9.3.2 Long-term Development Plan (year 2011-2020)

(1) Channels Development

As discussed in Chapter 8, measures for the coastal protection from erosion near the training jetties are, in principle, sand bypassing. It should be applied to the 10 channels shown below, each accompanied with roughly estimated sand volume/year.

Channels in Study Area for Execution of Sand Bypassing	
① Songkhla	15,000m^3/year
② Na Thap	10,000m^3/year
③ Sakom	30,000m^3/year
④ Thepha	15,000m^3/year
⑤ Bang Rapa	50,000m^3/year
⑥ Tanyong Pao	50,000m^3/year
⑦ Panare	50,000m^3/year
⑧ Bang Maruat	50,000m^3/year
⑨ Sai Buri	20,000m^3/year
⑩ Narathiwat	15,000m^3/year
Total	305,000m^3/year

(2) Ports Development

(a) Songkhla Port (See Figure 9.3.2-1)

i) Expansion of Container Cargo Berth in Songkhla Port

According to the "Expansion of Songkhla Deep Sea Port" by HD, the first stage development will be implemented from 2000 to 2010, and the second stage after 2010. Main facilities of the second stage development for the expansion of container cargo berth as follows.

- Container berth (Berth Length: 180m)
- Training Jetty (Length: 450m)
- Container Yard
- CFS and Administration Office
- Cargo handling equipment

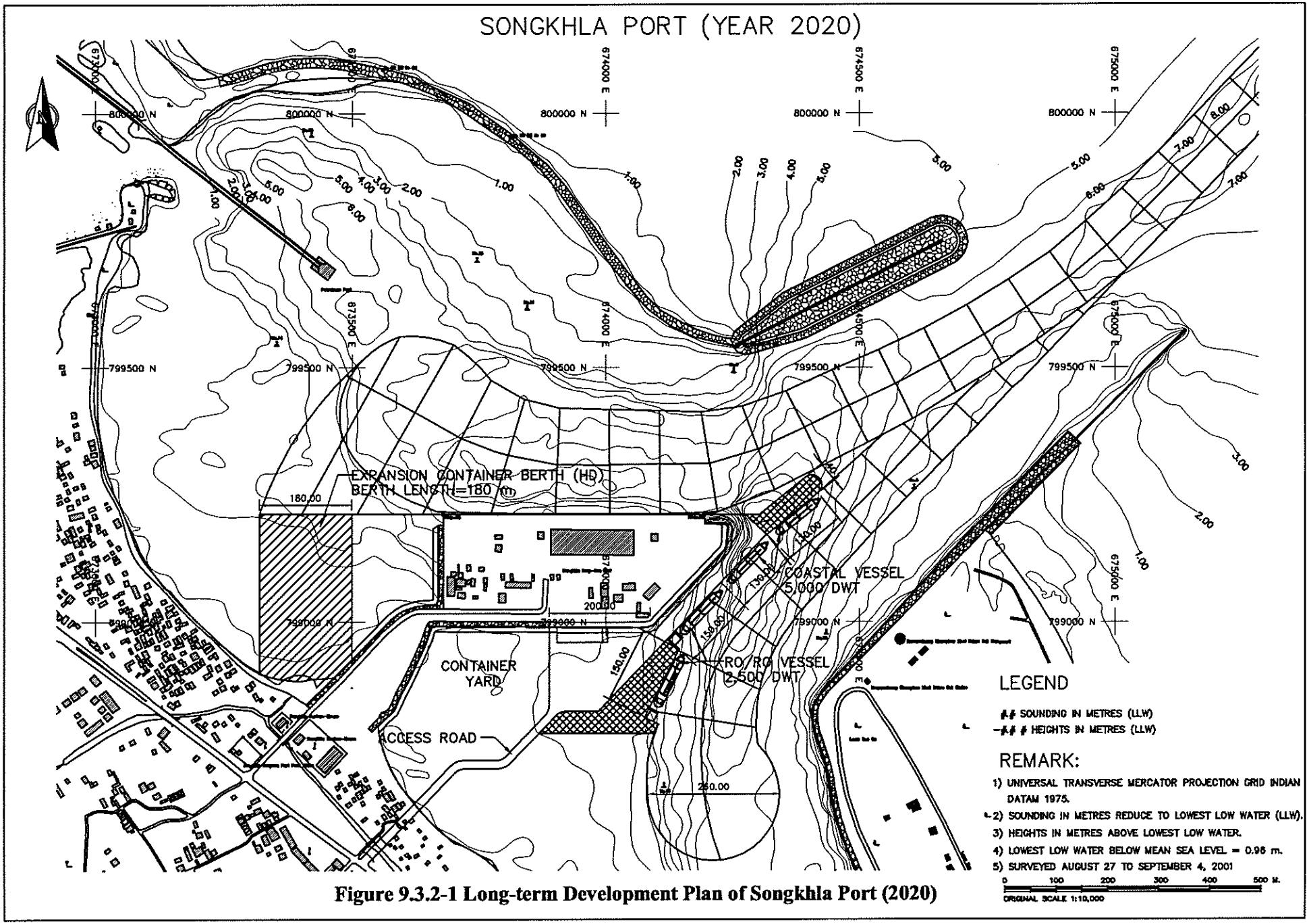


Figure 9.3.2-1 Long-term Development Plan of Songkhla Port (2020)

ii) Expansion of Coastal Cargo and Ro/Ro Berth in Songkhla Port

Based on the cargo forecast in 2020, two additional berths are necessary each for the coastal cargoes and Ro/Ro transport. Thus, the new development area will be utilized for the two Ro/Ro berths.

Expansion of Coastal and Ro/Ro Cargo Berth (Long-term development)		
5,000 DWT Cargo Vessel	Berth Length = 130m	Berth Depth =-7.5m
2,500 DWT Ro/Ro Vessel	Berth Length = 150m	Berth Depth =-6.5m

(b) New Sichon Port Development Plan in Land bridge Plan

The Sichon Commercial Port, which will be constructed as a gate port of the land bridge on the Gulf of Thailand. It will also support the provincial economy of both Surat Thani and Nakorn Si Thammarat provinces. The selection of the Sichon Commercial Port as the gate port is due to its depth sufficient to accommodate ocean-going large ships. The difficulty in maintaining Tha Thong channel (21.5km, dredging depth=5.0m) and Pak Phanang channel (27km, dredging depth=5.0m), both are located relatively close to Sichon, is also taken into account.

According to the “Feasibility Study on the Southern Seaboard Port and Industrial Complex Development Project” by Office of the Southern Seaboard Development Committee, the main port facilities of the conceptual development plan for the Sichon port (phase I) are as follows:

- Multi-purpose berth (Berth Length: 200m x 2 berth)
- Container and Bulk Storage (Approx. 1,200m^2)
- Maintenance and Operations Complex
- Open Storage
- Cargo handling equipment

9.3.3 Summary of Short and Long-term Development Plan

The construction projects to be implemented from 2001 to 2020 are shown in Table 9.3.3-1. Figure 9.3.3-1 shows the long-term development projects in the study area to be completed by 2020.

TABLE 9.3.3-1 Short and Long-term Development Project (year 2001 -2020)

	Coastal Channel	2001 (Present)			2001-2010			2011-2020		
		Channel Control Structure	Erosion Prevention Structure	Main Port Structure	Channel Control Structure	Erosion Prevention Structure	Main Port Structure	Channel Control Structure	Erosion Prevention Structure	Main Port Structure
1	**Songkhla (Harbour)**	Jetty & Breakwater		Cargo Wharf, Oil Jetties	Additional Jetty Plan	Detached Breakwater & Groin	Expansion Container Berth (HD, D/D), Additional Oil Jetty Facilities (PTT) Ro/Ro Berth/Coastal Berth (JICA)	Sand Bypassing 15,000m^3/year		Expansion Container Cargo Berth (HD, Phase II), Oil Jetty (PTT) Expansion Ro/Ro & Coastal Berth (JICA)
2	**Pak Phanang**			Public Fishing Jetties			Additional Oil Jetty Facilities (PTT)			
	New Sichon Plan							Breakwater (Southern Seaboard)		Deep Sea Port (Southern Seaboard)
3	**Pattani**	Dual Jetties		Private Fishing Jetties						
4	**Khanom (Outer & Inner Channel Sector 1&2)**			Cargo Wharf, Oil Jetty						
5	**Sai Buri**	Dual Jetties	Detached Breakwater, Revetment	Public Fishing Jetties		Additional Detached Breakwater, etc. (HD, beginning of construction in 2001)		Sand Bypassing 20,000m^3/year		
6	**Sichon**	Single Jetty		Public Fishing Jetties	Additional Jetty Plan, etc. (HD, F/S)	Additional Detached Breakwater, etc. (HD, F/S)				
7	**Khanom (Inner Channel Sector 3)**			Public Fishing Jetties						
8	**Narathiwat**	Dual Jetties	Groin (T-type)	Public Fishing Jetties		Improvement, Groin (T-type)		Sand Bypassing 15,000m^3/year		
9	**Tha Sala**	Dual Jetties	Detached Breakwater, Groin	Public Fishing Jetties, Mining Jetties		Groin (T-type), Improvement				
10	**Pak Nakhon**			Public Fishing Jetties						
11	**Na Thap**	Dual Jetties	Groin (L-type)			Improvement & Detached Breakwater		Sand Bypassing 10,000m^3/year		
12	**Sakom**	Dual Jetties	Detached Breakwater			Improvement & Detached Breakwater		Sand Bypassing 10,000m^3/year		
13	**Thepha**	Dual Jetties	Detached Breakwater			Improvement & Detached Breakwater		Sand Bypassing 15,000m^3/year		
14	**Panare**	Dual Jetties	Detached Breakwater		Improvement, Detached Breakwater, Sand Bypassing 50,000m^3			Sand Bypassing 50,000m^3/year		
15	**Bang Ra Pha**	Dual Jetties			Detached Breakwater & Sand Bypassing 50,000m^3			Sand Bypassing 50,000m^3/year		
16	**Tanyong Pao**	Dual Jetties			Detached Breakwater & Sand Bypassing 50,000m^3			Sand Bypassing 50,000m^3/year		
17	**Bang Ta Wa**	Revetment	Groin, Wave-dissipating Blocks			Groin (T-type), Improvement, Detached Breakwater				
18	**Bang Maruat**	Dual Jetties	Detached Breakwater			Improvement & Detached Breakwater		Sand Bypassing 50,000m^3/year		
19	**Tak Bai**	Dual Jetties	Groin							
20	**Laem Ta Chi (Pattani Outer Channel)**	Single Jetty								
21	**Pak Paya**									
22	**Pak Phun**									
23	**Pak Phaying**									
24	**Pak Duat**									
25	**Tha Mak**									
26	**Khlong Tung Ca**									
27	**Khlong Tu Yong**									
28	**Ban Sai Samo**									
29	**Ru Sa Mi Lae**									
30	**Ta Lo Lae Weng**									

Note:

: JICA Recommended Project

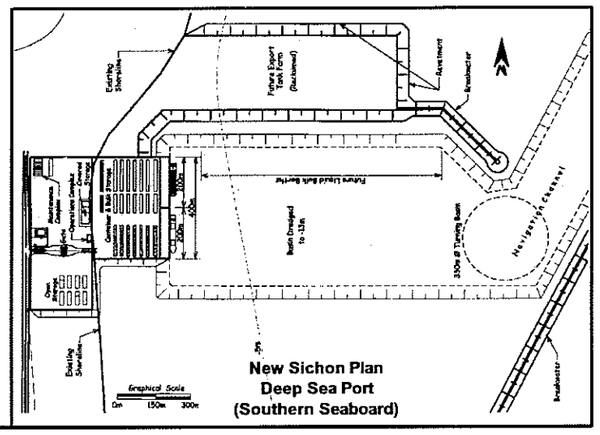
(HD, F/S): Feasibility Study by Hpoubour Department

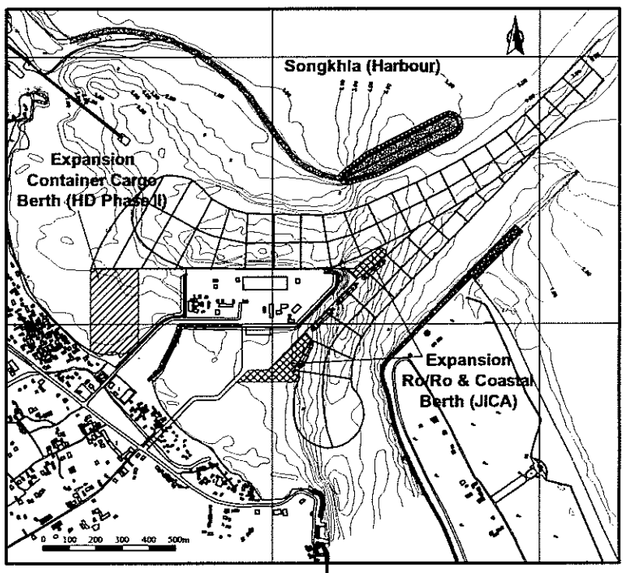
(HD, D/D): Detail Design by Hpoubour Department

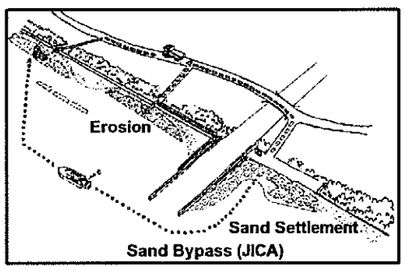
(PTT): Petroleum Authority of Thailand

(Southern Seaboard): The Southern Seaboard Development Committee

Shore protection work like detached breakwater will be re-examined







1. Khanom (Outer Channel)
2. Khanom (Inner Channel)
3. Sichon
4. Khlong Tung Ca
5. Tha Mak
6. Pak Duat 1)
7. Tha Sala
8. Pak Phaying
9. Pak Phun
10. Pak Paya
11. Pak Nakhon
12. Pak Phanang
13. Songkhla (SB)
14. Na Thap (SB)
15. Sakom (SB)
16. Thepha (SB)
17. Khlong Tu Yong
18. Bang Ra Pha (SB)
19. Tanyong Pao (SB)
20. Ban Sai Samo
21. Bang Ta Wa *
22. Ru Sa Mi Lae
23. Laem Ta Chi
24. Pattani
25. Panare (SB)
26. Bang Maruat (SB)
27. Sai Buri (SB)
28. Ta Lo Lae Weng
29. Narathiwat (SB)
30. Tak Bai

GULF OF THAILAND
ANDAMAN SEA
MALAYSIA

KORANGAN, KOSAMUI, DONSAK, KHANOM, SURATTHANI, KANCHANADIT, PHUNPHIN, SICHON, BANNASAN, WANGSRA, THASALA, PHIPUN, PHOMKHIRI, NAKHON SI THAMMARAT, CHAWANG, LANSAKA, Pak Khlong, PAK PHANANG, NABON, Pak Raya, CHAINYAI, THUNGSONG, LAMTHAP, Thale Noi, HUASAI, BANGKHAN, CHAUD, Takhria, KAISADA, KHUANKHANUN, NOKNAKTENDIPARK, RANOT, Sala Tham, Ban Mai, WANG WI SET, Hua Pa, SIKAO, SONGKHLA, Chiang Phong, PHATTHALUNG, TRANG, SATHINGPHRA, Mahakan Ok, KANTANG, YANTAKHAO, AKPHAYUN, La Pam, SALAIN, Ban Ku Khud-Ban Laem Vang, THUNGWA, HATYAI, LANGU, Khlong Sam Rong, KHUANKALONG, CHANA, KHLONGHOAE, THEPHA, KATAWI, PATTANI, YARING, PANARE, YARANG, MAYO, KHOKPO, SAIBURI, PADANGBESAR, SADAO, SA TUN, SABAYOI, Khlong Gor Tor, YAHA, YALA, MAIKAEN, Khlong Kok Kaan, NARATHIWAT, BANNANGSATA, TAK BAI, SRISAKHON, RANGAT, TANTO, SUNGAIPADI, SUNGAIKOLOK, BETONG

LEGEND

1. to 30. COASTAL CHANNEL
TRAINING JETTY PROVIDED
* REVETMENT PROVIDED ON BANK
FOR IRRIGATION
1) : No Jetties at Present

Note
(SB) : Sand Bypass Planning
(JICA) : JICA Recommended Project
(HD) : Harbour Department
(Southern Seaboard) :
The Southern Seaboard Development Commitee

SCALE (KM.)
0 10 50 100 150 km.

Figure 9.3.3-1 Master Plan of CDC II Management Channels (year 2020)

9.4 Estimate of Project Cost

Estimate of project cost presented in this section based on the following assumptions.

1) The applied exchange rate is 45 Baht = 120 Yen = 1 US$.
   (Source: Rate on October 10, 2001 by Bangkok Post in Thailand)
2) The material, equipment and labor cost based on October 2001 prices.
3) All the prices, costs are expressed in Thai Baht both for local and foreign currencies.
4) The price escalations for local and foreign portion are not considered.
5) The import taxes and duties are not included in the cost.
6) 7 % of VAT is included in the total prices and costs.
7) Engineering Fee for the detailed design, tender assistance, construction supervision and maintenance is estimated as approximately 10 % of the direct project cost.
8) The physical contingency is estimated as approximately 10 % of the direct project cost.

9.4.1 Cost Estimate of Sand Bypass Methods

There are four methods for Sand Bypass as mentioned in Section 9.3 which will be examined here.

1) Barge Method

Barge method is to dredge sedimentation sand by a grab dredger and load it onto a flat top barge. The barge is then moved by a tugboat to the disposal area or eroded area and dumped by wheel loader. The estimated execution cost of barge method is approximately 100 Baht/m^3.

2) Dump Truck Method

Dump truck method is to excavate deposition sand by an excavator and load it onto a dump truck to send it to the disposal area or eroded area. The estimated execution cost of dump truck method is approximately 60 Baht/m^3.

3) Pipeline with Back-Hoe Method

Pipeline with back-hoe method is to excavate deposition sand by an excavator into a pit where a sand pump is installed. Sand is discharged through the pipeline by the sand pump to the disposal area or eroded area. The estimated execution cost of pipeline with back-hoe method is approximately 65 Baht/m^3.

4) Pipeline with Jetty Method

Pipeline with jetty method is to dredge by slurry pumps in combination with high and low pressure water pumps set under a jetty. Dredged material is discharged through pipeline to the disposal area or eroded area. The estimated execution cost of pipeline with jetty method is

approximately 140 Baht/m^3.

The unit rate (execution cost only) for the Sand Bypass Methods is shown in Table 9.4.1-1.

Table 9.4.1-1 Unit Cost of Sand Bypass Methods

Method of Sand Bypass	Est. Unit Cost (Baht/m^3)
1. Barge Method	100
2. Dump Truck Method	60
3. Pipeline with Back-Hoe Method	65
4. Pipeline with Jetty Method	140

Among the four alternative methods of sand bypassing, transportation of sand by a dump truck is considered more economical than the other methods. Therefore, the dump truck method is applied for all the channels where sand bypassing is required. The cost of sand bypassing is estimated as computed in the Section 9.4.2.

9.4.2 Cost Estimates of Total Project Cost

JICA Study Team made a list of recommended ports and channels to be developed as stated in the Master Plan. This chapter deals with an estimation of project costs for the recommended facilities. Total Project Cost was estimated and confirmed based upon the data collected during the site investigation in Thailand.

Table 9.4.2-1 and Table 9.4.2-2 show Project Cost in the Short-Term and Long-Term Development Plans respectively.

Table 9.4.2-1 Project Cost Short-term Development Plan

(The following costs exclude (1) Engineering Fee, (2) Physical Contingency and (3) VAT)

Name of Ports	Project Items	Remarks (Quantity)	Project Cost (Baht)
1. Sichon	Construction of Training Jetty	1 unit	65,569,000
	Installation of Light beacon	4 unit	1,400,000
2. Tha Sala	Construction of Groin	10 unit	12,904,000
	Improvement of Groin	11 unit	32,260,000
3. Songkhla	Construction of Groin	6 unit	16,130,000
	Construction of Detached Breakwater	5 unit	9,678,000
	Construction of Coastal Berth	L=130m	156,556,000
	Construction of Ro/Ro Berth	L=150m	144,677,000
4. Na Thap	Improvement of Groin	4 unit	3,226,000
	Construction of Detached Breakwater	2 unit	3,226,000
5. Sakom	Improvement of Groin	3 unit	4,839,000
	Construction of Detached Breakwater	5 unit	8,065,000
6. Thepha	Improvement of Groin	2 unit	1,613,000
	Construction of Detached Breakwater	5 unit	4,032,500
7.Bang Ra Pha	Construction of Detached Breakwater	4 unit	6,452,000
	Execution of Sand Bypass	100,000m^3/year	31,000,000
8. Tanyong Pao	Construction of Detached Breakwater	8 unit	12,904,000
	Execution of Sand Bypass	100,000m^3/year	31,140,000
9. Bang Ta Wa	Improvement of Groin	8 unit	21,775,500
	Construction of Groin	1 unit	6,452,000
	Construction of Detached Breakwater	3 unit	4,839,000
10. Panare	Improvement of Groin	4 unit	5,326,000
	Construction of detached Breakwater	3 unit	7,989,000
	Execution of Sand Bypass	100,000m^3/year	30,000,000
11.Bang Maruat	Improvement of Groin	3 unit	2,419,500
	Construction of Detached Breakwater	2 unit	3,226,000
12. Narathiwat	Improvement of Groin	1 unit	3,226,000
	Construction of Groin	3 unit	2,419,500
Total of Project Cost (2001 – 2010)			633,344,000

Table 9.4.2-2 Project Cost in Long-term Development Plan

(The following costs exclude (1) Engineering Fee, (2) Physical Contingency and (3) VAT)

Name of Ports	Project Items	Remarks (Quantity)	Project Cost (Baht)
1. Songkhla	Execution of Sand Bypass	15,000m^3/year	19,120,000
	Expansion of Coastal Berth	L=130m	153,802,000
	Expansion of Ro/Ro Berth	L=150m	146,550,000
2. Na Thap	Execution of Sand Bypass	10,000m^3/year	6,000,000
3. Sakom	Execution of Sand Bypass	10,000m^3/year	6,000,000
4. Thepha	Execution of Sand Bypass	15,000m^3/year	9,000,000
5. Bang Ra Pha	Execution of Sand Bypass	50,000m^3/year	30,000,000
6. Tanyong Pao	Execution of Sand Bypass	50,000m^3/year	30,000,000
7. Panare	Execution of Sand Bypass	50,000m^3/year	30,000,000
8. Bang Maruat	Execution of Sand Bypass	50,000m^3/year	30,000,000
9. Sai Buri	Execution of Sand Bypass	20,000m^3/year	12,000,000
10. Narathiwat	Execution of Sand Bypass	15,000m^3/year	9,000,000
Total of Project Cost (2011 – 2020)			481,472,000