5.3. Required of Port Facilities Development

5.3.1 Supply and demand of container terminals in Cambodia

As the demand forecast in Chapter 3 indicates, a total of 1,750,000 TEUs of containerized cargoes are expected to be handled in Cambodian ports in 2030, of which 500,000 TEUs can be handled at the existing container terminal in Sihanoukville Port if it is improved in terms of software and hardware as discussed in Chapter 4, and 500,000 TEUs can also be handled in Phnom Penh New Port when its final phase development is completed. The existing container terminal in Phnom Penh Port will cease handling containers and be converted to a passenger terminal after the commencement of operation in the new terminal because the existing terminal is located in the vicinity of CBD and is not suitable for container handling. Accordingly, the shortage of capacity of container terminals in Cambodia in the target year is assessed to be 750,000 TEUs.

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

Although some private ports have ideas to develop container terminals, terminals based on these ideas are unlikely to be constructed because all of the ideas are very primitive; some planned terminals are located on shoals, which requires a large amount of capital and maintenance dredging, and the other is located on a green field in a very remote area from the capital city. In addition, since the dispersion of containers to small coastal terminals, if they could exsist, would hamper the reduction of ocean freight to/from Cambodia, which is much higher than that of neighboring countries, the Government should not approve these development plans. Accordingly, the Project Team assesses that the handling volume of containers in private ports in the target year will be null.

5.3.2 Quantity of the required port facilities

(1) Container terminal

As mentioned in the previous sub-section, an additional container terminal with the capacity of 650,000 TEUs is required in Sihanoukville Port in the target year. Although liner services calling at Sihanoukville Port in the target year would remain to be intra-Asia service and feeder service, and trunk line service would not call at the port, the present dimensions of port facilities are not sufficient for accommodating increased size of container vessels deployed in intra-Asia service. Since the assessment in 2.6 indicates that the maximum vessel which calls at the port in the target year is 4,500 TEU vessels, it is desirable that the new terminal could have a water depth of -15 m to accommodate this size of vessels with full draft as indicated in Table 5.3-1 and Table 5.3.2. However, it is Project Team's assessment that such case should be very rare case that a container ship that has the maximum size to arrive at or to depart from Sihanoukville Port with full draft. This is because those ships calling on Sihanoukville Port must carry substantial number of empty containers as well as loaded containers, due to considering the geographical location of Sihanoukville Port situated between ports in Thailand and in southern Viet Nam and the schedule of port calls along the container liner service routes in the Far East and the Southeast Asia (see Table 2.6-18). The Project Team, therefore, recommends that the quay depth of the new container terminal should be -14 meters, which is the same water depth as the maximum depths among the container terminals in Cai Mep area in Southern Region of Viet Nam, which, having been constructed recently, are the terminals that the container ships call on prior to their port call on Sihanoukville.

Table 5.3-1 Standard dimensions of container vessels

DWT	Length Overall (m)	Width (m)	Full load draft(m)	TEU Capacity
10,000	139	22.0	7.9	500 - 890
20,000	177	27.1	9.9	1,300 - 1,600
30,000	203	30.6	11.2	2,000 - 2,400
40,000	241	32.3	12.1	2,800 - 3,200
50,000	274	32.3	12.7	3,500 - 3,900
60,000	294	35.9	13.4	4,300 - 4,700
100,000	350	42.8	14.7	7,300 - 7,700

Source: OCDI

Table 5.3-2 Standard dimensions of container berths

Self weight tonnage DWT (t)	Length of berth (m)	Water depth of berth (m)	(Reference) Container capacity (TEU)
10,000	170	9	500 - 890
20,000	220	11	1,300 - 1,600
30,000	250	12	2,000 - 2,400
40,000	300	13	2,800 - 3,200
50,000	330	14	3,500 - 3,900
60,000	350	15	4,300 - 4,700
100,000	400	16	7,300 - 7,700

Source: OCDI

(2) RORO terminal

As discussed in the demand forecast in Chapter 3, imported used vehicles, which are transported by container vessels or general cargo vessels at present, will be diverted to RORO transportation until the target year. Therefore RORO terminal shall be constructed in the port.

(3) Dry bulk and general cargo terminal

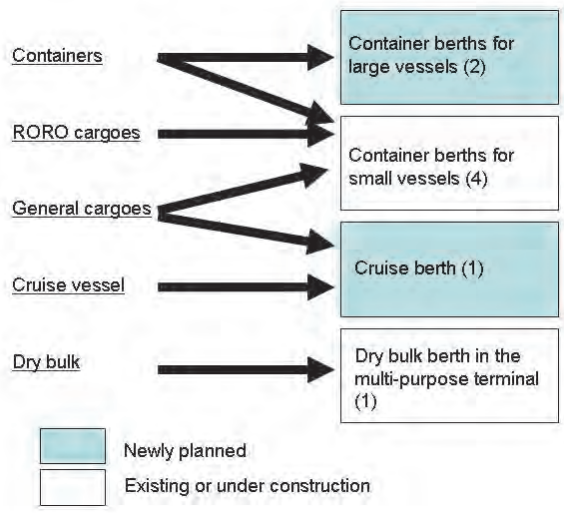
As for dry bulk, the new multi-purpose terminal will be able to respond the almost all demands up to the target year of 2030. On the other hand, a new facility for handling increased general cargoes such as milled rice and plant cargoes shall be constructed.

(4) Cruise terminal

As discussed in the forecast of passenger traffic demands in Chapter 3, the potential of Sihanoukville Port as a cruising base is very high and further increase of cruise vessels calls is expected. Therefore, a cruise terminal shall be constructed. However, construction of a terminal exclusively dedicated for cruise vessels is not realistic because cruise vessels are expected to call at the port only during dry season. Therefore the cruise terminal shall also handle some amount of cargos.

(5) Required quantity of quays

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



Prepared by Project Team

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

(6) Required development of navigation channel and basins

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

5.3.3 Repair and Improvement of Existing Facilities

(1) General

Sihanoukville Port equips a variety of existing port facilities for its port users. Those facilities have been provided from the 1960s to the present. Since 2003, there has been rapid development, especially through Official Development Assistance from the Government of Japan. Generally, aged facilities tend to have damage and deterioration compared to facilities that are newly developed, well-organized and considered for efficient and comprehensive use.

This subsection discusses the repair and improvement of the existing facilities through a general assessment which consists of an analysis of basic information on the facilities given by PAS, especially for the relevant civil and architectural facilities in the Port, facility assessment based on a general inspection and diagnosis. The approach of the general assessment is to evaluate the collected information of the facilities and to conduct facility assessment by a general inspection and diagnosis based basically on visual confirmation of the major items and facilities in consideration of information given from PAS. The results of the facility assessment accordingly highlight some conclusions. Furthermore, the conclusions give some suggestions as recommendations to be considered.

(2) Facility Assessment

As same as the mentioned in sub-section 5.2.2, the facility assessment refers to a method of a general inspection and diagnosis using a general inspection sheet developed in a Japanese manual issued by the Costal Development Institute of Technology (CDIT)[10]. The inspection and diagnosis were basically carried out by a visual inspection incorporating the results collected from PAS according to the common items and criteria listed in the said sheet for the major facilities. Table 5.3-3

[10] Coastal Development Institute of Technology (CDIT), Port & Airport Research Institute (PARIS), (2007), Technical Maintenance Manual of Port Facilities in Japan (Japanese Edition)

presents the deterioration criteria as specified in the said manual. The criteria define four (4) levels of conditions of member(s) as seen in the table.

Table 5.3-3 Deterioration Criteria for Inspection and Diagnosis

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

Source: Technical Maintenance Manual of Port Facilities in Japan

Based on the classification of the deterioration level, the manual indicates a method for assessment of objective facilities. Considering the impact on higher safety grade of the major facilities, the following assessment criteria were consequently applied to the facility assessment as described in Table 5.3-4.

Table 5.3-4 Applied Facility Assessment Criteria

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

Source: Technical Maintenance Manual of Port Facilities in Japan

1) Waterways & Basins

Table 5.3-5 shows the results of the facility assessment of waterways & basins for the approach channel, tug basin, new port basin and container berth basin. Figure 5.3-2 provides the actual site conditions of the inspected protective facilities. As seen in the table, the assessment gives a classification “D” which means “satisfactory capacity and performance remained without any defects” to all the facilities, except for the tugboat basin. The tugboat basin is supposed to be maintained at -3 meters deep, but the actual depth is -1.5 to -2.5 meters. It is not a significant problem upon the actual operation because only small-drafted boats and vessels are berthing at the basin and quay. However, in view of maximizing the capacity of the facilities for larger boats and vessels that may berth in the future, it is noted that the tugboat basin does not assure satisfactory capacity and performance as assessed.

Table 5.3-5 Facility Assessment on General Inspection (Waterways & Basins)

Facility / Insction Item	Waterways & Basins				Remark
	Approrch Channel	Tug Boat Basin	New Port Basin	Container Berth Baisin	
Depth	d	a	d	d	
Condition of Fairway or Basin	d	d	d	d	
Assessment	D	A	D	D	

Prepared by Project Team

(46) Approach Channel

(47) Tugboat Basin-1

(48) Tugboat Basin-2

(49) New Port Basin

(50) Container Berth Basin-1

(51) Container Berth Basin-2

Prepared by Project Team

Figure 5.3-2 Site Conditions of Waterways & Basins

2) Protective Facilities

Table 5.3-6 designates the results of the facility assessment of protective facilities such as the north breakwaters (north & south), and south breakwater. Figure 5.3-3 provides the actual site conditions of the inspected protective facilities. As seen in the table and figure, the assessment respectively assesses the three said facilities as "A," "C" and "D." The north breakwater (north) has the worst assessment because some defective conditions such as lost sections of rubble stones and/or backfilled materials as illustrated in Figure 5.3-4. Part of the situation might have originally happened due to uncompleted sections suspended at 60% progress of construction. The north breakwater (south) has minor dispersion and collapse of rubble stones but the damage is not at a significant or serious level. The south breakwater located in the old port shows no defective observations to date.

Table 5.3-6 Facility Assessment on General Inspection (Protective Facilities)

Facility / Insction Item	Protective Facilites			Remark
	North Breakwater		South Breakwater	
	North	South		
Movement, Dispersion, Settlement	a	c	d	
Damge	b	d	d	
Assessment	A	C	D	

Prepared by Project Team

(1) North Breakwater (N)-1
(nearly original section portion)

(2) North Breakwater (N)-2
(lacking stone fills portion)

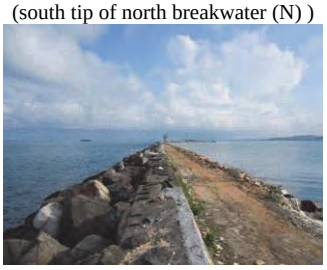
(3) North Breakwater (N)-3

(4) North Breakwater (N)-4
(no stone materials exist)

(5) North Breakwater (N)-5
(south tip of north breakwater (N))

(6) North Breakwater (S)-1

(7) North Breakwater (S)-2



(8) North Breakwater (S)-3

(9) North Breakwater (S)-4

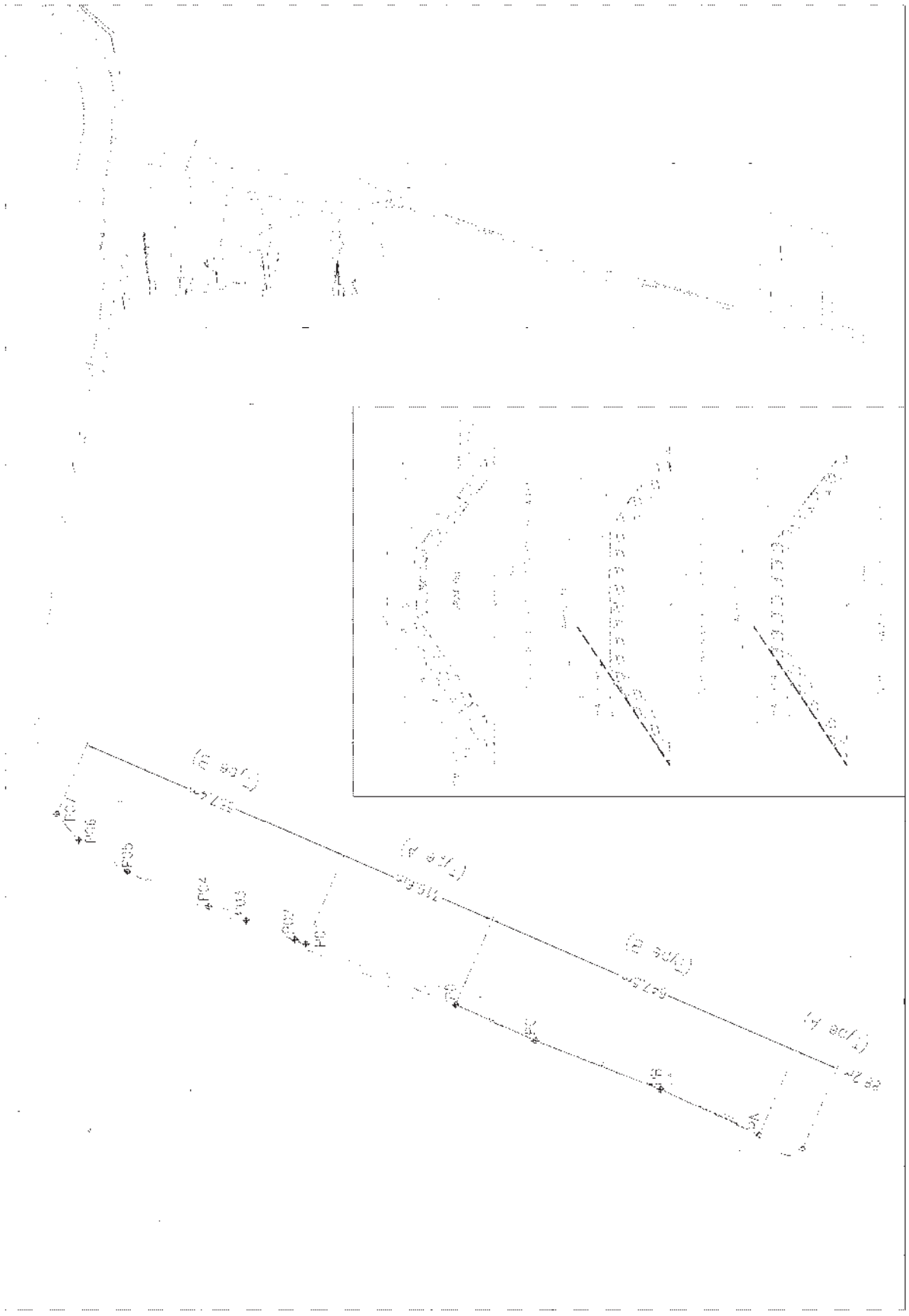
(10) South Breakwater-1

(11) South Breakwater-2

(12) South Breakwater-3

Prepared by Project Team

Figure 5.3-3 Site Conditions of Protective Facilities



Prepared by Project Team

Figure 5.3-4 Observed Actual Conditions of North Breakwater (North)

3) Mooring Facilities

As summarized in the list of port facilities in Sihanoukville Port, there are five (5) mooring facilities under jurisdiction of PAS. This assessment is only for four (4) facilities since the Old Jetty is specifically described in sub-section 5.2.2.

Table 5.3-7 provides the results of the facility assessment of the other four (4) mooring facilities: the new quay, container berth, tug boat quay and oil jetty. Figure 5.3-5 introduces the actual site conditions of the inspected mooring facilities. As found in the table and figure, the assessment gives the remarkable result of "A" or "B" to the new quay, container berth and oil jetty. The new quay was assessed with an apparently lowered capacity and performance for the ladder, concrete curb and copping concrete, which are lost or broken. For the container berth, settlement of the apron is observed particularly at excessively loaded sections. The oil jetty is assessed as the worst because it has many lowered capacity and performance levels for the fender system that has some missing sections, a cracked concrete curb, damage and cracks on the superstructure upper/side and extensive spalling underneath. No significant defects were observed for the tugboat quay probably due to the lower frequency of heavy use and the advantageous location covered by the breakwater.

Table 5.3-7 Facility Assessment on General Inspection (Mooring Facilities)

Facility / Insction Item			Mooring Facilities								Remark
			New Quay		Container Berh		Tug Boat Quay		Oil Jetty		
			Level	Assessment	Level	Assessment	Level	Assessment	Level	Assessment	
Drainage System			d	D	d	D	-	-	d	D	
Mooring Bollard			c	C	c	C	d	D	C	C	
Fender System			c	C	c	C	c	C	a	A	
Ladder			a	A	d	D	-	-	-	-	
Concrete Curb			a	A	-	-	-	-	a	A	
Quay Alighment			c	C	c	C	d	D	d	D	
Apron			c	C	b	B	d	D	-	-	
Gravity Type	Copping Concrete		b	B	c	C	c	C			
	Boddy Concrete		c	C	d	D	d	D			
Pier Type	Superstructure	Underneath							a	A	
		Upper/Side							b	B	
	Concrete Pile								N/A	N/A	Undone, not available
	Access Bridge								c	C	

Prepared by Project Team

4) Transportation Facilities

Table 5.3-8 presents the results of the facility assessment of transportation facilities such as west port road, internal roads behind warehouses No. 3 and Nos. 4&5, and the access and internal roads for the container terminal. Figure 5.3-6 displays the actual site conditions of the inspected transportation facilities. As shown in the table and figure, all the roads show no significant deterioration levels for each inspected item, except for the internal road for the container terminal. Some settlement of interlocking block pavement was observed on the east side.

Table 5.3-8 Facility Assessment on General Inspection (Transportation Facilities)

Facility / Insction Item	Transportation Facilities										Remark
	West Port Road		Internal Road behind Warehouse				Access Road (for Cotnaier Terminal)		Internal Road (for Conatainer Terminal)		
			No.3		Nos 4&5						
	Level	Assessment	Level	Assessment	Level	Assessment	Level	Assessment	Level	Assessment	
Pavement	c	C	c	C	c	C	c	C	b	B	
Gurdrail	-	-	-	-	-	-	-	-	-	-	
Drainage System	c	C	c	C	c	C	c	C	d	D	
Lighting System	d	D	d	D	d	D	d	D	d	D	

Prepared by Project Team

(1) New Quay-1
(quay line)

(2) New Quay-2
(mooring bollard)

(3) New Quay-3
(missing ladder)

(4) New Quay-4
(broken concrete curb)

(5) Container Berth-1
(overview)

(6) Container Berth-2
(berth line/fender/ladder, etc.)

(7) Container Berth-3
(apron settlement)

(8) Container Berth-4
(mooring bollard)

(9) Tugboat Quay-1
(overview)

(10) Tugboat Quay-2
(quay line/fender/mooring rings, etc.)

(11) Tugboat Quay-3
(apron)

(12) Oil Jetty-1
(overview)

(13) Oil Jetty-2
(superstructure: upper view)

(14) Oil Jetty-3
(superstructure: side view)

(15) Oil Jetty-4
(broken concrete curb)

(16) Oil Jetty-5
(superstructure: underneath view)

(17) Oil Jetty-6
(missing fender system)

(18) Oil Jetty-7
(rusted bollard)

Source: PAS, Project Team

Figure 5.3-5 Site Conditions of Mooring Facilities

(1) West Port Road-1
(AC pavement)

(2) West Port Road-2
(rotary junction)

(3) West Port Road-3
(ILB pavement)

(4) Internal Road-1
(entrance to internal road)

(5) Internal Road-2
(behind warehouse No.3)

(6) Internal Road-3
(behind warehouses Nos. 4&5)

(7) Access Road
(toward Gate No.3)

(8) CY Internal Road-1
(ILB pavement)

(9) CY Internal Road-2
(ILB pavement partially settled)

Prepared by Project Team

Figure 5.3-6 Site Conditions of Transportation Facilities

5) Cargo Sorting Facilities

Table 5.3-9 shows the results of the facility assessment for the container yard of the cargo storing facilities. Figure 5.3-7 designates the actual site conditions of the sorting facilities. As shown in the table and figure, the container yard has some partially unequal settlements of interlocking block pavement located around the east side of the container yard in heavy-loaded sections used by reach stackers and between transfer crane foundations.

It is assumed that the east side settlement may be caused by residual settlement but which is not progressive and minimal. The settlement near the concrete foundations is caused by frequent travel of relevant vehicles and cargo handling equipment. It often happens especially at a boundary between different structures which has different stiffness.

As far as visually observing the transfer crane and container stacking foundations, they have no settlement confirmed. This speculation is supported by the results of healing to PAS.

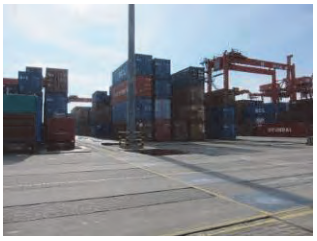
Furthermore, the portions of concrete pavement at such as maintenance workshop do not have any significant spall or breakage upon actual operation.

Table 5.3-9 Facility Assessment on General Inspection (Cargo Sorting Facilities)

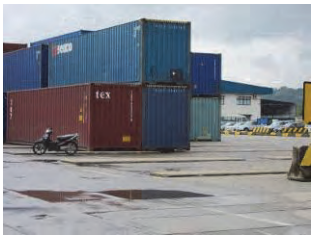
Facility / Insction Item	Cargo Sorting Facilities		Remark
	Conteiner Yard		
	Level	Assessment	
Pavement	b	B	
Continer Foundation	d	D	
Transfer Crane Foundation	d	D	
Drainage system	d	D	
Water Supply & F.F. System	d	D	
Power Supply System	d	D	
Lighting System	d	D	
Gurdrail	-	-	
Landscaping	-	-	
Gate & Fence	d	D	

Prepared by Project Team

(1) Container Yard-1
(RTG foundations/ILB pavement)



(2) Container Yard-2
(rainwater pooled)



(3) Container Yard-3
(partially depressed)

Prepared by Project Team

Figure 5.3-7 Site Conditions of Cargo Sorting Facilities

6) Storage Facilities

Table 5.3-10 shows the results of the facility assessment for storage yards behind warehouses No.3 and Nos. 4&5 of storage facilities. Figure 5.3-8 designates the actual site conditions of the tow (2) storage facilities. As shown in the table and figure, all the yards have no significant deteriorated levels for each inspection item.

Some concrete pavement has scratches and small cracks but those are minor defects at level of repairing work of ordinal maintenance.

Table 5.3-11 describes the results of the facility assessment for warehouses Nos. 1, 2, 3, 4 and 5 of storage faculties. Figure 5.3-9 presents the actual site conditions of the inspected warehouses. As shown in the table and figure, the assessment classifies the concrete structure as “B” with a lowered capacity and performance probably due to neglect, particularly for the concrete walls of all the warehouses. Several cracks are seen on the surfaces of building walls at the installed lines of reinforcement. The roof, floor slab and steel frame structures are not remarkably deteriorated at present.

Table 5.3-10 Facility Assessment on General Inspection (Storage Facilities; Storage yard)

Facility / Insction Item	Cargo Sorting Facilities				Remark
	Storage Yard behind Warehouse				
	No.3		Nos 4&5		
	Level	Assessment	Level	Assessment	
Pavement	c	C	c	C	
Continer Foundation	-	-	-	-	
Transfer Crane Foundation	-	-	c	C	
Drainage system	c	C	d	D	
Water Supply & F.F. System	-	-	-	-	
Power Supply System	d	D	d	D	
Lighting System	d	D	d	D	
Gurdrail	-	-	-	-	
Landscaping	-	-	-	-	
Gate & Fence	c	C	d	D	

Prepared by Project Team

(1) Storage Yard 1-1
(behind warehouse No. 3)

(2) Storage Yard 1-2
(behind warehouse No. 3)

(3) Storage Yard 1-3
(behind warehouse No. 3)

(4) Storage yard 2-1
(behind warehouses Nos. 4&5)

(5) Storage yard 2-2
(behind warehouses Nos. 4&5)

(6) Storage Yard 2-3
(behind warehouses Nos. 4&5)

Prepared by Project Team

Figure 5.3-8 Site Conditions of Storage Facilities (Storage Yard)

Table 5.3-11 Facility Assessment on General Inspection (Storage Facilities; Warehouse)

Facility / Insction Item	Storage Facilities										Remark
	Warehouse No.1		Warehouse No.2		Warehouse No.3		Warehouse No.4		Warehouse No.5		
	Level	Assessment	Level	Assessment	Level	Assessment	Level	Assessment	Level	Assessment	
Concrete Sturucuture	b	B	b	B	b	B	b	B	b	B	
Steel Structure	c	C	c	C	c	C	c	C	c	C	
Seawage System	-	-	-	-	-	-	-	-	-	-	
Water Supply System	-	-	-	-	-	-	-	-	-	-	
Power Supply System	d	D	d	D	d	D	d	D	d	D	
Lighting System	c	C	c	C	c	C	c	C	c	C	

Prepared by Project Team

(1) Warehouse No. 1
(RC/Steel framed structure)

(2) Warehouse No. 2
(RC/Steel framed structure)

(3) Warehouse No. 3
(RC/Steel framed structure)

(4) Warehouse No. 4
(RC/Steel framed structure)

(5) Warehouse No. 5
(RC/Steel framed structure)

(6) Warehouse Concrete Wall-1
(cracked concrete wall)

(7) Warehouse Concrete Wall-2
(cracked concrete wall)

(8) Warehouse Concrete Wall-3
(cracked concrete wall)

(9) Warehouse Concrete Wall-4
(cracked concrete wall)

Prepared by Project Team

Figure 5.3-9 Site Conditions of Storage Facilities (Warehouse)

7) Other Facilities

Table 5.3-12 summarizes the results of the facility assessment of other facilities, such as port security facilities, common port buildings, navigation aids and the weighbridge. Figure 5.3-10 gives the actual site conditions of the inspected other facilities. As shown in the table and figure, the assessment gives classification "A" to VTMS in Administration Building, and "C" or "D" to all the other facilities constructed or installed in 2008. Even Gates Nos. 1 and 2, which are older than No. 3, do not seem to have notable deterioration at present. Although the CCTV cameras were broken by lightning, the camera system has been repaired according to the latest information provided by PAS. VTMS installed in Administration Building is malfunction, because fiber optic cables connected to its radar tower have been accidentally cut by construction activities inside the Port area.

Table 5.3-12 Facility Assessment on General Inspection (Other Facilities)

Facility / Insction Item	Other Facilities																Remark
	Admin. Building		Maintenace Workshop		Utilitiy Buildings		Gate No.1		Gate No.2		Gate No.3		Navigation Aids		Weigh Bridge		
	Level	Assessment	Level	Assessment	Level	Assessment	Level	Assessment	Level	Assessment	Level	Assessment	Level	Assessment	Level	Assessment	
Concrete Sturucuture	c	C	c	C	c	C	c	C	c	C	-	-	-	-	c	C	
Steel Structure	-	-	d	D	-	-	-	-	-	-	d	D	c	C	c	C	
Seawage System	d	D	d	D	d	D	-	-	-	-	-	-	-	-	-	-	
Water Supply System	d	D	d	D	d	D	-	-	-	-	-	-	-	-	-	-	
Power Supply System	d	D	d	D	d	D	d	D	d	D	d	D	-	-	d	D	
Lighting System	d	D	d	D	d	D	d	D	d	D	d	D	d	D	d	D	
VTMS	a	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
CCTV System	c	C	-	-	-	-	c	C	c	C	c	C	-	-	-	-	
Perimeter Fence	c	C	-	-	-	-	c	C	c	C	c	C	-	-	-	-	

Prepared by Project Team

(1) Administration Building
(RC, PAS office)

(2) Maintenance Workshop
(RC/steel framed structure)

(3) Utility Building-1
(RC, pump house)

(4) Utility Building-2
(Generator & power supply bldg.)

(5) Gate No. 1
(RC)

(6) Gate No. 2
(RC)

(7) Gate No. 3
(Steel framed structure)

(8) X-ray Scanning Building
(RC)

(9) Container Checking Building
(RC, gamma-ray scanning system)

(10) Navigation Aids-1
(Red buoy)

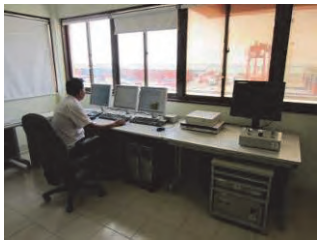
(11) Navigation Aids-2
(Navigation light)

(12) Navigation Aids-3
(spare buoys at old port apron)

(13) Weighbridge

(14) CCTV System-1
(CCTV camera)

(15) CCTV System-2
(CCTV control room)



(16) VTMS
(Control room)

(17) Perimeter Fence-1
(Cyclone wire-type)

(18) Perimeter Fence-2
(Concrete wall type)

Prepared by Project Team

Figure 5.3-10 Site Conditions of Other Facilities

8) Conclusions

Based on the facility assessments mentioned above, the following conclusions are drawn.

Waterways & Basins: The tugboat basin has not been maintained at the original depth, but the situation does not have a serious impact on the actual operation. It is presumed that the shallower depth is due to a lack of maintenance dredging.

- **Protective Facilities:** North breakwater (north), which has uncompleted sections, seems to have lost some filling materials previously placed on the top of the breakwater due higher waves which likely entered the harbor area through the damaged sections during extreme weather conditions.
- **Mooring Facilities:** The new quay has some remarkable problems including a missing ladder and breakage of the concrete curb and copping concrete due to deterioration from aging. The container berth has only some minor settlement on the apron area, which may be caused by the concentrated point load of vehicle and cargo handling equipment. The oil jetty has serious problems with the structural conditions of the fender system, concrete curb and superstructure due to deterioration from aging and a lack of maintenance.
- **Transportation Facilities:** The internal road for the container terminal has some depressed portions on the pavement due to frequent use by trailer trucks and other cargo handling equipment.
- **Cargo Sorting Facilities:** The same as the internal road for the container terminal, the container yard pavement has some minor depressed portions between RTG concrete foundations and/or container stacking foundations. This may be due to the effects of unconsidered loads beyond the design parameters.
- **Storage Facilities:** All the warehouses are becoming superannuated and the concrete walls have many cracks on the installed lines of reinforcement.
- **Other Facilities:** VTMS in the admin. building malfunctions due to the cable disconnection.

(3) Recommendations

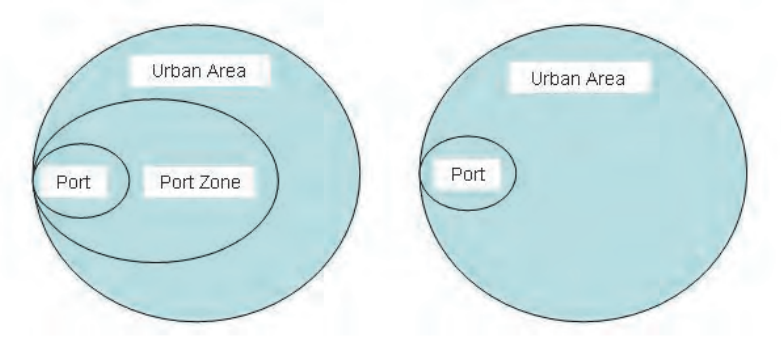
In consideration of the above, the following countermeasures are recommended based on the degree of deterioration:

- **Urgent Rehabilitation:** Oil jetty requires urgent rehabilitation because it is in a severely deteriorated state due to neglect. Countermeasures, especially for the concrete repair, should be taken based on those suggested in Table 5.2-16. To extend its service life, the most applicable method is sectional restoration with adequate reinforcement to the target vessels. It may be possible to carry out mortal spray to the underneath and concrete jacketing with high-grade epoxy mortar to the other defective structural members.
- **Rehabilitation:** North Breakwater (north), warehouses and VTMS in the administration building fall under the ‘rehabilitation’ category. The breakwater requires at least reconditioning of the opened sections where the top materials have been lost by filling with suitable stone materials up to the original elevation. The concrete walls of the warehouses need to have crack repairs such as epoxy injection, concrete filling to v-cut portions, chipping, re-concreting, etc. The fiber optic cables connected to the radar tower and VTMS need to be re-spliced by an experienced technician or be replaced.
- **Ordinal Maintenance:** All the observations of the tugboat basin, new quay, container berth, internal road and yard for the container terminal belong to this category. Respectively, maintenance dredging, reinstallation of missing items if needed, concrete repair, and re-basing of ILB pavement are commonly required as periodical maintenance activities.

5.3.4 Required development scale of land for industries

Figure 5.3-11 compares the spatial configurations of Sihanoukville Port (right) and ordinary ports (left). In general, a port zone, where logistics industries and manufacturers which are heavy users of the port are concentrated, is formed around a port. This zone acts also as a buffer zone between a port and urban area. Some countries such as Japan restrict urbanization and location of a residence or an industry indifferent to port activity in a port zone. In Preah Sihanouk, however, such a port zone doesn't exist and port-related industries are scattered in the urban area or residential zones. This spatial configuration of Preah Sihanouk lowers the efficiency of logistics. This is also a cause of negative impacts of the port upon urban activities such as traffic congestion around the port.

It is indispensable to form a port zone strategically in Preah Sihanouk and to locate port-related industries for competitiveness of the port and for better harmonization between the port and urban activities. However it would be difficult to form a port zone on the existing land area because the area around the port has been already urbanized. Accordingly, it is crucial to form a port zone on a newly reclaimed land behind port terminals and to utilize the zone exclusively for port-related industries. The depth of port zone behind port terminals shall be at least one kilo meter.



Prepared by Project Team

Figure 5.3-11 Comparison of spatial configurations of Sihanoukville Port (right) and ordinary ports (left)

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

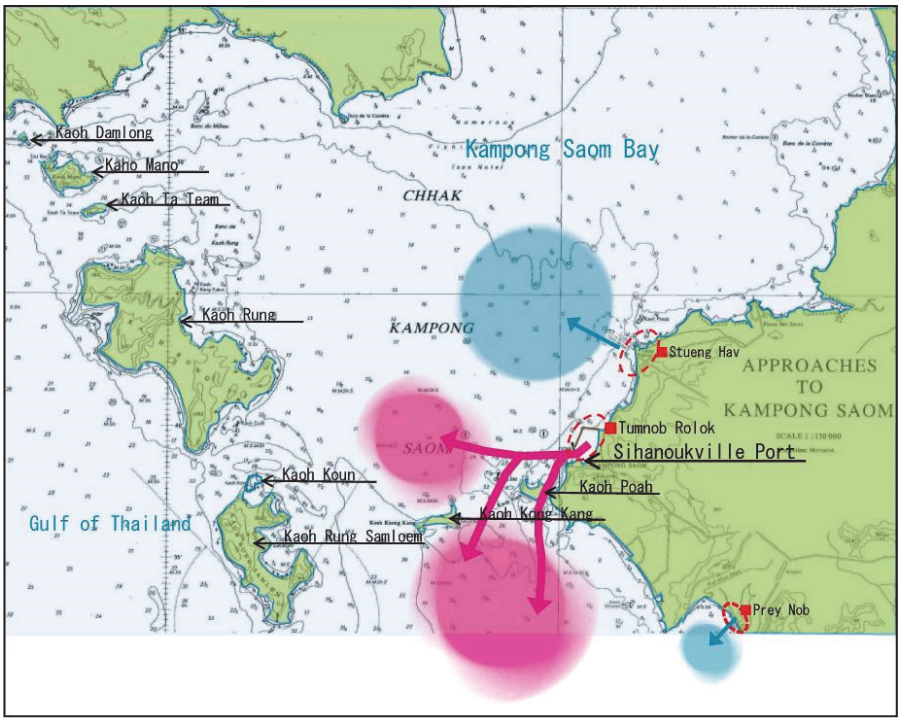
5.4. Space for Port Development

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

(1) Water area

1) Outside of the port

There are no existing fishing rights or fisherman's union defined in the statute of Cambodia. The sub-decree regarding water rights was promulgated once in the 1950's; however, it automatically lost its legal force under the chaos of civil war during the Pol Pot regime, and has since never been reformulated. In the coastal areas, there is a certain tacit consent among fisherman and regional government over fishery grounds. Fishery grounds among the three main fishery villages in Preah Sihanouk Province show clear separation without conflict. The Tumnob Rolok Village in Sihanoukville Port, which is the largest among the three village shares its ground broadly. (Figure 5.4-1)



Source: Marine Fisheries Administration Inspectorate, Kampong Som Fisheries Administration Cantonment, Ministry of Agriculture, Fishery and Forestry, British Admiralty Charts, Project Team

Figure 5.4-1 Fishing grounds of the three main fishing villages in Preah Sihanouk Province

2) Inside the port

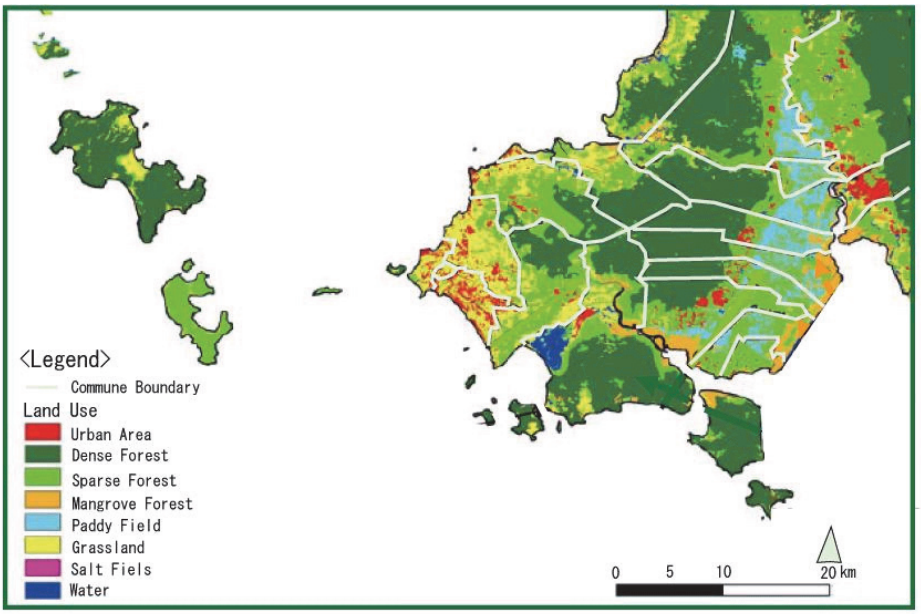
As shown in Figure 5.4-4, there is only one dike gate open to the sea and hence, logistics cargos, ships and vessels of the port and fishery boats share the same gate, which also suggests the port's safety concerns.

Aquaculture fish farmers share the same areas in the port with other boats/ships. There are residents in the city out of PAS jurisdiction, who commute to nearby preserves along the edge of the dike. Also, they do not have any permission or agreement with PAS. A total of 102 people (88 males, 14 females) from 21 families run the fish farming in this area with 973 preserves. Average size of a preserve cage is 9.6 m² (Figure 5.4-4).

(2) Land area

1) Coastal line of Preah Sihanouk Province

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



Source: 2008 Population Census, NIS, The Study on National Integrated Strategy of Coastal Area and Master Plan of Sihanoukville for Sustainable Development (2009-2010), Project team

Figure 5.4-2 Land use of coastal lines in Preah Sihanouk Province

2) PAS Jurisdiction

Land ownership system in Cambodia was destroyed during the civil war and has been an issue for years for not being rebuilt. Land title system has also not been established yet in Cambodia[11]. Today, it has become a considerable issue with economic growth and social stability (refer to Section 5.10.2 (1)).

In this context, PAS has a history of conflict to cordon off its own territory as a jurisdictional area through the chaos of the civil war and its aftermath. Finally, the sub-decree[12] in 2000 and 2009 terminated the conflict with the Municipality Government of Preah Sihanouk over land use plan, and defined its jurisdiction. However, the total area of PAS is not statistically clear. The sub-decree stipulated in the boundary of jurisdiction and land survey has not been finished yet. (Figure 5.4-3)

PAS jurisdiction consists of the port area, SEZ area, areas in Bet Traing Village, New Beach area, other areas, and unsurveyed areas including fishery town and residential quarters next to SEZ area.

[11] The project to formulate the land title system has been conducted in these five years with the assistance by GTZ and actually the pilot project to register the land title has been conducted in Banteay Meanchey Province, but not Preah Sihanouk yet.

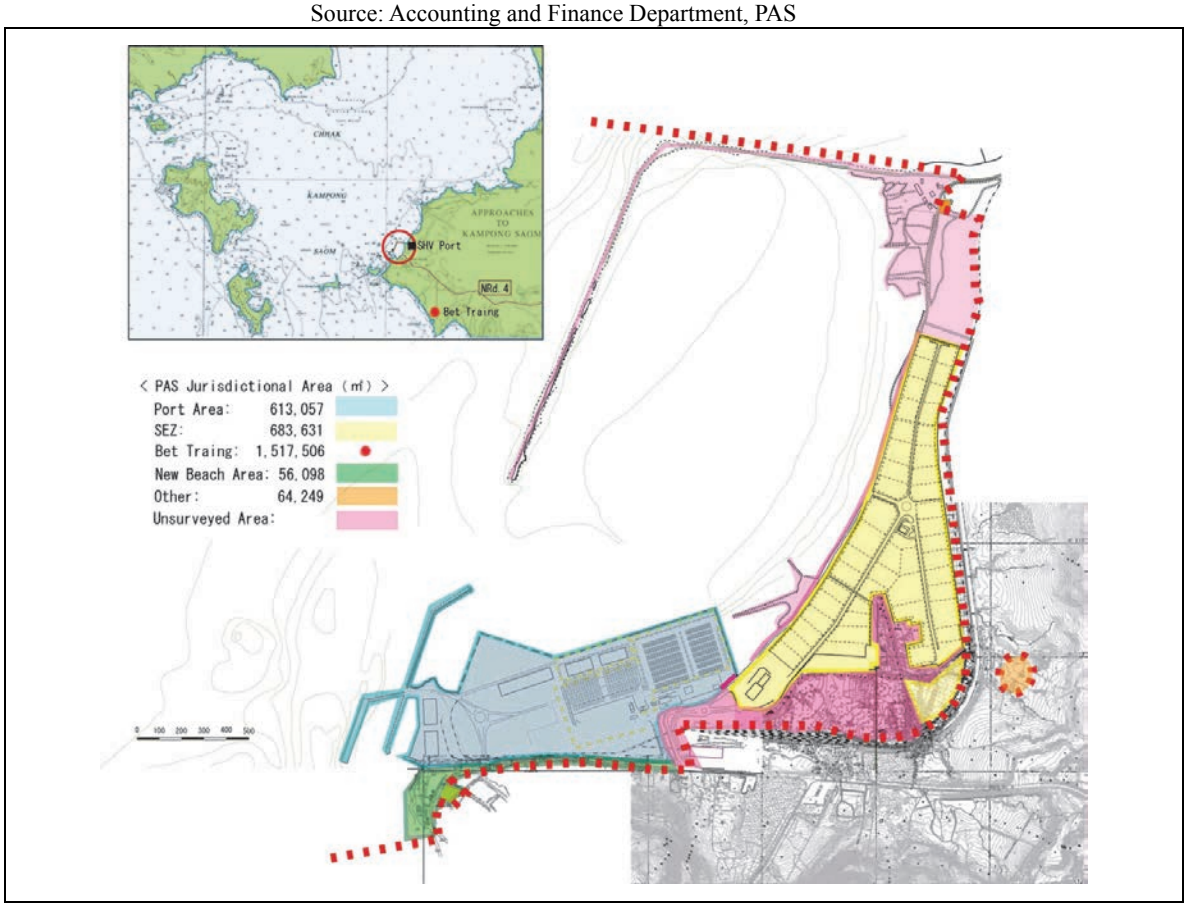
[12] Sub-decree on Development of Sihanoukvile Autonomous Port Area, Royal Government of Cambodia, No. 23 ANkr. BK and No.54 ANkr. BK, 2000

Sub-decree on Creating Sihanoukvile Port SEZ, Royal Government of Cambodia, No. 147 ANkr. BK, 2009

Table 5.4-1 Surveyed Jurisdictional Area of PAS

Category	Area (m²)
Port Area	613.057
SEZ Area	683,631
Bet Traing	1,517.506
New Beach Area	56,098
Other	64,249

Source: Accounting and Finance Department, PAS



Source: PAS, Project Team

Figure 5.4-3 Jurisdiction area of PAS

3) Residential area in PAS jurisdiction

The sub-decree in 2000 left PAS the issue regarding illegal residents in its territory. There are two residential quarter areas that exist in the PAS jurisdiction. These are the areas around SEZ and along the coast line (Figure 5.4-4). Because the relationship between PAS and the residents concerning compensation for resettlement in the development project in the past is extremely delicate, detailed survey of residents in the port area has never been conducted. Basic social survey of present situation of residents has been conducted and the result is described in Section 5.5.7. Their background and cause as to what brought them to live in PAS jurisdiction vary.

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

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

It is said that some of the residents had moved in from other coastal areas of Cambodia and Vietnam because the construction of the large dike during the development project of the port in 1955 made seawater surface in the dyke restful and safe enough for mooring small fish boats. Also, the

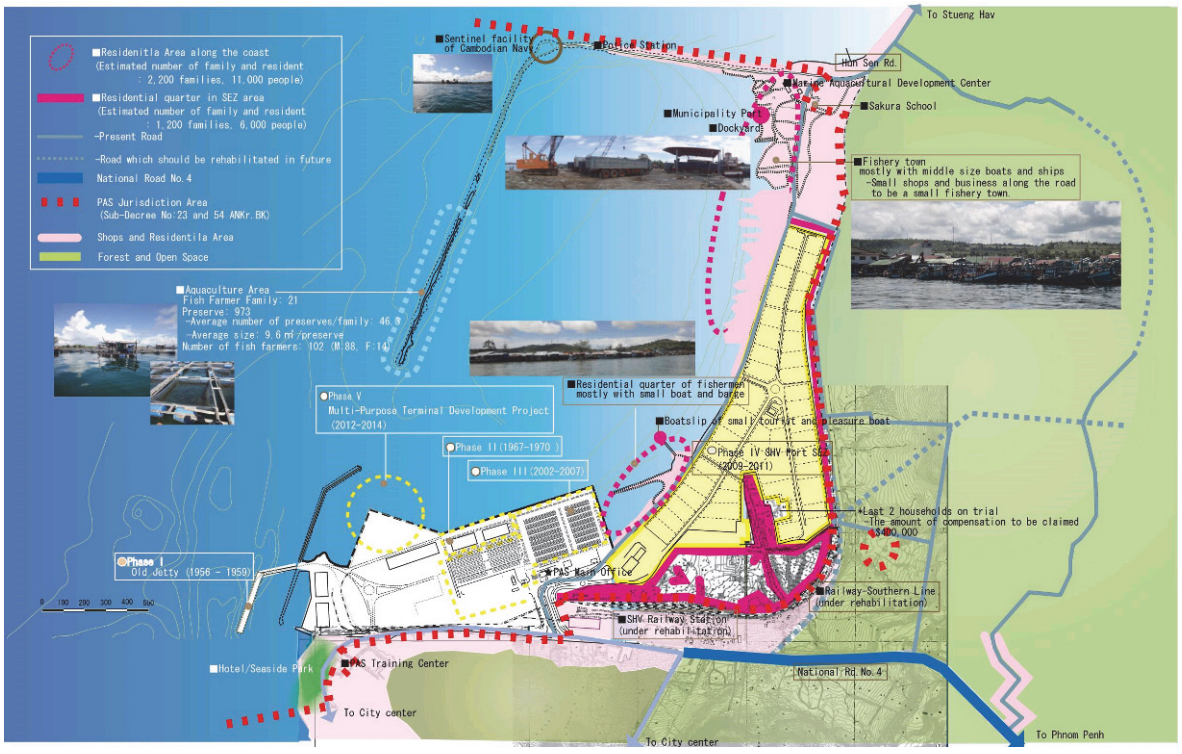
chaos during the Vietnam War, civil war and Pol Pot regime cause difficulty to the government and PAS with regards to control of port jurisdiction.

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

b) Residential quarter around SEZ

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

The background of these people varies; however, it is said that most of them started living in the area for the purpose of getting eligibility requirements for compensation for resettlement. However, there are also people who purchased land from the municipality government at their own expense during the era when the government set land use plan and declared its jurisdiction of the SEZ area in 1993. The sub-decree in 2000 fails to solve the issue of the people who purchased land from the government and thus remained as "illegal residents". Through development projects in the past, PAS created its own methodology to identify the residents, the system of compensation and private contracts to give them the right of residency called "Agreement", which consists of basic information of family members, fingerprints, photo of face of family members, list of assets, and location maps of immovable assets.



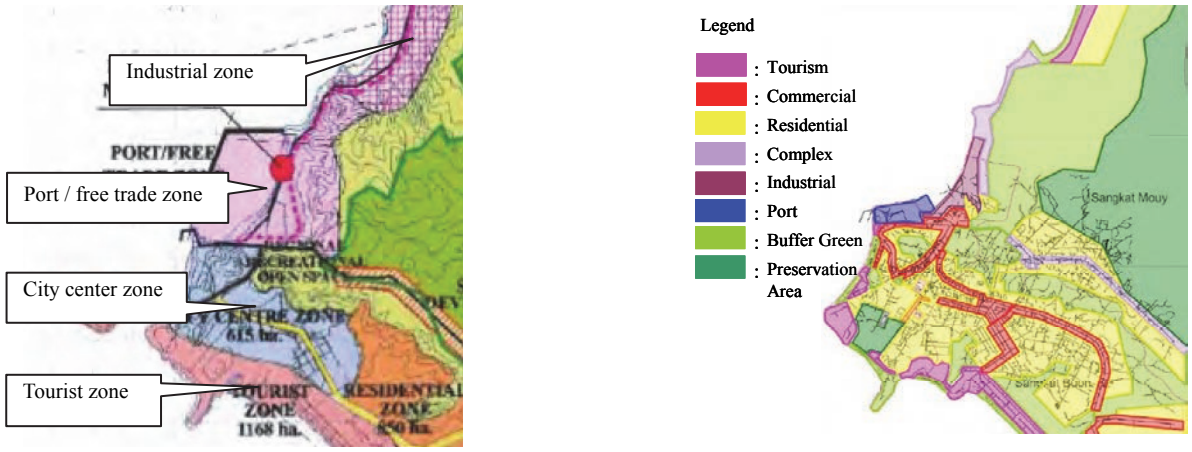
Source: PAS, Project Team

Figure 5.4-4 Present land use of Sihanoukville Port

5.4.2 Candidate areas for port development

Figure 5.4-5 shows land use plans around Sihanoukville Port defined in the urban plans in 1995 and 2010. These plans indicate that the land for manufacturers and logistics industries were reduced considerably during this period due to increased population, promotion of tourism industry and improved awareness on environment. Therefore PAS shall create a land for port-related industry

together with port development as mentioned in the previous section.

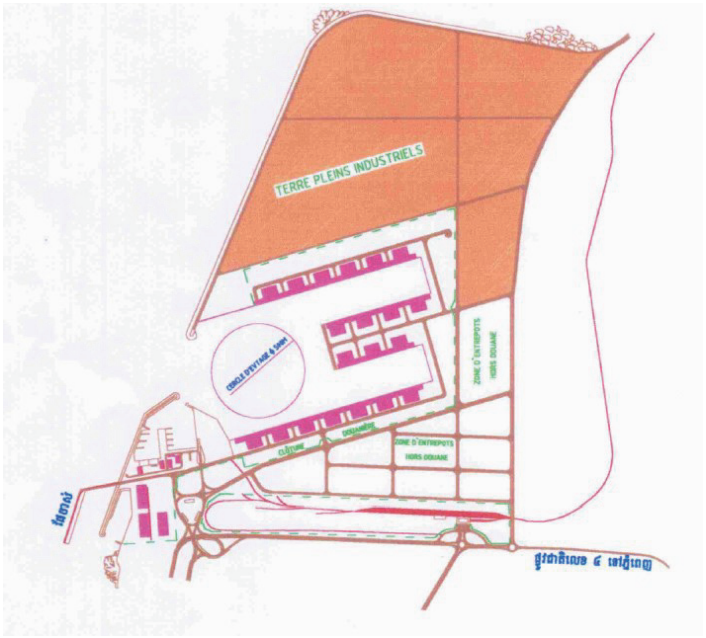


Source: JICA

Figure 5.4-5 Land utilization around the Port in the urban development plan in 1995（left）and 2010（right）

Figure 5.4-6 and Figure 5.4-7 shows the port plans of Sihanoukville in 1964 and Pol Pot era. Both plans secure the land for port-related industries by reclaiming around a half of the basin surrounded by breakwaters (sea walls). If these plans had been implemented, the port would not have had to operate inefficiently in a small area, nor would it have had a negative impact on urban traffic.

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



Source: PAS

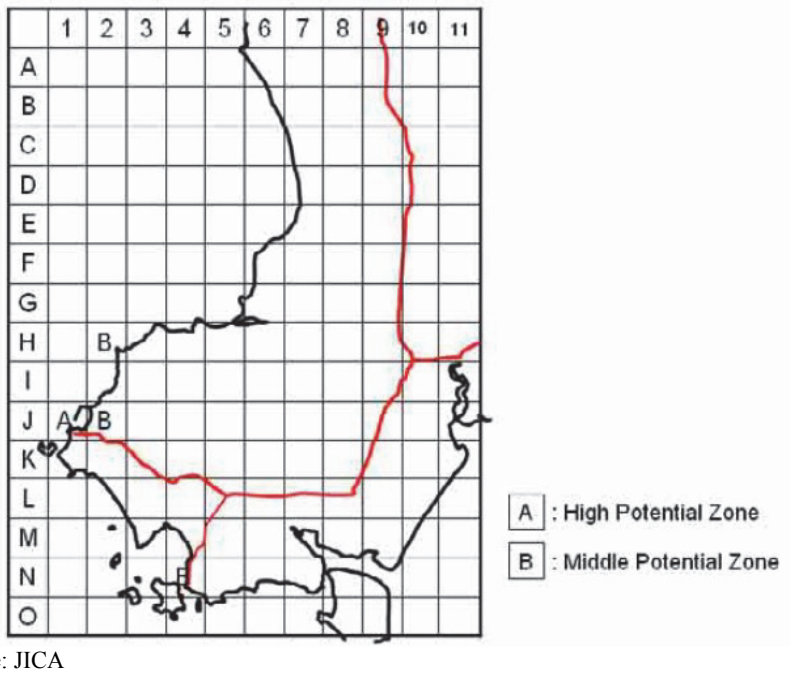
Figure 5.4-6 Port plan formulated in 1964

Source: PAS

Figure 5.4-7 Port plan formulated in Pol Pot era

5.4.3 Candidate areas for port development

"The Study on Maritime and Port Sector Master Plan" conducted by JICA evaluated the potential of the littoral zone between Sre Ambel and the area to the east of Ream National Park for port development by employing the mesh analysis method. The result is shown in Figure 5.4-8. Regarding the development potential for container terminals, which is the most important component of the port development strategy of this project, the study evaluated that the area surrounded by breakwaters had the highest potential.

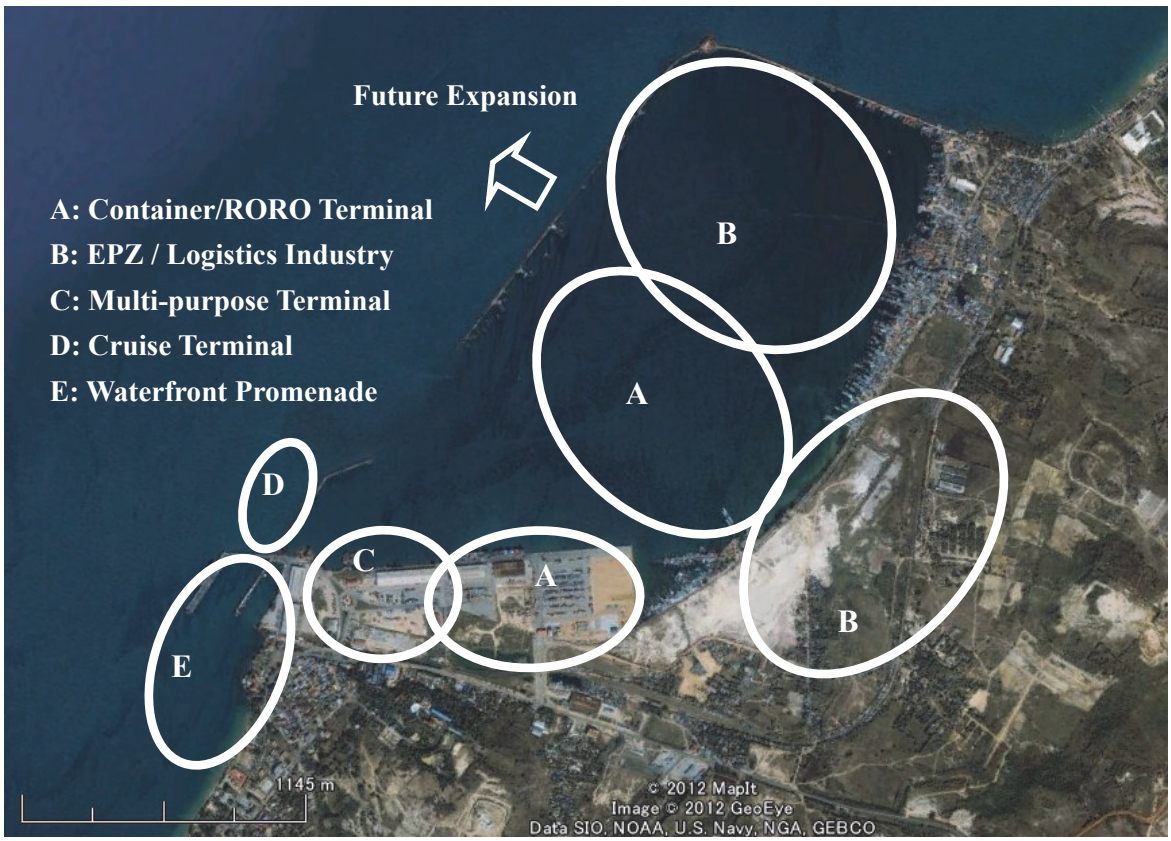


Source: JICA

Figure 5.4-8 Results of evaluation of development potential for container terminals by The Study on Maritime and Port Sector Master Plan

Considering rational arrangement of port functions and harmonization with spatial utilization of the surrounding area, the Project Team proposes the basic spatial configuration of port development area as shown in Figure 5.4-9. .

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



Prepared by Project Team

Figure 5.4-9 Configuration of the space for port development