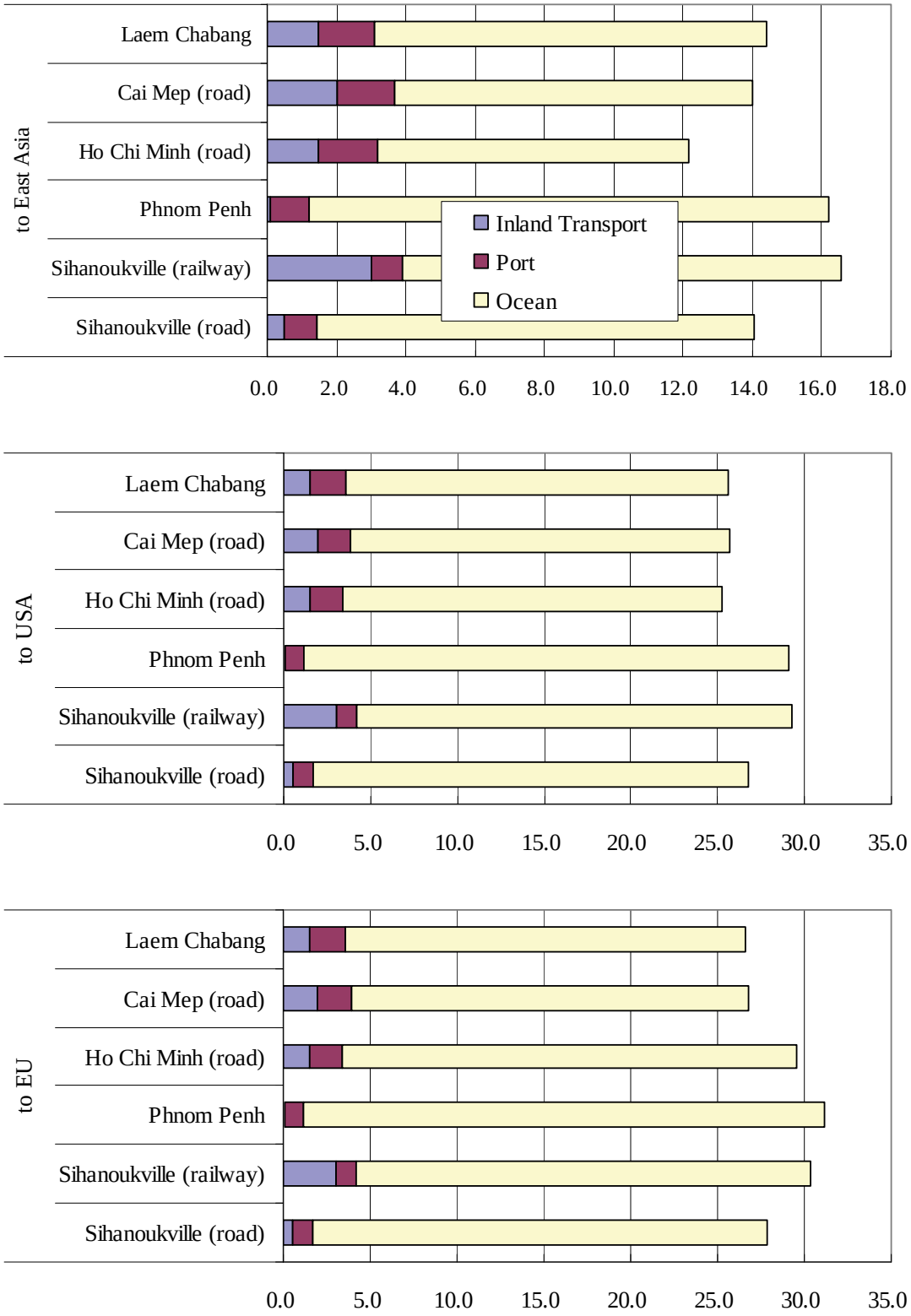


Prepared by Project Team

Figure 2.7-2 Comparison of cost for import to Phnom Penh from East Asia via each gateway port (unit: USD/TEU)

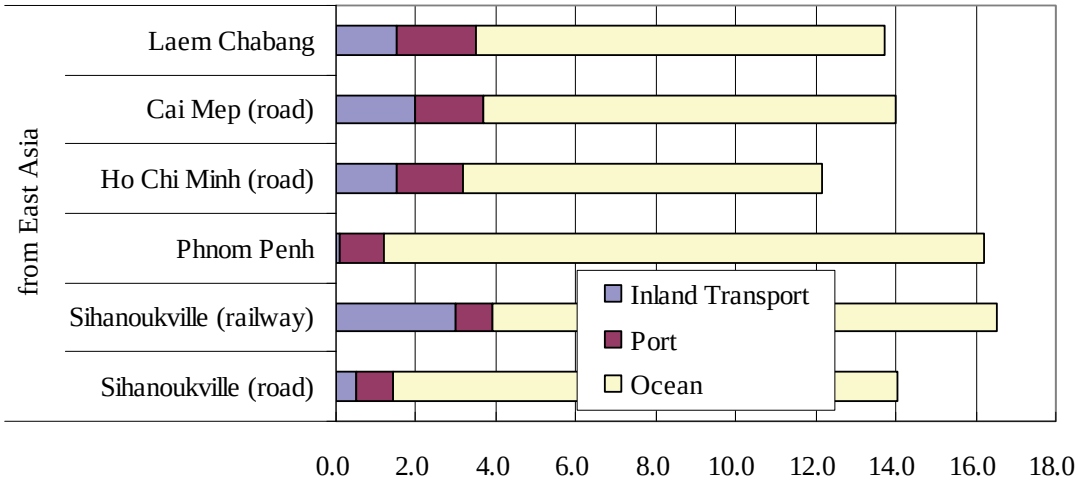
Figure 2.7-3 and Figure 2.7-4 compare days required for transportation between Phnom Penh and major cargo origin/destination through each gateway port. These figures indicate the following:

- The determinant of total transit time is duration of maritime transport. Duration of inland transportation or dwell time in ports has less influence on the total transit time.
- Unlike in the cost comparison, low competitiveness of Laem Chabang Port is not observed in the time comparison.
- As for the transportation to/from East Asia, the cross-border route via Ho Chi Minh Port requires the shortest transit time, followed by road route via Sihanoukville Port. This is due to the short duration of seaborne transportation which is realized by the diversified intra-Asia maritime connection of Ho Chi Minh Port. Waterborne transport via Phnom Penh Port and railway transport via Sihanoukville Port require longer transit time.
- Regarding export to the Americas or EU, the cross-border route via Cai Mep Thi Vai Port and road route via Sihanoukville Port require shorter transit time, whereas waterborne transport via Phnom Penh Port and railway transport via Sihanoukville Port require longer transit time.



Prepared by Project Team

Figure 2.7-3 Comparison of required days for export from Phnom Penh to major destinations via each gateway port



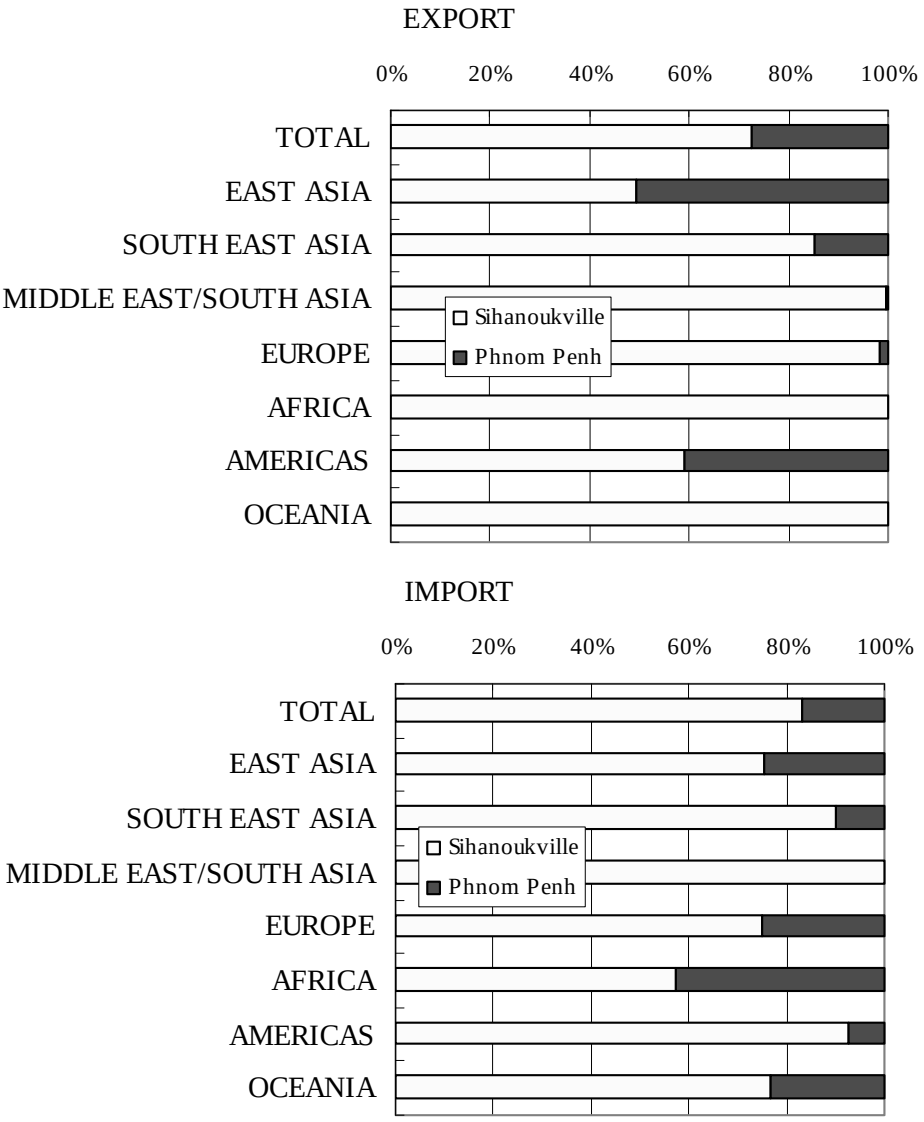
Prepared by Project Team

Figure 2.7-4 Comparison of required days for import to Phnom Penh from East Asia via each gateway port

Figure 2.7-5 depicts the market share of Sihanoukville Port and Phnom Penh Port by trade lanes. Cargoes transported to/from Vietnamese port by road are excluded from the calculation of market share. As for cargoes to/from the South East Asia, cargoes exported/imported to/from Viet Nam via Phnom Penh Port are also excluded from the calculation, because these cargoes are not seaborne cargoes.

For export to East Asia, the market share of Sihanoukville Port and Phnom Penh Port is almost the same. For import from East Asia, Sihanoukville has a larger share, though the transportation cost through Phnom Penh Port is estimated to be lower.

For export to USA, Sihanoukville has a larger share, though the transportation cost through Phnom Penh Port is estimated to be slightly lower. For export to EU, virtually all containers are loaded in Sihanoukville Port, whereas the estimated costs via the two ports are almost the same.



Prepared by Project Team (based on the data provided by PENPPAS

Figure 2.7-5 Container market share of Sihanoukville Port and Phnom Penh Port (tentative)

3. VISION OF SIHANOUKVILLE PORT

3.1. Socio-economic Framework

Based on the scenario described above, the growth rate of the GDP of Cambodia is assumed as listed in Table 3.1-1. Although the growth target set by the Rectangular Strategy is higher than the figures listed in the table, the Project Team will employ the growth scenario developed by IMF as a basis of the demand forecast in this chapter in order to avoid overestimation.

Table 3.1-1 Assumption of the GDP growth rate of Cambodia by IMF

	2010	2011	2012	2013	2014	2015	2020	2030
Real GDP growth (in percent)	4.8	6.8	6.5	6.5	6.6	6.8	6.8	6.7

Source: IMF

As for population, the Project adopts the forecast by UN as a basis of the demand forecast of

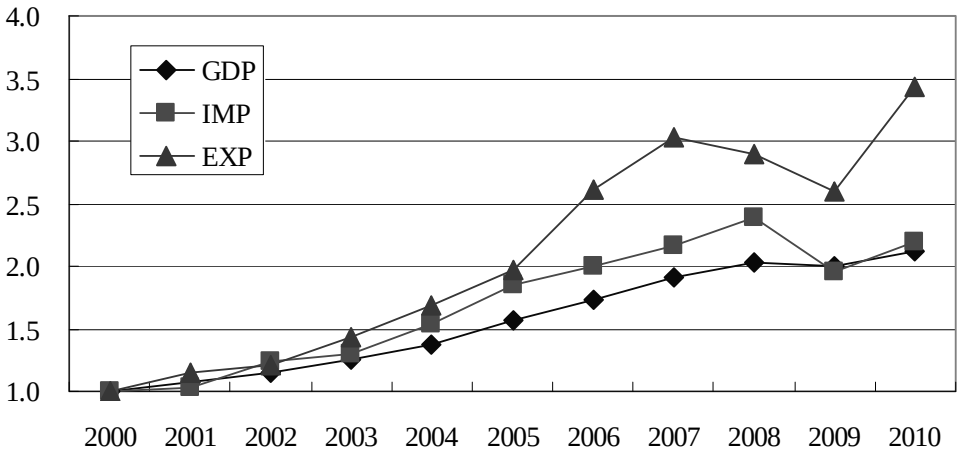
Sihanoukville Port.

3.2. Cargo Demand Forecast

3.2.1 Containers

(1) Cargo generation in Cambodia

Figure 3.2-1 shows indices of total import/export volume of containers to/from Cambodia and the country's GDP, where the container volume and GDP in 2000 are set to be 1.0. The figure indicates that container volume has been growing faster than GDP. The average GDP elasticity over the period from 2000 to 2010 is 1.1 for import and 1.8 for export.



Prepared by Project Team

Figure 3.2-1 Indices of import/export of containers and GDP of Cambodia

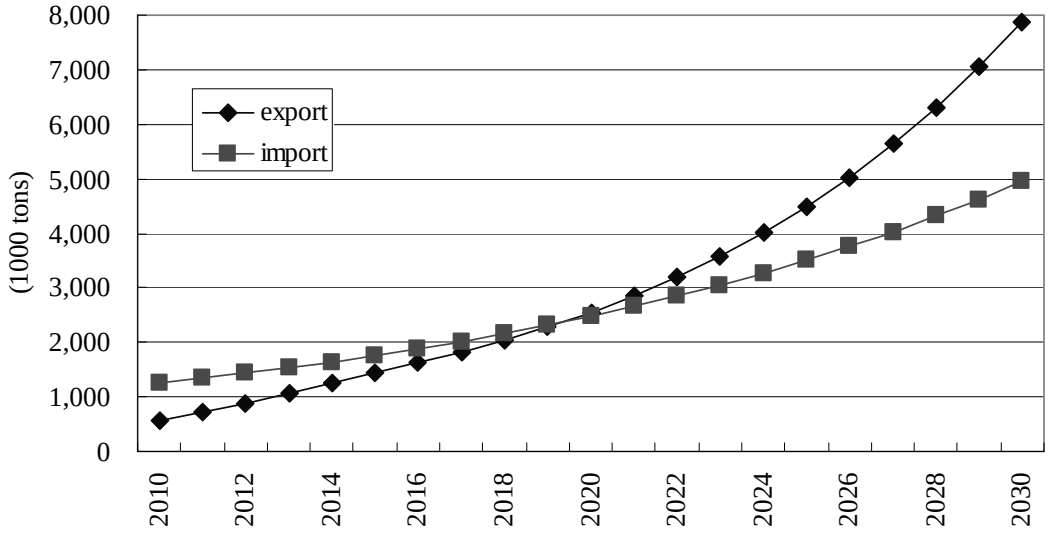
The Project Team assesses that the GDP elasticity will remain at the same level as the previous decade over the planning horizon of the year 2030 for following reasons:

- The Cambodian manufacturing industry is still in an early stage of development due to insufficient infrastructure and electric supply. The amount of investment in manufacturing industry has been relatively small compared with other sectors such as tourism. However, it is expected that manufacturing industry will be promoted rapidly in line with the improvement of infrastructures and electric supply. This will accelerate the growth of import and export. In the medium-term, the higher GDP elasticity than those of previous years can be expected.
- In general, there is a tendency that GDP elasticity for countries which achieved economic growth to a certain level becomes small. However, it is too early to foresee the decreased GDP elasticity for Cambodia. Cambodia is still in a very early stage of economic development. The country's GDP per capita in 2010 was 795 USD which accounts for 31st position from the bottom among 178 countries in the world. Even when Cambodia achieves economic development in line with the socio-economic framework described in the previous section, the country's GDP per capita in 2030 is still 2,400 USD which is smaller than that of the present average of developing countries in Asia and Pacific region and is less than 60% of GDP per capita of China in 2010. Based on the export volume index by UNCTAD, it is observed that the average annual increase rate of export volume from China from 2000 to 2008 is twice as large as its GDP growth rate.

Therefore the Project Team forecasted the volume of seaborne cargo based on the assumption mentioned above by multiplying the average elasticity of the past 10 years by the forecasted GDP by IMF shown in the previous section.

It is not expected that unilateral diversion from trade with non-ASEAN countries to intra ASEAN trade would occur since ASEAN is also promoting free trade with non-ASEAN countries such as East Asian countries. As mentioned in the previous chapter, the ratio of intra ASEAN export from Cambodia is still much lower than the average of that in ASEAN countries. Accordingly, it is assumed that the ratio of intra-ASEAN export from Cambodia will increase up to the present average intra-ASEAN export ratio among member countries in the target year. This results in lowering the volume of seaborne cargoes from Cambodia, because increased intra ASEAN trade means the increase of cross border transport to Thailand and Vietnam. As for import, it is assumed that the present intra-ASEAN ratio will remain unchanged since Cambodia's intra-ASEAN ratio is already more than the average in ASEAN members.

Based on the scenarios described above, the volume of container cargo generation in Cambodia is forecasted as listed in Figure 3.2-2.



Prepared by Project Team

Figure 3.2-2 Forecasted time series of container cargo generation in Cambodia

Based on the scenarios described above, the share of container cargoes by trade lanes in the target year of 2030 is estimated as shown in Table 3.2-1.

Table 3.2-1 Estimated share of each container trade lane in 2030

	2010		2030	
	EXPORT	IMPORT	EXPORT	IMPORT
EU	28.1%	4.7%	39.5%	4.9%
Africa	0.6%	0.3%	0.5%	0.3%
Americas	37.2%	5.5%	30.8%	4.5%
South Asia / Middle East	2.6%	3.7%	2.1%	3.8%
South East Asia	4.4%	14.6%	4.5%	15.1%
East Asia	26.5%	68.4%	21.9%	68.5%
Oceania	0.7%	2.8%	0.5%	2.9%

Prepared by Project Team

(2) Handling volume of Sihanoukville Port

By applying a nested aggregate logit model, container handling volume in Sihanoukville port in the target year is assessed. The Project Team estimated the demarcation corresponding to the scenarios described below.

Macro-economic Scenario

- According to IMF and the World Bank, the inflation rate of Vietnam is expected to be higher than that of Cambodia or the world average. Since the level of ocean freight is decided in the international market, the ocean freight in the target year is calculated by multiplying the current ocean freight and the average inflation rate in the world. However, the future cost of barge transportation on Mekong River, which is included in the ocean freight, is assessed based on the inflation rate of Vietnam.

Negative scenarios for Sihanoukville Port

- The frequency of barges calls at Phnom Penh Port increases by increased container handling volume. Since the service frequency of barges can be easily increased, it is assumed that daily service will be commenced. This can reduce the loss of opportunity cost.
- The required days for seaborne transport to/from Phnom Penh Port via Cai Mep Thi Vai Port are shortened up to one day due to efficiency improvement of transport including transshipment at Cai Mep Thi Vai Port.
- It is expected that cross border transportation between Cambodia and Viet Nam will be facilitated and the road network connecting with Cai Mep Thi Vai Port will be upgraded in the future. Accordingly, the Project Team assumed that the time required for inland transportation between Phnom Penh and Cai Mep will be reduced to the same level as that between Phnom Penh and Sihanoukville.
- By the completion of Neak Loeung Bridge, ferry fares will become unnecessary.
- The quota for number of trucks which can be deployed for direct transportation service between Cambodia and Viet Nam will be relaxed. This makes the trans-loading at the border unnecessary.
- It is said that the brokerage charged by customs brokers in Phnom Penh is higher than in Sihanoukville at present. The Project Team assumes that the level of brokerage will become the same between the two ports.

Positive scenarios for Sihanoukville Port

- The frequency of vessels calls at Sihanoukville Port increases by increased container handling volume. The Project Team assumes the frequency will double from the current twice a week service (weekend and middle of week).
- At present, ocean freight of liner service to/from Sihanoukville Port is much higher than that to/from Bangkok Port which is a feeder port too, since Sihanoukville's container handling volume is rather small and the competition among shipping lines is very limited. However, it is expected that the ocean freight to/from Sihanoukville will be lowered gradually by increased container throughput. Accordingly the Project Team assumes the difference of ocean freight between Sihanoukville and Bangkok will be reduced by half in the target year.

Higher inflation rate of Vietnam will reduce the competitiveness of waterborne transport via Phnom Penh Port or cross border transport route considerably. Even when all negative factors for Sihanoukville Port are considered and none of positive factors for Sihanoukville Port is considered in addition to the macro-economic scenario, Sihanoukville Port's market share is still larger than the present share.

Thus, it is evaluated that the market share of Sihanoukville will increase towards the target year.. As the most modest forecast, the Project Team evaluates that "the market share of each route for all trade lanes will remain unchanged until the target year". Since the above mentioned model doesn't consider the increased percentage of cargo generation from littoral area in around Preah Sihanouk due to SEZ and other industrial development, the scenario of unchanged market share is unlikely to overestimate the future container cargo demand of Sihanoukville Port. Even though the market share for each trade lane is unchanged, the market share of each route in terms of total throughput will be

changed because the growth rate of each trade lane is different. Though Sihanoukville's market share will increase slightly both in export and import due to a higher increase rate of EU cargoes, on the contrary the port's share in terms of total throughput will decrease slightly due to a higher increase rate of export containers for which difference of the market share between Sihanoukville Port and its competitors is smaller (see Table 3.2-2).

Table 3.2-2 Forecasted market share of each route in the target year

(%)

	2010			2030		
	Export	Import	TOTAL	Export	Import	TOTAL
Sihanoukville Port	60	69	67	62	70	65
Phnom Penh Port	23	15	17	22	14	19
CBT	17	16	16	16	16	16

Prepared by Project Team

Table 3.2-3 summarizes the result of forecast of future demarcation between Sihanoukville Port and Phnom Penh Port. In this forecast, TEU is calculated on the assumption that general import/export cargo volume in TEU is estimated at 10 tons. The volume of empty containers is calculated by estimating a proportion of the empty containers to the staffed containers for whichever larger volume cargo among import or export. Thus, the volume of empty containers is estimated by multiplying the empty container proportion number to the number of staffed containers in 2030. Intending to minimize financial risk caused by port development, the future container traffic was forecasted based on very severe conditions such as adoption of the most pessimistic scenario for the competition among transportation routes as mentioned above. However, it should be noted that the shortage of port capacity due to underestimated demand forecast will cause a loss in the context of national economy. Therefore, it is important to monitor the trends of container traffic continuously and to revise the demand forecast if it is necessary.

Table 3.2-3 Forecasted container throughput of each port in the target year

(TEUs)

			2010	2030
Sihanoukville Port	export	laden	62,371	491,000
		empty	44,259	104,000
		total	106,630	595,000
	import	laden	96,005	345,000
		empty	20,293	250,000
		total	116,298	595,000
	TOTAL	laden	158,376	836,000
		empty	64,552	354,000
		total	222,928	1,190,000
Phnom Penh Port	export	laden	24,276	193,000
		empty	10,671	85,000
		total	34,947	278,000
	import	laden	21,369	103,000
		empty	5,940	175,000
		total	27,309	278,000
	TOTAL	laden	45,645	296,000
		empty	16,611	260,000
		total	62,256	556,000

Prepared by Project Team

3.2.2 Non-containerized cargoes

Wood Chip;In Sihanoukville Port, around 1 million tons of wood chip is expected to be shipped

from the port. Since it is expected that the business environment of wood chip industry will be improved by the completion of the deep water bulk terminal, the Project Team adopts this forecast as the cargo volume in 2020 and estimates that the export volume will increase at the same percentage as the Cambodian GDP growth until 2030.

Milled Rice;The Project Team estimates that milled rice export will reach one million tons in 2015 and will continue increasing at the same percentage as other exported cargoes thereafter and fifty percent of exported milled rice will be shipped by general cargo vessels.

Wheat;Wheat consumption per capita in Cambodiais much less than that of the rice-eating nation of Thailand. Since the increase of wheat consumption is expected in line with the change of dietary habit in urban areas or poverty reduction in rural areas, the Project Team assumes that wheat consumption in Cambodia (currently 2.9 kg/year) will reach the present per capita in Thailand (14.7 kg/year) in the target year. The Project Team also assumes that virtually all of imported wheat is discharged at Sihanoukville Port, because mass transportation by larger bulker is very competitive for wheat import.

Coal;Diversion of cement supply in Cambodia from import to domestic production will increase the amount of coal import. For importers who require a larger volume of coal, transportation by large bulkers is advantageous, but normally these importers construct their own unloading facilities as the unloading jetty of thermal power plant in Preah Sihanouk. Therefore, the Project Team assesses that the handling volume of coal in Sihanoukville Port will not increase after 2020.

Vehicles;The Project Team assumes that Cambodia’s car ownership rate (currently about 2%) will increase up to 5% in 2030 with constant rate, which is equivalent to Indonesia’s current car ownership rate. In the calculation of demands of vehicle, it is assumed that vehicles are replaced every ten years.

The forecasted handling volume of general cargoes in Sihanoukville in 2030 based on the above-mentioned scenarios is shown Table 3.2-4.

Table 3.2-4 Forecasted handling volume of general cargoes in Sihanoukville Port in 2030

(tons)

		Base Year	2030
DRY BULK			
Wood Chip	export	71,000	1,921,000
Wheat	import	0	255,000
Steam Coal	import	123,000	240,000
BREAK BULK			
Milled Rice	export	0	933,000
Cement	import	46,000	0
Vehicle	import	17,000	194,000
Sugar	import	0	10,000
Others	import	58,000	571,000

Prepared by Project Team

3.3. Passenger Demand Forecast

The passengers of cruise ships are presumed to be increasing in proportion to the growth of international tourist arrivals in Cambodia. According to the projection by World Travel & Tourism Council, the growth rate of international tourist arrivals in Cambodia for the coming decade will be 4.5% per annum.

Few vessels are currently calling at Sihanoukville Port during the rainy season from May to October. However, it should be noted that a substantial number of cruise ships are calling at Ho Chi Minh Port even during the rainy season. The number of calls from May to October amounts to 20.8% of the same in other months, and 22.2% for passenger capacities respectively. As no significant difference is found in weather conditions of the rainy season between offshore of southern Cambodia

and southern Vietnam, the Project Team presumes that, Sihanoukville Port will be able to induce cruise ships in the rainy season if the Port can reserve the berthing windows for the cruise ships when the ship operators fix the cruise schedules; mostly 1 year before the callings.

Based on above, the number of calls and passengers for the year 2020 and 2030 are forecasted as follows.

Table 3.3-1 Forecast of cruise ship calls

	2010	2020	2030
Number of ships	11	20	31
Number of passengers	12,974	22,385	36,621

Prepared by Project Team

3.4. Formulation of the Vision

3.4.1 Mission of PAS

The role of PAS is to enhance the affectivity of sea-borne transport means among the transport sector infrastructure which supports the economic development of Cambodia

Taking into account the above, the Mission of PAS shall be “To accelerate the economic development of Cambodia in a manner to provide bases for maritime transport and internationally competitive coastal industries.”

3.4.2 Business Environment Analysis

Result of the business environment analysis is shown in Table 3.4-1.

Table 3.4-1 Result of Business Environment Analysis

Internal Environment		
Finance	1	Listing of PAS's stocks is expected.
	2	Repayment amount of JICA loan will increase.
	3	Operation cost is high due to high personnel costs and other expenses.
	4	PAS's current account balance shows a surplus.
Customers	5	Sihanoukville Port is the sole sea port in Cambodia which can accommodate oceangoing ships and large size bulk cargo ships.
	6	Major customers of PAS are garment exporters
	7	Connecting roads to hinterland are in relatively good condition and a railroad is provided in the port.
	8	Port operation efficiency rates is high because of the calmness of water area
	9	Increase of passenger ship tourists is expected.
Business Process	10	Use of container handling equipment is ineffective.
	11	Export/import document processing requires a long time.
	12	Employees lack awareness when it comes to cost, competitiveness, efficiency and job discipline
	13	Collection of informal charge is conducted.
Business Resources	14	Number of staff is about 1,100 workers which is excessive.
	15	Capacity of middle class management level personnel is low. However potential of young workers seems to be high.
	16	Staff training is poor. And insufficient coordination among departments and/or offices is found.
	17	Integral management of the port and the SEZ is conducted by PAS.
	18	Wide and calm water area is available but land area in the port is limited. Social environmental consideration needs to be taken in some areas around the port for the future development.
	19	Cargo handling equipment is not sufficient for peak operation periods.
External Environment		
Economic Trend	1	GDP in Cambodia is increasing. Coastal industrial development and the increase of cargo volume are expected.
	2	Worldwide recession is being observed.
	3	Inflation of Vietnam is anticipated.
	4	Progress of smooth trading practice and the improvement of investment environment are expected.
International Transport Trend	5	PPAP and a new port will strengthen the international shipping route through Cai Mep-Chi Vai port in Vietnam.
	6	The maximum size of mother vessel deployed in Asian region is increasing.
	7	The cross border transport between Phnom Penh and Vietnam is expected to streamline.
Market Trend	8	Garment, rice and wood chip export are expected to increase.
	9	Development of SEZs around Sihanoukville in particular the Port-SEZ is expected.
	10	Garment export is increasing by 30% annually.
	11	Private ports are being developed in SEZs.

Prepared by Project Team

3.4.3 Establishment of the Vision and the Strategic Targets

(1) Vision

Under the mission of PAS namely, "To accelerate the economic development of Cambodia in a manner to provide bases for maritime transport and internationally competitive coastal industries" the vision of PAS is determined as below;

(1) To become an international trade public sea port which connects Cambodia with overseas ports directly.
(2) To provide area or base for internationally competitive coastal industries such as export processing, agricultural products processing, marine resource development and tourism development.
(3) To become an internationally competitive port which meets customer's expectation.

(2) Strategic Targets

In order to fulfill the vision, it is necessary to establish strategic targets which can be formulated from the following 5 view points;

- Nation
- Finance
- Customer
- Business Process
- Learning and growth

The table below gives sorted result of SWOT analysis elements by means of the BSC method. This table also illustrates elements of the SWOT analysis which are sorted into groups with similar nature by using the BSC method.

Table 3.4-2 SWOT Analysis of PAS's Business

Internal	S (Strengths)		W (Weakness)	
National Viewpoint	1	Sihanoukville Port which handles the majority of seaborne cargo supports Cambodian industries.	1	Vision established at the time of port opening which aims to establish coastal industrial cities around Sihanoukville Port is not fulfilled yet.
	2	National interests can be reflected directly in the port management.	2	The benefit for Sihanoukville Port is very limited because transport cost preference between origin/destination and Phnom Penh via Sihanoukville Port is not significant compared to other transport routes.
Financial Viewpoints	3	The sales of the port are increasing and the current account balance shows a surplus.	3	Interest rate of JICA loan through MEF is high.
	4	Transparency of PAS's business will be enhanced due to the proposed listing of stocks.	4	Repayment amount of JICA loan will increase significantly from 2011 because the repayment of capital started from 2010.
			5	Increase of net profit will be required in order to pay the dividend after listing of PAS's stocks.
			6	Effective use of port assets has not materialized because of the concentration of cargo on particular dates and ineffective utilization of the port area.
			7	Burden of operation cost such as expenses for excessive personnel and electric generation for crane operation is large.
Customer's Viewpoint	5	Sihanoukville Port is the sole sea port in Cambodia which can accommodate oceangoing ships and large size bulk cargo ships.	8	Negative evaluations by customers about high cargo handling rates and ship entering related charges compared to neighboring foreign ports and collection of unreasonable charges
	6	Dwelling time of general cargo including garment products in the port is quite short.	9	Improvement of port service to shipping companies such as decrease in container handling operation time is needed.
	7	Connecting roads to hinterland are in relatively good condition and a railroad is provided in the port.	10	Improvement of port service to consigners such as long turnaround time of trucking operation due to long waiting time for container gate entry and scanning is needed.
	8	There are several foreign neighboring ports which handle containers. This situation makes it relatively easy to	11	Container ship calls is few compared to other foreign ports and ocean freight rates are high.

		form a port network.		
	9	The port situates at the calm water area. This results in performing high operation rates.	12	Inability to receive larger container ships which are navigating in Asian region due to insufficient depth of quaywalls and channels at Sihanoukville Port
	10	The nearest public sea port from the Phnom Penh large market	13	Passenger ship users who are required to be landed by launchers experience inconvenience due to insufficient provision of cruise ship berthing facilities.
	11	Integral management of the port and the SEZ is conducted PAS.		
Business Process	12	Sihanoukville Port conducts sophisticated container operation by making use of advanced cargo handling equipment and system.	14	Performance of research and analysis and development of port business is poor.
	13	No labor dispute is observed. As a result, stable port operation can be carried out.	15	Attitude of PAS's staff toward port business promotion is passive.
	14	A quick top-down decision making can be performed for important matters.	16	Information sharing among staff and consensus making is insufficient.
			17	Employees lack awareness when it comes to cost, competitiveness, efficiency and job discipline.
			18	Human resource development system is insufficient.
			19	Personnel assignment system is very rigid.
			20	Export/import document processing needs a long time.
			21	The use of container handling equipment is ineffective.
			22	Port security management is insufficient because anyone is able to enter the container terminal at any time.
Learning and Growth	15	Motivation of the top management in PAS's business innovation is superior with the trust of PAS's staff.	23	Human resource development related to information analysis and planning and development capability is insufficient.
	16	PAS has staff with high potential ability.	24	Social environmental consideration needs to be taken in some areas around the port for the future development.
	17	Marine tourism spots are located near the port.	25	Conflicts will be observed in land and water area utilization between port development and tourism development.
	18	A calm water area is available for the future development.		

External	**O (Opportunities)**		**T (Threats)**	
Macro Environment	1	Economic growth of Cambodia	1	Vulnerable industrial and trade structure against worldwide economic crisis
	2	Industrial development at the coastal area		
	3	Progress of smooth trading practice and the improvement of investment environment		
	4	Support of development partners for the development of Cambodia		
	5	Promotion of tourism industry		
	6	Increase of cargo generation in Cambodia as a whole		

Micro Environment	7	Increase of cargo generation associated with the development of SEZs in the vicinity of Sihanoukville Port	2	Expected operation of the Phnom Penh New Container Terminal
	8	Sharp decrease of ocean going container freight rates is expected in comparison with competitors	3	Expected full-scale operation of Cai Mep-Chi Vai Port in Vietnam
	9	Consistent port development based on the National Port Master Plan	4	Development of neighboring private ports
	10	Expected increase of transport cost through Vietnam due to high inflation rate in Vietnam	5	Streamlining of the cross border transport between Phnom Penh and Vietnam
	11	Development and progress of port statistic and port management system which is provided by the JICA's PENPPAS.		

Prepared by Project Team

3.4.4 Strategic Targets and Strategic Success Factors

Strategic targets, critical success factors and action plan are illustrated in Table 3.4-3 as a result of SWOT analysis and TOWS matrix analysis. Figure 3.4-1 shows the Strategy Map.

Table 3.4-3 Strategic Targets, Critical Success Factors and Action Plan

	Strategic Target		Critical Success Factor		Action Plan	
Learning and Growth	1	Strengthening of growth of organizational development	1	Outstanding human resource capacity of development strategy and implementation	1	Development of human resource for achieving excellent ability of information collection and analyzing
					2	Continuous use and improvement of strategic tools for the organizational growth such as port statistic system
					3	Fostering of ability of taking account of customers' requirement and solution proposing for the requirement
					4	Strengthening of ability of coordination and intermediation among relevant organizations for satisfying customers' requirement
					5	Strategic execution of port business promotion
	2	Systematic increase of port handling capacity based on demands	2	Steady implementation of port development	6	Enhancement of the capability for port planning and revision
					7	Appropriate management of free water area and preventing the spread of illegal occupation
					8	Sound cooperation with private entrepreneurs
					9	Formulation and revision of port planning including rearrangement of existing port area
					10	Common recognition among relevant persons concerning the direction of port development
Business Process	3	Efficiency increase of container handling operation by PAS	3	Appropriate management of container terminal	11	Clear indication of CY area and strict CY entry control
					12	Relocation of buildings for port related organizations outside of the terminal area
					13	Observance of traffic rules in CY
					14	Separation of container inspection area from the terminal area
			4	Effective use of cargo handling equipment and system	15	Increase of the use of gantry cranes
					16	Improvement of RTG operation
					17	Strengthening of the maintenance of handling equipment

					18	Reallocation of CY slots in accordance with the demand
					19	Restructuring of the organizations related to the container operation
					20	Vocational training of CY planner and ship lanner
					21	Acceleration of early entry practice of containers to the container terminal
					22	Complete implementation of loading/unloading works by PAS's staff
	4	Emphasizing on business development and planning capability	5	Establishment of business development and planning organization and prioritized assignment of human resource	23	Strengthening of cooperation between work-site and business development departments
					24	Securing of work-site staff and staff for strategic planning by the appropriate staff treatment in regulation and practice
					25	Promotion of young capable staff to important posts
			6	Effective port business promotion activities	26	Implementation of port promotion based on the growth strategy
					27	Upgrading of mass media tools
					28	Effective use of mass media
Customers	5	Increase of shippers' satisfaction	7	Reduction of the total transport cost	29	Realization of ocean freight reduction
					30	Prohibition of the collection unofficial charges under close cooperation with relevant organizations
					31	Reduction of gate entry waiting time and dwelling time of trucks in the terminal
					32	Coordination with relevant organizations in respect of the lightening of burden in container inspection
					33	Reduction of container handling charges
			8	Enhancement of service quality	34	Strengthening of port business promotion aiming at achieving diversification of navigation routes and high frequency ship calls
					35	Gradual extension of gate opening time aiming at performing 24 hour gate opening operation in the future
					36	Materialization of effective railway access service and strict monitoring and instructing to railway operating company about service quality
					37	Provision of advanced and low price logistic services to companies established in the Port SEZ
					38	Flexible application of container receiving cut-off time in paying attention to shippers and close communications with shippers
					39	Implementation of container cargo reconsolidation practice near the port in close cooperation with private companies
	6	Increase of cargo shipping companies' satisfaction	9	Reduction of the total transport cost	40	Reduction of ship related charges at the port
					41	Reduction of container handling operation time
			10	Enhancement of service quality	42	Deepening of quaywalls and deepening and widening of channels

					43	Releasing burden of shipping companies by the steady conduct of PAS's container operation works
					44	Enhancement of transparency and rationality of port related charges
					45	Strengthening of tug boat fleet
					46	Drastic increase of bulk cargo handling operation productivity
					47	Reduction of clerical burden of PAS's staff by the introduction of EDI
					48	Introduction of container receiving cut-off time with the understanding of shippers
					49	Complete execution of container damage checks
					50	Strengthening of the port security
					51	Strengthening of the ship navigation safety
	7	Increase of cruise ship companies' satisfaction	11	Increase of satisfaction of cruising tourist	52	Development of a cruise terminal
					53	Preservation and improvement of the port environment
					54	Streamlining of the traffic around the port
Finance	8	Maintaining and increasing profits	12	Retention and gaining of customers	55	Strengthening of the port business promotion activity
					56	Improvement of the quality of port service
					57	Aggressive involvement in the promotion of coastal industry development
			13	Effective use of asset	58	Improvement of the port operation efficiency including the effective use of equipment
					59	Land use based on a long-term perspective
					60	Monitoring of business performance of entrepreneurs which have long and exclusive contracts with PAS and renew of the contracts if necessary
					61	Introduction of incentive measures to port users which may contribute for peak shaving of demands
					62	Entrusting operation of the Phnom Penh Dry Port to private companies
					63	Prioritize allocation of PAS resources to large ship operation while traditional small coastal shipping business is entrusted to provincial ports
					64	Conversion of existing port facilities to cope with the new demands
					65	Precautious preservation of the port facilities
			14	Reduction of the operation cost	66	Increase of productivity by the establishment of basic work discipline and staff education
					67	Systematic reduction of PAS's staff number
	9	Decrease of financial risks	15	Strengthening of the risk management	68	Continuous implementation of the risk management of the organization
					69	Reduction of the investment risk by synchronizing the investment with the national port development plan
					70	Strict adherence to work safety measures
			16	Enhancement of	71	Listing of PAS's stocks

				transparency in the business management	72	Promotion of information disclosure
			17	Temporary decrease of interest rate of long-term loans from MEF	73	Decrease of interest rate of MEF loans to reduce repayment burden during a period of yen appreciation
National	10	Reduction of international transport cost of Cambodia	18	Reduction of ocean freight rates	74	Making use of the scale of economy resulting from the increase of handling volume
					75	Reduction of port related charges
					76	Strengthening of port business promotion for achieving diversification of shipping routes
	11	Promotion of coastal industrial zone	19	Promotion and enlargement of SEZs	77	Promotion of business establishment at the Port SEZ from long-term perspective
					78	Expansion of the Port SEZ
					79	Streamlining of cargo movement from/to coastal SEZs
	12	Contribution to the realization of national strategic target in various fields	20	Effective treatment of strategically important goods	80	Preferential handling treatment of cargo which contributes to the industrial diversification
					81	Increasing of rice export productivity taking into account appropriate use of space in the port
					82	Strengthening of port function as a supply base for off shore resource development

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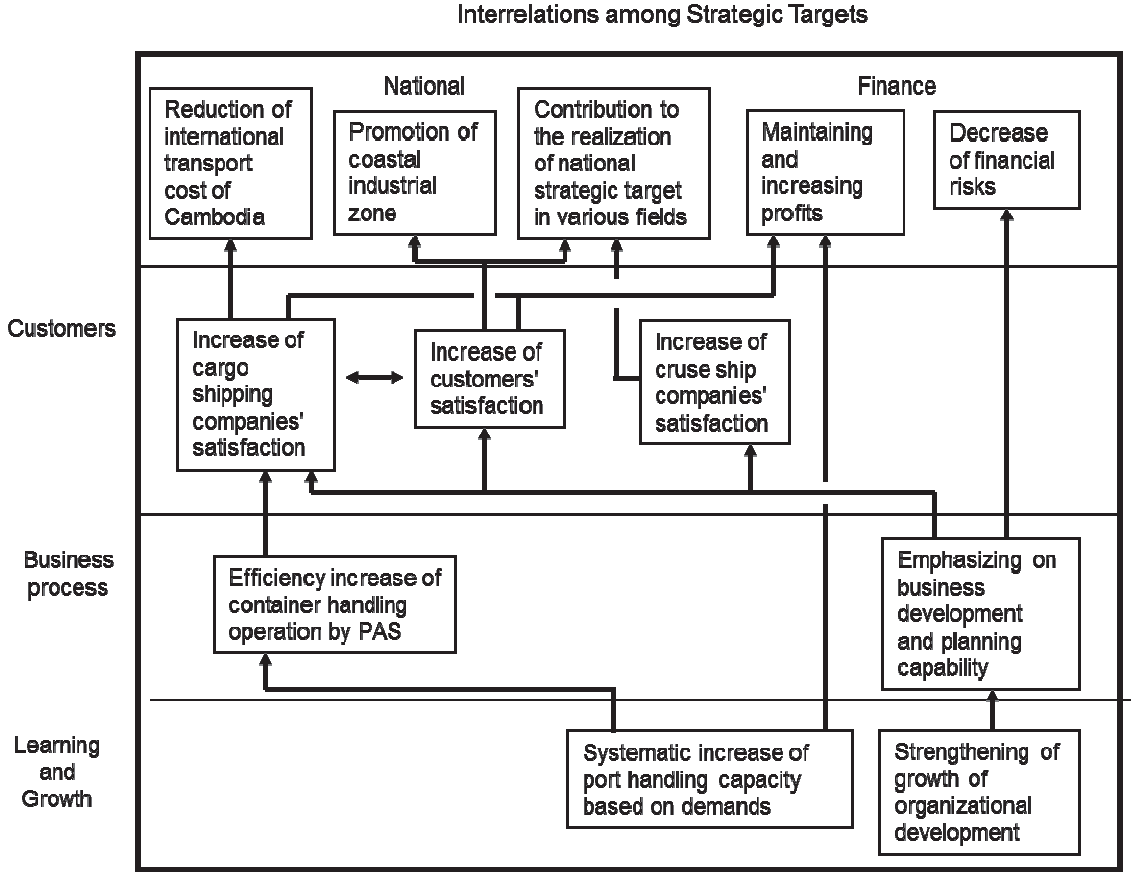

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Figure 3.4-1 Strategy Map

4. STRATEGY TO STRENGTHEN COMPETITIVENESS OF SIHANOUKVILLE PORT

4.1. Strategy on Port Service Improvement

4.1.1 Improvement of the Container Operation

(1) Current Condition of PAS Container Terminal Operation

Container operation of PAS Container Terminal (CT) has some issues. First, ships' operational productivity is low – 13.4 lifts/QGC/hour and 7.4 lifts/Ship-gear/hour - This low productivity is basically caused by a lack of management capacity. More specifically, lack of planning capacities both for ship and CY planners, lack of stevedore labors and absence of dicipline and order among them. There is no capable leader or trust among PAS' container operation departments and in between operational staffs and labors at present.

The second issue is that CY-Gate operation of PAS for delivering and or receiving (lift-on and lift-off) containers to/from external truckers is not performed well because there is no sufficient system in PAS to control the CY operations. Generally, CY controllers instruct RTG drivers which lanes to move to while monitoring entire CY-operations through container terminal management system (CTMC). In this way, unnecessary congestion or idling at any place in CY can be avoided.

In the case of PAS Terminal, ships' operation, especially loading, is managed by agents' personnel from shipping lines without preparing proper ship's working pre-plans. Since containers do not arrive at PAS Terminal until the last moment; although most export containers arrive at terminals before ships berth, it is very hard to prepare proper loading pre-plans beforehand.

Furthermore, Customs clearance system for entering export containers into CY Gate and loading them onto ships is unique which has made shipping lines hesitant to hand over the right of ship loading roles to PAS. Thus, PAS planners could not build up required skills for operating the container terminal, especially the stevedoring function. Nevertheless PAS has obtained modern container handling equipment such as QGC, RTG and CTMS in recent years.

The labor groups (total 164 persons) have been under the control of General Cargo Handling Operation (GCHO) Dept. since mid-2011, which has adopted a management style that is different from the CTO Dept. which previously was responsible for labor groups. New managers in GCHO Dept. are trying to train unskilled labors for operating ship's gears or managing ship's operation as gang-bosses at the actual operations. This change has made PAS' ships operational productivity worse.

PAS owns two (2) units of QGC, seven (7) units of RTG, nine (9) units of Reach Stackers and 22 units of Trailer head and chassis as major container cargo handling equipment (CHE). However, in day-shift through night-shift on Saturday, PAS has eight (8) gangs of stevedore labors for loading operations of these four (4) ships, arranging two (2) QGC, four (4) RTG, four (4) Reach Stackers and 21 Trailer/chassis in general as of Sept. 2011.

Thus, a maximum of only three (3) RTG are available for receiving export containers and or delivering import containers at RTG lanes once the loading operation has commenced; however, the handling volume is too high for three (3) RTG. PAS, therefore, needs to purchase one (1) or two (2) units of RTG immediately to cope with the needs of external truckers on Saturday.

PAS needs to prepare 264 labors (11 persons per gang x 8 gang x 3 shift=264); however, PAS has only 164 labors at present. For resolving this serious labor shortage problem, PAS utilizes truck and crane drivers belonging to GCHO Dept., assigned for GC operation, consisting of two (2) gangs (required 66 persons) by themselves. This labor shortage problem, together with the lack of discipline and order among workers, is one of the reasons why PAS' ships operational productivity is so low.

(2) Improvement of PAS Container Terminal Operation

It is recommened that PAS top management nominate a powerful and intelligent person as a

new leader of CTO Dept. for implementing not only common sense practices in the container operation, but also achieving PAS' operational targets (25.0 lifts/GC or 2SG/hour) promptly. The new leader is required to select and promote a certain number of competent persons in key sections, such as ship and CY planners, for conducting his duties/responsibilities steadily/effectively.

Required quality and capability for the leader should be;

- Business sense and capability of understanding PAS' issues clearly for operating and managing entire PAS Container Terminal effectively at minimum cost, cooperating with internal and external departments, organizations and customers.
- Strategic mind and capacity to develop business plans of CTO Dept., short-term and long-term, and strategic plans on daily ship and CY-Gate operations for increasing operational productivities.
- Required capability for ship and CY planners is mathematical capacity or persons trained to think logically. Planning works for both ship and CY require logic, and PAS can only achieve higher productivity with well-considered work pre-plans.

Once these improvements (as well as the restructuring described in another chapter) are carried out in PAS' operation as routine works, PAS will eventually achieve the operational target of 25.0 lifts/GC/hour and 12.5 lifts/SG/hour; then PAS can reduce its working system from 8-gang to 6-gang as described detail in the report. Furthermore, once the 6-gang system works well, and once the ships call the Port on schedule, PAS can work all the ships with 4-gang as maximum per shift at current deployment.

4.1.2 Improvement of procedures for port entry and cargo receiving/delivery

1) Present status of electronic data interchange (EDI)

a) Port entry procedures

Currently EDI system for port entry procedures has not yet been developed in Cambodia.Those procedures are done in principle with hard copies to obtain original stamps and handwritten signatures of government officers.

Future plan to introduce EDI for port entry procedures has not yet been formulated. Consequently at this moment, there is no cabinet-based workforce nor inter-ministry project team organized to exercise leadership and move ahead on EDI implementation in this field.

b) Import/export customs clearance

An EDI system for customs named "Asycuda" has been developed from 2006 to 2008 with financial aid from the World Bank. However, because customs' internal work process is yet to be restructured and infrastructures for internet or dedicated line have not been developed, utilization of Asycuda is currently rather limited and transition from legacy operations in customs has not been achieved yet.

(2) Improvement plan

1) Basic policy

It is essential for Sihanoukville Port to improve and facilitate port entry procedures in view of strengthening competitiveness of the Port itself as well as competitiveness of import/export industries in Cambodia as a whole. In order to reach this goal, step-by-step improvement needs to be made by RGC, that is, 1st; breakaway from "principle of original papers", 2nd; simplification of documents, 3rd; EDI implementation, 4th; development of National Single Window, and finally; integration into ASEAN Single Window.

2) Breakaway from the principle of original papers

a) Legal issues

According to the Minister Notification by MPWT and MMD , the Announcement of Ship Entry

can be transferred either by hard copy, fax or email. Other documents required for entry procedures are prescribed in the Sub-Decree which regulates KAMSAB's roles and responsibilities. Those relevant laws and regulations need to be reviewed to introduce/disseminate an EDI system efficiently.

Furthermore, it is essential for RGC to ratify the FAL Convention to implement the EDI system under a simplified work flow environment. As Cambodia has not ratified the FAL Convention yet, the preparation for the ratification and revision of relevant laws and regulations should be given priority.

b) Organizational issues

Among various government bodies involved in port entry procedures, a particular institute which takes leadership in implementation and dissemination of EDI system should be assigned. It should be considered whether existing role sharing among MPWT, port authorities among KAMSAB to be preserved intact or whether a new sharing structure would be more appropriate.

3) Implementation of EDI system to port entry procedures

a) Envisaged merits

Following merits are expected through the implementation of the EDI system.

① Enhancement of competitiveness of Cambodian ports in the international market
② Improvement of work efficiency of port users
③ Improvement of service quality and work efficiency of government bodies
④ Acceleration toward National Single Window and ASEAN Single Window

(3) Single window system

On 9 December 2005, ASEAN agreed to establish the ASEAN Single Window (ASW) to expedite customs procedures within ASEAN by setting-up a national single clearance channel for goods for ASEAN-6 (Brunei, Indonesia, Malaysia, Philippines, Singapore & Thailand) by 2008, and newer members (Cambodia, Lao, Myanmar & Vietnam) by 2012.

The activities include the exchange information of the ASEAN Customs Declaration Document and Certificate of Origin (Form D) under the CEPT Scheme of AFTA. To date, Indonesia, Malaysia, Myanmar, Philippines and Thailand have set up respective national working bodies to implement their National Single Window (NSW), which will be integrated to form the ASW.

ASEAN recognizes that the success in the implementation of NSW depends on the following points, and this will apply to Cambodia as well:

- Strong political commitment to establish an "e-governance" in the member state to lead toward the single window.
- Development of human resources in the member state.
- Partnership with the industrial sectors and business sectors
- Building of practical environment where the procedures can be integrated to ensure the regional economic growth in ASEAN.

The Pan-Asian E-Commerce Alliance (PAA) was founded in 2000 by the single window operators in Singapore, Taiwan and Hong Kong. PAA is now comprised of 11 members, each of them is the largest single window operator in each country. The combined customer base of the PAA members now exceeds 150,000 organizations, representing almost all active trading enterprises in the Asian market. It would be important to RGC to assign an institute representing and leading NSW project as soon as possible to take part in the discussions in PAA.

4.1.3 Alleviation of traffic congestion around the port

(1) Present condition of the traffic congestion and target of the alleviation

1) Present condition of traffic congestion in front of the gate (before alleviation)

At present, four container vessels (MCC/RCL/ACL/APL) have called Sihanoukville Port on Friday, and heavy traffic congestion due to container trucks transporting import/export cargoes occurred on Phe Street, which connects NR 4 and the approach road, every Saturday.

Traffic congestion i.e., the number of parked trucks around the gate peaked at 7:00–8:00 on Saturday, and three queues were composed on the single lane in both directions. In order to reduce the parking volume around the gate and prevent rear-end collision traffic accident on the slope of NR 4, the traffic police prohibited container trucks from parking on the road section between the connection point of Phe Street/ NR 4 and the point of NR4 in front of Angkor Brewery. According to a traffic police officer, the said traffic control was generally executed at 6:00~12:00 on Saturdays in accordance with traffic congestion around the gate.

(2) Critical factors for the enhancement of capacity of the port gates

The capacity of port gates which is mentioned here means not only a time needed for passing the gates but an overall turnaround time needed for entering trucks to be lifted off export containers and lifted on import containers and finally leave gates.

Present situation and problems of factors which governs the truck turnaround time and factors and measures for the enhancement of gate capacity are shown in Table 4.1-1.

Table 4.1-1 Present situation and problems of gate capacity factors and measures for the enhancement of gate capacity

	Factors related to gate processing capacity	Present situation and problems in relation with gate processing capacity	Important factor (**F**) and measure (**M**) for enhancement of gate processing capacity
1	Joint Inspection Report (JIR) is issued by customs and Camcontrol after finishing staffing of containers at factories or inland container depots (ICDs)	*JIR issue is carried out 24hours a day	No specific problems
2	Traveling of container trucks to Sihanoukville Port	*Trucks leave without carrying JIRs	**F:** Carrying of JIRs by trucks **M:** Let trucks allow to enter CT for container loading to a ship and travel with JIRs
3	Standby of trucks near CT before entering CY gate	*Trucks are waiting disorderly at road sides or available space before gate opening of completion of export approval *Waiting trucks cause traffic congestion which affects general traffic	**F:** Securing of parking space and observance of parking rule **M:** *Preparation of parking space *Designate park space and parking order and direction to trucks in the order of arrival to keep orderly parking direction
4	Processing of import approval document	*Import approval processing is carried at customs after arrival of JIRs which are carried by other transport means. Customs is closed between 12 PM and 7 AM.	**F:** Early arrival of JIRs at Sihanoukville Port **M:** *****Achieving early arrival of JIRs before arrival of trucks at the Port *Sending JIRs by Fax
5	Transit of CY gate	* Input of container entry data into CTMS and instruction of container placing location by PAS's clerks after export formality confirmation by customs, Camcontrol and immigration police	**F,1:** Export formality confirmation by customs, Camcontrol and immigration police **M,1:**Conduct of export formality confirmation by customs, Camcontrol and immigration police at separated place with CY gate in order not to allow gate entry of trucks which are not completed export formality confirmation
		*Occurrence of malfunctioning and capacity reduction of CTMS	**F,2:** Strengthening of capacity and coverage of CTMS and speedy repair service **M,2:** Capacity development of IT-section and close cooperation with CT department
		*Gate is closed between 12 PM and 7 AM.	**F,3:** Extending of gate opening time **M,3:**Reducing number of gate waiting trucks by early gate opening, for instance from 4 AM
6	Transfer of export containers to designated place	*Congestion in CT due to disorderly travelling direction of trucks	**F:**Observation of traffic direction rule in CT **M:**Monitoring and supervision of traffic direction rule
7	Lift of containers	*Insufficient handling capacity of RTGs and rigid working area assignment	**F,1:**Additional installation of RTGs and efficiency increase of RTG operation **M,1:**Supervision of GTR operation practice for conducting flexible and cooperative works
		*Time consuming operation due to disorderly located container direction	**F,2:**Unification of container placement direction on trucks **M,2:**Changing disorderly placed container direction to orderly direction
8	Waiting for import container receiving	*Trucks need to wait for lifting of import containers due to delay of import container unloading and	**F:**Additional installation of RTGs and parking space **M:**Purchasing new RTGs

		insufficient number of RTGs which should work also for loading of export containers.	
9	Lift-on of import containers	*Shortage of number of RTGs for lift-on containers	**F:**Additional installation of RTGs **M:**Purchasing new RTGs
10	Scanning of import containers	*All import containers are subject to scanning. Trucks are waiting for scanning due to insufficient number of scanning machine.	**F:**Conduct of sampling scanning practice **M:**Screening containers subject to scanning dependent on shippers and kind of commodities
11	Waiting for import/export approval processing	*Trucks which are not completed import/export approval formality are allowed to enter CT for lift-on import containers. Trucks which are loaded with import containers wait for import approval in CT. This practice develop traffic congestion in CT.	**F:**No admittance of truck entry to gate without completing import/export approval processing **M:**No allowance of gate entry of trucks which are not completed import/export approval processing. Prepare parking space outside CT for trucks which wait for import/export approval processing
12	Gate-out	*No specific problems	*No specific problems
13	Travelling of trucks to destination	*No specific problems	*No specific problems

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(3) Securing parking space

The reasons for the congestion are the following; 1) the road carriageway is narrowed by the heavy vehicles queuing on the both sides of shoulders, 2) the traffic in/out bound flow happens on the narrowed road, and 3) no appropriate traffic control measures are taken on these conditions.

There were approximately 70 vehicles lots in total, while investigating the number of 45 feet long container loaded heavy vehicles able to park in these areas. It would be ideal if the parking area capable of accommodating these 70 lots is constructed. Moreover, currently when queues around the port reach the intersection of roads heading towards the city center, the Police introduce heavy vehicle restriction at in front of the Angkor Beer Brewery at the top of the hill, and the number of vehicles comes under this traffic control is 20~30 vehicles. Hence, the construction of parking area that can accommodate up to 100 vehicles in total is suggested.

There are other ways to reduce the congestion by restricting the road side parkings and maintain the traffic flows, in the case of not being able to provide the parking areas as mentioned above. They are considered as per below.

- The two-way traffic flow can be maintained by controlling the vehicle parking location and direction.
- The vehicle queuing layout on the port access road is determined to regulate the traffic flow.

(4) Urgent project for alleviating traffic congestion

1) Contents of the urgent project

The proposed urgent project is as below;

Early gate opening operation at least on Saturdays from 4:00 AM

Currently, the gates are closed from 00:00 to 07:00 every day although 24 hour cargo handling operation is carried out. During this closing time trucks wait outside of the terminal.

The opening of the gate for 24 hours at least on Saturdays is a vital measure for alleviating traffic congestion. For the time being, it is proposed to open the gate from 4:00 AM temporarily in order to examine the effect of the early gate opening operation on the alleviation

of traffic congestion and improvement of container handling productivity.

2) Effects of the urgent project

a) Improvement of gate operation

The early gate opening operation was conducted aiming at not only alleviating traffic congestion around the port but also keeping ships' navigation schedule by ensuring scheduled departure thorough the advanced preparation of vessel planning and the completion of container loading as scheduled.

It is confirmed that the number of entering trucks increases from 5:00 AM.

According to the interview, 80% of containers among containers expected to be handled on some day is stacked on the container yard by 11:00 AM after the commencement of the operation. This 80% is considered the minimum requirement for effective yard planning preparation. Before the operation, the yard planning could be not prepared until after noon because of insufficient container numbers at the container yard in the morning. As a result of the early gate opening operation, the yard planner is able to start the yard planning preparation. The improvement of container yard operation seems to be materialized by the early gate opening operation.

b) Alleviation of traffic congestion

In respect of the alleviation of traffic congestion which is one of objectives of the operation, a peak time for truck arrivals at the port is at 7:00 AM before and after the early gate opening operation However, the number of trucks arriving at the port per hour is about 40 after the operation in comparison with about 35 before the operation. The arriving trucks increased by about 25 % after the commencement of the operation. This shows that truck arrivals concentrate sometime after the commencement of the operation. On the other hand, a peak time of truck departures from the port occurs 1-2 hours earlier than the time before the operation. Namely, the peak times of truck's arrival and departure occur 1-2 hours earlier than the time before the operation.

In respect of the traffic congestion, duration of traffic congestion in front on Angkor Beer Company is about 2 hours between 8-9 AM in comparison with about 7 hours before the commencement of the operation. It seems that the traffic congestion in front of Angkor Beer Company is alleviated due to the decrease of traffic congestion on the north section of Phe Street starting from the entrance of the port access road.

Although the early gate opening starting from 4:00 AM is in operation, the number of waiting trucks near the port does not seem to decrease because export/import documents processing cannot be completed. The effect of the early gate opening to the alleviation of traffic congestion is not fulfilled yet. In order to break this situation, it is necessary to implement the measures indicated in Table 4.1-1 **Critical factors for the enhancement of capacity of port gates** together with the continuous implementation of the early gate opening operation.

4.1.4 Effective utilization of railways

(1) Possibility of modal shift

The rail freight cost is more than the road freight by the cost of transportation from the factories in Phnom Penh to Samrong ICD (Inland Container Depot). .

Freight forwarders were interviewed on the possibility of rail freight use between the Phnom Penh and the port of Sihanoukville. They responded the use of rail freight which had been negotiated with TRR in the earlier stage was postponed by reasoning the fact that the completion of South line rehabilitation was delayed to January 2013. They raised 3 points before taking any further actions:

a) Railway freight operation: The procedures and method of scanning the containers, how are the containers handed over to consignee after arriving in PP, who prepares the truck to deliver containers to consignee, etc.

b) Operation cost: Whether on road freight transport is truly low cost or not?

c) Lead Time: On average how long does it take to use rail service once obtained the Customs clearance at the port?

(2) Business model of the railway utilization

The problems in the framework of the rail freight transport such as lead time, cost, schedule, securing the alternatives, and services were pointed out. The following attentions are required in the case of Cambodia,

- Although the freight cost competiveness of the railway over road is, in general, when less than 500km, the distance between PP and SHV is 230km.
- The planned number of train operation is one per day (from the TRR interview)

To promote the rail modal shift in Cambodia, below points are noted in consideration of the challenges in shifting the main freight transportation mode mentioned above.

- To operate uniform freight services among the rail operator and forwarders cooperatively,
- To operate on punctual schedules, and provide the customers with accurate location information of freight container transported by railway
- To operate free storage service of containers
- Provision of alternative transport modes in case of disruption (in cooperation with forwarders)
- To transport in accordance with the planned schedule, even though the only small amount of freight is required to be transported.
- To provide incentives for customers with regular freight volumes

(3) Container Operation at PAS Railway Terminal

Most of the leading ports in the world encourage CT operators at their ports to build on-dock RTs on their premises to make their ports and CTs more competitive whenever the situations allow. However, in the case of PAS RT, TOLL and PAS should store export containers carried by rail-cars in the rail stacking yards at once, and move them to marshaling yards in PAS CY later. Then, import ones discharged from ships should be stored in the rail yards once before mounting them onto the rail-cars. In the case of PAS RT, under TOLL (and PAS) system, the operations are complex and as result productivity will be very low. Accordingly, PAS should realize the various demerits of such operations and operate the RT as an On-dock RT.

4.1.5 Collaboration between the port and SEZs

It is necessary to materialize the concept of SPZ which was proposed in “The Study on Regional Development for the Phnom Penh - Sihanoukville Growth Corridor” conducted by JICA in order to accelerate industrial development in Preah Sihanouk and to make it lead the country’s economic development as “the head of dragon”. The area of the Sihanoukville SPZ shall be basically the entire administrative area of Preah Sihanouk Province, excluding the area of two national parks and the designated forest management and water conservation area as proposed by the said study.

The configuration of Preah Sihanouk SPZ shall be as described below:

- In the territory of SPZ, even in the place outside SEZs, all incentives for SEZ investors except those concerning customs procedures shall be furnished to the investors who do business equivalent to those of eligible investors in SEZ.
- SEZs shall be strategically located in Preah Sihanouk SPZ so as to be able to benefit from their synergy effect. Considering geographical characteristics of Preah Sihanouk SPZ where Sihanoukville Port exists and access control to outer region is easy because there are limited number of access roads connecting outer region, incentives on custom procedures

shall be furnished to investors in all SEZs within SPZ, even though a SEZ is located 20 km or more away from an official border, in addition to the general incentives for SEZ investors. These measures will ensure that SEZ developers won't plan non-viable ports in their perimeters, and contribute to the harmonized growth of Cambodian port sector.

- Sihanoukville Port shall be an important component of Sihanoukville Port SEZ. The area of the existing Port SEZ shall be expanded to include all areas of the port. The barrier between the port and other part of Port SEZ shall be as low as possible. The only required barrier would be one to secure access control to an international port as prescribed by the ISPS code. The expanded Port SEZ including port shall be a single bonded area. All customs barriers shall be removed basically between the port and other areas in Port SEZ. The cargo movement between the two areas shall be regarded as movement inside a bonded area. X-ray inspection of containers to/from the Port SEZ shall be exempted for the same reason.
- All areas of Port SEZ shall be an EPZ basically. For investors of EPZ in Port SEZ, if their business is regarded as an important industry from the national point of view, such as non-traditional industry which has never located in the country, incentives concerning port service such as free transportation between the port and the factory and priority handling of containers shall be furnished.

4.1.6 Port promotion

(1) Basic policy for attracting shipping lines

1) Target market

a) Main lines:

Intra-Asia trade lanes shall be the primary target market. If there is a service with the wayports in the range of Bangkok/Laem Chabang-Cai Mep-China/Taiwan/Korea/Japan, Sihanoukville will have a chance to be added to the ports of call. It is recommended for PAS marketing staffs to make a data base of potential shipping lines and update it regularly. The shipping lines currently calling at Bangkok, Laem Chabang, Cai Mep and Ho Chi Minh on the intra-Asia services are potential users.

b) Feeder lines:

The target market of feeders shall be the lines connecting with transship hubs such as Singapore for westbound, and Cai Mep, Chinese major ports, Hong Kong, Kaohsiung, Busan for eastbound. Feeder lines are composed of common feeder lines and main lines' own companies. It is noteworthy that main lines must be the virtual players behind any common feeder lines, as they are the users of common feeder lines, exercising an influence on the feeder lines' vessel deployment plans.

(2) Shipping line's criteria to determine an extra calling

It is important for PAS to know what the shipping lines' logic is, when they examine the possibility of an extra calling.

When a shipping line decides to deploy vessels at a port as an extra calling, they usually compare the costs and revenue relevant to the extra calling. If the revenue amount per call exceeds the costs amount per call, the shipping line will decide to place the vessel to that port. The cost to be considered will be "port charges" payable to the port of extra calling, and "deviation cost" for detouring a vessel away from the original navigation route and making her stay at the port. The revenue is actually the net profit to be gained from ocean freight for export/import cargoes which is expected to be captured additionally at the port of extra calling.

Deviation cost may vary according to which trade lane the shipping line intends to use to cover Sihanoukville Port. The most probable trade lane is considered as intra-Asia, connecting Laem Chabang-Cai Mep-China/Taiwan/Korea/Japan, adding an extra call between Laem Chabang and Cai Mep. A simulation result indicates that if 364 TEUs of additional cargoes can be secured in total of export and import, a shipping line may determine to make an extra call at Sihanoukville Port with a 2,500 TEU type vessel deployed on intra-Asia trade lane.

What is derived from this simulation is that the marginal TEU could be lowered if the amount of costs was reduced. Reduction of costs could be realized by a price cut of port charges, or shortening of the vessel's stay days. If the port charges were cut at 30% and the stay days were shortened from 1.5 days to 1.0 day, the marginal TEU could be lowered from 364 TEUs to 254 TEUs as calculated below:

The result of calculation above implies that, as long as the cargo generation from the hinterland is not sufficient, PAS would be wise to lower the tariff rates of port charges or improve the stevedoring efficiency to shorten the vessel's stay in order to induce more calls.

4.2. Managerial and Financial Strategy

4.2.1 Financial status of PAS

(1) Financial performance

Revenues from port services were USD 26 million in 2010, a 17% increase from the previous year. Operating expenses were USD 14.8 million and other expenses were USD 6.7 million. Income before interest and tax amounted to USD 5.2 million and net income after tax was USD 2.4 million in 2010. Sales of PAS increased from 2005 to 2008, and experienced a decrease in 2009 due to the world economic recession. However, sales recovered in 2010 to a level of 2008.

ROA of PAS's business activities is estimated at 1.64% in 2010, which is lower than PPAP's 4.56% and PAT's 11.25% in 2010.

(2) Comparison with PPAP's financial performance

PPAP's operating revenues in 2010 amounted to USD 6.4 million, which is one forth of that of PAS. Net profit of PPAP was USD 1.2 million in 2010, which is a half of PAS's net profit. Total assets of PPAP were USD 27 million at the end of 2010, which is 19% of the total assets of PAS. Consequently, ROA of PPAP is higher than that of PAS.

(3) Comparison with PAT (Thailand)'s financial performance

Revenues of PAT in 2010 amounted to USD 338 million. PAT indicates that revenues from the Bangkok Port had the biggest portion followed by incomes from Laem Chabang Port, but this portion will change in the future. Performance of PAT's business activities was very satisfactory as shown in ROA, i.e. 11.25% in a year from October 2009 through September 2010.

(4) Net profit margin

Net profit margin is a ratio of net profit to operating income of a commercial enterprise, which indicates profitability of the commercial enterprise. The net profit margin of PAS, PPAP and PAT are 9.0%, 18.7% and 31.1% (21.8% if corporate tax is levied) respectively. Net profit margin of PAS remains at a low level compared with PPAP and PAT.

4.2.2 Port dues and charges

(1) Comparison of port dues and charges

Supposing a model case, i.e. a container vessel of 10,000 GRT enters and discharges 220 boxes of import containers and loads 200 boxes of export containers, port dues and charges are compared between Sihanoukville Port, Bangkok Port and VICT (Ho Chi Minh). Port dues and charges paid at Sihanoukville Port are 37% higher than Bangkok Port and 40% higher than VICT (Ho Chi Minh).

(2) Comparison with private and provincial ports

Supposing a case of cement import from Thailand with a 1,500 DWT cement barge, port dues and cargo handling charges at Sihanoukville port are about USD 2,850, at Tomnop Rolok Port USD 2,750, at Oknha Mong Port USD 2,040, and at Sre Ambel Port USD 1,500.

(3) Income by business activities

Sixty five percent of PAS's revenues are generated by cargo handling services and 25% of the revenues are from port dues and charges for ships entering, mooring and leaving.

(4) Revision of tariff

Taking into account competitiveness, efforts shall be made to lower port dues and charges for cargo handling. It is important to revise tariff structure and rationalize/simplify tariff items. The following revisions are requested by port users:

- Lift on/lift off charges shall be collected separately when the actual service is provided.
- Berth fees shall be collected in accordance with actual berthing hours, instead of the number of times berthed
- Minimum quantity of water supply shall be lifted.
- Charges for performance bonus shall be included in charges for Vessel-Yard handling.
- Charges for delivery and receiving of cargoes shall be included in charges for lift on/lift off.
- KAMSAB delivery order shall be included in lift on charges.

4.2.3 Public private partnership in port development and operation

Private participation in a port development project has several patterns from a type that 1) the public sector develops minimum facilities such as a navigation channel, basin and breakwaters, and the private sector develops other facilities (Private initiative type); to a type that 2) the public sector develops all infrastructure and large scale equipment like quay gantry cranes and RTGs, and the private sector prepares small scale equipment such as reach stackers and tractors for operation. Several types between the above type 1) and type 2) are observed in actual cases of private participation in port development.

In the case that the private sector invests in some part or the whole part of port development, the development of an access road, railway, or navigational channel shall be discussed between competent public sectors and the private investor. A landlord port usually develops the infrastructure of the port and invites private terminal operators to invest in superstructure, such as quay gantry cranes, RTGs, and other cargo handling equipment.

4.2.4 Financial and managerial improvement

PAS's business produces lower profitability compared with PPAP and PAT. It may depend on the fact that consumption of fuel and oil is greater, non-operating cost reaches 25% and payment of interest reaches 8.2% of the total revenue. Payment of interest on loans will increase every year until 2017 and total repayment of principal will increase until 2020. Net income of PAS will reduce accordingly. Furthermore, PAS will have to pay dividends to shareholders after the sale of their stocks in June 2012. It is therefore imperative for PAS to increase their sales, improve efficiency of operation, reduce operational cost and idle labor force, lower non-operational cost and depress payment of interest.

PAS is faced with a rapid increase of repayment of loans. Payment of interest will be a heavy burden to PAS's financial management. While interest rates of ODA loans are from 0.01% to 1.0%, those of MEF sub-loans to PAS are from 2.5% to 3.85% and MEF collects service charges on sub-loans from 0.1% to 0.15%.

Interest rates of MEF sub-loans shall be reduced to or near the level of ODA. As a minimum request on interest rates of sub-loans, they shall be reduced to the level of ODA rates during the grace period. Interest on sub-loans during construction shall not be collected due to the fact that ODA provides the interest during construction.

4.3. Organizational Strategy

4.3.1 Pre-capacity assessment

PAS was established as a Public Enterprise with state-owned characteristics under the technical

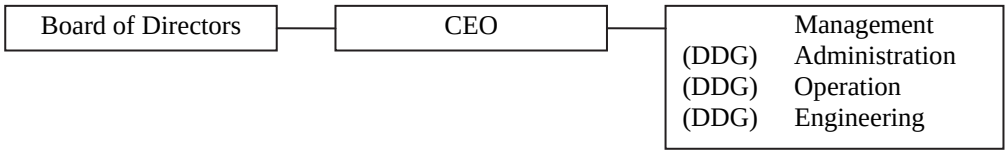
supervision of the Ministry of Public Works and Transport and the financial management of the Ministry of Economy and Finance.

PAS provides a comprehensive range of services including bringing vessels in and out for offloading and loading and storage and transport of cargo for customers from all social circles. According to the Sihanoukville Autonomous Port Sub-decrees and Statutes, the following are PAS' major duties for business operations and basic services:

- Pilotage, bringing vessels in and out and providing them with supplies
- Conduct cargo handling, offloading, loading and transport
- Maintenance, stock safeguarding, warehouse and yard
- Develop and rehabilitate the PAS's existing infrastructure that are required to be expanded
- Taking responsibility on health care, security and order in its management areas
- Adhere to the basic principles and working procedures in the same functions as the customers
- Commit to manage and organize the operational activities to be effective and progressive

PAS is led by a Board of Directors which consists of one chairman and six members from the ministries concerned shown below. The PAS's Board of Directors was appointed by the Head of the Royal Government of Cambodia.

The number of staff by Department and Office as of Sept. 2011 is as follows. Numbers in parenthesis are the total number of staff including Directors and Chiefs. The total number of staff is 1,104, comprising 1,064 PAS employees and 40 who work for Phnom Penh Dry Port.



Reflecting the basic feature of PAS's activity, the number of staff in port operation sections account for around 850, or 80% of total staff. It is also noted that the number of staff in the administration section is substantially large with around 190 (17%). On the other hand, the number of staff in the business development section for the Planning and Marketing Office, AFA Affairs Office and Customer and Promotion Office is comparatively small with only 8.

A Human Resource Development Office is not found in the organization chart except for the Training and Vocational Office and Human Resource and IT Office. The total number of staff for these two Offices is 15. This may mean that each department is responsible for its own human resource development. Considering that the role and function is quite different for each department, the department trains their staff by themselves. However, it is necessary to train all staff at PAS under the same objective, philosophy, target and common understanding.

PAS's organization is well arranged for a public organization. However, when the organization is evaluated from the viewpoint of a private institution, it has the following issues:

- Lack of aggressiveness in enhancing competitiveness
- Lack of aggressiveness in providing better services to customers
- Lack of aggressiveness in training all staff toward better service to people in Cambodia

4.3.2 Post capacity assessment

(1) Enabling environment in the target year

The Enabling Environment in the target year is shown in the business environment analysis in the formulation of PAS's vision discussed in Chapter 3.

(2) Required capacity for the service improvement

Major targets for the improvement of PAS's service are as below;

- To reduce the time needed for lifting-on and lifting-off containers
- To reduce ship berthing time
- Rationalize port related charges
- Conducting safe port management and operation
- Enabling document processing by using EDI
- Strengthening the shipping network

PAS personnel need to have the capacity to accomplish the targets mentioned above. The capacity is composed of the physical capacity and the human capacity. Further, the physical capacity can be divided into civil facilities and mechanical facilities. The human capacity contains two aspects, namely, quantitative and qualitative.

PAS personnel should have the physical and human capacities as shown in Table 4.3-1 in order to accomplish the targets.

Table 4.3-1 Required Capacity for the Service Improvement of PAS

Service to be improved		Required Capacity	
Target	Method	Physical Capacity	Human Capacity
1. To reduce the time needed for lifting-on and lifting-off containers	1. To streamline the entry of export container trucks and lift-off of the containers in the terminal	1. Construction of new gates for customs clearance processing before the PAS gates 2. Construction of parking lots for export container trucks around the terminal 3. Preparation of parking space at the roadsides of Phe Street or elsewhere 4. Expansion of the provision of container handling equipment such as RTGs and reach stackers	1. Ability to control traffic and entry and exit of trucks before the terminal gates 2. Capacity of PAS gate clerks to conduct entry processing 3. Appropriate use of CTMS 4. Competent yard planners 5. Ability to operate cargo handling equipment 6. Ability to properly maintain cargo handling equipment
	2. To prepare parking area for trucks waiting for receiving import containers	1. Construction of parking lots outside and near the terminal or inside the port area for bare chassis trucks	1. Ability to control traffic for the entry and exit of the parking lots for bare chassis trucks
	3. To receive import containers immediately after lifting-off of export containers and to depart from the terminal	1. Expansion of the provision of container handling equipment such as RTG and reach stacker 2. Construction of parking lots in the port area for trucks waiting for the scanning and customs clearance before exit	1. Ability to conduct import clearance document processing of customs and Kamsab 2. Ability to properly maintain cargo handling equipment*
2. To reduce ship berthing time	1. To hasten container handling operation	1. Expansion of the provision of container handling equipment such as QGCs and RTGs	1. Ability to conduct yard planning management 2. Ability to operate cargo handling equipment* 3. Ability to properly maintain cargo handling equipment* 4. Ability to manage cargo handling operation labor

			5. Ability of cargo handling operation labor
3. Rationalize port related charges	1. To reduce port tariff corresponding to the increase of cargo handling volume	Not required	1. Ability to analyze tariff and tariff structures of neighboring ports
	2. To simplify and rationalize the port tariff	Not required	1. Ability to analyze tariff and tariff structures and formulation of possible tariff revision
	3. To eliminate the collection of informal charges	Not required	1. Observance of the work discipline 2. Ability of organization management
4. Conducting safe port management and operation	1. To properly manage port entry and exit	1. Installation of fences surrounding the container terminal	1. Ability to control and streamline traffic at the port and maintain port safety
	2. To install proper navigation aids	1. Renewal of aged tug boats 2. Installation of navigation aids such as leading lights and buoys	1. Ability to properly maintain port vessels including tug boats 2. Capable pilots
5. Enabling document processing by using EDI	1. To conduct electrified port call and departure document processing	1. Introduction of an IT system	1. Ability to introduce and operate EDI system
	2. To promote information exchanges among customs, the harbor master and Camcontrol	1. Introduction of an integrated port information system including data related to import/export, port entry and exit, Camcontrol and customs	1. Ability to introduce and operate a port information system
6. Strengthening the shipping network	1. To promote marketing for the opening of new shipping routes	Not required	1. Ability to grasp and analyze world-wide maritime transport trend and formulate a new business plan 2. Marketing ability for shipping business

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(3) Required capacity for managerial and financial improvement

PAS's mission is to develop and operate an international port as a state owned company. The mission does not include profit making as a private enterprise however it will become an important issue once PAS changes to a joint stock company owned by shareholders.

As a joint stock company, PAS is required to increase sales through handling more cargo, reduce operation cost which is comparatively higher than neighboring ports, and also reduce non operating cost such as fuel grants to port workers. PAS will be required to increase the Net Profit Margin as a joint stock company and pay dividends to shareholders.

It is therefore important to develop the capacity of making strategy for business maneuvers and plan for business implementation. It is also critical to develop the capacity to tackle any obstacles to business maneuvering and find solutions for business promotion.

Necessary capacity for improving financial management shall include the following:

- Procurement of low interest loans and management of long-term debts;
- Management of financial resources to be borne by SEZ;
- Financial risk management of investment; and
- Revision of port tariffs in accordance with business maneuvers.

(4) Evaluation of capacity gap

Capacity gap is observed as follows.

（Administration staff）

- Density of work differs by Department and section within the Department. It differs among staff as well.
- Planning and research function seems to be weak.

(Port operation staff)

- Staffs directly engaged in port operation are well acquainted with knowledge and procedures. Although systems in the container terminal are computerized, due to breakdown, the system does not work smoothly resulting in a lack of competitiveness. Manuals are prepared for port operation and operation is carried out according to these manuals. However, a problem lies in cargo handling procedures that are not always done according to the manual. This brings about low productivity in port operations.
- Technical departments prepare the manual and their operation is done smoothly.

While communication between organizations is sufficient, communication within the organization is lacking. In this regard, the absence of teamwork poses a problem. For small matters, there are no serious problems; but for important matters, a serious problem arises because they should be dealt with under the full commitment of all staff under PAS. In this sense, improvement in communication is indispensable.

4.3.3 Filling capacity gap

(1) Organizational reform of PAS

Service ports around the world are often separated into regulatory and operational parts to introduce private competitive services to port operation. The World Bank Port Reform Toolkit recommends that a service port shifts to a landlord port. While PAS will change to a joint stock company in 2012, PAS shall aim at changing to a landlord port and establish a port operation company for providing stevedoring and other port services. When the new port development is planned, it may be appropriate to invite private operators to invest in terminal development.

(2) Reform of internal structure of PAS

The number of PAS employees is about 1,100 (inclusive of 65 contract personnel) in 2012. Due to modern cargo handling equipment and information technology, a necessary number of employee redundancies will be observed from the present 1,100 employees.

PAS is managed as a state owned company. Therefore, wages and working conditions of employees are decided by the Board of Directors as well as other personnel regulations on employees. Wages are not related to performance of individual persons. There is no incentive to follow instructions of the supervisor or increase performance. In order to improve efficiency of the organization, special attention shall be paid to following measures.

- To introduce performance related remuneration system (Higher payment for good performance);

- To allow the supervisor to assess bonuses of staff members under his supervision.

Five departments are involved in PAS' container operation. However, only one organization shall be in charge of managing and operating the container terminal in a comprehensive manner. The Container Terminal Operation Dept. should be the leading department of the entire CT operation, and the Labor Management Dept. as well as Maintenance and Repair (M&R) Dept. should be sub-departments for supporting CT operation through their professional services.

(3) Improvement in personnel and institutional frameworks

The age composition of PAS employees is unique Employees older than 50 years old account for 31％of total employees. The number of employees younger than 30 years old is comparatively small. With such an imbalance, it is rather difficult for the younger generation to work actively. Furthermore, it is difficult for all staff to work enthusiastically. In addition, it is not so easy for all employees to tackle difficult problems that they face. It is also not easy for all staff to join in overcoming various managerial difficulties. There is a serious lack of communication between employees. How to treat elder people poses another issue. Under these conditions, it is difficult to unite all employees towards one goal. These kinds of issues should be solved before enhancing PAS's competitiveness.

With respect to the improvement in age-based institutional structure and because the number of aged people increases year by year, it is necessary to provide positions suitable for elders. In this regard, preparing a staff-related business for ageing people is being considered. This business will create a staff organization and prepare work for them. Basically, people are provided with staff-related work, they are expected to accomplish the work within a period of time and when they finish it, they will get another staff-related work project. Since the staff-related work is quite different from line work, it is necessary to train the employees on how to proceed.

(4) Reform of capacity building system

1) Factors determining PAS's competitiveness

Competitiveness of PAS is enhanced through the introduction of high quality machinery and equipment, and recruitment of capable human resources. The high quality machinery and equipment is attained through capital investment and the investment becomes feasible only when PAS makes a profit. Whether PAS can make a profit is largely influenced by the quality of human resources.

2) Importance of human resources factor in PAS's competitiveness

Competitiveness of human resources is strengthened through the following three factors. The first one is the capability of staff who work under an organization. The capability is influenced by the amount of education or working experience of each staff member. The second one is capability improved through "On the job training" at PAS. When PAS is ardent in educating and training the staff, the staff's capability is easily enhanced. In this sense, training and education at PAS is important for staff capacity building. The third factor is the strength of the organization. When the organization is weak and has little power to provide various opportunities for capacity development for each staff member, the staff will not grow. The staff will improve and grow only when the above three factors are successfully implemented.

3) Human resources development and organizational reform for development

a) Viewpoints for the development

When development of human resources is discussed, the spotlight is cast on knowledge necessary for port operation. Knowledge is important when the unique characteristics of port operation are taken into consideration; however, it is necessary to train people engaged in port operation not only on knowledge for basic and technical areas but also for soft management areas such as teambuilding or communication. For these areas, training is indispensable for both young staff and management people including top management.

Every staff member should be educated and trained in the following areas:

- Teambuilding
- Role of staff
- Communication skills

b) Area where human resources development is urgent

- Strengthen overall planning function

In order to strengthen its competitiveness, PAS has to strengthen the overall planning function. Overall function means the total functions from gathering of cargo, smooth handling of the cargo within a short time, and improving the capacity of all staff at PAS. For this purpose, the name of the current planning department will be altered to the "Strategic Overall Planning Department."

The new department periodically prepares three kinds of management plan: One-year annual plan, Mid-term three years plan and Long-term five years plan. The role of the Strategic Overall Planning Department is to gather relevant data and information, to analyze and compile them for the relevant plan and to report to the CEO. The outlines of the above management plans are reported to all of the employees. For strengthening of the above function, one officer and two assistant officers are assigned for the work.

When it becomes necessary for PAS to make a long-term Sihanoukville port development plan as the result of this Master Plan Study, this strategic overall planning department will undertake the work. Taking into consideration the volume of the work, several new staff will be assigned.

- Creation of a new committee for enhancing efficiency at PAS

The effect of patchwork style reform is limited. Total and comprehensive reforms are to be searched. In this reform, all of the staff at PAS should be involved. A Deputy Director General for the Administration Division will be assigned as the Head of the committee. One officer and one assistant officer will be assigned as staff to manage the committee.

Creation of a new section for overall MIS development: Development of MIS is PAS's lifeline. PAS's current MIS has been restructured and improved. The new section will be set either in the Administrative Division or as a new independent department. MIS covers the following information:

- Basic data on customers
- Data on daily operations
- Data on internal management
- Data on revenue and profit

For system development, one officer and two assistant officers are assigned. In addition, system engineers are temporarily recruited for the development of the computer system.

- Strengthen Business Division

By using staff who become available as the result of efficient operation, new businesses will be created. Around port operation, several service works are to be born. One is husbandry. In addition, SEZ prepared adjacent to the port will need various kinds of operation services such as transportation and storage of cargos. These needs will be taken up by the Division. Further, looking around the world, the word "Port" is welcomed by people with a good image as shown in cases such as Yokohama and Kobe Ports. These ports are developing not only for the cargo handling business but also for local tourism. Considering the beautiful scenery and sand in Sihanoukville, it is quite natural to develop Sihanoukville port as a tourism area. The newly created Division is expected to develop these port related businesses in Sihanoukville. Officers at the Division are requested to have a wide view of connecting PAS's traditional role of sea transportation for cargos with development of the regional economy of Sihanoukville. Considering the importance of the Division, one officer and one assistant officer are newly assigned to intensify the activities.

- Strengthen Marketing and SEZ Department

A high priority should be given to securing customers. To accomplish this, the current Marketing and SEZ Department should be strengthened by increasing the number of marketing officials. Increased staff will also be involved in creating new PAS related businesses.

Major works requested for marketing staff are as follows:

--- Preparation of documents and brochures.
--- Analysis of basic statistics for further marketing activities.
--- Analysis of current customers' activities in detail.
--- Analysis of cargos and changes in investment behaviors of neighboring countries.

- Assign a new Personnel officer

One officer will be assigned to keep communication with all staff at PAS. He will be placed under the Deputy Director General, Administration Division. He will be involved in the selection of staff to attend educational training courses in foreign countries. Under the new officer, one assistant officer is assigned for support.

- Assign a Training officer

The officer will be responsible for planning and execution of education and training for all staff at PAS. Under him, 3-4 staff will be assigned as his subordinates. The officer will also be involved in selection of staff who are to be sent abroad for high-level, intensive training. Under the Training officer, three staff are to be assigned for support.

As a result, a total of five officers and eleven assistant officers are to be assigned for the new operational works. They are to be selected and assigned from existing departments taking their capability into consideration.

5. STRATEGIC MASTER PLAN FOR THE DEVELOPMENT OF SIHANOUKVILLE PORT

5.1. Methodology for the Planning

5.1.1 General

The Strategic Master Plan for the Development of Sihanoukville Port will be formulated by following the steps below:

- To clarify the roles of Sihanoukville Port toward socio-economic development of Cambodia and to identify the functions with which the port shall be furnished in order to discharge its roles.
- To estimate the demands for each function in the country in the target year.
- To identify the demands for Sihanoukville Port considering rational demarcation among ports including Phnom Penh Port and other international gateways.
- To identify the gap between the demands for Sihanoukville Port and the port's capacity of supply in the target year taking account of improvement both in the existing infrastructure/superstructure and software such as container operation.
- To identify the quantity of facilities which need to be newly constructed taking account of functional reorganization of the existing facilities.
- To identify the available space for port development considering the existing and planned special utilization, natural conditions etc.
- To determine the space for port development in the target year considering socio/natural environment and the growth direction of the port in ultra long term (beyond the target year).
- To select the optimum layout plan of facilities from alternative plans considering

functionality, cost efficiency, safety, future growth and socio/natural environment.

- To study required measures toward implementation of the plan, such as PPP.

5.1.2 Process of Strategic Environmental Assessment

(1) General concept

During the course of formulating the development plan of Sihanoukville Port, Strategic Environmental Assessment (SEA) was conducted so to try to devise a plan with minimal environmental impact. In this study, SEA is referred to as the environmental considerations implemented in the overall process of formulating the optimum development plan. The environmental considerations implemented in the process of development plan formulation are as follows:

- Identification of environmental impact factors to be considered in the process of formulating the alternative development plans
- Formulation of alternative development plans by considering the identified environmental impact factors
- Presentation of environmental considerations made in the process of formulating the alternative development plans
- Implementation of Initial Environmental Examination (IEE) for each development plan and comparison of environmental impacts
- Selection of optimum plan by considering factors such as cost, port operation, safety and environmental impacts

(2) Environmental impact factors to be considered in the process of formulating alternative plans

Based on JICA's Guidelines for Environmental and Social Consideration, 30 environmental impact factors were initially selected for potential consideration, and the most applicable factors were identified through consultation with stakeholders and JICA Advisory Committee. Eventually, 11 environmental impact factors were selected as applicable. Table 5.1-1 shows the selected environmental impact factors (as indicated by a check) and justification.

Table 5.1-1 Selected environmental impact factors and justification

Impact factor				Justification
Social environment	1	Involuntary Resettlement	✔	Port development may require resettlement of local communities.
	2	Local Economy such as Employment and Livelihood, etc	✔	Port development may affect local economic activities such as fishing and tourism.
	3	Land Use and Utilization of Local Resources	✔	Port development may affect existing land use.
	4	Social Institutions such as Social Infrastructure and Local Decision - making Institutions	✔	Port development may result in division of local communities.
	5	Existing Social Infrastructures and Services	✔	Port development may affect existing social infrastructures.
	7	Misdistribution of Benefit and Damage	✔	Port development may result in misdistribution of benefit and damage.
Natural environment	13	Topography and Geographical Features	✔	Port development may alter coastal topography by inducing coastal erosion.
	18	Flora, Fauna and Biodiversity	✔	Possible impacts on terrestrial flora/fauna through construction of new access road.
Pollution	22	Air Pollution	✔	Possible impacts on local community if the new access road runs through sensitive areas such as residential area.
	23	Water Pollution	✔	New port structure may reduce water exchange and create water stagnant areas.
	26	Noise and Vibration	✔	Possible impacts on local community if the new access road runs through sensitive areas such as residential area.

Prepared by Project Team

5.2. Present Capacity of Port Facilities

5.2.1 Outline of existing facilities and equipment

Waterways & Basins: there are an approach channel with dimensions of 1,700 meters long, 125 meters wide and -10 m deep, and three (3) basins: tugboat, new port and container berth basins are situated respectively in front of the tugboat quay, new quay and container berths. Depths of these basins are correspondingly -3, -9 and -10 meters.

Mooring Facilities: there are five (5) mooring facilities in the Port. Two (2) mooring facilities are made of concrete blocks: the new quay and the container berth stay inside the harbor area. The dimensions of the new quay are 350 meters long, -9 meters deep, +3.0 meters top elevation with a 9,056 square meter apron, and the container berth is 400 meters long, -10 meters deep, +3.0 meters top elevation with a 15,810 square meter apron. In the old port area, there are two (2) mooring facilities: one is the Old Jetty located on the west side facing the outer sea and made of a pier structure with dimensions of 2 x 290 meters long (both offshore and inshore sides), -9 meters deep and +5.2 meters top elevation. The other is the tugboat quay located at the tugboat basin made of concrete blocks with dimensions of 270 meters long, -3 meters deep, +2.0 meters top elevation with a 7,000 square meter apron. Except for the container berth, all the mooring facilities were constructed in the 1960s.

Cargo Sorting Facilities: PAS owns cargo handling equipment and accessories such as 2 units-QGCs (30.5 tons), 2 x 358 meter long-QGC rails, 7 units-RTGs, 9 units-reach stackers, 1 unit-forklift, 31 units-trailer head with chassis and 2 units-mobile harbor cranes, which have been procured since 1985. In the container terminal, there is a 42,000 square meter container yard made of inter-locking concrete block pavement with container and RTG concrete foundations. These facilities were constructed from 2001 to 2007.

Storage Facilities: Two (2) storage yards constructed after 2001 and located behind warehouses No.3 and Nos. 4&5 have areas of 5,328 and 19,094 square meters with concrete pavement. Warehouses Nos. 1 and 2 are made of reinforced concrete with a steel frame structure and are located in the old port area. Both their floor areas are 6,760 square meters. Warehouses Nos. 3, 4 and 5 were also made the same as Nos.1 and 2 and are located in the new port area. Respectively, the floor areas are 13,875, 6,988 and 6,988 square meters. All the warehouses were built in the 1960s.

Other Facilities (Nos. 36 to 55): 8 units-navigation buoys and 1 unit-navigation light are provided and installed at present. Some spare buoys are stored on the old port apron. VTMS, an X-ray scanning system and a container checking building (under the jurisdiction of Customs) and a CCTV system have been recently provided as port security facilities by the Grant Aid of Japan. Perimeter fence of the Port area behind the old and new ports, which is made of concrete walls, is already provided in 1960s but the one of expansion area at such as container terminal, which is made of cyclone wires, is newly installed at the construction of the terminal. There are eight (8) special boats working in the Port area: 3 units-tugboats (2 x 800 HP), 2 units-tugboats (800 HP), 1 unit-pilot boat (390 HP), 1 unit-mooring boat (175 HP), and 1 unit-patrol boat (2 x 210 HP). The patrol boat is also a item of the Grant Aid of Japan.

5.2.2 Structural Soundness of Old Jetty

Although repair works, load and operational restrictions enforcement are carried out by PAS, the Old Jetty still has significant damage/deterioration in the fender system, P/C beams and abutting beams. In particular, the damage for P/C beams is seriously progressing.

The examination using the results of the predicted damage/deterioration ratios by Markov Chain Model reveals an undeniable speculation that the main pier of the Old Jetty is already beyond the Serviceability Limit State (SLS) with steep declination and may reach the Ultimate Limit State (ULS) within/after 10 years.

5.2.3 Capacity of existing port facilities

(1) Container terminal

The handling capacity of the existing container terminal is 500,000 TEU per year on the condition that the concentration of vessels arrival on a particular day of a week will be alleviated with increased container handling volume. Increase of capacity of cargo handling equipment including introduction of new QGCs is also a precondition of the estimated handling capacity.

(2) Bulk terminal

The handling capacity of the bulk terminal which is to be constructed by the Multi-purpose Terminal Development Project is estimated to be 2,160 thousand tons per year.

(3) Cruise terminal

It can be assessed that Sihanoukville Port doesn't have a cruise terminal with necessary functions because there is no passenger building in the port. Furthermore, the old jetty which cruise vessels mainly use is severely deteriorated and its physical functions cannot be maintained in the target year. Therefore, the Project Team evaluates that the capacity of cruise terminal in the target year is zero.

5.3. Required of Port Facilities Development

5.3.1 Supply and demand of container terminals in Cambodia

A total of 1,750,000 TEUs of containerized cargoes are expected to be handled in Cambodian ports in 2030, of which 500,000 TEUs can be handled at the existing container terminal in Sihanoukville Port if it is improved in terms of software and hardware, and 500,000 TEUs can also be

handled in Phnom Penh New Port when its final phase development is completed. Accordingly, the shortage of capacity of container terminals in Cambodia in the target year is assessed to be 750,000 TEUs.

Based on the result of demand forecast, it would be preferable that additional 60,000 TEUs are handled in Phnom Penh New Port by increasing the quantity of equipment or the yard area, and the remaining 690,000 TEUs are handled in Sihanoukville Port by developing a new container terminal because this demarcation matches the preference of the market and would maximize generation of benefit.

5.3.2 Quantity of the required port facilities

(1) Container terminal

An additional container terminal with the capacity of 650,000 TEUs is required in Sihanoukville Port in the target year. Since the assessment indicates that the maximum vessel which calls at the port in the target year is 4,500 TEU vessels, the new terminal shall be able to accommodate this size of vessels. In general, for accommodating 4,500 TEU vessels with full draft, a fifteen meter deep quay is required. However, it is assessed that the maximum sized vessel is unlikely to arrive at or depart from Sihanoukville Port with full draft considering the geographical condition of Sihanoukville Port located between ports in Thailand and ports in southern Viet Nam. That is, in most cases of west-bound, Laem Chabang or Bangkok Port would be the last port. Likewise for east-bound, vessels would call at Cai Mep Port or others after calling at Sihanoukville Port to take additional export cargoes there.

(2) RORO terminal

Imported used vehicles, which are transported by container vessels or general cargo vessels at present, will be diverted to RORO transportation until the target year. Therefore RORO terminal shall be constructed in the port.

(3) Dry bulk and general cargo terminal

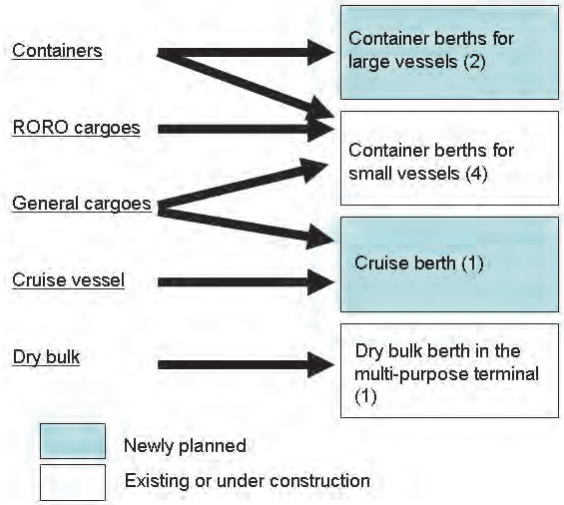
As for dry bulk, the new multi-purpose terminal will be able to respond the almost all demands up to the target year of 2030. On the other hand, a new facility for handling increased general cargoes such as milled rice and plant cargoes shall be constructed.

(4) Cruise terminal

The potential of Sihanoukville Port as a cruising base is very high and further increase of cruise vessels calls is expected. Therefore, a cruise terminal shall be constructed. However, construction of a terminal exclusively dedicated for cruise vessels is not realistic because cruise vessels are expected to call at the port only during dry season. Therefore the cruise terminal shall also handle some amount of cargos.

(5) Required quantity of quays

Based on the above description, two container berths and one cruise berth shall be newly constructed. Since the peak factor of containerized cargoes in Sihanoukville Port in the target year is estimated to be around 1.5, which is still higher than ordinary ports, it is assessed that the container terminal can also handle RORO cargoes during off period of container operation. General cargoes shall be handled at container terminal or cruise terminal depending on the characteristics of commodities. Figure 5.3-1 schematically shows the allocation of each type of cargoes and passengers to the existing (including under construction) and newly planned berths.



Prepared by Project Team

Figure 5.3-1 Allocation of cargoes and passengers to the existing and newly planned berths

(1) Required development of navigation channel and basins

The navigation channel and the basin in front of the new container berths shall be deepened up to -14m in order to accommodate 4,500 TEU vessels as mentioned above. Aiming at securing safe navigation and preventing oil contamination due to grounding of vessels, the navigation channel shall be widened up to around 440 m which is correspond to 1.5 times of LOA of the largest container vessels calling at the port in the target year.

5.3.3 Repair and Improvement of Existing Facilities

The inspection and diagnosis were basically carried out by a visual inspection incorporating the results collected from PAS according to the common items and criteria listed in the said sheet for the major facilities. Table 5.3-1 presents the deterioration criteria as specified in the said manual. The criteria define four (4) levels of conditions of member(s) as seen in the table.

Table 5.3-1 Deterioration Criteria for Inspection and Diagnosis

Level	Condition of Member(s)
a	Quality and performance conspicuously lowered
b	Quality and performance lowered
c	Disturbance started, but quality and performance not lowered
d	No defect confirmed

Source: Technical Maintenance Manual of Port Facilities in Japan

Based on the classification of the deterioration level, the manual indicates a method for assessment of objective facilities. Considering the impact on higher safety grade of the major facilities, the following assessment criteria were consequently applied to the facility assessment as described in Table 5.3-2.

Table 5.3-2 Applied Facility Assessment Criteria

Classification	A	B	C	D
Facility Condition	Capacity and performance apparently lowered	Capacity and performance might be lowered, in case of neglect	Continuous observation required, even no disturbance confirmed for capacity and performance	Satisfactory capacity and performance remained without any defect
Assessment Criteria	"a" is more than one (1) and capacity and performance of facility are already lowered	Either "a" or "b" is more than one (1) and capacity and performance of facility might be lowered	Except for A, B, C	All are "d"

Source: Technical Maintenance Manual of Port Facilities in Japan

1) Waterways & Basins

The assessment gives a classification “D” which means “satisfactory capacity and performance remained without any defects” to all the facilities, except for the tugboat basin. The tugboat basin is supposed to be maintained at -3 meters deep, but the actual depth is -1.5 to -2.5 meters. It is not a significant problem upon the actual operation because only small-drafted boats and vessels are berthing at the basin and quay. However, in view of maximizing the capacity of the facilities for larger boats and vessels that may berth in the future, it is noted that the tugboat basin does not assure satisfactory capacity and performance as assessed.

2) Protective Facilities

The assessment respectively assesses the three said facilities as “A,” “C” and “D.” The north breakwater (north) has the worst assessment because some defective conditions such as lost sections of rubble stones and/or backfilled materials. Part of the situation might have originally happened due to uncompleted sections suspended at 60% progress of construction. The north breakwater (south) has minor dispersion and collapse of rubble stones but the damage is not at a significant or serious level. The south breakwater located in the old port shows no defective observations to date.

3) Mooring Facilities

The assessment gives the remarkable result of “A” or “B” to the new quay, container berth and oil jetty. The new quay was assessed with an apparently lowered capacity and performance for the ladder, concrete curb and copping concrete, which are lost or broken. For the container berth, settlement of the apron is observed particularly at excessively loaded sections. The oil jetty is assessed as the worst because it has many lowered capacity and performance levels for the fender system that has some missing sections, a cracked concrete curb, damage and cracks on the superstructure upper/side and extensive spalling underneath. No significant defects were observed for the tugboat quay probably due to the lower frequency of heavy use and the advantageous location covered by the breakwater.

4) Transportation Facilities

All the roads show no significant deterioration levels for each inspected item, except for the internal road for the container terminal. Some settlement of interlocking block pavement was observed on the east side.

5) Cargo Sorting Facilities

The container yard has some partially unequal settlements of interlocking block pavement located around the east side of the container yard in heavy-loaded sections used by reach stackers and between transfer crane foundations. It is assumed that the east side settlement may be caused by residual settlement but which is not progressive and minimal. The settlement near the concrete foundations is caused by frequent travel of relevant vehicles and cargo handling equipment. It often

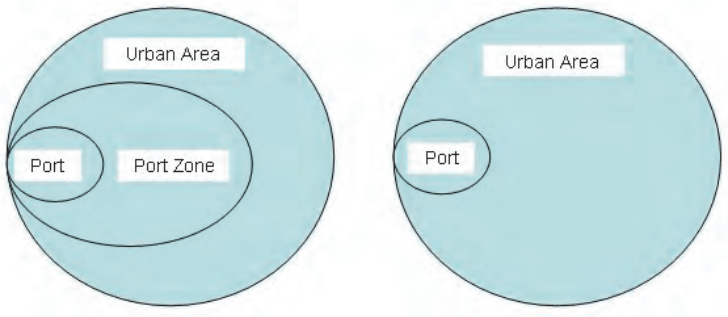
happens especially at a boundary between different structures which has different stiffness. As far as visually observing the transfer crane and container stacking foundations, they have no settlement confirmed. This speculation is supported by the results of healing to PAS.

5.3.4 Required development scale of land for industries

Figure 5.3-2 compares the spatial configurations of Sihanoukville Port (right) and ordinary ports (left). In general, a port zone, where logistics industries and manufacturers which are heavy users of the port are concentrated, is formed around a port. This zone acts also as a buffer zone between a port and urban area. Some countries such as Japan restrict urbanization and location of a residence or an industry indifferent to port activity in a port zone.

Although Sihanoukville Port is a newly developed port based on a master plan, such a port zone doesn't exist and port-related industries are scattered in the urban area or residential zones (in the original port development plan includes a development plan of industrial zones, but the plan has not been implemented due to the civil war and social dislocations as mentioned in the next section.). This spatial configuration of Preah Sihanouk lowers the efficiency of logistics. This is also a cause of negative impacts of the port upon urban activities such as traffic congestion around the port.

It is indispensable to form a port zone strategically in Preah Sihanouk and to locate port-related industries for competitiveness of the port and for better harmonization between the port and urban activities. However it would be difficult to form a port zone on the existing land area because the area around the port has been already urbanized. The urban plan of Preah Sihanouk doesn't allocate any port industrial zones in the land area except the existing Port SEZ. Furthermore, environmental impacts are concerned if the rolling hills surrounding the port are developed as a port industrial zone. Accordingly, it is crucial to form a port zone on a newly reclaimed land behind port terminals and to utilize the zone exclusively for port-related industries. The depth of port zone behind port terminals shall be at least one kilo meter.



Prepared by Project Team

Figure 5.3-2 Comparison of spatial configurations of Sihanoukville Port (right) and ordinary ports (left)

In Preah Sihanouk, development of SEZs by private investors are progressing more rapidly than the forecast of "The Study on Regional Development for the Phnom Penh - Sihanoukville Growth Corridor", and the SEZs and other industrial development would be accelerated toward the target year. Accordingly, as for quantitative expansion of industrial land, it would be possible to rely upon private investment; however, PAS should allocate a part of newly reclaimed port zone exclusively for manufactures which deeply rely on the port such as export processing.

5.4. Space for Port Development

5.4.1 Present condition of the utilization of land and basin around the port

(1) Water area

1) Outside of the port

There are no existing fishing rights or fisherman's union defined in the statute of Cambodia. The sub-decree regarding water rights was promulgated once in the 1950's; however, it automatically lost its legal force under the chaos of civil war during the Pol Pot regime, and has since never been reformulated. In the coastal areas, there is a certain tacit consent among fisherman and regional government over fishery grounds. Fishery grounds among the three main fishery villages in Preah Sihanouk Province show clear separation without conflict.

2) Inside the port

Tthere is only one dike gate open to the sea and hence, logistics cargos, ships and vessels of the port and fishery boats share the same gate, which also suggests the port's safety concerns. Aquaculture fish farmers share the same areas in the port with other boats/ships. There are residents in the city out of PAS jurisdiction, who commute to nearby preserves along the edge of the dike. Also, they do not have any permission or agreement with PAS. A total of 102 people (88 males, 14 females) from 21 families run the fish farming in this area with 973 preserves. Average size of a preserve cage is 9.6 m^2.

(2) Land area

1) Coastal line of Preah Sihanouk Province

Preah Sihanouk Province is considered a highly urbanized area. It covers about 15,000 ha or 6% of the total area of Preah Sihanouk Province. Most of the villages are located along National Road Nos. 3 and 4. Some lands located near these roads are used as paddy fields which cover about 7,800 ha. However, the total forest area covered in the province is still high and represents 81% of the provincial land area.

2) PAS Jurisdiction

a) Residential quarters along the coastal line of the Hun Sen Road

It is estimated that 11,000 people live in the area along the coast including 2,200 families.

It is said that some of the residents had moved in from other coastal areas of Cambodia and Vietnam because the construction of the large dike during the development project of the port in 1955 made seawater surface in the dyke restful and safe enough for mooring small fish boats. Also, the chaos during the Vietnam War, civil war and Pol Pot regime cause difficulty to the government and PAS with regards to control of port jurisdiction.

A fishing town of a certain scale has been formed in the area at the base of the large dike. Most of the residents along the coastal line of the Hun Sen Road live on fishing and small businesses. The actual land of this area is obviously not enough to contain its increasing population. Most fishermen in this area created small jetties from wood or lease them for living and mooring their fishing boats. According to PAS, many owners who had originally constructed these jetties had left the area already and often live in a city.

b) Residential quarter around SEZ

It is estimated that 1,200 families and 6,000 people live in the area around SEZ.

The background of these people varies; however, it is said that most of them started living in the area for the purpose of getting eligibility requirements for compensation for resettlement. However, there are also people who purchased land from the municipality government at their own expense during the era when the government set land use plan and declared its jurisdiction of the SEZ area in 1993. The sub-decree in 2000 fails to solve the issue of the people who purchased land from the government and thus remained as "illegal residents". Through development projects in the past, PAS

created its own methodology to identify the residents, the system of compensation and private contracts to give them the right of residency called "Agreement", which consists of basic information of family members, fingerprints, photo of face of family members, list of assets, and location maps of immovable assets.

5.4.2 Existing plans for the utilization of land and basin around the port

The urban plans in 1995 and 2010 indicate that the land for manufacturers and logistics industries were reduced considerably during this period due to increased population, promotion of tourism industry and improved awareness on environment.

The port plans of Sihanoukville in 1964 and Pol Pot era secure the land for port-related industries by reclaiming around a half of the basin surrounded by breakwaters (sea walls). If these plans had been implemented, the port would not have had to operate inefficiently in a small area, nor would it have had a negative impact on urban traffic.

As spatial utilization around the port has changed greatly since the times when these plans were formulated, it is inadequate and impossible to implement these plans as they are. But, it is of vital importance to realize the integrated development of port and littoral industrial zone, which has been the basic concept of port development since the port's initial stage, while paying due attention to socio-environmental affairs.

5.4.3 Candidate areas for port development

"The Study on Maritime and Port Sector Master Plan" conducted by JICA evaluated the potential of the littoral zone between Sre Ambel and the area to the east of Ream National Park for port development by employing the mesh analysis method. Regarding the development potential for container terminals, which is the most important component of the port development strategy of this project, the study evaluated that the area surrounded by breakwaters had the highest potential.

Considering rational arrangement of port functions and harmonization with spatial utilization of the surrounding area, the Project Team proposes the basic spatial configuration of port development area as follows.

The basin surrounded by breakwaters shall be reclaimed and an integrated port complex which comprises of terminal area (containers and RORO) and port-related industrial zone (logistics and EPZ) shall be developed there. The reclaimed land shall be as large as possible. This area, the existing port area and the existing Port SEZ shall be integrated and become the expanded Port SEZ. Further port development beyond the target year shall be implemented outside the north breakwater, where deep water quay can be constructed. The outer edge of the south breakwater shall be developed as a cruise terminal. The area around the old jetty which connects to the cruise terminal shall be developed as a waterfront promenade and open to the public. The old jetty which was constructed just after the recovery of independence of the nation shall be preserved eternally as a symbol of the independence.

5.5. Natural Conditions

5.5.1 Topography

Sihanoukville Port faces the Kompong Saom bay in the Gulf of Thailand, lies at 103º 30'E longitude and 10º 39'N latitude, and has a seawater depth of 5 to 10 m. Damlong Is., Mano Is., Ta Team Is., Rong Is., Rong Samloen Is. and Poah Is. are located in mouth of the bay. These islands function as natural breakwaters, especially against west and southwest waves from the Gulf of Thailand. The port area is enclosed with low rolling hills.

5.5.2 Bathymetry and sedimentation

The soil sedimentation area in the basin was limited and a small amount of sedimentation was found in the joint part between the dredging area and the existing seabed area. However, the soil sedimentation in the channel was more voluminous in the mouth area of the port and the middle part of channel.

5.5.3 Meteorology

According to the temperature data, the average temperature from 2000 to 2011 was 29.4 ºC. The coolest month is January with a monthly average temperature of 24.3 ºC and the hottest month is April with a monthly average temperature of 34.0 ºC.

Through the year, the strong wind blows mostly during the South-West Monsoon season in the west, southwest, and exceptionally northwest directions. The strongest winds on record during this period were 22 m/s in a southwest direction. Based on the wind direction frequency throughout year, Sihanoukville has 3 kinds of seasonal wind directions. High wind directions are west (18.4%), northwest (17.8%) and northeast (17.6%).

The average annual mean rainfall is 3,081 mm and the average number of rainy days was 194 days from 2000 to 2010 excluding 2008.

5.5.4 Oceanography

(1) Tide conditions

Based on the ACD (Admiralty Chart Datum) tide system, MSL (Mean Sea Level) is ACD+1.07 m and the Highest High Water Level is ACD+2.14 m. Tide observation was conducted by the JICA M/P and F/S in 1997 and then the Construction Datum Level (CDM) was determined based on the Japanese Standard. Consequently, ACD was lower than CDL by 0.47 m.

According to observation tidal data analysis by the Multi-Purpose Terminal Project Team, only 2.8% of observed tide levels were lower than CDL. Therefore, it seems insignificant for the construction works and ship maneuvering.

(2) Wave Conditions

Based on the wave condition analysis of the JICA M/P and F/S in 1997, offshore waves with a height not exceeding 0.5 meters accounted for 92.3% and those exceeding 0.75 meters in height were estimated to be only 0.8%. Dominant wave directions are ordinarily north and west. The majority (97.8%) of the wave period was less than 3.00 seconds.

(3) Current Conditions

According to the Final Report of JICA M/P and F/S in 1997, a current survey was carried out from April to May 1996 at locations in the south channel, north channel and a disposal offshore area around Dek Koul Island. The maximum velocity and frequent direction of the current in the south channel is approximately 50 cm/sec from northwest to north. In the north channel, the maximum velocity is also 50 cm/sec and flows from south to southwest. The currents around Dek Koul Island flow from the northeast with a maximum velocity of 80 cm/sec.

5.5.5 Geotechnical Conditions

A soft soil layer with an N-value of less than 5 was found in 5 boreholes inside the breakwater distributed approximately 5 – 8 m in depth from the seabed. Based on the laboratory test of particle size distribution, the soft sail layer is mostly sandy soil. A rock layer fluctuates from -11 m to -28 m of elevation in all 6 boreholes.

A sounding survey was conducted to identify the rock layer elevation in the inner and outer Sihanoukville Port in the JICA M/P and F/S in 1997. Moreover, a detailed sounding survey was conducted for detail design by E/S for Sihanoukville Port Multi-purpose Terminal Development Project (2011).

According to the detailed sounding survey, a rock layer with approximately -11 to -13 m elevation was found around the red buoy (about 450 m from entrance of the Port) in the north channel.

5.6. Baseline condition of natural environment

5.6.1 General description of the coastal area

The coastal area around Sihanoukville Port is mainly comprised of sandy beaches, rocky coasts and headlands. Mangroves are distributed along small inlets and in Ream National Park, which is located approximately 20 km south-east from the Port. Coral reefs are mainly distributed in the offshore islands.

5.6.2 Ecosystem

(1) Terrestrial ecosystem

1) Terrestrial flora/fauna survey

a) Results of flora survey

A total of 85 tree species were identified through the survey. Two identified tree species *Dipterocarpus costatus* and *Xylopia pierrei* are classified as threatened under the IUCN Red List. *Dipterocarpus costatus* is classified as Endangered (EN) and was found at transect T1. *Xylopia pierrei* is classified as Vulnerable (VU) and was found at transects T1 and T3. Both species are common in Cambodia and do not require any special conservation yet. Nevertheless, clearing of these threatened species should be avoided by careful route selection (e.g. avoidance of forest area).

b) Results of fauna survey

According to the interview survey, a total of 83 species were identified to exist around the survey area, consisting of mammals (16 species), birds (39 species), reptiles (18 species) and amphibians (10 species). Within the identified species, two mammal and three reptile species are classified as threatened under the IUCN Red List. Since the habitat range of these threatened species are uncertain, a detailed field survey should be conducted in the EIA to confirm whether the route of the access road does not overlap with their habitats. If impacts are predicted, the route should be altered or appropriate conservation measures considered.

(2) Marine ecosystem

Cambodian waters support important marine habitats such as coral reefs, seagrass beds and mangrove forests. While seagrass beds are limited or non-existent in waters adjacent to the Port, small patches of seagrass beds are found in Koh Rong and Koh Rong Samloem islands (UNEP, 2007[1]), which are located approximately 20 km west from Sihanoukville Port. While extensive seagrass beds are distributed along the coast of Kampot Province, these areas will not be affected from Port development as they are more than 30-40 km east from the Port.

Along the coast of Sihanoukville, mangroves are mostly distributed along small inlets and in Ream National Park, which is located approximately 20 km east from the Port. These mangroves are unlikely to be affected from Port development primarily due to their distant locations. No mangroves are found near the Port.

Coral reefs in Cambodia are mostly distributed along parts of the mainland and around islands. In Sihanoukville, coral reefs are found in the nearshore and offshore islands, which may be affected by port development such as dredging activities.

According to the survey conducted by Beasley et al. (2007)[2], ten marine mammal species have been confirmed in Cambodian waters. Nine are Cetaceans and one dugong. In the Sihanoukville area, Irrawaddy dolphins are known to inhabit the adjacent waters of Ream National Park. Oceanic species are commonly observed around Koh Rong and Koh Rong Samloem. Dugongs were formerly abundant in waters around Kep and Kampot Provinces but the present status is unknown. Dugongs have also

[1] UNEP 2007, National Report on Seagrass in the South China Sea

[2] Beasley et al (2007), Conservation Status of Marine Mammals in Cambodian Waters, Including Seven New Cetacean Records of Occurrence, Aquatic Mammals 2007, 33(3), 368-379

been reported around Koh Rong and Koh Rong Samloem, but probably persist occasionally and in very low numbers.

5.6.3 Air quality

Air quality around the port area may be considered to be in relatively good condition, as port and industrial activities in the area are at the moment relatively limited.

5.6.4 Water quality

Although the waters in and around the port area was polluted by oil and coliform bacteria, apart from these parameters, the water quality appears to be in relatively acceptable levels. However, due to the enclosed nature, the area inside the port breakwater will be susceptible to future water pollution, especially with the port expansion, SEZ operation and continuing wastewater discharge from the local community. Therefore, discharge of any untreated wastewater should be prevented or gradually phased out to minimize the risk of further water pollution.

5.6.5 Waste

The main non-hazardous wastes generated from Sihanoukville Port are plastics, wood chips, bottles, tins, and papers. These wastes are collected by a private company (CINTRI) and are disposed at the city's waste disposal area.

Hazardous wastes such as waste oil, paints, batteries are generated from Sihanoukville Port. Waste oil is sold to private companies for reuse/recycle. All other hazardous wastes are collected/disposed by CINTRI. Since there is no specific waste disposal facility for hazardous wastes, they are disposed at the same waste disposal area as non-hazardous wastes.

5.6.6 Noise

Currently, noise data around the port area is limited to the noise survey conducted as part of the EIA of Sihanoukville Port Urgent Development for Oil Supply Base and Multipurpose Terminal (2008). The survey was conducted at one site along the Hun Sen beach road (approximately 200 m from the main gate of SEZ) for a 24-hour period from September 7th, 2007 (6 AM Friday).

According to the survey results, hourly-averaged noise levels were within national noise standards for commercial and services areas during all hours. Although maximum noise levels occasionally exceeded the national standard, in general, noise around the port area can be considered to be under acceptable levels. However, noise levels along Phe Street (Road no.4) may become unacceptably high during hours of heavy cargo-truck movement.

5.6.7 Sediment quality

Sediments around the port area were slightly contaminated by heavy metals and dioxins. However, due to the lack of any obvious pollution sources in the vicinity, the sources of these contaminants are uncertain and will require further investigation.

5.7. Baseline Information on Social Environment

5.7.1 Involuntary resettlement

(1) Outline of public awareness survey

1) General

As compared to the other two deprived areas in Preah Sihanouk City in the original survey in 2009, results show that the living standard of residents in the port area is slightly higher than the other two areas. Residents around Sihanoukvilit Port have greater advantage in finding jobs and setting up micro-small businesses. However, infrastructure and living environment are not enough to improve the living standard. It seems that more than 70% of respondents are willing to continue living in the settlement areas; however at the same time, they hope for better quality of life and future. Some of the residents in SEZ area of Village No.3 started living in the port area to get compensation from the

project. Some of them have their own house in the city or other place in the province, and they only set-up a cabin in the port area to get compensation in the future. On the other hand, for residents along the coast line in the port area of Village No.1, fishing is a crucial livelihood issue.

2) Public services in the village

Health: The public health services were accessible in the village. The villagers could access the public referral hospital in Preah Sihanouk.

Education: With support and monitoring from NGOs and schools, children continue to go to school and only few of them have dropped out from schools in the last year (reported from the head of the village).

Infrastructure: There was no sewerage system in both ports and inland area of the village. The wastewater was going to the sea, which could possibly affect the local environment. Public electricity was accessible. Water supply was run by a private company and the price was slightly higher than local public water supply.

3) Advantage/disadvantage

Advantage: There were a lot of micro/small businesses and job opportunities in the village. There were jobs and business opportunities related to fishery, support in fishing industry, and food processing, transport service, cargo servicing and business marketing.

Disadvantage: There is no existing sewerage system in the village. This is similar to the squatter's area in Cambodia, where the poor living environment has posed health problems.

4) Future plan

People would not want to leave the area because they thought that there was no place better for them to stay. They realize that it is a squatter area; however, they alleged that if the government needed the areas for development, they should be provided with an appropriate location for them to live where they could get similar economic and social benefits.

5.7.2 Local economy

According to the 2008 census, the total population in Preah Sihanouk Province was 221,396, of which 40.6% live in urban areas. Out of the total population in the province, 32.4% (71,699) was under 15 years of age. The working age population (ages between 15 and 64) was 145,862 or 65.9% of the population.

The economically active segment of the population (employed population + unemployed population) was 102,290, which accounted for 46.2% of the total population in the province. Population density of the province was 230 persons/km^2, which was considerably higher than the national average of 56 persons/km^2.

Population of Preah Sihanouk Province has increased by 2.6% per annum between 1998 and 2008. During the same period, the number of labor force in the Study area has increased more rapidly from 56,346 in 1998 to 101,739 in 2008, with an annual average increase rate of 6.1%.

5.7.3 Fishery

The fishing industry contributes very significantly to domestic food security. The industry provides over 81.5% of protein amount being consumed in the national diet and also forming a critical source of essential vitamins and micro-nutrients. Statistics on fish catch indicate an upward trend in the coastal area, due to the rapid growth of consumer demand as well as the improvement of transportation infrastructures. It is assumed that 73% and more of fishery boats with 33 horse power (HP) and more in Preah Sihanouk Province is in the Port area. .JICA is currently engaged in the construction of Marine Aquaculture Development Center (MADeC) in Preah Sihanouk, which will be used to conduct training in aquaculture and infectious disease control techniques.

5.7.4 Infectious disease

HIV has been a main issue in terms of infectious diseases in Preah Sihanouk Province. The total number of people who carries HIV is 1,717 in 2011 according to the Department of Health (DH). Two villages in the port area and inland area have been among the crucial areas in the province in terms of people infected with HIV/AIDS. Among 107 families, at least one family member has HIV/AIDS, which is 2.91% of the total number of families in the area. This ratio is higher than in urban areas and other districts in the province. NGOs and other organizations are conducting programs to support and educate the residents regarding HIV/AIDS disease.

5.7.5 Traffic accidents

In and around the Sihanoukville Port area, there is no statistic record of traffic accidents. However, from interviews conducted, there are certain traffic accident-prone spots.

5.7.6 Tourism and natural environment

Preah Sihanouk City is recently developing rapidly in terms of manufacturing and tourism. Both local and international tourists have been increasing and the growth after six years has approximately rose by 3.5 times. However, the number of facilities such as hotels and restaurants were insufficient to meet the number of tourists.

5.8. Alternative Plans for Port Development

5.8.1 Layout plan of basic port facilities

(1) Facility Requirement

In cargo volumes at Sihanoukville Port in 2030 have forecasted in Chapter 3 as listed in Table 5.8-1.

Table 5.8-1 In required wharf cargo handling equipment and handling capacity

Type of Cargo/Commodity	Unit	2010	2030	Reference
Container	TEU	222,928	1,190,000	Table 3.2-11
Drybulk				
Wood Chop	ton	71,000	1,921,000	
Whaest		0	255,000	
Steam Coal		12,300	240,000	
Break bulk				Table 3.2-13
Milled Rice		0	933,000	
Cement	ton	46,000	0	
Vehicle		17,000	194,000	
Sugar		0	10,000	
Others		58,000	571,000	

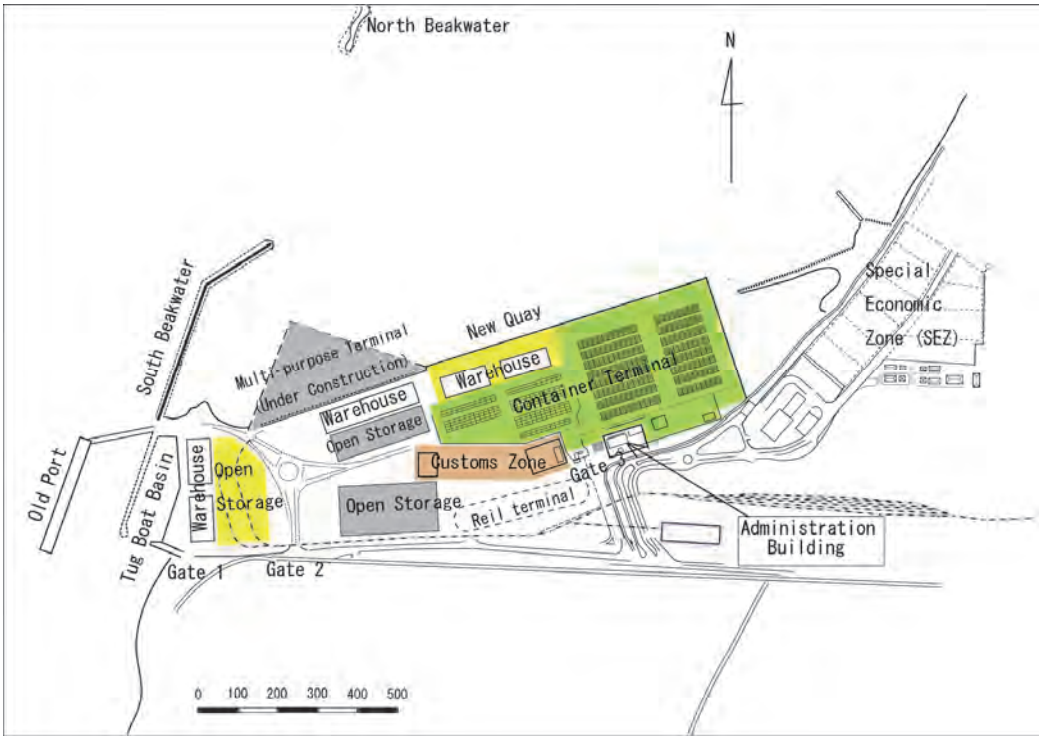
Prepared by Project Team

In addition to the cargoes listed in the Table, it has been estimated that import vehicles brought by RoRo ships will increase to 89,000 units or 194,000 tons and that the number calls of cruise ships will be 31 in 2030.

1) A cargo handling capacity of existing facilities

a) Container Terminal

The existing container terminal has a 400m long quay and a 10ha large container yard having a capacity of 6,050 TEU's. (see Figure 5.8-1). The terminal is equipped with two (2) QGC's, seven (7) RTG's, nine (9) reach stackers and 22 yard chassis. It has been estimated that the current capacity of the container terminal is 450,000 TEU per year, and that with additional equipment the capacity can be enhanced up to 500,000 TEU's.



Prepared by Project Team

Figure 5.8-1 Existing facilities and facilities under construction in Sihanoukville Port

b) Capacity of Dry Bulk and Break Bulk Cargo Terminal

The capacities of New Quay and Multi-purpose Terminal, where dry bulk and break bulk cargoes are handled, are estimated after commodities are allocated to respective terminals, because the cargo handling productivities varies depending on types of cargoes, commodities and ship size. Thus, the capacity of these terminals shall be determined in next section with commodity allocation on the basis of the results of the cargo forecast. It should be noted that New Quay is also used for container ships during peak days, and the total days available for the general cargo ships carrying cargo handling of dry bulk are limited. The available days of New Quay, which is 350 m long and can accommodates two (2) ships at a time, for dry bulk and break bulk handling is estimated to be 416 Berth-days（= 8 Birth-day × 52week）in a year.

2) Cargo allocation ton to respective terminals and assessment of facility requirement

Container Terminal

The capacity of the existing container terminal can be expanded up to 492,000 TEU's by installing additional units of container handling equipment. The container traffic at Sihanoukville Port is forecasted to grow up to 1,190,000 TEU in 2030, and the capacity will be short by 698,000 TEU's. Thus, two more container berths will be required, for the maximum capacity of a berth is estimated at 500,000* TEU's par year provided that the terminal has large enough container yard.

* The capacity of a container berth has been estimated under the following conditions:

Average container volume handled per ship call	:	1,000 TEU
Units of quay gantry crane	:	3 units
Capacity of a QGC	:	25Box/hour
Ratio of the numbers of 20' and 40' containers	:	1:1.5(TEU/Box=1.6)
Workable days in a year	:	360 days 日
Working hours per day	:	21 hours
Operating rate of QGC in a year	:	50%
Storage capacity of the container yard	:	12,000TEU

New Quay

With the assumption that the quay is used for the handling of coal and break bulk cargoes as currently observed and vehicles that are imported by RoRo ships. New Quay can handle a total of 594,000 tons (see Table 5.8-2).

Table 5.8-2 Commodities handled at New Quay

Commodity	Cargo ton	t/hr/gang	Gang	Work hr/day	t/day/ship	Berth-day	Berth Occupancy
Steam Coal	240,000	70	2	12.5	1,750	137.1	417 Berth-day
Other cargo	160,000	48	2	12.5	1,200	133.3	is available
RoRo	194,000					43.3	
Total	594,000				Total Berth-day	313.8	75.3%

Prepared by Project Team

The berth occupancy rate shown at the right end column of Table 5.8-2 is 75.3%, which seems to be considerably high. It is possible for the quay, however, to reduce by extending working hours per day beyond 12.5 hours when the quay is congested.

Multi-purpose Terminal

Taking into considerations of the advantage of having a -14m deep berth, Multi-purpose Terminal should be used for large ships carrying wood chip and wheat. In addition, it is assumed that heavy and large size cargoes such as machines and materials of plants are handled at the terminal as well as other dry bulk and break bulk cargoes.

For those dry bulk cargoes that are imported and exported in large volumes, it is assumed that cargo handling equipment having large capacity should be introduced. The total cargo volume handled at Multi-purpose Terminal is estimated at 2,430,000 tons (see Table5.8-3）.

Table 5.8-3 Cargoes handled at Multi-purpose Terminal

Commodity	Cargo Volume	Shipsize	Ship Calls	Handling Productivity	Gang	t/ship/hr	Work hr/day	Berth-day	Berth occupancy
	ton	DWT	Ships	t/hr			hr		
Wood Chip	1,921,000	50,000	38.42	280	4	1,120	20	85.8	Workable
Wheat	255,200	20,000	12.76	112	4	448	12.5	45.6	days
Sugar	10,000	5,000	2.00	48	2	96	12.5	8.3	340
Other	250,000	8,000	31.25	100	2	200	12.5	100.0	Berth-day
Total	2,436,200						Total B-D	239.7	70.5%

Prepared by Project Team

Other cargoes

It is forecasted that, in 2030, 933,000 tons of rice will be exported at Sihanoukville Port in a form of break bulk (see Table 3.2-4 in Chapter 3). The volume of other cargoes handled at the port will reach 571,000 tons. It is assumed that, of 571,000 tons, 180,000 tons should be handled at New Quay while 150,000 tons can be handled at Multi-purpose Terminal. Thus, the port needs additional berths to handle the rest of 150,000 tons of other cargoes. The port also needs additional berth capacity to accommodate cruise ships: the number of calls is forecasted to reach 31 in 2030.

To cope with these requirements, it is estimated that two additional berths should be newly constructed as calculated in Table 5.8-4.

Table 5.8-4 Requirement for additional berths for break bulk cargoes and cruise ship

Commodity	Cargo Volume	Shipsize	Ship Calls	Handling Productivity	Gang	t/ship/hr	Work hr/d	Berth-day	Berth Occupancy	
	ton	DWT	Ships	t/hr			hr		No. of Berths	
Rice	933,000	150,000	6.2	48	3	144	20	324.0		
Other	150,000	7,000	21.4	48	2	96	12.5	125.0	1	2
Cruise Ship								31.0		
							Total	480.0	141%	70.6%

Prepared by Project Team

3) Summary of facility requirement

Summing up above discussion, the allocation of cargoes to the terminals and the requirement of new facilities are listed in Table 5.8-5.

Table 5.8-5 Allocations of cargoes and facility requirement

Commodity	Unit	2030 Forecast	Container Terminal	New Quay	Multi-Purpose	Required Capacity	Required Facilities
Container	TEU	1,190,000	492,400			**697,600**	New Container Terminal (2 Berth)
Vehicle	t	194,000				**194,000**	
Wood Chip	t	1,921,000			1,921,000	0	
Wheat	t	255,200			255,200	0	
Steam Coal	t	240,000		240,000		0	
Sugar	t	10,000			10,000	0	
Milled Rice	t	933,000				**933,000**	New General Cargo berths (2 berths)
Other	t	571,000		130,000	285,500	**155,500**	
Cruise Ship							

Prepared by Project Team

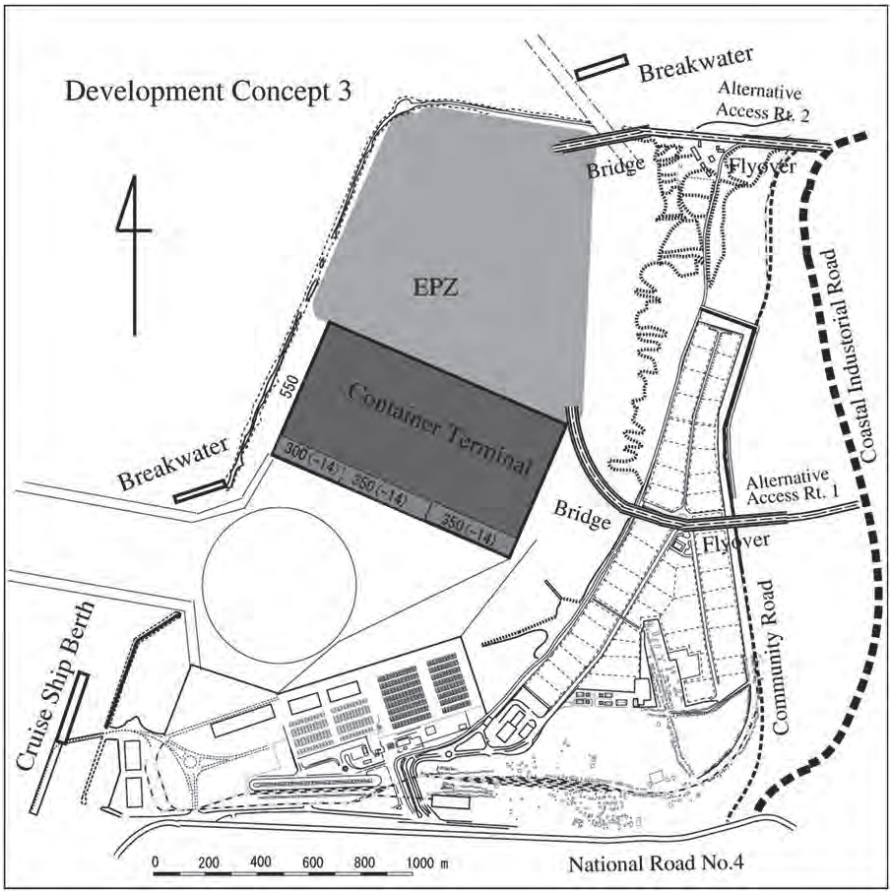
4) Conceptual Development Plan

Of three alternative conceptual plans for the long-term development of the port, the concept exhibited in Figure 5.8-2 that a container terminal together with an area for EPZ should be constructed on the reclaimed island across the basin enclosed by the breakwaters has been chosen as the long-term development concept of the new container terminal for the following reasons:.

- The conceptual plan has such advantage that the dredging volume is smaller than other conceptual plans because the location of the container berths is closer to the entrance and that large space is available behind the container terminal for EPZ.
- The plan proposes to construct a continuous 1,000 m long berth in a straight line, which is short of 50 m to accommodate three design ships, i.e., the maximum size ship. However, since such probability is very low that three maximum size container ships call on the port at the same time, the terminal can practically accommodate three container ships at a time. In addition, a continuous berth allows efficient utilization of QGC by sharing QGC's among the berths.

The development concept also includes the development of the following components:

- A cruise ship and general cargo terminal is constructed outside of South Breakwater.
- An opening is made at the north part of North Breakwater for the passage of fishing boats and small cargo ships calling on the local port. A breakwater is constructed to block waves coming from the north.
- Access road to the new container terminal with options of two routes, i.e., along the North Breakwater (Access Route-1) and through a bridge connecting the island and the coastal road (Access Route-2).



Prepared by Project Team

Figure 5.8-1 Conceptual Plan-3（Expansion toward the west）

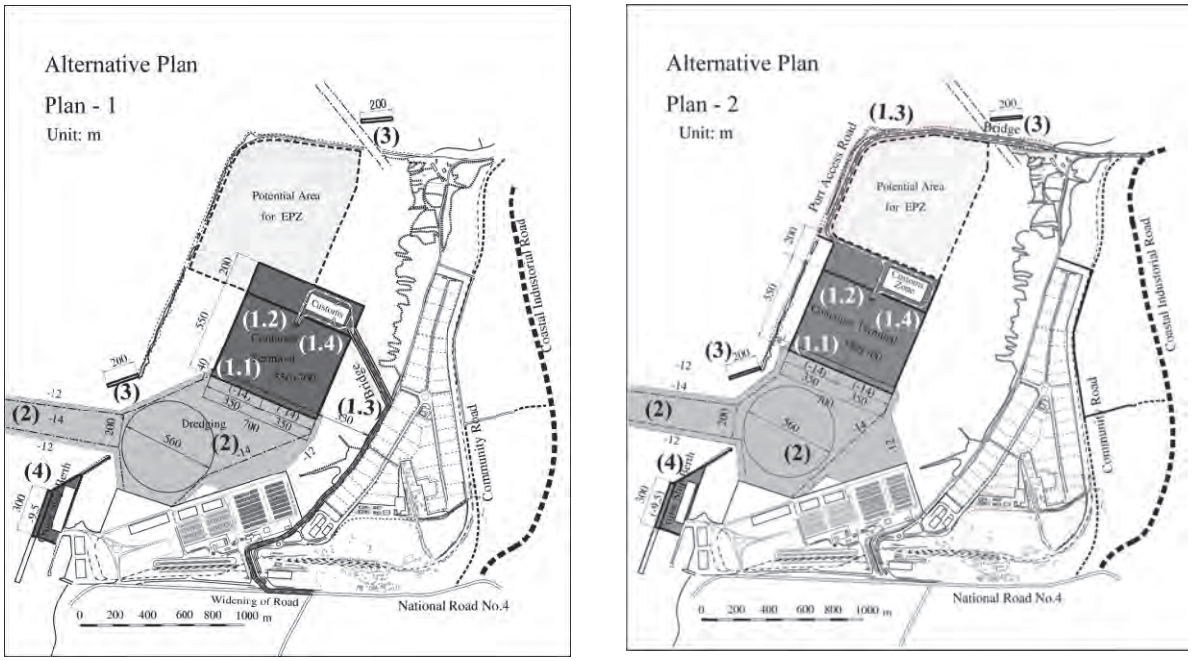
(2) Alternative layout plans of basic port facilities

1) Preparation of alternative facility layout plans

Of the three container berths drawn in Conceptual Plan-3, two berths should be constructed by 2030, and, thus, there are two alternative approaches: to construct two container berths either from land side (Alternative Plan-1) or from sea side (Alternative Plan-2). Figure 5.8-3 shows the facility layout of Alternative Plan -1 and Alternative Plan-2. The numbers with parentheses correspond to the code number of the project components shown in Table 5.8-6 and show the locations where the components shall be constructed or installed .

Since Industrial Road is still at the stage of proposal and it is uncertain when the road will be completed, the Project Team proposes that the port access roads should be connected to National Road via the existing coastal road until Industrial Road is completed.

The difference between the two alternative plans is the location of the container terminal and the routes of the port access road. The configurations of other facilities are the same for the two alternative plans. The project components are summarized in Table 5.8-6.



Prepared by Project Team

Figure 5.8-2 Alternative facility development plans toward 2030 on the basis of Conceptual Plan-3

Table 5.8-6 Project components

1. Container Terminal			
1.1 Container Berths			
Length 350m, Berth Depth -14m, Apron width 35m	Berth		2
Container Yard (700mx515m), Custom, Storage, etc.	ha		48
1.2 Building			
Administration Building, Power station, Maintenance shop, Fuel Station			4,300m^2
Terminal Gate (Export 3 Lanes, Import 2 Lanes)			5 Lanes
1.3 Access Road/Bridge/Fly Over	ls		
Plan 1	Access bridge, widening of coastal road		
Plan 2	Acces bridge, Access road		
1.4 Equipment			
Quay Gantry Crane	Unit	30.5 ton Post Panamax	6
RTG	Unit	35.6 ton, 5 stacks	18
Top Lifter/Reach Stacker	Unit	7.5 ton, Empty Container	9
Tracktor & chassis	Unit	40'	26
Light tower,	Unit		18
Operation System, Security Equipment			
2. Dredging of basin and access channel			
Dredging of Access Channel	1,000m^3		1,700
Dredging of Basin	1,000m^3		2,330
3. Breakwaters			
Main Entrance Breakwater	m		200
North Opening	m	Removal of Stones	100
	m	Breakwater	200
4. Cruise Shop Terminal			
Berth	Berth	400m(L)x30m(W)x-9.5m(D)	2
Recramation	ha		5
Warehouse (Rice)	m^2	50mx150m	7,500

Prepared by Project Team

5.8.2 Calmness of the basin

On the basis of the results of the analysis of the calmness of the basin for the two alternative layout plans, it is recommended that the North Breakwater should be extended and the berth structure of the new container terminal should be wave absorbing type, for the following reasons:

1) The net working rate of the new container berths

The net working rate of the new container berths is higher than 95% without extension of North Breakwater and the wave absorbing berth structure for both Alternative Plan-1 and Plan -2. However, for small size container ships having DWT of about 20,000 tons, there is a probability that container handling operation at the berths may be suspended about 20 days per year. The extension of North Breakwater and the employment of wave absorbing type of berth structure for the new container berths increase net working rate, and the net working days become no less than 350 days.

2) Impact on the existing container berth and New Quay

Due to the reflected waves from the new container berths, the wave height in front of the existing container berths and New Quay become larger when waves come from the west. By The extending North Breakwater and employing wave absorbing type structure for the new container berths, the impact of the reflection can be reduced to the level as low as without project case.

For the waves come from the northwest, the waves propagate to the existing container berths and New Quay without attenuation. This situation will remain the same regardless of the existence of the new container terminal. However, by extending North Breakwater, the calmness at the existing berths is improved.

3) Impact on fish port

When waves come from the west, the wave heights in the water area in front of the fish port adjacent to the existing container terminal tend to increase due to the wave reflection at the new container berths. By extending North Breakwater and by the employment of wave absorbing berth for the new terminal, the calmness scan be reduces as low as present level. The extension of Breakwater reduces the wave height in Area 2 by 10% for the waves coming from the northwest.

4) Impact on north basin

The new container terminal blocks wave propagation toward the north basin and reduces the wave height in Area 3 and 4 by 30%. On the other hand, the opening for the passage of small vessels of the north part of breakwater allows northwest waves to intrude into the north basin and cause disturbance in the basin. By constructing a breakwater to shelter the opening, the calmness in the north basin can be improved to the extent as calm as the present level.

5.8.3 Planning of lands for industrial use

The conceptual development Plan has been prepared to integrate port and EPZ. It proposes the construction of EPZ adjacent to the container terminal for the pursuance of the effectiveness of logistics functions and the promotion of the export processing industries in Sihanoukville port area. However, a careful assessment should be done on the advantage and disadvantage of having the EPZ just next to the port including the comparison of the development costs, demand for EPZ and the type of business suitable for EPZ next to the port. The scale of development of EPZ should be determined on the basis of the result of the assessment.

5.8.4 Planning port access

Both alternative layout plans proposed the construction of port access road up to the existing coastal road, because the industrial road, which is shown in these figures in thick broken line, is just planning stage and it is unknown when the road is operational. Therefore, once the industrial road is completed, the port access road should be directly connected with the industrial road. The intersection of the access road and the existing coastal road should be grade separation to avoid the congestion. For the case of Alternative Layout Plan -1, it is indispensable to construct by-pass access that is directly

connected to the industrial road via flyover across the existing SEZ. It is also recommended that a road behind SEZ, which is called the community, should be improved so that the local traffic currently using the coastal road should be by-passed.

To this end, PAS should take proactive approach for the realization of the industrial road and the community road at the earliest opportunity.

5.8.5 Environmental and social consideration in the process of formulating the alternative development plans

Through the JICA Advisory Committee, a total of eleven environmental impact factors were identified as particularly important for consideration in the process of formulating the alternative development plans. However, since the area available for development was limited, occurrence of certain impacts was unavoidable. Table 5.8-7 shows the environmental and social considerations made for each alternative development plan.

Table 5.8-7 Environmental and social considerations made for each alternative development plan

		Impact factor	Plan 1	Plan 2
Social environment	1	Involuntary resettlement	Facilities are planned to be situated no to cause the result of involuntary resettlement.	Facilities are planned to be situated no to cause the result of involuntary resettlement.
	2	Local economy such as employment and livelihood, etc	New opening for fishery boats going through has been planned at the pier to avoid to put much problems on fishery people's living condition an activities in the pier as possible.	New opening for fishery boats going through has been planned at the pier to avoid much problems on fishery people's living condition an activities in the pier as possible.
	3	Land use and utilization of local resources	Facilities are planned to be situated not to change present land use as much as possible.	Facilities are planned to be situated not to change present land use as much as possible. Regarding to the access road, the detail root selection study has not been done yet, because the route of the new industrial road has not been decided yet. In the next Project the route should be selected based on the study of land use condition around the alternative routes.
	4	Social institutions such as social infrastructure and local decision - making institutions	Facilities are planned to be situated not to divide community as much as possible.	Same as Plan 1

	5	Existing social infrastructures and services	Present coastal road will be used as an access road for the future plan. Because the first plan to construct a new route exclusively for vehicles and trucks related to the port to separate ordinary vehicles (with a bridge over SEZ) was not feasible in terms of cost.	In the plan new access road will cross the present coastal road. Because the first plan to construct a new route exclusively for vehicles and trucks related to the port to separate ordinary vehicles (with a bridge over the base of the pier) was not feasible in terms of cost.
	6	Misdistribution of benefit and damage	All plan are supposed to be set to avoid any negative effect as much as possible. However, due to limited developable area, adjustment of misdistribution of benefit and damage could not work at some extent.	Same as Plan 1
Natural environment	7	Topography and geographical features	No specific consideration was necessary as all new marine structures will be constructed inside or close to the existing breakwater.	Same as Plan 1
	8	Flora, fauna and biodiversity	No consideration on terrestrial flora/fauna was necessary as the new access road was routed along the existing coastal road.	The entire route of the new access road could not be planned as the route of the connecting new industrial road is unfixed. The precise route of the new access road should be determined in the ensuing F/S stage by taking into account important habitats of terrestrial flora/fauna.
Pollution	9	Air pollution	To avoid exhaust gas impacts from construction and cargo vehicles, the route of the access road was initially routed through a non-residential area by constructing a flyover over the SEZ. However, this option was not financially feasible. Apart from the above option, there was no route that could avoid residential area.	The new access road could not be routed through a non-residential area as the entrance area of the existing breakwater is fully occupied by residential houses.
	10	Water pollution	Due to the general lack of water depth inside the breakwater area, the potential location for the new container berth was limited to the deep water area adjacent to the current breakwater opening. Plan 1 is the case when the new container terminal is built as close to the shore as possible.	Due to the general lack of water depth inside the breakwater area, the potential location for the new container berth was limited to the deep water area adjacent to the current breakwater opening. Plan 2 is the case when the new container terminal is built from the existing breakwater area.

	11	Noise/vibration	To avoid noise/vibration impacts from construction and cargo vehicles, the route of the access road was initially routed through a non-residential area by constructing a flyover over the SEZ. However, this option was not financially feasible. Apart from the above option, there was no route that could avoid residential area.	The new access road could not be routed through a non-residential area as the entrance area of the existing breakwater is fully occupied by residential houses.

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5.8.6 Plans for utilization and management of basin which will become calm by the port development

1) Utilization of calm water area

Prior to the implementation of the project, the jurisdiction PAS including the proposed project site, the existing port area, basin, navigation channel, access road, SEZ and EPZ, etc. should be delineated, and the port area should be clearly separated from the areas for other activities. To this end, it is most desirable to elaborate the best plan through the discussions among all those concerned with the utilization of the water area enclosed breakwaters. There is enough time for the discussion before the project starts. It is the responsibility of PAS to proactively promote forums among relevant agencies and to draft consensus zoning plan of the water area enclosed by breakwaters.

2) Management plan

In accordance with the consensus zoning plan, PAS should administrate the utilization and development of the port area and the port related area, while the provincial government should administrate other activities outside of the port and the port related areas, Other use with specific purpose should be administrated by respective agencies responsible for the activities.

However, maintenance of those facilities for navigation and calmness of the basin such as navigation channel, basin, and breakwater should be done by PAS.

5.8.7 Preliminary design

The preliminary design was conducted based on design criteria in consideration of natural conditions at the site. Planned port facilities were the channel and basin, breakwaters, new container terminal, cruise ship terminal, access roads, bridges, and cargo handling equipment and port equipment. Outline of the design was summarized as follows:

Channel and basin: Considering the dredging plan of the multi-purpose terminal development project, the dimensions of channel were -14 m in depth and 150 m in width in the case of one-way traffic, and -14 m in depth and 300 m in width in the case of two-way traffic. The basin required a certain tuning radius for the target vessel; thus a depth of -14 m and a 300 m turning radius were secured in this study.

Breakwaters: Securing access for the current small boat traffic, about a 200 m length removal of the existing north breakwater was resultantly required. Because of a reduction in wave calmness inside the harbor due to the new container terminal arrangement and direct waves entering the opened existing breakwater, two new breakwaters of 200 m in length were required for mitigation of the anticipated situations.

New container terminal: At the locations of the new container terminal, a compressive sandy-silt soft layer exists around 5 m from the seabed. Based on a settlement study previously carried out, the final planned elevation of the reclamation area was determined as +3.0, the same as the quay

elevation. The seawall of the reclamation area applied slope protection formed of core stone, and under-layer and armor rocks.

Based on subsoil investigation results around the locations of the new container terminal, gravity type or deck on pile type was preliminarily suitable among other structural types of quay. So this study initially selected caisson type, block type, block type with wave dissipating block (WDB) and deck on pile type (raked pile) and carried out a comparative study for the structural types based on seven elements such as structural adaptability, suitability to subsoil conditions, wave calmness, durability, workability on construction, environmental impact and cost. Although the deck on pile type requires a further detailed subsoil investigation and must consider and analyze fluctuant market price of steel materials, it has been concluded so far that the deck on pile type is the most recommendable. The dimensions of the quay were determined as 700 m (350m x 2 berths) length, +3.0 m quay elevation and 35 m width of the superstructure considering the leg span of quayside gantry cranes. Pavement of the container yard was selected as interlocking paving block type, rubber mounted gantry crane (RTG) and container-stacking foundations were considered as pre-stressing concrete.

Mechanical facilities provided a water supply system for berthing vessels, fire hydrants, relevant terminal buildings, customs building, etc., and a sewerage system for the said buildings. Electrical facilities provided necessary power supplies to quayside gantry cranes, relevant terminal buildings, etc., generators, substations, yard lighting system, etc., assuming a stable external power source will be available by the target year 2030 of the master plan.

Cruise ship terminal: Based on soil investigation conducted in this Project, the seabed at the location of cruise ship terminal is already a rock layer unlike the one at the locations of the new container terminal, and no settlement is therefore considered at this location. The final planned elevation of the reclamation area of the terminal was determined as +5.2 matching the elevation of the existing old jetty. As the new container terminal, the seawall of the reclamation area applied slope protection of about 400 m long, which was formed of core stone, and under-layer and armor rocks. Based on subsoil investigation results at the location of the terminal, gravity type was the only applicable type among the structural types of quay. So this study initially selected caisson type, block type, cellular block type and carried out a comparative study for the structural types based on six elements such as structural adaptability, suitability to subsoil conditions, durability, workability on construction, environmental impact and cost. Generally, it has been concluded so far that the block type is most recommendable. The dimensions of the quay were determined as 300 m length, +5.2 m quay elevation, the same as that for reclamation.

Access roads and bridges: Access roads were required as an import access connection between the new container terminal and main truck roads, e.g. new coastal road conceptually planned. Required travelling lanes of relevant roads were 2-lane in two directions. However, the access portion near the new container terminal provided 4-lane two-way roads in consideration of future possible expansion and a queuing area for container tractor-trailers. Also, the roads provided two paved shoulders at the edge of both travelling lanes and two sidewalks at both ends of the paved shoulders. 4 m wide center medians were required on the 4-lane two-way roads for U-turns of 40’ tractor-trailers. Bridges were **required for road connection toward the new container terminal as passing access on the open seawater** surface. Required travelling lanes were the same as the access roads (2-lane two directions). Basic air clearance of the bridges was set at 10 m for securing navigational access of existing boats and vessels.

Cargo handling equipment and port equipment: Based on preliminary terminal planning of the new container terminal, cargo handling equipment basically required for each terminal was 2 units-quayside gantry crane (Post-Panamax, 14 rows), 9 units- rubber tired mounted yard gantry crane (6 rows, 4+1), 3 units- top lifter (10 tons), and 16 units-tractor & chassis (40’ container). In addition, port equipment required for each new container terminal was 1- CCTV system and 1- container yard management system. Likewise in the cruise ship terminal, 1- CCTV system was accordingly required.

5.8.8 Construction planning and implementation schedule

Construction planning: Each alternative plan was established considering the basic development policy of port planning, container cargo demand forecast, natural conditions such as wave calmness inside the harbor, socioeconomic conditions, environmental impacts, etc. Based on the preliminary design, work quantities were estimated for each alternative plan. The alternative plan 2 has more work volumes than plan 1 because of the addition of elevating the existing breakwater, access roads along the existing breakwater, an access bridge at the opened existing breakwater and a flyover. Scoped construction work items consisted of the approach channel and basin, breakwaters, new container terminal, cruise ship terminal, access roads and bridges, and are able to be carried out independently.

Implementation schedule: The project of the master plan 2030 requires efficient investment with consideration of cargo demand and its actual growth. Therefore, the project was divided into the following three packages :

Package 1 composed of implementation of external power cable installation and connection and procurement of cargo handling equipment was divided into two phases for maximizing the cargo handling capacity of the existing container terminal without drastic improvement of the infrastructures, matching the container cargo growth forecast (phase 1: 3.5 years from 2013 to 2016, and phase 2: 3.5 years from 2017 to 2020).

Package 2 composed of the channel and basin dredging works, breakwaters, new container terminal, access roads and bridges constructions, and procurement of cargo handling equipment and port equipment was also divided into two phases for accommodating increased container cargo volumes (phase 1: 5 years from 2018 to 2022, and phase 2: 5 years from 2024 to 2028).

Package 3 composed of the cruise ship terminal construction was planned to implement the works for 4 years from 2022 to 2025.

5.8.9 Capital cost estimation

Construction and procurement situations: Cement is mainly imported from Thailand, Vietnam, China, etc. but is now possibly supplied in Cambodia. The quality has improved to levels the same as imported cement and there is no significant difference in price these days. At present, there are three concrete batching plants around Sihanoukville Port within a 15 km area. It is possible to procure common reinforced concrete products such as U-ditch, concrete pipes, lighting poles, etc. in Cambodia. However, pre-stressing concrete product supply must rely on imports from Thailand, Vietnam and China. All the steel materials are imported mainly from Thailand, Vietnam, China and the like. Suitable reclamation materials are commonly obtained at some quarry sites located within 20 km of Sihanoukville Port. Laterite materials are available for reclamation of temporary work and backfilling at land civil works. Certain sand rocks can be supplied around Sihanoukville Port. Other rocks such as granite can be produced at some quarry sites located within 180 km of the Port.

Generally, construction equipment such as under 100-ton capacity cranes, excavators, bulldozers, pay-loaders, rollers, etc., which are commonly used for common land civil and architectural construction, are available to be leased from Cambodian construction companies. Full-scaled and special construction equipment for land and marine construction works can be only provided from other countries through foreign construction companies.

There are around 20 local construction companies that have less than 100 employees. Depending on the scale of work, they are generally able to carry out common civil and architectural works independently. However, it is difficult to implement large-scaled and special land and/or marine construction works by themselves because the works require advanced technologies and general management capability. Therefore the works depend on foreign construction companies at present.

Prerequisite of cost estimation: In cost estimation, local and foreign currency portions were applied respectively as US dollar and Japanese yen. Because the US dollar is commonly used at current markets all over Cambodia, the US dollar was used as the local currency portion. The basic

exchange rate in the cost estimation was applied as 1USD = 80.25 Japanese Yen which was sourced from the closing price of the Tokyo foreign exchange market on 22 February 2012.

Local currency component includes the cost of construction materials locally supplied, local currency portion of depreciation and maintenance costs of construction equipment, expenses of salary and others related for local employees, import duties of construction materials and inland taxes in Cambodia. Foreign currency component includes costs of construction materials imported from foreign countries, foreign currency portion of depreciation and maintenance costs of construction equipment, foreign currency portion of costs of construction materials locally supplied, and expenses of salary and others related to foreign employees.

Results of cost estimation: As a result, the total cost of Package 1 was 34.4 million US dollars. In case of 150 m channel width, the cost of the Alternative Plan 1 of Package 2 was 376 million US dollars and that of Alternative Plan 2 of Package 2 was 421 million US dollars. In case of 300 m channel width, all the costs trends were same as the case of 150 m channel width with 15 million US dollars added to each amount for those cases of 150 m channel width due to increasing dredging volumes. Furthermore, the total cost of Package 3 was estimated as 44 million US dollars.

5.8.10 Economic analysis and financial analysis

(1) Economic analysis

The economic benefit of the development of a new container terminal is to offset future port congestion at Sihanoukville Port, to reduce maritime transportation cost by deploying larger container ships, to promote the establishment of manufacturers in the hinterland of the port, and to generate other indirect positive effects on the regional economy. Resulting from the new terminal development, port related service companies will increase sales and employ more staff and workers. The economic benefit of the new terminal is assessed as follows:

a) To offset future port congestion at Sihanoukville Port;
b) To reduce maritime transportation cost by deploying larger ships;
c) To cancel possible increase of transportation cost which may happen by using other transportation routes and means;
d) To increase passenger ship calls;
e) To increase employment at the port and encourage the establishment of manufacturers in the hinterland,
f) To promote port related business activities; and
g) To increase job opportunities of service industries around the port

Assuming the abovementioned benefits from a) to d) will be realized in the case of the "with case" of the project, EIRR is estimated as shown in Table 5.8-8. Economic analysis shows that Alternatives No.1 and No.2 are worth implementing from the viewpoint of economic cost and benefit, and Alternative No.1 has higher EIRR than Alternative No.2.

Table 5.8-8 EIRR

Case	Base Case	Cost 10% up	Benefit 10% down	Cost 10% up and Benefit 10% down
Alt. No.1	9.19%	7.07%	6.84%	4.61%
Alt. No.2	7.43%	5.42%	5.20%	3.04%

Prepared by Project Team

(2) Financial analysis

Financial feasibility of the project is preliminarily assessed by analyzing the Financial Internal Rate of Return, Cash Flow, Working Ratio, Operating Ratio, Rate of Return on Net Fixed Assets, and Debt Service Coverage Ratio. Table 5.8-9 shows FIRR of base case and cases of sensitivity analysis.

Table 5.8-9 FIRR

Case	Base Case	Cost 10% up	Revenue 10% down	Cost 10% up and Revenue 10% down
Alt. No.1	4.27%	2.93%	1.53%	0.25%
Alt. No.2	2.97%	1.79%	0.36%	-0.81%
Alt. No.1'	7.42%	5.47%	4.26%	2.75%

Prepared by Project Team

Alternative No.1' is a case in which development of the container berth and superstructure of package 2 will be carried out by a private investor and the new container terminal will be operated by a private terminal operator. In the case of Alternative No.1', PAS will invest in land reclamation and channel dredging, and receive concession fees from the private terminal operator.

In order to realize package 2 and 3, it is essential to use low interest long-term loans, specifically loans less than 2.0% interest in the case of Alternative No.1 and 3.0% in the case of Alternative No.1'.

In the case of Alternative No.1, the second half of package 2 and/or package 3 must be postponed or suspended if cost increases by 10% or revenue decreases by 10% or if both take place simultaneously. In the case of Alternative No.1', the project will be feasible even if cost increases by 10% and revenue decreases by 10% due to the use of low interest long-term loans.

5.8.11 Scheme for new investment and operation

In order to reduce PAS's investment, it will be an effective and adequate means to invite a private investor for the development and operation of the container terminal.

Possible options for the development of the new container terminal are as follows:

a) PAS develops all infrastructure and superstructure, and operates container terminal;

b) PAS develops all infrastructure and large scale superstructure, and a private terminal operator prepares cargo handling equipment and operates the container terminal;

c) PAS carries out land reclamation and dredging work, and a private investor/terminal operator constructs the container wharf and yard, installs quay gantry cranes and RTGs, prepares cargo handling equipment, and operates the container terminal;

d) PAS and private investor(s) establish a joint stock company and the company implements container terminal development including land reclamation, and operates the terminal. PAS carries out channel dredging and access road development as a landlord port authority.

The decision on the method for development of the new container terminal shall be made from the viewpoint of commercialization (privatization) of PAS, future increases of container cargo throughput, and government policy for port administration and management.

5.9. Comparison of environmental impacts of a alternative plans

IEE was conducted for both Plan 1 and 2.

In regards to social environment, both plans are likely to have major adverse impacts such as: hindrance to fishing/aquaculture activities and degradation of living conditions through pollution. However, for the fishermen based inside the breakwater, Plan 2 may have less impact as the usable water area inside the breakwater is wider than Plan 1 (e.g. less risk of maritime accidents). Overall, Plan 2 was rated lower than Plan 1, primarily due to the requirement of resettlement at the access road.

In regards to natural environment, impacts from dredging/dumping activities are the main concern for both plans. However, the degree of impacts of both plans were similar, as there are no major differences in the dredging/dumping location between both plans. Hence both plans had the same score.

In regards to pollution, impacts from air pollution, water pollution and noise/vibration are the

main concern for both plans. Impacts from air pollution and noise/vibration are likely to be significant for both plans as the new access road will be located adjacent to residential area. Water quality inside the breakwater is likely to deteriorate for both plans, as the new container terminal will increase semi-enclosed water areas. Overall, both plans were considered to have similar level of impacts, hence the rating was same for both plans.

In conclusion, there was no significant difference in natural environment and pollution impacts. However, overall Plan 1 was assessed to have slightly less impacts than Plan 1, due to the requirement of resettlement.

5.10. Priority projects

The study team recommends that the facility development plan up to 2030 should be implemented in three packages.

Package 1: Capacity expansion of the existing container terminal

Installation of additional equipment and related works

Package 2: Construction of the new container terminal

Package 3: Construction of cruise ship and general cargo terminal

The volume of container cargoes is estimated to exceed the capacity of the existing container terminal, and Package 1 is the first priority project. The alternative plans that have been discussed in the previous sections consist of Package 2 and Package 3. Since Package 3 is the same for Alternative Plan -1 and Alternative Plan-2. The difference between the two alternative plans is the contents of Package 2. Therefore, the evaluation of the alternative plans shall focus on the Package 2 proposed in the two alternative plans with the assumption that Package 1 will have implemented before the implementation of Package 2.

5.10.1 Evaluation of alternative plans for port development

(1) Methodology

The evaluation of the alternative plans shall be cone from the following three viewpoints:

Viewpoint 1: Those quantitative criteria that should be fulfilled by the alternative plans such as the cargo handling capacity, economic and financial feasibilities and scale of the project.

Viewpoint 2: Qualitative evaluation regarding the construction and the operation of the facilities such as technical difficulties in the construction, difficulties in the maintenance, the convenience of the utilization, expandability of the facilities, the flexibility to the change of the plan due to the change of traffic demand and construction schedule. The evaluation from Viewpoint 2 shall be done comparatively between the alternative plans.

Viewpoint 3: The magnitude of the impact on the national and provincial economy and on the social and natural environment. The evaluation from this viewpoint shall be done either quantitatively or qualitatively. If the quantitative criteria are prescribed in laws and regulations such as environmental law, evaluation should be done quantitatively. For the items having no quantitative criteria, qualitative evaluation shall be done comparatively.

(2) Evaluation items

Evaluation items of each viewpoint are chosen as follows:

Evaluation items from Viewpoint 1

1) Cargo handling capacity
2) Scale of the project
3) Cost vs. Benefit (economic and financial feasibility of the plans)

Evaluation items from Viewpoint 2

1) Technical difficulties in the construction
2) Effectiveness of operation and Convenience of the users
3) Difficulties in the operation of the facilities (maintenance, navigation safety, port security and safety, etc.)
4) Flexibility to the change of the plan in accordance with the change of traffic demand
   a) Expandability for the future
   b) Availability of water and land spaces for the development of EPZ

Evaluation items from Viewpoint 3

1) Impact on natural environment
2) Pollution
3) Impact on social environment

(3) Evaluation and Weight of evaluation for each item

The evaluation results are listed in Table 5.10-1. The evaluation has been made in 5 grades. The weights of each evaluation item are equal because these items are so chosen that the weights are the same.

1) Evaluation criteria for Viewpoint 1

5: The requirement is fulfilled without any additional refinement.
4: The requirement is fulfilled with miner refinement work.
3: The requirement is barely fulfilled. Considerable refinement work is required
2: The requirement is not fulfilled. The implementation of the project involves some problems
1: The requirement is not fulfilled. The project is not implementable.

2) Evaluation criteria for Viewpoint 2

5: The requirement is fulfilled completely.
4: The requirement is fulfilled, but some minor inconvenience may occur.
3: The requirement is barely fulfilled. Considerable inconvenience or shortcoming may occur.
2: The requirement is not fulfilled. Some problems are foreseen to occur.
1: The requirement is not fulfilled. Serious problems are expected to occur.

3) Evaluation criteria for Viewpoint 3

5: No impacts expected
4: Possible moderate impact
3: The risk of major impact is moderate
2 : The risk of major impact is high
1: Major impact is certain and not environmentally feasible

Table 5.10-1 Evaluation Table for Alternative Plans

Evaluation item	Zero option		Alternative Plan-1		Alternative Plan-2	
	Description	Evaluation	Description	Evaluation	Description	Evaluation
Viewpoint 1 Evaluation items (Requirements that Projects should				**15**		**13**
1) Capacituy of cargo handling Capacity of contianer terminal Capacity of othr terminals	＜Cargo volume in 2030 500,000TEU 3,030,000 t	**1**	＞Cargo volume in 2030 1,500,000TEU 4,120,000 t	5	＞Cargo volume in 2030 1,500,000TEU 4,120,000 t	5
2) Scale of the project	US $ 34 million		US $ 544 million	4	US $625 milliin	3
3) Economic feasibility (EIRR)			8.78%	3	7.24%	3
4) Financial feasibility (FIRR)			3.59%	3	2.45%	2
Viewpoint 2 Evaluation Items				**18**		**16**
1) Technical difficulties and construction period			Intermediate Period 3 years	4	Intermediate Period 3 years	4
2) Efficiency of operation and Convenience for users			Productivities are improved for the large size container ships No congestion at contiane rterminal Existing SEZ is close to the port	5	Productivities are improved for the large size container ships No congestion at contiane rterminal Distance between Existing SEZ and new	4
3) Operational difficulties of the facil;ities (including maintenance, Navigation safety and security)			Cruise ships are docked safely With large powered tug boat, the safe Separation between cammercial vessels and fishing boats	5	Cruise ships are docked safely With large powered tug boat, the safe Separation between cammercial vessels and fishing boats	5
4) Flexibility to the change of traffic demend a) Flexibility for further expansion or b) Difficulties in the development of EPZ (Unit cost of the land area, availability of water area to recraim			Two-phase implementation is possible for slow growth of cargo volume Site of an additional berh is reserved construction cost is relatively small, for the reclamation area is shallow The water area for EPZ is relatively small	4	Due to the large cost for the access, slower growth of cargo volume may influence the finansial soundness Site of an additional berh is reserved Construction cost of reclamation is large, for the water depth is large The water area for EPZ is relatively large	3
Viewpoint 3 Evaluation items				**7**		**7**
1) Impact on natural environment			Dredging and dumping activities may have adverse impacts on marine life, especially on marine life that are vulnerable to high turbidity such as corals.	3	Dredging and dumping activities may have adverse impacts on marine life, especially on marine life that are vulnerable to high turbidity such as corals.	3
2) Polution			Air pollution and noise/vibration impacts may become of major concern as the access road/bridge will be located adjacent to the fishing community area. Water pollution is also a major concern due to the narrowing of the water area in front of the fishing community.	2	Air pollution and noise/vibration impacts may become of major concern as the access road/bridge will be located adjacent to the fishing community area. Water pollution is also a major concern due to the narrowing of the water area in front of the fishing community.	2
3) Impact on social environment			The fishermen based inside the breakwater may be adversely affected such as from decrease of available water usage area and water pollution.	2	For similar reasons as Plan 1, the fishermen based inside the breakwater may be adversely affected. The main difference from Plan 1 is the requirement of resettlement. However, oveall the level of impact is similar to Plan 1.	2
Overall Evaluation		**Fail**		**40**		**36**

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4) Multi-criteria evaluation

a) Evaluation from Viewpoint 1

Zero option, which is intended to expand the capacity of the existing container terminal up to 490,000 TEU's by installing additional equipment, is abandoned because the option cannot fulfill the capacity requirement. Both Alternative Plan-1 and Alternative Plan 2 have enough capacity to cope with the cargo volume forecasted in 2030. The scale of the project is few times larger than the projects that PAS has implemented in the past. The construction cost of Alternative Plan-2 is 20% higher than Alternative Plan-1. and, thus, both EIRR and FIRR are lower than Alternative

Plan-1. Thus Alternative Plan -1 is advantageous than Alternative Plan -2

b) Evaluation from Viewpoint 2

Utilization of the facilities and the expandability of facilities of Alternative Plan-1 are more advantageous than those of Alternative Plan-2: the interconnection between the new container terminal and the existing SEZ, and the flexibility for the change of the implementation to adjust slower increase of cargo traffic demand.

c) Evaluation from Viewpoint 3

There was no significant difference in natural environment and pollution impacts. However, in terms of social impacts, Plan 1 was in overall assessed to have slightly less impacts than Plan 2, due to the requirement of resettlement.

d) Conclusions of multi-criteria evaluation

As the result of the evaluation from three viewpoints, the Project Team recommends Alternative Plan -1 for the facility development toward 2030. The reasons are:

- Plan-1 is financially advantageous as the development plan up to 2030 (Viewpoint 1)

- the convenience of connection of container terminal and SEZ and the flexibility in the project implementation (Viewpoint 2), and

- the social and environmental impact (Viewpoint 3) of the both plans are assessed almost b the same.

5) Recommendation

a) For the purpose of the realization of the project, PAS should take proactive approach to the following items:

- To prepare zoning plan of the water and land area in the neighborhood of Sihanoukville Port including the project site of the new container terminal and EPZ and to build consensus on the zoning plan among relevant agencies and the local public.
- To make the jurisdiction of PAS universally known by relevant agencies and local people.
- To build consensus on the separation of the navigational water area for the ships calling on Sihanoukville Port and for other ships.
- To realize the industrial road
- To update the cargo demand forecast about every three years and to re-evaluate the performance of the port for the purpose of reviewing the scale and schedule of the project.

b) Water quality control in the water area enclosed breakwaters

Along the coast line of the basin enclosed by the breakwaters, many houses exist. Without proper sewage treatment system, sewage from these houses directly flows into the basin. This situation is the main cause of water pollution of the basin. It is urgently needed for the national and the provincial governments to take actions to settle this situation regardless of the project.

The new container terminal, which is a large island, constructed in the middle of the basin blocks the water circulation in the basin and may make the water pollution in the basin worse.

The port access roads proposed in the alternative plans will be constructed across or near the residential areas. This may impact the livelihood of the local residents: risks of air pollution, noise, vibration and traffic accidents.

This is particularly true for the residents in the fishing village adjacent to the existing

container terminal. Even though the project does not require any relocation of the residents in the village, the impact of the project is assessed to be considerable. In order to avoid the risks, it is desirable for both the port and all those who reside and run business in the fishing village to start discussion to prepare a draft plan of the relocation of the whole village to a more suitable place. It is vital for the national and provincial governments to play a responsible role in the process of the preparation of the relocation plan. PAS should proactively approach the relevant agencies and the local public and play as the coordinator among those who are concerned with and influenced by the expansion of Sihanoukville Port.

5.10.2 Draft TOR of EIA

The IEE identified the various adverse impacts that may occur through this project. Table 5.10-2 shows the impact factors that require detailed assessment in the EIA. Tables 5.10-3 and 5.10-4 show the recommended baseline survey.

Table 5.10-2 Impact factors that require detailed assessment in the EIA

Natural environment	Pollution	Social environment
Flora, fauna and biodiversity	Air pollution, water pollution, waste, noise/vibration, offensive odor, bottom sediment	"Local economy such as employment and livelihood, etc", "Land use and utilization of local resources", "Existing social infrastructures and services", "Misdistribution of benefit and damage", "Water usage or water rights and communal rights", "Sanitation", "Hazards (risk), infectious diseases such as HIV/AIDS Accidents", "Landscape"

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Table 5.10-3 Recommended baseline survey method for natural environment

	Survey method/item	Survey area	Survey period/frequency
Coral reef	Line-transect method (main coral species, coral coverage, bleaching rate, main fish/invertebrate species, presence of threatened species)	Coral reefs within the potential turbidity dispersion range, including the coastal area of Sihanoukville	Once (preferably in dry season)
Fish	Interview survey of fishermen, experts, fishery department (main species and commercial species, main spawning and nursery grounds, presence of threatened species)	Within the potential turbidity dispersion range	Once
Benthos	Trawling survey (abundance and wet-weight of collected species)	• Dredging area • Around the dumping area • Within the potential turbidity dispersion range	Once each in rainy and dry seasons

Marine mammal	Literature survey, interview survey of fishermen, experts, fishery department and boat survey (habitat range, species)	Within the potential turbidity dispersion range	Once each in rainy and dry seasons for boat survey
Water quality	Water temp., pH, salinity, DO, turbidity, SS, COD, T-N, T-P, Oil content, Coliform bacteria	• Inside/outside of breakwater • Upper/middle/bottom layers • Adjacent waters of natural (e.g. coral reef) and social (e.g. tourist beach) environment sensitive to turbidity	Once each in rainy and dry seasons (ebb and flood tide)
Sediment quality	Specific gravity, water content, particle size distribution, Total organic carbon, Total nitrogen, Total phosphorus, Total sulfur, heavy metals (Ar, Cd, Pb, Hg, Cu, Ni, Zn), PCBs, dioxins, TBT	• Dredging area (surface and -0.5 m from surface) • Inside/outside of breakwater (surface only)	Once
Air quality	CO, NO_2, SO_2, TSP, PM_{10}	Sensitive areas (e.g residential area) that may be affected from the traffic of new access road and port activities	Once each in rainy and dry seasons (continuously for 1 week)
Noise/vibration	Equivalent sound level (L_{Aeq}), max/min sound level	Sensitive areas (e.g residential area) that may be affected from the traffic of new access road and port activities	Once (continuously for 1 week)
Current	Current speed/direction	• Inside/outside of breakwater and approach channel (i.e. points required for conducting SS and water quality simulation) • All layers	Once each in rainy and dry seasons (at least continuously for 15 days)

Prepared by Project Team

Table 5.10-4 Recommended baseline survey method for social environment

Survey	Items	Survey period
Public awareness survey, population census,	-Target: all residents in the Project area -Purpose: to grasp statistically and spatially number and situation of people who would need the livelihood reestablishment assistance	After draft of specification and placement of facilities have been set generally in the fist half of the Project.
Inventory of estate and land, housing and livelihood	-Target: at least 20% of residents -Purpose: to grasp family structure, estate and livelihood, vulnerable groups and other fundamental data	
Regional economic activity	-Target: non-residents who have economic activity in the Project area. -Purpose: to grasp actual situation and regional relationship of economic activity.	
Status survey of fishery	-Target: residents and non-residents related to fishing industry in the Project area.	

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Stakeholder meeting

The stakeholder meeting should be held by inviting the fishermen and aquaculture operators that are based inside the breakwater. Topics such as the status of pollution, pollution mitigation measures and water use should be discussed in the meeting.

5.11. Port environment improvement plan

Table 5.11-1 summarizes the recommended environmental improvement measures of Sihanoukville Port.

Table 5.11-1 Port environment improvement plan

	Issue	Improvement measure	Implementation period	Cost
Air pollution	Dust dispersion from coal handling	Installation of mobile wind fence (e.g. 5 m x 30 m)	Before operation of multi-purpose terminal	US$10,000 (to be purchased by the terminal operator)
	Dust dispersion from coal stockyard	Repair of existing wind fence	As soon as possible	Negligible
Water pollution	Bilge water discharge from tug boat	• Prevention of discharge of untreated bilge water • Land disposal of bilge water through private contractor	As soon as possible	Collection and disposal fee
	Effluent discharge from SEZ	• Allocation of environmental management department and staff • Establishment of technical assistance system	As soon as possible	New recruit: US$6,000/year/staff
	Sewage discharge from fishing	Request local government to	As soon as possible	—

	community	consider and implement measures against sewage water		
Oil spill response	Difficulty in handling of existing oil skimmer	Purchase of light and compact oil skimmer	As soon as possible	To be updated in F/R
Organizational structure	No environmental management department and staff	• Allocation of environmental management department and staff • Establishment of technical assistance system	As soon as possible	New recruit: US$6,000/year/staff

Prepared by Project Team

5.12. Intensification of port security

5.12.1 Present situation and issues of port security

PAS applied the ISPS code and security has been carried out by the security office headed by PFSO (Port Facility Security Officer) according to the PFSP (Port Facility Security Plan). The Security Office which has a total staff of 77 performs the gate control tasks at four gates and the security tasks for the restricted area at all times.

The most serious finding in the assessment of the port security is that gate control is not implemented. When JICA cooperated with the PAS to install a security system, ID cards were issued and gate control was performed. However, the gate control was stopped when the system failed because some cables were broken, and since then, it has not been recovered. The surveillance through CCTV cameras cannot be implemented for some part of the port because of the broken cables. Therefore, the system should be restored and the gate control resumed as soon as possible. Further, it is desirable to construct a gate control system interlocking with container operations.

5.13. Improvement of maintenance and repair of port facility and cargo handling equipment

5.13.1 Transfer of technologies for improvement of maintenance and repair

(1) Port facilities

Port facilities are generally required to maintain the necessary functions in service for a long time. Not only the initial structural designs are important to meet this requirement, but also appropriate maintenance and repair of those facilities in service are essential for satisfying it.

In order to maintain/improve the level of service at the port facilities, it is necessary to reduce the cost for the maintenance and repair. However, with a limited budget, it would be impossible to meet the expected demand for repairs in the future to ensure that the port facilities continue to function as required with the current system that takes care of machinery/equipment failures on an occurrence basis. It is important to implement more efficient maintenance and repair on a preventive basis according to rational strategies to minimize the life-cycle costs of machinery/equipment. The PAS effectively uses the guidelines for strategic maintenance and repair of port facilities, created by the Port Technology Group of ASEAN-JAPAN Transport Partnership.

(2) Cargo handling machines/equipment

For the cargo handling machines/equipment in port facilities, a maintenance and repair system that reacts to failures on an occurrence basis will eventually lead to obstructions to the operation of the port terminal. Thus, a strategic maintenance and repair operation is desirable. It is extremely important

to be aware of the condition of cargo handling machines/equipment through routine checks and regular checks, create a checking schedule for them, and check and repair preventively to use them in a good condition. In other words, machines/equipment should be properly maintained to minimize their failures.

For the maintenance and repair of the cargo handling machines/equipment of the PAS, the basic checks are currently carried out. Further, a plan for implementation of checking should be created, and strategic maintenance and repairs should be implemented according to the plan.

5.14. Master Planning

5.14.1 Public and private partnership in implementing new development

PAS may change from a service port to landlord port and invite private investors and/or terminal operators for the development and operation of port facilities. The private sector may be involved only in the operation of terminal facilities in the case of operation concession, but heavily involved in development and operation of port/terminal facilities in the case of development concession.

Four patterns for the development and operation of the new container terminal are proposed:

a) PAS develops and operates the new container terminal;

b) PPP by public initiative (PAS develops all infrastructure and large scale superstructure);

c) PPP in middle case (PAS develops infrastructure and a private investor/terminal operator constructs container wharf and operates the new container terminal);

d) PPP by private initiative (PAS and private investor(s) establish a joint stock company and the company implements container terminal development and operation).

For the development of the new container terminal, it may be appropriate to introduce PPP in the middle case. If private companies are not so interested in participation, PPP by public initiative shall be taken into consideration. If many private companies are interested in participation, PPP by private initiative shall be pursued.

In order to make Sihanoukville Port more competitive, it may be imperative to involve private terminal operators/shipping companies in the development and operation of the new container terminal. Study shall be made on the transformation of PAS from a state owned enterprise to a commercial entity and on the involvement of a private terminal operator.

6. CONCLUSION AND RECOMMENDATIONS

Recommendations which need to be implemented by PAS and relevant organizations for the realization of the strengthening competitiveness and the future development of Sihanoukville Port are given in Table 6-1.

Table 6-1 Recommendations

Items		Recommendation on actions		
1	Strengthening of organization	1	Reorganization	・To reorganize such functions as cargo handling operations, business development planning and marketing, and strengthen IT system of PAS. ・To streamline PAS's personnel.
		2	Personnel management	・To perform appropriate personnel management by the enforcement of strict working discipline, personnel assignment under the-right-person-in-the-right-place policy and the fair personnel assignment through punishment-and-awards under the strong leadership of the management.
		3	Human resource development	・To train personnel to enhance capacities of the information collection and analysis, business planning, marketing and operations.
2	Enhancement of cargo handling operation efficiency	4	Early gate entry practice	・To simplify procedures before gate entry which is requested by such organizations as customs, Camcontrol, police and PAS. To allow gate entry only by checking seals on containers. ・To process necessary documents after gate entry. ・To set the cut-off time and provide incentives for early gate entry of trucks and to levy fines on trucks which arrive late. ・To prepare parking places for waiting trucks.
		5	Enhancement of handling productivity in the container yard	・To separate clearly the container yard from other port area by fencing and control the gate entry traffic and container yard traffic appropriately. ・To enhance container handling operation productivity in the yard by the normal use of quay gantry cranes (QGCs) and rubber mounted transfer cranes (RTGs) and strengthening of equipment maintenance. ・To conduct cargo handling operations completely by PAS's personnel.

		6	Process of import container receiving	・To control the yard traffic by making use of the provision of parking space in the port for trucks which wait for receiving import containers and scanning. ・To request relevant organizations to conduct sampling scanning and conduct import document processing rapidly.
		7	Development and use of port access	・To streamline road traffic by the provision of roadside expansion on the port access. ・To monitor and provide guidance on the railway transport service for the enhancement of the service quality.
3	Enhancement of customers satisfaction	8	Reduction and simplification of port charges	・To strengthen competitiveness by the reduction of port charges and increase convenience to port uses by the introduction of a unit rate system. ・And to eliminate informal charge collections. ・To enhance the container handling productivity by accelerating the use of QGCs under the unit rate system.
		9	Strengthening of shipping routes	・To enhance service quality in such ways as accelerating ocean freight reduction by making use of the reduction of the port charges, the provision of deep quaywalls and channels and increasing of the number of shipping routes and service frequency by shipping lines.
4	Reinforcement of facilities and equipment and their proper maintenance	10	Strengthening of the provision of QGC and RTG	・To install additional RTGs and QGCs for the enhancement of container handling capacity taking into account of the trend of container transport demand and the effect of the operation of a new container terminal at Phnom Penh Port.
		11	Maintenance of QGCs and RTGs	・To enhance container handling capacity by improving maintenance capability which will lead to a reduction in equipment malfunction.
5	Marketing	12	Demand generation	・To increase cargo demand such as containers, rice, wood chip and coal by providing good services and marketing and accelerate realization of economies of scale.
		13	Port promotion	・To increase the number of shipping routes and cargo demand by performing port promotion activities by increasing service quality and promotion capability together with the effective use of public relations and mass media and the dispatch of port promotion missions.
6	Safety and environment	14	Securing of port traffic safety	・To secure the safety of road traffic by strict terminal access control with the complete separation of container yard from other port area by fencing and the preparation of

				parking space and roadside widening of the port access. ・To restrict use of general purpose trucks for container transport.
		15	Securing of the safety of entering/leaving ships	・To secure the navigation safety of ships entering/exiting the port by the provision of navigational aids such as leading lights and buoys and the strengthening and proper maintenance of the fleet of port tug boats.
		16	Environmental improvement	・To request that relevant organizations install sewage systems in the habitat area near the port in order to prevent water contamination in the port water area. ・To provide appropriate measures for environmental improvement in the port at the time of the implementation of the future port development plan.
7	Strengthening of financial soundness	17	Reduction of the operation cost	・To reduce port operation cost by the streamlining of personnel, the reduction of personnel expenses, power supply cost by utilizing outer power supply and fuel for cargo handling equipment and the efficient port operations.
		18	Increase of profit	・To increase profit by increasing revenue with the enhancement of cargo handling productivity and the strengthening of port promotion activities and the reduction of port operation cost.
		19	Effective use of the assets	・To use PAS's land from a long term perspective together with monitoring of the land use situation and revising of land use contracts if necessary. And to enhance operation rate of equipment and convert existing port facilities to the facilities to be used for a new demand. ・To improve or entrust the operation of the Phnom Penh IDC to private companies.
		20	Fund raising	・To increase PAS's stock value by the rationalization of the business management, the disclosure of information and the securing of transparency in the business management in order to secure stable fund raising from the private sector. ・To secure low interest ODA loans and revise the surplus interest rates on loans by the government in order to improve financial soundness of PAS.
		21	Risk management	・To reduce risks of investment and exchange rates by enhancing risk management capacity of PAS.
8	Promotion of industrial	22	Port SEZ	・To contribute to the economic development of Cambodia through attractions of industries

	development			to the Port SEZ, expansion of the size of the Port SEZ, reduction of operation cost, increased convenience and the reduction of transport cost of the Port SEZ.
9	Formulation and implementation of the future port development plan	23	Management of the port premises	・To prevent expansion of the illegal occupation area by setting the port area and proper management of the area through consultation with the current illegal settlers.
		24	Social and environmental considerations	・To obtain the consent of the stakeholders in the formulation and implementation of the future port development plan. ・And to implement necessary measures for environmental preservation in the port area and request relevant organizations to implement necessary measures for the environmental preservation needed beyond the port area at the time of or before the implementation of the future port development.
		25	Port master plan	・To review the demand forecast prepared for the formulation of the port master plan properly and revise the implementation schedule and the master plan if necessary.

Prepared by Project Team

Figure 6-1 shows a road map which indicates the action flow of the important recommendation items in Table 6-1 for the strengthening competitiveness of Sihanoukville Port.

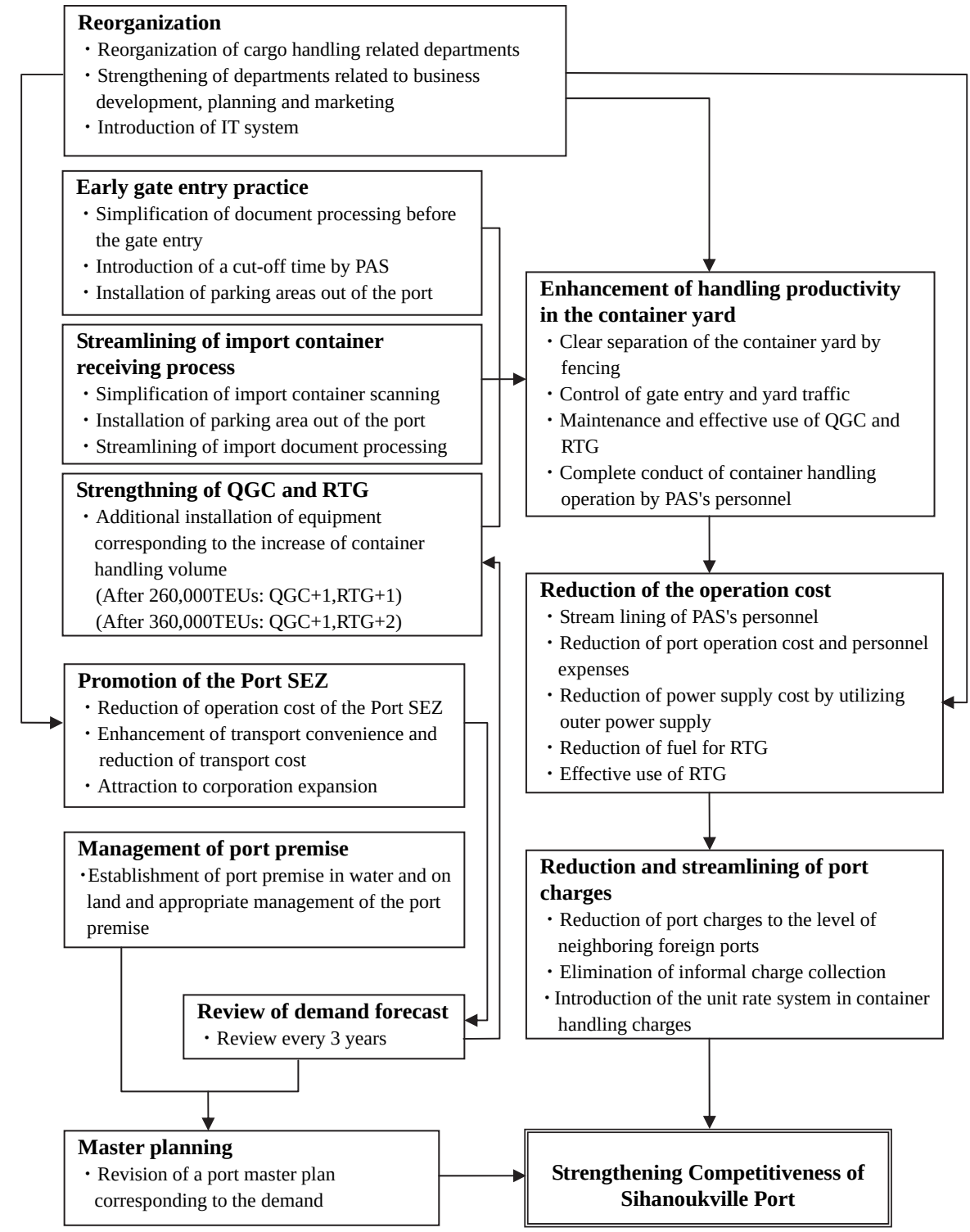

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Figure 6-1 Road map of Important Recommendation