8.3.3 Sensitivity Analysis on Fuel and Crew Costs

Sensitivity analysis has been worked out in Cases 3, 9 and 15 for

A) Profit after depreciation rate to revenue and

B) Internal Rate of Return (IRR) on the following fuel cost and crew cost.

Fuel cost: ±2% additional increase/decrease per year from 1988

Crew cost: +3% additional increase per year from 1988

As given below, it can be found out that impact on fuel cost is much greater than crew cost and that except Case 3, 2 percent annual increase of fuel will not give serious effect on the projected scheme.

A) Profit after Depreciation Rate to Revenue = $\frac{\text{Profit after Dep.}}{\text{Revenue}} \times 100\%$

Projected Scheme	Case 3	Case 9	Case 15
	5.0%	14.5%	16.7%
Fuel Cost: +2%	2.7%	12.1%	15.3%
Fuel Cost: -2%	7.1%	16.5%	18.0%
Crew Cost: +3%	3.5%	12.9%	15.6%

B) Internal Rate of Return (IRR)

	IRR		
	Case 3	Case 9	Case 15
Projected Scheme Fuel $185 in 1987 with 5% annual increase Crew Cost 1983 ∿1987: 5% annual increase 1988 ∿1996: 7% annual increase	10.6%	28.1%	21.2%
Fuel Cost: +2%	9.0%	26.3%	20.4%
Fuel Cost: -2%	11.9%	29.7%	21.9%
Crew Cost: +3%	9.6%	27.0%	20.6%

8.3.4 Conclusions

Based on the foregoings, the Study Team would like to recommend Cases 3, 9 and 15 as Stage 1 starting from 1987 and as Stage 2, the Expansion Plan of Stage 1, described below.

(1) Stage 1

Case 3 700 DWT Type General Cargo Vessel with shuttle service of 2 ports call.

Case 9 Same as the above at vessel price of 50%.

Case 15 Pusher Barge System with 2 ports call.

The details of each case are as follows:

1) Case 3: 700 DWT Type General Cargo Vessel, 2 ports call.

As shown in Table 8.3-5 and Fig. 8.3-1, the profit after income tax is 27,447 thousand Bahts based upon the fleet in the total decade. As shown in Table 8.3-7 and Fig. 8.3-2 based upon each vessel, loss after depreciation lasts through the second year and is transformed to a profit from the third year. The accumulated loss of the two years is completely recovered by the seventh year, and in the total period of ten years, the profit after depreciation becomes 50,533 thousand Bahts.

As shown in Table 8.3-10, judging from the revulsion ratio of investment, in the ninth year 94.9 percent is recovered, and in the tenth year 112.8 percent is recovered. Thus, in the tenth year the recovery of invested capital is finished and, as the result, all 7 vessels become owned assets. At the time of recovery, the vessels will be sold, and from the eleventh year a new fleet most suited to the conditions of the time becomes possible (Larger-scale vessels, improvement of fleet, etc.).

Among the types of general cargo vessel, profitability is higher in the order of 1,500 DWT Type, 1,000 DWT Type and 700 DWT Type. However, taking the present conditions of Thai coastal shipping into consideration, the 700 DWT Type is considered to be the most suitable vessel in size.

That is to say, the solicitation of the cargoes rerouted from trucks is an important condition for the feasibility of sea routes as mentioned before. In this sense it is most advantageous in terms of solicitation to put more vessels in service, if so much difference in the amount of invested capital is not seen.

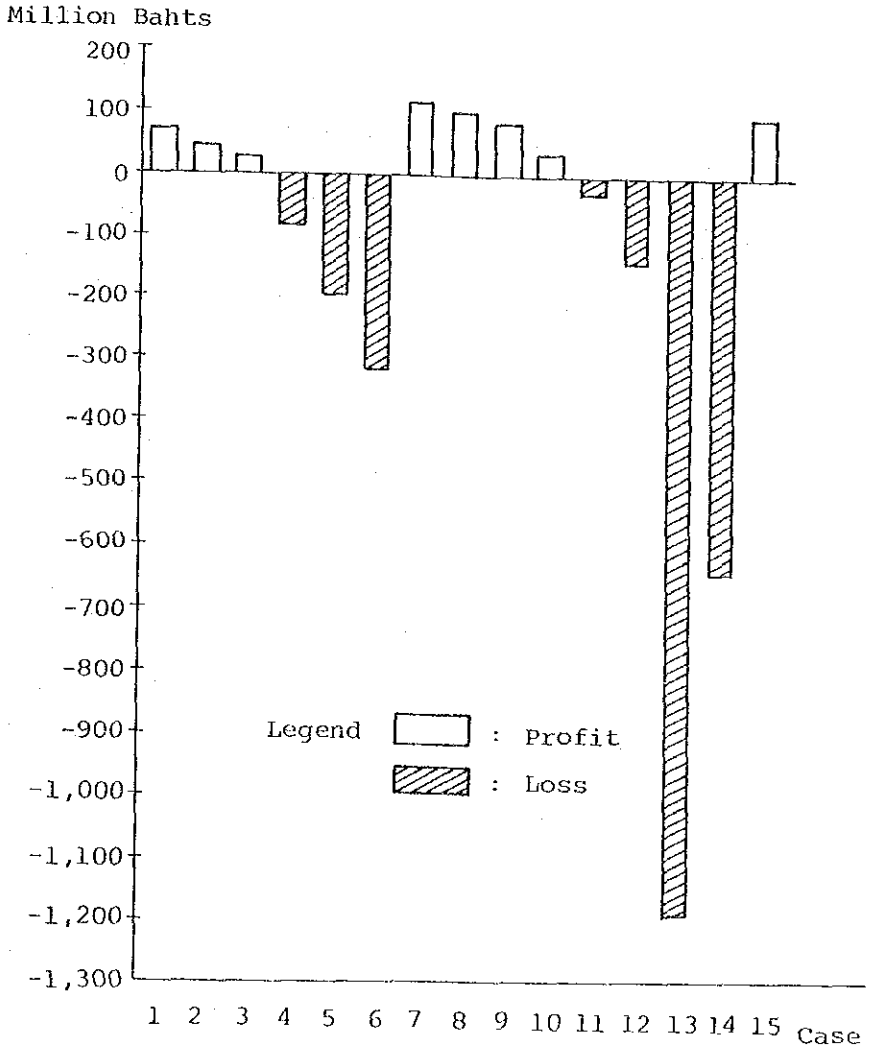

Fig. 8.3-1 Profit and Loss of 15 Cases on Fleet Bases for 10 Years (Profit After Income Tax)

Table 8.3-7 (1) Profit/Loss Analysis, Case 3 (Vessel)

Unit: ฿ 1,000

Year	1	2	3	4	5	6	7	8	9	10	Total
(a) Revenue	12,227	12,594	12,972	13,361	13,762	14,450	15,173	15,932	16,729	17,565	144,765
(b) Operating exp.											
(1) Port charge	76	78	79	81	82	84	86	87	89	91	833
(2) Stevedorage	2,257	2,370	2,488	2,613	2,743	2,881	3,025	3,176	3,335	3,501	28,389
(3) Fuel	2,710	2,845	2,988	3,137	3,294	3,459	3,632	3,813	4,004	4,204	34,086
(4) Agency fee	367	378	389	401	413	434	456	479	503	528	4,348
(5) Other exp.	611	629	648	667	687	721	757	795	835	877	7,227
(6) Total	6,021	6,300	6,592	6,899	7,219	7,579	7,956	8,350	8,766	9,201	74,883
(c) Ope. profit (a) - (b)	6,206	6,294	6,380	6,462	6,543	6,871	7,217	7,582	7,963	8,364	69,882
(d) Vessel exp.											
(1) Crew cost	1,318	1,410	1,167	1,249	1,336	1,430	1,530	1,637	1,752	1,875	14,704
(2) Maintenance	440	462	485	509	535	562	590	619	650	683	5535
(3) Insurance	220	220	220	220	220	220	220	220	220	220	2,200
(4) Adm. exp.	577	606	636	668	701	736	773	812	852	895	7,256
(5) Others	440	462	485	509	535	562	590	619	650	683	5,535
(6) Total	2,995	3,160	2,993	3,155	3,327	3,510	3,703	3,907	4,124	4,356	35,230
(e) Interest	2,045	1,806	1,566	1,326	1,087	847	607	367	128	64	9,843
(f) Pro bef dep. (c) - (d + e)	1,166	1,328	1,821	1,981	2,129	2,514	2,907	3,308	3,711	3,944	24,809
(g) Depreciation	1,759	1,759	1,759	1,759	1,759	1,759	1,759	1,759	1,759	1,759	17,590
(h) Pro aft dep. (f) - (g)	-593	-431	62	222	370	755	1,148	1,549	1,952	2,185	7,219
(i) Income tax	0	0	25	89	148	302	459	620	781	874	3,298
(j) Profit (h) - (i)	-593	-431	37	133	222	453	689	929	1,171	1,311	3,921

Table 8.3-7 (2) Profit/Loss Analysis, Case 3 (Fleet)

Unit: ₿ 1,000

Year	1	2	3	4	5	6	7	8	9	10	Total
(a) Revenue	85,589	88,158	90,804	93,527	96,334	101,150	106,211	111,524	117,103	122,955	1,013,355
(b) Operating exp.											
(1) Port charge	532	546	553	567	574	588	602	609	623	637	5,831
(2) Stevedorage	15,799	16,590	17,416	18,291	19,201	20,167	21,175	22,232	23,345	24,507	198,723
(3) Fuel	18,970	19,915	20,916	21,959	23,058	24,213	25,424	26,691	28,028	29,428	238,602
(4) Agency fee	2,569	2,646	2,723	2,807	2,891	3,038	3,192	3,353	3,521	3,696	30,436
(5) Other exp.	4,277	4,403	4,536	4,669	4,809	5,047	5,299	5,565	5,845	6,139	50,589
(6) Total	42,147	44,100	46,144	48,293	50,533	53,053	55,692	58,450	61,362	64,407	524,181
(c) Ope. profit (a) - (b)	43,442	44,058	44,660	45,234	45,801	48,097	50,519	53,074	55,741	58,548	489,174
(d) Vessel exp.											
(1) Crew cost	9,226	9,870	8,169	8,743	9,352	10,010	10,710	11,459	12,264	13,125	102,928
(2) Maintenance	3,080	3,234	3,395	3,563	3,745	3,934	4,130	4,333	4,550	4,781	38,745
(3) Insurance	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	15,400
(4) Adm. exp.	4,039	4,242	4,452	4,676	4,907	5,152	5,411	5,684	5,964	6,265	50,792
(5) Others	3,080	3,234	3,395	3,563	3,745	3,934	4,130	4,333	4,550	4,781	38,745
(6) Total	20,965	22,120	20,951	22,085	23,289	24,570	25,921	27,349	28,868	30,492	246,610
(e) Interest	14,315	12,642	10,962	9,282	7,609	5,929	4,249	2,569	896	448	68,901
(f) Pro bef dep. (c) - (d + e)	8,162	9,296	12,747	13,867	14,903	17,598	20,349	23,156	25,977	27,608	173,663
(g) Depreciation	12,313	12,313	12,313	12,313	12,313	12,313	12,313	12,313	12,313	12,313	123,130
(h) Pro aft dep. (f) - (g)	-4,151	-3,017	434	1,554	2,590	5,285	8,036	10,843	13,664	15,295	50,533
(i) Income tax	0	0	175	623	1,036	2,114	3,213	4,340	5,467	6,118	23,086
(j) Profit (h) - (i)	-4,151	-3,017	259	931	1,554	3,171	4,823	6,503	8,197	9,177	27,447

Table 8.3-8 (1) Profit/Loss Analysis, Case 9 (Vessel)

Unit: ฿ 1,000

Year	1	2	3	4	5	6	7	8	9	10	Total
(a) Revenue	12,227	12,594	12,972	13,361	13,762	14,450	15,173	15,932	16,729	17,565	144,765
(b) Operating exp.											
(1) Port charge	76	78	79	81	82	84	86	87	89	91	833
(2) Stevedorage	2,257	2,370	2,488	2,613	2,743	2,881	3,025	3,176	3,335	3,501	28,389
(3) Fuel	2,710	2,845	2,988	3,137	3,294	3,459	3,632	3,813	4,004	4,204	34,086
(4) Agency fee	367	378	389	401	413	434	456	479	503	528	4,348
(5) Other exp.	611	629	648	667	687	721	757	795	835	877	7,227
(6) Total	6,021	6,300	6,592	6,899	7,219	7,579	7,956	8,350	8,766	9,201	74,883
(c) Ope. profit (a) - (b)	6,206	6,294	6,380	6,462	6,543	6,871	7,217	7,582	7,963	8,364	69,882
(d) Vessel exp.											
(1) Crew cost	1,318	1,410	1,167	1,249	1,336	1,430	1,530	1,637	1,752	1,875	14,704
(2) Maintenance	440	462	485	509	535	562	590	619	650	683	5535
(3) Insurance	220	220	220	220	220	220	220	220	220	220	2,200
(4) Adm. exp.	577	606	636	668	701	736	773	812	852	895	7,256
(5) Others	440	462	485	509	535	562	590	619	650	683	5,535
(6) Total	2,995	3,160	2,993	3,155	3,327	3,510	3,703	3,907	4,124	4,356	35,230
(e) Interest	1,023	903	783	663	543	423	304	184	64	32	4,922
(f) Pro bef dep. (c) - (d + e)	2,188	2,231	2,604	2,644	2,673	2,938	3,210	3,491	3,775	3,976	29,730
(g) Depreciation	880	880	880	880	880	880	880	880	880	880	8,800
(h) Pro aft dep. (f) - (g)	1,308	1,351	1,724	1,764	1,793	2,058	2,330	2,611	2,895	3,096	20,930
(i) Income tax	523	540	690	706	717	823	932	1,044	1,158	1,238	8,371
(j) Profit (h) - (i)	785	811	1,034	1,058	1,076	1,235	1,398	1,567	1,737	1,858	12,559

Table 8.3-8 (2) Profit/Loss Analysis, Case 9 (Fleet)

Unit: ₹ 1,000

Year	1	2	3	4	5	6	7	8	9	10	Total
(a) Revenue	85,589	88,158	90,804	93,527	96,334	101,150	106,211	111,524	117,103	122,955	1,013,355
(b) Operating exp.											
(1) Port charge	532	546	553	567	574	588	602	609	623	637	5,831
(2) Stevedorage	15,799	16,590	17,416	18,291	19,201	20,167	21,175	22,232	23,345	24,507	198,723
(3) Fuel	18,970	19,915	20,916	21,959	23,058	24,213	25,424	26,691	28,028	29,428	238,602
(4) Agency fee	2,569	2,646	2,723	2,807	2,891	3,038	3,192	3,353	3,521	3,696	30,436
(5) Other exp.	4,277	4,403	4,536	4,669	4,809	5,047	5,299	5,565	5,845	6,139	50,589
(6) Total	42,147	44,100	46,144	48,293	50,533	53,053	55,692	58,450	61,362	64,407	524,181
(c) Ope. profit (a) - (b)	43,442	44,058	44,660	45,234	45,801	48,097	50,519	53,074	55,741	58,548	489,174
(d) Vessel exp.											
(1) Crew cost	9,226	9,870	8,169	8,743	9,352	10,010	10,710	11,459	12,264	13,125	102,928
(2) Maintenance	3,080	3,234	3,395	3,563	3,745	3,934	4,130	4,333	4,550	4,781	38,745
(3) Insurance	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	15,400
(4) Adm. exp.	4,039	4,242	4,452	4,676	4,907	5,152	5,411	5,684	5,964	6,265	50,792
(5) Others	3,080	3,234	3,395	3,563	3,745	3,934	4,130	4,333	4,550	4,781	38,745
(6) Total	20,965	22,120	20,951	22,085	23,289	24,570	25,921	27,349	28,868	30,492	246,610
(e) Interest	7,161	6,321	5,481	4,641	3,801	2,961	2,128	1,288	448	224	34,454
(f) Pro bef dep. (c) - (d + e)	15,316	15,617	18,228	18,508	18,711	20,566	22,470	24,437	26,425	27,832	208,110
(g) Depreciation	6,160	6,160	6,160	6,160	6,160	6,160	6,160	6,160	6,160	6,160	61,600
(h) Pro aft dep. (f) - (g)	9,156	9,457	12,068	12,348	12,551	14,406	16,310	18,277	20,265	21,672	146,510
(i) Income tax	3,661	3,780	4,830	4,942	5,019	5,761	6,524	7,308	8,106	8,666	58,597
(j) Profit (h) - (i)	5,495	5,677	7,238	7,406	7,532	8,645	9,786	10,969	12,159	13,006	87,913

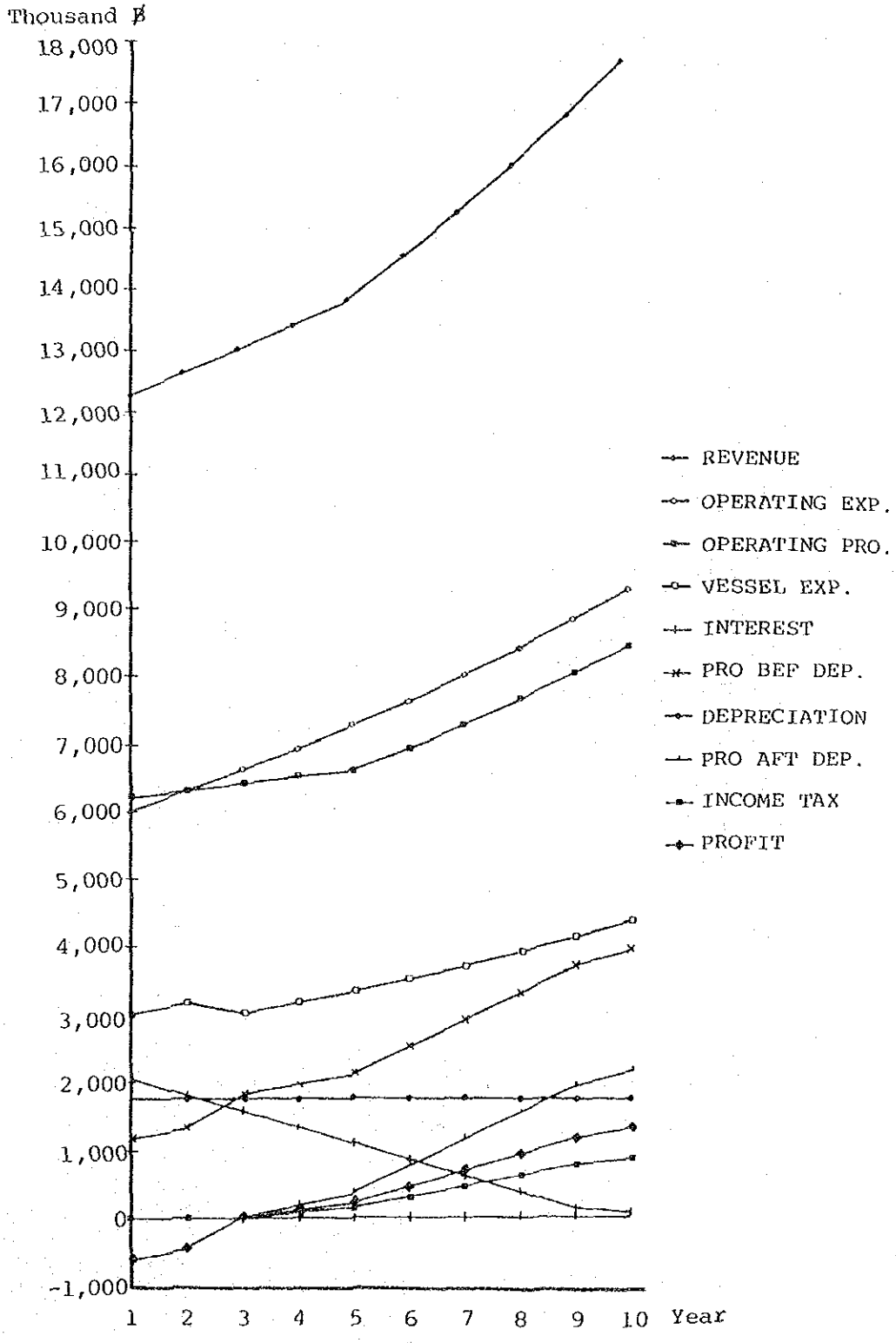

Fig. 8.3-2 Profitability of Case 3,700 DWT Type General Cargo Vessel - 2 Port Call

Table 8.3-9 Profit/Loss Analysis, Case 15 (Fleet)

Unit: ฿ 1,000

Year	1	2	3	4	5	6	7	8	9	10	Total
(a) Revenue	73,689	75,900	78,177	80,522	82,938	87,085	91,439	96,011	100,812	105,853	872,426
(b) Operating exp.											
(1) Port charge	1,106	1,128	1,151	1,174	1,197	1,221	1,246	1,270	1,296	1,322	12,111
(2) Stevedorage	15,246	16,008	16,809	17,649	18,532	19,458	20,431	21,453	22,525	23,652	191.763
(3) Fuel	10,021	10,522	11,048	11,601	12,181	12,790	13,429	14,101	14,806	15,546	126,045
(4) Agency fee	2,211	2,277	2,345	2,415	2,487	2,611	2,742	2,879	3,023	3,174	26,164
(5) Other exp.	3,684	3,795	3,909	4,026	4,147	4,354	4,572	4,801	5,041	5,293	43,622
(6) Total	32,268	33,730	35,262	36,865	38,544	40,434	42,420	44,504	46,691	48,987	399,705
(c) Ope. profit (a) - (b)	41,421	42,170	42,915	43,657	44,394	46,651	49,019	51,507	54,121	56,866	472,721
(d) Vessel exp.											
(1) Crew cost	4,758	5,091	5,097	5,454	5,836	6,245	6,682	7,150	7,651	8,187	62,151
(2) Maintenance	2,315	2,431	2,552	2,680	2,814	2,955	3,102	3,257	3,420	3,591	29,117
(3) Insurance	1,158	1,158	1,158	1,158	1,158	1,158	1,158	1,158	1,158	1,158	11,580
(4) Adm. exp.	4,040	4,242	4,454	4,677	4,911	5,156	5,414	5,685	5,969	6,267	50,815
(5) Others	2,315	2,431	2,552	2,680	2,814	2,955	3,102	3,257	3,420	3,591	291,17
(6) Total	14,586	15,353	15,813	16,649	17,533	18,469	19,458	20,507	21,618	22,794	182,780
(e) Interest	10,765	9,503	8,242	6,980	5,718	4,456	3,195	1,933	671	336	51,799
(f) Pro bef dep. (c) - (d + e)	16,070	17,314	18,860	20,028	21,143	23,726	26,366	29,067	31,832	33,736	238,142
(g) Depreciation	9,261	9,261	9,261	9,261	9,261	9,261	9,261	9,261	9,261	9,261	92,610
(h) Pro aft dep. (f) - (g)	6,809	8,053	9,599	10,767	11,882	14,465	17,105	19,806	22,571	24,475	145,532
(i) Income tax	2,724	3,221	3,840	4,307	4,753	5,786	6,842	7,922	9,028	9,790	58,213
(j) Profit (h) - (i)	4,085	4,832	5,759	6,460	7,129	8,679	10,263	11,884	13,543	14,685	87,319

Case	Number of vessels	Invested capital (1,000 Bahts)	Number of services
1. (1,500 DWT Type)	4	138,230	3 voyages per week (9 days/voy.)
2. (1,000 DWT Type)	6	169,645	One voyage per 1.5 days (8 days/voy.)
3. (700 DWT Type)	7	153,938	One voyage per day (6 days/voy.)

As daily service is possible by the 700 DWT Type, it is the most advantageous for the solicidation of cargoes among all the general cargo vessels.

2) Case 9: 700 DWT Type General Cargo Vessel, 2 ports call
Vessel price at 50 percent of Case 3

This is the case in which the vessel price is set up as 50 percent of Case 3 at the starting time and is equivalent to Case 3 in terms of all the conditions except the vessel price. The profitability is very high compared with Case 3 because the price of the vessel is fixed at 50 percent.

As shown in Table 8.3-5 and Fig. 8.3-1, the profit after depreciation is 146,510 thousand Bahts and profit after tax is 87,319 thousand Bahts based upon the fleet.

As shown in Table 8.3-8 and Fig. 8.3-3, this case makes a profit from the first year and the revulsion ratio of investment (Table 8.3-10) is 87.9 percent in the forth year and 112.2 percent in the fifth year. As a result, all the vessels invested can be obtained as owned assets in the fifth year.

3) Case 15: Pusher Barge System

Cases 3 and 9 mentioned above are conventionally conducted in the field of seaborne transport. In other words, as for general cargo ships, they are the popular cases for carrying general cargoes.

With regards to the barge system, the barge itself may be a prototype of the vessel which loads and unloads cargoes, and has been handed

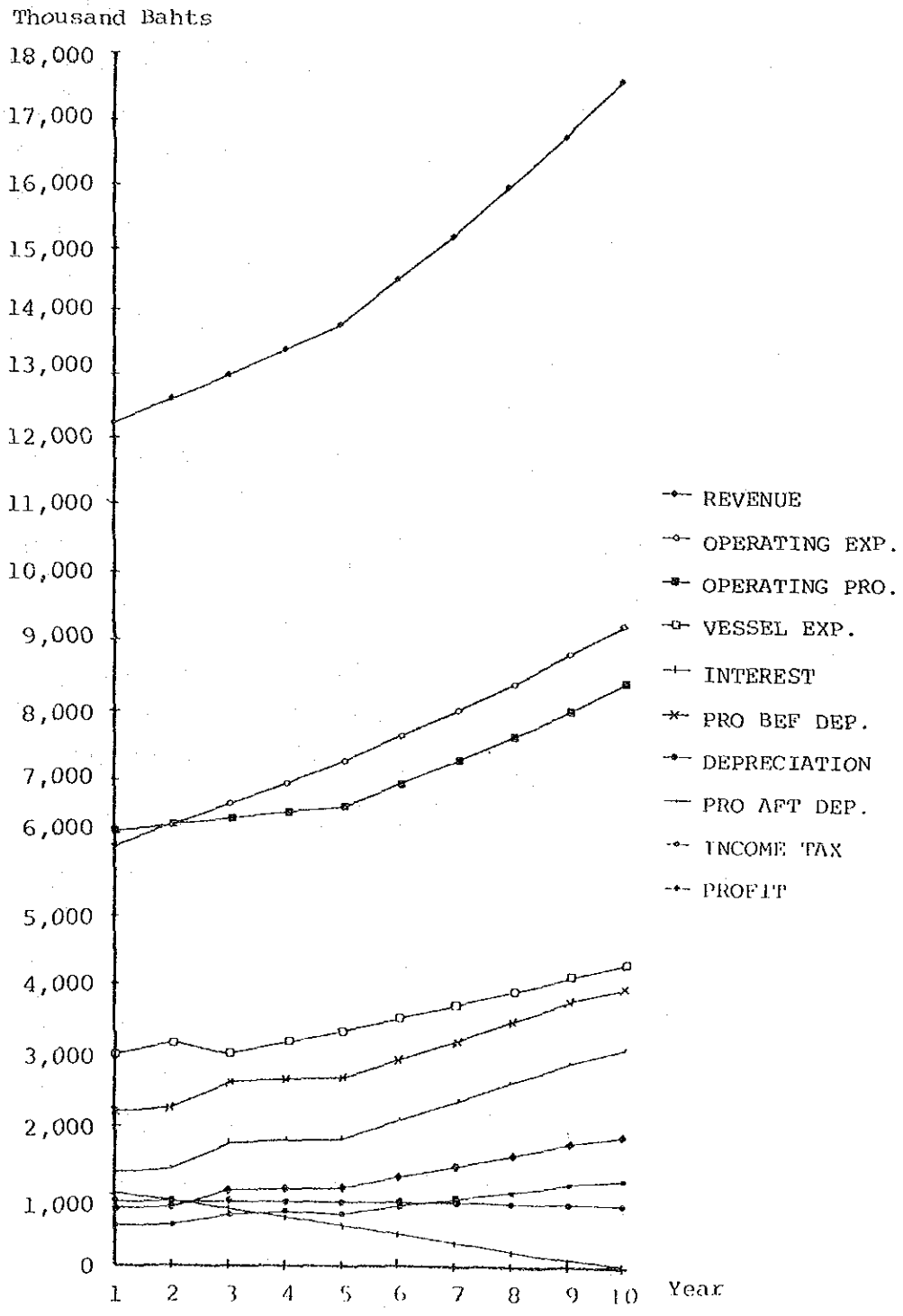

Fig. 8.3-3 Profitability of Case 9,700 Tons Type General Cargo Vessel - 2 Port Call (Ships Price 50%)

down from generation to generation. The barge system is not yet established as the seaborne transport in the field of the regular liner service dealing with general cargoes.

It is estimated that the sale of barges will be very difficult because of the narrow market world-wide and peculiar characteristics. The entrepreneurs must take such problems into consideration in adopting this system. However, the Study Team would like to recommend the system also as high profitability can be expected.

The pusher barge system (7 barges and 3 pusher tugs) obtains the profit after depreciation of 6,809 thousand Bahts (profit after tax of 4,085 thousand Bahts) from the starting year as shown in Table 8.3-9 and Fig. 8.3-4. In the total period of ten years' operation, the profit after depreciation is 145,532 thousand Bahts and profit after tax is 87,319 thousand Bahts. The revulsion ratio of investment reaches 80.7 percent in the fifth year and 101.2 percent in the sixth year and, therefore, the entire fleet is obtainable as owned assets in the middle of the ten years span.

Regarding the service of operation, it is understood that it can catch up with trucking service because of the availability of one voyage service per 1.5 days (every 36 hours), although it takes 2 days in transit from Bangkok to Songkhla, and vice versa.

Table 8.3-10 Revulsion Ratio of Invesement of 15 Cases

Unit: Percent

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	9.807	6.366	5.302	-0.420	-3.738	-7.194	28.914	22.034	19.898	8.461	1.825	-5.093	-9.320	-9.340	13.883
2	20.563	13.617	11.341	-0.145	-6.840	-13.924	58.632	44.741	40.187	17.217	3.827	-10.340	-17.835	-18.161	28.840
3	33.325	22.547	19.622	1.878	-8.513	-18.689	91.278	69.718	63.869	28.387	7.597	-12.750	-25.572	-26.514	45.132
4	47.032	32.330	28.630	4.575	-9.595	-23.000	124.718	95.310	87.914	39.806	11.459	-15.342	-32.557	-34.453	62.434
5	61.626	42.912	38.311	7.891	-10.140	-26.929	158.840	121.419	112.223	51.375	15.314	-18.252	-38.820	-42.039	80.699
6	78.245	55.312	49.743	12.660	-9.429	-29.785	195.920	150.074	138.941	64.755	20.591	-20.107	-44.028	-48.606	101.196
7	96.915	69.555	62.962	18.885	-7.456	-31.567	236.026	181.319	168.134	79.970	27.297	-20.917	-48.185	-54.160	123.973
8	117.681	85.676	78.005	26.579	-4.230	-32.281	279.229	215.230	199.882	97.031	35.418	-20.680	-51.295	-58.712	149.083
9	140.579	103.696	94.880	35.758	0.244	-31.949	325.603	251.850	234.212	115.967	44.946	-19.434	-53.365	-62.271	176.582
10	164.855	122.851	112.814	45.626	5.178	-31.381	374.443	290.451	270.371	135.992	55.104	-18.007	-55.199	-65.648	205.726

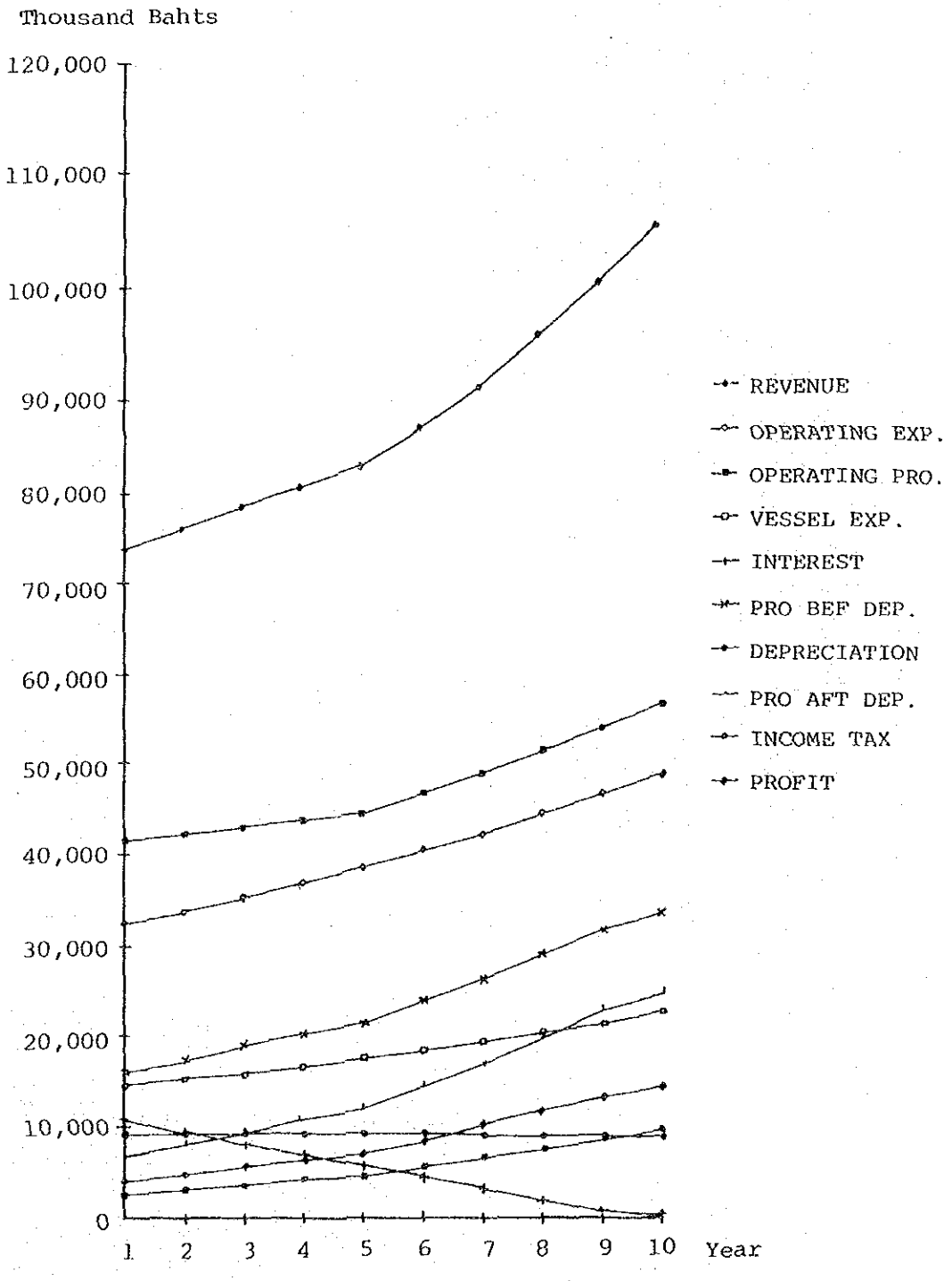

Fig. 8.3-4 Profitability of Case 15, Pusher-Barge System - 2 Ports Call

(2) Stage 2

As mentioned in the previous section of the Study, the feasibility of this project depends on the cargo movement by sea and if the cargo moves as predicted, in 1992 cargo movements between Bangkok and Songkhla will be:

	Total	Liftable Cargo
Southbound	819,000 tons	447,000 tons
Northbound	96,000 tons	68,000 tons

(See Appendix Fig. A.10-54 (1))

Compared with those of 1987, the southbound volume is 130 percent and the northbound volume is 140 percent over the 1st stage. Therefore, by 1992, the second stage of the project must be developed in domestic coastal shipping.

The Study Team recommends that the following steps be taken into consideration when the second stage project is developed:

1. On the trade route between Bangkok and Songkhla, 700 DWT Type vessels should be replaced by larger-size vessels.
2. 700 DWT Type vessels should be placed on another trade route, namely, Bangkok/Ban Don or Bangkok/Pak Panang.
3. The maximum sailings by one operator should be limited to one sailing per day, and when the operator can expect some over flow cargo, a replacement plan by larger-size vessels be promoted.
4. Development of containerization, container vessels and/or RoRo vessels should be taken up as alternatives by that time.
5. An additional calling at Laem Chabang or Mab Tha Phut should be studied on the way to the southern ports whenever the Eastern Seaboard Project is completed.

CHAPTER 9 DEVELOPMENT PLAN OF COASTAL PORTS

CHAPTER 9 DEVELOPMENT PLAN OF COASTAL PORTS

9.1 Selection of Pivotal Ports

This section covers the selection of pivotal ports concerning the coastal shipping in Southern region on the basis of the results of Cargo Demand Forecast and Projected Trade Routes described in the Chapter 7 and the Chapter 8 respectively. Following pivotal ports are selected.

A. Bangkok
B. Surat Thani (Ban Don)
C. Pak Phanang
D. Songkhla
E. Pattani

The selection is made by the following reasons.

1) The Port of Bangkok is the starting and terminal point of the coastal shipping between the South and the Central, therefore, it is to be desired that the port facilities for domestic trade should be provided collectively to cope with the expected cargo increases.

2) The Port of Surat Thani and Songkhla are chosen as the basic service ports of the projected trade route of this study, and the future cargo volume of Songkhla will make great strides.

3) The future cargo volume of the Port of Pak Phanang is estimated to be expanded on the same scale as Surat Thani's one.

4) New coastal wharves at the Port of Pattani are presently under construction by HD in spite of her weak future cargo volume.

5) It is considered that other ports (ie. Chumphon, Narathiwat, etc.) will be below the necessary standard of port improvements as pivotal ports in terms of the estimated cargo volume.

9.2 Development Plan of Pivotal Ports

(1) Methodology

The necessity and the scale on additional investments of individual ports should be examined with the result of the cargo demand forecast.

Outline of the method of the examination is summarized in the following flow diagram.

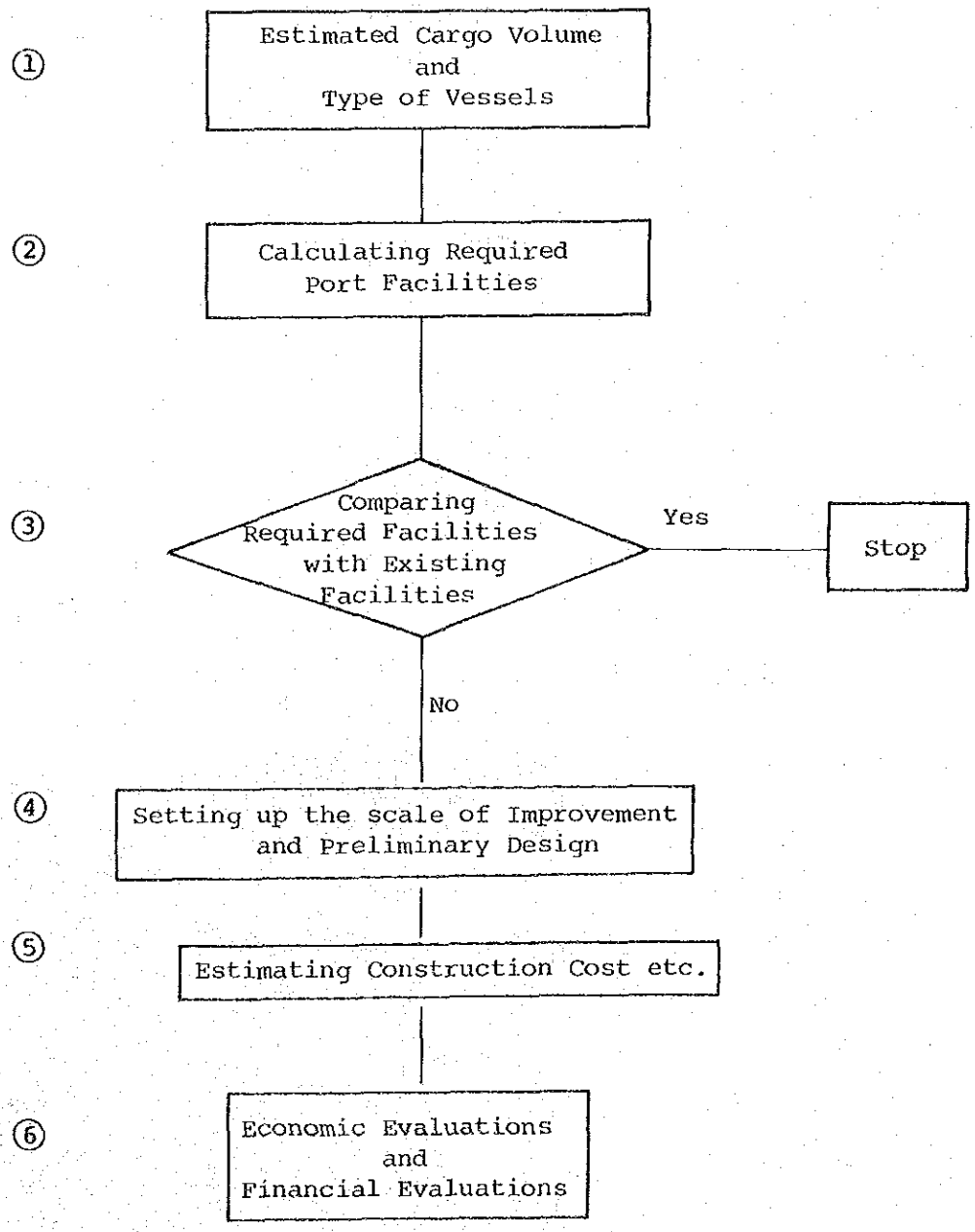

Fig. 9.2-1 Methodology of Development Plan

(2) Estimated Cargo Volume and Type of Vessels (Block ① of Flow Diagram)

1) Kinds of goods and style of packing

Generally speaking, the style of packing by each commodities is classified as follows.

Table 9.2-1 Style of Packing by Commodities

Commodity	Small Lot Size	Large Lot Size
* General Cargo (including Rubber)	A, (E)	A, (E)
Fuel	D	D
* Fertilizer	A, (E)	C
* Construction Materials	A, B,	B
* Rice & Maize	A, B, (E)	B, C, (E)
Wood Products (Log)	B	B
* Vegetable & Fruits	A, (E)	A, (E)
* Fish Products	A, (E)	A, (E)

where, A : Packed Cargo (ex. Box, Bag, Case, etc.)
B : Unpacked Cargo
C : Powder and Granular Cargo
D : Liquid Cargo & Bulk Cargo
(E): Palletized Cargo

In this study, the cargo marked with asterisk are selected as the basis of the examination for port developments, and the containerized cargo is excluded from the domestic trade.

For details of the palletized cargo, see Appendix 15.

2) Decision of the kind of berths

As stated before, the bulk cargo such as fuel is excluded from the examination with the assumption that the bulk cargo shall be handled exclusively by private wharves.

Therefore, the kind of berths in the proposal port improvement work is defined as the public wharf handling the general cargo.

It is considered that fuel and forestry products (log) shall be handled in private wharves as in the past.

On the other hand, fertilizer which is exclusively handled at private wharves at present, is treated as the cargo to be handled at both private and public wharves considering its future possibility.

3) Cargo to be handled at individual ports

The cargo volume is summarized as;-

Case 1: The volume excluding fuel, forestry products and fertilizer, and

Case 2: The volume excluding fuel and forestry products.

The low estimate value described in the Chapter 7, Cargo Demand Forecast, is applying for the purpose of minimum requirements for the port improvements.

Table 9.2-2 Estimated Volume of Cargo at Individual Ports

Unit: Thousand tons

Port	Estimated volume of Cargo					
	1987		1992		2000	
	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
BANGKOK						
S B (Out)	711	841	933	1,153	1,361	1,800
N B (In)	143	143	179	179	238	238
Total	854	984	1,112	1,332	1,599	2,038
SURAT THANI						
S B (In)	120	134	165	190	253	303
N B (Out)	18	18	26	26	35	35
Total	138	152	191	216	288	338
PAK PHANANG						
S B (In)	107	145	131	191	202	318
N B (Out)	54	54	69	69	93	93
Total	161	199	200	260	295	411
SONGKHLA						
S B (In)	347	398	447	533	631	801
N B (Out)	57	57	68	68	91	91
Total	404	455	515	601	722	892
PATTANI						
S B (In)	94	109	135	162	193	250
N B (Out)	10	10	12	12	14	14
Total	104	119	147	174	207	264

Note: S B ... Southbound N B ... Northbound

4) Type of calling vessels

As described in the Chapter 8, the following types of vessels are adopted for the examination of port facilities.

700 DWT, 1,000 DWT & 1,500 DWT Type convensional general cargo vessel.

1,000 DWT Type pusher barge.

Though the future cargo volume, estimated in the cargo demand forecast, is greater than the possible cargo volume to be handled by the proposed sailing plan, the Study Team adopted above-mentioned types as the calling vessels from the following reasons.

a) It is expected that the old-aged cargo vessels which is presently operated for the domestic trade will be enlarged at the replacement period.

b) The maximum design vessels for the coastal port improvement by HD is 1,500 DWT Type.

As described in the Chapter 8, Ro/Ro ship (2,600 DWT Type) which is not feasible in terms of its payability is eliminated.

(3) Required Port Facilities (Block ② of Flow Diagram)

This section should be read in conjunction with Appendix 15 "Explanation of proposed cargo handling system".

1) Cargo handling system and its efficiency

The cargo handling system for the convensional general cargo vessels at public wharves is generally consisting of the following equipment.

Loading & Discharging: Deck Crane, Wharf Crane, Mobile Crane and so on

Shifting : Fork-Lift Truck, Truck, Mobile Crane and so on

The typical equipment for loading and unloading are deck cranes in case of the large size vessel for foreign trade and mobile cranes in case of the coasters and lighters for domestic trade. The following model is adopted in this study.

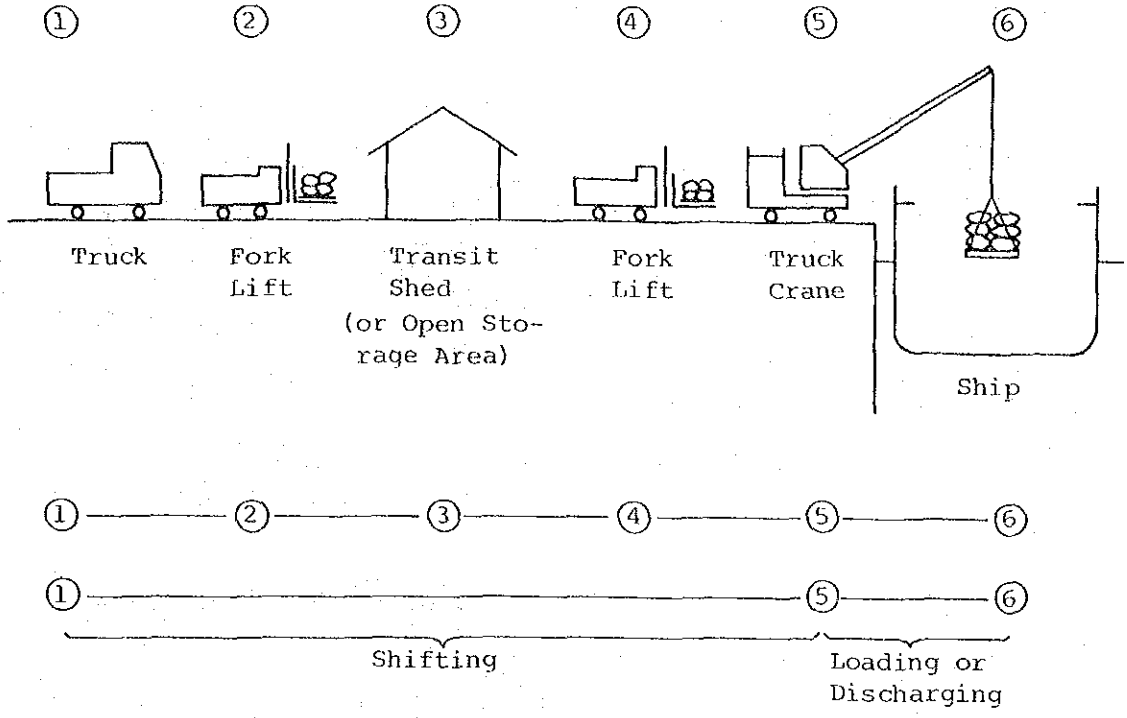

Fig. 9.2-2 Cargo Movements in Port Areas

For details, see Appendix 15.

If we try to palletize the above-mentioned cargo, a half of the total volume could be palletized because of the style of packing and its weight.

The cargo handling efficiency including various loss time (i.e. waiting due to various reasons, rigging, a rest and so on) is generally as follows.

Loose cargo	Approx. 20 t/gang/hr
Palletized cargo	Approx. 50 t/gang/hr

Therefore, the cargo handling efficiency set at the average value of the loose cargo and the palletized cargo.

Assuming the daily cargo handling volume at 900 t/day, the above set up seems to be practicable: 35 t/gang/hr × 2 gangs × 2 shifts (13 hrs).

2) Dimension of the proposed berths and required number of berths

a) Characteristics of standard berths

Table 9.2-3 Characteristics of Standard Berths

Vessel (DWT)	Standard Size of Vessel (m) LOA × B × D × Df				Standard Size of Berth (m) Depth × Length	
700	54.0	9.3	5.2	3.3	4.5	65
1,000	64.5	10.7	6.0	3.7	5.0	75
1,500	69.7	11.5	6.4	4.3	5.5	90

where,

1. Depth in front of the wharf is calculated by adding the allowance approx. 1 m to the loaded draft of ship.
2. Length of the wharf is calculated by adding the length of 10∿15 m (the mooring rope, etc.) to the overall length of ship.
3. The size of the pusher barge is similar to the convensional cargo ship.

b) Calculations of required number of berths

The required number of berths shall be calculated on the basis of the cargo handling efficiency as follows.

A Annual Cargo Volume (ton)

B Cargo Handling Efficiency
where, daily cargo handling volume set at 900 (t/day).

C Necessary Non-Handling Time
A half day idle time per call for official documentation, cargo inspection and others are added.

D Average Cargo Volume of a Vessel

Vessel (DWT)	1,570	1,070	700
Cargo Capacity (t) full loaded	1,450	950	600

E Number of Vessel Calls per Year

$$E = A / D$$

F Total days of berth occupancy

$$F = E \times \left(\frac{D}{B} + C \right)$$

Where, $\left(\frac{D}{B} + C \right)$ shows number of days a ship stays at a berth.

G Berth occupancy

Usually, a congested general cargo berth has an occupancy in the range of 0.6 and 0.8.

H Working Days

where, annual working days to be 310 (days), and this indicates actual working days that it is possible to be cargo handled. Because it is considered that there are about 50 days of strong rainfall more than 10 mm/day and wind speed more than 30 knots.

I Required Number of Berth

$$I = F / G / H$$

Results of calculations for pivotal ports are shown in Appendix Table A.16-1.

3) Examinations of channels, anchorages and basins

It is necessary to guarantee the suitable water area from the stand point of ship's safe maneuvering.

A. Navigation channels

The dimensions are decided to make the safe arrival and departure of the design maximum vessel (1,500 DWT Type).

1 Width of the channel

1.0 L = 90 (m) L: LOA of vessels

2 Depth of the channel

Same as the depth alongside of berths -5.5 (m).

B. Anchorages and basins

Following dimensions will be required for ship's turning, shifting from anchorage and waiting berth.

1 Surface area of the water

Turning circle = 2 L in diameter

Shifting from anchorage to berth = 1.8 L wide

Waiting berth = L + 6 D

where, L: LOA of vessels D: Depth

therefore, the area approx. 140 m wide in front of berth is required as anchorage and basin.

2 Depth of anchorages and basins

Same as the depth alongside of berth -5.5 (m).

4) Examinations of backup area

In case of the public wharf for general cargo, including port related offices, around 200 m wide backup area is generally required behind the berth.

i.e.: Backup Area = Length of berth × Number of berth × 200 m

Backup area is composed of following spaces.

A. Apron

B. Cargo Handling and Open Storage Area

C. Transit Shed (Ware House)

The cargo flows in port areas is assumed to be based on the model described in Appendix 15 "Cargo Handling System and its efficiency".

The cargo volume passing through respective storage facilities is assumed as follows.

Table 9.2-4 Cargo Flows in Port Areas

Cargo Flow	Model	Cargo Volume(%)
Ship - Apron - Truck (Direct)	①——————⑤ - ⑥	50
Ship - Apron - T.Shed (through T.Shed)	① - ② - ③ - ④ - ⑤ - ⑥	25
Ship - Apron - O.Storage (through O.Storage)	① - ② - ③ - ④ - ⑤ - ⑥	25

where, the above-mentioned percentage to be applied to both inward and outward cargo.

A. Width of apron

The apron width is determined by the size of ship and cargo handling equipments provided on the wharf.

The width is generally around 15 m against small vessels for domestic trades (ex. 14.18 m of Tha Thong Port), but the width of 20 m is proposed in considering the temporary storage of palletized cargo on the apron.

B. Cargo handling and open storage area

The required area is computed by the following formula.

$$A = \ell b = \frac{N}{R\alpha\omega}$$

where, A : Required Area (m^2)

ℓ : Length (m)

b : Width (m)

R : Yearly Turn-round = 20

α : Ratio of Space Utilization for Storage = 0.5

ω : Storage Capacity per m^2 = 2.5 (t/m^2)

N : Annual Cargo Volume (t)

Results of analysis are attached on the Appendix 15.

C. Transit shed

The required space is calculated by the same formula as open storages.

where, R = 35, α = 0.5

Results of analysis are attached on the Appendix Table A.16-2.

The required number of transit sheds (floor area 1,000 m^2) is nearly equal to the required number of berths with the results of calculations. Therefore, one shed per berth is proposed.

(4) Examination of Additional Investments (Block ③ of Flow Diagram)

The requirements of the additional investments for pivotal ports are made by comparing the required port facilities with the existing port facilities.

Results are summarized in Table 9.2-5.

The conclusions are drawn from the following premises.

1) Fuel, wood products and fertilizer are excluded from the estimated cargo volume used in the calculations to minimize the port investment, that is, Case 1.

2) One directional handling is assumed for the cargo movement on the wharf because of 90 percent of the cargo movement is southbound.

3) The cargo handling efficiency used in the calculations of required number of berths is 35 t/gang/hour, and therefore the cargo handling system has the capability of 900 t/day. In other words, the examination is made based on the assumption that the cargo shall be palletized as much as possible and shall be handled by the improved system with fork lifts.

4) The cargo vessel of 1,500 DWT is choosen as the design vessel for the designing of port facilities.

Table 9.2-5 Summary of Port Facilities & Examination of Additional Investments

Name of Port	Year	Ⓐ Number of Berth		Ⓑ Channel, Anchorage & Basin		Ⓒ Backup Area (Open Storage & Transit Shed)		Necessity of Additional Investment		
		Required Number of Berth	Existing Number of Berth	Required Facilities	Existing Facilities	Required Facilities	Existing Facilities	Ⓐ	Ⓑ	Ⓒ
Bangkok	1987 1992 2000	5 7 10	Private Wharves		Improved as foreign trade ports	--- O/S 11,100 m² T/S 7 Nos O/S 16,000 m² T/S 10 Nos	Private Facilities	Need	No	Need
Surat Thani (Ban Don)	1987 1992 2000	1 1 2	2 (4)		·Channel -4.5mD × 60mW ·Anchorage & Basin Approx. 200mW	--- O/S 1,900 m² T/S 1 Nos O/S 2,900 m² T/S 2 Nos	O/S 5,000 m² (23,000 m²) T/S 2 Nos (12 Nos)	No	No	No
Pak Phanang	1987 1992 2000	1 1 2	0	·Channel -5.5 m Deep 70 m wide ·Anchorage & Basin	·Channel -3.0mD × 60mW	--- O/S 2,000 m² T/S 2 Nos O/S 3,000 m² T/S 2 Nos	O/S 0 T/S 0	Need	Need	Need
Songkhla	1987 1992 2000	3 3 5	2 Privately operated at present	Approx. 140 m Wide in front of Berth	·Channel -5.5mD × 100mW ·Anchorage & Basin Approx. 200mW	--- O/S 5,200 m² T/S 3 Nos O/S 7,200 m² T/S 5 Nos	Private Facilities	Need	No	Need
Pattani	1987 1992 2000	1 1 1	2 (4)		·Channel -3.0mD × 60mW Will be deepen by IBRD loan 1984 - 1986.	--- O/S 1,500 m² T/S 1 Nos O/S 2,100 m² T/S 1 Nos	O/S 2,400 m² (20,000 m²) 1 Nos * (10 Nos)*	No	No	No

1.( ) indicates future expansion plan by H/D.

2. * Floos area 2,000 m²

3. O/S Open storage, T/S Transit shed

(5) Conclusions

Bangkok ..... The port facilities is capable to handle the present volume of cargo associated with coastal shipping by the private wharves along the Cha Phraya River at present. But, it is to be desired that the suitable public wharves are provided to cope with the expected cargo increase.

The port development for domestic trade should be proceeded by steps and stages in order to avoid the sharp increase in investments.

For example, following schedule is proposed:

1987	3 ∿5 Berths
1992	6 ∿8 Berths
2000	10 Berths

Surat Thani ... From the view point of the port facilities this port
(Ban Don) will be able to meet the estimated cargo volume of the year 2,000 subject to their usage with utmost efficiency. Therefore, the efficient use of port facilities is the problem to be solved instead of further improvements of facilities. Accordingly, it is considered that there is no urgent need to materialize the expansion plan of Tha Thong Port by HD.

Pak Phanang ... The development of port facilities which is capable to accomodate 1,500 DWT Type vessels will be essential in future.

And it is considered that the port improvement work proposed by HD as well as Pattani and Krabi is advisable to proceed for the future cargo increases. In this connection, the actualization of the alternative port at Ban Pak Nakhon is desirable.

Songkhla ..... Two berths near the entrance of the lake which are used for serving container feeder at present are possible to be used tentatively for domestic trade as the public wharves after the completion of the deep sea port. But in view of the fact that the future cargo volume is expected to be largest in the soth, it will be necessary to examine the comprehensive development plan including the backup area and the possibility to future expansion.

For example, following schedule for new berth construction is proposed:

1987	---
1992	1 ∿ 2 Berths
2000	5 Berths

Pattani ..... The port whose two berths for 1,500 DWT Cargo Vessels were completed in 1984 by HD shall be capable to handle the estimated cargo volume up to the year 2000. HD has the expansion plan on this port, but it is considered that the necessity of this plan is questionable at present in view of the future cargo volume. However, the probability of cargo increases due to the utilization of the industrial area behind the berths is not included in the above-mentioned cargo volume.

Therefore, the most important is to make this plan reasonable by promoting the industrial set up in the immediate port hinterland.

9.3 Design and Cost Estimates

(1) Design for Pivotal Ports Improvement

The general basic design and rough cost estimates are made for the following ports in accordance with the Summary of Port Facilities and Examination of Additional Investments and Conclusions described in Section 9.2.

1) Port Facilities (Wharf & Backup Area) of Bangkok and Songkhla

The improvement of the port of Bangkok should be preceded because the existing facilities in the port of Songkhla are possible to be used temporarily after the completion of the deep-sea port project.

The improvement of the port of Pak Phanang should be excluded as the on-going project with regard to the fact that the construction of new coastal ports will be commenced as soon as the proposed plan prepared by HD is approved.

2) Channel Dredging

Concerning the capital dredging, there is no port to be carried out. Because it will be executed under the financial assistance of IBRD in the port of Pattani and the capital dredging in the Port of Pak Phanang is already included in the improvement plan of HD as well as the port facilities.

(2) Basic Design

The proposed basic plan is shown in Appendix Fig. A.17-1.

The plan is made for two berths as a basic unit and the port improvement can be advanced continuously based on this unit in case of it's expansion.

The proposed typical section is shown in Fig. A.17-2 (1). The typical secton of wharf with all-weather shed is shown in Fig. A.17-2 (2) as an Alternative for the purpose of shortening ship staying time in the berth during rainy season.

(3) Cost Estimation

Conditions of rough cost estimation are as follows.

1) The scale and the structure of required facilities are equivalent to the port improvement plan prepared by HD. (i.e. Tha Thong, Pattani & Krabi)

2) Unit prices are based on the results of the above three ports.

3) All prices are expressed at April 1983 prices and the price escalation is not considered.

4) The cost for land compensation is not included.

The construction cost is summarized and shown in Table A.17-1. The alternative construction cost showing the all-weather shed is shown in Table A.17-2.

(4) Construction Timing and Cost of Berths Required

The required facilities corresponding to the estimated future cargo volume and timing of construction are as follows.

Name of Port	Construction Timing and Berths Required
Bangkok	1987 4 Berths ready for operation
	1989 2 Berths "
	1993 2 Berths "
	1997 2 Berths "
	(10 Berths)
Songkhla	1991 2 Berths ready for operation
	1995 3 Berths "
	(5 Berths)
	Total 15 Berths

The proposed construction schedule is summarized as follows.

After starting this project, the soil investigation will be concluded within 2 months, detailed design within 3 months, and tender, tender evaluation and award will be executed within 3 months.

The work period for constructing 2 berths will be in 18 months. Therefore, the construction should be started approx. two years prior to the said construction timing.

CHAPTER 10 THE ECONOMIC EVALUATION

CHAPTER 10 ECONOMIC EVALUATION

10.1 Conceptual Background

Having discussed the principles of promoting domestic trade and developing local ports from various aspects, these are not always attractive enterprises in developing countries.

Most programs for the development of shipping and ports are aimed at international trade in order to acquire the foreign currency and to pursure various other broad national interests. There are two schools concerning these matter that are broadly observed in developing countries in all port development policies.

The first is to see a port as a part of the social infrastructure. Therefore, the value of a port should be assessed not on its financial record, but in terms of the progress of industry and transportation in its hinterland.

The second, as the same style of the Port of Bangkok, is to see a port as a kind of industry that should earn a profit. At least it should not incur a loss and at best should earn a reasonable profit.

As for a local port which aims to serve as a foundation for the hinterland's economy, earning a profit is not necessarily a part of its mission.

It is often impossible for a small coastal port to balance the income and expenditure due to the weakness of its foundation. So the Study Team came to the conclusion that in evaluating port development they should examine the economic feasibility of the network of ports as a whole. As, in fact the Study Team has no obligation to evaluate ports such as Tha Thong, Pak Phanang and Pattani that have been evaluated by other consultants and are now in operation or planned, and it would be better to evaluate the feasibility of these local ports as part of a network system. From the view point of port development policy the Government should not examine each port one by one, but look at the overall network.

Accordingly we would like to evaluate the afore mentioned five ports as a single network in this chapter. However, when it comes to the finances of these ports we think that it would be better if they are able to independently carry on the routine operation by themselves.

Small administrative organization is the answer to getting along with the financial balance between the income from port charges and expenditures. At least the cost of investment and maintenance of facilities should be from the financial analysis in this case.

10.2 Economic Evaluation

(1) Outline of the Evaluation

The Study Team, based on the cargo forecast, recommended Bangkok-Songkhla route (See Chapter 7) as the most appropriate shipping route and for which detailed analysis both in financial and economic terms have been carried out on the newly proposed shipping services. However, the development of coastal ports must be evaluated in a different approach including all of the pivotal ports, namely Bangkok (possible domestic terminal), Songkhla, Ban Don (Tha Thong), Pattani and Pak Phanang.

According to the forecast and other basic socio-economic data, the South will experience rapid economies growth, so the Study Team recommends the development of five local ports as a single network; these are Bangkok, Songkhla, Ban Don (Tha Thong), Pattani and Pak Phanang.

The following benefits are expected from providing shipping services;

1) Reduction of transportation cost; the rerouting cargo from tracks to ships
2) Reduction of transportation cost by using large vessels
3) Reduction of road maintenance costs
4) Positive effect on regional development
5) Increase in employment opportunities and the incomes of local inhabitants, and
6) Promotion of international trade through these ports.

Of these above items, benefits 1), 2) and 3) can be readily analyzed, but 4), 5) and 6) are so difficult to measure quantitatively that these analysis are not undertaken here.

The following cost is considered;

1) Construction cost: Grand total of construction cost by port (wharves, terminal facilities and dredging channels), and

2) Maintenance cost: Maintenance costs for port facilities, especially maintenance dredging.

(2) Preliminaries

1) Socio-Economic Indicators

The inflation rate and growth rate of labor costs per year are assumed as follows.

Table 10.2-1 Socio-Economic Indicators

Inflation Rate	5%	Actual Past Values Averaged	6%
Growth Rate of Labor Costs	8%	Actual Past Value in the South	12%

2) Construction Costs

a) Port Facilities

From Chapter 9, the construction cost per one berth at 1983 prices is 32.6 million ¥.

According to our experts' estimation, the breakdown into labor cost and material cost is assumed as follows.

Table 10.2-2 Breakdown of Construction Cost

			Material	Labor etc.
Direct Cost 80%	Material	80%	64	-
	Labor	10%	-	8
	Equipment (Depriciation, Fuel)	10%	8	-
Indirect Cost 10%	Mobilization Preparation etc.		5	5
Profit/Overhead 10%			0	10
Total 100%			77%	23%

The Construction cost per berth in 1987 is assumed as 38.5 million ฿ and the Construction costs of Tha Thong Port and Pattani are estimated to be 56.7 and 71.7 million ฿ at 1987 prices.

b) Construction Schedule and Cost of the Required Berths

The facilities planned to cope with the estimated future cargo volumes are as follows.

Table 10.2-3 Actual and Proposed Construction Cost

Year	Port	Construction Cost (M฿) at 1987 prices
1981	Tha Thong/a (Ban Don)	56.7/b
1982	Pattani/a	71.7/b
1983		
1984		
1985	Bangkok	154.0
1986		
1987	Bangkok	
1988	Pak Phanang/a	77.0
1989	Songkhla	77.0
1990		
1991	Bangkok	77.0
1992		
1993	Songkhla	115.5
1994		
1995	Bangkok	77.0
1996		
1997		
1998		
1999		
2000		

Note: /a completed or On-going Project by H/D, /b Actual Cost

The construction time for each pair of berths will be 18 months. Therefore, the construction should be started approx. two years prior to the said completion dates.

c) Dredging Cost

From Chapter 4, the initial dredging costs for each port are estimated as follows.

Table 10.2-4 Capital Dredging Cost by Port

Port	Cost M ฿	Remarks
Bangkok	-	Dredging by PAT covers the requirement
Songkhla	-	Deep Water Ports's dredging covers coastal port's requirement
Ban Don	95.0	IDB loan's dredging (1982)
Pak Phanang	140.0	Our Estimation (1987)
Pattani	13.0	Our Estimation (1983)

d) Maintenance Cost for Facilities/Channel

The maintenance cost for each berth is assumed to be 1 percent of the construction cost.

The maintenance cost for dredging the channels at Bangkok and Songkhla should not be included, because these works are engaged in for ocean going vessels.

At the rest of three ports, namely Surat Thani, Pak Phanang and Ban Don, the following maintenance dredging cost are included.

Table 10.2-5 Maintenance Dredging Cost (1983 prices)

	10^3 m^3/year	million ฿
Ban Don	350	3.1
Pak Phanang	200	1.5
Pattani	230	1.7

According to the Study Team's estimation the breakdown into labor cost and material cost is estimated as follows. Here data for cutter suction dredger are utilized.

Table 10.2-6 Breakdown of Dredging Cost

	Labor	Material
Cutter Dredger	25%	75%
Hopper Dredger	32%	68%

3) Saving is Transportation Cost (conversion from road to sea)

The reduction of transport cost is calculated using the following formula.

$$R_n = \sum_{i=1}^{4} (T_{ic} - S_{ic} - D_c - D_e) \times Q_{in}$$

R : The transportation cost reduction over n year period

T_{ic}: The truck transportation cost over the distance between the hinterland of the ith port and Bangkok

S_{ic}: The shipping cost between the ith port and Bangkok (mentioned above)

Q_{in}: The two way cargo flow between Bangkok and the ith port in n year period (excluding fuel, wood products and fertilizer)

D_c : Drayage cost and double handling cost at port site
To make a valid comparison with door to door truck service, the costs from origin to the port site and from the port site to the destination are included.

D_e : Costs incurred during transport delay. This means the loss arising from having capital tied up in cargo in transit that might otherwise be used elsewhere.

a) Truck Transportation Cost (T_{ic})
According to the estimation based on ETO's data mentioned on page 114, the truck transportation costs between Bangkok and Ban Don, Pak Phanang, Songkhla and Pattani are respectively 442, 507, 608 and 661 ¥/ton (1987).

Table 10.2-7 Truck Transportation Cost (T_{ic}) by Hinterland, 1987

Unit: Bahts/ton

	Surat Thani	Nakhon Si Thammarat	Hat Yai	Pattani
Operational Cost				
Fuel	134	157	195	216
Oil	6	7	8	9
Maint./Spare.	65	77	95	104
Tyre	42	49	61	67
Dr. Allow.	42	49	61	67
Sub Total	289	339	420	463
Fix Cost				
Driver's Salary	29	31	33	34
Reg. Fee	2	3	3	3
Insurance	3	3	3	3
Depreciation	59	63	67	69
Canvas	2	2	3	3
Sub Total	95	102	109	112
Total	384	441	529	575
Office Exp. (15%)	58	66	79	86
Grand Total	442	507	608	661

Note: Calculated by the Data of "Study of Trucking Industry"
Loading Cargo for 10 wheel truck is assumed
Main haul 14.3 ton (overload 10% average)
Back haul 13.0 ton
Total 27.3 ton

b) Shipping Freight Cost (S_{ic})

After completion of the local ports, it is anticipated that many types of vessels will make port calls and that the size of these vessels will increase to take advantage of the enlargement of the ports' capacities.

The ports which are planned as the network will have the capacity of handling vessels up to 1500 DWT alongside their wharves.

However the average size of calling vessels depends on various factors such as the cargo volume on each route, seasonal cargo fluctuations.

The Study Team assumed 700 DWT as the average vessel size in the rest of this analysis.

The shipping cost S_{ic} between Bangkok and the other four ports are assumed as follows.

As these costs are treated as social costs interest is excluded.

Table 10.2-8 Shipping Freight Costs to and from Bangkok (700 DWT 1987 price)

Unit: Bahts/ton

	Songkhla & Pattani	Surat Thani	Pak Phanang	Growth Rate
Operating Expenses				
Port charge	2	2	2	2%
Stevedorage	60	60	60	5%
Fuel Oil	72	53	61	5%
Agency Fee	11	6	8	3%
Other Expense	18	10	13	5%
Sub Total	163	131	144	
Vessel Expenses				
Crew Cost	35	29	32	7%
Maintenance	12	10	11	5%
Insurance	6	5	5	-
Admi. Exp.	15	13	14	5%
Depreciation	47	39	43	-
Others	12	10	11	5%
Sub Total	127	106	116	
Total	290	237	260	

c) Drayage Cost and Port handling Cost (D_C)

Based on the ETO's table (See Chapter 3) the drayage cost of average 30 km is estimated at 93 ฿/ton and that the port handling cost, excluding stevedorage, is about 20 ฿/ton, which is for both the loading port and unloading port.

These amount to D_C = 113 ฿/ton

The details are in Tables 10.2-9 and 10.2-10.

d) Delay Cost

Undoubtedly sea transport takes much longer time than road transport. The time difference is about 1 or 2 days between Bangkok and the South.

Table 10.2-9 Truck Operation Costs of Drayage (30 km) (1987)

①	Variable Cost	Per Truck	Per ton
	Fuel	67.2	5.2
	Oil	2.8	0.2
	Maint./Spare.	32.7	2.5
	Tyre	21.1	1.6
	Dr. Allow.	18.8	1.4
	Total	142.5	11.0
②	Fixed Cost		
	Salary	96.3	7.4
	Reg. Fee	9.0	0.7
	Insurance	10.3	0.8
	Depreciation	217.3	16.7
	Canvas	8.2	0.6
	Total	341.0	26.2
③	Grand Total	483.5	37.2

Remarks: one way weight 13 ton
working day per month 30 × 0.9 = 27 day
daily trip 1.5
Inflation Rate 5%
Growth of Labour Cost 8%

Future Cost (ton/฿)

	1983	1987
Labour Cost	8.8	12.0
Others	28.4	34.5
Total	37.2	46.5

2 port (origin and destination)
46.5 × 2 = 93.0

Table 10.2-10 Cargo Handling Cost per ton, 1987

	1983	1987
Labour Cost etc.	4.3	5.9
Others	3.2	3.9
Total	7.5	9.8

2 port cost 9.8 × 2 = 19.6

So the delay cost is assumed to be the interest on the cargo's value. Estimated library of this covers to about 5 × 10 ฿/ton (value 10 thousand ฿/ton average, Interest 15%)
However, according to the field survey of the commodities carried by vessels are cargoes of large lot-size which comparatively cheaper and are carried from one warehouse to another.
This means some of the consignee's warehouse costs can be reduced by using vessels.
Accordingly this cost can be offset against the above mentioned benefit so the Study Team neglected this matter.
The difference between Truck Cost and Shipping Cost is summarized and shown as follows.

Table 10.2-11 Difference between Truck Cost and Shipping Cost (1987 prices)

Unit: Bahts/ton

	Songkhla & Pattani	Surat Thani (Ban Don)	Pak Phanang
T_{ic} Truck Cost (1)	608 661	442	507
S_{ic} Shipping Cost (2)	290	237	260
D_c Drayage and Cargo handling Cost (3)	113	113	113
Difference (1) - ((2) + (3))	205∿ 258	92	134

Table 10.2-12 Cargo Volume by Ship

Unit: Thousand tons

	Ban Don			Pak Phanang			Songkhla			Pattani		
	South-bound	North-bound	Total	South-bound	North-bound	Total	South-bound	North-bound	Total	South-bound	North-bound	Total
1987	120	18	138	107	54	161	347	57	404	94	10	104
1988	126	18	144	112	57	169	365	60	425	101	10	111
1989	135	21	156	115	59	174	384	61	445	108	10	118
1990	145	23	168	121	62	183	403	64	467	117	11	128
1991	155	24	179	126	65	191	425	65	490	126	11	137
1992	165	26	191	131	69	200	447	68	516	135	11	146
1993	174	26	200	139	71	210	456	71	527	141	12	153
1994	183	28	211	145	74	219	486	72	558	148	12	160
1995	193	29	222	153	76	229	507	76	583	153	12	165
1996	203	29	232	162	79	241	529	77	606	160	12	172
1997	214	31	245	171	83	254	553	81	634	169	13	182
1998	226	32	258	181	86	267	578	85	663	177	14	191
1999	238	34	272	190	89	279	605	87	692	181	14	195
2000	253	35	288	202	93	295	631	91	722	193	14	207

The reduction of transport cost from using ships is calculated as follows.

Table 10.2-13 Reduction of Transport Cost

Unit: Million Bahts

	Ban Don	Pak Phanang	Songkhla	Pattani	Total
1987	12.7	21.6	82.8	26.8	143.9
1988	13.2	22.6	87.1	28.6	151.5
1989	14.4	23.3	91.2	30.4	159.3
1990	15.5	24.5	95.7	33.0	168.7
1991	16.5	25.6	100.5	35.3	177.9
1992	17.6	26.8	105.8	37.7	187.9
1993	18.4	28.1	108.0	39.5	194.0
1994	19.4	29.3	114.4	41.3	204.4
1995	20.4	30.7	119.5	42.6	213.2
1996	21.3	32.3	124.2	44.4	222.2
1997	22.5	34.0	130.0	47.0	233.5
1998	23.7	35.8	135.9	49.3	244.7
1999	25.0	37.4	141.9	50.3	254.6
2000	26.5	39.5	148.0	53.4	267.4

4) The Reduction of Transport Costs from Using Large Vessels

After deepening the harbors at Tha Thong (Surat Thani), Pak Phanang and Pattani, the reduction of transport cost from using large size vessels for industrial cargo such as fuel, forest products and fertilizer is considerable.

Though Songkhla and Bangkok are also carrying out dredging work, these costs should not be considered as included in this coastal shipping project but as port of the deep sea project for international trade.

So the benefits at these two ports should be deleted.

Using conservative approach the Study Team analysed only the case of fuel.

Today fuel is carried by small tankers going to Ban Don and Pak Phanang, Pattani has no petroleum loading facilities so far. But after deepening the ports, petroleum companies will use the new terminal instead of transhipping from Songkhla.

The Study Team assume the present vessel size as 500 DWT and future vessel size as 1,500 DWT in accordance with the planned deepening of the channels.

The Study Team also make a rough estimate of the extra investment by petroleum companies for enlarging their facilities as 20 million ฿ per port.

According to the Study Team's estimation the actual transport costs for tankers serving from the Bangkok area to the South are as follows.

Table 10.2-14 Fuel Transport Cost (1987 prices)

Unit: Bahts/ton

	Ban Don		Pak Phanang		Pattani	
Voyage	500 DWT	1500 DWT	500 DWT	1500 DWT	500 DWT	1500 DWT
Year	'77	'77	'69	'77	'63	'63
Operating Exp.						
Port Charge	3.8	1.9	3.8	1.9	3.8	1.9
Fuel Oil	59.6	27.5	64.5	29.4	80.9	38.0
Others	6.5	6.5	8.5	8.4	10.5	10.5
Sub Total	69.9	35.9	76.8	39.7	95.2	50.4
Vessel Exp.						
Crew Cost	32.9	16.0	36.7	16.0	40.2	19.6
Mainte. Cost	22.8	11.5	25.4	11.5	27.8	14.0
Insurance	7.6	3.8	8.5	3.8	9.3	4.7
Admi. Exp.	11.7	5.3	13.1	5.3	14.3	6.5
Others	15.2	7.6	16.9	7.6	18.5	9.3
Sub Total	90.2	44.2	100.6	44.2	110.1	54.1
Depreciation	60.7	30.6	67.7	30.6	74.2	37.4
Cost	220.8	110.7	245.1	114.5	279.5	141.9

The cost reduction for a tanker per ton is:

Unit: Bahts/ton

Ban Don	110.1	→	110
Pak Phanang	130.6	→	130
Pattani	137.6	→	140

According to the cargo forecast the volume of fuel carried to each port is estimated as follows.

Table 10.2-15 Fuel Transport Volume by Shipping

Unit: Thousand tons

	Ban Don	Pak Phanang	Pattani
1987	296	129	135
1988	299	129	146
1989	302	128	157
1990	304	128	169
1991	307	127	183
1992	310	127	197
1993	313	129	212
1994	317	130	229
1995	321	132	247
1996	324	134	267
1997	328	136	288
1998	332	137	310
1999	335	139	335
2000	339	141	361

From the above, the reduction of the transport costs by using large size vessels is obtained as follows.

Table 10.2-16 Reduction of the Transport Costs by Using Large Size Vessels

Unit: Million Bahts

	Ban Don	Pak Phanang	Pattani	Total
1987	32.6	16.8	18.9	68.3
1988	32.9	16.8	20.4	70.1
1989	33.2	16.6	22.0	71.8
1990	33.4	16.6	23.7	73.4
1991	33.8	16.5	25.6	75.9
1992	34.1	16.5	27.6	78.2
1993	34.4	16.8	29.7	80.9
1994	34.9	16.9	32.1	83.9
1995	35.3	17.2	34.6	87.1
1996	35.6	17.4	37.4	90.4
1997	36.1	17.7	40.3	94.1
1998	36.5	17.8	43.4	97.7
1999	36.9	18.1	46.9	101.9
2000	37.3	18.3	50.5	106.1

5) The Reduction of Road Maintenance Costs

From the analysis summarized in Appendix 18, the reduction of road maintenance cost is estimated by the following procedure.

a) Estimate reduction of traffic volume expected by using of general cargo vessels, which otherwise loaded on the highway transport.

b) Estimate expected reduction of road maintenance cost for the above alleviation of truck transport. Details are explained in Appendix 18. Expected reduction of road maintenance costs are summarized as follows.

Table 10.2-17 Reduction of Road Maintenance Costs
Unit: Million Bahts

	Cost at 1983	Cost at 1987
1987	6.3	7.9
1988	6.7	8.4
1989	7.1	8.9
1990	7.4	9.2
1991	7.8	9.7
1992	8.2	10.2
1993	8.7	10.9
1994	9.1	11.4
1995	9.6	12.0
1996	10.0	12.5
1997	10.5	13.1
1998	10.9	13.6
1999	11.4	14.2
2000	11.8	14.7

(3) Economic Evaluation

1) 1987 prices

The cost and benefits already calculated have been shown at 1987 prices.

2) Shadow pricing

In general, distoration in the market price mechanism for goods and services in developing countries can be seen most clearly in two factors; The foreign exchange rate and the price of unskilled labor.

This study covers many ports which will be constructed using various different sources of capital and under different conditions. Therefore, the Study Team decided not to treat this matter.

3) Internal Rate of Return (IRR)

There are several indices for evaluating the economic return of a project. Here, however, the economic returns are evaluated in terms of the internal rate of return. (IRR).

The IRR is obtained from the following equations.

$$\sum_{i=0}^{n-1} \frac{Bi - Ci}{(1 + IRR)^i} = 0$$

Here, n = Period of calculation of IRR

Bi = Amount of benefit at i - th year

C = Amount of cost at i - th year

Assuming the project life to be 20 years, the calculations will cover the period from 1981 when Tha Thong Port was constructed to the year 2000.

Table 10.2-18 Cost-Benefit Table

Unit: Million Bahts

	Const. Wharf	Capital Dredging	Maintenance Wharf	Maintenance Dredging	Petro Investment	Total Cost	Reduction Cost Dry Cargo	Large Scale Tanker	Road Maintenance	Total Benefit	Benefit Cost
1981	56.7					56.7					-56.7
1982		125.8	0.6	3.9		130.3					-130.3
1983	71.7	16.3	0.6	3.9		92.5					-92.5
1984			1.3	6.0		7.3					-7.3
1985	154.0		1.3	6.0		161.3					-161.3
1986			2.8	6.0		8.8					-8.8
1987	77.0	175.2	2.8	6.0	72.0	333.0	143.9	68.3	7.9	220.1	-112.9
1988			3.6	7.9		11.5	151.5	70.1	8.4	230.0	218.5
1989	77.0		3.6	7.9		88.5	159.3	71.8	8.9	240.0	151.5
1990			4.4	7.9		12.3	168.7	73.4	9.2	251.3	239.0
1991	77.0		4.4	7.9		89.3	177.9	75.9	9.7	263.5	174.2
1992			5.1	7.9		13.0	187.9	78.2	10.2	276.3	263.3
1993	115.5		5.1	7.9		128.5	194.0	80.9	10.9	285.8	157.3
1994			6.3	7.9		14.2	204.4	83.9	11.4	299.7	285.5
1995	77.0		6.3	7.9		91.2	213.2	87.1	12.0	312.3	221.1
1996			7.1	7.9		15.0	222.2	90.4	12.5	325.1	310.1
1997			7.1	7.9		15.0	233.5	94.1	13.1	340.7	325.7
1998			7.1	7.9		15.0	244.7	97.7	13.6	356.0	341.0
1999			7.1	7.9		15.0	254.6	101.9	14.2	370.7	355.7
2000			7.1	7.9		15.0	267.4	106.1	14.7	388.2	373.2
Residual Value	427.9	317.3									

Table 10.2-19 IRR Calculation (Residual Value Deleted)

IRR (%) = 19.73

Unit: Million Bahts

No.	Year	Cost	Benefit	Bnft. -Cost	P. Cost	P. Bnft.	P. Value
1	1981	56.70	0.00	-56.70	56.70	0.00	-56.70
2	1982	130.30	0.00	-130.30	108.83	0.00	-108.83
3	1983	92.50	0.00	-92.50	64.53	0.00	-64.53
4	1984	7.30	0.00	-7.30	4.25	0.00	-4.25
5	1985	161.30	0.00	-161.30	78.49	0.00	-78.49
6	1986	8.80	0.00	-8.80	3.57	0.00	-3.58
7	1987	333.00	220.10	-112.90	113.03	74.71	-38.32
8	1988	11.50	230.00	218.50	3.26	65.21	61.95
9	1989	88.50	240.00	151.50	20.96	56.83	35.87
10	1990	12.30	251.30	239.00	2.43	49.76	47.27
11	1991	89.30	263.50	174.20	14.75	43.52	28.77
12	1992	13.00	276.30	263.30	1.79	38.12	36.32
13	1993	128.50	285.80	157.30	14.81	32.93	18.12
14	1994	14.20	299.70	285.50	1.37	28.84	27.47
15	1995	91.20	312.30	221.10	7.33	25.10	17.77
16	1996	15.00	325.10	310.10	1.01	21.82	20.82
17	1997	15.00	340.70	325.70	0.84	19.10	18.26
18	1998	15.00	356.00	341.00	0.70	16.67	15.97
19	1999	15.00	370.70	355.70	0.59	14.50	13.91
20	2000	15.00	388.20	373.20	0.49	12.68	12.19
	Total	1,301.40	4,159.90	2,849.50	499.72	499.73	0.00

Table 10.2-20 IRR Calculation (Including Residual Value)

IRR (%) = 20.57

Unit: Million Bahts

No.	Year	Cost	Benefit	Bnft. -Cost	P. Cost	P. Bnft.	P. Value
1	1981	56.70	0.00	-56.70	56.70	0.00	-56.70
2	1982	130.30	0.00	-130.30	108.07	0.00	-108.07
3	1983	92.50	0.00	-92.50	63.63	0.00	-63.63
4	1984	7.30	0.00	-7.30	4.16	0.00	-4.16
5	1985	161.30	0.00	-161.30	76.32	0.00	-76.32
6	1986	8.80	0.00	-8.80	3.45	0.00	-3.45
7	1987	333.00	220.10	-112.90	108.38	71.63	-36.74
8	1988	11.50	230.00	218.50	3.10	62.08	58.98
9	1989	88.50	240.00	151.50	19.81	53.73	33.92
10	1990	12.30	251.30	239.00	2.28	46.66	44.38
11	1991	89.30	263.50	174.20	13.75	40.58	26.83
12	1992	13.00	276.50	263.50	1.66	35.31	33.65
13	1993	128.50	285.80	157.30	13.61	30.27	16.66
14	1994	14.20	299.70	285.50	1.25	26.33	25.08
15	1995	91.20	312.30	221.10	6.64	22.75	16.11
16	1996	15.00	325.10	310.10	0.91	19.65	18.74
17	1997	15.00	340.70	325.70	0.75	17.08	16.32
18	1998	15.00	356.00	341.00	0.62	14.80	14.17
19	1999	15.00	370.70	355.70	0.52	12.78	12.26
20	2000	15.00	1,133.40	1,118.40	0.43	32.41	31.98
	Total	1,313.40	4,905.10	3,591.70	486.05	486.06	0.00

The average service life of each port is assumed to be 30 years.

Economic Internal Rate of Return of 19.53 percent is obtained from the above analysis. Consequently the proposed local port network is considered economically feasible even in the conservative estimate.

10.3 Financial Analysis for the Port Authorities

10.3.1 Outline of the Evaluation

As stated before, we recommends that the port authority should hand over the cargo handling business to the private sector and that it manages and controls over the port facilities but maintenance of facilities is assumed to be carried out by the HD.

The revenues and expenditures and summarized as follows.

Revenues

1) Wharf dues

We assumed the average vessel type to be 700 D/W and as stated in Chapter 8, the port charges for the said type of vessel are estimated for the year 1987.

Bangkok, Songkhla	670 ฿/day
Others	500 "

On one round trip voyage the cargo volume is estimated at 660 tons. The average wharf dues per ton for each port is as follows.

Bangkok, Songkhla	1.015 ฿/ton	average 0.8865 ∿ 0.9
Others	0.758 "	

This resulted in an assumed average wharf due per ton per port of 1.0 B/ton for all cargoes passing across a wharf.

2) Transit shed charges

The charges for the use of transit sheds are estimated at 1 ฿/ton/day applying to 25 percent of cargo passing across a wharf.

The average stay in a transit shed is assumed to be 3 days.

The average storage charges for the use of transit sheds for all cargo passing across a wharf can be obtained as

$1 \times 3 \times 0.25 = 0.75$ ฿/ton

3) Storage yard charge

The authority would not impose storage yard charges.

4) Water supply fee

The water supply business assumed to be carried out by the private sector. In this study it is not included in the port authorities revenue.

5) Rental fees for industrial sites

These fees should be included in the revenue, but they are difficult to measure quantitatively and therefore are left out of the present calculation.

6) Channel dues

As recommended in Chapter 4, channel dues ought to be imposed on private wharf cargo that passes through the dredged channels.

According to the economic analysis, the private wharf owners will receive considerable benefit from the dredging of the channel, so the authority should charge reasonable channel dues for managing the channel.

As an experts' view we recommended that the channel dues for private wharf cargo should be established so as to be in balance with the costs for using public port facilities. On terms of pricing policy, the dues are not expected to cover the maintenance dredging cost but should be set on the basis of the users benefits as a result of the dredging.

The shippers or consignees using common carrier pay a lumpsum of 1.75 ฿/ton for using public facilities from their benefit of 80 ∿ 240 ฿/ton, depend upon the shipping distance.

The industrial carrier operators receive a benefit of 110 ∿ 140 ฿/ton, and we recommend that 70 percent of the common carrier payment is a reasonable figure for the channel dues charged to them.

This comes to 1.75 0.7 = 1.2 ฿/ton

These results are presented in the following table.

Table 10.3-1 Revenue of the Local Authority per tonnage

Unit: Bahts

	Revenue per tonnage	Growth Rate per year	Commodity
Common Carrier	1.75	2%	Dry Cargo
Industrial Carrier	1.20	2%	Fertilizer, Fuel Wood products

Expenditures

The authorities direct expenditures are assumed as follows: (in 1984, price)

1) Staff Salaries

		Salary/month
Director	1	5,000
Chief	2	3,000
Clerk, etc.	4	2,500
Guard/Driver	5	2,000
		31,000 ฿/year

2) Overtime

1 person about 80 days

1 day 50 ฿

11 person × 50 ฿ ×80 = 44,000 ฿/year

44,000 ฿/year

3) House Expense 10,000 ฿/year

4) Travelling Expense 30,000 ฿/year

5) Expense for Equipment

Office Equipment	10,000 ฿/year
Car 500 ฿/day × 100 day	50,000 ฿/year
Motor Boat	
300 ฿/day × 150 day	45,000 ฿/year
	105,000 ฿/year

6) Expense for Committee 10,000 ฿/year

Total	Labor	354,000
	Material	155,000
		509,000

The growth rate Labor 8%

Inflation rate 5%

( ) excluding another organizations contributions

It is desirable that some part of the budget could be alloted from the central or local governments to the port authority, but in this analysis, as conservative one, the above consideration is not included.

The Expenditures of the authority in 1987 are summarized as follows.

Labor	$354 \times (1.08)^3 = 446$	2,230	five authorities
Material	$155 \times (1.05)^3 = 179$	895	
total	409 625	3,125	

10.3.2 Financial Evaluation

The total revenue for each port is presented as follows.

Table 10.3-2 Port Authority of Ban Don (Surat Thani)

Unit: Thousand tons
Thousand Bahts

	Cargo through Public Wharf A	Port Charge ฿/ton B	Cargo through Private Wharf C	Channel Due ฿/ton D	Total Income A × B + C × D
1987	138	1.75	381	1.20	699
1988	144	1.79	388	1.22	731
1989	156	1.82	393	1.25	775
1990	168	1.86	399	1.27	819
1991	179	1.89	406	1.30	866
1992	191	1.93	414	1.32	915
1993	200	1.97	420	1.35	961
1994	211	2.01	428	1.38	1,015
1995	222	2.05	437	1.41	1,071
1996	235	2.09	444	1.43	1,162
1997	245	2.13	453	1.46	1,183
1998	257	2.18	463	1.49	1,250
1999	272	2.22	471	1.52	1,320
2000	288	2.26	481	1.55	1,396

Table 10.3-3 Port Authority of Pak Phanang (Nakhon Si Thammarat)

	Cargo through Public Wharf A	Port Charge ฿/ton B	Cargo through Private Wharf C	Channel Due ฿/ton D	Total Income A × B + C × D
1987	161	1.75	210	1.20	534
1988	169	1.79	215	1.22	565
1989	174	1.82	219	1.25	590
1990	183	1.86	223	1.27	624
1991	191	1.89	228	1.30	657
1992	200	1.93	234	1.32	694
1993	210	1.97	242	1.35	740
1994	219	2.01	250	1.38	785
1995	220	2.05	259	1.41	835
1996	241	2.09	268	1.43	887
1997	254	2.13	279	1.46	948
1998	267	2.18	288	1.49	1,011
1999	279	2.22	300	1.52	1,075
2000	295	2.26	312	1.55	1,150

Table 10.3-4 Port Authority of Songkhla

	Cargo through Public Wharf A	Port Charge ฿ /ton B	Total Income A × B
1987	404	1.75	707
1988	425	1.79	761
1989	445	1.82	810
1990	467	1.86	869
1991	490	1.89	926
1992	516	1.93	996
1993	527	1.97	1,038
1994	558	2.01	1,122
1995	583	2.05	1,195
1996	606	2.09	1,267
1997	634	2.13	1,350
1998	663	2.18	1,445
1999	692	2.22	1,536
2000	722	2.26	1,632

The channel due of Songkhla Port should be charged by the management body of the deep water port.

Table 10.3-5 Port Authority of Pattani

	Cargo through Public Wharf A	Port Charge ฿/ton B	Cargo through Private Wharf C	Channel Due ฿/ton D	Total Income A × B + C × D
1987	104	1.75	126	1.20	333
1988	111	1.79	130	1.22	357
1989	118	1.82	135	1.25	384
1990	128	1.86	141	1.27	417
1991	137	1.89	146	1.30	449
1992	146	1.93	152	1.32	482
1993	153	1.97	156	1.35	512
1994	160	2.01	162	1.38	545
1995	165	2.05	166	1.41	572
1996	172	2.09	170	1.43	603
1997	182	2.13	177	1.46	646
1998	191	2.18	182	1.49	688
1999	195	2.22	190	1.52	722
2000	207	2.26	196	1.55	772

Table 10.3-6 Port Authority of Bangkok (Domestic)

	Cargo through Public Wharf A	Port Charge B	Total Income A - B
1987	807	1.75	1,412
1988	849	1.79	1,520
1989	893	1.82	1,625
1990	946	1.86	1,760
1991	997	1.89	1,884
1992	1,053	1.93	2,032
1993	1,090	1.97	2,147
1994	1,147	2.01	2,305
1995	1,199	2.05	2,458
1996	1,251	2.09	2,615
1997	1,315	2.13	2,801
1998	1,379	2.16	3,006
1999	1,438	2.22	3,192
2000	1,512	2.26	3,417

The five authorities' expenditures are totaled as follows.

Table 10.3-7 Total Expenditure

Unit: Thousand Bahts

	Labor	Material	Total
1987	2,230	895	3,125
1988	2,408	940	3,348
1989	2,601	987	3,588
1990	2,809	1,036	3,845
1991	3,034	1,088	4,122
1992	3,277	1,142	4,419
1993	3,539	1,199	4,738
1994	3,822	1,259	5,081
1995	4,128	1,322	5,450
1996	4,458	1,388	5,846
1997	4,814	1,458	6,272
1998	5,200	1,531	6,731
1999	5,616	1,607	7,223
2000	6,065	1,688	7,753

The five authorities' revenue income and expenditures are totaled as follows.

Table 10.3-8 Total Balance

Unit: Thousand Bahts

	Ban Don Surat Thani	Pak Phanang	Songkhla	Pattani	Bangkok	Total Income A	Total Expenditure B	A - B
1987	699	534	707	333	1,412	3,685	3,125	560
1988	731	565	761	357	1,520	3,934	3,348	586
1989	775	590	810	384	1,625	4,184	3,588	596
1990	819	624	869	417	1,760	4,489	3,845	644
1991	866	657	926	449	1,884	4,782	4,122	660
1992	915	694	996	482	2,032	5,119	4,419	700
1993	961	740	1,038	512	2,147	5,398	4,738	660
1994	1,015	785	1,122	545	2,305	5,772	5,081	691
1995	1,071	835	1,195	572	2,458	6,131	5,450	681
1996	1,162	887	1,267	603	2,615	6,534	5,846	688
1997	1,183	948	1,350	646	2,801	6,928	6,272	656
1998	1,250	1,011	1,445	688	3,006	7,400	6,731	669
1999	1,320	1,075	1,536	722	3,192	7,845	7,223	622
2000	1,396	1,150	1,632	772	3,417	8,367	7,753	614

These results indicate that some port will not be able to offset the balance, but including Bangkok and Songkhla to get appropriate balance as a whole.

So the Central Government should make the Councel for Ports and Harbors which plays the role to make budgets, to render accounts for five ports, and to mediate and adjust interests of among these ports by requesting MOC.