

9-2 Future Plan

9-2-1 Investment Plan

(1) Premises

Investment plans for HD's Dredging Plant Development Project, comprising the establishment of the Mechanical Center and building NH6, NH8 and RH2, are examined according to the following two interest rates of the loans.

Case 1 The loans are to be procured from a multilateral international financial institution with the following conditions.

Interest rate	9.5% per annum
Term of loans	20 years (including 7-year grace period)

Case 2 The loans are to be procured from a bilateral financial institution with the following conditions.

Interest rate	3.5% per annum
Term of loans	30 years (including 10-year grace period)

The construction costs are divided into two parts. The first is that of the Existing Channels Project and the second is that of the Chao Phraya Second Channel Project.

We assume that the local currency of the development investment funds will be procured by domestic budgetary appropriation and the foreign currency will be obtained by long term loans from multilateral or bilateral financial institutions.

(2) The Prices and the Exchange Rate Used in the Investment Plan

All cost analyzed quantitatively here are presented in prices for the year 1985, the year of this survey.

The foreign exchange rate used for the computation is 1 Baht = 9.01 Yen, the rate as of July 31, 1985, the date on which the present field survey was completed.

(3) Tentative Construction Schedule

In the financial analysis, the construction schedule is tentatively assumed as shown in Fig. 9-2-1.

(4) Costs

The scope of costs covered by this analysis comprises construction costs for the new dredgers and the Mechanical Center, expenses for their maintenance operation and the contract dredging cost.

As the Chao Phraya Second Project has been studied in detail by the Consultant sponsored

by ADB, only a rough cost estimate of the project is made herein to project the approximate cost of the overall development for reference at this time.

Fiscal Year		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Existing Channels	The Mechanical Center	Consulting Service Construction	_____	_____	_____	Operation					
	NH-6	Consulting Service Shipbuilding	_____	_____	Operation						
	RH-2	Consulting Service Shipbuilding							_____	_____	Operation
	Chao Phraya Second Channel	NH-8	Consulting Service Shipbuilding	_____	_____	Operation					
Contract Dredging			_____	Operation							

Fig. 9-2-1 Tentative Construction Schedule

- 1) The construction costs for the dredgers are shown in Table 9-2-1.

Table 9-2-1 Construction Costs of the Dredgers

(Unit: Thousands Baht)

Dredgers		Cost	Foreign Currency Portion	Local Currency Portion	Total	Term of Payment
NH-6	Building Cost		79,578	—	79,578	30% in 1988
	Consulting Fee		9,860	98	9,958	70% in 1989
NH-8	Building Cost		177,802	—	177,802	30% in 1990
	Consulting Fee		10,673	7	10,680	70% in 1991
NH-2	Building Cost		177,802	—	177,802	30% in 1995
	Consulting Fee		13,318	98	13,416	70% in 1996

- 2) The construction cost of the Mechanical Center is shown in Table 9-2-2.

Table 9-2-2 The Construction Costs of the Mechanical Center

(Unit: Thousands Baht)

Items	Cost	Foreign Currency Portion	Local Currency Portion	Total
Slipway		19,355	46,326	65,681
Civil Works		0	5,423	5,423
Related Works		59,241	19,950	79,191
Engineering Fee		18,416	1,617	20,033
Total		97,012	73,316	170,328

The condition of payment:
 30% at the beginning, 10% at the completion, the balance every 2 months.
 Details of payment are the same as shown in Table 8-3-5.

3) The costs for the submersible sand pump and ancillary equipment are shown in Table 9-2-3.

Table 9-2-3 The Costs of the Submersible Sand Pump and Ancillary Equipment

(Unit: Baht)

No.	Item	Unit	Quantity	Unit Price	Amount
1	Submerged sand pump	set	1	40,000	40,000
2	Generator (75 KVA)	set	1	222,000	222,000
3	Switch panel	set	1	9,000	9,000
4	Rubber hose (50 m)	set	1	36,000	36,000
5	Spare parts	L/S	—	—	70,000
6	Freight	L/S	—	—	23,000
	Total				400,000

Note: All amount is in foreign currency.

The above cost is for one unit. Therefore, if three units are procured, it would be 1,200,000 Baht.

4) The contract price at the capital dredging in Chao Phraya Second Channel is estimated as follows:

- a) Capital Dredging Price 33.7 Baht/m³
- b) The Cost for Mobilization 10,000,000 Baht
- c) Dredging Volume 3,700,000 m³
- d) The Contract Dredging Cost 10,000,000/3,700,000 + 33.7
= 36.4 ≈ 37.0 Baht/m³

Therefore, the capital dredging cost is estimated as follows:

$$3,700,000 \text{ m}^3 \times 37.0 \text{ Baht/m}^3 = 13,690,000 \approx 13,700,000 \text{ Baht}$$

5) The construction costs of all the entire development are shown in Table 9-2-4.

About 261,064,000 Baht is necessary for the initial investment for the existing channels project as follows:

One H-6 type trailing hopper dredger (NH-6)	89,536,000 Baht
The Mechanical Center	170,328,000 Baht
Submersible sand pumps and ancillary equipment	1,200,000 Baht
Total	261,064,000 Baht

Table 9-2-4 The Construction Costs of the Entire Development

(Unit: Thousands Baht)

Items	Costs			Initial Investment (1988 ~ 1991)			Investment for the Project Period (1988 ~ 2000)			Case A	Case B	Case C
		Foreign Currency Portion	Local Currency Portion	Total	Foreign Currency Portion	Local Currency Portion	Total	The Mechanical Center and Capital Dredging	Dredgers Excluding RH-2	Dredgers Including RH-2		
Existing Channels	The Mechanical Center	97,012	73,316	170,328	97,012	73,316	170,328	0	-	-		
	NH-6	79,578	-	79,578	79,578	-	79,578	-	0	0		
	RH-2	9,860	98	9,958	9,860	98	9,958	-	0	0		
Chao Phraya Second Channel	Building Cost	-	-	-	177,802	-	177,802	-	-	0		
	Consulting Fee	-	-	-	13,318	-	13,318	-	-	0		
	Submergible Sand Pump and Ancillary Equipment	1,200	-	1,200	1,200	-	1,200	0	0	0		
	Sub Total	187,650	73,314	261,064	378,770	73,512	452,282	-	-	-		
Total	NH-8	177,802	-	177,802	177,802	-	177,802	-	0	0		
	Capital Dredging by Contract	10,673	7*	10,680	10,673	7*	10,680	-	0	0		
	Sub Total	137,000	-	137,000	137,000	-	137,000	0	-	-		
	Foreign Currency Portion	325,475	7*	325,482	325,475	7*	325,482	-	-	-		
Total	Foreign Currency Portion			513,125			704,245	255,212	279,113	470,239		
	Local Currency Portion			73,421			73,519	73,316	105	203		
	Total			586,546			777,764	308,528	279,218	470,436		

Notes: 1) "*" stands for additional expense in the case when NH-8 is built together with NH-6 at the same shipyard.

2) 1 Baht = 9.01 Yen

6) The annual maintenance and operation costs of the dredgers and the Mechanical Center are shown in Table 9-2-5.

Table 9-2-5 The Annual Maintenance and Operation Costs

(Unit: Thousands Baht)

Items		Cost	Annual Maintenance and Operation Cost
Existing Channels	The Mechanical Center		5,076
	NH-6		5,659
	RH-2		6,605*
	Sub Total		17,340
Chao Phraya Second Channel	NH-8		6,605
Total			23,945
Maintenance cost is saved 442,618 Baht per annum, per dredger by the Mechanical Center. *As RH-2 is the replacement of H-2, her operation cost is not necessary to add, actually.			

7) The annual construction costs are shown in Table 9-2-6.

(5) Investment Plan for the Existing Channels Project in Case 1 and Case 2

The investment for the existing channels amounts to 451,082,000 Baht during the project term from 1987 to 2000, including the investment for the replacement dredger, RH2.

In case 1, the total funds required for the above investment are 971,328,000 Baht, which will be necessary over 20 years from 1988 to 2007, the end of the repayment period, as shown in Table 9-2-7.

In case 2, the total funds required for the above investment are 943,750,000 Baht, which will be necessary over 30 years from 1988 to 2017, the end of the repayment period, as shown in Table 9-2-8.

(6) Invest Plan for the Entire Development Including the Chao Phraya Second Project

The investment for the entire development including the Chao Phraya Second Project amounts to 777,764,000 Baht during the project term from 1987 to 2000.

In Case 1, the total funds required for the entire development are 1,822,451,000 Baht, which will be necessary over 20 years from 1988 to 2007, the end of the repayment period, as shown in Table 9-2-7.

In Case 2, the total funds required for the entire development are 1,669,170,000 Baht, which will be necessary over 30 years from 1988 to 2017, the end of the repayment period, as shown in Table 9-2-8.

(7) Case-study

Changing the assumptions of the main analysis, we examine two additional cases in which all the development investment funds will be obtained through foreign financing.

Case 3	Interest rate :	9.5% per annum
	Term of loan :	20 years (including 7-year grace period)
Case 4	Interest rate :	3.5% per annum
	Term of loan :	30 years (including 10-year grace period)

Investment plan in Case 3 is shown in Table 9-2-9. Investment plan in Case 4 is shown in Table 9-2-10.

Table 9-2-7 Statement of Source and Application of Funds in Case 1

(Unit: Thousands Baht)

Fiscal Year	Existing Channels (NH-6, RH-2, The Mechanical Center)								Chao Phraya Second Channel (NH-8, Capital Dredging)								Total							
	Source		Application						Source		Application						Source		Application					
	HD Funds (1)	Long-term Loans	Capital Costs	Maintenance & Operation Costs (2)	Balance of Loans	Interest on Loans (9.5%) (3)	Repayment of Loans (4)	HD Total Funds (1)+(2)+(3)+(4)	HD Funds (5)	Long-term Loans	Capital Costs	Maintenance & Operation Costs (6)	Balance of Loans	Interest on Loans (9.5%) (7)	Repayment of Loans (8)	HD Total Funds (5)+(6)+(7)+(8)	HD Funds (9)	Long-term Loans	Capital Costs	Maintenance & Operation Costs (10)	Balance of Loans	Interest on Loans (9.5%) (11)	Repayment of Loans (12)	HD Total Funds (9)+(10)+(11)+(12)
1 1988	730	36,011	36,741		86,011	3,421		4,151	2	125,043	125,045		125,043	11,879		11,881	732	161,054	161,786		161,054	15,300		16,032
2 1989	33,634	102,730	136,364		138,741	13,180		46,814	5	200,432	200,437		325,475	30,920		30,925	33,639	303,162	336,801		464,216	44,100		77,739
3 1990	23,788	29,405	53,193	5,659	168,146	15,973		45,420				6,605	325,475	30,920		37,525	23,788	29,405	53,193	12,264	493,621	46,893		82,945
4 1991	15,262	19,504	34,766	5,659	187,650	17,827		38,748				6,605	325,475	30,920		37,525	15,262	19,504	34,766	12,264	513,125	48,747		76,273
5 1992				10,292	187,650	17,827		28,119				6,162	325,475	30,920		37,082				16,454	513,125	48,747		65,201
6 1993				10,292	187,650	17,827		28,119				6,162	325,475	30,920		37,082				16,454	513,125	48,747		65,201
7 1994				10,292	187,650	17,827		28,119				6,162	325,475	30,920		37,082				16,454	513,125	48,747		65,201
8 1995	29	57,336	57,365	10,292	244,986	23,274	29,136	62,731				6,162	325,475	30,920	25,037	62,119	29	57,336	57,365	16,454	570,461	54,194	54,173	124,850
9 1996	69	133,784	133,853	10,292	349,634	33,215	29,136	72,712				6,162	300,438	28,542	25,037	59,741	69	133,784	133,853	16,454	650,072	61,757	54,173	132,453
10 1997				10,292	320,498	30,447	29,136	69,875				6,162	275,401	26,163	25,037	57,362				16,454	595,899	56,610	54,173	127,237
11 1998				10,292	291,362	27,679	29,136	67,107				6,162	250,364	23,785	25,037	54,984				16,454	541,726	51,464	54,173	122,091
12 1999				10,292	262,226	24,911	29,136	64,339				6,162	225,327	21,406	25,037	52,605				16,454	487,553	46,317	54,173	116,944
13 2000				10,292	233,090	22,144	29,136	61,572				6,162	200,290	19,028	25,037	50,227				16,454	433,380	41,172	54,173	111,799
14 2001				10,292	174,818	19,376	29,136	58,804				6,162	175,253	16,649	25,037	47,848				16,454	379,207	36,025	54,173	106,652
15 2002				10,292	174,818	16,608	29,136	56,036				6,162	150,216	14,271	25,036	45,469				16,454	325,036	30,879	54,172	101,505
16 2003				10,292	145,682	13,840	29,136	53,268				6,162	125,180	11,892	25,036	43,090				16,454	270,862	25,732	54,172	96,358
17 2004				10,292	116,546	11,072	29,136	50,500				6,162	100,144	9,514	25,036	40,712				16,454	216,690	20,586	54,172	91,212
18 2005				10,292	87,410	8,304	29,136	47,732				6,162	75,108	7,135	25,036	38,333				16,454	162,518	15,439	54,172	86,065
19 2006				10,292	58,274	5,536	29,137	44,965				6,162	50,072	4,757	25,036	35,955				16,454	108,346	10,293	54,173	80,920
20 2007				10,292	29,137	2,768	29,137	42,197				6,162	25,036	2,378	25,036	33,576				16,454	54,173	5,146	54,173	75,773
Total	73,512	378,770	452,282	175,990	0	343,056	378,770	971,328	7	325,475	325,482	111,802	0	413,839	325,475	851,123	73,519	704,245	777,764	287,792	0	756,895	704,245	1,822,451

Notes: 1) Long-term Loans and Balance of Loans are at the beginning of the year.

2) Repayment of Loans are at the end of the year.

Table 9-2-8 Statement of Source and Application of Funds in Case 2

(Unit: Thousands Baht)

Fiscal Year	Existing Channels (NH-6, RH-2, The Mechanical Center)								Chao Phraya Second Channel (NH-8, Capital Dredging)								Total							
	Source		Application						Source		Application						Source		Application					
	HD Funds (1)	Long-term Loans	Capital Costs	Maintenance & Operation Costs (2)	Balance of Loans	Interest on Loans (3.5%) (3)	Repayment of Loans (4)	HD Total Funds (1)+(2)+(3)+(4)	HD Funds (5)	Long-term Loans	Capital Costs	Maintenance & Operation Costs (6)	Balance of Loans	Interest on Loans (3.5%) (7)	Repayment of Loans (8)	HD Total Funds (5)+(6)+(7)+(8)	HD Funds (9)	Long-term Loans	Capital Costs	Maintenance & Operation Costs (10)	Balance of Loans	Interest on Loans (3.5%) (11)	Repayment of Loans (12)	HD Total Funds (9)+(10)+(11)+(12)
1 1988	730	36,011	36,741		36,011	1,260		1,990	2	125,043	125,045		125,043	4,377		4,379	732	161,054	161,786		161,054	5,637		6,369
2 1989	33,634	102,730	136,364		138,741	4,856		38,490	5	200,432	200,437		325,475	11,392		11,397	33,639	303,162	336,801		464,216	16,248		49,887
3 1990	23,788	29,405	53,193	5,659	168,146	5,885		35,332				6,605	325,475	11,392		17,997	23,788	29,405	53,193	12,264	493,621	17,277		53,329
4 1991	15,262	19,504	34,766	5,659	187,650	6,568		27,489				6,605	325,475	11,392		17,997	15,262	19,504	34,766	12,264	513,125	17,960		45,486
5 1992				10,292	187,650	6,568		16,860				6,162	325,475	11,392		17,554				16,454	513,125	17,960		34,414
6 1993				10,292	187,650	6,568		16,860				6,162	325,475	11,392		17,554				16,454	513,125	17,960		34,414
7 1994				10,292	187,650	6,568		16,860				6,162	325,475	11,392		17,554				16,454	513,125	17,960		34,414
8 1995	29	57,336	57,365	10,292	244,986	8,575		18,896				6,162	325,475	11,392		17,554	29	47,336	57,365	16,454	570,461	19,967		36,450
9 1996	69	133,784	133,853	10,292	378,770	13,257		23,618				6,162	325,475	11,392		17,554	69	133,784	133,853	16,454	704,245	24,649		41,172
10 1997				10,292	378,770	13,257		23,549				6,162	325,475	11,392		17,554				16,454	704,245	24,649		41,103
11 1998				10,292	378,770	13,257	18,939	42,488				6,162	325,475	11,392	16,274	33,828				16,454	704,245	24,649	35,213	76,316
12 1999				10,292	359,831	12,594	18,939	41,825				6,162	309,201	10,822	16,274	33,258				16,454	669,032	24,416	35,213	75,083
13 2000				10,292	340,892	11,931	18,939	41,162				6,162	292,927	10,252	16,274	32,688				16,454	633,819	22,183	35,213	73,850
14 2001				10,292	321,953	11,268	18,939	40,499				6,162	276,653	9,683	16,274	32,119				16,454	598,606	20,951	35,213	72,618
15 2002				10,292	303,014	10,605	18,939	39,836				6,162	260,379	9,113	16,274	31,549				16,454	563,393	19,718	35,213	71,385
16 2003				10,292	284,075	9,943	18,939	39,174				6,162	244,105	8,544	16,274	30,980				16,454	528,180	18,487	35,213	70,154
17 2004				10,292	265,136	9,280	18,939	38,511				6,162	277,831	7,974	16,274	30,410				16,454	492,967	17,254	35,213	68,921
18 2005				10,292	246,197	8,617	18,939	37,848				6,162	211,557	7,404	16,274	29,840				16,454	457,754	16,021	35,213	67,688
19 2006				10,292	227,258	7,954	18,939	37,185				6,162	195,283	6,835	16,274	29,271				16,454	422,541	14,789	35,213	66,456
20 2007				10,292	208,319	7,291	18,939	36,522				6,162	179,009	6,265	16,274	28,701				16,454	387,328	13,556	35,213	65,223
21 2008				10,292	189,380	6,628	18,938	35,858				6,162	162,735	5,696	16,274	28,132				16,454	352,115	12,324	35,212	63,990
22 2009				10,292	170,443	5,966	18,938	35,196				6,162	146,461	5,126	16,274	27,562				16,454	316,904	11,092	35,212	62,758
23 2010				10,292	151,504	5,303	18,938	34,533				6,162	130,187	4,557	16,274	26,993				16,454	281,691	9,860	35,212	61,526
24 2011				10,292	132,566	4,640	18,938	33,870				6,162	113,913	3,987	16,274	26,423				16,454	246,479	8,627	35,212	60,293
25 2012				10,292	113,628	3,977	18,938	33,207				6,162	97,639	3,417	16,274	25,853				16,454	211,267	7,394	35,212	59,060
26 2013				10,292	96,690	3,314	18,938	32,544				6,162	81,365	2,848	16,273	25,283				16,454	176,055	6,162	35,211	57,827
27 2014				10,292	75,752	2,651	18,938	31,881				6,162	65,092	2,278	16,273	24,713				16,454	140,844	4,929	35,211	56,594
28 2015				10,292	56,814	1,988	18,938	31,218				6,162	48,819	1,709	16,273	24,144				16,454	105,633	3,697	35,211	55,362
29 2016				10,292	37,876	1,326	18,938	30,556				6,162	32,546	1,139	16,273	23,574				16,454	70,422	2,465	35,211	54,130
30 2017				10,292	18,938	663	18,938	29,893				6,162	16,273	570	16,273	23,005				16,454	35,211	1,233	35,211	52,898
Total	73,512	378,770	452,282	278,910	0	212,558	378,770	943,750	7	325,475	325,482	173,422	0	226,516	325,475	725,420	73,519	704,245	777,764	452,332	0	439,074	704,245	1,669,170

Notes: 1) Long-term Loans and Balance of Loans are at the beginning of the year.
2) Repayment of Loans are at the end of the year.

Table 9-2-9 Statement of Source and Application of Funds in Case 3

(Unit: Thousands Baht)

Funds	Existing Channels (NH-6, RH-2, The Mechanical Center)								Chao Phraya Second Channel (NH-8, Capital Dredging)								Total								
	Source		Application						Source		Application						Source		Application						
	HD Funds (1)	Long-term Loans	Capital Costs	Maintenance & Operation Costs (2)	Balance of Loans	Interest on Loans (9.5%) (3)	Repayment of Loans (4)	HD Total Funds (1)+(2)+(3)+(4)	HD Funds (5)	Long-term Loans	Capital Costs	Maintenance & Operation Costs (6)	Balance of Loans	Interest on Loans (9.5%) (7)	Repayment of Loans (8)	HD Total Funds (5)+(6)+(7)+(8)	HD Funds (9)	Long-term Loans	Capital Costs	Maintenance & Operation Costs (10)	Balance of Loans	Interest on Loans (9.5%) (11)	Repayment of Loans (12)	HD Total Funds (9)+(10)+(11)+(12)	
1 1988		36,741	36,741		36,741	3,490		3,490		125,045	125,045		125,045	11,879		11,879		161,786	161,786		161,786	15,369		15,369	
2 1989		136,364	136,364		173,105	16,445		16,445		200,437	200,437		325,482	30,921		30,921		336,801	336,801		498,587	47,366		47,366	
3 1990		53,193	53,193	5,659	226,298	21,498		27,157				6,605	325,482	30,921		37,526		53,193	53,193	12,264	551,780	52,419		64,683	
4 1991		34,766	34,766	5,659	261,064	24,801		30,460				6,605	325,482	30,921		37,526		34,766	34,766	12,264	586,546	55,722		67,986	
5 1992				10,292	261,064	24,801		35,093				6,162	325,482	30,921		37,083				16,454	586,546	55,722		72,176	
6 1993				10,292	261,064	24,801		35,093				6,162	325,482	30,921		37,083				16,454	586,546	55,722		72,176	
7 1994				10,292	261,064	24,801		35,093				6,162	325,482	30,921		37,083				16,454	586,546	55,722		72,176	
8 1995		57,365	57,365	10,292	318,429	30,251	34,791	75,334				6,162	325,482	30,921	25,038	62,121		57,365	57,365	16,454	643,911	61,172	59,829	137,455	
9 1996		133,853	133,853	10,292	417,491	39,662	34,791	84,745				6,162	300,444	28,542	25,037	59,741		133,853	133,853	16,454	717,935	68,204	59,828	144,486	
10 1997				10,292	382,700	36,357	34,791	81,440				6,162	275,407	26,164	25,037	57,363				16,454	658,107	62,521	59,828	138,803	
11 1998				10,292	347,909	33,051	34,791	78,134				6,162	250,370	23,785	25,037	54,984				16,454	598,279	56,836	59,828	133,118	
12 1999				10,292	313,118	29,746	34,791	74,829				6,162	225,333	21,407	25,037	52,606				16,454	538,451	51,153	59,828	127,435	
13 2000				10,292	278,327	26,441	34,791	71,524				6,162	200,296	19,028	25,037	50,227				16,454	478,623	45,469	59,828	121,751	
14 2001				10,292	243,536	23,136	34,791	68,219				6,162	175,259	16,650	25,037	47,849				16,454	418,795	39,786	59,828	116,068	
15 2002				10,292	208,745	19,831	34,791	64,914				6,162	150,222	14,271	25,037	45,470				16,454	358,967	34,102	59,828	110,384	
16 2003				10,292	173,954	16,526	34,791	61,609				6,162	125,185	11,893	25,037	43,092				16,454	299,139	28,419	59,828	104,701	
17 2004				10,292	139,163	13,220	34,791	58,303				6,162	100,148	9,514	25,037	40,713				16,454	239,311	22,734	59,828	99,016	
18 2005				10,292	104,372	9,915	34,791	54,998				6,162	75,111	7,136	25,037	38,335				16,454	179,483	17,051	59,828	93,333	
19 2006				10,292	69,581	6,610	34,771	51,693				6,162	50,074	4,757	25,037	35,956				16,454	119,655	11,367	59,828	87,649	
20 2007				10,292	34,790	3,305	34,790	48,387				6,162	25,037	2,379	25,037	33,578				16,454	59,827	5,684	59,827	81,965	
Total		0	452,282	452,282	175,990	0	428,688	452,282	1,056,960	0	325,482	325,482	111,802	0	413,852	325,482	851,136	0	777,764	777,764	287,792	0	842,540	777,764	1,908,096

Notes: 1) Long-term Loans and Balance of Loans are at the beginning of the year.
2) Repayment of Loans are at the end of the year.

Table 9-2-10 Statement of Source and Application of Funds in Case 4

(Unit: Thousands Baht)

Fiscal Year	Existing Channels (NH-6, RH-2, The Mechanical Center)								Chao Phraya Second Channel (NH-8, Capital Dredging)								Total								
	Source		Application						Source		Application						Source		Application						
	HD Funds (1)	Long-term Loans (2)	Capital Costs (3)	Maintenance & Operation Costs (4)	Balance of Loans (5)	Interest on Loans (3.5%) (6)	Repayment of Loans (7)	HD Total Funds (1)+(2)+(3)+(4) (8)	HD Funds (9)	Long-term Loans (10)	Capital Costs (11)	Maintenance & Operation Costs (12)	Balance of Loans (13)	Interest on Loans (3.5%) (14)	Repayment of Loans (15)	HD Total Funds (9)+(10)+(11)+(12)+(13)+(14)+(15) (16)	HD Funds (17)	Long-term Loans (18)	Capital Costs (19)	Maintenance & Operation Costs (20)	Balance of Loans (21)	Interest on Loans (3.5%) (22)	Repayment of Loans (23)	HD Total Funds (17)+(18)+(19)+(20)+(21)+(22)+(23) (24)	
1 1988		36,741	36,741		36,741	1,286	1,286		125,045	125,045		125,045	4,377		4,377		161,786	161,786		161,786	5,663			5,663	
2 1989		136,364	136,364		173,105	6,059	6,059		200,437	200,437		325,482	11,392		11,392		336,801	336,801		498,587	17,451			17,451	
3 1990		53,193	53,193	5,659	226,298	7,920	13,579				6,605	325,482	11,392		17,997		53,193	53,193	12,264	551,780	19,312			31,576	
4 1991		34,766	34,766	5,659	261,064	9,137	14,796				6,605	325,482	11,392		17,997		34,766	34,766	12,264	586,546	20,529			32,793	
5 1992				10,292	261,064	9,137	19,429				6,162	325,482	11,392		17,554				16,454	586,546	20,529			36,983	
6 1993				10,292	261,064	9,137	19,429				6,162	325,482	11,392		17,554				16,454	586,546	20,529			36,983	
7 1994				10,292	261,064	9,137	19,429				6,172	325,482	11,392		17,554				16,454	586,546	20,529			36,983	
8 1995		57,365	57,365	10,292	318,429	11,145	21,437				6,162	325,482	11,392		17,554		57,365	57,365	16,454	643,911	22,537			38,991	
9 1996		133,853	133,853	10,292	452,282	15,830	26,122				6,162	325,482	11,392		17,554		133,853	133,853	16,454	777,764	27,222			43,676	
10 1997				10,292	452,282	15,830	26,122				6,162	325,482	11,392		17,554				16,454	777,764	27,222			43,676	
11 1998				10,292	452,282	15,830	22,614	48,736			6,162	325,482	11,392	16,275	33,829				16,454	777,764	27,222	38,889		82,565	
12 1999				10,292	429,668	15,830	22,614	47,944			6,162	309,207	10,822	16,275	33,259				16,454	738,875	25,860	38,889		81,203	
13 2000				10,292	407,054	14,247	22,614	47,153			6,162	292,932	10,253	16,274	32,689				16,454	699,986	24,500	38,888		79,842	
14 2001				10,292	384,440	13,455	22,614	46,361			6,162	276,658	9,683	16,274	32,119				16,454	661,098	23,138	38,888		78,480	
15 2002				10,292	361,826	12,664	22,614	45,570			6,162	260,384	9,113	16,274	31,549				16,454	622,210	21,777	38,888		77,119	
16 2003				10,292	339,212	11,872	22,614	44,778			6,162	244,110	8,544	16,274	30,980				16,454	583,322	20,416	38,888		75,758	
17 2004				10,292	316,598	11,081	22,614	43,987			6,162	227,836	7,974	16,274	30,410				16,454	544,434	19,055	38,888		74,397	
18 2005				10,292	293,984	10,289	22,614	43,195			6,162	211,562	7,405	16,274	29,841				16,454	505,546	17,694	38,888		73,036	
19 2006				10,292	271,370	9,498	22,614	42,404			6,162	195,288	6,835	16,274	29,271				16,454	466,658	16,333	38,888		71,675	
20 2007				10,292	248,756	8,706	22,614	41,612			6,162	179,014	6,265	16,274	28,701				16,454	427,770	14,971	38,888		70,313	
21 2008				10,292	226,142	7,915	22,614	40,821			6,162	162,740	5,696	16,274	28,132				16,454	388,882	13,611	38,888		68,953	
22 2009				10,292	203,528	7,123	22,614	40,029			6,162	146,466	5,126	16,274	27,562				16,454	349,994	12,249	38,888		67,591	
23 2010				10,292	180,914	6,332	22,614	39,238			6,162	130,192	4,557	16,274	26,993				16,454	311,106	10,889	38,888		66,231	
24 2011				10,292	158,300	5,541	22,614	38,447			6,162	113,918	3,987	16,274	26,423				16,454	272,218	9,528	38,888		64,870	
25 2012				10,292	135,686	4,749	22,614	37,655			6,162	97,644	3,418	16,274	25,854				16,454	233,330	8,167	38,888		63,509	
26 2013				10,292	113,072	3,958	22,614	36,864			6,162	81,370	2,848	16,274	25,284				16,454	194,442	6,806	38,888		62,148	
27 2014				10,292	90,458	3,166	22,614	36,072			6,162	65,096	2,278	16,274	24,714				16,454	155,554	5,444	38,888		60,786	
28 2015				10,292	67,844	2,375	22,614	35,281			6,162	48,822	1,709	16,274	24,145				16,454	116,666	4,084	38,888		59,426	
29 2016				10,292	45,230	1,583	22,615	34,490			6,162	32,548	1,139	16,274	23,575				16,454	77,778	2,722	38,889		58,065	
30 2017				10,292	22,615	792	22,615	33,699			6,162	16,274	570	16,274	23,006				16,454	38,889	1,362	38,889		56,705	
Total		0	452,282	452,282	278,910	0	260,832	452,282	992,024	0	325,482	325,482	173,422	0	226,519	325,492	725,423	0	777,764	777,764	452,332	0	487,351	777,764	1,717,447

Notes: 1) Long-term loans and Balance of Loans are at the beginning of the year.
2) Repayment of loans are at the end of the year.

9-2-2 Examination of Plans to Increase Revenue

In this section, some plans to increase revenue for HD will be examined.

(1) Repairing of Private Vessels

Under existing law, if the Mechanical Center belongs directly to HD, it can not gain revenues through the repairing of private vessels. But it is possible for the Mechanical Center to gain revenues if the existing law is amended. Therefore, we will base our study on the possibility that the Mechanical Center will repair private vessels.

1) Petroleum Tankers

Petroleum tankers ranging mainly from 2,000 D.W.T. to 3,000 D.W.T. serve coastal shipping in Thailand by the transportation of petroleum. These petroleum tankers are ordinarily maintained and repaired at the shipyard in Singapore, except for minor repairs which are done at Bangkok Dock Co., Ltd.¹⁾ These petroleum tankers are, therefore, not potential users of the Mechanical Center.

2) Cargo Vessels

Large-sized cargo vessels of more than 3,000 D.W.T. are maintained and repaired at the shipyards in Singapore. Cargo vessels less than 3,000 D.W.T. are maintained and repaired at the shipyards in the vicinity of Bangkok. The small boats are repaired at the local shipyards. These cargo vessels are maintained and repaired at existing facilities and so there is no demand for repair at HD's Mechanical Center.²⁾

3) Tin Mining Dredgers

There are high-grade tin deposits in the sea-bed of Andaman Sea in front of Ranong, Phuket and Krabi, so that many tin mining dredgers are operating on the sea. Many of them are suction cutter dredgers.

The biggest tin mining agency is OMO (Offshore Mining Organization). OMO was established in 1975 as a government enterprise to dig out the abundant tin deposits in the sea-bed in front of Phuket and Phang-nga. OMO has a large-sized tin mining dredger named "BODAN" that operates on the sea in front of Phuket.

The existing large-sized tin mining dredgers are presented in Table 9-2-11, which shows that four large-sized tin mining dredgers desire to be repaired at HD's Mechanical Center, if it will be constructed in Phuket.

Besides the above-mentioned, about 400 of the small-sized tin mining dredgers are operating. These are the twin-hull type suction cutter dredgers. Minor repairs of these dredgers are done by themselves and the big repairs are done at the shipyards in Singapore.

As we have seen, there will be some demand for repairing at HD's Mechanical Center, if it will be constructed in Phuket. In the preceding chapters of this report, however, we've shown this to be unlikely, so that it is impossible to consider the repairing the tin mining dredgers as a source of revenue.

(2) Lending the Repair Facilities to Private Shipyards

As examined in Chapter 6, the annual docking ratio of HD's Mechanical Center is nearly 100%. It is, therefore, impossible to lend the repair facilities to private shipyards.

(3) Possibility of Collecting Channel Dues

There is an opinion that the expense of the capital dredging is a social cost, but that the expense of the maintenance dredging must be partially recovered. We will, therefore, examine the possibility of collecting channel dues.

HD's revenue was 59,887,800 Baht in 1984, which accounts for only 9% of the expenditure, as shown in Table 9-2-12. The water transport fees account for 85% of the revenue. The water transport fees are the registration fees of all domestic vessels such as fishing boats, barges, domestic cargo vessels, etc. for HD. The Finance Division and the Regional Harbor Master's Office collect the fees and transfer them to the Ministry of Finance. There is a penalty in delay fees for the vessels that register after the year.

At present, HD does not collect channel dues. On the other hand, PAT collects channel dues simultaneously with other port dues from the ship owners at the following rate.³⁾

"Channel Dues

This is a tariff collected from vessels sailing through the channel to the inner area. The rates are:

- A vessel that has net registered tonnage under 500 tons will not pay channel dues.
- A vessel with net registered tonnage from 500 to 1,500 tons will pay 3 baht per ton.
- A vessel with net registered tonnage over 1,500 tons shall pay 5 baht per ton."

The problems with the collection of channel dues by HD are as follows:

- ① The amendment of existing law is necessary.
- ② It is very difficult, politically and socially, to collect channel dues from the fishing boats, because they have no bearing capacity.
- ③ We will examine the channels such as Bandon, Songkhla, Kha-norm, Phuket, etc. which are used by the petroleum tankers and the cargo vessels.
The general cargo shipping is sharply competing with land transportation at present. From the viewpoint of the fairness of the charges compared with what land transportation pays, it is not proper to collect channel dues from the cargo vessels.
It will be possible to collect channel dues from the petroleum tankers, because they have the bearing capacity.

If channel dues were collected from petroleum tankers in 1983, channel dues will total 759,400 Baht, as shown in Table 9-2-13. Channel dues in 2000 will total to 1,125,000 Baht, multiplied by the yearly growth rate of petroleum consumption 2.2% (Table 2-1-5).

- ④ It is necessary to prepare a collection system.

[References]

- 1) Interview at T.P.T.C. (Thai Petroleum Transports Co., Ltd.).
- 2) Interview at T.S.A. (Thai Shipowners' Association).
- 3) PAT, "Handbook of Port Authority of Thailand, 1983"

Table 9-2-11 Tin Mining Dredgers

Items	Organization	Dimension				Repairing	
		Width (m)	Length (m)	Height (m)	Draft (m)	Present Situation	Demands
Tin Mining Dredger							
BODAN	OMO	22.0	69.0	5.0		BODAN was repaired at the shipyard in Singapore. Repair charges cost 10,000,000 Baht.	OMO desires to have BODAN repaired at HD's Mechanical Center, if constructed in Phuket.
THAIWATANA No. 1	THAIWATANA Co., Ltd.	22.0	70.0	4.5	2.8	Minor repairs are done by themselves. Big repairs are done at the shipyard in Singapore.	THAIWATANA desires to have its dredgers repaired at HD's Mechanical Center, if constructed in Phuket.
THAIWATANA No. 2	THAIWATANA Co., Ltd.	8.5	42.0	5.5	2.8		
ASC 1	Asia Stunnum Co., Ltd.	18.0	76.3	2.9	1.6	Asia Stunnum has a shipyard with a slip way where most repairs are made. Annual repair charges are 20,000,000 Baht. Big repairs are done at the shipyard in Singapore.	Asia Stunnum does not desire the repair of its dredgers at HD's Mechanical Center.
ASC 2 Fuso Maru	Asia Stunnum Co., Ltd.	14.7	52.8	4.6	2.6		
ASC 5	Asia Stunnum Co., Ltd.						
Large-size dredger	Thaisarco Smeltery						

Source: Inquiry at each organization.

Table 9-2-12 HD's Revenue

(Unit: Baht)

Items \ Fiscal Year	1982	1983	1984
Sales of equipment parts	964,000	800,000	2,587,000
Water transport fees	48,096,000	48,424,000	51,268,000
Penalties	1,251,000	1,722,000	3,132,000
Others	4,000	82,000	1,266,800
Total	51,914,000	52,461,000	59,887,800

Source: HD

Table 9-2-13 Estimation of Channel Dues in 1983

Items \ Port	(A) Volume of petroleum loaded (Thousand metric ton)	(B) Average vessel size (D.W.T.)	(C) Number of vessels calling ($A/B \times f^{1}$)	(D) Average vessel size ($B \times 0.34$) (N.T.)	(E) Channel due rates ²⁾ (Baht/N.T.)	(F) Channel dues ($C \times D \times E$) (Baht)
Phuket	81,321.0	2,000	46	680	3	93,840
Kantang	7,825.6	900	10	306	—	—
Chumporn	70,951.9	400	197	136	—	—
Bandon	273,381.9	1,050	290	357	—	—
Kha Norm	160,000.0	1,500	119	510	3	182,080
Pak Phanang	153,596.4	1,050	163	357	—	—
Songkhla	240,949.0	2,000	134	680	3	273,360
Samut Songkram	184,437.8	2,000	103	680	3	210,120
Bangkok, Siracha	224.1	400	1	136	—	—
Total	1,172,687.6					759,390

Source: (A) . . . Table 2-1-9, (B) . . . Table 3-2-8

Notes 1) Loading capacity ratio $f = 0.9$

2) Channel due rates are supposed as same as PAT.

APPENDICES

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APPENDIX 1 Data for Appraisal of Channel Development Plans

Table A.1-1 Forecast Number of Marine Fishing Vessels

Year	No. of Fishing Boats	Year	No. of Fishing Boats
1978	9,167	2002	36,460
1979	9,225	2003	37,606
1980	11,777	2004	38,753
1981	12,692	2005	39,899
1982	13,678	2006	41,045
1983	14,337	2007	42,192
1984	15,825	2008	43,338
1985	16,971	2009	44,485
1986	18,117	2010	45,631
1987	19,264	2011	46,778
1988	20,410	2012	47,924
1989	21,557	2013	49,070
1990	22,703	2014	50,217
1991	23,849	2015	51,363
1992	24,996	2016	52,510
1993	26,142	2017	53,656
1994	27,289	2018	54,803
1995	28,435	2019	55,949
1996	29,581	2020	57,095
1997	30,728	2021	58,241
1998	31,874		
1999	33,021		
2000	34,167		
2001	35,313		

Table A.1-2 Labour Cost of Fishing Vessels

GT	No. of Crew	Chief (Baht/month/crew)	Deputy chief	Mechanical engineer or mechanic	Crew	Total wages per month (Baht/month)	(1) Wages per hour (Baht/hour)
1	2	1 2,000	-	-	1 2,000	4,000	19.2
5	4	1 3,000	-	1 2,500	2 2,000	9,500	45.6
10	8	1 3,000	-	1 2,500	6 2,000	17,500	83.9
20	11	1 4,000	-	1 2,500	9 2,000	24,500	117.5
30	15	1 4,000	-	1 2,500	13 2,000	32,500	155.8
40	17	1 5,000	1 4,500	1 2,500	14 2,000	40,000	191.8
50	19	1 5,000	1 4,500	1 2,500	16 2,000	44,000	211.0
60	22	1 5,000	1 4,500	1 2,500	19 2,000	50,000	239.7
70	24	1 6,000	1 4,500	1 3,000	21 2,000	55,500	266.1
80	25	1 6,000	1 4,500	1 3,000	22 2,000	57,500	275.7
90	27	1 6,000	1 4,500	1 3,000	24 2,000	61,500	294.9
100	29	1 8,000	1 5,000	1 4,000	26 2,000	69,000	330.8

Notes(1): Weekly working hours are assumed forty eight hours taking account of the standard working hours in Thailand.

Table A.1-3 (1/7) Petroleum Transportation Cost by Shipping Route by Tanker

Route: Siracha, Bangkok-Kantang (At 1983 prices)

No. of Tanker	DWT (metric tons)	Cargo Capacity (metric tons)	Draft (meter)	Ship price (Thousand Baht)	Crew cost per year (Thousand Baht)	No. of voyages per year	Operating expenses per voyage (Thousand Baht)			Vessel expenses per voyage (Thousand Baht per voyage)				Total cost per voyage (Thousand Baht)	Depreciation per voyage (Thousand Baht)	Unit transportation cost per petroleum volume (Baht/ton)		
							Fuel	Oil	Others	Maintenance	Repairs	Insurance	Others				Administration	
																	Crew cost	and
2	550	495	2.8	32,000	998.4	26	76.9	11.9	38.4	36.9	12.3	24.6	11.9	49.2	262.1	529.5		
3	600	540	3.0	30,000	879.6	21	123.0	15.4	41.9	42.9	14.3	28.6	15.4	57.1	338.6	527.0		
4	620	558	2.7	30,000	879.6	21	123.6	15.4	41.9	42.9	14.3	28.6	15.4	57.1	339.2	607.9		
5	813	732	3.7	35,000	998.4	26	129.0	15.1	38.4	40.4	13.5	26.9	15.1	53.8	332.2	453.8		
7	1,047	942	4.1	35,000	1,141.2	28	137.5	15.2	40.8	37.5	12.5	25.0	15.2	50.0	333.7	554.2		
8	1,558	1,402	4.7	41,000	1,141.2	26	208.0	20.5	43.9	47.3	15.8	31.5	20.5	63.1	430.6	321.4		
10	2,040	1,836	5.1	49,000	1,773.6	28	254.0	24.6	63.3	52.5	17.5	35.0	24.6	70.0	541.5	294.9		
11	2,088	1,879	4.0	75,000	2,198.4	26	207.0	29.0	84.6	86.5	28.9	57.7	29.0	115.4	638.1	339.6		
12	2,740	2,466	5.5	76,000	1,915.2	28	281.0	31.0	68.4	81.4	27.1	54.3	31.0	108.6	682.8	276.9		

Table A.1-3 (2/7) Petroleum Transportation Cost by Shipping Route by Tanker

Route: Siracha Bangkok-Chumporn (At 1985 prices)

No. of Tanker	DWT (metric tons)	Cargo Capacity (metric tons)	Draft (meter)	Ship price (Thousand Baht)	Crew cost per year (Thousand Baht)	No. of voyages per year	Operating expenses per voyage (Thousand Baht)			Vessel expenses per voyage (Thousand Baht per voyage)				Total cost per voyage (Thousand Baht)	Depreciation per voyage (Thousand Baht)	Unit transportation cost per petroleum volume (Baht/ton)		
							Fuel	Oil	Others	Maintenance	Repairs	Insurance	Others				Administration	
																	Crew cost	and
1	380	342	3.0	24,000	576.0	69	20.7	3.2	8.3	10.4	3.5	7.0	3.2	13.9	70.2	205.3		
2	550	495	2.8	32,000	998.4	86	14.1	3.1	11.6	11.2	3.7	7.4	3.1	16.9	69.1	139.6		

Table A.1-3 (3/7) Petroleum Transportation Cost by Shipping Route by Tanker

Route: Suez, Bangkok-Bandun (At 1985 prices)

No. of Tanker	DWT	Cargo Capacity (metric tons)	Draft (meter)	Ship price (Thousand Baht)	Crew cost per year (Thousand Baht)	No. of voyages per year	Operating expenses per voyage (Thousand Baht)			Vessel expenses per voyage (Thousand Baht per voyage)				Depreciation per voyage (Thousand Baht)	Total cost per voyage (Thousand Baht)	Unit transportation cost per petroleum volume (Baht/ton)
							Fuel Oil	Others	Others	Maintenance	Insurance	Others	Administration			
2	550	495 *(140)	2.8 *(1.5)	32,000	998.4	69	18.5	4.0	4.0	13.9	4.6	9.2	4.0	18.6	87.3	176.4 *(623.6)
3	600	540	3.0	30,000	879.6	69	29.0	4.3	4.3	13.0	4.3	8.6	4.3	17.4	93.6	173.3
4	620	558	2.7	30,000	879.6	69	29.0	4.3	4.3	13.0	4.3	8.6	4.3	17.4	93.6	167.7
5	813	732	3.7	35,000	998.4	69	31.5	4.3	4.3	15.2	5.1	10.2	4.8	20.3	106.4	145.4
7	1,047	942	4.1	35,000	1,141.2	86	32.0	4.3	4.3	12.2	4.1	8.2	4.3	16.3	94.6	100.4
8	1,558	1,402	4.7	41,000	1,141.2	89	50.0	6.3	6.3	17.8	5.9	11.8	6.3	23.8	138.5	98.8
10	2,040	1,836	5.1	49,000	1,773.6	86	60.5	6.9	6.9	17.1	5.7	11.4	6.9	22.8	151.9	82.7
11	2,088	1,879	4.0	75,000	2,198.4	69	50.5	9.6	9.6	32.6	10.9	21.8	9.6	43.5	210.3	111.9
12	2,740	2,466	5.5	76,000	1,915.2	86	67.0	8.9	8.9	26.5	8.8	17.6	8.9	35.3	195.4	79.2

Table A.1-3 (4/7) Petroleum Transportation Cost by Shipping Route by Tanker

Route: Bang Phakong-Kha Norm (At 1985 prices)

No. of Tanker	DWT	Cargo Capacity (metric tons)	Draft (meter)	Ship price (Thousand Baht)	Crew cost per year (Thousand Baht)	No. of voyages per year	Operating expenses per voyage (Thousand Baht)			Vessel expenses per voyage (Thousand Baht per voyage)				Depreciation per voyage (Thousand Baht)	Total cost per voyage (Thousand Baht)	Unit transportation cost per petroleum volume (Baht/ton)
							Fuel Oil	Others	Others	Maintenance	Insurance	Others	Administration			
2	550	495	2.8	32,000	998.4	69	20.0	4.0	4.0	13.9	4.6	9.2	4.0	18.6	88.7	179.2
3	600	540	3.0	30,000	879.6	69	30.5	4.3	4.3	13.0	4.3	8.6	4.3	17.4	95.0	175.9
4	620	558	2.7	30,000	879.6	69	30.5	4.3	4.3	13.0	4.3	8.6	4.3	17.4	95.0	170.3
5	1,000	900 *(699)	4.0 *(3.5)	45,000	1,257.6	69	54.0	6.9	6.9	19.6	6.5	13.6	6.9	26.1	151.3	168.1 *(216.5)
9	2,000	1,800 *(1,398)	4.0 *(3.5)	60,000	2,228.4	69	94.5	10.7	10.7	26.1	8.7	17.4	10.7	34.8	235.2	130.7 *(168.2)

*: Parenthesis stands for partially loaded condition.

Table A.1-3 (5/7) Petroleum Transportation Cost by Shipping Route by Tanker

Route: Siracha, Bangkok-Pak Phanang (At 1985 prices)

No. of Tanker	DWT (metric tons)	Cargo Capacity (metric tons)	Draft (meter)	Ship price (Thousand Baht)	Crew Cost per year (Thousand Baht)	No. of voyages per year	Operating expenses per voyage (Thousand Baht)			Vessel expenses per voyage (Thousand Baht per voyage)				Depreciation per voyage (Thousand Baht)	Total cost per voyage (Thousand Baht)	Unit transportation cost per petroleum volume (Baht/ton)	
							Fuel	Oil	Others	Maintenance	Repairs	Insurance	Others				Administration
2	550	495	2.8	32,000	998.4	69	23.0	4.2	4.2	14.5	13.9	4.6	9.2	4.2	92.1	186.1	
		*(392)	*(2.4)													*(234.9)	
3	600	540	3.0	30,000	879.6	57	36.0	5.2	5.2	15.4	15.8	5.3	10.6	5.2	114.7	212.4	
4	620	558	2.7	30,000	879.6	57	36.0	5.2	5.2	15.4	15.8	5.3	10.6	5.2	114.5	205.2	
5	813	732	3.7	35,000	998.4	69	39.0	5.2	5.2	14.5	15.2	5.1	10.2	5.2	114.8	156.8	
7	1,047	942	4.1	35,000	1,141.2	69	42.0	5.5	5.5	16.5	15.2	5.1	10.2	5.5	120.4	127.8	
8	1,558	1,402	4.7	41,000	1,141.2	69	62.0	6.9	6.9	16.5	17.8	5.9	11.8	6.9	151.5	108.1	
		*(1,125)	*(4.0)													*(134.7)	

*: Parenthesis stands for partially loaded condition.

Table A.1-3 (6/7) Petroleum Transportation Cost by Shipping Route by Tanker

Route: Siracha, Bangkok-Songkhla (At 1985 prices)

No. of Tanker	DWT (metric tons)	Cargo Capacity (metric tons)	Draft (meter)	Ship price (Thousand Baht)	Crew Cost per year (Thousand Baht)	No. of voyages per year	Operating expenses per voyage (Thousand Baht)			Vessel expenses per voyage (Thousand Baht per voyage)				Depreciation per voyage (Thousand Baht)	Total cost per voyage (Thousand Baht)	Unit transportation cost per petroleum volume (Baht/ton)	
							Fuel	Oil	Others	Maintenance	Repairs	Insurance	Others				Administration
2	550	495	2.8	32,000	998.4	57	27.5	5.1	5.1	17.5	16.8	5.6	11.2	5.1	111.3	224.8	
3	600	540	3.0	30,000	879.6	49	43.5	6.1	6.1	18.0	18.4	6.1	12.2	6.1	134.8	249.6	
4	620	558	2.7	30,000	879.6	49	43.5	6.1	6.1	18.0	18.4	6.1	12.2	6.1	134.8	241.6	
5	813	732	3.7	35,000	998.4	57	46.5	6.3	6.3	17.5	18.4	6.1	12.2	6.3	137.8	188.3	
7	1,047	942	4.1	35,000	1,141.2	57	50.5	6.6	6.6	20.0	18.4	6.1	12.2	6.6	144.9	153.8	
8	1,558	1,402	4.7	41,000	1,141.2	57	74.5	8.3	8.3	20.0	21.6	7.2	14.4	8.3	183.1	130.6	
10	2,040	1,836	5.1	49,000	1,773.6	57	93.0	10.3	10.3	31.1	25.8	8.6	17.2	10.5	231.1	125.9	
11	2,088	1,879	4.0	75,000	2,198.4	57	74.5	12.2	12.2	38.6	39.5	13.2	26.4	12.2	269.3	143.3	
12	2,740	2,466	5.5	76,000	1,915.2	57	102.5	13.5	13.5	33.6	40.0	13.3	26.6	13.5	296.2	120.1	

*: Parenthesis stands for partially loaded condition.

Table A.1-3 (7/7) Petroleum Transportation Cost by Shipping Route by Tanker

Route: Siracha, Bangkok-Samut Song Krao (At 1985 prices)

No. of Tanker	DWT	Cargo Capacity (metric tons)	Draft (meter)	Ship price (Thousand Baht)	Crew Cost per year (Thousand Baht)	No. of voyages per year	Operating expenses per voyage (Thousand Baht)			Vessel expenses per voyage (Thousand Baht per voyage)			Depreciation per voyage (Thousand Baht)	Total cost per voyage (Thousand Baht)	Unit transportation cost per petroleum volume (Baht/ton)
							Fuel Oil	Others	Admin-istration	Maintenance and repairs	Insurance	Others			
2	550	495	2.8	32,000	998.4	115	4.6	2.1	8.3	2.8	5.6	2.1	11.2	45.5	91.9
3	600	540	3.0	30,000	879.6	115	7.0	2.0	7.8	2.5	5.2	2.0	10.5	44.7	82.8
4	620	558	2.7	30,000	879.6	115	7.0	2.0	7.6	2.6	5.2	2.0	10.5	44.7	80.1
5	813	732	3.7	35,000	998.4	115	9.0	2.4	9.1	3.0	6.0	2.4	12.3	51.8	70.8
7	1,047	942	4.1	35,000	1,141.2	115	9.0	2.5	9.1	3.0	6.0	2.5	12.3	54.2	57.5
8	1,558	1,402	4.7	41,000	1,141.2	115	13.0	2.9	10.7	3.6	7.2	2.9	14.4	64.7	46.1
10	2,040	1,936	5.1	49,000	1,773.6	115	17.0	3.8	12.8	4.3	8.6	3.8	17.2	83.0	45.2
11	2,088	1,879	4.0	75,000	2,198.4	115	12.5	4.8	19.6	6.5	13.0	4.8	26.3	106.5	56.7
12	2,740	2,466	5.5	76,000	1,915.2	115	18.5	5.1	19.8	6.6	13.2	5.1	26.6	111.6	45.3

APPENDIX 2 Tables and Figures of Dredging Fleet and Operations

Table A.2-1 Ancillary Vessels

No.	Name	Manufacturing Country	Year Built	Gross Tonnage (tons)	Dimensions (m)				Main Engine (HP)	Speed (knots)	Base Port	No. of Crew	Price (million baht)
					L	B	D	Draft					
I.	Survey Boat S1	Japan	1966	210.11	35.5	7	2.37	2.1	400	12	Bangkok	23	8.0
	Survey Boat S2	Japan	1969	251.48	39.4	8	3.20	2.0	300 x 2	12	Bangkok	23	9.5
II.	Tugboat Tug 1	Japan	1982	224.42	35	7.8	-	2.50	1600	12	Bangkok	15	41.2

Source: HD

Table A.2-2 Discharging Lines

No.	Dredger	Discharging Pipe			Floater			Rubber Sleeve Quantity (sets)	Ball Joint Quantity (sets)
		Diameter (mm)	Length (m)	Quantity (sets)	Diameter (mm)	Length (m)	Quantity (sets)		
1	C-1	356	6	32	750	6	60	20	2
2	C-5	356	6	30	750	6	60	10	6
3	C-7	356	6	18	750	6	36	7	2
4	C-15	356	6	32	750	6	64	24	1
5	C-17	356	6	32	750	6	64	30	2
6	C-19	356	6	38	750	6	76	20	2
7	C-21	356	6	N/A	750	6	N/A	N/A	N/A
8	C-23	508	6	29	1000	4.5	58	34	2
9	C-25	508	6	35	1000	4.5	70	36	1

Source: Field Survey

Table A.2-3 Survey Instruments

Unit: Sets

No.	Item	H-2	H-4	H-6	H-8	C-1	C-5	C-7	C-15	C-17	C-19	C-21	C-23	C-25	Survey Team	Total
1	Echo Sounder	1	1	1	1								1	1	4	10
2	Sextant	2	2												7	11
3	Theodolite														1	1
4	Ranger System				1								1	1		3
5	Station Pointer														9	9
6	Compass	2	2	2		1	1	1	1	1	2	2	1	1	4	23
7	Binoculars	4	4	1	4								1	1	7	22

Source: Field Survey

Table A.2-4 Personnel and Shift for Cutter Suction Dredgers

No.	Classification	Dredger											
		C-1	C-5	C-7	C-15	C-17	C-19	C-21	C-23	C-25			
1	Dredge master	1	-	-	1	1	1	1	1	1	1	1	1
2	Officer	4	4	4	4	4	4	4	4	4	4	4	4
3	Second Officer	4	4	4	4	4	4	4	4	4	4	4	4
4	Sailor	4	4	4	4	4	4	4	4	4	4	4	4
5	Fitter	4	4	4	4	4	4	4	4	4	4	4	4
6	Worker	16	16	16	16	16	16	16	16	16	16	16	16
7	Tender boat	8	8	4	8	8	8	8	8	8	8	8	8
8	Repair and maintenance	2	3	3	4	4	1	1	4	4	4	4	4
9	Temporary reinforcements	-	-	2	-	-	-	-	-	-	-	-	-
	Total	43	43	41	45	45	42	42	45	45	45	45	45

No.	Classification	Dredger																	
		Day shift only					One shift												
		C-1	C-5	C-7	C-15	C-17	C-19	C-21	C-23	C-25	C-1	C-5	C-7	C-15	C-17	C-19	C-21	C-23	C-25
1	Dredge master	1	-	-	1	1	(1)	(1)	1	1	1	1	1	1	1	1	1	1	1
2	Officer										1	1	1	1	1	1	1	1	1
3	Second officer										1	1	1	1	1	1	1	1	1
4	Sailor										1	1	1	1	1	1	1	1	1
5	Fitter										1	1	1	1	1	1	1	1	1
6	Worker										4	4	4	4	4	4	4	4	4
7	Tender boat										2	2	2	2	2	2	2	2	2
8	Repair and maintenance	2	3	3	4	4	1	1	4	4	2	2	2	2	2	2	2	2	2
9	Temporary reinforcements			2															
	Total	3	3	5	5	5	(2)	(2)	5	5	10	10	10	10	10	10	10	10	10

Note: No.8 and No.9 belong to the site office
Source: Field Survey

Table A.2-5 Personnel and Shift for Trailing Hopper Dredgers

No.	Dredger Classification	Manpower				Dayshift only				One shift			
		H-2	H-4	H-6	H-8	H-2	H-4	H-6	H-8	H-2	H-4	H-6	H-8
1	Master	1	1	1	1	1	1	1	1				
2	Chief officer	1	1	1	1	1	1		1			1	
3	Second officer	1	1	-	1								
4	Third officer	1	-	-	1								
5	Boatswain	1	1	1	1								
6	Quarter master	2	4	2	3					1	1	1	1
7	Sailor	6	8	4	8					2	2	1	2
8	Chief drag tender	1	1	-	1								
9	Drag tender	8	8	3	8					2	2	1	2
10	Dredge master	-	1	-	1								
11	Chief engineer	1	1	1	1	1	1	1	1				
12	Second engineer	1	1	1	1							1	
13	Third engineer	1	1	1	2							1	
14	Fitter	10	16	4	12					3	4	1	3
15	Chief electrician	1	-	-	1								
16	Electrician	3	-	-	3					1			1
17	Radio officer	1	1	1	1	1	1	1	1				
18	Nurse (male)	-	1	-	1	-	1	-	1				
19	Chief cook	1	1	-	1	1	1	-	1				
20	Cook	1	1	1	1	1	1	1	1				
	Total	42	49	21	50	6	7	4	7	9	9	7	9

Source: Field survey

Table A.2-8 Form of Monthly Report for Cutter Suction Dredgers

Date	Location	Number of Spud	Dredged Volume (m ³)	Time			Remarks
				Operating	Non-operating	Working	

Source: HD

Table A.2-9 Form of Monthly Report for Trailing Hopper Dredgers

Date	Location	Number of Cycle	Dredged Volume (m ³)	Time							Remarks	
				Dredging	Mixing	Dumping	Transport	Operating	Non-operating	Working		

Source: HD

Table A.2-10 Form of Bi-weekly Report

Dredger	Dredging center/Dredging unit		Monthly
Time	Date	from	to
1. Dredging	from	to	Distance
2. Operating time	hour min.	Non-operating time	meter
3. Operating days	days	Non-operating days	hour min.
Reasons for not operating			
4. Dredging Volume		(m ³)	
5. Total expenditure			(Baht)
5-1 Ordinary expense			
5-2 Materials			
5-3 Temporary wages (Month)			
5-4 Temporary wages (Day)			
5-5 Service expense			
6. Total manpower			
6-1 Office			
6-2 Permanent employees			
6-3 Temporary workers (Month)			
6-4 Temporary workers (Day)			
7. Consumption of fuel oil			(ℓ)
8. Progress			
8-1 Distance			(m)
8-2 Dredged volume			(m ³)
9. Total time of non-operating			
9-1 Repairing machines and dredging equipment			
9-2 Wind, wave, and tide			
9-3 Waiting for fuel oil			
9-4 Others			
10. Obstacles or problems			
11. Comments			
Official		Copy/check	

Source: HD

Table A.2-11 Dredging Record by Classification

Unit: m³

Dredging Center and Dredger	Fiscal Year					Total
	1980	1981	1982	1983	1984	
TRANG						
H-2 & H-4	142,425	119,153	200,300	326,190	132,050	920,118
H-6	-	-	-	-	-	-
Cutter	455,625	822,015	699,400	867,410	805,995	3,650,445
Sub Total	598,050	941,168	899,700	1,193,600	938,045	4,570,563
SONGKHLA						
H-2 & H-4	-	276,670	237,000	134,728	19,540	667,938
H-6				30,225	78,200	108,425
Cutter	1,168,854	374,735	1,706,941	2,728,445	2,624,415	8,603,390
Sub Total	1,168,854	651,405	1,943,941	2,893,398	2,722,155	9,379,753
CHANTABURI						
H-2 & H-4	-	-	-	-	-	-
H-6				47,800	7,700	55,500
Cutter	931,124	752,196	424,434	1,363,591	1,134,023	4,605,368
Sub Total	931,124	752,196	424,434	1,411,391	1,141,723	4,660,868
Total						
H-2 & H-4	142,425	395,823	437,300	460,918	151,590	1,588,056
H-6	-	-	-	78,025	85,900	163,925
Cutter	2,555,603	1,948,946	2,830,775	4,959,446	4,564,433	16,859,203
Grand Total	2,698,028	2,344,769	3,268,075	5,498,389	4,801,923	18,611,184

Notes: Based on Table 4-1-1 and Table 5-1-2

Source: HD

Table A.2-12 (1/3) Completion Report

Dredger	Project	Dredged volume (m ³)	Expenditure (Baht)	Operation Days				Assessment				Remarks					
				Dredging	Repair	Adverse weather	Mobilization	Other	Total days	Action plan	Quantity total days (m ³ /day)		Quantity dredging days (m ³ /day)	Dredging total days (%)	Total days action plan (%)	Expenditure total days (Baht/day)	Expenditure dredging days (Baht/day)
I. 1980																	
H-2	Klong Tachin Kantang	34,600 107,825	438,795 947,821	24 26	12 27	-	25 16	3 2	64 71	30 150	541	1,542	37	213	685	18,283	12.7
H-4	Bandon	148,155	1,237,218	55	86	-	5	4	150	240	988	2,691	36	63	8,248	22,495	8.4
C-1	Dornsak Langsuan Tha-Sala	164,854 300,283 12,154	1,890,837 1,353,891 563,128	82 54 40	20 16 3	4 1 -	1 2 2	24 34 22	131 107 67	120 90 90	1,258 2,806 1,814	2,010 5,561 3,039	- 50 59	- 118 74	14,434 9,487 8,405	23,060 19,511 14,078	11.5 3.5 4.6
C-5	Satun	274,450	2,238,052	84	22	14	-	2	122	300	2,250	3,267	28	40	19,345	26,643	8.2
C-7	Raong Klong Tachin Krabi	21,297 87,010 72,868	1,927,996 1,176,362 1,109,233	45 67 45	35 9 38	-	3 - 1	43 - -	123 79 84	120 75 105	173 1,101 827	473 2,299 1,619	36 84 53	136 105 80	15,675 17,558 13,205	42,864 17,558 28,299	90.5 13.5 15.2
C-15	Chumporn Bang Pakong	262,834 474,298	1,128,716 4,688,307	83 157	23 25	-	3 -	44 14	153 196	90 240	1,718 1,602	3,167 2,458	54 65	170 76	7,377 15,839	13,599 24,291	4.3 3.9
C-17	Ban laem Rayong Phang rad Bang pakong	285,991 94,810 76,025	1,313,079 887,050 676,707	41 34 24	40 31 2	6 -	-	15 19 24	102 86 58	20 60 90	2,804 1,102 1,311	6,976 2,788 3,168	40 39 41	113 143 64	12,873 26,090 11,667	32,026 26,090 28,196	4.6 9.4 8.9
II. 1981																	
H-2	Bandon Songkhla	174,020 102,650	818,860 699,338	56 55	31 38	-	1 1	2 -	90 94	90 180	1,933 1,092	3,108 1,866	62 59	100 52	9,098 7,440	14,623 12,715	4.7 6.8
H-4	Satun Kantang	93,870 119,153	940,215 927,275	67 21	2 7	-	15 1	4 2	88 31	90 150	1,067 -	1,401 -	76 67	98 27	10,684 29,912	14,033 44,156	10.0
C-1	Narathiwat	164,575	998,802	57	13	-	2	-	72	90	2,286	2,887	79	80	13,872	17,523	6.1
C-5	Satun	446,550	3,157,740	223	25	-	-	4	252	210	1,772	2,002	88	120	12,531	14,160	7.1
C-7	Krabi	281,595	2,117,805	94	23	14	-	8	139	180	2,026	2,996	68	77	152,360	22,530	7.5
C-15	Rayong Praese Chantaburi	107,349 123,185 143,665	1,136,485 1,181,935 1,186,342	43 56 31	25 17 -	-	8 1 1	7 4 30	78 78 62	90 90 90	1,376 1,579 2,519	2,496 2,199 4,634	55 72 50	48 87 69	14,570 15,153 19,135	26,430 21,106 38,269	10.6 9.6 8.3
C-17	Bang pakong Ban laem	218,242 159,775	2,743,381 1,195,871	124 36	9 6	-	-	1 23	134 66	150 120	- -	- -	93 54	89 73	20,473 18,119	22,214 33,219	12.6 7.5

(cont'd)

Table A.2-12 (2/3) Completion Report

Dredger	Project	Dredged Volume (m ³)	Expenditure (Baht)	Operation Days				Assessment				Remarks		
				Dredging	Repair weather	Adverse weather	Mobilization	Other	Total days	Action plan	Quantity/total days (m ³ /day)		Quantity/dredging days (m ³ /day)	Dredging total days
III. 1982														
R-2	Klong tachin Satun	65,550	1,004,227	24	2	-	14	6	46	60	71	31,382	41,843	15.3
	Kantang	30,825	123,204	17	-	2	1	2	22	60	41	5,600	7,247	4.0
		103,925	1,374,934	57	24	-	1	5	87	90	88	16,975	26,441	13.2
R-4	Songkhla Kha-nom	140,000	1,639,784	75	23	-	1	-	99	120	79	17,081	22,159	11.7
		97,000	1,278,059	74	20	-	2	2	98	90	107	13,041	17,041	13.1
C-1	Bandon Sichaon	190,611	1,457,259	123	5	-	2	42	172	90	187	8,472	11,848	7.7
		114,003	1,103,776	49	2	-	1	6	58	90	61	19,365	22,526	9.7
C-5	Klong tachin	117,200	1,381,628	46	6	-	2	22	76	90	82	18,671	31,035	11.8
C-7	Krabi	582,200	3,621,502	258	-	-	-	-	258	240	106	14,036	14,036	6
C-15	Rayong MaeKlong	123,521	1,139,349	101	-	-	2	-	103	90	89	13,895	15,397	9.2
		297,835	1,735,568	74	8	-	2	-	84	90	114	16,850	17,183	5
C-17	Thachin	3,078	484,482	1	13	-	1	-	15	180	-	-	-	-
C-19	Pak-phanang	627,500	3,669,215	215	67	-	-	1	283	240	117	12,965	17,066	5.9
C-21	Pak-phanang	627,500	3,669,216	214	69	-	-	6	289	240	119	12,696	14,146	5.9
IV. 1983														
H-4	Krabi Satun	165,690	1,858,205	85	8	-	N/A	1	138	45	115	13,465	21,861	11.2
	Kantang	68,250	672,032	42	8	-	2	1	53	75	117	12,680	16,001	3.8
	Songkhla	92,250	1,278,162	60	-	-	1	17	84	75	112	15,216	19,366	13.1
		134,728	1,164,294	27	-	-	10	5	42	45	-	-	-	-
H-6	Prasae Bandon	18,100	323,229	48	-	-	1	6	55	45	93	5,877	6,734	17.9
	Bang pakong	30,225	341,425	49	-	-	2	6	57	45	126	5,990	6,968	11.3
	Tret	9,100	83,880	14	-	-	2	12	28	45	-	-	-	-
		20,600	439,415	32	-	-	2	5	59	45	-	-	-	-
C-1	Lungsvan Tha sala	327,784	1,580,253	108	23	-	1	4	136	150	-	-	-	-
	"	158,215	776,706	25	10	-	1	6	42	60	-	-	-	-
				(15)	(5)	-	-	(6)	(26)	(30)	-	-	-	-
C-5	Ranong	211,050	2,209,419	104	77	-	5	5	121	195	-	-	-	-
C-7	Krabi	656,400	4,297,032	217	37	-	-	10	264	270	96	16,277	19,802	6.6
C-15	Franburi	465,025	3,781,185	122	17	-	1	7	147	180	80	25,722	30,993	8.1

(cont'd)

Table A.2-12 (3/3) Completion Report

Dredget	Project	Dredged volume (m ³)	Expenditure (Baht)	Operation Days				Action	Assessment				Remarks		
				Dredging	Repair	Adverse weather	Mobilization		Other	Total days plan	Quantity/Total days (m ³ /day)	Quantity/dredging days (m ³ /day)		Dredging/total days (%)	Total action days/total days (%)
C-17	Thachin	385,390	2,113,254	133	10	-	-	47	190	120	70	138	11,122	13,889	5.5
	Ban Jaem	327,247	1,951,109	81	-	-	1	26	108	120	75	95	18,066	24,088	6.0
	Pak tako	251,007	1,240,249	47	6	-	3	11	67	75	70	88	18,512	26,389	4.9
C-19	Pak phanang	340,590	6,382,455	88	50	-	-	6	144	90	61	160	14,852	24,303	6.3
	Saiburi	99,060	677,432	38	2	-	2	30	72	60	52	120	9,407	17,827	6.0
	Narathivat	162,780	1,059,726	39	4	5	1	15	64	120	60	53	16,558	27,172	6.5
C-21	Pak phanang	676,080	6,382,455	221	33	-	-	-	254	270	87	93	16,708	19,202	6.3
	Rayong	167,030	1,168,353	39	8	-	1	37	85	90	45	95	13,745	29,958	7.0
C-23	Natrab	202,130	1,111,453	48	-	-	5	8	61	45	78	156	18,221	23,135	5.5
	Sakorn	241,073	1,111,453	44	-	-	1	1	46	30	35	121	24,162	25,260	4.6
C-25	Bang-pakong	18,899	662,876	11	19	-	1	11	42	60	26	70	15,783	60,261	35.1
	Chumphon	269,726	2,235,570	84	-	-	2	15	101	120	83	84	22,134	26,614	8.3
V. 1984															
H-2	Satum	76,400	1,449,483	33	34	-	19	19	105	90	31	114	13,806	43,928	19.0
	Krabi	79,100	1,141,289	50	21	-	1	15	87	90	59	97	12,118	22,826	14.4
H-4	Kantang	55,690	1,662,862	37	15	5	12	11	80	90	46	87	20,786	44,942	29.9
	Songkila	19,540	1,180,931	29	10	-	6	15	60	120	48	61	19,682	40,722	60.4
H-6	Kha nom	13,500	522,419	23	1	-	2	15	41	45	56	68	12,742	22,714	38.7
	Don sork	31,300	394,753	44	-	-	-	20	67	60	65	110	5,295	8,063	11.3
C-15	Saiburi	17,200	292,265	31	-	-	1	8	40	30	77	133	7,307	9,428	17.0
	Sichon	16,200	332,033	41	-	1	2	6	50	45	82	106	6,541	8,098	20.5
C-1	Maeklong	7,700	60,375	21	-	-	3	5	29	60	*72	*97	2,082	2,875	7.8
	Pak phanang	90,877	857,297	28	3	-	-	20	51	150	*55	*21	16,810	30,618	9.4
C-5	Kong Tachin	213,275	2,041,507	77	45	1	4	38	165	120	47	134	12,373	26,513	9.6
	Krabi	395,220	2,621,883	115	56	1	-	62	234	180	51	122	11,705	22,799	6.6
C-17	Trat	481,644	3,820,218	123	69	-	10	36	238	180	52	129	16,051	31,059	7.9
	Songkila	134,728	826,568	29	25	-	-	8	62	60	48	102	13,332	28,502	6.1
C-19	Narathivat	246,220	1,897,793	47	44	-	2	7	100	120	47	81	18,978	40,378	7.6
	Pak-nakorn	434,910	1,782,508	92	5	-	-	18	115	150	80	75	15,500	19,375	4.1
C-23	Pak-phansang	1,715,680	8,225,106	232	8	3	-	44	287	270	81	94	28,659	35,453	4.8
	Rayong	484,849	3,003,863	110	13	2	4	50	179	150	61	117	16,781	27,308	6.2
C-25	Phang rad	19,880	690,827	8	91	-	1	6	106	60	-	-	6,517	86,352	34.3

Notes: Translation from HD completion report

Source: HD

Table A.2-13 Weekly Report

Dredger	Project	Period	Dredged Volume (m ³)	Operating hours	Non-operating hours	Fuel Oil (kl)	Lubricant Oil (ℓ)	Hydraulic Oil (ℓ)	Grease (kg)	Kerosene (ℓ)	Petro-leum (ℓ)	Waste Yarn (kg)	Waste (kg)	Fresh Water (tons)	Days
H-2	Satun	Dec/1983-Feb/1984	76,400	183	1,183	28	1,145	100	15				2	224	57
	Kantang	Jun - Aug/1984	55,850	304	584	40	2,167	420						261	37
H-4	Krabi	Dec/1982 - Mar/1983	165,690	330	2,526	135	2,678	1,567	22				39	444	119
	Satun	Apr - May/1983	8,250	136	944	51	810	570	6					194	45
	Kantang	Jun - Aug/1983	94,875	161	1,471	73	2,482	694	3				22	272	68
H-6	Bandon	May - Jul/1983	30,225	80	1,240	23	328	15	4					75	55
	Bang-pakong	Jul - Aug/1983	9,100	84	492	16	450		9					42	24
	Kua-norn	Feb - Mar/1984	19,750	154	902	32	880	258	28				17	88	44
C-1	Langsuan	Apr - Aug/1983	327,784	1,425	1,767	64	2,616	1,672						63	133
	Tha-sale	Aug - Oct/1983	158,215	707	709	28	1,367	1,256						45	59
	Pak-phuang	Aug - Sept/1984	81,890	359	577	19	568	1,045		6			1	39	39
C-5	Klong tachin	Jan - Mar/1983	117,150	391	665	43	526	1,015	69	10				39	44
	Klong tachin	Apr - Jul/1984	213,275	712	2,432	70	1,178	1,162	52	48				81	131
C-7	Krabi	Dec/1983 - Jul/1984	395,220	1,354	3,998	111	4,075	4,082	183				187	279	223
C-15	Pran buri	Apr - Sept/1983	465,025	1,583	2,688	311	3,856	3,026	50	54			90	10	178
	Pran buri	Oct - Nov/1983	147,650	459	717	87	702	200	89	17			39	6	49
	Pak bura	Jun - Sept/1984	118,400	493	1,931	94	1,671	678	50					31	101
C-17	Ban-laem	Apr - Jul/1983	327,247	742	1,418	120	1,230	1,607	49				28	69	90
	Pak tako	Aug - Sept/1983	251,007	503	961	72	1,523	1,463	75		180		22	30	61
	Trat	Nov/1983 - May/1984	481,644	1,559	3,361	241	3,786	4,479	119				99	90	205
C-19	Pak phanang	Jan - May/1983	340,590	946	2,413	134	641	125	201				23	128	140
	Sai buri	Jun - Jul/1983	99,060	277	683	42	260	360	6				15	32	40
	Narathiwat	Aug - Sept/1983	162,780	455	793	61	346	1,085	537	5	318		5	39	52
	Narathiwat	Jul - Oct/1984	248,200	690	1,830	109	670	2,432	30	12	25		-	81	105
C-21	Pak nakorn	Jun - Sept/1984	439,410	1,208	1,528	172	839	739	133	1	10		32	114	114
C-23	Pak Phanang	Dec/1983 - Sept/1984	1,715,680	304	2,769	622	3,357	2,200	209						292
C-25	Chumporn	Jun - Sept/1983	269,726	621	1,755	167	1,155	3,489	43	0	15		40	64	99
	Rayong	Nov/1983 - Apr/1984	484,849	1,084	2,036	392	1,069	4,949	71				65	110	130

Source: HD

Table A.2-14 Summary of Questionnaire for Bi-weekly Report of Cutter Suction Dredgers

Dredger	Period	Total Days Rating days	Working time	Dredging time	Suction discharg- ing time	Spud time	Intermis- sion time	Consump- tion of fuel (%)	Dredged volume (m ³)	Original depth (m)	Dredging depth (m)	Dredging width (m)	Dredging advance per spud- ing pipe (m)	Length of discharg- ing pipe (m)	Kind of soil	Location
C-1	19/Jun. 3/Jul.	15	224:05	209:10	3:50	11:05	135:55	10,639	51,158	-2.2 -2.9	-3.5	40	1.0	120*130	Sand Sand with mud	Saiburi
C-5	23/Jun. 6/Jul.	14	62	49:35	6:15	6:10	274:00	5,145	14,875	-0.6 -1.0	-3.0	40	1.5	190*210	Coarse sand	Ranong
C-7	22/Jun. 7/Jul.	15	175:20	154:45	13:50	7:10	184:40	12,270	52,550	-1.1 -1.5	-2.6 -3.0	40	1.5	120	Sand	Ranong
C-15	21/Jun. 4/Jul.	14	0				336:00	-	-							Pak-Bara
C-17	22/Jul. 30/Jul.	9	84:40	73:30	4:00	7:10	131:20	14,930	23,390	-0.5	-3.0	40	-	180	Clay	Trat
C-19	29/Jun. 9/Jul.	11	207:30	191:30	1:50	14:10	56:30	26,063	82,170	-0.3 -1.8	-3.0	40	1.0	180	Sand with mud	Langsuwan
C-21	25/Jun. 8/Jul.	14	0				336:00									Bandon
C-23	25/Jun. 9/Jul.	15	49:05	37:15	7:45	4:05	310:55	10,120	15,895	-2.5	-4.0	60	1.8	160	Mud with sand	Chumporn
C-25	22/Jul. 5/Aug.	15	112:40	89:50	10:05	12:45	247:20	15,846	36,385	-2	-2.5	40	1.5	160*240	Muddy sand	Rayong

Source: HD and Field Survey

Table A.2-15 Summary of Questionnaire for Bi-weekly Report of Trailing Hopper Dredgers

Dredger Period	Total Opa. days	No. of cycle dredging	No. of dredging	No. of turning	Dredging		Dumping time	Sailing time	Total cycle mission time	Consumption of fuel (ℓ)	Loaded volume (m ³)	Original depth (m)	Dredging		Length of discharging (m)	Speed (knot)	Kind of soil	Location	
					Dredging time	Turning time							Depth (m)	Width (m)					
H-2 1/Jul 14/Jul	14	70	126	70	17:58	4:48	4:39	29:17	56:42	279:18	14,310	23,650	-6.2	6.42	80		3		Kha-Norm
H-4 21/Jun 4/Jul	14	47	47	47	19:35	16:00	3:55	16:00	55:30	280:30	15,500	16,450							Kantang
H-6 25/Jun 10/Jul	16	51	102	51	23:40	4:75	6:15	50:55	87:00	279:00	6,900	3,500	-1.5 -2.0	3.5	60	1,100	2 ~ 3	Mud	Chumporn

Source : HD and field survey

Table A.2-16 Details of Operating Days

Unit : %

No.	Dredger	Operation	Repair	Adverse weather	Mobilization	Others	Total
1	H-2	50	26	1	12	11	100
2	H-4	58	20	0	9	13	100
3	H-6	75	0	0	4	21	100
4	C-1	59	12	1	2	26	100
5	C-5	64	14	2	2	18	100
6	C-7	57	21	2	0	20	100
7	C-15	62	13	0	3	22	100
8	C-17	59	16	1	2	22	100
9	C-19	58	26	1	1	14	100
10	C-21	71	16	0	0	13	100
11	C-23	74	3	1	2	20	100
12	C-25	60	10	1	2	27	100

Note: Based on Table A.2-12 except extraordinary cases.

Source: HD

Table A.2-17 Average Operating Hours per Operating Day

No.	Dredger	Operating hour per Operating day	No.	Dredger	Operation hour per operating day
1	H-2	8.0 (h/d)	1	H-2	6.0 (h/d)
2	H-4	3.5	2	H-4	6.0
3	H-6	6.5	3	H-6	6.5
4	C-1	15.5	4	C-1	15.5
5	C-5	9.0	5	C-5	10.5
6	C-7	12.0	6	C-7	10.5
7	C-15	12.5	7	C-15	12.5
8	C-17	11.5	8	C-17	12.5
9	C-19	11.0	9	C-19	12.0
10	C-21	13.0	10	C-21	12.0
11	C-23	17.5	11	C-23	14.5
12	C-25	N/A	12	C-25	14.5

Notes: (1) Based on some data from Table A.2-12 and Table A.2-13.

(2) The right table is calculated considering two dredgers in each pair as one set.

Source: HD

Table A.2-18 Dredged Volume per Dredging Time

No.	Dredger	Standard capacity 1	Capacity from past records 2	Capacity from questionnaire 3	Ratio between 1 and 2	Ratio between 1 and 3
1	C-1	100(m ³ /h)	236 (m ³ /h)	245 (m ³ /h)	2.36	2.45
2	C-5	250	300	300	1.20	1.20
3	C-7	250	292	340	1.17	1.36
4	C-15	250	285	-	1.14	-
5	C-17	250	416	318	1.66	1.27
6	C-19	250	366	429	1.46	1.72
7	C-21	250	360	-	1.44	-
8	C-23	450	357	427	0.79	0.95
9	C-25	450	398	405	0.88	0.90

Note: Based on some data of Table A.2-12 and Table A.2-13

Source: HD

Table A.2-19 Consumption of Fuel Oil, Fresh Water, etc. of Cutter Suction Dredgers

No.	Dredger		C-1	C-5	C-7	C-15	C-17	C-19	C-21	C-23	C-25
	Item										
1	Fuel Oil/	(ℓ/day)	914	643	497	1500	1218	1030	1509	2130	2267
	Total days										
2	Lubricant oil/	(ℓ/day)	63	10	18	19	18	6	7	11	11
	Total days										
3	Hydraulic oil/	(ℓ/day)	16	12	18	12	21	12	6	8	19
	Total days										
4	Grease/	(g/day)	-	690	820	570	680	2290	1160	710	620
	Total days										
5	Kerosene/	(ℓ/day)	30	33	-	210	-	50	8	-	-
	Total days										
6	Petroleum/	(ℓ/day)	-	-	-	-	50	1070	80	-	20
	Total days										
7	Waste/	(g/day)	4	680	840	390	410	120	280	-	200
	Total days										
8	Fresh water/	(ton/day)	0.6	0.8	1.3	0.1	0.5	0.8	1.0	1.0	0.9
	Total days										
9	Dredged volume/	(m ³ /ℓ)	2.7	2.9	3.6	1.5	2.4	2.5	2.6	2.8	2.1
	Fuel oil										
10	Fuel oil/	(ℓ/hour)	85	102	82	194	155	146	142	147	199
	Dredging time										
11	Lubricant oil/	(ℓ/hour)	5.8	1.5	3.0	2.5	2.3	0.8	0.7	0.8	0.9
	Dredging time										
12	Hydraulic oil/	(ℓ/hour)	1.5	2.0	3.0	1.5	2.7	1.7	0.6	0.5	1.7
	Dredging time										
13	Grease/	(g/hour)	-	110	130	70	80	320	110	50	50
	Dredging time										
14	Fresh water/	(ℓ/hour)	60	120	200	10	60	110	90	70	80
	Dredging time										

Note: Based on relevant data of Table A.2-13.

Table A.2-20 Consumption of Fuel Oil, Fresh Water, etc.
of Trailing Hopper Dredgers

No.	Dredger		H-2	H-4	H-6
	Item				
1	Fuel oil/	(ℓ/day)	725	1,110	574
	Total days				
2	Petroleum/	(ℓ/day)	-	-	6.2
	Total days				
3	Lubricant oil/	(ℓ/day)	35	26	13
	Total days				
4	Hydraulic oil/	(ℓ/day)	6	12	2
	Total days				
5	Grease/	(g/day)	160	130	330
	Total days				
6	Waste/	(g/day)	20	260	130
	Total days				
7	Fresh water/	(ton/day)	5	4	2
	Total days				
8	Dredged volume/	(m ³ /ℓ)	1940	1270	840
	Fuel oil				
9	Fuel oil/	(ℓ/hour)	139	414	222
	Operating time				
10	Petroleum/	(ℓ/hour)	-	-	2.4
	Operating time				
11	Lubricant oil/	(ℓ/hour)	6.8	9.5	5.2
	Operating time				
12	Hydraulic oil/	(ℓ/hour)	1.1	4.5	0.9
	Operating time				
13	Grease/	(g/hour)	30	50	130
	Operating time				
14	Fresh water/	(ℓ/hour)	950	1450	640
	Operating time				

Note: Based on relevant data of Table A.2-13.

Table A-2-21 Average Consumption of Fuel Oil Estimated by HD

No.	Type of Vessel	Condition	Hourly Consumption of Fuel Oil (ℓ/hour)	Monthly Consumption of Fuel Oil (kl/month)
1	Trailing Hopper Dredger (400 m ³)	Dredging operation	200	55
		Sailing only	150	-
2	Trailing Hopper Dredger (100 m ³)	Dredging operation	150	20
		Sailing only	100	-
3	Cutter Suction Dredger (20 inch pipe)	Dredging Operation	170	65
4	Cutter Suction Dredger (14 inch pipe)	Dredging operation	120	50
5	Survey boat	Sailing	120	30
6	Tug Boat	Towing	200	-
		Sailing only	150	50

Source: HD

Table A.2-22 Analysis of Questionnaire Data for Cutter Suction Dredgers

No.	Item	Dredger							
		C-1	C-5	C-7	C-17	C-19	C-23	C-25	
1	Operating days/ Total days (%)	93	36	87	89	100	33	33	
2	Operating time/ Total days (hour/day)	15.0	4.4	11.7	9.4	18.9	3.3	7.5	
3	Operating time/ Operating days (hour/day)	16.0	12.4	13.5	10.6	18.9	9.8	22.5	
4	Dredging time/ Total days (hour/day)	13.9	3.5	10.3	8.2	17.4	2.5	6.0	
5	Dredging time/ Operating days (hour/day)	14.9	9.9	11.9	9.2	17.4	7.5	18.0	
6	Dredging time/ Operating time (%)	93	80	88	87	92	76	80	
7	Suction and discharging time/ Operating time (%)	2	10	8	5	1	16	9	
8	Spud time/ Operating time (%)	5	10	4	9	7	8	11	
9	Fuel oil consumption/ Total days (ℓ/day)	709	368	818	1659	2369	675	1056	
10	Fuel oil consumption/ Operating days (ℓ/day)	760	1029	944	1866	2370	2024	3169	
11	Fuel oil consumption/ Operating time (ℓ/hour)	48	83	70	176	126	206	141	
12	Dredged volume/ Fuel oil consumption (m ³ /ℓ)	4.8	2.9	4.3	1.6	3.2	1.6	2.3	
13	Dredged volume/ Total days (m ³ /day)	3410	1063	3503	2599	7470	1060	2426	
14	Dredged volume/ Operating days (m ³ /day)	3654	2975	4042	2924	7470	3179	7277	
15	Dredged volume/ Dredging time (m ³ /hour)	245	300	340	318	429	427	405	

Note: Based on Table A.2-14.

Table A.2-23 Analysis of Questionnaire Data for Trailing Hopper Dredgers

No.	Item	H-2	H-4	H-6
1	Operating days/ Total days (%)	64	64	75
2	Total of cycle time/ Total days (hour/day)	4	4	5.5
3	Total of cycle time/ Operating days (hour/day)	6.3	6.2	7.3
4	Dredging plus turning time/ Total of cycle time (%)	40	64	32
5	Dumping time/ Total of cycle time (%)	8	7	7
6	Sailing time/ Total of cycle time (%)	52	29	39
7	Fuel oil consumption/ Total days (ℓ/day)	1022	1107	431
8	Consumption of fuel/ Operating days (ℓ/day)	1590	1722	575
9	Dredged volume/ Consumption of fuel (m ³ /ℓ)	1.7	1.1	0.5
10	Consumption of fuel/ Total of cycle time (m ³ /day)	252	279	79
11	Dredged volume/ Total days (m ³ /day)	1689	1175	219
12	Dredged volume/ Operating days (m ³ /day)	2628	1828	292
13	Dredged volume/ Dredging time (m ³ /hour)	1316	4387	148
14	No. of cycle/ Operating days (cycle/day)	7.8	5.2	4.3

Note: Based on Table A.2-15.

Table A.2-24 Summary of Questionnaire for Details on Non-operation of Cutter Suction Dredgers

Unit: time

Dredger	Inter-mission time	Related work	Repair during dredging		Floater & pipe	Dumping	Adverse weather	Mob/De-mobilization	Others	Regular maintenance	Remarks
			Mechanical	Electric etc.							
C-1	135:55	22:30	28:45	9:00	53:40						Propeller of tender boat T-23 Arrangement of discharging pipe lines Change of swing wire.
C-5	274		260:55		13:05						
C-7	184:40	13:50	4:25		21:50	19:30			117:45		
C-15	336:00										Hydraulic pump for break of spud winch. Strong wind and high wave low tide.
C-17	131:20				19:00	33:10	42:10		37:00		
C-19	56:30	41:15				15:15					
C-21	336:00									336:00	Regular maintenance
C-23	310:55	0:55	42:50	53:00	177:00	1:10	12		24:00		Welding of suction pipe Hydraulic pipe
C-25	247:20		24:00	15:00	92:25	9:55			96:00		Change of rubber sleeve Leakage from discharging pipe lines

Note: Period of questionnaire is the same as Table A.2-14.

Source: HD and field survey.

Table A.2-25 Summary of Questionnaire for Details for Non-operation of Trailing Hopper Dredgers

Unit: time

Dredger	Inter-mission time	Related work	Repair during dredging		Floater & pipe	Dumping	Adverse weather	Mob/De-mobilization	Others	Regular maintenance	Remarks
			Mechanical	Electric etc.							
H-2	279:18	18:00	31:38	22:09			4:26		192:00		Main reason, Details of repair and maintenance, etc.
H-4	280:30		72	52:30					156:00		
H-6	297:00	149:15		80:15					48:00		

Note: Period of questionnaire is the same as Table A.2-15

Source: HD and field survey.

Table A.2-26. Mobilization Record of HD Tugboat

Dredger	From	To	Period	Days	Distance (N mile)	Speed (knot)
(Fiscal Year 1983)						
C-23	Samut Prakan	Rayong	15 - 16/Mar	2	113	5 - 6
T-223	"	"	18 - 21/Mar	4	113	4 - 5
C-25	"	Bong-Pokong	24 - 24/Mar	1	27	4 - 5
C-15	Samut-Songkrom Samut-Sakorn	Pranbukri Ban-Laem	4 - 10/Apr	7	60 27	5 - 7
C-25	Bang-Pakong	Samut Prakan	4 - 6/May	3	27	5 - 7
C-19	Pak-Phanang	Seiburi	20 - 31/May	11	175	5 - 7
C-23	Rayong	Natab	7 - 15/Jun	9	425	5 - 7
C-25	Samut Prakan	Chumporn	21 - 28/Jun	8	212	5 - 7
C-17	Ban-Laem	Pak-Tako	18/Jul-23/Aug	37	210	5 - 7
C-19	Saiburi	Narathiwat			200	5 - 7
C-1	Lungsuan	Tha-Sale			105	5 - 7
C-23	Sakorn	Pak-Panong	21 - 26/Sept	6	120	5 - 7
(Fiscal Year 1984)						
C-19	Narathiwat	Songkhla	6 - 8/Oct	3	95	5 - 7
C-17	Pak-Tako	Trat	12 - 21/Oct	10	182	5 - 7
C-25	Chumporn	Rayong	21 - 25/Oct	5	225	5 - 7
G-1	Tha-Sale	Bandon	26 - 29/Oct	4	69	5 - 7
C-15	Pranburi	Samut Prakan	17 - 19/Nov	3	85	5 - 7
C-15	Bankok Dock	Samut Prakan	11 - 12/Apr	2	24	4
C-25	Rayong	Pang-Rad	17 - 19/Apr	3	36	4 - 5
C-19	Songkhla	Narathiwat	18 - 26/Apr	9	95	5 - 7
C-1	Bandon	Pak-Panang	7 - 8/Aug	2	89	5 - 7

Source: HD

Table A.2-27 (1/2) Mobilization Record of Private Tugboats

Dredger, etc.	From	To	Period	Days	Cost (Baht)	Distance (N-Mile)	Company
(Fiscal Year 1980)							
C-1, T-23	DORNSAK	LUNGSWAN	1 - 11/Apr	11	177,500	49	VISIT ENGINEERING SONGKHLA CO.
"	LUNGSWAN	THA-SALE	78 - 29/Jul	2	198,000	105	"
"	THA-SALE	BANDON	27 - 28/Sept	2	197,000	69	"
C-15, T-215	BANG-PAKONG	RAYONG	5 - 17/Nov	13	212,000	86	BANGKOK BURAPA CO.
C-17, T-217	PHANG-RAD	BANG-PAKONG	20 - 25/Jun	6	266,000	122	"
(Fiscal Year 1981)							
C-1, T-23	BANDON	NARATHIWAT		15	362,000	263	BANGKOK BURAPA CO.
"	NARATHIWAT	BANDON		15	398,000	263	VIPANSIRI CO.
C-5, T-25	SATUN	KLONG-TACHIN		15	274,000	145	VIPANSIRI CO.
C-15, T-25	RAYONG	PRASAE		15	164,000	30	BANGKOK BURAPA CO.
"	PRASAE	CHANTABURI		15	199,000	29	"
C-17, T-217	BANG-PAKONG	BAN-LAEM		15	190,000	57	LAND & MARINE CONSTRUCTION CO., LTD.
	BAN-LAEM	THACHIN		15	148,000	27	"
C-19, C-21 T-219, T-211	SAMUT PRAKAN	PAK-PHANANG		15	667,000	367	BANGKOK BURAPA CO.
(Fiscal Year 1982)							
C-1, T-23	BANDON	SICHON		15	294,888	48	THAI NAVIGATION CO.
"	SICHON	LUNGSUAN		15	398,000	84	"
C-5, T-25	KLONG-TACHIN	RANONG		15	378,800	140	"
C-15, T-215	RAYONG	MAEKLONG		15	244,000	89	BANGKOK BURAPA CO.
(Fiscal Year 1983)							
	No Data						

(cont'd)

Table A.2-27 (2/2) Mobilization Record of Private Tugboats

Dredger etc	From	To	Period	Days	Cost (Baht)	Distance (N-Mile)	Company
(Fiscal Year 1984)							
C-5, T-25	RANONG	Klong-Tachin		20	715,000	140	EXPRESS TRANSPORT ORGANIZATION
C-15, T-215	SAMUTPRAKAN	PAK-BARA		30	1,995,000	1260	"
(Fiscal Year 1985)							
C-5, T-25	KLONG-TACHIN	RANONG		15	475,000	140	EXPRESS TRANSPORT ORGANIZATION
C-7, T-27	KRABI	PHANG-NGA		10	390,000		"
C-15, T-215	PAK-BARA	KANTANG		15	395,000		"

Source: HD

Table A.2-28 Record of Land Transportation

From	To	Period	Days	Cost (Baht)	Distance (km)	Main Item
(Fiscal Year 1983)						
Bangkok	Songkhla	20/Jan.-	-	209,200	950	Discharging pipe, Floater, Rubber sleeve, Ball joint, Cutter shaft, Impeller, Pump casing
Bangkok	Chantaburi	20/Jan.-	-	108,960	250	- ditto -
Banlaem	Chumporn	2/Jul.-	-	172,500	360	Discharging pipe, Floater, Rubber sleeve
Chumporn	Pak-Phanang	15/Jul.	-	152,000	330	- ditto -
(Fiscal Year 1984)						
Natab	Pak-Phanung	27/Oct.-23/Nov.	27	199,400	160	- ditto -
Pak-Taku	Trat	31/Oct.-20/Nov.	21	330,800	900	- ditto -
Chumporn	Rayong	2/Nov.-22/Nov.	21	334,350	640	- ditto -
Tha-Sale	Pak-Nakorn	4/Nov.-15/Nov.	12	81,600	50	- ditto -
Praun-buri	(Songkhla	11/Nov.-12/Nov.	12	267,300	750	- ditto -
	Trat	18/Nov.-20/Nov	3)	510	Rubber sleeve
(Fiscal Year 1985)						
Songkhla	Satun	3/May-	-	97,400	130	Discharging pipe, Floater, Rubber sleeve
Songkhla	Narathiwat	28/May-	-	91,000	190	- ditto -
Thachin	(Chantaburi	23/May-13Jun.	22	9,550	280	Pump casing
	Trat)	350	
Bandon	Saiburi	6/Jun-		120,200	440	Discharging pipe, Floater, Rubber sleeve

Source: HD

Table A.2-29 Details of Expenditure of Dredging Unit

No.	Dredger	Budget (Baht), (%)			Actual Expenditure (Baht), (%)			Dredged volume (m ³)	Expenditure per volume (Baht/m ³)	No. of projects		
		Ordinary	Utility	Material	Wage	Total	Ordinary				Utility	Material
1	H-2	2,517,240 (23)		8,455,800 (77)		10,973,040 (100)	1,994,082 (24)	236 (76)	6,148,497 (76)	8,142,815 (100)	553,875 (14.70)	8
2	H-4	4,245,250 (26)		11,806,650 (74)		16,051,900 (100)	2,154,791 (20)	59 (80)	8,857,031 (80)	11,011,881 (100)	943,908 (11.67)	9
3	H-6	3,050,000 (46)		3,920,000 (54)		6,970,000 (100)	481,829 (24)		1,684,295 (76)	2,166,124 (100)	126,525 (17.12)	6
4	C-1	5,659,700 (27)	10,700	13,897,160 (67)	1,044,842 (6)	20,612,402 (100)	2,885,622 (40)	6,909 (54)	3,981,175 (54)	7,337,221 (100)	1,058,219 (6.93)	7
5	C-5	2,326,500 (58)	3,200	1,512,750 (37)	206,900 (5)	4,079,350 (100)	2,388,999 (70)	3,025 (25)	857,128 (25)	3,623,135 (100)	330,475 (10.36)	2
6	C-7	4,875,000 (31)		10,301,100 (65)	762,100 (4)	15,938,200 (100)	5,464,697 (40)	31,082 (55)	7,486,912 (55)	13,644,775 (100)	1,742,127 (7.83)	5
7	C-15	2,294,200 (22)	5,300	7,097,070 (68)	1,084,300 (10)	10,480,870 (100)	1,974,162 (31)	320 (64)	3,995,190 (64)	6,282,291 (100)	735,289 (8.54)	5
8	C-17	4,719,650 (26)		12,454,760 (69)	867,000 (5)	18,041,410 (100)	4,043,664 (29)	650 (66)	9,126,320 (66)	13,916,498 (100)	1,837,443 (7.57)	5
9	C-19	2,301,000 (20)		8,490,000 (75)	536,012 (5)	11,277,012 (100)	2,341,190 (29)	1,906 (65)	5,269,905 (65)	8,130,733 (100)	1,272,288 (6.39)	5
10	C-21	3,051,000 (41)		4,000,000 (54)	337,312 (5)	7,388,312 (100)	2,707,355 (29)	855 (65)	2,373,280 (65)	5,451,723 (100)	1,062,410 (5.13)	2
11	C-23	3,404,000 (26)		8,860,000 (69)	676,100 (5)	12,940,100 (100)	8,332,911 (79)		1,741,220 (17)	10,504,912 (100)	2,084,840 (5.04)	3
12	C-25	1,190,000 (26)		3,140,000 (69)	232,900 (5)	4,562,900 (100)	1,109,827 (31)	1,441 (65)	2,333,830 (65)	3,589,273 (100)	308,505 (11.63)	3

Note: Based on some available completion reports during 1980 through 1984.

Source: HD

Table A.2-30 Minimum Wage

Date put in effect	Area	Central and Southern		North and	Northeast
	Bangkok and 5 provinces around Bangkok	PHANGNGA PHUKET	Others	CHANGMAI NAKHON-RATCHASRIMA	Others
Apr/1973	12	-	-	-	-
Jan/1974	16	-	-	-	-
Jun/1974	20	-	-	-	-
Oct/1974	20	18	18	16	16
Jan/1975	25	18	18	16	16
Oct/1977	28	21	21	19	19
Oct/1978	35	28	28	25	25
Oct/1979	45	38	38	35	35
Oct/1980	54	47	47	44	44
Oct/1981	61	61	52	61	55
Sept/1982	64	64 (61)	52	61	52
Oct/1983	64	66 (64)	56	64	56

Note : Figure in parentheses is applied to provinces except PHANGNGA and PHUKET.

Source : Ministry of Interior

Table A.2-31 Price List

No.	Item	Price	Unit
1	Fuel oil (high speed diesel)	7.13	Baht/ℓ
2	Grease	48.50	Baht/kg
3	Petroleum	10.87	Baht/ℓ
4	Fresh water	20.00	Baht/ton
5	Waste yarn	43.40	Baht/kg
6	Waste	25.50	Baht/kg
7	Discharging pipe	19,350	Baht/set
8	Floater	11,210	Baht/set
9	Rubber sleeve	7,000	Baht/set

- Note : (1) Based on HD record of purchasing during 1984 and 1985.
 (2) Price is average value.
 (3) The present official price of high speed diesel oil is 6.70 Baht/ℓ.

Source: HD

Table A.2-32 Parts Purchased by HD Headquarters

Dredger	Age	Amount (Baht)
C-1	20	2,673,700
C-5	16	1,809,001
C-7	16	2,467,470
C-15	7	856,625
C-17	7	871,625
C-19	5	127,000
C-21	5	127,000
C-23	3	360,800
C-25	3	199,800

Notes: (1) Period is from FY 1983 to Apr. of 1985.

(2) Data for trailing hopper dredgers are not available.

Source: HD

Table A.2-33 Purchased Record of Discharging Lines

No				Quantity (sets)	Unit Price (Baht)	Total Price (Baht)	Dredger	Company
1.	Discharging pipe on land	Sept/1981	Ø = 6 m t = 4.5 mm	50	7,200	360,000	14 inch dredger	Bis Trading Co., Ltd.
2.	Discharging pipe off shore	Jun/1981	Ø = 6 m t = 9 mm	110	12,300	1,353,000	"	"
3.	"	Sept/1981	"	100	13,220	1,322,000	"	"
4.	"	Jun/1984	Ø = 6 m t = 6 mm	20	19,500	390,000	C-23	K.P.C. Enterprise Co., Ltd.
5.	"	Oct/1984	"	60	19,400	1,164,000	C-23, 25	"
6.	Floater	Jun/1981	Ø = 6 m t = 4.5 mm	120	13,500	1,500,000	C-1, 5, 7, 15	Bis Trading Co., Ltd.
7.	"	Sept/1981	"	120	13,400	1,608,000	"	"
8.	"	Jan/1983	"	200	11,450	2,290,000	C-1, 5, 7	K.P.C. Enterprise Co., Ltd.
9.	"	Oct/1983	"	200	10,975	2,195,000	C-1, 5, 7, 15, 19, 21	"
10.	"	Oct/1983	Ø = 4.5 m t = 4.5mm	120	19,400	2,328,000	C-23, 25	"
11.	Rubber Sleeve	Jun/1982	Ø = 1 m	110	9,090	1,000,000	C-1, 5, 7, 15, 17	"
	"	Sept/1983	Ø = 1.1 m t = 30 mm	100	6,700	670,000	C-1, 5, 7, 15, 17, 19, 21	"
	"	Dec/1983	"	100	7,290	729,000	"	"
	"	Oct/1984	"	60	14,990	899,400	C-23, 25	"

Notes: Period is from 1981 to Dec. of 1984.

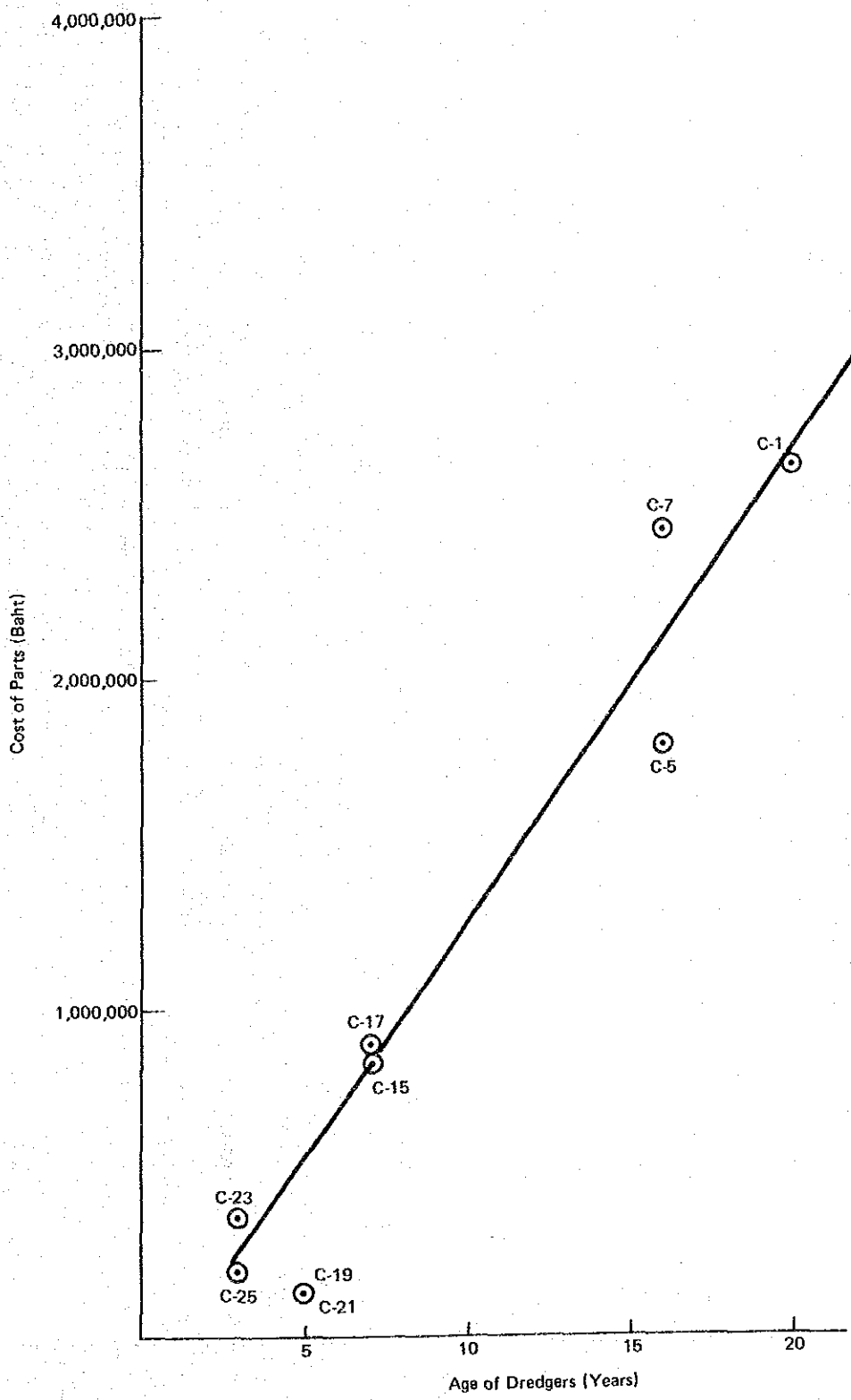
Source: HD

Table A.2-34 Cost of Regular Maintenance and Repairs

Unit: Baht

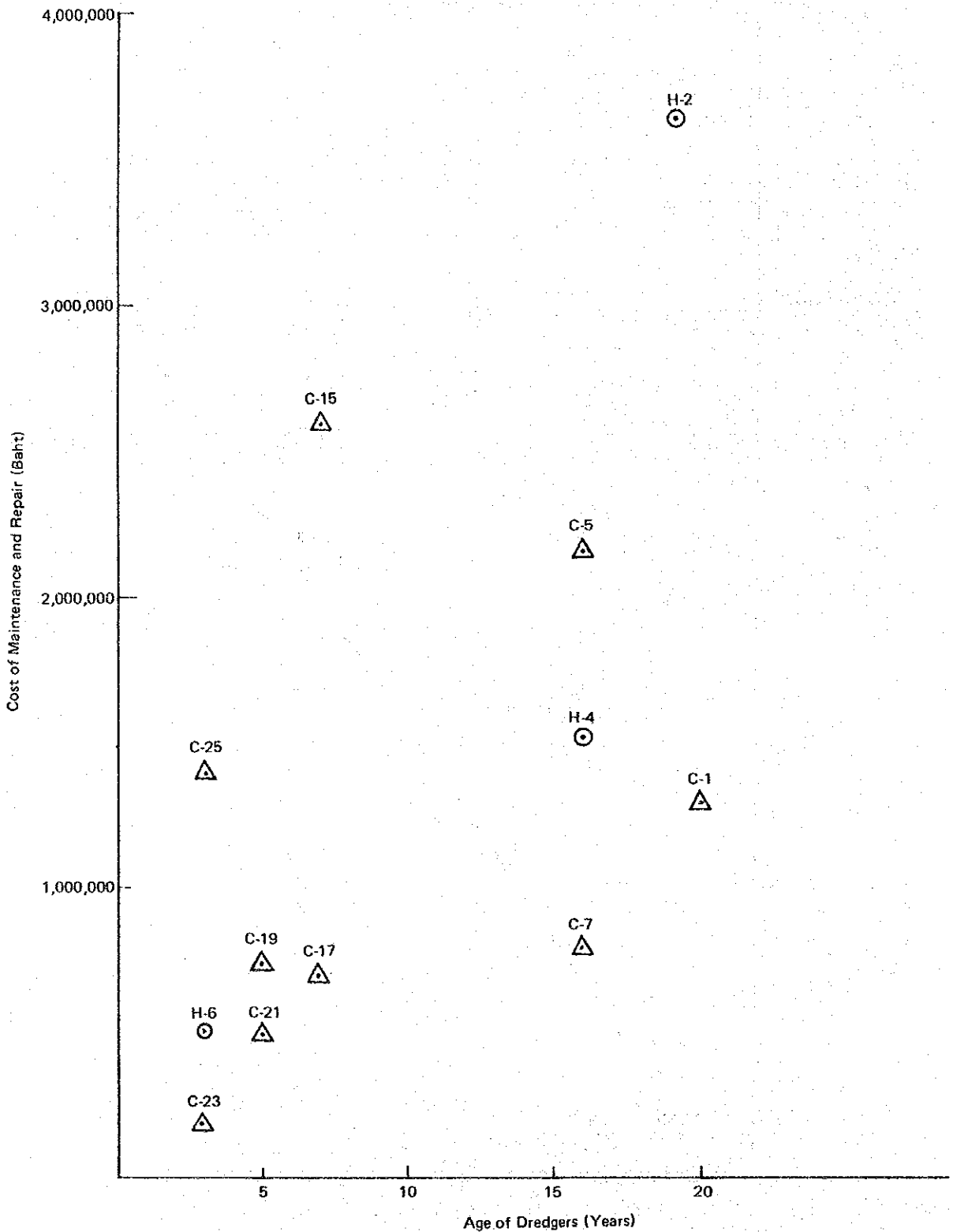
No.	Dredger	Age	Expenditure during each Fiscal Year				
			1982	1983	1984	1985	Total
1	H-2	19	97,160	1,295,460	-	2,243,858	3,636,478
2	H-4	16	1,486,830	-	36,810	-	1,523,640
3	H-6	3				494,500	494,500
4	C-1	20	560,000		740,000	-	1,300,000
5	C-5	16	486,600	165,000		1,521,000	2,172,600
6	C-7	16		793,500			793,500
7	C-15	7	-	647,000	1,125,588	845,000	2,617,588
8	C-17	7	478,000			228,800	706,800
9	C-19	5			499,500	240,000	739,500
10	C-21	5			497,500		497,500
11	C-23	3				195,800	195,800
12	C-25	3				1,400,000	1,400,000

Source: HD



Note: Based on data from FY 1982 through FY 1985
 Source: HD

Fig. A.2-1 Relation between Age of Dredgers and Cost of Parts



Note: Based on data from FY 1982 through FY 1985
 Source: HD

Fig. A.2-2 Relation between Age of Dredgers and Cost of Maintenance and Repairs

No.	Fiscal	Year																									
		1987			1988			1989			1990			1991													
Coastal Port and Channel	Volume Consist & Backlog	Volume Main- tenance	Mon- soon	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
1 RANONG	(118)	50																									
2 PHANG-NGA		20																									
3 KLONG-TACHIN		100																									
4 KRABI	(24)	333	133																								
5 KANTANG	(62)	400	234																								
6 PAK-BARA		38	176																								
7 SATUN	(109)	210	110																								

Notes: (1) The numbers above the bars are the names of dredgers.
(2) The figure below the bars expresses the dredging volume in thousand cubic meters.
(3) The figure in the parenthesis express the volume of backlog in thousand cubic meter.

Fig. A.2-3 (2/4) Trang Dredging Center Deployment Plan during the 6th National Five Year Plan without Project (Plan 1)

No.	Coastal Port and Channel	Volume Capital Maintenance (Million Baht)	Man - month	Fiscal Year																							
				1987			1988			1989			1990			1991											
8	CHUMPORN	(71)	75	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
9	PAK-TAKO		30																								
10	LUNGSUAN	(118)	65																								
11	OUTER BANDON		225																								
12	INNER BANDON		60																								
13	DORNSAK		50																								
14	KHA-NORM		100																								
15	SICHON		32																								
16	THA-SALE	(18)	25																								
17	PAK-NAKORN	(48)	40																								
18	PAK-PHANANG		260	163																							
19	OUTER SONGKHLA		82																								
20	INNER SONGKHLA	(250)	300																								
21	NATAB	(23)	25																								
22	SAKORN	(65)	54																								
23	NONG-JIK		-																								
24	PATTANI		120	30																							
25	SAIBURI		90																								
26	NARATHIWAT		32																								
			100																								

Fig. A.2-3 (3/4) Songkhla Dredging Center Deployment Plan during the 6th National Five Year Plan without Project (Plan 1)

No.	Dredger	Dredging Center	Month	Fiscal Year																																																
				1992			1993			1994			1995			1996																																				
1	C-5	Trang	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9																										
2	C-7	Trang	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9																						
3	C-15	Trang	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9																				
4	H-4	Trang and Songkhla	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9																					
5	C-1	Songkhla	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50																
6	C-19	Songkhla	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50										
7	C-21	Songkhla	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60										
8	C-25	Songkhla	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50									
9	H-2	Songkhla and Trang	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50						
10	H-6	Songkhla	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50		
11	H-8	Songkhla	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
12	C-17	Chantaburi	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60								
13	C-23	Chantaburi	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50				

Fig. A.2.4 (1/4) Deployment Plan during the 7th National Five Year Plan without Project (Plan 1)

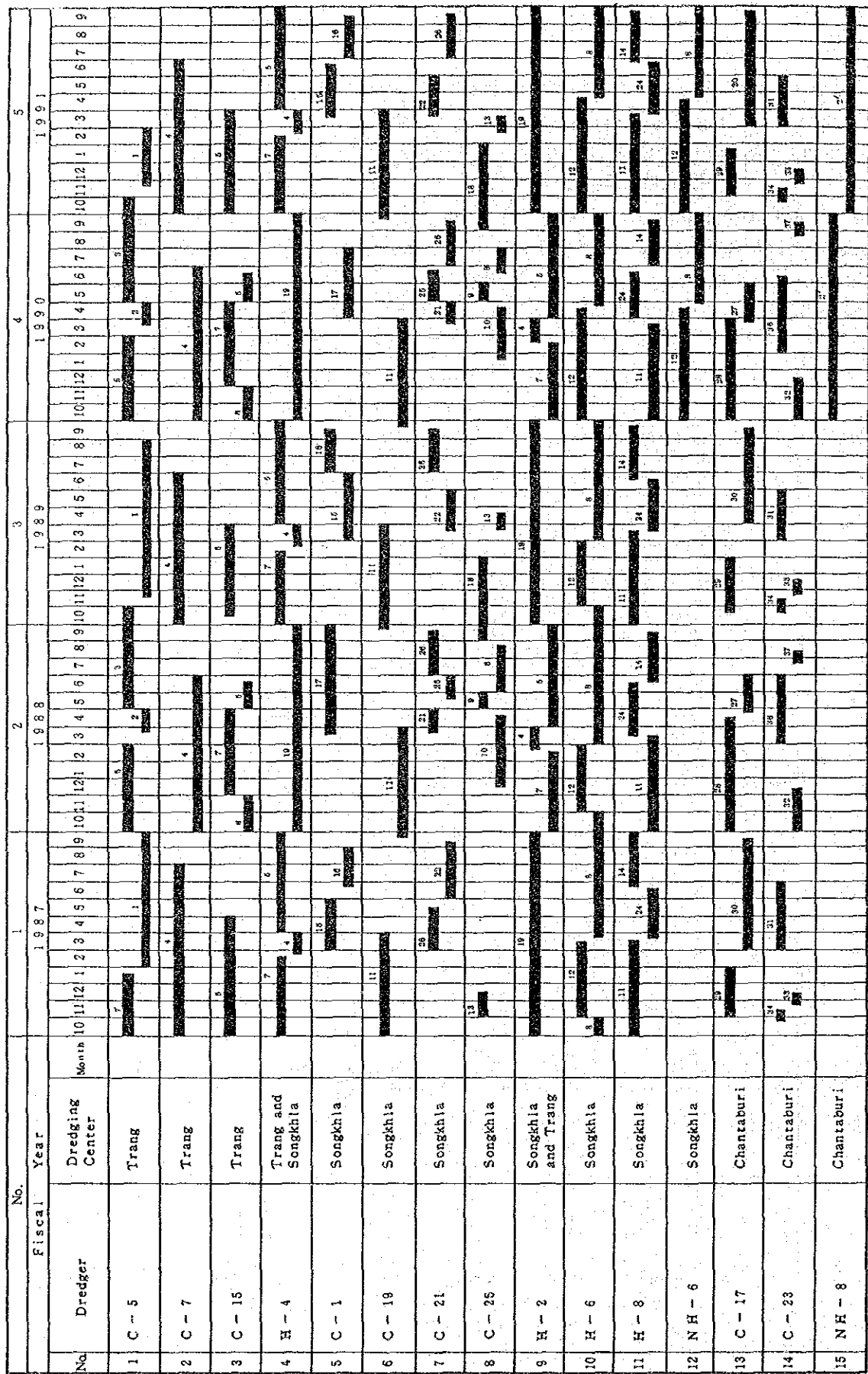
No.	Dredger	Fiscal Year	No.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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3	C-15	Trang	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
4	H-4	Trang and Songkhla	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
5	C-19	Songkhla	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
6	C-21	Songkhla	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
7	C-25	Songkhla	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								

Fiscal Year	1991												1992												1993												1994											
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Coastal Port and channel	[Grid with project activity markers]																																															
8 CHUMPHORN	[Grid with activity markers]																																															
9 PAK-TAKO	[Grid with activity markers]																																															
10 LUNGSUAN	[Grid with activity markers]																																															
11 OUTER BANDON	[Grid with activity markers]																																															
12 INNER BANDON	[Grid with activity markers]																																															
13 DORNSAK	[Grid with activity markers]																																															
14 KHA-NORM	[Grid with activity markers]																																															
15 SICHON	[Grid with activity markers]																																															
16 TRA-SALE	[Grid with activity markers]																																															
17 PAK-NAKORN	[Grid with activity markers]																																															
18 PAK-PHANANG	[Grid with activity markers]																																															
19 OUTER SONGKHA	[Grid with activity markers]																																															
20 INNER SONGKHA	[Grid with activity markers]																																															
21 NATAB	[Grid with activity markers]																																															
22 SAKORM	[Grid with activity markers]																																															
23 NONG-JIK	[Grid with activity markers]																																															
24 PATTANI	[Grid with activity markers]																																															
25 SAIBURI	[Grid with activity markers]																																															
26 NAKATHIWAT	[Grid with activity markers]																																															
27 PAKPOON	[Grid with activity markers]																																															
28 PUMRIENG	[Grid with activity markers]																																															

Fig. A.2-5 (3/4) Songkhla Dredging Center Deployment Plan during the 8th National Five Year Plan without Project (Plan 1)

Notes for Fig. A.2-3, Fig. A.2-4 and Fig. A.2-5

- (1) As for the maintenance dredging of Outer Bandon channel, the dumping area is far away. Therefore, dredging efficiency by trailing hopper dredger H-8 is extraordinarily low and this is clearly uneconomic. One solution is a combination of H-8 and one cutter suction dredger, and C-19 or C-21 would be suitable judging from dredging capacity. In this plan C-19 will be used. Two dumping areas along the channel will be dredged by C-19 at the location of one-fourth and three-fourth of Outer Bandon Channel, and H-8 will dump there and C-19 will discharge the soil dumped from H-8 by side casting. Trailing hopper dredger H-6 operating at Inner Bandon Channel will also dump at the closest area.
- (2) Average sailing speed of trailing hopper dredgers is estimated based on their service speed.
- (3) Dredging by trailing hopper dredgers is estimated to be completed around in 30 minutes.



Notes: The figures above the bars refer to the number of each coastal port and channel.

Fig. A.2-6 (1/4) Deployment Plan during the 6th National Five Year Plan with Project (Plan 2)

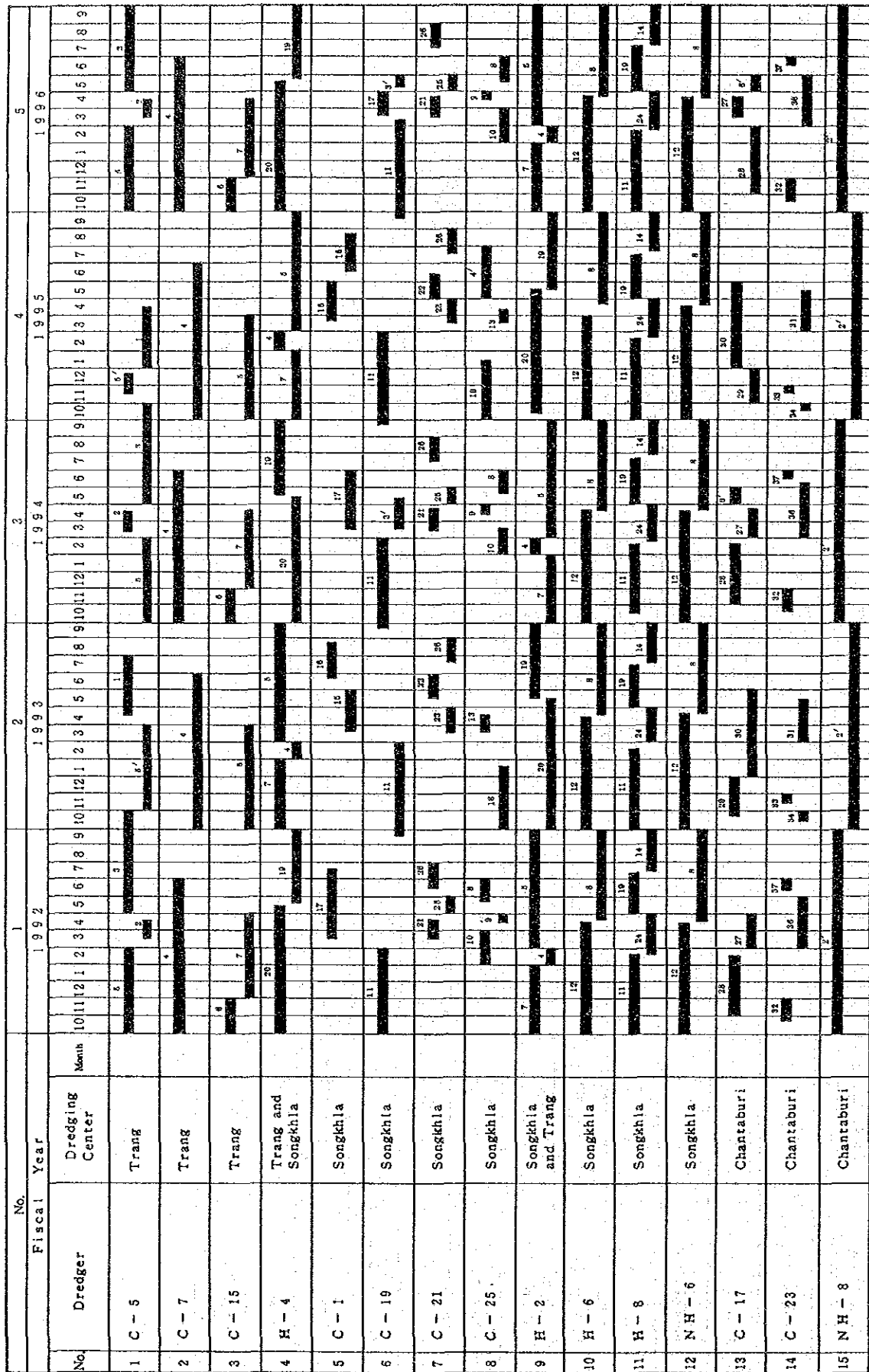


Fig. A.2-7 (1/4) Deployment Plan during the 7th National Five Year Plan with Project (Plan 2)

