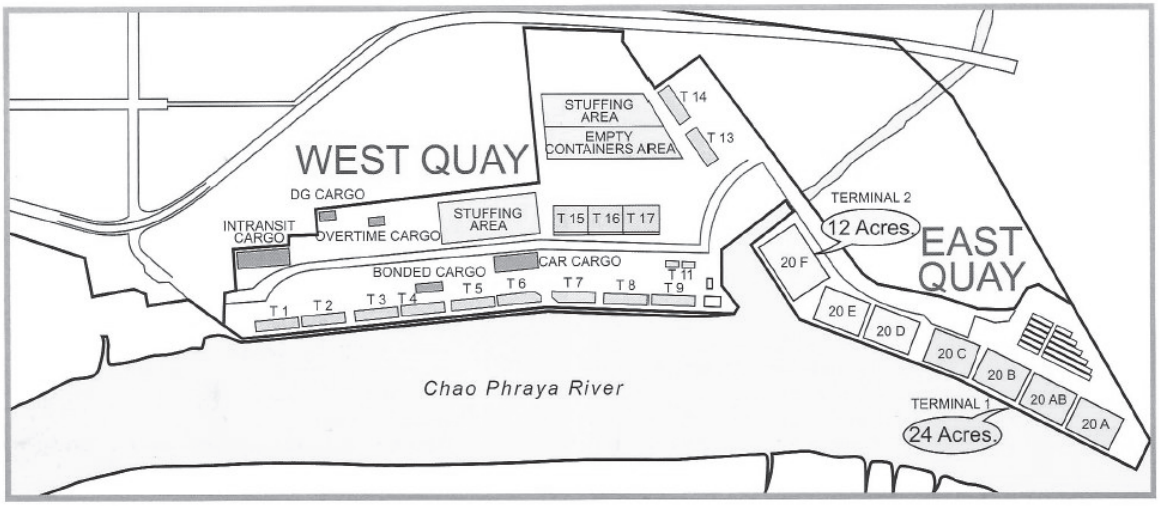


Source: BSAA

Figure 2.5-26 Layout of PAT Terminal in Bangkok Port

b) Private terminals

Besides the port terminals managed and operated by PAT, there are four private terminals along Chao Phraya River, i.e. BMTP Terminal, BDS Terminal, Thai Prosperity Terminal (TPT) and Unithai Container Terminal. Major facilities in the private terminals are summarized in Table 2.5-10.

Table 2.5-10 Major facilities in private terminals in Bangkok Port

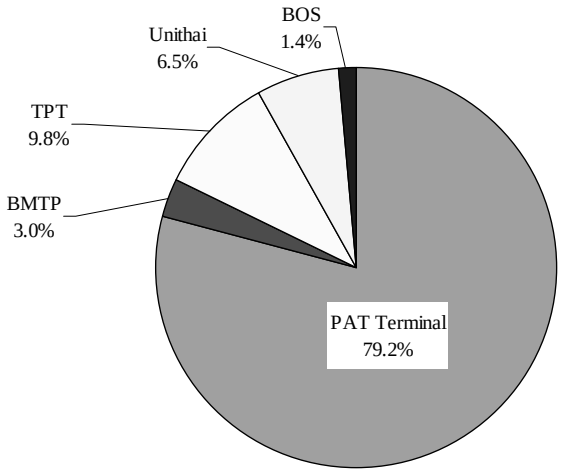
Berth	Length (m)	Depth (m)	Shore Cranes	Container Yard Capacity
BMTP 1C	315	8.5	3 mobile cranes (lift max 100 tons)	2,500 TEUs
BDS No.7	150	8.5	42 tons mobile crane 17 tons mobile crane	2,200 TEUs
TPT	275	8.5	2 x 100 tons mobile crane (To be increased for the extended berth)	9,600 TEUs
UTCT 2F	202	8.5	3 x 36 tons gantry crane	3,600 TEUs

Source: BSAA, TPT (Reorganized by the Project Team)

4) Cargo throughput

As shown in Figure 2.5-27, 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 as shown in Table 2.5-11. Since the area of PAT terminal has been fully developed, PAT doesn't have a plan to increase its terminal's capacity.

Thus, even after the development of Laem Chabang Port, Bangkok Port handles a considerable amount of containers, and the handling volume has been increasing, though the increase rate is rather moderate due to the limited handling capacity.



Source: BSAA (Reorganized by the Project Team)

Figure 2.5-27 Container handling share in Bangkok Port

Table 2.5-11 Time series of container throughput of Bangkok Port

(TEU)

		2005	2006	2007	2008	2009
PAT Terminal	Inbound	662,800	747,900	783,442	719,751	679,740
	Outbound	697,935	789,707	792,122	655,417	655,063
	Total	1,360,735	1,537,607	1,575,564	1,375,168	1,334,803
Private Terminals						
BMTP	Inbound	24,669	32,377	29,293	45,717	30,927
	Outbound	5,848	6,273	7,365	31,233	19,619
	Total	30,517	38,650	36,658	76,950	50,546
TPT	Inbound	83,303	83,534	86,557	118,266	103,138
	Outbound	38,302	35,527	40,208	59,217	62,765
	Total	121,605	119,061	126,765	177,483	165,903
Unithai	Inbound	31,106	35,087	37,196	62,241	55,177
	Outbound	28,658	30,763	30,765	64,365	54,511
	Total	59,764	65,850	67,961	126,606	109,688
BOS	Inbound	14,424	15,558	17,786	14,404	11,545
	Outbound	11,257	8,025	6,912	6,316	12,142
	Total	25,681	23,583	24,698	20,720	23,687
Total of Private Terminals	Inbound	153,502	166,556	170,832	240,628	200,787
	Outbound	84,065	80,588	85,250	161,131	149,037
	Total	237,567	247,144	256,082	401,759	349,824
Total of Bangkok Port	Inbound	816,302	914,456	954,274	960,379	880,527
	Outbound	782,000	870,295	877,372	816,548	804,100
	Total	1,598,302	1,784,751	1,831,646	1,776,927	1,684,627

Source: BSAA (Reorganized by the Project Team)

5) Development plans

PAT is implementing the following project in order to protect their terminals against flood of Chao Phraya River:

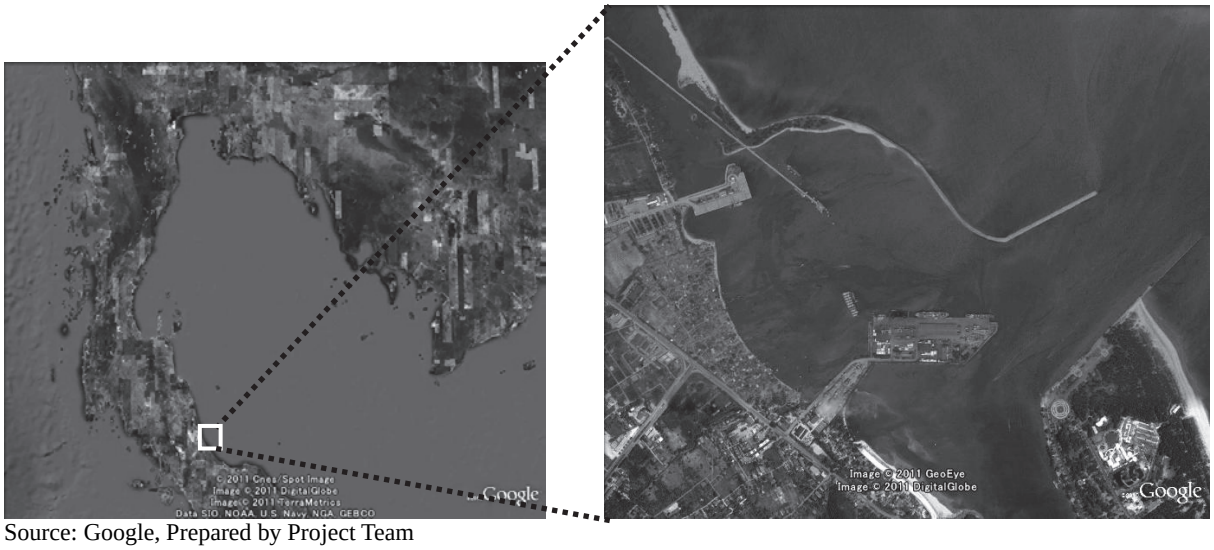
- To build a concrete flood wall of 15 cm thickness having + 2.65 m above mean sea level along the river side.
- To build the asphalt slope at +2.4 m height from mean sea level as the 2nd embankment. Also to build a double-layer brick wall at +2.65 m. above mean sea level in order to slow down water flow to OB Building and asphalt slope at 15 cm height at front of Fire Dept. in order to change waterways.

PAT also plans to redevelop their land located around PAT terminal which is mainly used by

logistics industry at present, and to construct an international business center. PAT is waiting for the approval of the development plan by the Government.

(5) Songkhla Port

Songkhla Port is located in Songkhla Province in southern Thailand, facing the Gulf of Thailand; it lies 950 km from Bangkok and 70 km from the Malaysian border.

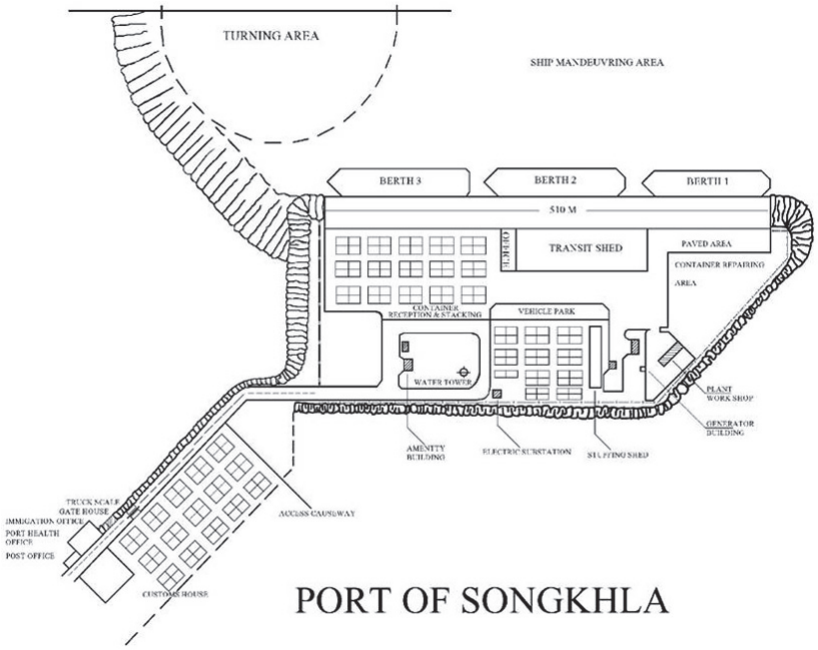


Source: Google, Prepared by Project Team

Figure 2.5-28 Location of Songkhla Port

The port consists of a container/conventional terminal (CTIC terminal) operated by Chao Phaya Terminal International Co., Ltd.; a private operator, and oil terminals operated by Petroleum Authority of Thailand (PTT). The port was constructed in 1986 with ADB loan. CTIC has been the concessionaire of the container/conventional terminal since 1988.

The port is administrated by the Marine Department as a part of the Ministry of Transport. Figure 2.5-29 and Table 2.5-12 show the facilities of CTIC terminal.



Source: Chaophaya Terminal International CO.,LTD.

Figure 2.5-29 Layout of the CTIC terminal

Table 2.5-12 Facilities of CTIC terminal

Berths		
Ship Berths		3
Total Berth Length	(m.)	510
Design Depth	(m.)	9.0
Maximum Vessel LOA	(m.)	173
Area & Capacity		
Total Area	(ha)	10
Container Yard:	(sq.m.)	50,000
Transit Shed:	(sq.m.)	6,726
Break Bulk Cargo Working	(sq.m.)	9,300
Container Capacity	(TEU/year)	160,000
Conventional Capacity	(Tons/year	600,000
Reefer Points		236
Equipments		
Quay mobile cranes (16 tons)		2
Forklifts (3 - 3.5 tons)		12
Forklifts (16 tons)		8
Forklifts (40 tons)		6
Tow Tractors (40 tons)		15
Semi-Trailers (40 tons)		12
Weigh Bridge (80 Tons)		2

Source: Chaophaya Terminal International CO.,LTD.

The major export cargoes are rubber, frozen sea foods, canned foods and furniture. The major import cargoes are frozen tuna and machineries. Table 2.5-13 shows the handling volume in the recent years.

Table 2.5-13 Handling volume of Songkhla Port

			2007	2008	2009	2010
Conventional ('000 tons)	Import		269	227	206	239
	Export		422	406	428	50
	Sub Total		691	633	634	289
Container ('000 tons)	Import		205	216	230	244
	Export		934	967	958	874
	Sub Total		1,139	1,183	1,188	1,118
Total ('000 tons)	Import		474	443	436	483
	Export		1,357	1,373	1,386	924
	Total		1,830	1,816	1,822	1,407
Container ('000TEUs)	Import	Laden	16	16	16	17
		Empty	53	54	53	45
		Sub Total	70	70	68	62
	Export	Laden	66	68	69	64
		Empty	3	2	1	2
		Sub Total	69	70	70	65
	Total	Laden	82	84	84	81
		Empty	56	56	54	47
		Total	139	140	138	128

Source: Chao Phraya Terminal International Co.,Ltd.

An expansion plan seems to have been examined which includes construction of 4th and 5th container berths, although it has not been disclosed by Marine Department nor has it been implemented.

(6) Kuantan Port

1) General

Kuantan Port is a commercial port located 25 km from Kuantan town, the capital of Pahang State facing to the South China Sea. Kuantan Port is the main gateway for trading with the Asia Pacific region and the East Coast Economic Region, Peninsular Malaysia.

2) Port management and operation

The management of Kuantan Port was privatized in 1998. Kuantan Port Consortium Sdn Bhd (KPC), a wholly owned subsidiary company of Road Builder Holdings Berhad, is the concessionaire holder and port operator for Kuantan Port. The consortium provides cargo handling service as well as maritime service.

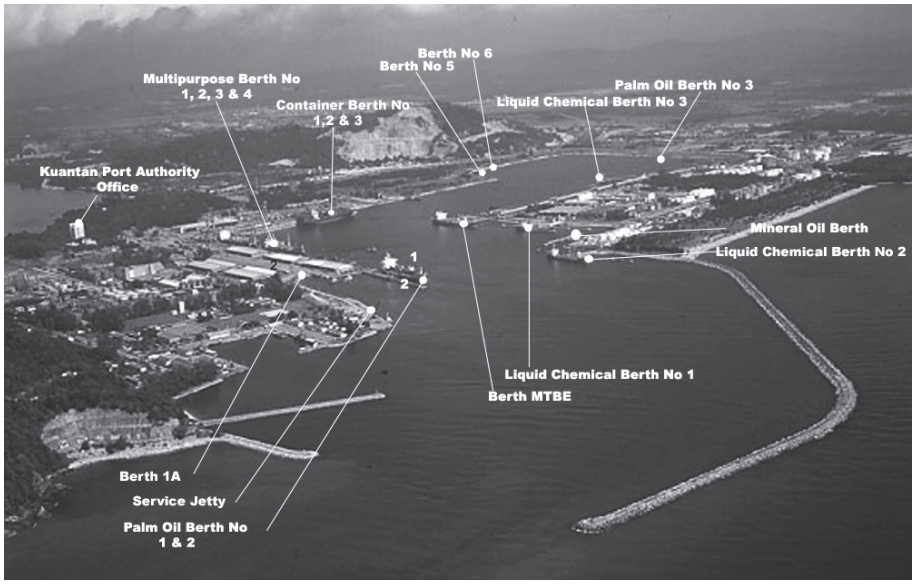
3) Facilities and equipment

Major facilities in the port are summarized in Table 2.5-14, and their layout is shown in Figure 2.5-30. The container terminal is equipped with quay gantry cranes and RTGs.

Table 2.5-14 Major facilities in Kuantan Port

	Number	Length (m)	Draft (m)
Liquid Bulk Berth			
Palm Oil Berth	3	630	8 - 11.2
Mineral Oil Berth	1	150	8.0
Liquid Chemical Berth	3	720	11.2
Multipurpose Berth	8	1,073	8 - 11.2
Container Berth	3	600	11.2

Source: Kuantan Port Consortium (Reorganized by the Project Team)



Source: Kuantan Port Consortium

Figure 2.5-30 Layout of facilities in Kuantan Port

4) Cargo traffic and vessel call

The time series of total cargo handling volume, container handling volume and number of vessels call are listed in Table 2.5-15. Comparing with the total cargo volume, the container handling volume is rather small.

Table 2.5-15 Cargo handling volume and vessels call of Kuantan Port

Year	Total Cargo Handling Volume (1,000 FT)	Container Handling Volume (TEUs)	Vessels Call
1998	5,500	50,989	1,410
1999	5,510	56,056	1,516
2000	6,027	62,783	1,677
2001	7,532	76,339	1,855
2002	8,999	91,524	2,067
2003	9,804	108,108	2,280
2004	9,699	122,745	2,382
2005	9,411	119,167	2,195
2006	10,673	124,834	2,324
2007	10,065	127,600	2,375
2008	9,402	127,061	2,315
2009	10,273	132,250	2,447
2010	12,079	142,080	2,405

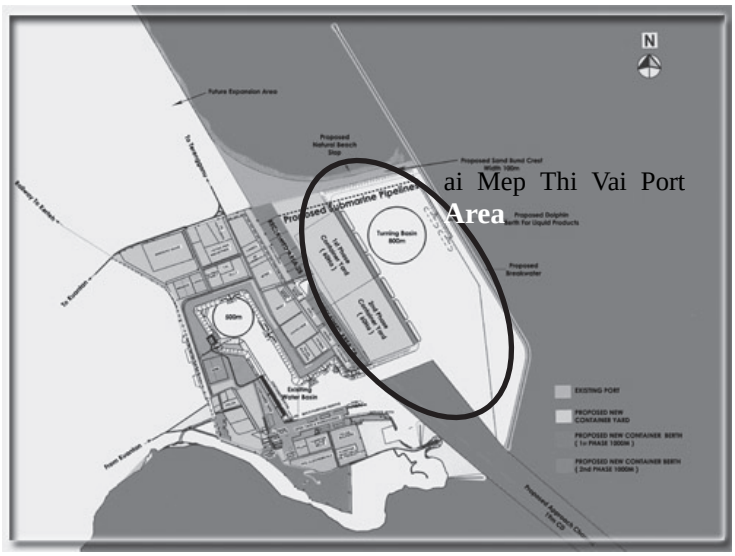
Source: Kuantan Port Consortium (Reorganized by the Project Team)

5) Development plans

Kuantan Port Consortium plans to develop the port as shown in Figure 2.5-31. The first phase development includes the construction of 1,000 m long container berth which will be able to accommodate post panamax container vessels. Additional 1,000 m long container berth construction is planned in the second phase development. Major components of the development plan are listed below:

- Increasing the depth at Kuantan Port from 12.2 meters to 18.0 meters
- Increasing the maximum draught of vessel from 11.2 meters to 16.0 meters
- Increasing the turning basin from 500 meters to 800 meters
- Increasing the cargo handling facilities

- Increasing the ship handling facilities



Source: Kuantan Port Consortium

Figure 2.5-31 Development plan of in Kuantan Port

2.6. Present Status and Future Trends of Maritime Network

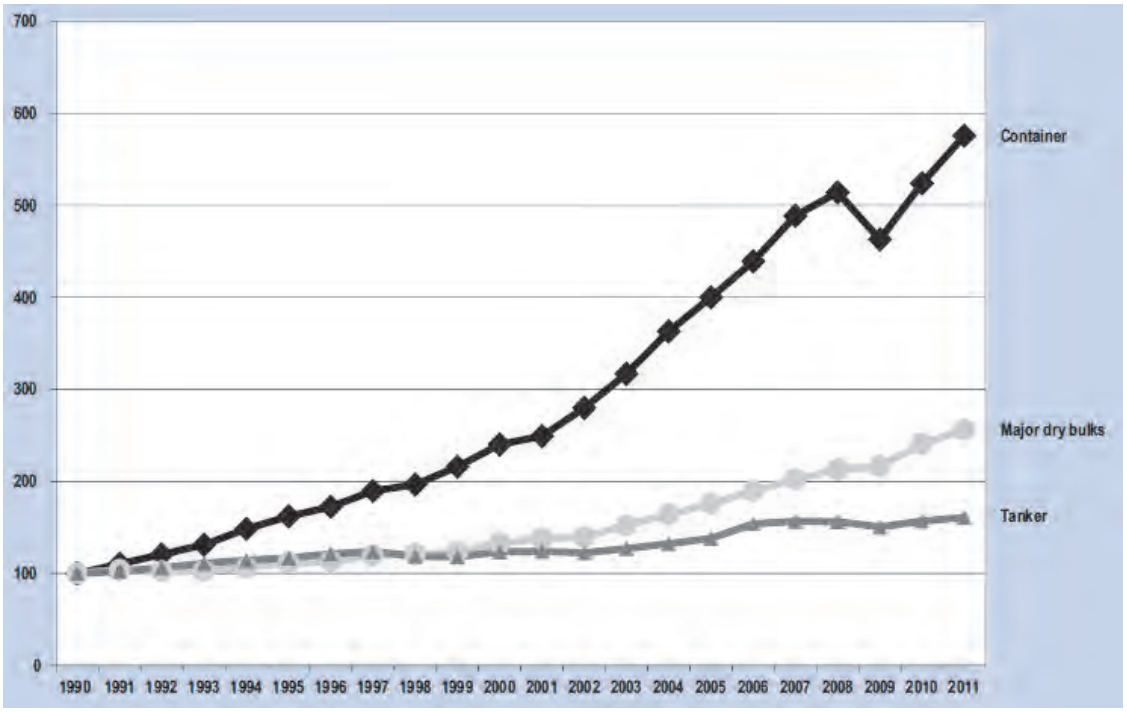
2.6.1 Container network

(1) Global trends

1) Slow recovery of cargo movements

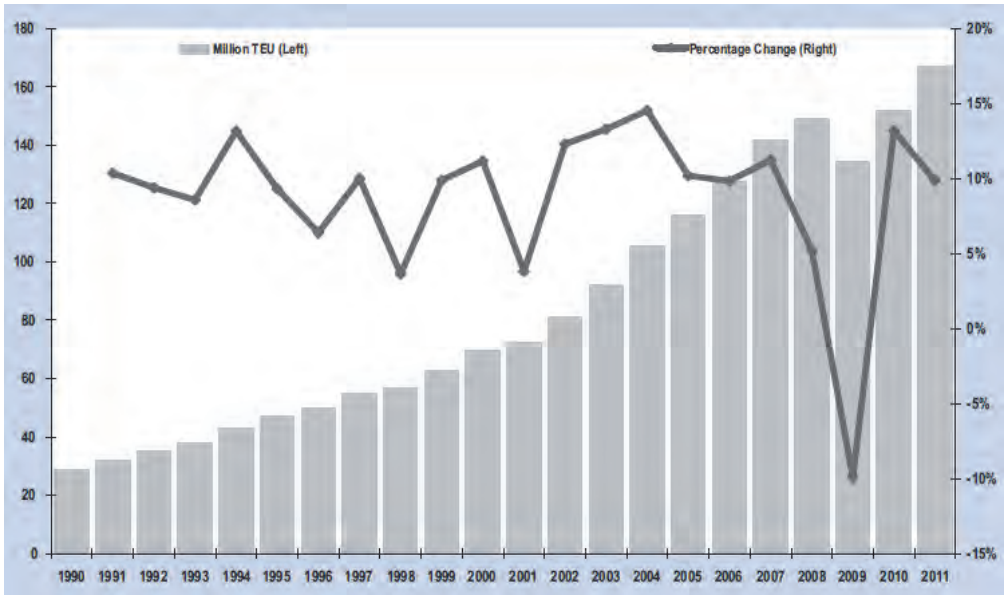
Just after 3 years from the Lehman Shock in September 2008, another economic problem has emerged from Europe. The global recession spilt out from the economically advanced countries has been taking negative effects on the world maritime transport.

The volume of cargo movements, as the demand side of maritime transport, is observed to have already hit the bottom in 2009 and is back on course for recovery, while it seems at a rather slow pace. Figure 2.6-1 shows the historical trend of the volume of all types of cargoes, and Figure 2.6-2 shows the volume of containers in recent years.



Source: UNCTAD "Review of Maritime Transport 2011"

Figure 2.6-1 Indices for global container, tanker and major dry bulks volumes, 1990–2011 (1990=100)



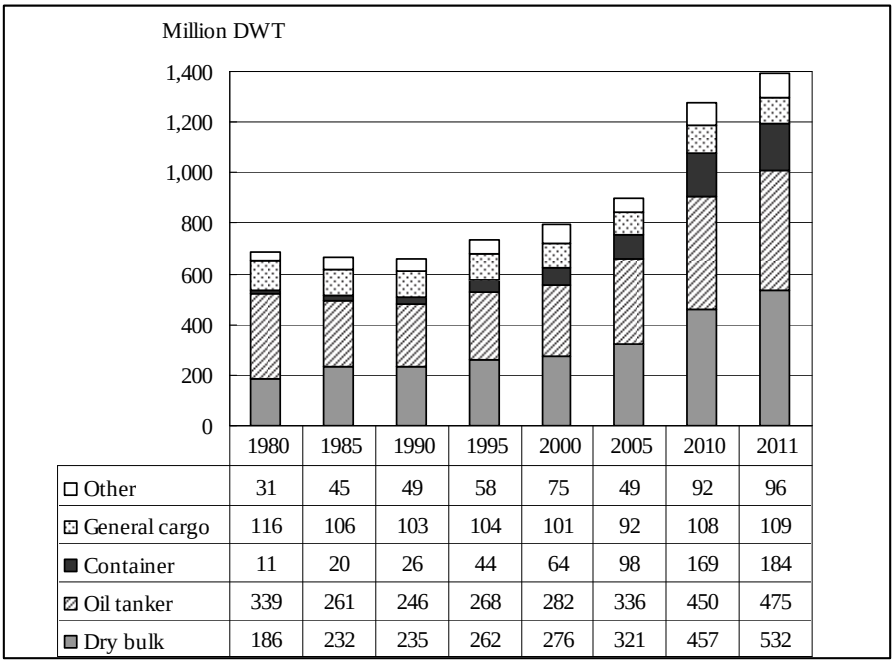
Source: UNCTAD "Review of Maritime Transport 2011"

Figure 2.6-2 Global container trade, 1990–2011 (TEUs and annual percentage change)

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.

2) Continued over tonnage

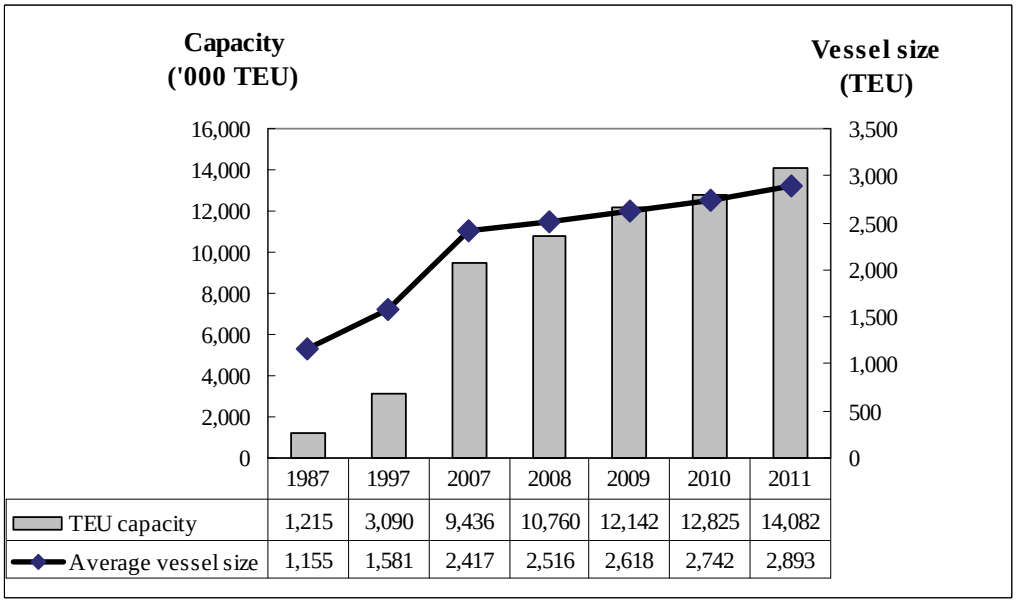
Looking at the vessel tonnage as the supply side of maritime transport, it is observed that the adjustment of vessel tonnage by shipping lines has not been working well after the decline of cargo movements in 2009 as shown in Figure 2.6-3 and 2.6-4. The surplus of vessel tonnage is now causing the serious decline of ocean freight rates especially for containers, which is further aggravating the shipping lines' economies.



	1980	1985	1990	1995	2000	2005	2010	2011
Other	31	45	49	58	75	49	92	96
General cargo	116	106	103	104	101	92	108	109
Container	11	20	26	44	64	98	169	184
Oil tanker	339	261	246	268	282	336	450	475
Dry bulk	186	232	235	262	276	321	457	532

Source: UNCTAD "Review of Maritime Transport 2011"

Figure 2.6-3 World fleet by principal vessel types (beginning-of-year figures)



	1987	1997	2007	2008	2009	2010	2011
TEU capacity	1,215	3,090	9,436	10,760	12,142	12,825	14,082
Average vessel size	1,155	1,581	2,417	2,516	2,618	2,742	2,893

Source: UNCTAD "Review of Maritime Transport 2011"

Figure 2.6-4 Long-term trends in the container ship fleet

The gap between supply and demand had been more or less a traditional problem in all area of maritime transport. Facing the Lehman Shock, shipping lines, especially container carriers, have tried to adjust the vessel tonnage to match the shrunk cargo movements. The measures taken by container carriers after the global economic crisis to mitigate over-tonnage situations were; cancellation of new orders to the shipyards, delaying the delivery times of new vessels, lay-up of existing vessels and so on. However, 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

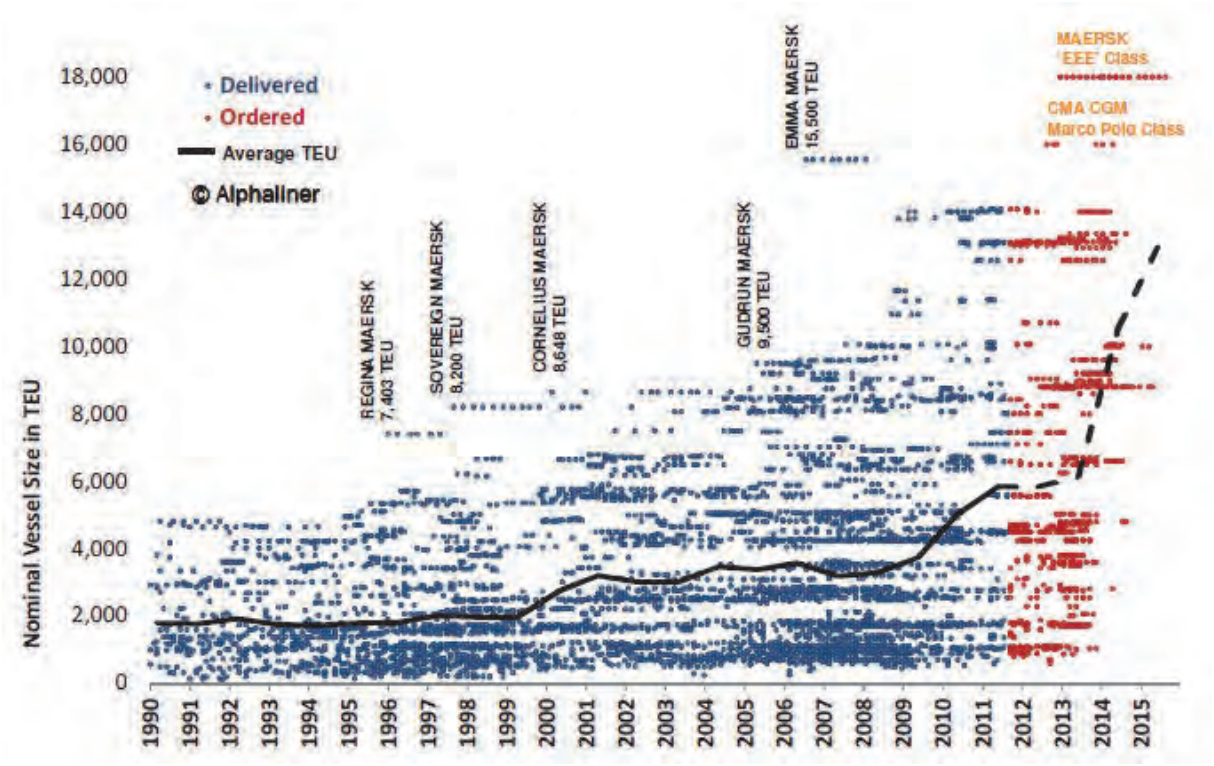
ports to call or in the demanding requests to the container terminal operators for the improvement of stevedoring efficiency.

3) Mega container vessels and "hub & spoke system"

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.

Figure 2.6-5 shows the scatter graph of historical size of container vessels delivered/ordered from 1990 to 2015. Container vessels of 10,000 TEUs and over accounted for 48 % of the order book as of October 1, 2011 followed by 7,500 to 9,999 TEUs ships which made up 21 % of contracts. The average size of new containerships in 2000 was only 2,900 TEUs compared to 6,100 TEUs this year, while the largest delivery was 8,200 TEUs compared to 16,000 TEUs by the end of 2012 and 18,000 TEUs by 2013. Asia-Europe trade is always the hottest spot where those brand-new mega vessels are deployed.

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.



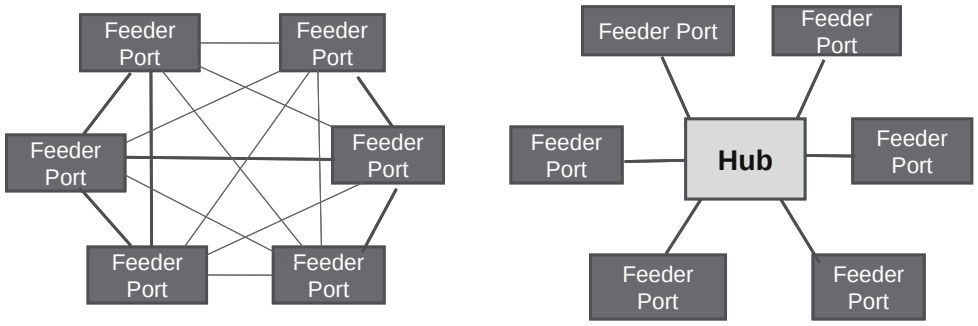
Source: Alphaliner Project Team

Figure 2.6-5 Containership deliveries 1990-2015 as of Oct. 1, 2011

Keep the pace with the trend above, an innovative trade lane management system suitable for mega vessels has been developed by the mega carriers, as it is too costly for mega vessels to call multiple ports under the legacy trade lane operations. "Hub & spoke system" originally invented in airborne industry in US is now broadly adopted by mega container carriers in the world.

Figure 2.6-6 illustrates how "hub & spoke" can save operational costs. In case of a region with 6

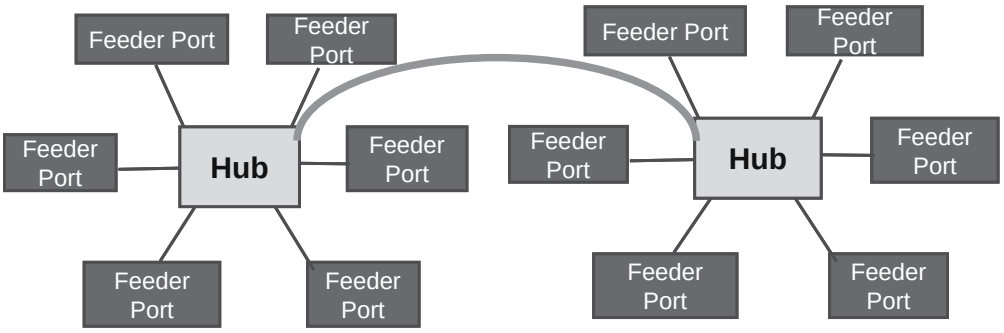
feeder ports to cover, total 15 feeder lines are required to cover all port pairs in the region under the legacy multiple-calling system. However, under the hub & spoke system, only 6 feeder lines are enough to cover those port pairs, which will bring substantial save of feeder costs to the carrier.



Source: Akio Imai "Global Intermodal Transportation" arranged by Project Team

Figure 2.6-6 Image of hub & spoke system

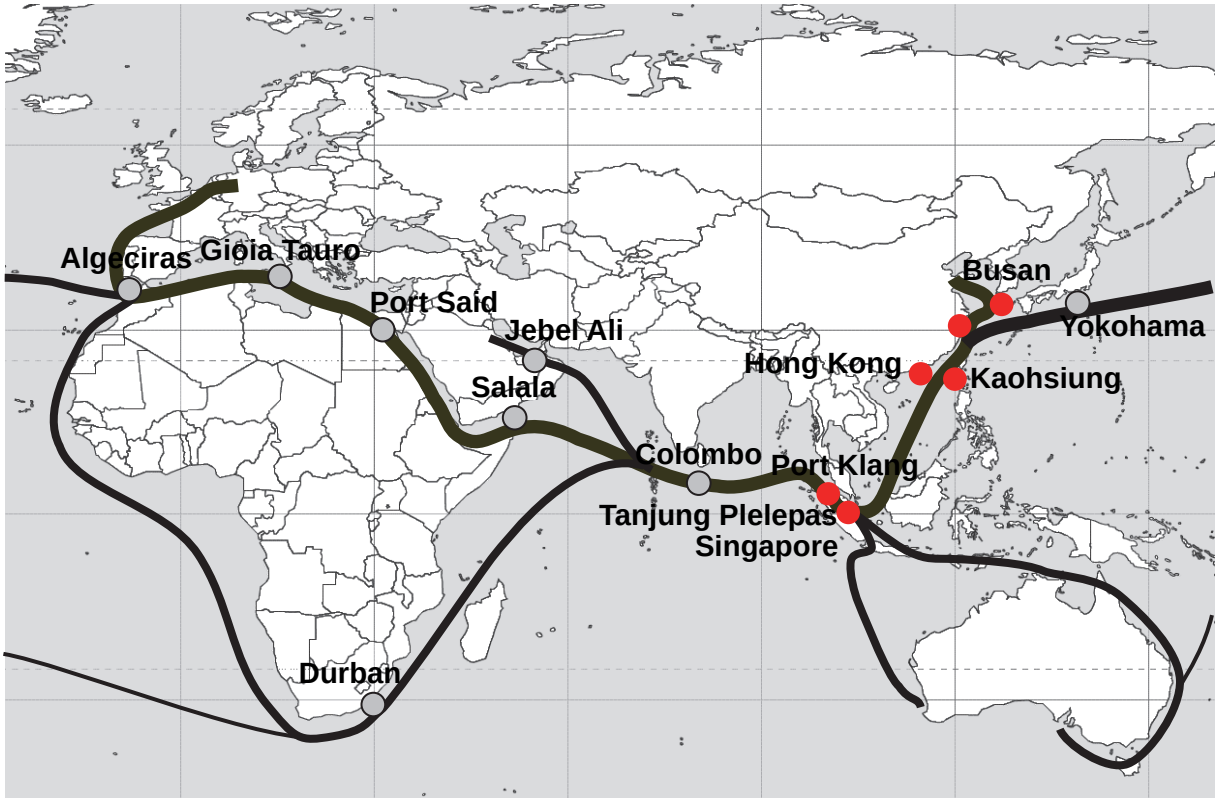
Furthermore as illustrated in Figure2.6-7, if the region is connected with another region, some new port pairs can easily be created, which will bring new business chances to the carrier.



Source: Akio Imai "Global Intermodal Transportation" arranged by Project Team

Figure 2.6-7 Image of 2 hubs connected

Figure 2.6-8 depicts the major hub ports in the world-busiest trade lane between Asia and Europe. Hub ports are selected by the carriers in consideration of geographical advantage, total transit time and total cost to maintain feeder networks. A hub port doesn't need to have a cargo source in its own hinterland. It can be built even at a quiet village without any industrial area nearby, if only the factors above can be optimized; Tanjung Pelapas, Salala, Gioia Tauro and Algeciras would be the real examples.



Prepared by Project Team

Figure 2.6-8 Major container trade lanes in the world

4) Inter-alliance service mergers

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. All those movements are aiming the enhancement of service frequency just as Maersk Line envisages in "Daily Maersk" concept, while those could not fundamentally eliminate the global over tonnage situation itself.

(2) Trends in Asia

Table 2.6-1 shows the OD-wise world container traffic in 2010. The largest origin of the movements is East Asia; which amounts to 58.1 million TEUs; 55% of total movements. Out of the movements originated from East Asia, the largest volume of 21.9 million TEUs is moving within East Asia itself (i.e. "intra-Asia trade"). The second largest destinations next to East Asia are Europe and North America with 13.5 million TEUs and 13.1 million TEUs respectively.

Table 2.6-1 Region-to-region container traffic in 2010

(Unit: '000TEU carried onboard in 2010)

↓ from to→	N.America	East Asia	Europe	S.America	Middle East	South Asia	Africa	Oceania	Total
N.America	130	6,272	2,536	2,198	373	490	244	288	12,531
East Asia	13,107	21,905	13,539	2,922	2,221	1,583	1,558	1,294	58,129
Europe	3,024	5,569	4,109	1,340	1,807	611	1,563	439	18,460
S.America	1,798	1,013	2,172	1,228	191	63	410	37	6,910
Middle East	70	787	728	24	488	171	344	25	2,638
South Asia	659	453	614	103	317	292	295	25	2,758
Africa	211	458	763	62	107	102	732	22	2,459
Oceania	182	807	188	31	76	61	61	508	1,915
Total	19,180	37,264	24,649	7,907	5,579	3,374	5,208	2,639	105,799

Note: * The volume to/from North Africa is counted in Europe.
Source: Mitsui O.S.K. Lines Research Office

Table 2.6-2 shows the increase of each traffic from 2008 to 2010 (the comparison is not made with 2009, as the movements in this year was extraordinarily low affected by the global economic crisis).

While many regions revealed decreases, only East Asia marked a significant increase for both outbound and inbound. Again the intra-Asia trade made a substantial contribution in the increase of world container traffic.

Table 2.6-2 2008-2010 increase of container traffic by region

(Unit: '000TEU carried onboard in 2010)

↓ from to→	N.America	East Asia	Europe	S.America	Middle East	South Asia	Africa	Oceania	Total
N.America	-136	-22	-70	-140	-93	128	-72	-6	-411
East Asia	-200	5,765	607	370	923	-270	-239	-385	6,571
Europe	188	419	-1,029	-110	-1,113	-216	613	60	-1,190
S.America	-175	64	247	-498	-32	23	-34	-20	-427
Middle East	8	542	-1,124	0	-52	-144	-151	2	-918
South Asia	14	-297	-539	-28	-149	-8	77	-13	-943
Africa	91	-20	148	-54	-67	-25	-13	-19	43
Oceania	-17	-209	-40	-20	-15	4	2	-37	-331
Total	-228	6,242	-1,800	-481	-599	-507	184	-417	2,393

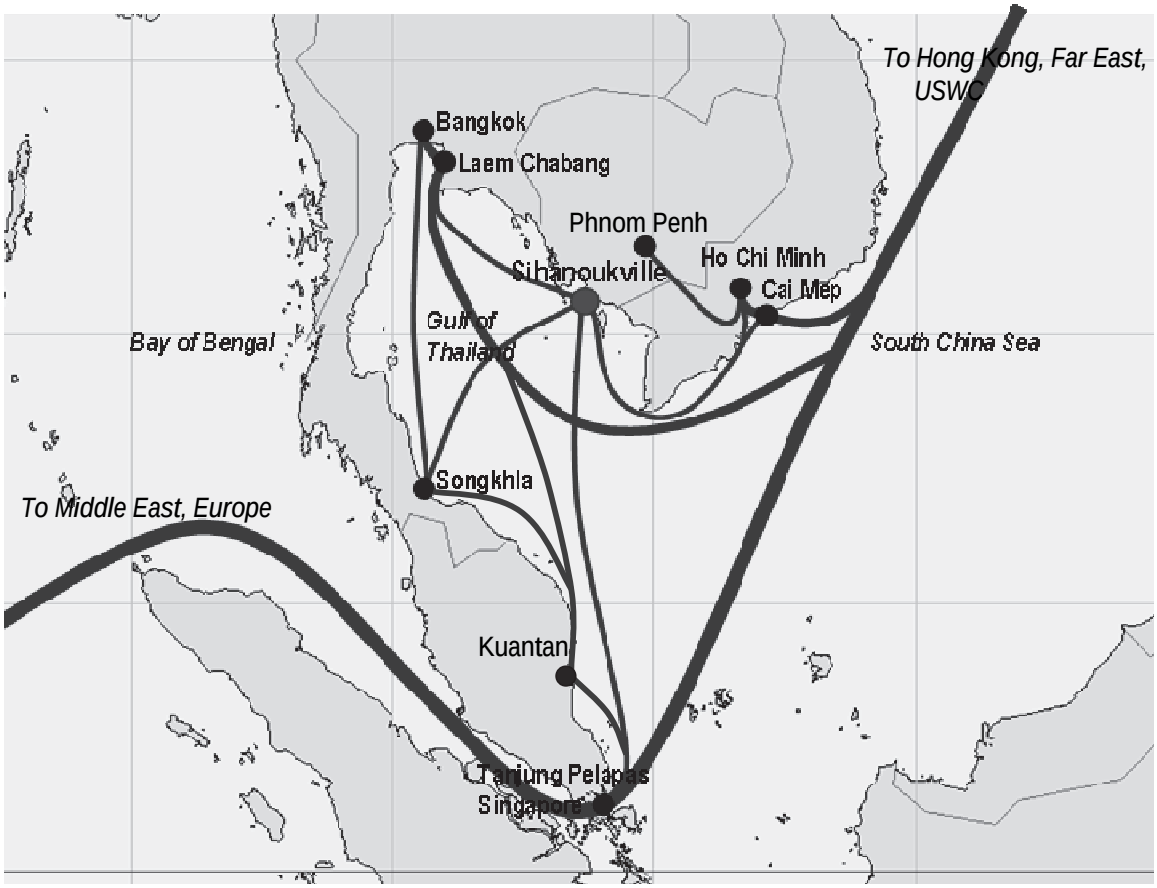
Note: * The volume to/from North Africa is counted in Europe.
Source: Mitsui O.S.K. Lines Research Office

(3) Trends in south-eastern Indochina

1) Current situations

Figure 2.6-9 depicts the current maritime network in south-eastern Indochina region. The thickest line represents the trunk line from East Asia up to Europe.

It is noteworthy that Cai Mep and Ho chi minh Port are located very close to the trunk line, while Laem Chabang and Bangkok are rather remote. Sihanoukdville has a better position than Laem Chabang's but still there is a substantial distance to that trunk line.



Prepared by Project Team

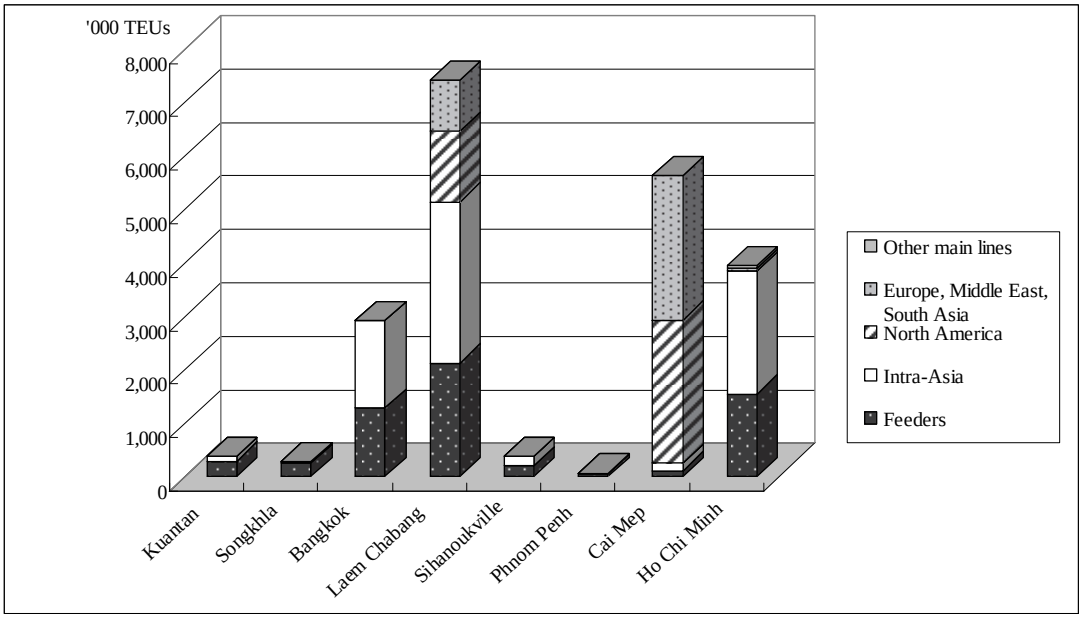
Figure 2.6-9 Container trade lanes in south-eastern Indochina

Figure 2.6-10 shows the yearly capacity of vessels currently calling at the ports in south-eastern Indochina. The largest vessel capacity of 7.4 million TEUs per annum is given to Laem Chabang, followed by Cai Mep with 5.6 million TEUs.

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.

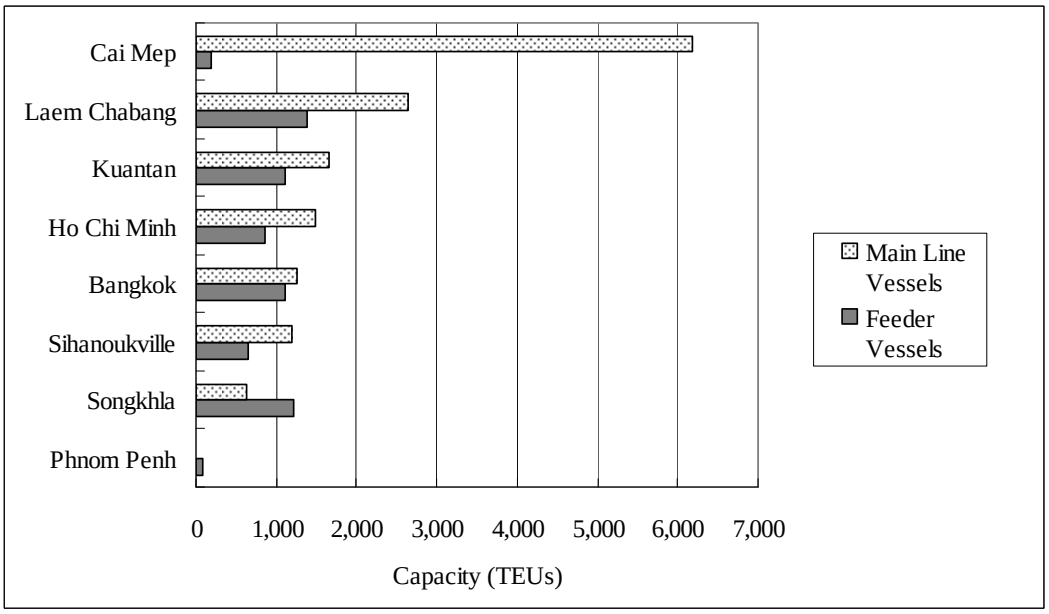
Kuantan, Songkhla and Sihanoukville also share the same feature composed of the feeders and some few intra-Asia with the small hinterlands.



Prepared by Project Team

Figure 2.6-10 Yearly capacity of vessels calling at south-eastern Indochina ports (as of July. 1, 2011)

Figure 2.6-11 shows the average size of vessels currently calling at the ports in south-eastern Indochina. 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.



Prepared by Project Team

Figure 2.6-11 Average size of vessels calling at south-eastern Indochina ports (as of Oct. 1, 2011)

The series of tables from Table 2.6-3 to Table 2.6-17 below shows the details of the shipping lines' services and vessel deployment for the ports of Kuantan, Songkhla, Bangkok, Laem Chabang, Cai Mep (namely; Cai Mep-Thi Vai) and Ho Chi Minh.

Table 2.6-3 Liner services calling at Kuantan Port

Shipping line	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
Evergreen Line	NSD	M	weekly	28	7	4	6,594	1,649	52	85,958	Tokyo-Yokohama-Nagoya-Yokkaichi-Keelung-Taichung-Kaohsiung-Singapore-Port Klang-Penang-Tanjung Pelapas-Kuantan-Hong Kong-Kaohsiung-Taichung-Keelung-Tokyo
Intra-Asia Total						4	6,594	1,649	52	85,958	
Evergreen Line	VSS	F	weekly	7	7	1	1,038	1,038	52	54,124	Ho Chi Minh-Kuantan-Tanjung Pelapas-Ho Chi Minh
MCC Transport [CMA CGM]	THA4	F	weekly	7	7	1	2,452	2,452	52	127,854	Tanjung Pelapas-Singapore-Songkhla-Kuantan-Tanjung Pelapas
Regional Container Lines	RHS	F	weekly	7	7	1	1,036	1,036	52	54,020	Singapore-Ho Chi Minh(Cat Lai, VICT)-Kuantan-Singapore
Advance Container Lines	SES	F	weekly	7	7	1	480	480	52	25,029	Singapore-Kuantan-Singapore-Port Klang-Singapore
Samudera Shipping	BKK1	F	weekly	7	7	1	600	600	52	31,286	Singapore-Kuantan-Lem Chabang-Bangkok-Laem Chabang-Singapore
Feeder Total						5	5,606	1,121	261	292,313	
Total						9	12,200	1,356	313	378,270	

Prepared by Project Team

Table 2.6-4 Liner services calling at Songkhla Port

Shipping line	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
Regional Container Lines	RSK	F	weekly	21	7	3	1,884	628	52	32,746	Songkhla-Hong Kong-Haiphong-Hong Kong-Keelung-Taichung-Hong Kong-Sihanoukville-Songkhla
Intra-Asia Total						3	1,884	628	52	32,746	
MCC Transport [CMA CGM]	THA4	F	weekly	7	7	1	2,452	2,452	52	127,854	Tanjung Pelapas-Singapore-Songkhla-Kuantan-Tanjung Pelapas
Regional Container Lines	RSZ	F	weekly	7	3.5	2	1,778	889	104	92,710	Singapore-Sihanoukville-Songkhla-Singapore
Advance Container Lines	RSZ	F	weekly	7	7	1	604	604	52	31,494	Singapore-Sihanoukville-Songkhla-Singapore
Feeder Total						4	4,834	1,209	209	252,059	
Total						7	6,718	960	261	284,804	

Prepared by Project Team

Table 2.6-5 Liner services calling at Bangkok Port (1)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity /vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
Unigiear	SWAf Conventional	M	every 21 days	63	21	3	2,656	885	17	15,388	Bangkok-Durban-Jakarta-Bangkok
Africa Sub Total						3	2,656	885	17	15,388	
Evergreen Line	KCT	M	weekly	21	7	3	3,182	1,061	52	55,306	Busan-Gwang Yang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Keelung-Busan
MOL (RCL;1vsl) [OOCL, Bien Dong]	CBC	M	weekly	21	7	2	2,064	1,032	35	35,874	Nagoya-Tokyo-Yokohama-Shanghai-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Nagoya
MOL	CBE	M	weekly	21	7	3	3,220	1,073	52	55,967	Tokyo-Yokohama-Shimizu-Nagoya-Busan-Laem Chabang-Bangkok-Manila-Tokyo
MOL	CBW	M	weekly	21	7	3	3,180	1,060	52	55,271	Osaka-Kobe-Moji-Hibikinada-Hakata-Busan-Manila-Laem Chabang-Bangkok-Osaka
NYK (Siam Paetra;1vsl) [Hyundai]	PHX	M	weekly	21	7	2	2,354	1,177	35	40,915	Kobe-Osaka-Nagoya-Tokyo-Yokohama-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Kobe
CNC Line (TS Line;1vsl, KMTC;1vsl) [Hyundai]	CHT	M	weekly	21	7	1	1,679	1,679	17	29,183	Incheon-Qingdao-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Xiamaen-Incheon
CNC Line [Evergreen, Yang Ming]	JTX	M	weekly	28	7	4	5,551	1,388	52	72,361	Tokyo-Yokohama-Nagoya-Osaka-Kobe-Keelung-Kaohsiung-Hong Kong-Bangkok-Laem Chabang-Hong Kong-Kaohsiung-Taichung-Keelung-Tokyo
K Line [Hanjin, TS Line]	B1	M	weekly	21	7	3	5,100	1,700	52	88,643	Tokyo-Yokohama-Shimizu-Nagoya-Shanghai-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Tokyo
K Line [Hanjin, NYK]	B2	M	weekly	21	7	3	5,100	1,700	52	88,643	Osaka-Yokkaichi-Kobe-Moji-Manila-Laem Chabang-Bangkok-Laem Chabang-Manila-Osaka
Wan Hai (Gold Star;1vsl)	NTE	M	weekly	21	7	2	2,318	1,159	35	40,289	Tokyo-Yokohama-Nagoya-Hong Kong-Bangkok-Laem Chabang-Shekou-Tokyo
Wan Hai	JST	M	weekly	28	7	4	4,240	1,060	52	55,271	Bangkok-Laem Chabang-Hong Kong-Kaohsiung-Taichung-Keelung-Osaka-Kobe-Moji-Tokuyama-Keelung-Kaohsiung-Hong Kong-Laem Chabang-Bangkok
Wan Hai	JTT	M	weekly	28	7	4	5,472	1,368	52	71,331	Bangkok-Laem Chabang-Hong Kong-Kaohsiung-Taichung-Keelung-Tokyo-Chiba-Yokohama-Nagoya-Yokkaichi-Keelung-Taichung-Kaohsiung-Hong Kong-Laem Chabang-Bangkok
Cosco Container Lines	CSI	M	weekly	21	7	3	3,180	1,060	52	55,271	Osaka-Kobe-Moji-Hibikinada-Hakata-Busan-Manila-Laem Chabang-Bangkok-Osaka
Yang Ming [CNC, Yanghai]	JTC	M	weekly	28	7	4	6,665	1,666	52	86,883	Tokyo-Yokohama-Nagoya-Osaka-Kobe-Keelung-Kaohsiung-Hong Kong-Bangkok-Laem Chabang-Hong Kong-Kaohsiung-Taichung-Keelung-Tokyo
Hanjin (KMTC;1vsl, STX Pan Ocean;1vsl)	NTS	M	weekly	21	7	1	1,700	1,700	17	29,548	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Busan
Hyundai [NYK, KMTC]	FTS	M	weekly	21	7	3	3,576	1,192	52	62,154	Busan-Shanghai-Ho Chi Minh-Bangkok-Laem Chabang-Manila-Busan
Regional Container Lines (Grand China;1vsl)	RBC	M	weekly	21	7	1	1,216	1,216	17	21,135	Bangkok-Laem Chabang-Ho Chi Minh-Ningbo-Shanghai-Bangkok
Korea Marine Transport (CNC;1vsl, TS Line;1vsl) [Hyundai]	CHT	M	weekly	21	7	1	1,613	1,613	17	28,035	Incheon-Qingdao-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Xiamaen-Incheon
Korea Marine Transport (Sinokor;1vsl)	KTS	M	weekly	21	7	2	3,200	1,600	35	55,619	Ulsan-Busan-Hong Kong-Ho Chi Minh-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Shekou-Keelung-Ulsan
Korea Marine Transport (Hanjin;1vsl, STX;1vsl)	NTS	M	weekly	21	7	1	1,440	1,440	17	25,029	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Busan

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Table 2.6-6 Liner services calling at Bangkok Port (2)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity /vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
Korea Marine Transport (STX;2vsls)	GTS	M	weekly	21	7	1	1,440	1,440	17	25,029	Shanghai-Busan-Ulsan-Pohang-Gwangyang-Hong Kong-Laem Chabang-**Bangkok**-Laem Chabang-Hong Kong-Shanghai
TS Line (CNC;1vsl, KMTC;1vsl) [Hyundai]	CHT	M	weekly	21	7	1	1,679	1,679	17	29,183	Incheon-Qingdao-Shanghai-Hong Kong-Laem Chabang-**Bangkok**-Laem Chabang-Hong Kong-Xiamaen-Incheon
Heung-A Shipping (Namsung;3vsls) [MOL, Hanjin, K Line]	BHS	M	weekly	21	3	4	4,836	1,209	70	84,054	Gwangyang-Ulsan-Busan-Hong Kong-Ho Chi Minh-**Bangkok**-Laem Chabang-Hong Kong-Busan-Gwangyang
Heung-A Shipping (STX;1vsl) [Samudera]	KCT	M	weekly	21	7	2	2,880	1,440	35	50,057	Incheon-Qingdao-Shanghai-Laem Chabang-**Bangkok**-Laem Chabang-Hong Kong-Xiamen-Incheon
STX Pan Ocean (Hanjin;1vsl, KMTC;1vsl)	NTS	M	weekly	21	7	1	1,440	1,440	17	25,029	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-**Bangkok**-Laem Chabang-Ho Chi Minh-Busan
STX Pan Ocean (KMTC;1vsl)	GTS	M	weekly	21	7	2	2,328	1,164	35	40,463	Shanghai-Busan-Ulsan-Pohang-Gwangyang-Hong Kong-Laem Chabang-**Bangkok**-Laem Chabang-Hong Kong-Shanghai
STX Pan Ocean (Heung-A;2vsls) [Samudera]	KCT	M	weekly	21	7	1	1,440	1,440	17	25,029	Incheon-Qingdao-Shanghai-Laem Chabang-**Bangkok**-Laem Chabang-Hong Kong-Xiamen-Incheon
SITC Container Lines	VTX1	M	weekly	28	7	4	4,318	1,080	52	56,288	Osaka-Kobe-Busan-Shanghai-Hong Kong-Ho Chi Minh-**Bangkok**-Laem Chabang-**Bangkok**-Laem Chabang-Ho Chi Minh-Ningbo-Shanghai-Osaka
SITC Container Lines	VTX2	M	weekly	28	7	4	3,778	945	52	49,249	Tokyo-Yokohama-Nagoya-Ningbo-Xiamen-Ho Chi Minh-**Bangkok**-Laem Chabang-Haiphong-Fang Cheng-Shekou-Ningbo-Tokyo
Gold Star Line (Wan Hai;2vsl)	NTE	M	weekly	21	7	1	1,032	1,032	17	17,937	Tokyo-Yokohama-Nagoya-Hong Kong-**Bangkok**-Laem Chabang-Shekou-Tokyo
Sinokor (KMTC;2vsls)	KTS	M	weekly	21	7	1	1,512	1,512	17	26,280	Ulsan-Busan-Hong Kong-Ho Chi Minh-Laem Chabang-**Bangkok**-Laem Chabang-Hong Kong-Shekou-Keelung-Ulsan
Namsung Shipping (Heung-A;4vsls) [Hanjin, K Line]	BHS	M	weekly	21	3	3	2,878	959	52	50,022	Gwangyang-Ulsan-Busan-Hong Kong-Ho Chi Minh-**Bangkok**-Laem Chabang-Hong Kong-Busan-Gwangyang
Grand China Shipping (RCL;2vsls)	RBC	M	weekly	21	7	1	1,216	1,216	17	21,135	**Bangkok**-Laem Chabang-Ho Chi Minh-Hong Kong-Ningbo-Shanghai-**Bangkok**
Siam Paetra International (NYK;2vsl) [Hyundai]	PHX	M	weekly	21	7	1	1,094	1,094	17	19,015	Kobe-Osaka-Nagoya-Tokyo-Yokohama-Laem Chabang-**Bangkok**-Laem Chabang-Ho Chi Minh-Kobe
Yanghai Shipping	KCT	M	weekly	21	7	3	3,182	1,061	52	55,306	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-**Bangkok**-Laem Chabang-Hong Kong-Keelung-Shanghai-Busan
Intra-Asia Sub Total						30	35,053	1,168	487	574,075	
Main Line Total						83	103,759	1,250	1,304	1,642,193	

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Table 2.6-7 Liner services calling at Bangkok Port (3)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity /vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
Evergreen Line [Yang Ming, Cosco]	TWT	F	weekly	14	7	2	2,328	1,164	52	60,694	Hong Kong-Kaohsiung-Taichung-Laem Chabang-**Bangkok**-Hong Kong
Evergreen Line (OOCL;1vsl)	TMI	F	weekly	14	7	1	1,164	1,164	26	30,347	**Bangkok**-Laem Chabang-Port Klang-Tanjung Pelapas-Jakarta-**Bangkok**
NYK [Cosco, Sea Consortium]	APX	F	weekly	14	7	2	2,314	1,157	52	60,329	**Bangkok**-Laem Chabang-Singapore-Jakarta-Port Klang-Bangkok
OOCL (Evergreen;1vsl)	TMI	F	weekly	14	7	1	1,164	1,164	26	30,347	**Bangkok**-Laem Chabang-Port Klang-Tanjung Pelapas-Jakarta-**Bangkok**
MSC	Siam Express	F	weekly	7	7	1	1,208	1,208	52	62,989	Singapore-**Bangkok**-Singapore
CNC Line	Thailand Feeder	F	weekly	10.5	3.5	3	4,473	1,491	104	155,490	Port Klang-**Bangkok**-Laem Chabang-Tanjung Pelapas-Port Klang
K Line (Wan Hai;1vsl) [Cosco]	ASECO X	F	weekly	14	7	1	1,700	1,700	26	44,321	**Bangkok**-Laem Chabang-Singapore-Jakarta-Singapore-Port Klang-Singapore-Laem Chabang-**Bangkok**
K Line	ASECO S	F	weekly	7	7	1	1,118	1,118	52	58,296	**Bangkok**-Laem Chabang-Singapore-Jakarta-Singapore-Laem Chabang-**Bangkok**
Wan Hai (K Line;1vsl) [Pacific Eagle Lines]	ASECO X	F	weekly	14	7	1	1,700	1,700	26	44,321	**Bangkok**-Laem Chabang-Singapore-Jakarta-Singapore-Port Klang-Singapore-Laem Chabang-**Bangkok**
Cosco Container Lines	Thailand Feeder	F	weekly	14	7	2	1,600	800	52	41,714	**Bangkok**-Laem Chabang-Singapore-**Bangkok**
Hanjin [PIL]	TSS	F	weekly	7	7	1	1,032	1,032	52	53,811	Singapore-**Bangkok**-Laem Chabang-Singapore
Regional Container Lines [MOL, K Line]	RBS	F	weekly	14	7	2	2,232	1,116	52	58,191	**Bangkok**-Laem Chabang-Manila-Hong Kong-Ho Chi Minh-**Bangkok**
Regional Container Lines	RTS	F	weekly	7	1.4	5	5,268	1,054	261	274,689	Singapore-**Bangkok**-Laem Chabang-Singapore
Samudera Shipping	BKK1	F	weekly	7	7	1	600	600	52	31,286	Singapore-Kuantan-Lem Chabang-**Bangkok**-Laem Chabang-Singapore
Samudera Shipping	BKK2	F	every 8 days	8	8	1	1,054	1,054	46	48,089	Singapore-Laem Chabang-**Bangkok**-Laem Chabang-Singapore
Samudera Shipping	BKK3	F	every 8 days	8	8	1	1,054	1,054	46	48,089	Singapore-Laem Chabang-**Bangkok**-Laem Chabang-Singapore
Advance Container Lines [PIL]	TSS	F	weekly	7	3.5	2	2,031	1,016	104	105,902	Singapore-**Bangkok**-Laem Chabang-Singapore
Hub Shipping	THEX	F	weekly	7	7	1	818	818	52	42,653	**Bangkok**-Port Klang-**Bangkok**
Bien Dong Shipping	Vietnam/Thailand	F	weekly	14	7	2	1,258	629	52	32,798	Haiphong-Ho Chi Minh-**Bangkok**-Laem Chabang-Ho Chi Minh-Haiphong
Feeder Total						31	34,116	1,101	1,186	1,284,357	
Total						114	137,875	1,209	2,490	2,926,550	

Prepared by Project Team

Table 2.6-8 Liner services calling at Laem Chabang Port (1)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
APL [MOL, Hyundai]	PS1	M	weekly	49	7	7	36,459	5,208	52	271,582	Laem Chabang-Singapore-Cai Mep-Yantian-Hong Kong-Seattle-Vancouver-Yokohama-Kaohsiung-Chiwan-Laem Chabang
MOL [APL, Hyundai]	PSX	M	weekly	49	7	7	44,654	6,379	52	332,627	Laem Chabang-Cai Mep-Hong Kong-Yantian-Los Angeles-Oakland-Tokyo-Hong Kong-Da Chan Bay-Laem Chabang
Hapag Lloyd (Zim;3vsls) [NYK]	PNX	M	weekly	49	7	4	30,024	7,506	30	223,648	Singapore-Laem Chabang-Shekou-Hong Kong-Kaohsiung-Vancouver-Seattle-Busan-Kaohsiung-Hong Kong-Shekou-Singapore
Zim Integrated Shipping Services (Hapag;4vsls) [NYK]	PNX	M	weekly	49	7	3	24,600	8,200	22	183,245	Singapore-Laem Chabang-Shekou-Hong Kong-Kaohsiung-Vancouver-Seattle-Busan-Kaohsiung-Hong Kong-Shekou-Singapore
USWC Sub Total						21	135,737	6,464	156	1,011,102	
MCC Transport (RCL;1vsl, Samudera;1vsl)	TCX	M	weekly	21	7	1	1,240	1,240	17	21,552	Laem Chabang-Singapore-Chennai-Vishakhapatnam-Singapore-Laem Chabang
Evergreen Line (Simatech;2vsls) [OOCL, Hub line]	AGI	M	weekly	35	7	3	8,255	2,752	31	86,088	Laem Chabang-Singapore-Tanjung Pelapas-Port Klang-Colombo-Jebel Ali-Karachi-Colombo-Port Klang-Singapore-Laem Chabang
Evergreen Line [MOL]	APG	M	weekly	42	7	6	31,170	5,195	52	270,882	Shanghai-Ningbo-Kaohsiung-Taipei-Hong Kong-Yantian-Tanjung Pelapas-Colombo-Jebal Ali-Singapore-Laem Chabang-Hong Kong-Shanghai
APL [MOL, Hyundai]	LWX	M	weekly	42	7	6	18,997	3,166	52	165,093	Laem Chabang-Singapore-Nhava Sheva-Karachi-Nhava Sheva-Colombo-Singapore-Laem Chabang
MOL (RCL;1vsl, BTL;1vsl)	RMB	M	weekly	21	7	1	1,831	1,831	17	31,825	Laem Chabang-Singapore-Port Klang-Chennai-Penang-Port Klang-Singapore-Laem Chabang
NYK [Hyundai, Cosco, K Line]	HLS	M	weekly	42	7	6	10,107	1,685	52	87,835	Tokyo-Shimizu-Omaezaki-Nagoya-Kobe-Laem Chabang-Singapore-Pipavav-Karachi-Nhava Sheva-Colombo-Singapore-Laem Chabang-Keelung-Tokyo
Regional Container Lines (MOL;2vsls) [OOCL, Bien Dong]	CBC	M	weekly	21	7	1	1,094	1,094	17	19,015	Laem Chabang-Singapore-Port Klang-Chennai-Penang-Port Klang-Singapore-Laem Chabang
Regional Container Lines (MCC;1vsl, Samudera;1vsl)	TCX	M	weekly	21	7	1	1,324	1,324	17	23,012	Laem Chabang-Singapore-Chennai-Vishakhapatnam-Singapore-Laem Chabang
Regional Container Lines (MOL;1vsl, BTL;1vsl)	RMB	M	weekly	21	7	1	1,858	1,858	17	32,294	Laem Chabang-Singapore-Port Klang-Chennai-Penang-Port Klang-Singapore-Laem Chabang
Samudera Shipping (MCC;1vsl, RCL;1vsl)	TCX	M	weekly	21	7	1	1,324	1,324	17	23,012	Laem Chabang-Singapore-Chennai-Vishakhapatnam-Singapore-Laem Chabang
Simatech Shipping (Evergreen;3vsls) [Hub Line]	AGI	M	every 15 days	35	7	2	4,899	2,450	21	51,090	Laem Chabang-Singapore-Tanjung Pelapas-Port Klang-Colombo-Jebel Ali-Karachi-Colombo-Port Klang-Singapore-Laem Chabang
Bengal Tiger Line (MOL;1vsl, RCL;1vsl)	RMB	M	weekly	21	7	1	1,608	1,608	17	27,949	Laem Chabang-Singapore-Port Klang-Chennai-Penang-Port Klang-Singapore-Laem Chabang
Sea Consortium [Maersk, NYK]	TSC	M	weekly	21	7	3	4,717	1,572	52	81,986	Laem Chabang-Singapore-Port Klang-Chennai-Penang-Port Klang-Singapore-Laem Chabang
South Asia/Middle East Sub Total						33	88,424	2,680	382	921,632	
OOCL (Hapag;4vsls) [NYK]	AEX	M	weekly	70	7	6	34,114	5,686	31	177,880	Cai Mep-Laem Chabang-Singapore-Colombo-Cagliari-Halifax-New York-Savannah-Norfork-New York-Halifax-Cagliari-Jeddah-Colombo-Singapore-Cai Mep
Hapag Lloyd (OOCL;6vsls) [NYK]	AEX	M	weekly	70	7	4	23,552	5,888	21	122,807	Cai Mep-Laem Chabang-Singapore-Colombo-Cagliari-Halifax-New York-Savannah-Norfork-New York-Halifax-Cagliari-Jeddah-Colombo-Singapore-Cai Mep
USEC Sub Total						10	57,666	5,767	52	300,687	
Rickmers Line	Euro-Asia	M	2 shipments /month	126	14	9	16,904	1,878	26	48,968	Hamburg-Antwerp-Genoa-Jakarta-Singapore-Laem Chabang-Ho Chi Minh-Hong Kong-Shanghai-Dalian-Xingang-Qingdao-Masan-Kobe-Yokohama-Houston-New Orleans-Philadelphia-Hamburg
Europe Sub Total						9	16,904	1,878	26	48,968	

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Table 2.6-9 Liner services calling at Laem Chabang Port (2)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
MCC Transport	IA2	M	weekly	21	7	3	8,032	2,677	52	139,604	Tanjung Pelapas-Laem Chabang-HongKong-Yantian-Tokyo-Yokohama-Nagoya-Kobe-Kaohsiung-Tanjung Pelapas
MCC Transport (CNC Line;1vsl, TS Line;1vsl)	IA5	M	weekly	28	7	3	4,877	1,626	39	63,575	Laem Chabang-Ho Chi Minh-Hong Kong-Kaohsiung-Shanghai-Osaka-Tokyo-Yokohama-Nagoya-Kaohsiung-Hong Kong-Yantian-Ho Chi Minh-Sihanoukville-Laem Chabang
Evergreen Line	KCT	M	weekly	21	7	3	3,182	1,061	52	55,306	Busan-Gwang Yang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Keelung-Busan
APL [MOL, Hyundai]	JTV	M	weekly	21	7	3	7,434	2,478	52	129,210	Laem Chabang-Cai Mep-Kaohsiung-Tokyo-Yokohama-Nagoya-Kobe-Chiwan-Hong Kong-Laem Chabang
APL [MOL, Hyundai]	CIS	M	weekly	28	7	4	14,136	3,534	52	184,273	Shanghai-Ningbo-Xiamen-Chiwan-Singapore-Jakarta-Surabaya-Singapore-Port Klang-Singapore-Laem Chabang-Shanghai
MOL (RCL;1vsl) [OOCL, Bien Dong]	CBC	M	weekly	21	7	2	2,064	1,032	35	35,874	Nagoya-Tokyo-Yokohama-Shanghai-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Nagoya
MOL	CBE	M	weekly	21	7	3	3,220	1,073	52	55,967	Tokyo-Yokohama-Shimizu-Nagoya-Busan-Laem Chabang-Bangkok-Manila-Tokyo
MOL	CBW	M	weekly	21	7	3	3,180	1,060	52	55,271	Osaka-Kobe-Moji-Hibikinada-Hakata-Busan-Manila-Laem Chabang-Bangkok-Osaka
NYK (Siam Paetra;1vsl) [Hyundai]	PHX	M	weekly	21	7	2	2,354	1,177	35	40,915	Kobe-Osaka-Nagoya-Tokyo-Yokohama-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Kobe
NYK [Hapag, OOCL, Hyundai]	SCX	M	weekly	49	7	7	44,132	6,305	52	328,738	Laem Chabang-Singapore-Cai Mep-Kaohsiung-Los Angeles-Oakland-Kaohsiung-Shekou-Laem Chabang
OOCL [MOL, Cosco]	KTX2	M	weekly	21	7	3	8,288	2,763	52	144,053	Osaka-Kobe-Tokyo-Yokohama-Hong Kong-Laem Chabang-Shekou-Hong Kong-Xiamen-Osaka
OOCL (Wan Hai;3vsls)	CHL	M	weekly	28	7	1	1,512	1,512	13	19,710	Shanghai-Dalian-Xingang-Qingdao-Hong Kong-Shekou-Hong Kong-Ho Chi Minh-Laem Chabang-Hong Kong-Shanghai
CNC Line (MCC;2vsls, TS Line;1vsl)	IA5	M	weekly	28	7	1	1,716	1,716	13	22,369	Laem Chabang-Ho Chi Minh-Hong Kong-Kaohsiung-Shanghai-Osaka-Tokyo-Yokohama-Nagoya-Kaohsiung-Hong Kong-Yantian-Ho Chi Minh-Sihanoukville-Laem Chabang
CNC Line (Yang Ming;1vsl, STX Pan Ocean;1vsl)	CTS	M	weekly	21	7	1	1,713	1,713	17	29,774	Incheon-Qingdao-Shanghai-Ho Chi Minh-Laem Chabang-Hong Kong-Shekou-Incheon
CNC Line (TS Line;1vsl, KMTC;1vsl) [Hyundai]	CHT	M	weekly	21	7	1	1,679	1,679	17	29,183	Incheon-Qingdao-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Xiamaen-Incheon
CNC Line [Evergreen, Yang Ming]	JTX	M	weekly	28	7	4	5,551	1,388	52	72,361	Tokyo-Yokohama-Nagoya-Osaka-Kobe-Keelung-Kaohsiung-Hong Kong-Bangkok-Laem Chabang-Hong Kong-Kaohsiung-Taichung-Keelung-Tokyo
K Line [Hanjin, TS Line]	B1	M	weekly	21	7	3	5,100	1,700	52	88,643	Tokyo-Yokohama-Shimizu-Nagoya-Shanghai-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Tokyo
K Line [Hanjin, NYK]	B2	M	weekly	21	7	3	5,100	1,700	52	88,643	Osaka-Yokkaichi-Kobe-Moji-Manila-Laem Chabang-Bangkok-Laem Chabang-Manila-Osaka
Wan Hai (OOCL;1vsl)	CHL	M	weekly	28	7	3	4,065	1,355	39	52,990	Shanghai-Dalian-Xingang-Qingdao-Hong Kong-Shekou-Hong Kong-Ho Chi Minh-Laem Chabang-Hong Kong-Shanghai
Wan Hai (Gold Star;1vsl)	NTE	M	weekly	21	7	2	2,318	1,159	35	40,289	Tokyo-Yokohama-Nagoya-Hong Kong-Bangkok-Laem Chabang-Shekou-Tokyo
Wan Hai	JST	M	weekly	28	7	4	4,240	1,060	52	55,271	Bangkok-Laem Chabang-Hong Kong-Kaohsiung-Taichung-Keelung-Osaka-Kobe-Moji-Tokuyama-Keelung-Kaohsiung-Hong Kong-Laem Chabang-Bangkok
Wan Hai	JTT	M	weekly	28	7	4	5,472	1,368	52	71,331	Bangkok-Laem Chabang-Hong Kong-Kaohsiung-Taichung-Keelung-Tokyo-Chiba-Yokohama-Nagoya-Yokkaichi-Keelung-Taichung-Kaohsiung-Hong Kong-Laem Chabang-Bangkok
Cosco Container Lines	CSI	M	weekly	21	7	3	3,180	1,060	52	55,271	Osaka-Kobe-Moji-Hibikinada-Hakata-Busan-Manila-Laem Chabang-Bangkok-Osaka
Yang Ming [CNC, Yanghai]	JTC	M	weekly	28	7	4	6,665	1,666	52	86,883	Tokyo-Yokohama-Nagoya-Osaka-Kobe-Keelung-Kaohsiung-Hong Kong-Bangkok-Laem Chabang-Hong Kong-Kaohsiung-Taichung-Keelung-Tokyo
Yang Ming (CNC;1vsl, STX Pan Ocean;1vsl)	CTS	M	weekly	21	7	1	1,687	1,687	17	29,322	Incheon-Qingdao-Shanghai-Ho Chi Minh-Laem Chabang-Hong Kong-Shekou-Incheon

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Table 2.6-10 Liner services calling at Laem Chabang Port (3)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
Hanjin (KMTC;1vsl, STX Pan Ocean;1vsl)	NTS	M	weekly	21	7	1	1,700	1,700	17	29,548	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Busan
Hyundai [NYK, KMTC]	FTS	M	weekly	21	7	3	3,576	1,192	52	62,154	Busan-Shanghai-Ho Chi Minh-Bangkok-Laem Chabang-Manila-Busan
Regional Container Lines (Grand China;1vsl)	RBC	M	weekly	21	7	1	1,216	1,216	17	21,135	Bangkok-Laem Chabang-Ho Chi Minh-Ningbo-Shanghai-Bangkok
Korea Marine Transport (CNC;1vsl, TS Line;1vsl) [Hyundai]	CHT	M	weekly	21	7	1	1,613	1,613	17	28,035	Incheon-Qingdao-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Xiamaen-Incheon
Korea Marine Transport (Gold Star;1vsl, Sinokor;1vsl) [Maersk]	ANS	M	weekly	28	7	2	3,213	1,607	26	41,884	Inchon-Busan-Ulsan-Shanghai-Hong Kong-Ho Chi Minh-Laem Chabang-Jakarta-Ho Chi Minh-Hong Kong-Shekou-Incheon
Korea Marine Transport (Sinokor;1vsl)	KTS	M	weekly	21	7	2	3,200	1,600	35	55,619	Ulsan-Busan-Hong Kong-Ho Chi Minh-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Shekou-Keelung-Ulsan
Korea Marine Transport (Hanjin;1vsl, STX Pan Ocean;1vsl)	NTS	M	weekly	21	7	1	1,440	1,440	17	25,029	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Busan
Korea Marine Transport (STX Pan Ocean;2vsls)	GTS	M	weekly	21	7	1	1,440	1,440	17	25,029	Shanghai-Busan-Ulsan-Pohang-Gwangyang-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Shanghai
TS Line	JHT	M	weekly	28	7	4	6,787	1,697	52	88,473	Osaka-Kobe-Nagoya-Yokohama-Tokyo-Keelung-Taichung-Kaohsiung-Hong Kong-Shekou-Laem Chabang-Shekou-Hong Kong-Osaka
TS Line (CNC;1vsl, KMTC;1vsl) [Hyundai]	CHT	M	weekly	21	7	1	1,679	1,679	17	29,183	Incheon-Qingdao-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Xiamaen-Incheon
Heung-A Shipping (Namsung;3vsls) [MOL, Hanjin, K Line]	BHS	M	weekly	21	3	4	4,836	1,209	70	84,054	Gwangyang-Ulsan-Busan-Hong Kong-Ho Chi Minh-Bangkok-Laem Chabang-Hong Kong-Busan-Gwangyang
Heung-A Shipping (STX;1vsl) [Samudera]	KCT	M	weekly	21	7	2	2,880	1,440	35	50,057	Incheon-Qingdao-Shanghai-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Xiamen-Incheon
STX Pan Ocean (CNC;1vsl, Yang Ming;1vsl)	CTS	M	weekly	21	7	1	1,138	1,138	17	19,780	Incheon-Qingdao-Shanghai-Ho Chi Minh-Laem Chabang-Hong Kong-Shekou-Incheon
STX Pan Ocean (Hanjin;1vsl, KMTC;1vsl)	NTS	M	weekly	21	7	1	1,440	1,440	17	25,029	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Busan
STX Pan Ocean (KMTC;1vsl)	GTS	M	weekly	21	7	2	2,328	1,164	35	40,463	Shanghai-Busan-Ulsan-Pohang-Gwangyang-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Shanghai
STX Pan Ocean (Heung-A;2vsls) [Samudera]	KCT	M	weekly	21	7	1	1,440	1,440	17	25,029	Incheon-Qingdao-Shanghai-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Xiamen-Incheon
SITC Container Lines	VTX1	M	weekly	28	7	4	4,318	1,080	52	56,288	Osaka-Kobe-Busan-Shanghai-Hong Kong-Ho Chi Minh-Bangkok-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Ningbo-Shanghai-Osaka
SITC Container Lines	VTX2	M	weekly	28	7	4	3,778	945	52	49,249	Tokyo-Yokohama-Nagoya-Ningbo-Xiamen-Ho Chi Minh-Bangkok-Laem Chabang-Haiphong-Fang Cheng-Shekou-Ningbo-Tokyo
Gold Star Line (KMTC;2vsls, Sinokor;1vsl) [Maersk]	ANS	M	weekly	28	7	1	1,608	1,608	13	20,961	Inchon-Busan-Ulsan-Shanghai-Hong Kong-Ho Chi Minh-Laem Chabang-Jakarta-Ho Chi Minh-Hong Kong-Shekou-Incheon
Gold Star Line [CNC]	CVX	M	weekly	28	7	3	3,619	1,206	39	47,176	Shanghai-Ningbo-Xiamen-Hong Kong-Ho Chi Minh-Laem Chabang-Port Klang-Laem Chabang-Ho Chi Minh-Hong Kong-Shanghai
Gold Star Line (Wan Hai;2vsl)	NTE	M	weekly	21	7	1	1,032	1,032	17	17,937	Tokyo-Yokohama-Nagoya-Hong Kong-Bangkok-Laem Chabang-Shekou-Tokyo
Sinokor (KMTC;2vsls, Gold Star;1vsl) [Maersk]	ANS	F	weekly	28	7	1	1,812	1,812	13	23,621	Inchon-Busan-Ulsan-Shanghai-Hong Kong-Ho Chi Minh-Laem Chabang-Jakarta-Ho Chi Minh-Hong Kong-Shekou-Incheon
Sinokor (KMTC;2vsls)	KTS	M	weekly	21	7	1	1,512	1,512	17	26,280	Ulsan-Busan-Hong Kong-Ho Chi Minh-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Shekou-Keelung-Ulsan

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Table 2.6-11 Liner services calling at Laem Chabang Port (4)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
Namsung Shipping (Heung-A;4vsls) [Hanjin, K Line]	BHS	M	weekly	21	3	3	2,878	959	52	50,022	Gwangyang-Ulsan-Busan-Hong Kong-Ho Chi Minh-Bangkok-Laem Chabang-Hong Kong-Busan-Gwangyang
Grand China Shipping (RCL;2vsls)	RBC	M	weekly	21	7	1	1,216	1,216	17	21,135	Bangkok-Laem Chabang-Ho Chi Minh-Hong Kong-Ningbo-Shanghai-Bangkok
Siam Paetra International (NYK;2vsl) [Hyundai]	PHX	M	weekly	21	7	1	1,094	1,094	17	19,015	Kobe-Osaka-Nagoya-Tokyo-Yokohama-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Kobe
Yanghai Shipping	KCT	M	weekly	21	7	3	3,182	1,061	52	55,306	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Keelung-Shanghai-Busan
Intra-Asia Sub Total						8	8,370	1,046	139	145,479	
Main Line Total						195	515,603	2,644	2,464	5,294,707	
MCC Transport	THA1	F	weekly	7	7	1	1,118	1,118	52	58,296	Tanjung Pelapas-Singapore-Laem Chabang-Tanjung Pelapas
MCC Transport	THA2	F	weekly	7	7	1	2,478	2,478	52	129,210	Tanjung Pelapas-Laem Chabang-Tanjung Pelepas
MCC Transport	THA3	F	weekly	7	7	1	2,452	2,452	52	127,854	Tanjung Pelapas-Laem Chabang-Tanjung Pelepas
MCC Transport [Evergreen]	IA3	F	weekly	14	7	2	3,104	1,552	52	80,926	Laem Chabang-Tanjung Pelapas-Singapore-Panjang-Jakarta-Tanjung Pelapas-Singapore-Laem Chabang
Evergreen Line (Pendulum Express Lines;1vsl)	LKX	F	weekly	14	7	1	2,778	2,778	26	72,426	Kaohsiung-Manila North-Manila South-Laem Chabang-Kaohsiung
Evergreen Line [Maersk]	SLH	F	weekly	7	7	1	1,510	1,510	52	78,736	Tanjung Pelapas-Laem Chabang-Tanjung Pelepas
Evergreen Line [Yang Ming, Cosco]	TWT	F	weekly	14	7	2	2,328	1,164	52	60,694	Hong Kong-Kaohsiung-Taichung-Laem Chabang-Bangkok-Hong Kong
Evergreen Line (OOCL;1vsl)	TMI	F	weekly	14	7	1	1,164	1,164	26	30,347	Bangkok-Laem Chabang-Port Klang-Tanjung Pelapas-Jakarta-Bangkok
NYK [Cosco, Sea Consortium]	APX	F	weekly	14	7	2	2,314	1,157	52	60,329	Bangkok-Laem Chabang-Singapore-Jakarta-Port Klang-Bangkok
OOCL (Evergreen;1vsl)	TMI	F	weekly	14	7	1	1,164	1,164	26	30,347	Bangkok-Laem Chabang-Port Klang-Tanjung Pelapas-Jakarta-Bangkok
MSC	Thai Express	F	weekly	7	3.5	2	4,843	2,422	104	252,528	Singapore-Laem Chabang-Singapore
CNC Line	Thailand Feeder	F	weekly	10.5	3.5	3	4,473	1,491	104	155,490	Port Klang-Bangkok-Laem Chabang-Tanjung Pelapas-Port Klang
K Line (Wan Hai;1vsl) [Cosco]	ASECO X	F	weekly	14	7	1	1,700	1,700	26	44,321	Bangkok-Laem Chabang-Singapore-Jakarta-Singapore-Port Klang-Singapore-Laem Chabang-Bangkok
K Line	ASECO S	F	weekly	7	7	1	1,118	1,118	52	58,296	Bangkok-Laem Chabang-Singapore-Jakarta-Singapore-Laem Chabang-Bangkok
Wan Hai (K Line;1vsl) [Pacific Eagle Lines]	ASECO X	F	weekly	14	7	1	1,700	1,700	26	44,321	Bangkok-Laem Chabang-Singapore-Jakarta-Singapore-Port Klang-Singapore-Laem Chabang-Bangkok
Cosco Container Lines [Evergreen, Sea Consortium, RCL]	SCS	F	weekly	21	7	3	5,568	1,856	52	96,777	Jakarta-Surabaya-Singapore-Laem Chabang-Ho Chi Minh-Jakarta
Cosco Container Lines	Thailand Feeder	F	weekly	14	7	2	1,600	800	52	41,714	Bangkok-Laem Chabang-Singapore-Bangkok
Hanjin [PIL]	TSS	F	weekly	7	7	1	1,032	1,032	52	53,811	Singapore-Bangkok-Laem Chabang-Singapore
Regional Container Lines [MOL, K Line]	RBS	F	weekly	14	7	2	2,232	1,116	52	58,191	Bangkok-Laem Chabang-Manila-Hong Kong-Ho Chi Minh-Bangkok
Regional Container Lines	RTS	F	weekly	7	1.4	5	5,268	1,054	261	274,689	Singapore-Bangkok-Laem Chabang-Singapore
Samudera Shipping	BKK1	F	weekly	7	7	1	600	600	52	31,286	Singapore-Kuantan-Lem Chabang-Bangkok-Laem Chabang-Singapore
Samudera Shipping	BKK2	F	every 8 days	8	8	1	1,054	1,054	46	48,089	Singapore-Laem Chabang-Bangkok-Laem Chabang-Singapore
Samudera Shipping	BKK3	F	every 8 days	8	8	1	1,054	1,054	46	48,089	Singapore-Laem Chabang-Bangkok-Laem Chabang-Singapore
Advance Container Lines [PIL]	TSS	F	weekly	7	3.5	2	2,031	1,016	104	105,902	Singapore-Bangkok-Laem Chabang-Singapore
Pendulum Express Lines (Evergreen;1vsl)	LKX	F	weekly	14	7	1	2,072	2,072	26	54,020	Kaohsiung-Manila North-Manila South-Laem Chabang-Kaohsiung
Bien Dong Shipping	Vietnam /Thailand	F	weekly	14	7	2	1,258	629	52	32,798	Haiphong-Ho Chi Minh-Bangkok-Laem Chabang-Ho Chi Minh-Haiphong
Feeder Total						42	58,013	1,381	1,551	2,129,488	
Total						237	573,616	2,420	4,015	7,424,196	

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Table 2.6-12 Liner services calling at Cai Mep Port (1)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity /vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
Maersk Line	TP6	M	weekly	98	7	14	127,198	9,086	52	473,748	Bremerhaven-Felixstowe-Le Havre-Tangier-Algeciras-Tanjung Pelapas-**Cai Mep**-Nansha-Yantian-Hong Kong-Los Angeles-Ningbo-Shanghai-Nansha-Yantian-Tanjung Pelapas-Tangier-Bremerhaven
MOL [APL, Hyundai]	PSX	M	weekly	49	7	7	44,654	6,379	52	332,627	Laem Chabang-**Cai Mep**-Hong Kong-Yantian-Los Angeles-Oakland-Tokyo-Hong Kong-Da Chan Bay-Laem Chabang
NYK [Hapag, OOCL, Hyundai]	SCX	M	weekly	49	7	7	44,132	6,305	52	328,738	Laem Chabang-Singapore-**Cai Mep**-Kaohsiung-Los Angeles-Oakland-Kaohsiung-Shekou-Laem Chabang
APL [MOL, Hyundai]	PS1	M	weekly	49	7	7	36,459	5,208	52	271,582	Laem Chabang-Singapore-**Cai Mep**-Yantian-Hong Kong-Seattle-Vancouver-Yokohama-Kaohsiung-Chiwan-Laem Chabang
CSAV	ASIAM	M	every 8 days	77	8	10	34,844	3,484	47	165,170	Nhava Sheva-Mundra-Karachi-Port Klang-**Cai Mep**-Yantian-Shanghai-Ningbo-Long Beach-Oakland-Busan-Shanghai-Ningbo-Chiwan-Port Klang-Colombo-Nhava Sheva
Hanjin (Cosco; 1vsl) [K Line, Wan Hai]	SJX	M	weekly	49	7	6	25,136	4,189	45	187,238	Port Klang-Singapore-**Cai Mep**-Hong Kong-Yantian-Osaka-Tokyo-Long Beach-Oakland-Tokyo-Osaka-Hong Kong-Port Klang
Cosco Container Lines (Hanjin;6vsls) [K Line, Wan Hai]	SJX	M	weekly	49	7	1	5,106	5,106	7	38,034	Port Klang-Singapore-**Cai Mep**-Hong Kong-Yantian-Osaka-Tokyo-Long Beach-Oakland-Tokyo-Osaka-Hong Kong-Port Klang
USWC Sub Total						52	317,529	6,106	308	1,797,137	
CMA CGM [APL, Evergreen, ANL]	FAL3	M	weekly	77	7	11	115,275	10,480	52	546,433	Qingdao-Ningbo-Chiwan-Nansha-Yantian-**Cai Mep**-Port Klang-Marsaxlokk-Le Havre-Dunkirk-Zeebrugge-Rotterdam-Hamburg-Zeebrugge-Southampton-Beirut-Jeddah-Port Klang-Chiwan-Qingdao
CMA CGM [Maersk, APL, Evergreen, ANL]	Med Club Express	M	weekly	77	7	11	88,812	8,074	52	420,992	Gwangyang-Busan-Shanghai-Xiamen-Hong Kong-Nansha-Chiwan-**Cai Mep**-Tanjung Pelapas-Port Klang-Port Said East-Beirut-Marsaxlokk-Valencia-Barcelona-Fos-Genoa-Marsaxlokk-Damietta-Khor Fakkan-Port Klang-Nansha-Gwangyang
MOL [CMA CGM]	JEX	M	weekly	70	7	10	67,240	6,724	52	350,609	Kobe-Nagoya-Shimizu-Tokyo-Hong Kong-Yantian-**Cai Mep**-Singapore-Rotterdam-Hamburg-Le Havre-Tangiers-Jeddah-Singapore-Yantian-Hong Kong-Kobe
Hanjin [Cosco, K Line, Yang Ming, UASC]	NE5	M	weekly	63	7	9	50,604	5,623	52	293,182	Shanghai-Ningbo-Kaohsiung-Yantian-**Cai Mep**-Singapore-Algeciras-Hamburg-Rotterdam-Le Havre-Algeciras-Singapore-Shanghai
NYK (OOCL;7vsls, Hapag;2vsls)	EUD	M	weekly	70	7	1	5,980	5,980	5	31,181	Busan-Qingdao-Shanghai-Ningbo-Shekou-Yantian-**Cai Mep**-Singapore-Southampton-Le Havre-Hamburg-Rotterdam-Singapore-Shanghai-Busan
OOCL (Hapag;2vsls, NYK;1vsl)	EUD	M	weekly	70	7	7	38,786	5,541	37	202,241	Busan-Qingdao-Shanghai-Ningbo-Shekou-Yantian-**Cai Mep**-Singapore-Southampton-Le Havre-Hamburg-Rotterdam-Singapore-Shanghai-Busan
CSAV	ASMED	M	every 8 days	77	8	10	47,661	4,766	47	225,926	Qingdao-Shanghai-Ningbo-Xiamen-Hong Kong-Chiwan-**Cai Mep**-Port Klang-Jeddah-Marsaxlokk-La Spezia-Genoa-Fos-Barcelona-Valencia-Marsaxlokk-Jeddah-Port Klang-Hong Kong-Chiwan-Xingang-Qingdao
UASC [Hanjin, Cosco, CSCL]	AEC2	M	weekly	70	7	10	67,708	6,771	52	353,049	Busan-Shanghai-Xiamen-Yantian-**Cai Mep**-Port Klang-Jeddah-Algeciras-Le Havre-Rotterdam-Hamburg-Antwerp-Port Said East-Jeddah-Port Klang-Busan
Zim Integrated Shipping Services [Gold Star]	AME	M	weekly	77	7	11	42,417	3,856	52	201,068	Shanghai-Xiamen-Shenzhen-**Cai Mep**-Port Klang-Nhava Sheva-Haifa-Ashdod-Felixstowe-Antwerp-Hamburg-Alexandria-Limassol-Haifa-Ashdod-Port Klang-Shanghai
Hapag Lloyd (OOCL;7vsls, NYK;1vsl)	EUD	M	weekly	70	7	2	13,500	6,750	10	70,393	Busan-Qingdao-Shanghai-Ningbo-Shekou-Yantian-**Cai Mep**-Singapore-Southampton-Le Havre-Hamburg-Rotterdam-Singapore-Shanghai-Busan
Europe Sub Total						82	537,983	6,561	412.403	2,695,073	

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Table 2.6-13 Liner services calling at Cai Mep Port (2)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity /vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
MOL (K Line;7vsls) [Hanjin, Yang Ming, Cosco, UASC]	AWE4	M	weekly	63	7	2	12,700	6,350	12	73,579	Singapore-Cai Mep-Shekou-Hong Kong-Yantian-Singapore-Halifax-New York-Norfolk-Jacksonville-Savannnah-Singapore
Hanjin (Yang Ming;3vsls, Cosco;3vsls) [K Line, Hyundai]	AW5	M	weekly	63	7	3	16,949	5,650	17	98,197	Kaohsiung-Hong Kong-Yantian-Cai Mep-Singapore-New York-Norfolk-Boston-Singapore-Kaohsiung
Cosco Container Lines (Hanjin;3vsls, Yang Ming;3vsls) [Hyundai]	AW5	M	weekly	63	7	3	16,016	5,339	17	92,791	Kaohsiung-Hong Kong-Yantian-Cai Mep-Singapore-New York-Norfolk-Boston-Singapore-Kaohsiung
OOCL (Hapag;4vsls) [NYK]	AEX	M	weekly	70	7	6	34,114	5,686	31	177,880	Cai Mep-Laem Chabang-Singapore-Colombo-Cagliari-Halifax-New York-Savannah-Norfork-New York-Halifax-Cagliari-Jeddah-Colombo-Singapore-Cai Mep
K Line (MOL;2vsls) [Hanjin, Yang Ming, Cosco, UASC]	AWE4	M	weekly	63	7	7	39,240	5,606	41	227,343	Singapore-Cai Mep-Shekou-Hong Kong-Yantian-Singapore-Halifax-New York-Norfolk-Jacksonville-Savannnah-Singapore
Yang Ming (Hanjin;3vsls, Cosco;3vsls) [Hyundai]	AW5	M	weekly	63	7	3	15,492	5,164	17	89,755	Kaohsiung-Hong Kong-Yantian-Cai Mep-Singapore-New York-Norfolk-Boston-Singapore-Kaohsiung
Hapag Lloyd (OOCL;6vsls) [NYK]	AEX	M	weekly	70	7	4	23,552	5,888	21	122,807	Cai Mep-Laem Chabang-Singapore-Colombo-Cagliari-Halifax-New York-Savannah-Norfork-New York-Halifax-Cagliari-Jeddah-Colombo-Singapore-Cai Mep
USEC Sub Total						28	158,063	5,645	156	882,352	
APL [MOL, Hyundai]	JTV	M	weekly	21	7	3	7,434	2,478	52	129,210	Laem Chabang-Cai Mep-Kaohsiung-Tokyo-Yokohama-Nagoya-Kobe-Chiwan-Hong Kong-Laem Chabang
Intra-Asia Sub Total						3	7,434	2,478	52	129,210	
Main Line Total						165	1,021,009	6,188	929	5,503,772	
CMA CGM	Vietnam 3	F	weekly	14	7	2	2,084	1,042	52	54,333	Port Klang-Haiphong-Da Nang-Cai Mep-Singapore-Tanjung Pelapas-Port Klang
Ocean Feeder Sub Total						2	2,084	1,042	52	54,333	
Gemadept	Mekong River waterway	F	weekly	7	0.8	9	728	81	469	37,960	Phnom Penh-Cai Mep-Ho Chi Minh-Phnom Penh
Sovereign	Mekong River waterway	F	weekly	7	2.3	3	312	104	156	16,269	Phnom Penh-Cai Mep-Ho Chi Minh-Phnom Penh
SNP-Cypress	Mekong River waterway	F	weekly	7	3.5	2	168	84	104	8,760	Phnom Penh-Cai Mep-Ho Chi Minh-Phnom Penh
Hai Minh	Mekong River waterway	F	weekly	7	7.0	1	72	72	52	3,754	Phnom Penh-Cai Mep-Ho Chi Minh-Phnom Penh
Mekong River Waterway Sub Total						15	1,280	85	782	66,743	
Feeder Total						17	3,364	198	834	121,076	
Total						182	1,024,373	5,628	1,763	5,624,848	

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Table 2.6-14 Liner services calling at Ho Chi Minh Port (1)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
Rickmers Line	Euro-Asia	M	2 shipments /month	126	14	9	16,904	1,878	26	48,968	Hamburg-Antwerp-Genoa-Jakarta-Singapore-Laem Chabang-Ho Chi Minh-Hong Kong-Shanghai-Dalian-Xingang-Qingdao-Masan-Kobe-Yokohama-Houston-New Orleans-Philadelphia-Hamburg
Europe Sub Total						9	16,904	1,878	26	48,968	
Tasman Orient Line	East South East Asia	M	3 sailing /month	63	10.5	6	9,164	1,527	35	53,093	Auckland-Wellington-Tauranga-Ho Chi Minh-Jakarta-Sri Racha-Jurong-Lae-Noumea-Lautoka-Suva-Auckland
Oceania Sub Total						6	9,164	1,527	35	53,093	
CNC Line (MCC;2vsls, TS Line;1vsl)	IA5	M	weekly	28	7	1	1,716	1,716	13	22,369	Laem Chabang-Ho Chi Minh-Hong Kong-Kaohsiung-Shanghai-Osaka-Tokyo-Yokohama-Nagoya-Kaohsiung-Hong Kong-Yantian-Ho Chi Minh-Sihanoukville-Laem Chabang
CNC Line (Yang Ming;1vsl, STX Pan Ocean;1vsl)	CTS	M	weekly	21	7	1	1,713	1,713	17	29,774	Incheon-Qingdao-Shanghai-Ho Chi Minh-Laem Chabang-Hong Kong-Shekou-Incheon
CNC Line (Yang Ming;2vsls)	JKS	M	weekly	21	7	1	1,740	1,740	17	30,243	Osaka-Hiroshima-Moji-Hakata-Busan-Gwangyang-Keelung-Taichung-Kaohsiung-Hong Kong-Ho Chi Minh-Hong Kong-Shekou-Xiamen-Osaka
CNC Line (Wan Hai;1vsl, TS Line;1vsl)	NCX	M	weekly	21	7	1	1,698	1,698	17	29,513	Dalian-Xingang-Qingdao-Lianyungang-Hong Kong-Shekou-Ho Chi Minh-Taichung-Dalian
MOL (RCL;1vsl) [OOCL, Bien Dong]	CBC	M	weekly	21	7	2	2,064	1,032	35	35,874	Nagoya-Tokyo-Yokohama-Shanghai-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Nagoya
MCC Transport (CNC Line;1vsl)	IA5	M	weekly	28	7	3	4,877	1,626	39	63,575	Laem Chabang-Ho Chi Minh-Hong Kong-Kaohsiung-Shanghai-Osaka-Tokyo-Yokohama-Nagoya-Kaohsiung-Hong Kong-Yantian-Ho Chi Minh-Sihanoukville-Laem Chabang
Hanjin (KMTC;1vsl, STX Pan Ocean;1vsl)	NTS	M	weekly	21	7	1	1,700	1,700	17	29,548	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Busan
Hanjin (STX Pan Ocean;1vsl) [Hapag, Yang Ming, Sinokor]	NHS	M	weekly	21	7	2	3,400	1,700	35	59,095	Gwangyang-Busan-Hong Kong-Ho Chi Minh-Singapore-Pasir Gudang-Ho Chi Minh-Hong Kong-Gwangyang
Cosco Container Lines [Evergreen, OOCL, Sea Consortium, RCL]	SCS	M	weekly	21	7	3	5,568	1,856	52	96,777	Jakarta-Surabaya-Singapore-Laem Chabang-Ho Chi Minh-Jakarta
Cosco Container Lines	HSH	M	weekly	21	7	3	5,568	1,856	52	96,777	Shantou-Hong Kong-Zhanjiang-Singapore-Ho Chi Minh-Shantou
NYK (Siam Paetra;1vsl) [Hyundai]	PHX	M	weekly	21	7	2	2,354	1,177	35	40,915	Kobe-Osaka-Nagoya-Tokyo-Yokohama-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Kobe
NYK	TWX	M	weekly	28	7	4	4,497	1,124	52	58,622	Tokyo-Kawasaki-Yokohama-Nagoya-Yokkaichi-Kobe-Cai Lan-Ho Chi Minh-Singapore-Jakarta-Ho Chi Minh-Cai Lan-Hong Kong-Tokyo
OOCL (Wan Hai;3vsls)	CHL	M	weekly	28	7	1	1,512	1,512	13	19,710	Shanghai-Dalian-Xingang-Qingdao-Hong Kong-Shekou-Hong Kong-Ho Chi Minh-Laem Chabang-Hong Kong-Shanghai
OOCL (Evergreen;1vsl, Yang Ming;1vsl)	THX	M	weekly	21	7	1	1,710	1,710	17	29,721	Ho Chi Minh-Kaohsiung-Keelung-Hong Kong-Ho Chi Minh-Kaohsiung-Taichung-Ho Chi Minh
Wan Hai (OOCL;1vsl)	CHL	M	weekly	28	7	3	4,065	1,355	39	52,990	Shanghai-Dalian-Xingang-Qingdao-Hong Kong-Shekou-Hong Kong-Ho Chi Minh-Laem Chabang-Hong Kong-Shanghai
Wan Hai (TS Linei;1vsl, CNC;1vsl)	NCX	M	weekly	21	7	1	1,504	1,504	17	26,141	Dalian-Xingang-Qingdao-Lianyungang-Hong Kong-Shekou-Ho Chi Minh-Taichung-Dalian
Wan Hai [MOL]	JSV	M	weekly	21	7	3	4,778	1,593	52	83,046	Hakata-Mizushima-Kobe-Osaka-Keelung-Taichung-Kaohsiung-Da Nang-Ho Chi Minh-Kaohsiung-Taichung-Keelung-Hakata
Wan Hai (K Line;1vsl)	JCV	M	weekly	21	7	2	3,465	1,733	35	60,225	Tokyo-Yokohama-Shanghai-Hong Kong-Huangpu-Da Nang-Ho Chi Minh-Hong Kong-Shekou-Tokyo
Wan Hai	KVS	M	weekly	21	7	3	3,549	1,183	52	61,685	Incheon-Gwangyang-Ulsan-Busan-Keelung-Taichung-Hong Kong-Ho Chi Minh-Kaohsiung-Taichung-Keelung-Incheon

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Table 2.6-15 Liner services calling at Ho Chi Minh Port (2)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
K Line [Hanjin, TS Line]	B1	M	weekly	21	7	3	5,100	1,700	52	88,643	Tokyo-Yokohama-Shimizu-Nagoya-Shanghai-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Tokyo
K Line (Wan hai;2vsls) [OOCL]	Jaseco-5(JCV)	M	weekly	21	7	1	1,700	1,700	17	29,548	Tokyo-Yokohama-Shanghai-Hong Kong-Huangpu-Da Nang-Ho Chi Minh-Hong Kong-Shekou-Tokyo
Evergreen Line [Cosco]	NSC	M	weekly	21	7	3	4,854	1,618	52	84,367	Tokyo-Yokohama-Shimizu-Nagoya-Yokkaichi-Taichung-Kaohsiung-Hong Kong-Ho Chi Minh-Hong Kong-Shekou-Hong Kong-Tokyo
Evergreen Line (OOCL;1vsl, Yang Ming;1vsl)	THX	M	weekly	21	7	1	1,452	1,452	17	25,237	Ho Chi Minh-Kaohsiung-Keelung-Hong Kong-Ho Chi Minh-Kaohsiung-Taichung-Ho Chi Minh
Yang Ming (CNC;1vsl, STX Pan Ocean;1vsl)	CTS	M	weekly	21	7	1	1,687	1,687	17	29,322	Incheon-Qingdao-Shanghai-Ho Chi Minh-Laem Chabang-Hong Kong-Shekou-Incheon
Yang Ming (Evergreen;1vsl, OOCL;1vsl)	THX	M	weekly	21	7	1	1,805	1,805	17	31,373	Ho Chi Minh-Kaohsiung-Keelung-Hong Kong-Ho Chi Minh-Kaohsiung-Taichung-Ho Chi Minh
Yang Ming (CNC;1vsl)	JKS	M	weekly	21	7	2	3,610	1,805	35	62,745	Osaka-Hiroshima-Moji-Hakata-Busan-Gwangyang-Keelung-Taichung-Kaohsiung-Hong Kong-Ho Chi Minh-Hong Kong-Shekou-Xiamen-Osaka
China Shipping Container Lines	CVT	M	weekly	14	7	2	2,927	1,464	52	76,311	Hong Kong-Nansha-Shekou-Laem Chabang-Ho Chi Minh-Hong Kong
Hyundai [NYK, KMTC]	FTS	M	weekly	21	7	3	3,576	1,192	52	62,154	Busan-Shanghai-Ho Chi Minh-Bangkok-Laem Chabang-Manila-Busan
Hyundai (STX Pan Ocean;2vsls, Emirates;1vsl)	NIS	M	weekly	28	7	1	1,504	1,504	13	19,606	Inheon-Busan-Shanghai-Ho Chi Minh-Singapore-Jakarta-Surabaya-Singapore-Ho Chi Minh-Incheon
Emirates Shipping Line (STX Pan Ocean;2vsls, Emirates;1vsl)	NIS	M	weekly	28	7	1	1,500	1,500	13	19,554	Inheon-Busan-Shanghai-Ho Chi Minh-Singapore-Jakarta-Surabaya-Singapore-Ho Chi Minh-Incheon
SITC Container Lines	VTX1	M	weekly	28	7	4	4,318	1,080	52	56,288	Osaka-Kobe-Busan-Shanghai-Hong Kong-Ho Chi Minh-Bangkok-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Ningbo-Shanghai-Osaka
SITC Container Lines	VTX2	M	weekly	28	7	4	3,778	945	52	49,249	Tokyo-Yokohama-Nagoya-Ningbo-Xiamen-Ho Chi Minh-Bangkok-Laem Chabang-Haiphong-Fang Cheng-Shekou-Ningbo-Tokyo
TS Line (Wan Hai;1vsl, CNC;1vsl)	NCX	M	weekly	21	7	1	2,000	2,000	17	34,762	Dalian-Xingang-Qingdao-Lianyungang-Hong Kong-Shekou-Ho Chi Minh-Taichung-Dalian
TS Line	JTV	M	weekly	21	7	3	4,734	1,578	52	82,281	Osaka-Kobe-Moji-Busan-Gwangyang-Keelung-Taichung-Hong Kong-Ho Chi Minh-Hong Kong-Shekou-Xiamen-Osaka
Korea Marine Transport (Gold Star;1vsl, Sinokor;1vsl) [Maersk]	ANS	M	weekly	28	7	2	3,213	1,607	26	41,884	Inchon-Busan-Ulsan-Shanghai-Hong Kong-Ho Chi Minh-Laem Chabang-Jakarta-Ho Chi Minh-Hong Kong-Shekou-Incheon
Korea Marine Transport (Sinokor;1vsl) [Hyundai]	KTS	M	weekly	21	7	2	3,200	1,600	35	55,619	Ulsan-Busan-Hong Kong-Ho Chi Minh-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Shekou-Keelung-Ulsan
Korea Marine Transport (Hanjin;1vsl, STX Pan Ocean;1vsl)	NTS	M	weekly	21	7	1	1,440	1,440	17	25,029	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Busan
Heung-A Shipping (Namsung;3vsls) [MOL, Hanjin, K Line]	BHS	M	weekly	21	3	4	4,836	1,209	70	84,054	Gwangyang-Ulsan-Busan-Hong Kong-Ho Chi Minh-Bangkok-Laem Chabang-Hong Kong-Busan-Gwangyang
Regional Container Lines [MOL, K Line]	RBS	M	weekly	14	7	2	2,232	1,116	52	58,191	Bangkok-Laem Chabang-Manila-Hong Kong-Ho Chi Minh-Bangkok
Regional Container Lines (Grand China;1vsl)	RBC	M	weekly	21	7	1	1,216	1,216	17	21,135	Bangkok-Laem Chabang-Ho Chi Minh-Ningbo-Shanghai-Bangkok
STX Pan Ocean (CNC;1vsl, Yang Ming;1vsl)	CTS	M	weekly	21	7	1	1,138	1,138	17	19,780	Incheon-Qingdao-Shanghai-Ho Chi Minh-Laem Chabang-Hong Kong-Shekou-Incheon
STX Pan Ocean (Hanjin;1vsl, KMTC;1vsl)	NTS	M	weekly	21	7	1	1,440	1,440	17	25,029	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Busan

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Table 2.6-16 Liner services calling at Ho Chi Minh Port (3)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
STX Pan Ocean (Hanjin;2vsls) [Hapag, Yang Ming, OOCL, Sinokor]	NHS	M	weekly	21	7	1	1,713	1,713	17	29,774	Busan-Gwangyang-Shanghai-Hong Kong-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Busan
STX Pan Ocean (Hyundai;1vsl, Emirates;1vsl)	NIS	M	weekly	28	7	2	3,480	1,740	26	45,364	Inheon-Busan-Shanghai-Ho Chi Minh-Singapore-Jakarta-Surabaya-Singapore-Ho Chi Minh-Incheon
Gold Star Line (KMTC;2vsls, Sinokor;1vsl) [Maersk]	ANS	M	weekly	28	7	1	1,608	1,608	13	20,961	Inchon-Busan-Ulsan-Shanghai-Hong Kong-Ho Chi Minh-Laem Chabang-Jakarta-Ho Chi Minh-Hong Kong-Shekou-Incheon
Gold Star Line [CNC]	CVX	M	weekly	28	7	3	3,619	1,206	39	47,176	Shanghai-Ningbo-Xiamen-Hong Kong-Ho Chi Minh-Laem Chabang-Port Klang-Laem Chabang-Ho Chi Minh-Hong Kong-Shanghai
Namsung Shipping (Heung-A;4vsls) [Hanjin, K Line]	BHS	M	weekly	21	3	3	2,878	959	52	50,022	Gwangyang-Ulsan-Busan-Hong Kong-Ho Chi Minh-Bangkok-Laem Chabang-Hong Kong-Busan-Gwangyang
Sinokor (KMTC;2vsls, Gold Star;1vsl) [Maersk]	ANS	M	weekly	28	7	1	1,812	1,812	13	23,621	Inchon-Busan-Ulsan-Shanghai-Hong Kong-Ho Chi Minh-Laem Chabang-Jakarta-Ho Chi Minh-Hong Kong-Shekou-Incheon
Sinokor (KMTC;2vsls)	KTS	M	weekly	21	7	1	1,512	1,512	17	26,280	Ulsan-Busan-Hong Kong-Ho Chi Minh-Laem Chabang-Bangkok-Laem Chabang-Hong Kong-Shekou-Keelung-Ulsan
Grand China Shipping (RCL;2vsls)	RBC	M	weekly	21	7	1	1,216	1,216	17	21,135	Bangkok-Laem Chabang-Ho Chi Minh-Hong Kong-Ningbo-Shanghai-Bangkok
Siam Paetra International (NYK;2vsl) [Hyundai]	PHX	M	weekly	21	7	1	1,094	1,094	17	19,015	Kobe-Osaka-Nagoya-Tokyo-Yokohama-Laem Chabang-Bangkok-Laem Chabang-Ho Chi Minh-Kobe
Intra-Asia Sub Total						14	18,932	1,352	213	283,349	
Main Line Total						112	165,738	1,480	1,647	2,394,170	
CMA CGM	Vietnam 1	F	weekly	7	7	1	1,216	1,216	52	63,406	Port Klang-Ho Chi Minh-Tanjung Pelapas-Port Klang-
CMA CGM [Evergreen]	SVN2	F	weekly	7	7	1	1,439	1,439	52	75,034	Ho Chi Minh-Tanjung Pelapas-Singapore-Ho Chi Minh
MCC Transport	SVN2	F	weekly	7	7	1	4,472	1,439	52	75,034	Tanjung Pelapas-Singapore-HoChi Minh(SPCT, Cat Lai)-Tanjung Pelapas
Cosco Container Lines	SGN	F	weekly	7	7	1	5,568	5,568	52	290,331	Singapore-Ho Chi Minh-Singapore
APL	SVX	F	weekly	14	7	2	2,232	1,116	52	58,191	Singapore-Ho Chi Minh(Cat Lai)-Kaohsiung-Ho Chi Minh(VICT)-Singapore
APL [ACL]	SVS	F	weekly	7	7	1	1,538	1,538	52	80,196	Singapore-Ho Chi Minh(VICT, Cat Lai)-Kuantan-Singapore
NYK (SITC;1vsl)	TVS	F	weekly	14	7	1	1,157	1,157	26	30,165	Singapore-Laem Chabang-Ho Chi Minh-Haiphong-Ho Chi Minh-Singapore
Evergreen Line	VSS	F	weekly	7	7	1	1,038	1,038	52	54,124	Ho Chi Minh-Kuantan-Tanjung Pelapas-Ho Chi Minh
MSC	Saigon Express	F	weekly	7	7	1	1,858	1,858	52	96,881	Singapore-Ho Chi Minh-Singapore
MSC	Mekong Express	F	weekly	7	7	1	2,020	2,020	52	105,329	Singapore-Ho Chi Minh-Singapore
Vinalines Shipping[Samudera]	HCX	F	4 shipments /week	7	1.75	4	3,040	760	209	158,514	Ho Chi Ming-Haiphong-Ho Chi Minh
Regional Container Lines	RHS	F	weekly	7	7	1	1,036	1,036	52	54,020	Singapore-Ho Chi Minh(Cat Lai, VICT)-Kuantan-Singapore
Bien Dong Shipping	Vietnam /Thailand	F	weekly	14	7	2	1,258	629	52	32,798	Haiphong-Ho Chi Minh-Bangkok-Laem Chabang-Ho Chi Minh-Haiphong
Bien Dong Shipping [MOL, Hanjin]	VSS	F	weekly	14	7	2	1,766	883	52	46,042	Haiphong-Ho Chi Minh(Ben Nghe, Cat Lai)-Singapore-Ho Chi Minh(Ben Nghe, Cat Lai)-Haiphong
Samudera Shipping [OOCL]	HCX	F	weekly	7	7	1	1,032	1,032	52	53,811	Singapore-Ho Chi Minh(VICT, Cat Lai)-Kuantan-Singapore
Advance Container Lines [APL]	Vietnam Express	F	weekly	7	7	1	938	938	52	48,910	Singapore-Ho Chi Minh(VICT, Cat Lai)-Kuantan-Singapore
Gematrans [CMA CGM]	Vietnam 2	F	weekly	7	7	1	836	836	52	43,591	Port Klang-Ho Chi Minh-Port Klang
Hub Shipping [CNC, Gematrans]	VNEX	F	weekly	14	7	2	1,428	714	52	37,230	Port Klang-Ho Chi Minh-Haiphong-Ho Chi Minh-Port Klang
Hainan PO Shipping	CSV	F	weekly	14	7	2	1,428	714	52	37,230	Port Klang-Ho Chi Minh-Haiphong-Ho Chi Minh-Port Klang
Ocean Feeder Sub Total						27	35,300	1,307	1,121	1,440,838	

Prepared by Project Team

Table 2.6-17 Liner services calling at Ho Chi Minh Port (4)

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turnround (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
Gemadept	Mekong River waterway	F	weekly	7	0.8	9	728	81	469	37,960	Phnom Penh-Cai Mep-Ho Chi Minh-Phnom Penh
Sovereign	Mekong River waterway	F	weekly	7	2.3	3	312	104	156	16,269	Phnom Penh-Cai Mep-Ho Chi Minh-Phnom Penh
SNP-Cypress	Mekong River waterway	F	weekly	7	3.5	2	168	84	104	8,760	Phnom Penh-Cai Mep-Ho Chi Minh-Phnom Penh
Hai Minh	Mekong River waterway	F	weekly	7	7.0	1	72	72	52	3,754	Phnom Penh-Cai Mep-Ho Chi Minh-Phnom Penh
Mekong River Waterway Sub Total						15	1,280	85	782	66,743	
Feeder Total						42	36,580	871	1,903	1,507,580	
Total						154	202,318	1,314	3,550	3,901,750	

Prepared by Project Team

2) Rise of Cai Mep Port

As stated in the previous sub section (1), 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.

The scenario above will be realized on assumption that Cai Mep Port has enough depth to accommodate the mega container vessels. 14m of the current depth at Cai Mep will be able to accommodate up to 9,000 or 9,500 TEU type at maximum.

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

Table 2.6-18 below shows the details of the shipping lines' services and vessel deployment for the Sihanoukville Port. 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.

Table 2.6-18 Liner services calling at Sihanoukville Port

Shipping line (Partner) [Slot charterer]	Service name	Main line or feeder	Frequency	Turn round (days)	Interval (days)	Vessels deployed	Fleet capacity (TEU /service)	Average capacity/ vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports
MCC Transport (CNC Line; 1vsl)	IA5	M	weekly	28	7	3	4,877	1,626	39	63,575	Laem Chabang-Ho Chi Minh-Hong Kong-Kaohsiung-Shanghai-Osaka-Tokyo-Yokohama-Nagoya-Kaohsiung-Hong Kong-Yantian-Ho Chi Minh-**Sihanoukville**-Laem Chabang
CNC Line (MCC; 3vsls)	IA5	M	weekly	28	7	1	1,716	1,716	13	22,369	Laem Chabang-Ho Chi Minh-Hong Kong-Kaohsiung-Shanghai-Osaka-Tokyo-Yokohama-Nagoya-Kaohsiung-Hong Kong-Yantian-Ho Chi Minh-**Sihanoukville**-Laem Chabang
Regional Container Lines [Heung-A, NYK]	RSK	M	weekly	21	7	3	1,884	628	52	32,746	Songkhla-Hong Kong-Haiphong-Hong Kong-Keelung-Taichung-Hong Kong-**Sihanoukville**-Songkhla
SITC Shipping	VTX1	M	weekly	28	7	4	4,622	1,156	52	60,251	Osaka-Kobe-Busan-Shanghai-Hong Kong-Ho Chi Minh-**Sihanoukville**-Bangkok-Laem Chabang-Ho Chi Minh-Ningbo-Shanghai-Osaka
Intra-Asia Total						11	13,099	1,191	156	178,941	
MCC Transport [MOL, Yang Ming]	KOM1	F	weekly	7	7	1	1,030	1,030	52	53,707	Penang-Port Klang-Tanjung Pelapas-Singapore-**Sihanoukville**-Tanjung Pelapas-Singapore-Port Klang-Penang
Regional Container Lines	RSZ	F	weekly	7	3.5	2	1,778	889	104	92,710	Singapore-**Sihanoukville**-Songkhla-Singapore
Advance Container Lines	RSZ	F	weekly	7	7	1	604	604	52	31,494	Singapore-**Sihanoukville**-Songkhla-Singapore
APL	SCS	F	weekly	7	7	1	319	319	52	16,634	Singapore-Laem Chabang-**Sihanoukville**-Singapore
Cots Shipping		F	bi-weekly	14	14	1	198	198	26	5,162	Bangkok, Songkhla-**Sihanoukville**-Bangkok, Songkhla
Feeder Total						6	3,929	655	287	199,707	
Total						17	17,028	1,002	443	378,648	

Prepared by Project Team

(5) Forecast of liner services calling at Sihanoukville Port

Based on the aforementioned scenario, the Project Team make 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 Non-containerized cargo transport

Table 2.6-19 shows the historical handling volume of non-containerized cargoes at Sihanoukville Port.

Table 2.6-19 Historical handling volume of non-containerized cargoes at Sihanoukville Port

(unit: '000 tons)

Commodity		2005	2006	2007	2008	2009	2010
Imports							
	Rice	8					4
	General Cargo	8	5	21	36	16	121
	Machinery	10	17	25	19	15	17
	Cement	66	144	87	72	53	13
	Sugar		7				0
	Steel	17	18	15	35	11	20
	Steam coal			37	125	116	128
	Salt					29	0
	Sub Total	108	191	184	287	241	303
Exports							
	Machinery						0
	Wood chip						71
	General Cargo		0	10	0	0	0
	Wood processing		6		4		
	Sub Total	0	7	10	4	0	72
Total		108	198	194	291	241	375

Source: PAS

Number of vessel calls and deadweight in 2010 were as per Table 2.6-20 below.

Table 2.6-20 Number of vessel calls and size of vessels for the year 2010

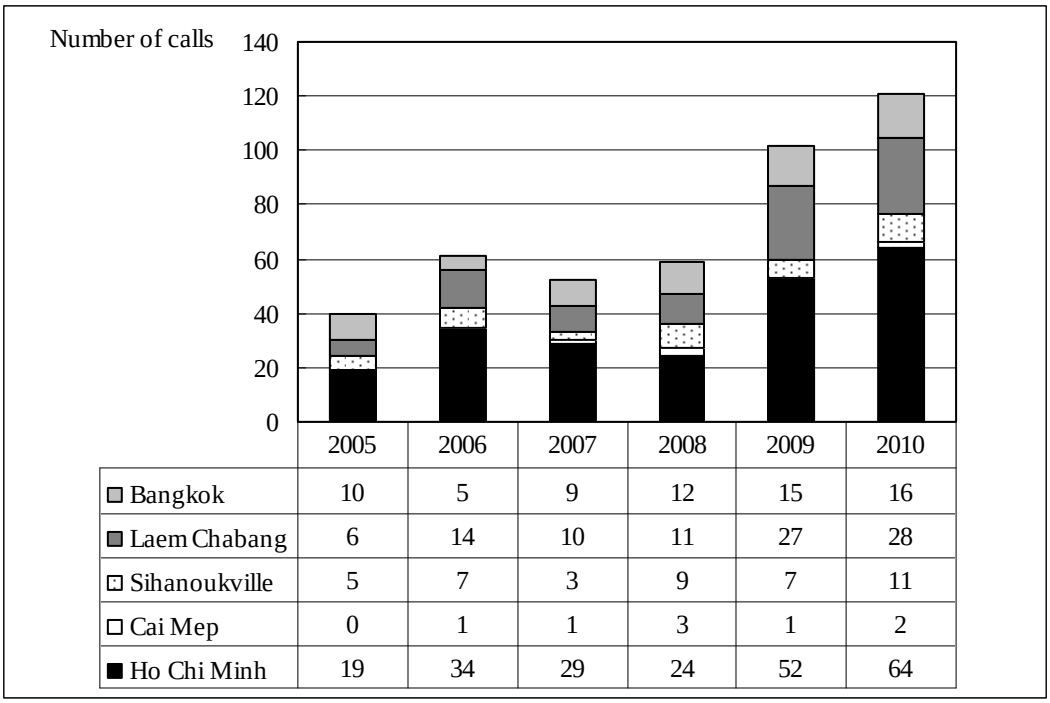
Vessel type	Number of calls	Total D/W	Vessel size (D/W)		
			Average	Maximum	Minimum
General cargo vessels	87	442,586	5,087	28,451	694
RoRo vessels	9	94,991	10,555	22,704	5,500
Bulkers	5	94,739	18,948	26,874	4,374
Total	101	632,316	6,261		

Source: Lloyds' List, organized by Project Team

2.6.3 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. Figure 2.6-12 shows the number of calls by port in recent 6 years. Total number of calls in those ports has rapidly increased from 40 calls in 2005 to 121 calls in 2010. During the years, Ho Chi Minh 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.



	2005	2006	2007	2008	2009	2010
Bangkok	10	5	9	12	15	16
Laem Chabang	6	14	10	11	27	28
Sihanoukville	5	7	3	9	7	11
Cai Mep	0	1	1	3	1	2
Ho Chi Minh	19	34	29	24	52	64

Source: Lloyds' List

Figure 2.6-12 Historical number of cruise ship calls at the ports in Gulf of Siam

Table 2.6-21 shows the passenger capacities and average days of stay of the cruise ships called 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.

Table 2.6-21 Capacities and stay days of cruise ships by port for the year 2010

Port	Number of calls	Total capacity of passengers	Capacity /ship			Average stay of ships (days)
			Average	Largest	Smallest	
Bangkok	16	7,530	471	824	208	2.1
Laem Chabang	28	45,251	1,616	3,100	208	1.7
Sihanoukville	11	12,974	1,179	3,100	226	1.1
Cai Mep	2	5,372	2,686	3,100	2,272	n/a
Ho Chi Minh	64	53,464	835	2,456	208	1.6
Total	121	124,591	1,030			

Prepared by Project Team

The details of the cruise ship calls at each port are shown in Table 2.6-22 to 2.6-26. At Sihanoukville, almost all the ships come in the dry season in and before April.

Table 2.6-22 Cruise ship calls at Sihanoukville Port in 2010

Cruise ship	Cruise line	Passenger capacity	LOA	GT	DWT	Arrived	Sailed	Stay days
Le Diamant	Compagnie du Ponant	226	124	8,282	1,575	31-Dec	1-Jan	2
Sun Princess	Princess Cruises	2,272	261	77,441	8,293	10-Jun	10-Jun	1
Europa	Happag-Lloyd	450	199	28,890	3,252	4-Apr	4-Apr	1
Columbus	Happag-Lloyd	423	144	15,067	1,300	27-Mar	27-Mar	1
Seabourn Odyssey	Seabourn	450	198	32,200	3,000	25-Mar	25-Mar	1
Amsterdam	Holland America Line	1,653	238	60,874	7,381	22-Mar	22-Mar	1
Arcadia	P&O Cruises	2,456	290	82,972	10,966	16-Mar	16-Mar	1
Diamond Princess	Princess Cruises	3,100	288	115,875	6,750	12-Mar	12-Mar	1
Azamara Quest	Azamara	694	181	30,277	2,000	14-Feb	14-Feb	1
Spirit of Adventure	Spirit of Adventure	470	139	9,570	1,796	1-Feb	1-Feb	1
Discovery	Voyages of Discovery	780	169	20,186	2,859	16-Jan	16-Jan	1
Total	11 calls	12,974				Average stay days=		1.1

Source: Lloyds' List, Prepared by Project Team

Table 2.6-23 Cruise ship calls at Bangkok Port in 2010

Vessel	Cruise Line	Passenger Capacity	Arrived	Sailed	Stay days
Seabourn Pride	Seabourn	208	16-Dec	18-Dec	3
Seabourn Pride	Seabourn	208	3-Sep	3-Sep	1
Nautica	Oceania Cruises	824	16-Apr	17-Apr	2
Seabourn Pride	Seabourn	208	6-Apr	7-Apr	2
Azamara Quest	Azamara	694	5-Apr	6-Apr	2
Silver Whisper	Silversea	486	11-Mar	12-Mar	2
Seabourn Pride	Seabourn	208	9-Mar	10-Mar	2
Nautica	Oceania Cruises	824	28-Feb	28-Feb	1
Azamara Quest	Azamara	694	23-Feb	24-Feb	2
Seabourn Pride	Seabourn	208	16-Feb	17-Feb	2
Azamara Quest	Azamara	694	15-Feb	17-Feb	3
Seabourn Pride	Seabourn	208	9-Feb	10-Feb	2
Spirit of Adventure	Spirit of Adventure	470	3-Feb	4-Feb	2
Azamara Quest	Azamara	694	26-Jan	27-Jan	2
Seabourn Pride	Seabourn	208	19-Jan	20-Jan	2
Azamara Quest	Azamara	694	18-Jan	20-Jan	3
Total	16 calls	7,530	Average stay days=		2.1

Prepared by Project Team

Table 2.6-24 Cruise ship calls at Laem Chabang Port in 2010

Cruise ship	Cruise line	Passenger capacity	Arrived	Sailed	Stay days
Costa Classica	Costa	1,420	30-Nov	1-Dec	2
Oriana	P&O Cruises	1,928	22-Nov	22-Nov	1
AIDAaura	Aida Cruises	1,687	21-Nov	22-Nov	2
Legend of the Seas	Royal Caribbean	2,076	18-Nov	20-Nov	3
Diamond Princess	Princess Cruises	3,100	5-Nov	6-Nov	2
AIDAaura	Aida Cruises	1,687	6-Nov	8-Nov	3
Amsterdam	Holland America	1,653	25-Oct	26-Oct	2
Diamond Princess	Princess Cruises	3,100	17-Oct	17-Oct	1
Sun Princess	Princess Cruises	2,272	24-Aug	24-Aug	1
Diamond Princess	Princess Cruises	3,100	14-Apr	14-Apr	1
Seabourn Pride	Seabourn	208	13-Apr	14-Apr	2
Amadea	Phoenix Reisen	604	11-Apr	13-Apr	3
AIDAcara	Aida Cruises	1,230	29-Mar	29-Mar	1
Seabourn Odyssey	Seabourn	450	23-Mar	24-Mar	2
Queen Victoria	Cunard	2,250	21-Mar	21-Mar	1
Seven Seas Voyager	Regent Seven Seas	752	20-Mar	20-Mar	1
Arcadia	P&O Cruises	2,456	17-Mar	17-Mar	1
AIDAcara	Aida Cruises	1,230	15-Mar	16-Mar	2
Diamond Princess	Princess Cruises	3,100	13-Mar	13-Mar	1
AIDAcara	Aida Cruises	1,230	15-Feb	16-Feb	2
Asuka II	NYK Cruises	800	13-Feb	14-Feb	2
Queen Mary 2	Cunard	2,800	8-Feb	8-Feb	1
Ocean Princess	Princess Cruises	824	4-Feb	4-Feb	1
AIDAcara	Aida Cruises	1,230	1-Feb	2-Feb	2
AIDAcara	Aida Cruises	1,230	18-Jan	19-Jan	2
Discovery	Voyages of	780	17-Jan	19-Jan	3
AIDAcara	Aida Cruises	1,230	4-Jan	5-Jan	2
Ocean Princess	Princess Cruises	824	3-Jan	3-Jan	1
Total	28 calls	45,251	Average stay days=		1.7

Prepared by Project Team

Table 2.6-25 Cruise ship calls at Cai Mep Port in 2010

Cruise ship	Cruise line	Passenger capacity	Arrived	Sailed
Sun Princess	Princess Cruises	2,272	10-Jun	n/a
Diamond Princess	Princess Cruises	3,100	12-Mar	n/a
Total	2 calls	5,372		

Prepared by Project Team

Table 2.6-26 Cruise ship calls at Ho Chi Minh Port in 2010

Cruise ship	Cruise line	Passenger capacity	Arrived	Sailed	Stay days
Azamara Quest	Azamara	694	31-Dec	1-Jan	2
AIDAaura	Aida Cruises	1,687	31-Dec	31-Dec	1
Seabourn Pride	Seabourn	208	29-Dec	30-Dec	2
Princess Daphne	Classic International	486	30-Dec	31-Dec	2
Europa	Happag-Lloyd	450	25-Dec	n/a	-
Le Diamant	Compagnie du Ponant	226	n/a	29-Dec	-
AIDAaura	Aida Cruises	1,687	17-Dec	17-Dec	1
AIDAaura	Aida Cruises	1,687	3-Dec	3-Dec	1
Silver Shadow	Silversea	423	3-Dec	4-Dec	2
Fuji Maru	Nippon Charter Cruise	328	n/a	8-Dec	-
Le Diamant	Compagnie du Ponant	226	n/a	7-Dec	-
Seabourn Pride	Seabourn	208	29-Nov	30-Nov	2
Costa Classica	Costa	1,420	27-Nov	n/a	-
AIDAaura	Aida Cruises	1,687	19-Nov	19-Nov	1
Costa Classica	Costa	1,420	15-Nov	15-Nov	1
Silver Shadow	Silversea	423	9-Nov	10-Nov	2
AIDAaura	Aida Cruises	1,687	5-Nov	5-Nov	1
Explorer	Stella Maritime	920	3-Nov	8-Nov	6
Costa Classica	Costa	1,420	2-Nov	2-Nov	1
Costa Romantica	Costa	1,440	2-Nov	3-Nov	2
Silver Shadow	Silversea	423	n/a	10-Nov	-
Silver Shadow	Silversea	423	n/a	26-Oct	-
Seven Seas Navigator	Regent Seven Seas	530	20-Oct	n/a	-
Seabourn Pride	Seabourn	208	n/a	7-Sep	-
Seabourn Pride	Seabourn	208	30-Aug	31-Aug	2
Seabourn Pride	Seabourn	208	20-Jul	21-Jul	2
Seabourn Pride	Seabourn	208	13-Jul	14-Jul	2
Super Star Virgo	Star Cruises	1,804	22-Jun	22-Jun	1
Costa Romantica	Costa	1,440	15-Jun	15-Jun	1
Super Star Virgo	Star Cruises	1,804	8-Jun	8-Jun	1
Costa Romantica	Costa	1,440	1-Jun	1-Jun	1
Costa Romantica	Costa	1,440	18-May	18-May	1
Amadea	Phoenix Reisen	604	9-Apr	9-Apr	1
AIDAcara	Aida Cruises	1,230	1-Apr	1-Apr	1
Europa	Happag-Lloyd	450	1-Apr	n/a	-
Clipper Odyssey	Clipper	128	31-Mar	n/a	-
Columbus	Happag-Lloyd	423	24-Mar	n/a	-
Costa Allegra	Costa	924	23-Mar	23-Mar	1
Seabourn Odyssey	Seabourn	450	20-Mar	n/a	-
Seabourn Pride	Seabourn	208	20-Mar	n/a	-
Seven Seas Voyager	Regent Seven Seas	752	17-Mar	18-Mar	2
Arcadia	P&O Cruises	2,456	n/a	n/a	-
Costa Classica	Costa	1,420	8-Mar	8-Mar	1
Silver Whisper	Silversea	486	8-Mar	9-Mar	2
Nautica	Oceania Cruises	824	5-Mar	6-Mar	2
Seabourn Pride	Seabourn	208	5-Mar	6-Mar	2
Explorer	Stella Maritime	920	26-Feb	n/a	-
Azamara Quest	Azamara	694	26-Feb	n/a	-
AIDAcara	Aida Cruises	1,230	n/a	n/a	-
Athena	Classic International	580	n/a	n/a	-
Silver Whisper	Silversea	486	20-Feb	n/a	-
Seabourn Pride	Seabourn	208	20-Feb	n/a	-
AIDAcara	Aida Cruises	1,230	13-Feb	13-Feb	1
Azamara Quest	Azamara	694	11-Feb	12-Feb	2
Asuka II	NYK Cruises	800	9-Feb	n/a	-
Spirit of Adventure	Spirit of Adventure	470	n/a	10-Feb	-
AIDAcara	Aida Cruises	1,230	30-Jan	30-Jan	1
Spirit of Adventure	Spirit of Adventure	470	29-Jan	30-Jan	2
Azamara Quest	Azamara	694	29-Jan	30-Jan	2
Costa Classica	Costa	1,420	26-Jan	26-Jan	1
Seabourn Pride	Seabourn	208	23-Jan	n/a	-
Discovery	Voyages of Discovery	780	n/a	23-Jan	-
AIDAcara	Aida Cruises	1,230	16-Jan	16-Jan	1
Azamara Quest	Azamara	694	n/a	15-Jan	-
Total	64 calls	53,464	Average satay days=		1.6

Prepared by Project Team

(2) Characteristic features of the cruise tourism

Cruise tourism has some quite different features compared with the ordinary style of tourism. The way of operations for cruise ships is also different from the same for cargo ships. Following points need to be recognized:

1) Sailing schedule to be fixed well in advance

- As the cruise companies are dealing with the human tourists, their process of scheduling and arrangement at the port are quite different from those of cargo ships. As it takes long time for cruise companies to promote and sell the expensive cruise packages, they usually fix the calling ports and cruise schedule well in advance; as long as 1 or 2 years before sailing.
- The cruises companies give a berthing request to all the calling ports immediately after they fix the sailing schedule. Thus a port which has an intention to induce cruise ships needs to give the cruise company a commitment to secure the berthing window at that moment.
- Equipped with luxurious fittings and manned with large number of crew, the daily cost of a cruise ship is much higher than that of a cargo ship. The land operation for the passengers at a port needs to be planned well in advance, as it will be a "fight against time" on the day of ship's arrival, and also the total price amount of the optional tours which passengers join will be huge in case of large cruise ships. Therefore, the sailing schedule once fixed will never be changed or delayed, otherwise the failure of a port may jeopardize the arrangement at the next port and cost a great deal to the cruise company.

2) Safety berthing

- Safety is given priority over any other issues, as it is a matter of life for the passengers; generally a cruise ship needs to be moored tight at the berth with a solid structure and enough length, dolphins should not be used. In case of shallow water, the passengers may go ashore by the tender boats provided the water is calm enough.
- That is why the cruise ships mostly come to this area in the dry season, not the rainy season.

3) Optional tours

- Most of the passengers enjoy the optional tours at every calling port. Variety of tours need to be prepared according to the individual's taste. In case of large cruise ships, an extensive parking area needs to be secured for tour buses just behind the berth.
- Enough number of CIQ officers need to standby at the berth for quick clearance of the passengers.

4) Passengers' preference

- Ocean cruising is an expensive product compared with other ordinary tour packages. The passengers of cruise ships tend to have strong preference in exploring untouched natural beauty or little known cultural heritages that ordinary tourists hardly access.

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

In the sense stated in (2) - 4) above, Sihanoukville may fit the cruise ship passengers' taste and have the potential to be more spotlighted as a likely destination for cruise tourism.

Provided that the physical issues stated in 1) to 3) above are improved, Sihanoukville will be able to attract more cruise ships even in rainy season.

In addition, the flying route between Sihanoukville and Siem Reap which resumed operation in December 2011 will also be effective to induce cruise passengers. As of February 1, 2012, 3 weekly

flights are in operation for outbound and inbound respectively by 67-seater turboprop aircraft. According to the officers at Sihanoukville International Airport, its aircraft parking apron has a capacity up to 800 pax, which means that the passengers of a medium size cruise ship could be mobilized from Sihanoukville Port to Angkor Wat, if a sufficient number of chartered aircrafts can be arranged.

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

2.7.1 Cost and transit time of seaborne cargoes to/from major Cambodian cities at present and in the future

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 after-mentioned analysis in 2.7.4 Comparative advantage of Sihanoukville Port and 3.2.1 Cargo Demand Forecast for Containers. 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.

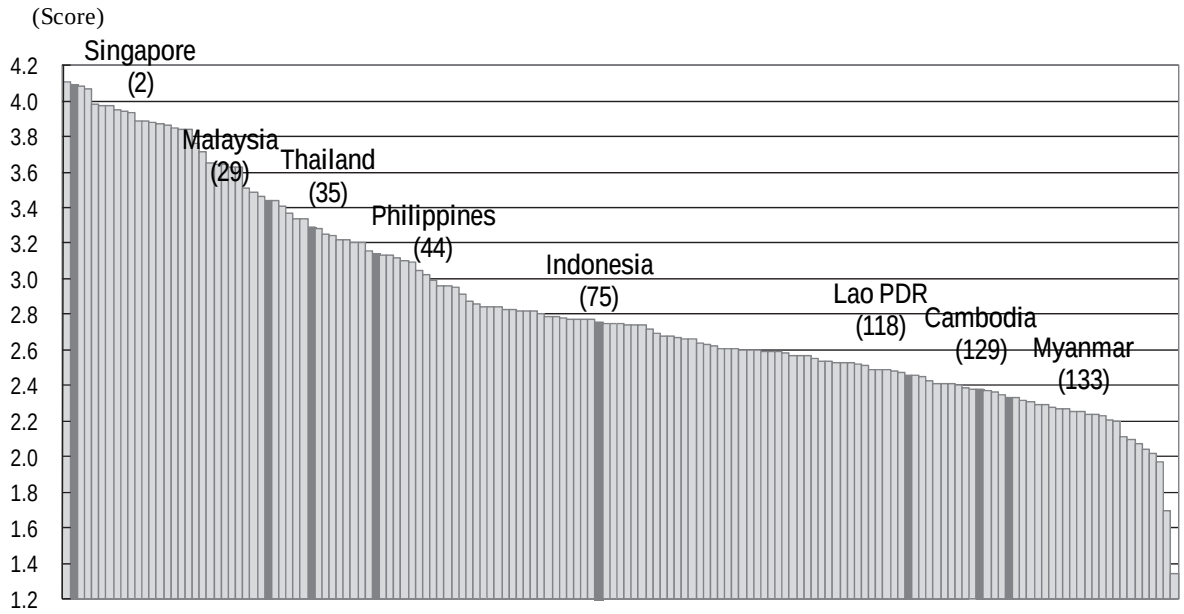
(1) Land transport

1) Logistics performance index

The efficiency of logistics has been a fundamental factor affecting trade and manufacturing. Better logistics performance is strongly associated with trade expansion, export diversification, ability to attract FDI, and economic growth.

The logistics performance index (LPI) is a multidimensional assessment rating of typical logistics performance made by the World Bank. The scale, which ranges from one (worst) to five (best), is based on the following key performance indicators: 1) efficiency of the customs clearance process, 2) quality of trade and transport-related infrastructure, 3) ease of arranging competitive priced shipments, 4) competence and quality of logistics services, 5) ability to track and trace consignments, and 6) frequency with which shipments reach the consignee within the scheduled or expected time.

Figure 2.7-1 illustrates the LPI score (vertical axis) and its ranking (mentioned in parenthesis) in 2010, and those for ASEAN countries are highlighted in dark color bars. In 2010, Cambodia ranked 129th (81st in 2007) in the world, and its average score is 2.37. Table 2.7-1 shows the detailed LPI scores and rank of Cambodia by each evaluation item. Cambodia's score on all evaluation items were relatively low, especially on international shipment and timeliness. It means that improvement of shipment and timeliness is an urgent issue regarding logistics in Cambodia in order for it to meet international logistics standards.



Source: Connecting to compete 2010, Trade Logistics in the Global Economy

Figure 2.7-1 LPI ranking and score in the world in 2010

Table 2.7-1 Detailed LPI score and ranking of Cambodia in 2010

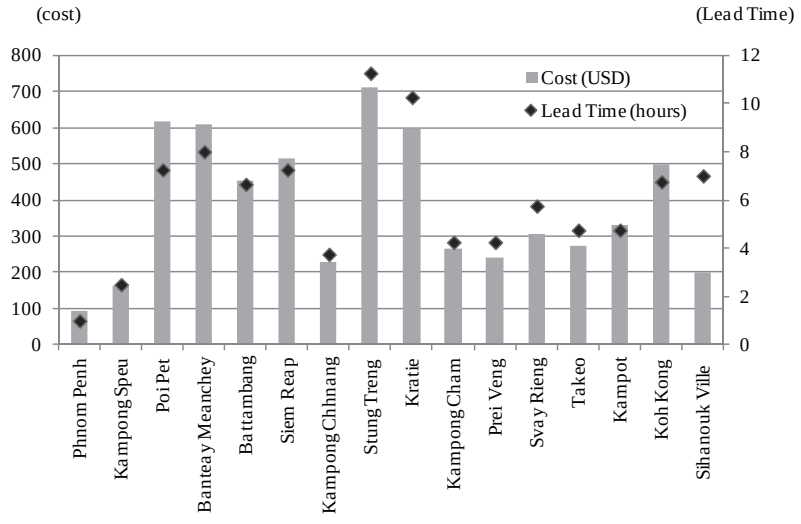
Evaluation Items	Score	Rank
Customs	2.28	95
Infrastructure	2.12	114
International shipments	2.19	146
Logistics quality and competence	2.29	118
Trackingand tracing	2.50	111
Timeliness	2.84	132
(Average)	2.37	—
(Total)	14.22	129

Source: Connecting to compete 2010, Trade Logistics in the Global Economy

2) Transportation cost and lead time

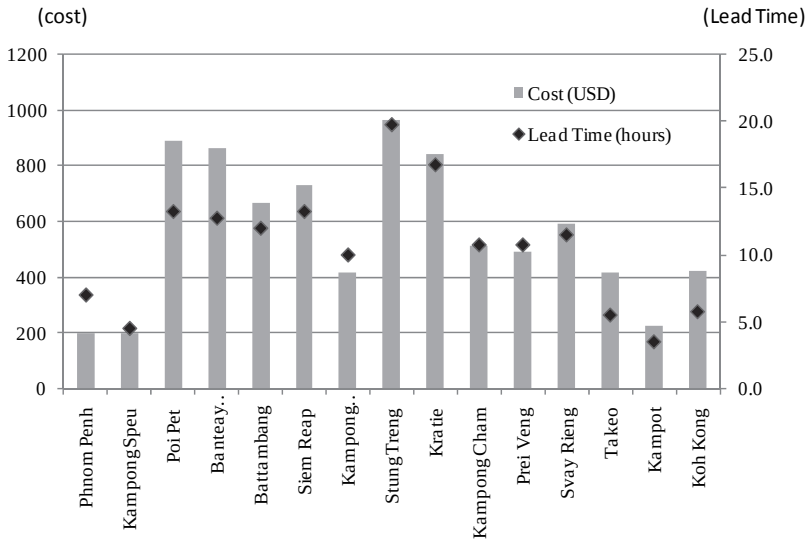
The Project Team conducted hearing surveys with several trucking companies and freight forwarders regarding the present situation of domestic transportation. Figure 2.7-2 shows the cost and lead time between Phnom Penh Port and major cities in Cambodia, and Figure 2.7-3 shows the cost and lead time between Sihanoukville Port and major cities in Cambodia. It was observed that transportation cost increases proportionally to lead time. However, transportation cost between Phnom Penh and Sihanoukville Port is quite low compared with other routes. This is because trucks are able to travel and maintain high speeds due to NR 4's good condition; therefore, the lead time of such trucks could be shortened. Furthermore, the route is the most thriving logistics trunk in Cambodia, and it is likely that competition among freight forwarders will bring down their prices.

It was supposed that the lead time will be slightly shortened with respect to the development or improvement of the road network in the future. Regarding transportation cost, it was expected to be reduced through competition among trucking companies and freight forwarders, although it depends to a large extent on fuel price.



Prepared by Project Team

Figure 2.7-2 Cost and lead time between Phnom Penh Port and major cities in Cambodia



Prepared by Project Team

Figure 2.7-3 Cost and lead time between Sihanoukville Port and major cities in Cambodia

(2) Inland waterway

As stated in 2.3.3-(2), inland waterway for the transportation of containers is currently limited at the Mekong River between Phnom Penh and Cai Mep/Ho Chi Minh.

1) Costs

Prevailing barge freight rates for containers are in the range of USD170-200/20', USD310-400/40' including loading stevedorage at Phnom Penh Port and customs clearance charges at Cambodia/Vietnam border on the Mekong River. The rates are different by shipping line depending on the volume. In this report, the lowest rates are bench-marked.

It should be noted that the barge freight is paid to the barge operators by the shipping lines who will include those costs in the ocean freight rates offered for the cargoes received at Phnom Penh CY, which means that the exporters are not the actual payer of the barge freight.

The barge freight rates for the target years of 2020 and 2030 are calculated applying 3.7% of average inflation rate from 2011 to 2030 projected by IMF. The size of barges is assumed to be the same as that of existing barges throughout the years based on the consideration stated in 3)-b) below. The result of calculation is as follows:

(USD)

		2010	2020	2030
Barge freight rate	20'	175.0	251.7	361.9
	40'	310.0	445.8	641.1

2) Time

As stated in 2.3.3-(2)-1), the barges are currently sailing between Phnom Penh and Cai Mep/Ho Chi Minh with 6 days turnaround. The transit time from Phnom Penh to Cai Mep is 25 hours, and to Ho Chi Minh 33 hours including 2 hours stay at Cambodia/Vietnam border.

As it would be difficult for barges to increase the navigation speed along the Mekong River, the shortening of the transit time will be achieved only by the facilitation of border procedures, such as extension of the border office hours, followed by the total abolishment of border procedures. The Project Team assumes that the procedures will be simplified by half by 2020, and total abolishment of the border procedures will be achieved by 2030, since the relevant parties concerned in Cambodia and Vietnam support the idea.

The Project Team also assumes that the hours so saved at the border will be spent mostly at Cai Mep Port to make additional calls at different berths or load more import containers, maintaining 6 days of current turnaround time as it is. Based on the above, sailing schedule and transit times of barges for the target years are forecasted as per Table 2.7-2 below.

It must be noted that the transit times of barges between Phnom Penh Port and Cai Mep/Ho Chi Minh Port are included in the ocean transit times stated in later section of 2.7.1-(4)-2)

Table 2.7-2 Forecast of sailing schedule and transit times of barges

Sailing schedule of barges

Present schedule			
Sunday	01:00	ETD	Phnom Penh
Sunday	07:00	ETA	Border
	09:00	ETD	Border
Monday	02:00	ETA	Cai Mep
	05:00	ETD	Cai Mep
Monday	10:00	ETA	Ho Chi Minh
Wednesday	24:00	ETD	Ho Chi Minh
Friday	07:00	ETA	Border
	09:00	ETD	Border
Friday	20:00	ETA	Phnom Penh

Schedule in 2020			
Sunday	01:00	ETD	Phnom Penh
Sunday	07:00	ETA	Border
	08:00	ETD	Border
Monday	01:00	ETA	Cai Mep
	06:00	ETD	Cai Mep
Monday	11:00	ETA	Ho Chi Minh
Thursday	01:00	ETD	Ho Chi Minh
Friday	08:00	ETA	Border
	09:00	ETD	Border
Friday	20:00	ETA	Phnom Penh

Schedule in 2030			
Sunday	01:00	ETD	Phnom Penh
Sunday	07:00	ETA	Border
	07:00	ETD	Border
Monday	00:00	ETA	Cai Mep
	07:00	ETD	Cai Mep
Monday	12:00	ETA	Ho Chi Minh
Thursday	02:00	ETD	Ho Chi Minh
Friday	09:00	ETA	Border
	09:00	ETD	Border
Friday	20:00	ETA	Phnom Penh

Transit times from Phnom Penh to Cai Mep/Ho Chi Minh

		2010	2020	2030
Transit time from Phnom Penh to Cai Mep	hours	25	24	23
Transit time from Phnom Penh to Ho Chi Minh	hours	33	34	35
Turnaround	days	6	6	6

Prepared by Project Team

3) Future vision and bottlenecks of inland waterways

a) Barges

In consideration of future progress in the facilitation of border procedures and the development of the new container terminal at Phnom Penh Port, physical bottleneck is not anticipated in particular in this transportation mode.

However, from an economic viewpoint, it is observed that the profitability of barge operators is declining badly due to the distress of main line carriers' financial situations. Though suffering from rising fuel cost, the barge operators have not been successful in increasing the barge freight rates for main line carriers. As a result, Hai Minh, one of previous 4 barge operators, withdrew from barge transportation business in late 2011. Under those circumstances, it might not be easy for the existing barge operators to make substantial investment in deploying additional barges, and for a new entrepreneur to enter into the barge transportation business. To reinforce their fragile management base, it might seem necessary to some barge operators to invite capital participation of main line carriers who in return can secure regular feeder slots with those barge operators.

b) Deployment of larger vessels

According to "Master Plan for Waterborne Transport on the Mekong River System in Cambodia" drafted by a Belgian consultant and approved by MPWT in 2006, operational scenarios are assumed based on the demand forecasts until 2035 as follows:

i) By 2015, container barges up to 3,000 DWT (capacity for 210 TEU, draft 5m) will be sailing between Phnom Penh and Ho Chi Minh, provided all channels are dredged at 6.5m deep/60m wide

ii) By 2025, sea-going vessels up to 5,000 DWT (capacity for 400 TEU, draft 6-6.5m) will be sailing between Phnom Penh and Ho Chi Minh, Singapore, Hong Kong, Shanghai, Laem Chabang etc., provided all channels are dredged at 7.0m deep/60m wide

However, it should be noted that the study above was conducted before the Lehman Shock. Under the current economic situation in the world, the scenarios above seem to require reconsideration from the following viewpoints:

- Due to the current financial constraints both of the barge operators and main line operators, it would be difficult for them to deploy larger barges which are not available in the regional markets at present and need to be newly built. Therefore realization of scenario i) would be delayed for some time. It should also be noted that some excavation works and maintenance dredging need to be done to ensure the navigation of 5m-draft barges in this scenario. The Project Team doesn't assume larger barges for the forecast of cost and time in 1) and 2) above for reasons stated below regarding scenario ii).
- The scenario ii) didn't assume the development of Cai Mep Port but assumed substantial excavation works of the channels to be done on the Vietnamese side with heavy burden of maintenance dredging afterwards. It should be noted that scenario ii) would be realized not by RGC alone but also by Vietnam Inland Waterway Administration (VIWA), Vinamarine and local government bodies in Vietnam together. The realization of this scenario depends on how inter-state cooperation can be organized between RGC and Vietnamese government.

(3) Ports

1) Costs

a) Present situation

The amount of costs relevant to the operations at a port may vary depending on the party involved in the trade or physical distribution processes. In this sub section, the Project Team focuses on the costs born by the importers (i.e. consignees) and exporters (shippers) in Cambodia.

When a consignee or shipper's cargo is handled at a port, Terminal Handling Charge (THC) is levied to the consignee/shipper by the shipping line. The shipping line compensates the stevedoring costs payable to the port operator with THC. The current THC rates applicable to the ports in south-eastern Indochina are as below:

		Bangkok	Laem Chabang	Sihanouk ville	Phnom Penh	Cai Mep	Ho Chi Minh
		(THB)	(THB)	(USD)	(USD)	(USD)	(USD)
Import	20'	2,600	2,600	90	90	85	85
	40'	3,900	3,900	120	120	130	130
Export	20'	2,600	2,600	90	90	85	85
	40'	3,900	3,900	120	120	130	130

At most modernized container terminals, the consignees/shippers don't bear any additional charges for stevedoring besides THC. However, at the ports in south-eastern Indochina where the conventional styles of port tariffs still remain, the consignees/shippers should bear Lift on-Lift off Charge (LoLo Charge) payable to the terminal operators in addition to THC as per the ports' tariff below.

		Bangkok	Laem Chabang	Sihanouk ville	Phnom Penh	Cai Mep	Ho Chi Minh
		(THB)	(THB)	(USD)	(USD)	(VND)	(VND)
Import	20'	1,650	770	70	46	475,000	440,000
	40'	2,850	1,100	107	63	785,000	730,000
Export	20'	600	600	24	46	475,000	440,000
	40'	1,000	850	19	63	785,000	730,000

Note: The amounts for Sihanoukville include USD 1/container of Delivery/Receiving Charges

Additionally in Cambodia, the consignees/shippers need to pay for customs' x-ray or γ -ray scanning, while this is not charged in Thailand and Vietnam where scanning is done on a random basis. The uniform tariff of scanning at Sihanoukville Port and Phnom Penh Port is as follows:

20'	USD 25
40'	USD 40

Compiling all those charges stated above, Table 2.7-3 shows the comparison of cost amounts borne by the consignees/shippers at the ports in south-eastern Indochina. The local currencies are converted to USD.

Table 2.7-3 Comparison of port costs currently borne by consignees/shippers at the ports in south-eastern Indochina

(USD)

	Charges	Payable to	Container	Bangkok	Laem Chabang	Sihanouk ville	Phnom Penh	Cai Mep	Ho Chi Minh
Import	Terminal Handling Charge	Shipping line	20'	84.5	84.5	90.0	90.0	85.0	85.0
			40'	126.8	126.8	120.0	120.0	130.0	130.0
	Lift on-Lift off Charge	Port	20'	53.6	25.0	70.0	46.0	22.2	20.6
			40'	92.6	35.8	107.0	63.0	36.7	34.2
	Cargo Scanning Charge	Customs	20'	0.0	0.0	25.0	25.0	0.0	0.0
			40'	0.0	0.0	40.0	40.0	0.0	0.0
	Total		20'	138.1	109.5	185.0	161.0	107.2	105.6
			40'	219.4	162.5	227.0	183.0	166.7	164.2
Export	Terminal Handling Charge	Shipping line	20'	84.5	84.5	90.0	90.0	85.0	85.0
			40'	126.8	126.8	120.0	120.0	130.0	130.0
	Lift on-Lift off Charge	Port	20'	19.5	19.5	24.0	46.0	22.2	20.6
			40'	32.5	27.6	19.0	63.0	36.7	34.2
	Cargo Scanning Charge	Customs	20'	0.0	0.0	2.6	2.6	0.0	0.0
			40'	0.0	0.0	4.2	4.2	0.0	0.0
	Total		20'	104.0	104.0	116.6	138.6	107.2	105.6
			40'	159.3	154.4	139.0	183.0	166.7	164.2

Prepared by Project Team

b) Forecast for the target years

The future amounts for 2020 and 2030 are calculated applying the inflation rates projected by IMF for relevant countries as below:

	2011	2012	2013	2014	2015	2016-2030
Thailand	1.3%	1.3%	2.0%	2.1%	2.1%	2.1%
Cambodia	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
Vietnam	7.1%	7.1%	7.1%	7.1%	7.1%	5.4%

Table 2.7-4 shows the result of calculations.

Table 2.7-4 Forecast of the costs borne by consignees/shippers at the ports in south-eastern Indochina

(USD)

		Import			Export		
		2010	2020	2030	2010	2020	2030
Sihanoukville	20'	185.0	266.0	382.6	116.6	167.7	241.2
	40'	227.0	326.4	469.5	139.0	199.9	287.5
Phnom Penh	20'	161.0	231.5	333.0	138.6	199.4	286.7
	40'	183.0	263.2	378.5	183.0	263.2	378.5
Bangkok	20'	138.1	167.2	205.8	104.0	125.9	155.0
	40'	219.4	265.6	326.9	159.3	192.8	237.3
Leam Chabang	20'	109.5	132.6	163.2	104.0	125.9	155.0
	40'	162.5	196.7	242.2	154.4	186.9	230.1
Cai Mep	20'	107.2	196.5	332.6	107.2	196.5	332.6
	40'	166.7	305.6	517.1	166.7	305.6	517.1
Ho chi Minh	20'	105.6	193.5	327.5	105.6	193.5	327.5
	40'	164.2	300.9	509.1	164.2	300.9	509.1

Prepared by Project Team

c) Charges for vessel operations

Charges for vessel operations are primarily borne by shipping lines (i.e. vessel operators) and then compensated by ocean freight. When the amount per call is divided by TEUs of loading/discharging, it can be said to be a part of ocean freight rate, while it is not directly charged to the shippers/consignees. Table 2.7-5 indicates the comparison of the amounts per call at major sea ports in south-eastern Indochina. The amounts are based on current average size of calling vessels at each port. Cost/TEU at Sihanoukville Port is highest among the 4 ports.

Table 2.7-5 Comparison of the charges for vessel operations at the sea ports in south-eastern Indochina (for current average vessel size)

		Sihanoukville	Laem Chabang	Cai Mep	Ho Chi Minh
Average vessel particulars	Capacity (TEU)	954	2,420	5,628	1,314
	DWT	12,649	33,000	71,300	16,900
	GT	9,854	27,200	68,500	15,700
	LOA (m)	136.8	200.0	284.0	161.0
	Draft (ft)	26.4	36.7	45.9	32.5
Average vessel stay (hours)	Anchorage stay	2.0	2.0	2.0	2.0
	Berth stay	25.0	19.3	21.0	19.9
	Total stay	27.0	21.3	23.0	21.9
Port charges per vessel (USD)	Tonnage due	2,464	5,256	870	2,192
	Tonnage due (out)	0	5,256	870	2,192
	Berth due	2,266	1,268	4,459	969
	Channel due	4,441	105	6,850	1,570
	Channel due (out)	0	105	6,850	1,570
	Anchorage	0	0	69	16
	Pilotage (in)	296	667	2,713	1,485
	Pilotage (out)	296	667	2,713	1,485
	Towage (in)	190	701	6,500	1,400
	Towage (out)	190	701	6,500	1,400
	Mooring	50	0	50	50
	Unmooring	50	0	50	50
	Port clearance (in)	100	0	100	100
	Port clearance (out)	100	0	0	0
	Quarantine	0	0	78	78
	Total	10,443	14,726	38,672	14,557
Average loading/discharging TEUs /vessel		371	833	1,684	852
Cost/TEU (USD)		28.2	17.7	23.0	17.1

Prepared by Project Team

When the comparison is made based on an assumption of uniform vessel size with 1,700 TEU type and loading/discharging of 600 TEUs per vessel, the result is given as per the Table 2.7-6 below. Again charges at Sihanoukville Port are highest among the 4 ports.

Table 2.7-6 Comparison of the charges for vessel operations at the sea ports in south-eastern Indochina (for 1,700 TEU vessel)

		Sihanoukville	Laem Chabang	Cai Mep	Ho Chi Minh
Model vessel particulars	Capacity (TEU)	1,700	1,700	1,700	1,700
	DWT	22,000	22,000	22,000	22,000
	GT	17,200	17,200	17,200	17,200
	LOA (m)	188.6	188.6	188.6	188.6
	Draft (ft)	31.2	31.2	31.2	31.2
Average vessel stay (hours)	Anchorage stay	2	2	2	2
	Berth stay	25	18	18	18
	Total stay	27	20	20	20
Port charges per vessel (USD)	Tonnage due	4,300	3,324	550	550
	Tonnage due Out	0	3,324	550	550
	Berth due	3,956	748	960	960
	Channel due	7,121	0	1,720	1,720
	Channel due Out	0	0	1,720	1,720
	Anchorage	0	0	17	17
	Pilotage In	516	573	681	1,627
	Pilotage Out	516	573	681	1,627
	Towage In	297	443	2,000	1,400
	Towage Out	297	443	2,000	1,400
	Mooring	117	0	50	50
	Unmooring	117	0	50	50
	Port clearance In	100	0	100	100
	Port clearance Out	100	0	0	0
	Quarantine	0	0	78	78
	Total	17,437	9,428	11,158	11,850
Average loading/discharging TEUs /vessel		600	600	600	600
Cost/TEU (USD)		29.1	15.7	18.6	19.8

Prepared by Project Team

On assumption that the current vessel size and loading/discharging TEUs remain the same until the target years, and inflation rate projection by IMF is applied, the forecast of cost/TEU for the target years is calculated as per Table 2.7-7 below.

Table 2.7-7 Forecast of the charges for vessel operations at the sea ports in south-eastern Indochina (for current average vessel size)

(USD)

	2010	2020	2030
Sihanoukville	28.2	40.5	58.2
Leam Chabang	17.7	21.4	26.3
Cai Mep	23.0	42.1	71.2
Ho chi Minh	17.1	31.3	53.0

Prepared by Project Team

Based on 1,700 TEU size with loading/discharging of 600 TEUs per vessel, the forecast of cost/TEU for the target years is calculated as per Table 2.7-8 below.

Table 2.7-8 Forecast of the charges for vessel operations at the sea ports in south-eastern Indochina (for 1,700 TEU vessel)

(USD)

	2010	2020	2030
Sihanoukville	29.1	41.8	60.1
Leam Chabang	15.7	19.0	23.4
Cai Mep	18.6	34.1	57.7
Ho chi Minh	19.8	36.2	61.3

Prepared by Project Team

2) Time

a) Present situation

Dwell time within a port is composed of time of loading and time before loading for export containers, likewise, time of discharge and time after discharge for import containers.

Time of loading/discharge shall vary depending on the operational efficiency at the port and number of containers to be loaded/discharged per vessel per call.

For export containers, time before loading shall vary depending on the CY closing time introduced by the port. CY closing will be set by the port responding to the number of containers to be loaded onto a vessel.

For import containers, time after discharge shall be influenced by the time required for import customs clearance.

Table 2.7-9 shows the current dwell times of export containers at major Indochinese ports. At every port, time for loading for East Asia is shorter than those for North America and Europe, as small size vessels are deployed for intra-Asia trade and a smaller number of containers are loaded onto those vessels. The times before loading are longer at Laem Chabang, Cai Mep and Ho Chi Minh where CY closing is introduced to accommodate/handle larger number of containers in the stacking yards.

Table 2.7-9 Current dwell times of export containers at major Indochinese ports (by destination)

Destination	Origin port	Loading (days)	Before loading (days)	Total dwell time (days)
East Asia (Shanghai)	Laem Chabang	0.6	1.0	1.6
	Cai Mep	0.7	1.0	1.7
	Ho Chi Minh	0.7	1.0	1.7
	Phnom Penh	0.6	0.5	1.1
	Sihanoukville	0.4	0.5	0.9
North America (LA, Long Beach)	Laem Chabang	1.1	1.0	2.1
	Cai Mep	0.8	1.0	1.8
	Ho Chi Minh	0.9	1.0	1.9
	Phnom Penh	0.6	0.5	1.1
	Sihanoukville	0.7	0.5	1.2
Europe (Rotterdam)	Laem Chabang	1.1	1.0	2.1
	Cai Mep	0.9	1.0	1.9
	Ho Chi Minh	0.9	1.0	1.9
	Phnom Penh	0.6	0.5	1.1
	Sihanoukville	0.7	0.5	1.2

Prepared by Project Team

Table 2.7-10 shows the dwell times of import containers.

Likewise, the times for discharge are longer for North America and Europe than those for East

Asia.

The times after discharge differ by country depending on how much facilitation of import customs clearance is achieved in the country. In the Table, the days after discharge refer to "Logistic Performance Index (LPI) 2010" issued by the World Bank. Customs clearance times in selected ASEAN countries are indicated as per Table 2.7-11 below. In case of Sihanoukville Port and Phnom Penh Port, the intermediate value between "with physical inspection" and "without physical inspection" is applied, as almost half of the import containers are usually moved from those ports to the dry ports near Phnom Penh with a simple procedures for bonded transportation only.

Table 2.7-10 Current dwell times of import containers at major Indochinese ports (by origin)

Origin	Destination	Discharge (days)	After discharge (days)	Total dwell time (days)
East Asia (Shanghai)	Laem Chabang	0.6	1.4	2.0
	Cai Mep	0.7	3.5	4.2
	Ho Chi Minh	0.7	3.5	4.2
	Phnom Penh	0.4	3.7	4.1
	Sihanoukville	0.5	3.7	4.1
North America (LA, Long Beach)	Laem Chabang	1.1	1.4	2.5
	Cai Mep	0.8	3.5	4.3
	Ho Chi Minh	0.9	3.5	4.4
	Phnom Penh	0.4	3.7	4.1
	Sihanoukville	0.5	3.7	4.2
Europe (Rotterdam)	Laem Chabang	1.1	1.4	2.5
	Cai Mep	0.9	3.5	4.4
	Ho Chi Minh	0.9	3.5	4.4
	Phnom Penh	0.4	3.7	4.1
	Sihanoukville	0.5	3.7	4.2

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Table 2.7-11 Customs clearance time in ASEAN countries

Country	Cambodia	Vietnam	Malaysia	Thailand	Singapore
Clearance time with physical inspection (days)	5.92	3.46	2.08	1.41	1.22
Clearance time without physical inspection (days)	1.39	1.41	0.74	0.71	0.50

Source: The World Bank "Logistics Performance Index 2010"

b) Forecast for the target years

The dwell times of major Indochinese ports for 2020 and 2030 are estimated based on the projection of following factors.

- Export

Time for loading will be influenced by following factors:

Factor (a) : Increase of TEUs/vessel

Factor (b) : Improvement of MPH (movement per hour)

Increase of loading time will be calculated by (a)÷(b).

Table 2.7-12 shows the projection of the factors above and result of calculations of loading

times for 2020 and 2030.

Table 2.7-12 Projection on the increase of loading times

	Increase of TEUs/vessel (a)		Improvement of MPH (b)		Increase of loading time (a/b)	
	2020 (vs 2011)	2030 (vs 2020)	2020 (vs 2011)	2030 (vs 2020)	2020 (vs 2011)	2030 (vs 2020)
Laem Chabang	50%	50%	50%	30%	0%	15%
Cai Mep	70%	70%	30%	30%	31%	31%
Ho Chi Minh	20%	20%	20%	20%	0%	0%
Phnom Penh	0%	0%	0%	25%	0%	-20%
Sihanoukville	70%	100%	50%	50%	13%	33%

Prepared by Project Team

Time before loading shall increase correlatively to the factor (a) above. In this projection, it is assumed to increase at 1/2 of (a) except for Cai Mep where 1/4 of (a) is applied, since in Cai Mep TEUs/vessel shall be increased partially by transshipment which has nothing to do with the local export containers.

Table 2.7-13 shows the projection of times before loading as well as the compilation to give the total dwell times.

Table 2.7-13 Forecast of dwell times of export containers at major Indochinese ports

Destination	Origin port	Loading (days)			Before loading (days)			Total dwell time (days)		
		2011	2020	2030	2011	2020	2030	2011	2020	2030
East Asia (Shanghai)	Laem Chabang	0.6	0.6	0.7	1.0	1.3	1.6	1.6	1.9	2.3
	Cai Mep	0.7	0.9	1.1	1.0	1.2	1.4	1.7	2.0	2.5
	Ho Chi Minh	0.7	0.7	0.7	1.0	1.1	1.2	1.7	1.8	1.9
	Phnom Penh	0.6	0.6	0.5	0.5	0.5	0.5	1.1	1.1	1.0
	Sihanoukville	0.4	0.5	0.6	0.5	0.7	1.0	0.9	1.1	1.6
North America (LA, Long Beach)	Laem Chabang	1.1	1.1	1.2	1.0	1.3	1.6	2.1	2.3	2.8
	Cai Mep	0.8	1.1	1.4	1.0	1.2	1.4	1.8	2.2	2.8
	Ho Chi Minh	0.9	0.9	0.9	1.0	1.1	1.2	1.9	2.0	2.1
	Phnom Penh	0.6	0.6	0.5	0.5	0.5	0.5	1.1	1.1	1.0
	Sihanoukville	0.7	0.8	1.0	0.5	0.7	1.0	1.2	1.4	2.0
Europe (Rotterdam)	Laem Chabang	1.1	1.1	1.3	1.0	1.3	1.6	2.1	2.4	2.8
	Cai Mep	0.9	1.2	1.6	1.0	1.2	1.4	1.9	2.4	3.0
	Ho Chi Minh	0.9	0.9	0.9	1.0	1.1	1.2	1.9	2.0	2.1
	Phnom Penh	0.6	0.6	0.5	0.5	0.5	0.5	1.1	1.1	1.0
	Sihanoukville	0.7	0.8	1.0	0.5	0.7	1.0	1.2	1.4	2.0

Prepared by Project Team

- Import

Table 2.7-14 shows the forecast of dwell times of import containers.

As for the time of discharge, the factors considered for exports are applied to the calculation in the same manner.

As for the time after discharge, it is assumed that Cambodia and Vietnam will improve the facilitation of import customs clearance to Thailand's current level by 2030, and Thailand will improve to Singapore's current level by 2030.

Table 2.7-14 Forecast of dwell times of import containers at major Indochinese ports

Origin	Destination	Discharge (days)			After discharge (days)			Total dwell time (days)		
		2011	2020	2030	2011	2020	2030	2011	2020	2030
East Asia (Shanghai)	Laem Chabang	0.6	0.6	0.7	1.4	1.3	1.2	2.0	1.9	1.9
	Cai Mep	0.7	0.9	1.1	3.5	2.4	1.4	4.2	3.3	2.6
	Ho Chi Minh	0.7	0.7	0.7	3.5	2.4	1.4	4.2	3.1	2.1
	Phnom Penh	0.4	0.4	0.4	3.7	2.5	1.4	4.1	3.0	1.8
	Sihanoukville	0.5	0.5	0.7	3.7	2.5	1.4	4.1	3.1	2.1
North America (LA, Long Beach)	Laem Chabang	1.1	1.1	1.2	1.4	1.3	1.2	2.5	2.4	2.4
	Cai Mep	0.8	1.1	1.4	3.5	2.4	1.4	4.3	3.5	2.8
	Ho Chi Minh	0.9	0.9	0.9	3.5	2.4	1.4	4.4	3.3	2.3
	Phnom Penh	0.4	0.4	0.4	3.7	2.5	1.4	4.1	3.0	1.8
	Sihanoukville	0.5	0.6	0.8	3.7	2.5	1.4	4.2	3.1	2.2
Europe (Rotterdam)	Laem Chabang	1.1	1.1	1.3	1.4	1.3	1.2	2.5	2.4	2.5
	Cai Mep	0.9	1.2	1.6	3.5	2.4	1.4	4.4	3.7	3.0
	Ho Chi Minh	0.9	0.9	0.9	3.5	2.4	1.4	4.4	3.3	2.3
	Phnom Penh	0.4	0.4	0.4	3.7	2.5	1.4	4.1	3.0	1.8
	Sihanoukville	0.5	0.6	0.8	3.7	2.5	1.4	4.2	3.1	2.2

Prepared by Project Team

(4) Maritime transport

1) Costs

Ocean freight rates for export/import containers may vary by service profile of the shipping line. The shipping line who deploys direct calling vessels or larger vessels will offer lower rates.

The current rates from major Indochinese ports to various world ports are shown in Table 2.7-15 for exports and Table 2.7-16 for imports respectively. The rate of each column represents almost the lowest one in the current market of each trade.

Table 2.7-15 Ocean freight rates for export containers from major Indochinese ports

Export (USD)

To ↓	Port	From→	Bangkok	Laem Chabang	Sihanoukville	Phnom Penh	Cai Mep	Ho Chi Minh
USWC	Los Angeles	20'	1,680	1,600	2,000	1,920	1,615	1,695
		40'	2,100	2,000	2,500	2,400	2,020	2,120
Japan	Tokyo	20'	400	400	550	555	505	400
		40'	700	700	1,140	1,150	935	700
China	Shanghai	20'	400	300	450	500	300	400
		40'	600	500	800	850	525	625
Middle East	Jebel Ali	20'	865	865	1,005	1,300	905	805
		40'	1,610	1,610	2,130	2,350	1,675	1,575
Europe	Rotterdam	20'	1,100	1,100	1,150	1,250	1,000	1,100
		40'	2,200	2,200	2,400	2,500	2,000	2,100
Australia	Sydney	20'	850	850	900	900	900	800
		40'	1,700	1,700	1,800	1,800	1,700	1,600

Note: Rates include Banker Adjustment Factor (BAF) and Currency Adjustment Factor (CAF)
Prepared by Project Team

Table 2.7-16 Ocean freight rates for import containers to major Indochinese ports

Import (USD)

From ↓	Port	To→	Bangkok	Laem Chabang	Sihanoukville	Phnom Penh	Cai Mep	Ho Chi Minh
USWC	Los Angeles	20'	1,600	1,500	1,800	1,800	1,500	1,600
		40'	2,000	1,900	2,000	2,000	1,900	2,000
Japan	Tokyo	20'	580	580	1,100	1,180	580	680
		40'	950	950	1,900	2,000	1,050	1,150
China	Shanghai	20'	300	300	550	575	375	415
		40'	600	600	950	965	665	730
Middle East	Jebel Ali	20'	460	460	660	800	800	700
		40'	920	920	1,320	1,400	1,400	1,300
Europe	Rotterdam	20'	700	625	900	975	675	675
		40'	975	850	1,100	1,150	775	775
Australia	Sydney	20'	1,250	1,250	1,350	1,350	1,350	1,250
		40'	1,900	1,900	2,000	2,000	2,000	1,900

Note: Rates include Banker Adjustment Factor (BAF) and Currency Adjustment Factor (CAF)
Prepared by Project Team

The rates for Sihanoukville and Phnom Penh are higher than those for other ports due to the feeder costs included.

For Sihanoukville and Phnom Penh, export rates are higher than import rates due to the imbalance of equipment (container) inventory; volume of the laden exports exceeds the laden import. Therefore the shipping line needs to bring empty containers from outside by themselves. Those cost for the positioning is added on the export rates.

As ocean freight rates fluctuate depending on demand (volume of cargoes) and supply (capacity of vessels), fuel prices and currencies, it will not be practical to make any projections on the rate level for the future.

2) Time

The transit times of the ocean transportation widely vary by shipping line and its service depending on routing, transshipment port, numbers of wayports, vessels' speed, etc.

In this Study, the average is taken among the port-to-port transit times in the services of main line container operators currently use Sihanoukville Port, namely, Maersk Line, CMA CGM, APL, MOL, Evergreen, Wan Hai, Hanjin, OOCL and Hyundai. Table 2.7-17 and Table 2.7-18 show the current average transit times of outbound and inbound respectively.

Forecast is not made as there are so many unpredictable factors as listed above

Table 2.7-17 Ocean transit times from major Indochinese ports (outbound)

Destination	Origin port	Ocean transit times to destination (days)
East Asia (Shanghai)	Laem Chabang	11.3
	Cai Mep	10.3
	Ho Chi Minh	9.0
	Phnom Penh	15.0
	Sihanoukville	12.6
US West Coast (LA, Long Beach)	Laem Chabang	22.0
	Cai Mep	21.9
	Ho Chi Minh	21.9
	Phnom Penh	23.0
	Sihanoukville	25.1
Europe (Rotterdam)	Laem Chabang	23.0
	Cai Mep	22.9
	Ho Chi Minh	26.2
	Phnom Penh	30.0
	Sihanoukville	26.2

Prepared by Project Team

Table 2.7-18 Ocean transit times to major Indochinese ports (inbound)

Origin	Destination port	Ocean transit times from origin (days)
East Asia (Shanghai)	Laem Chabang	10.2
	Cai Mep	10.6
	Ho Chi Minh	6.8
	Phnom Penh	13.5
	Sihanoukville	13.1
US West Coast (LA, Long Beach)	Laem Chabang	28.6
	Cai Mep	25.7
	Ho Chi Minh	31.3
	Phnom Penh	34.7
	Sihanoukville	32.0
Europe (Rotterdam)	Laem Chabang	28.3
	Cai Mep	35.3
	Ho Chi Minh	32.8
	Phnom Penh	40.0
	Sihanoukville	29.0

Prepared by Project Team

2.7.2 Cost and transit time of seaborne cargoes to/from Phnom Penh at present and in the future

(1) Phnom Penh/Sihanoukville (road)

1) Present situation

The main routes connecting Phnom Penh and Sihanoukville are NR 3 and NR 4. As mentioned in Subsection 2.4.1, NR 3 has already been rehabilitated and is deemed suitable for efficient transport. However, all container trucks pass through NR 4 at present. It was considered that the traffic condition caused by large vehicles is due to the existing factories and dry ports located along NR 4. On the other

hand, a small number of factories and logistics facilities are located along NR 3. It is expected that the transportation volume of large vehicles will increase in the future.

The cost of container transportation between Phnom Penh and Sihanoukville is shown in Table 2.7-19. It is slightly more expensive to import than export in terms of the truck transportation cost. This is because the balance of empty containers cannot be maintained since the importing volume is much more than the exporting volume. The containers with import goods are transported to the factories in Phnom Penh, then after unloading the goods, the containers which became empty are transported back to Sihanoukville again. This cost is calculated in the transportation cost. Also, the average lead time between the section is 6.75 hours.

Table 2.7-19 Container transportation cost between Phnom Penh and Sihanoukville Port (road)

(Export)

Cost Item	Cost (USD)	
	20'	40'
Lift on empty container and carry to factory	15-20	15-20
Trucking fee (factory - Sihanoukville Port)	170-220	190-300
Toll	14.42	18.82
Export custom clearance	190-250	220-280
Terminal handling charge (Sihanoukville Port)	90	120
Lift on/off charge (Sihanoukville Port)	24	19
(Total)	503.42-618.42	582.82-757.82

(Import)

Cost Item	Cost (USD)	
	20'	40'
Terminal handling charge (Sihanoukville Port)	90	120
Lift on/off charge (Sihanoukville Port)	70	107
Scan fee	25	40
Import custom clearance	150-200	180-250
Trucking fee (Sihanoukville Port - factory)	230-280	270-300
Toll	14.42	18.82
(Total)	579.42-679.42	735.82-835.82

Prepared by Project Team

As mentioned above, transportation cost between Phnom Penh and Sihanoukville Port is quite cheaper than other domestic routes. This is because trucks are able to travel and maintain high speeds due to NR 4's good condition; therefore, the lead time of such trucks could be shortened. Furthermore, the route is the most thriving logistics trunk in Cambodia, and it is likely that competition among freight forwarders will bring down their prices.

2) Bottleneck and future

NR 4 has a total length of 213 km and is paved with AC. Operation and maintenance (O&M) of NR 4 has been conducted by a private company called AZ Investment Co., Ltd. Toll fees are collected at three gates at NR 4. The toll fee is one of the factors which can lower competitiveness of Sihanoukville Port.

Trucking cost is composed of the driver's remuneration, diesel fuel cost and capital loss. It was not supposed to drastically reduce the trucking cost with respect to the rise of personnel cost along with economic growth. However, avoiding empty container trips, decreasing the rest time for gate-in, and advancing competition among freight forwarders will achieve savings in transportation cost.

The container transportation cost of the target year 2020 and 2030 which was calculated based

on the predicted inflation rates of countries by IMF mentioned in previous paragraphs is shown in Table 2.7-20.

Table 2.7-20 Container transportation cost between Phnom Penh and Sihanoukville Port of the target year (road)

	Container Box Size	2011 (Present)	2020	2030
Export	20'	561	778	1,119
	40'	670	930	1,337
Import	20'	629	873	1,255
	40'	786	1,090	1,567

Prepared by Project Team

(2) Phnom Penh/Sihanoukville (railway)

1) Present situation

a) General

The 264-km southern line connects Phnom Penh and Sihanoukville. For this railway line, the MPWT conducted rehabilitation works with financing from ADB since January 2008. The improvement target of the southern line is to achieve an operational speed of 50 km/h having a 20 t axle load. The 110 km section between Phnom Penh and Touk Meas already started operations in October 2010 by TRR in order to transport packed cement. According to TRR, the scheduled opening of the whole of Phnom Penh – Sihanoukville railway section is to be on January 2013.

b) Cost of transportation

As mentioned above, the railway operations body in Cambodia was transferred from RRC to the concessionaire TRR. The Study Team requested TRR to provide information on railway operations, including their fare/tariff table because such information is required in the project. However, very little significant information was obtained. (Note: It seems that TRR is not inclined to disclose their marketing information on railway operations since it is a private company.)

On the other hand, the ADB, in “Proposed Loan and Administration of Loan Kingdom of Cambodia: Greater Mekong Subregion: Rehabilitation of the Railway in Cambodia Project” (November 2006), estimates the transportation cost of containers to be 0.032 USD/ton-km. The estimated container transportation cost by railway based on the said unit cost is shown on Table 2.7-21.

Table 2.7-21 Estimated container transportation cost between Phnom Penh and Sihanoukville Port (railway)

(Export)

Cost Item	Cost (USD)	
	20'	40'
Lift on empty container and carry to factory	15-20	15-20
Trucking fee (factory - Samrong Station)	80-110	100-120
Lift on/off charge (Samrong Station)	24	19
Railway Fee	107	205
Export custom clearance	190-250	220-280
Terminal handling charge (Sihanoukville Port)	90	120
Lift on/off charge (Sihanoukville Port)	24	19
(Total)	515-605	683-763

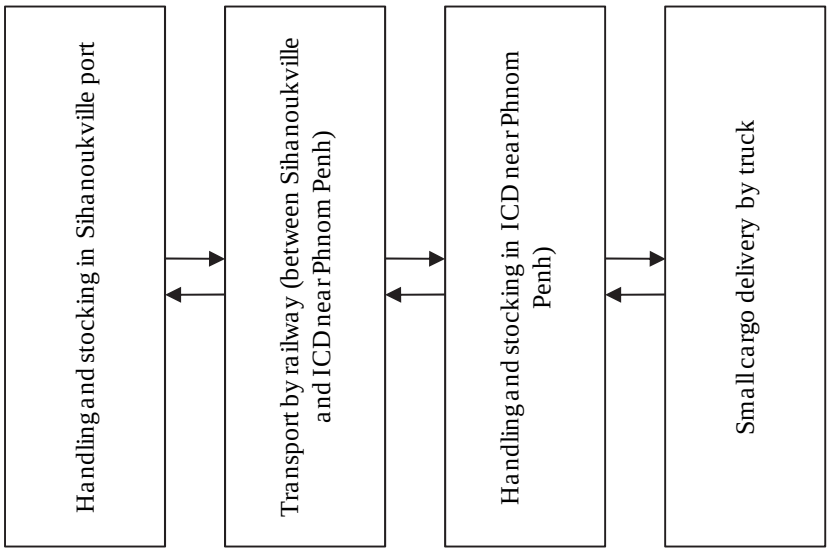
(Import)

Cost Item	Cost (USD)	
	20'	40'
Terminal handling charge (Sihanoukville Port)	90	120
Lift on/off charge (Sihanoukville Port)	70	107
Scan fee	25	40
Import custom clearance	150-200	180-250
Railway Fee	107	205
Lift on/off charge (Sihanoukville Port)	70	107
Trucking fee (Samrong Station - factory)	80-110	100-120
(Total)	592-672	859-949

Prepared by Project Team

c) Lead time

The process of cargo transport from Sihanoukville Port to a destination in Phnom Penh or vice versa is summarized in Figure 2.7-4 below.



Prepared by Project Team

Figure 2.7-4 Process of necessary work items for transportation between Sihanoukville Port and Phnom Penh

In the four work items, the time required for "transport by railway (between Sihanoukville and an ICD near Phnom Penh)" should be decided based on the train operations diagram prepared by TRR. However, no train operations diagram has been obtained from TRR because train operations between Phnom Penh and Sihanoukville have not yet been started. On the other hand, once the ADB railway rehabilitation project has been completed, it is expected that the operational speed between Phnom Penh and Sihanoukville will be improved to 50 km/h. Based on the plan, the time required for "transport by railway (between Sihanoukville and an ICD near Phnom Penh)" is calculated as follows:

- Time required for "transport by railway (between Sihanoukville and an ICD near Phnom Penh)" = 264 km / 50 km/h = 5 h and 17 min

2) Bottleneck and future

After the completion of the ADB railway rehabilitation project, almost all congestion of the railway network will be basically eliminated because the operational speed between Phnom Penh and Sihanoukville will be drastically improved to 50 km/h. (Note that the "maximum" speed before the ADB project was approximately 20 to 30 km/h and derailment occurred frequently) On the other hand, it seems that congestion will materialize due to the following:

a) Handling and delivery work before/after railway transportation

Cargo transportation cannot be completed by a single transportation mode; supplemental works and transportation modes such as short distance truck delivery, handling before/after railway transportation, etc. are required. The given condition of handling and stocking in Sihanoukville Port is not a disadvantage to railway transportation because it is the same as road transportation. On the other hand, other supplemental works such as handling and stocking in ICDs near Phnom Penh and small cargo delivery by trucks within Phnom Penh are not required in case of road transportation. Therefore, if these supplemental works have low work efficiency, there will be congestion on the entire railway network.

b) Delay due to many traffic accidents induced by the improved train speed

The target of the ADB railway rehabilitation project is to achieve a 50 km/h operational speed for the southern line by rehabilitating the existing track and related structures. However, the project scope does not include installation of safety devices/facilities such as automatic level-crossing, safety fences for local inhabitants and animals, etc. Before the ADB railway rehabilitation project, there have been few catastrophic railway accidents because the train speed was quite slow. After rehabilitation, large-scale accidents such as collision between train and vehicle at level-crossing are expected to occur if no additional safety facilities are installed. If frequent train delays and/or suspension of operations due to railway accidents occur, the railway section will receive a low rating by customers.

However, it is expected that these abovementioned causes of congestion will be eliminated. Therefore, the efficiency of handling and feeder delivery and the safety of railway operations will improve in the future in order to gain advantage from other competitors such as trucks.

c) Container transportation cost in the future

The container transportation cost of the target year 2020 and 2030 which was calculated based on the predicted inflation rates of countries by IMF mentioned in previous paragraphs is shown on Table 2.7-22.

Table 2.7-22 Container transportation cost between Phnom Penh and Sihanoukville Port of the target year (railway)

	Container Box Size	2011 (Assumption)	2020	2030
Export	20'	560	777	1,117
	40'	726	1,007	1,448
Import	20'	632	876	1,260
	40'	904	1,254	1,803

Prepared by Project Team

(3) Phnom Penh/Ho Chi Minh (road)

1) Present situation

The routes connecting Phnom Penh and Ho Chi Minh Port are NR 1 in Cambodia and NR 22 in Vietnam. NR 1 and NR 22 are part of the Southern Corridor, which is focused as the main logistics route in GMS countries as mentioned in Subsections 2.4.1. and 2.4.2. NR 1 has been rehabilitated and paved with AC and double bituminous surface treatment (DBST). The rehabilitation has provided for good transportation conditions. Moreover, the construction of a bridge crossing the Mekong River to eliminate congestion is planned, and the groundbreaking ceremony to mark the start of the construction works was held in February 2011. The bridge is being constructed with Japanese grant aid. Thus, it is expected that the construction project can contribute to efficient transportation between Phnom Penh and Ho Chi Minh. On the other hand, NR 22 has been paved by AC and maintained well.

At present, garments, shoes and agricultural products are being transported from Phnom Penh to Ho Chi Minh by container trucks, while garments, shoe materials and food supplies are being transported from Ho Chi Minh to Phnom Penh. There is an imbalance in the transportation volume between each direction. The transportation volume from Ho Chi Minh to Phnom Penh is far more than the other direction, and freight forwarders have procured empty containers from Phnom Penh. The container transportation cost from Phnom Penh to Ho Chi Minh Port is shown in Table 2.7-23. Additionally, the container transportation cost from Phnom Penh to Cai Mep Port is shown in Table 2.7-24, and the lead time from Phnom Penh to Ho Chi Minh Port is shown in Table 2.7-25.

Table 2.7-23 Container transportation cost between Phnom Penh and Ho Chi Minh Port

(Export)

Cost Item	Cost (USD)	
	20'	40'
Lift on empty container and carry to factory	15-20	15-20
Export custom clearance	200-265	220-300
Trucking fee (factory - border)	150-280	150-280
Custom clearance at border	70-120	80-130
Trans loading at Bavet	140	150
Trucking fee (border - Ho Chi Minh Port)	200-210	200-250
Terminal handling charge (Ho Chi Minh Port)	85	130
Lift on/off charge (Ho Chi Minh Port)	20.6	34.2
(Total)	880.6-1,140.6	979.2-1,289.2

(Import)

Cost Item	Cost (USD)	
	20'	40'
Terminal handling charge (Ho Chi Minh Port)	85	130
Lift on/off charge (Ho Chi Minh Port)	20.6	34.2
Trucking fee (Ho Chi Minh Port - border)	250-320	270-320
Custom clearance at border	70-120	80-130
Trans loading at Bavet	140	150
Trucking fee (border - factory)	260-330	280-330
Import custom clearance	180-200	200-220
(Total)	1,005.6-1,215.6	1,144.2-1,314.2

Prepared by Project Team

Table 2.7-24 Container transportation cost between Phnom Penh and Cai Mep Port

(Export)

Cost Item	Cost (USD)	
	20'	40'
Lift on empty container and carry to factory	15-20	15-20
Export custom clearance	200-265	220-300
Trucking fee (factory - border)	150-280	150-280
Custom clearance at border	70-120	80-130
Trans loading at Bavet	140	150
Trucking fee (border - Cai Mep Port)	400-440	400-460
Terminal handling charge (Ho Cai Mep Port)	85	130
Lift on/off charge (Ho Cai Mep Port)	22.7	36.7
(Total)	1,082.7-1,372.7	1,181.7-1,501.7

(Import)

Cost Item	Cost (USD)	
	20'	40'
Terminal handling charge (Cai Mep Port)	85	130
Lift on/off charge (Cai Mep Port)	22.2	36.7
Trucking fee (Cai Mep Port - border)	520-550	540-560
Custom clearance at border	70-120	80-130
Trans loading at Bavet	140	150
Trucking fee (border - factory)	260-330	280-330
Import custom clearance	180-200	200-220
(Total)	1,277.2-1,447.2	1,416.7-1,556.7

Prepared by Project Team

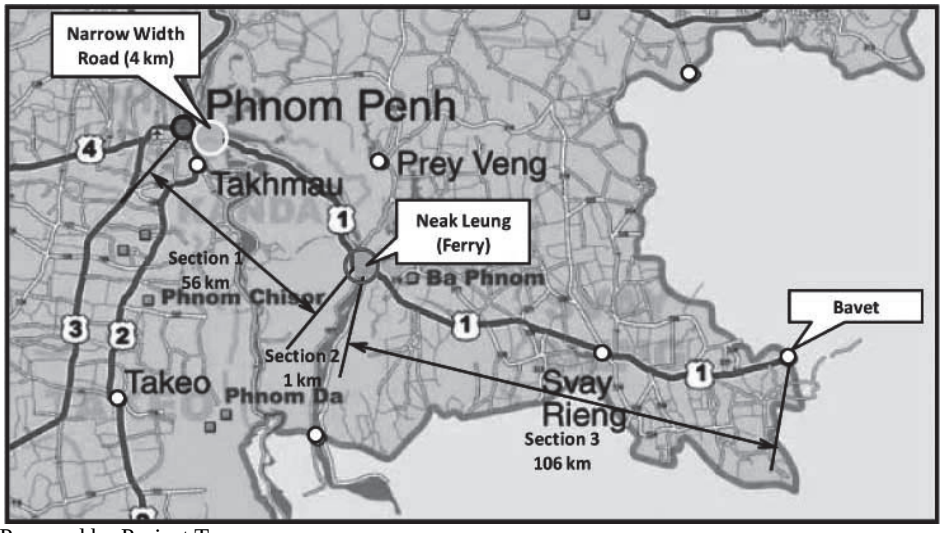
Table 2.7-25 Lead time of container transportation between Phnom Penh and Ho Chi Minh Port

Transport Items	Lead Time (hr)
Trucking from factory to border (including ferry at Neak Leung)	5-6
Customs clearance in Cambodia (procedure)	1
Customs clearance in Cambodia (waiting)	5-7
Transshipment at Bavet	1-2
Customs clearance in Vietnam (procedure)	1
Customs clearance in Vietnam (waiting)	2
Trucking from border to Ho Chi Minh Port	3
(Total)	18-22

Prepared by Project Team

2) Problems and future outlook

Although there has been congestion when crossing the Mekong River by ferry for many years, it will be solved by the bridge construction project as mentioned above. In the site survey, it was found that traffic congestion happens within about 4.0 km from the beginning point of NR 1. The short road section has a narrow width and is difficult for large vehicles to pass through because the section is urbanized and there are many residents along NR 1. It is considered that the section will be a problem for efficient transportation even if the new bridge is constructed at Neak Leung. The location of the narrow section and the new bridge at Neak Leung is shown in Figure 2.7-5.



Prepared by Project Team

Figure 2.7-5 Location map of section with narrow width section and the new bridge

Customs clearance for trucks at Cambodia-Vietnam Border (Bavet/Moc Bai) is available 24 hours per day on the Cambodian side, but is open on the Vietnamese side only from 12:00~05:00. Therefore, the truck operation plans must take this discrepancy into account.

At present, ADB promotes the regional development framework of GMS. The Cross-Border Transport Agreement (CBTA) is a significant component of the GMS program. Cambodia acceded CBTA on November 2001 and concluded the bilateral agreement of the CBTA with Lao PDR, Vietnam and Thailand, however, the improvement of cross-border operations has not been implemented as shown in Table 2.7-26.

Table 2.7-26 Progress of bilateral agreement between Cambodia and Vietnam

Agreement between the Royal Government of Cambodia and the Government of the Socialist Republic of Vietnam on Road Transportation was signed in June 1998.

Protocol for the Implementation of the Agreement between the Royal Government of Cambodia and the Government of the Socialist Republic of Vietnam on Road Transportation was signed in October 2005 and came into effect on 30 September 2006. At the time, Cambodia registered 19 buses and 21 trucks. Vietnam on the other hand registered 40 buses (no trucks).

In 2007, the two countries agreed to expand the quota to 150 vehicles each. There has been progress in CBTA to open the border between the two countries. Vietnam has been fully utilizing the quota of 150 vehicles. Cambodia, on the other hand, has not fully used the quota.

On 17 March 2009, the two countries agreed to expand the quota to 300. It is planned to be expanded again to 500, and eventually be of no limit.

In September 2009, the two countries agreed on MOU of SSI (Single Stop Inspection) and it was planned to be implemented three months later.

As of December 2011, SSI has not been implemented. A common control area that has been built in the border of Cambodia and Vietnam in 2010 is not in operation. The building is too small and there are no appropriate facilities.

Source: Date Collection Survey on Integrated Physical Distribution System in the Kingdom of Cambodia/JICA, Project Team

The cost involved in the Cambodia's trading procedure is relatively higher than in neighboring countries. In the list of customs related costs charged to the exporter/importer from the customs brokers, there are items not covered by laws and the billing amounts are much higher than prescribed by law. Because the customs brokers themselves do not reveal the sums actually paid to the public officials involved in the trading practices by the users of exporters/importers, the calculation basis of the bill cost from customs broker is not fully known.

For smoother trading, the Automated SYstem for CUstoms DAta (ASYCUDA) was introduced with the World Bank's assistance. At present, customs broker employee pays a visit to the Taxation Office where the outlet terminal of ASYCUDA exists, and conducts the declaration data entry. In the future, there is talk of introducing the module which enables direct entry from ASYCUDA outlets installed in customs broker's office, which will greatly improve the use-ability for customs brokers; hence it is anticipated to further smoothen trade.

Since the opening of Neak Leung Bridge, the river crossing time by ferry has been shortened by 20-40 minutes including the waiting time, and the US$15 crossing fee has become unnecessary. The container transportation cost of the target year 2020 and 2030 which was estimated based on the predicted inflation rates of countries by IMF mentioned in previous paragraphs is shown in Table 2.7-27. The container transportation cost of the target year excludes the ferry crossing fee at Neak Leung.

Table 2.7-27 Container transportation cost between Phnom Penh and Ho Chi Minh Port of the target year

	Container Box Size	2011 (Present)	2020	2030
Export	20'	1,011	1,482	2,266
	40'	1,137	1,682	2,588
Import	20'	1,111	1,646	2,537
	40'	1,229	1,833	2,835

Prepared by Project Team

(4) Phnom Penh/Ho Chi Minh (inland waterway)

1) Costs

a) Present situation

When exporters ship out their products from Phnom Penh Port through Cai Mep/Ho Chi Minh Port via Mekong River barge route, the amount of costs currently borne by the exporters in Phnom Penh is shown in Table 2.7-28 below. Costs for import are also indicated. The cost items are based on the movements via dry ports where shipping lines register as their Phnom Penh CY. Therefore, trucking fee between dry ports and Phnom Penh Port and LoLo charge at Phnom Penh Port are borne by the shipping lines.

The freight rates for barge transportation between Phnom Penh Port and Cai Mep/Ho Chi Minh Port are stated in 2.7.1-(2)-1), where the forecast for the target years is also indicated. It must be reminded that the barge freight is usually included in the ocean freight offered by shipping lines for the cargoes to be received/delivered at Phnom Penh CY. Consequently, the exporters/importers are not the actual payer of the barge freight.

Table 2.7-28 Inland costs between factories in Phnom Penh and Phnom Penh Port

(Export) (USD)

Item	20'	40'
Lift on empty container at depot	18.0	18.0
Trucking fee (depot-factory-dry port)	100.0	100.0
Lift off charge (dry port)	52.0	69.0
Export customs clearance charge	232.5	260.0
Total	402.5	447.0

(Import) (USD)

Item	20'	40'
Import customs clearance charge	190.0	210.0
Lift on charge (dry port)	52.0	69.0
Trucking fee (dry port-factory-depot)	100.0	100.0
Lift off emty contaier at depot	18.0	18.0
Total	360.0	397.0

Prepared by Project Team

b) Forecast for the target years

The forecast for the target years of 2020 and 2030 is indicated in Table 2.7-29 below. 3.7% of average inflation rate from 2011 to 2030 projected by IMF is applied to the calculations.

Table 2.7-29 Forecast of inland costs between factories and Phnom Penh Port

(USD)

		2010	2020	2030
Export	20'	402.5	578.8	832.4
	40'	447.0	642.8	924.4
Import	20'	360.0	517.7	744.5
	40'	397.0	570.9	821.0

Prepared by Project Team

2) Time

In this sub section, the lead time only for the part of inland transportation between the exporters' factories in Phnom Penh and Phom Penh Port is examined, as the transit time of barges between Phnom Penh Port and Cai Mep/Ho Chi Minh Port is included in the ocean transit times stated in

2.7.1-(4)-2). Table 2.7-30 shows the current lead times for exports and imports. It is assumed that the lead times will not be changed until 2030.

Table 2.7-30 Lead times between factories and Phnom Penh Port

(Export)

Event	Lead time (hours)
Trucking (depot-factory- dry port)	2
Export customs clearance	7
Trucking (dry port-Phnom Penh Port)	1
Total	10

(Import)

Event	Lead time (hours)
Trucking (Phnom Penh Port-dry port)	1
Trucking (dry port-factory-depot)	2
Total	3

Prepared by Project Team

(5) Phnom Penh/Laem Chabang (road)

1) Present situation

The routes connecting Phnom Penh and Laem Chabang are NR 5 in Cambodia and NR 7, NR 314, NR 304 and NR 33 in Thailand. NR 5 constitutes a part of the southern economic corridor similar to NR 1 in Cambodia. NR 5 is paved with DBST and its existing condition is generally good. On the other hand, the development of road infrastructure in Thailand has been completed and the road condition of the Southern Corridor is well-maintained as mentioned in Subsections 2.4.2 and 2.4.4.

At present, motorcycle manufacturers located at the suburbs of Phnom Penh have imported motorcycle parts and related products from Bang Na near Bangkok. Moreover, food manufacturing companies located at the Phnom Penh SEZ have imported materials for their products from the surrounding areas of Bangkok. Also, garments and agricultural products have been exported from Phnom Penh to Bangkok or its surrounding areas. However, seaborne cargo transported between Phnom Penh and Laem Chabang Port could not be confirmed.

Container transportation cost between Phnom Penh and Laem Chabang Port is shown in Table 2.7-31, and lead time of container transportation between Phnom Penh and Laem Chabang Port is shown in Table 2.7-32,

Table 2.7-31 Container transportation cost between Phnom Penh and Laem Chabang Port

(Export)

Cost Item	Cost (USD)	
	20'	40'
Lift on empty container and carry to factory	15-20	15-20
Export custom clearance	160-200	220-240
Trucking fee (factory - border)	600-685	600-700
Custom clearance at border	150-160	150-160
Trans loading at Poipet	210	210
Trucking fee (border - Laem Chabang Port)	750-860	840-960
Terminal handling charge (Laem Chabang Port)	84.5	126.8
Lift on/off charge (Laem Chabang Port)	19.5	27.6
(Total)	1,989.0-2,239.0	2,189.4-2,444.4

(Import)

Cost Item	Cost (USD)	
	20'	40'
Terminal handling charge (Laem Chabang Port)	84.5	126.8
Lift on/off charge (Laem Chabang Port)	25.0	35.8
Trucking fee (Laem Chabang Port- Border)	920-950	930-1,000
Custom clearance at border	150-160	150-160
Trans loading at Poipet	210	210
Trucking fee (border - factory)	700-800	720-800
Import custom clearance	200-250	200-250
(Total)	2,289.5-2,479.5	2,372.6-2,582.6

Prepared by Project Team

Table 2.7-32 Lead time of container transportation between Phnom Penh and Laem Chabang Port

Transport Items	Lead Time (hr)
Trucking from factory to border	7-8
Customs clearance in Cambodia (procedure)	1
Customs clearance in Cambodia (waiting)	5-7
Transshipment at Poipet	3-4
Customs clearance in Thailand (procedure)	1
Customs clearance in Thailand (waiting)	3
Trucking from border to Laem Chabang Port	5-6
(Total)	25-30

Prepared by Project Team

2) Problems and future outlook

A part of NR 5 in Cambodia has been submerged by flood due to the rise of water level in Tonle Sap Lake every year. NR 5 was paved with DBST, which has low water interception, and is easily damaged by flood. According to an interview with a logistics company, it is not safe to pass through NR 5 at night because there is possibility to be attacked by thieves.

As mentioned in the above clause, Cambodia acceded the CBTA in November 2001 and concluded the bilateral agreement of the CBTA with Lao PDR, Vietnam and Thailand. As mentioned in Table 2.7-33, bilateral CBTA with Thailand has not been enforced due to political issues and the difference of traffic regulation, however conferences by concerned governmental organizations have been held.

For smoother trading, the Automated SYstem for CUstoms DAta (ASYCUDA) was introduced by the World Bank's assistance. As mentioned in the previous section, from customs brokers point of view, improving the user-friendliness of ASYCUDA is expected to smooth out the current trading process further.

Table 2.7-33 Progress of bilateral agreement between Cambodia and Thailand

Under negotiations based on the GMS-CBTA framework, Thailand signed the CBTA in 1999 and Cambodia signed the CBTA in 2003.
All the attachments and protocols were signed by March 2007. MOU for the first phase of the bilateral road transport arrangement between Cambodia and Thailand (declaration in Kunming, China) was signed in 2005.
In 2009, the development of a new border check post at Poipet was planned, however it was suspended due to political issues between the two countries.
As of December 2011, bilateral CBTA between Cambodia and Thailand has not been enforced.

Source: Date Collection Survey on Integrated Physical Distribution System in the Kingdom of Cambodia/JICA, Project Team

The container transportation cost of the target year 2020 and 2030 which was estimated based on the predicted inflation rates of countries by IMF mentioned in previous paragraphs is shown in Table 2.7-34.

Table 2.7-34 Container transportation cost between Phnom Penh and Laem Chabang Port of the target year

	Container Box Size	2011 (Present)	2020	2030
Export	20'	2,114	2,757	3,740
	40'	2,317	3,011	4,069
Import	20'	2,385	3,107	4,209
	40'	2,478	3,220	4,351

Prepared by Project Team

2.7.3 Capacity of transportation routes between Phnom Penh and major gateway ports

(1) Phnom Penh/Sihanoukville (road)

1) Review method of traffic capacity

In the study, the possible capacity was examined as a traffic capacity. Possible capacity is the maximum traffic volume per hour that the vehicles can pass at a certain point in one direction (in case of two or three lanes on one side, both directions are examined). In case the road and traffic conditions meet a basic condition, the possible capacity equals the basic capacity. However, the basic capacity is reduced due to hindrance factors and the traffic volume decreases significantly. Basic capacity has to be corrected with respect to the road and traffic conditions so that the possible capacity can be calculated. In the study, lane width, lateral clearance, roadside condition, influence of large vehicles, and influence of motorbikes and bicycles were considered as hindrance factors used in calculating the possible capacity.

a) Basic capacity (C_B)

Basic capacity is shown below.

Table 2.7-35 Basic capacity of road

Road Type	Unit	Basic Capacity (pcu/hour)
Multilane (single direction)	Average on single direction	2,200
Double-lane (both direction)	Total of both direction	2,500

Note: passenger car unit (pcu)
Source: Road Transportation Capacity Manual

In consideration of the number of lanes of NR3 and NR 4 between Phnom Penh and Sihanoukville which is two, Basic Capacity is 2,500 vehicles per hour.

b) Lane width (γ_1)

Correction factor in consideration of road width is shown below.

Table 2.7-36 Correction factor in consideration of lane width

Lane Width (m)	Correction Factor
3.50	1.00
3.25	1.00
3.00	0.94
2.75	0.88
2.50	0.82

Source: Road Transportation Capacity Manual

Both of NR3 and NR 4 have a lane width of 3.25 m. Thus, the correction factor is 1.00.

c) Lateral clearance (γ_2)

Lateral clearance is the distance between an edge of road and roadside obstacle such as retaining wall, utility pole, road signage, guardrail and parked vehicles. In accordance with Road Transportation Capacity Manual, lateral clearance of more than 0.75m does not influence traffic capacity though it is basically 1.75m. In case of NR 3 and NR4, they have more than 0.75m of lateral clearance.

d) Roadside condition (γ_3)

According to the Road Transportation Capacity Manual, the travel speed becomes low due to pedestrians or bicycles pulling out in case of no access control even if traffic is of continuous flow. Considering the level of urbanization, the correction factors were decided as shown below.

Table 2.7-37 Correction factor in consideration of roadside condition

Level of Urbanization	Correction Factor
Not urbanized	0.95 - 1.0
Urbanized to some extent	0.90 - 0.95
Urbanized	0.85 - 0.90

Source: Road Transportation Capacity Manual

Most parts of the roadside of NR3 and NR have not been urbanized even where medium-scale towns exist. Thus, it is considered that the correction factor is 0.95.

e) Influence of large vehicles (γ_4)

Large vehicles occupy a large area on a road due to their size and need to reduce traveling speed in steep sections. Thus, they reduce the traffic capacity. Correction factor in consideration of mix rate of large vehicles is calculated as follows.

$$\gamma_4 = \frac{100}{(100 - PT + ET \cdot PT)}$$

where,

PT : Mix rate of large vehicles(%)*

ET : Passenger car unit for large vehicles

* Mix rate of large vehicles is 10 %, which is a standard value because there is no actual data.

Passenger car unit for large vehicle is shown below.

Table 2.7-38 Passenger car unit for large vehicle

Number of lane	Passenger Car Unit	
	urban/low land	mountainous
Double-lane	2.0	3.5
Multilane	2.0	3.0

Source: Road Transportation Capacity Manual

NR3 and NR4 have two lanes and mostly are located in low land. In accordance with the above table, Passenger car unit for large vehicles of 2.0 is adopted to calculate the influence of large vehicles of NR 3 and NR 4. Thus, the correction factor in consideration of mix rate of large vehicles of NR 3 and NR 4 is calculated to be 0.91.

f) Influence of motorbike and bicycle (γ_5)

Correction factor in consideration of motorbike and bicycle is calculated as follows.

$$\gamma_5 = \frac{Q}{(Q + \alpha \cdot Na + \beta \cdot Nb)}$$

where,

Q: Traffic volume of cars at peak time (total volume of both up and down lines: cars/hour)

Na: Traffic volume of motorbikes at peak time (total volume of both up and down lines: motorbikes/hour)

α: Passenger car unit for motorbikes

Nb: Traffic volume of bicycles at peak time (total volume of both up and down lines: bicycles/hour)

β: Passenger car unit for bicycles

Passenger car unit for motorbikes and bicycles is shown below.

Table 2.7-39 Passenger car unit for motorbike and bicycle

Road Category	Motorbike	Bicycle
Local Road	0.75	0.50
Urban Road	0.50	0.33

Source: Road Transportation Capacity Manual

NR 3 and NR 4 are mostly classified as a local road. Thus, passenger car unit for motorbikes of 0.75 is adopted for the calculation. In the study, traffic volume in accordance with the result of the traffic survey conducted at NR 4 in 2009 is used as a refulgence value for calculation of the collection factor. Thus, traffic volume of car at peak time (total volume of both up and down lanes: cars/hour) and traffic volume of motorbikes at peak time (total volume of both up and down lines: motorbikes/hour) are shown below.

- Traffic volume of cars at peak time (Q) : 167 cars/hour
- Traffic volume of motorbikes at peak time (Na) : 58 motorbikes/hour

On the other hand, traffic volume of bicycles was not surveyed. However, it is thought that the volume is not that large. Thus, the volume is not considered for the calculation. Correction factor in consideration of motorbikes and bicycles is calculated to be 0.79.

2) Calculation of possible capacity

Possible capacity is calculated by multiplying basic capacity by hindrance factors mentioned above. Calculating formula is shown below.

$$C = C_B \times \gamma_1 \times \gamma_2 \times \gamma_3 \times \gamma_4 \times \gamma_5$$

where,

C : Possible capacity (pcu/hour)
C_B : Basic capacity (pcu/hour)
γ_1 : hindrance factor (1) : Lane width
γ_2 : hindrance factor (2) : Lateral clearance
γ_3 : hindrance factor (3) : Roadside condition
γ_4 : hindrance factor (4) : Influence of large vehicles
γ_5 : hindrance factor (5) : Influence of motorbikes and bicycles

Thus, the possible capacity of NR 3 and NR 4, which connect Phnom Penh with Sihanoukville, is calculated to be 1,713 pcu/h. The unit of the possible capacity is given by PCU (Passenger Car Unit). To estimate the possible capacity for heavy vehicle based on the estimated possible capacity, it is needed to calculate the Basic Capacity (BC) for heavy vehicle with the heavy vehicle conversion coefficient (2.0) and multiply the Basic Capacity by each hindrance factor in relation to lane width, lateral clearance, roadside condition and influence of motorbikes and bicycles.

For the traffic capacity calculation, the possible heavy vehicle traffic capacity is 10%, since the estimated heavy vehicle mix ratio was 10%. Accordingly, the possible heavy vehicle traffic capacity of 171 vehicles per hour was calculated on NR3 and 4.

(2) Phnom Penh/Sihanoukville (railway)

1) Current situation

The railway route connecting Phnom Penh and Sihanoukville is not in service at present due to the ongoing ADB railway rehabilitation project. However, it is expected that the transport capacity will significantly improve after the completion of the project.

2) Expected transport capacity after the ADB railway rehabilitation project

Long trains with lengths of 1 km can be operated on the railway route connecting Phnom Penh and Sihanoukville after the completion of the ADB railway rehabilitation project.

On the other hand, a single track is applied for the section between Phnom Penh and Sihanoukville. The track capacity (maximum number of operable trains per day) of a single track line is calculated using the following formula:

$$N = \frac{1{,}440}{t+s} \times f$$

Where,

N: Track capacity (total of up and down line)
t: Travel time between signaling stations with passing loop (min)
s: Train handling time at signaling stations (2.5 min except automatic, interlocking, or tokenless

block system)

f: Track occupancy rate (common case: 0.6)

According to the reply of TRR to the questionnaire, they plan to treat Takeo Station, Tani Station, Kampot Station, and Veal Ring Station as signaling stations for the passing of two trains. The distance and required travel time between stations were calculated as shown in Table 2.7-40.

Table 2.7-40 Distance and required travel time between signaling stations (between Phnom Penh and Sihanoukville)

Station	PK	Distance (km)	Required time (min.)
Phnom Penh (Samrong) Sta.	9.4		
Takeo Sta.	74.5	65.1	78
Tani Sta.	100.5	26	31
Kampot Sta.	166	65.5	**79**
Veal Ring Sta.	216.6	50.6	61
Sihanoukville Sta.	262.6	46	55

Operational Speed (km/hr)= 50

Prepared by Project Team

The table shows that the section with the longest required travel time is between Tani Station and Kampot Station with 79 min. The required travel time of the section is treated as "*t*" in the formula above. Based on the results, the track capacity between Phnom Penh and Sihanoukville was calculated as follows:

$$N = 1,440 / (79 + 2.5) \times 0.6 = 10.6$$

The result means that the maximum number of operable trains per day between Phnom Penh and Sihanoukville is ten trains/day for both the up and down lines, or five trains/day for each direction.

However, the number of possible trains to be utilized for containers was calculated as "the maximum number of operable trains per day" minus "the number of non-container freight trains". The daily railway freight transport volume, excluding containers forecasted in the ongoing Sihanoukville Multipurpose Terminal Project, is equivalent to approximately 1,500 m of wagon length. It is equivalent to four up and down trains/day. Hence, the non-container freight trains occupy four trains in a ten-train capacity. From the above, the remaining six trains for both the up and down lines are available for container train operations (three trains from Phnom Penh to Sihanoukville, and three trains from Sihanoukville to Phnom Penh).

According to the results of hearing with TRR, the number of 40-ft container wagons per 1 km long train is 72. Therefore, the container transport capacity by railway between Phnom Penh and Sihanoukville was calculated as shown in Table 2.7-41.

Table 2.7-41 Calculated container transport capacity by railway

	Number of container wagons per train	Maximum number of trains per day	Possible wagon transport number per day	Equivalent TEU per day	Yearly possible transport TEU
From Phnom Penh to Sihanoukville	72 wagons	3 trains/day	216 wagons/day	432 TEU/day	152,000 TEU/yr
From Sihanoukville to Phnom Penh	72 wagons	3 trains/day	216 wagons/day	432 TEU/day	152,000 TEU/yr
Total		6 trains/day	432 wagons/day	864 TEU/day	304,000 TEU/yr

Prepared by Project Team

(3) Phnom Penh/Ho Chi Minh (road)

1) Review method of traffic capacity

The route which reaches from Phnom Penh to Ho Chi Minh and Cai Mep & Thi Vai Port consists of NR 1 in Cambodia, NR 22, NR 1A and NR 51 in Vietnam. The number of lanes is different in each section as shown below.

Table 2.7-42 Number of lane at each section between Phnom Penh and Cai Mep & Thi Vai Port

No	Road	Section	Country	Number of Lane (on single lane)
1	NR 1	Phnom Penh - Border of Vietnam	Cambodia	1
2	NR 22	Border of Cambodia (Moc Bai) - End point of one lane on NR 22	Vietnam	1
3	NR 22	Beginning point of double lanes on NR 22 - Connection point with NR 1A	Vietnam	2
4	NR 1A	Connection point with NR 22 - Connection Point with NR 51	Vietnam	2
5	NR 51	Connection point with NR1A - Cai Mep & Thi Vai Port	Vietnam	1

Prepared by Project Team

Possible capacity is calculated in each section because it is calculated based on basic capacity which depends on the number of lanes. Possible capacity is calculated as mentioned review method??? in (1) Phnom Penh/Sihanoukville (road).

a) Basic capacity (C_B)

Basic capacity of each section in accordance with the number of lanes is mentioned below.

Table 2.7-43 Basic capacity at each section between Phnom Penh and Cai Mep & Thi Vai Port

No	Road	Section	Number of Lane (on signle lane)	Basic Capacity (pcu/hour)
1	NR 1	Phnom Penh - Border of Vietnam	1	2,500
2	NR 22	Border of Cambodia (Moc Bai) - End point of one lane on NR 22	1	2,500
3	NR 22	Beginning point of double lanes on NR 22 - Connection point with NR 1A	2	8,800
4	NR 1A	Connection point with NR 22 - Connection Point with NR 51	2	8,800
5	NR 51	Connection point with NR1A - Cai Mep & Thi Vai Port	1	2,500

Prepared by Project Team

b) Lane width (γ_1)

Correction factor of each section in accordance with lane width is mentioned below.

Table 2.7-44 Correction factor of each section in accordance with lane width

No	Road	Section	Lane Width (m)	Correction Factor
1	NR 1	Phnom Penh - Border of Vietnam	3.50	1.0
2	NR 22	Border of Cambodia (Moc Bai) - End point of one lane on NR 22	4.00	1.0
3	NR 22	Beginning point of double lanes on NR 22 - Connection point with NR 1A	4.00	1.0
4	NR 1A	Connection point with NR 22 - Connection Point with NR 51	4.00	1.0
5	NR 51	Connection point with NR1A - Cai Mep & Thi Vai Port	4.00	1.0

Prepared by Project Team

c) Lateral clearance (γ_2)

In accordance with Road Transportation Capacity Manual, lateral clearance of more than 0.75m does not influence on traffic capacity though it is basically 1.75m. As shown in the table below, lateral clearance of each section is more than 0.75m.

Table 2.7-45 Lateral clearance of each section

No	Road	Section	Lateral Clearance (m)
1	NR 1	Phnom Penh - Border of Vietnam	1.2
2	NR 22	Border of Cambodia (Moc Bai) - End point of one lane on NR 22	1.2
3	NR 22	Beginning point of double lanes on NR 22 - Connection point with NR 1A	1.3
4	NR 1A	Connection point with NR 22 - Connection Point with NR 51	1.3
5	NR 51	Connection point with NR1A - Cai Mep & Thi Vai Port	1.3

Prepared by Project Team

d) Roadside condition (γ_3)

Correction factor based on level of urbanization is decided as shown below.

Table 2.7-46 Correction factor of each section in accordance with roadside condition

No	Road	Section	Level of Urbanization	Correction Factor
1	NR 1	Phnom Penh - Border of Vietnam	Not urbanized	0.95
2	NR 22	Border of Cambodia (Moc Bai) - End point of one lane on NR 22	Not urbanized	0.95
3	NR 22	Beginning point of double lanes on NR 22 - Connection point with NR 1A	Urbanized to some extent	0.90
4	NR 1A	Connection point with NR 22 - Connection Point with NR 51	Urbanized	0.85
5	NR 51	Connection point with NR1A - Cai Mep & Thi Vai Port	Not urbanized	0.95

Prepared by Project Team

e) Influence of large vehicles (γ_4)

Correction factor in consideration of mix rate of large vehicles is calculated as follows.

$$\gamma_4 = \frac{100}{(100 - PT + ET \cdot PT)}$$

where,

PT : Mix rate of large vehicles (%)*
ET : Passenger car unit for large vehicles
* Mix rate of large vehicles is 10 % which is a standard value because there is no actual data.

In accordance with the above equation, correction factor in consideration of mix rate of large vehicle of each section is calculated to be 0.91.

f) Influence of motorbike and bicycle (γ_5)

Correction factor in consideration of motorbikes and bicycles is calculated as follows.

$$\gamma_5 = \frac{Q}{(Q + \alpha \cdot Na + \beta \cdot Nb)}$$

where,

Q : Traffic volume of cars at peak time (total volume of both up and down lines : cars/hour)
Na : Traffic volume of motorbikes at peak time (total volume of both up and down lines : motorbikes/hour)
α : Passenger car unit for motorbikes
Nb : Traffic volume of bicycles at peak time (total volume of both up and down lines : bicycles/hour)
β : Passenger car unit for bicycles

In the study, an actual traffic volume survey was not conducted in each section. In order to calculate correction factor in consideration of motorbikes and bicycles, Q and Na are assumed to be 150 cars/hour and 50 motorbikes/hour respectively based on the traffic survey conducted in 2009. On

the other hand, traffic volume survey of bicycles has never been conducted. However, it is thought that the volume is not very large. Thus, the volume is not considered for the calculation. Correction factor in consideration of motorbikes and bicycles is calculated as shown below.

Table 2.7-47 Correction factor in consideration of motorbikes and bicycles

No	Road	Section	Correction Factor in consideration of motorbike and bicycle
1	NR 1	Phnom Penh - Border of Vietnam	0.80
2	NR 22	Border of Cambodia (Moc Bai) - End point of one lane on NR 22	0.80
3	NR 22	Beginning point of double lanes on NR 22 - Connection point with NR 1A	0.80
4	NR 1A	Connection point with NR 22 - Connection Point with NR 51	0.86
5	NR 51	Connection point with NR1A - Cai Mep & Thi Vai Port	0.80

Prepared by Project Team

2) Calculation of possible capacity

Possible capacity is calculated by multiplying basic capacity by hindrance factors mentioned above. Calculating formula is shown below.

$$C = C_B \times \gamma_1 \times \gamma_2 \times \gamma_3 \times \gamma_4 \times \gamma_5$$

where,

C : Possible capacity (pcu/hour)
C_B : Basic capacity (pcu/hour)
γ_1 : hindrance factor (1) : Lane width
γ_2 : hindrance factor (2) : Lateral clearance
γ_3 : hindrance factor (3) : Roadside condition
γ_4 : hindrance factor (4) : Influence of large vehicles
γ_5 : hindrance factor (5) : Influence of motorbikes and bicycles

Thus, possible capacity of each section, which connects Phnom Penh with Ho Chi Minh and Cai Mep & Thi Vai Port, is calculated as shown in the table below. Also, the possible capacity of heavy vehicles can be calculated as follows, based on the same method applied for "Phnom Penh-Sihanoukville (Road)".

Table 2.7-48 Possible capacity of each section connecting Phnom Penh with Ho Chi Minh and Cai Mep & Thi Vai Port

No	Road	Section	Possible Capacity (pcu/hour)	Possible Capacity of Large Vehicle (vehicle/hour)
1	NR 1	Phnom Penh - Border of Vietnam	1,727	173
2	NR 22	Border of Cambodia (Moc Bai) - End point of one lane on NR 22	1,727	173
3	NR 22	Beginning point of double lanes on NR 22 - Connection point with NR 1A	5,760	576
4	NR 1A	Connection point with NR 22 - Connection Point with NR 51	5,829	583
5	NR 51	Connection point with NR1A - Cai Mep & Thi Vai Port	1,727	173

Prepared by Project Team

(4) Phnom Penh/Ho Chi Minh (inland waterway)

Since the river channel of Mekong has enough capacity, the decisive factor of capacity of the inland waterway system is that of Phnom Penh Port. Although the current volume of fleet for Cambodia – Vietnam waterborne container transport is limited and barge operators don't have plans for strengthening their fleet, it would be very easy to increase the capacity of barges by diverting some barges from the large fleet deployed in Vietnamese domestic service when the demand arises.

At present, Phnom Penh Port has reached its capacity limit and its handling volume of 60,000 TEU/year can be considered as the capacity of the inland waterway. As mentioned in 2.5, the construction of the new container terminal of Phnom Penh Port is on-going and its capacity will be increased up to 120,000 TEU when first phase development is completed in 2012 and to 500,000 TEU when the entire project is completed. Since there is no further development plan approved by RGC which will be realized before the target year, the capacity of Mekong River waterborne transport can be assessed to be 500,000 TEU in 2030.

(5) Phnom Penh/Laem Chabang (road)

1) Review method of traffic capacity

The route which goes from Phnom Penh to Laem Chabang consists of NR 5 in Cambodia, NR 33, PR 304, PR 314, NR 7 and the approach road to Laem Chabang in Thailand. The number of lanes is different in each section as shown below.

Table 2.7-49 Number of lane at each section between Phnom Penh and Laem Chabang Port

No	Road	Section	Country	Number of Lane (on single lane)
1	NR 5	Phnom Penh - Border of Thailand	Cambodia	2
2	NR 33	Border of Cambodia (Aranyaprathet) - Connection point with PR304	Thailand	2
3	PR 304	Connection point with NR33 - Connection point with PR 314	Thailand	2
4	PR 314	Connection point with PR 304 - Connection point with NR 51	Thailand	2
5	NR 7	Connection point with PR 314 - Intersection of Laem Chabang Port	Thailand	4
6	Approach Road	Intersection of Laem Chabang Port - Gate	Thailand	2

Prepared by Project Team

The possible capacity was calculated for each section because it was calculated based on basic capacity which depends on the number of lanes. The possible capacity was calculated as mentioned in the review method discussed in item (1) Phnom Penh/Sihanoukville (Road).

a) Basic capacity (C_B)

Basic capacity of each section in accordance with the number of lanes is mentioned below.

Table 2.7-50 Basic capacity at each section between Phnom Penh and Laem Chabang Port

No	Road	Section	Number of Lane (on single lane)	Basic Capacity (pcu/hour)
1	NR 5	Phnom Penh - Border of Thailand	2	8,800
2	NR 33	Border of Cambodia (Aranyaprathet) - Connection point with PR304	2	8,800
3	PR 304	Connection point with NR33 - Connection point with PR 314	2	8,800
4	PR 314	Connection point with PR 304 - Connection point with NR 51	2	8,800
5	NR 7	Connection point with PR 314 - Intersection of Laem Chabang Port	4	17,600
6	Approach Road	Intersection of Laem Chabang Port - Gate	2	8,800

Prepared by Project Team

b) Lane width (γ_1)

Correction factor of each section in accordance with lane width is mentioned below.

Table 2.7-51 Correction factor of each section in accordance with lane width

No	Road	Section	Lane Width (m)	Correction Factor
1	NR 5	Phnom Penh - Border of Thailand	4.00	1.0
2	NR 33	Border of Cambodia (Aranyaprathet) - Connection point with PR304	4.00	1.0
3	PR 304	Connection point with NR33 - Connection point with PR 314	4.00	1.0
4	PR 314	Connection point with PR 304 - Connection point with NR 51	4.00	1.0
5	NR 7	Connection point with PR 314 - Intersection of Laem Chabang Port	4.00	1.0
6	Approach Road	Intersection of Laem Chabang Port - Gate	4.00	1.0

Prepared by Project Team

c) Lateral clearance (γ_2)

In accordance with Road Transportation Capacity Manual, lateral clearance which is more than 0.75m does not influence traffic capacity though it is basically 1.75m. As shown in the table below, lateral clearance of each section is more than 0.75m.

Table 2.7-52 Lateral clearance of each section

No	Road	Section	Lateral Clearance (m)
1	NR 5	Phnom Penh - Border of Thailand	1.0
2	NR 33	Border of Cambodia (Aranyaprathet) - Connection point with PR304	2.5
3	PR 304	Connection point with NR33 - Connection point with PR 314	1.5
4	PR 314	Connection point with PR 304 - Connection point with NR 51	1.5
5	NR 7	Connection point with PR 314 - Intersection of Laem Chabang Port	1.5
6	Approach Road	Intersection of Laem Chabang Port - Gate	2.0

Prepared by Project Team

d) Roadside condition (γ_3)

Correction factor in consideration of level of urbanization is decided as shown below.

Table 2.7-53 Correction factor of each section in accordance with roadside condition

No	Road	Section	Level of Urbanization	Correction Factor
1	NR 5	Phnom Penh - Border of Thailand	Not urbanized	0.95
2	NR 33	Border of Cambodia (Aranyaprathet) - Connection point with PR304	Urbanized to some extent	0.90
3	PR 304	Connection point with NR33 - Connection point with PR 314	Urbanized to some extent	0.90
4	PR 314	Connection point with PR 304 - Connection point with NR 51	Urbanized to some extent	0.90
5	NR 7	Connection point with PR 314 - Intersection of Laem Chabang Port	Urbanized	1.00*
6	Approach Road	Intersection of Laem Chabang Port - Gate	Urbanized	1.00*

Prepared by Project Team

*Both sections of NR 7 and approach road are urbanized. However, the sections are not influenced by roadside condition because the sections are part of a highway.

e) Influence of large vehicles (γ_4)

Correction factor in consideration of mix rate of large vehicles is calculated as follows.

$$\gamma_4 = \frac{100}{(100 - PT + ET \cdot PT)}$$

where,

PT : Mix rate of large vehicles (%)*

ET : Passenger car unit for large vehicles

* Mix rate of large vehicles is 10 % which is a standard value because there is no data measured actually without both section of NR 7 and approach road where there is a lot of traffic of large vehicles.

In accordance with the above equation, correction factor in consideration of mix rate of large vehicles of each section is calculated as shown below.

Table 2.7-54 Correction factor of each section in accordance with roadside condition

No	Road	Section	Mix Rate of Large Vehicles (%)	Correction Factor
1	NR 5	Phnom Penh - Border of Thailand	10	0.91
2	NR 33	Border of Cambodia (Aranyaprathet) - Connection point with PR304	10	0.91
3	PR 304	Connection point with NR33 - Connection point with PR 314	10	0.91
4	PR 314	Connection point with PR 304 - Connection point with NR 51	10	0.91
5	NR 7	Connection point with PR 314 - Intersection of Laem Chabang Port	15	0.87
6	Approach Road	Intersection of Laem Chabang Port - Gate	15	0.87

Prepared by Project Team

f) Influence of motorbike and bicycle (γ_5)

Correction factor in consideration of motorbikes and bicycles is calculated as follows.

$$\gamma_5 = \frac{Q}{(Q + \alpha \cdot Na + \beta \cdot Nb)}$$

where,

Q : Traffic volume of cars at peak time (total volume of both up and down lines : cars/hour)
Na : Traffic volume of motorbikes at peak time (total volume of both up and down lines : motorbikes/hour)
α : Passenger car unit for motorbikes
Nb : Traffic volume of bicycles at peak time (total volume of both up and down lines : bicycles/hour)
β : Passenger car unit for bicycles

In the study, an actual traffic volume survey was not conducted in each section. In order to calculate the correction factor in consideration of motorbikes and bicycles, Q and Na are assumed to be 150 cars/hour and 50 motorbikes/hour respectively based on the traffic survey conducted in 2009. However, correction factor in consideration of motorbike and bicycle in both sections of NR 7 and approach road is assumed to be 1.00 because no motorbikes or bicycles were found in the sections.

On the other hand, traffic volume survey of bicycles has never been conducted. However, it is thought that the volume is not very large. Thus, the volume is not considered for the calculation. Correction factor in consideration of motorbikes and bicycles is calculated as shown below.

Table 2.7-55 Correction factor in consideration of motorbikes and bicycles

No	Road	Section	Correction Factor in consideration of motorbike and bicycle
1	NR 5	Phnom Penh - Border of Thailand	0.80
2	NR 33	Border of Cambodia (Aranyaprathet) - Connection point with PR304	0.80
3	PR 304	Connection point with NR33 - Connection point with PR 314	0.86
4	PR 314	Connection point with PR 304 - Connection point with NR 51	0.86
5	NR 7	Connection point with PR 314 - Intersection of Laem Chabang Port	1.00
6	Approach Road	Intersection of Laem Chabang Port - Gate	1.00

Prepared by Project Team

2) Calculation of possible capacity

Possible capacity is calculated by multiplying basic capacity by hindrance factors mentioned above. Calculating formula is shown below.

$$C = C_B \times \gamma_1 \times \gamma_2 \times \gamma_3 \times \gamma_4 \times \gamma_5$$

where,

C : Possible capacity (pcu/hour)
C_B : Basic capacity (pcu/hour)

γ_1 : hindrance factor (1) : Lane width
γ_2 : hindrance factor (2) : Lateral clearance
γ_3 : hindrance factor (3) : Roadside condition
γ_4 : hindrance factor (4) : Influence of large vehicles
γ_5 : hindrance factor (5) : Influence of motorbikes and bicycles

Thus, possible capacity of each section which connects Phnom Penh with Laem Chabang Port is calculated as shown below. The possible heavy vehicle traffic capacity on each road can be calculated as below, since the estimated heavy vehicle mix ratio was 15% between the NR7 and approach roads to Laem Chabang Port.

Table 2.7-56 Possible capacity of each section connecting Phnom Penh with Laem Chabang Port

No	Road	Section	Possible Capacity (pcu/hour)	Possible Capacity of Large Vehicle (vehicle/hour)
1	NR 5	Phnom Penh - Border of Thailand	6,080	173
2	NR 33	Border of Cambodia (Aranyaprathet) – Connection point with PR304	5,760	576
3	PR 304	Connection point with NR33 – Connection point with PR 314	6,171	617
4	PR 314	Connection point with PR 304 - Connection point with NR 51	6,171	617
5	NR 7	Connection point with PR 314 – Intersection of Laem Chabang Port	15,304	1,320
6	Approach Road	Intersection of Laem Chabang Port - Gate	7,652	600

Prepared by Project Team

2.7.4 Comparative advantage of Sihanoukville Port

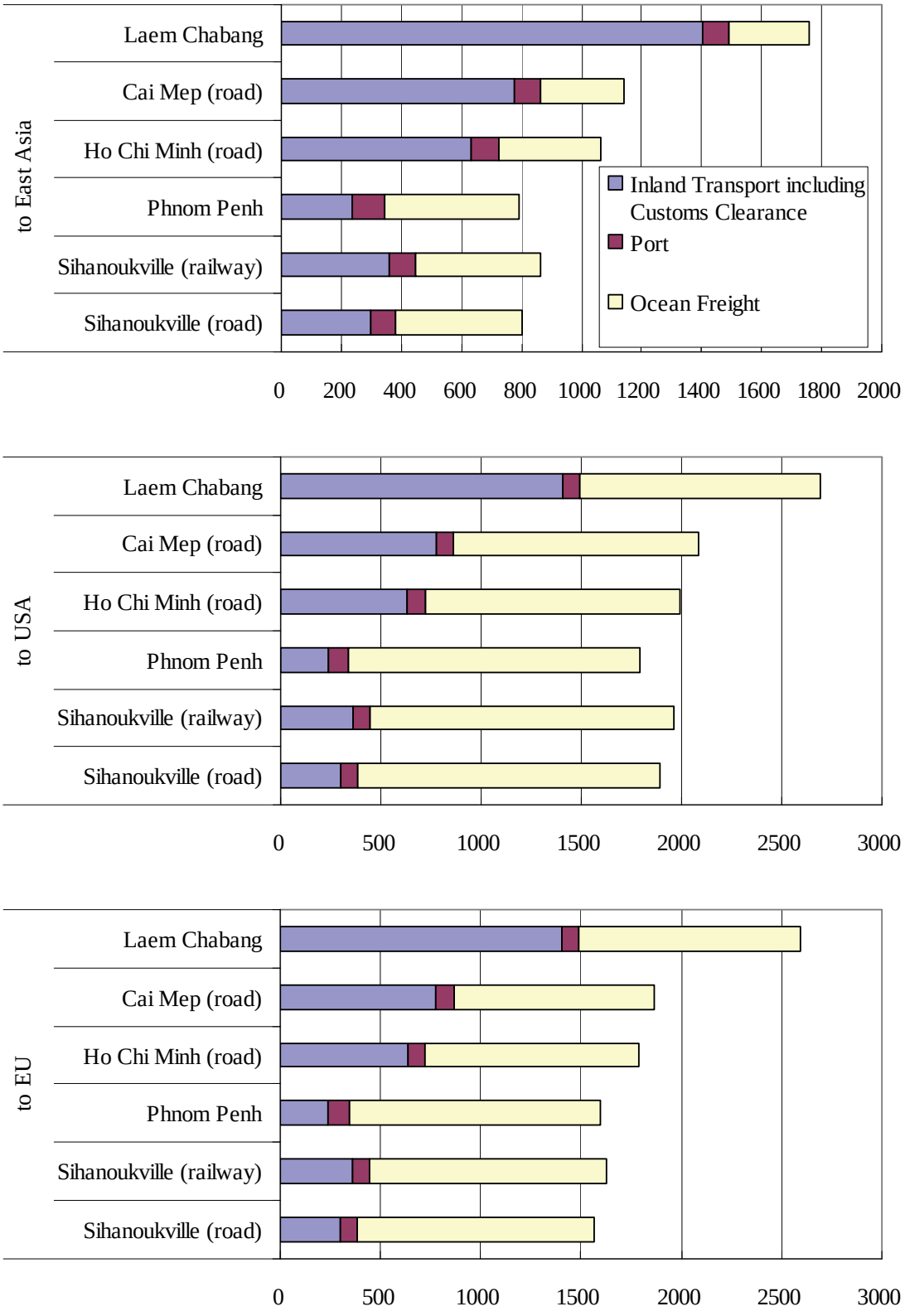
(The description below is based on the initial assessment. The data will be analyzed in detail in the course of the Project)

Figure 2.7-6 and Figure 2.7-7 compare the cost for transportation between Phnom Penh and major export destination or import origin via each gateway port. Since the transportation cost per TEU is different between 20-foot containers and 40-foot containers, the average cost per TEU corresponding to the composition of containers in Cambodia (20-foot:40-foot = 35:65) is shown in the figures. Import cost through Cambodian ports includes scanning fee (31.5 USD for 20-foot containers, 46.5 USD for 40-foot containers), whereas export cost through Cambodian port doesn't include it since scanning is exempted for garment products and footwear, which account for the major portion of exported cargoes. Ocean freight rate for East Asia is calculated based on that of Shanghai, for US based on Los Angeles, and for EU based on Rotterdam. 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:

- It would be difficult to lower the transportation cost through Sihanoukville Port by utilizing railway since distance between Phnom Penh and Sihanoukville is relatively short, and the cost reduction by the railway transportation would be cancelled by the cost for increased lift-on/lift-off and short drayage by trucks.
- 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

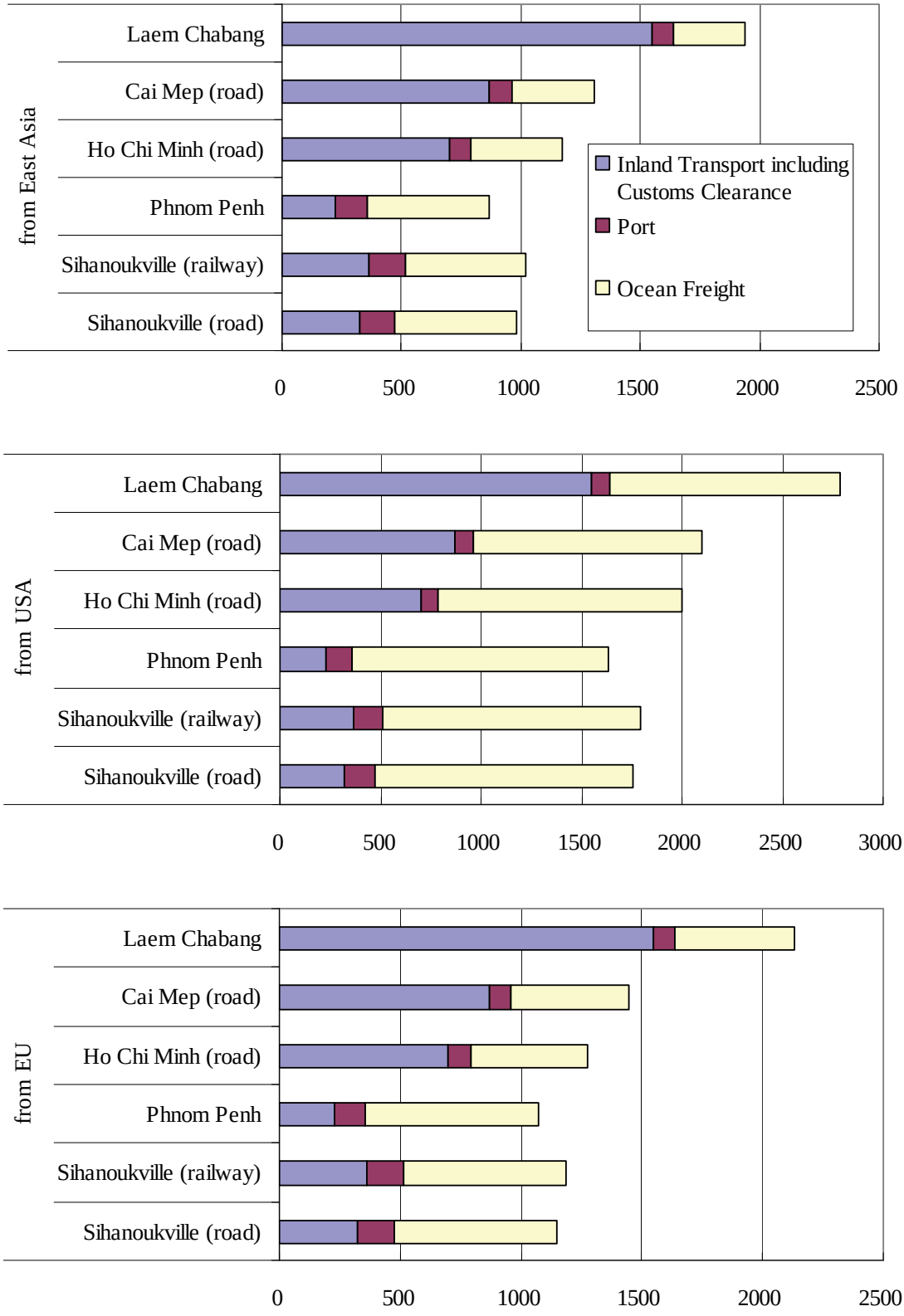
Sihanoukville Port and Phnom Penh is almost the same.

- For import from East Asia, Phnom Penh Port provides slightly the most economical route since Sihanoukville Port levies the lift-on fee for empty containers used for export on imported containers, and this lowers Sihanoukville's competitiveness in the import market. The difference of cost between Cambodian ports and the cross-border route which uses Vietnamese ports is smaller than that in export market because fee for compulsory scanning has to be borne by basically all imported containers in Cambodian ports.
- For export and import to/from 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. For import, Phnom Penh Port is slightly more competitive due to the above-mentioned lift-on fee in Sihanoukville Port.



Prepared by Project Team

Figure 2.7-6 Comparison of cost for export from Phnom Penh to major destinations via each gateway port (unit: USD/TEU)

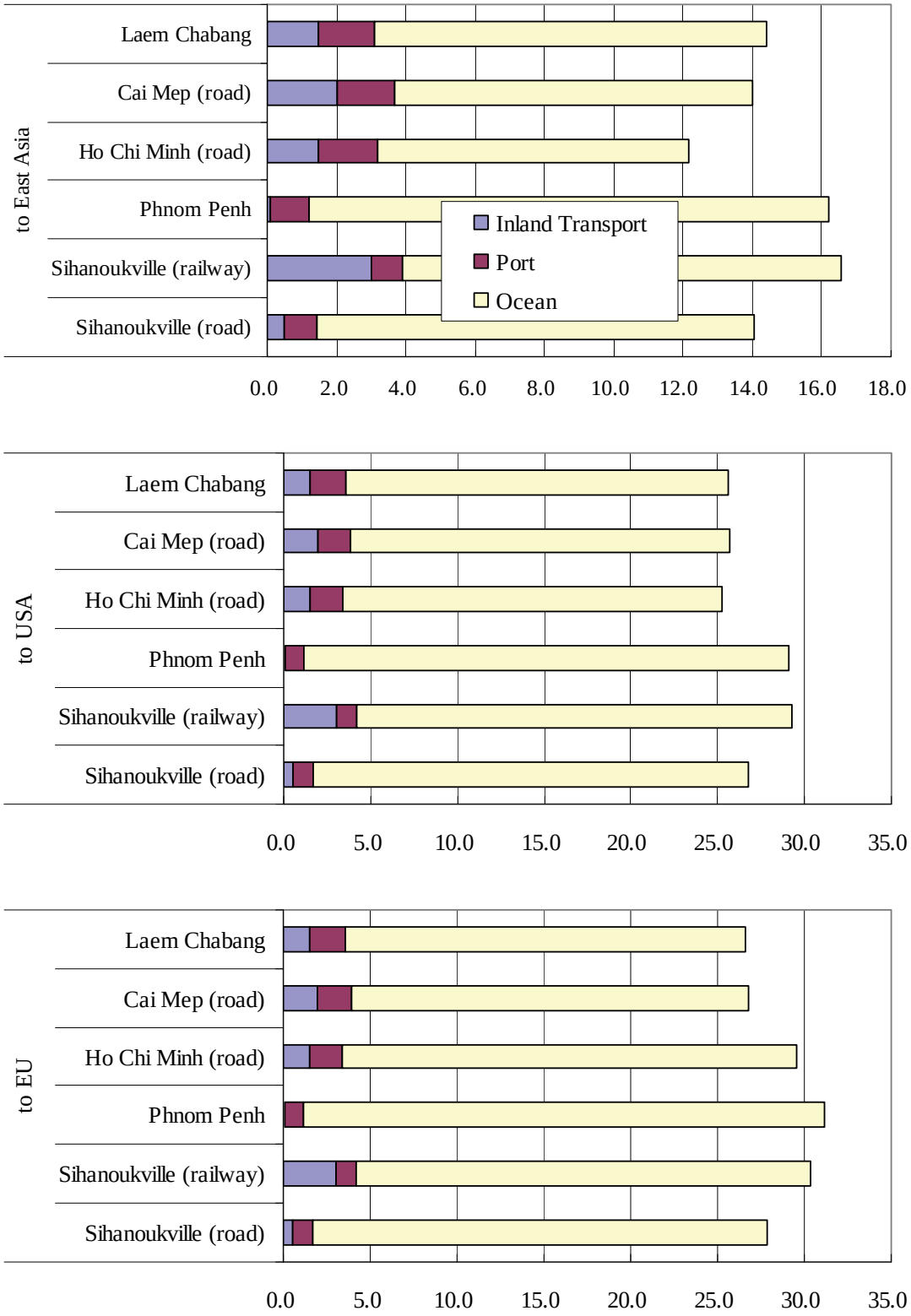


Prepared by Project Team

Figure 2.7-7 Comparison of cost for import to Phnom Penh from major origins via each gateway port (unit: USD/TEU)

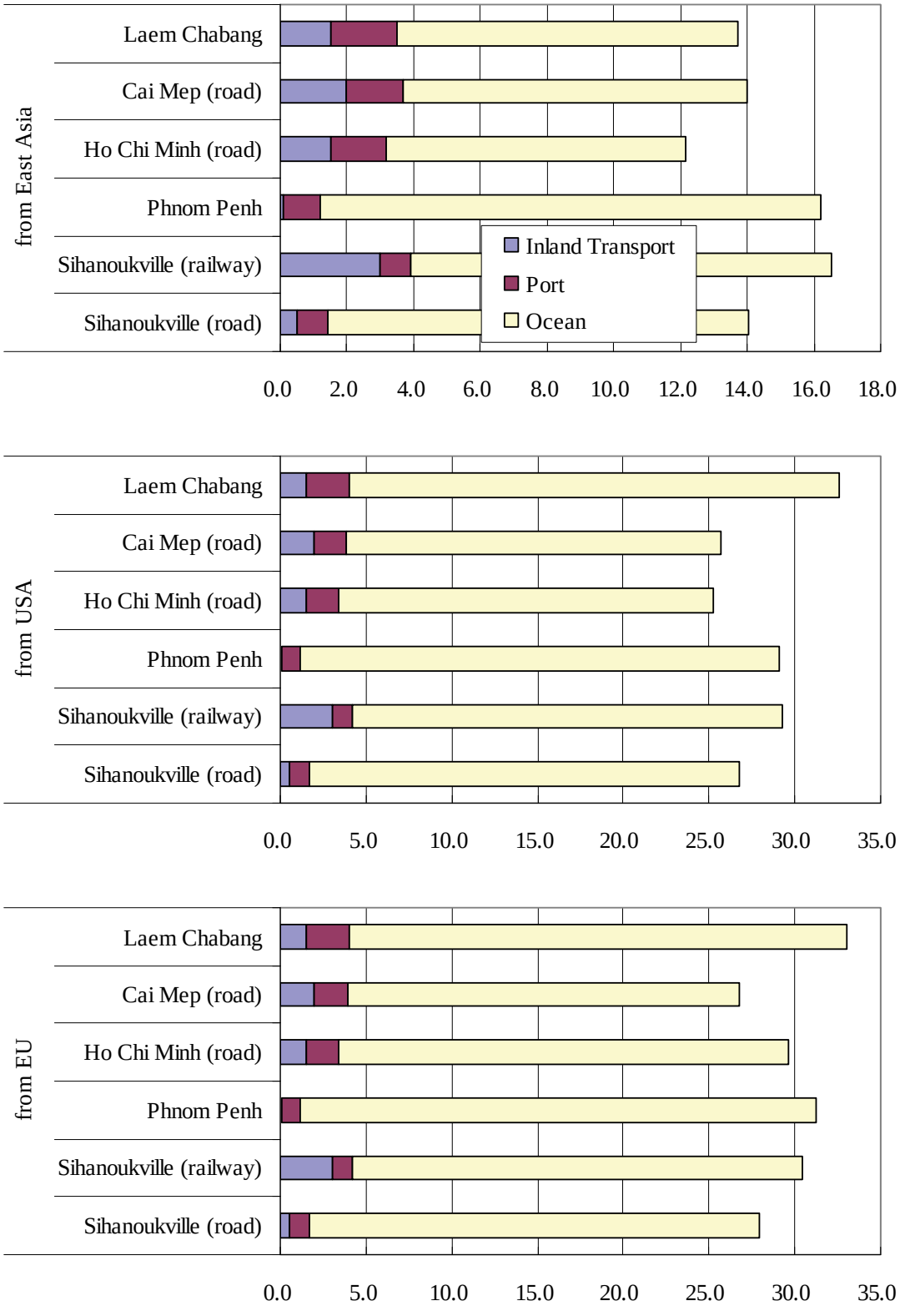
Figure 2.7-8 and Figure 2.7-9 compare days required for transportation between Phnom Penh and major cargo origin/destination through each gateway port. These figures indicate the following:

- 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 2.7-8 Comparison of required days for export from Phnom Penh to major destinations via each gateway port



Prepared by Project Team

Figure 2.7-9 Comparison of required days for import to Phnom Penh from major origins via each gateway port

Table 2.7-57 and Table 2.7-58 show the box trade partners of Sihanoukville Port and Phnom Penh Port calculated from port statistics prepared by PENPPAS. Based on these tables Figure 2.7-10

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 as mentioned above. This is partially because the Government of Viet Nam had been banning import and transit of second-hand machinery and vehicles until quite recently. The fact that garment and footwear industries tend to prefer land transport from Ho Chi Minh Port rather than waterborne transport via the Mekong River for import of raw materials for the purpose of early commencement of production even though the transportation cost is higher would also lower the share of Phnom Penh Port.

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. This is because the FOB Phnom Penh route via waterborne transport is less known among importers in the USA and EU. In addition, longer required days for the transportation, insufficient frequency of trunk line service in Cai Mep Port would also lower the share of Phnom Penh Port.

Following factors would affect the competitiveness of each route in the future:

- Higher inflation rate in Vietnam would lower the competitiveness of land transport routes between Phnom Penh and Vietnamese ports. This would also lower the advantage of Phnom Penh Port to some extent.
- On the other hand, completion of Neak Leung Bridge over the Mekong River and facilitation of cross border transport would push up the competitiveness of land transport routes between Phnom Penh and Vietnamese ports. This would also lower the advantage of Phnom Penh Port to some extent.
- The increased frequency of trunk line service at Cai Mep Port in line with the progress of port development would push up the competitiveness of land transport routes between Phnom Penh and Vietnamese ports as well as the waterborne transport route via Phnom Penh Port.
- Efficiency improvement of Sihanoukville Port and Phnom Penh Port would improve their competitiveness.
- The ban of import and transit of second hand machinery and vehicles at Vietnamese ports was lifted in 2011. This would lower the market share of Sihanoukville for import from Asia.
- The increased capacity of Phnom Penh Port by commencement of operation of the new container terminal will push up the market share of the port.
- Industrial development of littoral provinces in Cambodia would increase the market share of Sihanoukville Port.

The impacts of the above mentioned factors upon demarcation among transportation routes are analyzed quantitatively in the next chapter.

Table 2.7-57 Box trade partners of Sihanoukville Port

EXPORT

1	USA	29.7%
2	France	9.4%
3	China	8.4%
4	UK	8.1%
5	Netherlands	5.0%
6	Poland	4.3%
7	Germany	4.3%
8	Canada	3.9%
9	Malaysia	3.1%
10	Spain	2.1%

IMPORT

1	Singapore	27.2%
2	China	17.2%
3	Taiwan	11.4%
4	Malaysia	10.0%
5	Hong Kong	6.9%
6	Japan	4.0%
7	South Korea	3.9%
8	India	3.5%
9	Indonesia	3.0%
10	Viet Nam	2.3%

EAST ASIA	12.0%
SOUTH EAST ASIA	4.8%
MIDDLE EAST/SOUTH ASIA	2.4%
EUROPE	44.0%
AFRICA	0.7%
AMERICAS	34.7%
OCEANIA	1.4%

EAST ASIA	43.4%
SOUTH EAST ASIA	44.9%
MIDDLE EAST/SOUTH ASIA	4.7%
EUROPE	3.0%
AFRICA	0.0%
AMERICAS	3.5%
OCEANIA	0.4%

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

Table 2.7-58 Box trade partners of Phnom Penh Port

EXPORT

1	USA	29.7%
2	France	9.4%
3	China	8.4%
4	UK	8.1%
5	Netherlands	5.0%
6	Poland	4.3%
7	Germany	4.3%
8	Canada	3.9%
9	Malaysia	3.1%
10	Spain	2.1%

IMPORT

1	China	34.8%
2	Vietnam	30.4%
3	Hong Kong	8.7%
4	Singapore	6.1%
5	Indonesia	4.9%
6	Malaysia	4.4%
7	France	3.2%
8	South Korea	2.4%
9	Thailand	1.3%
10	Japan	1.1%

EAST ASIA	12.0%
SOUTH EAST ASIA	4.8%
MIDDLE EAST/SOUTH ASIA	2.4%
EUROPE	44.0%
AFRICA	0.7%
AMERICAS	34.7%
OCEANIA	1.4%

EAST ASIA	48.1%
SOUTH EAST ASIA	47.1%
MIDDLE EAST/SOUTH ASIA	0.0%
EUROPE	3.4%
AFRICA	0.1%
AMERICAS	0.9%
OCEANIA	0.4%

Box trade partner for seaborne cargoes

EAST ASIA	32.7%
SOUTH EAST ASIA	2.2%
MIDDLE EAST/SOUTH ASIA	0.0%
EUROPE	1.8%
AFRICA	0.0%
AMERICAS	63.3%
OCEANIA	0.0%

EAST ASIA	69.2%
SOUTH EAST ASIA	24.0%
MIDDLE EAST/SOUTH ASIA	0.0%
EUROPE	4.9%
AFRICA	0.1%
AMERICAS	1.3%
OCEANIA	0.5%

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

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

Figure 2.7-10 Container market share of Sihanoukville Port and Phnom Penh Port (tentative)

3. VISION OF SIHANOUKVILLE PORT

3.1. Socio-economic Framework

IMF developed a scenario for Cambodian GDP growth over the medium term in the course of the dept sustainability assessment as follows:

After a sharp slowdown in 2009, the economy will only gradually return to potential growth of about 6–7 percent. Important drivers of future growth will be new export opportunities in agri-business to markets in Asia as well as higher returns from tourism. Cambodia would continue to serve as a useful platform for China's textile industry. All this will depend on improvements in the investment climate and recovery of FDI.

Based on the scenario described above, the growth rate of the GDP of Cambodia is assumed as listed in Table 3.3-1. The project Team will employ these growth rates as a basis of the demand forecast in this chapter.

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

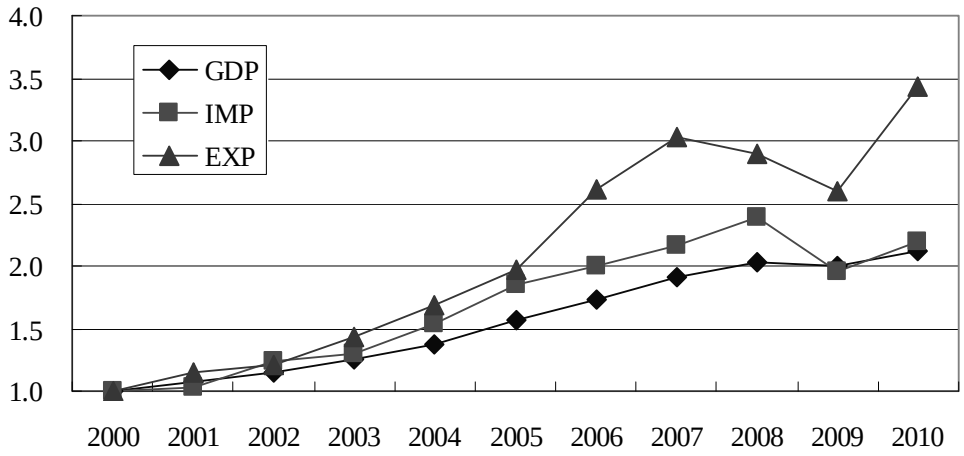
As for population, the Project adopts the forecast by UN described in 2.1.1 (1) as a basis of the demand forecast of Sihanoukville Port.

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. Containers transported to/from Vietnamese ports by road are excluded from the calculation of the indices for simplification. The figure indicates that container volume has been growing faster than GDP. This tendency is generally observed in developing countries. 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

It would be reasonable to assume that the GDP elasticity will remain at the same level as the previous decade over the planning horizon of the year 2030 because the Cambodian manufacturing industry is still in an early stage of development due to insufficient infrastructure and electric supply and further industrial development is expected to accelerate import and export. 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. However, the export/import volume of following commodities was forecasted separately.

Rice

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, RGC has set 2015 as the target year to achieve milled rice export of at least 1 million tons.

The target of rice export is likely to be accomplished because a huge amount of paddy has been informally exported already from Cambodia to the world via the market of neighboring countries. This informal flow can be diverted to the formal export by increasing milling capacity and improving border control. Further increase of rice export is also expected by increase of rice yield. At present, rice yield in Cambodia is still low, only 2.9 tons per hectare compared with 4.9 tons per hectare in Vietnam. Most Cambodian farmers cultivate once a year in the rainy season, compared to 3.5 times a year in low land Mekong plain in Viet Nam. Using higher yield seeds and expanding irrigation systems will help improve the productivity.

Therefore, the Project Team forecasted that the rice export will increase from the current level to one million tons in 2015, and then the export volume will increase at the same percentage as other exported commodities.

As discussed in the previous chapter, almost all of the officially exported milled rice from Cambodia is fragrant rice at present, which is shipped mainly to EU by container vessels. In the future, it is expected that the export of ordinary rice will also increase, which has a larger market in the world, in addition to the increase of exported fragrant rice to EU. The ordinary rice shipped to Asia will be transported partly by general cargo vessel. Therefore, 50 % of exported rice is estimated to be containerized cargoes in this study.

Vehicles

As shown in Table 3.2-1, 60 thousand tons of motor vehicles (excluding motorcycles and parts) and trailers are imported annually to Cambodia. Though customs statistics don't indicate whether they are used or new, it is judged that most of them are used vehicles from an interview to an automobile manufacturer in Thailand. As shown in Table 3.2-2, 93% of imported vehicles to Cambodia are from countries other than Thailand and Viet Nam, and they are transported by sea accordingly. Though a part of imported vehicles transported by sea would be shipped through ports in Thailand and be transported to Cambodia by road, the majority of imported vehicles are shipped through Sihanoukville Port. Since the Government of Viet Nam had banned the transit of used vehicles in its territory until 2011, no import flow of used vehicles through Phnom Penh Port or by the cross border transport existed until 2010.

As shown in Figure 3.2-1, around 70% of motor vehicles (excluding motorcycles and parts) and trailers handled in Sihanoukville Port are containerized. This cargo flow will be diverted from container to RORO transport which is more efficient than the former with the increased demand for vehicle import to Cambodia. Accordingly, it is assumed here that all containerized automobile cargoes will be diverted to RORO cargoes in the target year of 2030.

The transport mode for commodities other than the items listed above is expected to remain unchanged basically. No major diversion from containers to general cargoes or vice versa is forecasted. Although a small amount of consumption goods coming from Thailand are unloaded at private and provincial ports at present, these cargoes will not be diverted to containerized cargoes, because cross border road transport will become more convenient and competitive by the improved road network.

Furthermore, the impact of the progress of free trade in ASEAN on the containerized cargo generation in Cambodia is assessed. 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 in the target year of 2030 is forecasted as listed in Table 3.2-3. The time series of cargo generation volume are shown in Figure 3.2-3.

Table 3.2-1 Breakdown of imported vehicles to Cambodia in 2010

	Weight (ton)	Unit	Value (1,000 USD)
Tractors	6,152	145,286	12,449
Motor vehicles for the transport of ten or more	8,361	3,174	22,883
Motor vehicles for the transport of nine or less	28,046	17,862	130,215
Motor vehicles for the transport of goods	18,931	6,042	76,833
Trailers and semi-trailers	1,410	404	3,990
Special purpose motor vehicle	4,841	794	13,033
Motorcycles	16,016	173,347	67,022
Bicycles and other cycles	9,234	498,490	9,958
Other Vehicles	225	8,887	549
Parts of vehicles	10,079	490,634	16,023
TOTAL	103,295	1,344,920	352,955

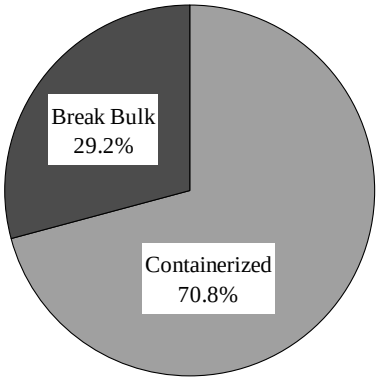
Source: GDCE (reorganized by the Project Team)

Table 3.2-2 Import origins of motor vehicles in 2010

(ton)

	Motor vehicles for the transport of nine or less		Motor vehicles for the transport of ten or more		Motor vehicles for the transport of goods	
1	USA	13,542	SOUTH KOREA	7,684	SOUTH KOREA	8,226
2	JAPAN	11,144	TAIWAN	247	CHINA	3,504
3	SOUTH KOREA	1,399	GERMANY	132	THAILAND	3,288
4	THAILAND	506	THAILAND	91	USA	2,334
5	GERMANY	319	CHINA	74	JAPAN	842
6	BELGIUM	228	UNITED KINGDO	50	TAIWAN	512
7	CHINA	201	JAPAN	29	VIETNAM	67
8	UKRAINE	197	SINGAPORE	20	BULGARIA	45
9	UAE	170	VIETNAM	13	GERMANY	33
10	VIETNAM	106	UGANDA	10	RUSSIA	19
	Others	232	Others	12	Others	60
	TOTAL	28,046	TOTAL	8,361	TOTAL	18,931

Source: GDCE (reorganized by the Project Team)



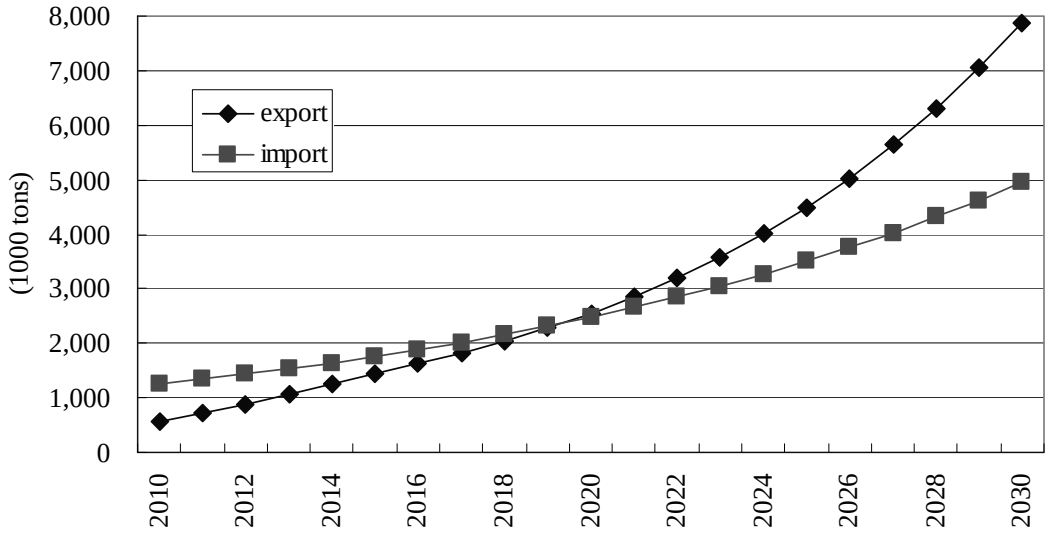
Source: Project Team

Figure 3.2-2 Percentage of cargo types for imported motor vehicles handled in Sihanoukville Port in 2010

Table 3.2-3 Forecasted container cargo generation in Cambodia in 2030

	2010	2030
Export	570,000 tons	7,880,000 tons
Import	1,270,000 tons	4,950,000 tons
TOTAL	1,840,000 tons	13,170,000 tons

Prepared by Project Team



Prepared by Project Team

Figure 3.2-3 Forecasted time series of container cargo generation in Cambodia

Next, the future trends of container cargoes to/from Cambodia by trade lane are analyzed. The following four factors are considered here:

- Increase of the share of export to South East Asia by the progress of free trade in ASEAN: The ratio of intra-ASEAN export from Cambodia is assumed to increase up to the present average of intra-ASEAN export among member countries.
- Increase of the share of export to EU by the increased milled rice export: 50 percent of exported milled rice by container vessels is assumed to be bound for EU, whereas the remaining portion is considered to be exported to other regions in proportion to the share of total exported cargo volume.
- Decrease of share of import from the Americas and East Asia due to the diversion of transportation mode for motor vehicles from containers to RORO.
- Increase of share of export to EU by the expansion of sales of Cambodian garment products in the European market: At present, the garment export volume to EU is 60% less than that to USA. Based on interviews to garment manufacturers, it is assumed that the gap will be narrowed and the difference between the two destinations will be 30% in the target year.

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 Figure 3.2-4.

Table 3.2-4 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 here. In the first step, the model allocates containers to each gateway port, namely, Sihanoukville, Phnom Penh and ports in southern Viet Nam. The route via Laem Chabang Port or Bangkok Port is not considered in the model since the cost for this route is very high and the route is rarely used for transportation of containers to/from Cambodia as shown in the previous chapter. Although some private ports announced plans to construct a container terminal as mentioned in Chapter 2, these routes are not regarded as alternative routes in the model because the plans are not feasible considering natural conditions or geographical conditions of planned sites and are unlikely to be implemented.

In the second step of the model, containers handled in Sihanoukville Port are allocated to two inland transportation routes: the road and the reconstructed railway.

Selection probability p_k^{rs} for route k of OD pair (r, s) is shown as the formula below:

$$p_k^{rs} = \frac{\exp(-\theta^{rs} \times C_k^{rs})}{\sum_i \exp(-\theta^{rs} \times C_i^{rs})} \quad (1)$$

where,

$$C_k^{rs} = c_k^{rs} + V^{rs} \times t_k^{rs} \quad (2)$$

c_k^{rs} : transportation cost from r to s via route k
t_k^{rs} : required time for transportation from r to s via route k

C_i^{rs} is generalized cost for route i of r-s transportation. Generalized cost includes time cost corresponding to transportation time as shown in the equation (2). The parameter θ^{rs} and time value V^{rs} can be obtained from actual share of route selection, transport cost and time for transportation.

Table 3.2-5 shows parameters of the logit model obtained based on actual route selection probability of seaborne containerized cargoes to/from Cambodia in 2010, transit time and transportation cost as described in chapter 2. Since liner container services in Sihanoukville Port and Phnom Penh Port are not daily service so far, the loss of opportunity cost is considered by adding imaginary ship waiting time to the actual transit time described in chapter 2. The precision of the model with these parameters is confirmed to be high with maximum deviation 0.3% from the actual route selection probability.

Table 3.2-5 Estimated parameters of logot model

	Export		Import	
	θ^{rs}	Time Value（USD/day/TEU）V^{rs}	θ^{rs}	Time Value（USD/day/TEU）V^{rs}
East Asia	0.0089	4.24	0.0540	61.76
Americas	0.0145	54.45	0.0160	128.22
EU	0.0233	98.60	0.0063	90.42

Prepared by Project Team

Then, applying the model with above mentioned parameters, the future demarcation among transportation routes is estimated. 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 as shown in Table 3.2-6. Since the difference of future inflation rate among countries is rather large, the transportation cost in the future is assessed corresponding to the location in which the cost is incurred. 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. The future transportation cost of each route is converted to the preset price by being divided by the world average inflation rate.

Table 3.2-6 Inflation rate of Cambodia and Vietnam

	The ratio of price in 2030 and in 2010.
The world average	1.74
Cambodia	2.07
Viet Nam	3.10

Source: WB, IMF (reorganized by the Project Team)

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.
- 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.

Table 3.2-7 shows the estimated future demarcation among transportation routes under the macro-economic scenario and combinations of the macro-economic scenario with the negative scenarios, the positive scenarios or the negative + the positive scenarios. In the estimation of demarcation for total cargoes, it is assumed that the present demarcation will remain unchanged for trade lanes other than East Asia, the Americas and EU.

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 in addition to the macro-economic scenario, Sihanoukville Port's market share is still much larger than the present share.

Thus, it is evaluated that the market share of Sihanoukville will increase towards the target year. However it should be noted that the estimation method applied here possesses some technical issues as follows:

- The Project Team developed the model assuming that all containerized cargoes to/from Cambodia are generated in Phnom Penh, since the assumption was necessary for stable estimation. This assumption makes it impossible to evaluate the difference of each route's competitiveness among Cambodian regions. For example, shippers in SEZs near Vietnamese border will keep using Vietnamese port even if any change arises in transportation cost and transit time. Thus, the actual demarcation of each route would change more moderately than the estimated one.
- Since Sihanoukville Port and Phnom Penh Port are complete with statistical data, the comparative advantages between the two ports would be described rather precisely in the model. On the other hand, the accuracy of estimated cross border cargoes is relatively low due to accumulated errors in the course of conversion from net weight listed in customs statistics to gross weight or classification of cargoes as containerized cargoes or bulk/general cargoes. A small amount of cross border containers to/from ports in Thailand is also included in the data.

Therefore, the Project Team is prudent in adopting directly the estimated result by the model as the forecasted demarcation of each route in 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 3.2-8).

Table 3.2-7 Estimated market share of each route under macroeconomic and transport scenarios

		Actual	Macro economic scenario	Macro economic scenario + Negative scenario	Macro economic scenario + Positive scenario	Macro economic scenario + Positive and Negative scenarios
export						
East Asia	Phnom Penh Port	0.48	0.19	0.23	0.14	0.17
	Sihanoukville Port	0.47	0.80	0.72	0.86	0.79
	CBT	0.05	0.01	0.05	0.01	0.04
USA	Phnom Penh Port	0.33	0.06	0.19	0.01	0.02
	Sihanoukville Port	0.48	0.94	0.72	0.99	0.97
	CBT	0.19	0.00	0.08	0.00	0.01
EU	Phnom Penh Port	0.02	0.00	0.02	0.00	0.00
	Sihanoukville Port	0.81	1.00	0.87	1.00	0.99
	CBT	0.17	0.00	0.12	0.00	0.01
import						
East Asia	Phnom Penh Port	0.14	0.00	0.01	0.00	0.00
	Sihanoukville Port	0.68	1.00	0.96	1.00	1.00
	CBT	0.17	0.00	0.03	0.00	0.00
USA	Phnom Penh Port	0.04	0.01	0.07	0.00	0.01
	Sihanoukville Port	0.71	0.99	0.79	1.00	0.97
	CBT	0.25	0.00	0.15	0.00	0.02
EU	Phnom Penh Port	0.14	0.08	0.15	0.04	0.08
	Sihanoukville Port	0.57	0.88	0.67	0.94	0.82
	CBT	0.29	0.04	0.19	0.02	0.10
TOTAL						
export	Phnom Penh Port	0.23	0.06	0.12	0.04	0.05
	Sihanoukville Port	0.60	0.91	0.77	0.94	0.91
	CBT	0.17	0.02	0.10	0.02	0.04
import	Phnom Penh Port	0.15	0.04	0.05	0.04	0.04
	Sihanoukville Port	0.69	0.94	0.90	0.95	0.94
	CBT	0.16	0.02	0.05	0.02	0.02
TOTAL	Phnom Penh Port	0.17	0.05	0.09	0.04	0.05
	Sihanoukville Port	0.67	0.92	0.82	0.94	0.92
	CBT	0.16	0.02	0.08	0.02	0.03

Prepared by Project Team

Table 3.2-8 Forecasted market share of each route in the target year

	2010			2030		
	export	import	TOTAL	export	import	TOTAL
Sihanoukville Port	0.60	0.69	0.67	0.62	0.70	0.65
Phnom Penh Port	0.23	0.15	0.17	0.22	0.14	0.19
CBT	0.17	0.16	0.16	0.16	0.16	0.16

Prepared by Project Team

As the second step analysis, the modal split of hinterland transport to/from Sihanoukville Port is calculated by applying the logit model based on the assumption of service level of railway described in Chapter 2. The result obtained from the calculation in Table 3.2-9 indicates that the modal share of

railway is around 3%. The result corresponds with the general understanding that railway is less competitive for relatively short distance transport (less than 200 km). However, the result shows that railway has a market share of 30% for exported cargo to East Asia, of which there is a considerable amount of low-time-value items such as rugs.

Table 3.2-9 Modal split of hinterland transport of containers to/from Sihanoukville Port

	East Asia	USA	EU	TOTAL
export				
ROAD	0.68	0.96	1.00	0.93
RAIL	0.32	0.04	0.00	0.07
import				
ROAD	1.00	1.00	0.85	0.99
RAIL	0.00	0.00	0.15	0.01
total				
ROAD				0.97
RAIL				0.03

Prepared by Project Team

Table 3.2-10 and Table 3.2-11 summarize the result of forecast of future demarcation between Sihanoukville Port and Phnom Penh Port. Container throughput of Phnom Penh Port listed in these tables includes regional trade between Cambodia and Vietnam, which is excluded in the above discussion. The estimated volume of regional cargoes in 2030 is obtained by assuming the same GDP elasticity as that of seaborne cargoes. The average weight per TEU in Sihanoukville and Phnom Penh in 2010 was 5.9 tons for export and 10.5 tons for import. The average weight for export is rather light compared with that in many ports in the world, since the present Cambodian export cargoes are dominated by garment products. However, it is expected that heavier cargoes such as milled rice will increase. Accordingly, the Project Team adopts a standard unit weight of 10 tons/TEU for converting the weight to the number of containers to avoid overestimation. The number of empty containers for the larger flow (export or import) in 2030 is estimated by using empty ratio of each port for the larger flow in 2010. The number of empty containers for the smaller flow is estimated by assuming that the numbers of inbound and outbound containers are balanced in each port.

Table 3.2-10 Forecasted container throughput of each port in the target year (1)

(1000 tons)

			2010	2030
Sihanoukville Port	export	road	343	4,570
		railway	0	344
		total	343	4,914
	import	road	872	3,416
		railway	0	35
		total	872	3,450
	TOTAL	road	1,215	7,986
		railway	0	379
		total	1,215	8,365
Phnom Penh Port	export	seaborne	129	1,710
		regional	22	217
		total	151	1,927
	import	seaborne	179	711
		regional	76	317
		total	255	1,028
	TOTAL	seaborne	308	2,421
		regional	98	534
		total	406	2,955

Prepared by Project Team

Table 3.2-11 Forecasted container throughput of each port in the target year (2)

(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

The volume of non-containerized cargoes handled in public terminals in Sihanoukville Port is forecasted in this sub-section. Accordingly, oil products which are handled in dedicated private terminals are excluded from the forecast. Supply cargoes for off-shore oil and gas development are also not included in the forecast, since it will be handled in the dedicated supply base (under construction) in Sihanoukville Port.

The Project for Construction of Multi-purpose Terminal in Sihanoukville Port has forecasted the volume of exported wood chip, exported milled rice, imported sugar and imported wheat which will be transported by large bulkers in 2020. The Project Team forecasts the volume of these cargoes in 2030 based on the forecast for 2020.

Wood chip

At present, only 70 thousand tons of wood chip is exported by sea; however, private investors plan to expand the production and export of wood chip. The first dedicated bulk terminal (multi-purpose terminal) with a deep-water quay in the country, which is under construction in Sihanoukville Port, will help facilitate the export of wood chip.

According to the construction plan of the multi-purpose terminal 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

As mentioned in 3.2.1, 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. Fifty percent of exported milled rice will be shipped by general cargo vessels.

There are three alternative routes for exporting milled rice: Sihanoukville Port, river ports

including Phnom Penh Port and southern Vietnamese ports. Each route has its advantages. Sihanoukville route can ship milled rice directly to importing countries by using large vessels with high cost performance. River ports and Vietnamese ports have an advantage of convenient access to the lower Mekong region, the main production area of ordinary rice which tends to be shipped by general cargo vessels rather than container vessels. Accordingly, the Project Team assumes that exported milled rice will be shared equally by these three routes.

Sugar

Cambodia consumes a much larger volume of sugar than it produces as mentioned in Chapter 2. According to FAO, import volume of sugar is around 200 thousand tons per year. Most of them are imported by container vessels, cross border transport or coastal shipping using private ports or provincial ports. According to the construction plan of the multi-purpose terminal in Sihanoukville Port, around 9,000 tons of sugar is expected to be imported via the bulk terminal of Sihanoukville Port in 2020. Since it is expected that the share of non-containerized transport via Sihanoukville Port will remain unchanged thereafter, the Project Team assumes the sugar import will increase at the same rate as the increasing rate of Cambodian population.

Wheat

As described in Chapter 2, FAO statistics indicates that wheat consumption per capita in Cambodia (2.9 kg/year) is much less than that of the rice-eating nation of Thailand (14.7 kg/year). 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 will reach the present per capita in Thailand in the target year. The 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.

As for export, no major commodity besides above mentioned commodities is expected to be shipped from Sihanoukville port as non-containerized cargoes. Regarding import, commodities listed in Table 3.2-12 are handled at Sihanoukville Port currently. The future trends of these cargoes including 30 thousand tons of used vehicles, which are classified as “General Cargo” in the table, are assessed below:

Table 3.2-12 Imported commodities handled at Sihanoukville Port as general cargoes

(tons)

Item	2005	2006	2007	2008	2009	2010
General Cargo	7,607	4,600	20,577	36,328	16,041	121,175
Machinery	9,771	16,562	24,640	18,632	15,083	16,728
Cement	65,849	144,462	86,886	72,190	53,431	13,242
Steel	17,144	18,408	14,577	34,896	11,416	19,650
Steam coal			36,825	125,066	116,245	128,356

Source: PAS

Cement

Cambodia produced 774,000 tons of cement and imported 804,000 tons of it in 2009. Thus more than 1.5 million tons of cement was consumed in the country, and the cement consumption is expected to increase in line with the growth of the construction market; however imported cement will be replaced by domestic products as domestic cement production capacity is increasing. Accordingly, the import volume is expected to decrease. For example, Kampot Cement announced a plan to double the plant’s cement production capacity. The planned expansions would increase the plant’s capacity output to 2 million metric tons per year. Phi Cham mining Corp., which was a joint venture between Paul Cham Group of Cambodia and Phi mining Group inc. of the United States, also announced its plans to build a cement plant with a production capacity of 1 million tons per year in Stung Treng Province.

Therefore the Project Team assumed the import flow of cement as seaborne cargoes would gradually decrease and cease until 2030.

Coal

Diversion of cement supply in Cambodia from import to domestic production will increase the amount of coal import. According to the interview to Kampot Cement by the engineering service team for the Multi Purpose Terminal Development Project in Sihanoukville Port, the company plans to increase the coal import volume up to 240 thousand tons until 2020.

Sihanoukville Port which is furnished with on-dock railway has competitiveness in the handling of coal for Kampot. However, Sihanoukville Port would not be suitable for coal handling because the port is situated adjacent to a residential area and an increased handling volume of commodities which shall be handled separately from coal (ex. milled rice and wheat) is expected. Furthermore, private ports such as Oknha Mong Port can accommodate barges carrying coal from Indonesia, which would continue to serve for importers whose import volume is 100,000 tons per year or less. 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

Vehicle ownership rate of Cambodia is lower than many ASEAN countries at present. According to information from a Japanese automobile manufacturer in Thailand, the vehicle ownership rate in Malaysia is 33%, 14% in Thailand and 5% in Indonesia, whereas statistics of MPWT indicate that the number of vehicles in Cambodia is 273,000 units, and only 2% of Cambodian people own vehicles in 2007.

The car ownership rate keeps increasing in Cambodia, and further increase is expected in line with the country's economic growth. Accordingly, the Project Team assumes that Cambodia's car ownership rate 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.

Although the increased demands for new vehicles are expected in the target year, used vehicles would still account for the major share in the market. The majority of used vehicles would be imported through Sihanoukville Port because only very few vehicles with left-hand steering are supplied from the used car market in Thailand, while a small number of used vehicles would be supplied from the Vietnamese market or imported from the third countries via Vietnamese port. Accordingly, the Project Team assumes that 80% of total imported vehicles will be imported through Sihanoukville Port. The current configuration of vehicle types and their unit weight are assumed to remain unchanged.

As discussed in the container demand forecast, all imported vehicles through Sihanoukville Port would be transported by cost-efficient RORO vessels in the target year, whereas around 70% of imported vehicles are transported by container vessels and the remaining part are by conventional general cargo vessels at present.

Other General Cargoes

Handling volume of general cargoes other than those listed above, which include plants and machinery are also expected to grow with industrial development in the littoral area. The Project Team forecast the future handling volume of other general cargoes by assuming that the GDP elasticity of general cargoes is the same as that of containerized cargoes. Since the yearly fluctuations of handling volume is rather large, the average handling volume over the last three years is regarded as the handling volume in the base year. The weight of steel pipes is eliminated in the estimation of cargo volume in the base year, because this includes off-shore supply

cargoes which are out of scope in the demand forecast in this chapter.

The forecasted handling volume of general cargoes in Sihanoukville in 2030 based on the above-mentioned scenarios is shown Table 3.2-13. The breakdown of vehicles is shown in Table 3.2-14.

Table 3.2-13 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

Table 3.2-14 Breakdown of RORO cargoes (vehicles) handled in Sihanoukville Port in 2030

	Weight (ton)	Unit
Motor vehicles for the transport of ten or more persons	26,337	9,998
Motor vehicles for the transport of nine or less persons	88,341	56,264
Motor vehicles for the transport of goods	59,631	19,032
Trailers and semi-trailers	4,441	1,273
Special purpose motor vehicle	15,249	2,501
TOTAL	194,000	89,067

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. Table 3.3-1 shows the projection of overnight visitors in Cambodia, Thailand and Vietnam through the year 2011 to 2021 with yearly growth rates.

Table 3.3-1 Projection of international overnight tourist arrivals upto 2021

Country	International tourist arrivals ('000 arrivals)		Yearly increase ratio
	2011	2021	
Cambodia	2,538	3,957	4.5%
Thailand	15,534	30,252	6.9%
Viet Nam	3,688	6,585	6.0%

Note: Arrivals include overnight visitors only.
Source: World Travel & Tourism Council

Since Cambodia still has a lot of maiden resources for tourism, the number of foreign visitors will keep constant growth until 2030, while the pace of growth will be slower than the neighboring countries of Vietnam and Thailand which already have well-established tourism resources and industries.

Based on the above, the Project Team assumes the basic growth rates for cruise ship calls as per Table 3.3-2 below.

Table 3.3-2 Projection of basic growth rates for cruise ship calls upto 2030

Year	2011-2021	2022-2030
Number of calls	4.5%	4.0%
Number of Passengers	4.5%	4.0%

Prepared by Project Team

As mentioned in 2.6.3, 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. Table xxx indicates that 11 ships with total 9,713 passenger capacity called at Ho Chi Minh Port from May to October in 2010, while 53 ships with 43,751 passengers called in other months. 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.

The project Team assumes that additional inducement of cruise ships will be realized as per the yearly growth rates in Table 3.3-3 below, which will be added to the basic growth rates assumed as per Table 3.3-2 above.

Table 3.3-3 Projection of additional growth rates for cruise ship calls upto 2030

Year	2013-2017	2018-2021	2022-2030
Number of calls	10.4%	15.6%	20.8%
Number of Passengers	11.1%	16.7%	22.2%

Prepared by Project Team

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

follows.

Table 3.3-4 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 Methodology

A vision for the strengthening competitiveness and development of Sihanoukville Port will be formulated as a joint product of PAS and the Project Team. Because this Study Project aims to formulate a result as joint works among the Team and PAS.

The vision is to be formulated in the following manner;

- To set up a challenge target of PAS in the target year taking into account changes in circumstances surrounding Sihanoukville Port
- To perform analysis on a business circumstance taking into account the following;
  - ✓ Internal Capacities: 5 points (national, financial, customer, business processes, learning and growth) will be examined.
  - ✓ External Capacities: macro circumstance such as trend in economy and international shipping and micro circumstance such as trend in markets
- To perform SWOT analysis focusing on 4 points of BSC
- To extract a strategic target to realize the challenge target from 2 combinations of strength and weakness and opportunity and threat in SWOT analysis
- To extract critical success factors (CSF) from viewpoints such as enhancement of strength or taking opportunity in reference to the 4 elements in SWOT analysis
- To classify the strategic target into the 4 points of BSC and formulate a strategic map. To tabulate the strategic target and CSF in each point

The Team planned to formulate the Vision of Sihanoukville Port by using the SWOT analysis method. The Team took place a meeting with the counterpart team group which is headed by the director general of PAS and composed of 15 members including 3 deputy director generals and all directors of departments. In this meeting, the Team explained about a need of the formulation of the vision and the method including SWOT analysis as a technological transfer. The Team prepared blank sheets for the SWOT analysis on which PAS staff are able to indicate their views or findings on the four components of the SWOT analysis, namely “Strengths”, “Weaknesses”, “Opportunities” and “Treats” in PAS’s business circumstance.

3.4.2 Mission of PAS

The national target of Cambodia is “poverty reduction”. This target is able to be accomplished by the cooperative efforts of public sectors and private sectors. The National Strategic Development Plan (NSDP) stipulates that the economic development of the country is the most important factor to achieve the National Target of the reduction of poverty. The Rectangular Strategy which is the most important philosophy for the achievement of the NSDP raises the following 4 points as national policies

- Enhancement of agriculture, forestry and fishing sector activities
- Construction, maintenance and management of social infrastructure
- Development of private sector activities and creation of employment opportunities
- Human resource and capacity development

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."

3.4.3 Challenging Target

Any vision to be formulated should conform to the ultimate target of national development. Formulation of the vision of Sihanoukville Port shall be carried out paying due attention on the national strategic development targets as discussed in 2.2.1.

The enhancement of international trade is the most important aspect for achieving the economic development of Cambodia. Sihanoukville Port, the sole public sea-port in Cambodia, together with Phnom Penh Port will play an important role in facilitating international cargo transport. Both ports can be developed through cooperative competition by making use of their locational advantages. Phnom Penh Port is located near the big market and production area and Sihanoukville Port is located at the area facing to the sea where a trunk shipping route passes. Sihanoukville Port is strategically located within the international maritime cargo transport network.

In order to improve the position of Sihanoukville Port in the international maritime cargo transport system, it is necessary to increase the number of international shipping routes connecting to Sihanoukville Port and this requires an increase in cargo handling volume. To achieve this, Sihanoukville Port will have to implement strategies for cargo volume generation such as increasing the production of export commodities in SEZs.

An important aspect to consider for the enhancement of the competitiveness of Sihanoukville Port is to improve the efficiency of the entire logistic system. Measures for the improvement of efficiency will be formulated as a soft-ware oriented method with the target year of 2020.

One of objectives of this project is to formulate a future development vision of Sihanoukville Port in the target year of 2030 with an intermediate target year of 2020 while clarifying the division of roles between Sihanoukville Port and Phnom Penh Port.

In order to realize the Strategy for Strengthening Competitiveness and Development of Sihanoukville Port, the cooperation among organizations related to the port activities including the customs is required. The firm intension and initiative of the Minister of MPWT and the Chairman/CEO of PAS are also indispensable for the realization of the strategy. The formulation of an implementation program for the strategy is also required.

3.4.4 Business Environment Analysis

Result of the business environment analysis is shown in Table 3.4-1. The background information is indicated below.

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

Sihanoukville Port at its inauguration was the creation of an international gateway function and the construction of a coastal industrial zone. As to the former, the gateway function has steadily been reinforced, while it is still at an early stage of development at this moment. Meanwhile, the governmental policies to develop maritime and other industries utilizing the coastal space have not been well formulated, which accounts for the fact that the concentration of those industrial sectors is still at a low level. Private investment approved for the coastal area including Preah Sihanouk in the past 15 years accounted for 40% of the total in Cambodia. However, 80% of private investment in the coastal area was in the sectors of tourism and urban development, while very little investment went into the manufacturing sectors.

However, industrial locations in the coastal area have increased since the enforcement of "Sub-Decree #148 on the Establishment and Management of the Special Economic Zone" in 2005 as discussed in 2.3.2. It appears that the most of SEZs are concentrated into the coastal areas including

Preah Sihanouk, excluding some on the borders with the adjacent countries. This is a great step forward for the formation of the coastal industrial zones, while the construction of some SEZs has yet to be commenced nor have manufacturing plants been located in large numbers.

The Port SEZ being developed by PAS which has an area of about 70 ha with 48 brocks is expected to start its operation in 2012. With its close ties to Sihanoukville Port, the Port SEZ is expected to create an industrial space that will not be hampered by high and obscure transportation costs, and to enhance the advantage and competitiveness of the coastal industrial city as a whole.

Thus it is expected that Sihanoukville Port will strengthen its function as an international gateway and contribute to the creation of a coastal industrial zone, reflecting the original objectives of the port's development, and realizing the synergy effect of those functions.

PAS can obtain private investment by the listing of its stocks. However, PAS needs to adopt the management practices of a private company which means that it will have to reveal its financial situation as well as other information in a transparent manner.

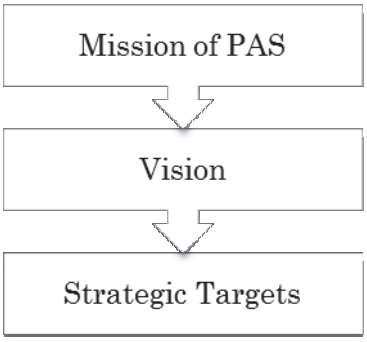
Competition with Phnom Penh Port is another important factor affecting PAS' financial situation. Phnom Penh Port is constructing a new container handling terminal about 25 km downstream of the existing port aiming at increasing the current handling capacity of about 70,000 TEUs to about 500,000 TEUs. It is expected that the first phase development with the capacity of 120,000 TEUs will be inaugurated in 2012. Currently, containers from Phnom Penh Port are transported by barges of about 50 TEU capacity to Chai Mep-Thi Vai Port taking about 36 hours and covering a distance of about 300 km. The containers are further transported to Asia, the USA and Europe by mother container ships directly from Chai Mep-Thi Vai Port. In case of container transport from Phnom Penh to Sihanoukville Port, containers are transported 230 km by trucks (travel time is about 6-8 hours) and further to Singapore Port for transshipment to the USA or Europe. As described, there are mainly two transport routes from Phnom Penh to both the USA and Europe. One is via Chai Mep-Thi Vai Port in Viet-Nam and the other is via Sihanoukville Port. Among them, the total transport cost from consigners to consignees through the former route is about 15% cheaper than through the latter route. It is considered that this difference is attributed to the hidden cost incurred in the case of the Sihanoukville route.

Another aspect affecting the business environment of Sihanoukville Port would be the construction of an exclusive use port for SEZ, in case it is located in the coastal area. Permission to construct such a port is not given by the Ministry of Finance but MPWT. The formation of a national port development plan is not integrated in one responsible organization. It is considered necessary to formulate the nation-wide port development plan under one organization such as MPWT in order to achieve the national development target including properly balanced development of the country.

Finally, the recent increase in the country's trading volume has implications for the port's business environment. As a national strategy, the government intends to increase rice export from 1 million tons to 3 million tons and promote wood-chip export.

3.4.5 Establishment of the Vision and the Strategic Targets

Based on the Mission of PAS, a vision will be established and subsequently strategic targets will be set as shown in the following figure:



(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

There are strategic targets in each viewpoint. The strategic targets are set by applying a Balance Score Card (BSC) method based on such analysis methods as a SWOT Analysis, a Cross Analysis (TOWS Analysis).

It is important to set strategic targets which will be established taking into account of such balance among the present situation of PAS illustrated in such elements as "Weakness", "Strength", "Opportunity" and "Threat" in a SWOT analysis. The balance above means comparison among elements of finance and non-finance, internal capacity and external capacity and time elements such as past event, present event and future event. Concretely, a SWOT analysis and a BSC method will be applicable.

Views of PAS' staff about elements such as "Weakness", "Strength", "Opportunity" and "Threat" are analyzed in the SWOT analysis as shown in Table 3.4-2. This table 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 form a port network.	11	Container ship calls is few compared to other foreign ports and ocean freight rates are high.
	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

3.4.6 Strategic Targets and Strategic Success Factors

The Strategic Objectives of Sihanoukville Port are to enhance its competitiveness, which will eventually contribute to alleviate poverty as explained in 3.4.2 above.

Strategic targets are established by applying a TOWS matrix method which is a kind of a SWOT analysis method. The TOWS matrix is composed of a horizontal axis component including an internal capacity such as “Strengths” and “Weakness” and a vertical axis component including an external

capacity such as "Opportunities" and "Threats". Strategic targets are able to be established on the matrix under following combination of elements.

- SO strategy：is to maximize "Strengths" under a favorable circumstance with "Opportunities"
- ST strategy：is to overcome "Threats" by making use of "Strengths"
- WO strategy：is to supplement "Weakness" with "Opportunities"
- WT strategy：is to minimize both "Weakness" and "Threats"

Table 3.4-3 illustrates the draft strategic targets based on the TOWS matrix method.

Strategic targets, critical success factors and action plan are illustrated in Table 3.4-4 as a result of SWOT analysis and TOWS matrix analysis. Figure 3.4-1 shows the Strategy Map.

Table 3.4-3 Draft Strategic Targets based on TOWS Matrix Analysis

Macro Environment		**S（Strengths)** (refer to items indicated in **Table 3.4-2 SWOT Analysis of PAS's Business)**		**W（Weakness)** (refer to items indicated in **Table 3.4-2 SWOT Analysis of PAS's Business)**	
O(Opportunities) (refer to items indicated in **Table 3.4-2 SWOT Analysis of PAS's Business)**	National Viewpoint	1	To accelerate the economic development of Cambodia in a manner to strengthen cooperation with the government and streamline transport of national strategically important goods such as export rice	1	To contribute to the development of coastal industry by the creation of a littoral industrial city with the port as a nucleus through the provision of industrial area such as SEZ and the increase of transport efficiency
		2	To accelerate the streamlining of trade and the improvement of investment climate together with the maintenance and strengthening of the function of Sihanoukville Port as the largest international gateway port	2	To increase the benefit to the national economy through the reduction of ocean freight to be materialized with the synergy effect of scale of economy resulting from the increase of transport demands in association with the economic development of Cambodia and the efficiency increase of Sihanoukville Port
	Financial Viewpoint	3	To maintain and develop sound relations with development partners by the enhancement of business transparency through the listing of PAS's stocks	3	To improve the financial situation of PAS under the increasing business scale resulting from growing cargo transport demands in association with the economic development of Cambodia
				4	To increase net profit by the effective utilization of assets, the reduction of operation cost including personnel expenditure and the increasing of cargo handling productivity.
	Customer's Viewpoint	4	To enhance convenience of customers by maintaining and strengthening its function as the sole port in Cambodia which can receive ocean going container and large bulk ships which are employed for making use of the scale of economy brought with the increase of transport demand resulting from the economic development	5	To return to customers the benefit derived from the scale of economy resulting from the increase of handling volume increase associated with the economic development of Cambodia
				6	To prepare for the increase of cruise ship callings corresponding to the tourism promotion by the development of a safe and comfortable cruise ship terminal
	Business Process	5	To contribute to the accumulation of littoral industries by actively disseminating information about the existence of a modern port which provides excellent service without labor disputes	7	To increase market share in the growing transport market resulting from the economic development by the strengthening of capacity of investigation and analysis of the market and business development,

					and by grasping the macro scope trend of the market
	Learning and Growth	6	To expand space in the port for port function, logistic, export processing and marine tourism industries by making use of the existing calm water area surrounded by breakwaters	8	To foster personnel who can materialize development of PAS by analyzing and adopting the business environment such as industrial development in the coastal area
T(Treats) (refer to items indicated in **Table 3.4-2 SWOT Analysis of PAS's Business)**	National Viewpoint	7	To promote the diversification of industry which can be realized by the introduction of new types of business by making use of Sihanoukville Port as a national gateway port which is the functionally strengthened	9	To ensure some profitability even during recessions by the increase of profit per unit cargo thorough the effort to reduce total transport cost via Sihanoukville Port
				10	To contribute to strengthen capacity of Cambodia to cope with economic crisis through diversification of industry through the formation of coastal industrial city
	Financial Viewpoint	8	To enhance ability for tackling crisis by the increase and maintenance of sales and current account profit	11	To enhance capacity against economic crisis through the strengthening of risk management capability
	Customer's Viewpoint	9	To enhance services as the sole port capable of receiving ocean going ships in order to maintain industrial production even when the macro economic situation deteriorates in Cambodia	12	To lower ship related charges to retain the ship calls even shipping companies cut down shipping network due to the world-wide shrinking cargo transport demand
	Business Process	10	To enhance external risk encountering capacity of PAS by maintaining prompt business decision under the preferable labor relation and rapid streamlining of business practice with the understanding of staff	13	To curb declining profit at the time of recession through the increase of port operation productivity
	Learning and Growth	11	To reform the organization to withstand macro-economic deterioration through strong leadership of the top management to the business reform and flexible thinking attitude of young staff	14	To foster personnel systematically in order to strengthening adaptive capability against PAS's crisis by analyzing the trend of macro scope economy

Micro Environment		**S（Strengths)** (refer to items indicated in **Table 3.4-2 SWOT Analysis of PAS's Business**)		**W（Weakness)** (refer to items indicated in **Table 3.4-2 SWOT Analysis of PAS's Business**)	
O(Opportunities) (refer to items indicated in **Table 3.4-2 SWOT Analysis of PAS's Business)**	National Viewpoint	12	To maintain and strengthen the function of the port as a gateway of Cambodia by maintaining and expanding market share in increasing container transport market	15	To enlarge national economic benefit by making use of synergy effect between the scale of economy derived from the increase of transport volume and the improvement of operation efficiency at Sihanoukville Port
	Financial Viewpoint	13	To increase and maintain sales and current account profit by maintaining and enlarging market share by making use of PAS's preferable situations such as cost increase of competitive transport routes and increase of cargo generation around the port in the	16	To respond to the increasing demands of the port use by the effective and optimum use of the narrow port area through reviewing the utilization situation of the existing land use in the port and the formulation of port area use plan without political interference

			growing market	17	To reduce investment risk by the implementation of port development in conformity with the national port development plan
	Customer's Viewpoint	14	To decrease transport cost by the reduction of ocean freight by making use of the scale of economy at the sole ocean going ship calling port	18	To increase operation efficiency in growing container transport market by the deepening of the quaywalls of the container terminal
		15	To increase the transport of growing bulk cargo by using railway effectively	19	To enhance the convenience of shippers by the diversification of navigation network under the growing port capacity
	Business Process	16	To deal with growing cargo demands by making ultimate use of modern container handling equipment and system	20	To perform strategic port management by making maximum use of tools for the establishment of management strategy through the strengthening of business development department
				21	To conduct strategic port promotion to maintain market share in the growing market
				22	To streamline handling of the growing cargo through rational terminal management with the drastic improvement of container operation efficiency
	Learning and Growth	17	To deal with emerging transport demands by increasing cargo handling capacity by utilizing existing calm water area so as to maintain and increase the role of Sihanoukville Port in the growing international transport market	23	To foster personnel capable of strongly implementing strategy which is formulated to gain new customers by the appropriate trend analysis of growing international transport market
		18	To gain new customers in the growing transport market in a manner to collect and analyze information about business environment of shippers and shipping companies continuously by effectively utilizing potentially capable staff	24	To materialize expansion of port area effectively in order to cope with the growing port use demand in conformity with space utilization plan including tourism industry together with the prevention of expansion of habitat area over the water area at the port
T(Treats) (refer to items indicated in **Table 3.4-2 SWOT Analysis of PAS's Business)**	National Viewpoint	19	To strengthen competitiveness of Sihanoukville Port against alternate transport routes based on the importance of the port in the national strategy which includes the maintenance and enhancement of port functions as the sole international gateway seaport in Cambodia	25	To contribute to the development of coastal industry city actively and secure some degree of national economic benefit even in times when it is observed that the declining of cargo handling share under the severe market competition situation of cargo originated or destined around Phnom Penh
	Financial Viewpoint	20	To reduce financial risk under severe financial situation by increasing transparency in business management by means of listing of PAS's stocks	26	To reduce the operation cost in order to maintain competitiveness of PAS even under severe competition environment through the systematic reduction of number of personnel under the intensive personnel control, drastic improvement of working discipline and the enhancement of working efficiency by the systematic human development
				27	To make effective use of the assets under severe competition environment by prioritizing business resources allocation to area with high competitive power such as facilities

					for large size ships
	Customer's Viewpoint	21	To retain customers by increasing convenience and economy of port users by maintaining and increasing the present advantages of the port such as a short dwelling time of cargo and by developing navigation routes under the close cooperation with neighboring foreign ports	28	To conduct organizational reform in order to offer preferable port service in terms of cost and quality in comparison with rival transport routes
	Business Process	22	To enhance competitiveness of Sihanoukville Port against alternate transport routes by the ultimate use of unique modern container handling equipment and system in Cambodia	29	To conduct reform in various areas at PAS in order to maintain and enhance the competitiveness of PAS against rival transport routes by streamlining decision making under the unification of entire organization
	Learning and Growth	23	To prevent the loss of customers by continuous collection and analysis of information about situation of competitive transport routes by potentially capable staff	30	To foster personnel who can make appropriate analysis trends in competitiveness strengthening of rival transport routes and make use of this analysis to maintain and increase of PAS's competitiveness

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Table 3.4-4 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'	9	Reduction of the total transport cost	40	Reduction of ship related charges at the port
					41	Reduction of container handling operation time

		satisfaction	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 transparency in the business management	71	Listing of PAS's stocks
					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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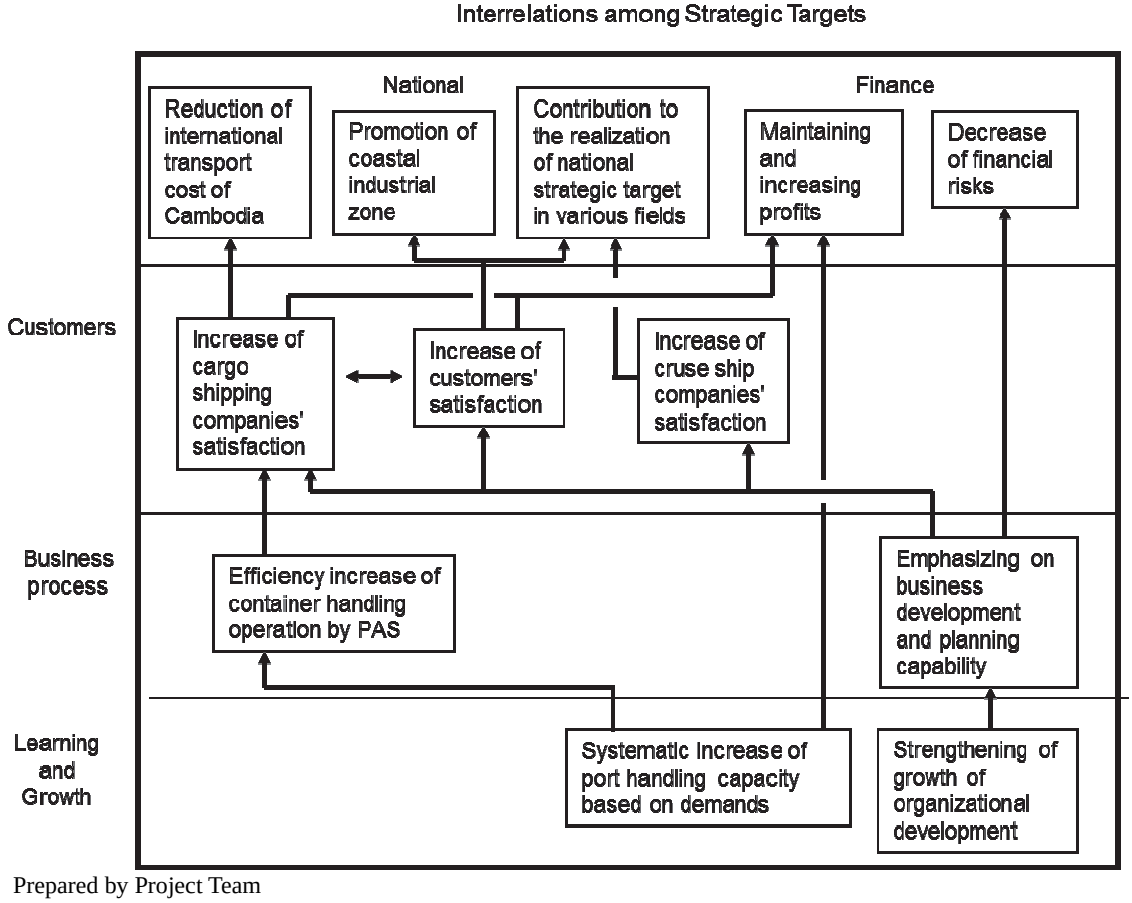

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Figure 3.4-1 Strategy Map

4. Strategy to Strengthen Competitiveness of Sihanoukville Port

4.1. Strategy on Port Service Improvement

4.1.1 Improvement of the Container Operation

(1) Entire System

1) Current Condition of PAS Container Terminal Operation

Container operation of PAS Container Terminal (CT) has some issues. First, ships' operational productivities are low - 12.0 lifts/QGC/hour and 7.4 lifts/Ship-gear/hour - based on data of August 2011, although some ships wait idling at berths for some hours on Saturdays until loading operations can be commenced. (*Table 4.1-1 shows ships operational performance in August 2011.)

This low productivity issue of PAS is basically caused by a lack of management capacity. Container terminal operation is similar to an orchestral performance that requires orchestra members to strictly obey the conductor in order to produce good music. There is a trust between the conductor and orchestra members; however, unfortunately there is no such conductor or trust among the three (3) PAS' container operation departments at present.

PAS container operations are carried out by staff and labors belonging to three (3) departments, the Container Terminal Operation (CTO) Dept., General Cargo Handling Operation (GCHO) Dept. and Security Office under Administration and Human-resource Dept. as described in the next section in more detail. Management of PAS container operation, thus, is unlike most other terminals in other countries and thus difficult to compare; however, if there is a powerful leader (conductor) and certain number of competent staff members (orchestra members) in CTO Dept., PAS could manage the container operation more efficiently.

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 RTG drivers. Generally, CY controllers instruct RTG drivers which lanes to move to while monitoring entire CY-operations through container terminal management system (CTMS). In this way, unnecessary congestion or idling at any place in the container yard (CY) can be avoided.

As a result, external trucks' CY turn-time (from gate-in to gate-out hours) is longer comparable to most terminals in the world, especially on peak days (Saturday). This is caused by reasons partially beyond the control of PAS, such as four (4) ships calling the Port every Friday through Saturday, which requires PAS to prepare manpower as well as container handling equipment (CHE) beyond its capacity; however, PAS can manage CY-Gate operation better than today once it masters the CY control system and reduces the CY turn-time.

PAS' container operation targets should be 25.0 lifts/GC or 2SG/hour in net and 15 minutes as CY turn-time for the year 2012; ways for achieving these targets are described in this chapter.

Table 4.1-1 PAS Ship Working Records by Service-wise in August 2011

Ship Name & Voy No.	Arrived Port	Berth No.	Handling Vol. (Box)	Kind of Gear GC/MC/SG	Unit Used (Unit)	Commence Operation	Complete Operation	Departed Berth	Berth days (Day)	Berth hours (Hour)	Berth Pro'ty (Box/hour)	Ops days (Days)	Ops hours (Hours)	Gear Pro'ty (Box/GR/hr)
SLZ V1117	2011/8/4 11:00	GC1	367	GC	2	2011/8/4 18:00	2011/8/5 2:30	2011/8/5 1:00	0.58	14.0	26.2	0.35	8.5	21.6
CVE V1125	2011/8/11 7:00	GC1	245	GC	2	2011/8/11 8:15	2011/8/11 19:30	2011/8/11 21:00	0.58	14.0	17.5	0.47	11.3	10.9
SMR V1117	2011/8/18 7:00	GC1	302	GC	2	2011/8/18 8:30	2011/8/18 18:30	2011/8/18 18:30	0.48	11.5	26.3	0.42	10.0	15.1
SCD V082	2011/8/25 8:00	GC1	381	GC	2	2011/8/25 13:10	2011/8/26 5:30	2011/8/26 8:30	1.02	24.5	15.6	0.68	16.3	11.7
MCC-1	Average:		324		2				0.7	16.0	20.2	0.5	11.5	14.1
OBS V1117	2011/8/5 5:00	GC1	882	GC	2	2011/8/5 8:40	2011/8/7 0:30	2011/8/7 1:30	1.85	44.5	19.8	1.66	39.8	11.1
OBS V1119	2011/8/12 5:00	GC1	784	SG	2	2011/8/12 8:30	2011/8/14 1:00	2011/8/14 1:00	1.83	44.0	17.8	1.69	40.5	9.7
OBS V1121	2011/8/19 14:00	GC2	756	GC	2	2011/8/19 15:40	2011/8/20 23:00	2011/8/20 23:59	1.42	34.0	22.2	1.31	31.3	12.1
OBL V1123	2011/8/26 8:00	GC1	754	GC	2	2011/8/26 11:00	2011/8/28 3:00	2011/8/28 3:30	1.81	43.5	17.3	1.67	40.0	9.4
MCC-2	Average:		794		2				1.7	41.5	19.1	1.6	37.9	10.5
LLB V666	2011/8/3 14:00	CT2	435	SG	2	2011/8/3 15:40	2011/8/4 18:30	2011/8/4 20:00	1.25	30.0	14.5	1.12	26.8	8.1
LLB V667	2011/8/10 7:00	CT2	535	SG	2	2011/8/10 9:00	2011/8/11 17:30	2011/8/11 19:00	1.50	36.0	14.9	1.35	32.5	8.2
LLB V668	2011/8/17 9:00	CT1	588	SG	2	2011/8/17 13:15	2011/8/18 22:10	2011/8/18 22:30	1.56	37.5	15.7	1.37	32.9	8.9
LLB V669	2011/8/24 10:00	CT2	497	SG	2	2011/8/24 10:30	2011/8/25 15:15	2011/8/25 15:30	1.23	29.5	16.8	1.20	28.7	8.6
LLB V670	2011/8/31 10:30	CT1	460	SG	2	2011/8/31 13:00	2011/9/1 12:20	2011/9/1 14:30	1.17	28.0	16.4	0.97	23.3	9.9
RCL-1	Average:		503		2				1	32	15.6	1	29	8.7
RTB V550	2011/8/4 22:00	CTI	523	SG	2	2011/8/4 20:30	2011/8/6 3:15	2011/8/6 5:30	1.31	31.5	16.6	1.28	30.8	8.5
ORB V281	2011/8/11 14:00	CT2	505	SG	2	2011/8/11 15:15	2011/8/12 21:00	2011/8/12 22:30	1.35	32.5	15.5	1.24	29.8	8.5
PRB V238	2011/8/18 17:00	CT2	493	SG	2	2011/8/18 20:00	2011/8/19 22:30	2011/8/19 22:30	1.23	29.5	16.7	1.10	26.5	9.3
RTB V551	2011/8/25 14:00	CT1	491	SG	2	2011/8/25 16:00	2011/8/26 17:10	2011/8/26 20:30	1.27	30.5	16.1	1.05	25.2	9.8
RCL-2	Average:		503		2				1.3	31.0	16.2	1.2	28.0	9.0
KTB V718	2011/8/6 6:00	CTI	358	SG	2	2011/8/6 18:00	2011/8/7 8:20	2011/8/7 8:30	1.10	26.5	13.5	0.60	14.3	12.5
KTB V719	2011/8/12 15:00	CT1	346	SG	2	2011/8/12 16:30	2011/8/14 0:30	2011/8/14 2:00	1.46	35.0	9.9	1.33	32.0	5.4
KTB V721	2011/8/19 19:00	CT1	444	SG	2	2011/8/19 19:00	2011/8/21 5:30	2011/8/21 5:30	1.44	34.5	12.9	1.44	34.5	6.4
KTB V721	2011/8/26 20:00	CT1	401	SG	2	2011/8/26 22:00	2011/8/28 5:30	2011/8/28 5:30	1.40	33.5	12.0	1.31	31.5	6.4
RCL-3	Average:		387		2				1.3	32.4	12.0	1.2	28.1	6.9
KDM V117	2011/8/7 8:00	GC1	329	SG	2	2011/8/7 8:30	2011/8/7 17:10	2011/8/7 17:30	0.40	9.5	34.6	0.36	8.7	19.0
KDM V1119	2011/8/14 0:30	GC1	279	GC	2	2011/8/14 3:00	2011/8/14 10:30	2011/8/14 11:00	0.44	10.5	26.6	0.31	7.5	18.6
KDM V121	2011/8/20 9:00	GC1	331	MC	1	2011/8/20 12:00	2011/8/21 4:00	2011/8/21 6:15	0.89	21.2	15.6	0.67	16.0	20.7
KDM V123	2011/8/27 6:00	GC1	367	SG	2	2011/8/27 7:00	2011/8/27 16:00	2011/8/28 7:00	1.04	25.0	14.7	0.38	9.0	20.4
ACL	Average:		327		2				0.7	16.6	19.7	0.4	10.3	18.1
CLB V365	2011/8/5 8:00	GC2	230	SG	2	2011/8/5 9:00	2011/8/7 2:00	2011/8/7 6:00	1.92	46.0	5.0	1.71	41.0	2.8
CLB V366	2011/8/12 8:00	GC2	243	SG	2	2011/8/12 9:30	2011/8/14 1:00	2011/8/14 6:00	1.92	46.0	5.3	1.65	39.5	3.1
CLB V367	2011/8/19 19:30	GC1	296	SG	2	2011/8/19 20:40	2011/8/21 3:30	2011/8/21 6:00	1.44	34.5	8.6	1.28	30.8	4.8
CLB V368	2011/8/26 8:00	GC2	285	SG	2	2011/8/26 9:00	2011/8/28 5:30	2011/8/28 6:00	1.92	46.0	6.2	1.85	44.5	3.2
APL	Average:		264		2				1.8	43.1	6.1	1.6	39.0	3.4
						Estimated Actual (24 hours as No-working hour):				19.1	13.8		15.0	8.8
COTS V1129	2011/8/9 8:05	CT1	36	MC	1	2011/8/9 9:25	2011/8/9 14:30	2011/8/9 16:20	0.34	8.3	4.4	0.21	5.1	7.1
COTS V1131	2011/8/22 8:00	CT1	26	MC	1	2011/8/22 9:00	2011/8/22 11:10	2011/8/22 14:30	0.27	6.5	4.0	0.09	2.2	12.0
COTS	Average:		31		1				0	7	4.2	0	4	8.6
Average as a whole in August			**418**		**1.9**				**1.21**	**29.0**	**7.6**	**1.04**	**24.9**	**8.8**
1) In the case used QGC/MC:			396		1.7				0.88	21.1	10.9	0.71	17.1	13.4
2) In the case used Ship-gear:			431		2.0				1.39	33.3	6.5	1.21	29.1	7.4

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2) Quantitative allocation for and capabilities of human resources

Container operation of PAS is carried out by staff members and labors belonging to three (3) departments as shown in Figure 4.1-1. Management staff such as ship planners, CY planners and CY controllers as well as clerks and tallies work at CY, Apron and ECD belong to CTO Dept. Also, CHE drivers such as QGC, RTG and Reach Stacker belong to CTO Dept.; however, stevedore labors such as gang boss, ship-gear operators and lashers belong to GCHO Dept. Moreover, Gate clerks and container inspectors working at the gate belong to Security Office under Administration and Human Resource Dept.

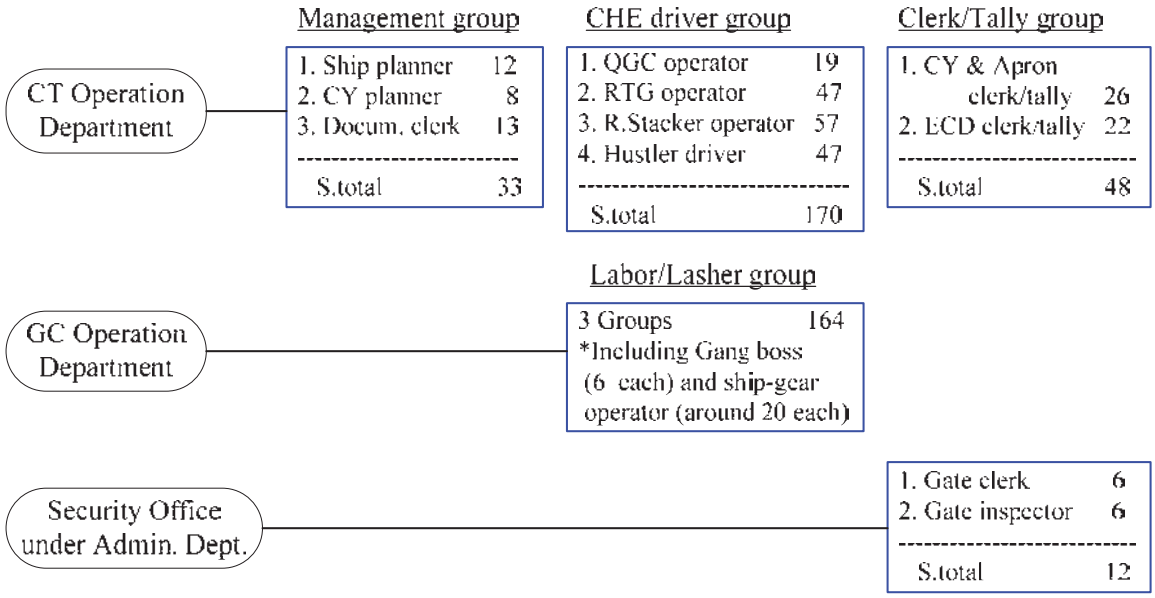

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Figure 4.1-1 Organization related to container operation

PAS has sufficient experience in container handling operation for both ship and CY-Gate; however, skills and capability of ship planners and CY planners/controllers, who play the key roles in container terminal operation, are still insufficient due to various reasons.

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. This is because of the nature of export cargoes, garments in this case, which don't arrive at the PAS Terminal until the last moment; although most export containers arrive at terminals before the ship arrives at berths in most countries in the world, making it is very hard to prepare proper loading pre-plans beforehand.

Furthermore, Customs clearance system of Cambodia for entering export containers into CY Gate and loading them onto ships are unique (See Figure 4.1-2); which has made shipping lines hesitant to hand over the right of ship loading roles to PAS. Thus, PAS could not build up required skills for operating the container terminal, especially the stevedoring function, though PAS has obtained modern container handling equipment such as QGC, RTG and CTMS in recent years.

- A key point to improve ship's operational productivity is to manage and control ship's operation through a well-considered working plan; which is prepared and shared among CHE drivers and stevedore labors before commencing ship's operation. This is regarded as common sense in most container terminals throughout the world.
- Garment and its related materials are the major shipment of Cambodia sharing more than 50% of the whole containers PAS handles at present.
- Most of the garment factories are located in Phnom Penh area, 6-7 hours distance from PAS Terminal in Sihanoukville (SHV) Port by container trailers.
- Some 75% of garment cargoes are ready to stuff into containers by Friday day-time through

the night; thus the majority of them arrive at PAS Terminal early Saturday morning through noon.

- Some of the garment containers arrive at PAS Terminal late in the evening on Saturday, because around 25% of garment products are completed for stuffing in Saturday AM. This will continue in the future too.
- After the cargo is stuffed into containers, Customs and Camcontrol issues the Joint Inspection Report (JIR) which becomes an important document for granting "Gate entry permission" at PAS Customs Gate (as well as PAS Gate) for the containers.
- Trucks drivers hauling these containers to PAS Terminal cannot pass through the gate until being granted entry permissions, which are prepared by various customs brokers in SHV after obtaining the original or fax copy of JIR from their head office in Phnom Penh.
- JIR are sent from Phnom Penh to SHV by taxi or by fax from early Saturday morning until around noon; although copy of export declaration (E/D) is sent by fax to the same brokers for granting "Loading Permission" of the containers after the process at Phnom Penh is completed.
- According to the information from trucking companies, Sihanoukville Port Customs charges US$5 per permission when it processed by fax copies of (original) JIR; however customs explains that faxed document can be accepted without any charges.
- PAS Customs allows containers to enter the PAS Gate once granted the gate entry permission through their officers in PAS Customs.
- On the other hand, PAS Terminal opens the gate at 07:00 for receiving these export containers, although Customs and other authority's offices do not open until 08:00. (Since Oct. 15th 2011 PAS CY Gate is opened at 04:00 on every Saturday based on an agreement reached with all the related parties.)
- Furthermore, the same permission documents are issued to Sihanoukville Customs (not PAS Customs) for granting loading permissions after the containers are stored in PAS CY.
- Thus, only some 60% of the containers become available to load onto the ships by noon Saturday after careful screening of the containers against the permissions; which is done by shipping lines.
- The screening work of shipping lines against permissions for confirming loadable containers is very sensitive and delicate; thus shipping lines wonder whether PAS can handle the work properly and in a timely manner or not. (Once containers are loaded improperly onto ships, these have to be discharged incurring a lot of re-handling works and possible delay of sailing schedules.)
- Furthermore, ships (4 ships in total) waiting for these garment export containers have to commence loading operations by around noon Saturday for sailing to the Port on time.
- Together with all these reasons, pre-planning work of PAS' ship planners for the loading operations, especially for Saturday callers, is very difficult at present.
- PAS cannot set a CY cut-off time for the garment containers because the cargo is the life line of the Port; also because of the PPAP's 2nd river port, which will be opened in 2012 and looks to become a tough competitor of PAS Terminal.

* JICA Team successfully negotiated with Customs Office in PAS that gate operation be commenced at 04:00 every Saturday from October 15th 2011; this will be a big step for PAS to become a competent terminal operator. Reasons are explained in Chapter 4.1.1.)

* JICA Team, including JICA expert of Customs matter in Customs head office in Phnom Penh, will work jointly for trying to simplify the current Customs processes at PAS Customs offices.)

Customs Clearance Process: Export Container (as of Dec. 2011)

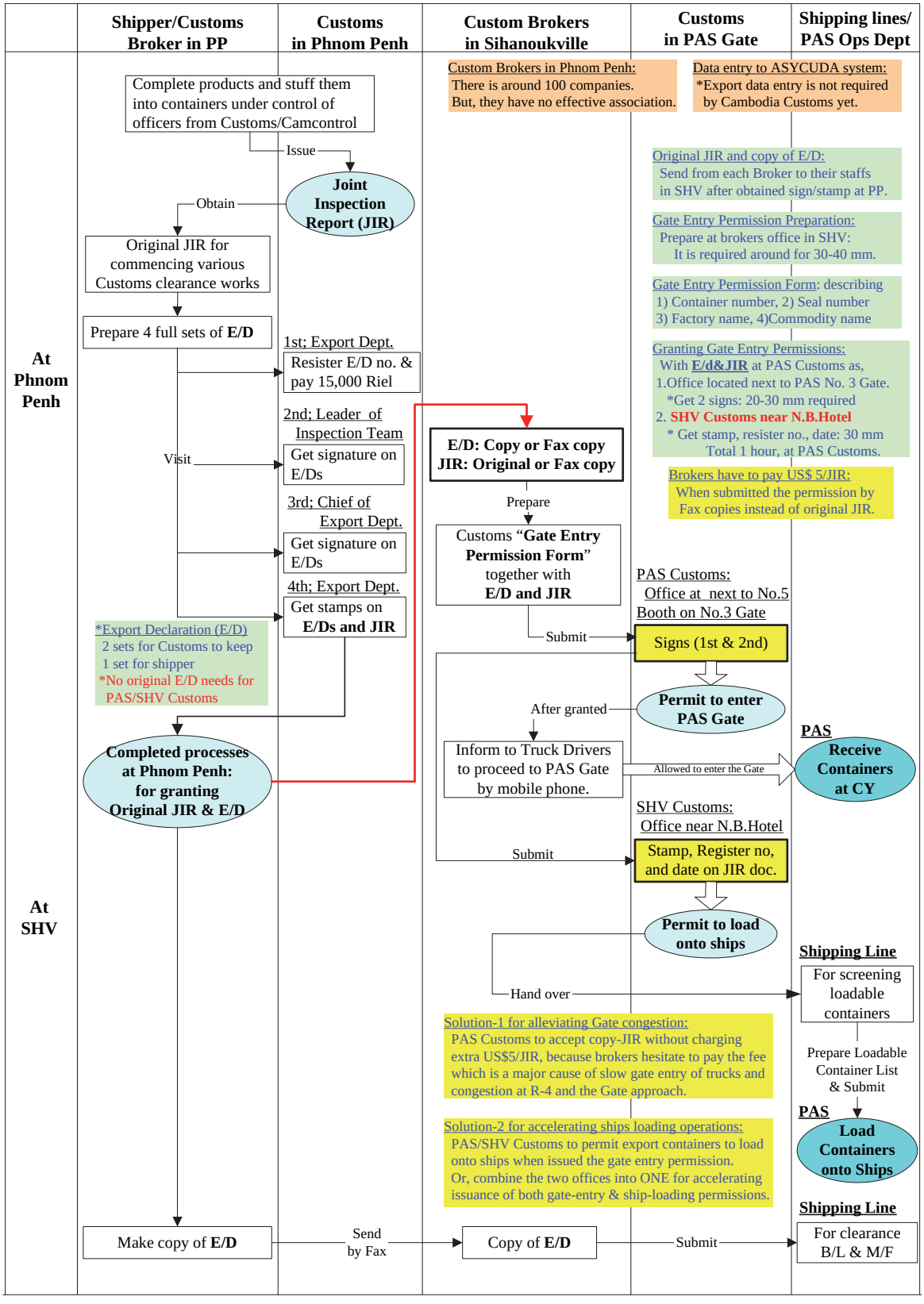

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Figure 4.1-2 Customs learance process of export containers through Sihanoukville Port

Skills of container handling equipment (CHE) drivers of PAS are passing grade in general. However, some behavior of drivers of Hustler trucks, RTG and Reach Stackers are not acceptable. Hustler truck drivers pay no notice to the traffic rules of PAS CY (clock-wise in ships operation) for saving fuel-consumption; then RTG drivers do not want to share lift on/off works with other RTG's for earning fuel-credit.

- PAS supplies fuel (diesel oil) for RTG, Reach Stackers and Hustler trucks by credit system, handing out coupons to drivers showing estimated quantities of fuel oil on them.
- The credit is paid to drivers by type of CHE by container moves, such as 1.5 liter per container move for Hustler driver, then 1.6 liter for RTG driver. (The amounts are not exact.)
- PAS has adopted this system to save fuel consumption because, unfortunately, many of these CHE drivers had pilfered fuel in past.
- Hustler truck drivers make short-cuts neglecting the traffic rules, or RTG drivers handle more lift on/off containers without sharing the works with others for saving some fuel/money; this is the cause of these lawless activities.
- Once PAS allows Hustler truck drivers to approach RTG lanes in a counter clock-wise direction, containers carried by these trucks have to be stacked in the CY in opposite-way from others. This practice of the drivers surely hinders PAS'attempt to realize safe and smooth operations.

(*It was observed that containers mounted on internal tractor-chassis under ships discharging operation were basically door-front conditions, opposite from the normal method; thus, these containers could be stacked in the CY in normal direction at PAS CT. However, once there are external trailers in the same RTG lanes, these external and internal trucks should be stacked there.)

- These behaviors of PAS CHE drivers have to be changed; otherwise PAS will not be able to operate the Terminal efficiently and safely.

Skills and behavior of PAS long-shore labors come into question too at present, although not all of them. The labor groups (total 164 persons) have been under control of 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.

Training of the labors is proper and much needed. However, the new way of labor management of GCHO Dept. requires ship planners to manage operation at the apron instead of gang-bosses who are undergoing training. This takes time away from ship planners' primary duty, namely ships planning, but also operational productivities became low due to the lack of expertise of labors in key positions.

The Project Team suggested that PAS consolidate all the CHE drivers and labors, for both container and general-cargo ships, in one department for managing them in a comprehensive manner. The suggestion was accepted by PAS top management partially, though the implementation date is not decided yet.

- Managers of the new department (Labor Management Dept.) have to supply enough skilled labors to meet the requests of CTO Dept.
- First priority of the daily labor provision is regular calling ships, then irregular callers.
- Managers of the Dept. are required to make adjustments in manpower by labor categories, such as 12 or 13 persons for QGC drivers although PAS allocates 19 of them at present. (2 units of QGC x 2 operator/shift x 3 Shifts = 12)
- Managers of the Dept. are required to offer training for all labors and encourage them to become multi CHE drivers and or adopt advanced/effective technologies for improving productivities of the ships operation, especially ship-gear operation.

Stevedore labor-gang ordering system through the new Dept. is shown in Figure 4.1-3.

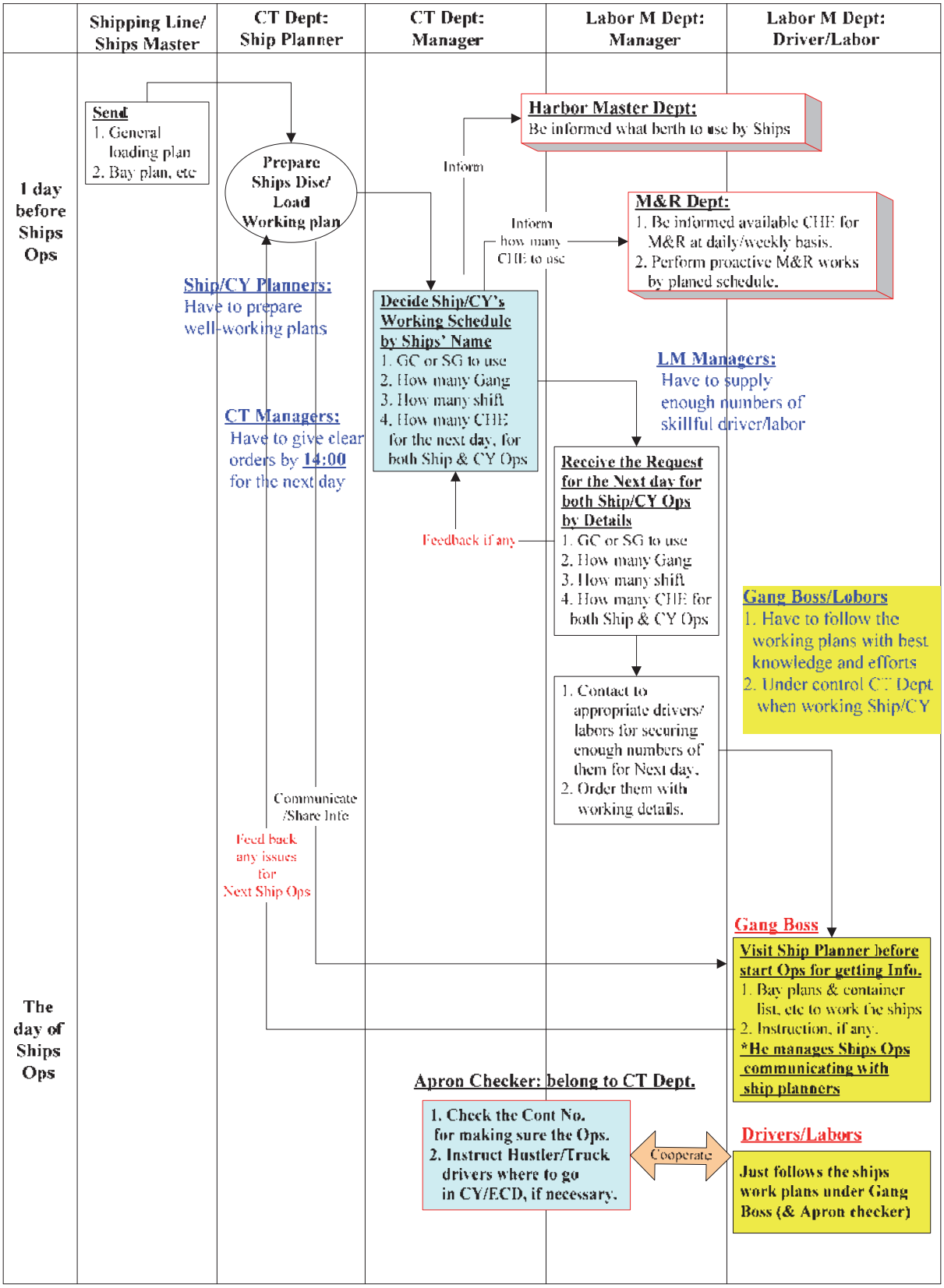

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Figure 4.1-3 New labor ordering system for operating container ships

3) Physical and intellectual resources (techniques)

Container handling equipment owned by PAS is shown in Table 4.1-2.

As shown in the table, 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). On the other hand, PAS handles seven and half (7.5) ships per week (one (1) ship calls PAS biweekly) and its handling volume are some 13,000 container boxes per month.

Four (4) ships out of seven and half (7.5) call PAS Terminal on Friday through Sunday aiming for garment shipment, the major export cargo of Cambodia. Busiest day for PAS is Saturday for not only loading these containers onto vessels, but also receiving them at CY, and delivering import containers discharged from these vessels.

Day-shift through night-shift on Saturday, PAS lineups 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. (Three (3) ships out of four (4) are worked out by ships' gears with two (2) gang each.) 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. (*See Table 4.1-3)

- Lift-on/off productivity of RTG for external truckers is some 12-15 moves per hour on average since lanes have to be changed often, especially when few RTG have to cover a wide area.

PAS, therefore, needs to purchase one (1) or two (2) units of RTG immediately to cope with the needs of external truckers on Saturday, or PAS has to sacrifice ship's operation using only one (1) RTG for two (2) ship-gears. Other than RTG, PAS has enough CHE at present. However, PAS can wait to purchase RTG until the opening of PPAP's new container terminal in 2012 to assess the impact of the new port on PAS's business.

PAS CHE drivers and labors on ship and CY-Gate operations are of questionable quality. As stated in the previous section, skill-level as well as professional awareness of these drivers and labors are low in general. Some gang-bosses cannot manage and control stevedore labors preferably, and some ship-gear operators cannot handle the gears smoothly. PAS needs to introduce not only effective training system for them, but also adopt discipline and order in this field too.

In addition, PAS' resource allocation for CHE drivers is excessive. PAS allocates 19 persons as QGC driver, but 12 persons are enough for covering PAS' current needs. Also, PAS allocates 47 RTG drivers, but 42 persons are enough (7 RTG x 2 x 3=42). Furthermore PAS allocates 57 Reach Stacker drivers at present, but 54 persons are enough (9 Reach Stacker x 2 x 3= 54). These CHE are used fully on every Saturday, but more than 50% of them are just idling without usage (when managed properly) on Sunday through Friday at present.

Table 4.1-2 CHE owned by PAS as of September 2011, and its conditions

No.	Type of Equipment	Name of Equipmentt	Quantity (Set)		Capacity (Ton, HP)	Owner	Year of Installation	Age	Aggregate Operating Houres for the last 6 months (average)	Manufacturer	Main Purpose of Usage	Technical Condition				Operational Condition
			Total	Each								Good	Medium	Accept able	Bad	
1	Quayside Gantry Crane	30.5 Ton	**2**	2	30.5 Ton	PAS	2009	2	545	MITSUI ZOSEN	Container	○				
2	RTG (Rubber Tired Gantry Crane)	40 Ton-Hyundai	**7**	2	40 Ton	PAS	2001	10	708	Hyundai	Container		○			
		35.6 Ton-Mitsubishi		5	35.6 Ton	PAS	2009	2	925	Mitsubishi	Container	○				
3	Reach Stacker	Laden Container	**9**	2	45 Ton	PAS	1995	16		PPM (France)	Container		○			
		Laden Container		2	45 Ton	PAS	1998	13		PPM (France)	Container		○			
		Laden Container		2	45 Ton	PAS	2003	8		Kalmar (Sweden)	Container	○				
		Empty Container		1	7.5 Ton	PAS	2004	7		Kalmar (Sweden)	Container	○				
		Laden Container		2	45 Ton	PAS	2008	3		Kalmar (Sweden)	Container	○				
4	Fork Lift	Fork Lift (Japan)	**1**	1	25 Ton	PAS	1993	18		Komatsu	Container General cargo			○		
5	Trailer Head and Chassis	Mitsubishi	**22**	10	40 Ton	PAS	1998	13		Mitsubishi	Container Cargo		○			
		Nissan		8	40 Ton	PAS	2009	2		Nissan	Container Cargo	○				
		Kamaz		4	40 Ton	PAS	2002	9		Kamaz (Russia)	Container Cargo	○				
8	Trailer Head and Chassis	Maz (Russia)	**9**	1	40 Ton	PAS	1985	26		Maz (Russia)	General Cargo Container			○		
				2	40 Ton	PAS	1988	23			General Cargo Container			○		
				1	40 Ton	PAS	1990	21			General Cargo Container			○		
				1	40 Ton	PAS	1992	19			General Cargo Container			○		
				1	40 Ton	PAS	1998	13			General Cargo Container			○		
		Kamaz (Russia)		3	40 Ton	PAS	2002	9		Kamaz (Russia)	General Cargo Container	○				
10	Mobile Harbour Crane	64 Ton (Germany)	**2**	2	64 Ton	PAS	2001	10		Liebherr (Germany)	General Cargo Container		○			

Source:PAS Machinery Department

Table 4.1-3 Lift-on and lift-off volume of laden containers by RTG on Sept. 10th ~ 17th 2011

	Date & Time	Sat 10/9/11		Sun 11/9/11		Mon12/9/11		Tue 13/9/11		Wed 14/9/11		Thurs15/9/11		Fri 16/9/10		Sat 17/9/11	
		Lift-On	Lift-Off	Lift-On	Lift-Off	Lift-On	Lift-Off	Lift-On	Lift-Off	Lift-On	Lift-Off	Lift-On	Lift-Off	Lift-On	Lift-Off	Lift-On	Lift-Off
Late Night Shift	00:00-1:00	1	2	0	0	0	0	0	0	0	0	0	1	0	0	2	0
	1:00-2:00	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	2:00-3:00	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	3:00-4:00	0	9	0	2	0	0	0	0	0	0	0	0	0	0	0	1
	4:00-5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0
	5:00-6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6:00-7:00	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	7:00-8:00	1	3	1	0	0	0	0	0	0	0	0	3	0	0	4	5
	S.Total	4	17	1	3	0	0	0	0	0	0	0	5	0	4	8	7
	Total		**21**		**4**		**0**		**0**		**0**		**5**		**4**		**15**
Day Shift	8:00-9:00	22	21	4	0	11	0	4	0	0	21	9	5	3	3	12	31
	9:00-10:00	30	42	1	0	24	0	7	1	11	13	7	5	5	15	27	44
	10:00-11:00	32	51	11	0	43	0	9	2	5	6	23	8	6	12	30	44
	11:00-12:00	46	44	1	0	27	0	8	2	3	2	3	5	34	1	29	31
	12:00-13:00	36	22	11	0	3	0	3	0	3	0	3	0	13	0	18	21
	13:00-14:00	44	9	0	0	6	0	1	0	2	0	4	0	9	0	59	28
	14:00-15:00	27	14	0	0	4	5	15	0	16	6	3	0	10	2	37	20
	15:00-16:00	55	6	0	0	21	0	15	1	21	3	14	16	34	25	65	45
	S.Total	292	209	28	0	139	5	62	6	61	51	66	39	114	58	277	264
	Total		**501**		**28**		**144**		**68**		**112**		**105**		**172**		**541**
Night Shift	16:00-17:00	28	11	0	0	23	0	17	14	15	6	31	7	25	26	40	3
	17:00-18:00	19	15	0	0	13	0	19	12	16	8	9	2	30	15	20	4
	18:00-19:00	16	10	0	0	2	0	14	1	5	4	1	2	28	5	27	6
	19:00-20:00	18	15	0	0	2	0	3	5	1	4	0	0	11	8	12	6
	20:00-21:00	6	3	0	0	0	0	1	0	0	0	1	0	6	0	12	5
	21:00-22:00	9	0	0	0	0	0	0	0	0	0	0	10	1	4	2	0
	22:00-23:00	0	11	0	0	0	0	0	0	0	0	0	9	7	0	0	0
	23:00-24:00	0	0	0	0	0	0	0	0	0	1	0	6	3	11	0	0
	S.Total	96	65	0	0	40	0	54	32	37	23	42	36	111	69	113	24
	Total		**161**		**0**		**40**		**86**		**60**		**78**		**180**		**137**
	Total	**392**	**291**	**29**	**3**	**179**	**5**	**116**	**38**	**98**	**74**	**108**	**80**	**225**	**131**	**398**	**295**

On the other hand, there is a shortage of PAS' stevedore labors when PAS lineups eight (8) gangs, which occurs every Saturday. Gang component of PAS is one (1) gang-boss, two (2) ship-gear operators together with signal-man (in the case of "ship-gear" operation) and eight (8) lashers, total 11 persons, in general. This means that 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 belong to GCHO Dept., assigned for GC operation, consisting of two (2) gangs (required 66 persons) by themselves. However, this labor shortage problem still remains (264-66=198. 164-198= (-) 34) in PAS. This is one of the reasons why PAS' ships operational productivity is so low.

- Full gang situation (6 ~ 8 gang) of PAS occurs from Friday-night through Saturday-night for four (4) continuous shifts; thus PAS needs to prepare eight (8) gangs at present.
- PAS supplies only a few stevedore labors (mainly lasher) at present for some ships on Saturday day and night shifts due to the serious labor shortage during the day.
- However, PAS can reduce the necessity of stevedore labor-gang from eight (8) to six (6) in the peak shifts in the near future; then from six (6) to four (4) based on the present scheme.

Ideas and plans for solving PAS' various problems on container ship operation at present are presented in 4.1.1-4.

4) Project process and project implementation capabilities

Many common sense practices in container terminals throughout the world are not adopted at PAS Terminal at present, even though many JICA experts, long-term and short, have recommended that such practices be adopted. This is partly based on lack of basic discipline and order in PAS organization as a whole, rather than a problem of CTO Dept. alone.

- Trucks' traffic rule in PAS Terminal is clock-wise for internal drivers and counter clock-wise for external ones; however, both of them sometimes proceed to RTG lanes in opposite ways.
- Available RTG and Reach stackers are fully hired for daily ship and CY's lift on/off operations in general, no matter what handling volumes for day-of-week/shift; which limits opportunities for PAS mechanics/engineers to conduct proactive maintenance and repair (M&R) operations for the CHE.
- RTG drivers stay in specific RTG lane(s) each for handling lift on/off containers exclusively there without having any effective controls of CY controllers, resulting in a considerable variation in services to external truckers.
- Containers are stacked in the CY in the opposite direction to that which the external truckers carried them (mounted as door-front conditions) in to prevent pilferage.
- In such case, PAS has to change the direction of such containers using Reach Stacker before the trucks go to designated RTG lanes. (PAS can charge lift-on charge for such containers.)
- Some of these abnormal practices stated above are caused by the "fuel credit" system of PAS which was introduced to prevent fuel pilferage by these CHE drivers.

PAS top management has to adopt discipline and order as well as professional awareness for not only PAS' container operation but also across the entire PAS' organization for preventing such activities as fuel pilferage. Upon these adoptions, PAS top management is suggested to take necessary measures including action on personnel affairs not only for implementing common sense practices in the container operation, but also achieving PAS' operational targets (25.0 lifts/GC or 2SG/hour) promptly. The leader of CTO 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 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; this will result in higher customer satisfaction as well as lower operational costs. (JICA experts will help him to develop these business plans as well as strategic plans for executing them effectively in PAS' container operations.)
- Leadership for implementing 1) business plans and strategies developed, 2) and for adopting discipline and order in the entire container operation with the support of PAS top management.

Container operation is the life-line of PAS at present and will continue to be so in the future, accounting for more than 80% of PAS' revenue. PAS has to put its best members in CTO Dept. and Labor Management Dept. for strengthening the life-line of PAS.

5) Status of occupational training and education

PAS has no facility for training or educating its own staff members or labors; however, PAS has a training system for some CHE drivers such as QGC or RTG that is conducted by experienced drivers.

PAS should have training facilities for stevedore labors, especially for "ship gear" operation. PAS needs to cope effectively with ship-gear operation in order to handle more than three (3) ships at a time in future. Even though PAS purchased its 3rd QGC, PAS cannot work three (3) ships at a time, only two, because the QGC berth is only 400 meters long. Thus, ship-gear operation will continue for some years to come, until PAS develops a new container terminal.

(2) Gate Operation

PAS container terminal (CT) is operated on a 24 hours a day 365 days a year basis. However, as shown in Table 4.1-3, a very few gate-in and out activities are recorded in between 20:00 and 08:00 in the next day. Therefore, PAS can eliminate the gate service in these night hours, except Saturday, without any problems boosting the morale of staffs and workers assigned in these shifts instead.

- Sihanoukville Customs stops the work for a day by 22:00 or 23:00; thus a catch phrase of PAS, open the CY-gate for 24 hours a day for 365 days a year, is not true.
- Once PAS eliminates majority of night shifts, except Saturday, PAS will have a sufficient number of available RTGs and or Reach Stacker for the ships operation (1 RTG or Reach Stacker per QGC or Ship-gear should be the minimum requirement) to increase/maintain its productivities.
- PAS orders only 1 RTG per 2 ship-gears for geared ships' operation in general due to the low productivity; however, this worsens the productivity in most cases.

As stated in the previous section, PAS CT Gate is operated by clerks and inspectors belonging to the Security Office under Administration and Human Resource Dept. instead of CT Ops Dept. Thus, there is observed some disadvantages in the entire PAS' CY-Gate operation. Therefore, it is better to transfer these clerks and inspectors from the Security Office under Administration and Human Resource Dept. to CT Ops Dept., although it is not an urgent issue.

However, only 6 gate-clerks cover 5 lanes of PAS CT gate on a 3 shifts a day 365 days a year basis under the Security Office; thus, if they were transferred to CT Ops Dept., their burden should be lightened, because CT Ops Dept. has enough numbers of clerks working for the CY and ECD operations. However, certain discipline shown by these gate clerks at present on their duties may be spoiled due to loose management of CT Ops Dept.

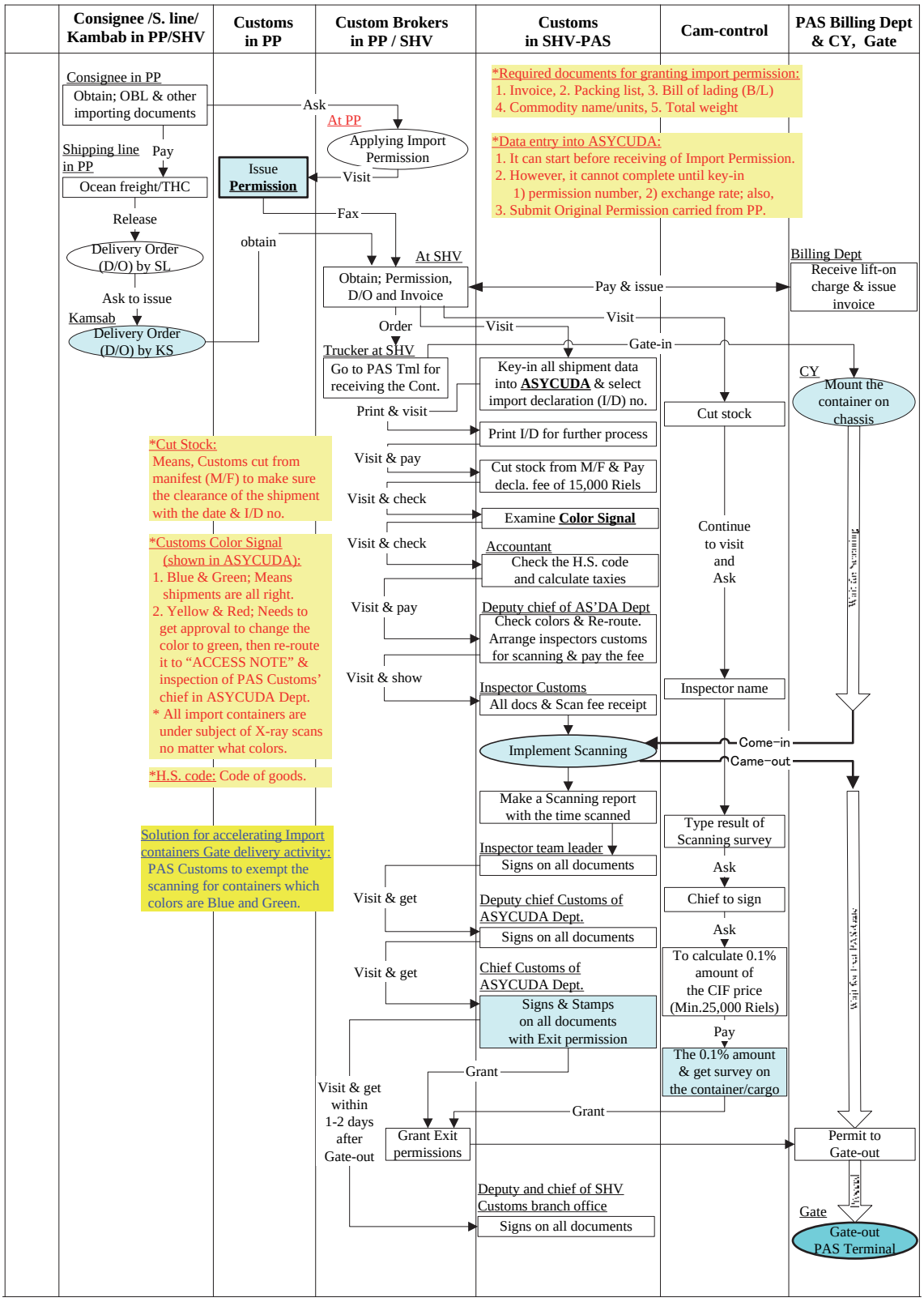
When hauling export containers into PAS CY, all the truck drivers are subject to inspections by 1) PAS Security clerks to determine whether they have a copy of invoices for the lift-off charges, by 2) Customs, 3) Cam-control, and 4) Police to determine whether the containers being hauled are listed on the gate-entry permission lists or not, and by 5) another PAS Security clerks whether they have entry passes issued by PAS once they arrive at PAS' gate.

After completing these processes, truck driver can finally go to PAS' gate-booth and submit carrying-in sheet for the container to a gate clerk who enters the data into CTMS. The data entry work of the clerk is minimized when the booking data for the container was obtained from shipping lines and entered into CTMS by PAS' documentation clerk beforehand. Thus, the processing time of the gate clerk at the booth is 1-2 minutes per container when the data was entered into CTMS, or 3-4 minutes in other cases resulting in 7-8 minutes in total for truck drivers on average.

It is necessary to introduce Customs clearance system such as NACCS in Japan in Cambodia for simplifying the gate entry processes from the current 6 stops to 1 stop, but this may take some years. Thus, PAS cannot expect to simplify the gate entry system until Customs installs a new system. However, PAS can change its current practices such as elimination of 1) and 5) stated above, asking shipping lines to submit booking data before the containers arrive at PAS gate.

- Simplifying gate-entry and ships loading permitting systems and processes of PAS and Sihanoukville Customs for export containers, and elimination of Customs' scanning for some import containers contain commodities categorized in blue and green colors by Cambodian Customs system should be effective for increasing the value of Sihanoukville port; although it is beyond the scope of the project to go into details.
- Declaration process of import containers is done by Customs brokers at Sihanoukville Port in general, inputting container and cargo data into ASUCUDA system (Cambodian Customs System) at Sihanoukville Port Customs. After keyed in the data into ASUCUDA, each broker has to visit many Customs offices to obtain signatures and permissions of various Customs officers for scanning the containers before getting out the terminal. (See Figure 4.1-4 for more details.)

Customs Clearance Process: Import Container (as of Dec. 2011)



Note: The flow chart is based on information from logistics companies. The chart might not describe official procedures.
Prepared by Project Team

Figure 4.1-4 Import containers customs clearance process for cargoes imported through Sihanoukville Port

(3) Yard Operation in PAS Container Terminal (CT)

1) Containers Storage Capacity of PAS CT

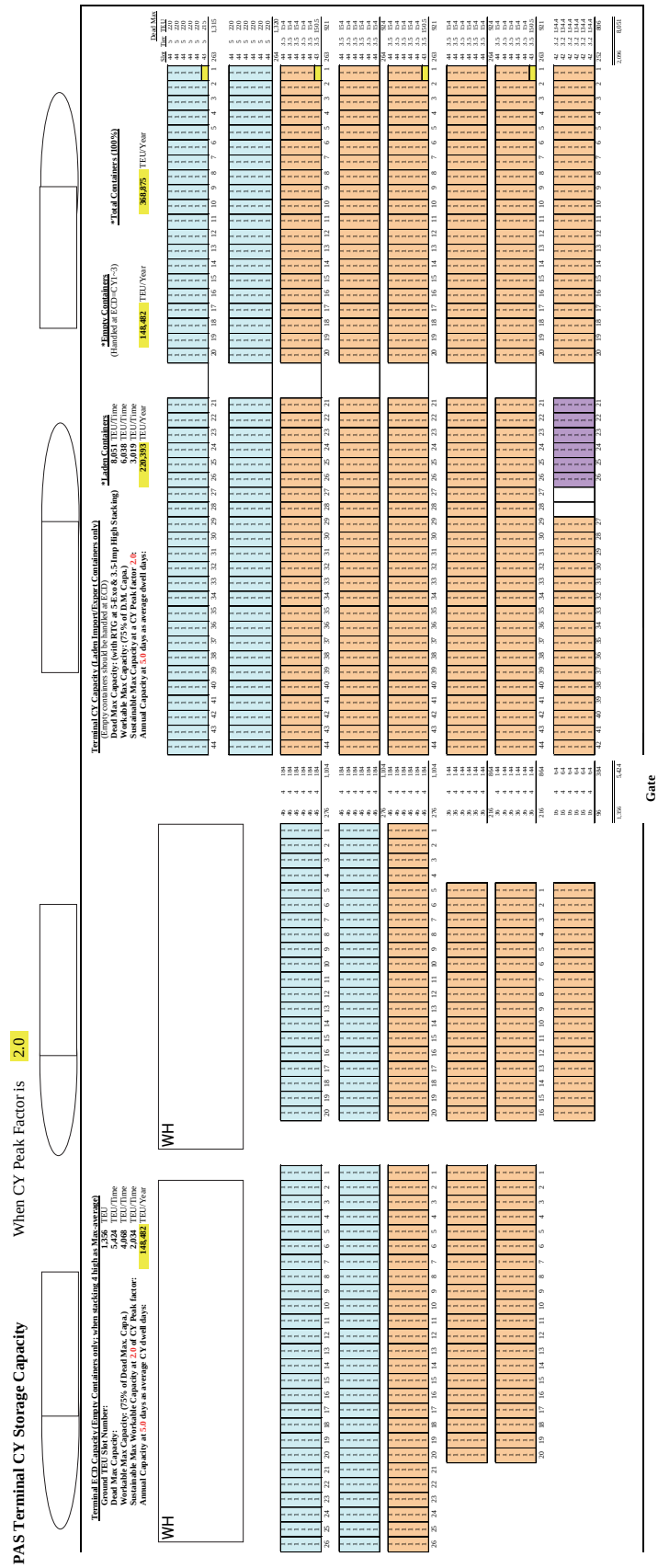
PAS's new CY became available to use in December 2011 when pavement works of half of the CY were completed. Thus, PAS has 2,096 ground TEU slots in the CY. This means sustainable maximum storage capacity of the containers at the entire CY of PAS is around 220,000 TEU per annum when stacking export containers 5 high and imports 3.5 high. Moreover, assuming that 75% of Dead Max CY capacity is Workable Max CY capacity, and 5 days are as average dwell-days of the containers, then 2.0 is as the CY peak factor. However, the sustainable maximum capacity of PAS CT, including empty container depot (ECD) becomes some 360,000 TEU per annum as shown in Figure 4.1-5.

- Dead Max CY Capacity is the maximum capacity for the CY (terminal); however, once containers are stored up to the capacity, that terminal cannot accept any other containers at all.
- Every terminal, thus, has to keep free space for receiving containers either from ship or gate to ensure seamless operations. Recommendable free space ratio is 25% of the Dead Max CY capacity of the terminal.
- Stacking highs for export containers can be 5 when using "4+1" type of RTG as PAS does; although the terminal operator has to set up strict marshaling yards separating containers by vessel-voyage, destination, size, height, weight and so on for avoiding yard-shifting during the ships loading operations.
- On the other hand, stacking high for import containers should be 3.5 as maximum when using the same type of RTG for preparing for yard-shifting that will happen very often during the delivering (lift-on) operation of containers to external truckers who call terminals randomly.
- At the ECD, it is assumed that containers (empty ones basically) will be stacked 4 high on average for the calculation.
- Number of dwelling days at PAS CT has not been surveyed, but 5 days on average is adopted for the calculation; however, 2 days are assumed for export laden containers and 7 days for import laden containers.
- CY peak factor (PF) is calculated by dividing "handling volume on the busiest day in a week" by "average handling volume per day for the week", applying the gate-in and out volumes by counting container boxes.
- In the case of PAS CT, actual PF is more than 2.0, by receiving and delivering numerous containers to and from 4 ships (Saturday callers) on every Saturday.
- Sustainable maximum CY capacity is calculated by the following mathematical formula.

"[(Dead CY&ECD Max Capacity x 75%) / Peak Factor] x 365"/Average dwell days

PAS handled around 250,000 TEU in 2011; thus it can be said that PAS has 110,000 TEU/year (or 44%) of room in the terminal at present. However, it is unusual for a certain size of container terminal as PAS to rush containers on a certain day in a week; thus, sooner or later, PAS should have another peak-day in the middle of the week. In that case, PAS CT's PF may become 1.5 or lower for increasing its sustainable maximum CY capacity to 490,000 TEU per annum.

- CY peak factor in moderate sized container terminals is around 1.3 ~ 1.5 since numbers of ships call such terminals spreading throughout a week.
- Once the Garment export volume is increased more, the cargo should be shipped out twice a week at least. Thus, PAS CT would be able to handle more than 500,000 TEU per annum as maximum without developing any new CY (Although, PAS has to purchase 2units of QGC and 5 units or more RTG at least for equalizing its apron (berth) capacity to CY's.).



Prepared by Project Team

Figure 4.1-5 CY and ECD capacity of Sihanoukville Port

2) Most suitable allocation Planning for PAS CY and ECD

A key factor in managing the CT successfully is to allocate the container yard (CY) reasonably based on the characteristics of containers at the CY area with minimum container handling equipment (CHE) to handle, and to make traffic-flow smooth and safe for both internal and external trucks.

Most the terminals, whether they use a RTG system or Straddle Carrier system, set marshaling yards for export containers close to the apron (berth) and stacking yard for import and or empty containers on the other side (shore-side) for efficient ship operation and safe CY-gate operation. RTG is the main CHE at the CY in RTG-system; although lift-type CHE such as reach stacker, top-lifter and side-lifter are also common for handling empty containers there.

How to set up effective marshaling yards for export containers and stacking yards for import containers is for competent terminal operators for maximizing ships stevedoring productivities as well as minimizing its operational cost with fewer CHE. These are planned by vessel-voyage based on actual discharging and loading TEU numbers reflecting stowage patterns and or particulars by ships.

- Marshaling yard is planned by booking information submitted by shipping lines in general; however, in the case of Cambodia, it is hard to get reliable information on time even from competent shipping lines such as Maersk. Thus, PAS cannot expect to set up the plan by booking data, but by historical data and patterns.

As described already, PAS uses RTG at CY and reach stackers at ECD in general. On Saturday, PAS faces a shortage of RTGs (by 2 units at least) as there are so many containers to handle for both ships and at the CY-gate, even though PAS orders all 7 units of RTG on that day. Thus, to cope with this problem, PAS has to set up marshaling yards in ECD instead of CY at least for 2 of the 4 ships so that the containers can be handled there by reach stackers instead of RTG.

Furthermore, once PAS commenced loading operations on Saturday, PAS has to split 4 units of RTG (out of 7) for 2 ships (working by 2 cranes each) to use at 1st marshaling yards in the CY. Rest of the RTG (3 units) have to be used for delivering (lift-on) import laden containers at other part of the CY. Accordingly, PAS must use reach stackers, instead of RTG, for stacking late arriving export containers for these 2 vessels at the 2nd marshaling yards at another area in the CY.

- It is common for container terminals in the world to set CY cut-off time for export containers by ships for preparing loading plans before the ship's arrival. If a ship arrives at a terminal in AM, cut-off time for the ship is usually set in the evening (17:00) on the previous day.
- However, PAS cannot set the CY cut-off time for the containers planned to be loaded onto Saturday callers because majority of the cargo stuffed in these containers are garment, a major export commodity of Cambodia.
- It is too risky for PAS to set cut-off times for loading export containers onto ships because it could possibly lose that cargo to the 2nd river port of PPAP in Phnom Penh.
- Furthermore, these garment containers arrive at PAS CT in the evening on Saturday. On the other hand, some of these ships have to sail the port by midnight Saturday; thus, PAS has to commence the loading operations for the ships by at least noon. This is why PAS has to prepare 2nd marshaling yards for these ships to prepare the loading plans twice per ship.

PAS can set up marshaling yards for export containers as well as stacking yards for import containers with more room due to incremental CY space since December 2011 as described already. However, part of the new CY area is not covered by CTMS at present; thus PAS has to operate the area, together with ECD, manually keeping some CY clerks there during the operation.

* According to the maker of CTMS, the entire CY area is covered by CTMS; lightening can cause the system to malfunction but the problem is easily rectified.

* ECD is not covered by CTMS at all; thus, PAS needs to install necessary devices for covering the area by the system when PAS cannot operate ECD without CTMS.

The best CY allocation plan for PAS CT based on the actual ships handling data in August 2011 (which is shown in Table 4.1-4) is presented here. Based on the data, required CY spaces for the

marshaling yards (export) and stacking yards (import) by TEU are stated in below.

- Only laden containers should be stored in the CY.
- Containers are assumed to be stored 4 high for export and 3.5 high for import.
- 45' containers should be stored in the end-bays of RTG lanes in the CY, counting 2.0 TEU per container the same as 40' containers.
- There are 44 bays by 20' in each RTG lane in the CY, 20 in the East side, then 24 in the West.

S.Line	Service	Dis(TEU)	Req.CY-bays	Load(TEU)	Req. CY-bays
MCC	MCC-1	363	17.3	62	2.6
MCC	*MCC-2	398	18.9	799	33.3
RCL	RCL-1	335	16.0	52	2.2
RCL	RCL-2	407	19.4	30	1.3
RCL	*RCL-3	163	7.8	258	10.7
ACL	*	134	6.4	298	12.4
APL	*	231	11.0	165	6.9

(4 ships with "*" mark call the port Friday through Saturday; call as Saturday callers.)

PAS can handle non-Saturday callers such as MCC-1, RCL-1 and RCL-2 as the main activity is discharging. However, Saturday callers are different as stated many times already. Their main activity is loading, and the containers of 4 ships arrive at PAS CT beyond the usual CY cut-off time; thus, PAS cannot handle them properly at the moment. It is necessary for PAS to master effective planning skills and execution.

Marshaling yard: Marshaling yards should be set independently by ships, or separated by ships with enough distance in between the yards so as not to interfere with CHE/trucks hired by ships during the loading operations. Also, a marshaling yard for a ship has to be divided into several sections based on the number of cranes to be used for the ship, with enough distance between each section, so RTG (or reach stackers) can operate without conflict.

Theoretically, PAS can set marshaling yards for MCC-2 and RCL-3 in CA and CB lanes in the CY, next to QGC berths, due to the ships basically use QGC for handling number of containers at the berths; which require using RTG for paralleling with the speed of QGC. Then, PAS can set the marshaling yards for ACL and APL in AA and BA lanes in ECD for handling the containers there by reach stackers alone because these ships alongside on New Quay berths, close to AA and BA, employ ship gears in principle. Accordingly, PAS can shorten the traffic distance of trucks working for the ships berthing at the New Quay and overcome the shortage of CHE, especially RTG.

According to the data in August 2011, 1 RTG lane (44 bays) in the CY is too large for RCL-3 (requires 10.7 bays); thus the lane can be shared with BEN Lines whose ship has started calling the port on Sunday recently. MCC-2 requires 33.3 bays; thus 1 lane should be enough together with the 2nd marshaling yard of the ship there. AA lane in ECD has 26 bays; thus enough for ACL, then BA lane has 20 bays enabling APL's to work at there.

* PAS decided to use a part of ECD (a part of "A" area) for purposes other than container business; thus, there is not enough space for the AA-lane planned for ACL.
* Once PAS introduces a systematic operation, PAS can handle all the ships with 4 gangs instead of the current 8 and work 2 ships a time with 2 gangs each. At that time, ACL and APL ships will be worked after completing MCC-2 and RCL-3 ships; thus the marshaling yard for APL (or ACL) can be set in CA lane in the CY together with RCL-3's and Ben line's.
* Marshaling yards for ACL and APL can be one each, due to late commencing the operations.

PAS has to set up marshaling yards for Saturday callers very carefully due to the limited space. PAS has to set up the marshaling yards in 2 stages (1st and 2nd) for all 4 ships in the CY and ECD (until PAS can work 2 ships/time at most with 4 gangs) for starting the loading operations at noon on Saturday. For making the marshaling yards workable, CY planners have to keep enough distance in

between the marshaling yards not only by ships, but also by stages at the same time.

* PAS has to commence the loading operations by noon Saturday for both MCC-2 and RCL-3 ships at the latest due to their loading volumes and the fact that their sailing schedules must be maintained; thus the preparation of the 2nd marshaling yards for them is an essential requirement for PAS.
* Once PAS realizes a "4-gang" system, loading works of ACL and APL ships can be commenced after completing those of MCC-2 and RCL-3 ships at around 23:00 on Saturday; only one marshaling yard for each ship will be required.

Stacking Yard: As the same as the marshaling yard, stacking yard for import laden containers should be independent by ships, or separated by ships with enough distance in between the yards for not conflicting by CHE/trucks working for ships during the operations. PAS has enough space for the stacking in the CY, separating lanes by shipping lines at present; thus, there is no major problem.

PAS can share 1 RTG lane (CC) for MCC-1 and MCC-2 because their discharging volume is equivalent to 36.2 bays in total per weekly basis; thus some extra room exists. In the case of RCL (1 through 3), their requirement is 43.2 bays per week; thus, PAS needs to prepare more than 1 RTG lane (whole CD and a part of CE). In the case of ACL and APL, their requirements are 6.4 and 11.0 bays each per week; thus PAS can set the stacking yards for them in CE together with RCL's.

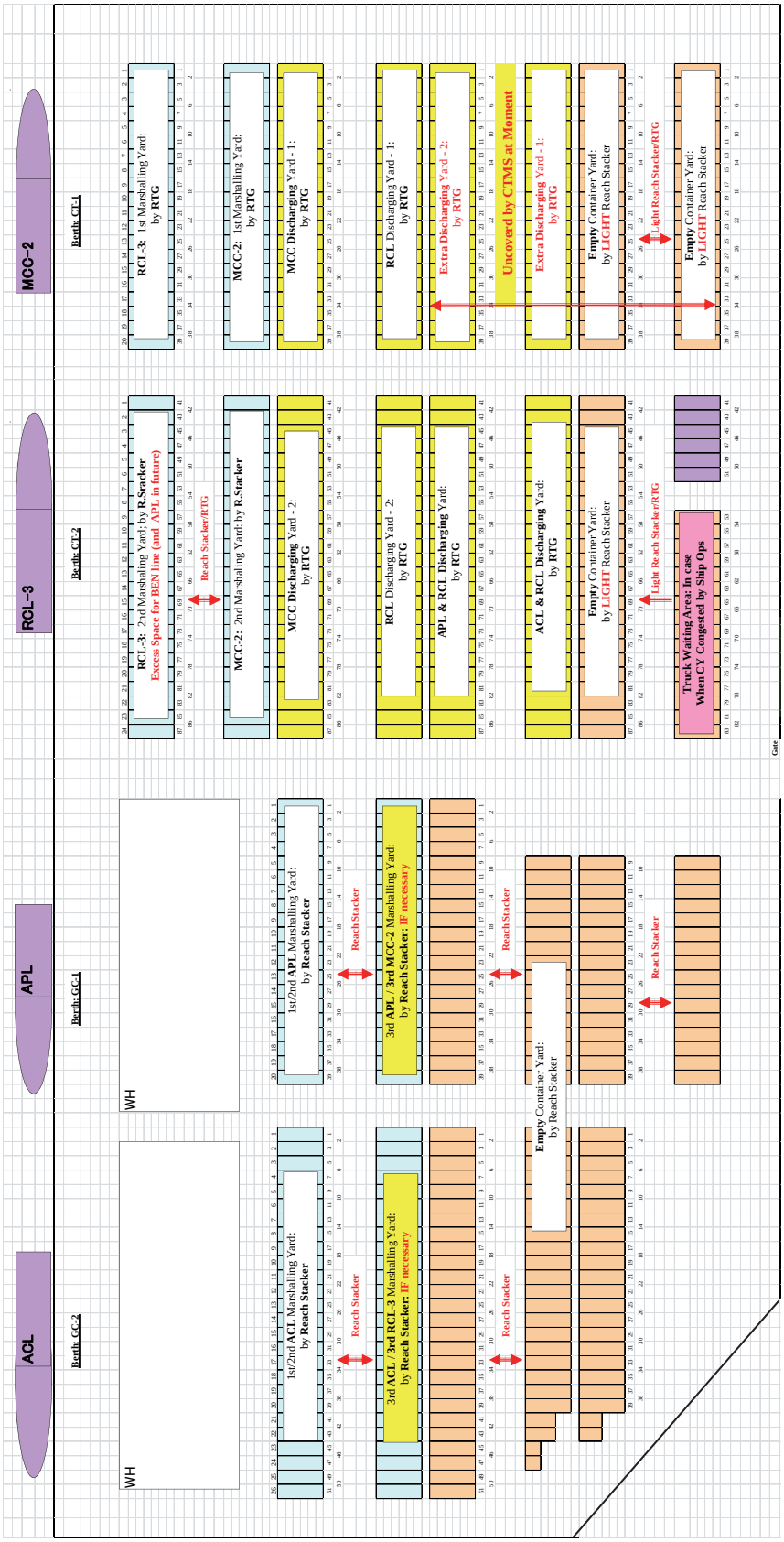
CF lane in the CY can be kept as spare for laden import containers for a while; then CG and CH lanes can be used for storing empty containers instead of ECD. Because a part of ECD is going to be used for purposes other than container business as stated already; thus the rest of the ECD's space will not be sufficient for storing all the empty containers.

The recommendable CY and ECD allocation plan for PAS at the current deployment should be as shown in Figure 4.1-6.

* CTMC does not cover a part of the new CY area at present as shown in the table; thus, the marshaling and stacking yards including ECD are different a little from the recommendations addressed here.

Table 4.1-4 PAS Container Terminal Monthly Ships Handling Volume by Service Loop; August 2011

	Shipping Line	Service Loop	Ships Name	Voyage Number	Ship Operation Commenced Date&Time	Ship Operation Completed Date&Time	Discharged								Loaded								Total							
							Laden			Empty			Total		Laden			Empty			Total		Laden			Empty			Total	
							20	40	45	20	40	45	Box	TEU	20	40	45	20	40	45	Box	TEU	20	40	45	20	40	45	Box	TEU
1	MCC	THLZP	CONVENT	1125	8/11/2011	8/11/2011	59	88	0	0	0	0	147	235	15	15	0	32	36	0	98	149	74	103	0	32	36	0	245	384
2	MCC	CNKAO	AS SCANDIA	082	8/25/2011	8/26/2011	61	174	16	0	0	3	254	451.75	48	15	0	55	9	0	127	151	109	189	16	55	9	3	381	603
3	MCC	VNSGN	SAN LORENZO	1117	8/4/2011	8/5/2011	99	176	17	0	0	0	292	489.25	13	18		42	1	1	75	95.25	112	194	17	42	1	1	367	585
4	MCC	JPOSA	ST-MARY	1117	8/18/2011	8/18/2011	63	113	0	0	1	0	177	291	56	9		58	2	0	125	136	119	122	0	58	3	0	302	427
	MCC-1; Berth Window:					S. Total:	282	551	33	0	1	3	870	1467	132	57	0	187	48	1	425	531.25	414	608	33	187	49	4	1,295	1,998
						Average:	71	138	8	0	0	1	**218**	**367**	33	14	0	47	12	0	**106**	**133**	104	152	8	47	12	1	**324**	**500**
						Box/TEU:		217	363		1	2				47	62		59	71				264	424		60	73		
	Required CY/ECD Bay-no.(at Imp-21TEU/bay, Exp&Mty-24 TEU/bay):						3.4	13.1	0.8	0.0	0.0	0.1	**17.3**	**0.1**	1.4	1.2	0.0	1.9	1.0	0.0	**2.6**	**3.0**	4.7	14.3	0.8	1.9	1.0	0.1	**19.8**	**3.1**
1	MCC	MYTPP	OEL BLESSING	1123	8/26/2011	8/28/2011	99	116	15	42	36	1	309	481	135	276	34	0	0	0	445	763.5	234	392	49	42	36	1	754	1,245
2	MCC	MYTPP	OEL BLESSING	1117	8/5/2011	8/7/2011	116	179	16	50	20	0	381	600	124	344	33	0	0	0	501	886.25	240	523	49	50	20	0	882	1,486
3	MCC	MYTPP	OEL BLESSING	1119	8/12/2011	8/14/2011	63	125	32	0	65	15	300	548.75	138	303	43	0	0	0	484	840.75	201	428	75	0	65	15	784	1,390
4	MCC	MYTPP	OEL BLESSING	1121	8/19/2011	8/20/2011	61	111	32	50	51	15	320	540.75	140	268	28	0	0	0	436	739	201	379	60	50	51	15	756	1,280
	MCC-2; Berth Window:					S. Total:	339	531	95	142	172	31	1310	2170.5	537	1191	138	0	0	0	1866	3229.5	876	1722	233	142	172	31	3,176	5,400
						Average:	85	133	24	36	43	8	**328**	**543**	134	298	35	0	0	0	**467**	**807**	219	431	58	36	43	8	**794**	**1,350**
						Box/TEU:		241	398		86	137				467	799		0	0				708	1,197		86	137		
	Required CY/ECD Bay-no.(at Imp-21TEU/bay, Exp&Mty-24 TEU/bay):						4.0	12.6	2.3	1.5	3.6	0.6	**18.9**	**5.7**	5.6	24.8	2.9	0.0	0.0	0.0	**33.3**	**0.0**	9.6	37.5	5.1	1.5	3.6	0.6	**52.2**	**5.7**
1	RCL	SGSIN	LILA BHUM	670	8/31/2011	1/9/2011	73	128	36	0	63	5	305	547.25	7	8		91	49	0	155	212	80	136	36	91	112	5	460	759
2	RCL	SGSIN	LILA BHUM	669	8/24/2011	8/25/2011	67	68	40	10	122	10	317	569.5	8	15		120	37	0	180	232	75	83	40	130	159	10	497	802
3	RCL	SGSIN	LILA BHUM	666	8/3/2011	8/4/2011	88	101	44	1	50	16	300	526	3	22		58	52	0	135	209	91	123	44	59	102	16	435	735
4	RCL	SGSIN	LILA BHUM	667	8/10/2011	8/11/2011	57	81	27	0	47	40	252	463.75	34	19		161	69	0	283	371	91	100	27	161	116	40	535	835
5	RCL	SGSIN	LILA BHUM	668	8/18/2011	8/18/2011	103	81	38	0	80	8	310	528.5	31	14	2	207	24	0	278	318.5	134	95	40	207	104	8	588	847
	RCL-1; Berth Window:					S. Total:	388	459	185	11	362	79	1484	2635	83	78	2	637	231	0	1031	1342.5	471	537	187	648	593	79	2,515	3,978
						Average:	78	92	37	2	72	16	**297**	**527**	17	16	2	127	46	0	**206**	**269**	94	107	37	130	119	16	**503**	**796**
						Box/TEU:		206	335		90	179				34	52		174	220				239	384		264	398		
	Required CY/ECD Bay-no.(at Imp-21TEU/bay, Exp&Mty-24 TEU/bay):						3.7	8.7	3.5	0.1	6.0	1.3	**16.0**	**7.4**	0.7	1.3	0.2	5.3	3.9	0.0	**2.2**	**9.2**	4.4	10.0	3.7	5.4	9.9	1.3	**18.1**	**16.6**
1	RCL	HKHKG	RATHA BHUM	551	8/25/2011	8/26/2011	95	181		0	3	0	279	463	3	7		94	108	0	212	327	98	188	0	94	111	0	491	790
2	RCL	HKHKG	RATHA BHUM	550	8/4/2011	8/6/2011	102	132	0	0	0	0	234	366	1		0	139	149	0	289	438	103	132	0	139	149	0	523	804
3	RCL	HKHKG	ORA BHUM	281	8/11/2011	8/12/2011	115	163		0	0	0	278	441	19	3		94	111	0	227	341	134	166	0	94	111	0	505	782
4	RCL	HKHKG	PIRA BHUM	338	8/18/2011	8/19/2011	83	140		0	0	0	223	363	57	5		116	92	0	270	367	140	145	0	116	92	0	493	730
	RCL-2; Berth Window:					S. Total:	395	616	0	0	3	0	1014	1633	80	15	0	443	460	0	998	1473	475	631	0	443	463	0	2,012	3,106
						Average:	99	154	0	0	1	0	**254**	**408**	20	5	0	111	115	0	**250**	**368**	119	158	0	111	116	0	**503**	**777**
						Box/TEU:		253	407		1	2				25	30		226	341				277	434		227	342		
	Required CY/ECD Bay-no.(at Imp-21TEU/bay, Exp&Mty-24 TEU/bay):						4.7	14.7	0.0	0.0	0.1	0.0	**19.4**	**0.1**	0.8	0.4	0.0	4.6	9.6	0.0	**1.3**	**14.2**	5.5	15.1	0.0	4.6	9.6	0.0	**20.6**	**14.3**
1	RCL	SGSIN	KITI BHUM	721	8/26/2011	8/28/2011	29	98	9	0	50	18	204	385.75	51	100	12	16	18	0	197	330	80	198	21	16	68	18	401	716
2	RCL	SGSIN	KITI BHUM	718	8/6/2011	8/72011	41	35	16	0	90	30	212	394.5	47	85	14	0	0	0	146	248.5	88	120	30	0	90	30	358	643
3	RCL	SGSIN	KITI BHUM	719	8/12/2011	8/14/2011	45	40	8	0	50	0	143	243	60	85	20	0	38	0	203	351	105	125	28	0	88	0	346	594
4	RCL	SGSIN	KITI BHUM	721	8/19/2011	8/21/2011	60	27	6	0	35	25	153	253.75	52	76	18	110	35	0	291	424.5	112	103	24	110	70	25	444	678
	RCL-3; Berth Window:					S. Total:	175	200	39	0	225	73	712	1277	210	346	64	126	91	0	837	1354	385	546	103	126	316	73	1,549	2,631
						Average:	44	50	10	0	56	18	**178**	**319**	53	87	16	32	23	0	**209**	**339**	96	137	26	32	79	18	**387**	**658**
						Box/TEU:		104	163		75	149				155	258		54	77				259	421		129	226		
	Required CY/ECD Bay-no.(at Imp-21TEU/bay, Exp&Mty-24 TEU/bay):						2.1	4.8	0.9	0.0	4.7	1.5	**7.8**	**6.2**	2.2	7.2	1.3	1.3	1.9	0.0	**10.7**	**3.2**	4.3	12.0	2.3	1.3	6.6	1.5	**18.5**	**9.4**
1	ACL	SGSIN	KOTA DAMAI	1123	8/27/2011	8/28/2011	57	25	14	0	70	17	183	316.75	53	126	5	0	0	0	184	316.25	110	151	19	0	70	17	367	633
2	ACL	SGSIN	KOTA DAMAI	117	8/7/2011	8/7/2011	67	21	6	30	4	5	133	171.75	51	126	18	0	1	0	196	345.5	118	147	24	30	5	5	329	517
3	ACL	SGSIN	KOTA DAMAI	1119	8/14/2011	8/14/2011	28	43	10	0	35	0	116	206.5	46	98	18	0	1	0	163	284.5	74	141	28	0	36	0	279	491
4	ACL	SGSIN	KOTA DAMAI	1121	8/20/2011	8/21/2011	66	39	1	0	65	0	171	276.25	59	91	10	0	0	0	160	263.5	125	130	11	0	65	0	331	540
	ACL; Berth Window:					S. Total:	218	128	31	30	174	22	603	971.25	209	441	51	0	2	0	703	1209.8	427	569	82	30	176	22	1,306	2,181
						Average:	55	32	8	8	44	6	**151**	**243**	52	110	13	0	1	0	**176**	**302**	107	142	21	8	44	6	**327**	**545**
						Box/TEU:		94	134		57	106				175	298		1	1				270	432		57	107		
	Required CY/ECD Bay-no.(at Imp-21TEU/bay, Exp&Mty-24 TEU/bay):						2.6	3.0	0.7	0.3	3.6	0.5	**6.4**	**4.4**	2.2	9.2	1.1	0.0	0.0	0.0	**12.4**	**0.0**	4.8	12.2	1.8	0.3	3.7	0.5	**18.8**	**4.4**
1	APL	SGSIN	COLOMBO	368	8/26/2011	8/28/2011	74	63	22	0	0	0	159	249.5	15	54	7	1	49	0	126	237.75	89	117	29	1	49	0	285	487
2	APL	SGSIN	COLOMBO	365	8/5/2011	8/7/2011	14	89	12	0	1	0	116	221	20	49	30	0	15	0	114	215.5	34	138	42	0	16	0	230	437
3	APL	SGSIN	COLOMBO	366	8/12/2011	8/14/2011	26	72	15	0	0	10	123	226.25	7	64	20	0	29	0	120	238	33	136	35	0	29	10	243	464
4	APL	SGSIN	COLOMBO	367	8/19/2011	8/21/2011	23	103	18	0	10	0	154	289.5	11	59	21	0	51	0	142	278.25	34	162	39	0	61	0	296	568
	APL; Berth Window:					S. Total:	137	327	67	0	11	10	552	986.25	53	226	78	1	144	0	502	969.5	190	553	145	1	155	10	1,054	1,956
						Average:	34	82	17	0	3	3	**138**	**247**	13	57	20	0	36	0	**126**	**242**	48	138	36	0	39	3	**264**	**489**
						Box/TEU:		133	231		5	11				89	165		36	72				222	397		42	83		
	Required CY/ECD Bay-no.(at Imp-21TEU/bay, Exp&Mty-24 TEU/bay):						1.6	7.8	1.6	0.0	0.2	0.2	**11.0**	**0.4**	0.6	4.7	1.6	0.0	3.0	0.0	**6.9**	**3.0**	2.2	12.5	3.2	0.0	3.2	0.2	**17.9**	**3.4**
1	COTS	THSGZ	CHIANG TUN	1129	8/9/2011	9/8/2011	13	2	0	0	0	0	15	17	0	1	0	14	6	0	21	28	13	3	0	14	6	0	36	45
2	COTS	THSGZ	CHIANG TUN	1131	8/22/2011	8/22/2011	12	3	0	0	0	0	15	18	0	0	0	8	3	0	11	14	12	3	0	8	3	0	26	32
	COTS; Berth Window:					S. Total:	25	5	0	0	0	0	30	35	0	1	0	22	9	0	32	42	25	6	0	22	9	0	62	77
						Average:	13	3	0	0	0	0	**15**	**18**	0	1	0	11	5	0	**16**	**21**	13	3	0	11	5	0	**31**	**39**
						Box/TEU:		15	18		0	0				1	1		16	20				16	19		16	20		
	Required CY/ECD Bay-no.(at Imp-21TEU/bay, Exp&Mty-24 TEU/bay):						0.6	0.2	0.0	0.0	0.0	0.0	**0.8**	**0.0**	0.0	0.0	0.0	0.5	0.4	0.0	**0.0**	**0.8**	0.6	0.3	0.0	0.5	0.4	0.0	**0.9**	**0.8**
						G.Total:	1,959	2,817	450	183	948	218	6,575	11,175	1,304	2,355	333	1,416	985	1	6,394	10,152	3,263	5,172	783	1,599	1,933	219	12,969	21,327
																											TEU/Box Ratio:			**1.64**
						Estimate Volume in 2011; at 31/365:	23,066	33,168	5,298	2,155	11,162	2,567	77,415	131,577	15,354	27,728	3,921	16,672	11,598	12	75,284	119,526	38,419	60,896	9,219	18,827	22,760	2,579	152,700	251,102



Prepared by Project Team

Figure 4.1-6 PAS Container Terminal CY and ECD Allocation Master Plan

2) Most Suitable Traffic Flow at PAS CT

Generally, the traffic direction inside the CY is one-way for all the trucks to ensure safety and that traffic flows smoothly. In the case of PAS CT, based on the location of the main gate and layout of the CY, external trucks have to turn right after passing through the gate to keep the traffic flowing smoothly.

This means external trucks have to move counter clock-wise, passing the CY from East to West while internal trucks move clockwise. Accordingly, external trucks can go out the terminal through the center passage in between the CY and ECD. This passage is also where trucks queue while waiting to exit, mounting import laden containers on the chassis.

Internal trucks under ship's operation can make clock-wise flow easily when the ship is alongside by starboard-side, because containers are stowed on ship by door-after condition. However, this is not the case when a ship's gears are used; then the cranes of the ship are installed in the port-side; or when the weather condition does not allow to alongside by starboard-side. In these cases, ships have to be alongside by port-side, forcing PAS' internal truck drivers to make extra turns at apron for proceeding to the CY or ECD by the right direction.

Recommendable traffic flow inside of the PAS CT is shown in Figure 4.1-7.

- External trucks for picking up import laden containers are subjected to scanning by PAS Customs; however, these trucks come back to the center passage when going out the gate.

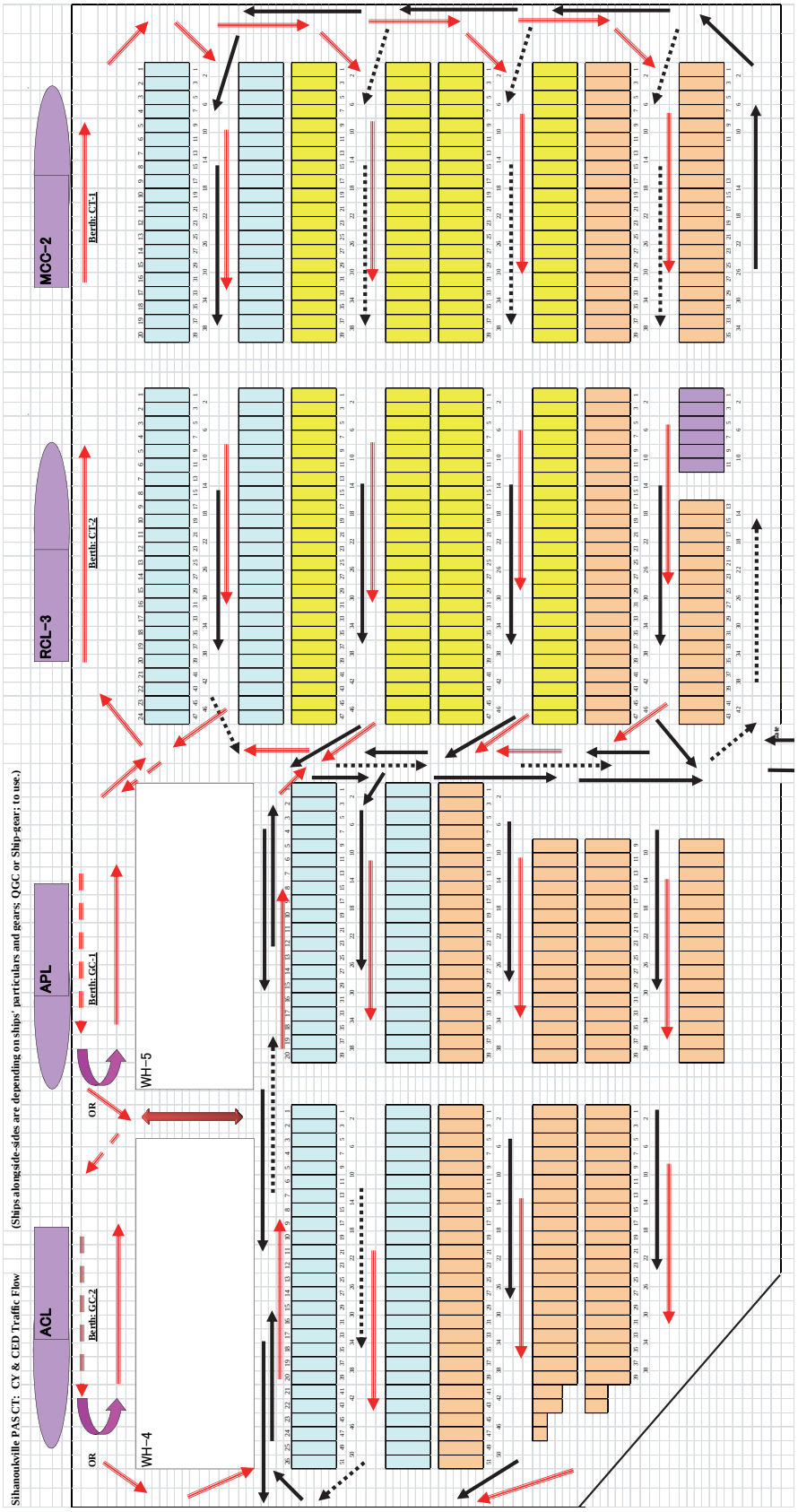


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Figure 4.1-7 PAS Container Terminal CY and ECD Traffic Flow

(4) Ship Operation

Ships stevedoring operation at PAS CT is performed by ships-gears (crane) mainly, though PAS has installed 2 units of Quay Gantry Crane (QGC) on its berths. One of the reasons that the QGC is not used is that PAS cannot procure stable electricity from outside. Thus, PAS has to generate electricity by itself whenever required to use the QGC by shipping lines; however due to the hike of fuel price, its operating cost is more than US$5 per container box at the productivity of @25.0 lifts/hour. Furthermore, shipping lines hesitate to use the QGC because PAS charges US$10.0 per 20' container and US$20.0 per 40' container extra when using the cranes. Accordingly, shipping lines use ship-gears instead of QGC whenever ships' schedule allows.

Because the QGC is not used, PAS has various problems such as 1) PAS has to prepare 8 gangs of stevedore-labor on a steady basis; then as its impacts, 2) shorted not only stevedore man-power, but also container handling equipment (CHE), and 3) lowered the qualities of them. Insufficient operations on ship and CY of PAS are partly caused by the disusage of QGC.

- As of January 2012, MCC and RCL are requiring PAS to use QGC for operating their ships.
- It is a good sign for PAS, but it disclosed a short-QGC problem of PAS by now. Because 2 units of QGC are not enough for completing MCC-2 and RCL-3 by due times on Saturday.
- PAS needs to purchase 1 unit of QGC if this situation continues.

Figure 4.1-8 is a modified berth window of PAS CT based on the actual data in Aug. 2011. MCC-2 and RCL-3 used to sail the port before midnight on Saturday in Aug. 2010; however, they were sailing the port after midnight 1 year later though the handling volumes increased a little. This means both ships have to consume more fuel for connecting containers loaded at PAS to mother vessels at Singapore or Tanjyung Pelepas, hub-ports for Sihanoukville, on schedule. Or these ships cannot keep their schedule at Sihanoukville Port, resulting in late delivery of import containers discharged from the ships.

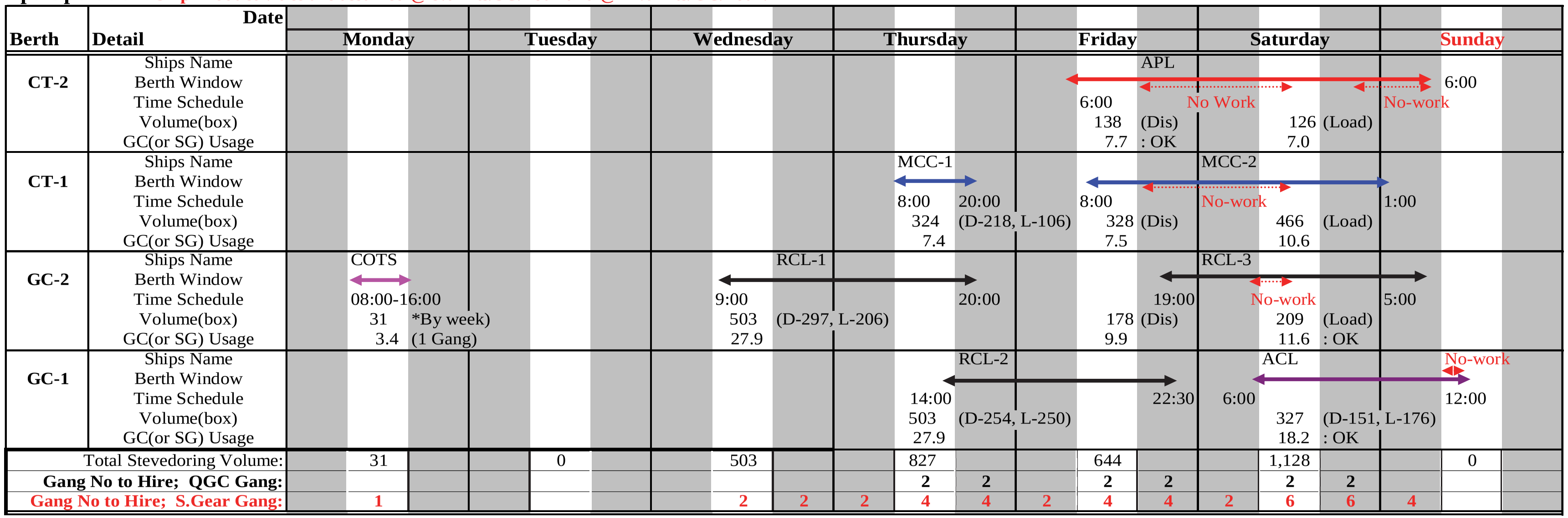
There are a lot of merits for both PAS as well as shipping lines to increase the ships operational productivity. However, PAS has to take many actions for increasing the efficiency. First, management persons in CT Ops Dept. have to re-study and adopt common practices on CT operation, and have to incorporate them into the daily operations. Second, planners have to master planning skills and theories for operating the ships as well as CY efficiently based on well-considered working plans. Third, managers in Labor Management (LB) Dept. have to upgrade the quality of stevedore labors for working the ships properly based on the working plans prepared by planners. Finally, top management of PAS has to support the front-line managers and staffs in CT Ops and LM Dept. for the execution of these practices in the daily operation at PAS CT.

Common practices above refers to ordering 1 unit of CHE (RTG or reach stacker) per crane (QGC or Ship-gear=SG) whenever available, even though the productivity is low as 6-8 lifts per hour. Low productivity of PAS in SG operation is partly caused by PAS' ordering of 1 CHE only per 2 units of SG. This practice is introduced into PAS operation by the complaints of CHE drivers who want to handle more containers all the time due to the "credit system". Also it means to order manpower and CHE at job requirement basis, because PAS orders all the available CHE for all the shifts at present; which have to be stopped immediately.

- Once PAS stops the current practices as stated above, ships productivities will surely rise, and n the situation of CHE will improved because mechanic and engineers in Technical Dept. in PAS can maintain the CHE proactively at scheduled times.

SVP CT: Ships Berth Window & its Labor-gang Requirement in 2011 as of August; Actual

Ships Operation: Ship Productivities are assumed @ 9.0 lifts/SG/hour and @ 22.0 lifts/GC/hour.



Discharging Operation	with 1SG	with 2SG	with 2 GC	with 2SG	2SG	2GC	2SG	2 SG	2 SG	2GC	2 SG	2 SG
					APL	MCC2	RCL3	ACL	RCL3	MCC2	APL	ACL
	COTS	RCL-1	MCC1	RCL-2	Disc.	Disc.	Disc.	Disc.	Load	Load	Load	Load
Discharging Volume:	15	297	218	254	138	328	178	151				
Net operational hour	1.67	16.50	4.95	14.11	7.67	7.45	9.89	8.39				
Possible idling hour	0.17 :10% of~	1.65 :10% of~	0.50	1.41	0.77	0.75	0.99	0.84				
Gross Disc. hours	1.83	18.15	5.45	15.52	8.43	8.20	10.88	9.23				
									Start Loading Ops at			
Loading Operation									12:00	12:00	12:00	15:00
Loading Volume:	16	206	106	250					209	466	126	176
Net operational hour	1.8	11.44	2.41	13.89	-	-	-	-	11.6	10.6	7.00	9.78
Possible idling hour	0.18 :10% of~	1.14 :10% of	0.2	1.4	-	-	-	-	1.16	1.06	0.7	1.0
Gross Loading hours	2.0	12.6	2.7	15.3	-	-	-	-	12.8	11.7	7.7	10.8
Gross working hours	3.8	30.7	8.1	30.8	8.4	8.2	10.9	9.2	12.8	11.7	7.7	10.8
Ships idling at Berth	2.0	2.0	2.0	2.0					1.0	1.0	1.0	1.0
Total Berth Hour	**5.8**	**32.7**	**10.1**	**32.8**	**8.4**	**8.2**	**10.9**	**9.2**	**13.8**	**12.7**	**8.7**	**11.8**
					till 16:	till 17:	till 06:	till 15:	till 02:	till 01:	till 21:	till 09:
Berth Window (hours)	8.0	35.0	12.0	32.5								
Examination	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Prepared by Project Team

Figure 4.1-8 CT berth window and ships operation as of August 2011

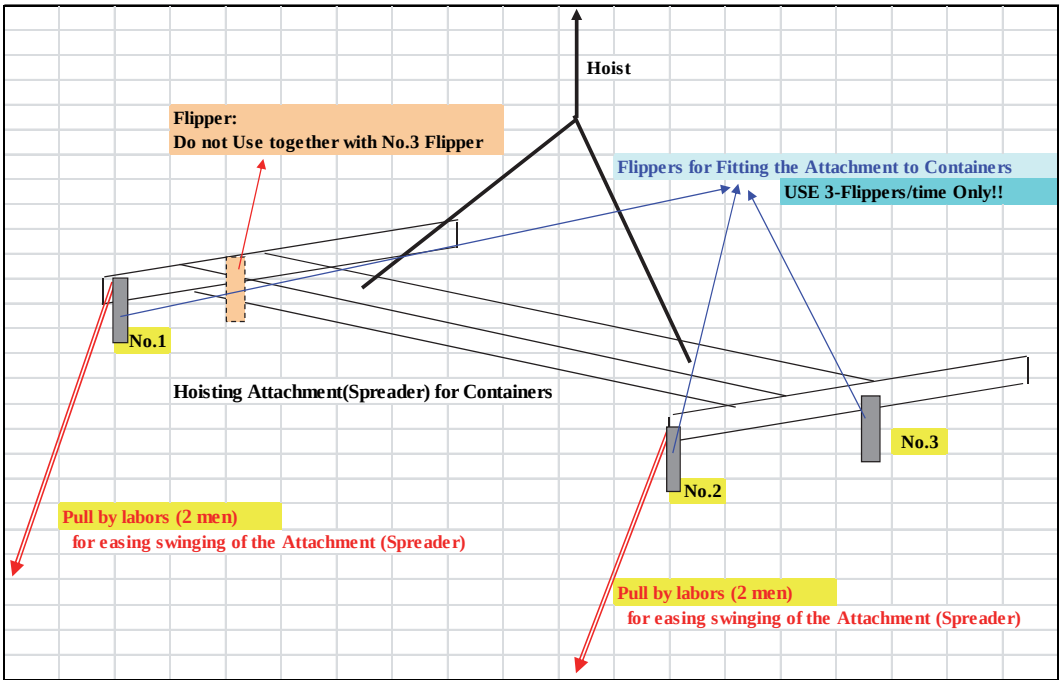
Master planning skills and theories means acquiring skills and knowledge for preparing workable ships stevedore working plans, including CY marshaling plans, for managing the ships operation productive, taking over the role from shipping lines especially for Saturday callers; although they are very tough. However, since starting the 04:00 Gate operation every Saturday since Oct. 15th, some 50% of export containers for these ships are ready to load by 10:00, the time-limit for commencing the planning works by PAS ship-planners for starting the loading operation at 12:00 on Saturday. Thus, the possibility of taking over the job from shipping lines will soon become a reality.

- Minimum arrival ratio of export containers by 10:00 on Saturday at PAS CY should be 70% or more for PAS to take-over the job from shipping lines.
- Basic knowledge and know-how for preparing useful ships working plans as well as CY marshaling plans are stated in the next chapter in “transfer of skill”.

Upgrading the quality of stevedore labors and operating the ships in accordance with the working plans means all the PAS stevedore labors have to acquire/master necessary knowledge and skills for operating the ships efficiently, especially geared-ships, selecting and assigning useful labors as gang-bosses and gear-operators as they are key persons in the SG operation.

Once PAS incorporates these practices into its daily operations, PAS can surely solve the “short labor” problem because reduce the gang size from 8 stevedores to 6 and eventually from 6 to 4. Managers in PAS LM Dept. thus need to replace aged labors with younger ones by certain scheduled plans for realizing efficient operations at PAS CT.

- It is recommendable to order and manage gang-bosses and QGC/SG-operators by name by shift, and record their performances for reviewing by managers including PAS top management. Accordingly, PAS can introduce competition among the labors/operators for up-grading PAS’ operation as a whole. (PAS can introduce an incentive system for them as well based on their performance; which should also be effective to upgrade PAS’ operation.)
- PAS can achieve 25 lifts/hour of net QGC productivity easily, once PAS ship planners prepare ships work-sequence plans by CTMS based on the skills mastered; then 30 or more when good QGC operators are assigned to work.
- In the case of “ship-gear=SG” operation, it is depends on the way of operation, i.e. how to fit an attachment (movable spreader) onto containers as quickly as possible. Because the attachment is hanged from a ship-gear by a wire-rope; thus, it is very unstable unlike QGC.
- The proper way of SG operation is to hook up 2 ropes on the attachment for breaking the move of the attachment by pulling the ropes; and to use “attachment-with-flippers” for fitting the attachment onto subjected containers quickly, stopping irregular moves of the attachment touching the flippers onto subjected containers by crane handling. (See the figure 4.1-9.)



Prepared by Project Team

Figure 4.1-9 The way of SG operation

PAS top management has to support the front-line managers and staffs in CT Ops and LM Dept. for the execution of these practices in the daily operation at PAS CT. This will result in building a collaborative relation among operational Depts. Accordingly, all the managers, staffs and labors in CT Ops, GCH Ops and LM Depts. can work together for solving various issues encountered in daily operations; and can develop preferable working environment for staffs and laborers.

For managers in CT Ops Dept.: Issues they have to solve by themselves within the Dept.;

a) Re-structure CY-gate working system; eliminating some of the night shifts between 21:00 and 08:00 the next day, except Saturday. By eliminating certain night-gates, CHEs PAS owns can be maintained proactively by planned schedule; which will allow PAS to use them in sound condition.

b) Order necessary CHE for the daily CY-gate operations based on the historical handling volume for the days and shifts, instead of ordering them regardless of the workloads.

c) Order 1 unit of RTG per QGC or SG as minimum, for achieving the higher productivity.

* By executing (a) and (b), PAS will no longer be susceptible to sudden breakdowns of CHE; then by (b) and (c), CHE drivers can learn to follow orders given by CY controllers. This will allow PAS to become a standard systematic CT operator.

d) Nominate and fostering capable persons as ship and CY planners (gang-bosses as well), due to they are the key persons for all CTs for becoming successful/productive CTs.

* Ships operational productivity is partly depending on the working plans. Thus, the managers have to examine their capability analyzing their performances through the operations they planned, and replace them whenever they are not adequate for the assignment.

For managers in CT Ops Dept.: Issues they have to solve cooperating with GCHO Dept. ;

e) Examine labors and operators dispatched from GCHO Dept. to determine whether the number and the quality are sufficient.

* PAS' operational targets should be 25.0 lifts/hour/QGC and 12.5 lifts/hour/SG as net in the 1st year after commencing the systematic operations after taking over from the shipping lines. However, some PAS operators can handle more than these; thus, by managing them by names, managers can see their capabilities exactly for assigning such good operators to ships in hard conditions, such as requiring to handle many containers in limited

hours and so on.

f) Solve labor issues (numbers and qualities of them in general, dispatching from GCHO Dept.) communicating and or negotiating with managers in the Dept., instead of asking ship planners or others staff to solve them. This is definitely an issue to be solved by managers.

* As described already, ships stevedoring supervision works are carried out by ship planners instead of gang bosses. This is certainly the job of gang bosses but a misunderstanding has arisen among the managers in both Depts.

External issues, especially between shipping lines: Responsibilities of managers in CT Ops Dept. instead of staffs such as planners and or documentation clerks;

g) Reach out to shipping lines for getting necessary information, such as booking data including empty containers, loading container list, loading general plan and so on for accelerating various planning works as well as gate-in and out activities; at least until they become routine works for the staffs.

h) Meet with shipping lines periodically for knowing and complying with their needs, building up trust and ensuring they remain customers and partners.

Other external issues solving together with PAS top management;

i) Ask SHV Customs to station their officers at an office near PAS Gate to allow them to issue "ships loading permissions" together with "gate entry permissions".

* As of Jan.29th 2012, PAS Customs has taken over the role from SHV Customs already, stationing their staff at an office next to PAS Gate.

j) Meet with truckers and Customs brokers periodically for knowing and complying with their needs and building up trust.

* It would be a good idea for PAS to compensate extra fees (US$5/JIR) of truckers when their trucks enter the PAS Gate on Saturday in between 04:00-06:00 with gate-entry permissions prepared by copies of JIR; this would make the 04:00 Gate's operation more meaningful.
* 1 JIR covers several containers in general; thus, the payment should be US$1~2 per container; however, PAS can become a competitive CT operator, downsizing its labor-gang from 8 to 4 in the near future by receiving 70% or more export containers by 10:00 on Saturday.

Managers in GCH Ops Dept.: Previously stated issues;

a) Secure enough number of labors and operators for complying with the needs of CT Ops Dept.

* PAS' stevedore gang will be reduced from 8 to 4 in the near future; thus the number at present should be enough in the future too. However, they need younger stevedores.

b) Upgrade the quality of the labors for achieving the PAS' operational targets.

* Hold periodical training courses for upgrading their skills by asking skillful gang bosses and or SG operators to teach the un-skilled labor.
* It is a good idea to compensate skillful labors/operators by some means. Such operators should be nominated to work the ships as this will increase the productivity of PAS and allow it to become a standard CT operator.

c) Inspections of the working places, with and without notice, for surveying performances, and for correcting /behaviors are very good tools for managers.

* Ships productivity is depending on the way of operation in the case of SG operation as previously stated; i.e. fit the attachment hanged from SG by a rope as quickly as possible.
* For fitting the attachment to containers swiftly, a gang-boss has to use "attachment with flippers" at first, and bind 2 ropes on it. Lashers, 2 persons each, have to hold/pull the ropes to break the irregular moves of the attachment for helping the operator to fit it onto containers smoothly and promptly.
* Once this practice become a routine work of PAS, it should be easy for PAS to achieve the target of 12.5 lifts/SG/hour; although PAS will have to order 1 RTG or reach stacker per crane at least.

(4)-1. Changing from 8-Gang system to 6-Gang system

Once these practices and procedures are carried out in PAS' operation as routine works, PAS can achieve the operational target, 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 shown in Figure 4.1-10. The key point in the scenario is to

handle APL's ship at around 21:00 Saturday after completing RCL-3. Discharging operation of ACL's ship should be commenced at around 08:00 on Saturday; thus, the operation may continue through the afternoon too. In that case some of import containers from the ship have to be stacked in ECD instead of CY for easing the shortage of RTGs in the PM on Saturday.

(4)-2. Changing from 6-Gang system to 4-Gang system

Once the 6-gang system works well, and once the ships call the Port on schedule, RCL-3 should berth Friday evening, and ACL's by 02:00 on Saturday for commencing the discharging operations immediately. In this case, RCL-3 can complete the discharging operation by 04:00 on Saturday with 2 SG gang, and the same gang shift to ACL ship. The discharging work of ACL's will be completed by 11:00 with no RTG problem. In this scenario, PAS needs to order 4-gang for only 3 shifts as Saturday's Day-shift, Night-shift and Late-night-shift. (See Figure 4.1-11 for further details.

* Night entry and berthing of ACL ship on Friday late-night is a must for PAS to realize the 4-gang system; thus, PAS pilots have to board the ship even if she arrives at the Port after midnight for commencing the work in the due time.

* As of Jan.2012, ACL's ship arrives at PAS CT in Saturday Night, instead of Friday; thus, the gang situation of PAS is more favorable than the plan shown here.

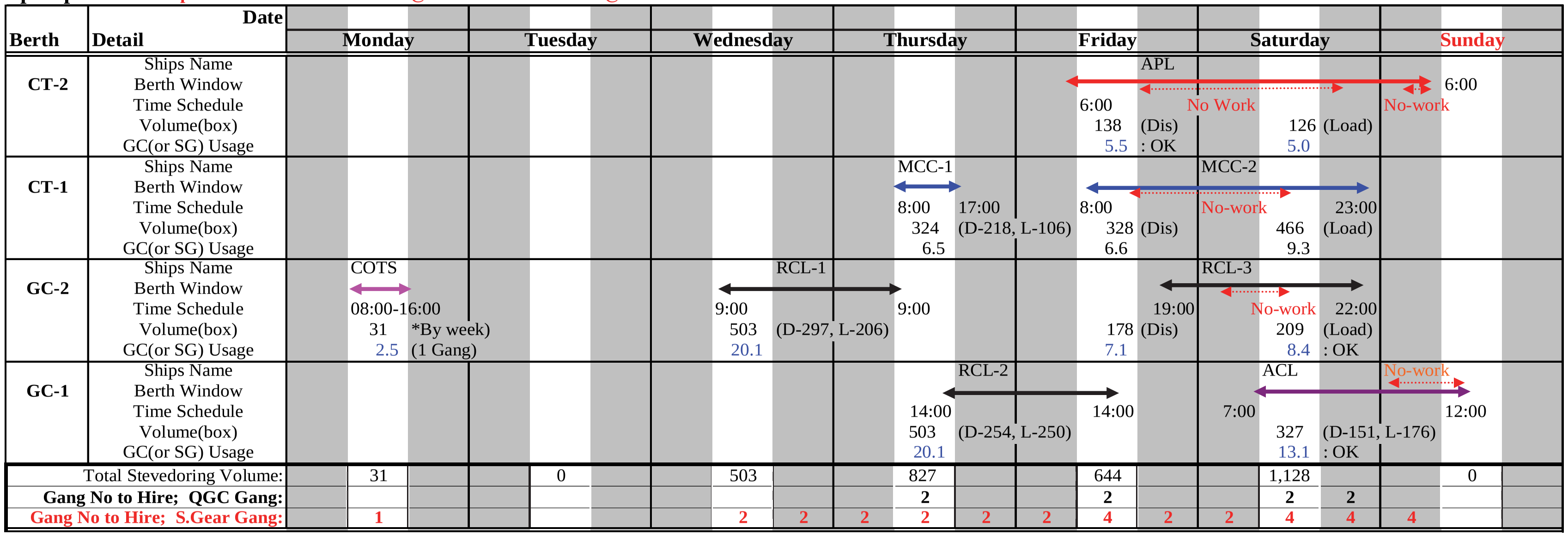
In this scenario, PAS has to start loading operation for both MCC-2 and RCL-3 at 12:00 on Saturday at least with 2 gangs each, MCC-2 by QGCs and RCL-3 by SGs. 2-SG-gang need to shift from RCL-3 to ACL ship after completing RCL-3's loading operation at around 21:00; then the loading operation of ACL's should be finished by 05:00 or 06:00 on Sunday. On the other hand, 2-QGC-gang shift from MCC-2 to APL ship at around 22:00 or 23:00 after completing loading works of MCC-2; and then the loading operation of APL's should be finished by 03:00 on Sunday.

In addition, PAS has to complete RCL-2 in the night-shifts on Thursday with QGCs after completing MCC-1 at around 17:00 on the day, for working MCC-2 and APL-ship on Friday in the day-shift with 2gang each.

- As of Jan. 2012, RCL asks PAS to use QGC instead of SG for handling works. Thus, the scenario mentioned above needs to be changed a little, namely, berthing MCC-2 and RCL-3 on the CT berths on Friday through Saturday.
- Accordingly, PAS decided to share 1-QGC each for the ships, discharging operations in Friday night and loading operations in Saturday day and night, at present; thus, both MCC-2 and RCL-3 have to order 1-SG as additional for completing its operations by the due time.
- PAS can handle both ships with "1-QGC plus 1-SG" system without major problems once systematic operation is introduced. However, at the moment shipping lines, especially MCC-2, are forced to sail the Port behind schedule sometimes, due to slow operation of the ship, which is managed by MCC manually.
- PAS has to consider the installation of a 3rd QGC, which will be needed sooner or later, once the export container volume increases.

SVP CT: Ships Berth Window & its Labor-gang Requirement in the near Future (6-Gang as Max)

Ships Operation: **Ship Productivities are assumed @12.5 lifts/SG/hour and @ 25.0 lifts/GC/hour.**



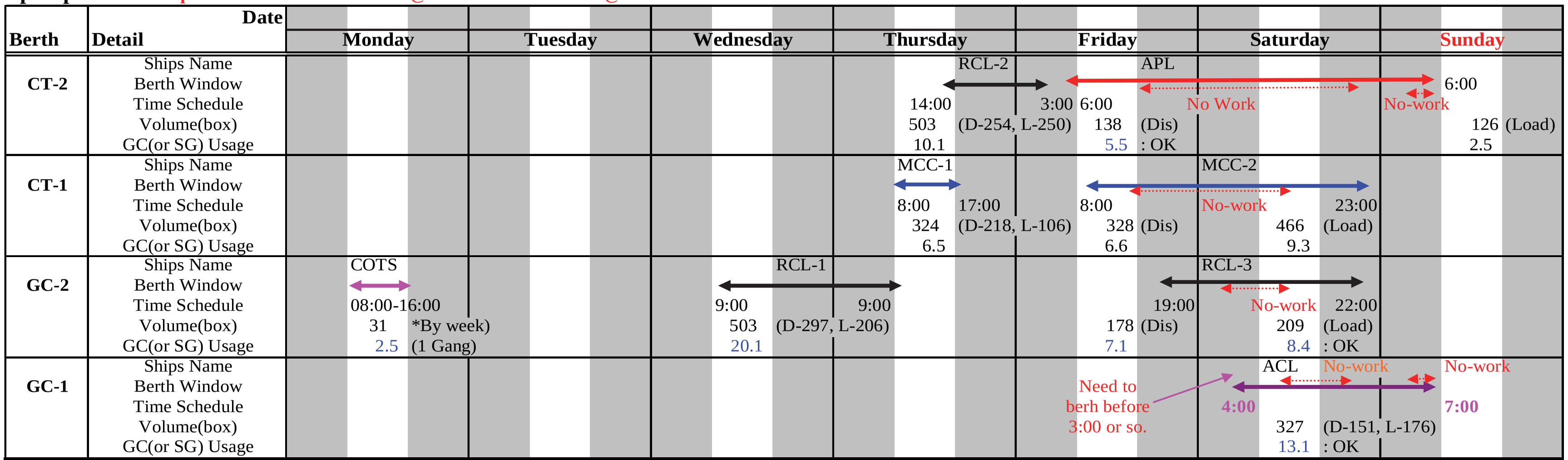
Discharging Operation	with 1SG	with 2SG	with 2 GC	with 2SG	2SG	2GC	2SG	2 SG	2 SG	2GC	2 SG	2 SG
	COTS	RCL-1	MCC1	RCL-2	APL Disc.	MCC2 Disc.	RCL3 Disc.	ACL Disc.	RCL3 Load	MCC2 Load	APL Load	ACL Load
Discharging Volume:	15	297	218	254	138	328	178	151				
Net operational hour	1.20	11.88	4.36	10.16	5.52	6.56	7.12	6.04	08:00 Start			
Possible idling hour	0.12 :10% of~	1.19 :10% of~	0.44	1.02	0.55	0.66	0.71	0.60				
Gross Disc. hours	1.32	13.07	4.80	11.18	6.07	7.22	7.83	6.64				
Start Loading Ops at									12:00	12:00	21:00	16:00
Loading Operation												
Loading Volume:	16	206	106	250					209	466	126	176
Net operational hour	1.28	8.24	2.12	10.00	-	-	-	-	8.36	9.32	5.04	7.04
Possible idling hour	0.13 :10% of~	0.82 :10% of	0.2	1.0	-	-	-	-	0.84	0.93	0.5	0.7
Gross Loading hours	1.4	9.1	2.3	11.0	-	-	-	-	9.2	10.3	5.5	7.7
Gross working hours	2.7	22.1	7.1	22.2	6.1	7.2	7.8	6.6	9.2	10.3	5.5	7.7
Ships idling at Berth	2.0	2.0	2.0	2.0					1.0	1.0	1.0	1.0
Total Berth Hour	**4.7**	**24.1**	**9.1**	**24.2**	**6.1**	**7.2**	**7.8**	**6.6**	**10.2**	**11.3**	**6.5**	**8.7**
	till 15:	till 09:	till 17:	till 14:	till 16:	till 17:	till 06:	till 15:	till 22:	till 23:	till 04:	till 01:
Examination	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Prepared by Project Team

Figure 4.1-10 PAS CT berth window under 6-gang system in the near future

SVP CT: Ships Berth Window & its Labor-gang Requirement in the near Future (4-Gang as Max)

Ships Operation: Ship Productivities are assumed @12.5 lifts/SG/hour and @ 25.0 lifts/GC/hour.



	Mon			Tue			Wed			Thu			Fri			Sat			Sun		
Total Stevedoring Volume:		31			0			503			827			644			1,002			126	
Gang No to Hire; QGC Gang:											2	2	2	2			2	2	2		
Gang No to Hire; S.Gear Gang:		1						2	2	2				2	2	2	2	2	2		

	Mon		Tue	Wed		Thu		Fri			Sat			Sun		
Discharging Operation	1 SG			with 2SG		2 GC	with 2GC	2SG	2GC	2SG	2 SG	2 SG	2GC	2GC	2 SG
	COTS			RCL-1		MCC1	RCL-2	APL Disc.	MCC2 Disc.	RCL3 Disc.	ACL Disc.	RCL3 Load	MCC2 Load	APL Load	ACL Load
Discharging Volume:	15			297		218	254	138	328	178	151				
Net operational hour	1.20			11.88		4.36	5.08 16:00	5.52	6.56	7.12	6.04	04:00 Start			
Possible idling hour	0.12	:10% of~		1.19	:10% of~	0.44	0.51 Start	0.55	0.66	0.71	0.60				
Gross Disc. hours	1.32			13.07		4.80	5.59	6.07	7.22	7.83	6.64				
												Start Loading Ops at			
Loading Operation												12:00	12:00	22:00	21:00
Loading Volume:	16				206	106	250					209	466	126	176
Net operational hour	1.28				8.24	2.12	5.00	-	-	-	-	8.36	9.32	2.52	7.04
Possible idling hour	0.13	:10% of~			0.82 :10% of	0.2	0.5	-	-	-	-	0.84	0.93	0.3	0.7
Gross Loading hours	1.4				9.1	2.3	5.5	-	-	-	-	9.2	10.3	2.8	7.7
Gross working hours	2.7				22.1	7.1	11.1	6.1	7.2	7.8	6.6	9.2	10.3	2.8	7.7
Ships idling at Berth	2.0				2.0	2.0	2.0					1.0	1.0	1.0	1.0
Total Berth Hour	**4.7**				**24.1**	**9.1**	**13.1**	**6.1**	**7.2**	**7.8**	**6.6**	**10.2**	**11.3**	**3.8**	**8.7**
	till 15:				till 09:	till 17:	till 03:	till 15:	till 16:	till 04:	till 11:	till 21:	till 22:	till 02:	till 06:
Examination	OK				OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Prepared by Project Team

Figure 4.1-11 PAS CT berth window under 4-gang system in the future

(5) Skill (Know-how) Transfer

One of the most important skills for CT operators for operating their terminals efficiently at minimum costs is the ability to develop superior ships-working-plans based on well-considered CY marshaling and stacking plans. Accordingly, there are large gaps in the service levels, such as ship's operational productivity, CT capacity and CY turn-time and so on, in between CTs by the skill levels of them.

PAS can prepare ships working plans as well as CY marshaling and stacking plans easily and promptly since PAS installed CTMS and learnt how to use the system. However, plans they prepare are not workable in many cases due to lack of basic knowledge and skills. PAS ship planners discharge containers mechanically in CTMS, from ship's bays to CY' bays prepared by CY planners, without considering how to stack them in the CY fluently from one-end to another by cranes.

These skills are being acquired by some planners in PAS through many work-shops given by the Project Team.

In PAS, the most qualified persons to serve as ship and CY planners are navigation pilots, because they know the particulars of ships and are familiar with mathematical conceptions. However, planners in PAS mostly graduated from academic schools instead of science or engineering; thus, it is very difficult for many of them to understand basic knowledge to become useful planners, such as ships particulars, various concepts on ships stowage or CY allocations, calculation of ships productivity or CY turn-time and so on.

Accordingly, it will take many years for PAS to foster and obtain useful ship and CY planners, even if PAS acquires talented personnel. This is because these skills cannot be obtained through academic learning or knowledge alone, but through experience over many years.

- The best idea for fostering adequate planners in PAS promptly is to send 2 JICA experts in ship and CY planning for 6 months at least for teaching the candidates selected from the current planners group through the daily operations, as OJT.
- At the same time, if JICA sends another expert in CHE mechanic and engineering, PAS can acquire maintenance and repairing skills and know-how for their CHE; this would help PAS to operate and manage the terminal more reliably.
- **All these ideas of JICA to support PAS addressed here may not make sense unless PAS top management change their mindset; restructuring its organization, nominating useful persons in top and managers in the key functions such as CT Ops Dept. to keep developing these skills in PAS sustainably for years to come.**

Given this environment, the Project Team and a JICA expert have held a series of workshops (WS) in the year 2010 through 2011 for PAS ship and CY planners, for transferring basic knowledge as well as skills to operate ships calling PAS and the CY systematically; such as ships particulars, methods to develop reasonable/workable plans on ships' stevedoring operations and CY allocation/marshaling planning and so on.

Basic skills and know-how based on the materials used at some of the WSs are explained here; although the operation manual/procedures for PAS based on CTMS system are described in the next chapter as "Operation Manual" independently..

1) Technologies on planning for ships discharging operation

a) Ships discharging bay-sequence planning and CY allocation planning

i) When using QGC

Ships discharging planning works start after obtaining ships discharging general and bay-plans with details from related shipping lines. Once the plans and details are obtained, ship planner in charge starts analyzing what kinds (laden, empty, size, type etc) and how many of containers are stowed on the vessel by bays and or hatches. After simulating some discharging ways (sequencing by

bays/hatches, equalizing the handling volume by cranes) in their minds, ship planners make discharging bay -sequence plans in CTMS mechanically. These processes are the same when using SG.

- Once discharging details are declared by ship planners, the data is sent to CY planners for their preparation of discharging container yards in CY (laden containers) and ECD (empty ones) by vessels, by size and type, counting the requiring spaces by TEU numbers instead of boxes.
- After getting CY stacking plans from CY planners, ship planners allocate discharge containers to the CY (or ECD) assigning them by ships bays by cranes based on the sequence plans.
- These sequences are equal to the orders to be followed strictly by gang bosses and CHE drivers, such as QGC, trucks, RTG and reach stackers. Thus, the sequencing and allocating works of ship planners have to be very careful as a conductor of an orchestra.

When using 2 units of QGC (PAS has 2 QGCs at moment) for a ship, ship planner in charge has to keep in mind the minimum clearance between the QGCs by ship's bays to avoid conflict during operations. In the case of MCC-2 ships, the minimum clearance is "1 x 40' bay" when both QGCs are handling 40' containers in the same time.

- For MCC-2 ship, however, 1x40' bay is not enough as clearance when one of QGC is handling 20' containers. The clearance is different by vessels; thus, PAS ship planners have to measure the distance between hatches by vessels obtaining ships blue-print from relevant shipping lines.
- 1.5x40' bays are required instead.

Furthermore, when using 2 units of QGC, ship planners have to figure out a branching bay of the operation at first by certain bay or hatch for splitting the work-volume equally by cranes. This is an important point on ships planning for the planners to complete the QGC operations in the same time, minimizing the Port stay of the ships.

- It is not necessary to split the works in two (2) exactly. An approximate split is sufficient when the stowage condition of the split-bay is complicated.

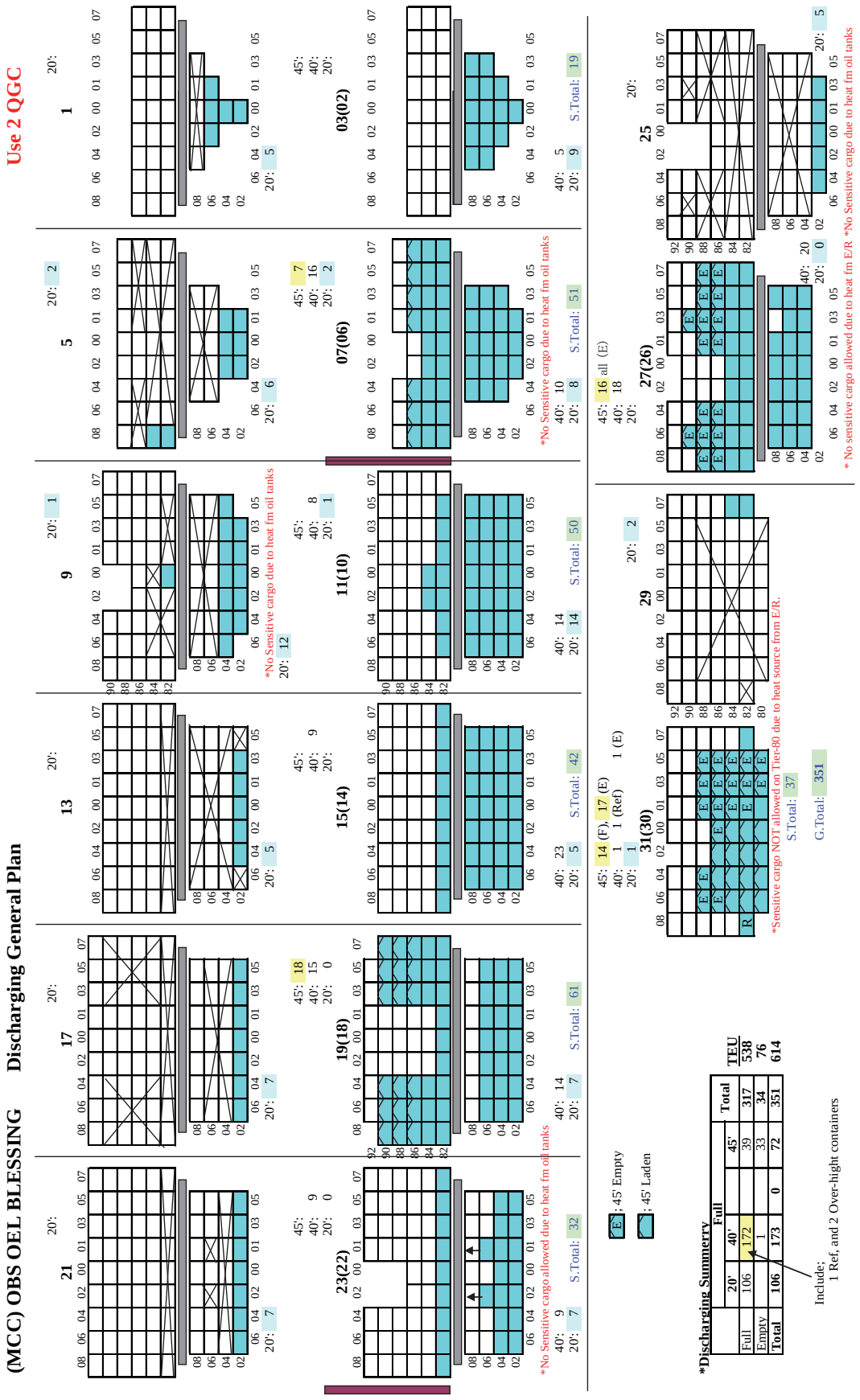
There are two (2) ways in sequencing the discharging containers, after splitting them in 2-QGC. One way is to start both QGC discharging from the forehand bays to backward, and the other is start discharging from backward bays to forehand. It is a good idea also to discharge containers stowed on-decks at first, then discharge containers stowed in below-decks when the situation allow; which is good for stevedore labors for keeping their working environment safe.

How to prepare the plan based on the materials used at a WS in Oct. 2011 is explained below.

Discharging general plan shown in Figure 4.1-12 is the actual plan of "OEL Blessing" who called PAS CT in Oct. 2011. The vessel had 351 container boxes (614 by TEU) to discharge at the Port; thus, the half number is 175.5. Accordingly, the branching bay of the vessel-voyage became No.18 on-deck; and then the branching point is 3rd tier of the bay.

As shown in Figure 4.1-13, the Project Team made the ship-discharging bay sequence plan to start the operation by No.2 QGC at No.18 on-deck, discharging 12 units of 45' containers at first stowed in the 5th and 4th tires; then moved to No.6 on-deck for discharging 45' ones ongoing. No.2 QGC, after that, shifted to bay No.14 for discharging 40' as well as 20' containers stowed in the hatch (bay No.13 and 15), then the crane moved to forehand bays accordingly.

On the other hand, No.1 QGC commenced the work at No.30 deck, the last bay of the ship, and moved forehand bays completing the discharging works at each bay by orthodox practice of the forward displacement. Or, the QGC could start the operation at No.26 on-deck for discharging 45' empty containers at first, and then could move to No.30 deck for handling the same 45' containers continuously.



	Full				Total	TEU
	20'	40'		45'		
Full	106	172		39	317	538
Empty		1		33	34	76
Total	106	173	0	72	351	614

Prepared by Project Team

Figure 4.1-12 Discharging General Plan: (OEL Blessing; MCC-2)

Drill for CY & Ship Planners: CY Allocation Planning & Discharging Ops

Decide Ships Work (Sequence) Plan at first

Vessel Name: OEL Blessing **Voy.No.** 1139D **Data:** Oct. 21

Crane No. 2

	Bay No.	Deck /Hold	Dis/Load or R/H	20' F	20' E	40' F	40' E	45' F	45' E	Sub Total	Accum. Total	Remarks	Ops time (by every 3 min.) Started	Finished	Worked hr
1	18	Deck	Dis					12		12	12	Top 2 tiers only			
2	6	Deck	Dis					7		7	19				
3	14	Deck	Dis			9				9	28				
4										0	28	Open H.Cover x 2			
5	14	Hold	Dis			23				23	51				
6	15	Hold	Dis	5						5	56				
7	13	Hold	Dis	5						5	61				
8	10	Deck	Dis			8				8	69				
9	11	Deck	Dis	1						1	70				
10	9	Deck	Dis	1						1	71				
11										0	71	Open H.Cover x 2			
12	10	Hold	Dis			14				14	85				
13	11	Hold	Dis	14						14	99				
14	9	Hold	Dis	12						12	111				
15	6	Deck	Dis			16				16	127				
16	7	Deck	Dis	2						2	129				
17	5	Deck	Dis	2						2	131				
18										0	131	Open H.Cover x 2			
19	6	Hold	Dis			10				10	141				
20	7	Hold	Dis	8						8	149				
21	5	Hold	Dis	6						6	155				
22										0	155	Open H.Cover x 2			
23	2	Hold	Dis			5				5	160				
24	3	Hold	Dis	9						9	169				
25	1	Hold	Dis	5						5	174				
26															
27															
28															
29															
30															
31			Total	70	0	85	0	19	0	**174**					
32															
33															

Drill for CY & Ship Planners: CY Allocation Planning & Discharging Ops

Decide Ships Work (Sequence) Plan at first

Vessel Name: OEL Blessing **Voy.No.** 1139D **Data:** Oct. 21

Crane No. 1

	Bay No.	Deck /Hold	Dis/Load or R/H	20' F	20' E	40' F	40' E	45' F	45' E	Sub Total	Accum. Total	Remarks	Ops time (by every 3 min.) Started	Finished	Worked hr
1	30	Deck	Dis			2	1	14	17	34	34	40'Ref x 1			
2	31	Deck		1						1	35				
3	29	Deck		2						2	37	Or, can discharge at 1st.			
4	26	Deck				18			16	34	71				
5										0	71	Open H.Cover x 2			
6	26	Hold				20				20	91				
7	25	Hold		5						5	96				
8	22	Deck				9				9	105				
9										0	105	Open H.Cover x 2			
10	22	Hold				9				9	114	Over Height: 40' x 2			
11	23	Hold		7						7	121				
12	21	Hold		7						7	128				
13	18	Deck				15		6		21	149				
14										0	149	Open H.Cover x 2			
15	18	Hold				14				14	163				
16	19	Hold		7						7	170				
17	17	Hold		7						7	177				
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31			Total	36	0	87	1	20	33	**177**					
32															
33															

Prepared by Project Team

Figure 4.1-13 Ship-Discharging Bay Sequence Plan (OEL Blessing; MCC-2)

Because PAS orders 1 unit of RTG per QGC at the most through the operation due to the shortage of RTGs, it is efficient for the RTG to handle 45' containers continually for stacking at the same end-bays of each RTG lanes, without moving back and forth to from 40' or 20' bays in the middle of the lanes.

On the other hand, CY planners prepare enough space in the CY (and ECD) for the container discharging from the ship, calculating the space by TEU once obtaining the discharging details. CY planners again examine the space after getting a discharging bay-sequence plan (Figure 4.1-14) from the ship planner in charge to determine whether the yard is workable by RTGs or not by checking the timing of the operations before sending the finalized plan to the ship planner.

- Discharging details of "OEL Blessing" were 20'x106, 40'x169 (including 1unit of reefer and 2 units of over-sized; which are stored in other CY places) and 45'x39 by laden containers, and 45'x33 by empty.
- Ship planners, under CTMS' work-environment, can commence discharging works (from ships' bays to CY's mechanically) in CTMS easily, examining both "discharging bay-sequence plan" and "CY stacking (allocation) plan" together with displaying them on a CTMS screen.

Figure 4.1-15 is a CY allocation plan prepared by the Project Team for the WS. There are 107 slots by 20' bays and 214 slots by 40' in the CY's bay No.1 through 65 in CD lane, except some prohibited bays as No.38 and 55 as shown in the figure. Accordingly, there are 1 slot by 20' container and 6 slots by 40' as surplus; although the end-slots for 45' containers are just 39 fitting for them perfectly; thus the space is good enough for the ship.

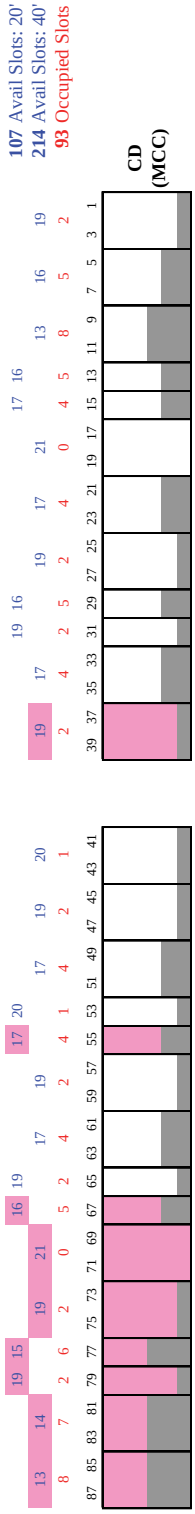
Once CY allocation plans prepared by CY planners are examined, ship planners have to think how to use the CY, splitting the space by QGC, based on the sequence-plans. In the WS, the Project Team splits the CY allocating right-side of the CD lane for No.2 QGC and the left-side for No.1 QGC, just following to the same position relation of the QGC at PAS CT, as shown Figure 4.1-15. Then, the Project Team allocated the containers in the CY from right-side bays to left, following to PAS' traffic rule, right to left, in the CY.

The RTG tied with No.2 QGC commenced the work at No.2 bay, an end bay, in CD lane for decking 45'x19 of containers, from ship's bay No. 18 and 6; then the RTG moves to No.6 and 10 bays for decking 40' containers ongoingly without any wasted motions. On the other hand, RTG tied with No.1 QGC are forced to move back and forth in between bay No. 34 and 55 for discharging 40' and 20' containers one after the other at the beginning of the operation.

This CY allocation plan was used as training in a WS. However, in real operation, CY planners have to prepare the spaces so as to minimize the back and forth movement of RTG's, examining the sequence-plans carefully. Accordingly, it is a good idea to separate the yard by center passage, right and left, by the cranes (RTG), due PAS has ample CY space at present.

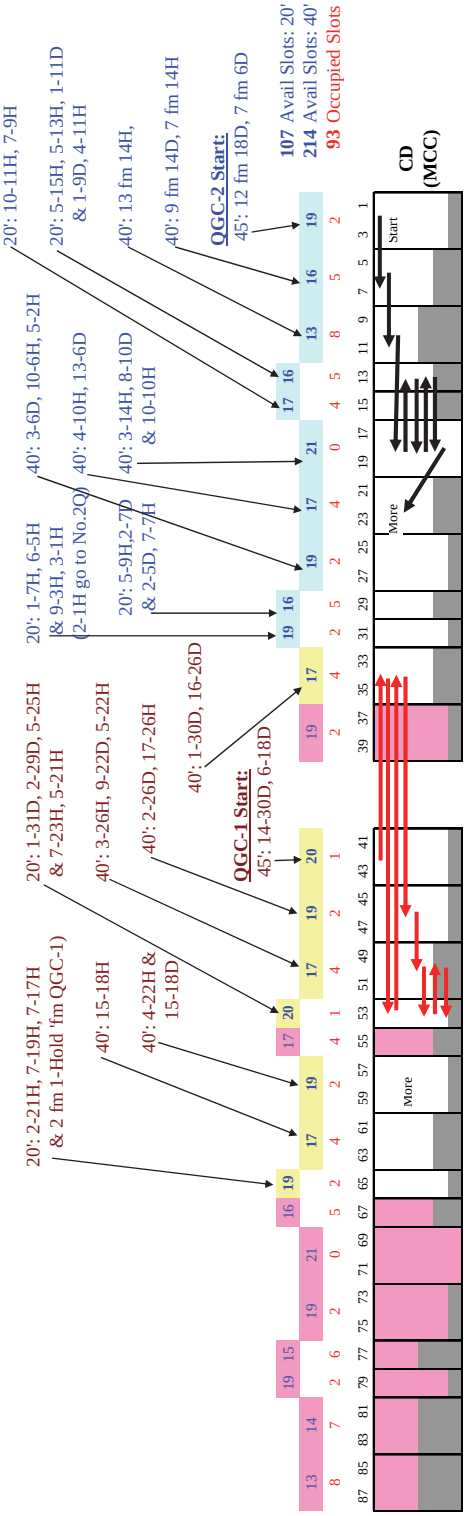
- As shown in a General Allocation Plan, PAS can share an entire RTG lane for import laden containers to deck for RCL and MCC. Thus, it is recommended to split the lanes, right and left, by cranes for stacking the containers with minimum movements of RTG tied with the cranes, especially when using QGC.
- How to handle "leftover containers" in the CY is a big question for all CY planners in the world when they prepare spaces for incoming vessels. One solution is to gather such containers in an area in the CY moving them with a few trucks and 2 units of RTG. This is recommendable when there are not many containers. Because the planner can prepare plain-space for coming ships, also can deliver them at there to external trucks without congestions during the ship's operation.
- When there are many leftover containers, it is better to shift them to back-side rows in the same CY-bays for preparing the space; although some trouble for CY controllers may occur during the operations, such as address changes in CTMS for containers discharged from the ship and or conflictions of internal and external trucks at the same CY

- This confliction can be stopped only by prohibiting external trucks from proceeding to the CY freely, or stopping ships operation for a while for handling the trucks at one shot.



Prepared by Project Team

Figure 4.1-14 Discharging Yard for OEL Blessing



Prepared by Project Team

Figure 4.1-15 CY Discharging Sequence Plan corresponding with Ships Discharging Bay-sequence Plan

ii) When Using Ship-gears (SG)

SG operation is inflexible compared to QGC's because the ship-bays covered by SGs are limited by the structure, except common-handling bays in between the SGs of some ships. Thus, container handling volumes by SGs vary in general. This means completion times of the operation are different by SGs.

There are many points for ship planners to pay attention to when planning discharging bay-sequence plans for SG ships such as:

(a) SG's installed position by vessels; Starboard-side or Center or Port-side; and coverage of the ships bays/hatches by SGs
(b) Commence discharging works from port-side of the ship-bays when SGs are installed in the port-side of the ship, after alongside by port-side. (Reverse when SGs are installed in starboard-side.)
(c) When discharging containers stowed on-decks in multistage; discharge containers stowed in far-side bays at first for creating rooms to discharge containers stowed in near-side bays next to SGs. This is MUST when the bays are blocked by the containers stowed in the far-side.
(d) Discharge 45' containers continuously even if they are stowed in several bays on-deck whenever available, for minimizing RTG's back and forth moves in between 45' bays (end bays of RTG lanes) and 20' or 40' bays (middle bays of the lanes).
(e) When discharging containers at convertible holds (able to stow 2x20' or 1x40' in a row); discharge 20' containers stowed in forehand bays at first because forehand bays have more room in between the containers and ship-walls in front due to the stern-trim of ships in general. Accordingly, containers stowed in backward bays can be discharged without problem.
(f) At the convertible hatches; discharge 20' containers by 2 tires by turns, forehand bays at first and then the afterward, for the safety of stevedore labors who work in the hatches, for not incurring large gaps from the top of containers in the hatch to bottom (floor) of the ships.

* At the SG operation, as described, stevedore labors have to use an "attachment (spreader) with flippers" connecting 2 ropes on it to pull the ropes by the labors for helping SG operator to fit the attachment onto containers promptly; otherwise, these efforts of ship planners are almost in vain.

CY allocation plans in discharging operation of SG ships are basically the same as the QGCs and thus will not be explained here.

2) Technologies on Planning of Ships Loading Operation

a) Ships Loading Bay-Sequence Planning and CY Marshaling Planning

Ships loading operation planning commences when a ship planner in charge receives loading container data based on booking information and loading general plan from shipping lines. Once obtaining the data and the plan, the planner examines whether numbers of containers by destinations, statuses, sizes, types and heights shown on the general plan are matched with the details or not. Then, he considers the loading bay-sequences by cranes splitting the containers by the number of cranes to use. These processes are the same for the planning of QGC operation or SG's.

However, PAS cannot get booking data until the last moment due to the Cambodian business circumstance. Moreover, loadable containers of Saturday callers are less than 50% on average at 10:00 on the day, the due-time, for preparing the 1st loading plans, for starting the operations at 12:00 to complete the works by 24:00 in the same day.

Accordingly, PAS CY planners cannot prepare reliable marshaling plans for Saturday callers based on the data. Accordingly, they prepare only rough plans by their experiences by two (2) stages at present. As a result, operational productivities of the ships are low.

- As described in above, PAS does not engage in the loading operations of Saturday callers at present; except stacking the export containers in the CY and searching them in the loading operations at the CY (ECD as well) after getting orders from supervisors of shipping lines.

How to adopt **modern operation systems** into PAS under such circumstance is a big question. The answer is to develop **certain pattern plans as system** in the operation as shown in the next section in "Operational Procedures". In this way, PAS planners can prepare certain level of ship as well as CY working plans without exposing their lack of experience.

Developing a **pattern of "loading bay-sequence plans" by vessels can be done** based on past ships' loading general plans, after confirming their tendencies on the usage of the loading bays by destinations, sizes, heights and so on. Then, develop **pattern of "CY marshaling plans" by the ships** following to the pattern of "loading bay-sequence plans".

- Loading general plans are basically patterned by shipping lines by service routes, especially in the case of liner vessels; although loading volumes are changed by seasons. Means, central planners of shipping lines develop loading general plans by service-routes and ports by patterns for sending them to CT operators related after adjusting slightly by vessel-voyages.
- Accordingly, PAS ship planners can ask shipping lines (central planner in charge of the lines) to develop and send stable patterned plans when there were no constancies on the received plans.

The methods and benefits of "patterned plans" based on materials used at a WS in Nov. 2011 are described below.

i) When uses QGC

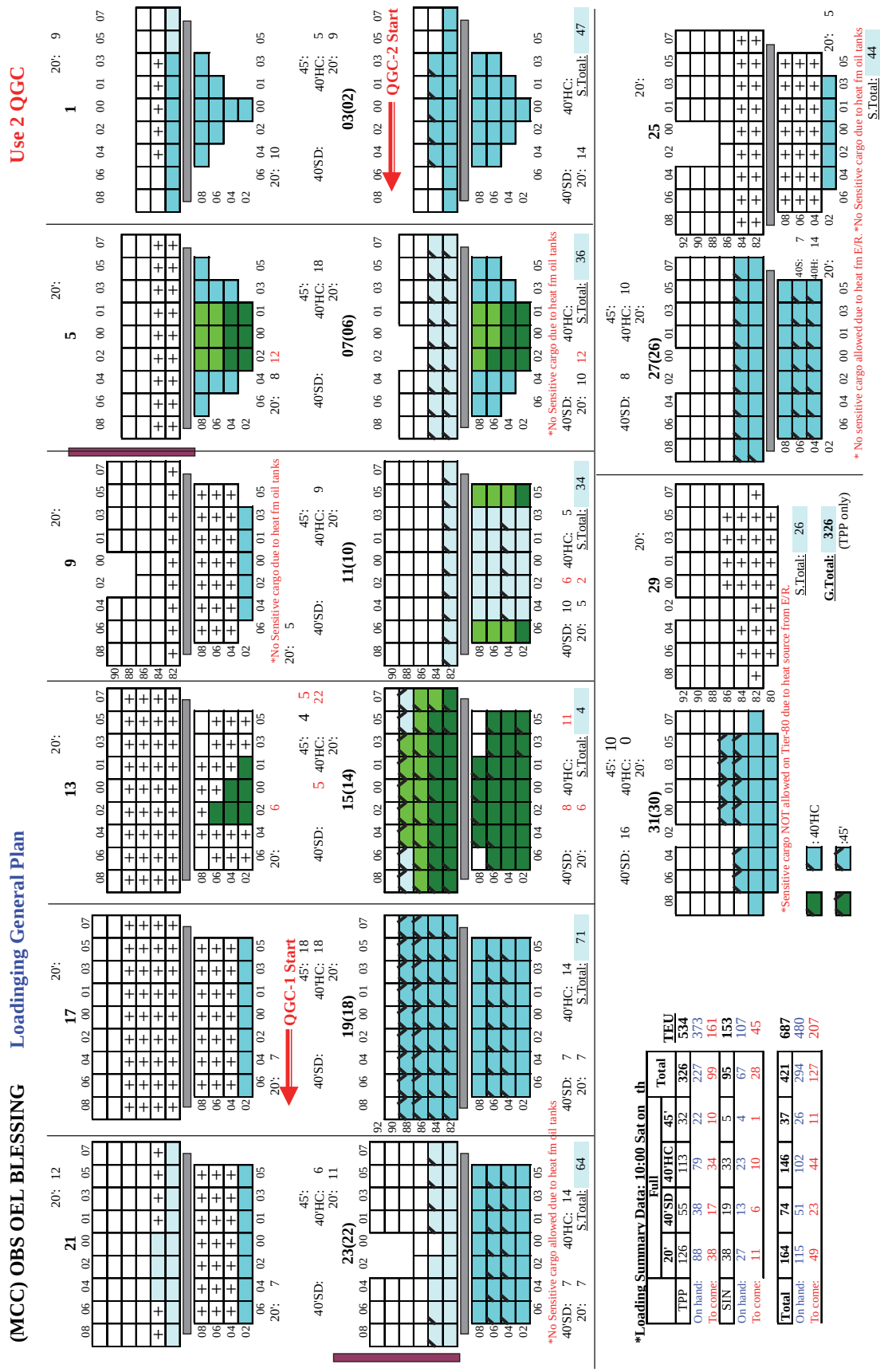
Loading general plan of OEL Blessing, MCC-2, called the Port in Oct. 2011 is shown in Figure 4.1-16, i.e. instructing to stow containers for Singapore (Sin) in parts of holds of bay No. 5,7,10 and 11, and entire holds of bay No. 13, 14 and 15, and a part of 14 on-deck; then other spaces are assigned for Tanjung Pelepas (TPP).

Loading volume is 421 boxes in total; thus, the branching point for the vessel-voyage is bay No.15 hold or No.14 on-deck as 2 QGCs are used. Accordingly, if all the loading containers are stored in the CY when starting the planning works as is a common practice in the world, ship planners can develop the plan for No.1 QGC to start its loading operation at No.30 on-deck, the last bay of the ship, and moves forehand bays completing each bay in order. On the other hand, No.2 QGC starts the work at No.15 hold and, as the same as No.1 QGC, moves fore bays in order, leaving 4 units of 45' containers for SIN on No.14 on-deck to be handled them by No.1 QGC for balancing the volumes. (Moving forward type planning) Or, in contrast, No.1 QGC can start its works at No.15 hold, loading 6 units of 20' containers for SIN only; then No.2 QGC starts at No.3 bay, and both QGC move backward together with for completing each bay. (Moving backward type planning)

However, in the case of PAS, it is impossible to do so as stated many time already. PAS can scarcely receive some 70% of booking containers as loadable ones (after granting loading permissions of Customs) at the most by 10:00 on Saturday. Therefore, PAS ship planners have to prepare loading bay-sequence plans for the ships with only 70% of the containers as the 1st loading plans.

- As of January 2012, Saturday 04:00 Gate operational performances are getting worse. Some 50% of the containers only were arriving at the Gate by 10:00 for the first 3 weeks in a row.
- This means, a possibility for PAS to take-over the loading operational planning and supervising rights from shipping lines is getting away at present.

Accordingly, simple "moving forward type planning" does not work for the vessel-voyage, because No.2 QGC cannot complete the work at No.14 on-deck, the starting hatch of the crane, due to many containers for SIN at the deck are to-come (should be stowed in later by 2nd plan). Means, both QGC should conflict at the middle bays (14 & 18) at the final stage of the operation.



Prepared by Project Team

Figure 4.1-16 Loading General Plan; OEL Blessing

Hence, "moving backward type planning" is better for this OEL Blessing as the loading at No.17-18-19 bays, holds and deck is completed at the beginning by No.1 QGC; it then moves to backward bays accordingly. This is because No.5 hatch (bay No.17~19) is the key hatch for the ship to make the loading operation workable with 2QGCs.

- "Moving forward" type planning could also be adopted though it is a little complicated, as shown below.
- No.2 QGC commences the work at bay No.13~15 (holds and deck) and moves to bay No.3 hold, leaving to-come containers for SIN at No.14 deck. At the same time, No.1 QGC, should be working at bay No.26, moves to bay No.17~19 immediately for completing the bays and deck, and then finally moving backwards to No.21 hold.
- This plan will enable more containers to be stowed at the 1st loading stage than the other plan. However, simple plan is better for PAS ship planners at present for developing "**pattern loading bay-sequence plans**" by vessels because it is easier for PAS CY planners to develop "**pattern CY marshaling plans**" by vessels based on SIMPLE "patterned loading bay-sequence plans".
- When planning, it is better to keep distance as much as possible in between QGC, though they are workable at the minimum clearance of 40'x1-bay when both QGC are handling 40' containers together with, for keeping ships operation smooth and safe.
- Assuming 70% of booking containers for OEL Blessing became ready to plan to stow on the ship at 10:00 on Saturday as shown in a table below as "On-Hand".

***Loading Summary Data:** As 70% of Booking are ready to load at 10:00 Sat.

	Full				Total	
	20'	40'SD	40'HC	45'	(Box)	(TEU)
TPP	126	55	113	32	326	534
On hand:	88	38	79	22	227	373
To come:	38	17	34	10	99	161
SIN	38	19	33	5	95	153
On hand:	27	13	23	4	67	107
To come:	11	6	10	1	28	45
Total	164	74	146	37	421	687
On hand:	115	51	102	26	294	480
To come:	49	23	44	11	127	207

Loading bay-sequence plan of OEL Blessing (MCC-2), based on the method described in above, becomes as shown in Figure 4.1-17 (including the 2nd loading plan as a whole). Based on the plan, No.1 QGC has 132 boxes to load, then 115 boxes by No.2 QGC; which are enough for both QGCs to handle in 4 hours, from 12:00 to 16:00, when the labors change the shifts (Day to Night).

- PAS' operational target is 25 lifts/hour as QGC's net productivity; thus, if the cranes could handle 100 boxes each in 4 hours, the productivity becomes 25.0 in gross, not in net; that is more than enough for PAS at present.
- While there are 294 boxes as "on-hand" in the CY as shown in the table. Thus, only 84% (132+115=247, 247/294=84%) of the on-hand containers are planned in the 1st plan.
- This plan is just workable, because the plan is simple for gaining the efficiency, and both QGC has more than 100 boxes each to handle, enough for 4 hours to work with.

Furthermore, PAS ship planners have to complete the 2nd (maybe the last as well) loading plans by 16:00 for the Night-gang to use; thus, planners have to commence the planning works by 14:30 on Saturday at least, adding (stowing) containers onto the 1st bay-sequence plan and bay-plans in CTMS, from 1st and 2nd marshaling yards as shown in Figure 4.1-17.

Drill for CY & Ship Planners: CY Allocation Planning & Loading Ops

Decide Ships Work (Sequence) Plan at first

Vessel Name: OEL Blessing **Voy.No.** 1141L **Data:** Nov. 7

Pattern - 1

Crane No. 1

	Bay No.	Deck /Hold	Dis/Load or R/H	20' F	20' E	40' F	40' E	45' F	45' E	Sub Total	Accum. Total	Remarks	Ops time (by every 3 min.) Started	Finished	Worked hr
1	19	Hold	Load	7						7	7				
2	17	Hold	Load	7						7	14				
3	18	Hold	Load			21				21	35	SDx7, HCx14			
4										0	35	Close Hatch Cover x 2			
5	18	Deck	Load			18		18		36	71	All HCx18			
6	23	Hold	Load	7						7	78				
7	21	Hold	Load	7						7	85				
8	22	Hold	Load			21				21	106	SDx7, HCx14			
9										0	106	Close Hatch Cover x 2			
10	30	Deck	Load			16		10		26	**132**	All SDx16. **Last Bay for 1st Loading**			
11															
12	**Stop the work whem No.2 QGC Start loading at 11-Hold.**														
13	**Move to 23-Deck when No.2 QGC start loading at 11-Hold**														
14															
15	**2nd Loading Plan should be;**														
16	23	Deck	Load	11						11	11				
17	21	Deck	Load	12						12	23				
18	22	Deck	Load			6				6	29	All HCx6			
19	25	Hold	Load	5						5	34				
20	26	Hold	Load			21				21	55	SDx7, HCx14			
21										0	55	Close Hatch Cover x 2			
22	26	Deck	Load			18				18	73	SDx8, HCx10			
23	30	Deck	Load	**Load the Balance at the last!**											
24															
25															
26															
27															
28															
29															
30															
31			Total	56	0	121	0	28	0	**205**					
32															
33															

Drill for CY & Ship Planners: CY Allocation Planning & Loading Ops

Decide Ships Work (Sequence) Plan at first

Vessel Name: OEL Blessing **Voy.No.** 1141L **Data:** Nov. 7

Pattern - 1

Crane No. 2

	Bay No.	Deck /Hold	Dis/Load or R/H	20' F	20' E	40' F	40' E	45' F	45' E	Sub Total	Accum. Total	Remarks	Ops time (by every 3 min.) Started	Finished	Worked hr
1	3	Hold	Load	14						14	14				
2	1	Hold	Load	10						10	24				
3										0	24	Close Hatch Cover x 2			
4	3	Deck	Load	9						9	33				
5	1	Deck	Load	9						9	42				
6	2	Deck	Load			5				5	47	All HCx5			
7	7	Hold	Load	12						12	59	Sin-first			
8	5	Hold	Load	12						12	71	Sin-first			
9	7	Hold	Load	10						10	81	TPP			
10	5	Hold	Load	8						8	89	TPP			
11										0	89	Close Hatch Cover x 2			
12	6	Deck	Load			18				18	107	All HCx18			
13	11	Hold	Load	2						2	109	Sin-first			
14	10	Hold	Load			6				6	**115**	Sin. **Last Bay for 1st Loading**			
15	**2nd Loading Plan should be;**														
16	11	Hold	Load	5						5	5				
17	9	Hold	Load	5						5	10				
18	10	Hold	Load			15				15	25	SDx10, HCx5			
19										0	25	Close Hatch Cover x 2			
20	10	Deck	Load			9				9	34	All HCx9			
21	15	Hold	Load	6						6	40				
22	13	Hold	Load	6						6	46				
23	14	Hold	Load			19				19	65	SDx8, HCx11			
24										0	65	Close Hatch Cover x 2			
25	14	Deck	Load			27		9		36	101	SDx5, HCx22			
26															
27															
28															
29															
30															
31			Total	108	0	99	0	9	0	**216**					
32															
33															

Prepared by Project Team

Figure 4.1-17 Loading Bay-sequence Plan; OEL Blessing

Marshaling yard for MCC-2 is set in CB lane in the CY at present. Accordingly, PAS CY planners have to prepare 2 stages marshaling yards, 1st and 2nd, in the lane for the ship. Once the loading operation starts at 12:00, internal trucks working for the ship rush to the 1st marshaling yard repeatedly, while the 2nd yard is busy for receiving (lift-off) export containers carried by external trucks. The lane becomes congested with internal and external trucks; thus, PAS CY planners should set the 1st yard in the right-side of the lane (No.1-39), then the 2nd in the left-side (no.41-87) in order to separate traffic.

Moreover, PAS CY planners have to prepare enough space to store some 70% of booking containers for the ship in the 1st yard. The rest of the containers should be stacked in the 2nd yard, after closing the 1st yard at 10:00 for planning the 1st plan, together with the over flowed containers at the 1st yard. Younger bays in the right-side of CB lane (No.1-18) should be the 1st marshaling yard for No.2 QGC, then elder bays (No.21-39) for No.1 QGC, as the same position-relation of the QGC of PAS for less confusion among labors.

Ideal CY marshaling yard for OEL Blessing (MCC-2) based on the above and the pattern loading bay-sequence plan of the ship is shown in Figure 4.1-18. Bay No.2 is allocated for SIN, 45' in 5th and 6th rows and the rest for 40'SD (8'6"). And then, bay No.5 through 11 is allocated for 20' containers to SIN and TPP, due the QGC handles 20' containers mainly at the first 3-4 hours. In addition, bay No.14 is allocated for 40'HC (9'6") to TPP and 18 for 40'HC to SIN for keeping enough clearance in between the RTG tied with No.1 QGC at the beginning of the operation.

a) Loading Container Detail (1st Marshaling yard should cover the On-hand volume in TEU)

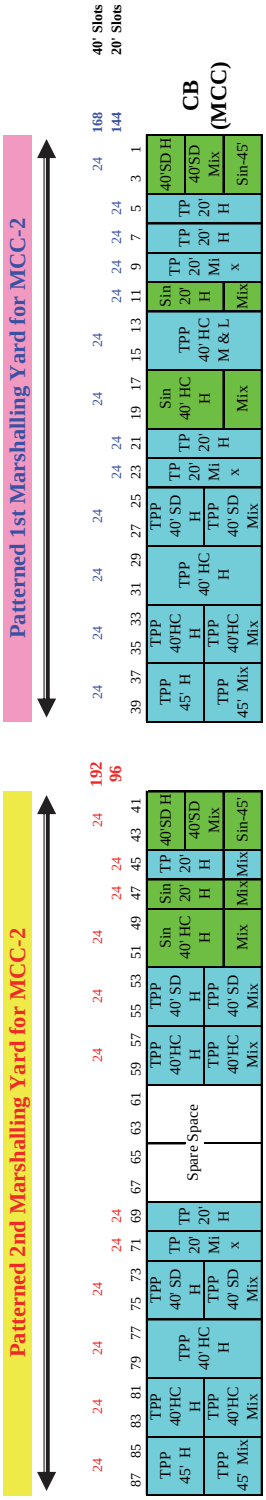
	Full				Total	
	20'	40'SD	40'HC	45'	(Box)	(TEU)
TPP	126	55	113	32	326	534
On hand:	88	38	79	22	227	373
To come:	38	17	34	10	99	161
SIN	38	19	33	5	95	153
On hand:	27	13	23	4	67	107
To come:	11	6	10	1	28	45
Total	164	74	146	37	421	687
On hand:	115	51	102	26	294	480
To come:	49	23	44	11	127	207

b) Required CY-Bays, counting 24 boxes per bay (20' or 40'), and preparing bays

		20'	40'SD	40'HC	45'
TPP	Box	88	38	79	22
Req.bay no.		3.7	1.6	3.3	0.9
Prep. bay no.		5.0	1.0	3.0	1.0

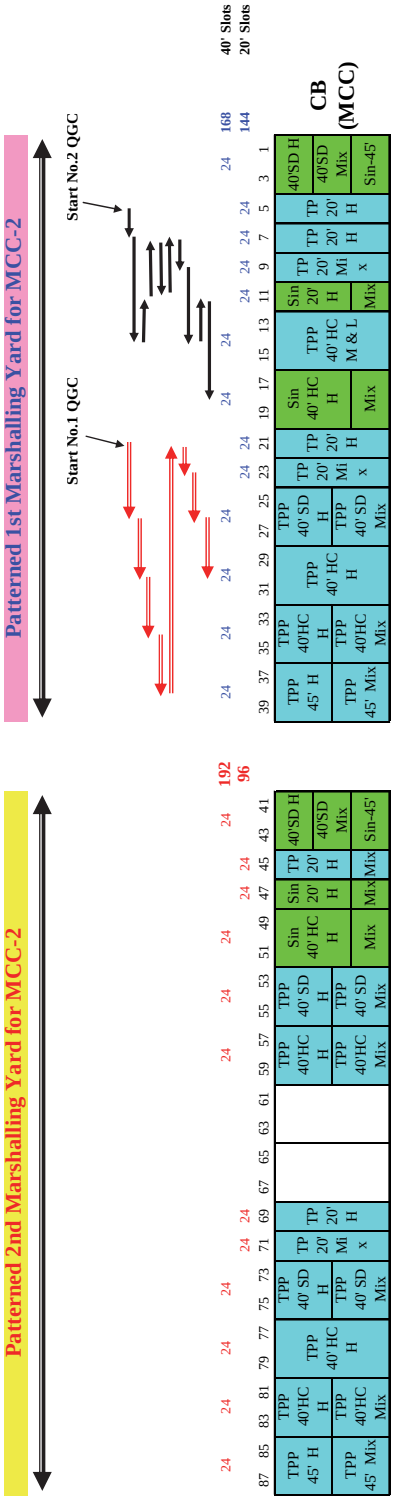
SIN	Box	27	13	23	4
Req.bay no.		1.1	0.6	1.0	0.1
Prep. bay no.		1.0	0.6	1.0	0.3

RTGs' lifting-on operations for the ship at the 1st marshaling yard become as shown in Figure 4.1-19; working very well without conflicting each other through the operation.



Prepared by Project Team

Figure 4.1-18 Patterned CY Marshaling Plan for MCC-2; based on OEL Blessing Loading Bay-sequence Plan



Prepared by Project Team

Figure 4.1-19 RTGs' Loading (Lift-on) Operation at CY from Patterned CY Marshaling Yarn of MCC-2

ii) When Uses Ship-gear (SG)

SG operation is inflexible compared with QGC operation. Reachable ship-bays by each SG are limited; thus, loading bay-sequence plans for the vessels are also limited with few variations. This means container handling volumes varies by SGs, and operation schedules will be different.

Following points require special attention.

(a) SG's installed position by vessels; Starboard-side or Center or Port-side; and coverage of the ships bays/hatches by the SGs.
(b) Commence loading works from starboard-side of the ship-bays when the SGs are installed in port-side of the ship, after alongside by port-side. (Reverse when SGs installed in starboard-side.)
(c) When loading containers in convertible hatches (able to stow 2x20' or 1x40' in a row); load 20' containers in backward bays at first, for loading other 20' containers in forehand bays of the hatches with less problems. Because, forehand bays have more rooms in between containers and ship-walls in front due to the stern-trim of ships in general.
(d) Moreover, when loading containers in convertible hatches; load 20' containers by 2 tires by turns, backward-bays at first and then forehand, for the safety of stevedore labors who work in the hatches, for not creating large elevation from the bottom.
(e) When loading containers on-deck with multistage, load at closer bays next to SG at first. This is MUST when the closer bays are blocked by far-side bays once loaded containers in the far-side.
(f) In the SG operation, stevedore labors have to change spreaders (attachments for catching containers) by containers' size whenever the size to handle are changed; thus, ship planners is better to plan to stow the same size of containers continuously as much as possible whenever available for gaining the productivity.

* At the SG operation, as described already, stevedore labors must use an "attachment (spreader) with flippers" connecting 2 ropes on it to pull by the labors for helping SG operator to fit the attachment onto containers promptly; otherwise, these efforts of ship planners are in vain mostly.

* Accordingly, SG operators can fit the containers (caught by attachments) in "cell-guides" promptly when loading them in ships-holds, and fitting the containers onto containers stowed already when loading them on-decks.

CY marshaling plans are the same for both SG operation and QGC operation.

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

(1) Present condition and issues

1) Port entry procedures

a) Responsible authorities

Following government bodies are concerned in ship entry procedures at Cambodian ports.

① MPWT

General Department of Transport (GDT) in MPWT obtains information on ship's registration, grants ship a permission for entry to sea/river ports in Cambodia. Merchant marine Department (MMD) and Inland Waterway Department (IWD) are instituted under GDT to take charge of sea/river ports respectively.

② Autonomous ports

PAS and PPAP are in charge of traffic control, providing pilot service, issuing Port Clearance, berth allocation etc. They also chair Port Clearance Committee called at the time of entry/departure of the ship.

③ Kampuchea Shipping Agency & Brokers (KAMSAB)

As only one organization offering ship's agency under license of RGC, KAMSAB handles all formalities for port entry on behalf of shipping line. Established in 1979, KAMSAB is a government-owned company controlled by MPWT and Ministry of Economics & Finance for its operational and financial activities respectively. Its organization and area of business activities are prescribed by Sub Decree No.81 August 1999. Other than its main business of shipping agency, it also performs customs broking, warehouse operations etc.

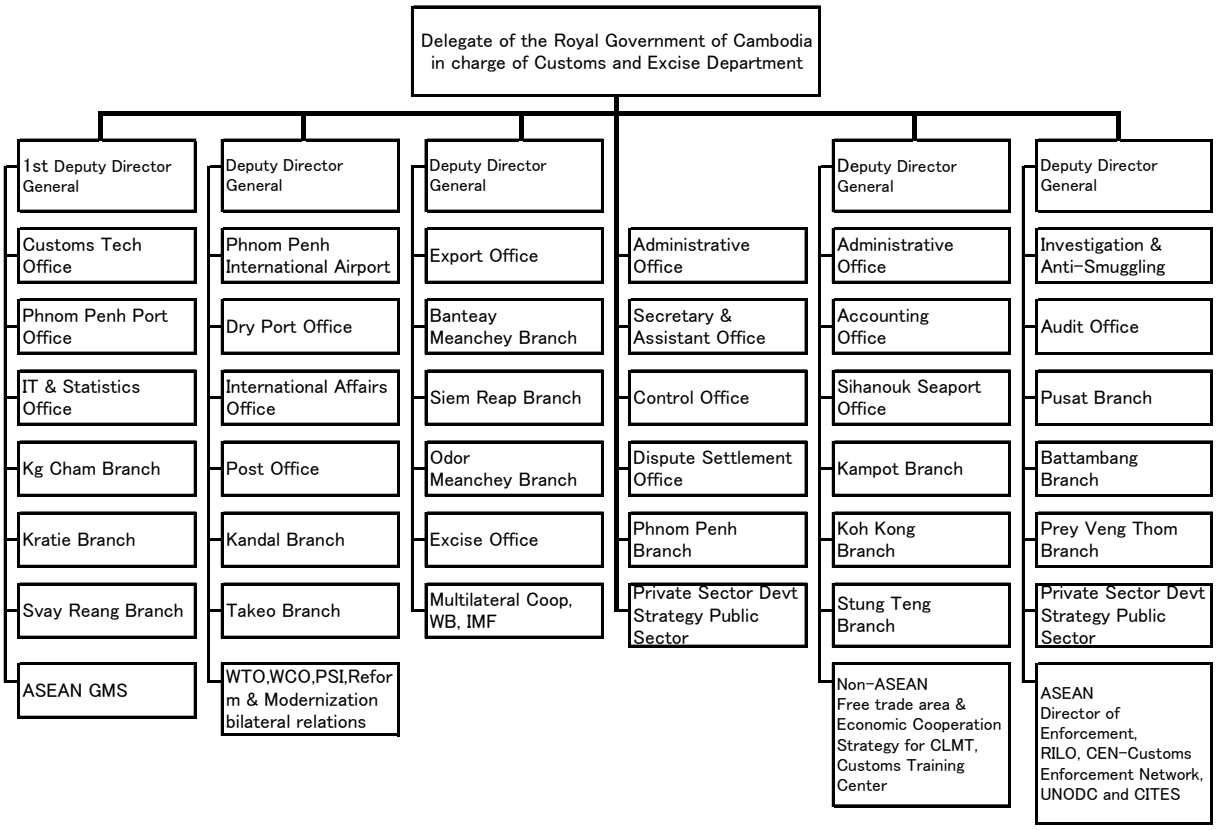
Table 4.1-5 Business description of KAMSAB

Shipping agency services	Port entry/departure procedures Husbanding Arrangement of stevedorers Bunker, provision, spare parts, mechanics supply Crew transfer, sign-on/off, repatriation, medical assistance Ship brokering, chartering, delivery and redelivery Arranging salvage of vessels in distress
Cruise and passenger services	Visa and visa extension arrangement Arranging sightseeing or tour to specific locations countrywide Transport supply Cash exchange, medical assistance Air, boat, bus ticket for individuals Accommodation and restaurants Provision and souvenirs supply
Logistics services	Customs clearance Cargo consolidation, packaging, warehousing, ICD Inland haulage Door-to-door delivery Goods moving Cargo insurance Total MTO logistics

Source: KAMSAB

④ The Cambodia General Department of Customs & Excise (GDCE)

GDCE gives approval of port entry for overall cargoes onboard. It makes a survey of cargo manifest, ship's store, crew personal effects etc. GDCE is an independent government body, not subject to any other ministries' supervision. Under the delegate 5 deputy directors are assigned, and beneath them, 13 central offices, 4 operational offices and 19 branches with 66 check points are in place.



Source: GDCE

Figure 4.1-20 Organization chart of GDCE

⑤ Immigration Police

Immigration police, belonging to Ministry of the Interior, is responsible for immigration control on foreign crew and passengers.

⑥ Port Quarantine Office

Port Quarantine Office, belonging to Ministry of Health, is responsible for sanitary conditions of incoming ships, health conditions of crew and passengers.

b) Procedures for port entry

One of distinctive points in the port entry procedures in Cambodia is "Port Clearance Committee" held at an office near the port or onboard ships every time of ship's entry/departure. Consisting of the officers from all relevant government bodies, Port Clearance Committee is supposed to handle all formalities required for port entrance/departure as a one-stop-center.

Another characteristic point is that ships are not allowed to enter into the port without using KAMSAB as an agent.

Since Cambodia has not yet ratified FAL Convention (Convention on Facilitation for International Maritime Traffic), the documents for port entry procedures are made in Cambodia's own format, not globally standardized.

① Announcement of ship entry and entry permit

When a foreign-flag ship calls at a port in Cambodia, an announcement needs to be made to GDT and port authority (harbor master) by either of hard copy, fax or email by 48 hours before arrival. The announcement shall include the information as indicated in Table 4.1-6. Any amendment thereafter also needs to be informed to them until they fix the information by 24 hours before arrival. Upon fixed, they stamp and sign the submitted documents, which are regarded as "Entry Permit". After issuing of entry permit, the ship can enter into the port according to the directions of harbor master.

Table 4.1-6 Items to be included in the Announcement of Ship Entry

・Name of ship
・Flag state
・IMO number
・Call sign
・Ship type
・Gross tonnage/ net tonnage/ dead weight
・Ship agent
・Last calling port
・Port of call
・Security levels at the last 10 ports of call
・Type and quantity of goods
・Estimate time of arrival
・Estimate time of departure

Source: MPWT

② Pilot order for entry

Pilot is compulsory within the port area of Sihanoukville Port and Phnom Penh Port. The ship permitted for entry shall place an order of pilotage to the harbor master by hard copy or fax through KAMSAB.

③ Application for berth / cargo handling job request

Upon the ship entry is permitted, the shipping line's agent shall apply for berthing and request for cargo handling to the port authority by hard copy or fax through KAMSAB.

④ Port entry procedures for Port Clearance Committee

Immediately after berthing of the ship, the shipping line's agent needs to go through the procedures with Port Clearance Committee (hereinafter called as PCC). PCC consists of approx. 10 officers from various government bodies such as port authority, customs, immigration police, quarantine office and KAMSAB. PCC is called by KAMSAB giving the members basic information of the ship. The members gather onboard the ship and examine the documents submitted by the ship. In case of container vessels which have voluminous cargo manifests, PCC is usually held at a conference room in the port authority's building. Master of the ship usually attends PCC meeting. Port authority is in a position to represent PCC. KAMSAB coordinates between government bodies and the shipping line.

KAMSAB prepares "Declaration of Ship's Arrival" based on the information of the ship and cargoes, submitting it to the port authority with copies to all PCC members. After the declaration of ship's arrival is accepted and other procedures with the government bodies are finished, the port authority issues "Port Clearance", with which all PCC procedures are completed and then stevedoring operation is commenced.

Source: OCDI

Figure 4.1-21 Scene of the Port Clearance Committee

Table 4.1-7 List of documents to be submitted to Port Clearance Committee

For port authority with PCC members in copy	・Declaration of ship's arrival
For port authority	・Last port clearance ・Crew list ・Passenger list ・Passemgert personal effects declaration ・Inward cargo manifest ・Ship's certificates (show only) International load line certificate International tonnage certificate International oil pollution prevention certificate Cargo vessel safety equipment certificate Cargo vessel safety construction certificate Cargo vessel safety radio certificate Minimum safe manning certificate ・Bounded store ・International Ship Security Certificate（ISSC） ・Marine Note of Protest (as required) ・Ship's particular ・Arrival condition ・Master request (as required) ・General list
For customs	・Crew list ・B/L copy ・Invoice copy ・Inward cargo manifest ・Passenger list ・Passenger personal effects declaration ・Crew personal effects declaration ・Bounded store declaration ・Currency list ・Provision list ・Deck & Engine store list ・Ship's inventory list ・Article list for duty exemption ・General list
For immigration police	・Crew list ・Passenger list ・Passport or Seaman book ・Inward cargo manifest

	・Master request (as required) ・List of articles forbidden to be used in port ・General list
For quarantine office	・Maritime declaration of health ・Crew list ・Deratization certificate or ship sanitation control certificate ・Inward cargo manifest ・Crew vaccination list ・Quarantine certificate for departure of ship (show only) ・Yellow book ・Provision store list ・Free pratique (Issued to Master for arrival))

Source: KAMSAB

⑤ Departure procedures for Port Clearance Committee

When a foreign-flag ship sails from a port in Cambodia, KAMSAB prepares "Declaration of Ship's Departure" to be submitted to the port authority, going through other necessary procedures as well. After completion of all required procedures and payment of port charges, the port authority issues "Certificate" which gives permission for ship's departure. Without this certificate, the ship is not allowed to leave the port nor to enter into the next port.

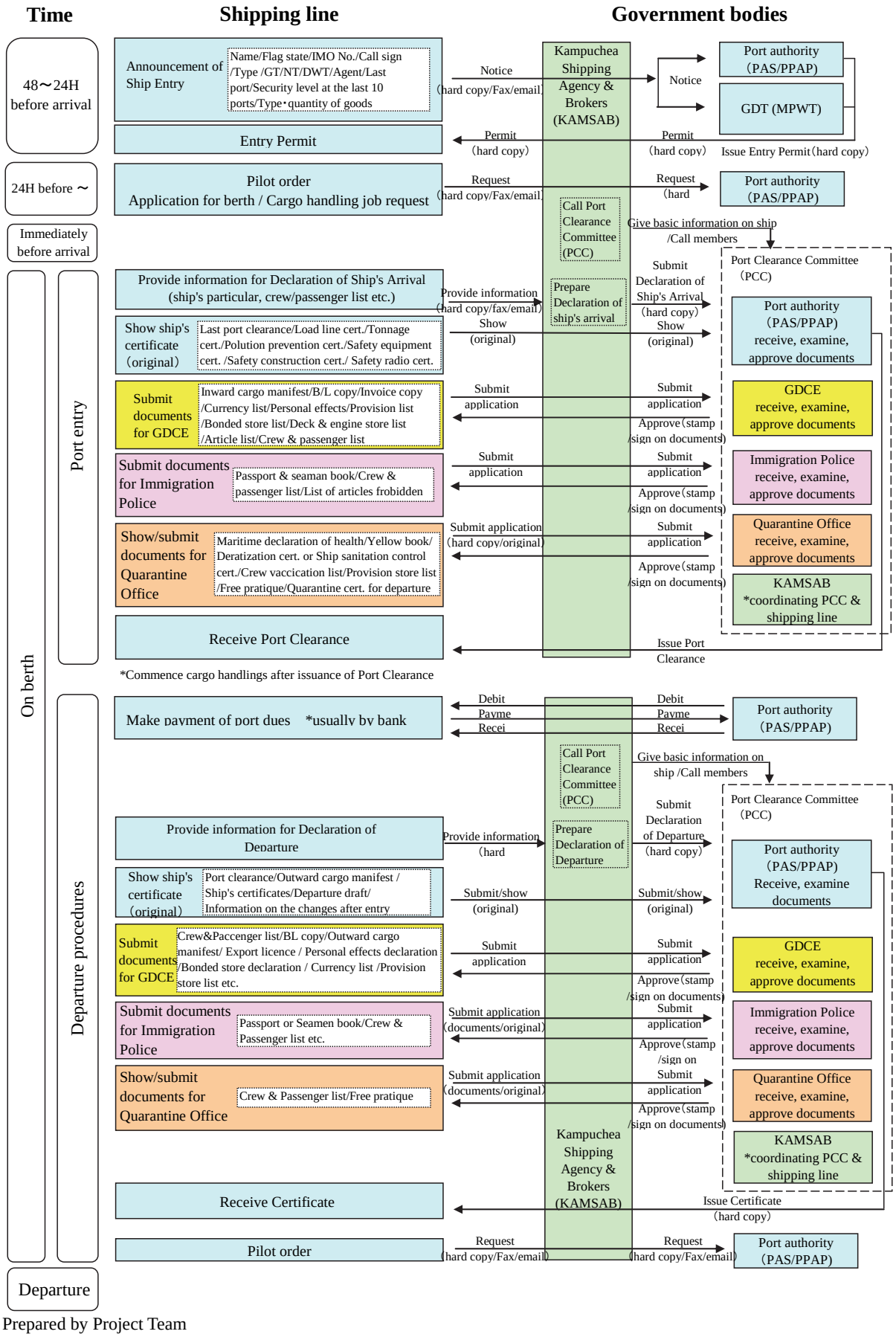
Table 4.1-8 List of documents to be submitted to PCC for port entry

For port authority with PCC members in copy	・Declaration of ship's departure
For port authority	・Port Clearance ・Outward cargo manifest ・Bounded store ・Departure condition ・Master request (as required) ・General list
For customs	・Crew list ・B/L copy ・Invoice copy ・Outward cargo manifest ・Passenger list ・Export licence ・Passenger personal effects declaration ・Crew personal effects declaration ・Bounded store declaration ・Currency list ・Provision list
For immigration police	・Crew list ・Passport or Seaman book ・Outward cargo manifest ・Nil list
For quarantine office	・Outward cargo manifest ・Crew list ・Free pratique (issued to master for departure))

Source: KAMSAB

⑥ Pilot order for departure

The ship permitted for departure shall place an order of pilot to the harbor master by hard copy or fax through KAMSAB.



Prepared by Project Team

Figure 4.1-22 Work flow of port entry procedures

2) Import/export customs clearance

When goods are imported/exported, customs clearance procedures need to be done with GDCE by the importer/exporter. This sub section gives an overview of the import/export customs clearance procedures, with an example of the container cargoes at Sihanoukville Port.

a) Import customs clearance

GDCE has a branch office at Sihanoukdville, which takes charge of all import/export cargoes handled at the ports in Preah Sihanouk Province.

① Discharging of import containers and stacking in the terminal

After berthing of the ship, KAMSAB and PAS watch over the discharging works checking whether the containers discharged are consistent with the description of the inward cargo manifest, and verify the condition of seals. The containers discharged from the ship are stacked at the terminal yard and placed under the custody of PAS. Customs regulations allow 45 days storage in the yard, beyond which a daily penalty of 1% of the value is exacted. Cargoes stored beyond 3 months are transferred to the customs warehouse.

② Submission of Import Declaration to customs

The importer or its agent (customs broker) prepares 3 copies of the Import Declaration with supporting documents such as Commercial Invoice, Packing List, B/L, Import license (if required), Report of Finding (ROF) if an import FOB value exceeds USD 4,000, and submit them to Clearance Point. 1 copy is kept at the Clearance Point, 1 goes to audit team at headquarters, 1 to the importer. Declaration information is validated and scrutinized. The Camcontrol form is also attached to the declaration.

③ Payment of import duty

After assessment, the importer pays import duty in cash or bank guarantee. Storage fee also needs to be paid at this time.

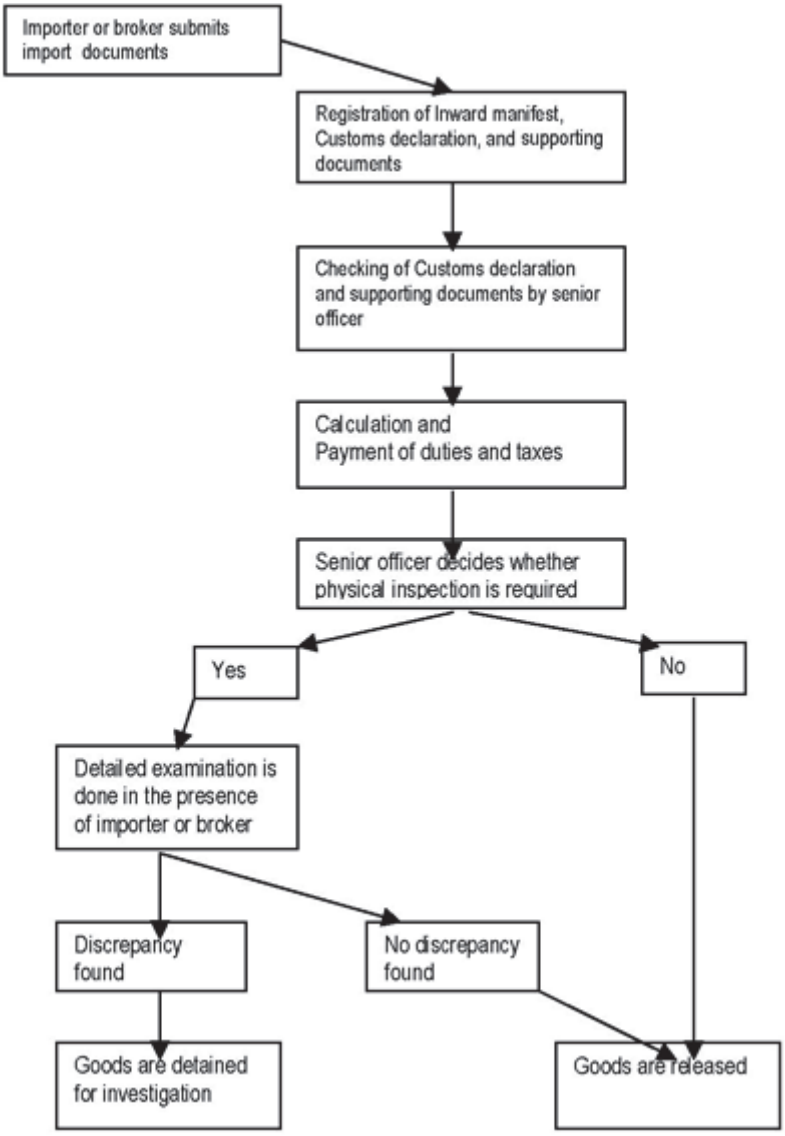
④ Cargo inspection

Customs Examination Team inspects the cargoes simultaneously with Camcontrol. Cargo is classified into 3 categories based on risk assessment: (a) Sealed PSI containers are not examined unless there is reason to suspect irregularities. On a selective basis, a maximum of 5% of containers is to be checked in detail. This was implemented since August 2002. (b) 100% of containers that bypass PSI are subject to detailed inspection. (c) 80% of investment company goods are inspected. Currently x-ray and γ -ray scan machines are installed in PAS compound, by which all import containers need to be scanned in addition prior to the inspection above.

⑤ Release of container

Containers are loaded on trucks for transport. Customs Entrance/Exit Team checks documents and receipts to verify payment, and matches container numbers against Inward Cargo Manifest.

Figure 4.1-23 shows the work flow of import customs clearance procedures.



Prepared by Project Team

Figure 4.1-23 Work flow of import customs clearance procedures

b) Export customs clearance

The majority of goods exported through Sihanoukville Port are garments. Most of those goods are examined by the Export Office in Phnom Penh, and the containers are sealed there. Customs at Sihanoukville port do not reopen the containers, but generally checking the documents and verify the seals on the containers. If everything is in order, containers are loaded on the vessels for export.

① Submission of Export Declaration to customs

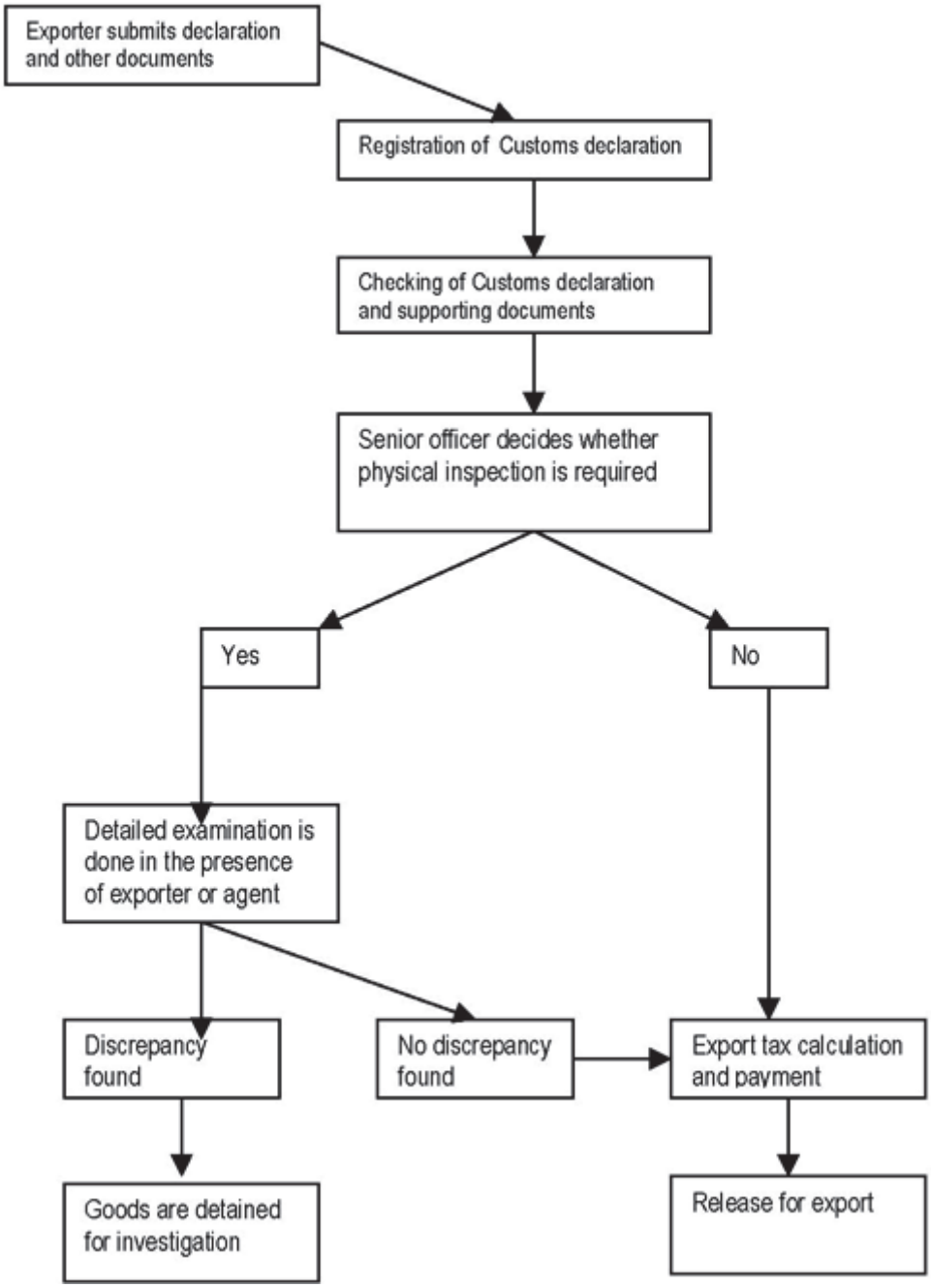
In case of the goods manufactured at the factories and cleared customs in Sihanoukville area, the chief of customs of Sihanoukville sends staffs to carry out the customs formality and examination at the exporter's premise. Export Declaration have to be made triplicate and be submitted to the Customs Office, accompanied with the supporting documents such as Commercial Invoice, Packing List, Export License (if any), Certificate of Origin (if any) etc.

② Cargo inspection

Cargoes must be inspected by GDCE as a spot check. Cargoess are released when documents are approved, the export tax if any is paid, and inspection is completed. Export Office at GDCE headquarters takes charge of garments exports, which examines and seals cargo with a container bolt

seal at the factory. Once they arrive at Sihanoukville Port the documents and container seal are checked by GDCE , and they are loaded onboard vessels. Other goods cleared in Sihanoukville undergo Customs formality and are inspected at exporter's premise by GDCE staffs who are sent by their Chief.

Figure 4.1-24 shows the work flow of export customs clearance procedures.



Prepared by Project Team

Figure 4.1-24 Work flow of export customs clearance procedures

3) Present status of electronic data interchange (EDI)

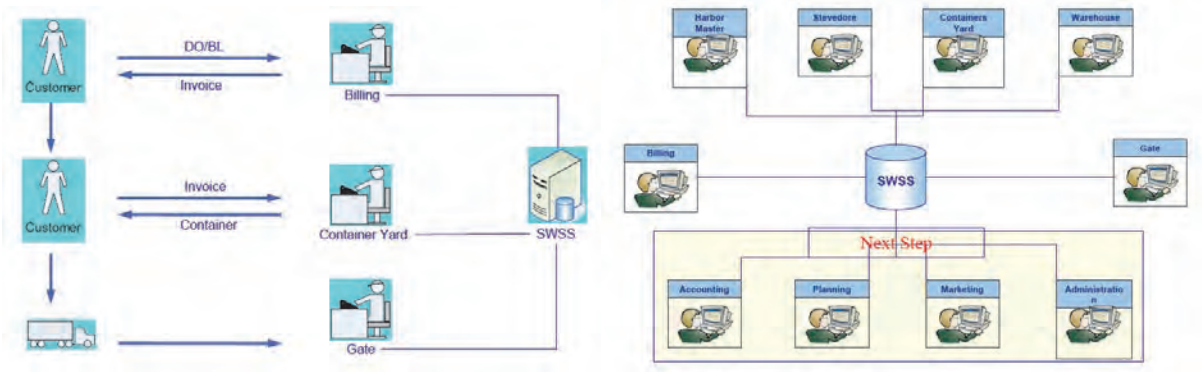
a) Port entry procedures

Currently EDI system for port entry procedures has not yet been developed in Cambodia, except some document data such as Announcement of Ship Entry which are transferred by email, as those procedures are done in principle with hard copies to obtain original stamps and signatures of

government officers in hand-writing on them.

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

However, it is worth noting that at Sihanoukville Port, a working group consisting of PAS, customs, KAMSAB and shipping lines is organized and working on development of an integrated system (called as "single window") connecting gate transaction, yard operation and accounting of PAS sharing information of Delivery Order (D/O), B/L and debit note among the parties concerned in EDI format, which is expected to improve the customer service and internal work efficiency of PAS. Though it is not for port entry procedures, it can be appreciated as an attempt to integrate the information among different parties in EDI format. Figure 4.1-25 depicts the concept of PAS "single window".



Source: PAS

Figure 4.1-25 Conceptual illustration of PAS single window

b) Import/export customs clearance

On the momentum of the consensus among ASEAN countries on "ASEAN Single Window" in 2003 and Cambodia's admission to WTO in 2004, an EDI system for customs named "Asycuda" has been developed from 2006 to 2008 with financial aid by World Bank. Asycuda, standing for "Automated System for Customs Data", is an common application system initially developed by United Nations Conference on Trade and Development (UNCTAD), which contains various functions such as declaration and manifest control, assessment, automated calculation of duties and taxes, database for trade statistics and internal administration etc. However, due to the constrains that 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 for the future, step-by-step improvement needs to be achieved 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. Though there is no clear provision to confine the nature of documents to original papers, there actually seems to be a principle among the relevant government bodies that original papers need to be submitted and approved with original stamps and signatures in hand-writing on them. Those relevant laws and regulations need to be reviewed to introduce/disseminate an EDI system efficiently.

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

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, otherwise to build a new sharing structure.

3) Simplification of documents

a) Overview of FAL Convention

Maritime transportation can be easily disrupted by long delays due to excessive documentation requested at ports of call, long customs procedures and lengthy inspections. Long delays mean extra work for the port and customs authorities, extra costs for the ship owners and ship operators, pressure for the ship masters and crew members who have to deliver the goods on time; cargo loss and even loss of business for importers/exporters.

"Convention on Facilitation of International Maritime Traffic (so called FAL Convention) was adopted among International Maritime Organization (IMO) member countries in 1965. It contains "Standards" and "Recommended Practices" on formalities, documentary requirements and procedures which should be applied on arrival, stay and departure to the ship itself, and to its crew, passengers, baggage and cargo.

The Organization has developed following 7 standardized forms covering arrival and departure of persons and goods, and is promoting the global use of EDI between ships and ports.

Table 4.1-9 7 standardized forms of FAL Convention

FAL Form1	IMO General Declaration
FAL Form2	IMO Cargo Declaration
FAL Form3	IMO Ship's Stores Declaration
FAL Form4	IMO Crew's Effects Declaration
FAL Form5	IMO Crew List
FAL Form6	IMO Passenger List
FAL Form7	IMO Dangerous Goods Manifest
Not stipulated by FAL	Security-related Information required by MSC

Source: IMO

b) Ratification of FAL Convention

FAL Convention has already been ratified by most of Advanced Economies including ASEAN countries as follows. Introduction of FAL forms is absolutely necessary to simplify and standardize the procedures then implement EDI system. It is recommended for RGC to ratify FAL Convention as soon as possible.

Country	Singapore	Thailand	Indonesia	Vietnam	Cambodia	Malaysia	Philippines
Ratification	Yes	Yes	Yes	Yes	No	No	No

4) Implementation of EDI system to port entry procedures

a) Envisaged merit

Following merit is expected in the implementation of 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

b) Transplant of EDI system from an Advanced Economy

It would be a realistic option for RGC to transplant EDI system from an Advanced Economy who has already implemented it, which would save considerable amount of costs and time for the system development by RGC.

① Form of cooperation

It would be a major issue for RGC to maintain the EDI system appropriately after implementation. There are many examples that an EDI system doesn't work effectively due to technical and financial constraints. Therefore, it would be important to make the schedule of cooperation project to cover certain period for maintenance after the commission of the system through technical assistance or ODA loan.

② Area of cooperation

There would be various areas from revision of laws/regulations until ensuring sustainability in operations and maintenance by RGC itself.

(Design of institutional arrangements)

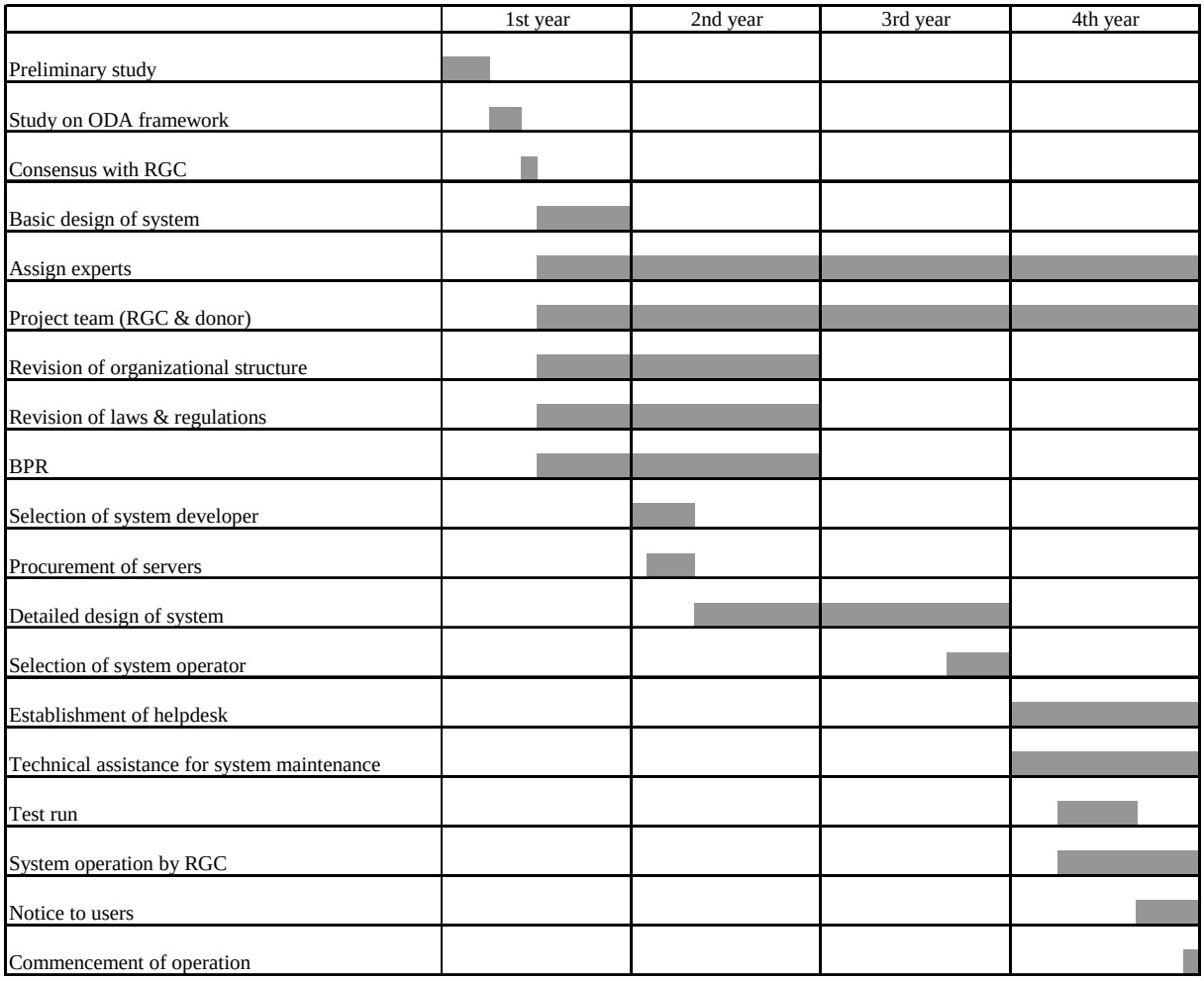
- Support for Business Process Re-engineering (BPR) of overall procedures
- Support for revision of laws and regulations
- Support for enhancement or re-establishment of organizational structures
- Study on streamlining of procedures in terms of FAL Convention
- Study on the are of system coverage
- Advice on the framework of ODA loan
- Policy making on operational support
- Support for the evaluation after implementation and administration of helpdesk

(System engineering)

- Consulting on analysis/identification of information required from BPR view point
- System designing (basic & details)
- Order specification
- Installation of system
- Advice on the administration, operation & maintenance of the system
- Providing the servers
- Advice on the operation & maintenance of the servers
- Support for establishment & operation of helpdesk

③ Process & time of cooperation

Figure 4.1-26 indicates an example of work schedule for implementation of EDI system in port entry procedures. 4 years might be required on full-turn-key basis.



Source: OCDI

Figure 4.1-26 Example of work schedule for implementation of EDI system

④ Role sharing of parties concerned

In order to complete the project in the shortest time, the role of each party on each side of RGC and donor needs to be clearly identified, including demarcation of roles between government sector and private sector. The area for technical assistance and ODA loan needs to be distinguished also. It would be important to adjust the possible conflict of interest among the parties.

(3) Single window system

1) ASEAN Single Window (ASW)

On 9 December 2005, ASEAN has 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.

2) National Single Window (NSW)

A National Single Window (NSW) is an electronic system to facilitate trade, increase efficiency of the delivery system and provide benefits to all members of the trading community, including

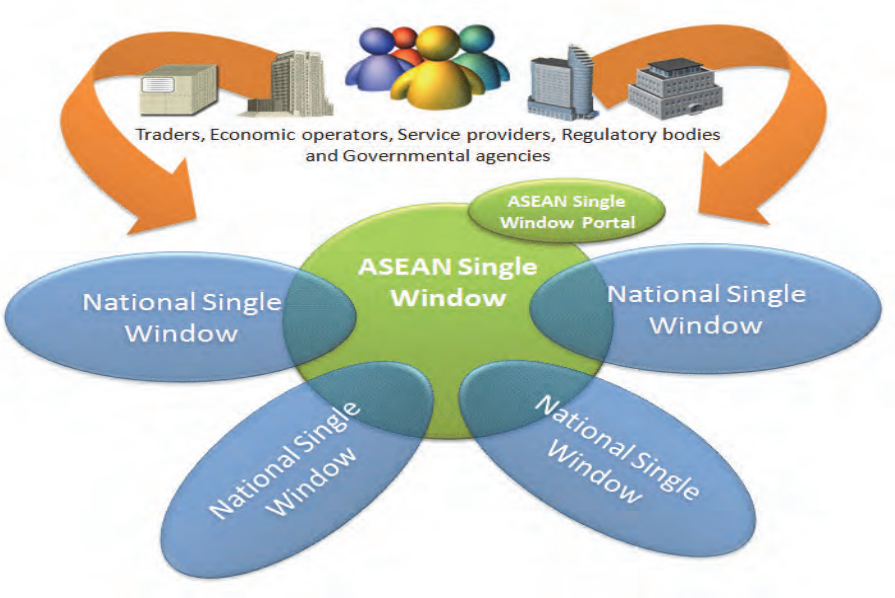
government agencies. The NSW allows:

- A single point of entry for submission of data and information;
- Re-use of data and information to avoid repeated keying-in of data;
- Single synchronous processing of data and information; and
- Quick and easy release and clearance of cargo.

The NSW will involve six major areas of coordinated processing of information and data. These areas of information processing within the NSW are:

- Customs;
- Permit Issuing Agencies / Other Government Agencies;
- Banking and Insurance Agency;
- Transport Community;
- Trading Community; and
- ASEAN / International Link.

Figure 4.1-27 depicts the concept of ASW and NSW.



Source: OCDI

Figure 4.1-27 Conceptual illustration of ASEAN Single Window and National Single Window

3) Issues for RGC to build NSW

ASEAN recognizes that the success in the implementation of NSW depends on following points, which must be true with Cambodia also:

- Strong political commitment to establish an “e-governance” in the member state to lead toward the single window.
- Development of human resource 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.

4) Inter-state alliance to discuss technical issues

The Pan-Asian E-Commerce (PAA) was founded in July 2000 by Crimson Logic (Singapore), TRADE-VAN Information Services Co. (Taiwan), and Tradelink Electronic Commerce Limited (Hong Kong). More memberships were subsequently accepted and now PAA comprised of 11 Members as follows:

State	Name of members
Singapore	Crimson Logic
Taiwan	Trade Van
Hong Kong	Trade Link
Korea	KT NET
China	CIECC
Japan	NACCS center
Macau	TEDMEV
Thailand	CAT Telecom
Philippines	Inter Commerce Network Services
Indonesia	P.T. EDI Indonesia
JAPAN	JASTPRO

As above members are the largest single window operators in each country, combined customer base of the PAA members now exceeds 150,000 organizations, representing almost all active trading enterprises in the Asian market.

As PAA is working on building a technical de facto standard of e-commerce in Asia region, ASW is expected to adopt the standard to be established by PAA. 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)

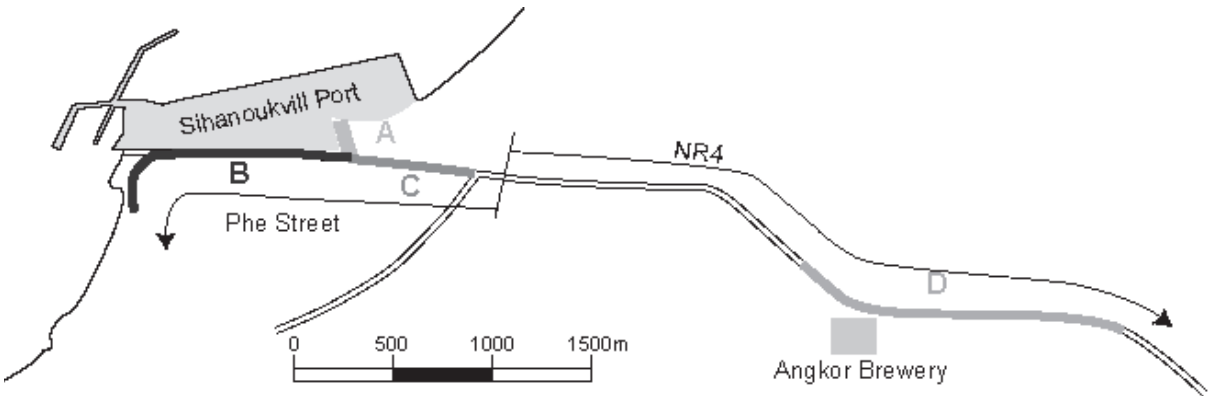
At present, four container vessels (MCC/RCL/ACL/APL) have called Sihanoukville Port on Friday, and heavy traffic congestion due to container trucks transporting import/export cargoes occurred on Phe Street, which connects NR 4 and the approach road, every Saturday.

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) Traffic condition survey

The project team conducted a preliminary traffic condition survey from 22:00 of 29 July 2011 to 3:00 of 31 July 2011 to grasp the traffic trends. Then, they conducted a focused survey from 5:00 of 17 September 2011 to 3:00 of 18 September 2011 based on the results of the preliminary survey. Details and the method of the survey are as follows:

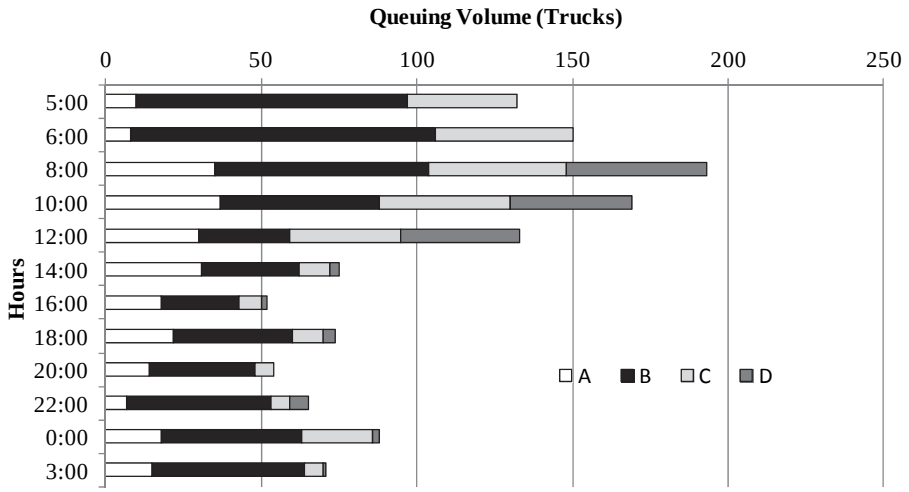
- Queuing Volume Survey: Count the number of parked trucks around the gate. The queuing area is partitioned into four as shown in Figure 4.1-28
- Traffic Volume Survey: Count the number of container trucks passing each direction at a point located 1.5 km east of Angkor Brewery on the NR 4.



Prepared by Project Team

Figure 4.1-28 Section of queuing volume survey (A/B/C/D)

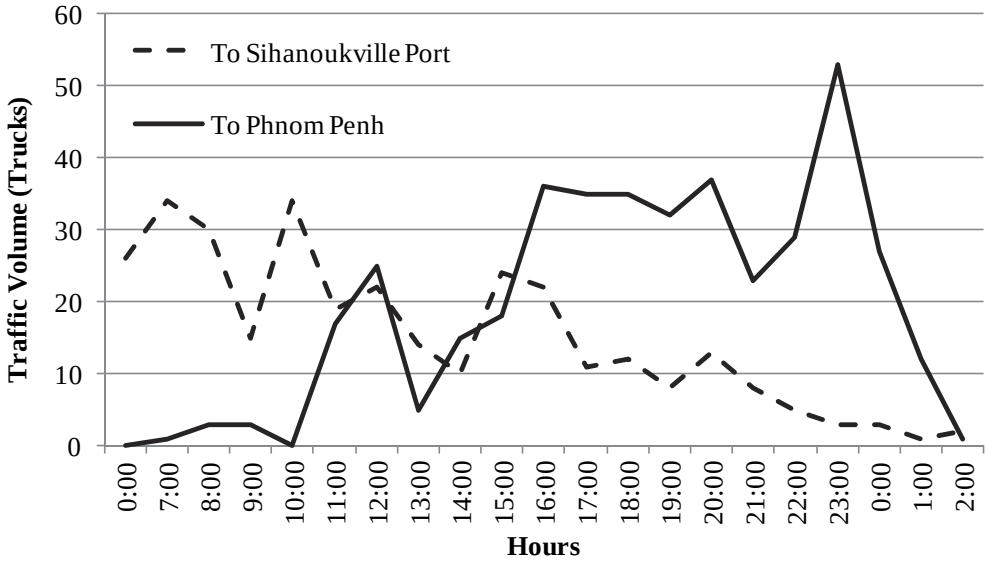
Figure 4.1-29 shows the results of the queuing volume survey. The queuing volume increased until 8:00 and then suddenly decreased. The opening time of the gate is at 7:00. Accordingly, the queuing volume was supposed to peak at 7:00. Queuing volume in Section-D was counted from 8:00 to 12:00 only while traffic police executed the traffic control as mentioned above. There are always some vehicles parked in Section-A, Section-B at side lanes (parking) and Section-C at side lanes (parking). This is because of the queuing trucks, while waiting for the port entry through the gate (in case of importing, Delivery Order, Carrying Sheet, Import Declaration, Invoice and so on).



Prepared by Project Team

Figure 4.1-29 Results of the queuing volume survey (17–18 September 2011)

Figure 4.1-30 shows the results of the traffic volume survey. The number of trucks towards Sihanoukville Port (gate-in) peaked at 34 vehicles/hr at both 7:00 and 10:00, and then gradually decreased. While the number of trucks towards Phnom Penh (gate-out) gradually increased from 6:00, peaked at 53 vehicles/hr at 23:00, and then suddenly decreased. It was remarkably observed that the number of trucks towards Sihanoukville Port was more than that towards Phnom Penh in the morning, and the said situation was reversed in the afternoon.



Prepared by Project Team

Figure 4.1-30 Results of the traffic volume survey (17–18 September 2011)

3) Target of the alleviation

When the congestion overwhelms during 7:00-10:00 on Saturday, the gate approach road and Phe Street T-intersection area is converged by trucks, consequently the congestion increasingly worsen since the truck queuing on the road, and hence becomes unable to secure the effective width of the road carriageway. As the result, the passing through passenger vehicles and motorcycles are blocked, and disrupting on the general public and their livelihood. The traffic congestion and on road queuing have greater adverse impacts on social economics, such as inciting road accidents, increasing environmental damage and running cost of truck. Therefore, to prevent truck queuing on the road, in

consideration of the parking spaces on Phe Street, the improved port gate operation is of urgent task.

(2) Measures for peak shaving

A major commodity which is handled at Sihanoukville Port is garment produced in such facilities as SEZs. The garment is made with such material as textile which is imported through Phnom Penh Port or Sihanoukville Port.

The materials for garment are delivered to factories at beginning days of week and then they are sewed to cloths. The production completion is obliged to be concentrated at weekend because it takes long time to finish production from the arrival date of materials. The produced cloths are subject to inspection by buyers before export. Aiming at weaken the intensity of the inspection and resulting less disqualification, producers use to intend concentrate the production completion date at weekend. As a result, the generation of garment export containers is concentrated on Fridays. In correspondence with the weekend generation of export containers, container ship calls are concentrates on Fridays and Saturdays as shown in Table 4.1-10.

Traffic congestion by container trucks is observed in the vicinity of Sihanoukville Port container terminal on weekend days by the above facts and the following reasons.

1) Since the container terminal gates are closed between midnight and 7 AM, arriving trucks should wait near the container terminal. The waiting container trucks which oblige to park roadsides due to insufficient provision of parking areas develop traffic congestion in the vicinity.
2) Even the container trucks arrive at the terminal during the gate opening time, the trucks should wait for the arrival of Joint Inspection Report (JIR) which is issued jointly by customs and Camcontrol. The JIRs are issued for each shipment lot but each container. The JIR are not able to be issued before the completion of staffing of one lot shipment. Without waiting for the issuing of JIR, complete container trucks depart to Sihanoukville Port successively. Issued JIRs are delivered to Sihanoukville Port by other cars by taking 3-4 hours from factories or ICDs.

The following measures will be needed for the peak shaving of traffic;

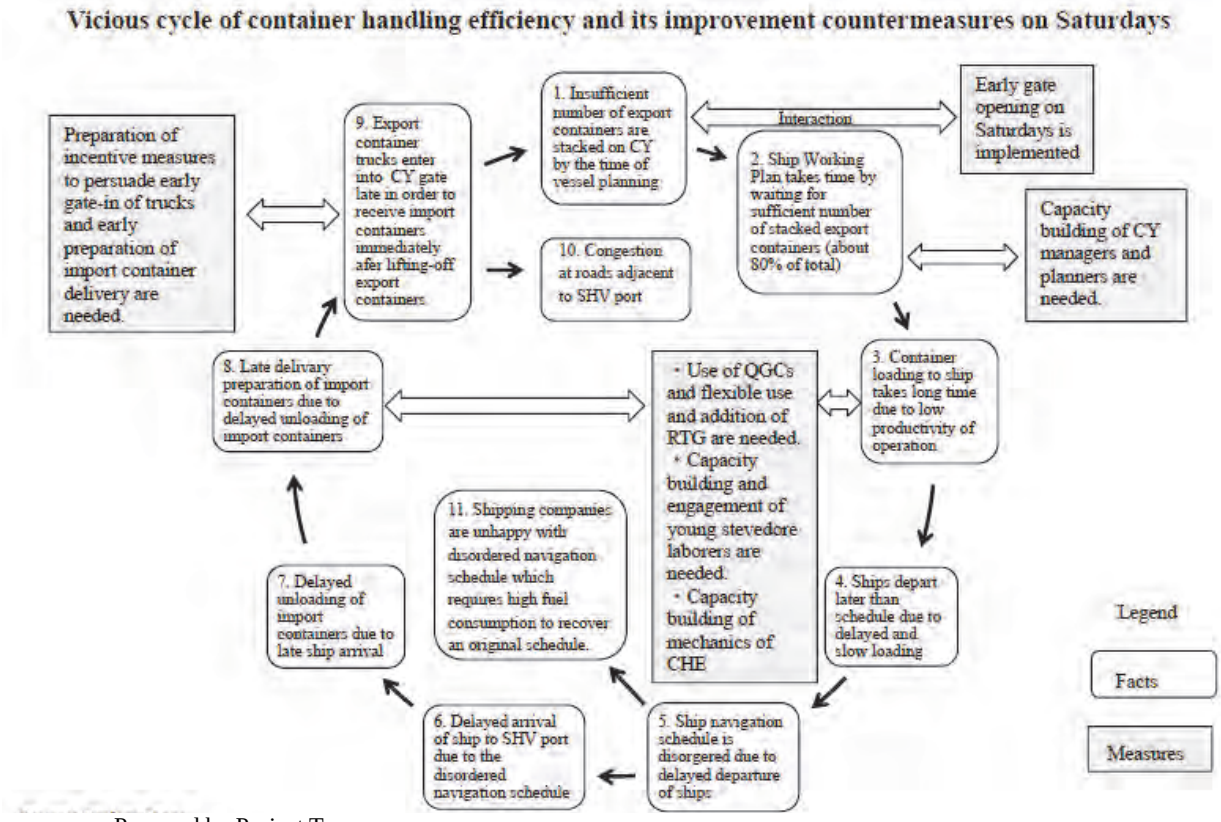
1) To provide incentives such as the reduction of container handling charges for early arrival of export containers in the week aiming at dispersing arrival days. By such measures, fabrication factories will hasten the production and send them early in the week.
2) To send JIRs by means of FAX instead of delivery them by cars. With this practice, container trucks need not any more to wait JIRs. This results in avoiding unnecessary waiting time of trucks which develops traffic congestion near the container terminal.
3) In order to persuade trucking companies to send containers as much as early, PAS campaigns to trucking companies about advantages of the early sending of containers to the port which results in the increase of turnover of truck operations.
4) In order to eradicate a vicious cycle which is shown in Figure 4.1-31 in relation with container handling efficiency, turnover of truck operations and ship navigation schedules, PAS and relevant organizations open the container terminal gates as early as 4 AM, for instance, on traffic concentration days such as on Saturdays. With this practice, all parties such as garment producing companies, trucking companies shipping companies and PAS can enjoy benefits of production increase and cost reduction.

Table 4.1-10 Container Ship Calling at Sihanoukville Port

Container Ship Calling at Sihanoukville Port

	Shipping line	Frequency	Turnround	Interval (days)	Vessels deployed	Fleet capacity (TEU/service)	Average capacity/vessel (TEU)	Number of voyages /year	Fleet capacity /year (TEU)	Calling ports	Vessel name (capacity; TEU)	Departure day
1	MCC Transport	weekly	28	7	3	4,877	1,626	39	63,575	Laem Chabang-Ho Chi Minh-Hong Kong-Kaohsiung-Shanghai-Osaka-Tokyo-Yokohama-Nagoya-Kaohsiung-Hong Kong-Yantian-Ho Chi Minh-Sihanoukville-Laem Chabang	Convent (1,686) St.Mary (1,679) San Lorenzo (1,512)	Fri
2	MCC Transport	weekly	7	7	1	1,030	1,030	52	53,707	Penang-Port Klang-Tanjung Pelapas-Singapore-Sihanoukville-Tanjung Pelapas-Singapore-Port Klang-Penang	Oel Blessing (1,030)	Sat
MCC Total					4	5,907	1,477	91	117,282			
3	CNC Line	weekly	28	7	1	1,716	1,716	13	22,369	Laem Chabang-Ho Chi Minh-Hong Kong-Kaohsiung-Shanghai-Osaka-Tokyo-Yokohama-Nagoya-Kaohsiung-Hong Kong-Yantian-Ho Chi Minh-Sihanoukville-Laem Chabang	As Scandia (1,716)	Fri
CNC Line Total					1	1,716	1,716	13	22,369			
4	Regional Container Lines	weekly	21	7	3	1,884	628	52	32,746	Songkhla-Hong Kong-Haiphong-Hong Kong-Keelung-Taichung-Hong Kong-Sihanoukville-Songkhla	Ora Bhum (628) Pira Bhum (628) Ratha Bhum (628)	Fri
5	Regional Container Lines	weekly	7	3.5	2	1,778	889	104	92,710	Singapore-Sihanoukville-Songkhla-Singapore	Lila Bhum (889) Kiti Bhum (889)	Thu, Sat
RCL Total					5	3,662	732	156	125,456			
6	Advance Container Lines	weekly	7	7	1	604	604	52	31,494	Singapore-Sihanoukville-Songkhla-Singapore	Kota Delima (604)	Sun
ACL Total					1	604	604	52	31,494			
7	APL	weekly	7	7	1	319	319	52	16,634	Singapore-Laem Chabang-Sihanoukville-Singapore	Colombo (319)	Sat
APL Total					1	319	319	52	16,634			
8	Cots Shipping	bi-weekly	14	14	1	198	198	26	5,162	Songkhla-Sihanoukville-Songkhla	Chiang Tun (198)	Tue
Cots Total					1	198	198	26	5,162			
Total					13	12,406	5,046	391	318,397			

Prepared by Project Team



Prepared by Project Team

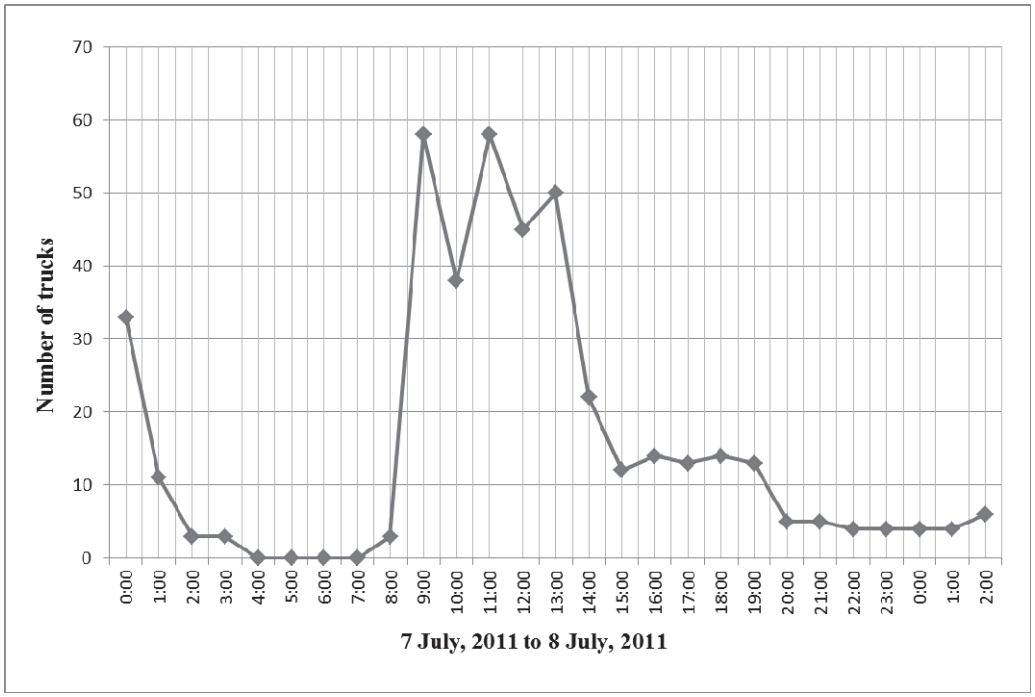
Figure 4.1-31 Vicious cycle of container handling efficiency and its improvement countermeasures on Saturdays

(3) Enhancement of the capacity of the port gates

1) Present capacity of the port gates

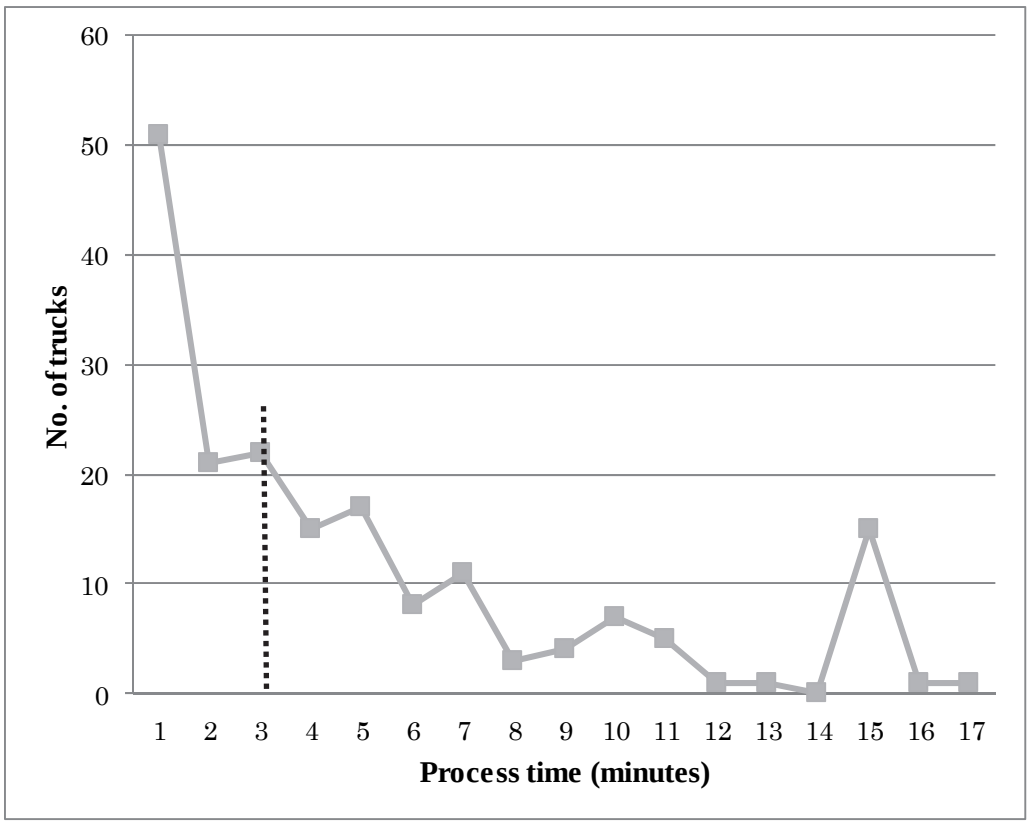
Number of trucks entering the 3 gates of the container terminal on July 29, 2011 is recorded by the Container Terminal Management System (CTMS) as shown in Figure 4.1-32. In accordance with Figure 4.1-32, the maximum capacity of the gate entering process is estimated at 40-60 trucks/hour/3gates. The process capacity at a gate per hour can be estimated as 14-20 trucks. Consequently, the entering process time per truck can be estimated as 3-4 minutes.

Measurement of the gate entering process time of stuffed container trucks was conducted on July 30, 2011. The result of the measurement is as shown in Figure 4.1-33. Measured gate entering process time varies between 1 and 17 minutes. By this measurement record, the gate entering process time can be estimated as 3 minutes on average.



Prepared by Project Team

Figure 4.1-32 CTMS record of entering truck number

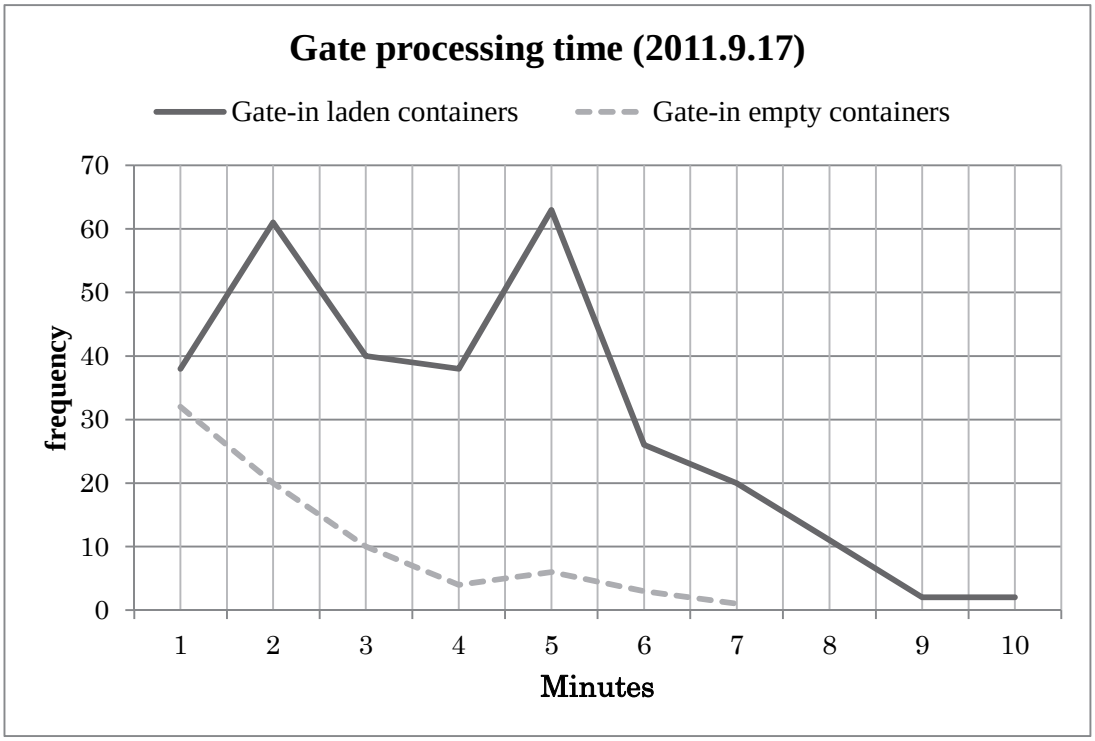


Prepared by Project Team

Figure 4.1-33 Gate entering process time of stuffed containers

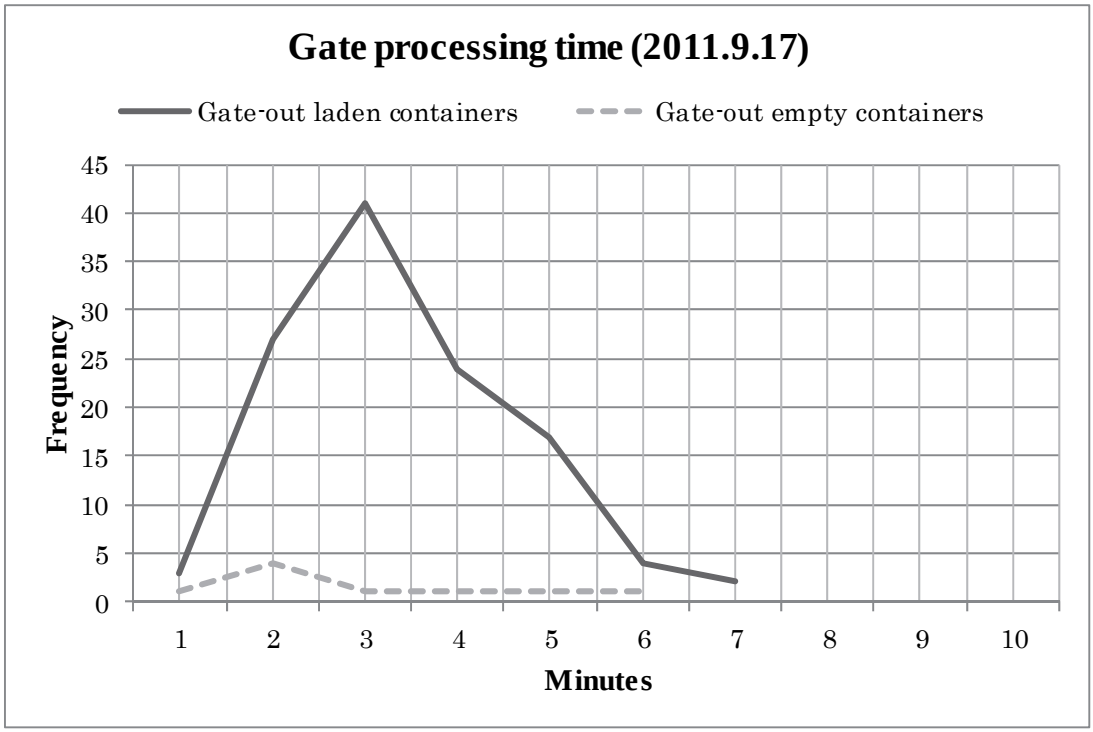
In addition to the above, the gate processing time record of PAS on September 17, 2011 indicate that an average gate processing time is estimated at about 3 minutes as shown in Figure 4.1-34 and Figure 4.1-35.

The above gate processing time, however, is a value which is measured from entry until exit of PAS's gate. Trucks normally need a time which is required for checking of lift-on/lift-off receipts by PAS and inspection of containers by customs and Camcontrol before entering PAS's gate. A total gate processing time including the above times can be estimated at 6-7 minutes.



Source: PAS

Figure 4.1-34 Gate-in process time



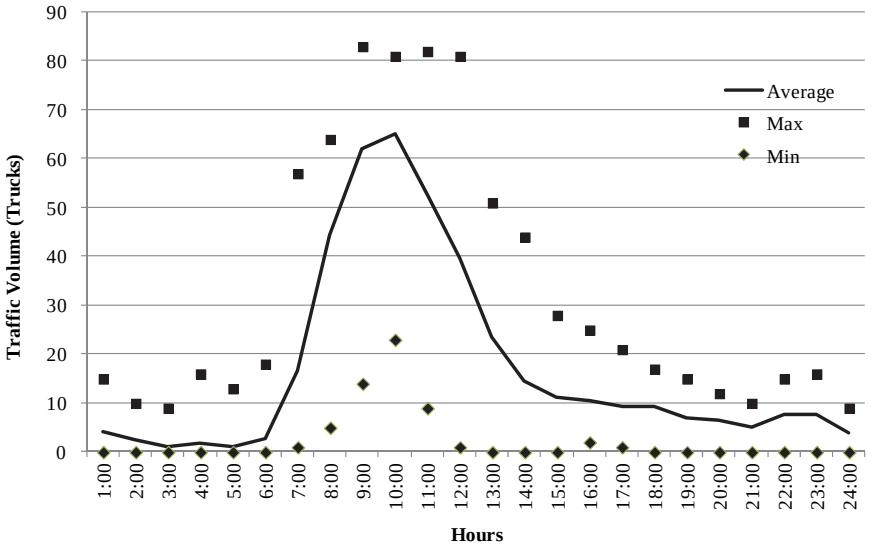
Source: PAS

Figure 4.1-35 Gate-out process time

2) Target of the capacity enhancement

If provisional parking spaces (of gravel pavement and reverse angle parked vehicle distance between: 2m) are provided, 34 vehicles at Section B, and 34 vehicles more at Section C of 45' container loaded trucks are able to park on the roadside. These parking spaces are used as a truck's waiting area to receive necessary documents from the customs brokers for the gate entry. It could be expected that the number of queuing truck waiting for documents will be reduced by speeding up the document issuing procedures, or extending the procedure hours, however, there is a need to maintain the functionality as a waiting area. Therefore, the parking space on Phe Street is thought to be not directly contributing to relieve the traffic congestion by the trucks heading towards the port's gate entrance.

Hourly gate-in volume of truck with export container on Saturday from 11th November 2011 to 21st January 2012 is shown on Figure 4.1-36. Maximum number of hourly entering trucks is around 80 vehicles/hr. Later mentioned before and after improvement on the maximum number of hourly traffic volume heading towards the Sihanoukville Port was 35 vehicles/hr and 46 vehicles/hr respectively. The gate's hourly processing ability is above the hourly maximum traffic volume of trucks heading towards the port's gate entrance. Therefore, by extending the gate operation and document processing service hours, it is possible to equalize the number of trucks entering through the gate. By doing this countermeasure, the traffic congestion occurring on Saturday morning can be relieved.



Source: PAS

Figure 4.1-36 Hourly gate-in volume of truck with export container on Saturday (11th November 2011 – 21st January 2012)

3) 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 4.1-11.

Table 4.1-11 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

(4) Securing parking space

1) Hearing of Opinions about Improvement of Congestion around Sihanoukville Port from the Governor of Preah Sihanouk

During a courtesy visit to the Governor of Preach Sihanoukville, the policy on the traffic congestion improvement around the port was questioned by the study team. In response, 3 points were raised; 1) To widening the main access road NR4 to Sihanoukville, 2) To construct detours and/or purpose-built roads for container loaded heavy vehicles, and 3) To secure heavy vehicle parking areas. These were often the discussion agendas on the development of Preah Sihanoukville, and the study team was able to re-confirm the improvement plan which had been considered.

2) Consideration of Preparation of Parking/Waiting Space

The traffic congestions occurs on the roads around the port during the arrival peaks of container loaded heavy vehicles, mainly because of the traffic flow of heavy vehicles coming from Phnom Penh way and the passenger vehicles and motorcycles heading the other way collide. There are some cases when the Police introduce the traffic restriction on the worsening congestion, especially on the morning of every Saturday when heavy vehicles converge from Phnom Penh to the port. The conditions of the congestion are as per below diagram.

Traffic Congesion at in front of the Access Raod to the Port

Traffic Restriction by Police

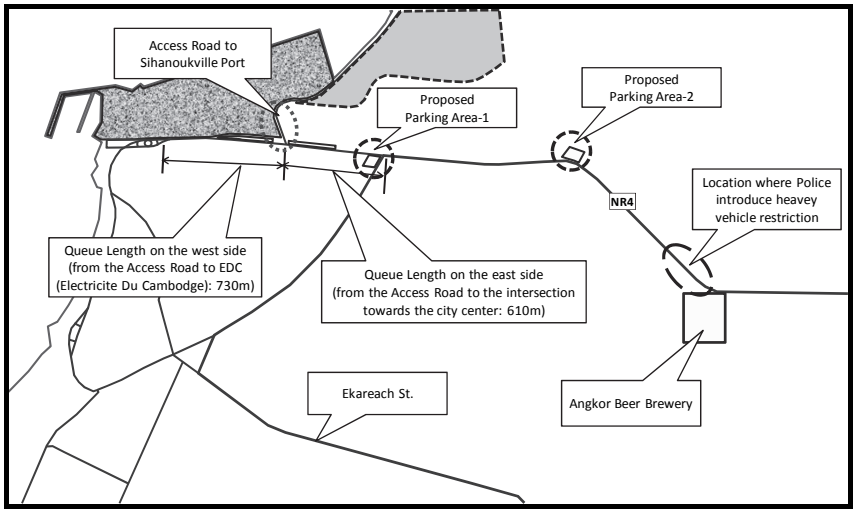
Prepared by Project Team

Figure 4.1-37 Traffic congestion occured around Sihanoukville Port

As can be seen from the above pictures, 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.

The parking/waiting areas for heavy vehicles were investigated as an effective measure to relieve the congestions. At first, the typical length of heavy vehicles queue was estimated. It was found that the queue, which forms on the west side of the port access road extended to around the EDC (Electricite Du Cambodge), and on the east side of the port access road extended to the intersection towards the city center.

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. The two proposed locations of parking area are as per below.



Prepared by Project Team

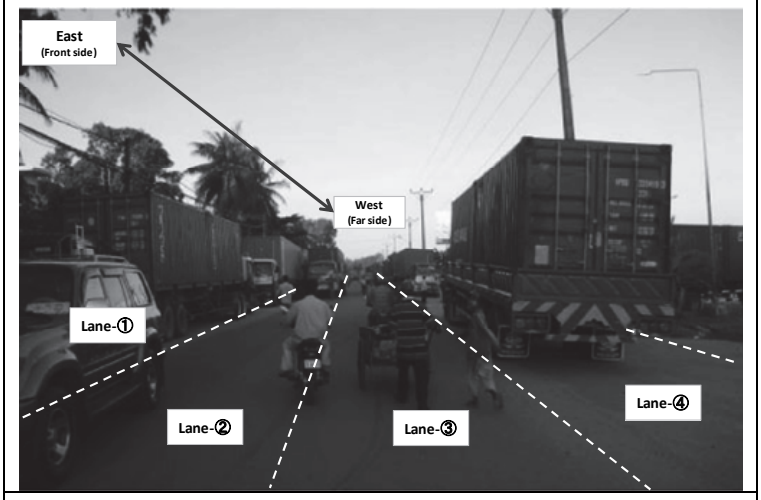
Figure 4.1-38 Proposed location to develop a parking/wating space around Sihanoukville Port

Approximately 30 and 50 heavy vehicles are able to park in the proposed parking area 1 and 2 respectively. Furthermore, because there are no existing buildings and further 20 heavy vehicle parking lots which become available can be developed in the parking area-2. In total, 100 vehicles can be accommodated in both areas. Besides providing these parking areas, the permanent traffic controllers are needed to be positioned and manage the traffic flows around the port area and access road queues by communicating to each others.

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.

a) The two-way traffic flow can be maintained by controlling the vehicle parking location and direction.

In consideration of enough carriageway widths for 4 vehicles to pass through in parallel, it should be secure a space to allow the two-way traffic at least. The vehicles from Phnom Penh should only be parked on the outbound road side and westward.



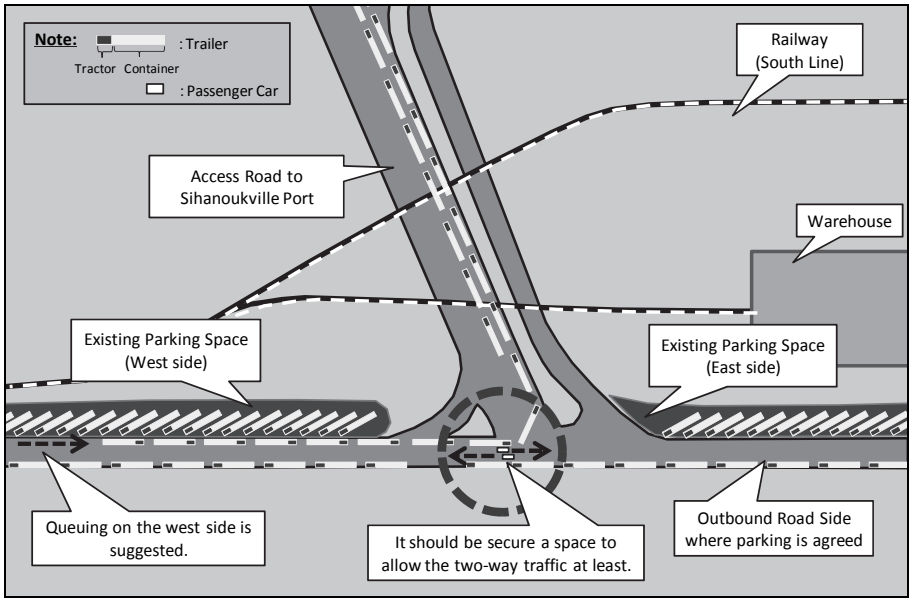
Width of the Existing Road at in front of the Access Road
(for 4 vehicles to pass through in parallel)

Prepared by Project Team

Figure 4.1-39 Width of the existing road

b) The vehicle queuing layout on the port access road is determined to regulate the traffic flow.

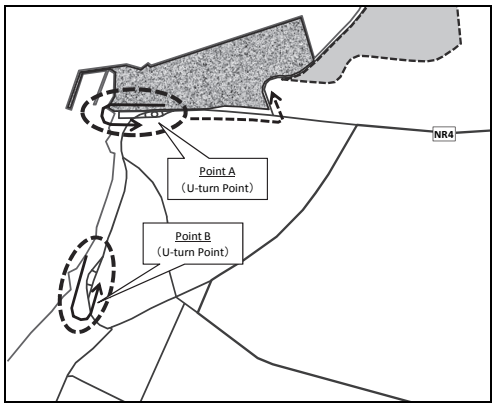
The congestion occurs around the port access road entrance intersection, because vehicles queue on both the east and west side the port access road. The vehicle queuing direction shall only be in one direction, and queuing on the west side is suggested (see below image). The traffic controllers are needed to guide the vehicle entry/exit from the existing parking areas to utilize itas per below.



Prepared by Project Team

Figure 4.1-40 Vehicle queuing and parking direction

The heavy vehicles from Phnom Penh way must take a U-turn at the point A on the below diagram and queue in the line, after passing through the access road. If the queue becomes too long for vehicles to take U-turn at the point A, then the point B is suggested as an alternative point of U-turn.



Prepared by Project Team

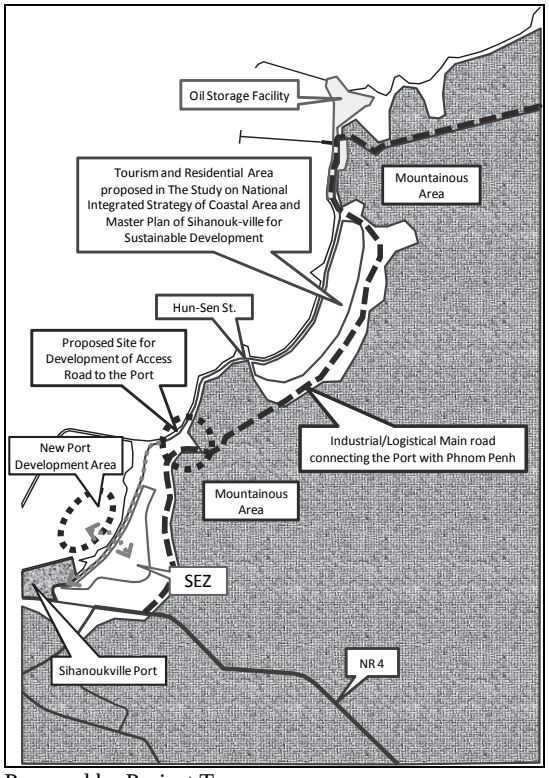
Figure 4.1-41 Location of u-turn Points

(5) Road network improvement

The development outline of industrial/logistical main road connecting the port with Phnom Penh was mentioned in section 2.4.2 previously. The section between Stung Hav and the port along this main road is required to take in consideration of the followings into the proposed new port access road plan.

- Accessibility
- Land use plan
- Existing residential area
- Minimal vertical profiled road route selection

The proposed new port access road is shown as below.



Prepared by Project Team

Figure 4.1-42 Proposed Route of Industrial/Logistic Road between Stung Have and Sihanoukville Port

If the new part access road is developed, which is diverted from the section mentioned above, it arrives at the port via Hun-Sen Street located at densely populated area. Therefore, it is required for extensive safety measures on the heavy vehicle traffic. The details of these safety measures are as below.

- Drive at reduced speed for pedestrian's safety
- Prohibited prolonged road side parking
- Patrolling by Road Safety Inspectors

(6) Urgent project for alleviating traffic congestion

1) Contents of the urgent project

The target of this project which aims at strengthening competitiveness of Sihanoukville Port is to obtain customer's satisfaction with the port. In order to achieve the target, it is necessary to increase gate capacity by enhancing container handling capacity and reducing port operation cost. As a result, the traffic congestion in and around the port can be alleviated.

Container handling improvement methods are shown in **4.1.1 Improvement of Container Operation** in detail. And measures for enhancing the capacity of port gates are as shown in Table 4.1-11. Some measures in Table 4.1-11 can be implemented urgently and their impact will be examined immediately. 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. This results in traffic congestion on the Road No.4 and Phe Street and consequently hinders ordinary road traffic.

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.

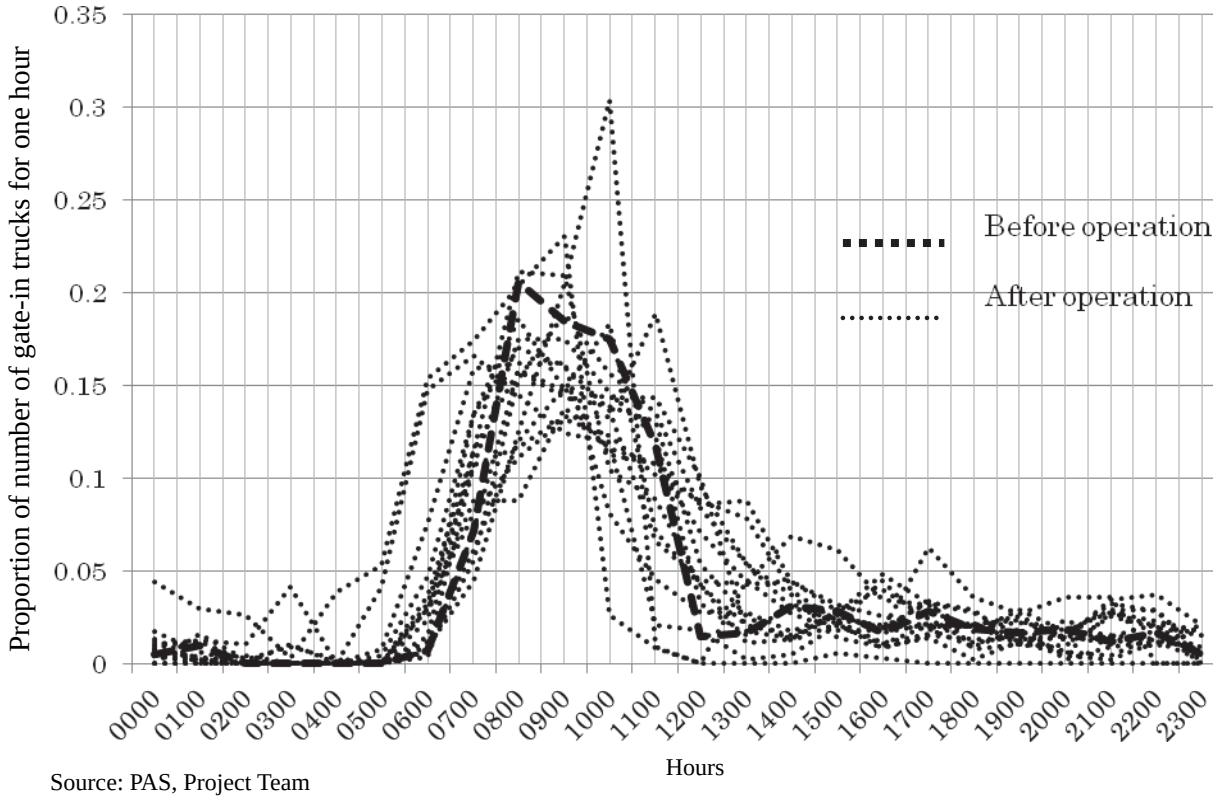
2) Effects of the urgent project

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.

The early (4:00 AM) gate opening operation began on October 15, 2011 (Sat.) with the cooperation of customs. Figure 4.1-43 shows the results of analysis of hourly gate-in truck number record obtained from CTMS on 15 Saturdays until January 21, 2012 and on October 7, 2011 (Sat.) which is the day before the beginning of the operation.

Before the early gate opening operation, trucks entered the gate after 7:00 AM as illustrated by the thick dotted line in Figure 4.1-43. The number of hourly entering trucks varies with observation days as illustrated by thin dotted lines. However, it is confirmed that the number of entering trucks increases from 5:00 AM.



Source: PAS, Project Team

Figure 4.1-43 Proportion of the numbers of entering trucks per hour against the numbers of total trucks per day before and after the early gate opening operation

Effect of the early gate opening on the ability to effectively conduct the preparation of container loading plan, which is another objective of the early gate opening operation, was investigated by interviewing a yard planner of the container terminal department. The findings are shown in Table 4.1-12.

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.

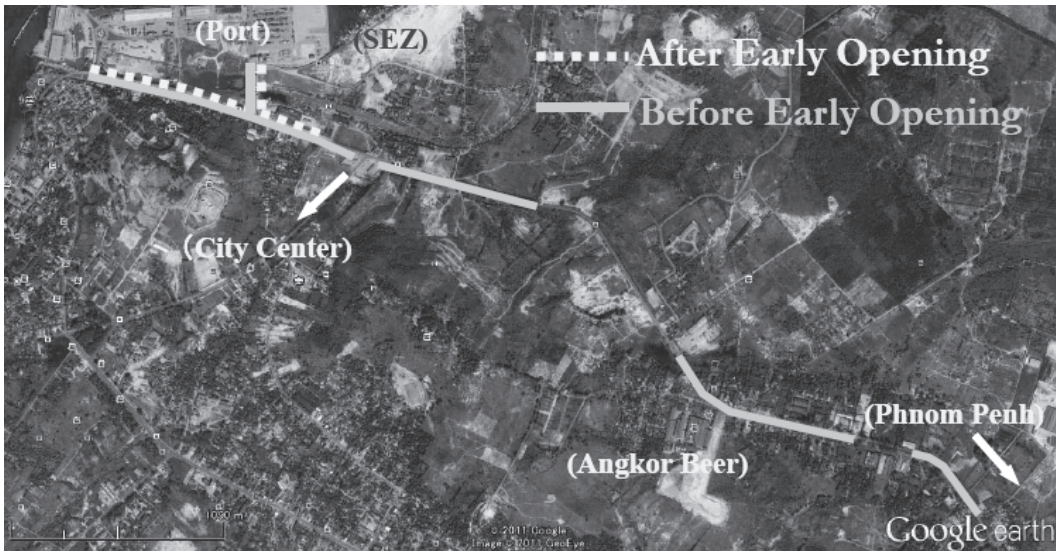
Table 4.1-12 Proportion of numbers of the entered containers against the total numbers of containers expected

	10:00	11:00	12:00
Before early gate opening	—	40%	40-50%
After early gate opening	65-70%	80%	90%

b) Alleviation of traffic congestion

As shown on Figure 4.1-44, on a Saturday in the late October after the implementing traffic congestion improvement, the queue was shorter in Section-C, and the end of the queue was at about in front of Sihanoukville Railway Station. Therefore, no restriction of truck at in front of the Angkor

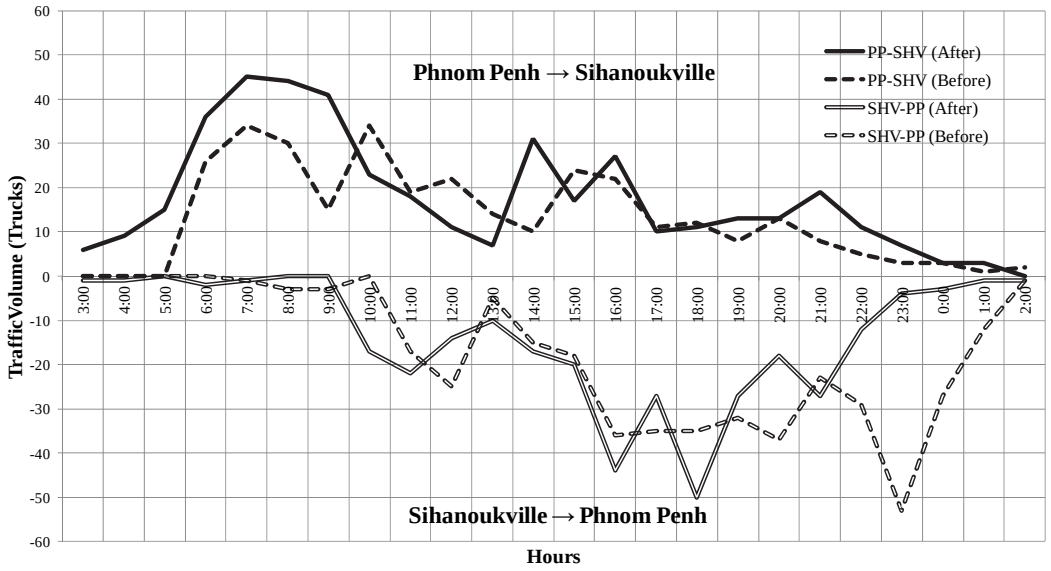
Brewery was observed.



Prepared by Project Team

Figure 4.1-44 Queuing condition before and after the congestion improvement

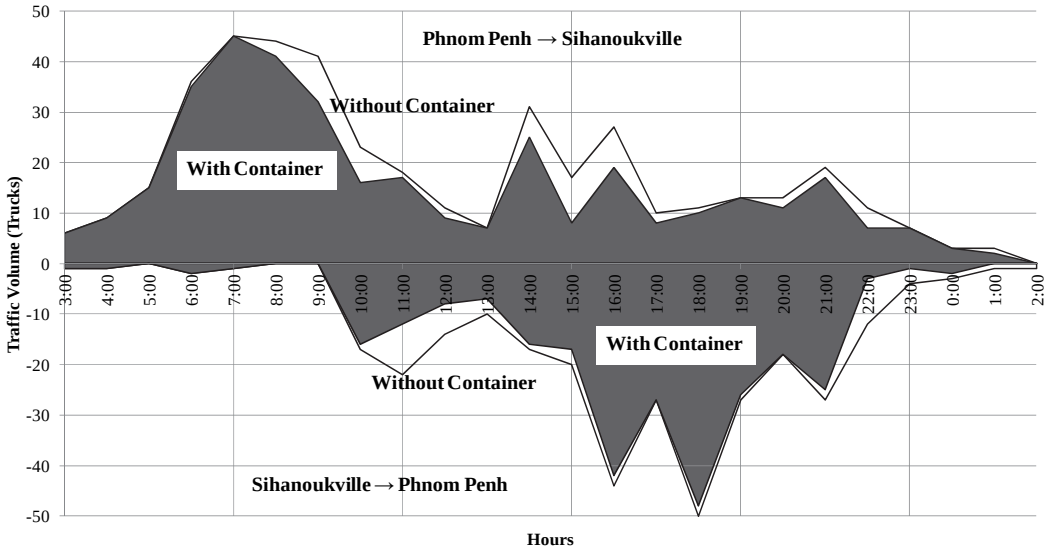
A confirmation survey was carried out by the project team from 3:00 of 17th December 2011 to 3:00 of 18th. The truck traffic volume per hour before and after implementation of the congestion improvement is shown on Figure 4.1-45. The truck heading from Phnom Penh to the port reached the maximum number of 35 vehicles/hr at 7:00 before the implementation and 46 vehicles/hr after the implementation, and gradually decreased after. On the other hand, the truck heading from the port to Phnom Penh increased gradually from the gate open hour, and reached the peak of 53 vehicles/hr at 23:00 before the improvement, and 44 vehicles/hr at 16:00, 50 vehicles/hr at 18:00 after the improvement.



Prepared by Project Team

Figure 4.1-45 Traffic volume survey result before and after the congestion improvement

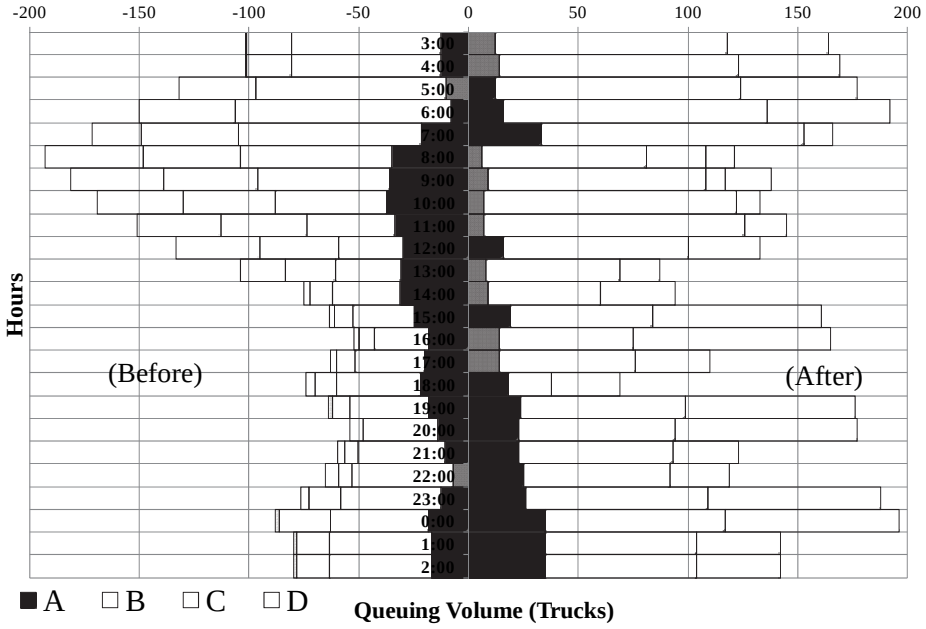
The hourly traffic volume of truck with and without container after the improvement is shown on Figure 4.1-46. There were no remarkable difference observed on both sides, and the ratio of trucks without container only against the total traffic volume was 14% for both sides.



Prepared by Project Team

Figure 4.1-46 Loading situation of traveling trucks after the congestion improvement

The hourly queuing volume of trucks before and after the improvement is shown on Figure 4.1-47. The peak queuing volume was 2 hours earlier at 192 vehicles on 6:00 after the improvement, compared to 193 vehicles on 8:00 before. Also, the entry restriction was 2 hours shorter from 8:00 to past 9:00, but the number of queuing vehicle did not show any reduction. According to the gate operation statistics for export containers obtained from PAS, the earlier gate opening routine was not fully effective on the survey date of 17th December 2011. Because of this, the reductions like the previously mentioned Saturday on late October immediately after the improvement was not observed.

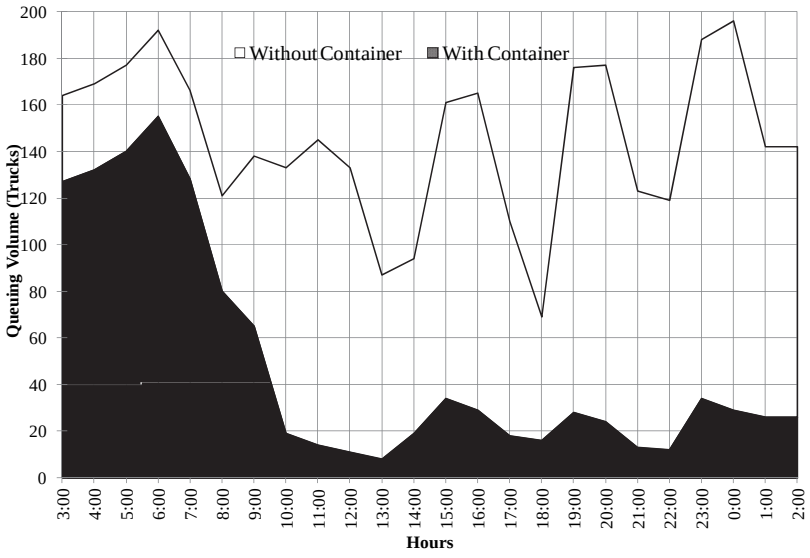


Note: The survey interval before the improvement is 2 hours. Therefore, the average of 2 hour survey before and after is taken for the hours in between.

Prepared by Project Team

Figure 4.1-47 Queuing volume per section before and after the congestion improvement

The ratio of trucks with and without container after the improvement is shown on Figure 4.1-48. The number of trucks with container reached the maximum volume at 155 vehicles on 6:00, and immediately decreased once the gate opened. On the other hand, because the container trucks without the container after unloading the export container at the yard once out of the gate, and stand by waiting for the import container loading, the number of parking vehicles increased after 8:00 and repeated the increase and decrease within the range between 41 to 167 vehicles.



Prepared by Project Team

Figure 4.1-48 Loading situation of queuing trucks after the congestion improvement

3) Evaluation of the urgent project

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 as indicated in **4.1.3 (6) 2) ii) Alleviation of traffic congestion**. 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 4.1-11 of **4.1.3 (3) 3) Critical factors for the enhancement of capacity of port gates** together with the continuous implementation of the early gate opening operation.