2.8. Present Status and Development Trends of SEZs in Cambodia

2.8.1 Present Status of SEZs in Cambodia

As shown in Table 2.8-1, the Cambodian government has so far officially approved the development of 23 SEZs by issuing conditional development certificates. Among them, fourteen SEZs have been authorized for establishment by the issuance of Sub-Decrees, and currently ten SEZs are in operation receiving investors. In all the SEZs, the investors' most favourable location is the Phnom Penh SEZ.

The location of each SEZ is shown in Figure 2.8-1, and the comparison of SEZs in operation is shown in Tables 2.8-2 and 2.8-3.

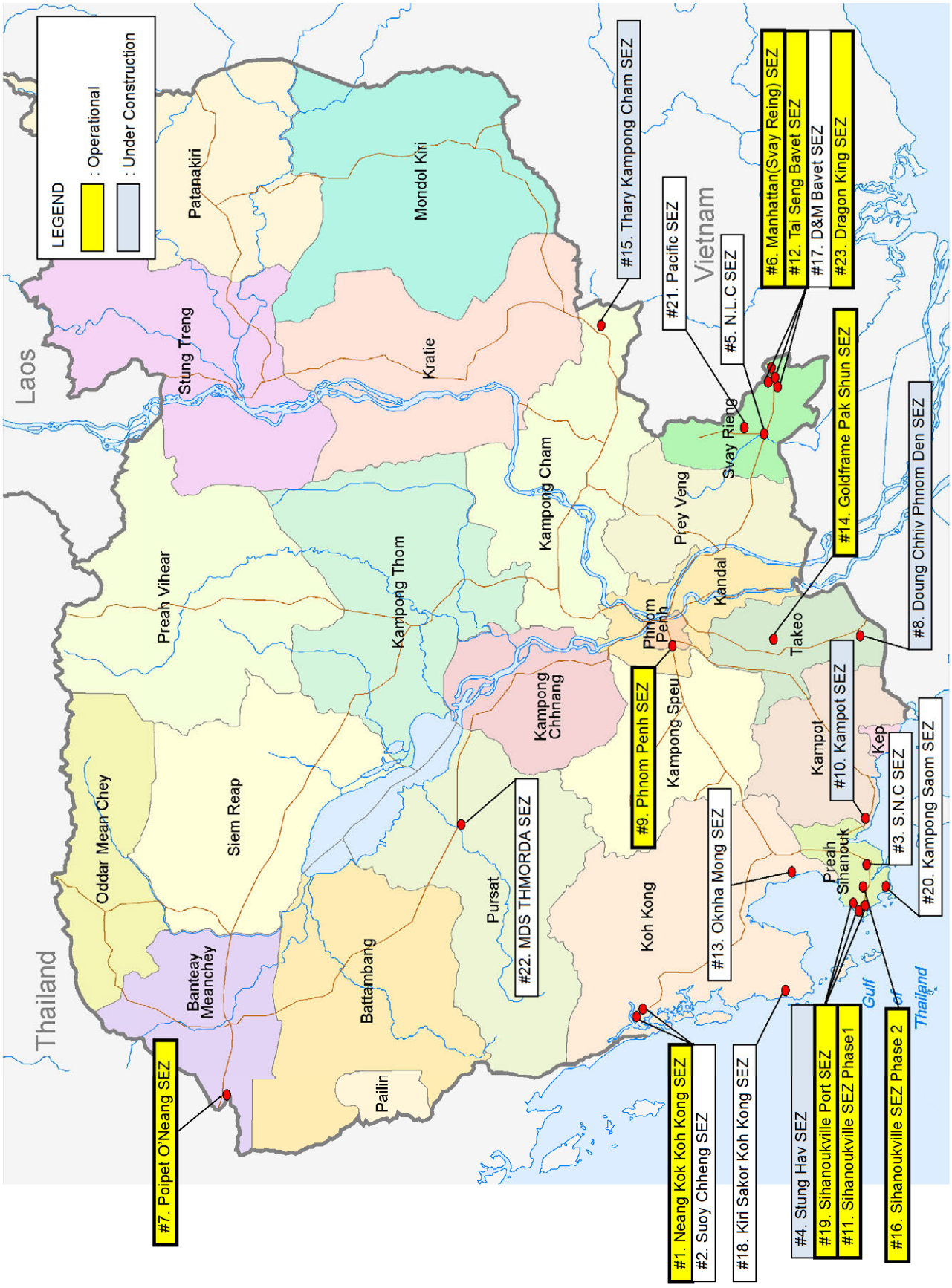
Also, the information (including investor data) of all 23 SEZs is shown in ANNEX-C.

Table 2.8-1 List of Existing SEZs in Cambodia

No.	Name of SEZ	Date of CDC license issued	Date of Sub-Decree issued	Areas (Ha)					No. of Investers		Remarks
				Licensed	Operational	Under Const.	No Activities	Invested	Total	Japan	
1	NeangKokKoh Kong SEZ	26/11/2002	26/10/2007	335	335			33	3	1	In Operation
2	SuoyChheng SEZ	26/11/2002	Not issued	100			100				No Activities
3	S.N.C SEZ	26/11/2002	Not issued	150			150				No Activities
4	Stung Hav SEZ	18/2/2005	25/3/2005	196		196					No Activities
5	N.L.C SEZ	15/7/2005	Not issued	105			105				No Activities
6	Manhattan (SvayReing) SEZ	28/8/2005	29/11/2006	157				53	15	1	In Operation
7	Poi Pet O'Neang SEZ	7/10/2005	1/6/2006	467	467			1	1		In Operation
8	DoungChhiv Phnom Den SEZ	20/2/2006	8/12/2006	79		79					Under Construction
9	Phnom Penh SEZ	20/2/2006	19/4/2006	350				85	34	18	In Operation
10	Kampot SEZ	23/5/2006	9/1/2007	145		145					Under Construction
11	Sihanoukville SEZ 1	4/9/1998	25/10/2006	178	178			20	2		In Operation
12	Tai SengBavet SEZ	4/1/2007	4/4/2007	99				34	13	8	In Operation
13	OknhaMong SEZ	4/1/2007	Not issued	100			100				No Activities
14	Goldfame Pak Shun SEZ	4/1/2007	4/4/2007	80				39	3		In Operation
15	Thary Kampong Cham SEZ	11/6/2007	16/7/2007	142		142					Under Construction
16	Sihanoukville SEZ 2	29/6/2007	17/3/2008	1,688				16	22	2	In Operation
17	D&M Bavet SEZ	1/11/2007	Not issued	118			118				No Activities
18	KiriSakorKoh Kong SEZ	25/12/2008	Not issued	1,750			1,750				No Activities
19	Sihanoukville Port SEZ	31/1/2008	2/9/2009	70	70			3	1	1	In Operation
20	Kampong Saom SEZ	6/1/2009	Not issued	255			255				No Activities
21	Pacific SEZ	6/1/2009	Not issued	108			108				Under Construction
22	Mds Thmorda SEZ	6/1/2009	Not issued	2,265			2,265				No Activities
23	Dragon King SEZ	No data	5/2012	120	120			15	No data	4	In Operation
	Total			**9,057**	**1,170**	**562**	**4,951**	**299**	**94**	**35**	

Source: CDC (November 2012)

Source: CDC, 2012



Source: JICA Study Team based on CDC Data

Figure 2.8-1 Location Map of Existing SEZs

Table 2.8-2 Comparison of SEZs in Operation (1/2)

Descreption	SEZ	1. Neang Kok Koh Kong SEZ	6. Manhattan (Svay Reing) SEZ	7. Poipet O'Neang SEZ	9. Phnom Penh SEZ	11. Sihanoukville SEZ Phase 1
1) Zone Developer		L.Y.P Group Co., Ltd.	Mr. Clement Yang (Taiwan)	Mrs. Van Ny	Phnom Penh SEZ Co.,Ltd. (Ms. Lim Chhiv Ho)	Oknha Lav Meng Khin
2) Establishment	License (CDC):	No.3399, 26 Nov. 2002	No. 2942, 28 Aug. 2005	No. 3412, 07 Oct. 2005	No.268, 20 Feb. 2006	No. 1966, 04 Sep.1998
	Sub-Decree :	No.159, 26 Oct. 2007	No.135, 29 Nov. 2006	No. 57, 01 Jun. 2006	No. 33, 19 Apr. 2006	No. 113, 25 Oct. 2006
3) Capital		No data available	$15 million	$15 million	$68 million	$100 million
4) Location		Neang Kok Village, Pakkhlong Commune, Mundul Seyma District, Koh Kong Province	Bavet Commune, Chantrea District, Svay Rieng Province	Poipet and Nimit Commune, O' Chhrov District, Banteay Meanchey Province	Khan Dangkao, Phnom Penh and AngSnuol District, Kandal Province	Stung Hav District, Preah Sihanouk Province
5) Land Area		340 ha	180 ha (1st: 20 ha, 2nd: 60 ha, 3rd: 100 ha)	483ha (1st: 328ha, 2nd: 155ha)	360 ha (1st: 141ha, 2nd: 162ha, 3rd: 57ha)	178 ha
6) Project Implementation		Completed: entrance, road, power supply and water supply, To be developed: fencing, admn.-building, waste water treatment	Completed: fence, entrance, administration building, power supply and water supply for the 1st 70ha,To be developed: waste water treatment	Completed: fencing, entrance, electric poles	Phase-1: Infrastructure completed Phase-2: Under construction Phase-3: residence area planned	Developing infrastructure
7) Access		5km from Thai border, 470㎞ from Bangkok, 297km from Phnom Penh, 370km from Laem Chabang Port, 233km from Sihanouk Ville Port	6km from Vietnam border on N.R. No.1, 86km to Pho Chi Minh City, 160km to Phnom Penh City,just in front of the Tai Seng Bavet SEZ	10km from Thai border (Poipet), 410km from Phnom Penh, 640km from Sihanouk Ville Port, 250km from Laem Chabang Port	8 km west of Phnom Penh International Airport, 18 km from Phnom Penh's city center	No data available
8) Infrastructure	Power supply	12MW （Power supplied from Thailand） To be increased upto 20MW in 2013	Power supplied from Vietnam by public transmission line (with 12MW own generator)	Power supplied to 2- 50MW S/S in SEZ from Thailand	Supplied from public transmission line (with 13MW by own generator)	No data available
	Water supply	5,000m3/day	Groundwater	No data available	5,300m3/day (Phase-1)	N.A.
	Wastewater	Currently none	None	No data available	4,500m3/day (Phase-1)	N.A.
9) Zone Investor		Total 3-Investors （1-Jap., 2-Others）	Total 18-Investors （1-Jap., 17-Others）	Total 1-Investors （0-Jap., 1-Others）	Total 37-Investors （17-Jap., 20-Others）	Total 2-Investors （0-Jap., 2-Others）
10) Land lease charge	Not include taxes Y.L. means "years lease"	40$/m2: 99 Y.L. 30$/m2: 70 Y.L. 20$/m2: 20 Y.L.	25$/m2: 99 Y.L.	33$/m2: 70 Y.L.	55$/m2: 99 Y.L.	No data available
11) Service charges	Power supply	6.5 Baht/kWh (no upper limit)	0.1265 $/kWh	0.12$/kWh (no upper limit)	0.193$/kWh	No data available
	Water supply	18 Baht/m3（plus 10%VAT）	0.15 $/m3	0.35$/m3	0.3$/m3(plus 10%VAT)	N.A.
	Wastewater	N.A.	0.25 $/m3	No data available	0.26$/m3 plus 10%VAT)	N.A.

Source: CDC, Survey Team

Table 2.8-3 Comparison of SEZs in Operation (2/2)

Descreption	SEZ	12. Tai Seng Bavet SEZ	14. Goldfame Pak Shun SEZ	16. Sihanoukville SEZ Phase 2	19. Sihanoukville Port SEZ	23. Dragon King SEZ
1) Zone Developer		Mr. Ly Hong Shin Tai Seng Enterprise Group, Tai Seng Bavet SEZ Co.,Ltd.	Mr. Chan Ji Kvong	Oknha Lav Meng Khin Jiangsu Taihu Cambodia International Economic Co. Investment Co.,Ltd. CIID Group Co.,Ltd.	Sihanoukeville Autonomous Port (H.E. Mr. Lu Kim Chhun)	Mrs. Ngov Mok
2) Establishment	License (CDC):	No.024, 04 Jan. 2007	No.025, 04 Jan. 2007	No. 2162, 29 Jun. 2007	No. 415, 31 Jan. 2008	No data available
	Sub-Decree :	No.29, 04 Apr. 2007	No. 30, 04 Apr. 2007	No.24, 17 Mar. 2008	No. 147, 2 Sep. 2009	No data available
3) Capital		$37 million	$34 million	N/A	$34 million	No data available
4) Location		Bavet Commune, Chantrea District, Svay Rieng Province	Sa Ang District, Kandal Province	Prey Nop District, Preah Sihanouk Province	Tomnop Rolok Area, Sangkat Lek1 and Lek3, Sihanoukville City, Preah Sihanouk Province	Bavet Commune, Chantrea District, Svay Rieng Province
5) Land Area		125ha Main-phase 77ha, Sub-phase 48ha	80 ha	1,688 ha	70 ha	120ha
6) Project Implementation		Completed: entrance, administration building, road, power supply from Vietnam, water supply To be developed: fence, waste water treatment	Completed: fence	Road, admi building, power supply and telecom have been completed. Fence, water supply and wastewater treatment plant are planned to install.	Completed: infrastructure, mainte-house, admi-building, container freight station, service apartments & dormitories	No data available
7) Access		6km from Vietnam border (Bavet), 86km to Pho Chi Minh City, 160km to Phnom Penh City, just in front of the Manhattan SEZ	No data available	12 km from Sihanoukville Port, 3 km from Sihanoukville Airport, 210㎞ from Phnom Penh's city	Adjacent to Sihanoukville port, 15 km from Sihanoukville Airport, 230㎞ from Phnom Penh's city	12km from Vietnam border (Bavet), 1km from the sub-phase of Tai Seng Bavet SEZ, 92km to Pho Chi Minh City, 160km to Phnom Penh City
8) Infrastructure	Power supply	Power supplied from Vietnam and Cambodia (Svay Rieng province) by public transmission line	No data available	Supplied from public transmission line (with 2MW own generator)	22 kV from EDC distribution line	Power supplied from Vietnam and Cambodia (Svay Rieng province) by public transmission line
	Water supply	Groundwater by tenant	N.A.	Planned to install	2,000m3/day	Groundwater by tenant
	Wastewater	None	N.A.	Planned to install	2,000 m3/day	None
9) Zone Investor		Total 13-Investors (8-Jap., 5-Others)	Total 3-Investors (0-Jap., 3-Others)	Total 21-Investors (2-Jap., 19-Others)	Total 1-Investors (1-Jap., 0-Others)	Total (No data) (1-Jap,)
10) Land lease charge	Not include taxes Y.L. means "years lease"	22$/m2: 50 Y.L.	No data available	28$/m2: 50 Y.L. 7$/m2: 10 Y.L.	65$/m2: 50 Y.L. (< 1ha) 47.5$/m2: 25 Y.L. (< 1 ha)	25$/m2: 50 Y.L.
11) Service charges	Power supply	0.1265$/kWh	No data available	0.25$/kWh	Under study	0.1265$/kWh
	Water supply	N.A.	N.A.	0.15$/m3(+10%VAT)	0.3 $/m3	N.A.
	Wastewater	N.A.	N.A.	N/A	0.35 $/m3	N.A.

Source: CDC, Survey Team

2.9. Present Status and Development Trends of Ports and Inland Waterways in Cambodia

2.9.1 Related Ports

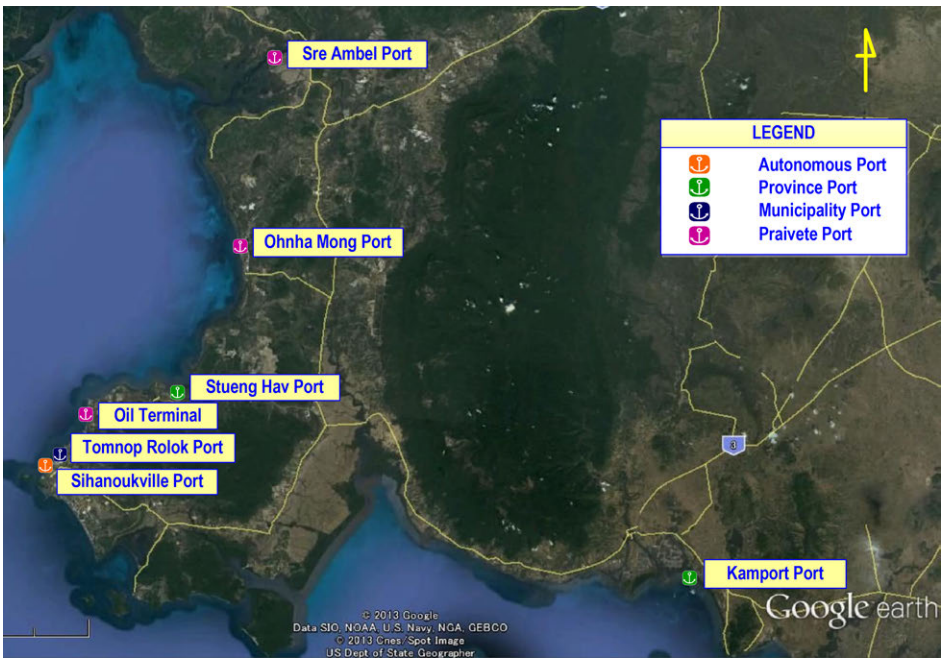
(1) General

As shown in Table 2.9-1, according to the Study on the Master Plan for the Maritime and Port Sectors in the Kingdom of Cambodia[3], the Ports in Cambodia are generally composed of two autonomous ports, three private ports, nine provincial ports, one municipal port and forty two district ports. Figure 2.9-1 shows location map of major sea ports in Cambodia, and Figure 2.9-2 and Table 2.9-2 respectively present a location map and a list of major river ports in Cambodia.

Table 2.9-1 List of Major Ports in Cambodia

Type	Name of Port	Management Body / Location
Autonomous	Sihanoukville Port	Sihanoukville Autonomous Port
〃	Phnom Penh Port	Phnom Penh Autonomous Port
Private	Sre Ambel Port	Koh Kong Province / Sre Ambel District
〃	Oknha Mong Port	Private Company / Sre Ambel District
〃	Oil Terminals	Private Company / Sihanoukville
Province	Stueng Hav Port	Koh Kong Province / Stueng Hav District
Municipality	Tomnop Rolok Port	Sihanoukville City
Province	Kampot Port	Kampot Province / Kampot
〃	Kompong Cham Port	Kompong Cham Province / Upper Mekong 105 km from PP
〃	Kratie Port	Kratie Province / Upper Mekong 220 km from PP
〃	Stung Treng Port	Stung Treng Province / Upper Mekong 370 km from PP
〃	Kampong Chhnang Port	Kampong Chhnang Province / Tonle Sap River 90 km from PP
〃	Chong Kneas Port	Siem Reap Province / Tonle Sap 260 km from PP
〃	Battambang Port	Battambang Province / Sangke River west of Tonle Sap
〃	Neak Loeang Terminal	Ferry Terminal / Lower Mekong 60 km from PP
District	42 ports	32 ports along the Mekong River 10 ports along the Tonle Sap River

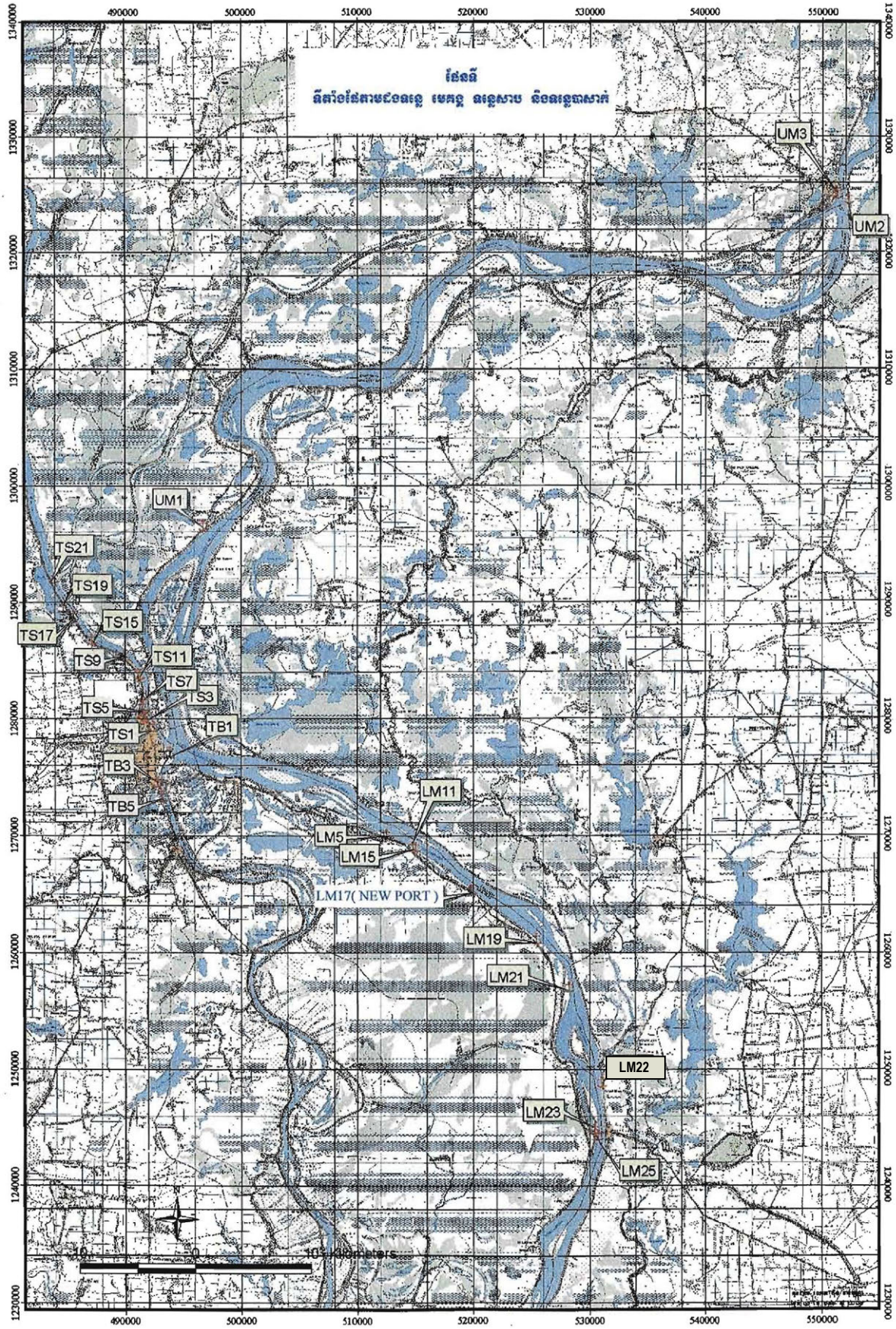
Source: The Study on the Master Plan for Maritime and Port Sectors in the Kingdom of Cambodia (2007)



Source: Google Earth, Survey Team

Figure 2.9-1 Location Map of Major Sea Ports in Cambodia

[3] The Overseas Coastal Area Development Institute of Japan (OCDI)、Japan Marine Science (JMS)（2007）, The Study on the Master Plan for Maritime and Port Sectors in the Kingdom of Cambodia, JICA



Source: PPAP

Figure 2.9-2 Location Map of Major River Ports in Cambodia

Table 2.9-2 List of Major River Ports in Cambodia

No	Name of Port/Terminal/Port Group	Ownership	Rivers	Cargo Type	Dimension			Remark
					Length (m)	Width (m)	Depth (m)	
1	Conventional and Passenger Floating Piers (TS1)	PPAP	Tonle Sap	General Cargo, Passenger	45	15	5.3	
2	Conventional and (TS3) Container Terminal	PPAP	Tonle Sap	General Cargo, Container	300	20	6.3	
3	Domestic Terminal (TS5)	PPAP	Tonle Sap	General Cargo			4.5	
4	Sokimex Floating Pier (TS7)	Sokimex Co., Ltd.	Tonle Sap	Fuel	30	7	4.6	
5	Sokimex Floating Pier (TS9)	Savimex Co., Ltd.	Tonle Sap	Fuel	15	5	4.0	
6	Terminal Km6 (TS11)	Green Trade Co. Ltd	Tonle Sap	General Cargo	40	6	4.0	
7	Prek Pneou Pier (TS15)	Siam Gas Co., Ltd.	Tonle Sap	Gas	2 Piles		5.0	
8	Tela Terminal (TS 17)	Tela Co., Ltd.	Tonle Sap	Fuel	30	8	4.6	
9	Bright Victory Pier (TS19)	Bright Victory Co., Ltd.	Tonle Sap	Fuel	25	6	4.6	
10	Men Sarun Terminal (TS21)	Men Sarun Co., Ltd.	Tonle Sap	General Cargo	200	15	5.0	
11	Kampong Chhang Port	MPWT	Tonle Sap	Domestic General Cargo	20	6	4.0	
12	Siem Reap Port (Chong Khneas)	MPWT	Tonle Sap	Domestic General Cargo, Passenger				Under Development
13	Mekong Shore Berth (Bright Victory Branch)	Bright Victory Mekong Petroleum Co., Ltd.	Upper Mekong	Fuel			5.5	
14	Prek Anchanh Shore Berths (UM1)	PPAP	Upper Mekong	Wood Products			5.0	
15	Tonle Bet Shore Berth (UM2)	PPAP	Upper Mekong	General Cargo			5.0	
16	Kampon Cham, Domestic Terminal (UM3)	PPAP	Upper Mekong	General Cargo, Passenger			4.0	
17	Dey Eth Terminal (LM5)	PPAP	Lower Mekong	General Cargo	35	20	14.0	
18	Total Floating Pier (LM11)	Total Co., Ltd.	Lower Mekong	Fuel, Gas	30	6	10.0	
19	New Container Terminal (LM17)	PPAP	Lower Mekong	Container	300	22	10.0	
20	Petronas Floating Pier (LM19)	Petronas Co., Ltd.	Lower Mekong	Fuel	30	6	14.0	
21	Prek Ksay Floating Pier	LHR Asean Investment Co.,	Lower Mekong	Fuel	20	6	2.0	
22	Sokimex Prek Ksay Pier (LM2)	Sokimex Co.Ltd	Lower Mekong	Fuel			3.0	
23	Neak Loeung Shore Berth 2 (LM25)	PPAP	Lower Mekong	General Cargo			4.0	
24	Asia Flour Mill Corporation Shore Berth (TB3)	Asia Flour Mild Co., Ltd.	Tonle Bassac	General Cargo			6.0	
25	Chak Angre Floating Pier (TB5)	EDC. Chak Angre.	Tonle Bassac	Fuel	25	6	4.0	

Source: PPAP, MPWT

According to the figures and tables shown, Cambodia has some sea ports facing the Thai Gulf and many river ports along the Mekong River and these ports play an important role for regional economies as logistics bases. In these ports, Phnom Penh Port (river port) and Sihanoukville Port (sea port) are recognized as the most important ports as the backbone of Cambodian logistics supporting the national economic development. These ports are respectively operated by Phnom Penh Autonomous Port (PPAP) and Sihanoukville Autonomous Port (PAS) under the jurisdiction of the Ministry of Public Works and Transport (MPWT) and the Ministry of Economy and Finance (MEF). The present status and development trends of the said two major ports are described as follows.

(2) Phnom Penh Port

1) Present Status

As presented in Figure 2.9-3, Phnom Penh Port has a 300 m long quay and is -6.2 m deep (at LWL) for container and general cargo terminals. The water elevations in the rainy and dry seasons are respectively +9.81 m and +0.74 m and the quay has a limit for accommodation of calling vessels because of such difference of seasonal water elevation, waterway conditions and air clearance up to Phnom Penh Port. The hinterland of the quay has about 1.4 ha yard area, PPAP port administration building, entrance gate (2 lanes), warehouses (2 buildings), X-ray inspection facility etc. The yard area

is long parallel to the quay line and seems to be confining due to higher utilization than planned because no alternative terminal has been operational prior to commencement of container cargo handling operation in the New Container Terminal (NCT). So PPAP has secured an inland container depot (ICD) located about 6 km up stream of the Tonle Sap River as shown in Figure 2.9-4 due to lack of yard area. The ICD has about 4.5 ha yard area especially used for storage of empty containers. Cargo loading/unloading activities at the quay are carried out by 3 crawler cranes and 2 ship gear barge cranes. Also because of the constraints of the yard area, cargo handling activities in the terminals are conducted by certain numbers of top-lifters, reach stackers and tractor-trailers.

Source: Google Earth, Survey Team

Figure 2.9-3 General Layout of Phnom Penh Port

Source: Google Earth, Survey Team

Figure 2.9-4 General Layout of Inland Container Depot (ICD)

About 90 % of the cargoes handled in Phnom Penh Port are container cargo and the rest is general cargo handled a few times a year. According to 2011 port statistics in Phnom Penh Port, total container throughput was 81,631 TEUs/year (import 32 %, export 44 % and empty 25 %), the total number of vessels called annually was 597 (mainly concentrated in weekends, average vessel weight: 1,500 DWT and average loading capacity of vessel: 73 TEUs). The latest statistics report that the total container throughput reached 95,333 TEUs in 2012 according to PPAP.

Based on 2011 container throughput and the results of reports from PPAP regarding the situation of cargo handling activities (actual quayside crane productivity, average vessel loading capacity, actual daily working hours, net annual working days, dwell time of containers, average container stacking height, entrance gate process hours etc.), the berth, yard and entrance gate utilizations were estimated as an assessment of current port capacities of Phnom Penh Port as shown in Tables 2.9-3, 2.9-4 and 2.9-5.

Table 2.9-3 Status of Quay Utilization in Phnom Penh Port

Description\Target Container Terminal		PHN Port
Container Throughput	**(TEU)**	81,631
Number of Crane	**(nr)**	5
Number of Berth	**(nr)**	4
Av. Vessel Called		1,500 DWT Container Barge
Required Berth Length per Vessel	**(m)**	75
Average Vessel Load	**(TEU/vessel)**	73
Number of Vessel Calls	**(vessel)**	1118
Av. Crane Productivity	**(box/hr)**	8
Conversion Ratio	**(TEU/box)**	1.54
Working Hour	**(hour/day)**	20
Crane Effectiveness Factor		1.1
Container Handling Capacity per Berth	**(TEU/day/berth)**	277
Service Time	**(day/vessel)**	0.39
Berth-Day Requirement per Berth		**110**
Berth Utilization(BOR)		**0.37**

Source: Survey Team

Table 2.9-4 Status of Yard Utilization in Phnom Penh Port

Description\Target Container Terminal		PHN Port			
Container Throughput	**(TEU)**	81,631			
Container Type		Import	Export	Empty	**Total**
Share	**(%)**	32	44	25	100
Weighted Container Throughput	**(TEU)**	25,787	35,647	20,197	81,631
Average Dwelling Time	**(day)**	3	2	1	
Average Stacking Height	**(layer)**	2	2	2.5	
Max. Stacking Height	**(layer)**	3	3	3	
Ratio of Av. to Max. Stacking Heights		0.7	0.7	0.8	
Required Holding Capacity	**(TEU)**	212	195	55	463
Yard Utilization Ratio		0.7	0.7	0.8	
Required TEU Ground Slots	**(TGS)**	151	140	28	**319**
Area Requirent per TEU	**Equipment**	Folklift/Side Loader/Reach Sracker			
	(m2/TEU)	30.0	30.0	30.0	
Required Net Teransit Storage Area	**(m2)**	6,359	5,860	1,660	**13,878**
Required Gross Teransit Storage Area	**(m2)**	9,538	8,790	1,992	**20,319**

Source: Survey Team

Table 2.9-5 Status of Terminal Entrance Gate Utilization in Phnom Penh Port

Description\Target Container Terminal		PHN Port
Container Throughput at Berth	(TEU)	81,631
Annual Working Day	(day)	300
Ratio of Box to TEU		0.65
Peak Fctor for Av. Troughput		1.2
Required Daily Gate Throughput	(box/day)	212
Assumed Gate Process Time	(min/box)	3
Assumed Gate Open Hour	(min/day)	600
Required Lane at Gate	**(lane)**	**1.06**

Source: Survey Team

As presented in Table 2.9-3, the berth-day requirement was estimated as 110 days/berth and the berth utilization ratio (BOR) was computed as 0.37. Even though calling vessels generally concentrate on weekends, it is understood that the berth does not have any congestion in average and still has enough capacity in the conditions of current container throughput, berth window pattern and actual crane productivity.

As presented in Table 2.9-4, the required net transit storage area without consideration of safety factor for future reserved capacity were estimated as 1.39 ha (13,854 m2) and nearly reached 1.4 ha total yard area in the terminals. In 2012, the container throughput grew to 95,333 TEUs and this situation means lack of yard area in Phnom Penh Port, even though empty containers are quickly transferred to ICD. Also this may create serious issues that increase terminal congestion and impact the safety of cargo handling activities.

As presented in Table 2.9-5, the required lanes at the entrance gate were estimated as two lanes (1.06 ≒2 lanes, one lane for container tractor-trailers and one lane for common service vehicles). The existing entrance gate has two lanes and therefore provides enough capacity for the current container throughput. However, the weigh bridge installed beside the entrance gate due to lack of yard area is inconvenient to use because of difficulty of smooth arrangement of the tractor trailer on the bridge. Also the gate may have congestion because there is no queuing area for tractor trailers.

Based on 2011 container throughput and the results of information from PPAP regarding cargo handling activities, the required number of each piece of cargo handling equipment was estimated as shown in Table 2.9-6.

As presented in Table 2.9-6, the quayside required four cranes against five cranes already used in actual operation, so the number of the cranes was satisfactory. Seventeen tractor trailers are required against eight units in the existing operation which means that nine were lacking based on the estimate. However, as previously mentioned, investment in the additional units is to be carefully determined due to limited yard area considering future planned container throughput and yard rearrangement. A total of three reach stackers and/or sky-lifters are required including a spare unit against four units in the existing operation and therefore, there are currently enough units based on the estimate.

Upon an assessment of port facilities in Phnom Penh Port as mentioned above, the following points are to be highlighted:

- Berth number is adequate but yard area is apparently lacking for handling the current container throughput, and more congestion and serious accidents in the terminals may occur if the current operation continues
- Berth and yard expansions are quite difficult due to limited space in the port area
- Additional handling equipment is to be carefully injected with consideration of setting future planned container throughput that should fit the actual capacities of the port facilities, reforming efficiency in actual operation, and rearrangement of the yard

Table 2.9-6 Required Number of Cargo Handling Equipment in Phnom Penh Port

Quay Crane

Location	Container Throughput at Berth	Crane Occupancy Ratio	Working Hour a Day	Annual Working Day	Average Crane Productivity	Container Operation Efficiency Ratio	Conversion Ratio	Req. Nr. of Quay Crane
	(TEU)		(hr)	(day)	(Box/hr)		(TEU/box)	(nr)
PHN Port	81,631	0.40	20	300	8	0.75	1.54	3.67

Tractor Trailler

Location	Container Throughput at Berth	Nr. of Quay Crane	Av. Travel Speed in Terminal	Handling Time under Quay Crane	Handling Time under Transfer Crane	Av. Traveling Distance of Yard	Operation Factor	Req. Nr. of Tractor Trailler	
								per Crane	per Terminal
	(TEU)	(nr)	(km/hr)	(min/cycle)	(min/cycle)	(km/cycle)		(unit)	(unit)
PHN Port	81,631	4	10.00	3.00	3.00	0.4	0.70	4	17

Reach Stacker

Location	Container Throughput at Berth	Nr. of Quay Crane	Av. Nr. of Reach Stacker per Quay Crane	Req. Nr. of Reach Stacker per Terminal
	(TEU)	(nr)	(unit)	(unit)
PHN Port	81,631	4	0.50	2.00

Source: Survey Team

2) Development Trends

At present, PPAP seems not to have a clear master plan for Phnom Penh Port in black and white. However, according to the reports from PPAP, PPAP plans to operate heavy container cargo handling in Phnom Penh Port on a limited basis, to rearrange yard utilization and to efficiently maximize existing port facilities. Currently, a Korean private company proposed rice/cassava export as a new use in the existing port facilities where most of the cargo operation has been transferred to NCT. Also, PPAP plans to further expand 5 ha more in ICD which will total 9.5 ha. (refer to Figure 2.9-4)

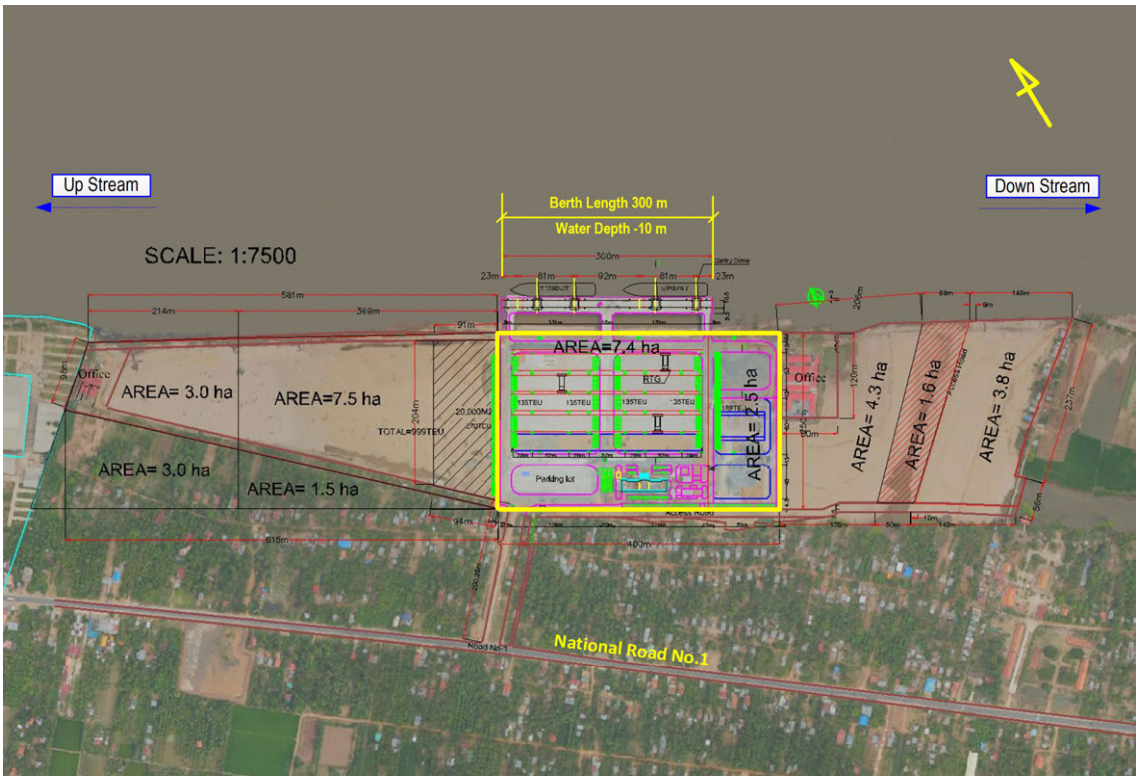
(3) New Phnom Penh Port

1) Present Status

a) Existing Facilities

As shown in Figure 2.9-5, The New Phnom Penh Port (NCT: new container terminal) provides a full-scaled container terminal with planned annual container throughput of 120,000 TEUs, 300 m long quay, and -10 m deep. Main cargo handling equipment is to be 3 Quayside Gantry Cranes (QGC, TCC type), and 4 Rubber Tired Gantry Cranes (RTG, 6 over 1). The construction of NCT was completed in 2012 and that cargo handling equipment is now under procurement (one each of the QGC and RTG were already provided to NCT). The operation mostly shifted from Phnom Penh Port starting from January 2013. The water levels in rainy and dry seasons are respectively +8.60 m and +0.65 m, which is different from those of Phnom Penh Port. Due to seasonal fluctuation of the water levels, the depths in front of the quay and in the basin are variable but secure more than 10 m, which is enough to accommodate larger vessels. In view of the depth naturally secured, 10,000 DWT class vessels can be accommodated at NCT. The Mekong waterways up to NCT currently have several bottlenecks and budget constraints do not basically allow periodic maintenance dredging overall. So the accommodation of larger vessels depends on an increase of cargo lots with their direct/indirect revenues, and cost-effectiveness for infrastructure investment as well as maritime trends in Vietnam and other surrounding countries. The hinterland of the quay provides space for a 4 ha container yard, PPAP administration building, entrance gate (4 lanes), emergency generator and machine houses,

X-ray inspection facilities, empty container stacking yard and reserved area. PPAP secures reserved areas, one up and one down-stream of NCT, each of about 10 ha.



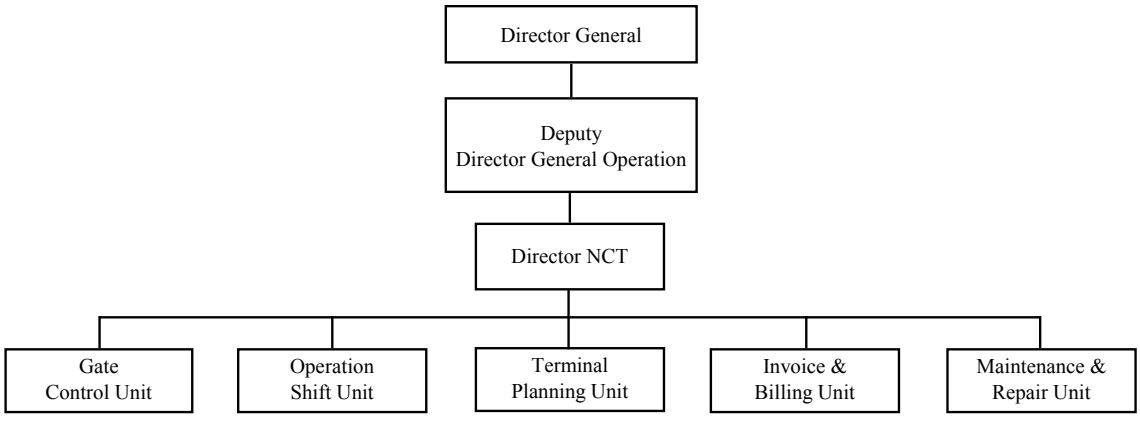
Source: PPAP, Survey Team

Figure 2.9-5 General Layout of New Phnom Penh Port (NCT)

b) Terminal Management

PPAP currently have requested MRC (Mekong River Commission) to study and propose the operations and management plan for the container terminal and just started operation of a new terminal based on their proposal for a new organization structure. MRC have recognized this study as the pilot project which will be including current port management for Phnom Penh Port/PNH.

The reorganization that is underway places the CEO of PPAP as the top of the management team followed by the deputy director general, and then the director NCT who is responsible for 5 operation teams consisting of Terminal planning, Operation-Shift, Gate Control, Invoicing and Maintenance and Repair (refer to Figure 2.9-6).



Source: Survey Team

Figure 2.9-6 Organization Chart of NCT

The organization structure of the cargo handling operation separates the planning process from the cargo handling process at the site, adding the gate control process. According to this separation, the operational units are organized based on necessary job processes instead of the method used by the previous management focusing the cargo operation work at the site. The PHN Port NCT already launched the new Terminal Operating System (TOS) with the features of the port network. It is significantly important to organize the structure in compliance with the required job processes, and that is essential to perform safe cargo operation and achieve the efficiency of business operation. However, implementation has just recently been initiated and the immediate rearrangement of job processes has been undertaken under the initiative and supervision of the management in order to ensure proper job processes.

In this process, the terminal planning unit has become the initial point of all job processes and manages all terminal functions. It importantly functions not only for terminal operation but also as the focal point of the direct stakeholders including the shippers, consignees and shipping agents in customer service viewpoints. The berth allocation plan, container loading plan, yard plan, cargo data management and container equipment control are the responsibility of this unit in the terminal organization. At the time of the study, the port control division of PPAP supervised by the port master has been responsible for port access/stay control of the ships and worked on allocation management of the berth and berthing schedule with the assistance of the terminal operation staff. The terminal planning unit has not been working on the container loading plan because the actual loading has been carried out under supervision of the captains of the barges based on the container list prepared by the shipping agents of the barges. Therefore, this unit mainly has so far undertaken the yard planning, processing of the cargo data, cargo data control and equipment control. During the transfer period, the working processes have been under rearrangement in accordance with the TOS process. It is observed that they have difficulty to ensure the container storage management including the yard planning because the container data for delivery is not available in a timely manner due to late booking by the shipping agents/customers.

The operation-shift unit is responsible for preparation of the arrangement of the stevedores/workers/handling equipment and preparation of the working plan for the yard, loading/unloading operation at the quay and gate in accordance with the yard and loading/unloading plan as well as supervision of the site. The staff of this unit are required to ensure safe work at the site with improvement of the efficiency and undertake the job mainly consisting of the working instruction, workers allocation and safety officer but it is observed that the previous role has been taken over and remains unchanged at the time of the study.

The gate control unit is responsible for verification of the containers gated-in/out supported by the data, which is input in TOS, and checking on the containers delivered. The standard terminal does not have such organization wherein the gate unit is at the same level as the other units. It is supposed that the manager of the gate unit was required to work independently because the location of the gate is not close to the terminal main building and therefore it was newly set up this way in the reorganization.

The invoice & billing unit is set up to generate the invoices relating to cargo handling, storage and loading/unloading operation through TOS and dispatch them. These works which were previously undertaken by each department are centralized so that it is considered to be beneficial for the customers. The billing relating to the port charge and pilotage has been carried out by PPAP office at PNH port.

It is confirmed that the maintenance and repair for terminal facilities and quay, and procurement of the handling equipment are the responsibility of the technical department of PPAP but the maintenance & repair unit will be in charge of the cargo handling equipment in the terminal. At the time of the study, the cargo operation has been carried out by pontoon barge and cargo handling equipment shared with the PNH port. No maintenance of the equipment is confirmed at the terminal.

At the meeting of the operating officers in the terminal for arrangement of the operating workforce, it was decided that 111 operating labourers will be arranged in the terminal except for temporary workers and contractors. The staff allocation is shown in Table 2.9-7.

Table 2.9-7 Staff Allocation of NCT

No.	Unit/Division	Planned No. of staff
1	Middle Management	14
2	Terminal Planning Unit	21
3	Operation Shift Unit	43
4	Invoicing & Billing Unit	2
5	Gate Control Unit	9
6	Maintenance Unit	11
7	Security Unit	12
	Total	**111**

Source: PPAP

The temporary labourers are mainly engaging the stevedore work in the loading/unloading operation at the quay. The cargo handling equipment has been operated by the permanent employees in the terminal. The ship cargo operation needs 3 shifts of the labourers in principle but it is unnecessary to allocate many labourers except on the weekends when most of the ships are alongside the berth. The terminal operation has been undertaken by the direct employees but there have been no labour disputes due to absence of a labour union.

c) Operation

NCT mainly has ships calling (barges) on Friday to Saturday and has accepted 70% of the total ships calling during the weekend. However, it is recognized that the terminal has lower berth occupancy on average as the cargo operations have taken only 3.2 hours/ship for unloading and 5.2 hours/ship for loading. The loading operation has been extended due to the idle time for waiting for delivery of the export containers, resulting in it taking longer than the unloading operation time. In the meantime, in spite of the short cargo operation time, the berthing time has been extended due to the idle time as the ships need to wait for shipping instructions for the containers from the shipping agents after completion of the unloading operation. During the idle time, the ships have been moored in 2-3 rows in parallel with the quay to ensure sufficient space at the quay for cargo operation on the other ships. The quay is 300m in length, where 3 x ships can be alongside the berth simultaneously for cargo operation by the pontoon barge or crawler crane. In accordance with the cargo operation record during the week of Jan.3-9, the handling volume on average for a ship shows 148TEU with productivity of 11 container /hour for loading (refer to Table 2.9-8 and Figure 2.9-7).

Table 2.9-8 Actual Container Cargo Vessels Called and Container Cargo Handling in NCT

Vessel Name	Flag	Unloading(TEU)	Loading(TEU)	Berthing Hours	Unloading Hours	Loading Hours	Idle Hours
PHUOC LONG 16	VN	70	72	55.5	1.5	7.5	46.5
TAY NAM 10	VN	95	91	55	6.5	7	41.5
GOLDEN FORTUNE 08	CAM	104	104	30	5	7	18
SONG XANH 18	VN	78	84	33	2.5	6	24.5
CAI MEP 16	VN	89	86	27	3.5	4.5	19
GEMADEPT 96	VN	84	95	32.5	2	6.5	24
PHUOC LONG 24	VN	0	66	31	-	4.5	-
PHUOC LONG 18	VN	42	72	11.5	1	3	7.5
CAI MEP 06	VN	84	83	21	6	4	11
SONG XANH 09	VN	59	81	19	3.5	3	12.5
PHUOC LONG 34	VN	0	72	14.5	0	4.5	10
CAI MEP 10	VN	83	83	15	4	4	7
Golden Fortune02	VN	56	97	156.5	2.5	-	-
PHUOC LONG 28	VN	69	72	45	3	5.5	36.5
Total		913	1158	546.5	41	67	258
Average		**65.2**	**82.7**	**39.0**	**3.2**	**5.2**	**21.5**

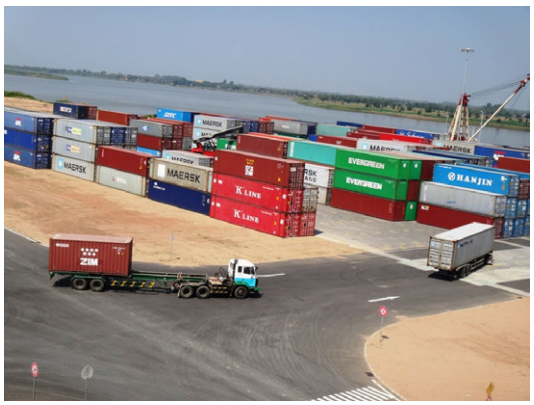
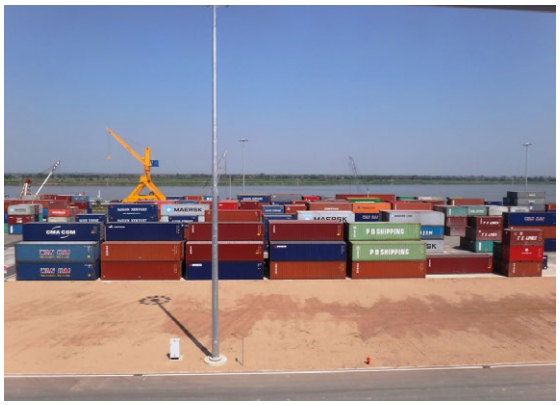
Source: PPAP, Survey Team


Source: Survey Team

Figure 2.9-7 Container Cargo Barge Berthing at NCT

At the time of the study, the formality for delivery and picking-up of the containers has been undertaken by EIR (Equipment Interchange receipt) instead of TOS as the system process is not workable yet. For import, the terminal is unable to prepare for the unloading plan for cargo operation as the shipment information from the shipping agents has been delayed. Therefore, the actual unloading operation has been carried out in accordance with the unloading list prepared by the shipping agent. For export, it is learnt that the booking ratio in the TOS through the internet currently shows about 20%. The increase of the input ratio is expected to follow the process work in the system by inducing the data transfer to the TOS and contribute to improvement of the current complicated work.

In respect of the yard work, the terminal has intended to continue to operate using the reachstackers until replacement with the RTG. For the import containers unloaded, these have been gated –out for delivery after examination by the mobilized X-ray inspection facility and customs clearance. The import laden containers have been stored in 4 blocks located in the south part of the yard with occupancy of 40~60% of the storage capacity in 4 high stacking. The export laden containers delivered to the yard have been stored temporarily in 4 blocks located in the north part of the yard as the containers have been delivered to the yard prior to placing the booking including the nominated vessel. It is reported that it takes time to shift the laden containers from the yard to the quay for loading due to increase of the re-handling at the yard as no shipping instruction is fixed at the time of delivery and the loading list becomes available just before the loading operation starts. These export containers have been delivered to the yard just before the export containers have been delivered toward the weekend for shipment but there seems to be no shortage of storage area due to immediate loading after delivery to the yard.

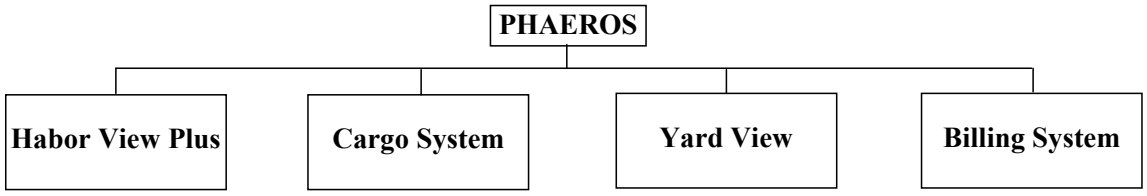
Source: Survey Team

Figure 2.9-8 Container Yard at NCT

The terminal facilities have not been completed yet but the layout plan shows that the facilities were well arranged in consideration of the location of the stacking yard storage and effective traffic

routes and spare space of the expansion. There is no equipment maintenance facility on the layout plan. The weigh station is under construction behind the fence in the north instead of the truck lane of the gate. In general, the truck parking area is very commonly adopted in other container terminals and effective to control the traffic flow inside the terminal but it is observed that the terminal does not review traffic routes or awareness of safety rules with the light traffic inside the terminal at the moment.

Regarding the terminal operation system (TOS), the program of Belgium supplier (Phaeros) was implemented in the terminal. However, the scope of this program involves not only the TOS function required by the container terminal but also the benefits for the port control division for ship access control, the shipper/forwarder/customs broker and shipping carriers/agents. It was recognized as the integrated port system covering major port activities and functions and requiring the full support of these stake holders who access to the system. Actually, it is essential to gain this support and cooperation in order to operate the system properly but it is observed that all features and functions cannot be enjoyed due to a lack of understanding of the system process by the stake holders. The system features of the TOS are shown in Figure 2.9-9.



Source: Survey Team

Figure 2.9-9 Components of TOS at NCT

As indicated in the above figure, TOS consists of Harbour View Plus (Port access/stay control), Cargo System (Gate control/Cargo information control), Yard View (Yard management) and Billing System (Billing and Invoicing). In addition, TOS also provides the various functions including the application /acceptance of port access, issuance of the delivery orders by the shipping agents and trucking orders etc. in consideration of the benefits of the port users. However, the function necessary for the terminal operation has not been in workable order because of a lack of input of the booking/cargo data from the users outside the terminal and the system does not accept skipping of the process in linkage. Under this situation, it is observed that the TOS has not functioned properly and completely and the terminal functions in the system are not available separately.

2) Development Trends

At present, NCT has been constructed and its necessary cargo handling equipment is under procurement, so it seems that there is no new development in NCT. Only minor developments are on-going such as pavement of reserved area and construction of the X-ray inspection building. According to PPAP, there is no clear picture for the reserved areas up and down stream of NCT, 3 ha of the 10 ha at the up steam area was already committed to utilize as a bulk terminal area to be jointly operated by PPAP and a local private company.

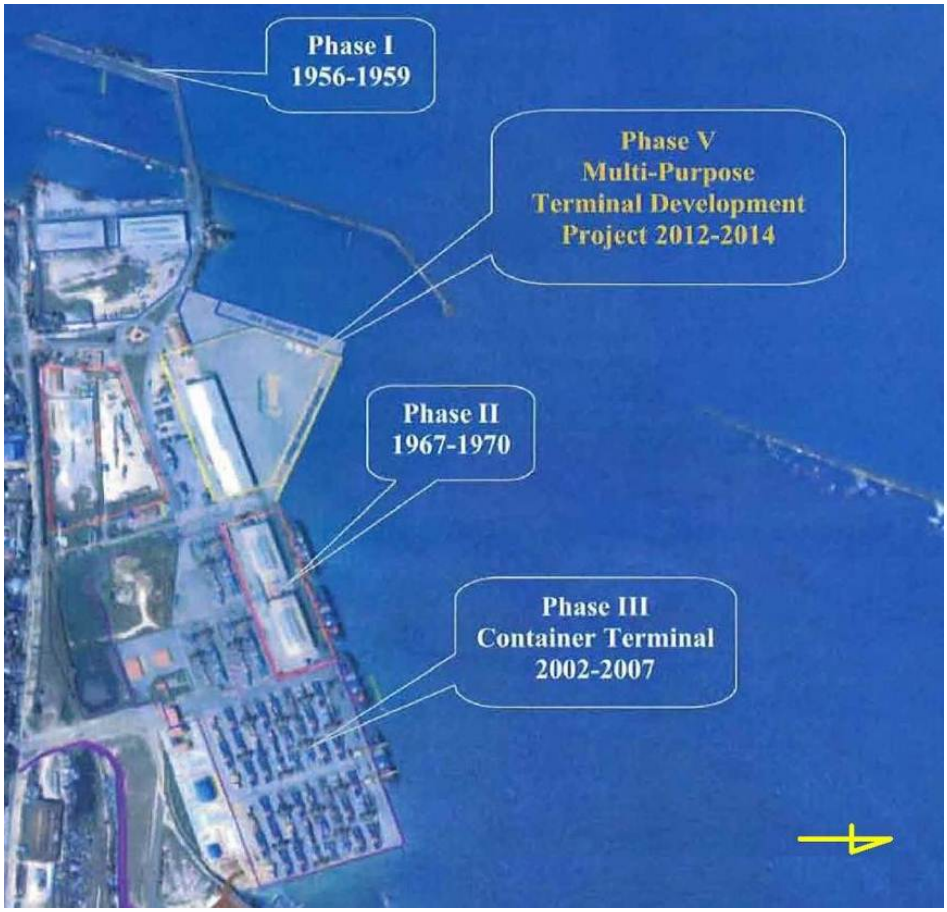
(4) Sihanoukeville Port

1) Present Status

As presented in Figure 2.9-10, Sihanoukville Port is a full-scaled gateway sea port in Cambodia, comprised of an old jetty as a backup quay for general cargo and passenger boat terminal (Phase I: berth length 288 m, quay depth -7.5 m), general cargo terminal (Phase II: berth length 290 m, quay depth -7.0 m, yard area 2 ha), and container terminal (Phase III: berth length 750 m, quay depth -8.5 m, yard area 14 ha). In this port, there are wave protective facilities such as breakwaters, fairways and navigational aids, port security system, Vessel Traffic Service (VTS), and Terminal Operating System (TOS). In 2011, Sihanoukville Port recorded 2.4 million tonnes in annual cargo handling

including liquid cargoes such as fuels, and container throughput in the same year became 240,000 TEUs, approximately 10 % annual growth. The Port equips 2 QGC (container crane), 7 RTG, 9 reach stackers (8 for laden containers and 1 for empty containers), and 33 tractor trailers. Also, there are two 60 ton capacity Harbour Mobile Cranes (HMC) in the Port, which are generally used in unloading/loading operations for general cargo vessels without ship gear cranes or smaller container vessels that have called at the general cargo berth without QGCs. It is well known that the old jetty has suffered many damages and deteriorations due to the age of the structure, which is more than 60 years even though successive maintenance measures have been taken, so its use as a cargo handling jetty is currently limited with certain load restrictions specified by PAS.

In addition to the above, Sihanoukville Port has an SEZ of 50 ha adjacent to the Port area. This SEZ started its operation in 2012. It has some tenants already and continues promotion by extoling the advantages of enhancement of regional employment and convenience of logistics services linked to port activities.



Source: Sihanoukville Autonomous Port (PAS)

Figure 2.9-10 General Layout of Sihanoukville Port

2) Development Trends

With increasing cargo volumes handled, Sihanoukville Port has an on-going project to construct a multi-purpose terminal for dry bulk cargo and oil rig exploration base between the old jetty and the general cargo terminal (Phase V: berth length 330/200 m, quay depth -13.5/-7.5 m, yard area 2.4/0.4 ha) by Japanese Yen Loan. Also, JICA executed "The Project for the Study on Strengthening Competitiveness and Development of Sihanoukville Port" in 2012 in order to establish a strategic plan for competitiveness and to update the master plan of the Port.

2.9.2 Inland Waterways

(1) Present Status

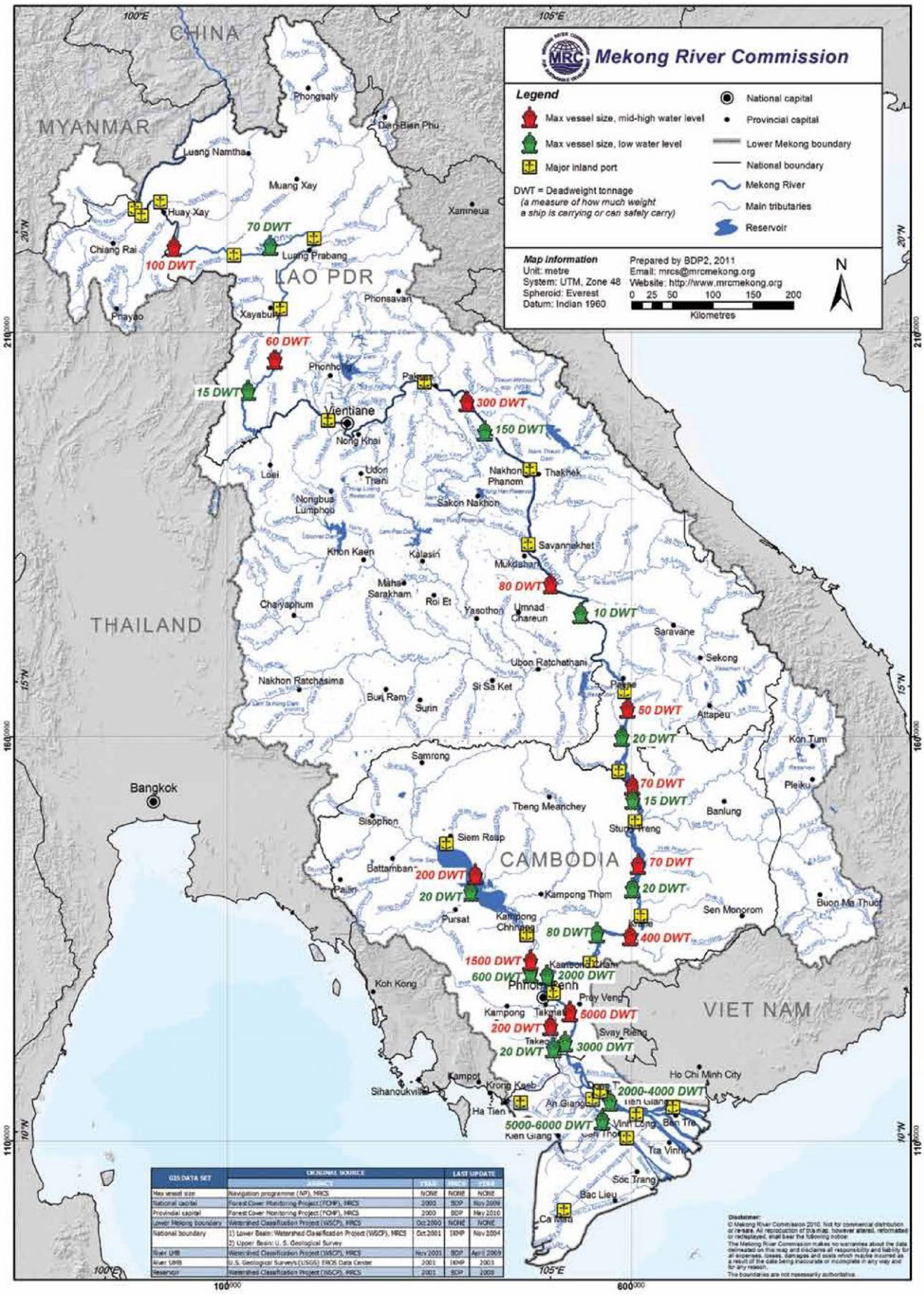
Cambodia has totally 1,800 km of waterways available and about 600 km of the waterways, equivalent to 30 % of the total length, are navigable year-round. Figure 2.9-11 shows inland waterway networks such as regulated waterways and transit routes in Cambodia and Vietnam territories along the Mekong Basin.

Source: Google Earth, Survey Team

Figure 2.9-11 Inland Waterway Networks in Cambodia and Vietnam along Mekong Basin

As presented in the Figure, inland waterways from Phnom Penh cross the Vietnam border, pass through a branching point called Km 215, and stretch along two routes including the Mekong mainstream route toward Cua Tie Estuary and the Bassac River route via Vam Nao Pass toward Dinh An Estuary. In the case of the Mekong mainstream route, the total length of the waterway from Phnom Penh to Cua Tie Estuary is about 350 km. In the case of the Bassac River route, the total length of the waterway from Phnom Penh to Dinh An Estuary is same of the Mekong mainstream route. Barge feeder transport additionally requires 30-50 km length from Cau Tie Estuary in connection between Phnom Penh and Cai Mep-Thi Vi Port and/or Saigon Port and the total transport length between Phnom Penh and such Vietnamese hub ports is 380-400 km.

Figure 2.9-12 shows vessels that can be accommodated during the rainy and dry seasons along the Mekong Basin. As found in the Figure, 4,000-5,000 DWT class vessels can be accommodated up to NCT depending on seasonal water level fluctuation and vessel dimensions. In the Vietnam territory, 5,000 DWT class vessels are substantially able to pass throughout the year from downstream of Vam Nao Pass and Km 215 point to both the Estuaries.



Source: MRC, Planning Atlas of the Lower Mekong River Basin (2011)

Figure 2.9-12 Vessels Accommodated along Mekong River Basin

Table 2.9-9 describes a summary of bottlenecks and constraints upon inland navigation along the Mekong Basin based on information from the PPAP harbourmaster about the Cambodian territory and collected information about Vietnam territory. Figure 2.9-13 also shows a location map of the bottlenecks and constraints upon inland navigation.

As presented in the table and figure, Koh Keo Channel (C3), Prek Dach Channel (C5), Koh Ream Rang Channel (C7), Downstream at the end of Peam Island Channel (C8) require widening and deepening (may also require realignment and removal of sunken vessels) in the Cambodia territory, and new pylons are to be constructed for reinstallation of the high voltage line across the waterway between Tan Chau and Xyugen in the Vietnam territory, in order to accommodate 4,000-5,000 DWT class vessels year-around on the waterways.

Table 2.9-9 Bottlenecks and Constraints upon Inland Navigation along Mekong Basin

Ref. No.	Location		Bottleneck/Constraint
1C	Cambodia	Chaktomuk Channel	The channel is the access way from Mekong River to Tonle Sap River and versa. It was the famous channel of Cambodian navigator, it consist with the two buoys, which were installed at the edge of the channel. The depth in the Channel was about 5.50m, the width was about 60m and the length was about 1km, but it was become larger and deeper because of sand dredging activities for business.
2C		Dey Eath	It is not small and it's wide big enough for vessel to sail. The depth in the Channel is about 8.0m, the width is about 90m and the length is about 200m.
3C		Koh Keo Channel	The river is large, but it was a dangerous place for navigator. The sand was appeared and spread to more and more place every year, so the channel also changes. Here, when we installed the buoys, and it will be removed them the next year, thus we need often to perform a survey. The channel was made for vessel sail pass at the shallow water. The depth in the Channel is about 6.0m, the width is about 80m and the length is about 1km.
4C		Neak Luoeng Bridge	The bridge will be safe for vessel to sail, because its air clearance will be 37.5m from the highest water of the Mekong River was, and the fairway will be around 300m.
5C		Prek Dach Channel	This is a critical channel for navigation. It was small and sharp bend the way to turn the course of vessel. The vessel was took more dangerous when she was gone follow the current, because of one side edge of the channel is the bank and the vessel must be turned in 90 degree for up and down. The depth in the Channel is about 5.50m, the width is about 80m and the length is about 1.5km. In the new dredging proposal, the new channel will be dredged straightly and shorter than the old, and can facilitate the vessel movement and traffic accordingly.
6C		Peam Chor	It is small, but the access is enough for vessel navigation. The depth in the Channel is about 8.0m, the width is about 100m and the length is about 200m.
7C		Koh Peam Rang Channel	This channel has two buoys red and green installed on the edge of it. It was the critical point to lead avoided a sunken vessel. The depth in the Channel is about 5.50m, the width is about 90m and the length is about 1km.
8C		Downstream at the end of Peam Rang Island Channel	The River is large here, but the route for navigation has limited. The navigation way is on the middle of the river. The areas surrounding the channel are shallow. The course must be leaded by lending marks, which it should be located on the end of Koh Peam Rang (not yet install). The depth in the Channel is about 6.50m, the width is about 80m and the length is about 4km.
1V	Vietnam	Tan Chau - Long Xuyen	The area has a height tension power line which has only 12 meters air clearance.

Note: The above information is not sufficiently covered and updated timely for all bottlenecks and constraints on Inland Waterway Navigation from Phnom Penh and Vietnamese Estuaries due to no detailed investigation and survey conducted.

Source: PPAP, Survey Team

Source: Google Earth, Survey Team

Figure 2.9-13 Location Map of Major Bottlenecks and Constraints upon Inland Navigation

Furthermore, in order to guarantee safe navigation for larger vessels, it is also required to periodically conduct maintenance dredging based on constant hydrographic surveys, to materialize night navigation with provision of enough navigational aids and mileage posts along the waterways, and to coordinate with local fishermen and communities for harmonized water use.

(2) Development Trends

For access to National Road No.1, the Neak Loeung Bridge is now under construction funded by Japan Grant Aid. When the bridge is constructed, the air clearance from HWL will be 37.5 m and at least 4,000-5,000 DWT class vessels will be therefore passable under the bridge without any restriction at any seasons. PPAP now plans to dredge Prek Dach Channel, which is a bottleneck for accommodation of larger sized vessels.

3. IMPLEMENTATION PROGRAMME OF PNH PORT NCT's SEZ DEVELOPMENT AND ASSOCIATED PORT FACILITIES EXPANSION

3. IMPLEMENTATION PROGRAMME OF PNH PORT NCT's SEZ DEVELOPMENT AND ASSOCIATED PORT FACILITIES EXPANSION

3.1. Economic Development Scenario

Economic growth of Cambodia from 2001 to 2010 is summarized in the previous chapter 2.2.1, which showed GDP statistics of IMF, the National Institute of Statistics and other organizations. Since the IMF and NIS use the same statistics, this report follows the IMF's GDP statistics and forecast. Table 3.1-1 shows the growth rate of GDP from 2001 to 2010 quoting from the IMF report.

IMF has estimated Cambodian economic growth from 2011 through 2017 in its report[1] as shown in Table 3.1-2, column of 2011-2017. Growth rates of 6.5%-7.7% are predicted during the period up to 2017. The Cambodian government stated a goal to make its GDP double by 2020, which needs an annual growth of 7.5% following IMF's projection period. The Cambodian Development Policy Research Institute (GDRI) showed a development scenario up to 2030[2], which estimates a growth rate of 9% in the case of high growth, 7% in the middle growth case, and 5% in the low growth case.

Taking into account these predictions, this report assumed that GDP growth of Cambodia up to 2017 will follow the projection of IMF. In the ordinary growth case, GDP growth rate after 2017 is assumed to be 7.5% which is the government goal up to 2020, and 6.5% from 2021-2025 followed by 6.0% from 2026-2030 as shown in Table 3.1-2. Growth rates after 2021 are assumed to decrease to the middle of CDRI projections of 5%-7% in 2030.

In the case of low growth, it is assumed that GDP growth up to 2017 will follow the projection of IMF, and it will decrease by 0.5% from the government projection up to 2020. After 2021, the growth rate is assumed to be 6.0% from 2021-2025 and 5.0% from 2026-2030 as shown in Table 3.1-3. Low case growth rates after 2021 are assumed to decrease to the low case of GDRI projection of 5.0% in 2030.

Table 3.1-1 GDP Growth 2001-2010

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GDP Gr. Rates	8.15%	6.58%	8.51%	10.34%	13.25%	10.77%	10.21%	6.69%	0.09%	6.10%

Source: IMF World Economic Outlook Database, 2012, (2001-2010)

Table 3.1-2 GDP Growth Projections (Ordinary Case)

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GDP Gr. Rates	7.08%	6.45%	6.68%	7.24%	7.40%	7.56%	7.68%	7.50%	7.50%	7.50%

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
6.50%	6.50%	6.50%	6.50%	6.50%	6.00%	6.00%	6.00%	6.00%	6.00%

Source: IMF World Economic Outlook Database, 2012, (2011-2017)
Cambodian government goal doubling GDP by 2020 (2018-2020)
Annual Development Review 2011-2012, CDRI, (2021-2030)

[1] IMF World Economic Outlook Database, 2012
http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/weoseladv.aspx?a=&c=522&s=NGDP_R

[2] Annual Development Review 2011-2012, Cambodian Development Policy Research Institute

Table 3.1-3 GDP growth projections (Low Growth Case)

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GDP Gr. Rates	7.08%	6.45%	6.68%	7.24%	7.40%	7.56%	7.68%	7.00%	7.00%	7.00%

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
6.00%	6.00%	6.00%	6.00%	6.00%	5.00%	5.00%	5.00%	5.00%	5.00%

Source: IMF World Economic Outlook Database, 2012, (2011-2017)
Cambodian government goal doubling GDP by 2020 (2018-2020)
Rates from 2021-2030 are estimated based on "Annual Development Review", CDRI, (2021-2030)

Future population of Cambodia is estimated by the National Institute of Statistics as shown in Chapter 2.4.1 (1) and this report assumed that Cambodian population will increase as predicted by NIS. NIS forecast that Cambodia will have a population of 16.5 million in 2020 and 18.4 million in 2030, and the annual growth rate will decrease to 0.9% in 2030.

3.2. Implementation Programme of PNH Port NCT's SEZ Development

3.2.1 Future Development Framework of PNH Port NCT's SEZ

(1) SEZ Demand Forecast

1) Current Industrial Area and Demand Forecast

In the Report「Survey on Industrial Policy Formulation Assistance in Cambodia」,the October, 2012 JICA Study, the demand for the industrial sites in Cambodia was forecast on the basis of the past process of FDI for Cambodia, as shown in Table 3.2-1.

Table 3.2-1 Demand for Industrial Site Development

Estimation of Demand for Industrial Site Development (Ha)

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Higher Case	998	1,349	1,700	2,051	2,402	2,753	3,104	3,455	3,806	4,157	4,508
Medium Case	1,000	1,295	1,589	1,884	2,178	2,473	2,767	3,062	3,356	3,651	3,945
Lower Case	1,001	1,239	1,477	1,715	1,953	2,191	2,429	2,667	2,905	3,143	3,381

Source: JICA Report "Data Collection Survey on Industrial Policy Formulation Assistance in Cambodia (Oct. 2012)"

The above table does not show only the demand for SEZ, it estimates the demand for all the industrial sites in Cambodia. The SEZ is for a development area of more than 50 ha. Therefore, the existing small scale industrial sites in Cambodia are estimated at more than 500 ha in all.

The current demand for SEZ in 2012 is estimated as actual contracted area for the factories which is about 165 factories i.e. approx. 480 Ha in total. In the plan for the development of SEZ, the development area generally plans its demand for five years which takes about twice the required area of the present year before its demand is realized. This fact recognizes that the actual areas occupied by factories are about 50% of the developed area for the SEZ in Vietnam.

Hence, the demand for SEZ in Cambodia in 2012 is estimated as the 960 Ha (twice of 480 ha) which is about 57% of the demand of industry site development in Table 3.2-1. Moreover, the SEZ demand is also increasing more rapidly than the demand for all industry sites based on the following increase rate for Japanese factories from 2009 and the share of the SEZ area in the industrial sites will be about 77% in 2020. Increasing rate of SEZ occupied for Japanese factories: 36% per year (an average for past three years). The demand for SEZ development is estimated in Table 3.2-2 based on the above conditions.

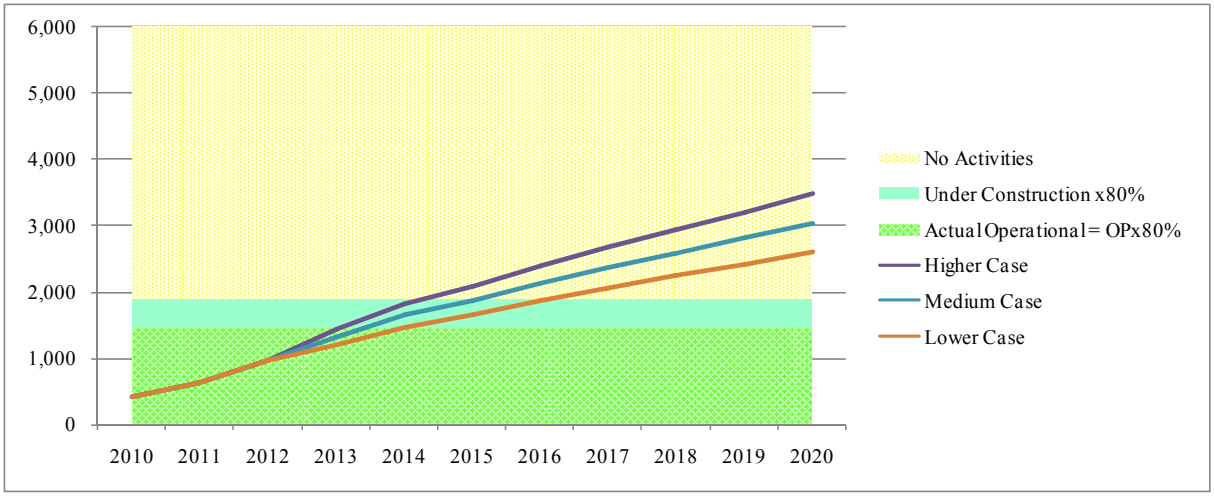
Table 3.2-2 Demand Forecast for SEZ Development in Cambodia

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Higher Case	424	642	973	1,450	1,811	2,076	2,395	2,666	2,937	3,207	3,478
Medium Case	424	642	973	1,331	1,642	1,864	2,135	2,362	2,589	2,817	3,044
Lower Case	424	642	973	1,212	1,472	1,652	1,874	2,058	2,241	2,425	2,609

Source: Study Team based on the table of Demand for Industrial Site Development

The existing 23 SEZ are almost all located at borders of Thai land, Vietnam and Sihanoukville area, only the Phnom Penh SEZ is in the capital area. The nominal development area for the 23 SEZ is about 9,057 Ha and 4,951 Ha is not developed yet in the nominal area. Only 10 SEZ in the 23 are operating now and those nominal development areas are about 3,500 Ha including residential area, parks and commercial area. Actually, the SEZ area designated for factories is estimated to operate about 1,820 Ha and the area under development is about 562 Ha, indicated by the green part and blue part respectively in Figure 3.2-1. In view of the site conditions for the SEZ, about 20% of those operating and developing area of the SEZ is difficult to move tenants into the SEZ. Hence, the current of SEZ could only supply the following area for the factories.

Area = (1820+562) x 80% = 1,906 Ha (available area for the factories in 2012). Above demand forecast and SEZ area to be supplied is shown in Figure 3.2-1 and its summary in 2017 and 2020 is shown in Table 3.2-3.



Source: PPAP, Survey Team, estimated based on the Table of Demand for Industrial Site Development, JICA2012

Figure 3.2-1 SEZ Demand Forecast and Current SEZ Development

Table 3.2-3 SEZ Demand in 2017 and 2020

(Unit ha)

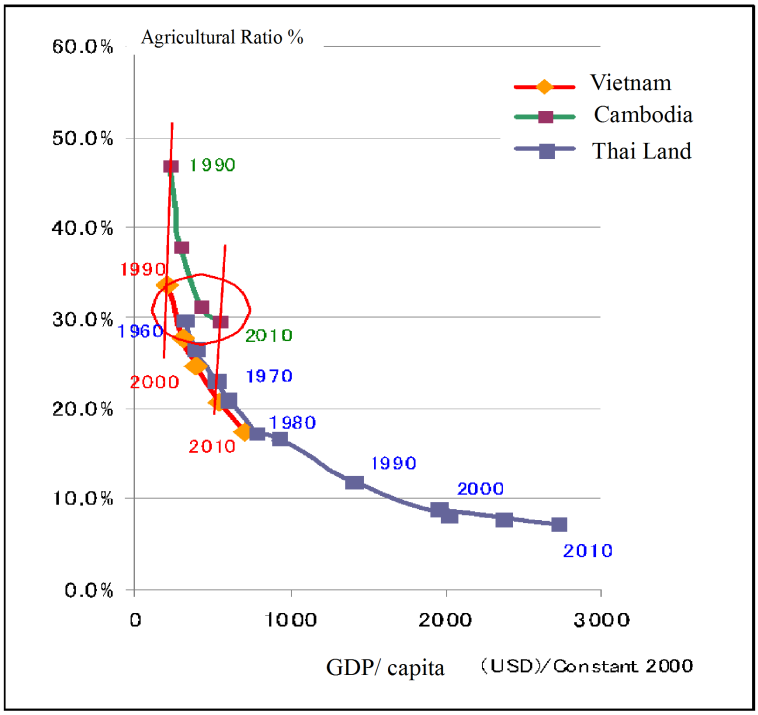
Year		2,017	2,020
Demand	High Case	2,666	3,478
	Medium Case	2,362	3,044
	Low Case	**2,058**	**2,609**
Supply	Availability Existing SEZ (Estimation)	80%	80%
	Available Area to be moved into (including Developing area)	**1,906**	**1,906**
Demand (Low Case) Balance of Supply and Demand		**-152**	**-703**

Source: Survey Team

2) Forecast for Attracting Tenants of SEZ

Cambodia is surrounded by Thailand and Vietnam and is developing later than Thailand and Vietnam. However, Japanese firms have been rapidly advancing into Cambodia since 2010. Economic growth of Thailand and Vietnam is brought by FDI of industries especially Japanese industrial firms. After investment from Japan, the economy is expanded, the total income is increasing and the agricultural portion of GDP is going down. The correlation between the agricultural ratio for GDP and the Real GDP / capita for Thailand, Vietnam and Cambodia are shown in Figure 3.2-2.

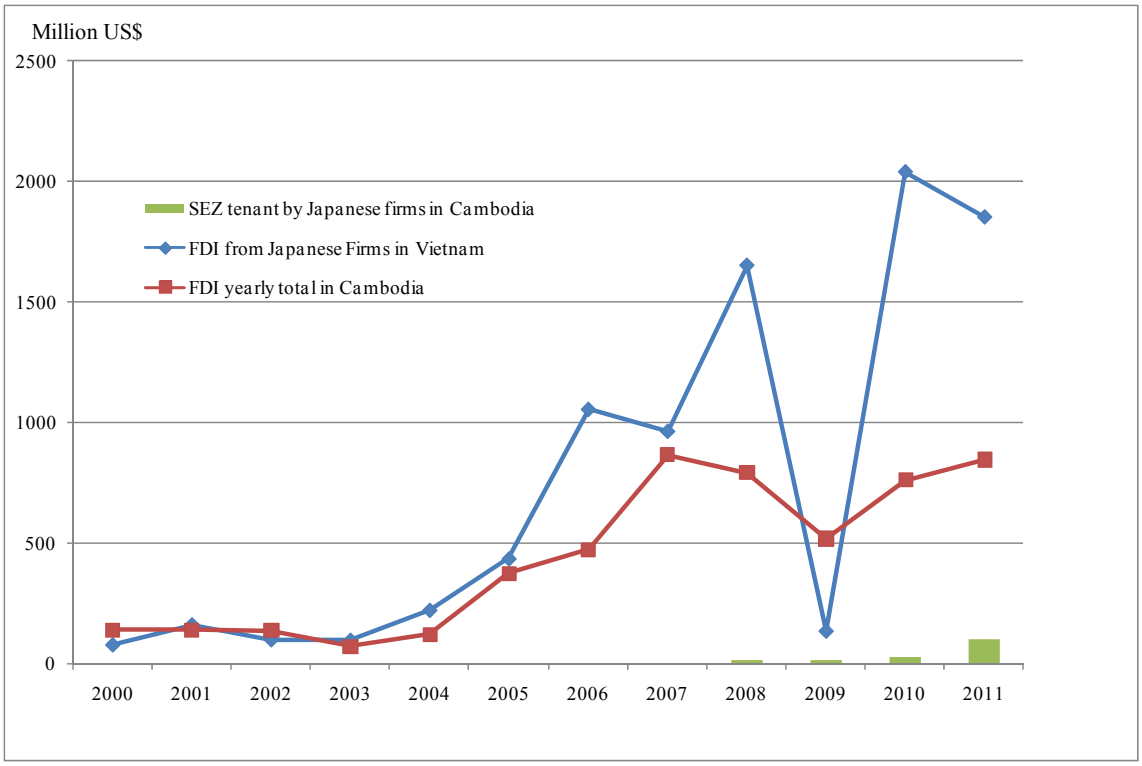
As shown in the Figure, the three countries show similar movement. However, regarding the differences in the ratio of agriculture in the GDP of the countries, Vietnam is lower than Thailand, and Cambodia is higher than Thailand. Also, Vietnam and Cambodia have reduced their agricultural ratios by about 18% from 1990 to 2010 as well. Therefore, Economic growth for Cambodia is 6 years later than Vietnam and 40 years later than Thailand.



Source : Mizuho Corporate Bank Industry Research Dep. Report

Figure 3.2-2 Agricultural Ratio for GDP and GDP/capita

FDI for Vietnam from Japanese firms has already exceeded 50% of all FDI in Vietnam. Cambodia will follow after 6 years as shown in Figure 3.2-3 and therefore, the Cambodian economy will grow due to the FDI from Japanese firms as well.

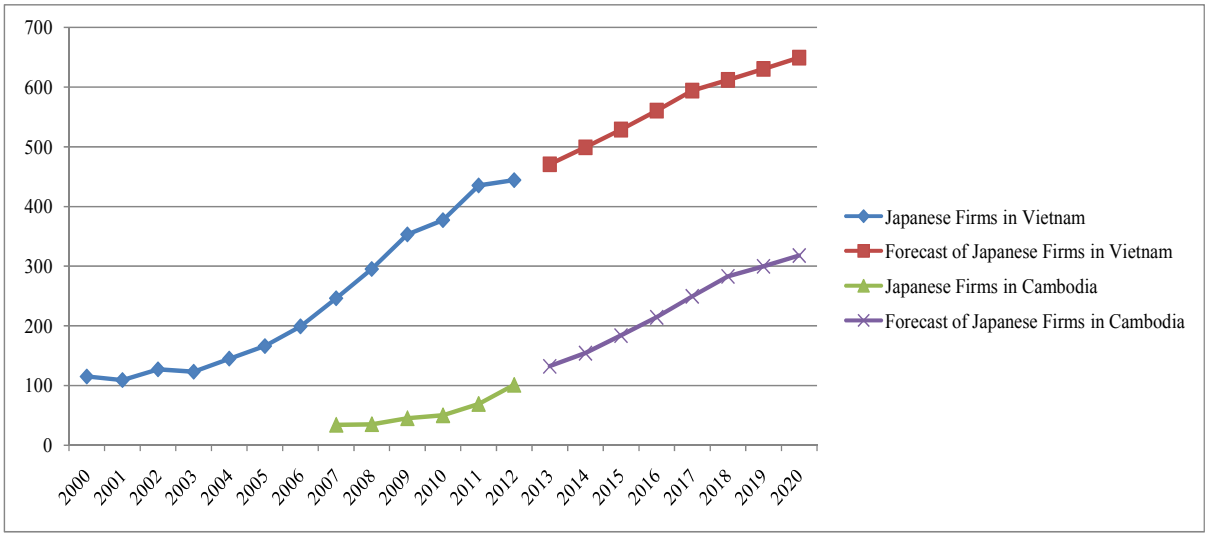


Source: Survey Team

Figure 3.2-3 FDI Movement for Vietnam and Cambodia from Japanese Firms

In line with Figure 3.2-2 and Figure 3.2-3, the Japanese firms will be major investors in Cambodia following 6 years in Vietnam. The Japanese firms that moved into Cambodia are estimated on the basis of the movement of Japanese firms into the Chambers of Commerce of Vietnam and Cambodia. The estimation is based on the following conditions and is shown in Figure 3.2-4.

- Increase rate of members in Vietnam from 2013 is taken as 6% which is an average of the past three years.
- Increase rate of members in Cambodia in 2013 is taken as 31% which is an average of the past two years.
- Increase rates of members in Cambodia from 2014 for four years are taken to be the same as the increase rates in Vietnam from 2006 to 2009. (average rate : 20%)
- Increase rates of members from 2018 are taken as 5% in Vietnam and 13% in Cambodia with consideration of the movement into Myanmar and Bangladesh.



Source: Survey Team

Figure 3.2-4 Actual and Forecast for Members of Japanese Chambers of Commerce in Vietnam and Cambodia

In the above forecast for Japanese firms moving into Cambodia, The firms invested in SEZ is about 60% of all the members in the Japanese chamber of commerce and the firms moving into the SEZ developed or invited by Japanese developers or with Japanese assistance is 95% of all. The past results and demand of the Japanese firms moving into Cambodia SEZ after 2013 is shown in Table 3.2-4.

Table 3.2-4 Forecast Japanese Firms moving into SEZ Developed/Supported by Japan

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Japanese Firms in Vietnam	246	295	353	377	435	444	471	499	529	561	595	613	631	650
Japanese Firms in Cambodia	34	35	45	50	69	101	132	154	184	214	249	283	300	318
Japanese factories invested/or contract to Cambodian SEZ (accumulated total and estimation)				15	28	43	66	92	110	128	149	170	180	191
Japanese factories invested to Cambodian SEZ (Yearly Investment Nos and estimation)							23	26	18	18	21	20	10	11

Source: Survey Team

The Japanese factories in Phnom Penh SEZ are 40% on average and 60% in the largest past three years. Approximately 60% of the Japanese firms were situated in an SEZ. The demand of the factories including the foreign factories for space in an SEZ developed or supported by Japan is estimated in Table 3.2-5.

Table 3.2-5 Forecast of Factories moving into SEZ Developed/Supported by Japan

Year	2013	2014	2015	2016	2017	2018	2019	2020
Forecast SEZ Invested by Japanese Factory (yearly)	23	26	18	18	21	20	10	11
Forcast SEZ Invested by Foreign Factory (Yearly)	9	9	7	7	8	8	4	4
Forecast SEZ Investment (Total Nos. of Factory)	**32**	**35**	**25**	**25**	**29**	**28**	**14**	**15**

Source: Survey Team

3) Forecast of Factory Investment for Phnom Penh SEZ and Sihanoukville Port SEZ

The following issues in Tai Seng Bavet SEZ (developed by Cambodian Firms) have occurred in 2012 as serious problems for the Japanese firms in the SEZ.

- **Issues of Management and Services in the SEZ:** The Tai Seng Bavet SEZ does not have good management and service for tenants. The cleaning and collection of garbage in the SEZ is often executed only in the SEZ. The tenants complained the services to be continued.
- **Electrical Power Supply:** The Tai Seng Bavet SEZ has been supplied power by Vietnam. However, the capacity of the power supply is limited due to lack of the capacity in Vietnam. Hence, black outs in the SEZ occur sometimes and the tenants are required to provide their own power generators in order to continue their operations.
- **Labour Problem:** There is insufficient labour available for the tenants in the Tai Seng Bavet SEZ. The labour shortage created problems for the tenants in the SEZ such as competition for labourers between factories, requirements to provide the labourers' accommodation and long distance commuting allowance and strikes for higher pay.
- **Environmental Pollution:** The Tai Seng Bavet SEZ has no sewerage treatment plant. The factories in the SEZ are obliged to provide their own treatment plant. However, some tenants have not built one and the sewer water is discharged into the rainwater drainage directly. This is polluting the environment around the area in which there are rice fields. In the requirement for the SEZ qualification (QIP), CDC was asked to construct the sewerage treatment plant for the SEZ in the Sub-Decree No.148 and this SEZ may act in violation of the QIP of the SEZ. Moreover, the Phnom Penh SEZ and the Sihanoukville Port SEZ constructed sewerage treatment plants in all the SEZ approved QIP. Therefore, this environmental problem is the biggest issue to attract the Tenants for SEZ in Cambodia.

Eight Japanese firms moved into the Tai Seng Bavet SEZ, four of the factories are fixed up by a Japanese Real Estate Company and other some factories are fixed up by the CDC. The matter came to the surface in October 2012, the Japanese Real Estate Company no longer invites factories to the Tai Seng Bavet SEZ and now only invites factories to the **Phnom Penh SEZ and the Sihanoukville Port SEZ**. The CDC may also attract Japanese factories only for the two SEZs. Therefore, Japanese firms that are expected to move into an SEZ will selects only one of the above two SEZs from 2013. The actual established or contracted factories and their area including the attracting area in the above two SEZs as of January 2013 are presented in Table 3.2-6.

Table 3.2-6 Current Conditions of SEZ Developed /Supported by Japan

SEZ Developed by Japan's Investor/ Fund	Development Area (ha)	Tenant Area (ha)	Invested/ Contract Factory Numbers	Invested/ Contract Factory area (ha)	Not Invested Area (ha)	Future Factory Numbers (Estimation)
Phnom Penh SEZ Phase 1	141	72	39	71	1	1
Phnom Penh SEZ Phase 2	162	101	21	58	43	20
Sihanoukville Port SEZ	70	47	1	4	43	20

Source: Survey Team

For the Phnom Penh SEZ, about 75% of the area for factories is occupied as of the January 2013, the remaining area will be sold out within 2013. Also, the Phnom Penh SEZ Phase III is planned to develop for residential purpose only.

In the following current conditions for both SEZs (Phnom Penh SEZ and Sihanoukville Port SEZ), the Phnom Penh SEZ has advantages and these will not change until the area is sold out.

- **Secure source of Workers:** The working population is concentrated in the capital area (Phnom Penh). This is a major advantage to secure the labourers for the SEZ.
- **Electrical Power Cost:** Electrical power cost (EDC tariff) in the Phnom Penh Area, Koh Kong Area (border of Thai land) and Bavet Area (border of Vietnam) is about 0.18US$ ~ 0.2 US$/kwh and 0.3 US$/kwh for the Shihnoukville Area. Hence, the Sihanoukville Area has a lower competitiveness than the others. However, the competitiveness of the power cost in Shihanoukville will be improved to the same value as Phnom Penh area with the installation of the power grid line from Kampot area and construction of a coal power plant in Sihanoukville area in April 2013.
- **Land Leasing Fee: The** Land Leasing Fee of the Phnom Penh SEZ is 60US$/m2 as of January 2013 and 65 US$/m2 for the Sihanoukville Port SEZ. However, those costs are calculated as almost the same price with consideration of the transportation cost between the SEZ and the port.

In the above conditions, the factories to move into these SEZs from 2013 are divided into 85% for Phnom Penh SEZ and 15% for Sihanokuville Port SEZ. The demand forecast of the numbers of factories and their area for the above two SEZs and the planned Phnom Penh New Port SEZ are shown in Table 3.2-7.

Table 3.2-7 Demand of Factories for SEZ Developed by Japan

SEZ Developed by Japan's Investor/ Fund	Not Invested Area (ha)	Demand Investor	2013	2014	2015	2016	2017	2018	2019	2020
Forecast Japanese investor to SEZ	—	147	23	26	18	18	21	20	10	11
Demand of other investor to SEZ	—	56	9	9	7	7	8	8	4	4
Phnom Penh SEZ Phase 1	1	1	1	sold out	sold out	sold out	sold out	sold out	sold out	sold out
Phnom Penh SEZ Phase 2	43	20	20	sold out	sold out	sold out	sold out	sold out	sold out	sold out
Sihanoukville Port SEZ	43	20	3	17	sold out	sold out	sold out	sold out	sold out	sold out
Phnom Penh New Port SEZ	106	53	-	-	-	5	29	19	sold out	sold out

Source: Survey Team

(2) Marketing Plan

1) Target Industries and Prospective Tenants

a) Target Industries

The category of the industries and business activities to be invited into the SEZ shall be non-pollution type both for manufacturing and commercial businesses, and the following industries which may have a bad environmental influence on the SEZ and/or other tenants in the SEZ and industries that use the large quantities of industrial water and electricity over the total capacity of the SEZ's utilities, shall be excluded from the tenant selection by SPC.

a. Petrochemical and chemical plant
b. Steel mill, non-metal, refinery such as aluminium, copper etc.
c. Wood chips and pulp plant

d. Fertilizer plant
e. Stock-raising plant
f. bricks and ceramic plant
g. Glass factories,
h. Commercial facilities requiring a lot of land
i. Other industries and businesses which will not comply with the requirements of the SEZ 's scale and concept

The following industries and manufacturing firms are recommended as tenants for the SEZ in this report from the view points of the advantage, location and scale of the SEZ.

While, these industries and manufacturing firms are typical types similar in scale to those in industrial parks or SEZ seen in other ASEAN countries, and it is necessary for Cambodia to target not only conventional types of industry which require only mass-labour forces, but also more valuable industries to contribute to exports as a type of export processing enterprise and also the import-substitute industries.

a. Steel and non-metal fabricated products (various pre-fabricated steel structures, aluminium processing products, die cast products etc.)
b. Plastic parts and products (for automobiles, office equipment, electric and electronics equipment, etc.)
c. Electronics parts and assembled products (for telephones and IT equipment etc.)
d. Electric parts and assembled products (for home appliances, condensers, industrial cable etc.)
e. Parts for automobiles, motorbikes
f. Mechanical parts and assembled products (construction equipment, agricultural equipment etc.)
g. High-technology products, precision equipment, optical equipment, medical equipment etc.
h. Agro-products (beverage, household goods, confectionery, food-stuffs, etc.)
i. Garments and textiles

While, these industries and manufacturing firms are typical types similar in scale to those in industrial parks or SEZ seen in other ASEAN countries, and it is necessary for Cambodia to target not only conventional type of industry which requires only mass-labour forces, but also more valuable industries to contribute to exports as a type of export processing enterprise and also the import-substitute industries.

b) Selection of Tenants

The SEZ must select the tenants who will match the requirements of the SEZ on the following points:

- To be matched with the category of industry for the SEZ (especially to be a non-polluting industry) (land space, utility consumption, product, raw materials, kind of industrial waste, method of waste water or solid waste treatment, smell, noise, air pollution., etc.)
- To be proper and have a reliable financial status
- To be matched with Government and SEZ's principles and concept.

2) Marketing Operation

It is required for the SEZ to establish a Marketing and Customer Service Division or Department (Marketing Department) in the SPC's operation and management organization. The SPC is recommended to have an overseas marketing network in cooperation with an overseas marketing agency on an exclusive or non-exclusive basis to invite international foreign investment. In this report, the following marketing and operations are recommended taking into consideration the concept of SEZ and its scale.

a) Activities of Marketing Department

The following activities are required of the marketing department in cooperation with other departments of SPC.

- To create a marketing plan
- To select, cooperate with continuously and supervise the marketing agent(s) overseas
- To prepare the marketing materials for the prospective tenants such as the various laws and regulations of Cambodia, catalogue of SEZ as well as SPC, home page, power point, newsletter, internal manuals for SPC including questions & answers for Tenants, etc.
- To prepare required format of various contracts such as Marketing agency contract, reservation contract, sub-leasing contract, internal regulation of SEZ, etc.
- To evaluate and select the prospective tenants (whether prospective tenant will be qualified as a suitable tenant or not.)
- To carry out marketing work through seminars and/or workshops both in Cambodia and overseas
- To provide various services to tenants in SEZ free or with compensation/fee
- To have regular meetings with tenants to exchange opinions with each other and to get tenant's requirements
- To get the various information of other competitor's SEZ or industrial parks domestically and in overseas countries especially neighbouring countries of ASEAN.

b) Working Schedule for the Marketing Department

SPC can start the marketing activities from the stage of beginning of development i.e. before completion of all the on-site infrastructures when the schedule of development will be decided. And SPC may conclude reservation contracts with prospective tenants asking for a deposit within a reasonable range.

If a part of the SEZ (Phase I) will be completed in the latter part of 2017, SPC may start the Marketing (sales) and conclude reservation contracts with tenant(s) from 2016. SPC must prepare a Business Plan immediately after establishment SPC together with the Marketing Plan, and this plan will be required to be reviewed and revised from time to time.

c) Important Subjects for Marketing

The marketing department will surely play a very important role to invite good tenants in time which may influence the success of the SEZ and therefore the following are the key points for this department.

The management and staff of the marketing department must have sufficient knowledge in various fields (laws and regulations of Cambodia, comparison list of other industrial parks or SEZ both in Cambodia and ASEAN countries, logistics, utilities, trading, various procedures of establishing a company and factory, environment., etc.) be versed in SEZ and industrial parks and for this purpose training will be required:

- To create a proper and realistic marketing plan
- To establish the proper marketing network domestically and overseas
- To have a proper and realistic pricing structure for the land leasing prices for negotiation with prospective tenant(s) taking into consideration various factors of land area, plot location in SEZ, the time of contracting, marketing price, and all this is to be reviewed from time to time. The leasing price must be flexible in view of the circumstances and marketing situation.

3) Necessity of Earlier Establishment of SEZ and Its Advantage

a) Necessity of Earlier Establishment

There are many SEZ or industrial zones in Cambodia under operation and developing, but these SEZ are at present rather behind the scale, location advantage and quality such as infrastructure, compared with the first class SEZ or industrial parks in Thailand, Vietnam and Indonesia.

Especially, the industrialization will start from a location near to the capital city where foreign investors wish to have factories for easier hiring of capable staffs and engineers required for manufacturing and operation, but now in Phnom Penh City or its suburbs there is only one SEZ.

For Cambodia, it is essential to construct a first class SEZ near Phnom Penh City like an SEZ next to the new Phnom Penh Port with advantageous and convenient location for logistics, and then it is expected that this SEZ will get good foreign investors who may have high technology industries or valuable industries which need capable engineers and staffs rather than conventional type of mass-cheaper labour forces industry.

There are many industrial parks and SEZ in ASEAN countries such as Vietnam, Thailand, Indonesia, Philippines, and Malaysia which causes heavy competition among these industrial parks and SEZ to invite foreign investors and therefore each developer is now appealing each advantage or characteristic for the foreign investors.

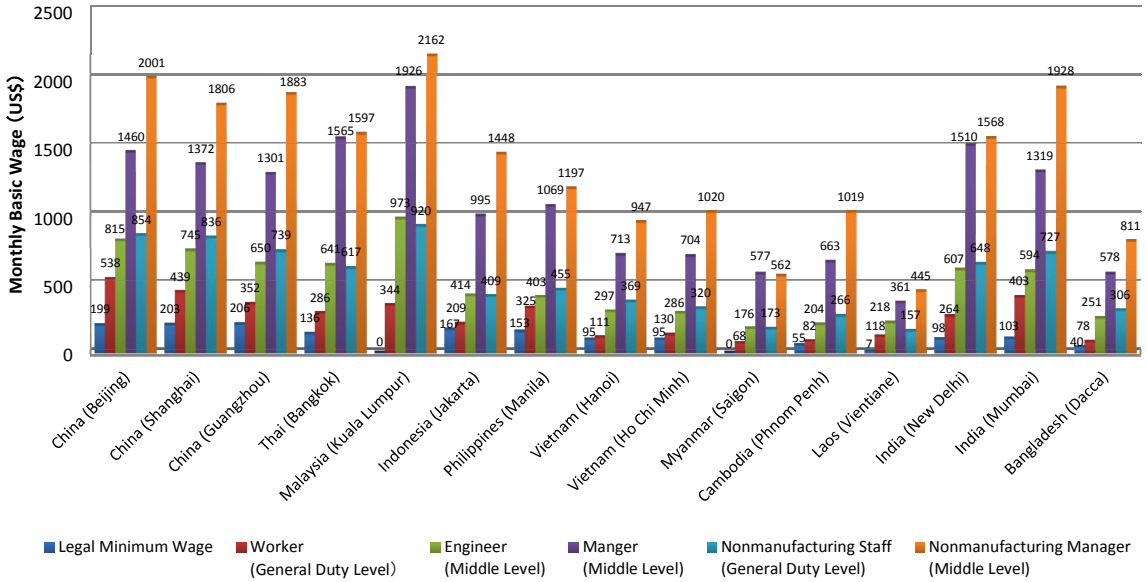
Recently, Myanmar, as a new coming competitor, is going to plan and construct new SEZ and industrial parks, and many foreign investors show interest in this market, and therefore Cambodia is required to realize this first class SEZ as soon as possible so as to not loose tenants.

While cooperating among ASEAN countries in trading, severe competition also exists among these countries for catching good investors through the means of industrial parks and SEZ.

b) Attractive Points and Advantage of SEZ

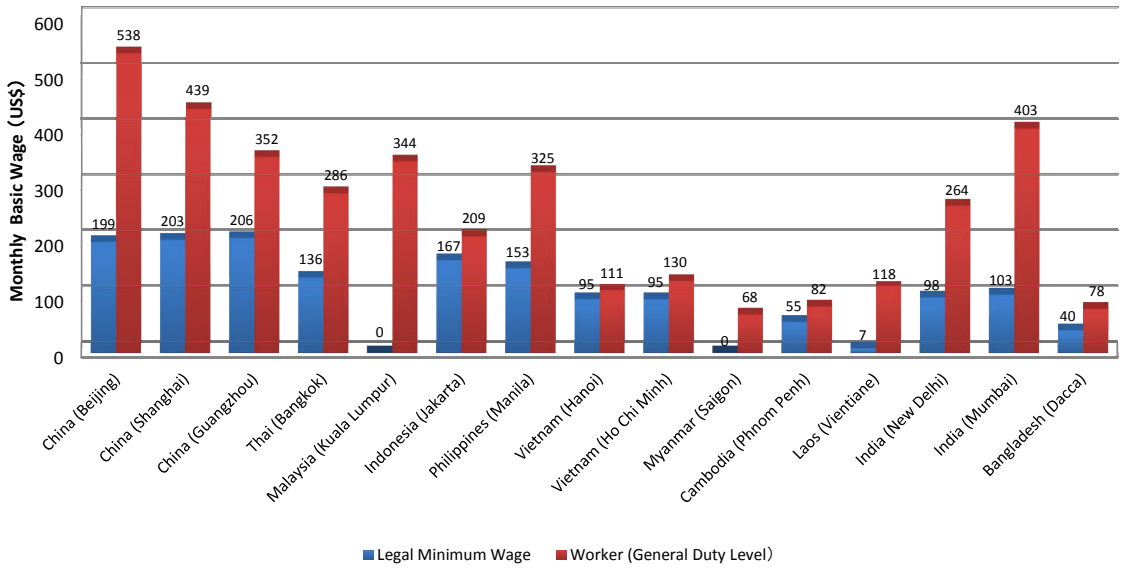
This SEZ will have the following attractive points and advantages not only for the foreign investors but also the domestic investors.

a. The logistic corridor connecting the countries of Thailand, Cambodia and Vietnam is now going to be realized through roads, new bridges, railways, sea and water lanes, and these logistic channels will start to contribute to trading among these countries. While Cambodia is starting to get keen attention from foreign investors to shift their factories due to the background that in Thailand the currency “Baht “is getting stronger which causes exporting prices to rise and also in Vietnam the land cost of industrial parks near the main city is rapidly increasing to US$80~100/m2/50 years recently and also the labour cost is also rapidly increasing year by year (refer to Figures 3.2-5 and 3.2-6). Under these circumstances, it is fact that many foreign manufacturers including Japanese manufacturers who have factories in Thailand as well as in Vietnam, are planning to shift their factories to make the best use of the above logistic corridor.



Source: JETRO, Project Team

Figure 3.2-5 Comparison of Monthly Basic Wage for Major Asian Countries (Status Base)



Source: JETRO, Project Team

Figure 3.2-6 Comparison of Monthly Basic Wage for Major Asian Countries (Legal Min. Wage and Worker Wage on General Duty Level)

b. Under these circumstance, foreign investors (manufacturers) will usually select the land for a factory by evaluating the following key factors and if this SEZ will meet the requirements of the tenant, have first class on-site and off-site infrastructure and propose a reasonable range of land leasing price and sufficient services, then the SEZ will be predominant over other SEZ or industrial parks in Cambodia or other ASEAN's ones.

- ◆ To easily hire capable engineers and expert staffs in the capital city and also a rich supply of skilled and un-skilled workers. In the future, it is expected for the SEZ to attract high-technology or valuable industries if the SEZ has such attractive points for the foreign investor.
- ◆ To use the new Phnom Penh Port, which will make it possible to receive 5000DWT class of ocean going vessels, which is a good advantage for logistics.

- To use air-cargoes from Phnom Penh International Airport easily because recently air cargoes will have a tendency to increase especially for high-technology industrial products.
- To be convenient to smooth trading with Vietnam through water lanes by using this new Phnom Penh Port.
- To enable foreign investors to use first class SEZ with sufficient on-site and off-site infrastructure such as access roads, port facilities, water supply systems and waste treatment, electricity supply and substations etc. including service apartments for foreign expatriates and commercial zones in the SEZ which make it possible to support the business activity as well as life support for the foreign investors.

c. In addition to the above, if the SEZ will have the following attributes to get more advantage, the SEZ will be more attractive to the foreign investors.

- To easily hire capable engineers and expert staffs in the capital city also with a rich supply of skilled and un-skilled workers. In the future, it is expected that the SEZ will receive high-technology or valuable industries if the SEZ has such attractive points for the foreign investors.
- To create the ECO-SEZ by placing importance on protection of the environment (example: Solar Power Systems, waste-water recycling systems etc.)
- To facilitate sufficient infrastructure to meet the requirements from high-technology Industry.
- To get ISO for SEZ
- To have sufficient counter-measurements to prevent damage from natural disasters, especially preventing damage from flood and deluge
- To establish a business development centre (BDC) for training human resources in the fields of language, IT, trading of export/import, accounting, technology, etc., various seminars or workshops, one-stop-shop service for various procedures with the government sector or authority by tenants, and other services required by tenants, and also to contribute to the society.

4) Expected Effects of SEZ Development

The following benefits from the SEZ will be expected.

- To accelerate foreign investment:

  The SEZ will have lot of opportunities to receive foreign investors owing to the good location near to the capital city having all the government sectors and commercial sectors, where they can easily get capable engineers, specialized staffs, and sufficient labour force, and all the basic infrastructure is available such as ports and airports etc.

- To get a new type of foreign investor in the field of manufacturing:

  The SEZ may expect new foreign investors in the field of high technology industry and/or valuable industry other than conventional type of industry with mass-cheaper labour force such as textiles, garments, etc. This tendency has been actually seen in other ASEAN countries such as in Thailand, Vietnam, and Indonesia from past history of development.

- Assumption of Tenant Numbers:

  The number of tenants in the SEZ will be expected to be from 40~ 50 firms in view of the location factor and its characteristics.

- Contribution to industrialization and to earn foreign currency:

  In the case of developing 150 hectares as an SEZ and the portion of the industrial park is about 130 hectares, then the total production from the industrial park may be estimated to be

about US$ 1.5billion at the stage of stable operation, and if 80% of the products from the industrial park will be exported, Cambodia may earn from this SEZ foreign currency of about US$1.2 billion which will be corresponding to about 23% of the total export amount of Cambodia in 2011.

- Acceleration of logistic business:

  If 40~50 tenants of the industrial park in the SEZ next to the new Phnom Penh Port will start operation, then these tenants may receive raw materials or parts required for products and export the products, and it will produce a lot of logistics business which will be estimated at more than 55,000 TEU per year in the stable operation period.

- Job Creation:

  Direct labour force required in the SEZ (industrial park, commercial zone, and residence zone) will be estimated at more than 25,000 persons and including indirect labour forces produced from the SEZ the total may be estimated at more than 3 times that of the direct labour force.

- Enhancement of technology:

  Through the activities of the foreign manufacturers, especially high-technology industry or valuable industry, the level of the engineer's capacity will surely be enhanced which also indirectly affects the improvement of education in university or college because the foreign investors need capable staffs and engineers.

- To contribute to the environmental protection:

  The establishment of SEZ and industrial parks, makes it far easier for the government to supervise and control environmental protection because it is much more difficult for the Government to supervise the activities of each independent factory located in separate places.

(3) Logistics Plan

As explained in a previous chapter, the industries promoted to be invited into the SEZ are divided into following eight industries. The promoted ratio of each industry to be invited into the SEZ, average area for a factory and average monthly cargo (container TEUs) generated by a factory are presented in Table 3.2-8 based on the research for the general occupancy ratio of the mid-size factory in SEZ of ASEAN countries.

Table 3.2-8 Assumed Industry Types and Cargo Volumes

Industry	Occupancy Ratio	Occupancy area per factory	Estimated container cargo volume (TEU/month/factory)
Car component/parts	25%	1~5 ha (average 2.5)	120
Metal/Non-metal Processing	20%	2 ha	70
Electrical/ Electronic component/parts	15%	2 ha	60
Machinery component/parts	10%	2 ha	100
General Processing	10%	2~4 ha (average 3ha)	100
Plastic Processing	10%	1~2ha (average1.5ha)	90
Processed marine/agriculture products	5%	2 ha	120
Garment/ others	5%	1~3ha (average 2ha)	120

Source: Survey Team

On the basis of Table 3.2.8 above, it is expected that the planned factories will move into the Phnom Penh New Port SEZ over a period of 5 years starting in 2017. The areas to be occupied by the planned factories and their cargo volumes (Import /Export) are presented in Table 3.2-9.

Table 3.2-9 Factory Numbers and Cargo Volume for Export and Import

Industries	Area in SEZ	Factory Numbers in SEZ	Estimated Import Cargo (Container) TEU/month	Estimated Export Cargo (Container) TEU/month
Car component/parts	25 ha	10	500	700
Metal/Nonmetal Processing	22 ha	11	290	480
Electrical/ Electronic component/parts	16 ha	8	180	300
Machinery component/parts	10 ha	5	220	280
General Processing	12 ha	4	180	220
Plastic Processing	9 ha	6	180	360
Processed marine/agriculture products	6 ha	3	100	260
Garment/ others	6 ha	3	165	195
Total	**106 ha**	**50**	**1,915**	**2,895**

Source : Consultant's Estimation

Yearly Import (Total) ＝1,815 x 12＝21,780 TEU , Yearly Export(Total)＝2,795 x 12＝33,540 TEU
Total Cargos (Yearly) =55,320 TEU

Source: Survey Team

In line with the GOC's policy to invite factories to SEZ, the factories are basically targeted as "Export Processing Industries". The SEZ is connected directly to the Phnom Penh New Port. Therefore, the cargos generated by the factories will be mainly imported and exported through the port.

Cargos for the SEZ are transported between the Phnom Penh New Port and the SEZ over the access road to the SEZ. The cargo transportation, debarkation/embarkation of the containers, temporary cargo storage, empty container storage and customs arrangement are planned to be executed by the Logistic Center which is allocated in the SEZ and is operated by a private party as the concessionaire. The Logistic Center is planned to occupy the area in the SEZ as follows:

- Cargo storage for debarkation/embarkation: 3,000 m2
- Empty container area : (Total export- Total import) / 360days x 10days (duration) = 324 Numbers = 162 nos (2 stacking) x 30 m2 = approx. 5,000 m2
- Track space around the storage : 35m x 85 m = 3000 m2
- Parking space for trucks and handling equipment : 1500 m2 (Trailer 20 units x 18m x 3.5m +200m2)
- Office area : 500 m2 (office 250 m2 + parking 250 m2)
- Other necessary area : above total x 30% = 4,000 m2

Required total area = 17,000 m2, In addition to the above area, 10,000 m2 as a reserve space will be planned for expansion. Hence, the total area for the Logistic Center is planned at 27,000 m2 in the SEZ.

3.2.2 SEZ Development Plan

(1) SEZ Development Policy

1) Basic Concept

As mentioned in 3.2.1, the SEZ development at this site would require approximately 1,000 ha in the future. It is recognized as the prerequisite that the SEZ development is to be generally carried out by private investment. To induce the private investment, the scope of this Survey was to establish the development plan as the pilot project of 143 ha SEZ including industrial park, commercial, residential and public areas with provision of basic common infrastructure and related utility facilities, and an access road connecting to National Road No.1.

The developer shall have the following basic objectives and principles of SEZ development.

- To contribute to the economic development of Cambodia and especially as a project for development of Phnom Penh City as the capital city and its surrounding area
- To be a project to receive foreign investors whose target is for manufacturing export products and to contribute to the earning of foreign currency
- To be a project to create jobs and to improve the capacity of the human resources
- To establish a better SEZ than any other in Cambodia or any of the other neighbouring ASEAN countries with sufficient infrastructure and services through cooperation between the governmental sector and private sector
- To achieve the target to invite useful investor(s) into SEZ who will contribute much to the industrial development of Cambodia in the future.

2) Basic Concept of SEZ Zoning

The basic layout of the SEZ must have the following zoning concept. The SEZ is required to be designed under the concept of the pollution-free investor as listed in Section 3.2.1 and give consideration to the various types of industries in SEZ or industrial parks which are of a similar scale in other ASEAN countries as well as the zoning ratio for each manufacturing industry.

a) Zoning of Total SEZ

Table 3.2-10 shows the basic concept of SEZ zoning.

Table 3.2-10 Basic Concept of SEZ Zoning

Zone	Area (ha)	Category of Business
I. Industrial Park	140	Export processing manufacturers : about 40~50 factories
II. Commercial Zone	1.2	Supermarket, shop, bank, business development centre, etc.
III. Residential Zone	1.2	Serviced Apartments
IV. Public Zone	0.6	School, clinic, hospital, etc.
Total	143	

Source: Survey Team

b) Zoning of Industrial Park

The ratio of zoning in the industrial park for each category of industry will be estimated as follows. These are pollution free types as shown in Tale 3.2-11 and also prospective investor(s) expected in the future in Cambodia by reference to the current industrial parks with similar size in ASEAN countries.

Table 3.2-11 Ratio of Zoning of Industry

Category of Industry	Ratio of Zoning
Automobile parts	25%
Metal/non-metal processing	20%
Electric/ electronics parts	15%
Mechanical parts	10%
General assembling	10%
Agro-products	5%
Garments and others	5%

Source: Survey Team

3) Development Framework

The framework of the Industrial park in the SEZ will be designed on the following assumptions which are average figures in Japan and the ASEAN countries.

a) Expected Employment

Table 3.2-12 shows expected employment assumed.

Table 3.2-12 Expected Employment Assumed

Zoning	Number of employees/ha	Total Employees
I. Industrial park	50~250/ha	7,000~35,000
II. Commercial zone	250~300/ha	300~360
III. Residential zone	50~100/ha	60~120
IV. Public zone	50~300/ha	30~180
Total		7,390~35,660

Remarks: The above estimated number of employees for each zone is at the peak time but is changeable by the kind of tenants, scale and its products. Actual figures in the existing ASEAN's industrial parks show a similar number of employees.

Source: Survey Team

b) Assumed Total Utility Demand

Table 3.2-13 shows assumed total utility demand. The breakdown of the utility demand is shown in ANNEX-D.

Table 3.2-13 Assumed Total Utility Demand

Name of Utilities	Consumption
I. Water	1,500m3~2,000m3/day
II. Electricity	Peak: APD (annual total demand)/(operation Days x 24 hours x load rate) 148,200Mwh/(250days x 24 hours x 0.65) ≒40MW

Remarks: The above figures are estimated for peak time of operation. If the demand for the future is forecast, then counter-measures such as increasing the number of trains etc., may be required to match the requirements.

Source: Survey Team

4) Utility Supply Plan

a) Water Supply

The water supply demand for PPAP-NCT SEZ is estimated at about 2,000m3/day as per Table 3.2-13.

Currently, a water supply pipe of 200mm dia. is installed along the national road No.1, however, the existing water pipe could not be used for PPAP-NCT SEZ due to high demand. Therefore, PPAP-NCT SEZ water supply pipe is to be connected directly to the secondary water station located in the area about 5Km from PPAP-NCT SEZ.

b) Electricity

The maximum electrical demand of PPAP-NCT SEZ is estimated at about 40 MVA. According to a standard of Electricite Du Cambodge (EDC), the maximum distribution capacity of an overhead 22 kV distribution line is 10 MVA. In view of the standard, the capacity of the existing 22 kV distribution line is not enough to cover the demand of PPAP-NCT SEZ.

EDC plans a new 115kV transmission line from Phnom Penh to Neak Loeung Bridge along national road No.1 This plan has been designed and budgeted, the planned new transmission line is expected to be completed by 2015.

After completion of the above project, EDC will install a 115/22 kV substation in PPAP- NCT SEZ area, and an incoming transmission line of the above 115/22 kV substation is to be connected to the 115 kV transmission line installed along the road No. 1. The 115/22 kV substation will be installed by EDC, however, part of expenses related to installation of the above substation will be borne by PPAP-NCT SEZ.

The maximum electrical demand of Phnom Penh in 2010 was approximately 300 MW and generating capacity was about 10% less than the above demand. The generating capacity included import of electricity from a neighbouring country. Due to shortage of generating capacity, EDC is forced to carry out a scheduled power breakdown on the peak demand of electricity. However, a project for a coal fired power plant with 100 MW capacity will be completed and scheduled to start generating electricity from June, 2013. After completion of the above power station, the generating capacity becomes larger than maximum demand of Phnom Penh. Then EDC will be able to supply stable electricity for the time being. In addition to the above power plant, a new hydro power station will be expected to start operating from 2018, once the hydro power station will start generating electricity, the generating capacity will exceed the electrical demand substantially.

In view of the above future generating capacity, PPAP-NCT SEZ will be able to receive a stable power supply from EDC.

(2) SEZ General Layout

1) Scale of SEZ Development

The SEZ development area is designed to plan for the scale of the necessary facilities and tenant's area. The development area is determined based on the following priority considerations.

① Development Land Acquisition: Possible land acquisition and its conditions before the planning of the development.

② Development Financing Plan: Available development finance and its scale.

③ Conditions of Development Cost: Estimated development unit cost for the development area based on the physical conditions.

④ Estimated Leasing Price and Tenant Numbers: Other SEZ leasing prices and yearly tenant movement.

In line with the above Priority Issues, the implementation agency (PPAP) will be able to secure land acquisition of 205 ha for the SEZ development. PPAP could not develop the SEZ using its own funds due to difficulty obtaining enough finance. Therefore, Japan's ODA support for the development will be required as a Yen soft loan or the PSIF. In this SEZ development cost, land reclamation (development) is required to raise the site more than 5m in height which is estimated to cost about US$ 20 /m2, in the other development cost, the minimum infrastructures for the SEZ generally require about US$ 25/m2 to US$30/m2 for the development area.

The road network and green area in the SEZ is about 25% of the development area, the area for the common facilities (office, logistic centre) and service facilities (water, power and sewer facilities) takes about 5ha ~ 8 ha in general. If those areas could not be less than 30% of the SEZ development area, the necessary area for the tenants could not be secure for a feasible leasing price in the SEZ. In this case, the leasing price shall be raised and it is not a competitive price as well.

In order to secure the competitive price, the required development area is calculated to be more than 100 ha in this project.

Concerning ①, the above, Phnom Penh SEZ has been moving the tenants into the SEZ at an average of 8 factories per year for five years, and then averaged 15 factories per year for the most recent two years and has been occupied 90% in the SEZ. Therefore, the tenants are planned to move from 10 to 12 factories per year for five years and totally about 55 factories will be moved in this project. The planned factories having an average size of 2ha is calculated as 110 ha in total tenant areas. Therefore, the suitable development area for the SEZ is calculated as follows; 110 ha x 125% + 5ha~8ha =about 145ha.

Concerning ②, the above, PPAP secured 205 ha for the SEZ area. If 150 ha of the area is developed for the SEZ, about 55 ha of the area remain. Therefore, the remaining area could be utilized as the water reservoir area for the neighbouring rice field. The area shall be excavated to create a pond and the excavated materials could be utilized for filling the SEZ in order to reduce the reclamation soil volume and its cost to the SEZ.

2) SEZ Basic Common Facilities and Layout Plan

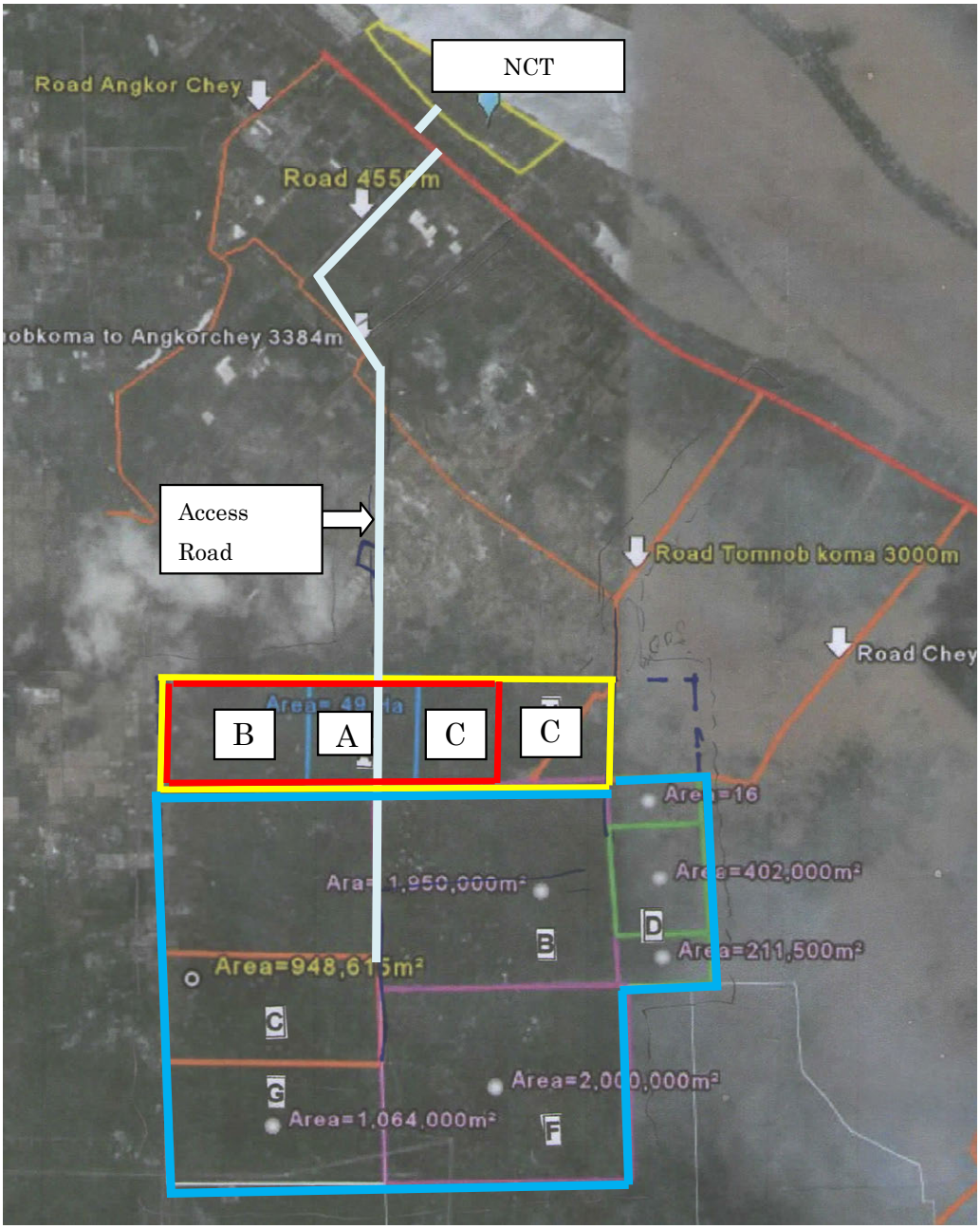
The common infrastructural facilities and area allocations are planned as shown in Table 3-2-14**.**

Table 3.2-14 PPNP SEZ Common Facilities and Area Allocation

Land Use	Area (ha)
Development Area （Area outside SEZ＋Area Inside SEZ）	**143**
Area Outside of SEZ	**3.02**
Detailed	
Apartment Area for Tenant (Rental)	1.22
School and Clinic Area (Rental)	0.6
Commercial Area (Rental)	1.2
Area inside of SEZ	**139.98**
Detailed	
Area for Tenant (factories)	106.3
Logistic Center Area (Concessionaire)	2.7
Road Network	10.6
SEZ Management Office & Maintenance shop	0.9
SEZ Common Utility (Facilities Area)	2.98
Park (garden & Pond)	7.42
Other common area and green area	9.08

Source: Survey Team

The location and the area of the SEZ are shown in Figure 3.2-7, the planned development areas of the SEZ are marked red in the figure, SEZ basic layout is presented in Figure 3.2-8, and the SEZ Access Road general layout is shown in figure 3.2-9.



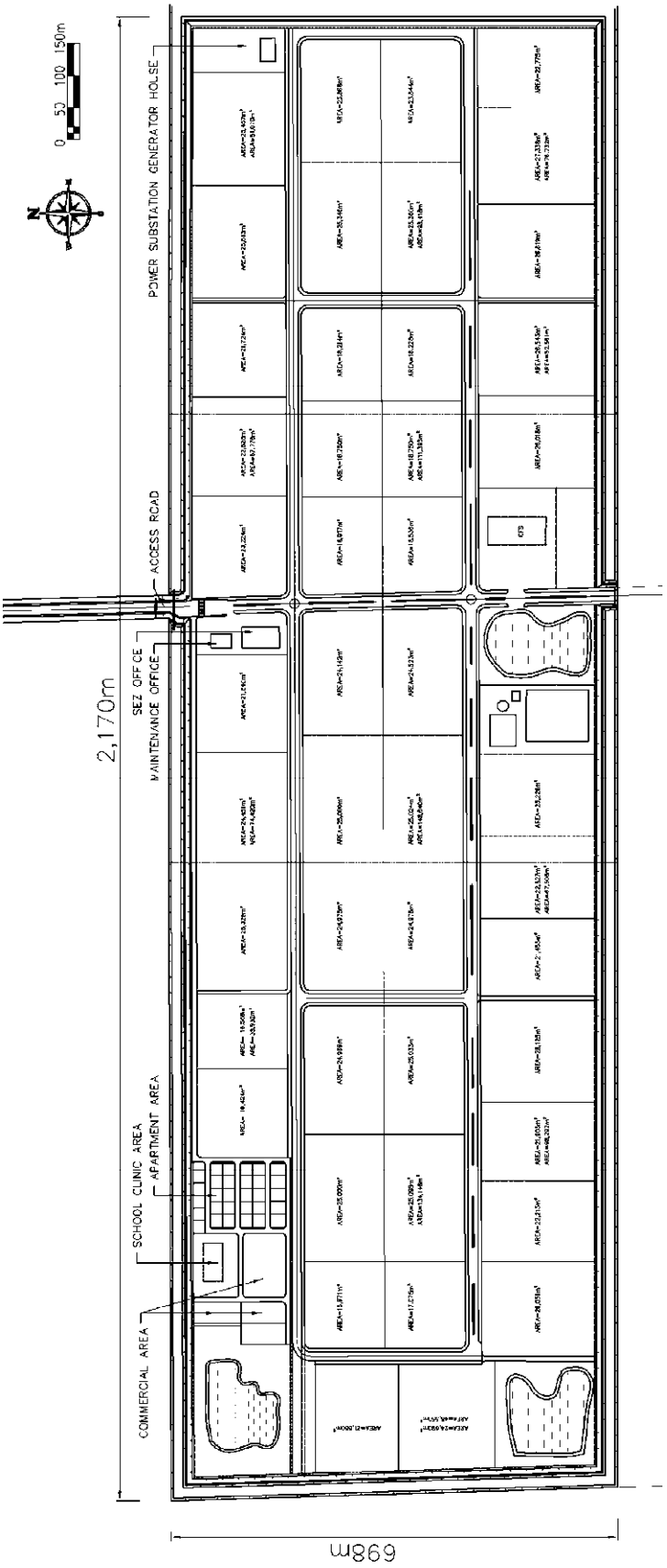
: SEZ Target Area （143ha A+B+C）

: PPAP Development Area （205ha A+B+C）

: Future SEZ Development Area （約 830ha）

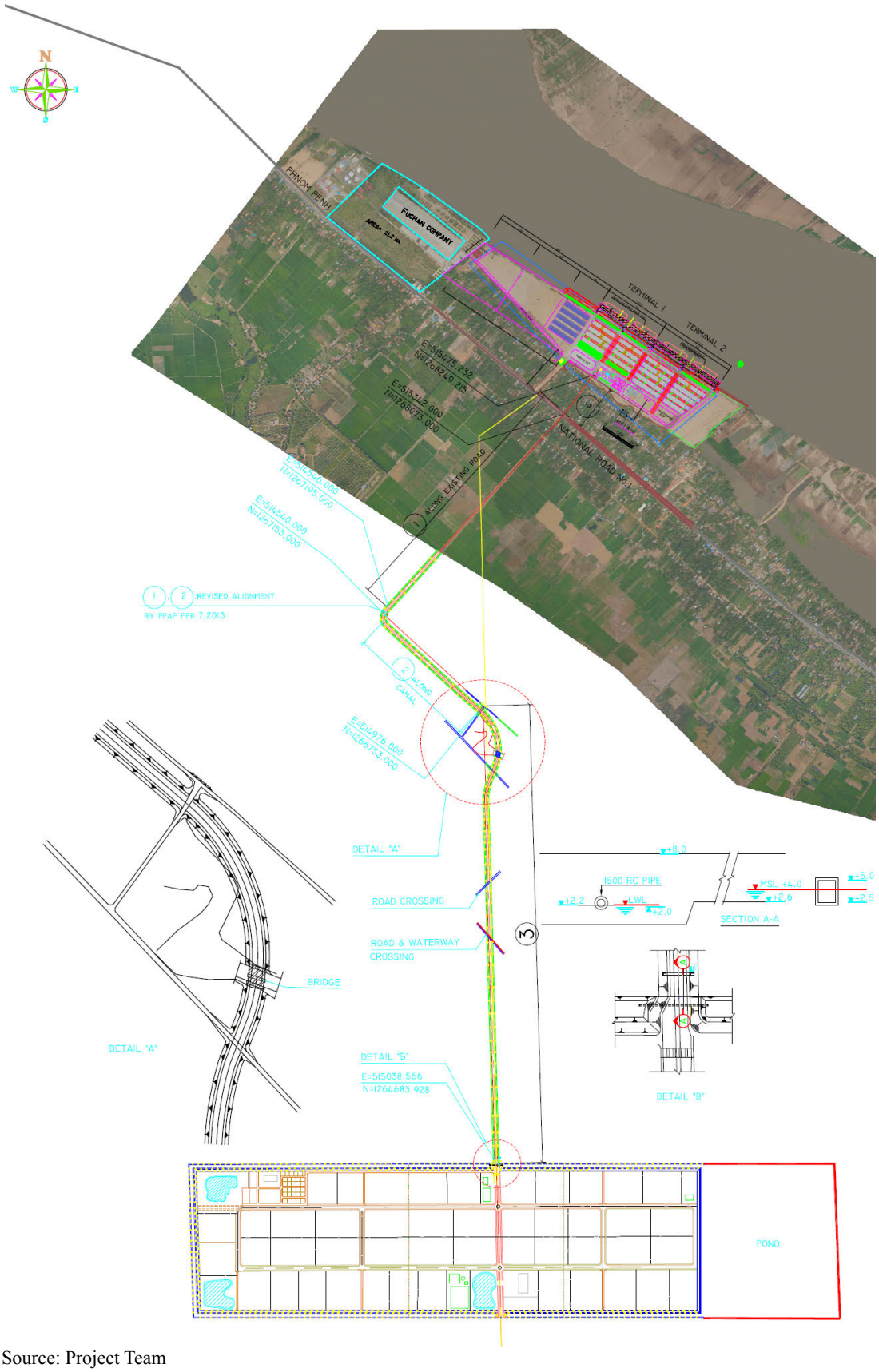
Source: Project Team

Figure 3.2-7 Planned SEZ Development Areas



Source: Project Team

Figure 3.2-8 SEZ General Layout



Source: Project Team

Figure 3.2-9 Planned General Layout of SEZ Access Road

3.2.3 Concept Design and Facility Planning (SEZ)

(1) Design and Planning Criteria

1) Applicable Codes and Standards

The following design codes and standards were applied in this concept design and facility planning:

- Road Structure Ordinance in Japan (2003)
- Highway Design Standard by DOH (Department of Highways, Kingdom of Thailand)
- General Specifications by DOH (Department of Highways, Kingdom of Thailand)
- The Structural Design of Heavy Duty Paving for Port and other Industries (British Port Federation)
- American Association of State Highway and Transportation Officials (AASHTO)
- American Society of Testing Materials (ASTM)
- A policy on Geometric Design of Highways and Streets, ASSHTO (2011)
- Guideline for Concrete Pavement in Japan
- Guideline for Asphalt Concrete Pavement in Japan
- Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)
- A Standard for Building Utilities in Japan (2009)
- Japanese Industrial Standards（JIS）
- British Standards (BS)
- International Plumbing Code (IPC)
- National Fire Protection Association (NFPA)
- Water Environment Partnership in Asia (WEPA)
- International Electrotechnical Commission (IEC)
- Institute of Electrical and Electronics Engineers (IEEE)

2) Natural Conditions

a) Temperature and Rainfall

The following characteristics of temperature and rainfall observed in Phnom Penh for past ten years were considered in this concept design and planning:

Temperature	:	27°C(average), 35°C (Maximum), 22°C (Minimum)
Rainfall	:	1,500 mm (annual), 350 mm (monthly max. September), 40 mm (monthly min. December and January)
Rainfall Intensity	:	Phnom Penh City rainfall intensity –duration – frequency curves (maximum Rainfall/hour = 100mm/hour)

b) Wind

Past meteorological observations in Phnom Penh city recoded 16 m/sec as average monthly maximum wind velocity, 11 m/sec as average daily maximum wind velocity and 25 m/s as maximum gust wind velocity. In Kampong Cham province, 28 m/sec as average monthly maximum wind velocity was observed over the past 10 years. Considering the above, the design wind velocity was determined as 30 m/sec in this concept design and planning.

c) Water Level

The following water levels, which are the same as the existing new container terminal design and construction, were applied in this concept design and planning:

Highest Water Level (HWL)	:	+8.60 m (Mekong River Water Level)
Highest water Level (HWL)	:	+7.30 m (Inland Flooding Water Level at SEZ Area)
Lowest Water Level (LWL)	:	±0.65 m
Datum Level (DL)	:	±0.00 m (MSL at Ha Tien)

d) Subsoil Conditions

Design parameters for the subsoil for the SEZ and access road areas were determined based on the soil investigation results carried out in this Survey as well as existing available soil information. Table 3.2-15 presents the subsoil conditions and design parameters applied for both the areas:

Table 3.2-15 Design Subsoil Conditions

Location	Layer	Depth	Soil Property			
			Av. N-Value	Unit Weight		Strength
		(CDL)		γ(kN/m3)	γ'(kN/m3)	
SEZ	Silty Clay	+3.0 to -18.0	7-13	14.6	10	C=12 kN/m2 Kh=15 N/cm3
	Sility Sand/Fine Sand	-18.0 to -30.0	35<	18	10	$<\phi=35^{\circ}$ Kh=53 N/cm3

Source: Survey Team

e) Seismic Factor

The following seismic factors, which are the same as in the design for the existing Phnom Penh Port rehabilitation, were applied in this concept design and planning:

Horizontal seismic factor : 0.05
Vertical seismic factor : 0.00

3) Structural Design Conditions

a) Service Life

All civil and building facilities were designed and planned for a service life of 50 and 30 years, respectively.

b) Material Properties

< Concrete >

Table 3.2-16 shows design concrete strength assumed in the concept design.

Table 3.2-16 Design Concrete Strength

f'c (Mpa)	Usage
28	Reinforced Concrete (Wharf Structures)
28	Reinforced Concrete (On-land Structures) and Pre-cast Concrete Piles and Blocks etc.
21	Plain Concrete
4.8 (Flexural Tensile) 30.4 (Flexural Compressive)	Concrete Pavement
34.5	Prestressed Coccrete Beams, Slabs, Piles etc.

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

< Rebar Materials >

Table 3.2-17 shows allowable stresses of structural rebar.

Table 3.2-17 Allowable Stresses of Rebar

Grade	Yield Strength, fy (N/mm^2)	Allowable Tensile Strength (N/mm2)
JIS SD390A or equal	390	206
JIS SD295	295	176
JIS SR235	235	137

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

< Stone, Quarry Run, Sand and Backfill Materials >

Considering initially investigated availability of local materials and their properties, the following properties were adapted in this design as shown in Table 3.2-18.

Table 3.2-18 Adapted Materials Properties of Stone, Quarry Run, Sand and Backfill Materials

Discreption	Unit Weight		Angle of Shearing Resistance
	γ (kN/m3)	γ' (kN/m3)	ϕ (degree)
Fill Material, Sand	18	10	30-35
Rubble Backing, Stone, Rock	18	10	35
Rubble Base Stone	18	10	40

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

c) Factor of Safety

Table 3.2-19 shows the factor of safety in structural computations in this design.

Table 3.2-19 Factor of Safety in Structural Computation

Structure	Condition	Factor of Safety
Gravity Type	Sliding	1.20
	Over-Turning	1.20
	Tolerable Rubble Base Reaction	500 kN/m2
	Circular Slip Failure	1.30
	Bishop Method	1.00
Deck on Pile Type	Bearing Capacity	2.50
	Pullout	3.00
	Circular Slip Failure	1.30

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

d) Margin of Allowable Stress

The margin of allowable stresses was 50 % for seismic conditions as referenced from Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009).

e) Coefficient of Friction

The coefficient of friction applied for design of gravity type structures was 0.5 for between concrete and concrete, and 0.6 for between concrete and rubble base stone as referenced from Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009).

f) Others Concerns

Vertical inclination of the access road was less than 3 % making it possible to attain a 40 km per hour travel speed for a 40' trailer truck, based on the relevant codes and standards.

4) Planning Conditions

Table 3.2-20 shows planning conditions for facilities operation.

Table 3.2-20 Design Conditions for SEZ Facilities Operation

Item	Criteria	Investment	Operation & Maintenance	Standard, Code
Site grading	Minimum slope 0.2%	SEZ	SEZ	Construction Specification (ADB/MPWT)
Storm water drainage	Minimum slope 0.15% Max flow 3m/sec Design intensity of rainfall: 20 years return period intensity curve	SEZ	SEZ	Construction Specification (ADB/MPWT)
Roads	Axle load 15 ton Design speed 35 km	SEZ	SEZ	Construction Specification (ADB/MPWT)
Main gate	1 gate for Cargo-in／out 1 gate for Commuter-in/out	SEZ	SEZ	None
Sub gate	Future planned	SEZ	SEZ	None
Power	Demand in future: 35 MW Power source: 115 kV from EDC distribution line Backup generator for:1000 kVA for minimum operation of utilities	SEZ/ EDC	SEZ	EDC
Telecom & IT	96 kbps IP phone/factory 2560 kbps internet/factory	SEZ to invest provider to install cables and equipment	Telecom service provider	ITU-T, ITT-F
Water supply	Design demand: 2000 m3/day Source: water provider Reservoir: 12 hours for peak-cut and fire reservation Fire water: take from water supply network End pressure: 2 bar(0.2 MPa)	SEZ	SEZ	Drinking Water Quality Standards
Wastewater disposal	Design volume: 2000 m3/day Design BOD-in: 250 mg/L Design BOD5-effluent: 80 mg/L	SEZ	SEZ	Sub-Decree on Water Pollution Control
Solid waste disposal	Design volume: 10ton/day	Solid waste contractor	Solid waste contractor	
SEZ center	50m x 15m, 2 story	SEZ	SEZ	
Miscellaneous buildings	Maintenance Office for SEZ Generator house, Substation Puming & Disinfection house Sewage treatment house Main Gate	SEZ	SEZ	

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

(2) Summary of Concept Design and Planning for SEZ Facilities

1) Civil and Architectural Facilities

Based on planned scale and area of SEZ facilities as stated in Section 3.2.2 (2), the basic dimensions of major SEZ civil and architectural facilities are presented below:

a) Soil Embankment :SEZ Development Area =143 ha (Fill Volume : 6,900,000 m3) (Excavated soil materials from 50 ha area = 3,200,000 m3, Sand reclamation from quarry site = 3,700,000 m3), Land Elevation +7.5 (SEZ area) and +8.5 (Boundary Dike)

b) SEZ Road

Main Road : Four lane two way road with two lanes each way (3.5m width x 4), Median strip (1m width),

Round Road : Four lane two way road with two lanes each way (3.5m width x 4),

Other Road : Two lane two way road with a Parking lane each side (2.5m +3.5m x 2) Small Road : Two lane two way road (3.5m width x 2)

Buffer Zone : Both sides of road (natural green grass) = 5m width each side

c) Access Road : Two lane two way road with a Parking lane each side (2.5m +3.75m x 2)

d) Rain Water Drainage :Open ditch drainage installed at both sides of road. (1m x 0.5~1.0m), Diameter 800mm~1000m RC pipe culvert installed for crossing the road and for outlet.

e) Buildings : 1ha area for the SEZ office and Maintenance office, SEZ office (Two story building having 2400m2 space) Maintenance Office & shop (600 m2 one story) SEZ gate (3lanes and 3 checking booths)

f) Green area and Park

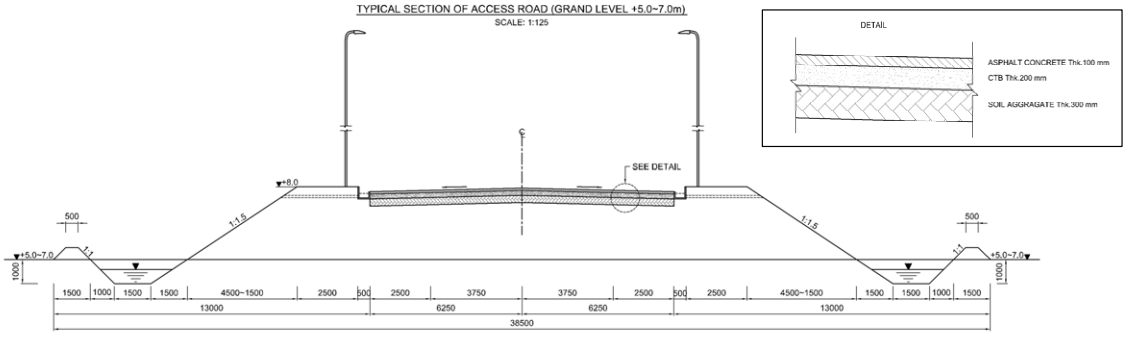
Park : Planted green grass around the park, water pond planned in the park, 5m width protection around the pond.

Green grass : Planted green grass and trees (palm and acacia 10m interval) at buffer zone, median strip and park.

Brick wall : Installed around SEZ and around commercial area, 2.5m height brick wall.

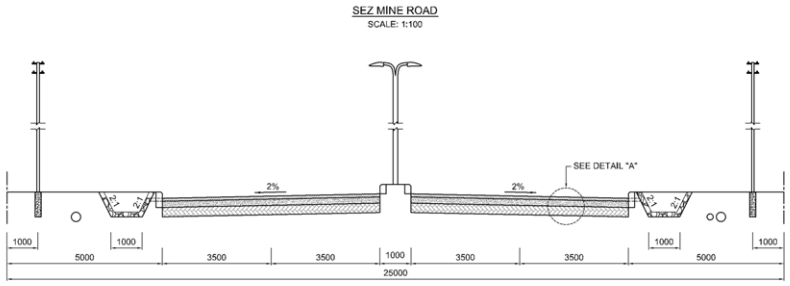
g) Area Outside SEZ : Commercial area, school clinic area and apartment area is located outside of SEZ separated by the wall installed at boundary of the SEZ factory area.

Figures 3.2-10 and 3.2-11 show typical sections and pavement compositions of SEZ access road, service and other road.

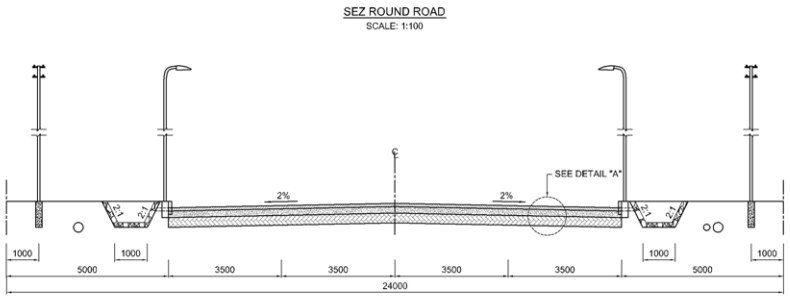


Source: Project Team

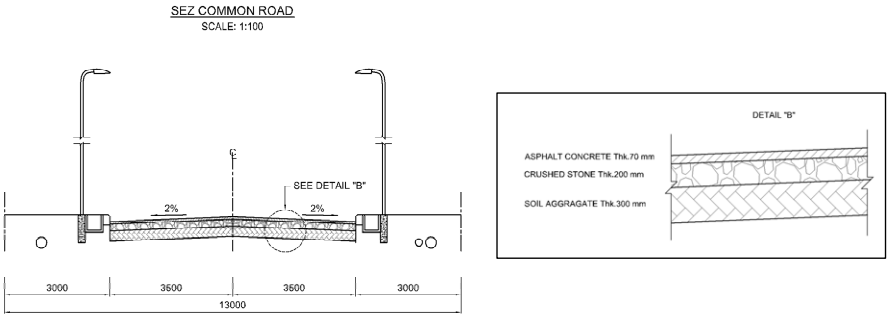
Figure 3.2-10 SEZ Access Road Typical Section and Pavement Composition



a. Main Road



b. Service Road



c. Other Common Road

Source: Project Team

Figure 3.2-11 SEZ Access Road Typical Section and Pavement Composition

Floor space plan for the SEZ Management Office is summarized in Table 3.2-21.

Table 3.2-21 Room Space Plan for SEZ Management Office

Department of SEZ to be accommodated	Title	Nos	First floor	Area (m2)	Second Floor	Area (m2)
Top Management	Director General	1			25 m2	50
	Vice Director	1			15m2	
	Secretary	1			10m2	
Marketing & Tenant Service	Director	2	12m2	50		
	Section Chief	2	12m2			
	Staffs	6	25m2			
Accounting /Financing Dept.	Director	1	12m2	45		
	Section Chief	1	12m2			
	Staffs	4	20m2			
Administration Dept.	Director	1			12m2	50
	Section Chief	1			12m2	
	Staffs	6			25m2	
Technical Dept.	Director	1			12 m2	75
	Section Chief	1			12 m2	
	Staffs	12			50m2	
Advisory	Private Adviser	1			15m2	15
Temporary office for Tenant	Personal	6	30m2 x 5 tenants	150		
Marcketing Company Office	Officers	5			30m2	30
Logistic Center Office (IT Center)	Officers	5	30m2	30		
Security Company Office	Director / staffs	2	12m2 x2 = 24m2	60		
	Labours	8	35m2			
Customs Office	Officers	4	20m2	20		
Bank Branch office	Personal	3	20m2+ 10m2	30		
Vocational /labour Service Room	Personal	30			200m2	200
Cleaning (Park & office) Company	Director / staffs	2	12m2 x2 = 24m2	100		
	Labours	14	70 m2			
Meeting Rooms (small)			20m2 x 4=80m2	80	20m2 x 4=80m2	80
Meeting Rooms (Large)			100m2	100	200 m2	200
Canteen/ Coffee house	Kitchin	100	20m2	120		
	Room		100 m2			
Total		221		785		700
Common Space			40%	325	35%	250
Grand Total				**1,110**		**950**
Water Requirment	0.6m3 x121= Canteen 100 x 0.1=	8.5 m3/day				

Source: Survey Team

2) Mechanical Systems

a) Water Supply System

The water demand for PPAP-NCT SEZ is estimated at about 2,000 m3/day as per Table 3.2-13 in Section 3.2.2 (2).

Currently, a water supply pipe of 200mm dia. is installed along national road No.1, however, the existing water pipe could not be used for PPAP-NCT SEZ due to high demand.

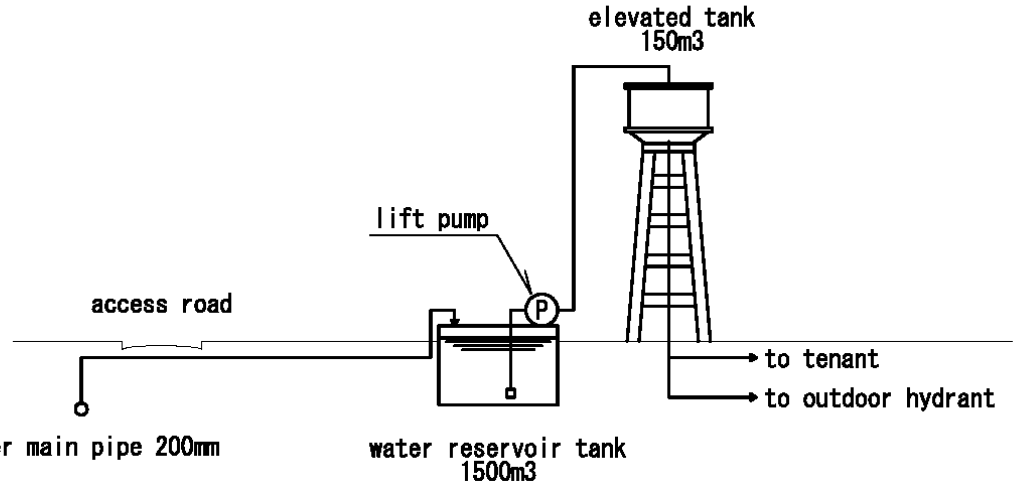
Therefore, PPAP-NCT SEZ water supply pipe is to be connected directly to the secondary water station located about 5Km from PPAP-NCT SEZ. Currently, the capacity of the primary water station located about 15 km from PPAP-NCT SEZ is 4,000 m3/day, however this water station will be able to supply up to 10,000 m3/day. The name of the water supply company is MEKONG MEPOVASIMEX IMPORT & EXPORT.

Water from city water is stored in the water reservoir tank (storage volume: 2,000 cubic metres) for countermeasures against water outage, the water in the reservoir tank is lifted to an elevated tank (storage volume: 150 cubic meters) by 3 sets of lift pumps (2,500L/min x 0.46MPa one pump as a backup), and water is supplied to tenants and the facility buildings from the elevated tank. The Schematic Flow for the Water Supply System is shown in Figure 3.2-12.

A gate valve is provided for future water supply connection. Water supply pressure is to be kept at more than 2 Bar (0.2 MPa) at the gate valve installed at each tenant site. Water supply pipe is of High Density polyethylene pipe (HDPE) in consideration of corrosion resistance, flexibility and workability.

Major equipment of the Water Supply System is as follows:

- lift pumps (2,500L/min x 0.46 MPa) 3 nos. (1 for standby)
- Water reservoir tank (storage volume: 1,500 cubic metres) 1 lot
- Elevated Tank (storage volume: 1,500 cubic meters, Height : 25 metres) 1 lot
- Water Supply Pipe (HDPE 100 mm) Approx. 2,000 m
- Water Supply Pipe (HDPE 200 mm) Approx. 6,500 m



Source: Survey Team

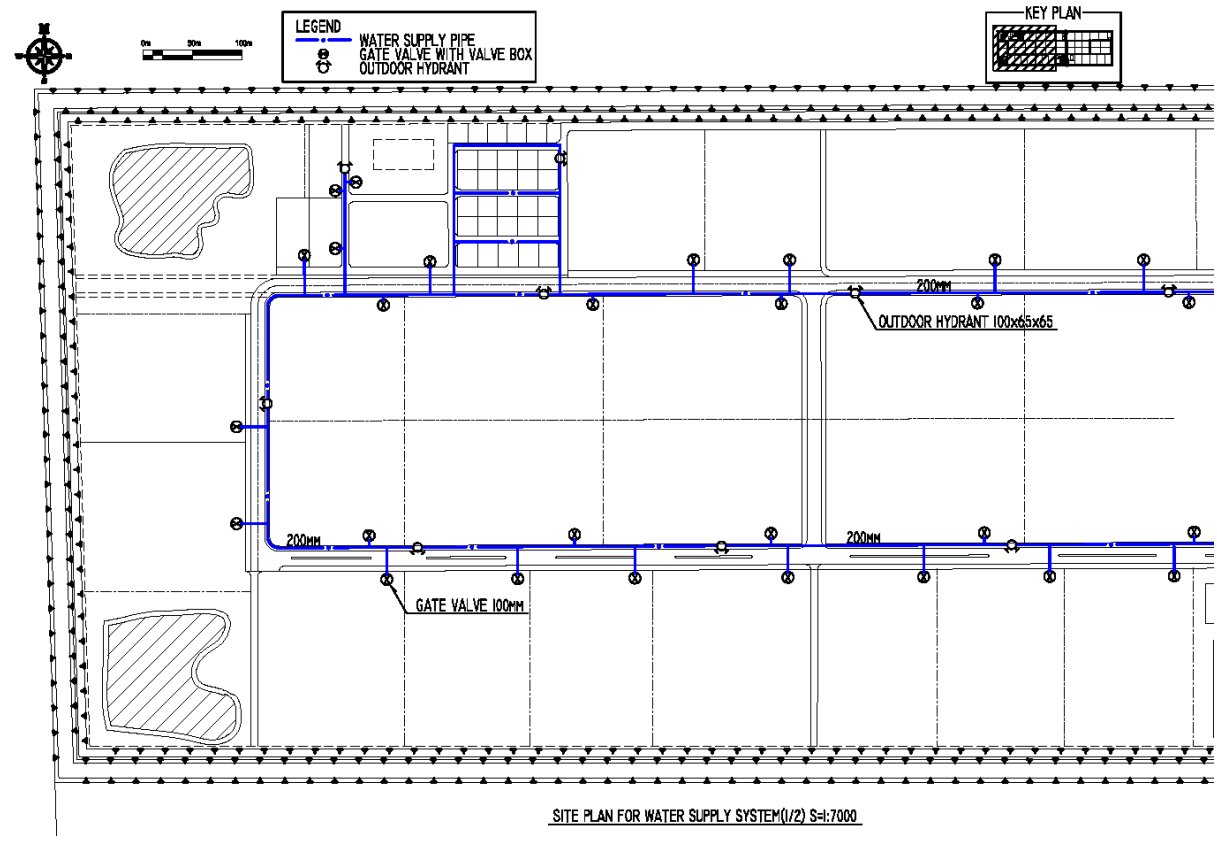
Figure 3.2-12 Schematic Diagram for Water Supply System

Site Plan for the Water Supply System is shown in Figure 3.2-13.

b) Fire Fighting System

Outdoor hydrants were planned at roads and the facility buildings in PPAP-NCT SEZ. The distance between the outdoor hydrants is 200 metres. Fire fighting will be carried out by connecting the fire fighting truck's hose to the outdoor hydrant, because the existence of a fire station near PPAP-NCT SEZ is confirmed. Fire fighting pipe is used for both Fire fighting and Water supply pipe. Major equipment of the Fire Fighting System is as follows:

- Outdoor hydrants (65 mm x 65 mm x 100 mm) 20 nos.



Source: Survey Team

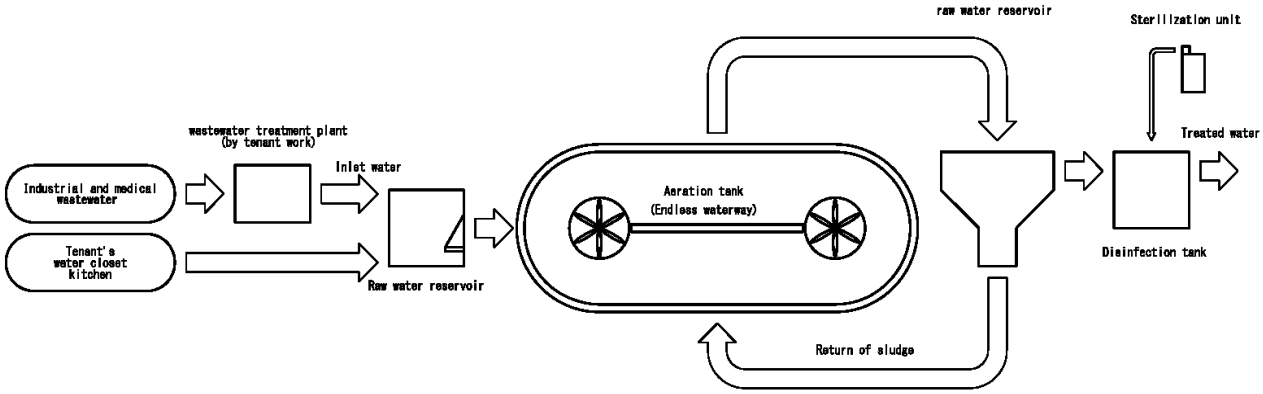
Figure 3.2-13 Site Plan for Water Supply System

c) Sewerage System

The Sewerage System for the tenants is intended for sewage water from water closets and kitchens. The oil and fat content is to be separated from the sewage water using grease separators to treat the sewage water that is discharged from the kitchens. A Schematic Diagram for a Sewerage Treatment Plant is shown in Figure 3.2-14. Industrial and medical wastewater is to be discharged to a sewer manhole after being treated at the respective treatment plant that is to be installed by the tenant. The water quality from the sewerage treatment plant will meet the requirements of Cambodian standards. The sewer pipe is of a concrete pipe in consideration of corrosion resistance, impact resistance and cost of pipe. An "Oxidation Ditch Process" will be employed for the Sewerage Treatment Plant in view of the easy maintenance and low installation cost. A Site Plan for the Sewerage System is shown in Figure 3.2-15. Major plant and components of the Sewerage System are as follows:

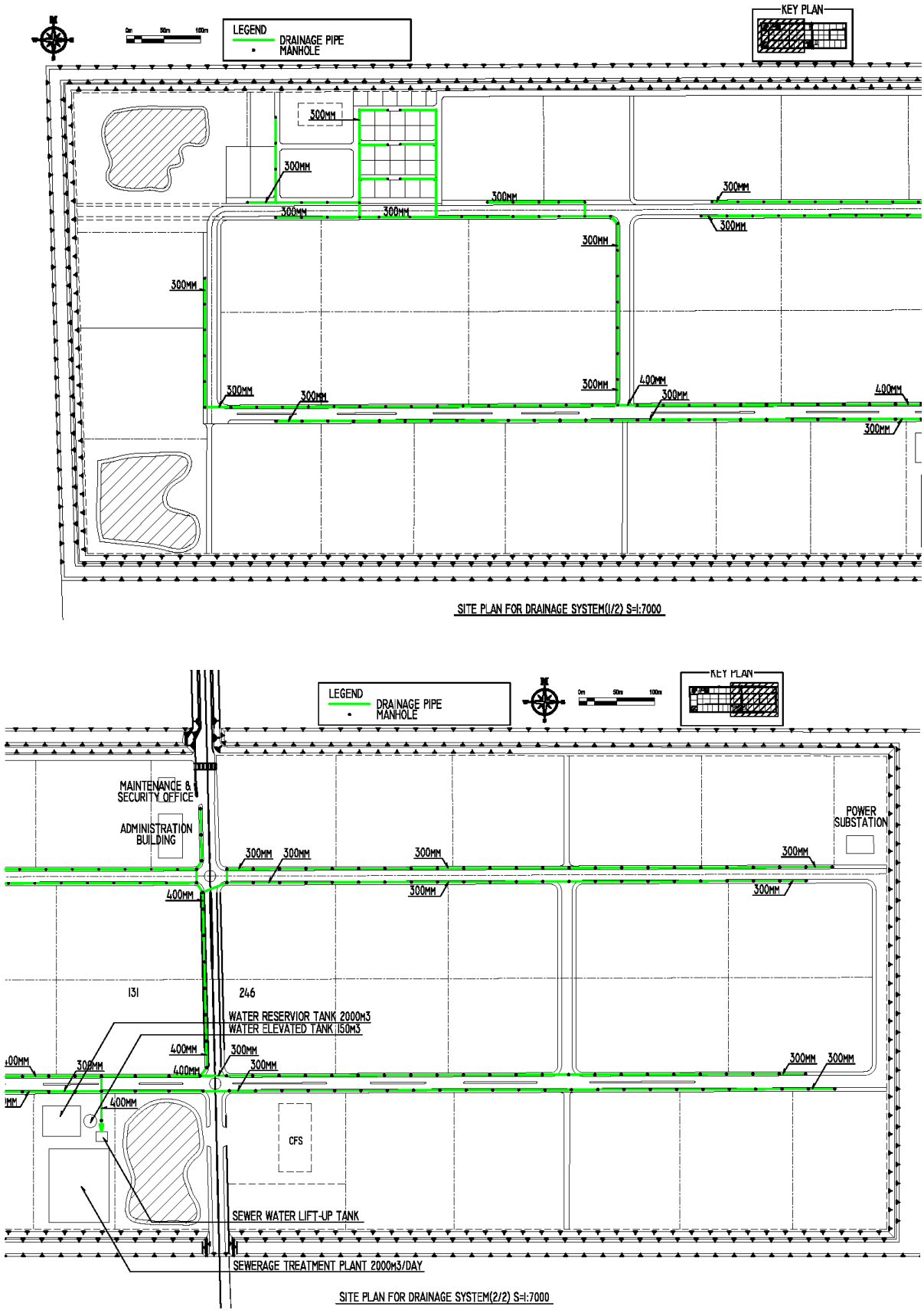
Major equipment of the Sewerage System is follows:

- Sewerage treatment plant (cap.:2,000 cubic metres per day) 1 unit
- Sewer Pipe (RC 300mm) Approx. 8,800 m
- Sewer Pipe (RC 400mm) Approx. 1,100 m



source: Survey Team

Figure 3.2-14 Schematic Diagram for Sewerage Treatment Plant



Source: Survey Team

Figure 3.2-15 Site Plan for the Sewerage System

3) Electrical Systems

a) Power Supply

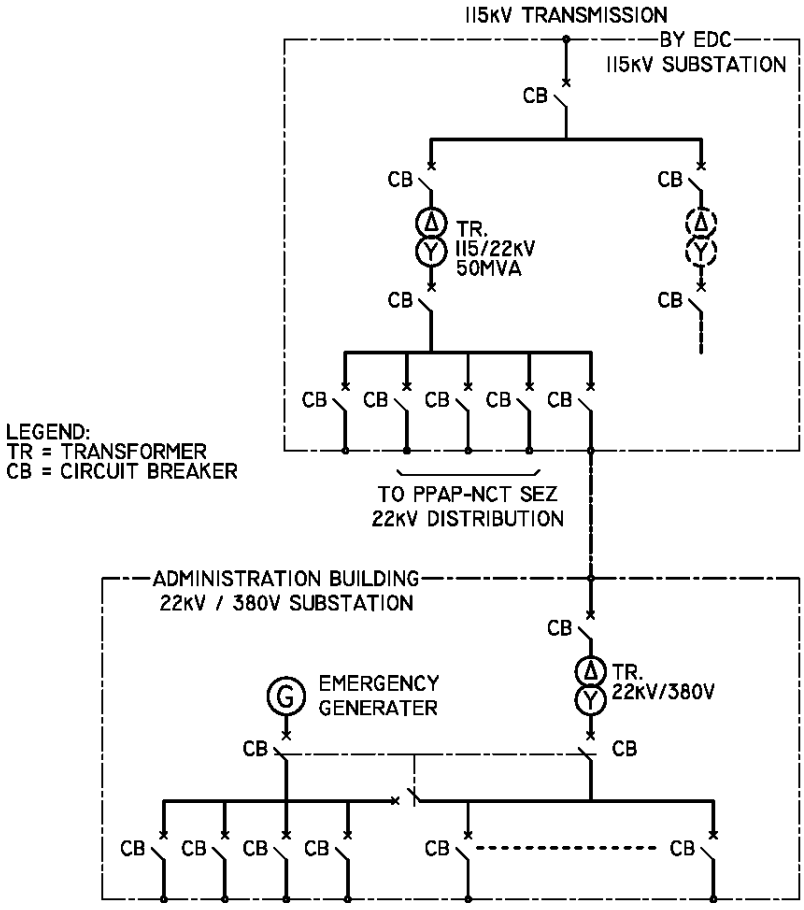
The maximum electrical demand of PPAP-NCT SEZ is estimated at about 40 MVA based on Table 3.2-13. According to a standard of Electricite Du Cambodge (EDC), the maximum distribution capacity of an overhead 22 kV distribution line is 10 MVA. In view of the standard, the capacity of the existing 22 kV distribution line is not enough to cover the demand of PPAP-NCT SEZ.

EDC plans a new 115kV transmission line from Phnom Penh to Neak Loeung Bridge along national road No.1 This plan has been designed and budgeted, the planned new transmission line is expected to be completed by 2015 For PPAP-NCT SEZ, EDC will install a 115/22 kV substation in PPAP- NCT SEZ area, and an incoming transmission line of the above 115/22 kV substation is to be connected to the 115 kV transmission line installed along the road No. 1. The 115/22 kV substation will be installed by EDC, however, part of the expenses related to installation of the above substation will be borne by PPAP-NCT SEZ.

Major equipment of the 115/22 kV substation is as follows:

- 115/22 kV Substation（Installed by EDC） 1 unit
- 22 kV Distribution Panel 1 unit

Single line diagram of the 115/22 kV substation and a 22 kV/380 V substation are shown in Figure 3.2-16.



Source: Survey Team

Figure 3.2-16 115/22 kV and 22 kV/380 V Sub Station Single Line Diagram

b) Distribution System of PPAP – NCT SEZ

A 22 kV 3 phase 3 wire overhead distribution system was designed for PPAP-NCT SEZ, the distribution lines are to be installed along roads in consideration of easy hooking up for tenants. Aluminium wire is used for the overhead distribution system.

The 22 kV distribution lines are distributed from the 22kV distribution panel located in the 115/22 kV substation. A direct buried cable is to be used from the 22 kV distribution board up to the nearest pole of the overhead distribution lines. The maximum design carrying capacity of 22 kV distribution lines is to be less than 10 MVA.

The 22 kV/380 V substation was planned in an administration area for supplying power to a sewerage treatment plant, a water supply system and an administration building. An emergency generator was planned for supplying essential power to the following facilities in case the commercial power goes out:

- Sewerage treatment plant and water supply system
- 30% electrical demand of the administration building

Pole mounted transformers (22 kV/380 V) were planned for supplying power to electrical loads in the common space in PPAP-NCT SEZ.

Major equipment of the 22 kV/380 V substation is as follows:

- Transformer（22 kV/380 V, 1000 kVA） 1 unit
- Emergency Generator (1,000 kVA) 1 unit
  Fuel Tank, 10 hours operation
- 380V Distribution Panel 1 unit

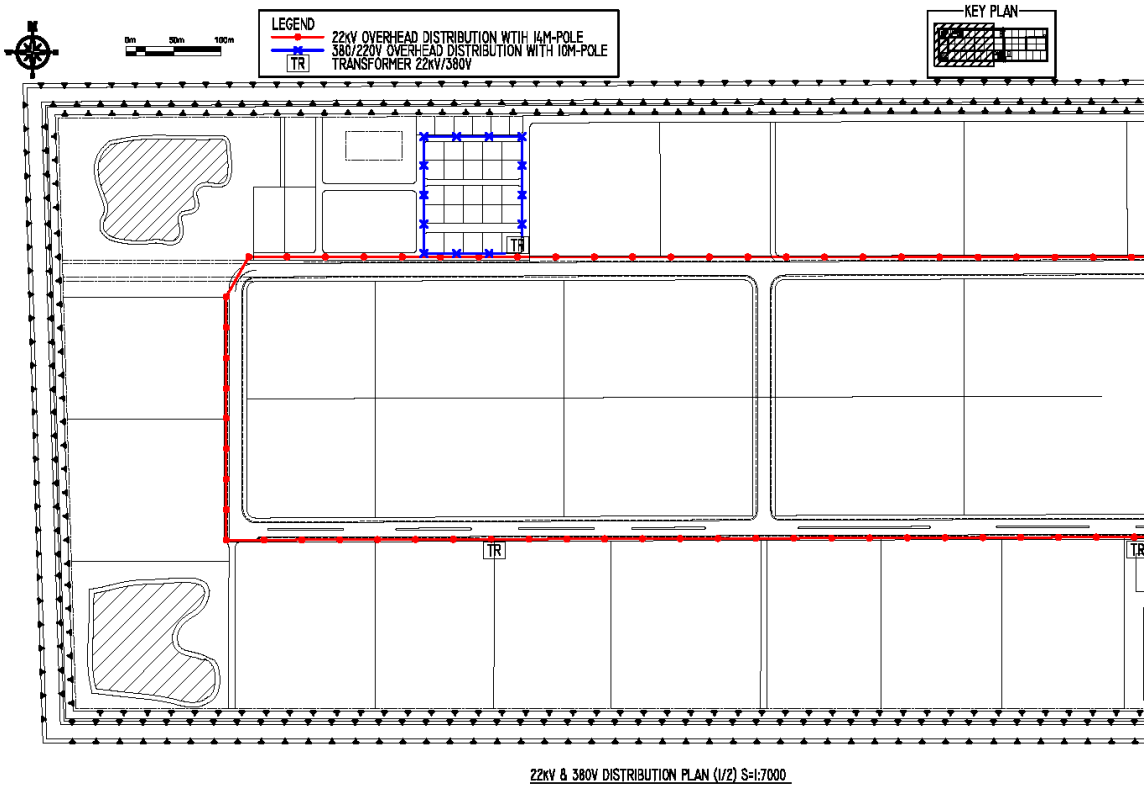
The Overhead 22 kV & 380/220 V Distribution Line Layout Plan is shown in Figure 3.2-17.

c) Road Lighting

Road lighting was planned for inner roads as shown in Figure 3.2-18. The distance between road lighting fixtures is 30 metres, and the fixtures are mounted on 10 metre in height poles. The above lighting fixtures and arrangement are to be applied to the access road from national road No. 1 to PPAP-NCT SEZ.

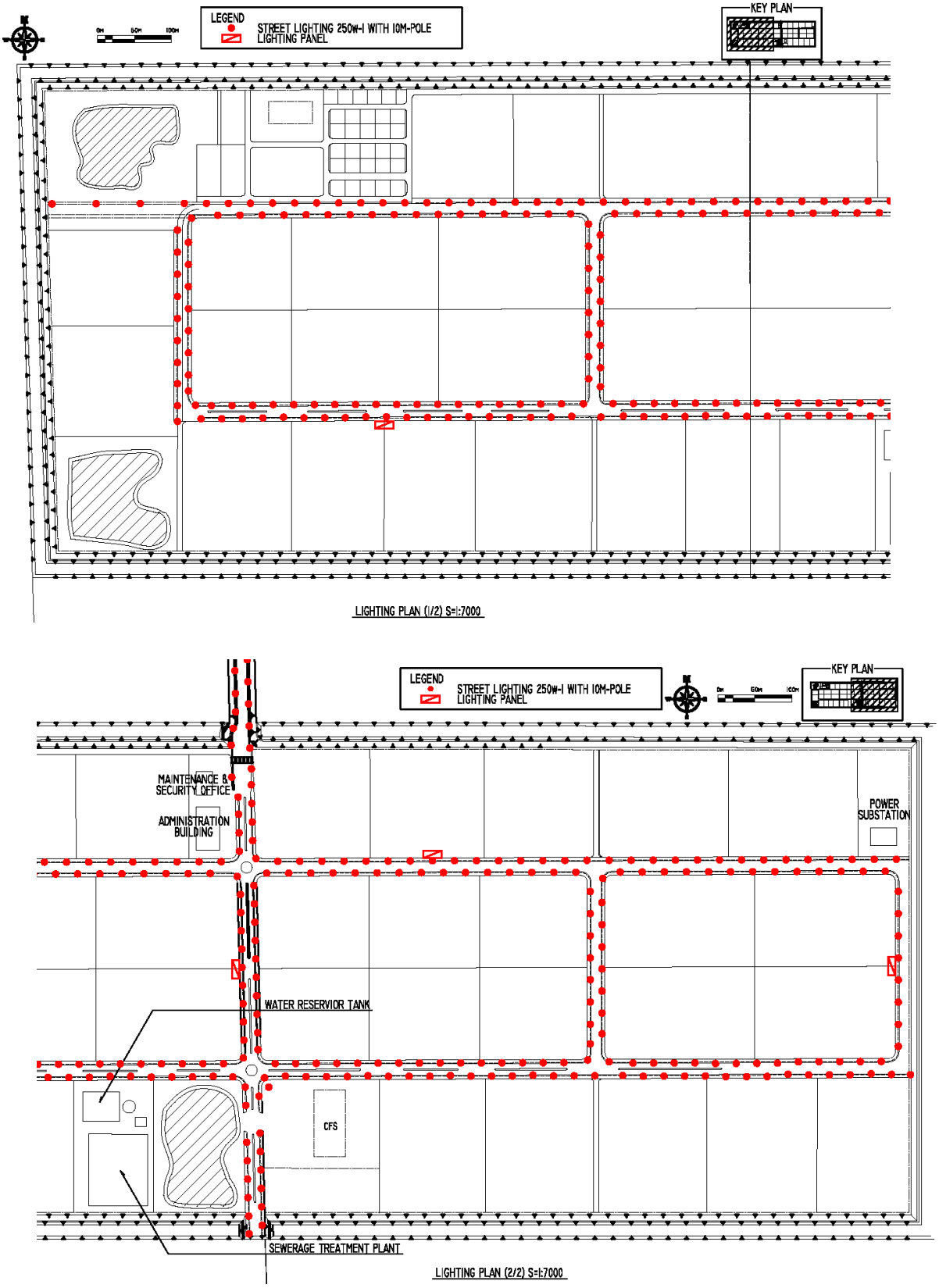
d) Communication System

Provision of a communication system is important for the operation of tenants of PPAP-NCT SEZ. In view of this, underground empty conduit (100 mm dia.) and hand-holes were planned in PPAP-NCT SEZ. In the future, communication cables will be installed by local providers at the request of each tenant.



Source : Study Team

Figure 3.2-17 22 kV & 380/220 V Over Head Distribution Line Layout Plan



Source : Study Team

Figure 3.2-18 Road Lighting Plan

3.2.4 Construction Programme

(1) Estimated Construction Quantities

Based on the basic design and facilities plan, estimation of the construction quantities of the major works for the SEZ development and the SEZ Access Road construction is presented in Tables 3.2-22 and 3.2-23 respectively.

Table 3.2-22 Estimated Construction Quantities and Specifications for SEZ

No			Facilities and Equipment	Unit	Tentative Estimated	Remarks
1	**SEZ Soil Embankment**			ha	143ha SEZ Development	
	1-1		Reservoir Pond Excavation around SEZ	m3	400,000	Around the SEZ 20m width x 4m depth
	1-2		Dike Embankment around SEZ	m3	400,000	Excavated material used for filling
	1-3		Reservoir Pond Excavation for Filling Material	m3	3,510,000	320,000 m3 will be used for Access Road
	1-4		Sand Filling into SEZ (Embankment fill by sand)	m3	3,700,000	Total Volume of SEZ Filling (6,900,000m3)
2	**SEZ Pavement**					
	2-1		Concrete Pavement (RC pavement)	m2	2,000	Around SEZ Main Gate
	2-2		Asphalt Concrete Pavement (AC Pavement)	m2	80,000	SEZ Road (Inner SEZ)
	2-3		Crushed Rock Pavement	m2	9,000	Future Expansion Road
	2-4		Asphalt Concrete Pavement for Common Area	m2	17,860	For small and medium size car
	2-5		Curb Concrete Stone (for Road)	m	17,000	150mm ×250mm
3	**Storm Water Drainage and Sewerage System**					
	3-1		V-ditch Drainage （Average 1m width ×0.5~ 1m depth)	m	11,850	Both sides of the SEZ road
	3-2		V-ditch Drainage （Average 1.5m width ×1~ 1.5m dept	m	850	from center area to outlet
	3-3		RC Pipe Culvert（RC dia: 800mm）	m	1,500	Road Crossing area, entrance of Tenants
	3-4		RC Pipe Culvert（RC dia: 1000mm）	m	300	Road Crossing area, entrance of Tenants
	3-5		RC Pipe Culvert（RC dia: 1200mm）	m	50	from center area to outlet
	3-6		Sewer Pipe Culvert（RC dia: 300mm）	m	8,800	Along the Road for Tenants
	3-7		Sewer Pipe Culvert（RC dia: 400mm）	m	1,100	Final Connection to the Treatment Plant
4	**Electrical Power Cable**					
	4-1		High Voltage（22KV ）Aluminum Power Cable 150 sq	m	7,140	Inner SEZ main power line
	4-2		Low Voltage（400／200V）Cupper Cable, 10sq	m	11,190	For road lighting /under ground lines
	4-3		Road Lighting Pole and Light	Nos	362	One side of Road (20m intervals)
	4-4		Power Cable Pole	Nos	300	One side of Road (20m intervals)
	4-5		Sub Station (Transformer 250kv～22kv）	Unit	1	High Voltage Pylon and Sub-station 10,000m2 Construction and installation requested to
	4-6	1)	Transformer 22kv～400v Administration Building, Oth	Unit	1	Transformer for road lighting and common
	4-6	2)	Transformer 22kv～400v (Lighting)	Unit	4	Transformer for road lighting and common
5	**Water Supply Pipe**					
	5-1		HDPE Pipe（dia : 200mm）	m	6,200	One side of Road (main pipeline)
	5-2		HDPE Pipe（dia :100mm）	m	2,000	Road Crossing area, entrance of Tenants
	5-3		Hydrant（100～65mm 2 outlets ）	Nos	20	Installation 200m intervals
	5-4		Water Distribution Pump	Unit	3	Pumping up to the elevated tank
6	**Buildings and Utility Facilities**					
	6-1		Gate and Checking Booth	m2	300	SEZ main gate
	6-2		SEZ Administration Office	m2	2,000	Office, Customs, Bank, Service Center、Seminar Room and Tenant Office
	6-3		SEZ Maintenance Office and Shed	m2	300	
	6-4		Power Supply Maintenance and Generator House	m2	300	Generator House
	6-5		Emergency Generator	KVA	1,000	Emergency Generator
	6-6		Water Reservoir Tank	ton	2,000	
	6-7		Water Elevated Tank	ton	150	
	6-8		Sewerage Treatment Plant	ton	1,500	Oxidation Ditch System
	6-9		Sewer Pumping Tank and Pump	ton	200	Pumping up to the Treatment Plant
7	**Land Scraping**					
	7-1		Green Area (buffer zone, parks, and common area)	m2	70,000	Green installation
	7-2		Tree Planting	Nos	1,800	Palm and Acacia
	7-3		Protection around the pond	m2	5,500	Stone protection
	7-4		Fence	m	7,000	Block Fence (2.5m height)
8	**Temporary Works, Others**					
	8-1		Mobilization/Demobilization	L.s	1	
	8-2		Temporary works, Temporary office for Contractor	L.s	1	
	8-3		Site Expenses and General Expenses	%	8	8% of direct Construction cost
9	**Detailed Design and Construction Supervision**			%	6	6% of direct Construction Cost
Escalation & Physical Contingency				%	2.5%＋5%	7.5% of Direct construction cost

Source: Survey Team

Table 3.2-23 Estimated Construction Quantities for SEZ Access Road

No			Facilities and Equipment	Unit	Tentative Estimated	Remarks
1	**Access Road**					
	1-1		Soil Transportation and Embankment	m3	320,000	Transportation, Grading and Compaction
	1-2		Area Clearance	m2	100,000	Clearance
	1-3		Concrete Pavement (RC pavement)	m2	1,000	250mm thickness RC pavement
	1-4		Asphalt Concrete Pavement (AC Pavement)	m2	47,000	100mm asphalt concrete pavement (thickness 58cm)
	1-5		Bridge	m	1	RC Bridge
	1-6		RC Pipe Culvert（RC dia: 1500mm）	m	90	RC Pipe
	1-7		RC Culvert (Road Crossing)	m	125	RC Culvert (2.5m height)
	1-8		Curb Concrete Stone (for Road)	Nos	7,200	150mm x250mm
	1-9		Road Lighting Pole and Light	Nos	193	25m Intervals
	1-10		Transformer 22kv～400v	m	7	For road lighting
	1-11	1)	Low Voltage（400／200V）Cupper Cable, 120 sq	m	11,475	For road lighting /under ground lines
		2)	Low Voltage（400／200V）Cupper Cable, 70 sq	m	8,975	
		3)	Low Voltage（400／200V）Cupper Cable, 10 sq	m	6,600	
	1-13		Water Supply Pipe (HDPE dia : 200mm)	m	3,850	(Road No.1～SEZ entrance)
	1-14		U-type RC Drainage (Road)	m2	7,200	RC300x300 U ditch
	1-15		Green Area (Walkway and slope protection)	Nos	32,000	Both sides of road (2.5m width), slope 2m
	1-16		Tree Planting	Nos	480	15m Intervals in the both sides of road
2	**Temporary Works, Others**					
	2-1		Mobilization/Demobilization	L.s	1	
	2-2		Temporary works, Temporary office for Contract	L.s	1	
	2-3		Site Expenses and General Expenses	%	8	8% of direct Construction cost
3	**Detailed Design and Construction Supervision**			%	6	6% of direct Construction Cost
Escalation & Physical Contingency				%	2.5%＋5%	7.5% of Direct construction cost

Source: Survey Team

(2) General Construction Work Sequence

The general construction sequence of the SEZ development is presented in the following Figure 3.2-19, in which is described major construction components of the project.

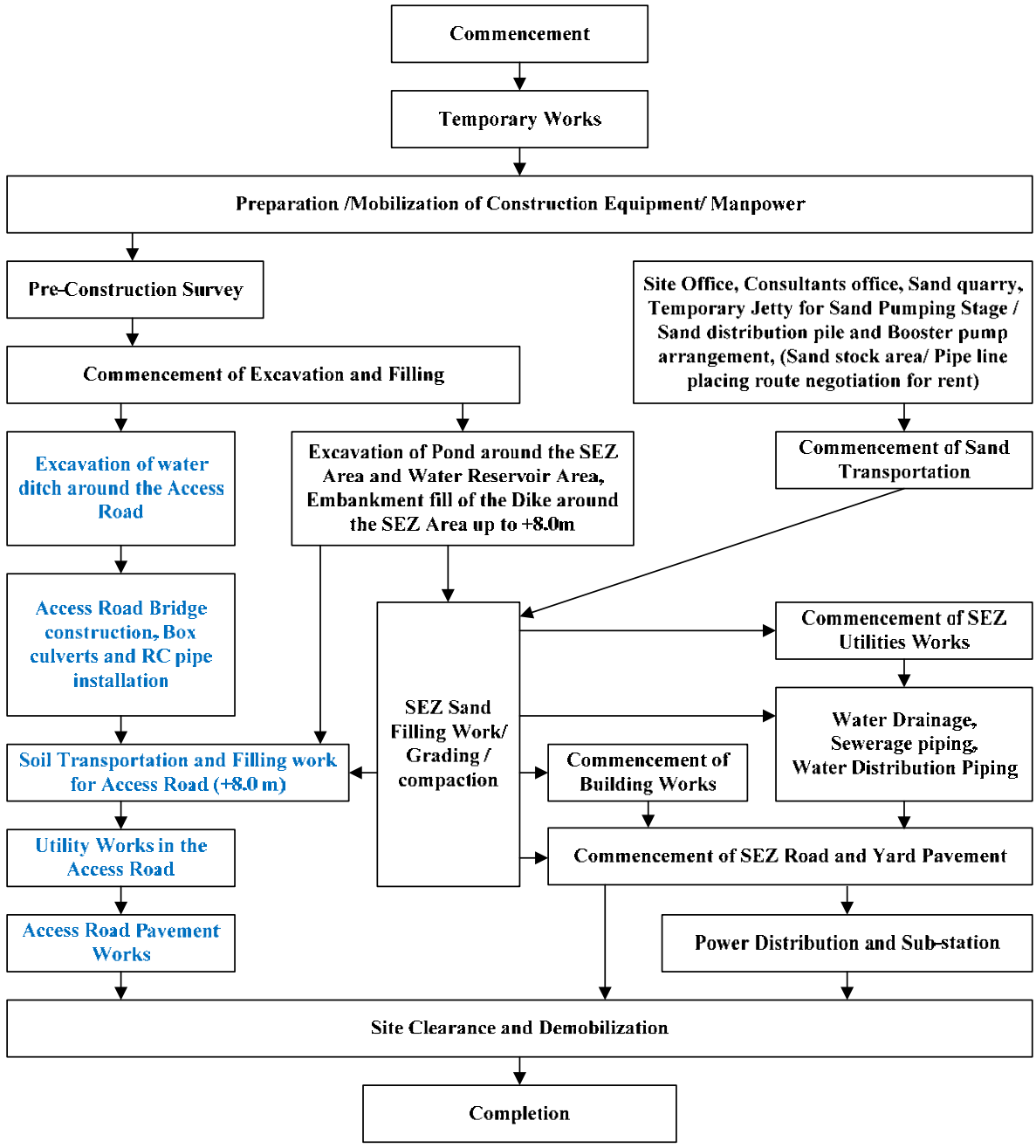
(3) Construction Plan for Major Works

1) Temporary Work

The temporary works consist of the equipment and manpower mobilization, setting contractor's necessary facilities such as site office, labourers' camp, contractor's staff accommodation, laboratory, warehouse, generator, and etc. After commencement of the construction, the contractor will dispatch key persons, and prepare the construction equipment and materials to be imported. Those works will take two months, and setting-up the plant and office will take one month in addition.

2) Embankment Fill for SEZ Area and Access Road

Land fill material for SEZ is planned to come from two sources, excavated soil approximately 3,900,000 m3 from the PPAP property land around the SEZ area and approximately 3,700,000 m3 from the sand quarry at Chak-tomuk, totally 6,900,000 m3 soil will be necessary for the fill for the SEZ and the access road. The water height in the SEZ area reaches +6.0 m to 7.0m elevation with flooding in the rainy season and has been utilized as a rice field during the dry season from December to July. Therefore, the area for the SEZ shall be filled to +7.5m which is 1.0m higher than the average water elevation in the rainy season. The present ground elevation in the SEZ area is + 2.6 m on average, hence the fill depth is about 5m. The excavated area around the SEZ is planned for a water reservoir pond that will be used for irrigation for the rice field around the SEZ area.

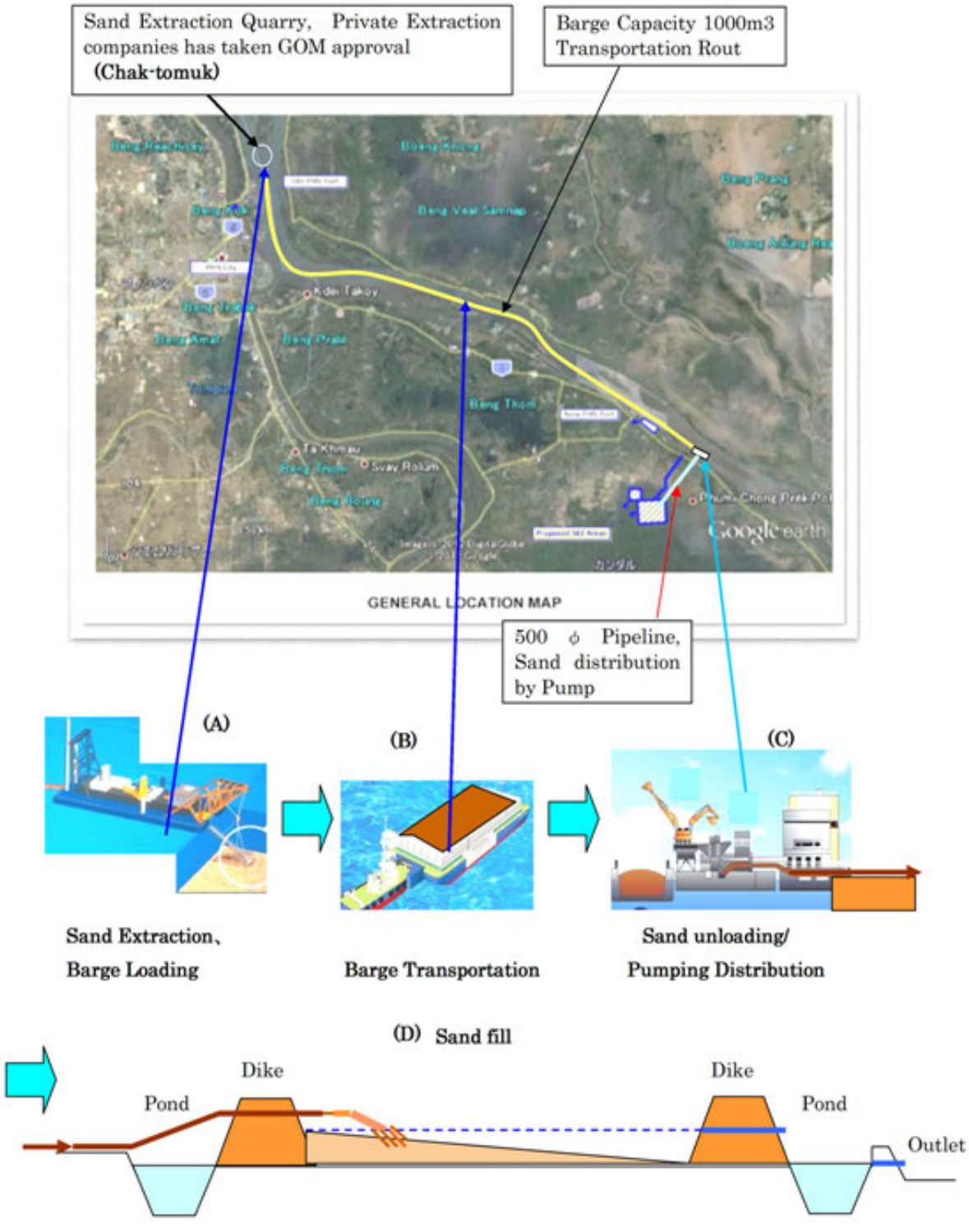


Source : Study Team

Figure 3.2-19 Construction Work Flowchart

3) Boundary Dike of SEZ Area and Reservoir Pond (refer to Figure 3.2-20, D)

Prior to placing the sand fill onto the SEZ area, a ditch will be excavated 20m in width and 5m deep inside of the boundary around the SEZ area. The excavated soil will then be used to construct a dike having a top elevation of +8.0m and a 3m width at the top all around the SEZ area. This work will be done using large excavators in the dry season. The areas excavated outside the SEZ to produce the landfill will become water ponds connected with existing cannels in order to use the water for irrigation. More than six large excavators will be necessary to work during dry seasons (Productivity =700 m3/day x 6 units = 4,200 m3/day). In addition to the boundary dike, another large area of 50 ha, which is the PPAP property remaining after allocation for the SEZ area located beside the SEZ shall be excavated for fill for the SEZ and to create another reservoir pond for irrigation. The required volume of the irrigation water is follows:



Source : Study Team

Figure 3.2-20 Sand Fill Works

- Required volume of water reservoir :150 ha x 0.5 m (natural water reservoir depth) = 750,000 m3 Necessary depth of the Ponds : 0.5m + 750,000 /(205ha – 145ha)= Approx. 2.0m depth
- The ponds should be 6.0 m deep in order to provide fill material for the SEZ.

4) Access Road Construction

The fill soil excavated from the pond could be transported, filled and compacted for the access road using dump trucks, a bulldozer and roller. The soil material shall be graded and compacted in fill layers having 150mm thickness each for the core embankment under the base course of the road (1.0m lower than the road surface). In case of water cannels crossing the access road, pipe culverts (having necessary capacity to carry the water) are planned under the road. In case of existing roads crossing the access road, the existing roads shall be provided with an at grade crossing in order to allow trucks to cross for farming. During flood season, two waterway crossings will be constructed under the road for farmers such as a bridge or culvert as well.

5) Fill Sand Extraction, Transportation and Pumping Fill

In the first dry season, a sand distribution pumping barge will be set on the Mekong river bank beside the new container terminal. Then, sand distribution pipelines having 500mm diameter are to be installed through the water gate and along the existing farming roads. After completion of the soil dike around the SEZ area, fill sands extracted at Chak-tomuk (quarry) are transported to the NCT bank by sand barges. Then, the sands are pumped with water as a slurry and distributed to the SEZ area for fill (refer to Figure 3.2-17). Capacity of the quarry at Chak-tomuk is assumed at about 6 million m3 per year (6,000,000m3/year) as reported.

- A project to supply sand for a housing project was 8 million m3 from 2008 to 2010.
- From 2008 to present, yearly sand extraction volume is assumed to be about 6 million m3/ year
- Available volume for a project is assumed to be about 3 million m3/year.

In this project, the sand volume extracted from Chak-tomuk is planned for 3,700,000 m3 during two years and three months which means about 2,300,000 m3/year. This much is available volume considering other projects' demands for fill materials. Therefore, the sand fill work is planned to secure about 7,000 m3 / day productivity in this project.

6) Pavement, Utilities and Buildings

After the embankment filling for the access road (one year after the commencement of the construction), the access road could be utilized as a temporary road in order to transport materials for the pavement, utility works and building works in the SEZ. Therefore, those works will be started one year after the construction of the project. The pavement is mainly built up in three courses, sub-base course is a laterite soil layer, the base course is a crushed rock layer and the surface curse is an asphalt concrete layer.

Storm water drainage in the SEZ is planned be drained through open ditches along the roads, R.C pipe culvert is only installed where the drainage crosses roads. Then the drain water flows into the reservoir pond around the SEZ. Sewer water from the factory shall be carried to the sewerage treatment plant by R.C pipelines. A 115kv electrical power line from EDC is to be connected to the sub-station (transformer) having 40 MW capacity in the SEZ. After reducing to 22kv by a transformer, overhead lines along roads distribute the 22kv power to each area in the SEZ.

The planned buildings are made of reinforced concrete, the SEZ administration building is two story having 2000 m2 floor area in total. A water reservoir tank and elevated water tank is also made of R.C supported by RC piles.

Materials for the construction are transported over the access road. Therefore, a tire cleaning facility for the trucks and traffic watchmen shall be arranged at the entrance of the access road.

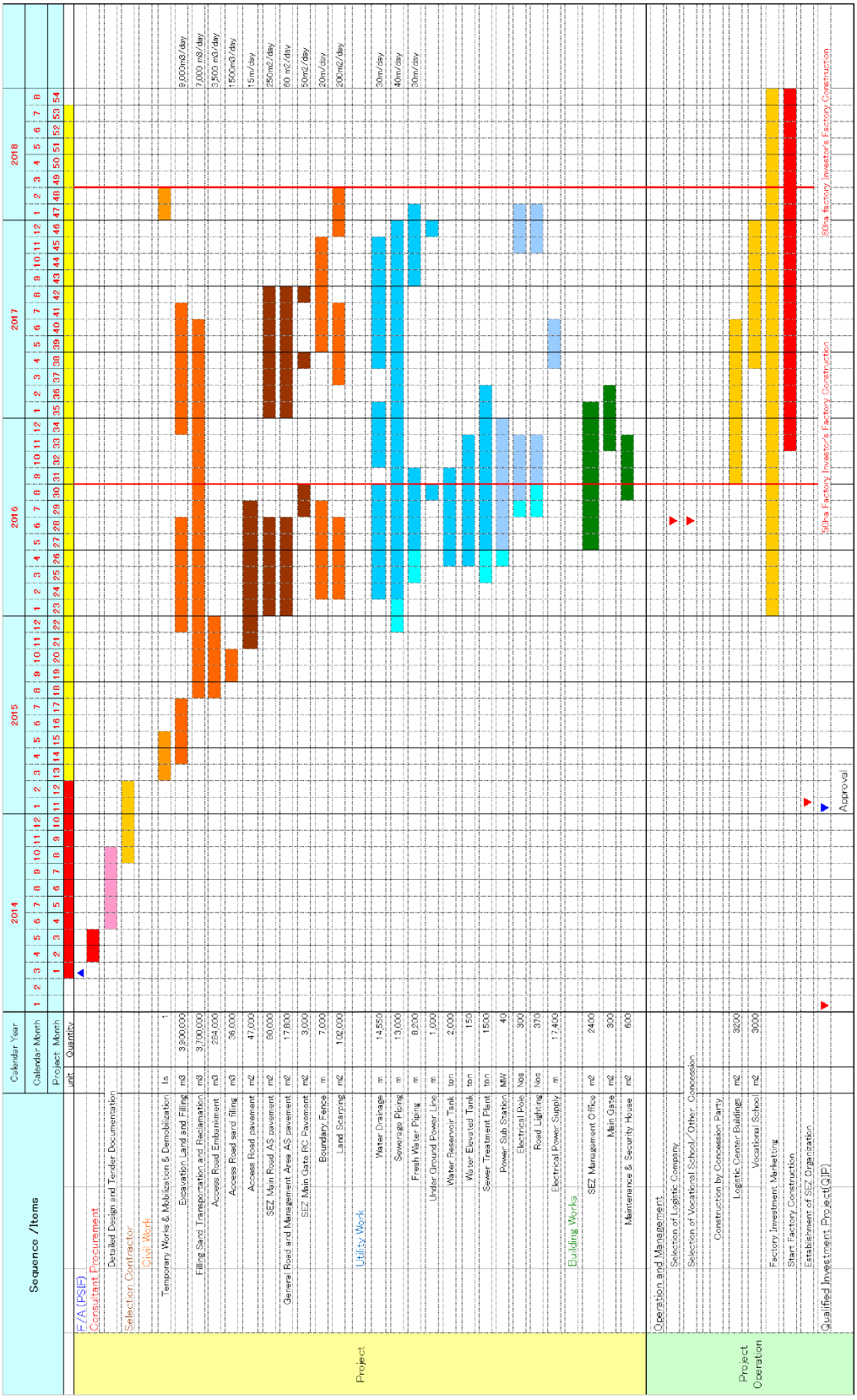
The construction area is about 3km from the resident's area. Therefore, the noise and exhaust from the construction equipment will have no impact on the residents. The contractor shall transport construction debris and garbage to the disposal area approved by the GOC (MOE) during the construction period.

(4) Construction Schedule

Construction Schedule for SEZ development is shown in Table 3.2-24, based on the following progress of the major works.

- Soil Excavation, Transportation and Filling : 8,000 m3 /day
- Sand Transportation and Sand Reclamation : 7,000 m3 /day
- Access Road Fill Material Transportation: 3,500 m3/day
- Pavement for Access Road : 15m /day
- Pavement for SEZ Road : 250m2/day
- Buildings with related facilities: 1 year

Table 3.2-24 SEZ Construction Schedule



Source: Survey Team

3.3. Implementation Programme of Associated Port Facilities Development

3.3.1 Future Development Framework of Associated Port Facilities

(1) Cargo Demand Forecast

1) Container Cargo Throughput

Container throughput at Phnom Penh Port increased by 16.8% in 2012 and reached 95,000 TEUs, while Sihanoukville Port handled 255,000 TEUs in 2012 which increased by 7.3% from the previous year, as shown in Tables 3.3-1 and 3.3-2 respectively.

Phnom Penh Port has experienced a large increase in the laden containers imported since 2009, and it has increased by 3.6 times from 2009 to 2012. Annual growth rate of laden containers imported was 16.9% and that of laden containers exported was 17.6% in 2012.

Sihanoukville Port also experienced a fairly large increase of container cargo, where laden containers imported have increased by 13.8%, but laden containers exported decreased slightly by 0.8% in 2012.

Since the opening of Cai Mep Port in 2009, the number of laden containers exported at Phnom Penh Port has considerably increased, and it is deemed that part of this increase is caused by the shift from Sihanoukville Port. This shift is believed to continue for the time being.

The number of laden containers imported at Phnom Penh Port has increased by 16.9% while it has increased by 13.8% at Sihanoukville Port in 2012. The increase in the number of containers in 2012 was 14,600 TEUs at Sihanoukville Port and 4.300 TEUs at Phnom Penh Port, which indicate that Sihanoukville Port plays a major role in container export from Cambodia.

It is therefore deemed that the share of Phnom Penh Port in container export will increase further due to evolution of Cai Mep Port. However, in the case of container import, the shift from Sihanoukville Port to Phnom Penh Port will not make much progress due to the convenience of shipping services from origin ports. The share of Phnom Penh Port in container import will remain at the same level or increase gradually.

Table 3.3-1 Container Throughput at Phnom Penh Port

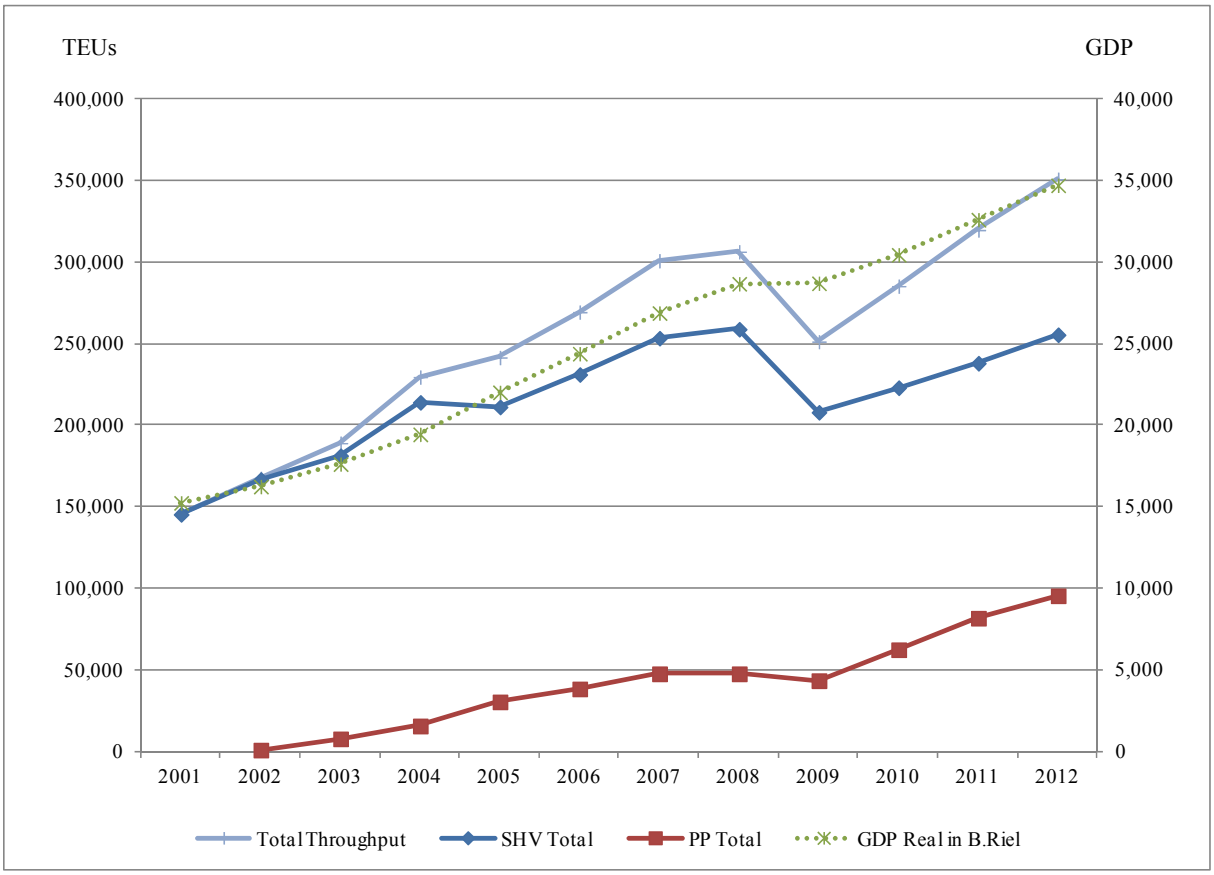
	Phnom Penh Port									
Year	Import				Export				Total	Gr. Rate
	Laden	Gr. Rate	Empty	Emp. R.	Laden	Gr. Rate	Empty	Emp. R.		
2000										
2001										
2002	242		100	29.2%	237		167	41.3%	746	
2003	4,134	1608%	306	6.9%	2,072	774%	1,118	35.0%	7,630	922.8%
2004	7,054	70.6%	985	12.3%	3,237	56.2%	4,250	56.8%	15,526	103.5%
2005	14,077	99.6%	867	5.8%	3,767	16.4%	11,570	75.4%	30,281	95.0%
2006	18,099	28.6%	477	2.6%	5,341	41.8%	14,316	72.8%	38,233	26.3%
2007	23,783	31.4%	1,126	4.5%	5,942	11.3%	16,653	73.7%	47,504	24.2%
2008	23,623	-0.7%	1,387	5.5%	5,743	-3.3%	16,754	74.5%	47,507	0.0%
2009	16,735	-29.2%	3,769	18.4%	11,775	105.0%	11,033	48.4%	43,312	-8.8%
2010	21,369	27.7%	5,940	21.8%	24,276	106.2%	10,671	30.5%	62,256	43.7%
2011	25,344	18.6%	10,124	28.5%	35,696	47.0%	10,467	22.7%	81,631	31.1%
2012	29,627	16.9%	12,877	30.3%	41,961	17.6%	10,868	20.6%	95,333	16.8%

Source: PPAP

Table 3.3-2 Container Throughput at Sihanoukville Port

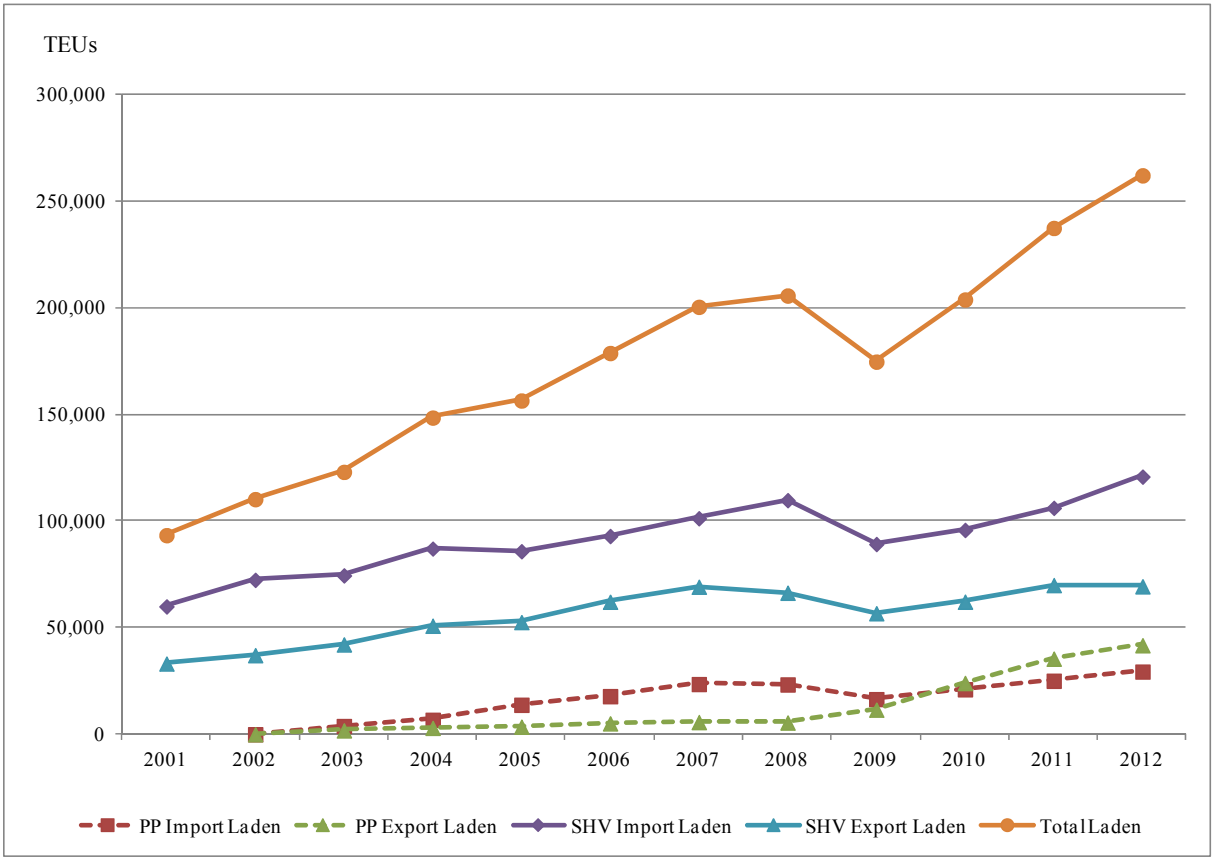
	Sihanoukville Port									
Year	Import				Export				Total	Gr. Rate
	Laden	Gr. Rate	Empty	Emp. R.	Laden	Gr. Rate	Empty	Emp. R.		
2000	57,303		8,508	12.9%	26,287		38,337	59.3%	130,435	
2001	60,181	5.0%	12,560	17.3%	33,391	27.0%	39,160	54.0%	145292	11.4%
2002	72,630	20.7%	11,366	13.5%	37,343	11.8%	45,299	54.8%	166,638	14.7%
2003	74,700	2.9%	16,054	17.7%	42,324	13.3%	48,208	53.2%	181,286	8.8%
2004	87,281	16.8%	20,284	18.9%	51,101	20.7%	55,250	52.0%	213,916	18.0%
2005	86,034	-1.4%	19,821	18.7%	52,814	3.4%	52,472	49.8%	211,141	-1.3%
2006	93,155	8.3%	23,931	20.4%	62,340	18.0%	51,610	45.3%	231,036	9.4%
2007	101,474	8.9%	25,064	19.8%	69,388	11.3%	57,345	45.2%	253,271	9.6%
2008	109,960	8.4%	19,658	15.2%	66,559	-4.1%	62,598	48.5%	258,775	2.2%
2009	89,404	-18.7%	16,005	15.2%	56,987	-14.4%	45,465	44.4%	207,861	-19.7%
2010	96,005	7.4%	20,293	17.4%	62,371	9.4%	44,259	41.5%	222,928	7.2%
2011	106,364	10.8%	19,158	15.3%	70,153	12.5%	42,266	37.6%	237,941	6.7%
2012	121,023	13.8%	13,695	10.2%	69,607	-0.8%	51,053	42.3%	255,378	7.3%

Source: PAS



Source: PPAP, PAS Statistics

Figure 3.3-1 Container Throughput Changes and GDP Growth



Source: PPAP, PAS Statistics

Figure 3.3-2 Laden Container Throughput

2) Demand Forecast for Container Export and Import

a) GDP Growth and Container Throughput

Container export and import has a close relationship with economic growth, so the correlation between GDP growth and container cargo growth is examined for the demand forecast. Since the growth rate of container export and import usually exceeds the growth rate of GDP, the ratio of container import/export growth to GDP growth is estimated for the cargo projection. GDP growth and the number of laden containers are shown in Figure 3.3-1.

Since the container throughput in 2008 and 2009 showed unusual trends due to the world recession, figures of these two years are excluded from the correlation analysis. The ratio of the growth of laden containers imported to the growth of GDP is estimated at 1.4, and the ratio of the growth of laden containers exported to the growth of GDP was 1.8 during the period from 2002 to 2011 except for 2008 and 2009.

b) Ratio of Empty Containers

Empty containers are imported and exported to fill the gap in the necessary number of laden export containers and discharge the excess of laden import containers. While some boxes of laden import containers are used for export cargo after discharging import cargo, some boxes are exported empty. While empty containers are imported for loading export cargo, some boxes are still exported empty due to the convenience of shipping companies or box owners.

Export and import of empty containers are closely related to the number of laden containers. The ratio of empty containers was 15% of all imported containers and 36% of all exported containers in 2012. The ratio of empty containers at Phnom Penh Port was 30.3% in import and 20.6% in export, while it is 10.2% in import and 42.3% in export at Sihanoukville Port. The empty container ratio is expected to decrease in proportion to the scale of container throughput. The empty container ratio at

Phnom Penh Port is shown in Table 3.3-1 and that at Sihanoukville Port is in Table 3.3-2. Future ratio of empty containers is estimated as shown in Appendix E-1 (ANNEX-E).

c) Forecast of Container Export and Import

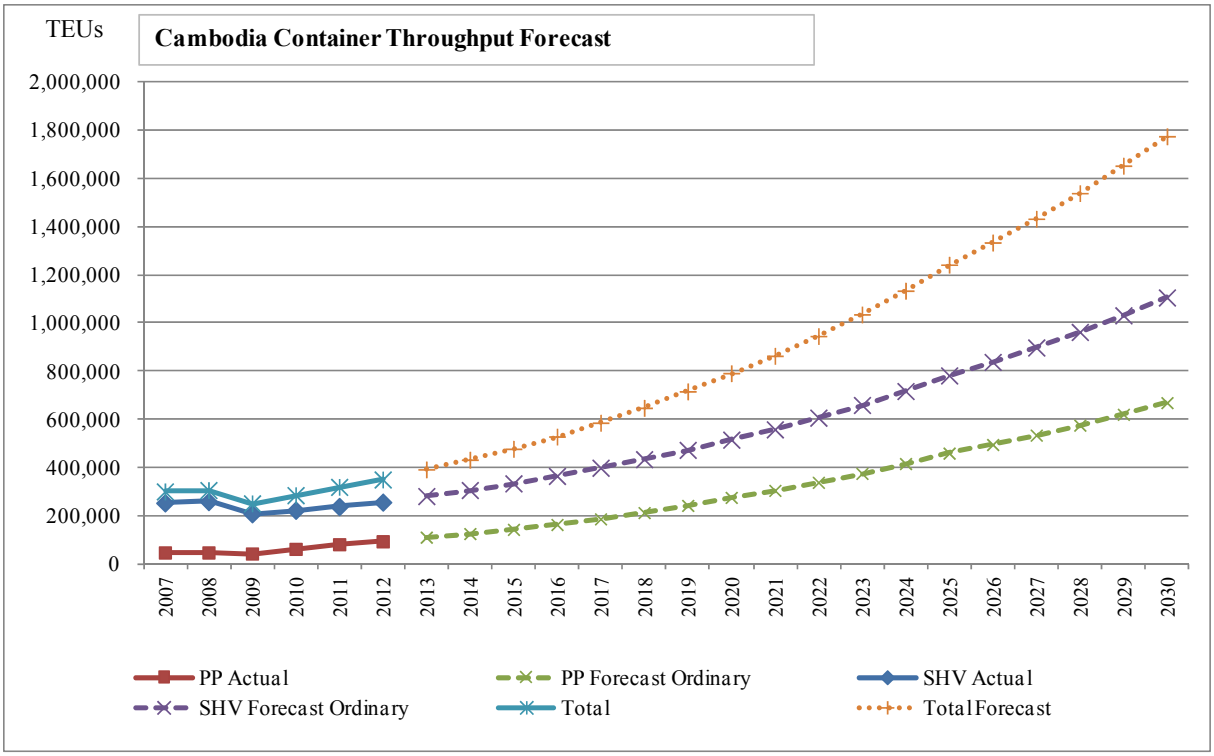
Based on the assumptions of the previous two sub sections (1) and (2), container cargo export and import in the ordinary case are estimated as shown in Table 3.3-3, and details of the forecast are shown in Appendix E-2 (ANNEX E). The low case forecast is made based on assumptions that GDP growth is low case as shown in Table 3.1-3, the ratio of import container growth to GDP growth is 1.3 and the ratio of export container growth is 1.7, those are 10% lower than the estimated ones. The low case forecast is summarized in Table 3.3-4 and details of the forecast are shown in Appendix E-3 (ANNEX-E).

Table 3.3-3 Container Throughput Forecast, All Cambodia (Ordinary Case)

(TEUs)

Year	Import Laden	Export Laden	Import Empty	Export Empty	Total
2015	202,659	156,618	36,022	82,063	477,361
2020	334,881	296,117	60,704	99,468	791,170
2025	517,624	514,908	102,982	105,697	1,241,210
2030	732,804	770,683	154,137	116,257	1,773,882

Source: Survey Team



Source: Survey Team

Figure 3.3-3 Container Throughput Forecast, All Cambodia (Ordinary Case)

Table 3.3-4 Container Throughput Forecast, All Cambodia (Low Case)

(TEUs)

Year	Import Laden	Export Laden	Import Empty	Export Empty	Total
2015	198,757	153,678	35,346	80,425	468,205
2020	311,769	274,724	56,318	93,363	736,176
2025	453,866	446,483	80,367	87,749	1,068,465
2030	607,374	626,216	112,719	93,877	1,440,187

Source: Survey Team

d) Demarcation between Sihanoukville Port and Phnom Penh Port

A former study on Sihanoukville Port, i.e. the Study on Strengthening Competitiveness and Development of Sihanoukville Port (2011-2012), estimated the share of Sihanoukville Port and Phnom Penh Port by means of a Logit Model. The study reported that the share of Sihanoukville Port will slightly decrease, the share of Phnom Penh Port will increase, and the share of cross border land transport will remain at the present level.

Based on recent fares of land transport from HCM/Cai Mep to Phnom Penh, and from Sihanoukville to Phnom Penh, and statistics of cross border land traffic via Bavet, the Logit Model is applied to the recent situation of actual transport cost. The result of the Logit Model calculation is shown in Appendix E-4 (ANNEX-E).

Applying the model, it is estimated that laden container export through Sihanoukville Port and Phnom Penh/Cai Mep Port will have similar shares of 50% due to the fact that total transportation cost of both routes have little difference. It is also assessed that barge transportation will have a large share in container export from Phnom Penh area to HCM/Cai Map Port due to the advantage of simultaneous transportation.

In the case of laden container import, Sihanoukville Port handled about 80% of total laden containers imported in 2012, but the model estimates it is 54%-58% based on the difference in economic cost of both routes. Since some preferences are seen for Sihanoukville Port in the case of laden container import, the model is modified with a dummy parameter and the share of Phnom Penh Port is deemed to be about 25% in the case of laden container import. If there is no preference for Sihanoukville Port, it is assumed that the share of Sihanoukville Port will be 55% in laden container import. Laden import containers through cross border land transportation are assessed to increase and part of the demand for container export through Phnom Penh Port will shift to the cross border land transportation.

While Appendix E-4 (ANNEX-E) shows the theoretical share estimated, no direct service is available from Cai Mep to Europe, and consequently Sihanoukville Port has a dominant share in export and import to/from Europe.

e) Cross Border Land Transport

The number of container trucks passing Bavet Gate is revealed by the Customs and Excise Office as shown in Table 3.3-5. About 24,000 trucks passed with laden import containers, of which 16,000 trucks transported containers to Phnom Penh area in 2012. To the contrary, about 8,000 trucks passed with laden export containers, of which 6,800 trucks were from adjacent Manhattan SEZ or Tai Seng SEZ. The area within 20 km from the border is especially allowed to receive trucks from Vietnam other than the quota agreed in the bilateral cross border transport agreement.

Based on the number of container trucks, TEUs of import and export through Bavet border are estimated as shown in Table 3.3-6 supposing that the ratio of 40' containers is 90% - 95% at Bavet gate. TEU of import containers to Phnom Penh through CBT is nearly the same number as that of Mekong barge transport.

Fares and charges of cross border land transport and Mekong barge transport are compared as shown in Appendix E-5, E-6 and E-7 (ANNEX-E) including unofficial charges at the border. Fare of the land transportation from HCM/Cai Mep to Phnom Penh is slightly higher than Mekong barge transport, but has advantages in door to door transport, easy customs clearance at the border, and shorter transportation time. Taking into account economic cost, it is estimated that CBT will transport about 50-60% of laden container import.

However, a truck company indicated that 95% of trucks from Phnom Penh to HCM are carrying empty containers or nothing. Laden export containers are mainly carried by Mekong barges, and it is deemed to continue for the time being.

Assuming that container import through CBT will increase by the same ratio as the container import growth to GDP growth, and the ratio of container import by CBT to container import by Mekong river transport will increase to 60%, future container import by CBT is estimated as shown in Appendix E-8 (ANNEX-E). While it is assumed that container export by CBT remains at the same level as the present situation and the ratio of empty export containers to laden export containers is considerably high, CBT trucks will carry the same number of boxes of import and export containers including empty containers. The ratio of empty containers is gradually decreasing and it will continue to decrease to lower levels as shown in Appendix E-9 (ANNEX-E).

Table 3.3-5 Estimated TEUs transported through Bavet Border Gate

		2007	2008	2009	2010	2011	2012
Import	Container Trucks to Bavet Area	2,097	2,856	2,200	3,085	4,773	7,636
	Non Container Trucks to Bavet Area	1,314	1,613	2,957	3,376	4,135	6,658
	Container Trucks to PP Area	-	1,478	3,673	10,974	15,243	16,522
	Bus	5,018	7,716	9,825	14,658	17,996	22,812
Export	Container Trucks from Bavet Area	1,923	2,198	1,901	2,591	3,299	6,791
	Non Container Trucks from Bavet Area	213	79	411	532	596	1,016
	Container Trucks from PP Area	-	-	161	736	951	1,147
	Bus	5,015	7,714	9,868	14,608	18,001	22,797

Source: Compilation by Customs and Excise, 2012

Table 3.3-6 Number of trucks passed Bavet Border Gate

Cross Border Container Transport (Estimated TEU)

		2007	2008	2009	2010	2011	2012
Laden Import Containers	Bavet Area	4,037	5,498	4,235	5,939	9,188	14,699
	Phnom Penh Area	0	2,845	7,071	21,125	29,343	31,805
	Total	4,037	8,343	11,306	27,064	38,531	46,504
Laden Export Containers	Bavet Area	3,702	4,231	3,659	4,988	6,351	13,073
	Phnom Penh Area	0	0	310	1,417	1,831	2,208
	Total	3,702	4,231	3,969	6,404	8,181	15,281

Phnom Penh Container Throughput (TEU)

	2007	2008	2009	2010	2011	2012
Laden Import Containers	23,783	23,623	16,735	21,369	25,344	29,626
Laden Export Containers	5,942	5,743	11,775	24,276	35,696	41,807

Source: Survey Team

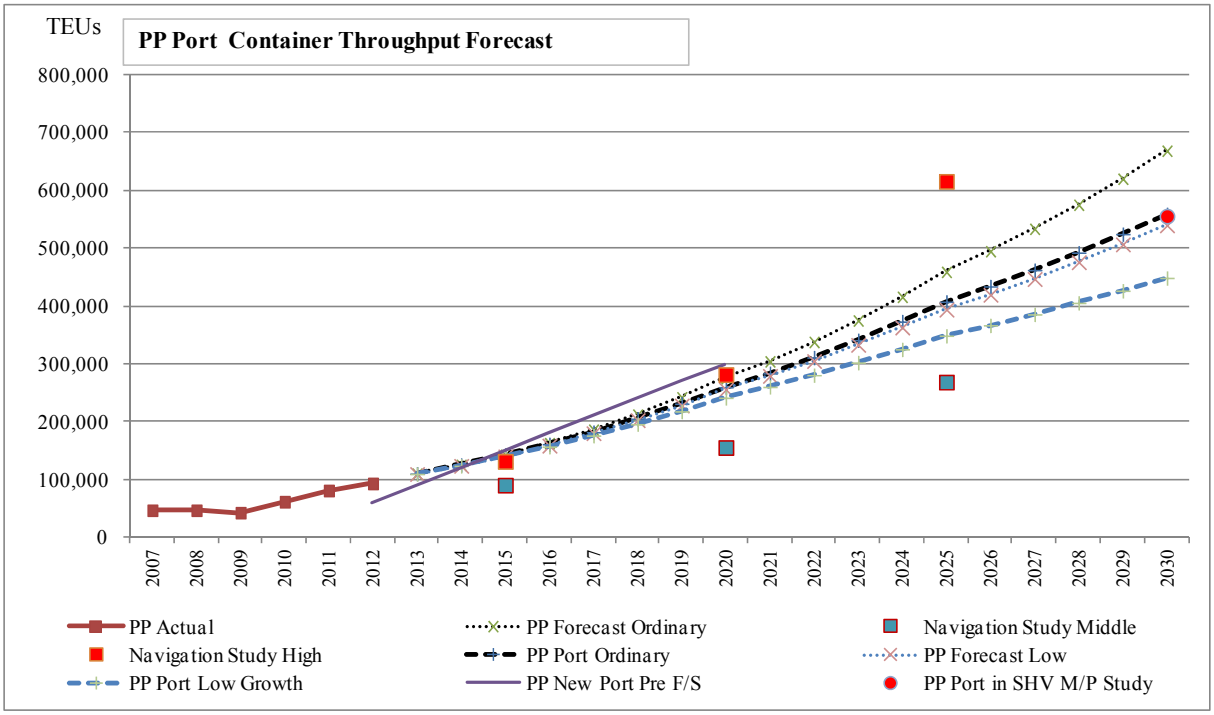
f) Phnom Penh Port Container Throughput Forecast

Container throughput at the Phnom Penh Port is estimated based on assumptions on GDP growth, empty container ratio, demarcation between Sihanoukville Port and Phnom Penh Port, and share of cross border land transport, as shown in Figure 3.3-4 and Table 3.3-7. Details of estimations are shown in Appendix E-10 (ANNEX-E).

In the ordinary case, GDP growth is assumed to be 6.5%-7.7% (2012-2020) and 6.5%-6.0% (2021-2030), and the demarcation between Sihanoukville Port and Phnom Penh Port is about 50% and 50% for laden export containers and 75% and 25% for laden import containers in the future. Container throughput at Phnom Penh Port is estimated at about 560,000 TEUs in 2030.

In the high share case, it is assumed that preference for Sihanoukville Port in laden container import is lost and demarcation of Phnom Penh Port will increase to about 45 % in laden container import. Other conditions are assumed to be the same as the ordinary case. Container throughput at Phnom Penh Port is estimated at about 610,000 TEUs in 2030 in the high share case.

In the low growth case, GDP growth rate is assumed to be 7.0% (2018-2020) and 6.0%-5.0% (2021-2030), which is lower by 0.5%-1.0% than the ordinary case and the ratio of container import/export growth to GDP growth is 10% lower than the ordinary case. Container throughput is estimated at about 450,000 TEUs in the low growth case.



Source: Survey Team

Figure 3.3-4 Phnom Penh Port Container Throughput (Ordinary Case, Low Growth Case)

Table 3.3-7 Phnom Penh Port Container Throughput (Ordinary/High Share/Low Growth)

Year	2013	2014	2015	2016	2017	2018
PP Port Ordinary	111,000	126,000	143,000	162,000	182,000	206,000
PP Port High Share	113,000	130,000	149,000	170,000	194,000	220,000
PP Port Low Growth	110,000	124,000	141,000	157,000	177,000	196,000

Year	2019	2020	2021	2022	2023	2024
PP Port Ordinary	232,000	260,000	284,000	311,000	341,000	374,000
PP Port High Share	250,000	282,000	309,000	339,000	371,000	406,000
PP Port Low Growth	218,000	242,000	261,000	281,000	303,000	326,000

Year	2025	2026	2027	2028	2029	2030
PP Port Ordinary	408,000	434,000	463,000	493,000	525,000	559,000
PP Port High Share	443,000	473,000	505,000	539,000	574,000	610,000
PP Port Low Growth	349,000	367,000	386,000	406,000	427,000	449,000

Source: Survey Team

3) Non-container Cargo

a) General/Bulk Cargo at Phnom Penh Port

General and dry bulk cargoes imported at Phnom Penh Port are coal, fertilizer, construction materials, steel coil, steel bar, wheat and other general cargoes, and exported are dry cassava, rice and others, as shown in Table 3.3-8.

Total tonnage of imported general/bulk cargo reached 102,000 tons in 2012, which increased by 22% from the previous year, and that of exported was 14,000 tons, most of which was dry cassava. Rice export in dry bulk was 10,000 tons in 2012, but it was only 800 tons in 2012. Volume of general or dry bulk cargo fluctuates in a wide range owing to commercial activities. Since the tonnage of imported container cargo was 379,000 tons in 2012 and that of exported was 247,000 tons, tonnage of general/bulk cargo remains at a small scale at Phnom Penh Port.

Besides Phnom Penh Port, private port facilities are used for import of coal for power generation, and fertilizer, steel coil, fuel, and other general cargo. Phnom Penh Port is expected to export more rice and dry cassava in the near future.

b) Export of Agricultural Products

The government encourages rice export as an important tool to boost its economy and announced a rice export policy which intends to export 1 million tons of milled rice in 2015. In order to realize this goal, the government organized the Secretary of One Window Service for Rice Export Formality (SOWF-REF) and promotes rice export. Tonnage of exported rice was released by the Ministry of Agriculture, Forest and Fisheries as shown in Table 3.3-9. Volume of rice export remains at a level of 200,000 tons due to the limited capacity of rice mill facilities.

Ernst & Young[3] estimates that Cambodia produced rice of 8.25 million tons in 2010, of which 4 million tons was consumed domestically, 180,000 tons was exported as milled rice, and the rest was unofficially sold to Thai and Vietnam companies as paddy rice. Volume of unofficial export of paddy rice does not appear on statistics and price of paddy rice is much lower than the milled rice. It is therefore expected that export of milled rice will increase rapidly in the near future backed by the strong government policy.

[3] Agricultural Logistics Center in Phnom Penh and Development of a Pricing Mechanism of Agricultural Products, The 3rd Seminar on Economic Development of Cambodia, 25 Oct. 2012

Table 3.3-8 General/Bulk Cargoes handled at Phnom Penh Port (2007-2012)

Cargo \ Year	2007	2008	2009	2010	2011	2012
Imported Cargo						
Animal food						6,504
Cement				3,153	4,150	1,000
Sand	11,200					
Coal			32,448	18,143	39,523	29,300
Drink (Coffee…..)						4,470
Construction Material	32,019	34,328	11,630	9,514	4,669	4,928
Fertilizer			2,653		3,217	16,756
General Cargo	703			4,590	11732	1,501
Machine	158					847
Antena			12,490	1,076		
Steel Coil-Steel Bar (Pole)		18,214	26,242	22,533	13,055	23,319
White Sugar						3,441
Electronic Material						0,949
Wheat		4,868	8,137	8,315	5,590	
Wheat Flour	6,615	30,781			2,096	9,423
Total General Cargo Imported	50,695	88,191	93,600	67,324	84,033	102,438
Exported Cargo						
General Cargo			671			
Steel Coil-Steel Bar (Pole)				7,628		
Dry Cassava						13,441
Rice					10,082	815
Total General Cargo Exported	-	-	671	7,628	10,082	14,256
Imported Fule	704,501	780,036	867,942	777,868	852,716	824,616

Source: PPAP

Table 3.3-9 Export of Milled Rice from Cambodia

(Tons)

Year Rice Exported	2009	2010	2011	2012(8M)
One Year	12,613	105,259	201,899	
(8 months)	(4,678)	(76,805)	(113,984)	(114,064)

Source: New Initiative in Rice Export Facilitation
Secretary of One Window Service for Rice Export Formality (SOWF-REF)
Deputy Director General of GDA/MAFF, 25 October 2012

Future volumes of export of agricultural products are assessed and estimated by the Study Improving Efficiency of Logistics and Distribution Center of the East-West Economic Corridor and the Southern East-West Economic Corridor[4], March 2012, as shown in Table 3.3-10. The study also covered import of vegetables and some grains.

The study estimates Cambodia may export 2.24 million tons of rice, 7.51 million tons of cassava, a half million tons of sugar cane, and other subsidiary/industrial crops in 2020. The study also estimates that Cambodia will import 18,000 tons of vegetables and 18,000 tons of peanuts.

Phnom Penh Port will be used for exporting rice and cassava in the future. The port exported 10,000 tons of rice in 2011 and 14,000 tons of cassava in 2012. Therefore, the port will be requested to handle more export of rice and cassava in the near future.

Sihanoukville Port exported milled rice of 145,000 tons in 2011, all of which was shipped by containers. As the Agricultural ministry reported that export of milled rice was 202,000 tons in 2011, and 10,000 tons of rice was exported in bulk from Phnom Penh Port, part of the remaining 44,500 tons of rice may be shipped by containers through Phnom Penh Port.

Table 3.3-10 Export and Import Forecast for Agricultural Products (Cambodia)

Paddy and Grain Crops			Import volume	Export volume	Total
Paddy		Current	0	1,170,000	1,170,000
		Year 2020	0	2,243,000	2,243,000
Subsidiary Crops	Maize	Current	0	3,000	3,000
		Year 2020	0	26,000	26,000
	Cassava	Current	0	1,373,000	1,373,000
		Year 2020	0	7,506,000	7,506,000
	Sweet potato	Current	0	20,000	20,000
		Year 2020	0	70,000	70,000
	Vegetable	Current	10,000	0	10,000
		Year 2020	18,000	0	18,000
	Mung bean	Current	0	5,000	5,000
		Year 2020	0	18,000	18,000
	Total	Current	10,000	1,401,000	1,411,000
		Year 2020	18,000	7,620,000	7,638,000
Industrial Crops	Peanut	Current	5,000	0	5,000
		Year 2020	18,000	0	18,000
	Soy bean	Current	0	1,000	1,000
		Year 2020	0	6,000	6,000
	Sesame	Current	0	20,000	20,000
		Year 2020	0	93,000	93,000
	Sugar cane	Current	0	202,000	202,000
		Year 2020	0	510,000	510,000
	Total	Current	5,000	223,000	228,000
		Year 2020	18,000	609,000	627,000

Source: The Feasibility Study on Improving Efficiency of Logistics and Distribution of the East-West Economic Corridor and the Southern East-West Economic Corridor, Executive Summary March, 2012

[4] The Feasibility Study on Improving Efficiency of Logistics and Distribution Center of the East-West Economic Corridor and the Southern East-West Economic Corridor, Final Report for MOC, March 2012

4) Liquid Cargo

Private oil jetties are located in the Phnom Penh Port area and 853,000 tons of fuel was imported in 2011, which slightly decreased to 825,000 tons in 2012 as shown in Table 3.3-11 and Figure 3.3-5. Private oil companies in Sihanoukville imported 625,000 tons of fuel in 2011 and 785,000 tons in 2012. Besides these two oil import areas, a new oil terminal was recently developed and imports oil products. Total fuel import of Cambodia will be greater than the figures in the table. All of the fuel import is handled by private oil facilities, and more private oil facilities will be developed in accordance with the increase of demand for fuel.

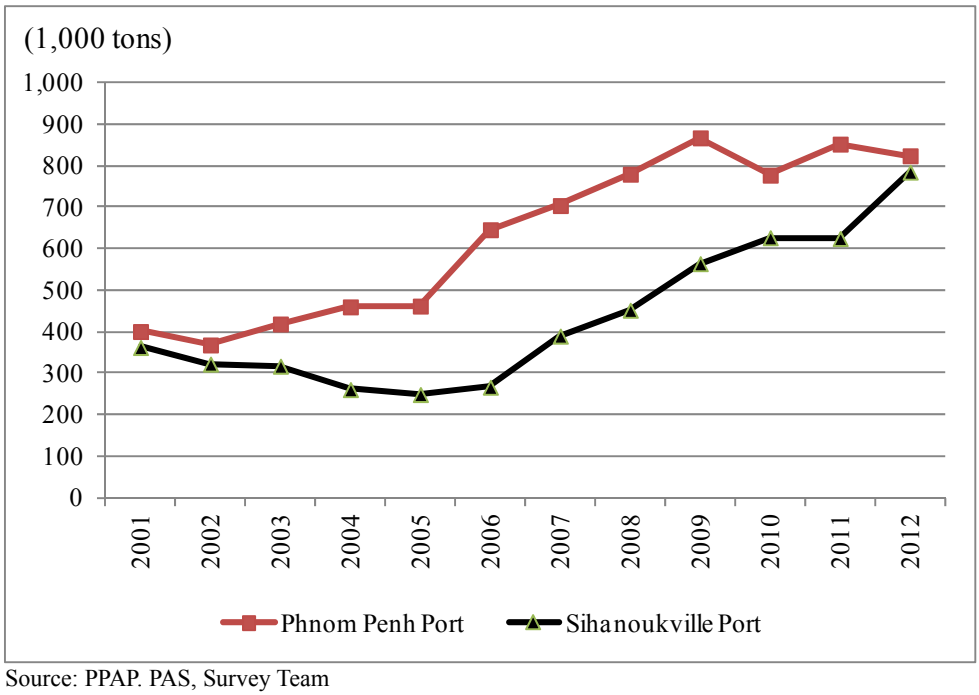
Table 3.3-11 Fuel import at Phnom Penh Port and Sihanoukville Port

(Tons)

Year	2001	2002	2003	2004	2005	2006
Phnom Penh Port	401,050	368,775	419,276	460,652	462,366	646,325
Sihanoukville Port	362,522	322,553	317,505	261,039	249,148	266,689
Total	763,572	691,328	736,781	721,691	711,514	913,014

Year	2007	2008	2009	2010	2011	2012
Phnom Penh Port	704,501	780,036	867,942	777,868	852,716	824,616
Sihanoukville Port	389,885	452,294	564,570	626,985	625,235	785,035
Total	1,094,386	1,232,330	1,432,512	1,404,853	1,477,951	1,609,651

Source: PPAP, PAS



Source: PPAP. PAS, Survey Team

Figure 3.3-5 Fuel import at Phnom Penh Port and SHV Port

(2) Logistics Plan

As the Phnom Penh Port is transferred to the Phnom Penh New Port, all of the containers handled in the Phnom Penh New Port shall be transported to the factories around the Phnom Penh City through the national road No.1. Therefore, about 65,000 additional container transport trips between the Phnom Penh New Port and Phnom Penh City are newly generated now.

The container volume for the Phnom Penh New Port is estimated to reach 115,000 containers totalling170,000 TEUs in 2020 when the port will be requested to expand terminal 2. Also, the container numbers generated from the Phnom Penh New Port SEZ in 2020 is estimated at about 12,000 which are not transported to Phnom Penh City. Therefore, the containers generated at the Phnom Penh New Port in 2020 to transport through the national road no.1 will be about 100,000 in total. Those containers will be collected and transported to the Inland Container Depot or Logistic Center operated by private companies.

The exported cargo transportation to the Phnom Penh Port is concentrated on three days of the week end in the current conditions. Therefore, as the conditions will not change in the future, the number of cargo transportation trailers to the Phnom Penh New Port during peak periods is calculated as follows.

100,000 numbers /12 months /4 weeks /3 days = about 700 numbers /day

The current situation at the Terminal Gate for the Phnom Penh New Port is that once all the container trucks have entered through the gate into the terminal they wait for checking of the export cargos in the parking area in order to avoid the congestion of the entrance gate. Therefore, a truck parking lot in the terminal shall need enough space which is calculated as follows:

- 700 trucks x 60% (share of export cargos) / 12 hours (gate time) = 35 trucks /hours
- Peak Period: 4 hours x 35 trucks x 1.3 (Peak time rate)= 182 trucks / three hours
- Checking time of export container = about 5 min. / container
- Waiting space outside of the entrance gate = 25 container trucks
- Trucks waiting in terminal = 182-(60 /5 x 3) – 25 = about 120 trucks
- Necessary parking space in the terminal= 120 x 80 m2 = about 10,000 m2 (1 Ha)

Hence, above parking space or the truck waiting area around the Gate shall be taken into the detailed design of this project when the project proceeds. This is a difficult aspect to be solved by technical considerations, therefore, the change of the terminal gate system shall be taken into account.

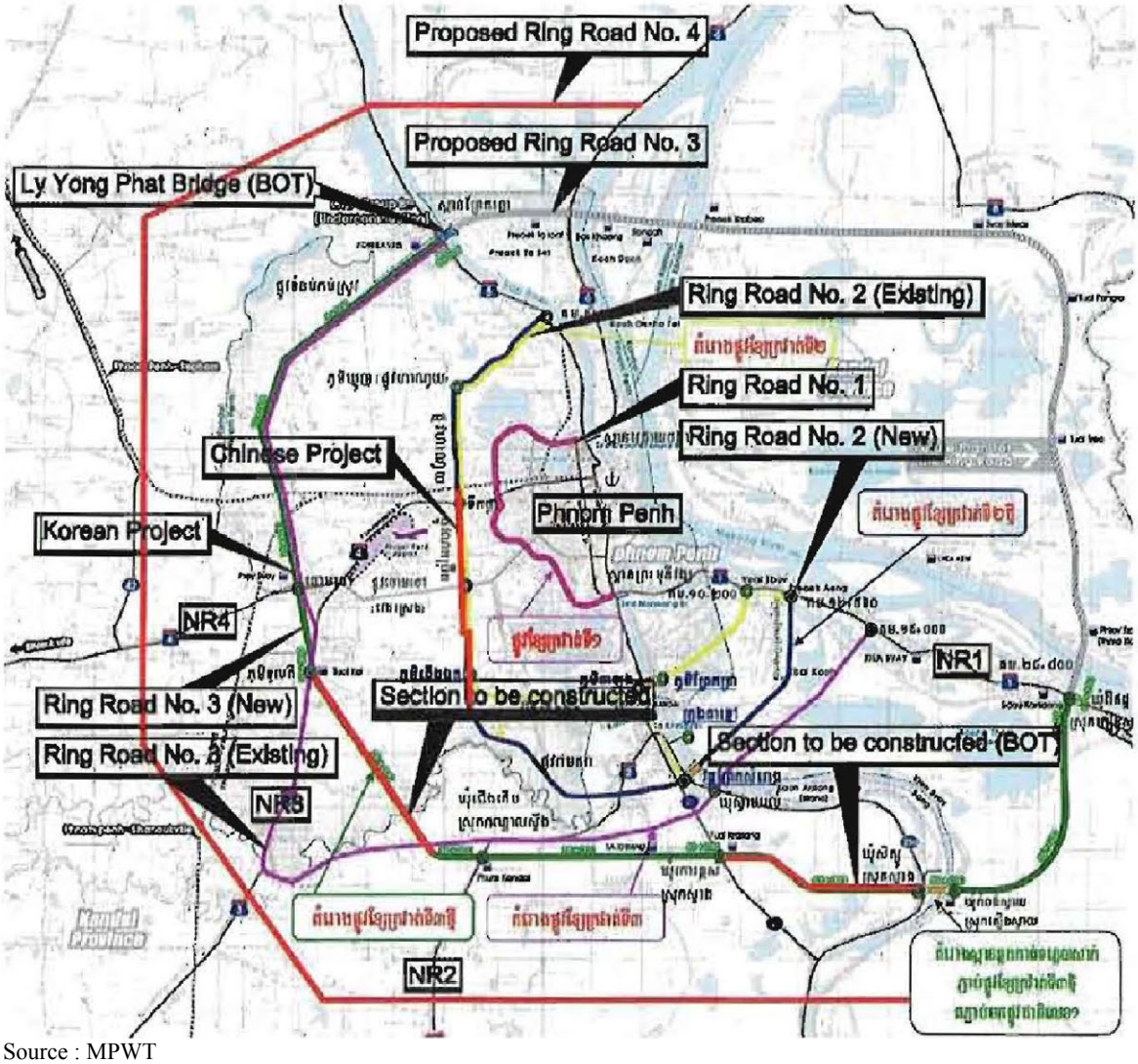
On the other hand, the cargo traffic generated by the Phnom Penh New Port is evaluated for traffic jams of the national road No.1 in the social environmental survey. By the results of the traffic survey in front of the port, the cargos generated by the port are not expected to have major impacts for the traffic jams of the national road No.1 in 2028. In the results of the EIA, the cargo volume generated by the port is too small to give impacts for the total traffic volumes through the national road No.1.

In view of the current conditions of the national road No.1, the volume of the traffic is increasing day by day and the border of the Phnom Penh City at the Monivong Bridge in the national road No.1 already hinders traffic chronically.

For the planning of the logistics of the cargos for the Phnom Penh New Port, the congestion of the national road No.1 is a major issue. To cope with the issue, the urgent implementation of the diversion road construction planned by GOC as “Outer Ring Road No.2” shall be watched and forward of the project. The plan of the Outer Ring Road is shown in Figure 3.3-6.

The Ring Road No.2 will be connected with National Road No.1 at the border of Phnom Penh City and Kandal Province, about 15km far from the New Port. Then, the road along the city border will be connected with National Road No.4 at the eastern side of the Phnom Penh Airport. This Ring

Road No.2 would be constructed by 2019 before this Phnom Penh New Port expansion is constructed. Therefore, the Ring Road No.2 will become the major transportation route of the project.
Subsequently, the Ring Road No.3 will be constructed and connected near the Phnom Penh New Port in the National road No.1 in the future. This road is also planned to connect the industry sites surrounding the Phnom Penh City. Therefore, the road will become the industrial road connecting between the port and the industry area directly. For the connection of the road, the development of the SEZ unified with the expansion of the Phnom Penh New Port shall be necessary and bring the economic growth of Cambodia.



Source : MPWT

Figure 3.3-6 Plan of Outer Ring Road for Phnom Penh City

3.3.2 Extension Plan of Associated Port Facilities

(1) General

According to PPAP, the present location of the New Phnom Penh Port was finally selected by comparing some of the alternatives near Phnom Penh Port, because the land acquisition at the present location was easier and more economical than the others. The Port reserves extension areas up and down stream of NCT. In this study, the future extension was planned within the reserved areas in consideration of continuity with NCT. This study discusses the general layout of associated port facilities based on future port extension scenarios including Phnom Penh Port and NCT, cargo handling methods in NCT, and arrangement plan for cargo handling equipment.

(2) General Layout of Associated Port Facilities

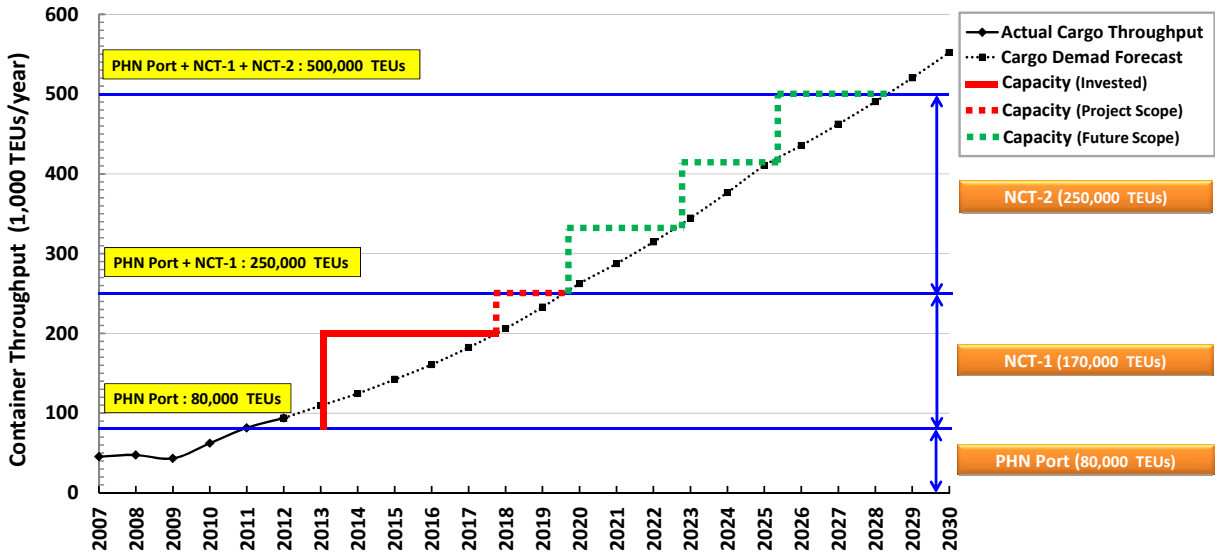
1) Scenario for Port Extension

Considering the status and development trends of Phnom Penh Port and New Phnom Penh Port as stated in Section 2.7 and cargo demand forecast as mentioned in Section 3.2, the following basic development policies were established for each Port:

- **Phnom Penh Port:** Although most container operations have been transferred to NCT from January 2013, the Port is to especially handle heavy containers. The planned container throughput of the Port is determined as 80,000 TEUs/year, since the yard area of the Port is already over capacity as assessed in 2.7. Vacant space at the berth and yard of the Port, which was re-arranged by shifting of the container operation to NCT, is to be assumingly utilized for cargo handling facilities for rice, general cargo and conventional cargo etc.
- **New Phnom Penh Port:** NCT was initially planned to handle 120,000 TEUs/year with 3 QGC (TCC) and 3 RTG (6 over 1). After due evaluation of the equipment allocation and planning to maximize terminal capacity, PPAP decided to procure 1 additional unit each of the QGC (TCC) and RTG. In fact, the QGC (TCC) needs a certain working radius and the maximum accommodative number of the QGC (TCC) per berth is consequently limited for vessels expected to call in at NCT. Also it is presumed that 5,000 DWT or over class vessels will be few and 1,500-4,000DWT class vessels calling will still be the majority in the future. In view of cost-effective investment, the total numbers of the QGC (TCC) and RTG already procured are practically suitable to such circumstance. Considering the above, the revised planned container through put in NCT is assumed as 170,000 TEUs/year with 3 QGC (TCC) and 5 RTG. If the throughput exceeds the planned 170,000 TEUs, NCT would lack the capacity of the existing port facilities (berth length, yard area etc.) and the NCT extension is to be planned with a target handling capacity of 250,000 TEUs/year up stream of NCT in consideration of future terminal manoeuvring and shorter access to the existing entrance gate.

Based on the above basic policies, a port extension scenario of each Port and terminal was established as below and Figure 3.3-7 shows a schematic diagram for the port extension scenario based on the cargo demand forecast.

- Phnom Penh Port : planned container throughput 80,000 TEUs/year
- NCT-1(existing container terminal) : planned container throughput 170,000 TEUs/year
- NCT-2(future extension terminal) : planned container throughput 250,000 TEUs/year



Source: Survey Team

Figure 3.3-7 Port Expansion Scenario based on Cargo Demand Forecast

2) Prerequisites for Port Extension Planning

Prerequisites for port extension of Phnom Penh Port, NCT-1 and NCT-2 were set as shown in Table 3.3-12 in consideration of information obtained from PPAP and/or the results of PPAP regarding actual cargo operations, restriction of topographic conditions for each port and terminal, consistency with existing port facilities and cargo handling equipment already provided, cargo demand forecast, future vessel dimensions etc.

Table 3.3-12 Summary of Prerequisites for Port Extension Planning

Category & Item\Target Location				PHN Port			NCT-1			NCT-2			Remark
Berth	Total Berth Length		(m)	300			300			350			
	Target Vessel	Weight	(DWT)	1,500	3,000	5,000	1,500	3,000	5,000	1,500	3,000	5,000	1,500 DWT crane barge (70 TEU/vessel) averaged for actual vessels called to PHN Port in 2011, 3,000 DWT crane barge (137 TEU/vessel) averaged between future large-sized barge (4,500 DWT, LOA110m, Beam 11.5m, Draft 3.6m, Capacity 200TEU/barge) and 1,500 DWT barge
		Type		CB	CB	CC	CB	CB	CC	CB	CB	CC	
		Load Capacity	(TEU/vessel)	75	137	320	75	137	320	75	137	472	
		Req. Berth Length	(m/vessel)	73	106	144	73	106	144	73	106	154	
		Nr of Berth	(nr)	3	2	2	3	2	2	4	3	2	
	Quay Crane	Type		Crawler Crane			Gantry Crane (TCC)			Gantry Crane (STS Crane)			
		Av. Capacity	(box/hr)	10			17			28			Assumed 80 % of nominal capacity
	Conversion Ratio		(box/TEU)	1.54			1.54			1.54			Actual record in 2011 applied
	Working Day		(day/year)	300			300			300			
	Working Hour		(hr/day)	20			20			20			
Container Yard	Cargo Share	Import	(%)	32			32			32			Actual record in 2011 applied
		Export	(%)	44			44			44			
		Empty	(%)	25			25			25			
	Av. Dwelling Time	Import	(hr)	3			7			7			Hearing result (PHN Port) Assumed future operation averaged (NCT-1&-2)
		Export	(hr)	2			5			5			
		Empty	(hr)	1			10			10			
	Av. Stacking Height	Import	(layer)	2.5			3.5			3.5			Observed and upon hearing result (PHN Port) Assumed future operation averaged (NCT-1&-2)
		Export	(layer)	2			3.5			3.5			
		Empty	(layer)	2.5			5			5			
	Max. Stacking Height	Import	(layer)	3			6			6			Observation & hearing result (PHN Port) Planned future operation (NCT-1&-2)
		Export	(layer)	2			6			6			
		Empty	(layer)	3			6			6			
	Working Day		(day/year)	365			365			365			
	Working Hour		(hr/day)	20			20			20			
	Area Requirement	Equipment Type		Forklift, Reach Stacker etc.			Yard Transfer Crane (RTG)			Yard Transfer Crane (RTG)			
		Req. Area	(m2/TEU)	30			6			6			Port Development. UNCTAD (1985)
Entrance Gate	Working Day		(day/year)	365			365			365			
	Gate Process Time		(min/box)	3			3			3			Assumed actual gate processing operation
	Gate Open Time		(min/day)	600			600			600			

Notes: CB and CC respectively mean "Container Barge" and Container Carrier"

Source: Survey Team

3) Phnom Penh Port

Based on the prerequisites established in 2), berth-day requirements (BDRs) and berth utilization ratio (BORs), the required TEU ground slots (TGSs) and container parking area, and the required number of gate lanes for handling the planned container throughput of 80,000 TEUs/year were estimated as follows.

Berth-Day Requirements (BDRs) and Berth Utilization Ratios (BORs)

Due to the lower berth occupancy anticipated in Phnom Penh Port, the berth was determined to be used concurrently with other cargo handling such as rice/cassava, general cargo and conventional cargo. Table 3.3-13 presents the estimated BDRs per berth and BORs for Phnom Penh Port.

Table 3.3-13 Estimated BDRs and BORs (Phnom Penh Port)

Description\Target Container Terminal		PHN Port		
Container Throughput	**(TEU)**	80,000		
Number of Crane	**(nr)**	3	3	3
Number of Berth	**(nr)**	3	2	2
Target Vessel		1,500 DWT Container Barge	3,000 DWT Container Barge	5,000DWT Container Carrier
Required Berth Length per Vessel	**(m)**	75	106	144
Average Vessel Load	**(TEU/vessel)**	73	138	320
Number of Vessel Calls	**(vessel)**	1096	580	250
Av. Crane Productivity	**(box/hr)**	10	10	10
Conversion Ratio	**(TEU/box)**	1.54	1.54	1.54
Working Hour	**(hour/day)**	20	20	20
Crane Effectiveness Factor		1.0	1.4	1.4
Container Handling Capacity per Berth	**(TEU/day/berth)**	308	416	416
Service Time	**(day/vessel)**	0.37	0.46	0.90
Berth-Day Requirement per Berth		**134**	**134**	**112**
Berth Utilization (BOR: Berth Occupancy Ratio)		**0.45**	**0.45**	**0.37**

Source: Survey Team

As seen in the table, the estimated BDRs per berth and BORs for target vessels 1,500, 3,000 and 5,000 DWT container barges/carriers were respectively 134 days and 0.45, 134 days and 0.45, and 112 days and 0.37. The BDR per berth and BOR estimated in 2011 were respectively 111 days and 0.37 and are almost the same in each target vessel case.

Commonly, higher berth utilization seems to be more financially rewarding, however, it generates congestion of the berth. Table 3.3-14 presents congestion time factors computed by queue for each BOR by number of berths, and suitable BOR for each berth number estimated based upon recommended congestion time factor. As shown in the table, the estimated BORs in the Table 3.3-13 are within the suitable BOR range between 0.38 and 0.58 (2 berths). It is understood that the berth will not be congested ordinarily and extension of the berth is therefore not necessary.

Table 3.3-14 Suitable BORs for Recommended Congestion Time Factor

Number of Berth	Suitable Berth Utilization (BOR)	Recommended Congestion Time Factor
1	0.18-0.37	0.05-0.20
2	0.38-0.58	
3	0.50-0.68	
4	0.57-0.74	
5	0.62-0.79	

Note: Recommended congestion time factor suggested by Carl A. Thoresen in Port Designer's Handbook (2010)

Relation among BOR, Number of Berth and Simulated Congetion Time (Waiting Time) Factor
(Container Berth)

	Number of Berths							
Occupancy	1	2	3	4	5	6	7	8
0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.15	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00
0.20	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00
0.25	0.09	0.02	0.01	0.00	0.00	0.00	0.00	0.00
0.30	0.13	0.02	0.01	0.00	0.00	0.00	0.00	0.00
0.35	0.17	0.03	0.02	0.01	0.00	0.00	0.00	0.00
0.40	0.24	0.06	0.02	0.01	0.00	0.00	0.00	0.00
0.45	0.30	0.09	0.04	0.02	0.01	0.01	0.00	0.00
0.50	0.39	0.12	0.05	0.03	0.01	0.01	0.01	0.00
0.55	0.49	0.16	0.07	0.04	0.02	0.02	0.01	0.01
0.60	0.63	0.22	0.11	0.06	0.04	0.03	0.02	0.01
0.65	0.80	0.30	0.16	0.09	0.06	0.05	0.03	0.02
0.70	1.04	0.41	0.23	0.14	0.10	0.07	0.05	0.04
0.75	1.38	0.58	0.32	0.21	0.14	0.11	0.08	0.07
0.80	1.87	0.83	0.46	0.33	0.23	0.19	0.14	0.12
0.85	2.80	1.30	0.75	0.55	0.39	0.34	0.26	0.22
0.90	4.36	2.00	1.20	0.92	0.65	0.57	0.44	0.40

Source: Port Development, United Nations Conference for Trade and Development (1985)

Source: Survey Team

Required TEU Ground Slots (TGSs) and Yard Parking Areas

Table 3.3-15 presents the required TEU ground slots (TGSs) and yard parking area for Phnom Penh Port. As shown in the table, the required TEU ground slots was 283 TGSs composed of 119 TGSs for import-laden containers, 137 TGSs for export-laden containers, and 27 TGS for empty containers and the required container parking area considering 10 % safety factor for reserved area was about 1.7 ha (16,690 m2).

The existing Port has 1.4 ha yard area and that area lacks 0.3 ha for handling the planed container throughput. However ICD can complement the lacking area in the actual operation as previously operated by PPAP.

Table 3.3-15 Required TGSs and Container Parking Areas (Phnom Penh Port)

Description\Target Container Terminal		PHN Port			
Container Throughput	**(TEU)**	80,000			
Container Type		Import	Export	Empty	**Total**
Share	**(%)**	32	44	25	100
Weighted Container Throughput	**(TEU)**	25,272	34,935	19,793	80,000
Average Dwelling Time	**(day)**	3	2	1	
Average Stacking Height	**(layer)**	2.5	2	2.5	
Max. Stacking Height	**(layer)**	3	2	3	
Ratio of Av. to Max. Stacking Heights		0.8	1.0	0.8	
Required Holding Capacity	**(TEU)**	208	191	54	453
Yard Utilization Ratio		0.7	0.7	0.8	
Required TEU Ground Slots	**(TGS)**	119	137	27	**283**
Area Requirement per TEU	**Equipment**	Forklift/Side Loader/Reach Stacker			
	(m2/TEU)	30.0	30.0	30.0	
Required Net Transit Storage Area	**(m2)**	6,232	5,743	1,627	**13,601**
Required Gross Teransit Storage Area	**(m2)**	7,478	5,743	1,952	**15,173**
Safety Factor for Reseved Capacity		1.1			
Container Parking Area	**(m2)**	8,226	6,317	2,147	**16,690**

Source: Survey Team

Required Number of Gate Lanes

Table 3.3-16 presents the required number of gate lanes for Phnom Penh Port. As shown in the table, the required number of gate lanes was 2 lanes including 1 common use lane.

The existing gate already has 2 lanes and those gate lanes are sufficient for handling the planed container throughput without any extension for the meantime. It should be noted that more gate lanes might be required if other cargo handling operations increase.

Table 3.3-16 Required Number of Entrance Gate Lanes (Phnom Penh Port)

Description\Target Container Terminal		PHN Port
Container Throughput at Berth	**(TEU)**	80,000
Annual Working Day	**(day)**	365
Ratio of Box to TEU		0.65
Peak Factor for Av. Throughput		1.2
Required Daily Gate Throughput	**(box/day)**	171
Assumed Gate Process Time	**(min/box)**	3
Assumed Gate Open Time	**(min/day)**	600
Required Lane at Gate	**(lane)**	**0.85**
Required Common Use Lane	**(lane)**	**1**
Total Lane Required at Gate	**(lane)**	**2 (1.85)**

Source: Survey Team

4) New Phnom Penh Port

a) NCT-1

Based on the prerequisites established in 2), berth-day requirements (BDRs) and berth utilization ratios (BORs), the required TEU ground slots (TGSs) and container parking area, and the required number of gate lanes for handling the planned container throughput of 170,000 TEUs/year were estimated as follows.

Berth-Day Requirements (BDRs) and Berth Utilization Ratios (BORs)

Table 3.3-17 presents estimated BDR per berth and BOR for NCT-1.

Table 3.3-17 Estimated BDRs and BORs (NCT-1)

Description\Target Container Terminal		NCT-1		
Container Throughput	**(TEU)**	170,000		
Number of Crane	**(nr)**	3	3	3
Number of Berth	**(nr)**	3	2	2
Target Vessel		1,500 DWT Container Barge	3,000 DWT Container Barge	5,000DWT Container Carrier
Required Berth Length per Vessel	**(m)**	75	106	144
Average Vessel Load	**(TEU/vessel)**	73	137	320
Number of Vessel Calls	**(vessel)**	2329	1241	531
Av. Crane Productivity	**(box/hr)**	17	17	17
Conversion Ratio	**(TEU/box)**	1.54	1.54	1.54
Working Hour	**(hour/day)**	20	20	20
Crane Effectiveness Factor		1.0	1.4	1.4
Container Handling Capacity per Berth	**(TEU/day/berth)**	524	707	707
Service Time	**(day/vessel)**	0.27	0.32	0.58
Berth-Day Requirement per Berth		**209**	**201**	**155**
Berth Utilization (BOR: Berth Occupancy Ratio)		**0.70**	**0.67**	**0.52**

Source: Survey Team

As seen in the table, the estimated BDRs per berth and BORs for target vessels 1,500, 3,000 and 5,000 DWT container barges/carriers were respectively 209 days and 0.70, 201 days and 0.67, and 155 days and 0.52.

As previously presented in Table 3.3-14, compared with the above estimated BORs corresponding to the necessary berth numbers in each case, two BORs of target vessels 1,500 and 3,000 DWT container barges were out of the range of the suitable BORs shown in the table and might create congestion at the berth, but the BOR of target vessel 5,000 DWT container carrier was within the suitable range. Actual future calling vessels are uncertain and so all types of the target vessel cases should be satisfactory within the suitable BOR ranges. Therefore, it is understood that the berth requires extension before annual container throughput reaches 170,000 TEUs.

Required TEU Ground Slots (TGSs) and Yard Parking Area

Table 3.3-18 presents the required TEU ground slots (TGSs) and yard parking area for NCT-1. As shown in the table, the required TEU ground slots is 1,123 TGSs composed of 420 TGSs for import-laden containers, 415 TGSs for export-laden containers, and 288 TGSs for empty containers and the required container parking area considering 30 % safety factor for reserved area was about 8.1 ha (81,299 m2).

The existing NCT-1 container yard has yard storage capacity of 846 TGSs = 8 blocks x 108 TGSs/block (6 rows x 18 bays) and a combined total 835 TGSs for the import and export laden containers are accommodated in the yard that has elsewhere 2 bays reserved as vacant areas. The existing empty container stock yard is estimated to only store 182 TGSs (7 rows x 13 bays x 2 blocks), so an additional empty container stock yard requires some of the area behind the X-ray inspection facilities, which makes it possible to secure more than 110 TGSs, for handling the planned container throughput.

Table 3.3-18 Required TEU Ground Slots (TGSs) and Container Parking Area (NCT-1)

Description\Target Container Terminal		NCT-1			
Container Throughput	(TEU)	170,000			
ContainerType		Import	Export	Empty	**Total**
Share	(%)	32	44	25	100
Weighted Container Throughput	(TEU)	53,704	74,236	42,060	170,000
Average Dwelling Time	(day)	7	5	10	
Average Stacking Height	(layer)	3.5	3.5	5	
Max. Stacking Height	(layer)	6	6	6	
Ratio of Av. to Max. Stacking Heights		0.6	0.6	0.8	
Required Holding Capacity	(TEU)	1,030	1,017	1,152	3,199
Yard Utilization Ratio		0.7	0.7	0.8	
Required TEU Ground Slots	(TGS)	420	415	288	**1,123**
Area Requirent per TEU	Equipment	Yard Transfer Crane		Top Lifter	
	(m2/TEU)	6.0	6.0	30.0	
Required Net Transit Storage Area	(m2)	6,180	6,102	34,570	**46,851**
Required Gross Teransit Storage Area	(m2)	10,594	10,460	41,484	**62,538**
Safety Factor for Reseved Capacity		1.3			
Container Parking Area	(m2)	13,772	13,598	53,929	**81,299**

Source: Survey Team

Required Number of Gate Lanes

Table 3.3-19 presents the required number of gate lanes for NCT-1. As shown in the table, the required number of gate lanes was 3 lanes including 1 common use lane.

The existing gate already has 4 lanes in NCT-1 and those gate lanes are sufficient for handling the planed container throughput without any extension.

Table 3.3-19 Required Number of Entrance Gate Lanes (NCT-1)

Description\Target Container Terminal		NCT-1
Container Throughput at Berth	(TEU)	170,000
Annual Working Day	(day)	365
Ratio of Box to TEU		0.65
Peak Factor for Av. Throughput		1.2
Required Daily Gate Throughput	(box/day)	363
Assumed Gate Process Time	(min/box)	3
Assumed Gate Open Time	(min/day)	600
Required Lane at Gate	(lane)	**1.81**
Required Common Use Lane	(lane)	**1**
Total Lane Required at Gate	(lane)	**3 (2.81)**

Source: Survey Team

b) NCT-2

Based on the prerequisites established in 2), berth-day requirements (BDRs) and berth utilization ratio (BORs), the required TEU ground slots (TGS) and container parking area, and the required number of gate lanes for handling the planned container throughput of 250,000 TEUs/year except for those in NCT-1 were estimated as follows.

Berth-Day Requirements (BDRs) and Berth Utilization Ratios (BORs)

Table 3.3-20 presents estimated BDR per berth and BOR for NCT-2.

Table 3.3-20 Estimated BDRs and BORs (NCT-2)

Description\Target Container Terminal		NCT-2		
Container Throughput	**(TEU)**	250,000		
Number of Crane	**(nr)**	3	3	3
Number of Berth	**(nr)**	5	3	2
Target Vessel		1,500 DWT Container Barge	3,000 DWT Container Barge	5,000DWT Container Carrier
Required Berth Length per Vessel	**(m)**	75	106	144
Average Vessel Load	**(TEU/vessel)**	73	138	320
Number of Vessel Calls	**(vessel)**	3425	1812	781
Av. Crane Productivity	**(box/hr)**	28	28	28
Conversion Ratio	**(TEU/box)**	1.54	1.54	1.54
Working Hour	**(hour/day)**	20	20	20
Crane Effectiveness Factor		0.5	1.0	1.4
Container Handling Capacity per Berth	**(TEU/day/berth)**	466	862	1,164
Service Time	**(day/vessel)**	0.29	0.29	0.40
Berth-Day Requirement per Berth		**196**	**175**	**158**
Berth Utilization(BOR)		**0.65**	**0.58**	**0.53**

Source: Survey Team

As seen in the table, the estimated BDRs per berth and BORs for target vessels 1,500, 3,000 and 5,000 DWT container barges/carriers were respectively 196 days and 0.65, 175 days and 0.58, and 158 days and 0.53.

As previously presented in Table 3.3-14, compared with the above estimated BORs corresponding to the necessary berth numbers in each case, all the BORs of target vessels 1,500, 3,000 and 5,000 DWT container barges/carriers were within the range of the suitable BORs. It is therefore understood that the berth additionally required in NCT-2 will not be congested ordinarily and will be sufficient to accommodate the planed container throughput in all target vessel cases.

Required TEU Ground Slots (TSGs) and Yard Parking Area

Table 3.3-21 presents the required TEU ground slots (TGS) and yard parking area for NCT-2. As shown in the table, the required TEU ground slots was 1,652 TGSs composed of 618 TGS for import-laden containers, 610 TGSs for export-laden containers, and 424 TGSs for empty containers and the required container parking area considering 30 % safety factor for reserved area was about 12.0 ha (119,557 m2).

For accommodation of the above 1,228 TGSs composed of 618 TGSs for import and 610 TGS for export laden containers, NCT-2 as extension of NCT-1 can secure its container yard with the stacking capacity of a maximum of 1,234 TGS (6 rows x 22 bays x 6 blocks + 442 TGSs) inside its new terminal and the said containers could be accommodated in the area to be secured downstream of the existing NCT-1. Due to limited lot dimensions of the area, although the yard area in NCT-2 does not reserve any vacant area elsewhere, the 2 blocks reserved for vacant areas in NCT-1 could still be shared for the meantime in case an excessive number of containers may suddenly appear from future cargo operations inside NCT-1 and -2 terminals.

The 288 TGSs for empty containers required in NCT-1 cargo operations will not have sufficient area at the location proposed as mentioned in a) NCT-1, 4) Phnom Penh Port. Aside from the 288 TGSs to be generated in NCT-1 cargo operations, NCT-2 further requires 424 TGSs and the total TGSs becomes 712 TGSs. The 712 TGSs can be accordingly accommodated at the new expansion area to be secured upstream of the existing NCT-1.

Table 3.3-21 Required TEU Ground Slots (TGSs) and Container Parking Area (NCT-2)

Description\Target Container Terminal		NCT-2			
Container Throughput	(TEU)	250,000			
ContainerType		Import	Export	Empty	**Total**
Share	(%)	32	44	25	100
Weighted Container Throughput	(TEU)	78,976	109,171	61,853	250,000
Average Dwelling Time	(day)	7	5	10	
Average Stacking Height	(layer)	3.5	3.5	5	
Max. Stacking Height	(layer)	6	6	6	
Ratio of Av. to Max. Stacking Heights		0.6	0.6	0.8	
Required Holding Capacity	(TEU)	1,515	1,495	1,695	4,705
Yard Utilization Ratio		0.7	0.7	0.8	
Required TEU Ground Slots	(TGS)	618	610	424	**1,652**
Area Requirent per TEU	Equipment	Yard Transfer Crane		Top Lifter	
	(m2/TEU)	6.0	6.0	30.0	
Required Net Transit Storage Area	(m2)	9,088	8,973	50,838	**68,899**
Required Gross Teransit Storage Area	(m2)	15,579	15,382	61,006	**91,967**
Safety Factor for Reseved Capacity		1.3			
Container Parking Area	(m2)	20,252	19,997	79,308	**119,557**

Source: Survey Team

Required Number of Gate Lanes

Table 3.3-22 presents the required number of gate lanes for NCT-1 and -2 which are considered as the same operation by the same operator(s). As shown in the table, the required number of gate lanes was 6 lanes including 1 common use lane.

The existing entrance gate of NCT-1has 4 lanes and therefore 2 more lanes are needed for handling the planed container throughput. Moreover, some queuing areas are to be required sooner or later for prevention of congestion around the gate area.

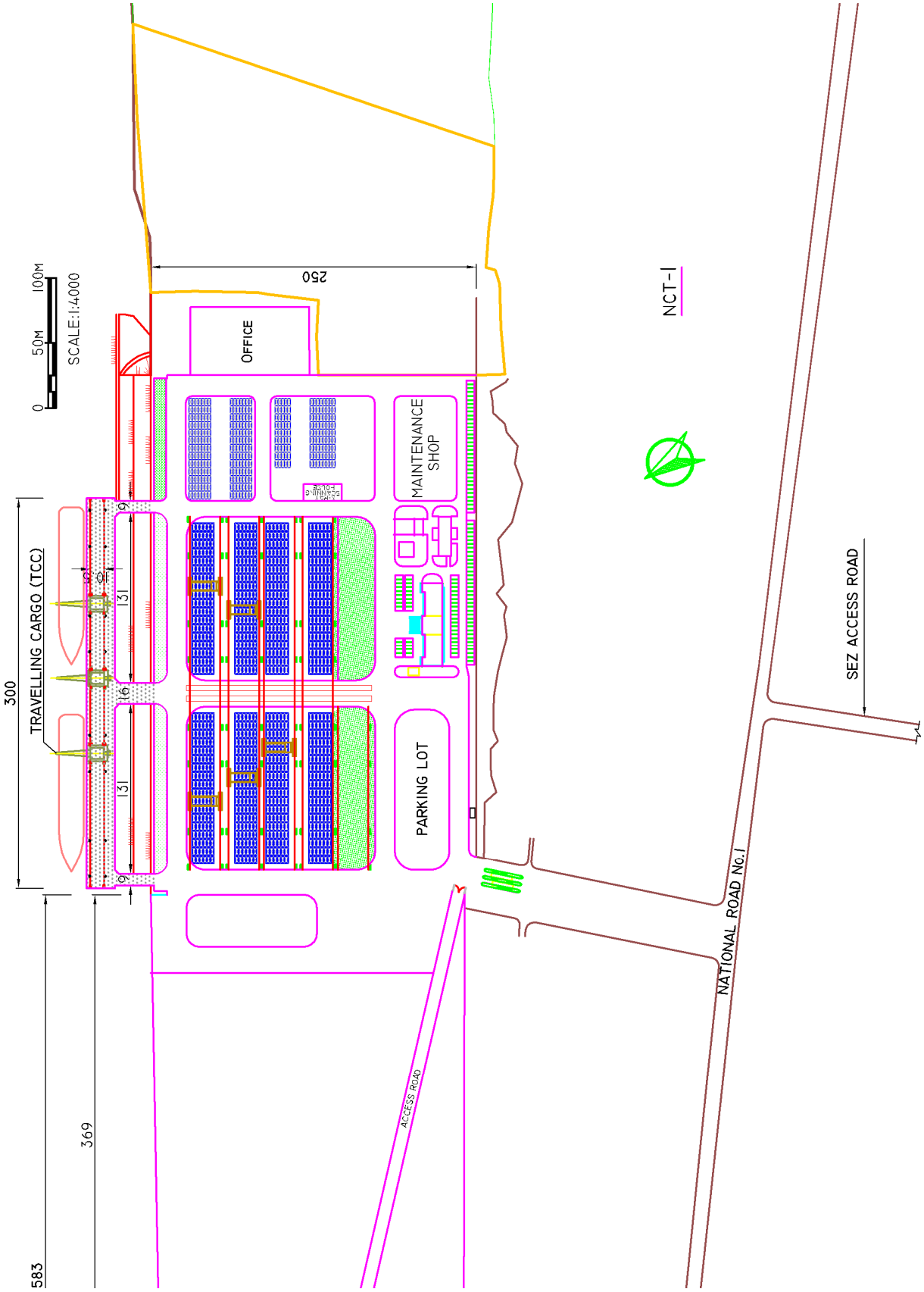
Table 3.3-22 Required Number of Entrance Gate Lanes (NCT-1&-2)

Description\Target Container Terminal		NCT-1	NCT-2	NCT-1&-2
Container Throughput at Berth	(TEU)	170,000	250,000	420,000
Annual Working Day	(day)	365	365	365
Ratio of Box to TEU		0.65	0.65	0.65
Peak Factor for Av. Throughput		1.2	1.2	1.2
Required Daily Gate Throughput	(box/day)	363	534	897
Assumed Gate Process Time	(min/box)	3	3	3
Assumed Gate Open Time	(min/day)	600	600	600
Required Lane at Gate	(lane)	**1.81**	**2.67**	**4.48**
Required Common Use Lane	(lane)			**1**
Total Lane Required at Gate	(lane)			**6 (5.48)**

Source: Survey Team

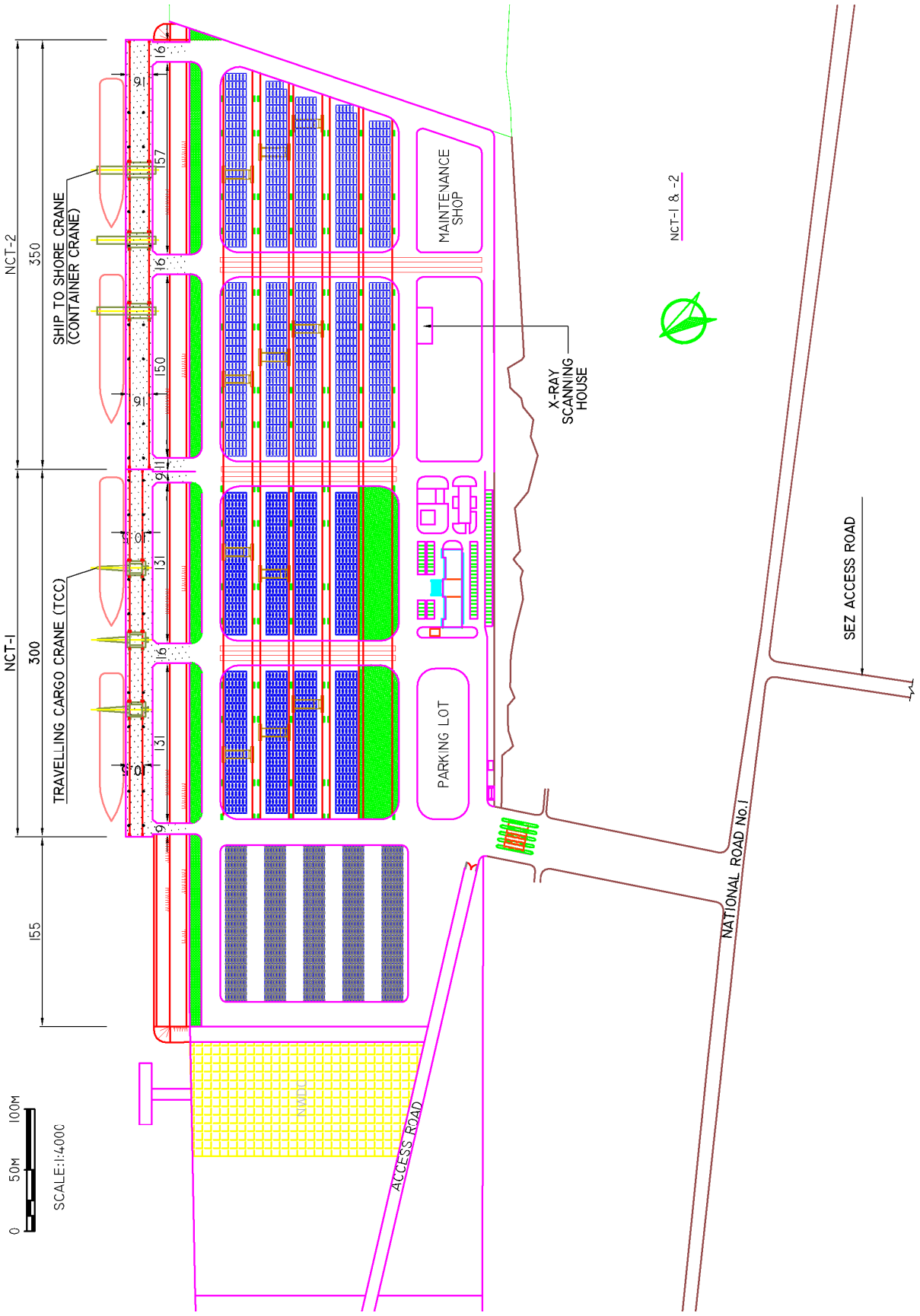
5) General Layout of Port Extension at NCT-1 and -2

Based on the aforementioned in 1), 2), 3) and 4), this study looked at the future general layout of NCT-1 and -2 which required extension of port facilities. Figure 3.3-8 describes the NCT-1 general layout for the planned container throughput of 170,000 TEUs/year, Figure 3.3-9 illustrates the NCT-1 & -2 general layout for the planned container throughput of 420,000 TEUs/year (NCT-1: 170,000 TEUs/year and NCT-2: 250,000 TEUs/year).



Source: Survey Team

Figure 3.3-8 NCT-1 General Layout (NCT-1: 170,000 TEUs/year)



Source: Survey Team

Figure 3.3-9 NCT-1&-2 General Layout (NCT-1&-2: 420,000 TEUs/year)

(3) Cargo Handling Method

Due to the restrictions of the berth and yard area, crawler cranes or ship gear cranes for loading/unloading operations from vessels to land, tractor trailers for container transfer inside the terminal, and top-lifter and reach stacker for yard container handling works are to be applied to Phnom Penh Port the same as the existing operation.

Because of certain scaled container terminals in NCT-1 and -2, QGC (NCT-1: TCC, NCT-2: STS crane) for the quay cargo handling operation, Yard Transfer Crane (RTG) for yard cargo handling operation, tractor trailer for container transfer inside terminal, top-lifter and reach stacker for supplemental yard cargo handling operations are to be used in place, in order to maintain efficient cargo operation.

(4) Arrangement Plan of Cargo Handling Equipment

1) Phnom Penh Port

Based on the cargo handling method specified in (3), the necessary cargo handling equipment in Phnom Penh Port includes Quay Crane (crawler crane), reach stacker and tractor trailer.

Table 3.3-23 shows the required cargo handling equipment in Phnom Penh Port for the planned container throughput 80,000 TEUs/year.

Table 3.3-23 Required Number of Cargo Handling Equipment (Phnom Penh Port)

Quay Crane

Terget Terminal	Container Throughput at Berth	Crane Occupancy Ratio	Working Hour a Day	Annual Working Day	Average Crane Productivity	Ratio of Box to TEU	Req. Nr. of Quay Crane
	(TEU)		(hr)	(day)	(box/hr)	(TEU/box)	(nr)
PHN Port	80,000	0.40	20.00	300.00	10	0.65	2.02

Tractor Trailler

Terget Terminal	Container Throughput at Berth	Number of Quay Crane	Average Travel Speed in Terminal	Handling Time under Quay Crane	Handling Time under Transfer Crane	Av. Traveling Distance of Yard Tractor	Operation Factor	Req. Nr. of Tractor Trailler	
								per Crane	per Terminal
	(TEU)	(nr)	(km/hr)	(min/cycle)	(min/cycle)	(km/cycle)		(unit)	(unit)
PHN Port	80,000	3	10.00	3.00	3.00	0.7	0.70	5	15

Reach Stacker

Terget Terminal	Container Throughput at Berth	Number of Quay Crane	Av. Nr. of Reach Stacker per Quay Crane	Req. Nr. of Reach Stacker per Terminal
	(TEU)	(nr)	(unit)	(unit)
PHN Port	80,000	3	0.50	1.50

Source: Survey Team

As presented in the table above, the necessary cargo handling equipment for Phnom Penh Port is summarized as below:

- Quayside Crane (crawler crane) 3 units
- Tractor Trailer 15 units
- Reach Stacker 2 units (1 for spare)

2) New Phnom Penh Port

a) NCT-1

Based on the cargo handling method specified in (3), the necessary cargo handling equipment in NCT-1 includes QGC (TCC), top-lifter, reach stacker and tractor trailer.

Table 3.3-24 shows the required cargo handling equipment in NCT-1 for the planned container throughput of 170,000 TEUs/year.

Table 3.3-24 Required Number of Cargo Handling Equipment (NCT-1)

Quay Crane

Terget Terminal	Container Throughput at Berth	Crane Occupancy Ratio	Working Hour a Day	Annual Working Day	Average Crane Productivity	Ratio of Box to TEU	Req. Nr. of Quay Crane
	(TEU)		(hr)	(day)	(box/hr)	(TEU/box)	(nr)
NCT-1	170,000	0.40	20.00	300.00	17	0.65	2.53

Transfer Crane

Terget Terminal	Container Throughput at Berth	Working Hour a Day	Av. Transfer Crane Productivity	Number of Quay Care	Working Hour a Day	Annual Working Day	Peak Factor	Conversion Ratio	Req. Nr. of Yard Carane per Terminal		
									Berth/Yard	Gate/Yard	Total
	(TEU)	(hr)	(box/hr)	(nr)	(hr)	(day)		(TEU/box)	(nr)	(nr)	(nr)
NCT-1	170,000	20.00	15	3	20.0	300	1.20	1.54	3.0	1.5	4.5

Tractor Trailler

Terget terminal	Container Throughput at Berth	Number of Quay Crane	Average Travel Speed in Terminal	Handling Time under Quay Crane	Handling Time under Transfer Crane	Av. Traveling Distance of Yard Tractor	Operation Factor	Req. Nr. of Tractor Trailler	
								per Crane	per Terminal
	(TEU)	(nr)	(km/hr)	(min/cycle)	(min/cycle)	(km/cycle)		(unit)	(unit)
NCT-1	170,000	3	10.00	3.00	3.00	0.7	0.70	5	15

Top Lifter

Location	Container Throughput at Berth	Number of Quay Crane	Av. Nr. of Reach Stacker per Quay Crane	Req. Nr. of Reach Stacker per Terminal
	(TEU)	(nr)	(unit)	(unit)
NCT-1	170,000	3	0.30	0.90

Reach Stacker

Location	Container Throughput at Berth	Number of Quay Crane	Av. Nr. of Reach Stacker per Quay Crane	Req. Nr. of Reach Stacker per Terminal
	(TEU)	(nr)	(unit)	(unit)
NCT-1	170,000	3	0.30	0.90

Source: Survey Team

As presented in the table above, the necessary cargo handling equipment for NCT-1 is summarized as below:

- Quayside Gantry Crane (TCC) 3 units
- Yard transfer Crane (RTG: Rubber Tired Gantry Crane, 6 over 1) 5 units
- Tractor Trailer 15 units
- Top Lifter 1 unit
- Reach Stacker 1 unit

Also the basic arrangement of major cargo handling equipment such as QGC (TCC) and RTG in NCT-1 is described in Figure 3.3-8.

b) NCT-2

Based on the cargo handling method specified in (3), the necessary cargo handling equipment in NCT-2 includes QGC (container crane), top-lifter, reach stacker and tractor trailer the same as NCT-1.

Table 4.4-19 shows the required cargo handling equipment in NCT-2 for the planned container throughput of 250,000 TEUs/year.

Table 3.3-25 Required Number of Cargo Handling Equipment (NCT-2)

Cargo Handling Equpiment

Terget Terminal	Container Throughput at Berth	Crane Occupancy Ratio	Working Hour a Day	Annual Working Day	Average Crane Productivity	Ratio of Box to TEU	Req. Nr. of Quay Crane
	(TEU)		(hr)	(day)	(box/hr)	(TEU/box)	(nr)
NCT-2	250,000	0.40	20.00	300.00	28	0.65	2.26

Transfer Crane

Location	Container Throughput at Berth	Working Hour a Day	Av. Transfer Crane Productivity	Number of Quay Care	Working Hour a Day	Annual Working Day	Peak Factor	Conversion Ratio	Req. Nr. of Yard Carane per Terminal		
									Berth/Yard	Gate/Yard	Total
	(TEU)	(hr)	(box/hr)	(nr)	(hr)	(day)		(TEU/box)	(nr)	(nr)	(nr)
NCT-2	250,000	20.00	15	3	20.0	300	1.20	1.54	3.0	2.2	5.2

Tractor Trailler

Location	Container Throughput at Berth	Number of Quay Crane	Average Travel Speed in Terminal	Handling Time under Quay Crane	Handling Time under Transfer Crane	Av. Traveling Distance of Yard Tractor	Operation Factor	Req. Nr. of Tractor Trailler	
								per Crane	per Terminal
	(TEU)	(nr)	(km/hr)	(min/cycle)	(min/cycle)	(km/cycle)		(unit)	(unit)
NCT-2	250,000	3	10.00	3.00	3.00	0.7	0.70	5	15

Top Lifter

Location	Container Throughput at Berth	Number of Quay Crane	Av. Nr. of Reach Stacker per Quay Crane	Req. Nr. of Reach Stacker per Terminal
	(TEU)	(nr)	(unit)	(unit)
NCT-2	250,000	3	0.50	1.50

Reach Stacker

Location	Container Throughput at Berth	Number of Quay Crane	Av. Nr. of Reach Stacker per Quay Crane	Req. Nr. of Reach Stacker per Terminal
	(TEU)	(nr)	(unit)	(unit)
NCT-2	250,000	3	0.30	0.90

Source: Survey Team

As presented in the table above, the necessary cargo handling equipment for NCT-2 is summarized as below:

- Quayside Gantry Crane (STS crane) 3 units
- Yard transfer Crane (RTG: Rubber Tired Gantry Crane, 6 over 1) 6 units
- Tractor Trailer 15 units
- Top Lifter 2 units
- Reach Stacker 1 unit

Also the basic arrangement of major cargo handling equipment such as QGC (STS crane) and RTG in NCT-2 is described in Figure 3.3-9.

3) Required Additional Number of Cargo Handling Equipment

Table 3.3-26 presents the required total number of pieces of cargo handling equipment based on the aforementioned in 1) and 2), the procured (scheduled) total number of pieces of cargo handling equipment, and the required additional number of pieces of cargo handling equipment by each item.

Table 3.3-26 Required Additional Number of Pieces of Cargo handling Equipment

a) Required Total Number of Cargo Handling Equipment (CHE): b)+c)

Terminal Facility Dimension & CHE \ Target Terminal			PHN Port	NCT-1	NCT-2
Planned Container Throughput		(TEU)	80,000	170,000	250,000
			250,000		
			500,000		
Target Vessel/Berth Number			1500DWT Barge		
			3 berths	3 berths	4 berths
			3000DWT Barge		
			2 berths	2 berths	3 berths
			5000DWTContainer Carrier		
			2 berths	2 berths	2 berths
Total Berth Length		(m)	300	300	350
Total Yard Area Required		(ha)	1.4 (1.6)	8.1	12.0
Quay Crane	Crawler Crane	(unit)	3	-	-
	QGC (Traveling Cargo Crane)	(unit)	-	3	-
	QGC (Ship To Shore Crane)	(unit)	-	-	3
Yard Transfer Crane (6 over 1)		(unit)	-	5	6
Tractor Trailer		(unit)	15	15	15
Top Lifter		(unit)	-	1	2
Reach Stacker		(unit)	2	1	1

b) Procured (Scheduled) Total Number of Cargo Handling Equipment by PPAP

CHE \ Target Terminal			PHN Port	NCT-1	NCT-2
Quay Crane	Crawler Crane	(unit)	3	-	-
	QGC (Traveling Cargo Crane)	(unit)	-	3	-
	QGC (Ship To Shore Crane)	(unit)	-	-	-
Yard Transfer Crane (6 over 1)		(unit)	-	4	-
Tractor Trailer		(unit)	8	12	-
Top Lifter		(unit)	-	2	-
Reach Stacker		(unit)	-	3	-

c) Required Additional Number of Cargo Handling Equipment

CHE \ Target Terminal			PHN Port	NCT-1	NCT-2
Quay Crane	Crawler Crane	(unit)	-	-	-
	QGC (Traveling Cargo Crane)	(unit)	-	-	-
	QGC (Ship To Shore Crane)	(unit)	-	-	+3
Yard Transfer Crane (6 over 1)		(unit)		+1	+6
Tractor Trailer		(unit)	+7	+3	+15
Top Lifter		(unit)	-	-	+2
Reach Stacker		(unit)	-	+1	-
Expected Procurement Schedule			2011	2017-2018	2020/2023/2026 (phased investment)

Source: Survey Team

3.3.3 Concept Design and Facility Planning (Port)

(1) Design and Planning Criteria

1) Applicable Codes and Standards

The following design codes and standards were applied in this concept design and facility planning:

- Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)
- Port Development, UNCTAD
- Approach Channels, A Guideline for Design, PIANC
- Road Structure Ordinance in Japan (2003)
- A policy on Geometric Design of Highways and Streets, ASSHTO (2011)
- American Society of Testing Materials (ASTM)
- Guideline for Concrete Pavement in Japan
- A Standard for Building Utilities in Japan (2009)
- British Standards (BS)
- International Plumbing Code (IPC)
- National Fire Protection Association (NFPA)
- Water Environment Partnership in Asia (WEPA)
- International Electrotechnical Commission (IEC)
- Institute of Electrical and Electronics Engineers (IEEE)

2) Natural Conditions

a) Temperature and Rainfall

The following characteristics of temperature and rainfall observed in Phnom Penh for past ten years were considered in this concept design and planning:

Temperature	:	27°C (average), 35°C (Maximum), 22°C (Minimum)
Rainfall	:	1,500 mm (annual), 350 mm (monthly max. September), 40 mm (monthly min. December and January)

b) Wind

Past meteorological observations in Phnom Penh city recoded 16 m/sec as average monthly maximum wind velocity, 11 m/sec as average daily maximum wind velocity and 25 m/s as maximum gust wind velocity. In Kampong Cham province, 28 m/sec as average monthly maximum wind velocity was observed over the past 10 years. Considering the above, the design wind velocity was determined as 30 m/sec in this concept design and planning.

c) Water Level

The following water levels, which are the same as the existing new container terminal design and construction, were applied in this concept design and planning:

Highest Water Level (HWL)	:	+8.60 m
Lowest Water Level (LWL)	:	±0.65 m
Datum Level (DL)	:	±0.00 m (Mean Sea Level at Ha Tien, Vietnam)

d) River Flow Velocity

The following river flow velocity was applied in this concept design and planning, which is the same as for the existing new container terminal design and construction:

River flow velocity	:	4 knots

e) Subsoil Conditions

Design parameters for the subsoil for the NCT expansion areas was determined based on the soil investigation results carried out in this Survey as well as existing available soil information. Table 3.3-27 presents the subsoil conditions and design parameters applied for both the areas:

Table 3.3-27 Design Subsoil Conditions

Location	Layer	Depth	Soil Property			
			Av. N-Value	Unit Weight		Strength
		(CDL)		γ(kN/m3)	γ'(kN/m3)	
NCT	Silty Clay	+8.5 to -1.5	4	14.6	10	C=3.6 kN/m2 Kh=6 N/m3
	Silty Sand	-1.5 to -7.5	21	18	10	ϕ =31° Kh=32 N/cm3
	Silty Fine Sand	-7.5 to -20.0	28	18	10	ϕ =33° Kh=42 N/cm3
	Dense Sility Fine Sand	-20.0 to -43.5	35	18	10	ϕ =35° Kh=53 N/cm3

Source: Survey Team

f) Seismic Factor

The following seismic factors, which are the same as in the design for the existing Phnom Penh Port rehabilitation, were applied in this concept design and planning:

Horizontal seismic factor : 0.05
Vertical seismic factor : 0.00

3) Structural Design Conditions

a) Service Life

All civil and building facilities were designed and planned for a service life of 50 and 30 years, respectively.

b) Material Properties

<Concrete>

Table 3.3-28 shows design concrete strength assumed in the concept design.

Table 3.3-28 Design Concrete Strength

f'c (Mpa)	Usage
28	Reinforced Concrete (Wharf Structures)
28	Reinforced Concrete (On-land Structures) and Pre-cast Concrete Piles and Blocks etc.
21	Plain Concrete
4.8 (Flexural Tensile) 30.4 (Flexural Compressive)	Concrete Pavement
34.5	Prestressed Coccrete Beams, Slabs, Piles etc.

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

<Rebar>

Table 3.3-29 shows allowable stresses of rebar.

Table 3.3-29 Allowable Stresses of Rebar

Grade	Yield Strength, fy (N/mm^2)	Allowable Tensile Strength (N/mm2)
JIS SD390A	390	206
JIS SD295	295	176
JIS SR235	235	137

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

<Steel Materials>

Table 3.3-30 shows allowable stresses of structural steels.

Table 3.3-30 Allowable Stresses of Structural Steels

Structural steel (steel pipe)	SM490/SKK490/SKY490 (N/mm^2)
Axial tensile stress	185
Axial compressive stress	185 : l/r<16, 185-1.2x(l/r-16):16<l/r<79, $1,200,000/(5,000+(l/r)^2)$:79<l/r
Bending tensile and compressive stress	185
Examination of members simultaneouslysubject to axial compressive and bending compressive stress	$\sigma_c/\sigma_{ca}+\sigma_b/\sigma_{ba}< 1.0$

Where

l: effective buckling length of member (cm)

r: radius of gyration of area for the gross cross-sectional area of the member (cm)

σc: compressive stress due to axial compressive force acting on the section (N/mm2)

σb :maximum compressive stress due to bending moment acting on the section (N/mm2)

σca: allowable axial compressive stress relating to smallest moment of inertia (N/mm2)

σba: allowable bending compressive stress (N/mm2)

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

<Stone, quarry run, sand and backfill materials>

Considering initially investigated availability of local materials and their properties, the following properties were adapted in this design as shown in Table 3.3-31.

Table 3.3-31 Adapted Materials Properties of Stone, Quarry Run, Sand and Backfill Materials

Discreption	Unit Weight		Angle of Shearing Resistance
	γ (kN/m3)	γ' (kN/m3)	ϕ (degree)
Fill Material, Sand	18	10	30-35
Rubble Backing, Stone, Rock	18	10	35
Rubble Base Stone	18	10	40

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

c) Factor of Safety

Table 3.3-32 shows the factor of safety in structural computations in this design.

Table 3.3-32 Factor of Safety in Structural Computation

Structure	Condition	Factor of Safety
Gravity Type	Sliding	1.20
	Over-Turning	1.20
	Tolerable Rubble Base Reaction	500 kN/m2
	Circular Slip Failure	1.30
	Bishop Method	1.00
Deck on Pile Type	Bearing Capacity	2.50
	Pullout	3.00
	Circular Slip Failure	1.30

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

d) Margin of Allowable Stress

The margin of allowable stresses was 50 % for seismic conditions as referenced in the Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009).

e) Friction Factor

The friction factor applied for design of gravity type structures was 0.5 for between concrete and concrete, and 0.6 for between concrete and rubble base stone as referenced in the Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009).

f) Other Concerns

Vertical inclination of the access road was less than 3 % making it possible to attain 40 km per hour travel speed for a 40' trailer truck, based on the relevant codes and standards.

4) Operational Conditions

a) Target Vessels

Table 3.3-33 shows design target vessels of the new container terminal expansion (NCT-2).

Table 3.3-33 Design Target Vessels

Description	Target Vessel						Remark
	Vessel Type	Weight (DWT)	LOA (m)	Beam (m)	Draft (m)	Capacity (TEU/Vessel)	
NCT-2	Container Carrier	10,000	136	23	8.1	699	Future possible vessel to be called depending on fairway improvement
		7,000	124	22	7.4	472	
		5,000	116	22	6.7	320	Probable vessel to be called
	Container Barge	3,000	85	11.5	3.6	137	Averaged between future large-sized barge (LOA 110m, Beam 11.5m, Draft 3.6m, Capacity 200TEU/barge) and present averaged barge called (1,500DWT)
		1,500	60	11.5	3.6	73	Averaged of present container barge called

Source: Survey Team

b) Quay Dimensions

Table 3.3-34 shows basic quay dimensions of the NCT-2.

Table 3.3-34 Basic Quay Dimensions

Description	Total Berth Length (m)	Planned Depth (DL)	Design Depth (DL)	Apron Width (m)
NCT-2	350	-7.5	-8.5	22

Source: Survey Team

c) Loads

<Quay>

Table 3.3-35 shows loading conditions of the new quay at NCT-2. Table 3.3-36 and Figure3.3-10 respectively present loading conditions and assumed wheel arrangement of quayside gantry crane (QGC).

Table 3.3-35 Loading Conditions (NCT-2 Quay Structures)

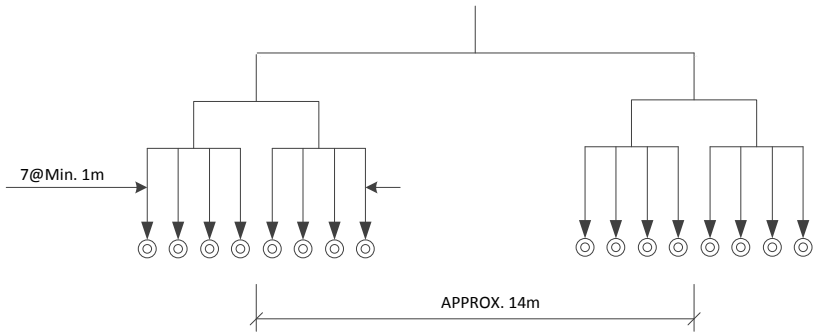
Description	Surchanrge (Apron)		Berthing Condition				Tractive Force on Mooring Bollard
	Normal	Seismic	Vessel Type	Vessel Weight	Contact Velocity	Contact Angle	
	(kN/m2)	(kN/m2)		(DWT)	(m/sec)	(degree)	(kN)
NCT-2	30	15	Container Carrier	10,000	0.10	10	500
				7,000	0.15	10	500
				5,000	0.15	10	350
			Container Barge	3,000	0.15	5	350
				1,500	0.15	5	250

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

Table 3.3-36 QGC Loading Conditions

Type	Condtion			Seaside (kN/wheel)	Landside (kN/wheel)
Small-scaled (below Panamax class)	Operation	Vertical		350	315
		Holizontal	⇔	-	35
		Holizontal	⇕	28	21
	Storm/Sismic	Vertical		455	455
		Holizontal	⇔	-	70
		Holizontal	⇕	42	42

Source: Survey Team



Source: Survey Team

Figure 3.3-10 Assumed QGC Wheel Arrangement

<Yard, Relevant Road and SEZ Facilities>

Tables 3.3-37 and 3.3-38 respectively show design vehicles and cargo handling equipment, and their wheel loads.

Table 3.3-37 Design Vehicles and Cargo Handling Equipment

Facility		Design Vehicle/Cargo Handling Equipment	Frequency
NCT-2	Apron	Trailer	
		Container (larden/empty)	
		Top Lifter	Occasional
		Reach Stacker	Occasional
	Container Stacking Area	RTG (6over 1)	
		Trailer	
		Container (larden/empty)	
		Top Lifter	Occasional
		Reach Stacker	Occasional
	Empty Container Storage Area	Trailer	
		Container (empty)	
		Top Lifter	
		Reach Stacker	
	Maintenance Shop	Trailer	Occasional
		Forklift	Occasional
		Reach Stacker	Occasional
		Top Lifter	Occasional
	Office Area	Regular Vehicle	
	Yard Service Road, Main Gate, Terminal Access Road, Related Terminal Buildings	Regular Vehicle	
		Trailer	
		Top Lifter, Reach Stacker Forklift (not loaded)	Occasional

Source: Survey Team

Table 3.3-38 Wheel Loads of Major Design Vehicles and Cargo Handling Equipment

Equipment	Description	Conditions	Front Wheels	Rear Wheels
Chassis for Container Transport	2 x 20 ft or 1 x 40/45 ft	with load	(15 t King Pin on 5th wheel)	3.8 t x 8 wheels
		without load	(0.9 t King Pin on 5th wheel)	0.4 t x 8 wheels
Tractor Head for Container Transport	40.5t, Container Chassis Towing	with load on 5th wheel	3.2 t x 2 wheels	2.5 t x 8 wheels
		without load on 5th wheel	2.0 t x 2 wheels	0.6 t x 8 wheels
Top Lifter for Empty Containers	5 Tiers, 4.5 t under preader	with load	8.6 t x 4 wheels	3.1 t x 2 wheels
		without load	5.4 t x 4 wheels	7.2 t x 2 wheels
Top Lifter for Loaded Containers	4 Tiers, 30.5 t under Spreader	with load	21.2 t x 4 wheels	7.5 t x 2 wheels
		without load	9.7 t x 4 wheels	12.9 t x 2 wheels
Reach Stacker for Empty Containers	5 Tiers, 4.5 t under Spreader	with load	8.6 tx 4 wheels	3.1 t x 2 wheels
		without load	5.4 t x 4 wheels	7.2 t x 2 wheels
Reach Stacker for Loaded Containers	4 Tiers, 30.5 t under Spreader	with load	21.2 t x 4 wheels	7.5 t x 2 wheels
		without load	9.7 t x 4 wheels	12.9 tx 2 wheels
Forklift Truck for heavy cargo	15 ton capacity	With load	14.5t tire pressure 7.6 kg/cm2	
ForkLift Truck for General Use	2.5 ton capacity	with load	2.9 t x 2 wheels	0.6 tx 2 wheels
Mobile Crane	100t capacity	with load	Per outrigger 70t	

Source: Survey Team

Table 3.3-39 shows loading conditions for the yard transfer crane (rubber tired transfer crane: RTG) required in NCT-2 terminal expansion.

Table 3.3-39 Loading Conditions of Yard Transfer Crane (RTG)

Condition	Wheel Lad per wheel (kN)		Remark
	Vertical	Horizontal	
Operation	304	-	at all runway locations
	196	-	at traverse runway locations
Storm	441	-	at rest positions
Earthquake	412	-	at all runway locations

Note: Traverse travelling is operated without load.
Source: Survey Team

Tables 3.3-40 and 3.3-41 respectively show basic dimensions and loading conditions of containers to be handled.

Table 3.3-40 Basic Container Dimensions

Nominal Length	ISO Code	Dimension				Av. Self Weight	Maximum Gross Weight
		Length	Width	Height	Ground Contact Area		
(ft)		(m)	(m)	(m)	(m2)	(kN)	(kN)
40	1AAA	12.192	2.438	2.894	29.72	39	299
	1AA			2.591			
	1A			2.438			
20	1CC	6.058	2.438	2.591	14.77	24	235
	1CC			2.438			

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2007/2009)

Table 3.3-41 Loading Conditions of Container

Condition			Max. Stacking Height	Surcharge	Corner Load
			(layer)	(kN/m2)	(kN/corner)
Normal	40 ft	Laden	5	50	374
		Empty	6	8	59
	20 ft	Laden	5	80	294
		Empty	6	10	36
Seismic	40 ft	Laden	5	25	187
		Empty	6	4	29
	20 ft	Laden	5	40	147
		Empty	6	5	18

Source: Survey Team

(2) Summary of Concept Design and Planning for Related Port Facilities

1) Civil and Architectural Facilities

a) Civil Facilities

<Reclamation>

The areas reserved by PPAP for port expansion (NCT-2 and -3) were already reclaimed two years ago. The material for the reclamation was sand sourced from the Mekong River using a pump dredger. According to our geotechnical investigation, a clay layer appeared with average N value 4 from existing ground to 10 m below. Because the areas were backfilled by the reclamation material two years ago, it is presumed that the clay layer will not have significant settlement on the harder sand layer. Besides, the existing container yard in NCT-1 currently being utilized does not have serious settlement and there is no visible disturbance to yard traffic or cargo handling activities based on our field observations. Considering the above situations and successive trafficability between the existing and the new terminals, the design elevation of the container yard in NCT-2 was determined as +9.5m the same as NCT-1.

<Quay>

The quay structure of NCT-1 is a deck on pile type the same as Phnom Penh Port and has three access bridges, one at the centre and one on each end of the quay. It is necessary to select a quay structure type in consideration of structural adaptability, suitability of subsoil conditions, durability, workability for construction, environmental impact, and overall cost. This comparative study for quay structural section selected three applicable structural sections, such as deck on pile type, gravity wall type and steel sheet pipe pile type and evaluated the advantages and disadvantages based on the said six aspects. Table 3.3-42 shows the results of the preliminary comparative study for quay section.

Structural adaptability: Deck on pile type was advantageous for the unified superstructure as a foundation for the quayside gantry cranes even though a certain amount of pile driving is required. The gravity wall type was disadvantageous because of the necessity for replacement of the exiting soft subsoil layer with a rubble base stone up to hard stratum in order to secure the required bearing capacity, and for placing quayside gantry cranes on different structures. Although for the steel sheet pipe pile type it was not necessary to provide a rubble stone layer, unlike the gravity type, two different structures were required for installation of quayside cranes the same as the gravity wall type.

Suitability of subsoil conditions: Deck on pile and steel sheet pipe pile types were basically suitable to the exiting subsoil layer. However, the steel sheet pipe pile type was possibly disadvantageous because of the existence of boulders or other hard layers along the quay alignment. The gravity wall type required a deeper stiff layer for supporting the heavy structure and was consequently disadvantageous.

Durability: The gravity wall structure consisting of concrete without exposure of any steel materials was more advantageous than the other steel structure types.

Workability for construction: The gravity wall type required large scaled preparatory works such as provision of a floating dock for fabrication and installation of rubble stones under the water. The deck on pile and steel pipe pile types did not require provision of large scaled preparatory works like the gravity type, but it would be necessary to provide a piling barge.

Environmental impact: The gravity wall type was cause for concern regarding environmental impacts because of the many underwater works required during its construction. Also the gravity wall and steel sheet pile types had to have backfill materials provided behind each wall and the situation might not only cause disturbance of river water flow but also induce riverbank erosion. The deck on pile type had relatively fewer environmental impacts because of fewer underwater works and no disturbance of river water flow unlike the other structural types.

Overall cost: The gravity wall type was the most expensive among the types due to fabrication and installation of the concrete wall and placing the rubble base stone and backfill materials.

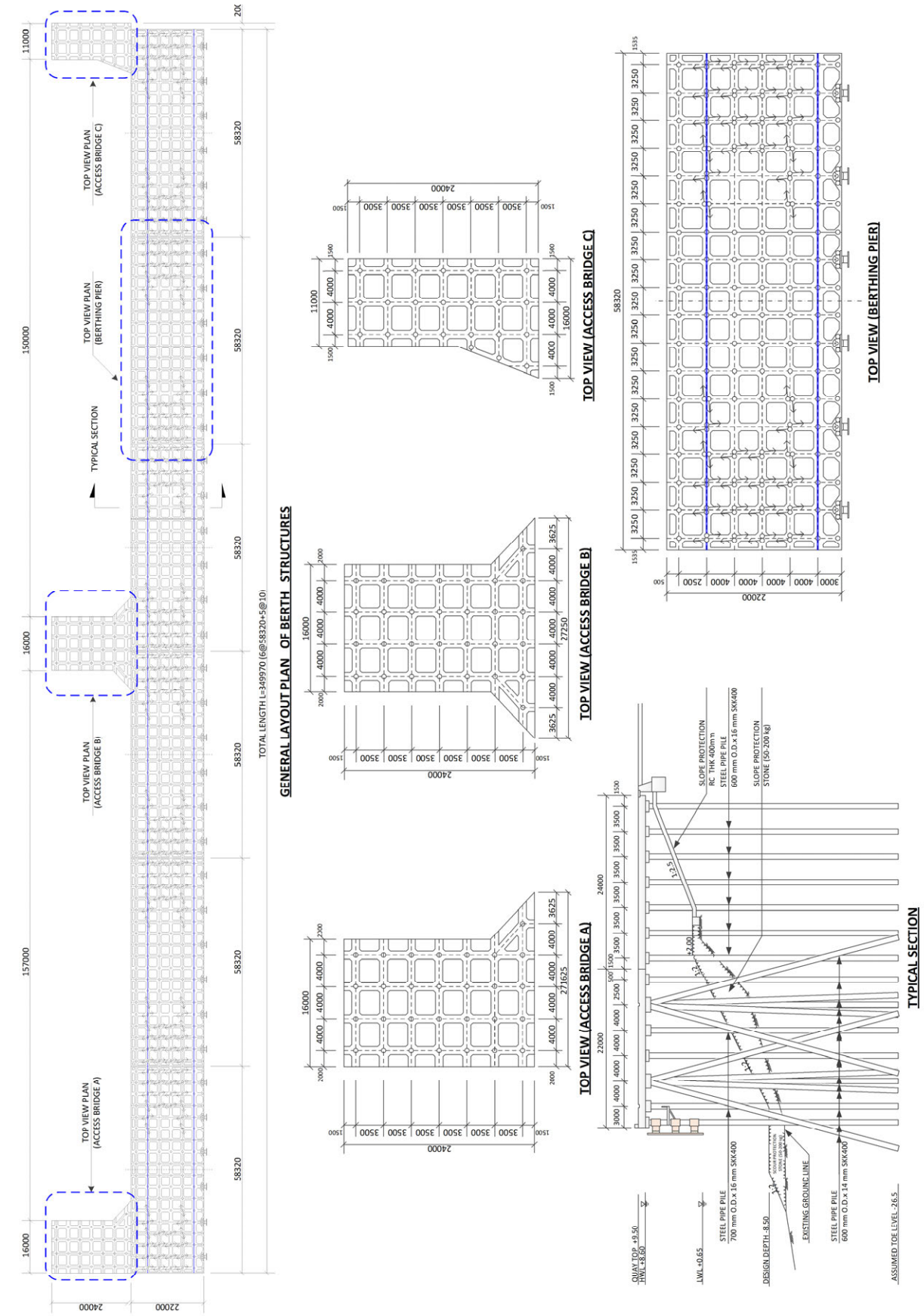
Depending on market price fluctuations of steel materials, the deck on pile and steel sheet pipe pile types were cheaper than the gravity wall type because of less volumes of dredging and rubble base stone. The steel sheet pipe pile type required less steel materials but a greater volume of backfill materials compared with the deck on pile type.

Evaluation: In this preliminary comparative study, the deck on pile type was most recommendable among the types in consideration of the said six aspects at this moment. Figure 3.3-11 describes the general plan and typical section of the deck on pile type that is recommended. As shown in the figure, the elevation and width of the deck were determined respectively as +9.5 and 22m and the length of the access bridge was set as 24 m, since NCT-2 requires continuity with NCT-1 facilities. The width of crane rail gage was assumed as 16 m in consideration of expandability accommodative for possible large-sized vessel and the availability of container cranes to be procured.

Table 3.3-42 Preliminary Comparative Study of Quay Structure for NCT-2

Item \ Structure Type	Deck on Pile	Gravity Wall	Steel Sheet Pipe Pile
Structural Adaptability	Certain piles required up to bearable subsoil layer. Rigid concrete deck with quayside crane supported by the pile foundation stably. Less impact for riverbed scouring.	18 meters concrete wall required with certain thickness of ruble stone. Two different structures required for foundation of quayside crane.	Successive steel sheet piles required at least more than 35 meters length. Two different structures required for foundation of quayside crane.
	A	C	B
Suitability for Sub-soil Condition	Stable due to fitting to existing subsoil layer conditions.	Deeper stiff layer required to support heavy concrete wall structure.	Stable due to fitting to existing subsoil layer conditions. Difficulty to be possible arisen from encountering partial hard layer on the quay line for pile driving.
	A	C	B
Durability	Smaller corrosion of steel materials due to freshwater environment	No significant impacts given to structural durability.	Smaller corrosion of steel materials due to freshwater environment
	B	A	B
Construction	Certain volume of piling and concrete works required. Less impact for riverbed scouring.	Difficulty upon preparation of rubble mound under water condition.	Difficulty upon maintaining alignment of steel sheet pile driving in case stone or hard layer exists on the quay line.
	B	C	B
Environmental Impact	Less impact for disturbance of existing river water flow.	Obvious impact to existing river water flow. Possibly inducing of riverbank erosion.	Obvious impact to existing river water flow. Possibly inducing of riverbank erosion.
	A	C	C
Economic Efficiency	Certain weight of steel pipe piles costly required.	Large-scaled stone foundation preparation and concrete wall fabrication and installation needed.	Certain weight of steel sheet pile (less than Deck on Pile Type) and reclamation materials costly required.
	B	C	B
Evaluation	**A**	**C**	**B**

Source: Survey Team



Source: Survey Team

Figure 3.3-11 Quay General Plan and Typical Section for NCT-2

<Container Yard>

The NCT-2 container yard is planned to provide four major civil structures such as pavement, RTG travelling concrete slab, drainage system and perimeter fence.

Based on design vehicles and cargo handling equipment assumed, each pavement composition inside the yard was determined as shown in Table 3.3-43. As shown in the table, all the yard areas are to be concrete pavement. Especially, the container stacking area, terminal service road, other terminal areas and empty container storage area are planned to apply heavy duty concrete pavement. This pavement design considered future multi-purpose use for rearrangement of the yard layout.

Table 3.3-43 Proposed Pavement Composition

Pavement Type	Pavement Section		Applied to
	Compsition	Thickness (mm)	
Concrete Pavement	Concrete with Wiremesh	250	Portion around Related Buildings Container Stacking Yard Area Terminal Service Road Other Terminal Yard Area Empty Container Storage Area
	Base Course	150	
	Sub Base	300	

Source: Survey Team

Based on design loading conditions of the RTG, basic dimensions of the concrete foundation slabs were determined as summarized in Table 3.3-44.

Table 3.3-44 Basic Dimensions of Yard Transfer Crane (RTG)

Item	Structure Type	Foundation Slab Dimension			Basic Section under Slab	
		Length (m)	Width (m)	Thickness (m)	Compsition	Thickness (m)
RTG Carane Foundation Slab	Pre-stressed Concrete	4 to 40	1.5	0.25	Course Sand	40
					Base Course	200
					Sub Base	300

Source: Survey Team

The drainage system provides surface drainage, underground pipelines and open ditches for the entire yard area. Also perimeter fences were considered as 2.5 m high on all terminal boundaries except for the quay line and connection to NCT-1 area upon the assumption that the same terminal operation will be continued.

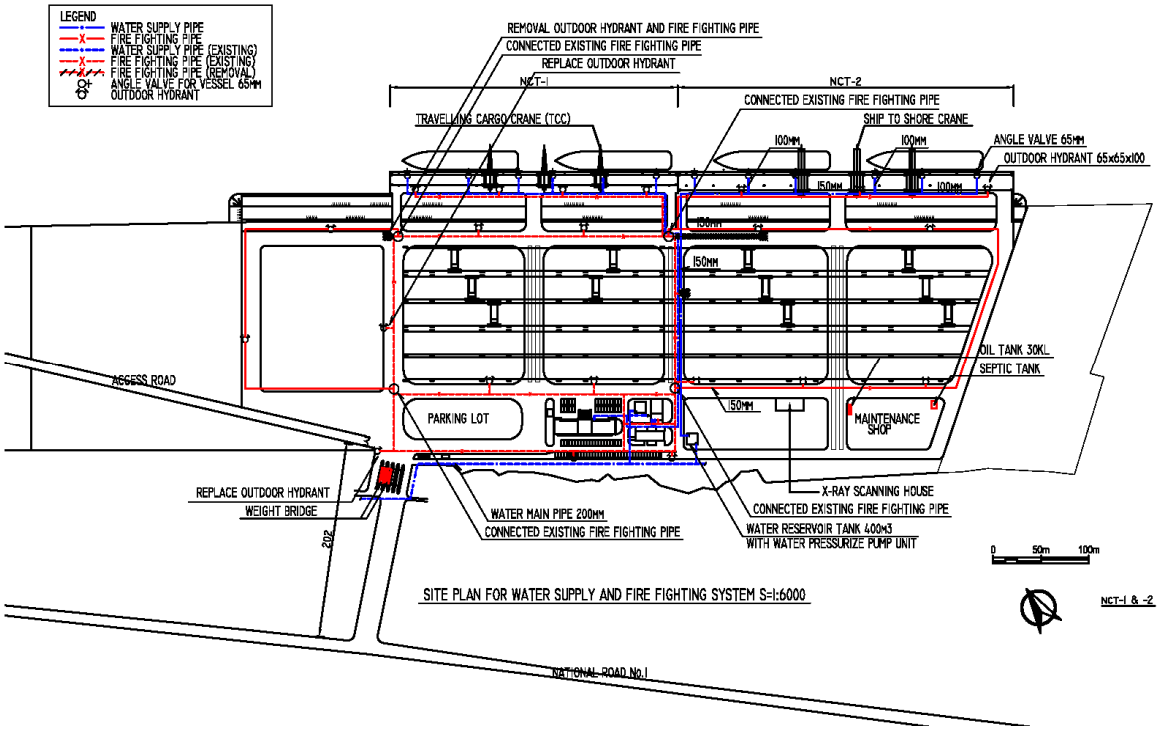
b) Building facilities

Based on preliminary terminal planning of the new container terminal, the following buildings were basically required:

- Maintenance shop (1,200 m2) 1 bldg
- Additional entrance gate (2 in & out) 1 bldg
- Substation (80 m2) 1 bldg
- Generator house (50 m2) 1 bldg
- Fuel station (60 m2) 1 bldg
- Sewerage treatment plant control house(2 m2) 1 bldg
- Weigh bridge control house (10 m2) 1 bldg

2) Mechanical Systems

General site plan for the Mechanical Systems is shown in Figure 3.3-12.



Source: Survey Team

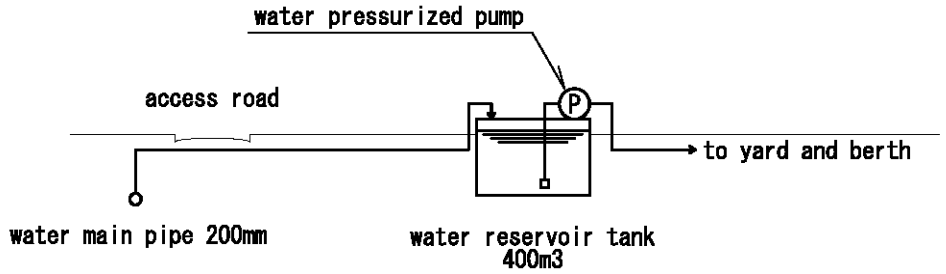
Figure 3.3-12 General Site Plan for Mechanical Systems

a) Water Supply System

As for the existing PHN port NCT Phase 1(PHN port NCT1), a water Supply pipe of 150mm was installed for receiving city water from the main 200 mm water supply pipe (water supplier: MEKONG MEPOVASIMEX IMPORT & EXPORT) which is installed along national road No.1. The water from the city water supply is stored at first in a water reservoir tank (storage volume: 5,000 cubic metres x 2 units). And then, water is supplied to buildings and the wharf by employing a water pressurizing pump from the water reservoir tank.

As for PHN port NCT Phase 2 (PHN port NCT2), a water supply pipe of 150mm was designed for receiving city water from the main 200 mm water supply pipe that is installed along national road No.1. The water supply system was designed to supply the water to the buildings and the quay. Water pressurizing pumps (450L/min x 0.35MPa: 3 pumps in rotation and 2 pumps running parallel) were designed at the water reservoir tank (storage volume: 400 cubic metres) to achieve proper water pressure for the users. The water reservoir tank was designed as a countermeasure for water outages as referred to Fig. 3.3-13. The water supply pipe is of Electric Arc Welded Carbon Steel Pipe in consideration of corrosion resistance and cost performance. Major equipment and components of the Water Supply System are as follows:

- Water pressurizing pump (450L/min x 0.35MPa) 1 unit
- Water reservoir tank (storage volume: 400 cubic metres) 1 lot
- Water Supply Pipe (100 mm) Approx. 150 m
- Water Supply Pipe (150mm) Approx. 1,200 m



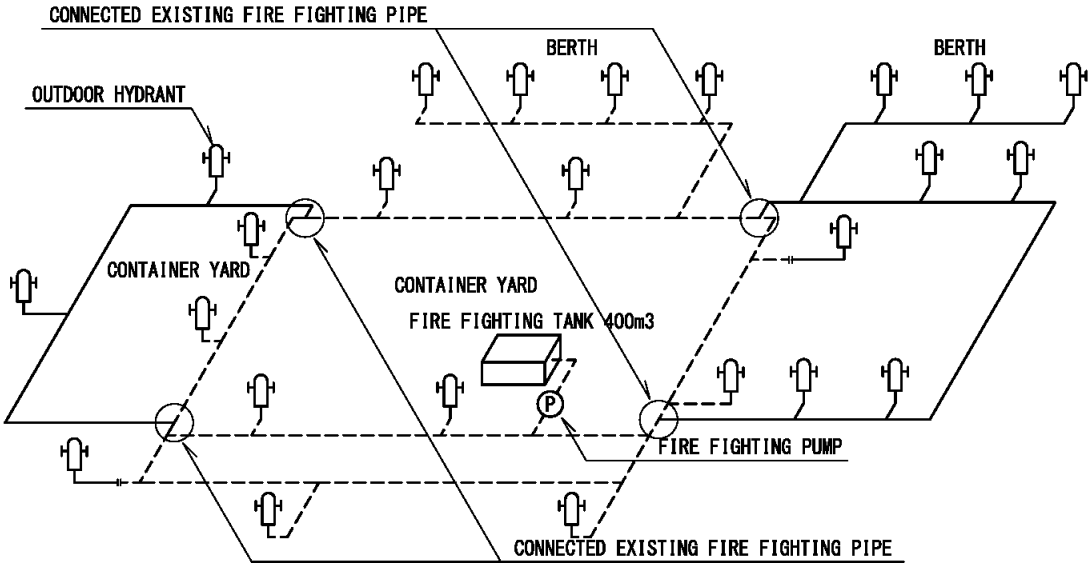
Source: Survey Team

Figure 3.3-13 Schematic Diagram for the Water Supply System

b) Fire Fighting System

The Fire Fighting System of the existing PHN port NCT1 consists of a fire storage tank (storage volume: 400 cubic metres), fire fighting pump (2,400L/min x 0.45MPa) and outdoor hydrants. The Fire Fighting System of PHN port NCT2 was designed by expanding the existing fire fighting pipes. For that reason, no fire storage tank or fire fighting pump was designed for PHN port NCT2. The distance between the hydrants is 200 metres the same arrangement as PHN port NCT1. A Schematic Diagram of the Fire Fighting System is shown in Figure 3.3-14. Major components of the Fire Fighting System are as follows:

- Outdoor hydrant (65mm x 65mm x 100mm) 9 nos.
- Fire Fighting Pipe (HDPE 100mm) Approx. 120 m
- Fire Fighting Pipe (HDPE 150mm) Approx. 1,200 m



Source: Survey Team

Figure 3.3-14 Schematic Diagram for the Fire Fighting System

c) Sewerage System

As for PHN port NCT2, sewage water from water closets and kitchens are to be treated in a septic tank, and after treatment, sewerage water is discharged into the MEKONG River. The water quality from the septic tank must meet the requirements of Cambodian standards. Major equipment of the Sewerage System is as follows:

- Septic tank 1 unit

d) Fuel Oil Supply System

The fuel oil tank (capacity: 30,000L) and fuel oil dispenser were designed to supply fuel oil to the RTG (Rubber Tired Gantry Crane) and Reach Stacker. Major equipment and components of the Fuel Oil Supply System are as follows:

- Fuel Oil tank (capacity: 30,000L) 1 unit
- Fuel Oil dispenser (floor mounted type) 1 unit
- Fuel Oil supply pipe (steel 50mm) Approx. 50 m

e) Weigh Bridges

Weigh Bridges were designed adjacent to the container gate for measuring the weight of containers.

Major equipment of the Weigh Bridge System is as follows:

- Weigh Bridge (maximum measure: 60 t) 2 units

3) Electrical Systems

a) Power Supply

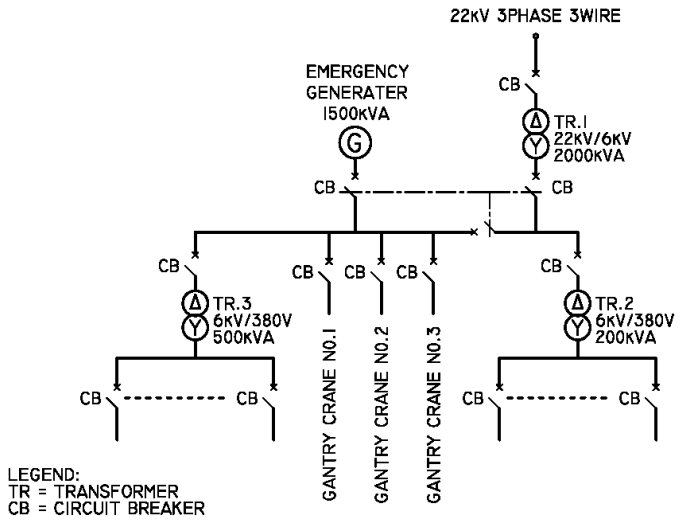
The existing PHN Port NCT 1 receives electricity from EDC's 22 kV overhead distribution line installed near a gate of PHN Port NCT 1.

The electrical demand of PHN Port NCT 2 is estimated at about 3 MVA, therefore PHN Port NCT 2 will be able to receive electricity from the existing 22kV distribution line.

Major equipment of the 22 kV substation is as follows:

- 22 kV Power Receiving Panel : 1 unit
- Transformers（22 /6 kV - 2,000 kVA、22 kV/380 V – 200 kVA、6 kV/380 V – 500 kVA
- Low Voltage Distribution Panel: 1 unit

A Single Line Diagram of the 22 kV/6 kV/380V is shown in Figure 3.3-15.



Source: Study Team

Figure 3.3-15 Single Line Diagram of 22 kV/6 kV/380 V

Related voltages for equipment are as follows:

- Quay Gantry Crane : 3 Phase 3Wire 6kV
- Others : 3 Phase 4 Wire 380/220V

b) Emergency Generator

An emergency generator is planned to supply emergency power to essential equipment in case of power break down. Rated voltages for the equipment are as follows:

The specifications of the emergency generator are as follows:

Engine	: Diesel Engine, 1,500 rpm.
Generator Voltage	: 3 Phase 3 Wire 6000 V
Rated Capacity	: 1,500kVA
Fuel Tank	: 10 hours continuous operation

The emergency power is to be connected to the following equipment:

Gantry Crane	: 2 of 3 units
Ref. containers	: All ref. containers
Yard Lighting	: Quay lighting

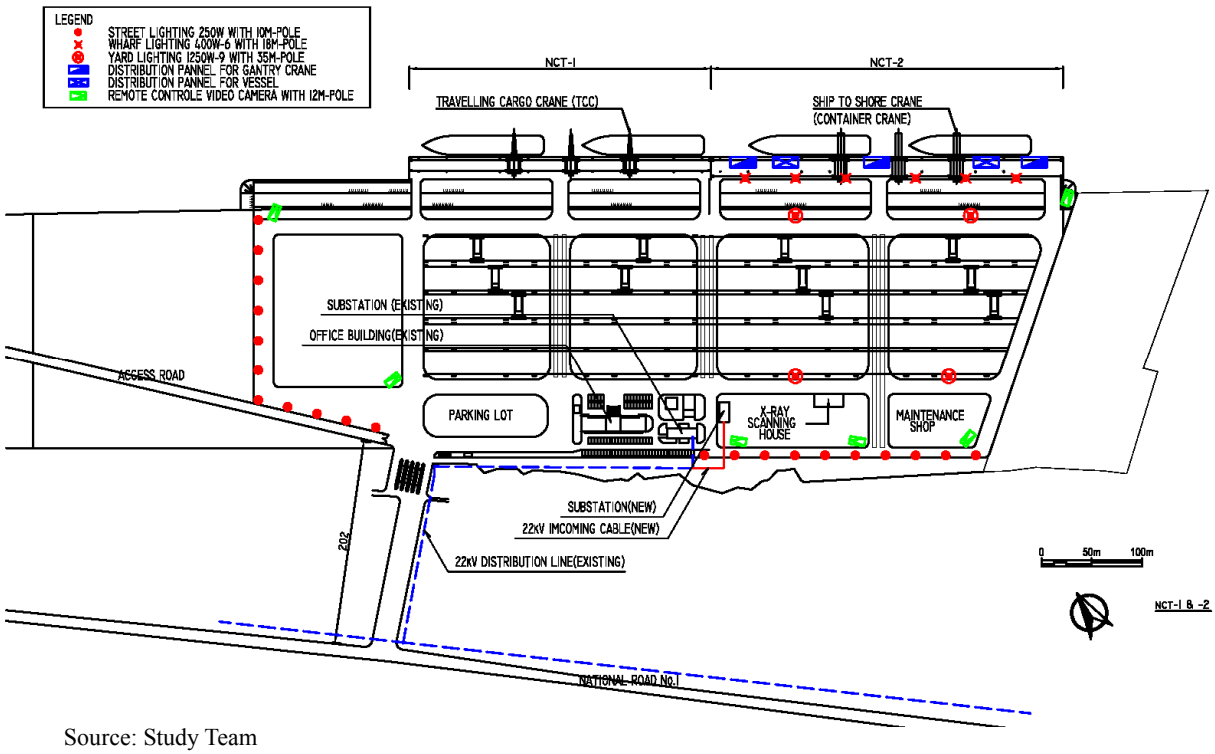
c) Lighting System

The following lighting systems are planned to enable 24 hours port operation:

Container Yard	: 35m height pole, 30Lux. Illumination level
Quay	: 18m height pole, 30Lux. Illumination level
Road/Boundary	: 10m height pole, 25Lux. Illumination level

d) Port Security System

As a part of port security systems, a Closed Circuit Television (CCTV) Surveillance system is planned. Surveillance cameras were arranged to monitor the boundary of PHN Port NCT 2 as shown in Figure 3.3-16. Electrical Systems Layout is shown in Figure 3.3-16.



Source: Study Team

Figure 3.3-16 Electrical Systems Layout

3.3.4 Construction Programme

(1) Estimated Construction Quantities for Associated Port Facilities

Based on the basic design and facilities plan, the estimation of the construction quantities of the Container Terminal 1 Complement Project and the Port Expansion of Terminal 2 Project for the associated facilities construction is presented in Tables 3.3-45 and 3.3-46 respectively.

Table 3.3-45 Estimated Construction Quantities and Specifications for Terminal 1 Complement

No.		Facilities and Equipment	Tentative Estimated Quantity	unit	Remarks
PPAP Portion					
1		Container Yard/ Road Expansion			
	1.1	Empty container yard pavement	8,000	m2	Yard Pavement
	1.2	Entrance Road Expansion	2,000	m2	Filling (1.5m), 15m width x 200m
	1.3	Yard Fence / Landscaping	300	m	Chain link fence height 3.0m
	1.4	Yard Lighting Pole , Lights＋CCTV (10m height	15	nos	
	1.5	Boundary lights	20	nos	
	1.6	Low Voltage Cable (600 V ）50 sq	600	m	Lights , others
2		Buldings			
	2.1	Entrance gate	300	m2	
	2.2	Maintenance shop	1,200	m2	40m x 30m RC
	2.3	Weiging Bridge	1	unit	60 tons (including base & house)
3		Temporary, Mobi/Demobilazation	1	L.s	
4		General and Site Expenses	1	L.s	
5		Escalation and Contingency	1	L.s	
6		Enginieering Cost	1	L.s	
Private Portion					
7		Additional Container Handling Equipment			
	7.1	RTG （Transfer Crane）	1	unit	
	7.2	Reach Stacker	1	unit	
	7.3	Tractor and Trailer	3	unit	

Source: Survey Team

Table 3.3-46 Estimated Construction Quantities and Specifications for Terminal 2 Expansion

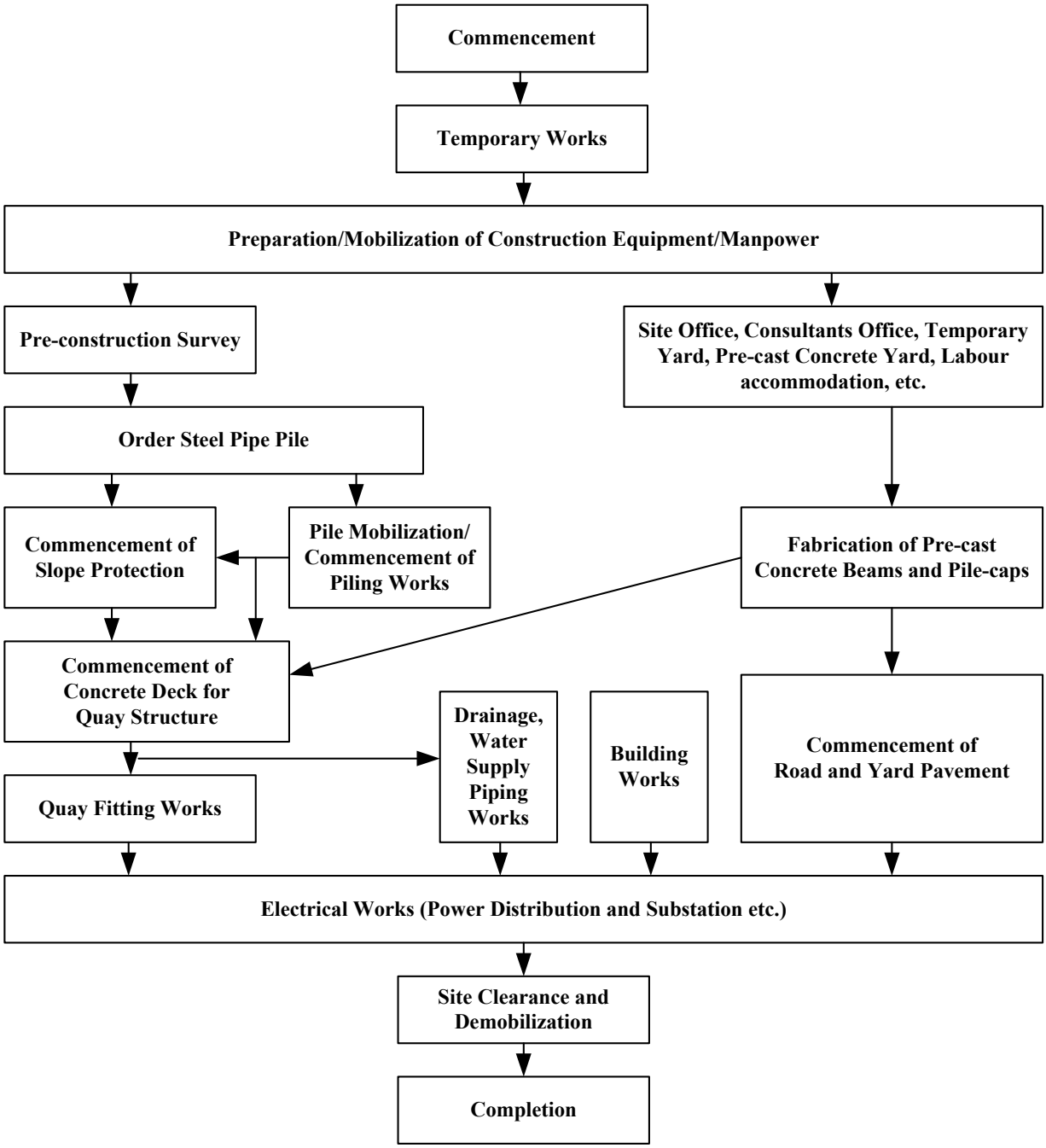
No.		Facilities and Equipment	Tentative Estimated Quantity	unit	Remarks
Public Portion					
1		**Expansion of Quay wall (Jetty)**			
	1.1	Slope Excavation under the Quay	350	lm	Grub Bucket dredger (6m3)
	1.2	Slope Protection	350	lm	Stone Protection (1m thickness)
	1.3	Construction of Quay wall	350	lm	375m length x22 width ＋Access bridge
	1.3.1	Steel Pipe Piling Works	202	Nos	Piling Barge φ700 x 16t, L=35 m、6 blocks
			516	Nos	Piling barge φ600 x 14t, L=35 m、6 blocks
			98	Nos	Piling Barge φ600 x 16t, L=35 m、(Access
	1.3.2	Quay wall (Jetty) Concrete Works	9,650	m3	RC Slab、RC Beam, Pile Caps （Beam : Pre-cast , using concrete pumping car ）
	1.3.3	Fenders	102	Nos	700H
	1.3.4	Bollards	70	Nos	50ton
	1.3.5	Crane rails	700	m	73kg
	1.3.4	Water supply piping , hydrant	500	m	150 φSteel pipe 、Water supply : 3 position
2		**Land Facilities**			
	2.1	Yard pavement（Stacking Yard and Road）	61,000	m2	Concrete Pavement (RC Pavement)
	2.2	RTG Traveling Lanes	5,550	m2	PC Lanes (200mm thickness, 1.5m width)
	2.3	Yard Drainage (U-type 500mm x 800mm)	1,900	m	Collection water in the Yard
	2.4	Yard Drainage RC pipe dia＝1000mm	300	m	Outlet to the River （Manhole 6 nos）
	2.5	Yard Fence and Green	550	m	Chain link fence height 3.0m
	2.6	Water and Fire Fighting Pipeline (150mm)	2,000	m	Water Supply Pipeline/ Hydrant : 6 nos
	2.7	1)Yard Lighting Pole , Lights＋CCTV (10m height	17	Nos	
		2) Yard Lighting Pole , Lights+CCTV (18 m height,	6	Nos	
		3) Yard Lighting Pole , Lights (height , 1250W)	4	Nos	
	2.8	Boundary lights	25	Nos	
	2.9	Transformer（22kv～6000v, 3000kw）	1	unit	QGC Power
	2.10	1) Transformer (6000v～400v 700kw）	1	unit	Yard Light and Reefer panel）
		2) Transformer (6000v～400v 700kw）	1	unit	Lighting , others
	2.11	1) High Voltage Cable（22 KV）	110	m	Road no.1 ~ Sub-station
		2)High Voltage Cable (11KV) 6000 v	1,230	m	Distribution Cable for QGC
	2.12	1) Low Voltage Cable (600 V ）50 sq	1,350	m	
		2) Low Voltage Cable (600 V ）70 sq	520	m	
		4) Low Voltage Cable (600 V ）120 sq	840	m	
	5	Generator	1	Unit	1500KVA
	6	Temporary, Mobi/Demobilazation	1	L.s	
	7	General and Site Expenses	1	L.s	
	8	Escalation and Contingency	1	L.s	
	9	Enginieering Cost	1	L.s	
Private Portion					
	3	Buildings			
	3.1	Power Sub-Station	80	m2	Sub-Station
	3.2	Emergency Generator House	50	m2	for Generator 1500 KVA
	3.3	Fuel Tank	60	m3	Steel Tank ＋Oil dispenser
	3.4	Entrance Gate and booths	400	m3	3 lanes, three booths
	小計				
4		**Container Handling Equipment**			
	4.1	QGC (Quay Gantry Crane）	3	unit	
	4.2	RTG （Transfer Crane）	6	unit	
	4.3	Tractor and Trailer	15	unit	
	4.4	Top Lifter	2	unit	Empty Container
	4.5	Reach Stacker	0	unit	45tons

Source: Survey Team

(2) General Construction Work Sequence

The major construction works for the Port Related Facilities (Terminal 1 Complement) Project are small scale consisting of the yard/road pavement and the maintenance shop with related utilities of which the facilities are constructed individually at separate locations. Therefore, PPAP will construct the facilities by themselves.

With consideration of the above, the general construction sequence of the associated facilities construction is only presented for the Port Expansion of Terminal 2 Project in the following Figure 3.3-17 in which is described major construction components of the project.



Source: Study Team

Figure 3.3-17 Construction Work Flowchart

(3) Construction Plan for Major Works

1) Temporary Works

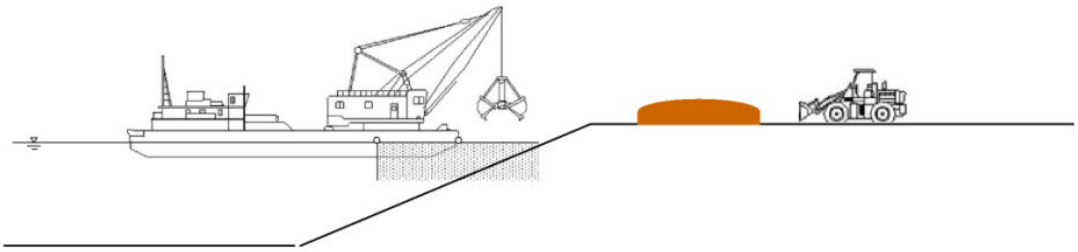
Within three months after commencement of the construction, a grab bucket dredger, large equipment and temporary materials could be mobilized to the site. Temporary facilities such as office, temporary yard and temporary utilities will be constructed as well. Steel pipe piles are to be ordered at that time and mobilization of the piles will be started three months after commencement of the construction. Materials for the construction are mainly transported over road No.1 and enter through the port gate to the site directory. Therefore, material transportation will have no impact on the surrounding residents.

2) Quay Slope Excavation

No dredging works for the channel or quay will be executed in this project. However, the quay slope excavation work is to be done by a grab bucket dredger (6m3 capacity) which is a grab bucket crane mounted on a floating barge. Silt diffusion will not occur for following reasons.

- As the results of the subsoil investigation, the excavated soil is mostly sand.
- In order to avoid soil turbulence, a grab bucket type excavator shall be specified.

The contractor will be requested to prepare a silt fence around the dredger if silt diffusion occurs. The excavated soil is to be embanked and graded on the land side by a bulldozer. The work is shown in Figure 3.3-18.



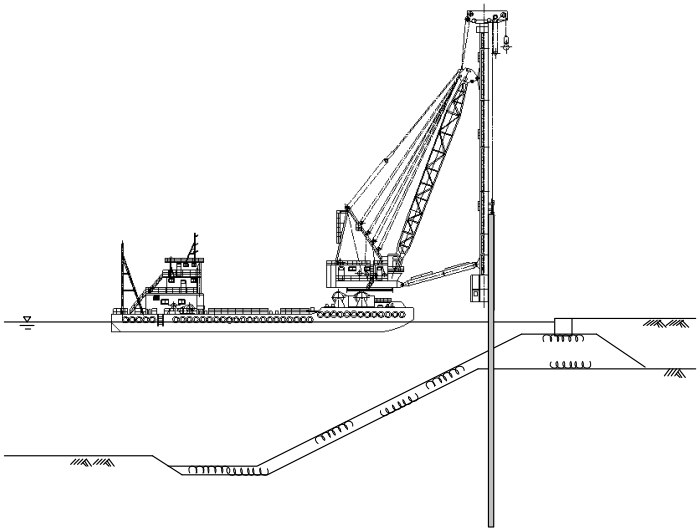
Source: Study Team

Figure 3.3-18 Slope Excavation Works

3) Piling Works for Quay

After preparation of the slope under the quay, piling work for the quay is started by a piling barge (piling crane mounted on the barge). Steel piles are fabricated and transported to NCT 1 from abroad. Those piles are stockpiled on the site for splicing work. The piling works is planned for 10 months and the environmental impacts are mainly noise and vibration and will not have an impact on the surrounding residents for the following reasons. The work is shown in Figure 3.3-19.

- The Terminal 1 project done by a Chinese contractor has used same method for the piling works. No environmental impacts have occurred.
- Residential area is approx. 400m from the site of the piling works.



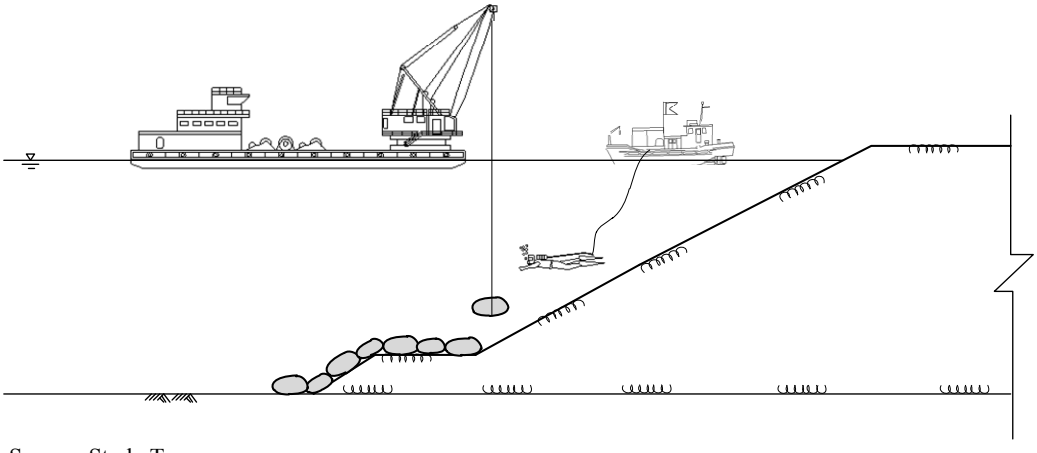
Source: Study Team

Figure 3.3-19 Piling Works by Piling Barge

4) Slope Protection under Quay (Stone Installation Works)

Slope protection works could be started after completion of piling works for 150m of quay length.

The protection materials to be used are granite stones 100kg ~500kg in weight. The stones will be transported from the quarry at Kampong Speu (private quarries with more than 10 companies) to the site by dump trucks. Volume of the transportation is estimated at about five trucks per day, so that impacts on road traffic or the residents are not taken into account. Working period is estimated at about 8 months. The stone installation work in the deep water areas is done by floating crane barge and the work in shallow water areas is done by the large excavator. The work is shown in Figure 3.3-20.



Source: Study Team

Figure 3.3-20 Slope Protection Works

5) Quay Deck Concrete Work

Subsequently to the slope protection work completed for 150m in quay length, concrete deck construction will be started. Pre-cast reinforced concrete (P.C) beams and P.C pile caps will be built in the temporary yard before commencement of deck construction works. Then, scaffolding works on the piles is arranged. The P.C beams and pile caps are transported and installed on the piles using cranes from the land side. After installation of the beams and pile caps, reinforced slab in-situ concrete is cast using concrete pumping trucks. The ready mixed concrete is supplied by private companies

surrounding the site. Transportation volume of the concrete is estimated at about 10 trucks per peak day (2 trucks per day on average), so that impacts on road traffic and the residents are not taken into account. The trucks and agitator trucks shall wash their containers and tires in a washing area located on the site before leaving the site.

6) Yard Pavement, Utility Works and Building Works

Materials for pavement works, utility works and building works are to be transported over road No.1 and through the existing entrance of NCT1. Transportation volumes of materials are estimated at about 6 trucks per peak day (3 trucks per day on average), so that impacts on road traffic and the residents are not taken into account.

The pavement is mainly made with three courses, a sub-base course such as a laterite soil layer, a base course such as a crushed rock layer and a surface course such as a reinforced concrete layer. The construction equipment is the same as for road construction such as motor graders and rollers which do not generate loud noise or heavy vibration.

The utility works are done together with the pavement works using small equipment. The planned buildings are made of reinforced concrete. Materials for the construction are transported over road No.1. Therefore, a tier cleaning facility for the trucks and traffic watchmen shall be arranged at the entrance of the site.

(4) Construction Schedule

The construction schedule of the NCT-1 Complement Project and the NCT-2 Extension is shown in Table 3.3-47

Table 3.3-47 Construction Schedule of NCT-1 Complement and NCT-2 Extension

Source: Survey Team

3.4. PPP Scheme

3.4.1 PPP Scheme Model

As for the PPP Infrastructure Project, this survey is basically conducted using the following three models.

- **Separated Model:** A PPP Infrastructure Project is divided into the part to be executed by the government /authority of the developing country and the other part to be executed by the private corporation as a private project.
- **United Model:** ODA's finance would be appropriated for the Development and Operation of the PPP Infrastructure Project which is executed by a private corporation using public finance.
- **Private Model:** A PPP Infrastructure Project is only provided the land space by the government /authority of the developing country and whole of development is financed by the private corporation as a private project.

In this survey, the SEZ development project and the related port facility project are studied as independent projects for the consideration of the above three models.

(1) SEZ Development and Operational Model

The SEZ Project could retain more than 60% of all the income from the initial sales of the area for the tenants and use it to cover long term operation costs. The initial development cost could be recovered at the beginning of the operation to later be applied to all areas for the tenants. The operational service revenue of the SEZ will be appropriated for the yearly operation costs and profits.

Therefore, the SEZ business sets up the land lease fee and service fee for the tenants based on the execution for the repayment of the initial development cost by the initial high revenue for the long term land lease. Those fees and service tariffs shall be kept competitive enough compared to the other SEZ and industries in the country and neighbouring countries. The area for the tenants shall be occupied as soon as possible and every method possible to retain the tenants which are directly connected to the service revenues subsequent to the land leasing revenue. This is a high risk business for maintaining constant revenues.

The project is basically implemented as the United Model, only the separation of the development of facilities for the SEZ and the outside base facilities of the SEZ (Access road, public power supply and reclamation) is considered as the Separated Model. The following four financial schemes are taken into account.

- **United Model Private Development Type:** The development and the operation are invested by private entities, only the land acquisition for the SEZ and access road is provided by PPAP.
- **United Model Sihanoukville Port SEZ Type:** All of the project development cost is financed by the ODA soft yen loan, the development and the operation are executed by the government agency (PPAP) as the public infrastructure
- **United Model by PSIF:** About 70% of the development cost will be financed by PSIF, about 30% of the development cost and all of operation cost is invested by a private corporation with PPAP. The development and the operation are executed by the private corporation.
- **Separate Model by ODA Loan:** Land filling and the Access Road as the Public portion are financed by the ODA Loan, other SEZ facilities and the operation are invested by the private corporation with PPAP. The development and the operation are executed by the private corporation.

1) Project Scope, Role Allocation of Public and Private Participation

PPAP has acquired 205 ha of land for the SEZ development. This land is planned for the SEZ development in the project. In addition to the PPAP's land, the private sectors have acquired a land area of about 500 ha on the southern side of the PPAP's land. However, those private sector's lands are basically to be developed as SEZ by private investment in the future.

The project scope is divided as shown in Table 3.4.1 in line with the financial scheme explained above.

Table 3.4-1 SEZ Project Scope, Role Allocation of Public and Private Participation

Project Scope	United Model ①	United Model ②		United Model ③			Separated Model		
	PPAP/ Private Investment	PSIF	PPAP/ Private Investment	PPAP	Yen Loan	PPAP/ Private Investment	PPAP	Yen Loan	PPAP/ Private Investment
SEZ Development on **PPAP Land**	✓		✓	✓			✓		
SEZ Development on **Private Land**	✓	✓(70%)	✓(30%)		✓			✓ (Public)	✓ (Private)
Operation & Management for PPAP SEZ	✓		✓			✓			✓

Source: Survey Team

(2) Associated Port Facilities Development Model

Phnom Penh New Port Terminal 1 has been developed by Chinese funds and started operation in January 2013 by PPAP. The maximum cargo handling volume at the Terminal 1 is estimated to be 120,000 TEUs. The cargo handling equipment at the Terminal 1 was provided by PPAP and related private corporations, not the Chinese fund. The cargo handling volume could be expanded up to 170,000 TEUs by injecting additional equipment for the Terminal 1.

The Terminal 1 is estimated to achieve the 170,000 TEUs cargo volume in 2020 and the Terminal 1 is required to expand the quay wall, container yard, and increase its handling equipment after 2020 as the Terminal 2 in this study.

Therefore, the Terminal 1 is required to add the necessary facilities and handling equipment to handle the 170,000 TEUs increasing together with the cargos generated in the SEZ from 2017. This is the Terminal 1 complement project implemented with the SEZ project. After 2017, Phnom Penh New Port expansion (Terminal 2) is planned as the future project.

1) Project Scope, Role Allocation of Public and Private Participation

It is a major public investment to develop and operate a public port for handling public cargos but the investment is not a large risk under the condition of increasing cargo demand. Therefore, in order to strengthen the competitiveness of the port, private investment for the port expansion and operation is expected as a PPP infrastructure project. Also, the Terminal 1 complement project to add facilities and equipment is a very small scale project that could be funded by the PPAP and the Private entity respectively. Therefore, the project is adopted as the Separated Model for the additional facilities invested by PPAP and the additional equipment are to be invested by the private entity.

The project scope and role allocation for the Terminal 1 complement project and Terminal 2 expansion project are presented in Table 3.4-2 and Table 3.4-3 respectively.

Table 3.4-2 Project Scope & Role Allocation of Public & Private Participation (Terminal-1)

Terminal 1 Complement Project (Additional Facilities anad Equipment)	Separated Model	
	PPAP Investment	Private (Mitsui & Co.,Ltd.) Investment
Land (Area Provided)	✓	
Additional Facilities	✓	
Additional Handling Equipment		✓
Operation of Terminal 1	✓	

Source: Survey Team

Table 3.4-3 Project Scope & Role Allocation of Public & Private Participation (Terminal-2)

Terminal 2 Expansion Project	Separated Model	
	PPAP/International Agency's Loan	Private Investment/ Public finance
Land (Area Provided)	✓	
Civil Works for Terminal 2	✓	
Buildings & Handling Equipment		✓
Operation of Terminal 2	✓	✓

Source: Survey Team

3.4.2 Fund Sourcing for Project

(1) Source of Funds and Funding Possibility for Phnom Penh New Port SEZ

Concerning the source of funds mentioned in the Table 3.4.1, the land acquisition for the SEZ of PPAP land and the access road shall be funded by PPAP. The PPNP SEZ development, United Model ①, is sourced from private investment. The PPNP SEZ development, United Model ②, is planned to source about 70% of development cost by PSIF and about 30% of development cost by private investment. The PPNP SEZ development, United Model ③, is sourced from an ODA soft loan. The public portion of the Separate Model is sourced from an ODA soft loan and the private portion is sourced from private investment. For the O&M of SEZ for all Models, the Operational Consortium (PPAP and Private companies) shall pay for the initial O&M and continue the O&M by using operational revenues.

Funding possibility and conditions for each of the above models are presented as follows:

a. United Model ① (Private Developing Type)

It is impossible under the financial conditions of PPAP to fund all of the SEZ development. Therefore, a private company formed SPC with PPAP shall invest in the development for the SEZ in this model.

The private firms in this PPP survey declared that they would not participate in the SEZ project due to the low profitability of the project. Then, the survey team researched the possibility of other Japanese firms to invest for the SEZ development. After research of the firms, some companies expressed an interest for the SEZ development. However, all the interested companies mentioned conditions to avoid the high risks which are the huge volumes of filling works. A company respond that the minimum requirement to invest is that 1.3 times the development cost shall be kept in the initial revenue for land leasing fee of the tenants to invest for SEZ development. (about 1.7~1.8 times of all the development cost / m2 = leasing fee/m2)

For the support of the above research, the comparison between this SEZ project, Phnom Penh SEZ and Recent SEZ development conditions around Phnom Penh are presented in Table 3.4-4.

Table 3.4-4 SEZ Development Cost relation with Leasing Fee

This Project (PHN New Port SEZ) (143ha)				Phnom Penh SEZ around Phnom Penh (250ha)			On going /Future Industry around Phnom Penh (50 Ha)		
Major Item for Investment	Unit	Cost (US$)	Remarks	Unit	Cost (US$)	Remarks	Unit	Cost (US$)	Remarks
Land Acquisition Fee	m2	2	Present	m2	11	8 years ago	m2	35	Present
Land Filling and Grading Fee	m2	22	6m Fill up	m2	0.8	no filling	m2	4	0.5m Fill up
Access Road	L.s	6.3 Million	3800m	L.s	1.3Million	500m	L.s	1million	400m
SEZ Inner Road	m2	3.6	Development Area	m2	4.2	Development Area	m2	3	Development Area
Power Supply	L.S	6 Million	40 MW	L.S	4 Million	15MW	L.s	3 million	Intial Power 6MW
Sewerage Treatment Plant	L.S	2.5 Million	2000 t	L.s	4 Million	4000 t	L.s	None	
Total (A)	m2	38	Development Cost	m2	19.7	Development Cost	m2	44	Development Cost
Available Selling Price (B) **by ODA (IRR 7%)**	m2	60	1.6 times (A)	m2	32	1.6 times (A)	m2	70	1.6 times (A)
Available Selling Price(B) **by Private (IRR 13%)**	m2	70	1.8 times (A) Difficult to Sell	m2	45	2.2 times (A) Sold Price 1yeras ago IRR = more than 15%	m2	80	1.8 times (A) Difficult to Sell

Source: Survey Team

In the above table, Land Acquisition around Phnom Penh (within 30km) is US$ 35~ US$ 40 and these prices are for land that does not require significant fill. There are no examples of prices for property that needed fill on the order of 5m deep. In order for this project to be profitable the cost for Land Acquisition must be less than 30 US$.

The Phnom Penh SEZ can be profitable with a leasing fee of 50US$ /m2 if the land acquisition fee is low enough. However, new SEZ developments around Phnom Penh would have difficulty making a profit without more than 70 US$ /m2 leasing fee if they were developed by a private company.

Therefore, the United Model ① (Private Developing Type) is difficult to execute in the area within 50 km from Phnom Penh.

b. United Model ② (PSIF Utilization Type)

As mentioned above a), the interested companies for the SEZ have mentioned the conditions to avoid the high risks which are the huge volumes of filling works. Therefore, PSIF will be utilized for the filling works, the contribution for the power sub-station and the access road development (less than 70% of the total development cost) as the responsibility of the PPAP and the other portions (more than 30%) will be invested by a Japanese private firm. This scheme will make it possible to be joined by a private company to execute the project.

c. United Model ③ (Sihanoukville Port SEZ Type)

For the project, the development is financed by ODA Loan and a Japanese private firm participates and funds the operation. This scheme is preferable to secure the profits and avoid the risk for the private firms. The ODA loan for the project is basically to finance the GOC (MEF has responsibility). However, the MEF decided to be developed the SEZs by private investment in the basic policy of the GOM, if the private sector is expected to invest for a part of the development. Therefore, it is unlikely that this scheme is would be approved by GOM.

d. Separated Model (ODA Loan and Private Investment)

An ODA soft loan will be provided for the public portion which will consist of the filling works and the access road development. The private portion will cover other works for SEZ using private investment. This model is also preferable to secure the profits and avoid the risk for the private firms. However, as for appropriation of the ODA loan, utilization of the loan shall be approved by the MEF.

Of the above funding possibilities, only **b) United Model ② (PSIF Utilization Type) and d) Separated Model (ODA Loan and Private Investment)** have a possibility of implementing the

project. Recently, PPAP stated that the access road for SEZ will be developed by GOC and PPAP with their own funds. Therefore, funding scope for the two models will consider other alternative cases. Hence, the financial sources for the work items of SEZ development for those two models are presented in Table 3.4-5.

Table 3.4-5 Funding Source for SEZ Development

Project Scope	United Model ②					Separated Model		
	Case 1		Case 2			Case 3		
	PSIF	PPAP/ Private	GOC/ PPAP	PSIF	PPAP/ Private	GOC/ PPAP	Yen Loan	PPAP/ Private
Access Road (NR no.1~ SEZ)	✓ (less than 70%)	✓ (more than 30%)	✓	✓ (less than 70%)	✓ (more than 30%)	✓		
Reclamation/ Filling Works							✓	
Power Sub-station								✓
Boundary Fence								✓
Road and Yard Pavement (In SEZ)								✓
Power Distribution/ Lighting								✓
Management Facilities (Buildings/Gate)								✓
Water Supply Facilities/ Sewerage Treatment Plant								✓
Park, Pond/ landscaping								✓
Tenants Attraction / Operation & Management		✓			✓			✓

Source: Survey Team

(2) Source of Funds for Associated Port Facilities (Terminal 1 Complement)

PPAP Terminal 1 Complement Project is planned as a Separate Model, the additional facilities are to be funded by PPAP, the additional equipment is to be funded by the Japanese Company (Mitsui &Co., Ltd.). The components of the facilities and equipment are presented in Table 3.4-6.

Table 3.4-6 Funding Source for PPAP Terminal 1 Complement

Terminal 1 Complement Project (Additional Facilities anad Equipment)	Separated Model	
	PPAP	Japanese Firm (Mitsui & Co., Ltd.)
Empty Container Yard Expansion	✓	
Entrance Road Expansion	✓	
Entrance Gate Expansion	✓	
Maintenance Shop	✓	
Weiging Bridge	✓	
Handling Equipment (RTG :1unit, Tractor Trailer :3 sets, Reach Stacker : 1unit)		✓

Source: Survey Team

3.4.3 Tariff Plan

(1) SEZ Development

1) Land Leasing Fee for Tenants of SEZ

The land leasing fee for tenants of the SEZ is major revenue source providing more than 60% of all the income of the SEZ operation for the long term period. Therefore, the land leasing fee is a very important factor to be decided for the management of the SEZ. Basically, the leasing term shall be on a long term basis from 50 years to 100 years. For the PPNP SEZ, it is planned to be a 50 year leasing period in line with the GOC suggestion for SEZ. The price of the long term lease shall be decided based on the strategic considerations before issuing invitations to tenants for the SEZ based on the following conditions.

① The Leasing fee shall be competitive with other SEZ that are subject to the same location conditions as in Cambodia

② The Leasing fee shall be competitive with neighbouring countries' SEZ that are subject to the same location conditions and considering the price of the infrastructure.

③ The Leasing fee shall take the transportation cost of the cargos from the Port into account for the comparison of the above.

④ The Leasing fee shall take its land acquisition cost and development cost into account for feasible operation.

⑤ Inflation of the land fee at the time of inviting the tenants is basically not considered into the leasing fee in the study. The rise of the fee by inflation shall take into account the necessary discount or negotiations with the tenant.

Generally, the SEZ leasing price to produce a feasible return is recommended as follows. Feasible leasing fee = (Land Cost + Development Cost)/ Development Area x (130%+2~5%). In this Project, the land acquisition fee is approx. US$ 2.0/m2, development cost is about US$42 /m2. Hence, feasible leasing fee =(2+42) x (133%) = $59 /m2. Based on the above basic leasing fee ($59/m2), the leasing fee of the project shall be decided taking the above ①～⑤ into consideration.

Concerning ①: The Phnom Penh SEZ has declared its leasing price to be US$ 55/ m2, and actually negotiated with tenants for the leasing fee to be reduced to US$ 45/m2 which is the declared price from three years ago. This means that the current revised price includes the inflation of the land fee for every year. This SEZ project will start to invite tenants four years from now, therefore the leasing price of US$ 59/m2 is competitive in consideration of the discount for the negotiation in 2016.

Concerning ②: As for the SEZ with the same location conditions in Vietnam, the leasing price has increased to about US$120/m2 at present. However, the power supply fee is about 2.5 times higher than in Cambodia. A general factory having 2ha area in the SEZ is compared between this SEZ and the SEZ in Vietnam considering the yearly operation cost for the power consumption and leasing fee with depreciation for 10 years as follows:

- This SEZ Project: 2ha x $59/10 years + $200,000(yearly power consumption) = $318,000 / year
- SEZ in Vietnam : 2ha x $120/10 year + $80,000(yearly power consumption) = $320,000 / year

Hence, $59 for this project is a competitive price.

Concerning ③: Cargo transportation cost compared between Phnom Penh SEZ (PP SEZ) and this SEZ is about $100 /TEU for PP SEZ and $10/TEU for this SEZ. A comparison of yearly operation cost with consideration of the leasing fee and transportation fee is as follows:

- This SEZ : 2ha x $59 /10 years + 100TEU (yearly cargo) x10$ =$119,000
- PP SEZ : 2ha x $55/10 years + 100 TEU (yearly cargo) x100$ =$120,000

Hence, $59 for this project is a competitive price.

Concerning ④&⑤: Feasible and competitive leasing prices need to be from US$ 54/m2 ~ US$ 62/m2. This SEZ project will start to invite tenants four years from now and its inflation will be calculated as ; 3.6 % (yearly inflation rate 2012) x 4 years x $59=$67 /m2. This price could be declared as publicity in 2016 and about 12$/m2~5$/m2 could be negotiated as the discount for the tenants.

Therefore, in this study, the leasing price of SEZ is set at $55/m2 ~ $62/m2 (average $59/m2).

2) Operation and Service Price of SEZ

Subject to the establishment of a successful SEZ, the services required meeting with the SEZ location and conditions in the country are to be provided to the tenants. Based on the conditions of the SEZ, the services are planned as shown in Table 3.4-7. The operational body of the SEZ is mainly PPAP, considering the joint operation with the private party, PPAP has no experience in operating an SEZ. Therefore, the specific works and services are planned to be executed by specialized companies as an out in a sourcing contract. The operation and service price is planned on the basis of the prices of other SEZ in the country and neighbouring countries, as follows:

① Marketing and Sales (out sourced): PPAP pays the marketing company about 3% of the leasing fee for tenants.

② Water supply and wastewater treatment: City water fee for consumption ($0.45/ m3) and add $0.3/ m3 for wastewater treatment cost for the tenants.

③ Usage fee for the Access Road : $0.15/m2 (area leased by the industrial tenants or apartment tenants)/ year

④ Power supply: EDC will supply the power for SEZ, EDC's Tariff = $0.2/kwh, and facilities maintenance cost to be added is $0.01/kwh for tenants.

⑤ Other services excluding out sourced: Yearly SEZ service fee = $ 0.7/m2 (for occupied area) for the tenants.

⑥ Out sourced works: Specialized companies will charge the tenants directly. Its tariff shall be discussed and approved by PPAP in the contract agreement with PPAP.

⑦ Leasing fee of apartment area: $10/m2 / year with infrastructure of water, power, security and road network.

⑧ Leasing fee of area for commercial, school and clinic: $6/m2 /year with infrastructures for the tenants.

⑨ Room leasing fee: For the temporary office of the tenants and offices for specialized companies, $120/m2/year.

⑩ Logistic Center (concession): PPAP will grant a concession for a logistic company. PPAP will charge $7/m2 for the area set in the concession agreement.

Table 3.4-7 SEZ Services, Service Provider and Service Fee

Operation and Services by PPAP		Out Sourcing Contract	
Business Description	Revenue/Payment	Business Description	Revenue/Payment
Management (Contract/Price Negotiation)	3%of Leasing fee for Payment	Contract with PPAP	3%of Leasing fee for Revenue
Management （Tariff Control 、Customs Documents)	Land Leasing fee（6＄／m2）for Revenue	Contract with PPAP	Tariff collection from Tenants
Maintenance of Facilities/ Payment to City Water	Water Fee Collection ($0.7/m3) from Tenants		
Maintenance of Facilities/ Payment to EDC	Power Fee Collection ($0.21/kwh) from Tenants		
Management	Including SEZ Service Fee ($0.7/m2/year)	Contract with PPAP	Tariff collection from Tenants
Management	Including SEZ Service Fee ($0.7/m2/year)	Contract with PPAP	Service Fee collection from Tenants and PPAP
Management	Including SEZ Service Fee ($0.7/m2/year)	Contract with PPAP	Service Fee collection from Tenants and PPAP
Room Rental of SEZ Office	Rental Fee Collection		
Management	Including SEZ Service Fee ($0.7/m2/year)	Contract with PPAP	Service Fee collection from PPAP
Environmental Maintenance / Waste Water Checking of Tenants	Including SEZ Service Fee ($0.7/m2/year)		
Management	Including SEZ Service Fee ($0.7/m2/year)	Contract with PPAP	Service Fee collection from PPAP
Management	Including SEZ Service Fee ($0.7/m2/year)	Contract with PPAP	Service Fee collection from PPAP
Rental of Area	Rental Fee Collection ($10/m2/year)		
Rental of Area	Rental Fee Collection ($6/m2/year)		
Rental of Area	Rental Fee Collection ($6/m2/year)		

Source: Survey Team

(2) Associated Port Facilities (NCT-1 Complement & NCT2 Expansion Project)

Phnom Penh Port charges port dues, pilot fees, channel dues, and cargo handling charges based on the Decision declared by the Ministry of Public Works and Transport in 1993. The board of directors of PPAP is authorized to decide cargo handling charges, therefore, PPAP levies a special tariff on cargo handling charges from the view point of commercial management of a state owned company. Cargo handling charges include stevedoring fees from/to a ship, crane charges, lift on lift off charges, gate fees and the like. However, port dues, pilot charges and other maritime services remain unchanged since 1993.

PPAP gives a volume discount off of stevedoring fees to shipping companies according to their quantity of container handling as shown in Table 3.4-8, Item III 7, which is a 20 % discount for users handling over 17,000 TEUs per year. Lo/Lo charges changed as of January 2013 from a system to charge lift-on and lift-off charges together at the timing of the import, to a system to increase lift-on charges on imported containers and exempted lift-off charges on exported containers whose boxes are imported through Phnom Penh Port as shown in the Table 3.4-8, Item III 2. Due to this amendment, PPAP encourages shipping companies and cargo owners to use Phnom Penh Port for both import and export. Consequently, lift-on charges are three times higher than lift-off charges on export containers whose boxes are not imported through Phnom Penh Port.

Table 3.4-8 Tariff for Services at the Phnom Penh Port (2012)

PPAP PORT DUES & STEVEDORING CHARGE TARIFF

Original: The Decision No 110c M dated September 1987, and Prakas No 239 M.T. Dated 08.05.93
Final Revision: 04 January 2013, by Phnom Penh Autonomous Port Announcement No.012

I. NAVIGATION CHARGE & DUES

1. NAVIGATION CHARGES
US$ 0.13 x GRT x 2 (for each entry departure)

2. BERTHHAGE CHARGES
A : For cargoes vessels bellow 2 days
a: At quay US.$ 0.23 x GRT
b: At buoy US.$ 0.10 x GRT
c: At anchorage US.$ 0.05 x GR

B: For Tourist and service vessels:
a: At quay US.$ 0.003 x GRT x hrs
b: At buoy US.$ 0.001 x GRT x hrs
c: At anchorage US.$ 0.0005 x GRT x hrs

For cargo vessels discharge or loading over 5 days the first period to be applied in point A. And over this period of alongside to surplus in point B. In case of receiving of harbor sailing. Order but still occupying a berth the vessels shall be fined as follow:
a: At quay US$ 0.70/meter /hrs
b: At buoy US$ 50.00/hrs

3. CHANNEL DUES for commercial vessel US.$0.31 x GRTx2
for lighter carrier US.$ 0.16 x GRT

4. PILOTAGE CHARGE for each entry departure
(Minimum charges US$ 100.00)
a: US.$ 0.003 x GRT x miles (for commercial sea port)
b: US.$ 0.03 x GRT (for refinery port)
c: US.$ 0.017 x GRT (for each shifting)

5. TUG ASSISTANCE CHARGES UP TO REGISTER TONNAGE OF VESSEL.

Kind of Vessels	Tug assistance charge US.$ / hrs
Vessel below 1.000GR T	83.00
do • from 1.001 to 4.000	149.00
do -from 4.001 to 10.000	165.50
do -from 10.001 to 15.000	215.00
Above 15.000 GRT every subsequent of 1.000 GRT to be charged in additional to	18.00

6. MOORING & UNMOORING up to GRT of the vessel

Kind of Vessels	Tug assistance charge US.$ / hrs	
	At quay	AT buoy
GRT bellow 1.000	16.50	50.00
from 1.001 to 4.000	33.00	83.00
from 4.000 to 10.000	50.00	110.00
from 10.001 to 15.000	66.00	132.00
above 15.001	83.00	149.00

7. CHARGE FOR OPENING& CLOSING HATCHES

Kind of Vessels	Tariff for each opening or closing	
	Hatch without beam	Hatch with beam
below 5.000 GRT	13.00	26.00
from 5.001 to 10.000	32.00	46.00
above 10.001	36.00	73.00

8. CHARGE FOR CLEANIG AND SWEEPING HATCHES

Kind of Vessel	Innocuous -cargo	Dangerous & Poisonous cargo
below 5000 GRT	33.00	53.00
from 5001 to 10.000	41.00	83.00
above 10.001	56.00	116.00

9. CHARGES FOR SWEEPING AND WASHING SHIP'S DECKS

A. with water supply by ship: US$ 0.17 /m2
B. with water supply by port: US$ 0.20 /m2

10. CHARGES FOR DUMPING SERVICE (garbage removal changes)

A: At quay US$ 2.50 /times
B: At buoy US$ 3.75 /times

11. FRESH WATER CHARGES

- Supplied from hydrant at quay US$ 2.50 /m3
- Supplied by truck US$ 3.75 /m3

12. OTHER CHARGES

-Clearance fee US$ 100.00 /vessel
-Watchman US$ 1.60/person /hrs

II. STEVEDORING CHARGES

Charges for discharging or loading cargoes

II.1. Ship's hold over ship's rail using ship's gear.

	CATEGORY OF CARGO	US$
1	- Cargo in bulk, mental, ores gravels, block stone, food fertilizer, salt, raw, sugar	1.46
2	- Cargo in bags packed in cotton, jute, paper, rad-nylon rash-bags	1.58
3	- Machinery equipment empty container empty drums empty case log wood	2.12
4	- Cargo in drums, in cases or in bundles, coins bars, plates	2.32
5	- Cargo in bales (raw cotton raw jute humps rush paper textiles, clothing materials, household utensils sun dried.	2.45
6	- Sawn timber, flooring stripes, wooden & bamboo wares	2.52
7	- Cargo in baskets	2.65
8	- Fragile material cargo, in bottles, glass, ceramic, pots. TV camera sets valuable cargo - Fresh fruit, livestock, frozen products	2.81
9	- Special and valuable cargo (gold, silver, diamond motor car, trucks heavy weight and long	2.92
10	construction material.	4.97

II.2. Charge for cargo operation other than above, and increase rate to point II.1 shall apply as follow

a:	Discharge cargo at anchorage at buoy	50%
b :	From ship onto trucks, wagon or vice -versa	50%
c :	Moving or shifting cargo in hold the same ship	30%
d :	From warehouse or open space to trucks or vise-versa	35%

e : Discharging from ship to warehouse or open space or vise -versa 100%
f : Warehouse or open space to wagon or vise -versa 50%
g : From ship to ship or barge 75%

IL3. FOR OVER LENGTH AND OVER WEIGHT (Except containers)

This rate to increase to point II.1 shall be applied as follow

a: Discharging cargo in hold which dept over 3m 100%
b: For cargo caked or hardened which require picking splitting crushing when handle and increase of 40%
c: For cargo in small cases packed, drums below 10 Kg packed an increase of 30%
d: Discharging in cool holds from 10c to 0c an increase 50% -For frozen cargo or refrigerator an increase 50%
e: Discharging or loading run through the scales to be pluses US$ 0.50/ton 100%
f: In case of consignee bring the equipment or labors for operated the cargo (loading or discharging) the consignee must be paid 20% to the for over-weight and over-length

No.	Weight or length of package of cargo	Rate increase
1	Weight from 5t to 10t	50%
2	-do- from 10t to 20t	100%
3	Over 200t	200%
4	Length from 12m up to 16m	50%
5	-do- from 16m up to 20m	100%
6	Over 20m	200%

In case of discharging or loading cargo using port's mobile crane increase US$ 1.00 /ton (except have not ship's crane)
- Dangerous and poisonous cargo increase 50%
- Night shift from 06.00 PM to 12.00 increase 25%
- Night shift from 00.00 hrs to 06.00 increase 50%
- Holiday and Sunday increase 50%

II.4 STORAGE CHARGES (Except containers)

a: In warehouse US$ 0.20 /day or US$ 0.25 /m2/day
b: In open space US$ 0.10 /day or US$ 0.125 /m2/day

III. OTHER CHARGES

CONTAINER HANDLING CHARGES

1-Stevedoring Charge:

A-Quay-CY, CY-Quay

	20'	40'. 40'HU, 45'
-Full CNTR	US$49.00/Unit	US$74.00/Unit
-Empty CNTR	US$26.00/U nit	US$37.00/U nit

B-Crane Charge:

	20'	40'. 407HU, 45'
-Full CNTR	US$16.00/Unit	US$25.00/Unit
-Empty CNTR	US$10.00/U nit	US$16.00/U nit

2-Lift on Lift off (CY-Truck or Truck-CY)

(Revision on 04 Jan. 2013, effective from the 16th January 2013)

Container		Laden 20’	Laden 40’/45’	Empty 20’	Empty 40’/45’
Import		**$70**	**$106**	**$70**	**$106**
Export	Laden Imported via PPAP	**$24**	**$36**	**0**	**0**
	Empty Imported via PPAP	**0**	**0**	**0**	**0**
	Container imported via other gate	**$24**	**$36**	**$24**	**$36**

3-STUFFING OR UNSTUFFING OF CNTR

	20'	40', 40'HU, 45'
	US$S50.00/U nit	US$100.00/U nit

4-STORAGE CHARGE

-For import cargoes: 7days free of charge after completion of discharging from Vessel.

-For export cargoes: 5days free of charge from the moment the cargoes come to store yard

	20'	40', 40'HU, 45'
-Full CNTR	US$3.00/U nit	US$6.00/U nit
-Empty CNTR	US$1.20/Unit	US$2.00/U nit

5-TRUCKING (Around Trip)

	20'	40', 40'HU, 45'
-Full CNTR	US$55.00/Unit	US$66.00/Unit

6. TALLY FEE

-All import laden containers are subject to tally fee of US$1.00/Unit

Lo/Lo tariff above is inclusive of $1.00 tally fee for both import and export containers

(Revised on 04 January 2013)

7-THE GOVERNMENT INCOME TAX:

- All the cost presented above are not included VAT 100/0
- All taxes will be carried out in accordance with the law of the Royal Government of Cambodia.

***Remark:**

- Phnom Penh Autonomous Port Collect Lo/Lo CNTR One way only.
- The following rates have been offered to any shipping lines according to their quantity in TEUs provided through PPAP.

Container	Less than 3,000 TEUs	From 3,001 - 7,000 TEUs	From 7,001 - 12,000 TEUs	From 12,001 - 17,000 TEUs	From 17,001 TEUs up
Laden 20’	US$49.00	US$46.00	US$44.00	US$41.00	US$39.00
Empty 20’	US$26.00	US$24.00	US$23.00	US$22.00	US$20.00
Laden 40’	US$74.00	US$70.00	US$66.00	US$62.00	US$59.00
Empty 40’	US$37.00	US$35.00	US$33.00	US$31.00	US$29.00

IV. Truck’s Gate Fees

Revised by PPAP Notice No.759 dated December 06, 2010

Type of truck	Gate Fees (Duration)		
	1-180 minutes	181-300 minutes	301-360 minutes
1ton - 6 ton	$2.00	$3.00	$4.00
> 6 ton	$3.00	$4.00	$5.00
Container 20’	$5.00	$7.00	$8.00
Container 40’ - 45’	$8.00	$10.00	$12.00

Source: PPAP

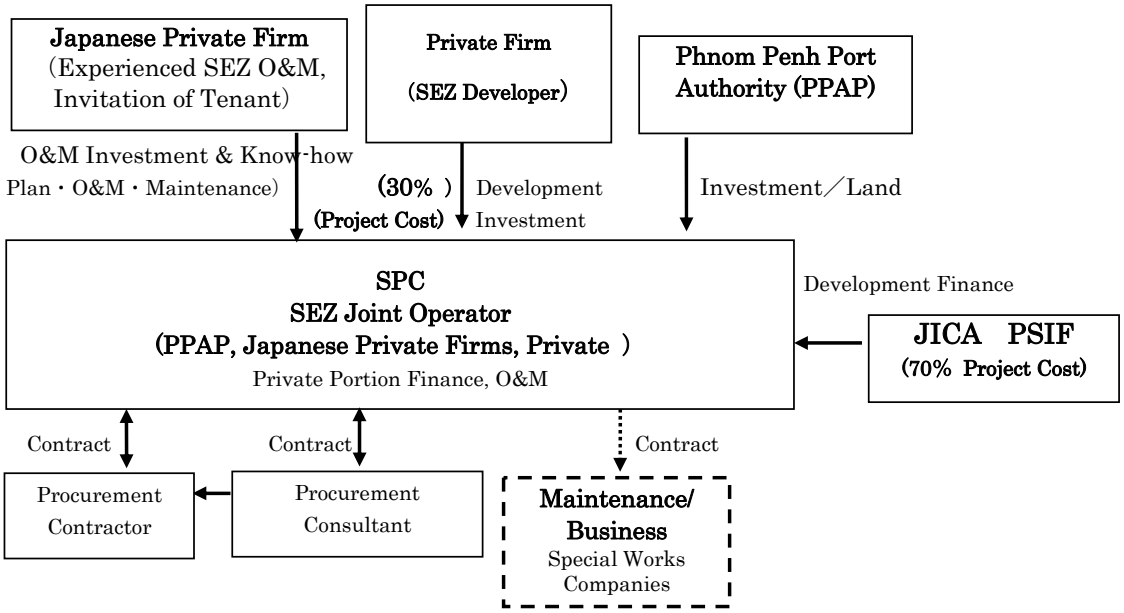
3.4.4 Implementation Organization

(1) Implementation Organization for SEZ Development

The Operation and Management body for the SEZ is set up as an SPC including PPAP and the Japanese private party. The invitation and service for the Tenants shall be mainly executed by the Japanese private company having a great deal of experience in the operation of SEZ. Depending on the financial schemes such as the PSIF+ Private Investment and the ODA Loan + Private Investment, both of the schemes will utilize the different organization procedures presented in Figure 3.4-1 and Figure 3.4-2 respectively.

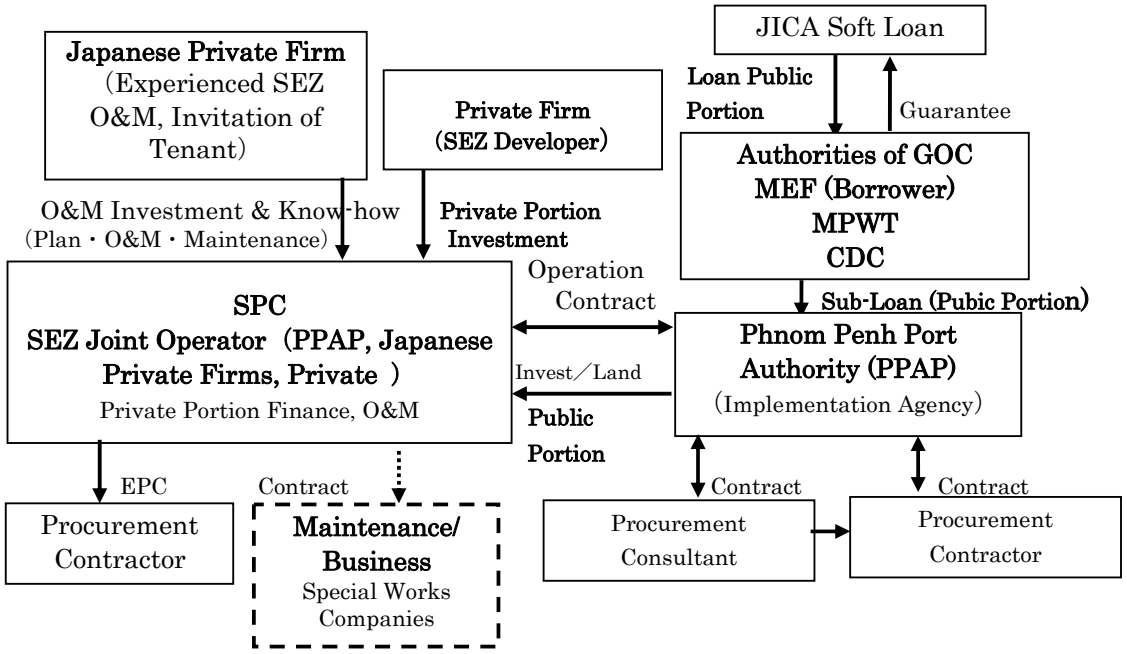
(2) Implementation Organization for Associated Port Facilities

Operation and Management for Terminal 1 Complement Project is to be executed by the PPAP. However, for the future Terminal 2 Expansion Project, it would be better for the private operator to participate in its operation in order to strengthen the port competitiveness by the effective operation and the improved services. Hence, hereunder, the organization procedure under the planned financial scheme for Terminal 2 Expansion Project is presented in Figure 3.4-3.



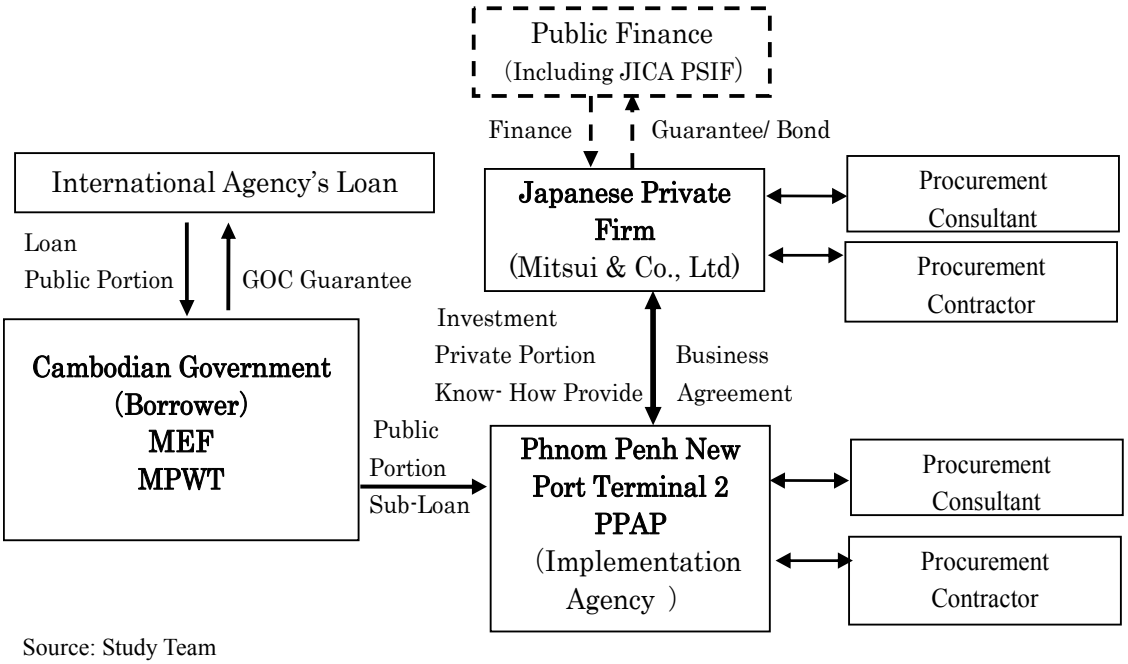
Source: Study Team

Figure 3.4-1 SEZ Organization Procedure for Related Parties (PSIF Model)



Source: Study Team

Figure 3.4-2 SEZ Organization Procedure for Related Parties (ODA Loan Separated Model)



Source: Study Team

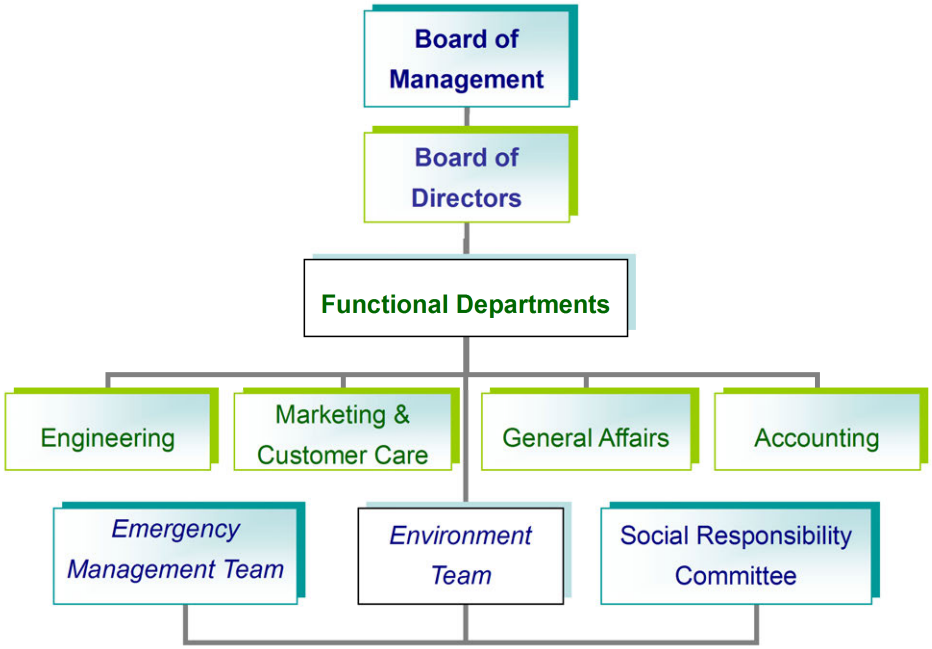
Figure 3.4-3 NCT 2 Expansion Project Organization Procedure (ODA Loan Separated Model)

3.4.5 Operation and Maintenance (O&M) Organization

(1) SEZ O&M Organization

With consideration of the scale for the development of SEZ, the operation and maintenance for the utilities of the SEZ would be outsourced to special maintenance companies for each utility. PPAP (SPC) could maintain the road and drainage for the SEZ and the Access Road. Therefore, the SPC manage the outsourced works and maintenance will be done by the specialized companies. As for the tenants' services which are the marketing, the labour recruiting support, QIP application support and logistic support, the experienced Japanese company formed of the SPC shall operate and manage the

services. In addition to the above, the logistic centre that is planned to be established in the SEZ will also enter into a concession contract with the third party logistic company. Based on the above O&M plan for the SEZ, necessary staffing arrangements and the preferable organization for the SPC are presented in Figure 3.4-4 and Table 3.4-9.



Source: Survey Team

Figure 3.4-4 Recommended Overall Organization of SPC for SEZ

Table 3.4-9 Manpower Requirements for the SPC's Operation

Department		Director		Manager		Staff		Total	
		Initial	**Final**	Initial	**Final**	Initial	**Final**	Initial	**Final**
	General Director	1	**1**					1	**1**
	Deputy General Director	1	**1**					1	**1**
1	Marketing & Customer Care	1	**2**	1	**2**	2	**6**	4	**10**
2	Accounting	1	**1**	1	**1**	3	**4**	5	**6**
3	General Affairs	1	**1**	1	**1**	3	**6**	5	**8**
4	Engineering	1	**1**	1	**1**	5	**12**	7	**14**
Total		6	**7**	4	**5**	13	**28**	21	**40**

Source: Survey Team

(2) Operation and Maintenance (O&M) for Associated Port Facilities (NCT)

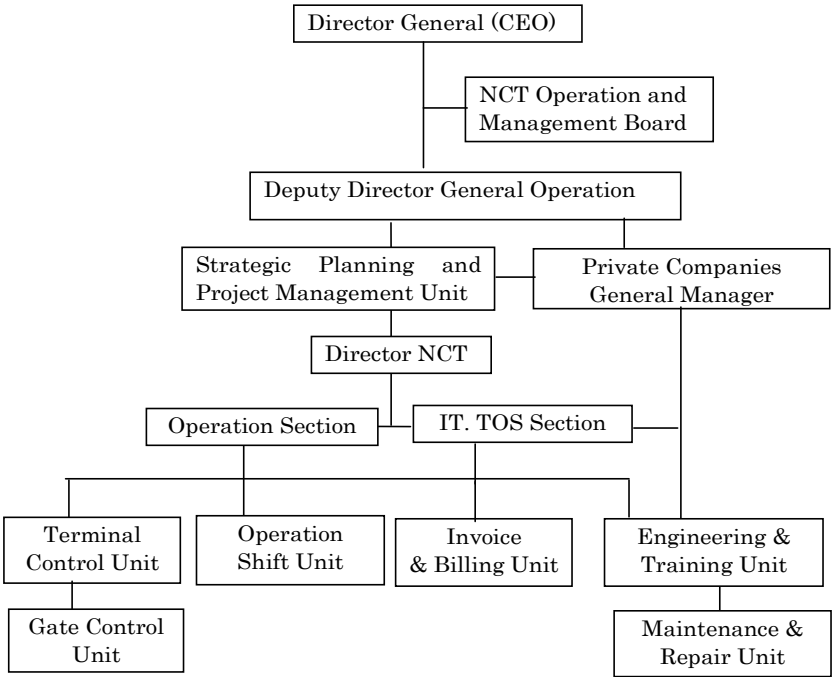
NCT1 Complement Project with Terminal 1 is basically operated by PPAP. PPAP has organized the operation and maintenance for the terminal 1. Therefore, the recommendation for the organization in the future when the Terminal 2 expands, is presented as follows.

The existing port terminal operation was explained in Chapter 2, the issues to improve for the operation are as follows.

- To establish the Project Management Unit in the Port management in order to improve the effective procurement of the equipment and materials, to develop future plans and research for users and to manage projects and financial strategy.
- To establish the instruction and data communication procedure in the Planning Section for the operational staff by using TOS (Terminal Operation Computer System).
- To communicate the information regarding containers to be entered and exited from /to the yard between the gate booth and operation section in order to avoid congestion of the gate.

- To establish the communication procedure by using TOS between the handling equipment (RTG, TCC) newly employed for the terminal operation and the operation section.
- To establish the Equipment Maintenance Unit for RTG, QGC, Reach stacker and Tractor trailer in order to secure the effective operation for the management of the spare parts and the planned repair works.
- To establish the Training Unit in order to implement a training scheme for the operational skill and the safety skill regarding the equipment and the effective staffing arrangement for the operation.
- To set new traffic rules in the terminal in order to secure the effective and safe operation to cope with the rapidly increasing number of containers.

When the terminal 2 is constructed, to cope with the above issues, the existing organization for the terminal operation is recommended to modify its practices by engaging the participation of the private operator, as shown in Figure 3.4-5. The staffing plan is recommended in Table 3.4-10



Source: Survey Team

Figure 3.4-5 Recommended Organization for NCT (Future)

Table 3.4-10 Associated Port Facilities (NCT 2 Expansion) Staffing Plan

No.	Unit /Division	Nos, of Staff Plan NCT 1	NCT 1 & NCT 2 Staffing Plan
1	Middle Management	14	14+1=15
2.	Strategic Planning & Project Management Unit	0	4+1=5
3.	Operation Section	0	5
4	IT/ TOS Section	0	2＋1＝3
5	Terminal Planning Unit	21	0
6	Terminal Control Unit	0	20
7	Operation Shift Unit	43	90
8	Invoice & Billing Unit	2	4
9	Engineering & Training Unit	0	3+1=4
10	Gate Control Unit	9	12
11	Maintenance & Repair Unit	11	15+5=20
12	Security Unit	12	18
	Total	**111**	**PPAP :187** **Private :9**

Source: Survey Team

3.5. Implementation Programme

3.5.1 Project Scheme

(1) Phnom Penh New Port SEZ Development Scheme

The economic growth of Cambodia has been produced by FDI in industries, especially by Japanese industrial firms. Also, growth of Phnom Penh New Port is dependent on the cargo demand due to the expansion of Japanese factories. However, no SEZ near the Phnom Penh area could accommodate the demand for new factory sites. Therefore, The SEZ development is aimed to accept Japanese factories as much as possible near Phnom Penh New Port in order to grow the Port and the Cambodian economy.

PPAP, as the implementation agency for the SEZ development has no experience, then the Japanese developer having experience in SEZ operation shall join PPAP and form an SPC for its operation. Therefore, after confirmation of the possibility to be funded by Japanese Firms having SEZ experience, a Japanese private company will form the SPC with PPAP.

For the development scheme, ODA assistance as PSIF will be appropriated to the SPC for a part of the development of the SEZ. The flow-chart for the implementation of the development is shown in Figure 3.5-1.

(2) Associated Port Facilities Development Scheme

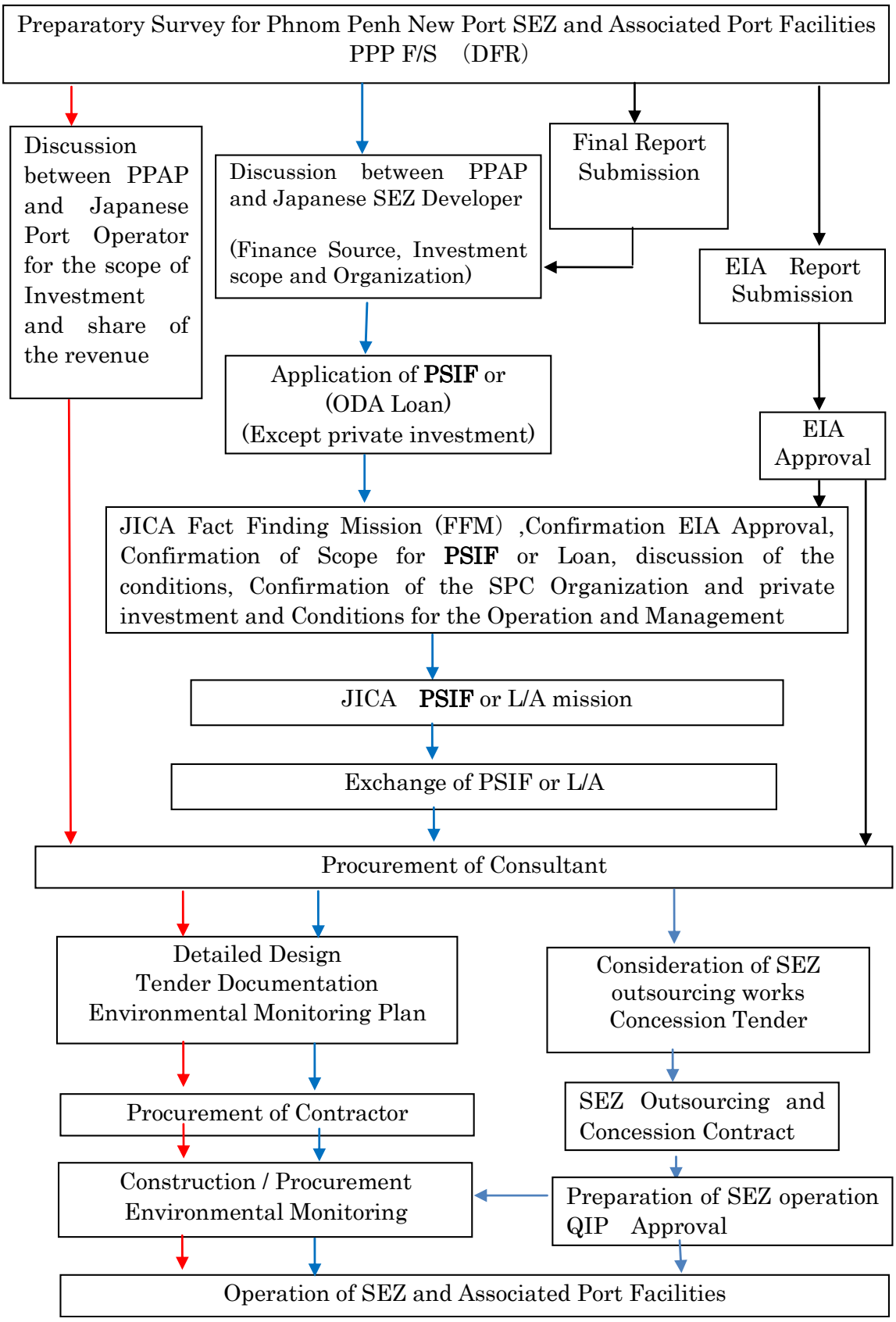
The associated port facilities plan is divided into the following two phases, ①the Terminal 1 complement project is aimed to handle the container volumes of 120,000 TEUs including the containers generated from the planned SEZ and the project is required to be completed by 2017. ② Expansion of the new port as Terminal 2 will need to be completed by 2020.

The Terminal 1 Complement consists of the expansion of the empty container yard and the entrance road, the expansion of the entrance gate, construction of the maintenance shop building and procurement of additional equipment, which is a small scale project. Therefore, the construction facilities will be done and financed by PPAP and equipment is invested and procured by the Japanese private company, as the separated model. Therefore, the implementation schedule is planned by themselves after discussion between PPAP and the private company.

The Terminal 2 expansion project is required to review the conditions and container demand of the NCT 1 by 2017. After review of the conditions, the development plan of the Terminal 2 will be revised. In line with the development plan, the civil and utility works will be funded as the public portion using an international agency loan and the equipment and buildings will be funded as the private portion by a private cooperating company, using the separated model.

3.5.2 Implementation Flow and Programme

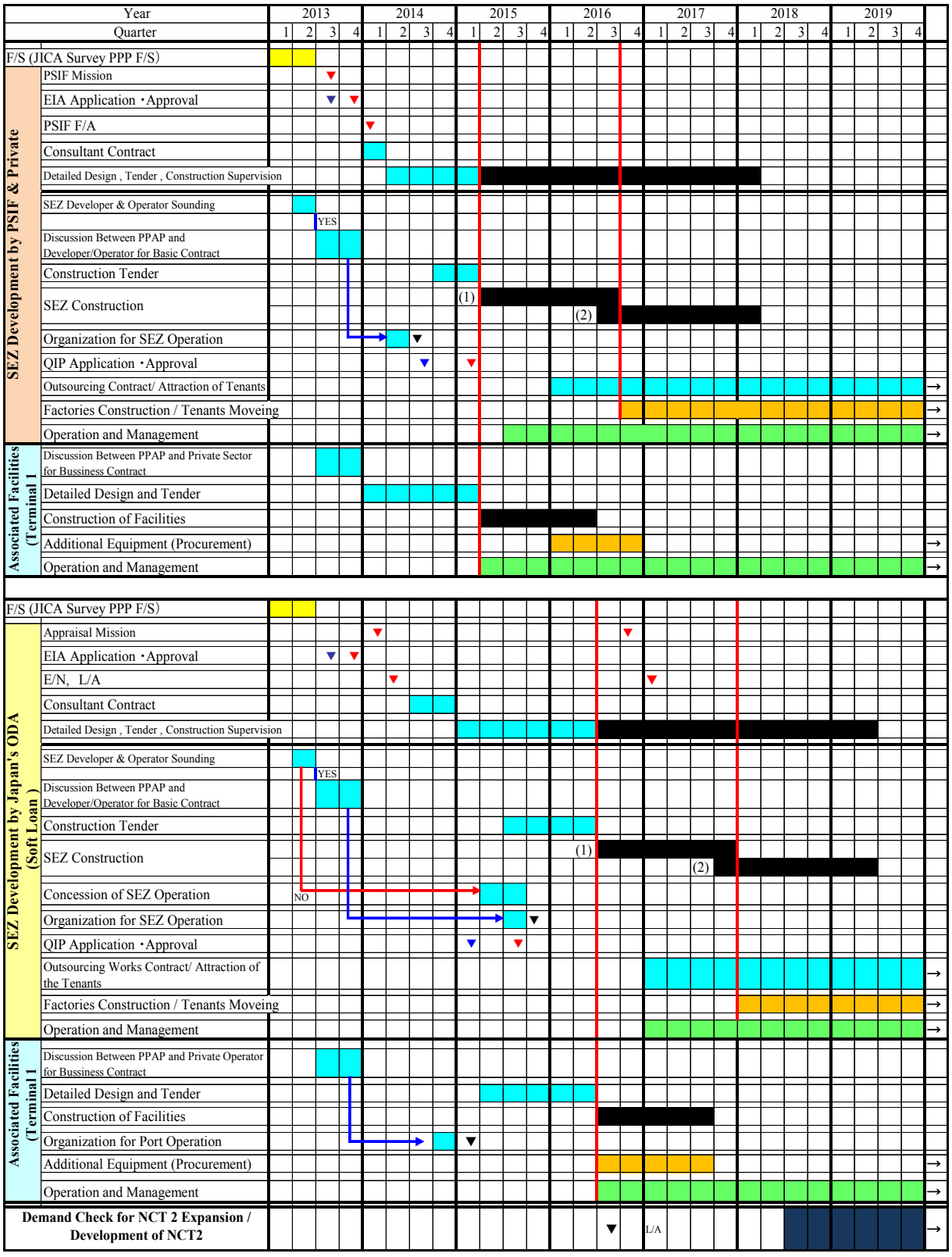
The Implementation flow for Phnom Penh New Port SEZ and Associated Port Facilities (Terminal 1 Complement) Development is shown in Figure 3.5-1. The implementation program of the two schemes, the PSIF and the ODA loan are described in Table 3.5-1.



Source: Survey Team

Figure 3.5-1 Project Implementation Flow Chart

Table 3.5-1 Project Implementation Programme



Source: Survey Team

3.6. Capital Cost Estimation

3.6.1 Outline of Cost Estimation

The Project Cost is divided into the construction cost and indirect construction cost, engineering cost and contingency. The construction cost consists of the direct construction cost, the site office expenses and the temporary work cost. The indirect cost consists of the site manager's expense, head office expense and profit, which is generally about 7%~8% of the construction cost.

The direct construction cost is calculated by the quantity of the works and unit cost of the works. The unit cost for the works was also calculated on the basis of the material cost, man-power cost and equipment cost researched in Phnom Penh.

The temporary works includes cost for mobilization and demobilization of the equipment, temporary facilities (office, accommodation of the workers, temporary shed and necessary temporary facilities) the costs of which are estimated using the market price.

In addition of the above construction cost, price escalation is applied as 2%~2.5% and physical contingency is applied as 5% of the construction cost, totally 7%~7.5 of the construction cost for the contingency.

3.6.2 Conditions of Cost Estimation

(1) Basic Unit Cost and Exchange Rate

Basic unit cost for materials, man-power and equipment is applied as of December 2012. Exchange Rate is applied as the average rate of January 2013 by Tokyo Mitsubishi UFJ Bank (average for TTS and TTB in January), 1US$= 91,14 Japanese Yen.

(2) Price Escalation and Contingency

Price escalation applied is about 2%~2.5% on the basis of the escalation rate of the construction materials in 2012. The physical contingency applied is 5% of the construction cost, which is basically applied on the JICA Loan project.

(3) Local Currency and Foreign Currency

For evaluation of the economic analysis for the project, the project cost is divided into the local currency and the foreign currency. The local currency is the cost generated in Cambodian Riel and is converted to US$ as the local portion. The foreign currency is the import goods and equipment, and foreign workers as the US$ foreign portion.

(4) Engineering Cost (DD and SV)

As for the engineering cost for the construction facilities, about 4~10% of the construction cost is applied for the port projects depending on the construction periods and details of the construction facilities.

(5) Infrastructure Construction (Civil and Buildings) and Procurement of Equipment

The project cost is separated into the Infrastructure Construction and the Procurement of Equipment. The unit cost of equipment includes the engineering fee, transportation fee and installation fee. The procurement of the equipment does not apply the escalation and the contingency on the account of the private company.

3.6.3 Cost Estimation

The project cost is estimated on the basis of the conditions mentioned in the above section. The project cost takes the public portion and the private portion into consideration, as shown in Table 3.6-1 for the United Model Case 1 (Case 2 excludes the construction cost of the Access Road from the table). The Separated Model Case 3 is presented in Table 3.6-4 (Excluding Access Road).

The Breakdown of the Project Cost for Phnom Penh New Port SEZ Project (Public portion or the PSIF and the Private portion) is presented in Table 3.6-2 for PSIF and Table 3.6-3 for the Private portion. The cost breakdown for the Separated Model Case 3 is shown in table 3.6-5.

The breakdown of the project cost for Associated Port Facilities (Terminal 1 Complement) is presented in Table 3.6-6.

Furthermore, the breakdown of the project cost for Associated Port Facilities (Terminal 2 Expansion) is presented as a reference in Table 3.6-7.

Table 3.6-1 Summary of the Capital Cost for the Project (United Model Case 1)

Category	Portion	Facilities	Development Cost	
			Million US$	Handred Million Yen
SEZ	Public	Filling & Land Reclamation	21.74	19.81
		Power Supply（Share of Sub-Station Cost）	5.00	4.56
		Boundary Fence	0.56	0.51
		SEZ Access Road Construction	6.37	5.81
		Temporary & Mobilization, General & Site Epense, Design and Supervision	3.97	3.62
		Price Escalation & Contingency	2.36	2.15
		Sub-Total of Public Portion	40.00	36.46
	Private	Road and Yard Pavement	5.17	4.71
		Utilities（Power Distribution、Water Supply、Sewerage Treatment Plant、Road Lighting、Raine Water Drainage）	4.54	4.14
		Buildings, Utility Facilities and etc.	5.60	5.10
		Temporary & Mobilization, General & Site Epense, Design and Supervision	2.53	2.31
		Price Escalation & Contingency	1.07	0.98
		Sub-Total of Private Portion	18.91	17.24
		Total Cost for SEZ Development	**58.91**	**53.69**
Associated Facilities (NCT1 Complement)				
	Public	Empty Container Yard & Entrance Road Expansion	0.89	0.81
		Entrance Gate Expansion	0.18	0.16
		Buildings (Maintenance Shop & Weighing Bridge)	1.06	0.97
		Temporary & Mobilization, General &	0.24	0.22
		Price Escalation & Contingency	0.08	0.07
		Sub-Total of Public Portion	**2.45**	**2.23**
	Private	Additional Container Handling Equipment	2.72	2.48
		Sub-Total of Private Portion	**2.72**	**2.48**
	Total Cost for Associated Facilities		**5.17**	**4.71**
Total (SEZ+Associated Facilities)	Public		42.5	38.7
	Private		21.6	19.7
	Grand Total		**64.1**	**58.4**

Source: Survey Team

Table 3.6-2 Breakdown for PSIF (Public Portion) of Project Cost for Phnom Penh Port SEZ (United Model Case 1)

No			Facilities and Equipment	Unit	Estimated Quantity	Unit Price (US$)	Construction Cost (US$)	Remarks
1	**SEZ Soil Embankment**			ha	143ha SEZ Area		(205ha PPAP Area)	Average height (+8.25m)
	1-1		Reservoir Pond Excavation around SEZ	m3	400,000	1.0	400,000	Around the SEZ 20m width x 4m depth
	1-2		Dike Embankment around SEZ	m3	400,000	0.8	320,000	Excavated material used for filling
	1-3		Reservoir Pond Excavation for Filling Material	m3	3,510,000	2.3	8,073,000	320,000 m3 will be used for Access Road
	1-4		Sand Filling into SEZ (Embankment fill by sand)	m3	3,700,000	3.5	12,950,000	Total Volume of SEZ Filling (6,900,000m3)
2	**Access Road**							
	2-1		Soil Transportation and Embankment	m3	320,000	1.5	480,000	Transportation, Grading and Compaction
	2-2		Area Clearance	m2	100,000	0.5	50,000	Clearance
	2-3		Concrete Pavement (RC pavement)	m2	1,000	58	58,000	250mm thickness RC pavement
	2-4		Asphalt Concrete Pavement (AC Pavement)	m2	47,000	50	2,350,000	100mm asphalt pavement (thickness 58cm)
	2-5		RC Pipe Culvert (RC dia: 1500mm)	m	90	210	18,900	RC Pipe
	2-6		RC Culvert (Water Way Crossing)	m	125	1,700	212,500	RC Culvert (2m height)
	2-7		Curb Concrete Stone (for Road)	m	7,200	19	136,800	150mm x250mm
	2-8		Lighting Pole	Nos	193	850	164,050	25m Intervals
	2-9		Transformer 22kv～400v	Nos	7	2,200	15,400	For road lighting
	2-10	1)	Low Voltage (400／200V) Cupper Cable 120sq	m	11,475	80	918,000	For road lighting /under ground lines
		2)	Low Voltage (400／200V) Cupper Cable 70sq	m	8,975	45	403,875	
		3)	Low Voltage (400／200V) Cupper Cable 10sq	m	6,600	8	52,800	
	2-11		Water Supply Pipe (HDPE dia : 200mm)	m	3,850	290	1,116,500	(Road No.1～SEZ entrance)
	2-12		U-type RC Drainage (Road)	m	7,200	40	288,000	RC300x300 U ditch
	2-13		Green Area (Walkway and slope protection)	m2	32,000	2	64,000	Both sides of road (2.5m width), slope 2m
	2-14		Tree Planting	Nos	450	80	36,000	15m Intervals in the both sides of road
3	**Electrical Works**							
	3-1		Sub Station (Transformer 250kv～22kv)	Unit	1	5,000,000	5,000,000	High Voltage Pylon and Sub-station 10,000m2 Construction and installation requested to EDC(Capacity 35MW)
4	**Landfscaping**							
	4-1		Fence	m	7,000	80	560,000	Block Fence (2.5m height)
Sub-total							**33,667,825**	
5	5-1		Mobilization/Demobilization	L.s	1	1.20%	404,014	1.2% of Direct Construction Cost
	5-2		Temporary works, Temporary office for Contracto	L.s	1		200,000	
	5-3		Site Expenses and General Expenses	%	6	6%	2,020,070	6% of Direct Construction Cost
	Detailed Design and Construction Supervision			%	4	4%	1,346,713	4% of Direct Construction Cost
Escalation & Physical Contingency				%	2%+5%	7.0%	2,356,748	7% of Direct Construction Cost
Grand Total Cost (US$)							**39,995,369**	

Source: Survey Team

Table 3.6-3 Breakdown for Private Portion of Project Cost for Phnom Penh Port SEZ (United Model Case 1 & Case 2)

No			Facilities and Equipment	Unit	Estimated Quantity	Unit Price (US$)	Construction Cost (US$)	Remarks
1	**SEZ Pavement**							
	1-1		Concrete Pavement (RC pavement)	m2	2,000	58	116,000	Around SEZ Main Gate
	1-2		Asphalt Concrete Pavement (AC Pavement)	m2	80,000	50	4,000,000	SEZ Road (Inner SEZ)
	1-3		Crushed Rock Pavement	m2	9,000	8	72,000	Future Expansion Road
	1-4		Asphalt Concrete Pavement for Common Area	m2	17,860	37	660,820	For small and medium size car
	1-5		Curb Concrete Stone (for Road)	m	17,000	19	323,000	150mm x250mm
2	**Storm Water Drainage and Sewerage System**							
	2-1		V-ditch Drainage (1m width x0.5~ 1m depth)	m	11,850	50	592,500	Both sides of the SEZ road
	2-2		V-ditch Drainage (1.5m width x1~1.5m depth)	m	850	90	76,500	from center area to outlet
	2-3		RC Pipe Culvert (RC dia: 800mm)	m	1,500	140	210,000	Road Crossing area, entrance of Tenants
	2-4		RC Pipe Culvert (RC dia: 1000mm)	m	300	180	54,000	Road Crossing area, entrance of Tenants
	2-5		RC Pipe Culvert (RC dia: 1200mm)	m	50	210	10,500	from center area to outlet
	2-6		Sewer Pipe Culvert (RC dia: 300mm)	m	8,800	62	545,600	Along the Road for Tenants
	2-7		Sewer Pipe Culvert (RC dia: 400mm)	m	1,100	68	74,800	Final Connection to the Treatment Plant
3	**Electrical Power Cable**							
	3-1		High Voltage (22,000V)Aluminum Power Cabl	m	7,140	8	57,120	Inner SEZ main power line
	3-2		Low Voltage (400／200V)Cupper Cable	m	11,190	8	89,520	For road lighting /under ground lines
	3-3		Road Lighting Pole and Light	Nos	362	850	307,700	One side of Road (20m intervals)
	3-4		Power Cable Pole	Nos	300	900	270,000	One side of Road (20m intervals)
	3-6	1)	Transformer 22kv～400v	Unit	1	120,000	120,000	Transformer for Administration Building
		2)	Transformer 22kv～400v	Unit	4	13,000	52,000	Transformer for road lighting and common facilities
4	**Water Supply Pipe**							
	4-1		HDPE Pipe (dia : 200mm)	m	6,200	295	1,829,000	One side of Road (main pipeline)
	4-2		HDPE Pipe(dia :100mm)	m	2,000	100	200,000	Road Crossing area, entrance of Tenants
	4-3		Hydrant (100～65mm 2 outlets)	Nos	20	1000	20,000	Installation 200m intervals
	4-4		Water Distribution Pump	Unit	3	12,000	36,000	Pumping up to the elevated tank
5	**Buildings and Utility Facilities**							
	5-1		Gate and Checking Booth	m2	300	450	135,000	SEZ main gate
	5-2		SEZ Administration Office	m2	2,000	750	1,500,000	SEZ Office(Administration Office, Customs, Bank, Service Center、Seminar Room and Tenant Office)
	5-3		SEZ Maintenance Office and Shed	m2	300	550	165,000	
	5-4		Power Supply Maintenance and Generator House	m2	300	700	210,000	Generator House (Distribution Panels)
	5-5		Emergency Generator	KVA	1,000	550	550,000	Emergency Generator
	5-6		Water Reservoir Tank	ton	2,000	170	340,000	
	5-7		Water Elevated Tank	ton	200	170	34,000	
	5-8		Sewerage Treatment Plant	ton	2,000	1125	2,250,000	Oxidation Ditch System
6	**Land Scraping**							
	6-1		Green Area (buffer zone, parks, and common area	m2	65,000	2	130,000	Green installation
	6-2		Tree Planting	Nos	1,800	80	144,000	Palm and Acacia
	6-3		Protection around the pond	m2	5,500	25	137,500	Stone protection
Sub-total							**15,312,560**	
7	7-1		Mobilization/Demobilization	L.s	1	1.20%	183,751	1.2% of Direct Construction Cost
	7-2		Temporary works, Temporary office for Contracto	L.s	1		200,000	
	7-3		Site Expenses and General Expenses	%	7	7%	1,071,879	7% of Direct Construction Cost
8	**Detailed Design and Construction Supervision**			%	7	7%	1,071,879	7% of Direct Construction Cost
Escalation & Physical Contingency				%	2%+5%	7.0%	1,071,879	7% of Direct Construction Cost
Grand Total Cost (US$)							**18,911,948**	

Source: Survey Team

Table 3.6-4 Summary of the Capital Cost for Project (Separate Model Case 3)

Category	Portion	Facilities	Development Cost	
			Million US$	Handred Million Yen
SEZ	Public	Filling & Land Reclamation	21.74	19.81
		Temporary & Mobilization, General & Site Epense, Design and Supervision	2.70	2.46
		Price Escalation & Contingency	1.52	1.39
		Sub-Total of Public Portion	25.96	23.66
	Private	Road and Yard Pavement	5.17	4.71
		Utilities（Power Distribution、Water Supply、Sewerage Treatment Plant、Road Lighting、Raine Water Drainage）	4.54	4.14
		Power Supply（Share of Sub-Station Cost）	5.00	4.56
		Boundary Fence	5.60	5.10
		Buildings, Utility Facilities and etc.	0.56	0.51
		Temporary & Mobilization, General & Site Epense, Design and Supervision	4.04	3.68
		Price Escalation & Contingency	1.67	1.52
		Sub-Total of Private Portion	26.58	24.23
		Total Cost for SEZ Development	**52.54**	**47.89**
Associated Facilities (NCT1 Complement)				
	Public	Empty Container Yard & Entrance Road Expansion	0.89	0.81
		Entrance Gate Expansion	0.18	0.16
		Buildings (Maintenance Shop & Weighing Bridge)	1.06	0.97
		Temporary & Mobilization, General &	0.24	0.22
		Price Escalation & Contingency	0.08	0.07
		Sub-Total of Public Portion	**2.45**	**2.23**
	Private	Additional Container Handling Equipment	2.72	2.48
		Sub-Total of Private Portion	**2.72**	**2.48**
	Total Cost for Associated Facilities		**5.17**	**4.71**
Total (SEZ+Associated Facilities)	Public		28.4	25.9
	Private		29.3	26.7
	Grand Total		**57.7**	**52.6**

Exchange Rate: JP Yen 91．14/US$

Source: Survey Team

Table 3.6-5 Breakdown of Project Cost for Phnom Penh Port SEZ (Separated Model Case 3)

No			Facilities and Equipment	Unit	Estimated Quantity	Unit Price (US$)	Construction Cost (US$)	Remarks
1	**SEZ Soil Embankment**			ha	143ha SEZ Area		(205ha PPAP Area)	
	1-1		Reservoir Pond Excavation around SEZ	m3	400,000	1.0	400,000	Around the SEZ 20m width x 4m depth
	1-2		Dike Embankment around SEZ	m3	400,000	0.8	320,000	Excavated material used for filling
	1-3		Reservoir Pond Excavation for Filling Material	m3	3,510,000	2.3	8,073,000	320,000 m3 will be used for Access Road
	1-4		Sand Filling into SEZ (Embankment fill by sand)	m3	3,700,000	3.5	12,950,000	Total Volume of SEZ Filling (6,900,000m3)
5	Sub-total						**21,743,000**	
	5-1		Mobilization/Demobilization	L.s	1	1	300,000	
	5-2		Temporary works, Temporary office for Contractor	L.s	1	1	78,300	
	5-3		Site Expenses and General Expenses	%	6	6%	1,195,865	6% of Direct Construction Cost
Detailed Design and Construction Supervision				%	4	4%	1,124,409	4% of Direct Construction Cost
Escalation & Physical Contingency				%	2%+5%	7.0%	1,522,010	7% of Direct Construction Cost
Grand Total Cost (US$) for Public Portion							**25,963,584**	

No			Facilities and Equipment	Unit	Estimated Quantity	Unit Price (US$)	Construction Cost (US$)	Remarks
1	**SEZ Pavement**							
	1-1		Concrete Pavement (RC pavement)	m2	2,000	58	116,000	Around SEZ Main Gate
	1-2		Asphalt Concrete Pavement (AC Pavement)	m2	80,000	50	4,000,000	SEZ Road (Inner SEZ)
	1-3		Crushed Rock Pavement	m2	9,000	8	72,000	Future Expansion Road
	1-4		Asphalt Concrete Pavement for Common Area	m2	17,860	37	660,820	For small and medium size car
	1-5		Curb Concrete Stone (for Road)	m	17,000	19	323,000	150mm x250mm
2	**Storm Water Drainage and Sewerage System**							
	2-1		V-ditch Drainage (1m width x0.5~ 1m depth)	m	11,850	50	592,500	Both sides of the SEZ road
	2-2		V-ditch Drainage (1.5m width x1~1.5m depth)	m	850	90	76,500	from center area to outlet
	2-3		RC Pipe Culvert (RC dia: 800mm)	m	1,500	140	210,000	Road Crossing area, entrance of Tenants
	2-4		RC Pipe Culvert (RC dia: 1000mm)	m	300	180	54,000	Road Crossing area, entrance of Tenants
	2-5		RC Pipe Culvert (RC dia: 1200mm)	m	50	210	10,500	from center area to outlet
	2-6		Sewer Pipe Culvert (RC dia: 300mm)	m	8,800	62	545,600	Along the Road for Tenants
	2-7		Sewer Pipe Culvert (RC dia: 400mm)	m	1,100	68	74,800	Final Connection to the Treatment Plant
3	**Electrical Power Cable**							
	3-1		High Voltage (22,000V)Aluminum Power Cable	m	7,140	8	57,120	Inner SEZ main power line
	3-2		Low Voltage (400/200V)Cupper Cable	m	11,190	8	89,520	For road lighting /under ground lines
	3-3		Road Lighting Pole and Light	Nos	362	850	307,700	One side of Road (20m intervals)
	3-4		Power Cable Pole	Nos	300	900	270,000	One side of Road (20m intervals)
	3-5		Sub Station (Transformer 250kv~22kv)	Unit	1	5,000,000	5,000,000	High Voltage Pylon and Sub-station 10,000m2 Construction and installation requested to EDC(Capacity 35MW)
	3-6	1)	Transformer 22kv~400v	Unit	1	120,000	120,000	Transformer for Administration Building
		2)	Transformer 22kv~400v	Unit	4	13,000	52,000	Transformer for road lighting and common facilities
4	**Water Supply Pipe**							
	4-1		HDPE Pipe (dia : 200mm)	m	6,200	295	1,829,000	One side of Road (main pipeline)
	4-2		HDPE Pipe(dia :100mm)	m	2,000	100	200,000	Road Crossing area, entrance of Tenants
	4-3		Hydrant (100~65mm 2 outlets)	Nos	20	1000	20,000	Installation 200m intervals
	4-4		Water Distribution Pump	Unit	3	12,000	36,000	Pumping up to the elevated tank
5	**Buildings and Utility Facilities**							
	5-1		Gate and Checking Booth	m2	300	450	135,000	SEZ main gate
	5-2		SEZ Administration Office	m2	2,000	750	1,500,000	SEZ Office(Administration Office, Customs, Bank, Service Center、Seminar Room and Tenant Office)
	5-3		SEZ Maintenance Office and Shed	m2	300	550	165,000	
	5-4		Power Supply Maintenance and Generator House	m2	300	700	210,000	Generator House (Distribution Panels)
	5-5		Emergency Generator	KVA	1,000	550	550,000	Emergency Generator
	5-6		Water Reservoir Tank	ton	2,000	170	340,000	
	5-7		Water Elevated Tank	ton	200	170	34,000	
	5-8		Sewerage Treatment Plant	ton	2,000	1125	2,250,000	Oxidation Ditch System
6	**Land Scraping**							
	6-1		Green Area (buffer zone, parks, and common area)	m2	65,000	2	130,000	Green installation
	6-2		Fence	m	7,000	80	560,000	Block Fence (2.5m height)
	6-2		Tree Planting	Nos	1,800	80	144,000	Palm and Acacia
	6-3		Protection around the pond	m2	5,500	25	137,500	Stone protection
	Sub-Total						**20,872,560**	
7	7-1		Mobilization/Demobilization	式	1		313,000	
	7-2		Temporary works, Temporary office for Contractor	式	1		280,000	
	7-3		Site Expenses and General Expenses	%	8.5	8.5%	1,774,168	8.5% of Direct Construction Cost
8	**Detailed Design and Construction Supervision**			%	8	8%	1,669,805	8% of Direct Construction Cost
Escalation & Physical Contingency				%	3%+5%	8.0%	1,669,805	8% of Direct Construction Cost
Grand Total Cost (US$) for Private Portion							**26,579,337**	

Source: Survey Team

Table 3.6-6 Breakdown of the Cost for Associated Port Facilities (Terminal 1 Complement)

No.	Facilities and Equipment	Tentative Estimated Quantity	unit	Remarks	Unit rate(US$)	Construction Cost (US$)
PPAP Portion						
1	Container Yard/ Road Expansion					
1.1	Empty container yard pavement	8,000	m2	Yard Pavement	60	480,000
1.2	Entrance Road Expansion	3,000	m2	Filling (1.5m), 15m width x 200m	70	210,000
1.3	Yard Fence / Landscaping	565	m	Chain link fence height 3.0m	260	146,900
1.4	Yard Lighting Pole , Lights+CCTV (10m height	15	nos		1,300	19,500
1.5	Boundary lights	20	nos		500	10,000
1.6	Low Voltage Cable (600 V) 50 sq	600	m	Lights , others	40	24,000
Sub-total						**890,400**
2	Buldings					
2.1	Entrance gate	300	m2		600	180,000
2.2	Maintenance shop	1,200	m2	40m x 30m RC	815	978,000
2.3	Weiging Bridge	2	unit	60 tons (including base & house)	40000	80,000
3	Temporary, Mobi/Demobilazation	1	L.s			50,000
4	General and Site Expenses	1	L.s		8%	85,632
5	Escalation and Contingency	1	L.s		7.50%	80,280
6	Enginieering Cost	1	L.s		10%	107,040
Total for PPAP Portion						**2,451,352**
Private Portion						
7	Additional Container Handling Equipment					
7.1	RTG (Transfer Crane)	1	unit		1,820,000	1,820,000
7.2	Reach Stacker	1	unit		450,000	450,000
7.3	Tractor and Trailer	3	unit		150,000	450,000
Sub-total						**2,720,000**
Total for Private Portion						**2,720,000**
Associated Port Facilities (Terminal 1 Complement) Total						**5,171,352**

Source: Survey Team

Table 3.6-7 Breakdown of the Project Cost for Associated Port Facilities (Terminal 2 Expansion)

No.		Facilities and Equipment	Tentative Estimated Quantity	unit	Remarks	Unit rate(US$)	Construction Cost(US$)
Public Portion							
1		**Expansion of Quay wall (Jetty)**					
	1.1	Slope Excavation under the Quay	350	lm	Grub Bucket dredger (6m3)	3.5/m3	318,500
	1.2	Slope Protection	350	lm	Stone Protection (1m thickness)	30/m2	720,000
	1.3	Construction of Quay wall	350	lm	375m length x22 width +Access bridge		
	1.3.1	Steel Pipe Piling Works	202	Nos	Piling Barge φ700 x 16t, L=35 m、6 blocks	19,600	3,959,200
			516	Nos	Piling barge φ600 x 14t, L=35 m、6 blocks	15,800	8,152,800
			98	Nos	Piling Barge φ600 x 16t, L=35 m、(Access	17,200	1,685,600
	1.3.2	Quay wall (Jetty) Concrete Works	9,650	m3	RC Slab、RC Beam, Pile Caps （Beam : Pre-cast , using concrete pumping car ）	370	3,570,500
	1.3.3	Fenders	102	Nos	700H	10,000	1,020,000
	1.3.4	Bollards	70	Nos	50ton	3,000	210,000
	1.3.5	Crane rails	700	m	73kg	110	77,000
	1.3.4	Water supply piping , hydrant	500	m	150 φSteel pipe 、Water supply : 3 position	100	50,000
2		**Land Facilities**					
	2.1	Yard pavement（Stacking Yard and Road）	61,000	m2	Concrete Pavement (RC Pavement)	59	3,599,000
	2.2	RTG Traveling Lanes	5,550	m2	PC Lanes (200mm thickness, 1.5m width)	80	444,000
	2.3	Yard Drainage (U-type 500mm x 800mm)	1,900	m	Collection water in the Yard	310	589,000
	2.4	Yard Drainage RC pipe dia＝1000mm	300	m	Outlet to the River （Manhole 6 nos）	178	53,400
	2.5	Yard Fence and Green	550	m	Chain link fence height 3.0m	140	77,000
	2.6	Water and Fire Fighting Pipeline (150mm)	2,000	m	Water Supply Pipeline/ Hydrant : 6 nos	100	200,000
	2.7	1)Yard Lighting Pole , Lights＋CCTV (10m height	17	Nos		1,300	22,100
		2) Yard Lighting Pole , Lights+CCTV (18 m height,	6	Nos		7,500	45,000
		3) Yard Lighting Pole , Lights (height , 1250W)	4	Nos		78,000	312,000
	2.8	Boundary lights	25	Nos		500	12,500
	2.9	Transformer（22kv～6000v, 3000kw）	1	unit	QGC Power	120,000	120,000
	2.10	1) Transformer (6000v～400v 700kw)	1	unit	Yard Light and Reefer panel）	86,000	86,000
		2) Transformer (6000v～400v 700kw)	1	unit	Lighting , others	50,000	50,000
	2.11	1) High Voltage Cable(22 KV)	110	m	Road no.1 ~ Sub-station	80	8,800
		2)High Voltage Cable (11KV) 6000 v	1,230	m	Distribution Cable for QGC	60	73,800
	2.12	1) Low Voltage Cable (600 V) 50 sq	1,350	m		40	54,000
		2) Low Voltage Cable (600 V) 70 sq	520	m		54	28,080
		4) Low Voltage Cable (600 V) 120 sq	840	m		80	67,200
Sub-total							25,605,480
	3-1	Temporary, Mobi/Demobilazation	1	L.s			500,000
	3-2	General and Site Expenses	1	L.s		7.0%	1,792,384
	3-3	Escalation and Contingency	1	L.s		7.50%	1,920,411
	3-4	Enginieering Cost	1	L.s		7%	1,792,384
							31,610,658
Private Portion							
	4	Buildings					
	4.1	Power Sub-Station	80	m2	Sub-Station	500	40,000
	4.2	Emergency Generator House	50	m2	for Generator 1500 KVA	500	25,000
	4.3	Fuel Tank	60	m3	Steel Tank ＋Oil dispenser	800	48,000
	4.4	Design and Construction Supervision	1	L.s	Detailed Design / SV		297,000
	Sub-total						**410,000**
5		**Container Handling Equipment**					
	5.1	QGC (Quay Gantry Crane)	3	unit		2,500,000	7,500,000
	5.2	RTG （Transfer Crane）	6	unit		1,800,000	10,800,000
	5.3	Tractor and Trailer	15	unit		150,000	2,250,000
	5.4	Top Lifter	2	unit	Empty Container	277,000	554,000
	5.5	Generator	1	Unit	1500 KVA	700,000	700,000
	5.6	Spare parts	1	L.s			128,000
	Sub-total						21,932,000
	Equipment & Buildings (Private Portion) Total						22,342,000
	Terminal 2 Expansion Project（Public + Private）Grand Total						**53,952,658**

Source: Survey Team

3.7. Economic and Financial Analysis

3.7.1 Financial Situation of PPAP

The profit and loss statement of PPAP shows that operating income of 2011 was US 8.27 million, operating expense was US 5.60 million, and operating revenue was US 2.67 million dollars. Profit after interest and tax was US 1.58 million dollars in 2011. Operating revenues, ordinary revenues, net profit and other financial indicators from 2006 to 2011 are summarized in Table 3.7-1.

Operating income of PPAP does not include 80% of crane charges, which are paid to a private operator as profit share. Crane charges, i.e. USD 16/20F container and USD 25/40F container, are collected by PPAP and 20% of the charges are included in the operating income, but 80% is shared with private operators and not included in the profit and loss statement. Operating expenses of cranes are borne by the private operators.

Table 3.7-1 Profit and Loss of PPAP (2006-2011)

Year		2006	2007	2008	2009	2010	2011
I	Operating Income	4,587	5,515	5,276	5,181	6,587	8,266
II	Operating Expense	3,000	3,876	4,248	4,190	4,534	5,597
III	Operating Revenue (I-II)	1,587	1,639	1,027	991	2,053	2,668
IV	Financial Income	25	17	5	2	1	2
V	Financial Expense	0	0	0	2	33	151
VI	Financial Revenue (IV-V)	25	17	5	993	-33	-149
VII	Ordinary Revenue (III+VI)	1,612	1,656	1,032	993	2,020	2,520
VIII	Extraordinary Income	3	673	423	346	6	38
IX	Extraordinary Expense	191	782	687	406	485	576
X	Extraordinary Profit (VIII-IX)	-189	-109	-264	-60	-479	-538
XI	Profit before Tax (VII+X)	1,423	1,547	768	933	1,541	1,982
XII	Income Tax	285	309	154	187	308	396
XIII	Net Profit (XI-XII)	1,139	1,238	615	747	1,233	1,585

Source: Survey Team

3.7.2 Financial Situation of PPAP

PPAP received Chinese preferential Buyer's Credit and developed the new container terminal No.1 beginning in 2010 and completed in August 2012. The terminal entered into operation in January 2013 and the inauguration ceremony was held on 22 January 2013. Most of the container cargo has been shifted to the new terminal as of January 2013.

Terms of the Chinese buyer's credit are as follows:

Amount of credit : USD28.22 million
Interest : 2%
Currency : US Dollar
Credit period : 2010-2040
Grace period : 8 years

Credit from China was used for the development of infrastructure of the NCT No.1 and the cargo handling equipment was provided by PPAP, KAMSAB and a private company. KAMSAB provided and operates two quay cranes and a private company operates one, and they will receive some share from the crane charges. Investment in the equipment is as follows:

Investment in equipment : USD13.27 million
Quay cranes (Three TCC) : two by KAMSAB; one by a private company
Yard cranes and other equipment : PPAP

3.7.3 Financial Analysis of SEZ Development Project

Phnom Penh New Port SEZ has a plan to develop several hundred hectares and the first package of the development is proposed to include an area of 143 ha, in which 106 ha is for long term lease to manufacturers, 3.0 ha for apartments and shops, 2.7 ha for a logistic centre and the remaining for service facilities. Details of the planned areas are summarized in Table 3.7-2.

Table 3.7-2 Land-use Planning of Phnom Penh New Port SEZ

Category	Area (ha)
Total Development Area (SEZ & Supporting Area)	143
Supporting Area	3.0
Details of Supporting Area	
Housing Quarters	1.2
Schools & Hospitals	0.6
Shops	1.2
SEZ Area	140.0
Details of SEZ Area	
Long-term Lease Area for Manufacturing	106.3
Logistics Area	2.7
Road	10.6
SEZ Management Area	0.9
SEZ Utility Area	3.0
Parks	7.4
Other public space	9.1

Source: Survey Team

(1) Construction Cost

Total Cost for SEZ Development : USD 58.9 million (see Table 3.7-3)

Construction Period : 2014-2018

Table 3.7-3 Breakdowns of SEZ Construction Cost

(1,000 USD)

Capital Cost	Total
Land Acquisition (221.2 ha, Local Portion)	5,455
Construction Cost	40,454
Landfill	21,848
Access Road Development	6,309
Yard Pavement, Drainage, Water Supply and Utilities	30,753
Engineering Cost	2,150
Sub-total (Construction Cost)	58,910
Operation and Management Cost	2014-2054 Total
Administration Staff Cost	7,647
Infrastructure Maintenance Cost	11,532
Power Cost	14,985
Office Expenses	2,130
Sub-total (Operation and Management Cost)	36,295

Source: Survey Team

(2) Operating Incomes

- Long-term lease contracts with SEZ tenants : First offer (2016), First construction of a factory (2017), First operation of a tenant factory (2018)
- Occupation ratio: 10% (2017), 30% (2018), 50% (2019), 80% (2020) 100% (2021)
- Price of long-term lease of SEZ (50 year lease contract) : USD 54/m2 (2017), USD 57/m2 (2018), USD 59/m2 (2019), USD 62/m (2020 and later)
- Incomes from logistic centre
- Incomes from Operation (see Table 3.7-4 and Appendix- F-a-3)

Table 3.7-4 Incomes from SEZ Lease and Operation (2017-2054)

(1,000 USD)

Revenues from SEZ Land Lease	63,555
Revenue from Other Land Lease	15,495
Revenues from Office Lease	1,296
Revenue from Operation	67,025
Total	147,171

Source: Survey Team

(3) Funds for Construction

1) Case 1: SPC Develops All Components of the SEZ Project

A special purpose company is expected to be established for the SEZ and to implement the project. Initial capital for the SPC will be USD 500,000 and the land of 221 ha for SEZ. It is expected that 30% of the construction cost of SEZ will be funded by SPC's own capital, and 70% will be funded by JICA's private sector investment finance (PSIF). Conditions of PSIF may be as follows: Interest 4.0%, Loan period 20 years, Grace period 10 years). However, these conditions are not confirmed and may change due to each loan agreement.

As the SPC will receive payments from SEZ tenants for 50 year lease contracts at once when it inters into the contracts for the long-term leases, it is deemed that SEZ lease contracts will be completed during the 5 years from 2017 to 2021 and the SPC will repay the principal during the period of 2020-2023. If the SPC repays the principal in accordance with the conditions mentioned in the above paragraph, the SPC shall have invested their funds at an interest of 5% or more, which is 20% higher than the interest of the PSIF loan in consideration of the income tax to pay.

2) Case 2: Public Sector Develops Access Road, SPC Develops the Other Components

The access road is expected to be developed by the public sector and is excluded from the SEZ project. The other components of the SEZ will be developed by SPC.

3) Case 3: Public Sector Develops Access Road and Land Reclamation, SPC Develops the Other Components

The access road is expected to be developed by the public sector and is excluded from the SEZ project as well as the case 2. The reclamation work in the SEZ area is expected to be implemented by PPAP utilizing ODA loans. Terms and conditions of ODA loans and sub loans are assumed to be as follows: Interest rate 2.5% through MEF, repayment period 40 years including grace period 10 years.

SPC is expected to develop the SEZ superstructure including pavement and utility facilities, and pay a certain proportion of income to PPAP to enable them to cover the cost of land reclamation.

(4) Analysis of Financial Performance

Taking into account private investment in SEZ project, Project's Internal Rate of Return (PIRR) and Equity Internal Rate of Return (EqIRR) are calculated based on investment, estimated capital of

SPC, and detailed cash flow shown in Appendix F-a-1, F-a-2 and F-a-3. Project period is supposed to be 20 years in view of loans from PSIF or other financial sources. Some parts of the land for the project area were already acquired, some parts are under negotiation and the others will be acquired in the near future, this calculation supposed that SEZ land was acquired in 2012 with compensation of USD 3.86 million and the area of access road was acquired in 2013 with compensation of USD 1.6 million.

Supposing a case that the SEZ project is implemented by public sector, FIRR is calculated based on investment, revenues, and cost of management and operation. The project period is supposed to be 40 years from 2014-2054.

1) Case 1: SPC Develops All Components of the SEZ Project

In case that SPC develops access road, land reclamation and other all components of SEZ and operates SEZ, PIRR, EqIRR and FIRR are estimated as shown in Table 3.7-5 and details of the calculations are shown in Appendix F-a-5. PIRR is calculated at 6.6%, and it is estimated at 9.4% if SPC could save the investment at 90%, and at 9.7% if SPC could save both of the investment and maintenance/operation cost at 90 %.

EqIRR is calculated at 10.3% and it is also estimated at 15.7% if SPC could save the investment at 90%, and at 16.1% if SPC could save both of the investment and maintenance/operation cost at 90%.

The estimated FIRR is 7.2%, and its sensitivity is checked by adding 10% on the cost and reducing the revenue by 10%. If the construction cost and operation cost increase by 10%, FIRR is 5.2%. If the revenue is reduced by 10%, FIRR is 4.8%. If both took place together, FIRR is estimated at 3.0%.

Table 3.7-5 PIRR, EqIRR and FIRR of SEZ Development Project (Case 1)

PIRR		
Basic Case	Investment saved at 90%	Investment, Maintenance & Operation Cost saved at 90%
6.6%	9.4%	9.7%

EqIRR		
Basic Case	Investment saved at 90%	Investment, Maintenance & Operation Cost saved at 90%
10.3%	15.7%	16.1%

FIRR			
Ordinary Case	Cost up by 10%	Revenue down by 10%	Cost up by 10%, Revenue down by 10%
7.2%	5.2%	4.8%	3.0%

Source: Survey Team

2) Case 2: Public Sector Develops Access Road, SPC Develops the Other Components

In case that public sector develops access road in the capacity of public road investment and SPC develops all other components of SEZ project including land reclamation, the estimated PIRR, EqIRR and FIRR are shown in Table 3.7-6. A return rate of the project considerably increases and PIRR is calculated at 10.6%, and it is estimated at 13.6% if SPC could save the investment at 90%, and at 13.8% if SPC could save both of the investment and maintenance/operation cost at 90 %.

EqIRR increases to 19.1% in this case, and it is estimated at 23.3% if SPC could save the investment at 90%, and at 23.6% if SPC could save both of the investment and maintenance/operation cost at 90%.

FIRR is calculated at 10.3%, and its sensitivity is checked by adding 10% on the cost and reducing the revenue by 10%. If the construction cost and operation cost increase by 10%, FIRR is 8.0%. If the revenue is reduced by 10%, FIRR is 7.60%. If both took place together, FIRR is estimated at 5.5% (Table 3.7-6, Details are shown in Appendix F-a-5).

SPC is supposed to maintain the access road, but repair work of every 25 years shall be responsibility of public sector. Investment in access road and SEZ is estimated as follows:

Construction of access road: USD 6.3 million, Land acquisition: USD 1.6 million
Development of SEZ: USD 52.6 million, Land acquisition: USD 3.85 million

Table 3.7-6 PIRR, EqIRR and FIRR of SEZ Development Project (Case 2)

PIRR		
Basic Case	Investment saved at 90%	Investment, Maintenance & Operation Cost saved at 90%
10.6%	13.6%	13.8%

EqIRR		
Basic Case	Investment saved at 90%	Investment, Maintenance & Operation Cost saved at 90%
19.1%	23.3%	23.6%

FIRR			
Ordinary Case	Cost up by 10%	Revenue down by 10%	Cost up by 10%, Revenue down by 10%
10.3%	8.0%	7.6%	5.5%

Source: Survey Team

3) Case 3: Public Sector Develops Access Road and Land Reclamation, SPC Develops the Other Components

In case that the public sector develops the access road in its own capacity and PPAP reclaims the land for the SEZ area, SPC develops the superstructure of SEZ including pavement and utility facilities. PPAP is expected to receive 57.8% of the income from the long-term land lease contracts and the same percentage of the annual income from short-term land leases. SPC receives 42.2 % of the income from the land leases and the operating income from SEZ utilities. Maintenance of SEZ superstructure is the responsibility of SPC.

While the actual proportion of the investment in SEZ is 52.8% for PPAP and 47.2% for SPC, it is expected that PPAP receives 5% more from land lease incomes in consideration of preparatory work for SEZ development and taking the initial risks of investment in SEZ. SPC is expected to make a profit from operation of SEZ utilities and services to tenants. In spite of these assumptions, the actual share of income shall be decided by contract between PPAP and SPC. Investment of PPAP and SPC is estimated as follows:

Land reclamation work (PPAP): USD 26.0 million, Land acquisition: USD 1.6 million
Superstructure inclusive of utilities: USD 26.6 million

In this case, the estimated PIRR, EqIRR and FIRR are shown in Table 3.7-7. A return rate of this case is similar with the Case 2, and PIRR is calculated at 10.0%, and it is estimated at 13.5% if SPC could save the investment at 90%, and at 14.0% if SPC could save both of the investment and maintenance/operation cost at 90 %.

EqIRR increases to 21.6% in this case, and it is estimated at 30.5% if SPC could save the investment at 90%, and at 31.8% if SPC could save both of the investment and maintenance/operation

cost at 90%. Return on estimated capital may be satisfactory high in this case.

The estimated FIRR of the investment of SPC is 11.4%. If the construction cost and operation cost increase by 10%, FIRR is 8.8%. If the revenue is reduced by 10%, FIRR is 8.6%. If both took place together, FIRR is estimated at 6.3% (Details are shown in Appendix F-a-5).

FIRR of the investment of PPAP is estimated at 9.0%. If the construction cost and operation cost increase by 10%, FIRR is 6.9%. If the revenue is reduced by 10%, FIRR is 6.3%. If both took place together, FIRR is estimated at 4.4% (Table 3.7-8, Details are shown in Appendix F-a-5).

Table 3.7-7 PIRR, EqIRR, and FIRR of SEZ Development Project (Case 3)

PIRR		
Basic Case	Investment saved at 90%	Investment, Maintenance & Operation Cost saved at 90%
10.0%	13.5%	14.0%

EqIRR		
Basic Case	Investment saved at 90%	Investment, Maintenance & Operation Cost saved at 90%
21.6%	30.5%	31.8%

FIRR			
Ordinary Case	Cost up by 10%	Revenue down by 10%	Cost up by 10%, Revenue down by 10%
11.4%	8.8%	8.6%	6.3%

Source: Survey Team

Table 3.7-8 FIRR of SEZ Development Project (Case 3, Public Sector)

FIRR			
Ordinary Case	Cost up by 10%	Revenue down by 10%	Cost up by 10%, Revenue down by 10%
9.0%	6.9%	6.3%	4.4%

Source: Survey Team

(5) Analysis of Financial Condition

In the case that SPC implements the SEZ project, the Profit Loss Statement, Balance Sheet and Cash Flow of the SPC are estimated as shown in Appendix F-a-1.

- While the SPC will get income from long-term lease contracts with tenants from 2017-2021, it is expected that repayment of the PSIF loan will start from 2020 and be completed in 2023. This assumption is made in consideration of possible delays in long-term lease contracts, which may be up to three years.
- As income tax will be levied on the profit from long-term lease contracts of SEZ sections, it may be exempted for 9 years if the SEZ project is authorized under SEZ law. This calculation assumed that the income tax is exempted for 9 years from the beginning of construction.
- SPC is expected to provide USD 500,000 and land for SEZ (USD 5.5 million) as its initial capital. Then SPC is required to provide 30% of the construction cost (USD 17.7 million) under its own capacity, and this will compose part of the capital of the SPC. Therefore, the final capital of the SPC is estimated at about USD 23.6 million including the value of land sections of the SEZ.

- Land sections of the SEZ are leased out for 50 years and the SPC for SEZ receives a lump-sum payment for 50 years. Therefore, cost of landfill, utility facilities, and other appurtenant work is categorized as inventory, which will be removed when the payment is made. As the access road is constructed and managed by the SPC, the cost of landfill for the access road is depreciated over 50 years and the cost of pavement, lighting and other facilities is depreciated over 15 years. The project period is assumed to run from 2014 to 2054.

- Possible dividends on shares (capital) are expected to be about 5.5%.

- Return on equity of the SPC is high during the period of 2017-2021 due to the income from long-term lease contracts. After the repayment of loans, ROE is estimated at about 20% - 25% due to annual expenditure on facility maintenance, and it is estimated at about 22% at the end of the project period.

- Financial indicators of the management of the SPC fell into an acceptable range. i.e. Working Ratio: (Cost except Depreciation)/Revenue, Operating Ratio: (Cost/Revenue), Rate of Return on Net Fixed Assets: (Revenue/Net Assets); Debt Service Coverage ratio: (Cash plus Depreciation)/(Repayment of Principal and Interest), as shown in Appendix F-a-1.

- In the case that the access road is developed by the public sector, FIRR of SEZ development and operation improves from 7.15% to 10.28%, and payable dividend on SPC's equity is estimated at 7.5%.

- If land reclamation work is implemented by PPAP in addition to the development of the access road by the public sector, and SPC invests in the superstructure and utility facilities, financial statements of PPAP and SPC can be kept at a sound level. Revenue share between PPAP and SEZ shall be discussed and agreed to before implementing the SEZ project.

3.7.4 Financial Analysis of the Development of New Container Terminals

Construction of the Phnom Penh New Container Terminal was started in 2010 and completed in two and a half years with an investment of USD 43.3 million. The new terminal entered into operation on 6 January 2013. NCT No.1 Complement project is assumed to start in 2014 and be completed in 2017 with a total investment of USD 5.2 million, and enter into operation in 2018. NCT No.2 terminal is expected to start construction in 2017 and be completed in 2020. Total investment in NCT No.2 is estimated at about USD 54.0 million and it is assumed to open in 2021.

NCT No.1 and No.2 terminals will have a total capacity of 420,000 TEUs, it is therefore effective to operate two terminals as one single container terminal from the viewpoint of gate operation, yard planning, empty container stacking and other ancillary services. Supposing NCT No.1 terminal, NCT No.1 Complement facilities and NCT No.2 terminal are managed as one single terminal, the financial analysis is undertaken to evaluate the financial feasibility of all projects.

The basic case assumes that PPAP will construct and operate NCT No.1 Complement facilities and NCT No.2 terminal infrastructure and superstructure. The private participation case assumes that a private company is established for construction and operation of NCT No.1 Complement facilities and NCT No.2 superstructure, while NCT No.2 infrastructure is developed by PPAP. The superstructure includes quay gantry cranes, RTGs, trailers, reach stackers, cargo handling equipment, buildings, and ancillary facilities. Analysis of the basic case evaluates the feasibility of the total project and the private participation case assesses financial conditions of the SPC to be established for NCT.

NCT No.1 Complement facilities:

- Expansion of container yard: 8,000 m2
- Gate expansion, Maintenance shop building
- Procurement and installation of Cargo handling equipment: RTG 1 unit, Trailers 3 units, Truck scales

Facilities of NCT No.2 are planned as follows:

- Quay length: 350 m
- Terminal area: 7 ha
- Cargo handling equipment: Quay Gantry Cranes 3 units, RTG 6 units, Truck Trailers and Others
- Capacity of container handling: 250,000 TEUs/year

(1) Construction Cost

Construction cost of the NCT No.1 terminal, NCT No.1 Complement facilities, and NCT No.2 terminal is estimated as shown in Table 3.7-9. Repair cost of the old port is also estimated at about USD 5.4 million as shown in the Table including the cost of replacement of cargo handling equipment. The old port is expected to handle containers up to 80,000 TEUs and general cargoes.

Table 3.7-9 Construction cost for NCT No.1, NCT No.1 Complement, and NCT No.2

Capital Cost			(1,000 USD)
NCT No.1			
	(1)	Infrastructure	28,220
	(2)	TCC (3)	5,400
	(3)	RTG (4)	7,200
	(4)	Other CHE	2,470
		Cost Sub-total NCT No.1	43,290
NCT No.1 Complement			
	(1)	Cargo Handling Equipment	2,720
	(2)	Maintenance Shop	978
	(2)	Yard Expansion and Others	1,473
		Cost Sub-total NCT No.1 Complement	5,170
NCT No.2			
	(1)	Construction Cost (Public)	31,608
		1) Construction Cost (Infrastructure)	29,713
		2) Others	1,845
	(2)	Equipment and Building (Private)	22,345
		Quay Gantry Crane: 3 units	7,500
		RTG 6 units	10,800
		Tractor and Trailer :15 units	2,250
		Top Lifter :2 units	554
		Generator 1000 KVA	700
		Building	244
		Others	297
		Cost Sub-total NCT No.2	62,771
Old Port Terminal Repair and Replacement			
	Repair and Reinforcement Work		5,404
	Equipment		5,667
	Cost Sub-total: Old Port		11,071

Source: Survey Team

(2) Revenues from Port Operation

Revenues from container cargo handling are shown in Appendix F-b-1 and port fees from container vessels are summarized in F-b-2. The present port tariff rates are expected to continue till 2019 including crane charges and Lo/Lo charges. Stevedoring revenues are estimated by assuming that the stevedoring charge per box is the rate for shipping companies handling 3,000 - 7,000 TEUs annually. It is also assumed that the present tariff rate for stevedoring, crane and Lo/Lo will be reduced by 10% after 2020, 20% after 2022, 25% after 2024 and 30% after 2028 due to possible increase of container cargo and handling productivity.

Port fees, i.e. tonnage fees, channel fees, pilot fees, port clearance fees, berthing fees, mooring fees and the like, are assumed to be collected from calling ships at the same rates as the present tariff till the end of the project.

(3) Funds for Construction

Necessary investment in infrastructure of NCT No.2 is estimated at around USD 31.6 million and it is expected that this amount may be funded by an overseas funding agency. Terms of the loan are assumed to be such that interest is 0.01%, and the loan period is 40 years with a grace period of 10 years. It is also assumed that MEF may grant sub loans to PPAP with interest of 2.5% including service charges.

Cost for the procurement and installation of cargo handling equipment and construction of the buildings is estimated at about USD 22.3 million and the private sector is expected to carry out this procurement and installation. For this investment, it is assumed that the private sector can raise a low interest fund, i.e. interest of 4.0%, loan period of 20 years including a 10 year grace period.

(4) Financial Feasibility as a Public Investment Project

FIRR of the NCT Development Project (NCT No.1 terminal, NCT No.1 Complement facilities and NCT No.2 terminal) is estimated at about 13.5% as shown in Table 3.7-10. While development of NCT No.1 and No.2 terminals is independent from each other, operation of the two terminals may be carried out as one single terminal because of efficiency of operation and convenience for users. FIRR is therefore calculated assuming that the NCT No.1 and No.2 will be operated as a single terminal. Details of FIRR calculation are shown in Appendix F-b-4.

Table 3.7-10 FIRR of the NCT Development Project

FIRR			
Ordinary Case	Cost up by 10%	Revenue down by 10%	Cost up by 10%, Revenue down by 10%
13.5%	10.8%	9.7%	6.7%

Source: Survey Team

Profit and loss statement, balance sheet, and cash flow of NCT development project including NCT No.1, NCT No.1 Complement and NCT No.2 are estimated as shown in Appendix F-b-3. No problem is identified in cash flow or repayment of loans, and no short-term loan is necessary for operation and maintenance. Financial indicators, i.e. the working ratio, operating ratio, rate of return on net fixed assets, and debt service coverage ratio, are in a satisfactory range.

(5) Rate of Return on Private Investment

It is expected that NCT No.1 Complement facilities and the cargo handling equipment/building for NCT No.2 will be provided by the private sector with a total cost of USD 27.5 million. This amount may be recovered by profit sharing between PPAP and the private investor. A Business Corporation Contract (BCC) shall therefore be agreed to between the two parties, which may refer to a share of the profit from cargo handling equipment and to cooperation in terminal operation.

Financial analysis of NCT development is undertaken based on the following assumption. NCT No.1 terminal has three quay cranes, one of which was installed by a private company and two were by KAMSAB. As those three cranes are maintained and operated by the private sector, 80% of crane charges collected by PPAP are transferred to the owner/operator of those cranes.

Development of NCT No.2 terminal supposes that all types of cargo handling equipment and buildings will be provided by the private sector. The profit share of cargo handling charges may be carefully assessed by both parties in the business cooperation contract. Provisionally, the financial analysis assumed that profit sharing of crane charges is 80% for the private sector and 20% for PPAP, and profit sharing of RTG and trailer operation is 56% for the private sector out of the stevedoring charges in the PPAP tariff and out of the Lo/Lo charges. (56% is sum of 46%, which is the ratio of private investment among the total investment in NCT No.1 Complement and NCT No.2, and 10%, which is the operational expenses for the equipment.)

In case that SPC constructs NCT No.1 Complement facilities, installs all cargo handling equipment of the NCT No.2 terminal, and operates them with bearing the expenses for fuel, electricity, labour and other operational materials, PIRR, EqIRR and FIRR for the investment of SPC are evaluated as shown in Table 3.7-11. The period of the project is supposed to be 20 years.

PIRR is calculated at 9.1%, and it is estimated at 15.4% if SPC could save the investment at 90%, and at 16.2% if SPC could save both of the investment and maintenance/operation cost at 90 %.

EqIRR is estimated at 28.1%, and it increases to 32.4% if SPC could save the investment at 90%, and to 34.5% if SPC could save both of the investment and maintenance/operation cost at 90%. Return on estimated capital will be satisfactory high in this project.

The estimated FIRR of the investment of SPC is 14.8%. If the construction cost and operation cost increase by 10%, FIRR is 12.7%. If the revenue is reduced by 10%, FIRR is 12.4%. If both took place together, FIRR is estimated at 10.3% (Details are shown in Appendix F-b-5).

Table 3.7-11 PIRR, EqIRR and FIRR of NCT No.1 Complement Project and NCT No.2 Cargo Handling Equipment Installation and Operation Project

PIRR		
Basic Case	Investment saved at 90%	Investment, Maintenance & Operation Cost saved at 90%
9.1%	15.4%	16.2%

EqIRR		
Basic Case	Investment saved at 90%	Investment, Maintenance & Operation Cost saved at 90%
28.1%	32.4%	34.5%

FIRR			
Ordinary Case	Cost up by 10%	Revenue down by 10%	Cost up by 10%, Revenue down by 10%
14.8%	12.7%	12.4%	10.3%

Source: Survey Team

Financial conditions of the SPC for NCT project are assessed in view of the profit and loss statement, cash flow, and balance sheet as shown Appendix F-b-6. It is expected that 30% of the total investment is borne by SPC's own funds and 70% is financed by PSIF loan. Financial analysis revealed that the working ratio, operating ratio, rate of return on net fixed assets, and debt service coverage ratio remain in a satisfactory range. No problem is identified in cash flow or repayment of loans. Maximum dividends payable to shareholders are estimated at about 12% annually.

3.7.5 Economic Analysis of the Development of SEZ

(1) Economic Cost

An economic cost and benefit analysis was undertaken to evaluate the worthiness of the SEZ project. Economic cost implies cost without import duties, VAT, or other forms of tax in order to clarify the actual economic input into a project. The foreign portion of the cost estimate in this report excludes import duties and VAT, but the local portion of the cost estimates includes VAT. The economic cost of the project is estimated without VAT in the local portion and contingency cost of the project.

(2) Economic Benefit

Development of SEZ brings economic benefits to Cambodia, such as the increase of foreign investment, establishment of factories and manufacturers, employment opportunities, tax income for the country, ripple effect on regional economic activities, and the like. Without the development of PPAP SEZ, possible enterprises that would have been located there may go to another SEZ or not come to Cambodia. As the present PPSEZ will not be able to provide further sections to lease and no other SEZ is available in Phnom Penh, it is assumed that the establishment of new factories and manufactures will not be realized or considerably delayed in the "without" case, and consumer goods to be produced at the SEZ for domestic use will be imported.

Economic benefits of the project can be assessed by comparing the consumer surpluses of the "with" case and the "without" case. The largest benefit of SEZ development is establishment of factories and manufacturers and their production, which contributes to the increase of national product and export. Economic benefit of the increase of manufacturing is measured by the amount of value added to their products, which is estimated by the ratio of value-added to the amount of production. The amount of value-added is owed to the construction of factories, installation of manufacturing equipment and operation, and partly to the development of SEZ. Therefore, the economic benefit of the development of SEZ is measured by the ratio of investment in SEZ to the total investment in factories and equipment among the total value added by manufacturers located in the SEZ, which is shown in Table 3.7-12.

Table 3.7-12 Estimated Production of Manufacturers to be located in PPAP SEZ and Value-added

(1,000 USD)

Industries	Area in SEZ (ha)	Number of Factories	Investment in Factories/ Equipment	Annual Production	Annual Value-Added
Car components/parts	25	10	90,000	300,000	30,000
Metal/Non-metal Processing	22	11	99,000	330,000	33,000
Electrical/Electronic component/parts	16	8	120,000	400,000	40,000
Machinery components/parts	10	5	45,000	150,000	15,000
General Processing	12	4	28,000	120,000	18,000
Plastic Processing	9	6	42,000	180,000	27,000
Processed Marine/Agricultural Products	6	3	12,000	15,000	3,000
Garments/Others	6	3	12,000	15,000	3,000
Total	106	50	448,000	1,510,000	193,000

Investment	Amount	Ratio
SEZ	55,697	11.1%
Factories and Equipment	448,000	88.9%

Source: Survey Team

(3) EIRR of SEZ Project

The Economic Internal Rate of Return is calculated based on the assumptions shown in the above sub chapter (1) economic cost and (2) economic benefit. Supposing that the project period of SEZ development and operation is the 40 years from 2014, EIRR of the project is estimated at 22.1%. The ratio of SEZ's contribution to the total economic benefit of industrial production in SEZ is assumed at 11.1% as shown in Table 3.7-12. Sensitivity analysis shows that EIRR is 20.5% in case of 10% cost increase, 20.4% in case of 10% revenue decrease, and 18.9% in case both happened at once (refer to Table 3.7-13). Details of EIRR calculation are shown in Appendix F-c-1.

Table 3.7-13 EIRR of SEZ Project

	Ordinary Case	Cost up by 10%	Revenue down by 10%	Cost up by 10%, Revenue down by 10%
EIRR	22. 1%	20.5%	20.4%	18.9%

Source: Survey Team

3.7.6 Economic Analysis of the Development of NCT No.1 Complement & NCT No.2

(1) Economic Cost

The economic cost of the development of NCT No.1 Complement and NCT No.2 is estimated by excluding import duties, VAT and contingencies from the cost estimate for financial analysis. The basic idea for estimating economic cost is the same as Chapter 3.7.5 (1).

(2) Economic Benefit

Economic benefit of the development of the New Container Terminal is to reduce port and terminal congestion anticipated in the near future and to ensure smooth operation of import and export cargoes. In addition, it is expected that port related industries will be promoted, employment opportunities increase, and industrial development is encouraged in the hinterland. If NCT is not developed, NCT No.1 terminal will be very congested and the old port will be in use, long waiting queues of entering ships will congregate at NCT and the old port, ocean freight rate to/from Phnom Penh will increase to very high levels, and industries in Phnom Penh area will have to reduce production due to poor logistics, and some manufactures will withdraw from the PP area.

Items of economic benefit due to NCT development are deemed as follows:

a) Reduction of port congestion anticipated in the future;

b) Lower transportation cost compared with those of alternative routes;

c) Employment opportunities;

d) Promotion of port related businesses;

e) Industrial development and promotion of production in the hinterland; and

f) Encouragement and promotion of service industries around the port.

Taking into account these items of economic benefit, this report assumes that the national economic benefit of the NCT project can be evaluated by comparing the "with" and the "without" cases regarding items a) and b). Other items may bring considerable economic benefits, but numerical comparison is made on items a) and b) only.

Item a): Container handling capacity of NCT No.1 terminal is 120,000 TEUs and that of the old port is 80,000 TEUs. If NCT No.1 Complement project and NCT No.2 project are not implemented, Phnom Penh Port will be faced with heavy congestion after container cargo reaches 200,000 TEUs. If such situation appears, some container shippers will use Sihanoukville Port and some will use cross border truck transportation. Shipping companies will charge congestion surcharges on containers through Phnom Penh Port. For example, congestion surcharges collected at an African port sometimes

reach USD 700/box, a lower example is USD 50 per 20' container and USD 100 per 40' container at Bangkok Port in 2011, a moderate example is USD 100 per 20' container and USD 200 per 40' container at Sidney Port in 2011, a higher example is USD 180 per 20' container and USD 360 per 40' container at Chennai Port in 2011.

This report assumes that congestion surcharges will be levied on containers passing through Phnom Penh Port if the total container throughput exceeds 200,000 TEUs in the "without" case. The rate of surcharge is deemed to be USD 75 per 20' container and USD 150 per 40' container, taking into consideration the lower moderate examples. Because such surcharges are not levied in the "with" case, the difference in congestion surcharges is deemed as an economic benefit of NCT No.1 Complement and No.2 projects. While the benefit of no congestion is enjoyed by foreign consignees as well as domestic consignees, it is assumed that a half of the savings of congestion surcharges comprise economic benefit to the country.

Item b): If Phnom Penh Port is full, some cargoes have to shift to Sihanoukville Port or cross border truck transport and transportation cost for shippers and consignees will increase in the "without" case. It does not increase in the "with" case, the difference in transportation cost is deemed as an economic benefit of NCT No.1 Complement and NCT No. 2 project. Since the shift from Mekong river transport to cross border truck transport is taken into consideration and included in the demand forecast of this report, it is assumed that excess cargo of Phnom Penh Port will shift to Sihanoukville Port. Savings of transportation cost in the "with" case are deemed as an economic benefit of NCT No.1 Complement and NCT No.2 project. While the benefit of transportation cost savings is enjoyed by foreign consignees, it is assumed that a half of the cost savings comprise economic benefit to the country.

The difference in truck transportation cost is summarized in Table 3.7-14.

Table 3.7-14 Truck Transportation Cost Comparison (PP Port vs. SHV Port)

(USD)

PP Port to Factory in PP Area	A	B	C
PP Port to Factory; 20F	85.0	85.0	60.0
PP Port to Factory; 40F	115.0	150.0	90.0
Factory to PP Port			
Factory to PP Port; 20F	85.0	85.0	60.0
Factory to PP Port; 40F	115.0	150.0	90.0
SHV Port to Factory in PP Area			
SHV Port to Factory; 20F	194.7	194.7	204.7
SHV Port to Factory; 40F	279.2	299.2	254.2
Factory to SHV Port			
Factory to SHV Port; 20F	194.7	194.7	169.7
Factory to SHV Port; 40F	239.2	219.2	204.2

(USD)

Difference of Trucking Cost	SHV-Old PP	SHV-New PP
Import 20F	127.2	77.2
Import 40F	156.7	106.7
Export 20F	109.7	79.7
Export 40F	101.7	71.7

Note: A, B, C is trucking company or forwarder

Source: Survey Team

(3) EIRR of NCT Development Project

Economic Internal Rate of Return is calculated based on the economic cost and benefit shown in the above (1) and (2). The project period of NCT is supposed to be the 40 years from 2017 covering a period of repayment on a long-term loan. EIRR of the project is estimated at 17.0% as shown in Table 3.7-15. Sensitivity analysis shows that EIRR is 14.2% in the case of 10% cost increase, 13.9% in the case of 10% revenue decrease, and 11.5% in the case of both happening at once. EIRR shows that this project is worthy enough to implement from the viewpoint of economic cost and benefit. Details of EIRR calculation are shown in Appendix F-d-1.

Table 3.7-15 EIRR of NCT No.1 Complement and No.2 Project

	Ordinary Case	Cost up by 10%	Revenue down by 10%	Cost up by 10%, Revenue down by 10%
EIRR	17.0%	14.2%	13.9%	11.5%

Source: Survey Team

3.8. Environmental and Social Considerations

3.8.1 Comparative Study for Development Alternatives

The proposed project site for the SEZ is located behind the PHN Port NCT for integrated development with NCT. The process for the alternative analysis to select the site for each project, namely, PHN Port NCT, PPAP-NCT SEZ and the access road, are reviewed in this section.

(1) PHN Port NCT

The site for PHN Port NCT was selected based on the Master Plan for Waterborne Transport on the Mekong River System, prepared by the Belgian Technical Cooperation. In the Master Plan, the site was selected out of the candidate sites along the Mekong River considering the suitability in terms of topographic condition and consistency with the future traffic plan. The site is located is about 30 km from Phnom Penh (see 'd' in Figure 3.8-1). The suitability evaluated from those viewpoints was also confirmed in this study. In terms of environmental and social considerations, the selected site was deemed to be able to avoid relocation of residents. Actual relocation has not occurred.

Table 3.8-1 shows a comparison between candidate sites along the Mekong River in terms of topographic suitability as a port construction site, environmental and social consideration (impacts on residents and land use) and existence of connecting points in future road traffic plans.

Topographic suitability: According to the following conditions, the selected site ('d' in Figure 3.8-1) is the most suitable as a port construction site.

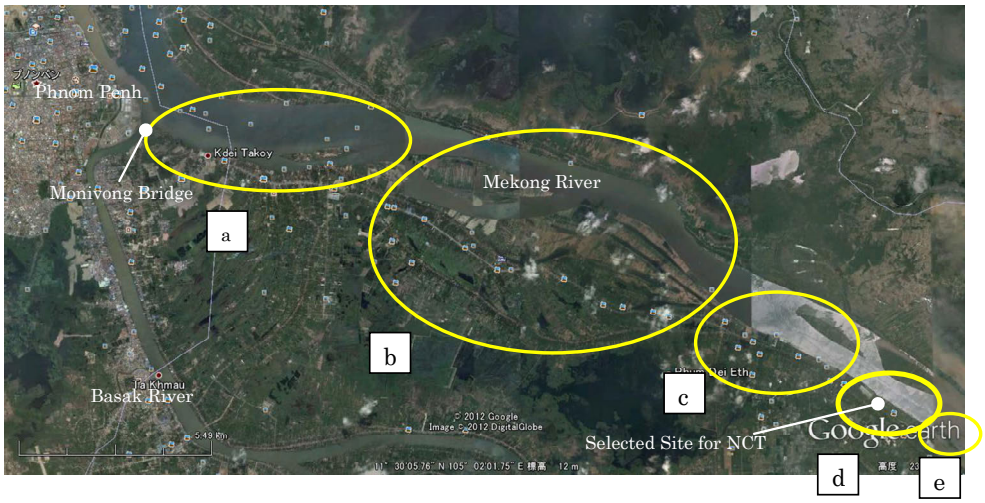
- The site is to be located on the right bank of the Mekong River so as to secure the access to the hinterland.
- Water depth close to the river bank is to be enough for navigation.
- Water area in front of the berth is to be more than 300m in width for navigation and basin.
- River channel and bank are to be straight so as to secure the site for berths.
- Area between the Mekong River and the National Road No.1, which is parallel with the Mekong River, is to be more than 250m in width to provide room for the container terminal

Suitability on environmental and social considerations: 'c', 'd' and 'e' in Figure 3.8-1 take into account the following situations.

- Out of the areas between the right bank of the Mekong River and the National Road No.1, area located in Phnom Penh Municipality ('a' in Figure 3.8-1: up to about 10 km downstream from Monivong Bridge at Bassac river) most are not suitable because of the existence of crowded residential areas.
- At the downstream area ('b' in Figure 3.8-1), restriction on the environmental and social consideration becomes smaller due to the smaller number of houses.
- In the farther downstream areas ('c',' d' and 'e' in Figure 3.8-1), the number of existing houses becomes much smaller.

Suitability of future traffic plan:

- The crossover point where National Road No.1 joins the planned Phnom Penh Outer Ring Road was selected for the project site considering that the site should be outside of the congested urban area as well as within the urban transportation area. The selected site is expected to provide a smooth connection to the west and the north of the traffic network of Phnom Penh without passing through urban traffic bottle necks.



Source: Google Earth, Survey Team

Figure 3.8-1 Candidate Locations of PHN Port NCT

Table 3.8-1 Comparison between Candidate Sites for PHN Port NCT

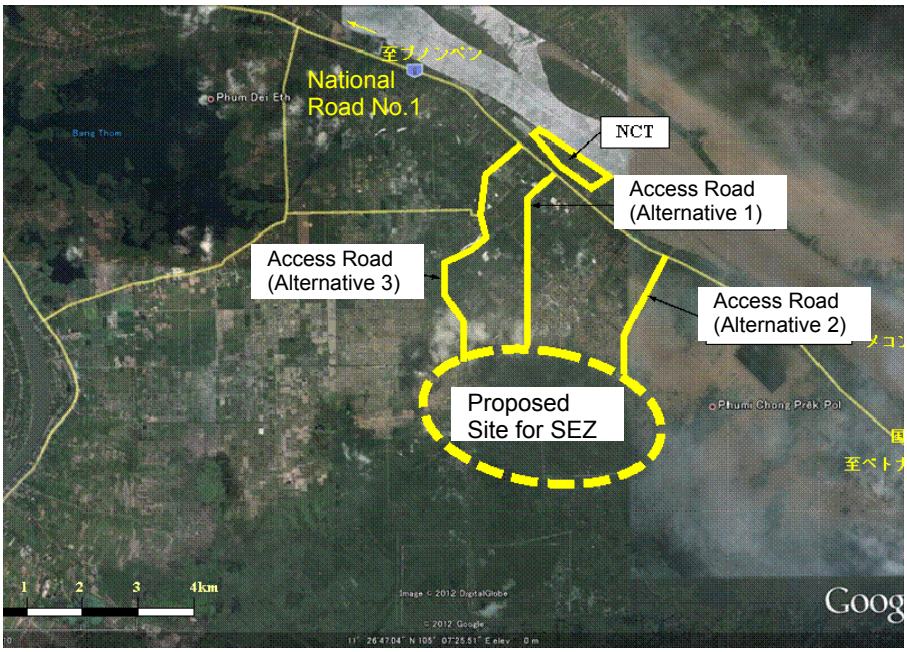
Area		a	b	c	d	e
Distance from the River Mouth of the Mekong River		347-338 km **	338-329 km	329-324 km	324-322 km *	322-316 km
Topography	Water Depth at Right Bank of the River	Shallow	Shallow	Shallow-Deep	Deep	Deep-Shallow (There are sandbars in the middle of the river.)
	Potential Width for Navigation Channel and Basin	Wide	Wide-Middle	Wide	Wide	Wide-Narrow
	Straightness of the River	Bending	Bending	Straight	Straight	Straight-Bending
	Potential Width for Terminal	Narrow	Wide	Narrow	Wide	Narrow
Environmental and Social Considerations	Land Use	Crowded residential area along the riverside.	Mixture of residence and farm land. Sandbar is existing.	Mixture of factories and farm land.	Farm land at the riverside.	Farm land at the riverside. Sandbar and pond are partly existing.
	Houses and Structures	Crowded	Crowded-less crowded	Not crowded	Not crowded	Not crowded- a little crowded
Traffic Plan	Traffic Plan of Phnom Penh	–	Connection with Inner Ring Road (Ring Road 2)	Connection with Outer Ring Road		–
Overall Evaluation		Topographic condition is not suitable for port. Significant impacts on land use and houses are expected.	Fewer houses, but the topography is not suitable for port.	Houses are not crowded, but the width for terminal is too narrow.	Suitable topographic condition for port and small number of the affected houses. Suitable on traffic plan which propose outer ring road.	Houses are not crowded or a little crowded, but the width for terminal is too narrow.

Notes: * Selected site for the terminal-2: 323.5 km, ** Branch point of the Mekong River and Bassak river: 347 km

Source: Survey Team

(2) PPAP-NCT SEZ

The site for SEZ needs to be located close to PHN Port NCT as possible for the integrated development. However, the closest area behind NCT, up to about 4 km south from the National Road No.1, has been widely used as farm land and is deemed not to be appropriate due to the significant impacts on land use. Considering the situation, the project site was selected as shown in Figure 3.8-2 to avoid impacts to the farm land. Although the selected area is also used as farm land, the production is lower than the area up to 4 km south from the National Road due to the low elevation and the long flooded periods during the rainy season; therefore, the impacts on land use and the other related social impacts are expected to be smaller in the case of the selected site.



Source: Google, Survey Team

Figure 3.8-2 Selected SEZ Site and Alternatives for the Access Road

(3) Access Road for SEZ

For the access road, three alternatives shown in Figure 3.8-2 were compared in terms of the functionality, economic efficiency, construction ease, social environment and natural environment (Table 3.8-2). As a result, alternative-1 was selected due to the high functionality and economic efficiency in addition to the smaller environmental impacts.

Table 3.8-2 Comparison between Alternatives of the Access Road

Items	Alternative -1 (Constructing New Road)	Alternative-2 (Expanding Existing Road)	Alternative -3 (Expanding Existing Road)
Functionality	The shortest access to the access road from NCT traveling over National Road No.1 for about 100m.	Need to travel over National Road No.1 for about 3 km to reach the access road from NCT.	Need to travel over National Road No.1 for about 750m to reach the access road from NCT.
Economic Efficiency (Construction Cost)	Construction cost is expected to be higher than alternative 2 and lower than alternative 3 considering the length of the road, about 4 km.	Construction cost is expected to be the lowest due to the shortest length, about 2km.	Construction cost is expected to be the highest due to the longest length, about 5km.
Construction Ease	Construction works are easy due to the surrounding land use such as rice fields.	Need to prepare alternative road because the existing road traffic would be interrupted by the construction works.	Need to prepare alternative road because the existing road traffic would be interrupted by the construction works.
Social Environment	Relocation of houses is expected to be minimized affecting 12 houses at the maximum.	More than 60 houses need to be relocated.	More than 200 houses need to be relocated.
Natural Environment	Significant impact to the natural environment is not expected because the construction site is already developed as farm land.	Significant impact to the natural environment is not expected because the construction site is already developed as farm land.	Significant impact to the natural environment is not expected because the construction site is already developed as farm land.
Overall Evaluation	Relocation of houses is minimized. Prioritized on functionality and construction ease as well.	Not appropriate due to large number of house relocations.	Significant impact due to very large number of house relocations.

Source: Survey Team

3.8.2 Scoping

Scope of the EIA study was discussed for (1) PPAP-NCT SEZ, (2) Access road for SEZ and (3) PHN Port NCT. The scoping results are summarized in the following tables, Table 3.8-3, 3.8-4 and 3.8-5, together with the prediction methods and the evaluation policies.

Table 3.8-3 Scoping for PPAP-NCT SEZ

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
Pollution	1	Air pollution	C	C	**Construction Phase:** Construction dust may affect residential areas depending on the location where the construction equipment works.	Possibility of impacts to residential areas is assessed based on the type of construction equipment, amount of equipment and the work locations. Measures for dust prevention are proposed considering the possibility of the impacts although the possibility will be low as no residence has been found around the construction area.
					Operation Phase: Emission from factories and vehicles passing through SEZ may affect ambient air quality.	Quantitative prediction is not available because the type of the factory has not been decided. Instead, present air quality and existing regulations for restricting air pollution are surveyed. If the existing measures are deemed not to be adequate for preventing the possible pollution comparing with Japan or other international standards, additional measures such as new standards are proposed.
	2	Water pollution	C	C	**Construction Phase:** Turbidity may be generated in accordance with earth works and reclamation works in SEZ area. Domestic wastewater is generated from the workers camp.	Possibility of turbidity generation is assessed considering the present water quality and the construction method. If turbidity is predicted, measures for reducing turbidity such as preparing sedimentation ponds are proposed. Wastewater treatment measures are proposed if the workers' camp is estimated to be a pollution source considering the scale of the camp.
					Operation Phase: Wastewater from factories may cause water pollution.	Treatment facilities and drainage plan are reviewed. Based on the drainage facility plan, possibility of groundwater pollution is assessed. For the measures, preparing sewage treatment plant and restricting factories which discharge harmful substances are proposed.

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
	3	Waste	B-	B-	**Construction Phase:** Garbage is generated at construction workers' camp. Construction waste may be generated although there is no need for demolishing structures at the construction site.	Method for collecting and disposing of garbage is reviewed. If the present method is not adequate, collecting and disposing by contractor are made compulsory.
					Operation Phase: Industrial waste is generated.	Regulation for collecting and disposing of industrial waste is reviewed. If the existing measures are deemed not to be adequate comparing with Japan or other international standards, additional measures such as new regulations for disposal are proposed.
	4	Soil contamination	C	C	**Construction Phase:** Riverbed materials collected from the Mekong River are planned to be used for the reclamation. The collecting site has already been approved by the government and used for other reclamation projects around the proposed construction site. Contents of harmful substances need to be examined.	Contents of harmful substances in the materials are examined and assessed comparing with standards such as those in Japan.
					Operation Phase: Industry which generates harmful substances is not planned to be invited but needs to be confirmed.	Possible type of industry and the regulation for managing harmful industrial waste are reviewed. If the existing measures are deemed not to be adequate comparing with Japan or other international standards, additional measures such as new regulations are proposed.
	5	Noise and vibration	C	C	**Construction Phase:** Construction noise may affect residential areas.	Possibility of the impacts to residential areas is assessed based on the type of construction equipment, amount of equipment and the work locations. Measures for noise prevention are proposed considering the possibility of the impacts although the possibility will be low as no residence has been found around the construction area.

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
					Operation Phase: Noise from factories and vehicles passing through SEZ may affect residential areas.	Quantitative prediction is not available because the type of the factory has not been decided. Instead, present noise levels are surveyed and the possibility of impacts is assessed considering the distance to the residential areas. The possibility of impacts will be low as no residence has been found around the construction area.
	6	Ground subsidence	D	D	**Construction Phase:** Construction works which cause ground subsidence such as collecting large amounts of groundwater has not been planned.	-
					Operation phase: Low possibility of ground subsidence has been identified because of the sufficient groundwater supply from the Mekong River and Bassac river even if entities which use groundwater are attracted.	-
	7	Odour	D	C	**Construction Phase:** Construction works that generate odour are not expected.	-
					Operation Phase: Waste storage and sewage treatment facility may generate odour.	Possibility of odour generation is assessed considering the type of industry and the sewage facility plan. If it may be generated, regulation or facilities for preventing odour are proposed.
	8	Sediment quality	C	C	**Construction Phase:** Siltation may occur at the bottom of the irrigation canals around the site if significant turbidity is generated by the construction works.	The possibility is assessed based on the assessment results of turbidity generation (see No.2).
					Operation Phase: Industry which generates harmful substances is not planned to be invited but needs to be confirmed.	Possible type of industry, regulation for managing harmful industrial waste, wastewater management facility and drainage plan are reviewed. If they are deemed not to be adequate comparing with Japan or other international standards, additional measures such as new regulations are proposed.

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
Natural Environment	9	Protected area	D	D	Impact is not expected since no protected area such as national park is designated around the project site.	-
	10	Ecosystem	B-	C	**Construction Phase:** Flora and fauna in the SEZ area lose their habitat.	Plants, birds, amphibians, reptiles and aquatic life such as fish are investigated to find protected species. If they are identified, a mitigation plan is developed for each species, for example, relocating to an area outside of the project area.
					Operation Phase: If polluted water is discharged from SEZ, aquatic life in the canals may be affected. SEZ may split the habitat if migratory species are living therein.	Impact is assessed considering the possibility of polluted water discharge and the existing aquatic species. If necessary, measures for improving water discharge are proposed. Information regarding animals living around the site is collected through interviews with local residents. If the habitat is expected to be split, mitigation measures, for example, securing a migration route are proposed.
	11	Hydrology	**C**	C	**Construction Phase and Operation Phase:** Existence of SEZ area may alter the hydrology during high water season.	Flooding area and the water depth are reviewed based on the topographic survey. Inflow and outflow of water are estimated based on the information regarding the surroundings such as location of water gates. Possibility of the impact is assessed based on the collected information and the results of estimation.
	12	Topography and geology	C	D	**Construction Phase:** Elevation is altered by raising the ground level for SEZ. Although the topographic features at the site are not to be protected, the alteration is to be assessed after confirmation of the elevation change. Geological impacts are not expected because no underground construction has been planned. **Operation Phase:** No activities are expected which could cause topographic or geological alteration.	The impact is assessed based on the present topographic condition and the alteration plan.

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
Social Environment	13	Involuntary resettlement	B-	D	**Pre-construction Phase:** It has been confirmed that there is no residence in the SEZ area. Land acquisition has been partly completed. **Operation Phase:** No relocation of a residence is required for operation.	Land owners and the process of acquisition are reviewed including for the land already acquired, and disparity with JICA's Guideline is assessed. If necessary, additional compensation is discussed.
	14	The poor	C	C	Evaluation is made after comprehending socio-economic conditions.	Economic condition of local residents is reviewed through interviews in each village. If the poor are found, special consideration is discussed.
	15	Indigenous and ethnic people	C	C	Evaluation is made based on the social survey results although no indigenous or ethnic people are expected to be found.	Existence of indigenous and ethnic people is reviewed through interviews in each village. If they are identified, special consideration is discussed.
	16	Local economy such as employment and livelihood	C	C	**Pre-construction:** Livelihood of the agricultural land owners may be lost by the land acquisition.	Compensation is discussed based on the information regarding the landowners and the impacts on their livelihood.
					Construction Phase: Job opportunities may be increased due to the construction works and the related works.	Number of construction workers is estimated. Possibility of the employment of local residents is assessed considering their education, work experience and the examples of the other projects.
					Operation Phase: Job opportunities and activation of local economy are expected by the operation of SEZ.	Present local livelihood and local economic level are reviewed to assess the possibility of the improvement by operation of SEZ.
	17	Land use and utilization of local resources	B-	C	**Pre-construction:** Farm land at the proposed SEZ area such as rice fields is altered. If the irrigation canal is split, the land use as rice fields is affected.	Considering the possibility of splitting canals (results of No.19), impact on local economy in case of elimination of the rice field is evaluated.
					Operation Phase: Surrounding rice field may be affected if polluted water is discharged from SEZ.	Measures for water treatment are discussed considering surrounding land use.
	18	Water usage	D	C	**Construction Phase:** Water volume for transporting sand for reclamation is expected to be below 1 ㎥/sec. The water is planned to be collected from the Mekong River. Since the discharge of the Mekong River is sufficient, about 2,000-40,000㎥/sec at Kuratie located upstream (Mekong River Commission), impacts on water use are not expected.	-

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
					Operation Phase: Water for supplying SEZ is planned to be collected from the existing piped water network and stored in the water tank, excluding that for industries which use large amounts of water. Although the capacity of the existing piped water is estimated to be adequate so as not to affect the existing water users, it needs to be confirmed. If any industries which use large amounts of water are attracted, groundwater is expected to be developed separately.	Capacity of the existing piped water is reviewed. If necessary, alternatives such as groundwater use are discussed.
	19	Existing social infrastructures and services s	C	C	**Pre-construction:** Existing irrigation canals and small path around farm land may be split.	Location of the canals and the paths are reviewed to identify the impact. If they are split, measures such as installing culverts and tunnels are discussed.
					Construction Phase: Traffic congestion may occur if traffic volume on the national road is increased by the construction vehicles.	Impacts are assessed based on the number of construction vehicles. If congestion is predicted, measures such as deploying flagman are proposed.
					Operation Phase: Traffic congestion may occur if traffic volume on the national road is increased by the traffic relevant to SEZ.	Impacts are assessed based on the number of relevant vehicles. If congestion is predicted, measures such as road expansion are proposed.
	20	Social institutions such as social infrastructure and local decision making institutions	D	D	Impact is not expected because local decision making functions in the commune and villages are maintained before and after the project.	-
	21	Misdistribution of benefits and damage	C	C	Misdistribution of benefits and damage may occur, for example in the case that any residents are affected by farm land acquisition.	Possibility of the misdistribution and the factors are identified based on the results of No.16, stakeholder meetings and interview surveys.
	22	Local conflict of interests	C	C	Local conflict may occur, for example if any residents are affected by farm land acquisition. Conflict between local residents and migrated people may occur by inflow of construction workers and SEZ workers.	Possibility of the conflict and the factors are identified based on the results of No.16, stakeholder meetings and interview surveys.
	23	Cultural heritage	D	D	No cultural heritage sites are identified around the project site。	-

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
	24	Landscape	D	D	No landscape that needs to be protected is identified around the project site.	-
	25	Gender	D	D	No impacts specified for women are expected.	-
	26	Rights of children	D	D	No impacts specified for children are expected.	-
	27	Infectious diseases such as HIV/AIDS	C	C	**Construction Phase:** Risk of infectious diseases may be increased by inflow of construction workers. **Operation Phase:** Risk of infectious diseases may be increased by inflow of SEZ workers.	Present condition of the diseases such as HIV/AIDS is reviewed to propose measures for reducing the risk.
	28	Labour environment (including work safety)	C	C	**Construction Phase:** Working conditions of construction workers needs to be considered. **Operation Phase:** Working conditions of SEZ workers needs to be considered.	Regulations for construction works and factory works are reviewed. If the existing measures are deemed not to be adequate comparing with Japan or other international standards, additional measures such as new regulations are proposed.
Others	29	Accidents	B-	B-	**Construction Phase:** Risk of construction accidents and traffic accidents is expected. **Operation Phase:** Risk of traffic accidents is expected. Although industries which handle hazardous materials are not expected to be invited, this needs to be confirmed.	Risk is assessed considering present condition of traffic accidents and estimation of traffic volume. Type of industry and safety measures in SEZ are reviewed.
	30	Cross boundary impacts and climate change	D	D	Impact is not expected because the project is not wide scale.	-

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: Survey Team

Table 3.8-4 Scoping for Access Road to SEZ

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
Pollution	1	Air pollution	C	C	**Construction Phase:** Construction dust may affect residential areas depending on the location where the construction equipment works.	Possibility of the impacts to residential areas is assessed based on the type of construction equipment, amount of equipment and the work locations. Measures for dust prevention are proposed considering the possibility of the impacts although the possibility will be low as no residence has been found around the construction area.
					Operation Phase: Emission from vehicles passing through the access road may affect ambient air quality.	Present air quality is surveyed. Approximate number of the passing vehicles is estimated to estimate the emission volume to be compared with the standards in Cambodia.
	2	Water pollution	C	C	**Construction Phase:** Turbidity may be generated in accordance with earth works. Domestic wastewater is generated from the workers camp.	Possibility of turbidity generation is assessed considering the present water quality and the construction method. If turbidity is predicted, measures for reducing turbidity such as preparing sedimentation ponds are proposed. Wastewater treatment measures are proposed if the workers camp is estimated to be a pollution source considering the scale of the camp.
					Operation Phase: Storm water is generated from the access road.	Drainage plan is reviewed. If necessary, measures such as installing storm water pits are proposed.
	3	Waste	B-	D	**Construction Phase:** Garbage is generated at construction workers camp. If structures exist at the construction site, construction waste is generated for the demolition. Other construction waste also may be generated for the construction works.	Method for collecting and disposing of garbage is reviewed. If the present method is not adequate, collecting and disposing by constructor are made compulsory.
					Operation Phase: Waste generation is not expected from the road operation.	-
	4	Soil contamination	D	D	Activities which cause soil contamination are not expected.	-

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
	5	Noise and vibration	C	C	**Construction Phase:** Construction noise may affect residential areas.	Possibility of the impacts to residential areas is assessed based on the type of construction equipment, amount of equipment and the work locations. Measures for noise prevention are proposed considering the possibility of the impacts although the possibility will be low as no residence has been found around the construction area.
					Operation Phase: Noise from vehicles traveling over the access road may affect residential areas.	Present noise level is surveyed. Noise level during operation is predicted based on the estimated number of vehicles to be compared with the standard in Cambodia or other international standards.
	6	Ground subsidence	D	D	**Construction Phase:** Construction works which cause ground subsidence such as collecting large amount of groundwater have not been planned.	-
					Operation phase: Ground subsidence is not expected from the road operation.	-
	7	Odour	D	D	Activities which generate odour are not expected.	-
	8	Sediment quality	C	D	**Construction Phase:** Siltation may occur at the bottom of the irrigation canals around the site if significant turbidity is generated by the construction works.	The possibility is assessed based on the assessment results of turbidity generation (see No.2).
					Operation Phase: Sediment pollution caused by the road operation is not expected.	-
Natural Environment	9	Protected area	D	D	Impact is not expected since no protected area such as national park is designated around the project site.	-
	10	Ecosystem	B-	C	**Construction Phase:** Flora and fauna in the road construction site area lose their habitat.	Plants, birds, amphibians, reptiles and aquatic life such as fish are investigated to find protected species. If they are identified, a mitigation plan is developed for each species, for example, relocating to an area outside of the project area.

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
					Operation Phase: The access road may split the habitat if migratory species are living therein.	Information regarding animals living around the site is collected through interviews with local residents. If the habitat is expected to be split, mitigation measures, for example, securing a migration route are proposed.
	11	Hydrology	**C**	C	**Construction Phase and Operation Phase:** Existence of the access road may alter the hydrology during high water season.	Flooding area and the water depth are reviewed based on the topographic survey. Inflow and outflow of water are estimated based on the information regarding the surroundings such as location of water gates. Possibility of the impact is assessed based on the collected information and the results of the estimation.
	12	Topography and geology	C	D	**Construction Phase:** Elevation is altered by raising the ground level for the access road. Although the topographic features at the site are not to be protected, the alteration is assessed after confirmation of the elevation change. Geological impacts are not expected because no underground construction has been planned. **Operation Phase:** No activities are expected which could cause topographic or geological alteration.	The impact is assessed based on the present topographic condition and the alteration plan.
Social Environment	13	Involuntary resettlement	B-	D	**Pre-construction Phase:** Relocation of houses may be needed as they have been observed around the proposed access road site. Acquisition of land is necessary. **Operation Phase:** No relocation of residence is required for operation.	Necessity of relocation is confirmed. Land owners and the process of acquisition are reviewed. Abbreviated RAP (Resettlement Action Plan) is developed if land acquisition and relocation are required.
	14	The poor	C	C	Evaluation is made after comprehending socio-economic conditions.	Economic condition of local residents is reviewed through interviews in each village. If the poor are found, special consideration is discussed.
	15	Indigenous and ethnic people	C	C	Evaluation is made based on the social survey results although no indigenous or ethnic people are expected to be found.	Existence of indigenous and ethnic people is reviewed through interviews in each village. If they are identified, special consideration is discussed.

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
	16	Local economy such as employment and livelihood	C	D	**Pre-construction:** Livelihood of the agricultural land owners may be lost by the land acquisition.	Compensation is discussed based on the information regarding the landowners and the impacts on their livelihood.
					Construction Phase: Job opportunities may be increased due to the construction works and the related works.	Number of the construction workers is estimated. Possibility of the employment of local residents is assessed considering their education, work experience and the examples of the other projects.
					Operation Phase: Road operation does not affect employment or livelihood.	-
	17	Land use and utilization of local resources	B-	D	**Pre-construction:** Farm land around the proposed access road such as rice fields is altered. If the irrigation canal is split, the land use as rice fields is affected.	Considering the possibility of splitting canals (results of No.19), impact on local economy in the case of elimination of the rice field is evaluated.
					Operation Phase: Road operation does not affect land use.	-
	18	Water usage	C	C	**Construction Phase:** If the access road splits irrigation canals, it may affect water use.	The impact is assessed considering the possibility of splitting irrigation canals (results of No.19).
					Operation Phase: If the access road splits irrigation canals, it may affect water use.	Same as above.
	19	Existing social infrastructures and services s	C	C	**Pre-construction:** Existing irrigation canals and small path around farm land may be split.	Location of the canals and the paths are reviewed to identify the impact. If they are split, measures such as installing culverts and tunnels are discussed.
					Construction Phase: Traffic congestion may occur if traffic volume on the national road is increased by the construction vehicles.	Impacts are assessed based on the number of construction vehicles. If congestion is predicted, measures such as deploying flagman are proposed.
					Operation Phase: Traffic congestion may occur if traffic volume on the national road is increased by the traffic relevant to SEZ.	Impacts are assessed based on the number of relevant vehicles. If congestion is predicted, measures such as road expansion are proposed.
	20	Social institutions such as social infrastructure and local decision making institution	D	D	Impact is not expected because local decision making functions in the commune and villages are maintained before and after the project.	-

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
	21	Misdistribution of benefits and damage	C	C	Misdistribution of benefits and damage may occur, for example if any residents are affected by farm land acquisition.	Possibility of the misdistribution and the factors are identified based on the results of No.16, stakeholder meetings and interview surveys.
	22	Local conflict of interests	C	C	Local conflict may occur, for example if any residents are affected by farm land acquisition.	Possibility of conflict and the factors are identified based on the results of No.16, stakeholder meetings and interview surveys.
	23	Cultural heritage	D	D	No cultural heritage sites are identified around the project site。	-
	24	Landscape	D	D	No landscape that needs to be protected is identified around the project site.	-
	25	Gender	D	D	No impacts specified for women are expected.	-
	26	Rights of children	D	D	No impacts specified for children are expected.	-
	27	Infectious diseases such as HIV/AIDS	C	D	**Construction Phase:** Risk of infectious diseases may be increased by inflow of construction workers. **Operation Phase:** The road operation is not expected to increase risk of infectious diseases.	Present condition of the diseases such as HIV/AIDS is reviewed to propose measures for reducing the risk.
	28	Labour environment (including work safety)	C	D	**Construction Phase:** Working conditions of construction workers needs to be considered. **Operation Phase:** Workers for the road operation are not required.	Regulations for construction works are reviewed. If the existing measures are deemed not to be adequate comparing with Japan or other international standards, additional measures such as new regulations are proposed.
Others	29	Accidents	B-	B-	**Construction Phase:** Risk of construction accidents and traffic accidents is expected. **Operation Phase:** Risk of traffic accidents is expected.	Risk is assessed considering present condition of traffic accidents and estimation of traffic volume.
	30	Cross boundary impacts and climate change	D	D	Impact is not expected because the project is not wide scale.	-

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected.

Source: Survey Team

Table 3.8-5 Scoping for PHN Port NCT

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
Pollution	1	Air pollution	C	C	**Construction Phase:** Construction dust may affect residential areas depending on the location where the construction equipment works.	Possibility of the impacts to residential areas is assessed based on the type of construction equipment, amount of equipment and the work locations. Measures for dust prevention are proposed considering the possibility of impacts although the possibility will be low as no residence has been found around the construction area.
					Operation Phase: Emission from vessels and vehicles related to the port may affect ambient air quality.	Present air quality is surveyed. Approximate number of vessels and vehicles is estimated to estimate the emission volume to be compared with the standard in Cambodia.
	2	Water pollution	C	C	**Construction Phase:** Turbidity may be generated in accordance with the excavating works (river bank shaping) at the berth construction site. Concrete washing water may be discharged into the river. Domestic wastewater is generated from the workers camp.	Possibility of turbidity generation is assessed considering the present water quality and the construction method. Construction drainage plan is reviewed and measures for preventing polluted water discharge into the river are proposed if necessary. Wastewater treatment measures are proposed if the workers camp is estimated to be a pollution source considering the scale of the camp.
					Operation Phase: Wastewater from vessels may cause water pollution in the river. Domestic wastewater is generated from the terminal office.	Present condition of sewage management from vessels is reviewed. If the measures are deemed not to be adequate comparing with Japan and the other international standard, additional measures such as establishing regulation are proposed. Installing sewage treatment facilities are reviewed. If the measures are deemed not to be adequate, additional measures such as installing another treatment facility are proposed.

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
	3	Waste	B-	B-	**Construction Phase:** Excavated materials are generated during the excavating works (river bank shaping) at the berth construction site. Contents of harmful substances need to be examined although they are not expected to be found as there is no pollution source around the site. Garbage is generated at the construction workers' camp. Dredging for navigation channel is not required since the water depth is already secured.	Contents of harmful substances in the dragged materials are examined to assess the suitability of the disposal method referring to international ocean dumping criteria. Method for collecting and disposing of garbage is reviewed. If the present method is not adequate, collecting and disposing by the contractor are made compulsory.
					Operation Phase: Domestic waste is generated at the terminal office. Waste oil may be generated from vessels. Maintenance dredging for navigation channel is not required since the water depth has been secured.	Method for collecting and disposing of garbage is reviewed. If the present method is not adequate, collecting and disposing by the port administrator are made compulsory. Method of waste oil management at the existing terminal is reviewed. If the existing measures are deemed not to be adequate, suitable measures are proposed.
	4	Soil contamination	D	D	**Construction Phase:** Construction works which cause soil contamination are not expected.	-
					Operation Phase: Operation of port facilities is not expected to cause soil contamination.	-
	5	Noise and vibration	C	C	**Construction Phase:** Construction noise may affect residential areas.	Possibility of the impacts to residential areas is assessed based on the type of construction equipment, amount of equipment and the work locations. Measures for noise prevention are proposed considering the possibility of the impacts although the possibility will be low as no residence has been found around the construction area.
					Operation Phase: Noise from cargo-handling equipment and vehicles may affect residential areas.	Present noise level and traffic volume are surveyed. The possibility of impacts is assessed considering the distance to the residential areas and the estimated number of vehicles. The possibility of the impacts will be low as no residence has been found around the construction area.

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
	6	Ground subsidence	D	D	Activities which cause ground subsidence such as collecting large amounts of groundwater have not been planned.	-
	7	Odour	D	D	Activities that generate odour are not expected. Odour generation by the excavation is not expected because the sediment is not like polluted sludge.	-
	8	Sediment quality	C	D	**Construction Phase:** Siltation may occur downstream if significant turbidity is generated by the construction works.	The possibility is assessed based on the assessment results of turbidity generation (see No.2) and the sediment condition downstream of the site.
					Operation Phase: Port operation does not cause sediment pollution since facilities which cause the pollution have not been planned.	-
Natural Environment	9	Protected area	D	D	Impact is not expected since no protected area such as national park is designated around the project site.	-
	10	Ecosystem	B-	C	**Construction Phase:** Aquatic benthic fauna at the berth construction site is affected. Navigation of construction vessels may affect fish resources. The terminal site has been prepared by reclamation and is currently vacant. There is no habitat of Mekong dolphin around the site.	Aquatic benthos at the berth construction site and the surrounding fish species are investigated to find protected species. If they are identified, a mitigation plan is developed for each species considering the biology and the life cycle.
					Operation Phase: If polluted water is discharged from vessels, aquatic life may be affected. Disturbance and elimination of habitat by constructing revetment and berths may affect the surrounding ecosystem.	Impact is assessed considering the possibility of polluted water discharge and the existing aquatic species. If necessary, measures such as improving polluted water discharge and creating alternative habitat are proposed.
	11	Hydrology	D	D	**Construction Phase:** Construction works which prevent river water flow have not been planned. **Operation Phase:** The berth does not prevent river water flow since the structure is on piers.	-

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
	12	Topography and geology	C	D	**Construction Phase:** Topography of the river bank is altered by excavation for shaping. Although the topographic features at the site are not to be protected, the alteration is assessed after confirmation of the topographic change. Geological impacts are not expected because no underground construction has been planned. **Operation Phase:** No activities are expected which could cause topographic or geological alteration.	The impact is assessed based on the present topographic condition and the alteration plan.
Social Environment	13	Involuntary resettlement	C	D	**Pre-construction Phase:** The project site is vacant reclaimed land that PPAP developed. Land owners and existence of residents need to be confirmed. **Operation Phase:** No relocation of residence is required for operation.	Land owners and existence of residents before the development are confirmed.
	14	The poor	C	C	Evaluation is made after comprehending socio-economic condition.	Economic condition of local residents is reviewed through interviews in each village. If the poor are found, special consideration is discussed.
	15	Indigenous and ethnic people	C	C	Evaluation is made based on the social survey results although no indigenous or ethnic people are expected to be found.	Existence of indigenous and ethnic people is reviewed through interviews in each village. If they are identified, special consideration is discussed.
	16	Local economy such as employment and livelihood	C	C	**Construction Phase:** Construction works may affect fishing activities if the activities are operated around the project site. Job opportunities may be increased due to the construction works and the related works.	Fishing activities are reviewed. If an impact is predicted, necessity of compensation is discussed. Number of the construction workers is estimated. Possibility of the employment of local residents is assessed considering their education, work experience and the examples of the other project.
					Operation Phase: Port operation may affect fishing activities if the activities are operated around the project site. Job opportunities and activation of local economy are expected by the port operation.	Fishing activities are reviewed. If an impact is predicted, necessity of compensation is discussed. Present local livelihood and local economic level are reviewed to assess the possibility of improvement by port operation.

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
	17	Land use and utilization of local resources	C	C	**Construction Phase:** Impact is not expected since the site belongs to PPAP. Fishery resources may be affected in case of water pollution during construction works.	Fishing activities and present condition of fishery resources are reviewed. Impact is assessed considering the possibility of water pollution.
					Operation Phase: Fishery resources may be affected in the case of water pollution during port operation.	Same as above.
	18	Water usage	D	C	**Construction Phase:** Impact is not expected since large amounts of water are not required for the construction works.	-
					Operation Phase: Water for supplying to the port is planned to be collected from the existing piped water network and stored in the water tank. Although the capacity of the existing piped water is estimated to be adequate so as not to affect the existing water users, it needs to be confirmed.	Capacity of the existing piped water is reviewed. If necessary, alternatives such as groundwater use are discussed.
	19	Existing social infrastructures and services s	C	C	**Construction Phase:** Traffic congestion may occur if traffic volume on the national road is increased by the construction vehicles.	Impacts are assessed based on the number of construction vehicles. If congestion is predicted, measures such as deploying flagman are proposed.
					Operation Phase: Traffic congestion may occur if traffic volume is increased by the port.	Impacts are assessed based on the number of relevant vehicles. If congestion is predicted, measures such as road expansion are proposed.
	20	Social institutions such as social infrastructure and local decision making institution	D	D	Impact is not expected because local decision making functions in the commune and villages are maintained before and after the project.	-
	21	Misdistribution of benefits and damage	C	C	Although residents who are especially damaged by the project are not expected, it is to be confirmed through stakeholder meetings and the others.	Possibility of damage is identified through stakeholder meetings and interview surveys.

		Impacts	Rating		Description of the Rating	Prediction Method/ Evaluation Policy
			Pre /During Construction Phase	Operation Phase		
	22	Local conflict of interests	C	C	Although no factors which cause local conflict have been identified, it is to be confirmed through stakeholder meetings and others. Conflict between local residents and migrated people may occur by inflow of construction workers and port workers.	Possibility of conflict and the factors are identified through stakeholder meetings and interview surveys.
	23	Cultural heritage	D	D	No cultural heritage sites are identified around the project site。	-
	24	Landscape	D	D	No landscape that needs to be protected is identified around the project site.	-
	25	Gender	D	D	No impacts specified for women are expected.	-
	26	Rights of children	D	D	No impacts specified for children are expected.	-
	27	Infectious diseases such as HIV/AIDS	C	C	**Construction Phase:** Risk of infectious diseases may be increased by inflow of construction workers. **Operation Phase:** Risk of infectious diseases may be increased by inflow of port workers.	Present condition of the diseases such as HIV/AIDS is reviewed to propose measures for reducing the risk.
	28	Labour environment (including work safety)	C	C	**Construction Phase:** Working condition of construction workers needs to be considered. **Operation Phase:** Working condition of port workers needs to be considered.	Regulation for construction works and factory works is reviewed. If the existing measures are deemed not to be adequate comparing with Japan or other international standards, additional measures such as new regulation are proposed.
Others	29	Accidents	B-	B-	**Construction Phase:** Risk of construction accidents and traffic accidents is expected. **Operation Phase:** Risk of traffic accidents by vessels and vehicles are expected.	Risk is assessed considering present condition of traffic accidents and estimation of traffic volume.
	30	Cross boundary impacts and climate change	D	D	Impact is not expected because the project is not wide scale.	-

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: Survey Team

3.8.3 Impact Assessment and Mitigation Measures

Impacts and the mitigation measures were discussed for each item on which impacts were expected as the result of the scoping. The results are summarized in Tables 3.8-6, 3.8-7 and 3.8-8. The details are explained in the EIA study report.

Table 3.8-6 Results of Impact Assessment and the Mitigation Measures for PPAP-NCT SEZ

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
Pollution	1	Air pollution	B-	B-	**Construction Phase:** Since the land fill materials are conveyed by pumping directly from NCT to the construction site, air pollution caused by the soil transportation is negligible. Estimated number of construction-related trucks is 15 trucks /day at peak time and 5 trucks /day on an average. The number shows that the dust generation related to the trucks will be limited. However, consideration is required for the residential area located at the northwest edge of the SEZ area.	-To conduct measures for minimizing the dust i.e. sprinkling water on the construction site near the communities. -To wash tires of trucks in washing area before leaving the construction site.
					Operation Phase: Since present ambient air quality is much better than the standard, the operation of SEZ will not cause an increase in pollutants which exceeds the standard. However, possibility of air pollution is not deniable depending on type of the industry.	- To oblige strict obedience to the Sub-decree on Air Pollution Control and Noise Disturbance by the factories. The Sub-decree stipulates that the emission of pollutants from an immovable source into the atmosphere shall asked for permission from the Ministry of Environment and that the owner or responsible person of the pollution source shall be responsible for installing the equipment for measurement of the amount of pollutant contained in his/her pollution sources and store the result for record keeping.
	2	Water pollution	B-	B-	**Construction Phase:** Turbid surplus water will be generated from the land filling materials conveyed from NCT by pumping. Proper treatment of human waste is required, since up to 80 workers will join the construction works.	-To prepare sedimentation ponds to reduce the turbid water from the dredged soil at the SEZ construction site. -To install treatment facilities for waste water such as temporary toilets or septic tanks at the construction sites.

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
					Operation Phase: Discharge of wastewater from factories, and also rain water, sewage, and industrial and medical wastewater is anticipated.	-Rain water shall be discharged into ponds in the SEZ area and the canal around the SEZ. -Sewage shall be discharged to the canal around the SEZ after being treated at the sewage treatment plant which shall be installed in the SEZ. -Industrial water containing oily waste or metals and medical waste water generated from factories or the clinic shall be discharged after being treated by the respective tenant properly. -To conduct periodic water monitoring in the canals around the SEZ to compare with the standards.
	3	Waste	B-	B-	**Construction Phase:** Garbage is generated at construction workers' camp. Construction waste may be generated although demolishing structures at the construction site is not needed.	-To obligate the contractor to collect and dispose of the garbage and construction waste properly.
					Operation Phase: Industrial waste is generated.	-To obligate tenants to collect and dispose of the waste by hiring a contractor licensed by the Ministry of Environment.
	4	Soil contamination	D	B-	**Construction Phase:** Baseline survey results showed that the pollutant level of the candidate landfilling materials satisfied the standards of Soil Contamination Countermeasures Act and Agricultural Land Soil Pollution Prevention Law of Japan. Therefore, soil contamination by landfilling is not expected.	-
					Operation Phase: Soil contamination caused by discharge of sewage, industrial and medical wastewater is not deniable.	-To prevent soil contamination by securing measures against water pollution.

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	5	Noise and vibration	B-	B-	**Construction Phase:** Consideration for the construction noise is required for the residential area at the northwest edge of the SEZ area although the construction work is small scale with 5 excavators, 2 bulldozers, 1 pile-driver and others.	In order to minimize the noise, the following exampled measures need to be taken by the contractor when the construction works are conducted adjacent to the residential area. -Measures for reducing noise; for example, installing noise barriers and selecting low-noise equipment as much as possible, -To restrict works which will cause loud noise during night time, -Reporting the construction schedule to surrounding communities to obtain their consensus. etc.
					Operation Phase: Anticipated type of industry is light manufacturing such as automobile parts or metal/non-metal processing. Power generators will not be installed except for one emergency unit. A school and hospital are planned to be constructed in the SEZ area, but fences installed around the factory will work for restraining the noise. However, noise generation is not deniable because the type of factory has not been decided.	-To oblige strict obedience to the Sub-decree on Air Pollution Control and Noise Disturbance by the factories. The Sub-decree stipulates that the noise from immovable sources shall ask for permission from the Ministry of Environment and that the owner or the responsible person of the noise source shall be responsible for installing or equipping any equipment to reduce noise and vibration in order to meet the noise standard.
	6	Ground subsidence	D	D	**Construction Phase:** No construction works which could cause ground subsidence such as collecting large amounts of groundwater have been planned.	-
					Operation phase: The possibility of ground subsidence has been identified as being low because of the sufficient groundwater supply from the Mekong and Bassac rivers even if the tenants use groundwater.	-
	7	Odour	D	B-	**Construction Phase:** Construction works that generate odour are not expected.	-
					Operation Phase: Although it may not affect outside of the SEZ, generation of odour from waste storage and the sewage treatment facility is not deniable.	-To monitor odour as well as the number of complaints. If any impacts are identified, measures such as installing concrete walls shall be considered.

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	8	Sediment quality	B-	B-	**Construction Phase:** Siltation may occur at the bottom of the irrigation canals around the site if turbid surplus water is generated from the landfill materials transported from NCT by pumping.	-To prepare sedimentation ponds to reduce the turbid water discharge (see No.2, water pollution).
					Operation Phase: Sediment pollution caused by discharge of sewage, industrial and medical wastewater is undeniable.	-To prevent sediment pollution by securing measures against water pollution.
Natural Environment	9	Protected area	D	D	Impact is not expected since no protected area such as national park is designated around the project site.	-
	10	Ecosystem	B-	B-	**Construction Phase:** Most portions of the construction site have been developed as rice fields. Aquatic organisms and birds were observed in the rice fields, canals and swamps. For the aquatic organisms, impacts of the turbid water are a concern. On the other hand, for the birds and mammals, vast swamps and inundated shrub land where they can move to will remain on the south side of the SEZ area; therefore, the impact is deemed to be limited.	-To secure measures against water pollution. (see No.2)
					Operation Phase: Wastewater discharge from the SEZ may affect aquatic organisms in the surrounding canals. Existence of the SEZ may reduce habitat and/or divide aquatic organisms' habitat.	<Fish, aquatic organisms, amphibians and reptiles > -To create a canal around the SEZ area and connect it to the existing canals in order to secure the habitat and migration pathway. -To create habitat by installing ponds and green space in the SEZ area. -To conduct mitigation measures against the water pollution (see No.2). <Plants> -To create habitat by installing ponds and green space in the SEZ area.

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	11	Hydrology	B-	B-	**Construction Phase and Operation Phase:** The area around the SEZ is flooded in the rainy season due to inflow of river water from the Mekong and Bassac Rivers through water gates and culverts, while it is dried up in the dry season after the water flows out. It is said that flood damage is eased by making the area submerged intentionally. Therefore, decreasing of submerged area may make the flooded area stretch out to the surroundings.	-To install a water reservoir pond adjacent to the SEZ area in order to secure water volume as large as that or more than that lost due to the project. The pond shall be connected with the existing ones to secure the water flow.
	12	Topography and geology	D	D	**Construction Phase:** Ground elevation is altered by landfilling from the present elevation of 2-3m to about 7.5m. However, the topographic features at the site are not to be protected, impacts on topography are not expected. Geological impacts are not expected because no underground construction has been planned. **Operation Phase:** No activities are expected which could cause topographic or geological alteration.	-
Social Environment	13	Involuntary resettlement	B-	D	**Pre-construction Phase:** Land which has been used for rice fields needs to be acquired. There are no houses in the SEZ area. **Operation Phase:** No relocation of residence is required for operation.	-Abbreviated RAP was developed in accordance with JICA Guidelines.
	14	The poor	B-	B+	**Pre-construction Phase:** There is a possibility that low-income households categorized as the poor are included in renters and workers of the affected land, while they are not found in the group of landowners.	-Mechanism is proposed for the poor of the affected landowners, renters and workers whose income is below the national poverty line (20 USD/month/person) to ask PPAP to support them; for example to provide employment opportunities.
					Operation Phase: It is expected that employment opportunities for the poor without land are increased.	-
	15	Indigenous and ethnic people	D	D	No indigenous or ethnic people were found around the project site.	-

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	16	Local economy such as employment and livelihood	Pre-construction phase: B- Construction phase: B+	B+	**Pre-construction:** Livelihood of the landowners and the renters may be affected if they cannot find alternative lands for farming.	See No.13.
					Construction Phase: Job opportunities may be brought by the construction works and the related works.	-
					Operation Phase: Income from working at factories and companies is presently about half of the average income of the local people. Operation of SEZ will increase opportunities for the said type of jobs and income, so that it will increase income and activate the local economy.	-
	17	Land use and utilization of local resources	B-	B-	**Pre-construction:** Farmlands near the proposed SEZ area such as rice fields will be altered; however, the impact is relatively small because the productivity of the farmland is not high due to its low elevation. On the other hand, reserved water volume for irrigating the surrounding farmland during the dry season will be reduced by about 750,000 m^3.	-To install a water reservoir pond adjacent to the SEZ area to supply irrigation water to surrounding rice fields.
					Operation Phase: Surrounding rice fields may be affected if polluted water is discharged from SEZ.	-To secure the measures for water pollution. (see No.2)
	18	Water usage	D	D	**Construction Phase:** Water volume for transporting sand for reclamation is expected to be below 1 m^3/sec. The water is planned to be collected from the Mekong River. Since the discharge of the Mekong River is sufficient, about 2,000-40,000 m^3/sec at Kuratie located upstream (Mekong River Commission), impacts on water use are not expected.	-
					Operation Phase: Water for SEZ is planned to be collected from the existing piped water network and stored in the water tank. Due to the sufficient capacity of the existing piped water, collecting water from the network will not affect the existing water users.	-

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	19	Existing social infrastructures and services	D	D	**Pre-construction:** The SEZ will not split irrigation canals or paths around the farmlands.	-
					Construction Phase: Construction vehicles will not cause traffic congestion because the estimated number of construction related trucks is limited: 15 trucks /day at peak time and 5 trucks /day on an average.	-
					Operation Phase: Traffic congestion may not occur because the estimated number of the SEZ related vehicles is limited: 500 vehicles /hour (about 8 vehicles /minute).	-
	20	Social institutions such as social infrastructure and local decision making institutions	D	D	Impact is not expected because local decision making functions in the commune and villages are maintained before and after the project.	-
	21	Misdistribution of benefits and damage	B-	D	Misdistribution of benefits and damage may occur if any residents are affected by farmland acquisition.	See No.13.
	22	Local conflict of interests	B-	B-	**Pre-construction Phase:** Local conflict may occur if any residents are affected by farmland acquisition.	See No.13.
					Construction Phase and Operation Phase: Conflict between local residents and migrated people may occur by inflow of construction workers and SEZ workers.	-To prioritize local workforce for the employment.
	23	Cultural heritage	D	D	No cultural heritage sites are identified around the project site。	-
	24	Landscape	D	D	Landscape that needs to be protected is not identified around the project site.	-
	25	Gender	D	D	No impacts specified for women are expected.	-
	26	Rights of children	D	D	No impacts specified for children are expected.	-
	27	Infectious diseases such as HIV/AIDS	B-	B-	**Construction Phase:** Risk of infectious diseases may be increased by inflow of construction workers.	-To promote awareness of the workers on the infectious diseases such as HIV/AIDS, for example by waging a campaign.

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
					Operation Phase: Risk of infectious diseases may be increased by inflow of SEZ workers.	-To promote awareness on the infectious diseases such as HIV/AIDS and to monitor collaborating with local clinics.
	28	Labour environment (including work safety)	B-	B-	**Construction Phase:** Working conditions of construction workers need to be considered.	-To comply with Labour Laws and the relevant sub-decrees and declarations. -To ensure safety control by measures such as safety training for the workers, safety patrols at the construction site by supervisors and periodic meetings for securing the measures. -To prepare a first aid station near the construction site.
					Operation Phase: Working conditions of SEZ workers need to be considered.	-To obligate tenants to comply with the Labour Law and the relevant sub-decrees and declarations.
Others	29	Accidents	B-	B-	**Construction Phase:** Risk of construction accidents and traffic accidents is expected.	-To install a fence or signboard at the construction site to keep out local people. -To deploy a flagman at the entrance of the construction site.
					Operation Phase: Risk of traffic accidents is expected. It is not deniable that industries which handle hazardous materials could become tenants of the SEZ.	-To control speed of vehicles on the site. -To obligate tenants who handle hazardous materials to take proper measures. -To install hydrants at the site.
	30	Cross boundary impacts and climate change	D	D	Impact is not expected because the project is not wide scale.	-

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected.

Source: Survey Team

Table 3.8-7 Results of Impact Assessment and the Mitigation Measures for Access Road to SEZ

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
Pollution	1	Air pollution	B-	B+	**Construction Phase:** The estimated number of construction related trucks is 15 trucks /day at peak time and 5 trucks /day on an average. The number shows that the dust generation related to the trucks will be limited. However, consideration is required for the residential area located at the north part of the construction site.	-To conduct measures for minimizing the dust i.e. sprinkling water at the construction site nearby communities. -To wash tires of trucks in washing area before leaving the construction site.
					Operation Phase: The estimated traffic volume of the access road is 2,000 light vehicles/day and 106 heavy trucks /day. The environmental standard in Cambodia is predicted to be satisfied except SPM due to the limited emission volume. SPM will decrease because the existing road in the location proposed for the access road will be surfaced with asphalt.	-
	2	Water pollution	B-	B-	**Construction Phase:** For earth fill works for the access road, excavated land soil for creating the reservoir pond is to be utilized; therefore, surplus turbid water will not be generated. Proper treatment of human waste is required, since up to 80 workers will join the construction works.	-To install a treatment facility for waste water such as temporary toilets or septic tanks at the construction sites.
					Operation Phase: Discharge of rain water is anticipated.	-To install drain ditches and collection pits with oil separators on each side of the access road. Rain water shall be discharged into the existing canals after being separated from flotsam and oil at the collection pits.
	3	Waste	B-	D	**Construction Phase:** Garbage will be generated at the construction workers' camp. Construction waste is generated by demolishing structures in the construction site. Other waste from construction works may be generated.	-To obligate the contractor to collect and dispose of the garbage and the construction waste properly. Demolished materials shall be reused as much as possible.
					Operation Phase: Waste generation is not expected from the road operation.	-
	4	Soil contamination	D	D	Activities which cause soil contamination are not expected.	-

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	5	Noise and vibration	B-	B-	**Construction Phase:** The estimated construction traffic is 15 trucks /day at peak time and 5 trucks /day on an average. The number shows that the noise generated from the traffic will be limited. Consideration for the residential area at the north part of the construction site is required although the construction work is small scale with one dump truck, one concrete pumping truck and others.	In order to minimize the noise, the following measures need to be taken by the contractor when the construction works are conducted adjacent to the residential area. -Measures for reducing noise; for example, installing noise barriers and selecting low-noise equipment as much as possible, -To restrict works which will cause loud noises during the night time, -Reporting the construction schedule to the surrounding communities to obtain their consensus. etc.
					Operation Phase: Anticipated traffic volume on the access road is 1,000 light vehicles/hour and 9 heavy vehicles/hour during peak time. The predicted noise level shows that the night time traffic noise (10 PM- 6 AM) will exceed the standard in Cambodia and affect the residential area along the road, while daytime noise (6 AM-10 PM) will satisfy it. Impact of traffic vibration is negligible as the predicted level is far below the standard in Japan.	-To monitor the noise and the traffic volume along the access road. -Measures for reducing noise shall be taken if the noise generated by the project turns out to be significant.
	6	Ground subsidence	D	D	**Construction Phase:** No construction works which cause ground subsidence such as collecting large amounts of groundwater have been planned.	-
					Operation phase: Ground subsidence is not expected from the road operation.	-
	7	Odour	D	D	Activities which generate odour are not expected.	-
	8	Sediment quality	D	D	**Construction Phase:** For earth filling works for the access road, excavated soil from creating the reservoir pond is utilized; therefore, surplus turbid water will not be generated. In addition, ditches will be installed on both sides of the road. Hence, turbid water generation which causes sediment pollution will not be expected.	-
					Operation Phase: Sediment pollution caused by the road operation is not expected.	-

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
Natural Environment	9	Protected area	D	D	Impact is not expected since no protected area such as national park is designated around the project site.	-
	10	Ecosystem	B-	B-	**Construction Phase:** Sugar palm trees are found along the proposed access road site, which are listed as endanger species in the IUCN red list. Even though they are not listed in the national red list, consideration is recommended on this species.	-To transplant the affected sugar palm trees to the edge of the access road or inside of the premises of SEZ.
					Operation Phase: Habitat of aquatic organisms will be split by the access road. Impacts on mammals are deemed to be small because the site has already been used for existing roads, canals and rice fields.	-To install bridges and pipe culverts at the crossing point with the existing canals in order to secure the water flow and the migration pathway of aquatic organisms. -To install canals on both sides of the access road so as to connect them with the existing canals.
	11	Hydrology	B-	B-	**Construction Phase and Operation Phase:** The area around the SEZ is flooded in the rainy season due to inflow of river water from the Mekong and Bassac Rivers through water gates and culverts, while it is dried up in the dry season after the water flows out. It is said that flood damage is eased by making the area submerged intentionally. Therefore, splitting of the existing canals by the access road may affect the water flow and make the flooded area change or stretch out to the surroundings.	-To install bridges and pipe culverts at the crossing points with the existing canal in order to secure the water flow. -To install canals along both sides of the access road and connect them to the existing canals in order to secure the water flow.
	12	Topography and geology	D	D	**Construction Phase:** Topographic change is expected due to expansion of the existing road and alteration of the rice fields. However, the topographic features on the site are not to be protected, impacts on topography are not expected. **Operation Phase:** No activities are expected which could cause topographic or geological alteration.	-

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
Social Environment	13	Involuntary resettlement	B-	D	**Pre-construction Phase:** Land which has been used for rice fields and residences needs to be acquired. Up to 12 households need to be relocated. **Operation Phase:** No relocation of residence is required for operation.	- Abbreviated RAP was developed in accordance with JICA Guidelines.
	14	The poor	B-	D	**Pre-construction Phase:** There is a possibility that low-income households categorized as the poor are included in the group of landowners, renters and workers of the affected land.	-Mechanism is proposed for the poor of the affected landowners, renters and workers whose income is below the national poverty line (20 USD/month/person) to ask PPAP to support them; for example to provide employment opportunities.
					Operation Phase: Operation of the road will not affect the poor.	-
	15	Indigenous and ethnic people	D	D	No indigenous or ethnic people were found around the project site.	-
	16	Local economy such as employment and livelihood	Pre-construction phase: B- Construction phase: B+	D	**Pre-construction:** Livelihood of the landowners and the renters may be affected if they cannot find alternative lands for farming.	See No.13.
					Construction Phase: Job opportunities may be brought by the construction works and the related works.	-
					Operation Phase: Operation of the road will not affect employment or livelihood.	-
	17	Land use and utilization of local resources	B-	D	**Pre-construction:** Farmlands near the proposed SEZ area such as rice fields will be altered; however, the impact to the region is small because the affected area is limited. Meanwhile, the access road will cross the major irrigation canal of the village.	-To install bridges and pipe culverts at the crossing points with the existing canals in order to secure the water flow. -To install canals on both sides of the access road so as to prevent splitting of irrigation water flow.
					Operation Phase: Operation of the road will not affect land use.	-
	18	Water usage	D	B-	**Construction Phase:** Construction works will not affect surrounding water users because the works do not need to interrupt water flow at the crossing points with the existing irrigation canals.	-
					Operation Phase: The access road will cross existing irrigation canals at two points.	See No.17.

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	19	Existing social infrastructures and services s	Pre-construction phase: B- Construction phase: D	D	**Pre-construction:** The access road will cross existing irrigation canals at three points and existing roads at four points. Navigation routes of fishing boats during the rainy season will be blocked.	-To install bridges and pipe culverts in order to secure the water flow. - To make the access road cross the existing road at grade so that the local vehicles and the pedestrians can cross and enter the access road. - To install culvert tunnels and a bridge to secure fishing boats' navigation.
					Construction Phase: Construction vehicles will not cause traffic congestion because the estimated number of construction related trucks is limited: 15 trucks /day at peak time and 5 trucks /day on an average.	-
					Operation Phase: Traffic congestion may not occur because the estimated number of the SEZ related vehicles is limited: 500 vehicles /hours (about 8 vehicles /minute).	-
	20	Social institutions such as social infrastructure and local decision making institution	D	D	Impact is not expected because local decision making functions in the commune and villages are maintained before and after the project.	-
	21	Misdistribution of benefits and damage	B-	D	Misdistribution of benefits and damage may occur if any residents are affected by farmland acquisition.	See No.13.
	22	Local conflict of interests	B-	B-	**Pre-construction Phase:** Local conflict may occur if any residents are affected by farmland acquisition.	See No.13.
					Construction Phase: Conflict between local residents and migrated people may occur by inflow of construction workers.	-To prioritize local workforce for the employment.
	23	Cultural heritage	D	D	No cultural heritage sites are identified around the project site.	-
	24	Landscape	D	D	Landscape that needs to be protected is not identified around the project site.	-
	25	Gender	D	D	No impacts specified for women are expected.	-
	26	Rights of children	D	D	No impacts specified for children are expected.	-

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	27	Infectious diseases such as HIV/AIDS	B-	D	**Construction Phase:** Risk of infectious diseases may be increased by inflow of construction workers. **Operation Phase:** Infectious disease caused by the road operation will not be expected.	-To promote awareness of the workers on the infectious diseases such as HIV/AIDS, for example by waging a campaign.
	28	Labour environment (including work safety)	B-	D	**Construction Phase:** Working conditions of construction workers need to be considered.	-To comply with z Labour Law and the relevant sub-decrees and declarations. -To ensure safety control by measures such as safety training for the workers, safety patrols on the construction site by supervisors and periodic meetings for securing the measures. -To prepare a first aid station near the construction site.
					Operation Phase: Labour is not needed for the road operation.	-
Others	29	Accidents	B-	B-	**Construction Phase:** Risk of construction accidents and traffic accidents is expected.	-To install a fence or signboard at the construction site to keep out local people. -To deploy a flagman at the entrance of the construction site.
					Operation Phase: Risk of traffic accidents is expected. Surrounding rice fields may be affected in case of oil contamination caused by the traffic accidents.	-To control the speed of vehicles on the site. -To install oil separators in ditches on both sides of the road.
	30	Cross boundary impacts and climate change	D	D	Impact is not expected because the project is not wide scale.	-

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: Survey Team

Table 3.8-8 Results of Impact Assessment and the Mitigation Measures for PHN Port NCT

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
Pollution	1	Air pollution	B-	D	Construction Phase: Residential areas are identified on the south and east sides of the construction site. Construction dust may affect the residential areas although the impact will not be significant because the land preparation works have already been completed.	-To conduct measures for minimizing the dust i.e. sprinkling water on the construction site near the communities. -To wash the tires of trucks in a washing area before leaving the construction site.
					Operation Phase: The estimated number of cargo vehicles is up to 1,230 /day (total traffic from/to the terminal 1-3). Current SPM at the national road No.1 is almost equal to the environmental standard. Since predicted increment of SPM by the port traffic is less than 0.1% (0.0003mg/L or less), the impact of the project is limited. Emission from the vessels is predicted to be up to 71 kg/day of NOx and 50 kg/day of SOx. Since current concentration of NOx and SOx is far below the standards, impacts of vessels and cargo vehicles are limited.	-
	2	Water pollution	B-	B-	Construction Phase: The river bank will be shaped when the berth is constructed. Although the construction volume is small at about 90,000 m3, turbidity may be generated because the sediment on the river bank includes silt. Concrete washing water may be discharged into the river. Proper treatment of human waste is required, since up to 80 workers will join the construction works.	-To prepare a silt screen to prevent turbidity from diffusing to the lower stream during the river bank shaping. -To prepare sedimentation ponds to prevent the turbid water generated by concrete washing etc. from flowing into the river directly. -To install treatment facilities for waste water such as temporary toilets or septic tanks at the construction sites.
					Operation Phase: Even though the possibility of wastewater discharge from vessels is not deniable, it will not cause water pollution because the area is not enclosed. Domestic wastewater is generated from the terminal building.	-To install treatment units to treat sewage generated at the buildings.

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	3	Waste	B-	B-	**Construction Phase:** 90,000m^3 of excavated soil will be generated for the river bank shaping. The soil can be disposed of on the land as the materials do not include pollutants above the standards of the Soil Contamination Countermeasures Act or Agricultural Land Soil Pollution Prevention Law in Japan. Capital dredging for the navigation channel is not needed as the water depth is already secured. Garbage will be generated at the construction workers' camp. Other waste from the construction works may be generated.	-The excavated soil generated by the river bank shaping shall be used for backfilling for the yard. -To oblige the constructor to collect and dispose of the garbage and the construction waste properly.
					Operation Phase: Domestic waste will be generated at the terminal building. Waste oil generation from vessels is not expected as it is hardly observed at the existing port or terminal. Maintenance dredging for the navigation channel is not needed as the water depth is already secured.	-To ensure domestic waste collection by hiring a proper contractor following the existing methodology at Terminal-1.
	4	Soil contamination	D	D	**Construction Phase:** Construction works which cause soil contamination are not expected.	-
					Operation Phase: Operation of port facilities is not expected to cause soil contamination.	-
	5	Noise and vibration	B-	B-	**Construction Phase:** Consideration of the construction noise is required for the residential area on the south and east of the construction site although the construction work is small scale with 2 excavators, 1 bulldozer, 1 pile driver and others.	In order to minimize the noise, the following measures need to be taken by the contractor when the construction works are conducted adjacent to the residential area. -Measures for reducing noise; for example, installing noise barriers and selecting low-noise equipment as much as possible, -To restrict works which will cause loud noises during night time, -Reporting the construction schedule to surrounding communities to obtain their consensus. etc.

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
					Operation Phase: The predicted noise level caused by the cargo vehicles shows that the night time traffic noise (10 PM- 6 AM) will exceed the standard in Cambodia and affect the residential area along the road, while daytime noise (6 AM-10 PM) will satisfy it. (Comparing with the standard in Japan, the predicted night time traffic noise satisfies the standard (65dB) for an area close to a main road.) Port equipment such as cranes will generate noise; however, equipment which generates noise continuously such as electric generators will not be installed. Also, the residential area is more than 100m from the noise source. Hence, impacts of the port operation are limited.	-To monitor the noise and the traffic volume along the access road. -Measures for reducing noise shall be taken if the noise generated by the project turns out to be significant.
	6	Ground subsidence	D	D	Activities which cause ground subsidence such as collecting large amounts of groundwater have not been planned.	-
	7	Odour	D	D	Activities that generate odour are not expected. Odour generation by excavation is not expected because the sediment is not polluted sludge.	-
	8	Sediment quality	B-	D	**Construction Phase:** The river bank will be shaped when the berth is constructed. Although the construction volume is small at about 90,000 m^3, turbidity will be generated because the sediment at the river bank is silt, and may change downstream sediment quality.	-To install a silt screen to prevent turbidity from diffusing to the lower stream during the river bank shaping.(See No.2)
					Operation Phase: Port operation will not cause sediment pollution since facilities which cause the pollution have not been planned.	-

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
Natural Environment	9	Protected area	D	D	Impact is not expected since no protected area such as national park is designated around the project site.	-
	10	Ecosystem	D	D	**Construction Phase:** The volume of the river bank shaping is small at 90,000m^3 of soil, and the affected area is limited within and in front of the berth construction site. No endangered benthic organisms are found in/around the site. The proposed berth type is with piers, so that the elimination of benthic habitat is limited. For these reasons, the impact is deemed to be negligible.	-
					Operation Phase: Since water pollution is not anticipated by the terminal operation, impacts on the aquatic ecosystem are not expected.	-
	11	Hydrology	D	D	**Construction Phase:** No construction works which prevent river water flow have been planned. **Operation Phase:** The berth does not prevent river water flow due to the pier structure.	-
	12	Topography and geology	D	D	**Construction Phase:** The volume of the river bank shaping is small at 90,000m^3 of soil, and the affected area is limited within and in front of the berth construction site. The topographic features at the site are not to be protected; therefore, impact is not anticipated. **Operation Phase:** No activities are expected which could cause topographic or geological alteration.	-
Social Environment	13	Involuntary resettlement	D	D	**Pre-construction Phase:** The project site is vacant reclaimed land that PPAP developed. No houses were there before the reclamation. No grievances or problems have been identified related to the land acquisition. **Operation Phase:** No relocation of residences is required for operation.	-

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	14	The poor	D	D	Impacts specified to the poor are not anticipated although households categorized as the poor are identified in the surrounding villages.	-
	15	Indigenous and ethnic people	D	D	No indigenous or ethnic people were found around the project site.	-
	16	Local economy such as employment and livelihood	D	B-/+	**Construction Phase:** Construction works will not affect fishing activities because the area in front of the NCT and some hundreds meters wide on both sides has already been restricted for safety control.	-
					Operation Phase: The area within 2 km downstream of the above-mentioned restricted area has been used as fishing grounds by local fishermen. For operation of the new terminal the restricted area may be expanded to300m on the downstream side. On the other hand, employment opportunities for port labour and other related jobs are expected as well as activation of the local economy.	-To minimize the area restricted for fishing activities and consult with local fishermen to obtain consensus prior to the operation.
	17	Land use and utilization of local resources	B-	D	**Construction Phase:** Impact is not expected since the site belongs to PPAP. Fishery resources may be affected in case of water pollution during construction works.	-To prevent impacts on fishery resources by securing measures against water pollution. (See No.2)
					Operation Phase: Impact on fishery resources due to water pollution is not anticipated as the area is not enclosed and the pollution source is limited to domestic sewage from terminal buildings.	-
	18	Water usage	D	D	**Construction Phase:** Impact is not expected since large amounts of water are not required for the construction works.	-
					Operation Phase: Water for the port is planned to be collected from the existing piped water network and stored in the water tank. Due to the sufficient capacity of the existing piped water, collecting water from the network will not affect the existing water users.	-

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	19	Existing social infrastructures and services	D	D	**Construction Phase:** Construction vehicles will not cause traffic congestion because the estimated number of construction related trucks is limited: 15 trucks /day at peak time and 5 trucks /day on an average.	-
					Operation Phase: Predicted number of the port related vehicles is 771/day in 2029 when the cargo volume reaches the full-capacity of terminal 2. The increase corresponds to 18% of the current traffic volume, 4,248/day. On the other hand, comparing with the capacity of the national road No.1 (more than ten thousand per day), the increase is not at a level deemed to cause traffic congestion or affect regional transportation. In addition, the increase will be a long-term change; therefore, it is expected that surrounding new road construction will alleviate the risk of the congestion. Number of the port traffic trips after 2029 at the time when terminal 3 is constructed and becomes full is 1,230/day, which corresponds to 29% of the current traffic volume.	-
	20	Social institutions such as social infrastructure and local decision making institution	D	D	Impact is not expected because local decision making functions at commune and villages are maintained before and after the project.	
	21	Misdistribution of benefits and damage	B-	B-	**Construction Phase:** Misdistribution of benefits and damage may occur between affected fishermen and the other residents who get job opportunities in case of water pollution which affects the fishery resources.	-To secure the measures against water pollution. (See No.2)
					Operation Phase: Misdistribution of benefits and damage may occur between affected fishermen and the other residents in case of reduction of fishing ground due to expansion of the restricted area.	-To consult with the fishermen to obtain consensus prior to the operation. (See No.16)

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	22	Local conflict of interests	B-	B-	**Construction and Operation Phase:** Conflict between local residents and migrated people may occur by inflow of construction workers and port workers.	-To prioritize local workforce for the employment.
	23	Cultural heritage	D	D	No cultural heritage sites are identified around the project site。	
	24	Landscape	D	D	Landscape that needs to be protected is not identified around the project site.	
	25	Gender	D	D	No impacts specified for women are expected.	
	26	Rights of children	D	D	No impacts specified for children are expected.	
	27	Infectious diseases such as HIV/AIDS	B-	B-	**Construction Phase:** Risk of infectious diseases may be increased by inflow of construction workers.	-To promote awareness of the workers on the infectious diseases such as HIV/AIDS, for example by waging a campaign.
					Operation Phase: Risk of infectious diseases may be increased by inflow of port workers.	-To promote awareness on the infectious diseases such as HIV/AIDS and to monitor collaborating with local clinics.
	28	Labour environment (including work safety)	B-	B-	**Construction Phase:** Working conditions of construction workers need to be considered.	-To comply with the Labour Law and the relevant sub-decrees and declarations. -To ensure safety control by measures such as safety training for the workers, safety patrols on the construction site by supervisors and periodic meetings for securing the measures. -To prepare a first aid station near the construction site.
					Operation Phase: Working conditions of port workers need to be considered.	-To obligate tenants to comply with the Labour Law and the relevant sub-decrees and declarations.
Others	29	Accidents	B-	B-	**Construction Phase:** Risk of construction accidents and traffic accidents is expected.	-To install fence or signboard at the construction site to keep out local people fishermen. -To deploy flagman at the entrance of the construction site.
					Operation Phase: As the road traffic volume will be increased by the port operation, the risk of traffic accidents may be accelerated. Collision accidents of vessels including fishing boats have not happened. Interviews with fishermen also showed that no accidents have happened at least for these 10 years. The risk of oil leaking from the facilities for oil supply and fire disaster need to be considered.	-To monitor the traffic volume and the number of accidents on national road No.1. (combined with the traffic survey for the noise monitoring) -To install an embankment around the oil tank to prevent oil leaking, and -To install fire fighting systems at the terminal.

		Impacts	Rating		Description of the Rating	Mitigation Measures
			Pre /During Construction Phase	Operation Phase		
	30	Cross boundary impacts and climate change	D	D	Impact is not expected because the project is not wide scale.	-

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: Survey Team

3.8.4 Environmental Management and Monitoring Plan

The environmental management and monitoring plan are prepared together with the responsible/implementation agencies and the cost during construction and operation phase is tabulated in Table 3.8-9 – Table 3.8-12 for the SEZ, Access road and NCT, respectively.

The environmental team and the social responsibility committee shown as implementation agencies are proposed as a part of SPC organization. The roles are:

- **Environmental Team:** Execution of leading and consultation for environmental measures of tenants, environmental monitoring and general environmental measures in SEZ.
- **Social Responsibility Committee:** Execution of measures requiring interlocution and cooperation with local communities such as the work environment and employment. Inquiries regarding grievances.

Monitoring form for reporting to JICA is attached in ANNEX-G.

Table 3.8-9 Environmental Management and Monitoring Plan for PPAP-NCT SEZ and the Access Road (Construction Phase)

Items	Explanation	Responsible Agency	Implementation Agency	Cost
Pollution				
Air Pollution	-To conduct measures for minimizing the dust i.e. sprinkling water on the construction site near communities -To wash the tires of trucks in a washing area before leaving the construction site.	PPAP	Contractor	Included in the construction cost.
Water Pollution	-To prepare sedimentation ponds to reduce the turbid water from the dredged soil on the SEZ construction site. -To install treatment facilities for waste water such as temporary toilets or septic tanks at the construction sites.	PPAP	Contractor	Included in the construction cost.
Waste	-To obligate the contractor to collect and dispose of the garbage and the construction waste properly.	PPAP	Contractor	Included in the construction cost.

Items	Explanation	Responsible Agency	Implementation Agency	Cost
Noise and Vibration	In order to minimize the Noise and Vibration, the following measures need to be taken by the contractor when the construction works are conducted adjacent to communities. -Measures for reducing noise; for example, installing noise barriers and selecting low-noise equipment as much as possible, -To restrict works which will cause loud noise during the night time, -Reporting the construction schedule to surrounding communities to obtain their consensus. etc.	PPAP	Contractor	Included in the construction cost.
Sediment Quality	-To prepare sedimentation ponds to reduce turbid water discharge which may cause siltation at the bottom of the irrigation canals. (See Water Pollution)	PPAP	Contractor	Included in the construction cost.
Natural Environment				
Ecosystem	-To prepare sedimentation ponds to reduce turbid water. (See Water Pollution) -To transplant affected sugar palm trees (*Borassus flabellifer*) to the edge of the access road or in the premises of SEZ.	PPAP	Contractor	Included in the construction cost.
Hydrology	<SEZ> -To install a water reservoir pond adjacent to the SEZ area in order to secure water volume as large as that or more than that lost due to the project. The pond shall be connected with the existing ones to secure the water flow. <Access Road> -To install bridges and pipe culverts at the crossing points with the existing canal in order to secure the water flow. -To install canals along both sides of the access road and connect them to the existing canals in order to secure the water flow.	PPAP	To be specified in Detail Design	-
Social Environment				
Local conflicts	-To prioritize local workforce for the employment.	PPAP	Contractor	-
Infectious diseases such as HIV/AIDS HIV/AIDS	-To promote awareness of the workers on the infectious diseases such as HIV/AIDS, for example by waging a campaign.	PPAP	Contractor	Included in the construction cost.
Labour environment (Including work safety)	-To comply with z Labour Law and the relevant sub-decrees and declarations. -To ensure safety control by measures such as safety training for the workers, safety patrols on the construction site by supervisors and periodic meetings for securing the measures. -To prepare a first aid station near the construction site.	PPAP	Contractor	Included in the construction cost.
Accidents				
Accidents	-To install a fence or signboard at the construction site to keep out local people. -To deploy a flagman at the entrance of the construction site.	PPAP	Contractor	Included in the construction cost.

Source: Survey Team

Table 3.8-10 Environmental Management and Monitoring Plan for PPAP-NCT SEZ and the Access Road (Operation Phase)

Items	Explanation	Responsible Agency	Implementation Agency	Cost
Pollution				
Air Pollution	- To oblige strict obedience to the Sub-decree on Air Pollution Control and Noise Disturbance by the factories. The Sub-decree stipulates that the emission of pollutants from an immovable source into the atmosphere will require permission from the MOE and that the owner or responsible person of the pollution source shall be responsible for installing the equipment for measurement of the amount of pollutant contained in his/her pollution sources and store the result for record keeping.	SPC	Environment Team	Included in the operating cost
Water Pollution	<SEZ> -Rain water shall be discharged to the ponds in the SEZ area and the canal around the SEZ. -Sewage shall be discharged to the storm canal around the SEZ after being treated at the sewage plant which shall be installed in the SEZ.	PPAP	To be specified in Detail Design	Included in the operating cost
	<SEZ> -Industrial water containing oily waste or metals and medical waste water generated from factories or the clinic shall be discharged after being treated properly by the respective tenant. -To conduct periodic water monitoring in the canal around the SEZ to compare with the standards. **(Number of Stations)** 1 [treated sewage water] **(Frequency)** 4 times/year **(Period)** 5 years after operation	SPC	Environment Team	Included in the operating cost Monitoring:14,000 USD/5years
	<Access Road> -To install drain ditches and collection pits with oil separators on each side of the Access Road. Rain water shall be discharged into the existing canals after being separated from flotsam and oil at the collection pits.	PPAP	To be specified in Detail Design	-
Waste	-To obligate tenants to collect and dispose of the waste by hiring a contractor licensed by the Ministry of Environment.	SPC	Environment Team	Included in the operating cost
Soil contamination	-To prevent soil contamination by securing measures against water pollution.	SPC	Environment Team	Included in the operating cost
Noise and Vibration	<SEZ> -To oblige strict obedience to the Sub-decree on Air Pollution Control and Noise Disturbance by the factories. The Sub-decree stipulates that the noise from an immovable source shall need permission from the MOE and that the owner or the responsible person of noise source shall be responsible for installing or equipping any equipment to reduce noise and vibration in order to respond to the noise standard.	SPC	Environment Team	Included in the operating cost
	<Access Road> -To monitor the noise and the traffic volume along the Access Road. -Measures for reducing noise shall be taken if the noise generated by the project turns out to be significant.	SPC	Environment Team	Monitoring: 65,000 USD /5years

Items	Explanation	Responsible Agency	Implementation Agency	Cost
	(Number of Stations) 1 [near the residential site] **(Frequency)** 2 times/year **(Period)** 5years after operation			
Odour	-To monitor odour as well as the number of complaints. If any impacts are identified, measures such as installing concrete walls shall be considered.	SPC	Environment team and social responsibility committee	Included in the operating cost
Sediment quality	-To prevent sediment pollution by securing measures against water pollution.	SPC	Environment team and social responsibility committee	Included in the operating cost
Natural Environment				
Ecosystem	<SEZ> <Fish, aquatic organisms, amphibians and reptiles> -To create a canal around the SEZ area and connect it to the existing canals in order to secure the habitat and migration pathway of aquatic organisms. -To create habitat by installing ponds and green space in the SEZ area. -To conduct mitigation measures against water pollution. (See Water pollution) <Plants> -To create habitat by installing a green zone in the SEZ area.	SPC	To be specified in Detail Design	-
	<Access Road> -To install bridges and pipe culverts at the crossing points with the existing canals in order to secure the water flow and the migration pathway of aquatic organisms. -To install canals on both sides of the access road so as to connect them with the existing canals.	SPC	To be specified in Detail Design	-
Social Environment				
Water usage	-To install pipe culverts and bridges to secure the water flow of the canals under the new access road. -To install canals on both sides of the access road to preserve the water flow network in the rice field.	SPC	To be specified in Detail Design	-
Local conflict	-To prioritize local workforce for the employment.	SPC	Social responsibility committee	-
Infectious diseases such as HIV/AIDS	-To promote awareness of the infectious diseases such as HIV/AIDS and to monitor collaborating with local clinics.	SPC	Environment team and social responsibility committee	Included in the operating cost
Labour environment (Including work safety)	-To obligate tenants to comply with the Labour Law and relevant sub-decrees and declarations.	SPC	Environment team and social responsibility committee	Included in the operating cost
Others				
Accidents	-To control speed of vehicles on the site. - To obligate tenants who handle hazardous materials to take proper measures.	SPC	SPC	Included in the operating cost
	-To install hydrants on the site. -To install collection pits (oil separators) in the storm water ditches of the access road.	PPAP	To be specified in Detail Design	-

Source: Survey Team

Table 3.8-11 Environmental Management and Monitoring Plan for PHN Port NCT (Construction Phase)

Items	Explanation	Responsible Agency	Implementation Agency	Cost
Pollution				
Air Pollution	-To conduct measures for minimizing the dust i.e. sprinkling water on the construction site near communities -To wash the tires of trucks in a washing area before leaving the construction site.	PPAP	Contractor	Included in the construction cost.
Water Pollution	-To install silt screens to prevent turbidity from diffusing into the lower stream during the river bank shaping. -To prepare sedimentation ponds to prevent the turbid water generated by concrete washing etc. to flow into the river directly. -To install treatment facilities for waste water such as temporary toilets or septic tanks at the construction sites.	PPAP	Contractor	Included in the construction cost.
Waste	-The excavated soil generated by the river bank shaping shall be used for backfilling for the yard. -To oblige the constructor to collect and dispose of the garbage and the construction waste properly.	PPAP	Contractor	Included in the construction cost.
Noise and Vibration	In order to minimize the dust generation, the following measures need to be taken by the contractor when the construction works are conducted adjacent to communities. -Measures for reducing noise; for example, installing noise barriers and selecting low-noise equipment as much as possible, -To restrict works which will cause loud noise during the night time, -Reporting the construction schedule to surrounding communities to obtain their consensus. etc.	PPAP	Contractor	Included in the construction cost.
Sediment Quality	To install a silt screen to prevent turbidity from diffusing into the lower stream during the river bank shaping.(See Water Pollution)	PPAP	Contractor	Included in the construction cost.
Social Environment				
Land use and utilization of local resources, misdistribution of benefits and damages	-To prevent impacts on fishery resources by securing measures for water pollution.	PPAP	Contractor	Included in the construction cost.
Local conflicts	-To prioritize the local workforce for the employment.	PPAP	Contractor	Included in the construction cost.
Infectious diseases such as HIV/AIDS HIV/AIDS	-To promote awareness of the workers on the infectious diseases such as HIV/AIDS, for example by waging a campaign.	PPAP	Contractor	Included in the construction cost.

Items	Explanation	Responsible Agency	Implementation Agency	Cost
Labour environment (Including work safety)	-To comply with the Labour Law and the relevant sub-decrees and declarations. -To ensure safety control by measures such as safety training for the workers, safety patrols on the construction site by supervisors and periodic meetings for securing the measures. -To prepare a first aid station near the construction site.	PPAP	Contractor	Included in the construction cost.
Others				
Accidents	-To install a fence or signboard at the construction site to keep out local people and fishermen. -To deploy a flagman at the entrance of the construction site.	PPAP	Contractor	Included in the construction cost.

Source: Survey Team

Table 3.8-12 Environmental Management and Monitoring Plan for PHN Port NCT (Operation Phase)

Items	Explanation	Responsible Agency	Implementation Agency	Cost
Pollution				
Water pollution	-To install treatment units to treat sewage generated at the buildings.	PPAP	To be Specified in Detail Design	-
Waste	-To ensure domestic waste collection by hiring a proper contractor following the existing methodology at Terminal-1.	PPAP	PPAP	Included in the operating cost
Noise and Vibration	-To monitor the noise and traffic volume along the national road No.1. -Measures for reducing noise shall be taken if the noise generated by the project turns out to be significant. **(Number of Station)** 1 **(Frequency)** 2 times/year **(Period)** 5 years after operation	PPAP	PPAP	Monitoring: 65,000 USD/5years
Social Environment				
Local economy such as employment and livelihood, misdistribution of benefits and damages	-To minimize the area restricted from fishing activities and consult with local fishermen to obtain consensus prior to the operation.	PPAP	PPAP	Included in the operating cost
Local conflict	-To prioritize the local workforce for the employment.	PPAP	PPAP, terminal operators, the other port related enterprises	Included in the operating cost
Infectious diseases such as HIV/AIDS	-To promote awareness on the infectious diseases such as HIV/AIDS and to monitor collaborating with local clinics.	PPAP	PPAP	Included in the operating cost
Labour environment (Including work safety)	-To obligate tenants to comply with the Labour Law, the relevant sub-decrees and declarations.	PPAP	PPAP	Included in the operating cost

Items	Explanation	Responsible Agency	Implementation Agency	Cost
Others				
Accidents	-To monitor the traffic volume and the number of accidents on national road No.1. (combined with the traffic survey for the noise monitoring)	PPAP	PPAP	-
	-To install an embankment around the oil tank to prevent oil leaking, and -To install fire fighting systems on the terminal.	PPAP	To be specified in Detail Design	-

Source: Survey Team

3.8.5 Local Stakeholder Meeting

A local stakeholder meeting was held by PPAP on the 11th of December 2012 for discussing scoping results. Number of the local people attending was 29; they were residents of the villages in Banteay Daek Commune. In addition, representatives of local authorities such as the Commune chief and deputy governor of Kien Svay District attended as well as the other project related authorities such as the Ministry of Public Works and Transportation. In the meeting, the local villagers addressed their opinions and requests on the project after the entrusted local consultant presented the project outline and the draft scoping results. Basically, the opinions were to support the project because they expected job opportunities and improvement of living conditions. The requests from the villagers are listed in Table 3.8-13.

Table 3.8-13 Requests from Local People at the 1st Stakeholder Meeting with Villagers and the Response

No.	Request	Response
1	Existing local roads are affected by flood in the rainy season. Please rehabilitate the roads to be elevated.	Elevation of the new access road is planned to be sufficient so as not to be affected by flood. Villagers are allowed to use it.
2	Please let the villages use the new constructed road.	
3	Please construct irrigation systems for farmers.	The project is planned so as not to affect existing irrigation systems but a new system cannot be built by the project.
4	Please find mitigation measures to avoid negative environmental impacts.	Considered in the study.
5	Please consider securing people's health and safety.	Considered in the study.

Source: Survey Team

3.8.6 Schedule for the Next Step

Table 3.8-14 presents the schedule of the EIA and the project.

Table 3.8-14 Schedule of EIA and the Project

	2013												2014											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Preparatory Survey (JICA)																								
Submission of EIA report to the Ministry of Environment								☆																
Review and approval by the Ministry of Environment																								
Opening EIA report by JICA																								
Funding Agreement																								
Selecting Consultant																								
Detailed Design																								

Source: Survey Team

3.9. Risk Analysis

3.9.1 Assumed Risks and Countermeasures

The risks in the development of the SEZ Project are classified into 3 major risk fields i.e., (1) Commercial (Project) Risks, (2) Macro Economic (Market) Risks, and (3) Political (Country)) Risks. Of which, (1) Commercial Risks can be categorized into 1) Construction Risks, 2) Environmental Risks, 3) Financial Risks, and 4) Operational Risks. For each Risk Category, assumed risks are extracted and corresponding countermeasures are discussed in Tables 3.9-1, 3.9-2 and 3.9-3.

As for the New Container Terminal Port portion, which has close reciprocal relation to the SEZ, similar risk items and relevant countermeasures are discussed, in the same Table assuming NCT2 will be implemented in the near future.

Among those risks brought forward in the Table, the following major risks and proper management therefor will be key points leading to successful project implementation and operation.

(1) SEZ Development (see yellow highlighted or double lines in Tables 3.9-1, 3.9-2 and 3.9-3)

The most significant Profit Loss Risks (Financial Risks) are dependent on the marketing (tenant promotion), that is, how to promote many qualified enterprises. In order to realize this, it is essential to procure an experienced and practical developer. At same time, in order to overcome the competition with other similar SEZ the selling price of the SEZ land lots, and management/operation charges to the tenants have to be properly determined, with balancing on planning of distinct higher level facilities and services than other SEZ.

In order to minimize the above management/operation charges, the electric power rate will be a big element. According to EDC (Cambodian Electric Company) the main power distribution grids will be developed in the vicinity of the SEZ, and a lower power rate is anticipated.

The condition on recruitment of factory workers with ample and high level manpower is one of the substantial factors to promote the tenants. In some other SEZ in remote areas, the difficulty regarding recruiting factory workers has arisen.

Aside from the above key factors, the earliest implementation of the Project is essential to overcome the competition in SEZ development.

(2) Port Development (see blue highlighted or bold lines in Tables 3.9-1, 3.9-2 and 3.9-3)

In order to strengthen the competitiveness of the PPAP NCT by maintaining cargo demand growth and higher productivity, it will be significant to reduce port charges taxation and institute a fair charging system to dominate among other modal shifts, with a harmonized and cooperating relationship with Sihanoukville Port. The improvement of the port management will be largely dependent on the education and training of the port staff.

It should be noted that the said improvement of the port competitiveness will also contribute to the promotion of the SEZ tenants and will generate synergy effects between the SEZ and the Port.

Table 3.9-1 Risks &Countermeasures on the Project Implementation and Operation (1/3)

Risk Field	Risk Category	Risk Item	Project Package		Assumed Risks	Assumed Countermeasures	Responsible Body			
			SEZ	Port			SPC PPAP	SPC Private	Const. Contractor	Tenant Factories
Commercial (Project) Risks	Construction Risks	Accidents in construction stages	✓	✓	Accidents by construction activities on workers construction plants and loss of third party	Confirmation of insurance policy contract of the **contractors' and third party insurances**			✓	
						Review and approval of "Safety Plan" which will be prepared by the construction contractor, and continuation of improvement thereof. Establishment of Safety management organization (Contractor, SPC), Safety Patrol and Monitoring, Improvement and sustain of safety activity and consciousness of all parties concerned.			✓	
				✓	Accidents of Contractors working vessels	**Review of PI (Protection and Indemnity) insurance policy and insure.**			✓	
				✓	Large scale maritime accident between contractors working vessels) and third party commercial ship(s) or facilities, causing ship collision, sinking, grounding, oil spill and etc.	**Review of Marine Liability Insurance policy and insure.**	✓			
		Natural disaster	✓		Submergence of SEZ and surrounding area by high water of Mekong River	Secure the top height of SEZ area by embankment	✓			
			✓			Provision of retarding ponds in SEZ site and rain water discharge pump systems.	✓			
				✓	Scoring of river bank by Mekong river stream	Provision of slope and river bed protection and monitoring water depth by periodical hydrographical survey.	✓			
		Construction material supply deficit and price rise.	✓		Lack of banking materials for SEZ	Secure the river sand volume	✓		✓	
			✓		Lack of banking materials volume and low quality	Secure land soil volume and quality	✓		✓	
		Delay of Construction	✓	✓	Delay of financial arrangement, construction contractors bidding procedure and contract agreement	Previous check and confirmation of each procedural steps	✓		✓	
			✓		Delay of construction by high water level	Quick construction of perimeter embankment of SEZ and Access Road			✓	
				✓	Affect construction by river water level	Provision and review of construction schedule to meet the water level timing Secure reclamation compaction workability by using river sand for banking materials			✓	
	Environmental Risks	Social Environment	✓	✓	Consideration on local habitant on land acquisition	LARAP	✓			
		Natural/physical environmental issues (pollution, local habitants fishery folks)	✓	✓	Turbid water by construction works	Settling pond, treatment system, monitoring			✓	
			✓	✓	Construction solid waste	Confirmation of waste by type volume and relevant treatment procedure, monitoring			✓	
			✓	✓	Noise and air pollution by construction	Prior check on construction methodology type of equipment and approval, monitoring			✓	
			✓		Factory: waste water（toilet, kitchen）	Tenants pre-qualification, Provision of public waste water treatment system, Monitoring.	✓			
			✓		Factory: waste water（Factory manufacturing waste water）	Tenants pre-qualification, Waste water treatment system in individual factories、monitoring				✓
			✓		Factory: Noise, Air pollution	Tenants pre-qualification, provision of treatment system, monitoring	✓			✓
				✓	Port operation: Waste water, Noise, Air pollution	Mitigation facilities, Monitoring	✓			
			✓	✓	Complaint of local habitat, fishery folks	Provision of complaint desk and quick reaction	✓		✓	
	Financial Risks	increment of construction cost	✓	✓	increment of bid price than budget	Provision of contingency fund	✓			
			✓	✓	Additional works, increment of quantity, material/equipment price	Provision of contingency fund	✓		✓	
		Profit Loss	✓		Marketing, Promotion: Delay on incoming tenants Lack of experience/ ability of developer	Proper selection and procurement of developer Provision of incentive (margin) for the developer. Public Relation for tenants promotion Setting of proper selling price of SEZ lots. Substantial facilities and service distanced from other SEZ Substantial Logistic service with competitive transportation cost.	✓			
			✓		Discount of lot selling price					
				✓	Stagnant of Demand of cargo volume, shipping company, shipping agencies	Strengthening of competitiveness、port charges, Future enlargement of ship size （see "Competitiveness modal shift" below）	✓			
		Cash flow	✓	✓	Shortage of operation fund	Short term bank loan, Guarantee for financial institution, Direct finance of stockholders	✓			
		Lack of credibility	✓	✓	Credibility of SPC（private）	Rating survey of SPC(PPAP/Private), Proper review of the agreement of SPC	✓	✓		
		IPO		✓	Fluctuation of stock prices		✓			

Source: Survey Team

Table 3.9-2 Risks &Countermeasures on the Project Implementation and Operation (2/3)

Risk Field	Risk Category	Risk Item	Project Package		Assumed Risks	Assumed Countermeasures	Responsible Body			
			SEZ	Port			SPC: PPAP	SPC: Private	Const. Contractor	Tenant Factories
Commercial (Project) Risks (cont'd)	Operation Risk	Competition with other SEZ	✓		Selling lot price	Minimize construction cost (DD stage)	✓			
			✓		Facility level, Service grade	Substantial facilities and service distinct from other SEZ	✓			
		Competition with other ports and modal shift		✓	Port tariff/charges, Tax, Shipping/Transportation cost	Shifting to the charge system to real value of service	✓			
				✓	Complicated procedure of shipping customs clearance etc.	One-stop service, Fair transaction	✓			
				✓	Future enlargement of commercial vessels	On time future planning on the improvement of navigation channel fairway deepening (initial and maintenance dredging), fairway alignment, berthing/cargo handling system	✓			
				✓	Navigational charge/toll including future development of Vietnam water-ways	Bi-lateral conference, agreement, ratification	✓			
		Stoppage of Utility Supply Raise of supply price	✓	✓	Electric power supply	Confirmation of power supply contract with EDC(Supply capacity unit price). Confirmation of power supply facilities items and share between EDC and SPC	✓			
			✓			Review of power charge to the Tenants	✓			✓
			✓	✓		Provision of emergency power system	✓			✓
			✓	✓	Water supply/ Waste water treatment system and services	Confirmation of supply conditions of water company	✓			
			✓	✓		Review of service charge levels for the tenants	✓			✓
			✓	✓		Comparison and provision of deep-well and/or retarding pond water treatment system (in future)	✓			
			✓	✓	Solid waste treatment	Confirmation of garbage/waste treatment contract conditions	✓			
			✓	✓		Review of service charge for the tenants				✓
		Quality of Facilities and Services	✓		Settlement or consolidation of sub-soil and/or filling soil	Confirmation by DD survey and study (Duration of sinking time and value), Provision of proper foundation for major/heavy structure	✓		✓	
			✓		Lack of capacity of utilities	Proper planning for future demand and additional systems	✓			
			✓	✓	Lack of services/information/guidance	Provision of Business Development Center which will serve for tenants business information, advice, trouble-shooting, one-stop service	✓			
		Operation maintenance of facilities	✓	✓		Proper maintenance program with budget, Proper management fee, Quick response by developer	✓			
		Human resources	✓		Lack of human resources (tenants' employee) 、labor dispute	Proper wages/salaries, promotion, commutation allowance/Dormitory, work environment				✓
				✓	Ability/knowledge/technology of port management /operation staff	Technology transfer by private operator, staff education	✓			
		Factory operation safety	✓			Safety management by individual factory, Safety Manual, Monitoring				✓
		Port operation safety		✓		Safety management by SPC, safety manual and ceaseless improvement of safety perception of both management and workers	✓			
		Compliance	✓	✓		Fair taxation/charge Observance of JICA procurement guidelines Observance of anti-corruption law of Cambodia Observance local law/regulation on employment environment tax bill and etc.	✓		✓	✓
		Accounting system	✓	✓		Introduction and operation of auditing system	✓			
		Risks on Factory Construction	✓			Cope and management by tenants and support by developer and SPC				✓
		Risks on Factory Operation	✓							✓
		Lack of material/utility supply	✓							✓
	Force Majors		✓	✓			✓			✓

Source: Survey Team

Table 3.9-3 Risks &Countermeasures on the Project Implementation and Operation (3/3)

Risk Field	Risk Category	Risk Item	Project Package		Assumed Risks	Assumed Countermeasures	Responsible Body			
			SEZ	Port			SPC		Const. Contractor	Tenant Factories
							PPAP	Private		
Macro. Economic Risks		Fluctuation of currency exchange rate	✓	✓	Loss due to different rate for re-payment		✓			
		Fluctuation of interest rate	✓	✓	Bank guarantee rate for PSIF		✓			
			✓	✓	Fluctuation of local bank interest		✓			
			✓	✓	MEF's sub-loan interest rate in case ODA Loan		✓			
		Price escalation	✓	✓	increment of construction cost	Compensation in accordance with contract, Provision of fiscal contingency	✓		✓	
Political (Country) Risks		Country risks	✓		Competition of wages level of labor-force	Earliest commencement of the project	✓			
			✓	✓	Ascendancy of preference measures	Cope with implementation of AFTA in 2018				
		Amendment/Revision of law/regulation	✓	✓	Abolition/shortening of preference law	Earliest commencement of the project	✓			✓
			✓	✓	Difficulty on Business permission, custody of financer, fairness of taxation, opportunity of business closure	Enactment of relevant laws regulations				
		Pease and order, terrorism, turmoil	✓	✓		Ceaseless data collection, crisis management, Drill	✓			

Source: Survey Team

4. CONCLUSIONS AND RECOMMENDATIONS

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions

(1) Advantages and Necessity of SEZ in Cambodia

It is recognized that geographical location, competitiveness and demand for an SEZ in Cambodia are respectively more advantageous than those of neighbouring countries because of the wage growth of other ASEAN counties and China where SEZs were developed previously. These factors and the stable Cambodian politics, society and public peace and order increase the price per square meter of SEZ in Cambodia.

The majority of the 23 SEZs currently approved by GOC have been mainly developed near the border lines with Vietnam and Thailand, e.g. the Bavet area along National Highway No.1 near the boundary with Vietnam, Sihanoukville port area facing Thailand Gulf, Koh Kong and Poipet areas adjacent to the Thailand boundary etc. Those SEZs were made to locate near such surrounding areas far from Phnom Penh City to secure direct transportation access to the neighbouring countries, due to the congestion that resulted from lack of cargo handling capacity and undeveloped port services of PHN port. However, those SEZs seem not to ensure enough labour force or skilled manpower, nor have they presented attractive promotions to foreign investors. Furthermore, such existing SEZs have other issues such as insufficient infrastructure, especially wastewater treatment plants and stable power supply systems, and do not accordingly provide advantageous conditions for marketing to foreign enterprises that stress compliance with measures regarding the environment and employment. At the present, it is commonly presumed that PHN SEZ and SHV Port SEZ are most likely adequate for acceptance of foreign enterprise investment in terms of development scale and grade of the related SEZ infrastructure.

Such SEZs are mostly positioned to attract Japanese enterprises operating in Cambodia. The ratio of Japanese enterprises in the existing SEZs is 27% of the total amount of foreign investment and 37% of the total number of foreign enterprises currently operating in Cambodia. This is more than the Chinese, Korean, Taiwanese or Hong Kong enterprises.

PHN SEZ located along National Highway No.4 near PHN city has more than half of the Japanese enterprises operating in Cambodia, and is spoken of as a successful model of foreign investment by Japanese enterprises. Lots available for tenants in the SEZ have been running short and it is assumed that they will be all sold out within a few years. On the other hand, SHV Port SEZ started selling lots for tenants in May 2012 and is anticipated to sell all its lots within a few years as well, since the SEZ provides sufficient infrastructure built with Japanese ODA, connects directly to SHV port, which is the unique gateway seaport in Cambodia, and may receive an attractive discount from the power supply company on electricity charges due to earlier completion of a new power trunk line that provides stable power supply facilities with higher capacity and only has 50 ha that are still available for prospective tenants.

In addition to the above, it is apparent that SEZ demand in Cambodia will rapidly increase in association with commencement of operation of NCT from January 2013 and facilitation of transport infrastructure such as several ring roads to be linked between existing National Highways, and therefore, the existing SEZ capacities will be insufficient accordingly.

(2) Demand and Competitiveness of SEZ

Attraction of foreign direct investment (FDI) by marketing to foreign enterprises is essential not only for improvement of the financial balance of Cambodia but also for provision of long-term sustainable socio-economic effects in the country such as establishment of backbone industries, development of human resources, enhancement of employment etc. This is also on the urgent agenda for implementation as a national goal established by GOC.

Currently, a total of 23 SEZs (totalling over 9,057 ha) have been approved by GOC for development and operation. However, only 10 of those SEZs (approved nominal areas 3,544 ha) are currently operating. Even considering another 4 SEZs (approved area 562 ha) that are currently under construction are added with the 10 SEZs, and only total actual operative areas of about 1,900 ha are estimated to be available in the whole of Cambodia, because there is inclusion of un-development area of common facilities in above nominal areas and proximity of the SEZ sites from the Capital region. Furthermore, the total SEZ areas that are physically operating and/or under construction total only 299 ha and of the 94 foreign enterprises, 35 Japanese enterprises are operating in the areas.

According to the "Data Collection Survey on Industrial Policy Formulation Assistance" carried out by JICA in 2012, SEZ demand was estimated at 2,058 ha in 2017 and 2,609 ha in 2020 in the low economic growth case, so the shortage in SEZ area was projected to be 152 ha in 2017 and 703 ha in 2020 compared with the present status of Cambodian SEZs. In particular, it is expected that a lack of SEZs will become a serious situation because Phnom Penh City and its surroundings will require adequate employment opportunities soon.

Vietnam, one of the neighbouring countries, is on a course of economic growth in spite of its past tragic experience of warfare similar to Cambodia. Vietnam has successful experience in SEZ development. Today, 49 SEZs have been developed in Vietnam, which have totally 9,566 ha and 2,979 enterprises (including 544 Japanese enterprises) operating. It is clearly highlighted that there is an overwhelming difference in the present SEZ situation in Vietnam and that in Cambodia even considering some gaps between both the countries.

(3) Importance of Effective Development and Strategic Marketing of SEZ

It is necessary for the Cambodian economy not only to increase FDI through SEZ development but also to establish backbone industries through promotion of a localized industrial framework for development and reactivation of national industry. In this point of view, some expectations are arising in Cambodia to develop reliable quality FDI from firms such as Japanese enterprises. The following are common characteristics of Japanese FDI[1]:

- Higher ratio of export manufacturing industry
- Presenting an opportunity to the host country to join the Global Value Chain (GVC) with evolution of regional specialization of manufacturing processes especially for machining
- Enhancement of productivity in the host country, expansion of products sent to Japan, technology transfer and local production
- Progress in high-level technology transfer and development of supporting industries by sectionalized manufacturing processes with accumulated techniques and workmanship
- Enhancement of transition of movement for overseas production not only of major but also small and medium sized enterprises into Cambodia and Myanmar next to advanced countries such as China, Thailand, Vietnam etc. for SEZ development

(4) Ripple Effects, Site Selection, Proposed Facilities of PHN-NCT SEZ

It is anticipated that attracting fruitful enterprises from places such as Japan will provide certain economic ripple effects in Cambodia. In the case of a proposed SEZ development scale (possible 100 ha of area available), the SEZ could attract 60 enterprises as tenants, 0.8 to 1 billion USD as initial capital investment for construction and machinery, 25,000 persons as employees, and produce 1.5 billion USD as annual production, and 55,000 TEUs as estimated container cargoes to be newly generated from the SEZ. Assuming 80 % of the annual production to be for export, this would correspond to 22 % of the total annual export of Cambodia in 2011. Concurrently with realization of direct/indirect ripple effects from SEZ development, the SEZ may avoid a negative cycle consisting of

[1] Final Report of Data Collection Survey on Industrial Policy Formulation Assistance in the Kingdom of Cambodia, December 2012, JICA

low-quality facilities and tenants, little value-added, low cost, low wages, labour disputes, environmental issues etc. with injection of FDI by higher productive and value-added quality enterprises. In fact, it is reported that some SEZs in Cambodia currently fall into the negative cycle as stated.

The concept of the proposed SEZ with 143 ha area is to develop its necessary basic infrastructure as well as NCT extension in the hinterland of the new port facilities. The location of the SEZ was selected in order to avoid higher priced land to reduce the project capital cost. The selected SEZ area and its surroundings are low productive single crop farmland due to flooding from the Mekong River during the rainy season. Also, the target SEZ area consequently requires an access road, because the SEZ is located 3.5 km from National highway No.1. So, the land elevation must be raised by backfilling to prevent flooding in the rainy season. Although the previously mentioned infrastructure such as access road, land elevation and utilities are additionally required it is presumed that 59 USD per square meter as a proposed selling price will be reasonable and competitive compared to other existing SEZ in Cambodia.

The SEZ area is expected to be a part of an important logistic corridor to connect with PHN capital city by future construction of an outer ring road (RR3). This new road network is advantageous for foreign enterprises due to securing alternative access to be linked with PHN international airport without passing through the centre of PHN city.

The proposed NCT-SEZ area totals 143 ha, consisting of 37 ha as public facility area and 106 ha as area for tenants, which include minimal selling lot areas with satisfaction of financial feasibility even though some portion may be funded by public financing such as ODA. Although SEZ demand is expected to reach more than 700 ha after 2020, the target SEZ area has not been developed by the private sector due to the necessity of a new access road to connect with National Highway No.1. From another point of view, it is important for the proposed SEZ to be developed in the first phase as a pilot project by public finance in order to mitigate the financial burden on the private sector, since the SEZ will play an important role to induce further SEZ developments by private finance with total area of 1,000 ha reserved in the southern part of the proposed SEZ area. The outline of the proposed SEZ is summarized below:

- Total lot areas for sale: 106 ha planned for traditional industries such as textiles and garments, and possible machinery industries that would be environmentally friendly to be expanded in Cambodia
- Public facilities: 37 ha including wastewater treatment plant, power supply system with transformers with connection to the new grid trunk line of EDC, water supply system, service roads, pavement, drainage system and lighting system inside the SEZ, establishment of a Business Development Centre (BDC) to provide an open window for marketing, assistance and information exchange for tenant enterprises, logistic facilities linked between SEZ and NCT, bounded facilities, a logistic centre etc.
- Access road

(5) Container Cargo Demand in PHN Port

Annual container cargo throughput of PHN port has drastically increased since Cai Mep Port started operation in 2012. The container cargo handling operation was transferred from the existing PHN Port to NCT in January 2013. The latest statistics report shows that container cargo throughputs of both PHN and SHV ports have continuously grown. Future container cargo throughput of PHN port was forecast in consideration of GDP elasticity, reciprocal role allocation between PHN and SHV ports, and future deployment of CBT (Cross Border Transport). Based on the demand forecast, the annual container cargo throughput of the whole of Cambodia was estimated as 1,770,000 TEUs in 2030. In the case of PHN port, it was estimated that the cargo throughput in 2030 would be 559,000 TEUs in the mid growth case, 610,000 TEUs in the high growth case, and 449,000 TEUs in the low growth case.

(6) Container Cargo Handling Capacity of Existing PHN Port and Proposed NCT-1 Port Facilities

Based on a technical assessment of performance and capacity through evaluation of current operational data and information provided by PPAP for existing quay facilities, container storage yard facilities and cargo handling equipment at PHN port and NCT, the existing PHN port including ICD was estimated to reserve 80,000 TEUs/year container handling capacity in case of appropriate arrangement of the existing cargo storage yard with other cargo handling activities as planned, and also NCT was estimated to secure at least 120,000 TEUs/year considering the present operational status, in consistence accordingly with its planned annual throughput. The capacity of NCT was further estimated to provide 50,000 TEUs/year more by provision of additional CHE (Cargo Handling Equipment) and extension of the container yard areas, which have been implemented by PPAP. The above mentioned assessment concludes that the total 250,000 TEUs of container cargo handling capacity of the existing port facilities combined with PHN port and NCT-1 is to be in shortage for forecast container cargo demand in 2020, and consequently new port facilities will be required.

(7) Required NCT-2 Port Facilities as Future Extension of NCT-

The new port facilities named "NCT-2" were planned within PPAP reserved areas downstream of the existing NCT named "NCT-1" taking into account the existence of a construction plan for a new bulk cargo terminal to be built in the reserved areas upstream of NCT-1. Although the site selection was conducted for the two options, upstream and downstream of NCT-1, the selected site for NCT-2 was confirmed to have merit in securing a larger and more convenient yard area considering efficiency and trafficablity of the new terminal. The target container cargo handling capacity of NCT-2 was determined as 250,000 TEUs/year, based on the forecast demand of 500,000 TEUs/year in 2028/2029 in the whole of the PHN port including NCT-1 and NCT-2. The dimensions of the proposed facilities and major items considered in the NCT-2 extension plan are summarized as follows:

- **Quay:** 350 m long, detached pier structure type, and provision of scour protection with stones and gabions on the formed slopes behind and on both sides of the upstream and downstream portions of the pier
- **Target vessel:** 5,000 DWT container carrier in port planning and 10,000 DWT container carrier in quay structural analysis for future up-sized objective vessels.
- **Container yard:** 3 ha laden container yard and 6 ha empty container yard
- **Cargo handling equipment (CHE):** 3 units Ship to Shore (STS) crane, 6 units Rubber Tired Gantry Crane (RTG), reach-stackers, top-lifters, tractor-trailers etc.
- **Terminal utilities:** Power supply system including transformers, water supply system, sewerage system including sewage treatment plant (SPT), drainage system, port security system etc.
- **Buildings:** Maintenance shop, entrance gate, substation house etc.

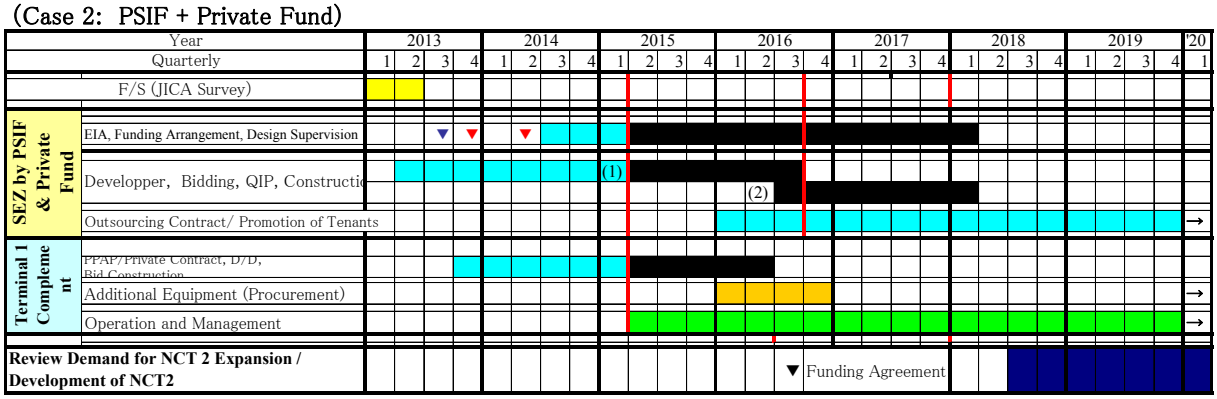
(8) Implementation Programme

The Project is assumed to principally apply a PPP Scheme. In order to minimize the preparation for project implementation and to secure the definite commencement of the project, the financing of the Project is to be prepared by ODA (PSIF or Japanese Yen Loan) as well as private funds. If the financing agreement for the SEZ development is concluded before the first half of 2014, the SEZ is to be possibly developed by the first half of 2015, sales could commence from the beginning of 2015, and the completion of the SEZ development is to be in the first half of 2018. Formation of substantial operation & maintenance organization(s) for the SEZ is accordingly necessary by the third quarter of 2014. NCT-2 extension is assumed to be implemented aside from the SEZ development. It is expected that the financing of the extension is to be completed by 2016, the construction and procurement is commenced in the middle of 2018, and the completion is in the first half of 2020. The following are

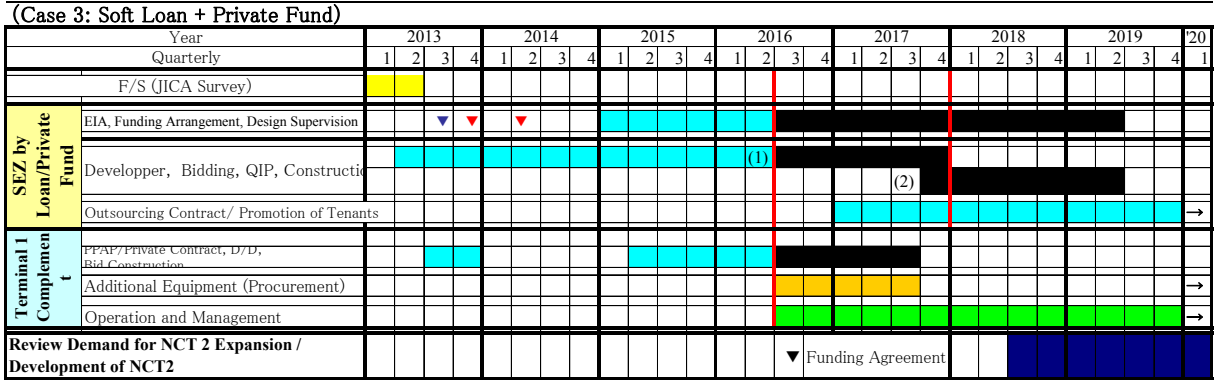
comparisons of the Project implementation programme for two options such as PSIF with private fund, and Japanese Yean Loan with private fund.

Table 4.1-1 Proposed Project Implementation Programme (PSIF/Japanese Yean Loan)

(Case 2: PSIF + Private Fund)



(Case 3: Soft Loan + Private Fund)



Source: Survey Team

(9) Capital Project Cost

The capital Project cost was estimated at 64.1 million USD consisting of 58.9 million USD for the SEZ and Access Road development and 5.2 million USD for the NCT-1complement facilities. Private sector portions are 51 % of the project cost of the SEZ development (part of the SEZ utilities and buildings). Demarcation between private and public portions is presented in Table 4.1-2.

Table 4.1-2 Summary of Capital Project Costs

(Unit: Million US$)

Item	Public	Private	Total
SEZ	26.0	26.6	52.5
Port (NCT-1 Complement Facilities)	2.5	2.7	5.2
Total	28.4	29.3	57.7
Percentage	49 %	51 %	100 %
Access Road	6.4	-	6.4

Source: Survey Team (Tentative)

The development of the NCT2 is deemed to be a future expansion project of which total cost is estimated to be US$55 million.

Table 4.1-3 shows the scoped project items and breakdown of the presented project costs of the SEZ development and procurement of NCT-1 complement facilities.

Table 4.1-3 Scoped Project Items and Breakdown of Project Costs

Item			Project Cost	
			Million US$	Billion JPY
I.	**SEZ Development**	**Total**	**52.5**	**4.79**
SEZ	Public	(PSIF/Loan Scheme)	26.0	2.37
		a. Land Filling	21.7	19.8
		b. Temporary Work, Other Expenses, Consultancy Service Fees, Contingency etc.	4.2	3.9
	Private	(Investment by SPC)	26.6	2.42
		a. SEZ Road Pavement	5.2	0.47
		b. Power Station (shared expense)	5.0	0.46
		c. Utilities, Buildings, Sewage Treatment, Fence	10.7	0.98
		d. Temporary Work, Other Expenses, Consultancy Service Fees, Contingency etc.	5.7	0.52
Public		Access Road	6.4	0.58
II.	**Procurement of NCT-1 Complement Facilities**	**Total**	**5.2**	**0.47**
Port	Public (PPAP)	(Own Fund)	2.5	0.22
		a. Container Yard & Entrance Road Widening, Maintenance Shop	2.1	0.20
		b. Temporary Work, Other Expenses, Consultancy Service Fees, Contingency etc.	0.3	0.30
	Private	(Own Fund)	2.7	0.25
		a. Cargo Handling Equipment	2.7	0.25

Source: Survey Team

(10) Project Scheme

It is recommended that the suitable project scheme for the procurement of NCT-1 complement facilities is by public (PPAP own fund) and private funds as presented in the above Table 4.1-3.

As presented in Table 4.1-4, three comparative cases to determine the suitable project scheme for the SEZ development are given; Case 1 is of PSIF and private fund including the cost of the Access Road, Case 2 is of PSIF and private fund but not including the cost of the Access Road, and Case 3 is of Japanese Loan and private fund. In Case 1, the cost of the Access Road became too great a financial burden for the SPC. If the Access Road is funded by the public and extracted from the project scope, the financial burden is improved. According to the interview survey made by the Team, however, some of the private developers have grave concerns regarding the implementation of the large scale land filling works and they deem it as too great a risk for their investment. In Case 3, the land filling works are separated from other work items and considered to be financed by ODA Loan. This measure will encourage the private sector to invest for the remaining portion of the project scope.

Table 4.1-4 Comparison of Project Schemes

Alternative Cases		Implementing Agency /Organization	Facilities and Funding			Cost (Mill. US$)	FIRR	Risk Level of Private Finance	ADVANTAGE /DISADVANTAGE
			SEZ Land Filling	Power Sub stations, Utilities	Access Road				
1	PSIF (including Access Road)	PPAP/Govm't							●Difficult for private sector due to overburdened initial investment such as utilities, access road, land filling, and etc.
		SPC (PPAP/Private) (PSIF)	✔	✔	✔	58.9	7.15%	High	
2	PSIF (Access Road by Govm't Fund)	PPAP/Govm't			✔	52.6	10.28%		●The private Developer might be discouraged to finance as a member of SPC due to big investment (risk) for SEZ land fill.
		SPC (PPAP/Private) (PSIF)	✔	✔				Medium	
3 ODA Loan +Private Fund (Access Road by Govm't Fund)	SEZ Land Filling	Government Fund			✔	26.0	9.01%		●Land filling which are overburden for private sector and therefore recommendable to be done by public fund. ●Possible to enhance private sector participation by less risks of investment for private sectors.
		ODA Loan	✔						
	Powe sub-station, Utilities	Private		✔		26.6	11.37%	Low	

Source: Survey Team

(11) Project Evaluation

For the aforementioned capital Project cost, the selling price of the proposed SEZ lots to possible tenants was assumed as an average 59 US$ per square meter with the range between 57 to 62 US$ per square meter from 2017 to 2020. If SPC implements the Project by PSIF which provides 70% of the Project cost from JICA and outsources 30% from its own fund, the interest is 4% fixed for 10 years with a 20 year repayment period. If PPAP implements the Project by using a Japanese Yen Loan, the interest is assumed as 0.01% fixed for 10 years with a 40 year repayment period and 2.5% as subleasing interest of MEF.

The results of financial and economic analyses are shown in Tables 4.1-5 and 4.1-6. Although FIRR of the proposed SEZ seems comparatively lower than the one of the Port, the proposed SEZ development can be sufficiently implemented by public or PPP finances. If PSIF is adopted for the implementation of NCT-2 extension in the future, FIRR of the private portion (30 % of the project cost) is mostly at an appropriate level. Each EIRR of the SEZ development and NCT-2 extension shows adequate figures in terms of cost benefit effect and it is evaluated that implementation of both the development and extension is meaningfully valuable.

Table 4.1-5 Results of Financial Analysis

<Financial Internal Rate of Return (FIRR) of SEZ Project by alternative cases>

Category	Base Case	Sensitivity Analysis		
		Cost 10% Up	Income 10% Down	Cost 10% Up & Income 10% Down
Case 1 including Access Road	7.15 %	5.22 %	4.77 %	3.02 %
Case 2 Excluding Access Road	10.28 %	8.02 %	7.60 %	5.54 %
Case 3-1 (by Public) Reclamation, Power Sub Station (Excluding Access Road)	9.01 %	6.94 %	6.30 %	4.42 %
Case 3-2 (by Private) Utilities (Ditto)	11.37 %	8.83 %	8.58 %	6.31 %

Source: Survey Team

<FIRR of Port Project (For NCT2 as future expansion)>

Project	Base Case	Sensitivity Check		
		Cost up 10%	Revenue down 10%	Cost up Revenue down 10%
Port	13.49 %	10.83 %	9.71 %	6.74 %

<FIRR in case of separation of infrastructure from operation in Port (Private Portion)>

Category	Base Case	Sensitivity Analysis		
		Cost 10% Up	Income 10% Down	Cost 10% Up & Income 10% Down
Private (CHE)	14.81 %	12.65 %	12.43 %	10.33 %

Source: Survey Team

Table 4.1-6 Results of Economic Analysis

Category	Base Case	Sensitivity Analysis		
		Cost 10% Up	Income 10% Down	Cost 10% Up & Income 10% Down
SEZ	22.1 %	20.5 %	20.4 %	18.9 %
Port	17.0 %	14.2 %	13.9%	11.5 %

Source: Survey Team

(12) Environmental and Social Considerations

The Survey carried out an EIA study for the SEZ development and NCT-2 extension project. As there could be possible disturbance and/or change of the present situation by site developments through the Project implementation, such as loss of flatland by backfilling the SEZ area or diversion of the existing small waterway and/or farm roads by the new access road construction, some mitigation measures were duly considered for such environmental and social impacts, e.g. provision of floodwater retention ponds around the proposed SEZ area, installation of small bridges and some culverts traversing the access road, implementation of successive monitoring for increase of traffic and its noise during/after the construction stage of the SEZ and NCT-2, execution of coordination meetings with fishermen before/during NCT-2 service operation, preparation of RAP for land acquisition of SEZ and new access road areas in accordance with JICA Environmental Guidelines.

4.2. Recommendations

(1) Urgent Project Implementation

The proposed SEZ development requires urgent implementation for attracting reliable and quality foreign enterprises beneficial to the Cambodian economy without delay to get ahead of SEZ developments in neighbouring countries such as Myanmar and Bangladesh in consideration of the coming into effect of ASEAN FTA in 2015 and the Project implementation in 2018, and the sale of SEZ lots is to be conducted beginning not later than 2016. It is therefore necessary to execute construction of the access road and several SEZ lots beforehand as soon as possible.

(2) Necessity of Project Implementation by ODA (PSIF or Japanese Yen Loan) with Private Sector Participation

It is presumed that the proposed SEZ that has 143 ha development area including access road and utility facilities is a sort of pilot project for inducing more foreign private investment to probable extensive development areas connected to the proposed SEZ. In order to urgently complete the development and to ensure successful operation by stable, reasonable and reliable financial resources, the Project implementation by public finance (PSIF or Japanese Yen Loan) is favourable. Similarly, previous SEZ developments in other countries such as Vietnam, the Philippines and China have succeeded not only for their construction by ODA public finance at the initial stage but also for their operations by attracting reliable and high quality Japanese enterprises.

(3) Advantage of Project Implementation of SEZ Development and NCT-2 Extension by ODA

Based on the assessment for container cargo growth from the areas surrounding the proposed SEZ and NCT, approximately 10 % of the total container cargoes handled in the whole of the PHN port will be generated by the proposed SEZ, and NCT will be the logistic base of those areas, especially for cargoes to be transported by the Inland Waterway. The aforementioned implies that the SEZ and NCT are closely related in their developments as well as operations. This is a quite important factor for formation of a competitive SEZ the same as previous experiences that comprehensive involvement in the SEZ planning, design, operation, management and maintenance stages gives reliability to SEZ users in order to establish a functional logistic demand-supply chain system among the SEZ, its associated factories, hinterland users and the port. Moreover, it is clear that implementation of combined SEZ development and NCT extension will produce an attractive impression and effect upon determination of investment to reliable and high quality Japanese enterprises as one of the best strengths in commercial appeal and promotion, and also practical port operation planning and its undertaking could be improved by introducing efficient and advanced know-how of experienced private terminal operators to PPAP. Considering the above, it is emphatically recommended that the Project combined with SEZ development and NCT extension should be executed by ODA (PSIF or Japanese Yen Loan) with involvement of the Japanese private sector, which will be a “primer” for formation of an internationalized logistic supply-demand chain base composed of the proposed SEZ linked with NCT for securing stable and sustainable socio-economic development for the people and nation of Cambodia.

(4) Strengthening of Competitiveness of SEZ and Port

Preferential tax treatment in Cambodia is not remarkably advantageous compared with other countries and the collection process of custom duties and port service charges in relation with port and maritime sectors is complicated and is an obstacle to competitiveness in comparison to land transport such as CBT. Although it is simply difficult to suggest lowering the rates of custom duties as an important income source of the Cambodian government, revision and modification of the process and rates are expected in connection with implementation of SEAN FTA from the point of view for strengthening competitiveness.

(5) Development and Improvement of Inland Waterways in Association with the Government of Vietnam and MRC

In view of the increase in cargo traffic that will result from the revitalization and promotion of Cambodian economic development, it is anticipated that inland waterway transport will require higher capacity for large-sized vessels and vessels connected to ocean routes in South East Asia in the near future. At the present, the Government of Vietnam has implemented projects such as deepening of Bassac River, river ports development, and construction of a bypass canal at the estuary (Quan Chanh Bo Canal) targeting their completion by 2015. In addition, the Government of Vietnam and MRC plan to implement waterway improvements on Van Nao River connecting between the Mekong and Bassac Rivers, and the upstream reaches of Van Nao River up to the border with Cambodia. Additionally, PPAP and MRC have improvement plans for the bottleneck portions along Mekong River from the border of Cambodia to the existing PNH port. Considering that vessels calling at PNH port and NCT will become larger in size and the said waterway and canal that have been improved by the Government of Vietnam and MRC are passable for the large-sized vessels without any obstructions, the maintenance and improvement costs should be fully/partially shouldered by both Governments based on mutual agreement. It is therefore required to prepare due assistance for organizing and facilitating such framework and co-involvement, taking into account the timeframe of cargo increase and SEZ demands.