

## 1. Introduction

This volume is intended to propose the Short-term Development Plan up to 2005 of Sihanoukville Port within the framework of the Long-term Development Plan, which, as discussed in Volume one of this study, was identified to be most recommendable.

The feasibility of the proposed Short-term Plan was evaluated from the various viewpoints. The feasibility study covered the following work items:

- a. Review of the cargo volume forecast which carried out for the formulation of the Long-term Development Plans,
- b. Careful examinations of the scale of the development of the port up to 2005, construction schedule, engineering soundness of the structural design, the construction plan and the construction cost,
- c. Proposals of procurement and replacement plans of cargo handling equipment, tug boat, etc., and in-depth layout plan of the various facilities included in the project,
- d. Evaluation of both the Economic and the Financial feasibility, and
- e. The Environmental Impact Assessment for those elements which, in the course of the preparation of the Long-term Plan, were identified to be the potential impacts caused by the project.



## 2. Cargo traffic forecast

### 2.1 Condition

In the Master Plan, three cases, the High case, Middle case and Low case, are assumed in the projection of socio-economic indices of GDP. This future GDP is forecasted by extrapolation of past years trend based on the correlation between the sectoral GDP of agriculture, industry and service and year in each sector.

In the High case, GDP growth rates of agriculture, industry, service sector and whole sector are 5.0 %, 9.5 %, 8.5 % and 7.4% from 1996 to 2015 respectively. Low case has rates of 4.0 %, 8.0 %, 6.5 % and 5.8% respectively. And in the Middle case, GDP growth rate from 1996 till 1999 is the same as the Low Case, and from 2000 to 2015 is the same as the High Case, hence the whole GDP growth rate is 7.1% from 1996 to 2015. Demand forecast of the master plan is carried out based on the above three cases.

Considering the recent economic indices, economic growth will not increase rapidly because foreign aid has been curtailed at constant price. The foreign investment and industrial development will be increased after the consolidation of infrastructure such as road, communication, various energy supply utilities and so on. Judging from the present condition in Cambodia, development of these infrastructures is progressing rapidly, but will take several years before foreign investment actively. On the other hand, according to the population by age group (under 15 years was very high), labor force will increase and can be utilized for new industry after 2000. This may be a big incentive for foreign investment in the industrial sector. Therefore, GDP growth rate is assumed to gradually increase till 1999 and steadily increase after 2000.

For the reason as mentioned above demand forecast will be carried out on the assumption that GDP growth rate will be as Middle case (Low case from 1996 to 1999 and High case after 2000). For reference, the comparison of forecasted cargo volume with latest data (January to November) in 1996 is provided in the appendix. Where, the data is estimated as annual by 12 / 11 of the volume. In both imports and exports, not only in the High case but also in the Middle / Low case, forecasted total cargo volume exceeds the estimated volume. In particular, imported bagged cargo (include cement, fertilizer, rice and so on) and exported wood product will decrease rapidly compare to 1995. It is true that there are some problems in judging the adequacy of applying the Middle / Low case as the GDP growth rate in Cambodia based on only one year additional data, but the data seems to support the above opinion.

## 2.2 Cargo forecast

According to the above condition, demand forecast of the Short-term plan (including Urgent-measures) for target year 2005 will be carried out in the same way as in the Master Plan.

The results of the import and export volume by commodity in Cambodia (both Sihanoukville Port and Phnom Penh Port) are as shown in Table - 2.2-1 and Fig. - 2.2-1. Cargo volume at Sihanoukville Port by commodity / package type and commodity are as shown in Table - 2.2-2 and Fig. - 2.2-2 respectively. Table - 2.2-3 and Figure - 2.2-3 shows the TEU of container.

Table - 2.2-1 Forecasted cargo volume in Cambodia

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
IMPORT (Excluding Fuels)	672,600	765,731	865,282	972,397	1,050,399	1,137,609	1,233,908	1,340,393	1,455,935	1,582,974
Fertilizer	33,828	38,045	42,755	48,014	53,881	60,426	67,723	75,857	84,919	95,013
Cement	164,108	171,081	178,313	185,812	196,643	208,033	220,005	232,584	245,796	259,665
Rice	65,543	94,470	125,602	159,779	141,548	124,831	108,858	94,023	78,426	63,676
Sugar	24,635	29,287	34,311	39,737	46,695	54,315	62,659	71,795	81,800	92,754
Wheat	8,609	10,151	11,816	13,614	15,920	18,445	21,211	24,238	27,554	31,185
Bitumen	21,170	23,753	26,541	29,553	33,416	37,646	42,277	47,349	52,902	58,983
Steel	19,178	22,798	26,707	30,929	36,344	42,274	48,766	55,876	63,661	72,185
Machinery	51,637	58,389	65,551	73,151	83,289	94,207	105,970	118,647	132,311	147,044
Other general cargo	283,892	317,759	353,686	391,808	442,662	497,432	556,438	620,024	688,566	762,470
Fuels	483,787	540,966	601,624	665,987	751,847	844,319	943,942	1,051,299	1,167,022	1,291,799
EXPORT	242,964	274,067	293,332	312,677	333,393	353,700	373,992	394,130	415,040	436,025
Rice	0	0	0	0	0	0	0	0	0	0
Rubber	40,778	45,928	51,383	57,144	63,211	69,583	76,261	83,244	90,533	98,128
Wood product	148,554	163,124	165,244	167,392	169,569	171,773	174,006	176,268	178,560	180,881
Agriculture product	24,787	32,119	39,511	46,386	52,777	57,956	62,281	65,568	68,699	70,928
Other general cargo	28,846	32,897	37,194	41,754	47,836	54,387	61,445	69,051	77,249	86,089
TOTAL (Excluding Fuels)	915,565	1,039,798	1,158,615	1,285,073	1,383,792	1,491,309	1,607,900	1,734,524	1,870,975	2,018,999

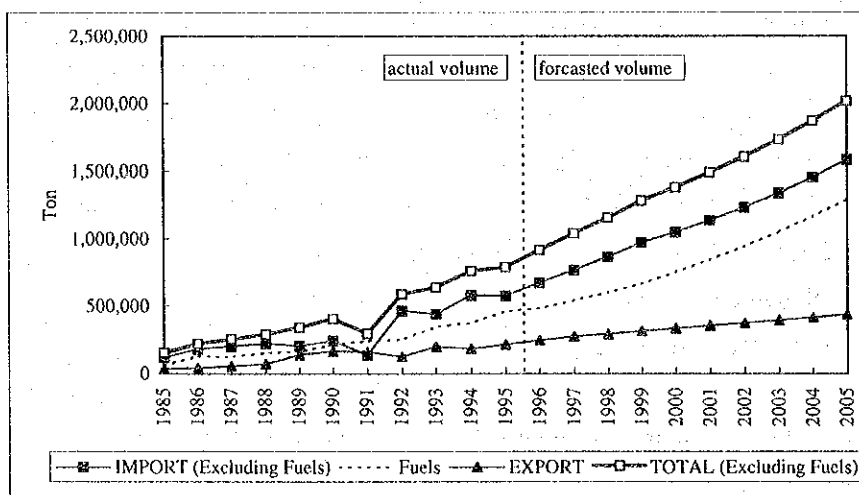


Fig. - 2.2-1 Forecasted cargo volume in Cambodia

Table 2.2-2 Cargo volume by commodity / package type at Sihanoukville Port

(Unit: ton)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<b>IMPORT</b>										
(Including Fuels)	701,370	827,451	965,529	1,106,728	1,227,083	1,362,532	1,513,461	1,681,485	1,866,021	2,070,097
(Excluding Fuels)	611,401	708,302	813,263	917,223	990,492	1,072,473	1,163,080	1,263,413	1,372,324	1,492,226
Bagged Cargo	242,291	290,825	345,318	396,179	399,439	405,998	415,245	427,742	441,782	459,175
Fertilizer	33,828	38,045	42,755	48,014	53,881	60,426	67,723	75,857	84,919	95,013
Cement	131,286	136,865	142,650	148,650	157,315	166,426	176,004	186,067	196,637	207,732
Rice	52,543	86,629	125,602	159,779	141,548	124,831	108,858	94,023	78,426	63,676
Sugar	24,635	29,287	34,311	39,737	46,695	54,315	62,659	71,795	81,800	92,754
Bitumen	21,170	23,753	26,541	29,553	33,416	37,646	42,277	47,349	52,902	58,983
General Cargo	98,304	87,597	86,668	92,050	103,699	118,143	134,835	153,586	174,393	197,359
Machinery	7,746	9,834	12,248	15,015	18,630	22,808	27,608	33,096	39,345	46,435
Steel	19,178	22,798	26,707	30,929	36,344	42,274	48,766	55,876	63,661	72,185
Equipment	10,464	7,978	6,844	6,525	6,804	7,298	7,910	8,589	9,312	10,068
Other General Cargo	60,916	46,988	40,870	39,580	41,921	45,762	50,551	56,025	62,076	68,671
Container	249,635	306,128	354,735	399,440	453,938	510,686	570,723	634,736	703,247	776,709
Equipment	33,427	40,577	46,460	51,610	57,855	64,101	70,452	76,961	83,653	90,541
Other General Cargo	194,587	238,995	277,448	313,047	356,475	401,927	450,244	501,997	557,634	617,552
from Phnom Penh Port	21,621	26,555	30,828	34,783	39,608	44,659	50,027	55,777	61,959	68,617
Fuels	89,969	119,149	152,266	189,505	236,591	290,059	350,381	418,072	493,696	577,871
<b>EXPORT</b>										
Bagged Cargo	0	0	0	0	0	0	0	0	0	0
Rice	0	0	0	0	0	0	0	0	0	0
Wood Product	89,535	73,519	55,915	44,531	38,005	34,686	33,187	32,645	32,589	32,778
General Cargo	15,189	13,925	12,256	10,973	10,568	10,706	11,247	12,037	13,025	14,117
Agriculture Product	4,124	4,143	3,866	3,568	3,420	3,384	3,435	3,511	3,626	3,716
Other General Cargo	11,065	9,782	8,390	7,405	7,148	7,322	7,813	8,525	9,399	10,400
Container	66,313	103,088	132,743	155,829	173,578	187,116	198,329	208,390	218,186	227,958
Wood Product	50,515	74,823	92,805	106,122	114,606	119,909	123,418	125,996	128,114	130,015
Agriculture Product	2,327	4,216	6,416	8,503	10,314	11,698	12,773	13,552	14,253	14,742
Other General Cargo	6,243	9,956	13,926	17,647	21,554	25,311	29,054	32,905	36,950	41,253
from Phnom Penh Port	7,229	14,093	19,596	23,556	27,103	30,197	33,083	35,956	38,868	41,948
(Including Fuels)	872,407	1,017,982	1,166,443	1,318,061	1,449,235	1,595,040	1,756,224	1,934,556	2,129,820	2,344,950
(Excluding Fuels)	782,438	898,833	1,014,177	1,128,556	1,212,644	1,304,981	1,405,843	1,516,484	1,636,124	1,767,079

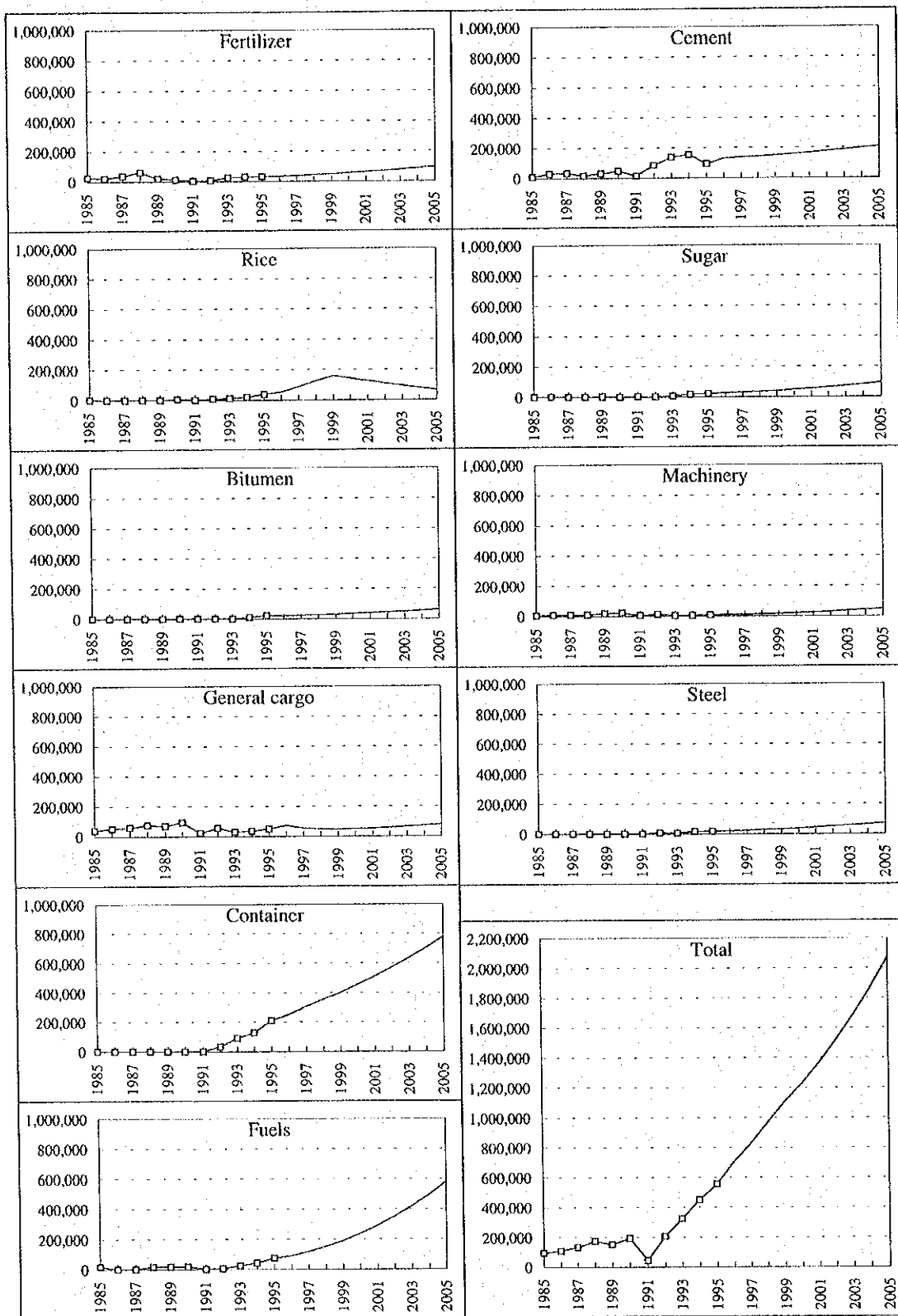


Fig. - 2.2-2(a) Forecasted cargo volume by commodity at Sihanoukville Port (Import)

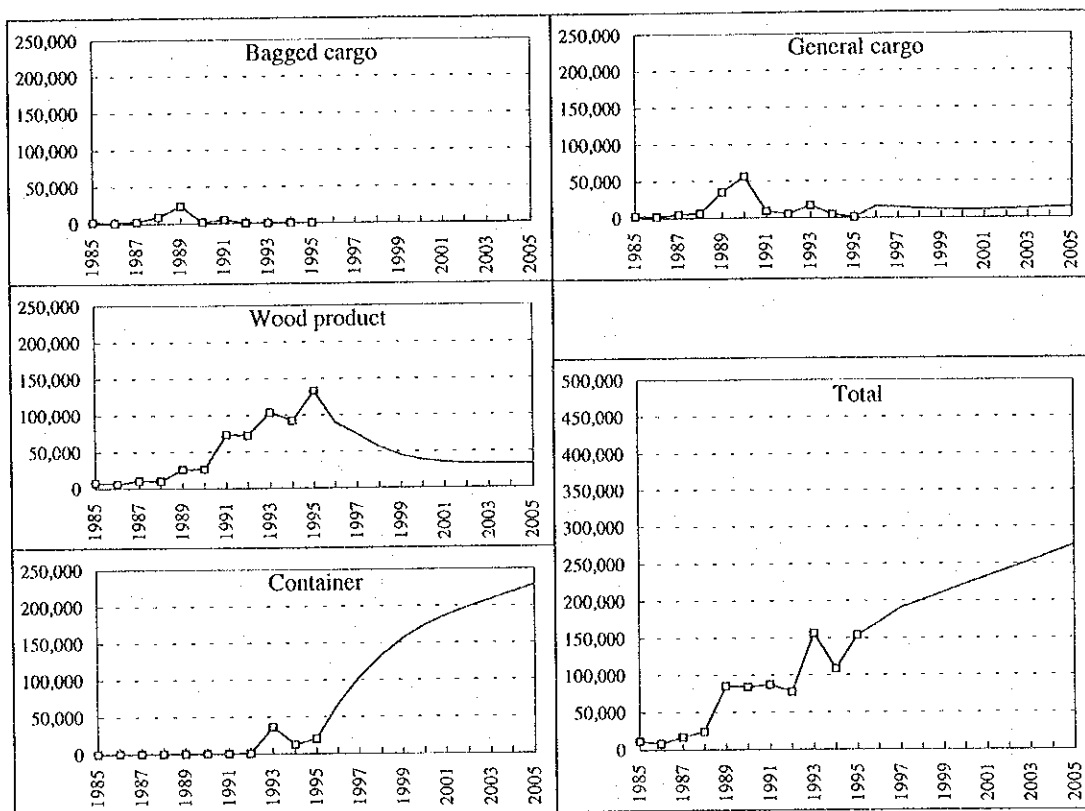


Fig. - 2.2-2(b) Forecasted cargo volume by commodity at Sihanoukville Port (Export)

Table 2.2-3 TEU at Sihanoukville Port

		(Unit: TEU)									
		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Import	Loaded	24,964	30,613	35,473	39,944	45,394	51,069	57,072	63,474	70,325	77,671
	Export Loaded	8,289	12,886	16,593	19,479	21,697	23,389	24,791	26,049	27,273	28,495
	Export Empty	16,674	17,727	18,881	20,465	23,696	27,679	32,281	37,425	43,051	49,176
Sub total		24,964	30,613	35,473	39,944	45,394	51,069	57,072	63,474	70,325	77,671
TOTAL	Loaded	33,253	43,499	52,066	59,423	67,091	74,458	81,863	89,522	97,598	106,166
	Empty	16,674	17,727	18,881	20,465	23,696	27,679	32,281	37,425	43,051	49,176
	Total	49,927	61,226	70,947	79,888	90,788	102,137	114,145	126,947	140,649	155,342

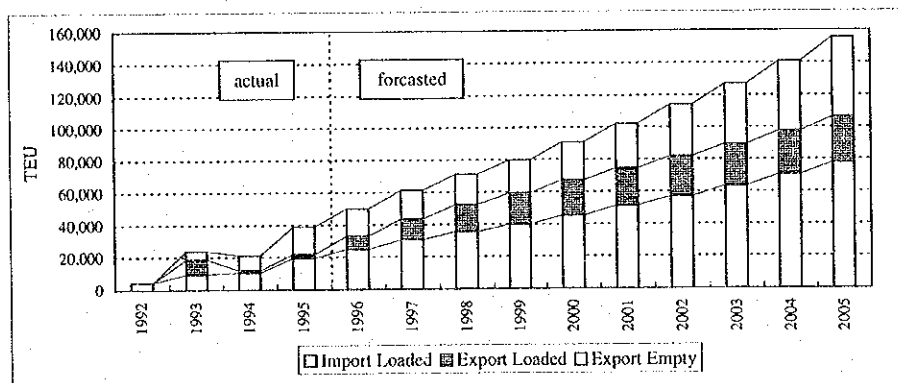


Fig. - 2.2-3 TEU at Sihanoukville Port





### **3. Short-term development plan**

#### **3.1 Strategy of the formulation of the Short-term Development**

The Short-term Development Plan is herein defined as the project which intended to develop new facilities for the handling of the general and the container cargoes. The maintenance, repair and minor improvement of the existing facilities are considered to be the normal management and operation of the port, and thus those items are not covered by the Short-term Development Plan.

The Urgent Improvement Plan, which is proposed in Volume 2 of the study, is considered as a part of the Short-term Plan which need to be implemented urgently.

Projects requires investment first to construct facilities. Benefits are generated only after the completion of the facilities. The larger the scale of the project, the longer construction period is required. To make the project ensure the economic and financial feasibility, all the efforts to shorten the time span between the investment and the start of the operation of the facilities. Staged construction has thus advantage to avoid investment for the facilities which are not needed urgently.

The construction plan of the Short-term Plan shall be carefully prepared so that the expansion of the port is done in accordance with the growth of the cargo volume.

The Short-term Development is the first expansion project of the port of considerable scale since the completion of the New Quay in 1969. The project, when it completes, give impacts on the calling ships and the types and the sizes of the ships are expected to change. A trend from small to larger size and general cargo ships to specialized cargo ships, i.e., container carriers of bulk carriers, is widely seen. These change in the size and type of calling ships may provide such opportunity that improve the cargo handling productivity. The effect of these change shall be dully considered in the plan.

The life of the Old Jetty is unpredictable precisely. However, it seems to be practical to assume the handling capacity of the jetty tends to reduce in the coming years. Such deterioration of the existing facilities shall be taken into consideration.

### 3.2 Requirement for facilities and berth construction plan

#### (1) Assumption employed

The key elements which affect the cargo handling capacity of a berth are assumed as follows:

##### a. Ship size and cargo handling productivity

It is assumed that the ship size changes as the cargo volume increases and this leads to the change of the cargo handling productivity. The change of the ship size and cargo handling by year are chosen as shown in Table - 3.2-1.

##### b. Total working days per year

Rough seas and strong wind which causes suspension of cargo handling work rarely occur in the water area near and inside the port. It is assumed that total working day of a berth over a year is chosen to be 320 days.

##### c. Load factor of the ships

The average load factor, which is defined as actual cargo volume divided by the carrying capacity of the ship is assumed to be 0.6 until the year 2004, and 0.8 after 2005.

##### d. The time needed for the ships to dock and to leave

The time needed for docking and leaving of a ship. Certain period of time is needed before the loading and unloading start after the ship arrives and the ship leaves after the loading and unloading work completes. It is assume that such loss time is 0.125 days (or 3 hours) pr ship.

##### e. Berth Occupancy Rate (BOR)

The BOR is defined by the following equation:

$$\text{BOR} = \frac{\text{(The Sum of the days the berths is occupied by ships)}}{\text{(Number of berths x Total working days)}}$$

#### (2) Number of berths required

The number of berths required in each year between 1996 and 2015 to accommodate the cargo volume expected in the corresponding year is defined as the minimum number of berths with which the BOR as a whole does not exceed 0.7.

Table - 3.2-2 is a sample calculation table used for the calculation of the numbers of berths required in 2004. For this year, two alternative cased are examined: one without container gantry cranes and the other with a couple of gantry cranes.

Without gantry cranes, 8 berths or total berth length 1,010m is required, while with gantry cranes 7 berths or total berth length 940m is enough to accommodate the cargo in 2004. Thus, it is concluded that 7 berths and a couple of container gantry cranes are needed.

Table - 3.2-3 is the summary of the number of berth required in each year over the 20 year up to 2015. In the Table, the commodity which is handled at the bulk terminal is marked with X, and the number of calling ships are also shown.

In order to fulfill the berth number required in each year, the construction schedule of the new berths are proposed. Table - 3.2-4 shows the lengths of existing berths and those of new berths, namely, the general cargo berths, container cargo berths and bulk berths.

Figure - 3.2-1 is prepared to schematically exhibit how the new berths should be constructed in accordance with the growth of cargo volume up to 2015.

Table - 3.2-1 Ship size and cargo handling productivity assumed to various commodities

Middle Cases		Ver. 1, Jan. 8, 1997																					
Commodity		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
(1) Bagged Cargo:																							
a. Fertilizer																							
Cargo Volume (ton)	29,808	33,826	38,045	42,756	48,014	53,881	60,426	67,723	75,857	84,919	95,013	105,251	118,780	132,678	140,161	155,370	184,520	201,720	220,436	240,005	262,959		
Max. Ship Size(DWT)	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
Ave. Ship Size(DWT)	6,000	5,000	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	4,34	
Hnd. Productivity(t/d/berth)	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	
b. Cement																							
Cargo Volume (ton)	93,386	131,286	136,885	142,850	148,650	157,315	166,426	176,004	186,067	196,637	207,732	219,371	231,574	244,360	257,744	280,862	309,557	340,978	375,384	413,059	454,313		
Max. Ship Size(DWT)	5,000	8,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	
Ave. Ship Size(DWT)	3,000	3,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
Hnd. Productivity(t/d/berth)	278	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	
c. Rice																							
Cargo Volume (ton)	36,684	52,543	66,628	125,602	159,779	141,548	124,831	108,858	94,073	78,428	63,676	48,647	34,132	20,801	7,305	6,672	21,508	38,775	60,131	83,858	112,999		
Max. Ship Size(DWT)	17,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
Ave. Ship Size(DWT)	2,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	
Hnd. Productivity(t/d/berth)	372	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	
d. Sugar																							
Cargo Volume (ton)	19,987	24,635	29,287	34,311	39,737	46,695	54,315	62,859	71,795	81,800	92,754	104,750	117,805	132,268	148,017	165,282	184,146	204,923	227,465	252,258	279,407		
Max. Ship Size(DWT)	2,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
Ave. Ship Size(DWT)	2,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
Hnd. Productivity(t/d/berth)	288	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	
(2) Bitumen																							
Cargo Volume	19,987	21,170	22,753	26,541	28,553	33,416	37,646	42,277	47,349	52,902	58,983	65,642	72,933	80,917	89,659	99,232	109,714	121,192	133,761	147,523	162,593		
Max. Ship Size	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000		
Ave. Ship Size	2,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
Hnd. Productivity(t/d/berth)	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	
(3) General Cargo																							
a. Machinery																							
Cargo Volume (ton)	6,530	7,746	9,834	12,248	15,015	18,630	22,808	27,808	33,096	39,345	46,435	54,454	63,500	73,681	85,116	97,934	112,262	128,317	146,216	166,172	188,398		
Max. Ship Size(DWT)	8,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	
Ave. Ship Size(DWT)	2,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
Hnd. Productivity(t/d/berth)	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	
b. Steel Product																							
Cargo Volume (ton)	17,936	19,178	22,798	26,707	30,929	36,344	42,274	48,766	55,876	63,661	72,185	81,519	91,740	102,932	115,187	128,607	143,301	159,391	177,010	196,303	217,428		
Max. Ship Size(DWT)	8,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	
Ave. Ship Size(DWT)	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
Hnd. Productivity(t/d/berth)	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	
c. Wood Prod.																							
Cargo Volume (ton)	133,396	89,534	73,519	55,915	44,531	30,005	34,686	33,187	32,645	32,569	32,770	32,089	33,463	33,070	34,297	34,737	35,105	35,641	36,103	36,572	37,048		
Max. Ship Size(DWT)	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	
Ave. Ship Size(DWT)	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
Hnd. Productivity(t/d/berth)	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	
d. General Cargo																							
Cargo Volume (ton)	48,974	85,565	83,690	59,960	57,078	55,293	63,767	69,708	76,651	84,413	92,866	101,982	111,785	122,283	133,557	145,676	156,712	172,777	187,989	204,393	222,159		
Max. Ship Size(DWT)	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
Ave. Ship Size(DWT)	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
Hnd. Productivity(t/d/berth)	156	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	
(4) Container																							
Cargo Volume (TEU)	30,942	49,927	61,226	70,947	79,888	90,786	102,137	114,145	126,947	140,649	155,342	171,112	188,051	206,251	225,016	246,633	269,481	293,626	320,027	348,233	378,604		
Max. Ship Size(DWT)	4,300	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	
Ave. Ship Size(DWT)	1,200	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
Hnd. Productivity(TEU/d/berth)	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	

Table - 3.2-2 Calculation of number of berth required in each year up to 2015

Total Working Days per Year = 320									
Berth Length required (2004, Middle Case) No Container Gantry Crane									
2004 Middle Commodity	Cargo Vol. ton	Ship Size	Ld. factor	Ave. Load	Ship Calls	Handling t/d/berth	Work time Day/Ship	BerthTime Day/Ship	Total B.T. Day-Berth
(1) Bagged Cargo	441,782							0.125	
a. Fertilizer	84,919	7,000	0.6	4,200	20.2	651	6.45	6.58	133.0
b. Cement	196,637	10,000	0.6	6,000	32.8	651	9.22	9.34	308.2
c. Rice	78,428	5,000	0.6	3,000	28.1	434	6.91	7.04	184.0
d. Sugar	81,800	5,000	0.6	3,000	27.3	434	6.91	7.04	191.9
(2) Bitumen	52,902	5,000	0.6	3,000	17.6	1620	1.85	1.96	34.9
(3) General Cargo	220,008								
a. Machinery	39,345	5,000	0.6	3,000	13.1	700	4.29	4.41	57.8
b. Steel Product	63,661	5,000	0.6	3,000	21.2	688	4.37	4.50	95.5
c. Wood Prod.	32,589	5,000	0.6	3,000	10.9	609	4.93	5.05	54.9
d. General Cargo	84,413	3,000	0.6	1,800	46.9	364	4.95	5.07	237.8
G.C.(Import)	71,388								
G.C. (Export)	13,025								
G. Cargo Total	714,692				216.1				
(4) Container Import (ton)	703,247	4000							
(TEU)	140,849			200	703.2	280	0.71	0.84	590.2
Export (ton)	218,186								
Total Cargo ton	1,636,125				919.4				1886.0

2004 Middle	Required Berths				Berth Plan 1			Berth Plan 2			
	Day-Berth	No. of Bth	B. Length	T. Length	Depth	No. of Bth	B. Length	T. Length	No. of Bth	B. Length	T. Length
10000 Berth	306.2	1.37	165	225.5	9.0	2	165	330	2	165	330
7000 Berth	133.0	0.59	150	89.0	8.5	1	150	150	1	150	150
5000 Berth	618.9	2.76	120	331.5	7.5	2	120	240	2	120	240
3000 Berth	237.8	1.06	100	106.1	6.5	1	100	100	1	100	100
Container Berth	590.2	2.63	110	289.8	7.0	3	110	330	4	110	440
	1,886.0	8.42		1,042.1		9		1,150.0	10		1,280.0
								Berth Occup. Rate	0.65	Berth Occupancy	0.59

2004 Middle	9 berths			10 berths		
	Day-Berth	No. of Bth	B. Length	Day-Berth	No. of Bth	B. Length
10000 DWT Berth	0.478			0.478		
7000 DWT Berth	0.416			0.416		
5000 DWT berth	0.967	0.661		0.967	0.661	
3000 Berth	0.743	0.675		0.743	0.675	
Container berth	0.615		0.655	0.461		0.589
Whole berths	0.655	0.655	0.655	0.589	0.589	0.589

Total Working Days per Year = 320									
Berth Length required (2004, Middle Case) With Container Gantry Crane									
2004 Middle Gantry Commodity	Cargo Vol. ton	Ship Size	Ld. factor	Ave. Load	Ship Calls	Handling t/d/berth	Work time Day/Ship	BerthTime Day/Ship	Total B.T. Day-Berth
(1) Bagged Cargo	441,782							0.125	
a. Fertilizer	84,919	7,000	0.6	4,200	20.2	651	6.45	6.58	133.0
b. Cement	196,637	10,000	0.6	6,000	32.8	651	9.22	9.34	308.2
c. Rice	78,428	5,000	0.6	3,000	28.1	434	6.91	7.04	184.0
d. Sugar	81,800	5,000	0.6	3,000	27.3	434	6.91	7.04	191.9
(2) Bitumen	52,902	5,000	0.6	3,000	17.6	1620	1.85	1.96	34.9
(3) General Cargo	220,008								
a. Machinery	39,345	5,000	0.6	3,000	13.1	700	4.29	4.41	57.8
b. Steel Product	63,661	5,000	0.6	3,000	21.2	688	4.37	4.50	95.5
c. Wood Prod.	32,589	5,000	0.6	3,000	10.9	609	4.93	5.05	54.9
d. General Cargo	84,413	3,000	0.6	1,800	46.9	364	4.95	5.07	237.8
G.C.(Import)	71,388								
G.C. (Export)	13,025								
G. Cargo Total	714,692				216.1				
(4) Container Import (ton)	703,247	5000							
(TEU)	140,849			400	351.6	800	0.50	0.63	219.8
Export (ton)	218,186								
Total Cargo ton	1,636,125				567.8				1515.5

2004 Middle	Required Berths				Berth Plan 1			Berth Plan 2			
	Day-Berth	No. of Bth	B. Length	T. Length	Depth	No. of Bth	B. Length	T. Length	No. of Bth	B. Length	T. Length
10000 Berth	306.2	1.37	165	225.5	9.0	2	165	330	2	165	330
7000 Berth	133.0	0.59	150	89.0	8.5	1	150	150	1	150	150
5000 Berth	618.9	2.76	120	331.5	7.5	2	120	240	2	120	240
3000 Berth	237.8	1.06	100	106.1	6.5	1	100	100	1	100	100
Container Berth	219.8	0.98	120	117.7	7.0	1	120	120	2	120	240
	1,515.5	6.77		870.0		7		940.0	8		1,060.0
								Berth Occup. Rate	0.68	Berth Occupancy	0.59

Berth occupancy Rate									
2004 Middle	7 berths			8 berths					
	Day-Berth	No. of Bth	B. Length	Day-Berth	No. of Bth	B. Length			
10000 DWT Berth	0.478			0.478					
7000 DWT Berth	0.416	0.5		0.416	0.457				
5000 DWT berth	0.967	0.661		0.967	0.661				
3000 Berth	0.743	0.675		0.743	0.675				
Container berth	0.667		0.677	0.343		0.592			
Whole berths	0.677	0.677	0.677	0.592	0.592	0.592			

Table - 3.2-3 Summary of berth requirement and number of calling ships

Middle Case	1995		1996		1997		1998		1999		2000		2001		2002		2003		2004		2005	
	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length
Berth Plan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	330	2	330	2	330	2	330
10,000 Berth (-9.0m)	1	150	1	150	1	150	1	150	2	300	3	450	2	300	0	0	0	0	1	150	1	150
7000 Berth (-8.5m)	1	120	1	120	3	360	2	240	2	240	1	120	3	360	3	360	3	360	2	240	2	240
5,000 Berth (-7.5m)	4	400	4	400	3	300	2	200	1	100	1	100	1	100	1	100	1	100	1	100	0	0
3,000 Berth (-6.5m)	1	110	1	110	1	110	1	110	2	220	2	220	2	220	2	220	0	0	0	0	0	0
Container Berth (-7.0m)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	120	1	120
Container Berth (-7.5m)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulk Berth (-8.5)	7	780	7	780	7	800	7	820	7	860	7	890	8	980	8	1010	7	910	7	940	7	960
Total Length	LF	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8
Number of Ship Calls		237	231	201	206	217	206	191	214	214	191	191	214	214	214	214	214	214	216	216	216	155
General Cargo Ship		260	333	409	473	533	473	454	511	511	454	454	511	511	570	570	317	317	352	352	388	388
Container Ship		40	50	66	85	105	85	99	121	121	99	99	121	121	146	146	174	174	206	206	193	193
Tanker *		537	614	676	764	855	764	744	846	846	744	744	846	846	930	930	705	705	774	774	736	736
Total Number																						

Middle Case	2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015	
	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length
Berth Plan	2	330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,000 Berth (-9.0m)	1	150	1	150	2	300	2	300	2	300	2	300	2	300	3	450	3	450	3	450	3	450
7000 Berth (-8.5m)	2	240	4	480	3	360	3	360	3	360	3	360	3	360	2	240	2	240	2	240	2	240
5,000 Berth (-7.5m)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3,000 Berth (-6.5m)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Container Berth (-7.0m)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Container Berth (-7.5m)	2	240	2	240	2	240	2	240	2	240	2	240	2	240	2	240	2	240	2	240	2	240
Container berth (-8.5m)	0	0	1	150	1	150	1	150	1	150	2	300	2	300	2	300	2	300	2	300	2	300
Bulk Berth (-8.5m)			X		X		X		X		X		X		X		X		X		X	
Cement																						
Fertilizer																						
Bitumen																						
Total Length	7	960	8	1020	8	1050	8	1050	8	1050	9	1260	9	1260	9	1290	9	1290	9	1290	10	1440
Number of Ship Calls		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
General Cargo Ship		155	177	190	204	220	204	242	260	260	242	260	260	260	289	289	308	308	342	342	380	380
Container Ship		388	428	470	516	565	516	411	449	449	411	449	449	449	490	490	533	533	580	580	631	631
Tanker*		193	168	194	222	254	222	206	233	233	206	233	233	263	263	296	296	331	331	331	370	370
Total Number		736	773	854	942	1039	942	859	942	942	859	942	942	1077	1077	1077	1077	1253	1253	1381	1381	

\* Note Sizes of Tankers are assumed to be: 1995-1999: 3,000 DWT, 2000-204: 4,000 DWT, 2005-2009: 5,000 DWT, 2010-2015: 7,000DWT

Table - 3.2-4 Construction schedule of berths

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<b>Middle Case</b>											
Without Gantry Crane	780	780	800	820	860	890	980	1010	1010	1150	
Berth Length needed	0.681	0.59	0.61	0.64	0.69	0.63	0.61	0.67	0.69	0.65	
Berth Occupancy Rate	7	7	7	7	7	7	8	8	8	9	
Number of Berths											
<b>With Gantry Crane</b>											
Berth Length needed									910	940	960
Berth Occupancy Rate									0.64	0.67	0.68
Number of Berths									7	7	8
<b>Implementation Plan</b>											
Existing Berth (Old Jetty)	580	580	580	580	580	348	209	125			350
Existing Berth (New Quay)	350	350	350	350	350	350	350	350	350	350	350
Renovation						200	400	400	400	400	400
Container Terminal								140	240	240	240
Gantry Crane (Units)	930	930	930	930	930	898	959	1015	990	990	990
<b>Total Length</b>											
	930	930	930	930	930	898	959	1015	990	990	990
<b>Middle Case</b>											
Without Bulk Wharf	960	1080	1080	1080							
Berth Length needed	0.68	0.63	0.67	0.72							
Berth Occupancy Rate	8	8	8	8							
Number of Berths											
With Bulk Wharf	150	150	150	150	150	300	300	300	300	300	300
Berth Occup. R. of Bulk	0.543	0.57	0.604	0.604	0.624	0.68	0.632	0.695	0.509	0.559	0.558
Berth Length needed(New Port)	870	900	900	900	900	960	960	960	990	990	1140
Berth Occupancy Rate	0.56	0.6	0.650	0.650	0.7	0.62	0.582	0.641	0.54	0.591	0.57
Number of Berths(Excluding Bulk)	7	7	7	7	8	7	7	7	7	7	8
<b>Implementation Plan</b>											
Bulk Terminal	150	150	150	150	150	300	300	300	300	300	300
Existing Berth (New Quay)	350	350	350	350	350	350	350	350	350	350	350
Renovation	400	400	400	400	400	400	400	400	400	400	400
Container Terminal	240	240	240	240	240	240	240	240	240	240	240
Gantry Crane (Units)	2	2	2	2	2	3	3	3	3	4	4
<b>Total Length(Excl. Bulk)</b>	990	990	990	990	990	990	990	990	990	990	1150

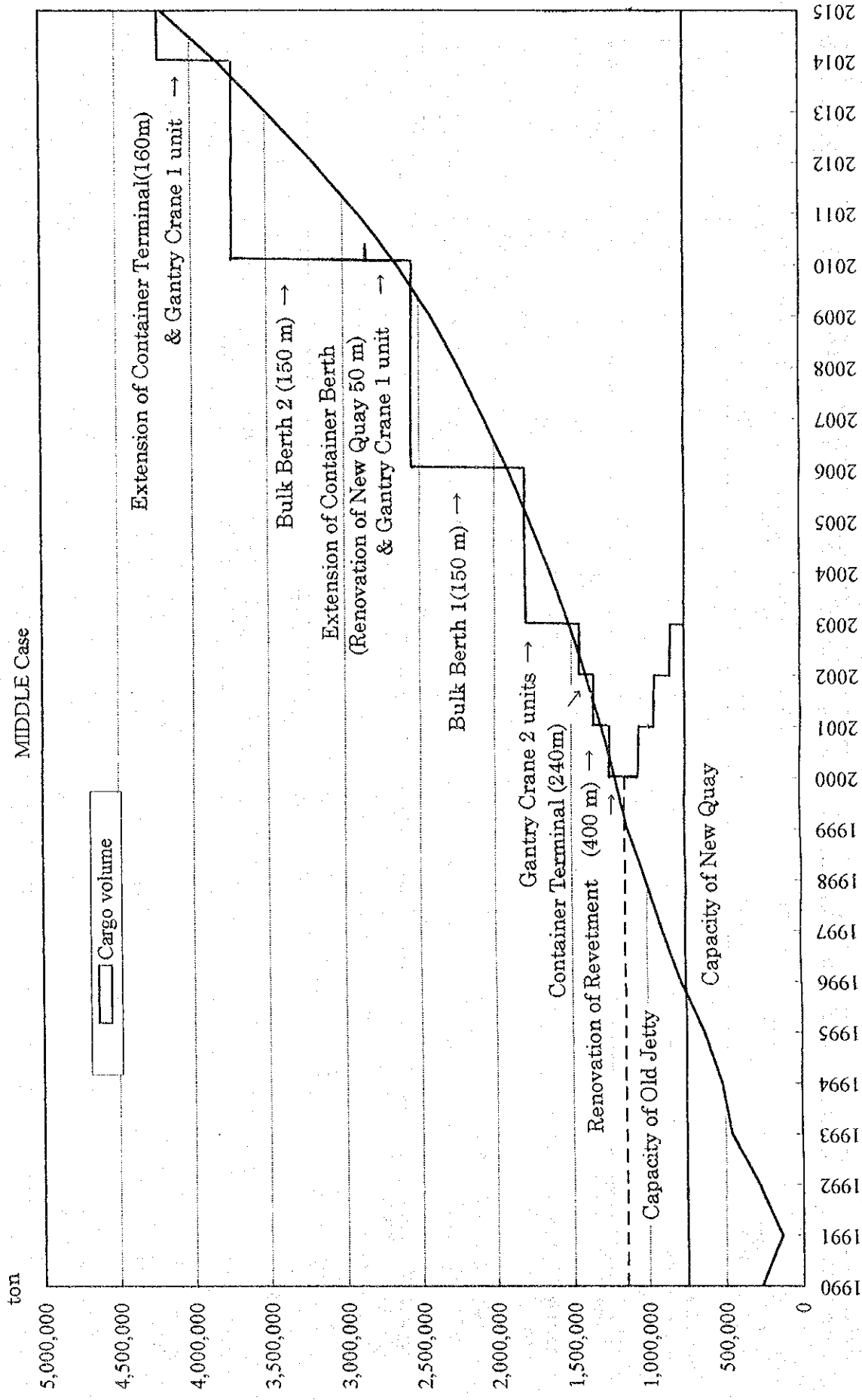


Fig. - 3.2-1 Cargo volume forecast and handling capacities



### 3.3 Preliminary design

Based on the facilities requirement and layout plans determined in the previous section, a layout of individual facilities and relevant preliminary design were made in this section. This section covers those facilities determined to be for the Short-term plan, as well as for Urgent improvement plan.

#### 3.3.1 Required facilities

##### (1) Layout of facilities

Layout plans of Urgent improvement plan and Short-term plan were prepared taking the following points into consideration. A concrete plan is indicated in Figs. - 3.3.1-1 and 3.3.1-2 for Urgent improvement plan and Short-term plan respectively.

- a. The layout and the size of area of container yard was determined not only to accommodate forecasted number of containers to be handled under the Short-term stage, but also to facilitate the development of the succeeding stages, i.e.:
- b. Shape of reclamation area:  
In order to minimize re-location of revetment as a marginal protection of the reclamation area, by individual development stages, the configuration of the reclamation area for container yard was determined to be of pentagonal shape as shown in Fig.-3.3.1-1.
- c. Paved container yard area :  
Out of above reclamation area, central ward and land-side half of east ward of container yard slots were included into a scope of yard pavement of Short-term plan. This arrangement was made considering that, i) this area could handle the forecasted number of containers under Short-term stage, ii) center ward is most convenient for approach from/to containers ship and entrance of yard, iii) a probable differential subsoil settlement between new reclamation area and existing land area along the existing revetment will affect the pavement and transfer-crane track foundation, iv) the turn-over of existing shed No. 5 by CAMSIN may not be completed by the time of commencement of the implementation of the Short-term plan.
- d. Traffic flow of container yard:  
In order to minimize the level-crossing and collision between transfer-crane and trailer-trucks, the direction of the trailer circulation within container yard is determined as summarized below. This arrangement was made, considering the mooring direction of ships in-to the port along-starboard side, and right-side land-traffic rule of Cambodia:

- i) Trailer flow at quay apron is to be east bound.(reefer container is exceptional)
  - ii) Trailer flow at container slot is to be west bound.
  - iii) Yard trailer flow is to be clock-wise.
  - iv) Out-side trailer flow is to be anti-clock-wise.
  - v) Basically, only east and west end passages should be utilized for north-south movement of trailers.(no crossing with transfer crane)
- e. Location of administration office building:  
In order to keep close communication between yard operation and office documentation activities, the administration office building is located at the land-side center of the container yard area, which is also close to the main gate. This location will also help for the observation and control of container cargo movement.
- f. Location of work shop and generator house:  
Since, work shop and generator house are not directly connected to the container cargo flow, these buildings were grouped together into the south east corner of the container yard. Near by this area, 1) transfer-crane maintenance spot, 2) parking space of forklifts, tractor heads, and chassis, and 3) reefer container slots will be prepared. This arrangement will be convenient for the maintenance works of generators and cargo handling equipment .
- g. Access road:  
Since the land space of outer area of the container yard along the national road No. 4 is limited, the width of the access road was proposed to be 30 m excluding the diversion road to Oil Port so that this access road will serve as a cueing area of trailer tracks coming from the out side.
- h. Diversion of existing road to Oil Port and future railway container terminal:  
As the proposed new container terminal will deter traffic flows to the existing road connecting to Oil Port, a diversion road is prepared along the south margin of the container terminal area and along the east end of proposed access road. Upon completion of bulk terminal with access road which was scheduled in the later development stages, this diversion road will be closed and be utilized for railway container track lane. The area between the diversion road and the container yard should be, therefore, reserved for future railway container yard.

(2) Scale of required facilities

The scale of required facilities for Urgent improvement plan and Short-term plan are summarized in the following Table respectively.

Table - 3.3.1-1 Scale of required facilities for Urgent improvement plan and Short-term plan

Facilities	Urgent improvement plan	Short-term plan	Total	Remarks
<b>Civil works</b>				
Dredging of approach channel	225,600 m <sup>3</sup>	239,400 m <sup>3</sup>	465,000 m <sup>3</sup>	
Dredging of Basin	490,000 m <sup>3</sup>	822,000 m <sup>3</sup>	1,312,000 m <sup>3</sup>	
Land reclamation	-	808,000 m <sup>3</sup>	808,000 m <sup>3</sup>	
Revetment	-	980 m	980 m	
Container yard	-	75,000 m <sup>2</sup>	75,000 m <sup>2</sup>	
Parking area	5,000 m <sup>2</sup>	5,000 m <sup>2</sup>	10,000 m <sup>2</sup>	
Road	5,600 m <sup>2</sup>	10,000 m <sup>2</sup>	15,600 m <sup>2</sup>	
<b>Main port facilities</b>				
Container berth	-	170 m	170 m	Type A
Container berth	-	70 m	70 m	Type B
Accessories of New Quay	350 m	-	350 m	Type C-2
General cargo berth (-9.0m)	160m	-	160 m	Type E
General cargo berth (-8.5m)	140 m	-	140 m	Type E
Navigation aids	-	2 units	2 units	Light buoy
Reefer container facilities	-	LS	LS	
<b>Building works</b>				
Administration office	-	1,500 m <sup>2</sup>	1,500 m <sup>2</sup>	
Maintenance workshop	-	1,000 m <sup>2</sup>	1,000 m <sup>2</sup>	incl. machine
Container repair facility	-	600 m <sup>2</sup>	600 m <sup>2</sup>	ditto
Cont. fumigation facility	-	50 m <sup>2</sup>	50 m <sup>2</sup>	ditto
Container cleaning facility	-	50 m <sup>2</sup>	50 m <sup>2</sup>	ditto
Customs office	-	50 m <sup>2</sup>	50 m <sup>2</sup>	
Gate house	-	4 units	4 units	
Generator house	-	180 m <sup>2</sup>	180 m <sup>2</sup>	
Renovation of shed No. 3	-	10,000 m <sup>2</sup>	10,000 m <sup>2</sup>	
Truck scale	-	2 units	2 units	
CPS(conversion of Shed No. 1)	-	LS	LS	
<b>Utility</b>				
Electrical works	LS	LS	LS	
Water supply	LS	LS	LS	
Sewerage	-	LS	LS	
Computer system	-	LS	LS	
Yard fence/Gate	-	LS	LS	
Fire fighting system	-	LS	LS	
<b>Procurement /Installation of equipment</b>				
Gantry crane	-	2	2 units	
Transfer crane	-	6	6 units	for container
Top loader	2	-	2 units	ditto
Tractor	6	7	13 units	ditto
Chassis	10	6	16 units	ditto
Forklift	-	2	2 units	ditto
Tractor	-	4	4 units	for other cargo
Trailer	-	3	3 units	ditto
Forklift(3 ton)	2	4	6 units	ditto
Forklift((5 ton)	-	3	3 units	ditto
Belt conveyer	3	-	3 units	ditto
Forklift(15 ton)	1	-	1 unit	ditto
Tug boat	-	2	2 boats	

### 3.3.2 Civil works

#### (1) Approach channel and port basin

Dredging works were examined from the view point of 1) thickness and characteristics of dredging soil layer, 2) design water depth of dredging area, 3) environmental mitigation, 4) distance between dredging and disposal areas, 5) oceanographic conditions (wave, current, wind), and concluded that following work procedure is recommendable for both Urgent improvement and Short-term plans:

Table - 3.3.2-1 Dredging works of approach channel and port basin

Dredging area	Recommended type of dredger	Dumping site of dredged soil	Side slope of dredging area	Recommended extra dredging depth
Port basin	Grab dredger	In the vicinity of Dek Koul Is. deeper than -20m	1:10	0.6 m
Approach channel	Drag suction dredger	Ditto	1:10	1.0 m

A pre-construction survey for dredging and dumping areas, monitoring the flow of turbid sea-water during construction period, and periodical hydrographic survey after dredging at dredging area, are recommended.

#### (2) Land reclamation for container yard (Short-term plan)

The top elevation of the container yard (Short-term plan) is designed to be +3.0 m to +3.5 m above DL. as 0.0 m. Considering the existing seabed depth at proposed container yard, the thickness of reclaimed soil layer would be approximately 4 to 7 m. When applying this reclaimed fill as an additional load, soil settlement by consolidation on the existing seabed strata was estimated to be approximately 1 m with a time duration of 1 year. To accelerate the settlement period and to minimize the construction period, some counter measures such as pre-load method or soil improvement by sand pile or any other method is recommended. For this purpose further soil investigation and laboratory tests including consolidation test should be conducted during the detail design stage.

In addition to the above study, a possibility to apply dredged sea-bed soil (wet fill) as reclamation fill material was examined. As a result, however, dry fill by using land soil is more recommendable than dredged soil for the following reasons:

- a. In order to utilize the dredged material for reclamation fill, cutter suction dredging with discharge pipe is most economical with the shortest time duration. The method,

however, will cause wide contamination of sea water by turbid discharged water, and as a result, the cost will be higher for environmental mitigation.

- b. In case that dredging was made by grab dredger, it will become necessary to double handle the discharge dredged material from dredger to reclamation site.
- c. Wet fill material will cause longer construction period by the required consolidation period for the filling material itself.
- d. Existence of very soft ooze on the sea bed is anticipated at the proposed reclamation site. In case of the wet fill method, removal of ooze would become difficult.
- e. Dry fill material is available in the vicinity of the port.

### (3) Yard

In order to adjust the settlement of reclamation fill, a concrete interlocking block type pavement was considered. As for the tracks of transfer cranes, concrete slabs will be used.

## 3.3.3 Main port facilities

### (1) Container berth (Short-term plan)

Taking into account the possible future port development to accommodate larger size container ships, the quay structure of Container berth was designed for -12 m water depth for east side 170 m long portion for which typical cross section is shown in Fig. - 3.3.3-1(a). While the remaining west side 70 m long portion was designed for -9 m water depth as a transitional part a to the existing "New Quay", which typical cross section is given in Fig. - 3.3.3-1(b). To show a more concrete view, a typical cross section of container berth including quay structure, gantry crane, transfer cranes and container ship is shown in Fig. - 3.3.3-1(c).

### (2) General cargo berth (Urgent improvement plan)

As described in Section 2.5 of Vol. 2, it was revealed that the hard stratum along proposed face line of General cargo berth exists at around -17.5 m below DL as 0 at east end of the proposed Quay (west end of existing "New Quay"), and at around -10 m below DL at the other end which is close to Pt. Loune.(refer to Fig. - 3.3.3-2(a)) Based on this subsoil condition, adoption of gravity type quay structure was confirmed. As the subsoil is relatively strong, concrete block type structure was proposed. The concrete block type quay will, however, cause a rough wave condition at the port basin due to reflected waves. Reflection coefficient of several different type of water-front structures are given below for reference.

Table - 3.3.3-1 Comparison of wave reflection coefficient by type of structures

Type of structures	Reflection coefficient: Kr	1)	Remarks
Vertical wall type (conc. block)	0.7 ~ 1.0	2)	ex. existing "New Quay"
Revetment with riprap	0.3 ~ 0.6	2)	ex. existing "Revetment"
Vertical wave dissipating blocks	0.3 ~ 0.8	2)	ex. proposed Gen. cargo quay
Natural beach	0.05 ~ 0.2	2)	
Vertical wave dissipating blocks	0.2 ~ 0.5	3)	for reference
Vertical wave dissipating blocks	0.17 ~ 0.45	4)	for reference

Note 1. where  $K_r = H_r/H_i$  ( $H_r$ : reflected wave height,  $H_i$ : incident wave height)

2. Source "Handbook of Civil Engineering" 1993

3. Catalogue, A Company (Manufacturer)

4. Catalogue, B Company (Manufacturer)

From the above table, which is self-explanatory, following points are known:

- a. Adoption of vertical wall type structure such as existing "New Quay" will cause a rough port basin and lower port availability.
- b. Wave dissipating concrete block type will keep similar calmness of port basin as is.

Based on the past model test results, it is known that wave dissipating blocks are effective for those waves with relatively short periods. Although reflection coefficient will be different by angle of incident wave direction, examples of  $K_r$  by different wave periods as represented by wave steepness ( $H/L$ : where  $L$  = wave length) are shown below:

$$H/L = 0.03, \quad K_r = 0.45 \quad 1)$$

$$H/L = 0.07, \quad K_r = 0.32 \quad 1) \quad 1): \text{Manufacturer's catalogue}$$

As to Sihanoukville Port, hindcasted wave condition by wind directions at the port entrance is summarized hereunder:

	Wind direction							
	N	NNE	SW	WSW	W	WNW	NW	NNW
H1/3 (m)	1.9	1.9	2.1	2.2	2.4	1.9	2.0	1.8
T 1/3 (sec)	5.5	5.3	4.0	4.8	5.6	5.1	5.5	5.2
L 1/3 (m)	38.4	36.5	23.8	31.7	39.4	34.6	38.4	35.6
H1/3/L 1/3	0.049	0.052	0.088	0.069	0.061	0.055	0.052	0.051

Note; hindcasted by Study Team

Although it will be a little higher in cost than ordinary concrete block type, a wave dissipating block type quay structure is recommended, based on the above results. A typical section of the General cargo berth is given in Fig. - 3.3.3-2(a).

### 3.3.4 Building facilities

Outline of proposed building facilities is summarized in Table - 3.3.4-1 hereunder:

Table - 3.3.4-1 Proposed building facilities for Short-term plan

Name of Building	No. of stories	Floor area (m <sup>2</sup> )	Structure			Remarks
			Frame	Wall	Roof	
Admin. Office	3, partially 5	1,500	R/C	Conc. blk.	R/C	
Work shop	1, partially 2	1,000	Steel	ditto	Corr. GI	
Container repair	1, partially 2	600	ditto	ditto	ditto	
Cont. fumigation	1	50	ditto	ditto	ditto	
Cont. cleaning	1	50	ditto	ditto	ditto	
Customs Office	1	50	R/C	ditto	R/C	
Gate house	1	20x4	R/C	ditto	Corr. GI	
Generator house	1	180	R/C	ditto	ditto	
Renovation of Shed 3	1	10,000	-	-	-	
Truck scale	1	8x2	R/C	Conc. blk.	Corr. GI	
CFS	1	6,480	-	-	-	Convert Shed 1

Note: CFS(Container freight station), R/C(Reinforced concrete), Conc. blk.(Concrete block), Corr. GI(Corrugated galvanized iron sheet)

#### (1) Administration office building (Short-term plan), (see Fig. - 3.3.4-1(a))

The layout plan of administration office building was determined based on the staffing organization schedule as stated in the chapter of port management. The main office spaces with approx. total floor area of 1,500 m<sup>2</sup> are accommodated in a three story building of which is partially planned as five stories where a terminal observation & control room was located so that the entire container yard will be in view over the stacked containers. As for the foundation type of the building, further soil investigations should be conducted in the latter engineering stages.

#### (2) Container freight station (CFS), (Short-term plan)

Considering the idle space of existing sheds in the port area, it was recommended to utilize Warehouse N1 as CFS with some modifications. The construction of new CFS in container terminal was, therefore, scheduled in the Long term plan. The existing Shed No. 1 with total floor area of 6,480 m<sup>2</sup> (54 m × 120 m) is located in the vicinity of Tug-boat basin and is close to the west port entrance gate. The Warehouse N1 was originally built in 1964 for railway cargo shed and rehabilitated by ADB fund in 1994 to 1995. A railway platform with 1.2 m high and full-opening type sliding doors were prepared along the land side (east side) of the Warehouse

which can receive container trailers for vanning / de-vanning with minimal modifications such as removal of railway tracks and paving instead.

(3) Renovation of existing Warehouse N3 (Short-term plan)

Existing warehouse N3 is located along the riprap revetment connected to existing “New Quay” where a proposed General cargo berth with total length of 400 m will be constructed. In order to accommodate cargoes handled at proposed General cargo berth, renovation of existing Warehouse N3 was proposed, since N3 was out of scope of the rehabilitation project funded by ADB. The scope of works for the renovation was similar to that performed for warehouses N1, 2 and 4 under ADB funding, i.e.

- a. Repair of roofing, including adoption of skylights.
- b. Repair of roof truss and purlin.
- c. Floor concrete pavement
- d. Demolition of railway tracks along land side of N3

(4) Work shop (Short-term plan)

A work shop with total floor area of 1,000 m<sup>2</sup> (25m × 40m) was proposed at south-east part of the container terminal. This shop will be utilized for repair and maintenance of cargo handling equipment, generators, and other mechanical and electrical items. A transfer crane track was extended nearby for this purpose. In order to accommodate a ceiling hoist crane for handling repair equipment, the required ceiling height will be approx. 4.3 m. A series of repair machines and tools such as lathe machine, drilling machine, pipe bender, welding machine, air compressor, portable generator etc. will be installed in the shop.

### 3.3.5 Utilities

(1) Electricity

Existing capacity of power supply of Sihanoukville city is only 3700 KVA. Even including additional power plant, which is scheduled to be constructed for the capacity of 5,000 KVA, the total capacity will be only 8700 KVA. While this power supply source is neither enough and nor reliable, an independent power generation system for the Port is proposed and described hereunder:

Based on the power demand unit load shown in Table - 3.3.5-1(a), total power load is estimated in Table - 3.3.5-1(b).



Table - 3.3.5-1(a) Power demand unit load

Facilities	Unit load (VA/m <sup>2</sup> )				Total
	Lighting	Receptacles	Air-con.	Others	
Yard	2.5	-	-	-	2.5
Shop	21	11	-	20	52
CFS	6	11	-	20	37
Office	38	11	62.5	20	131.5
Canteen	38	11	62.5	20	131.5

Table - 3.3.5-1(b) Power load estimation

Facilities	Area (m <sup>2</sup> )	Unit load (VA/m <sup>2</sup> )	Demand factor	Power load		Particular load (kw)	Total (kw)
				(KVA)	(KW)		
Yard/road	100,600	2.5	0.7	176	141		141
Reefer container 20' outlet	(20 units x 8 kw)		0.5	100	80		80
Ditto but 40'	(20 units x 11 kw)		0.5	138	110		110
Admin. Bldg.	1,500	131.5	0.6	118	95		95
Work shop	950	52	0.6	30	24	100	124
Work shop office	50	131.5	0.7	5	4		4
Cont. repair shop	550	52	0.7	20	16	100	116
Cont. repair office	50	131.5	0.7	5	4		4
Cont. fumigation	50	131.5	0.7	5	4		4
Conc. cleaning	50	131.5	0.7	5	4	10	14
Customs	50	131.5	0.7	5	4		4
Gate house	80	131.5	0.7	7	6		6
Generator house	180	52	0.5	5	4		4
Warehouse N3	10,000	37	0.5	185	148		148
Truck scale	16	131.5	0.7	1	1		1
CFS (N1)	6480	37	0.5	120	96		96
Gantry crane	(2 units x 750 kw)		0.6	1125	900		900
Belt conveyor	(3 units x 2.5 kw)		0.6	6	5		5
Total				2054	1644	210	1854

Four sets of 750 KVA generators with voltage of 2 to 2.4 KV, of which one is for stand-by, were considered for power supply. The generated power was designed to be distributed to power centers at individual port terminals or facilities and transformed to the lower voltage required. This capacity of power generation system is estimated for the Short-term plan. A future expansion area for latter development stages should be, therefore, provided on the space of Generator house or spares of electrical terminal in the power centers.

## (2) Water supply

### a. Source of water

Since, City water supply does not have enough capacity, the existing fresh water pond located in between existing container yard and railways, was proposed as a source of water supply for drinking and fire fighting water supply. As for the capacity of the possible supply water volume, however, further confirmatory investigations will be required. Continuous observation on

the water level of pond, record of precipitation, and the record of water consumption, if any, should be taken and analyzed. Probable alternative water sources such as ground water by deep or shallow well, surface water, and any others should also be explored in latter engineering stages.

#### b. Quality of water

According to the water quality laboratory test results furnished by the Port office, the pond water was within tolerable saline contents (200 mg/l) and some other test items were also within permissible values, except for the number of coliform (68 / 100 ml) which showed a trace of contamination. A simple purification system with sterilization device would work for drinking water so far as the above level of water quality could be maintained throughout the year even during dry or rainy seasons. A periodical water quality test should be conducted. A control of water contamination by preparing of fencing and drainage system around the pond will be required so that human disposal, contaminated land water or any other hazardous items will not intrude into the water supply system.

#### c. Water supply demand

##### 1) Potable water

The demand of potable water for the port use is estimated in Table - 3.3.5-2.

Table - 3.3.5-2 Demands of potable water

Facilities	Assumed Population	Unit demand (m <sup>3</sup> /day/person)	Water demand (m <sup>3</sup> /day)	Particular demand (m <sup>3</sup> /day)	Total (m <sup>3</sup> /day)
Admin. office	149	0.1	14.9	5.0	19.9
Workshop	50	0.4	20.0	5.0	25.0
CFS	26	0.1	2.6	5.0	7.6
Canteen	250	0.04	10.0		10.0
Cleaning equipment				12.0	12.0
Sub-total			47.5	27.0	74.5
Demand peak factor		(150 %)			112
					say 120 m <sup>3</sup> / day

An underground reservoir with purification system will be required. As for water distribution system, centrifugal water pumps with pressure tank is considered.

##### 2) Fire fighting water

Eleven fire fighting hydrants were considered for the Short-term plan. The water source is also from the pond using underground reservoir for potable water supply as back-up. The water demand for fire fighting was estimated as shown below:

Standard rate of discharge	: 1 m <sup>3</sup> / min / hydrant
Minimum supply of pressure	: 70 m
Minimum diameter of hydrant pipe	: 100 mm
Total demand for fire fighting	11 × 1.0 m <sup>3</sup> / min = 110 m <sup>3</sup> / 10 min

Two sets of fire fighting pumps with fire alarm system were considered for the Short-term plan.

### (3) Sewerage system

Waste water from offices, canteen, container cleaning, work shop, etc. are to be discharged into septic tanks and treated naturally. Septic tanks will be installed by several groups of facilities i.e. 1) for container terminal, 2) for CFS and 3) for others. Volume of sewage was estimated on the basis of the following figures:

$$\text{Daily sewage flow (Qs)} = 0.9 \times Q_w \text{ (m}^3\text{/day)} \quad \text{where } Q_w = \text{fresh water demand}$$

$$\text{Infiltration (Qi)} = 0.15 \times Q_s$$

$$\text{Maximum daily sewage flow (Qave)} = 0.8 \times Q_{\text{max}}$$

$$\text{Peak sewage flow (Qpk)} = 1.5 \times Q_{\text{max}} / 24 \text{ (m}^3\text{/hr)}$$

Sewage volume by group is estimated in Table - 3.3.5-3 below.

Table - 3.3.5-3 Sewage volume

Group	Qw (m <sup>3</sup> /day)	Qs (m <sup>3</sup> /day)	Qi (m <sup>3</sup> /day)	Qmax (m <sup>3</sup> /day)	Qave (m <sup>3</sup> /day)	Qpk (m <sup>3</sup> /hr)
Cont terminal	66.9	60.2	9.0	69.2	55.4	3.5
CFS	7.6	6.8	1.0	7.8	6.2	0.4
Others	5.0	4.5	0.7	5.2	4.2	0.3
Total	79.5	71.5	10.7	87.2	65.8	4.2

Table List of Proposed Facilities for Short-Term Plan

No.	Facilities	No.	Facilities
0	Port Basin and Navigation Channel Dredging	14	Customs Office
1	Container Terminal	15	Gate House
2	Container Cargo Berth	16	Gate
3	General Cargo Berth (Existing "New Quay")	19	Parking Area
4	General Cargo Berth	21	Administration / Office Building
5	Bulk Cargo Berth	25	Generator House
6	Gantry Crane	26	Water Pump House
7	Transfer Crane	27	Fire Fighting Pump House
8	CFS (Long Term Plan)	28	Diversion of Road to Existing Oil Terminal
9	Maintenance Work Shop	30	Future Railway Terminal
10	Container Fumigation Facility	31	Navigation Aids
11	Container Repair Facilities	32	Breakwater
12	Container Cleaning Facilities	33	Navigation Aids (Light Buoys at the Entrance of Channel)
13	Truck Scale		

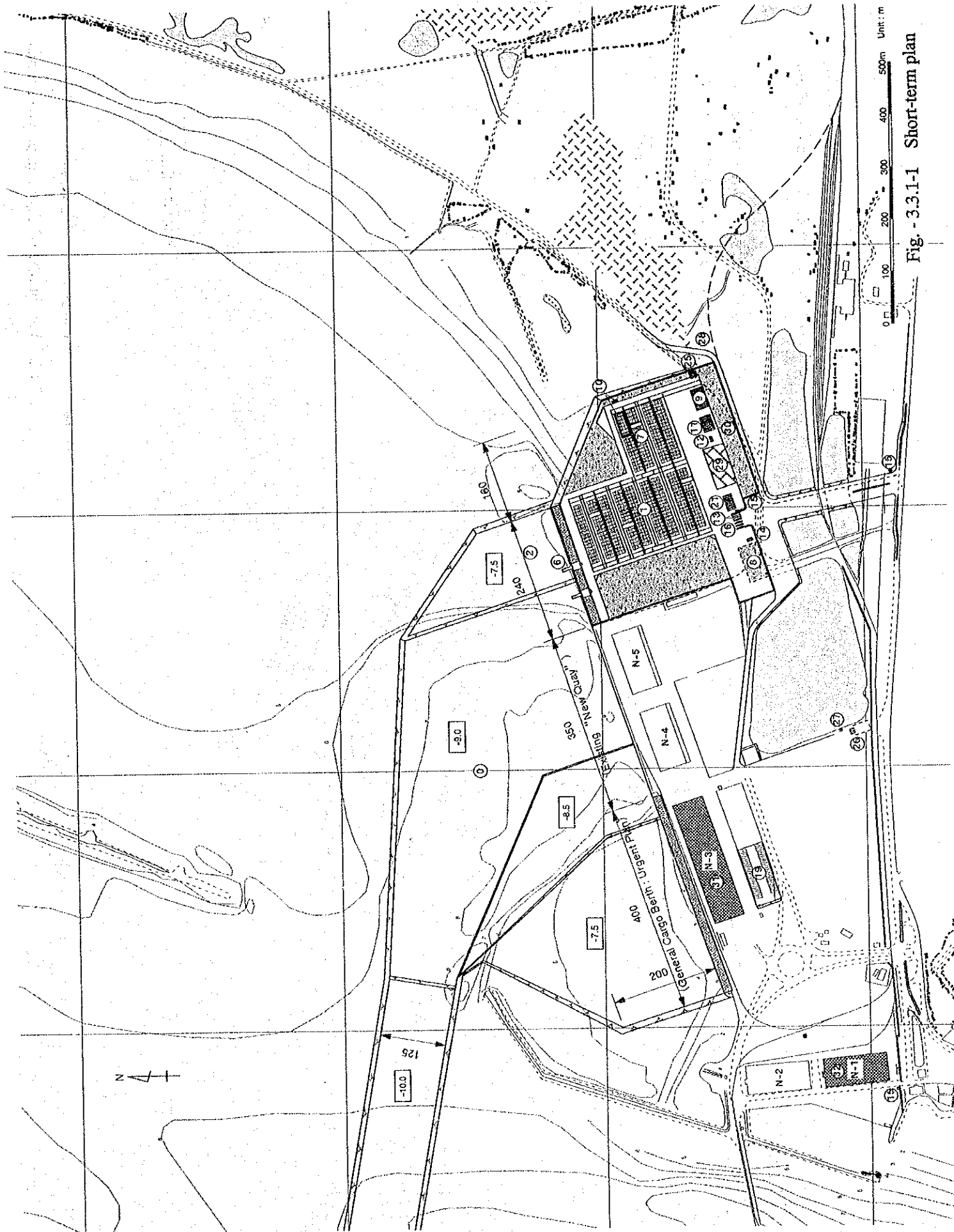


Fig. - 3.3.1-1 Short-term plan

- a. Dredging of Navigation Channel (-9.0m)
- b. Dredging of Port Basin (-8.5m to -6.5m)
- c. Road
- d. Empty Container Yard & Parking Area
- e. Renovation of "The New Quay" (-9.0m)
- f. General Cargo Berth (-9.0m)
- g. General Cargo Berth (-9.0m)

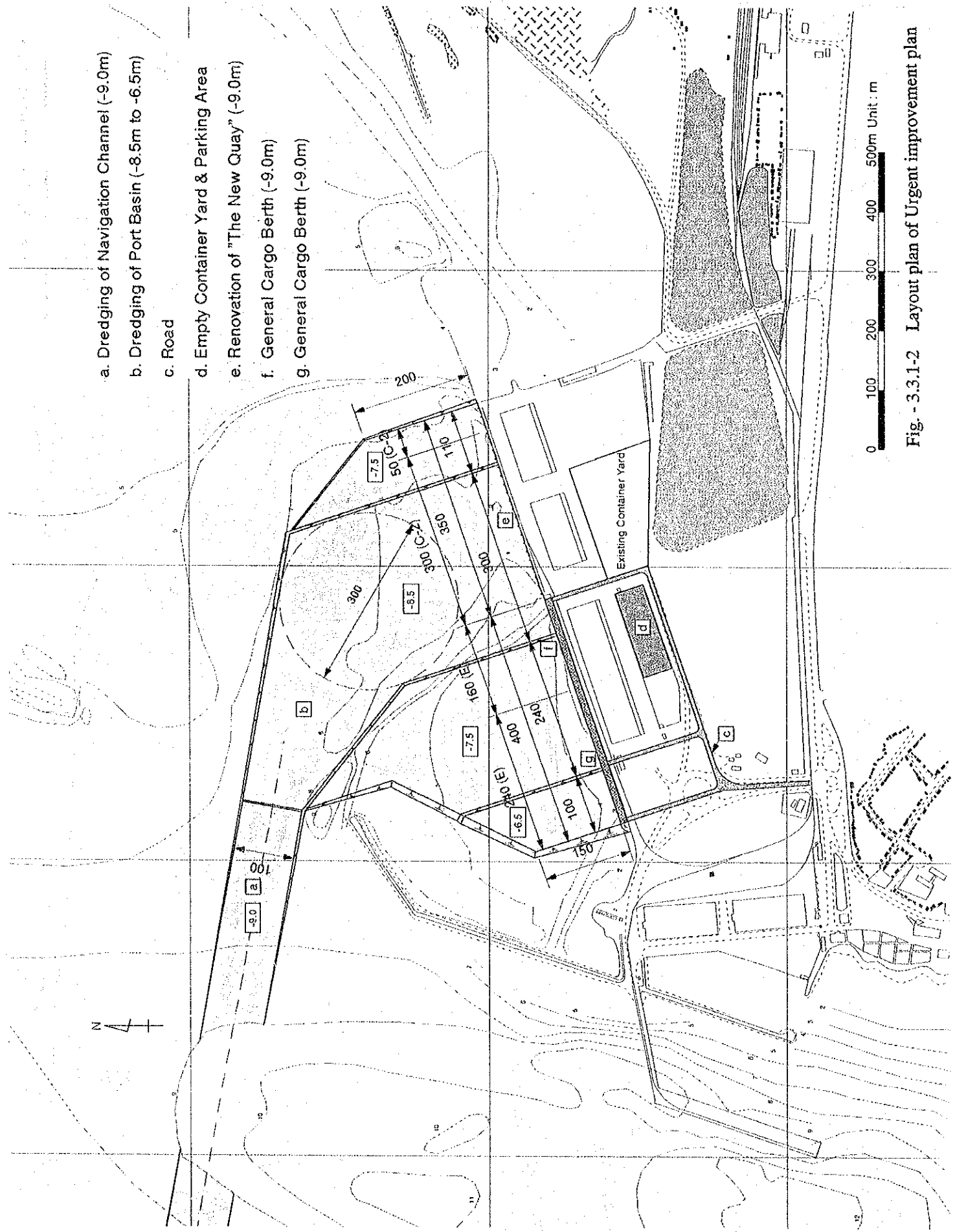


Fig. - 3.3.1-2 Layout plan of Urgent improvement plan

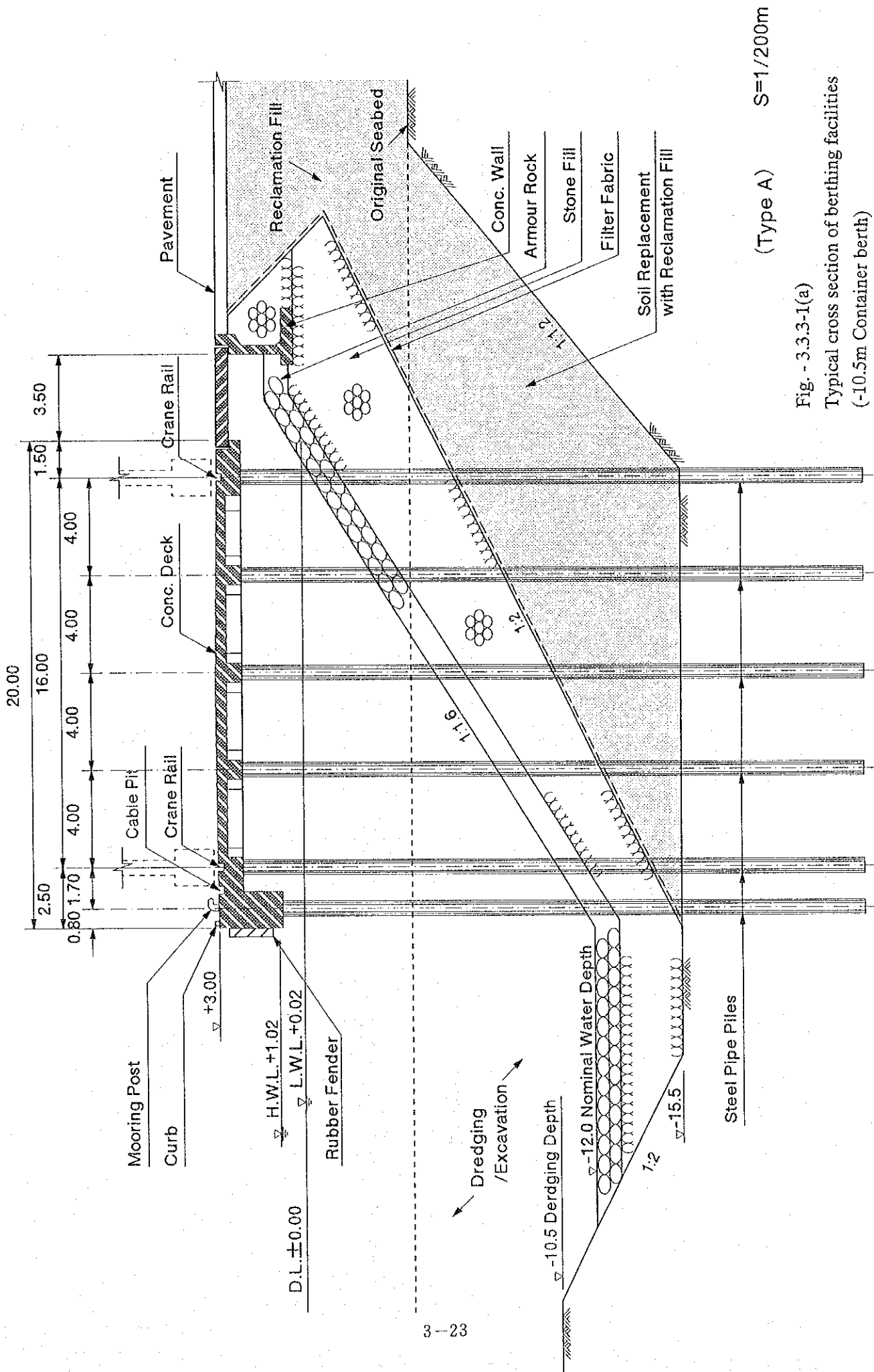
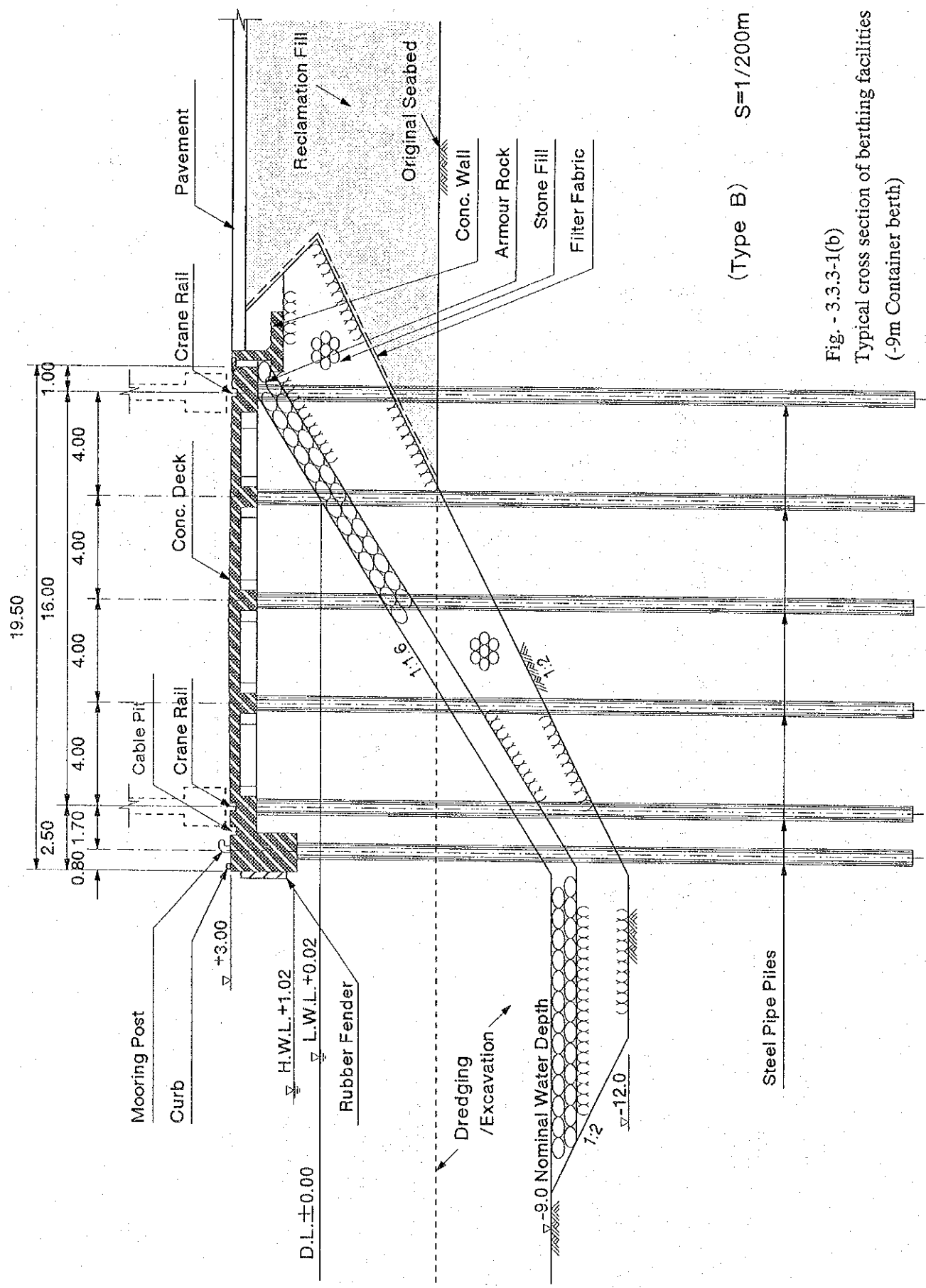


Fig. - 3.3.3-1(a)  
 Typical cross section of berthing facilities  
 (-10.5m Container berth)



(Type B) S=1/200m

Fig. - 3.3.3-1(b)  
 Typical cross section of berthing facilities  
 (-9m Container berth)



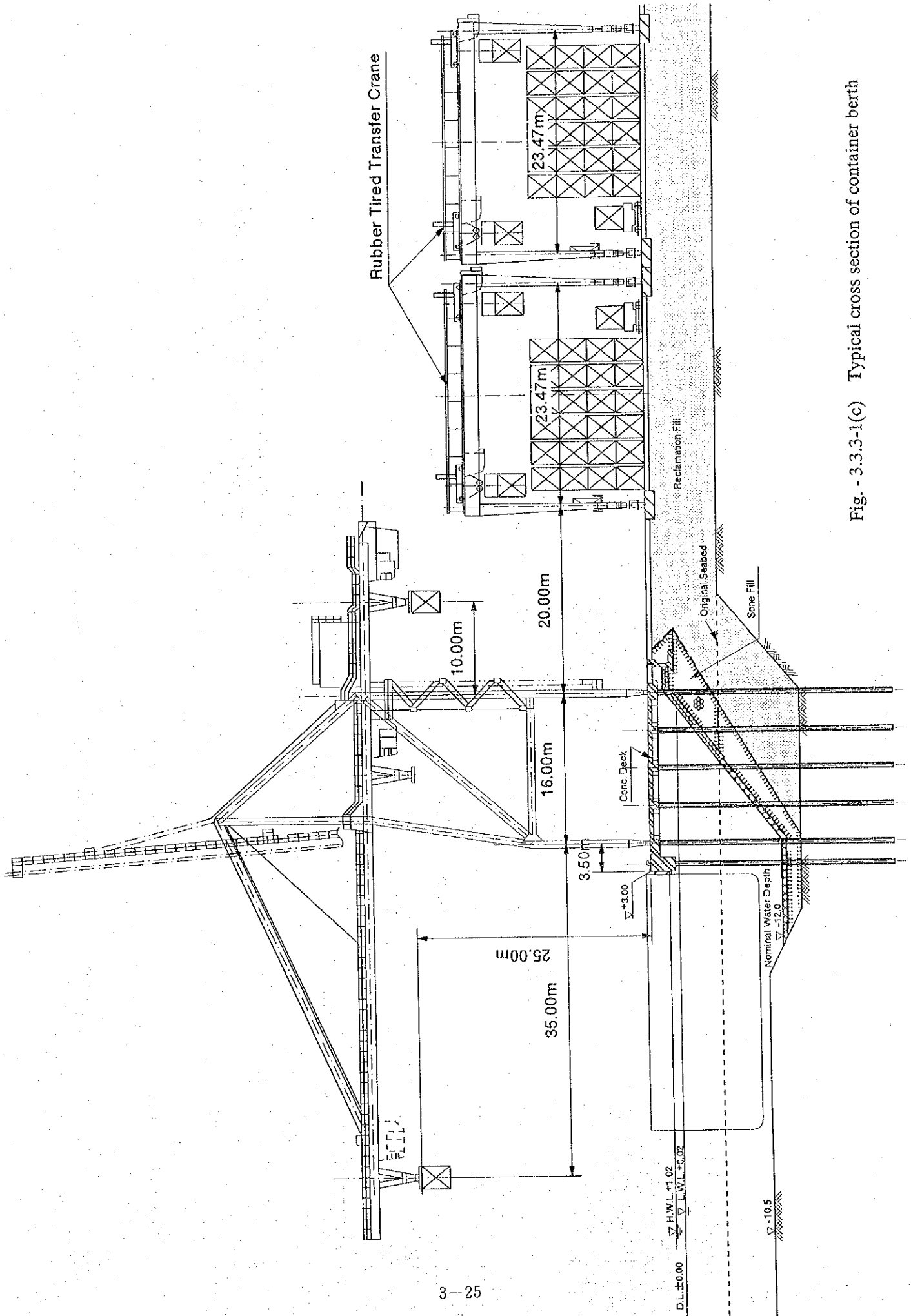


Fig. - 3.3.3-1(c) Typical cross section of container berth

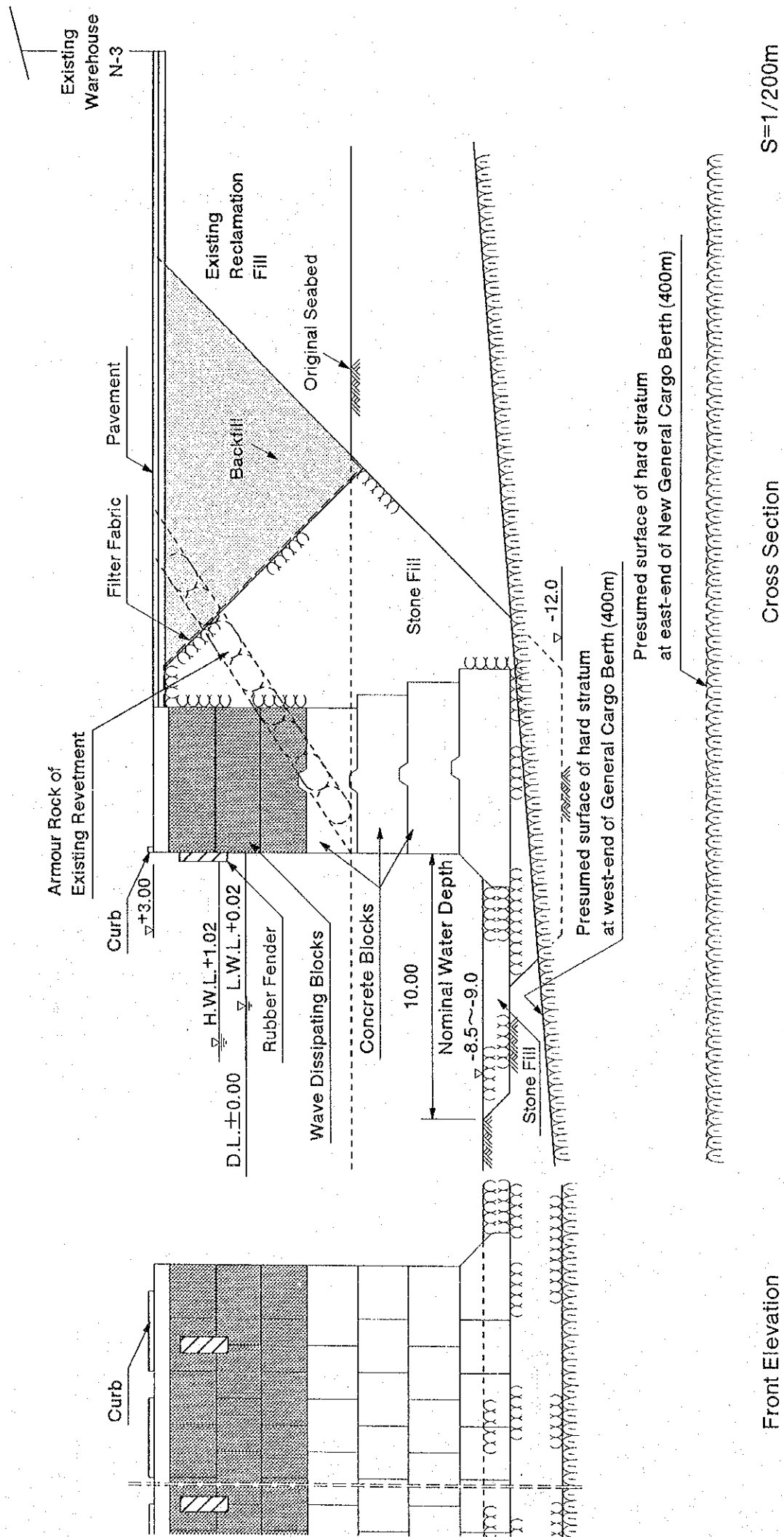
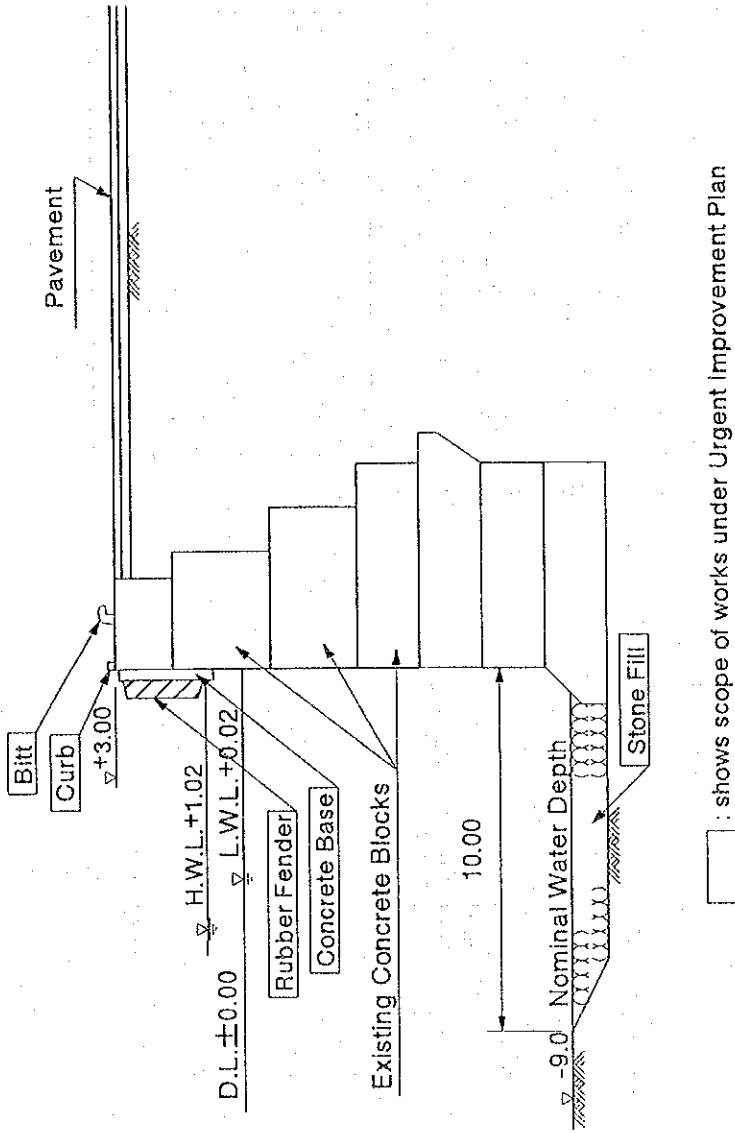
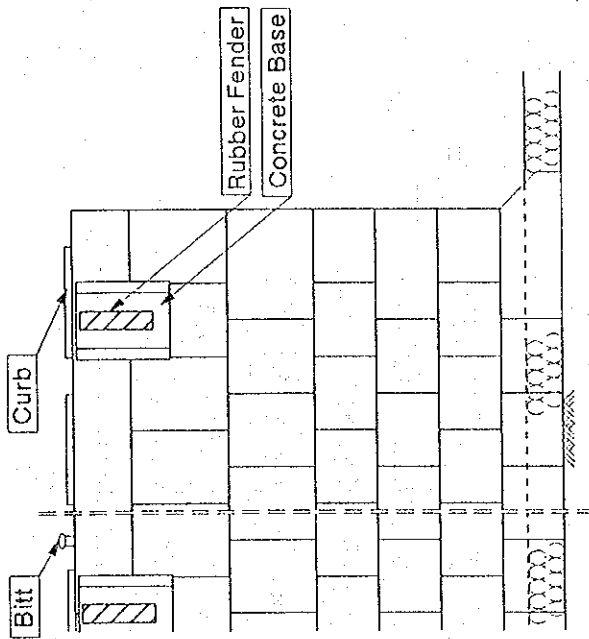


Fig. - 3.3.3-2(a) Typical cross section of berthing facilities (-8.5~-9.0m General cargo berth)



Cross Section

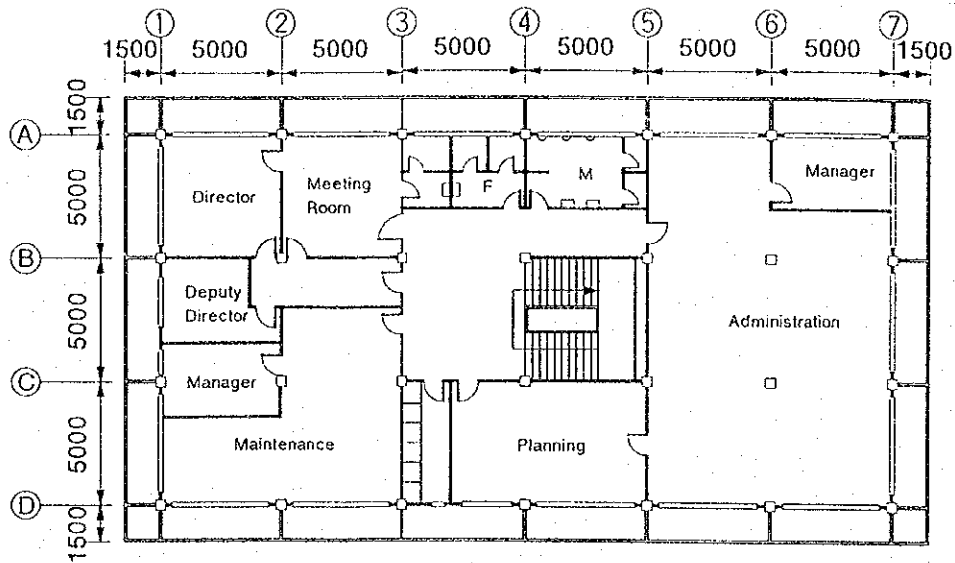


Front Elevation

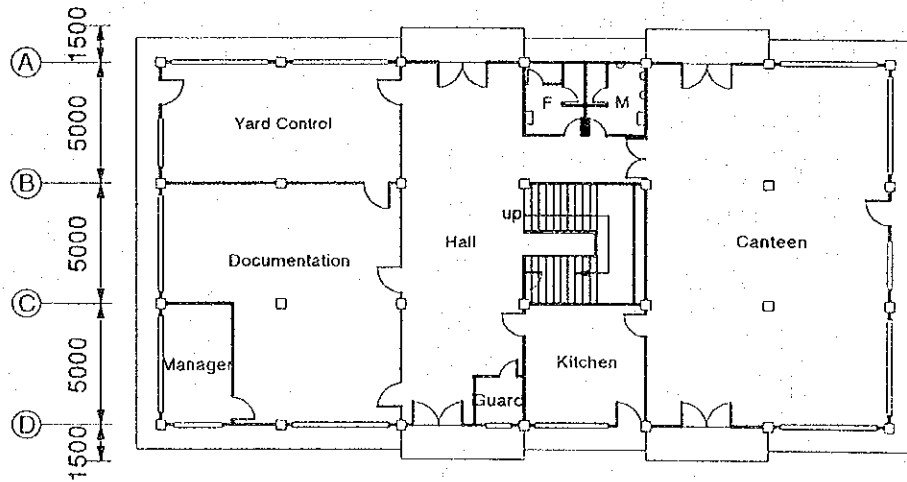
(Type C-2)

S=1/200m

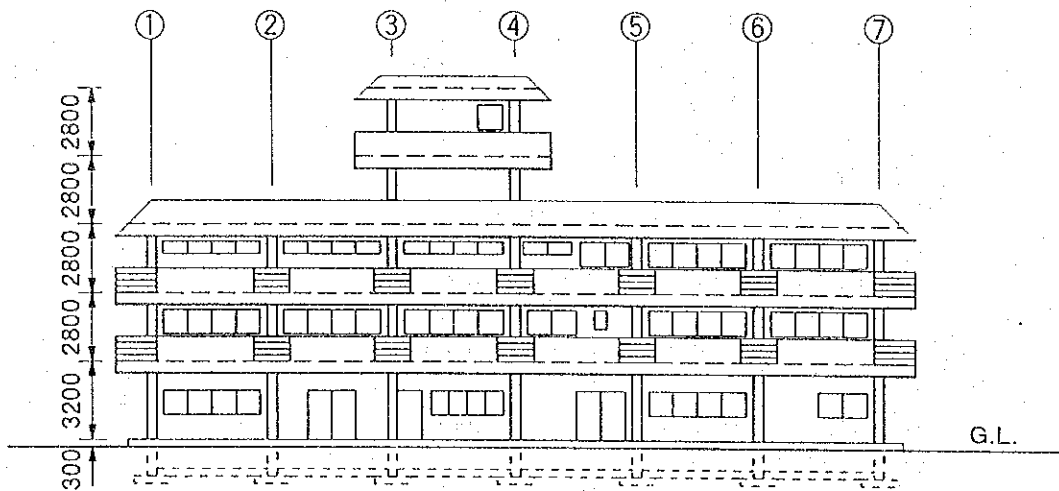
Fig. - 3.3.3-2(b) Renovation of the "New Quay" for container crane foundation



2nd Floor Plan



Ground Floor Plan



Front Elevation



Fig. - 3.3.4-1(a) Administration office building

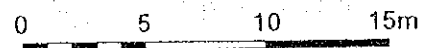
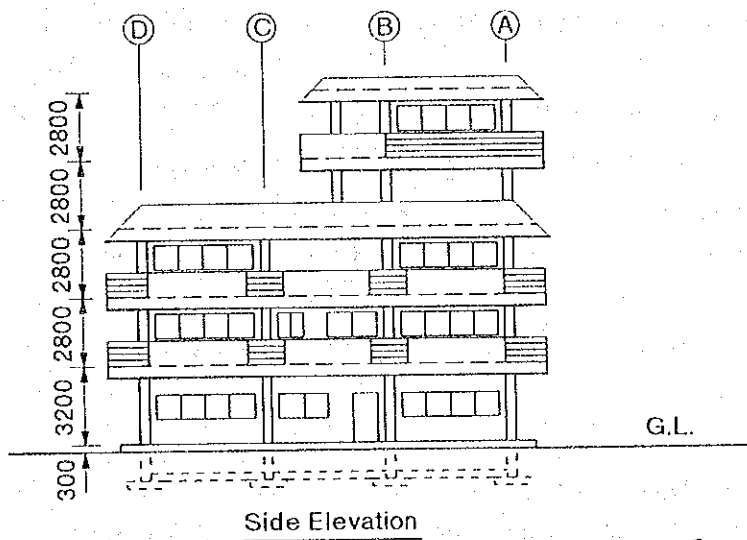
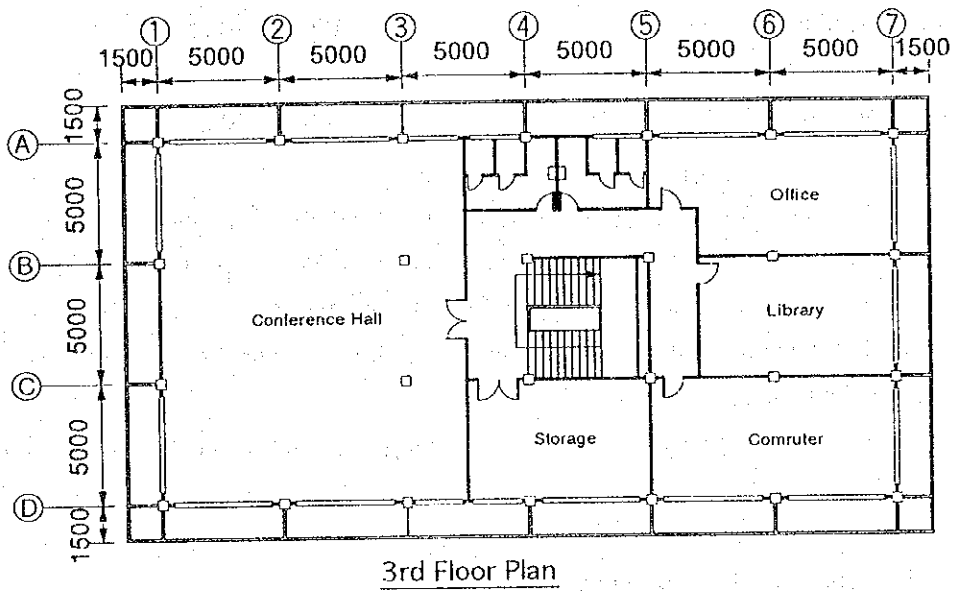
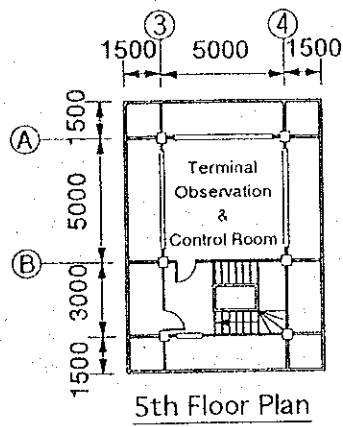


Fig. - 3.3.4-1(b) Administration office building

### 3.4 Implementation plan

Project implementation schedule is determined to meet the required timing of completion for individual facilities included in four stages of implementation, based on the study results as described in previous sections. The project duration studied in this section including construction / procurement of equipment and engineering services for relevant stages are given below and at the lowest column of Table - 3.4:

<u>Implementation stages</u>	<u>Project duration (year)</u>
(1) Urgent improvement plan	1998 to 2000
(2) Short-term plan	1999 to 2004
(3) Mid-term plan	2004 to 2009
(4) Long-term plan	2008 to 2015

In order not to disturb the existing port activities, the construction of General cargo berth under Urgent improvement plan is determined to be two phases construction period for 200 m long quay construction each, which makes total construction period to be two years. As for Short-term plan, construction period is considered to be 3 years, in which sub-soil consolidation and treatment of ooze on existing sea-bed were included.

To determine the construction schedule, following construction work efficiency on major items were applied:

- (1) Working days considered in schedule  
Number of working days considered in the construction schedule: 22 days / month.
- (2) Productivity of dredging and disposal works: Grab dredger group : 6,000 m<sup>3</sup> / day  
Drag suction dredger: 7,200 m<sup>3</sup> / day
- (3) Productivity of quay wall concrete blocks: 50 pieces / 15 days / cycle
- (4) Productivity of reclamation by dry fill including compaction: 900 m<sup>3</sup> / day
- (5) Productivity of steel pipe pile driving for berth structures : 3 piles / day
- (6) Productivity of concrete work : R/C beams and columns: 20 m<sup>3</sup> / day  
R/C slabs: 80 m<sup>3</sup> / day
- (7) Productivity of pavement: Concrete block pavement: 30 m<sup>2</sup> / day / party  
Concrete pavement: 100m<sup>2</sup> / day / party

Based on above duration and efficiency, schedule of construction, procurement and engineering services in four stages are prepared and summarized in Table - 3.4.

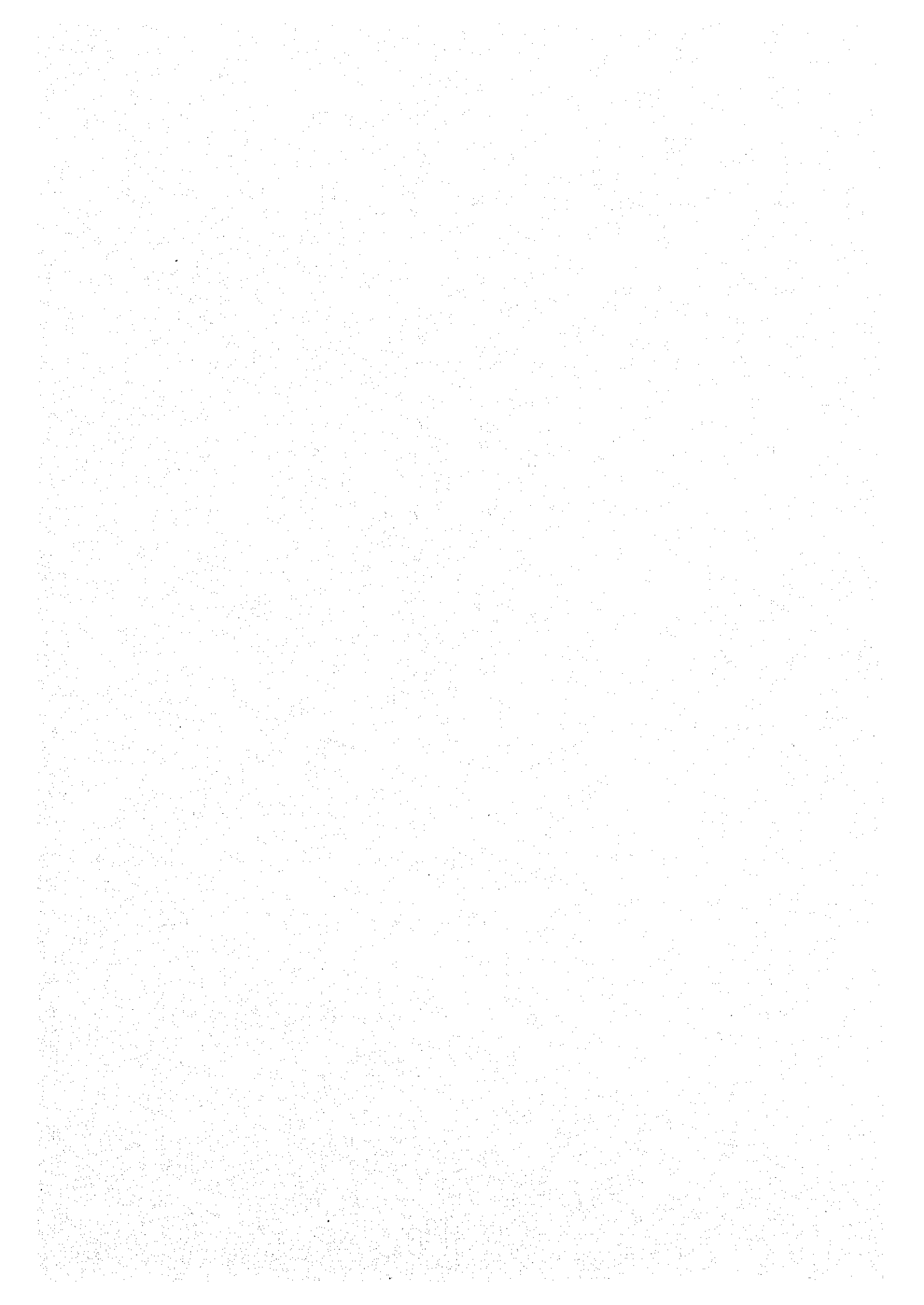


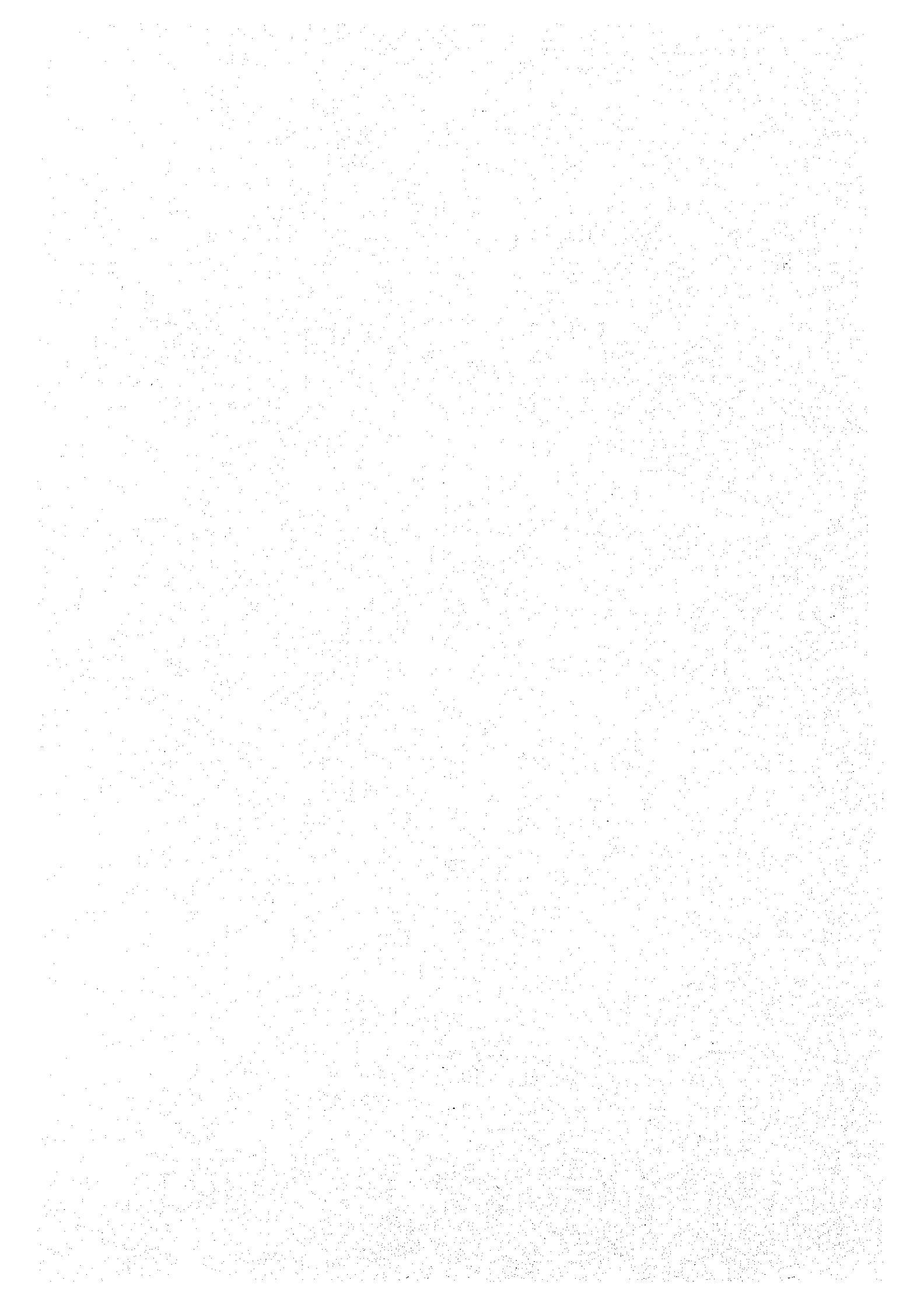
Table-3.4 Project implementation schedule

Work Item	Unit	Quantity	Urgent Plan			Short Term Plan			Mid-Term Plan			Long Term Plan									
			1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
<b>A. Construction Cost</b>																					
<b>1. Civil Works</b>																					
a. Dredging of Approach Channel	cu.m	1,080,000				(225,600 cu.m)	(490,000 cu.m)	(822,000 cu.m)	(239,400 cu.m)	(66,000 cu.m)	(1,526,000 cu.m)	(549,000 cu.m)	(550,000 cu.m)								
b. Dredging of Basin	cu.m	3,388,000				(750,000 cu.m)															
c. Land Reclamation (Container Yard)	cu.m	840,400																			
d. Land Reclamation (Bulk Cargo Yard)	cu.m	788,000																			
e. Land Reclamation (Pond)	cu.m	58,000																			
f. Revetments (Container and Bulk Berths)	lm	1,370																			
g. Revetments (Pond)	lm	560																			
h. Container Yard	sq.m	129,000																			
i. Bulk Cargo Yard	sq.m	10,000																			
j. Empty Container Yard Open Storage & Parking Area	sq.m	50,000																			
k. Roads	sq.m	60,000																			
<b>2. Main Port Facilities</b>																					
a. Container Berth (-10.5 m)	lm	330																			
b. Container Berth (-9.0 m)	lm	70																			
c. Renovation of the New Quay (-9.0 m)	lm	50																			
d. Accessories of New Quay (-9.0 m)	lm	350																			
e. General Cargo Berth (-9.0 m)	lm	160																			
f. General Cargo Berth (-8.5 m)	lm	240																			
g. Bulk Cargo Berth (-8.5 m)	lm	300																			
h. Extension of Breakwater	lm	200																			
i. Navigation Aids	unit	9																			
j. Cement Silo (25,000 ton)	unit	1																			
k. Bitumen Tank (9,000 ton)	L.S	1																			
l. Reefer Container Facilities	L.S	1																			1/2
<b>3. Building Works</b>																					
a. Administration Office	sq.m	3,000																			
b.1 Maintenance Workshop	sq.m	1,000																			
b.2 Machinery/Equipment	L.S	1																			
b.3 Service Truck	unit	1																			
c.1 Container Repair Facility	sq.m	600																			
c.2 5 ton Hoist Crane	unit	2																			
c.3 Others	L.S	1																			
d.1 Container Fumigation Facility	sq.m	50																			
d.2 Machinery/Equipment	L.S	1																			
e.1 Container Cleaning Facility	sq.m	50																			
e.2 Machinery/Equipment	L.S	1																			
f. Customs Office	sq.m	50																			
g. Gate House	unit	4																			
h. Generator House	sq.m	180																			
i. Renovation of Exist. Shed (No.3)	sq.m	10,000																			
j. Truck Scale	unit	2																			
k. CFS	sq.m	3,000																			
l. Demolition of Sheds (No.5)/ Railway	L.S	1																			
<b>4. Utilities</b>																					
a. Power Supply	L.S	1																			
b. Lighting System	L.S	1																			
c. Water Supply	L.S	1																			
d. Sewerage	L.S	1																			
e. Computer System	L.S	1																			
f. Yard Fence	lm	850																			
h. Fire Fighting System	L.S	1																			
<b>B. Procurement/Installation of Equipment</b>																					
<b>1. Container Handling Equipment</b>																					
a. Gantry Crane (50.5 ton type)	no.	4																			
b. Transfer Crane (30.5 ton RTG)	no.	12																			
c. Top-loader (45 ton type)	no.	4																			
d. Tractor (for Yard)	no.	42																			
e. Chassis (for Yard (20-40))	no.	49																			
f. Forklift Truck (2 ~ 4 ton type)	no.	6																			
<b>2. Other Cargo Handling Equipment</b>																					
a. Tractor (for transport)	no.	12																			
b. Trailer (for transport)	no.	10																			
c.1 Forklift Trucks (3 ton type)	no.	30																			
c.2 -ditto- (5 ton type)	no.	15																			
d.1 Mobile Crane (100 ton type)	no.	1																			
d.2 -ditto- (200 ton type)	no.	1																			
e. Pneumatic Unloader (200 t/hr for cement)	no.	1																			
f. Belt-conveyor (200 t/hr for cement)	L.S	1																			
g. Grab Bucket (4 cum for fertilizer)	no.	3																			
h. 2-way Dozer (for fertilizer on board)	no.	2																			
i. Movable Hopper (15 cum for fertilizer at apron)	no.	3																			
j. Belt Conveyor (for bagged cargo)	no.	3																			
k. Forklift Trucks (15 ton type for heavy cargo)	no.	1																			
3. Tug Boat (1,500 p.s.)	no.	5																			
<b>C. Engineering Services</b>																					









## 3.5 Cost estimate

### 3.5.1 General

The project cost for the development of Sihanoukville Port is estimated in two stages individually i.e, 1) Urgent improvement plan and 2) Short-term plan, and summarized hereunder.

The project cost is divided into four parts i.e. Construction Cost, Procurement of Equipment, Engineering Services and Contingency. The construction cost was estimated based on the combined construction cost which consists of the materials cost, depreciation of construction equipment and the labor wages. As for the procurement of equipment, in principal, such cargo handling equipment as cranes, transfer cranes, forklift trucks, trailer-trucks etc. are to be imported from the manufacturing countries.

### 3.5.2 Composition of the project cost

The composition of the project cost is composed as schematized below by means of certain percentages of the direct construction cost. The ratio was obtained from the cost estimates for similar projects presently under construction in the country as well as recently completed.

#### Composition of the Project Cost

a. Construction Cost (CC) = DC + IC

- Direct Construction Cost (DC)

- Basic Port Facilities: Dredging of Channels/Basins, Breakwaters, Revetments, Quay walls, Navigational Aids, etc.
- Civil Works: Open-sheds, Container-yards, Roads, Drainage, etc.
- Building Works: Container Freight Station (CFS), Offices, Workshops, Canteen, etc.
- Utilities: Power Supply, Lighting System, Water Supply, Sewerage, Communication System, Processing System, Computer System, etc.

- Indirect Construction Cost (IC=T+M+S+O=33% of "DC")

- Common Temporary Cost (T=3% of "DC")
- Mobilization Cost (M=10% of "DC")
- Site Expenses (S=10% of "DC")
- Overhead (O=10% of "DC")

- b. Procurement of Equipment (PE) = E+I+Me+Oe
  - Equipment Cost on CIF basis (E)
  - Installation Cost (I=10% of "E")
  - Mobilization Cost (Me=10% of "E")
  - Overhead (Oe=3.5% of "E")
- c. Engineering Services (ES) = BD+DD+SV
  - 8% of Civil works + 3% of Procurement
- d. Contingency (CG)
  - Physical Contingency (CG=10% of "CC+PE+ES")

### 3.5.3 Basis and exchange rate

In this Study, the following exchange rate was used for the cost estimate. Furthermore, as the US dollar is commonly distributed in Cambodia, the project cost is expressed only in US dollars.

1 US \$ = 107 Yen = 2,594 Riels as of May 20, 1996 (Sources: Asiaweek, May 31, 1996)

### 3.5.4 Sources of unit prices (U/P) obtained

Since there are no official data regarding the prices for the construction industry in the country, the related prices of materials, equipment available in the country and labor wages are obtained from such various sources as officers of the Ports of Sihanoukville and Phnom Penh, several bid documents, contractors, and local markets.

### 3.5.5 Estimate of project cost

Based on the study results made in the previous sub-sections, relevant project costs for Short-term plan and Urgent improvement plan were estimated and summarized below: The breakdown of cost were shown in Tables 3.5-1 and 3.5-4 respectively.

(1,000 US\$)

	Urgent plan	Short-term plan	Total
Construction cost	21,673	43,792	65,465
Procurement	2,145	29,380	31,525
Sub-total	23,818	73,172	96,990
Engineering	1,798	4,385	6,183
Physical contingency	2,562	7,756	10,318
Grand total	28,178	85,312	113,490

### 3.5.6 Foreign and local currency components

The project was classified into foreign and local currency portions, both indicated in US Dollar, and estimated in the following categories.

(1) Foreign currency components

- Imported construction materials.
- Foreign components of depreciation and operation / material cost of construction equipment and plant.
- Foreign components of domestic materials.
- Salaries and costs of foreign personnel

(2) Local currency components

- Local construction materials.
- Local components of depreciation and operation / material cost of construction and plant.
- salaries and costs of local personnel.
- Import duties on imported materials
- Cambodian taxes.

Foreign and local currency costs for 1) Urgent improvement plan, and 2) Short-term plan are given in Tables 3.5-2 and 3.5-5 respectively.

### 3.5.7 Annual disbursement schedule for the project

Annual disbursement schedule for 1) Urgent improvement plan and 2) Short-term plan are estimated based on the project implementation schedule, and presented in Table - 3.5-3 and 3.5-6(1) & (2) respectively.

Table-3.5-1 Project cost for Urgent plan

A.	Description	Unit	Quantity	Unit cost (US\$)	Amount (1,000US\$)			
					Total	1998	1999	2000
<b>Construction Cost</b>								
<b>1. Civil Works</b>								
	a. Dredging of Approach Channel	cu.m	225,600	10	2,256		2,256	
	b. Dredging of Basin	cu.m	490,000	10	4,900	2,000	2,900	
	c. Land Reclamation (Container Yard)	cu.m		11				
	d. Land Reclamation (Bulk Cargo Yard)	cu.m		11				
	e. Land Reclamation (Pond)	cu.m		11				
	f. Revetments (Container and Bulk Berths)	Lm		2,310				
	g. Revetments (Pond)	Lm		800				
	h. Container Yard	sq.m		65				
	i. Bulk Cargo Yard	sq.m		58				
	j. Empty Container Yard Open Storage & Parking Area	sq.m	5,000	58	290		290	
	k. Roads	sq.m	5,597	77	431		431	
<b>2. Main Port Facilities</b>								
	a. Container Berth (-10.5 m)	Lm		48,424				
	b. Container Berth (-9.0 m)	Lm		43,265				
	c. Renovation of the New Quay (-9.0 m)	Lm		14,000				
	d. Accessories of New Quay (-9.0 m)	Lm	350	2,100	735		735	
	e. General Cargo Berth (-9.0 m)	Lm	160	31,215	4,994	4,000	994	
	f. General Cargo Berth (-8.5 m)	Lm	240	30,279	7,267		4,239	3,028
	g. Bulk Cargo Berth (-8.5 m)	Lm		30,279				
	h. Extension of Breakwater	Lm		17,757				
	i. Navigation Aids	unit		90,000				
	j. Cement Silo (25,000 ton)	unit		1,598,000				
	k. Bitumen Tank (9,000 ton)	L.S		3,270,000				
	l. Reefer Container Facilities	L.S		93,000				
<b>3. Building Works</b>								
	a. Administration Office	sq.m		500				
	b.1 Maintenance Workshop	sq.m		400				
	b.2 Machinery/Equipment	L.S		60,000				
	b.3 Service Truck	unit		45,000				
	c.1 Container Repair Facility	sq.m		450				
	c.2 5 ton Hoist Crane	unit		280,000				
	c.3 Others	L.S		69,000				
	d.1 Container Fumigation Facility	sq.m		350				
	d.2 Machinery/Equipment	L.S		50,000				
	e.1 Container Cleaning Facility	sq.m		350				
	e.2 Machinery/Equipment	L.S		10,000				
	f. Customs Office	sq.m		400				
	g. Gate House	unit		15,000				
	h. Generator House	sq.m		400				
	i. Renovation of Exist. Shed (No.3)	sq.m		30				
	j. Truck Scale	unit		60,000				
	k. CFS	sq.m		400				
	l. Demolition of Sheds (No.5) Railway	L.S		100,000				
<b>4. Utilities</b>								
	a. Power Supply	L.S		1,860,000				
	b. Lighting System	L.S	3	186,000	500		500	
	c. Water Supply	L.S	1	300,000	300		300	
	d. Sewerage	L.S		200,000				
	e. Computer System	L.S		5,643,000				
	f. Yard Fence	Lm		50				
	h. Fire Fighting System	L.S		200,000				
	Subtotal				21,673	6,000	11,845	3,828
<b>B. Procurement/Installation of Equipment</b>								
<b>1. Container Handling Equipment</b>								
	a. Gantry Crane (30.5 ton type)	no.		7,000,000				
	b. Transfer Crane (30.5 ton RTG)	no.		1,630,000				
	c. Top-loader (45 ton type)	no.	2	550,000	1,100		1,100	
	d. Tractor (for Yard)	no.	6	90,000	540		360	180
	e. Chassis (for Yard (20'-40'))	no.	10	30,000	300			300
	f. Forklift Truck (2 - 4 ton type)	no.		25,000				
<b>2. Other Cargo Handling Equipment</b>								
	a. Tractor (for transport)	no.		30,000				
	b. Trailer (for transport)	no.		15,000				
	c.1 Forklift Trucks (3 ton type)	no.	2	30,000	60		60	
	c.2 -ditto- (5 ton type)	no.		55,000				
	d.1 Mobile Crane (100 ton type)	no.		1,800,000				
	d.2 -ditto- (200 ton type)	no.		3,200,000				
	e. Pneumatic Unloader (200 t/hr, for cement)	no.		4,000,000				
	f. Belt-conveyor (200 t/hr, for cement)	L.S		1,500,000				
	g. Grab Bucket (4 cu.m for fertilizer)	no.		13,000				
	h. 2-way Dozer (for fertilizer on board)	no.		70,000				
	i. Movable Hopper (15 cu.m for fertilizer at apron)	no.		100,000				
	j. Belt Conveyor (for bagged cargo)	no.	3	15,000	45			45
	k. Forklift Trucks (15 ton type for heavy cargo)	no.	1	100,000	100			100
	3. Tug Boat (1,500 p.s.)	no.		2,100,000				
	Subtotal				2,145		1,460	685
<b>C. Engineering Services (8% of "A" + 3% of "B")</b>					1,798	450	899	450
<b>D. Physical Contingency (10 % of "A"+"B"+"C")</b>					2,562	645	1,420	496
<b>Grand Total ("A"+"B"+"C"+"D")</b>					28,178	7,095	15,625	5,459

Table-3.5-2 Foreign and local and currency portion of the project cost for Urgent plan

A.	Description	Unit	Quantity	Unit cost (US\$)	Amount (1,000 US\$)			Ratio		Unskilled Labor	
					Total	Local	Foreign	Local (%)	Foreign (%)	(%)	Amount
<b>A. Construction Cost</b>											
<b>1. Civil Works</b>											
a.	Dredging of Approach Channel	cu.m	225,600	10	2,256	158	2,098	7	93	2	45
b.	Dredging of Basin	cu.m	490,000	30	4,900	343	4,557	7	93	2	98
c.	Land Reclamation (Container Yard)	cu.m		11				47	53	12	
d.	Land Reclamation (Bulk Cargo Yard)	cu.m		11				47	53	12	
e.	Land Reclamation (Pond)	cu.m		11				47	53	12	
f.	Revetments (Container and Bulk Berths)	lm		2,310				35	65	12	
g.	Revetments (Pond)	lm		800				35	65	12	
h.	Container Yard	sq.m		65				35	65	12	
i.	Bulk Cargo Yard	sq.m		58				35	65	12	
j.	Empty Container Yard Open Storage & Parking Area	sq.m	5,000	58	290	102	189	35	65	12	35
k.	Roads	sq.m	5,597	77	431	108	323	25	75	12	52
<b>2. Main Port Facilities</b>											
a.	Container Berth (-10.5 m)	lm		48,424				17	83	8	
b.	Container Berth (-9.0 m)	lm		43,265				15	85	8	
c.	Renovation of the New Quay (-9.0 m)	lm		14,000				15	85	8	
d.	Accessories of New Quay (-9.0 m)	lm	350	2,100	735	74	662	10	90	5	37
e.	General Cargo Berth (-9.0 m)	lm	160	31,215	4,994	749	4,245	15	85	8	400
f.	General Cargo Berth (-8.5 m)	lm	240	30,279	7,267	1,090	6,177	15	85	8	581
g.	Bulk Cargo Berth (-8.5 m)	lm		30,279				15	85	8	
h.	Extension of Breakwater	lm		17,757				35	65	12	
i.	Navigation Aids	unit		90,000				5	95	1	
j.	Cement Silo (25,000 ton)	unit		1,598,000				15	85	8	
k.	Bitumen Tank (9,000 ton)	L.S		3,270,000				10	90	8	
l.	Reefer Container Facilities	L.S		93,000				10	90	8	
<b>3. Building Works</b>											
a.	Administration Office	sq.m		500				20	80	10	
b.1	Maintenance Workshop	sq.m		409				15	85	8	
b.2	Machinery/Equipment	L.S		60,000					100		
b.3	Service Truck	unit		45,000					100		
c.1	Container Repair Facility	sq.m		450				20	80	10	
c.2	5 ton Hoist Crane	unit		280,000					100		
c.3	Others	L.S		69,000					100		
d.1	Container Fumigation Facility	sq.m		350				20	80	10	
d.2	Machinery/Equipment	L.S		50,000					100		
e.1	Container Cleaning Facility	sq.m		350				20	80	10	
e.2	Machinery/Equipment	L.S		10,000					100	8	
f.	Customs Office	sq.m		400				20	80	8	
g.	Gate House	unit		15,000				15	85	8	
h.	Generator House	sq.m		400				15	85	8	
i.	Renovation of Exist. Shed (No.3)	sq.m		30				20	80	10	
j.	Truck Scale	unit		60,000				10	90	5	
k.	CFS	sq.m		400				20	80	10	
l.	Demolition of Sheds (No.5) Railway	L.S		100,000				95	5	40	
<b>4. Utilities</b>											
a.	Power Supply	L.S		1,860,000				5	95	2	
b.	Lighting System	L.S	3	186,000	300	50	450	10	90	5	25
c.	Water Supply	L.S	1	300,000	300	60	240	20	80	10	30
d.	Sewerage	L.S		200,000				20	80	10	
e.	Computer System	L.S		5,643,000				5	95	2	
f.	Yard Fence	lm		50				20	80	10	
h.	Fire Fighting System	L.S		200,000				20	80	10	
Subtotal					21,673	2,731	18,940	13%	87%	6%	1,302
<b>B. Procurement/Installation of Equipment</b>											
<b>1. Container Handling Equipment</b>											
a.	Gantry Crane (30.5 ton type)	no.		7,000,000						100	
b.	Transfer Crane (30.5 ton RTG)	no.		1,650,000						100	
c.	Top-loader (45 ton type)	no.	2	550,000	1,100		1,100			100	
d.	Tractor (for Yard)	no.	6	90,000	540		540			100	
e.	Chassis (for Yard (20'-40'))	no.	10	30,000	300		300			100	
f.	Forklift Truck (2 - 4 ton type)	no.		25,000						100	
<b>2. Other Cargo Handling Equipment</b>											
a.	Tractor (for transport)	no.		30,000						100	
b.	Trailer (for transport)	no.		15,000						100	
c.1	Forklift Trucks (3 ton type)	no.	2	30,000	60		60			100	
c.2	-ditto- (5 ton type)	no.		55,000						100	
d.1	Mobile Crane (100 ton type)	no.		1,800,000						100	
d.2	-ditto- (200 ton type)	no.		3,200,000						100	
e.	Pneumatic Unloader (200 t/hr, for cement)	no.		4,000,000						100	
f.	Belt-conveyor (200 t/hr, for cement)	L.S		1,500,000						100	
g.	Grab Bucket (4 cu.m for fertilizer)	no.		13,000						100	
h.	2-way Dozer (for fertilizer on board)	no.		70,000						100	
i.	Movable Hopper (15 cu.m for fertilizer at apron)	no.		100,000						100	
j.	Belt Conveyor (for bagged cargo)	no.	3	15,000	45		45			100	
k.	Forklift Trucks (15 ton type for heavy cargo)	no.	1	100,000	100		100			100	
3.	Tug Boat (1,500 p.s.)	no.		2,100,000						100	
Subtotal					2,145		2,145			100%	
C. Engineering Services (8% of "A" + 3% of "B")					1,798	360	1,439	20%	80%		
D. Physical Contingency (10% of "A" + "B" + "C")					2,562	309	2,252	12%	88%	5%	130
Grand Total ("A" + "B" + "C" + "D")					28,178	3,402	24,776	12%	88%	5%	1,432



Table-3.5-3 Annual disbursement schedule of the project cost for Urgent plan

(1,000 US\$)

Description	Unit	Quantity	Unit cost (US\$)	1998			1999			2000			Total														
				Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total												
<b>A. Construction Cost</b>																											
<b>1. Civil Works</b>																											
a. Dredging of Approach Channel	cu.m	225,600	10				158	2,098	2,256					158	2,098	2,256											
b. Dredging of Basin	cu.m	490,000	10	140	1,860	2,000	203	2,697	2,900					343	4,557	4,900											
c. Land Reclamation (Container Yard)	cu.m		11																								
d. Land Reclamation (Bulk Cargo Yard)	cu.m		11																								
e. Land Reclamation (Pond)	cu.m		11																								
f. Revetments (Container and Bulk Berths)	Lm		2,310																								
g. Revetments (Pond)	Lm		800																								
h. Container Yard	sq.m		65																								
i. Bulk Cargo Yard	sq.m		58																								
j. Empty Container Yard Open Storage & Parking Area	sq.m	5,000	58				102	189	290					102	189	290											
k. Roads	sq.m	5,597	77				108	323	431					108	323	431											
<b>2. Main Port Facilities</b>																											
a. Container Berth (-10.5 m)	Lm		48,424																								
b. Container Berth (-9.0 m)	Lm		43,265																								
c. Renovation of the New Quay (-9.0 m)	Lm		14,000																								
d. Accessories of New Quay (-9.0 m)	Lm	350	2,100				74	662	735					74	662	735											
e. General Cargo Berth (-9.0 m)	Lm	160	31,215	600	3,400	4,000	149	845	994					749	4,245	4,994											
f. General Cargo Berth (-8.5 m)	Lm	240	30,279				636	3,603	4,239	454	2,574	3,028	1,090	6,177	7,267												
g. Bulk Cargo Berth (-8.5 m)	Lm		30,279																								
h. Extension of Breakwater	Lm		17,757																								
i. Navigation Aids	unit		90,000																								
j. Cement Silo (25,000 ton)	unit		1,598,000																								
k. Bitumen Tank (9,000 ton)	L.S		3,270,000																								
l. Reefer Container Facilities	L.S		93,000																								
<b>3. Building Works</b>																											
a. Administration Office	sq.m		500																								
b. 1 Maintenance Workshop	sq.m		400																								
b. 2 Machinery/Equipment	L.S		60,000																								
b. 3 Service Truck	unit		45,000																								
c. 1 Container Repair Facility	sq.m		450																								
c. 2 5 ton Hoist Crane	unit		280,000																								
c. 3 Others	L.S		69,000																								
d. 1 Container Fumigation Facility	sq.m		350																								
d. 2 Machinery/Equipment	L.S		50,000																								
e. 1 Container Cleaning Facility	sq.m		350																								
e. 2 Machinery/Equipment	L.S		10,000																								
f. Customs Office	sq.m		400																								
g. Gate House	unit		15,000																								
h. Generator House	sq.m		400																								
i. Renovation of Exist. Shed (No.3)	sq.m		30																								
j. Truck Scale	unit		60,000																								
k. CFS	sq.m		400																								
l. Demolition of Sheds (No.5)/ Railway	L.S		100,000																								
<b>4. Utilities</b>																											
a. Power Supply	L.S		1,860,000																								
b. Lighting System	L.S	3	186,000							50	450	500	50	450	500												
c. Water Supply	L.S	1	300,000							60	240	300	60	240	300												
d. Sewerage	L.S		200,000																								
e. Computer System	L.S		5,643,000																								
f. Yard Fence	Lm		50																								
h. Fire Fighting System	L.S		200,000																								
Subtotal				740	5,260	6,000	1,429	10,416	11,845	564	3,264	3,828	2,733	18,940	21,673												
<b>B. Procurement/Installation of Equipment</b>																											
<b>1. Container Handling Equipment</b>																											
a. Gantry Crane (30.5 ton type)	no.		7,000,000																								
b. Transfer Crane (30.5 ton RTG)	no.		1,650,000																								
c. Top-loader (45 ton type)	no.	2	550,000					1,100	1,100					1,100	1,100												
d. Tractor (for Yard)	no.	6	90,000					360	360	180	180			540	540												
e. Chassis (for Yard (20-40'))	no.	10	30,000							300	300			300	300												
f. Forklift Truck (2 - 4 ton type)	no.		25,000																								
<b>2. Other Cargo Handling Equipment</b>																											
a. Tractor (for transport)	no.		30,000																								
b. Trailer (for transport)	no.		15,000																								
c. 1 Forklift Trucks (3 ton type)	no.	2	30,000								60	60		60	60												
c. 2 -ditto- (5 ton type)	no.		55,000																								
d. 1 Mobile Crane (100 ton type)	no.		1,800,000																								
d. 2 -ditto- (200 ton type)	no.		3,200,000																								
e. Pneumatic Unloader (200 t/hr, for cement)	no.		4,000,000																								
f. Belt-conveyor (200 t/hr, for cement)	L.S		1,500,000																								
g. Grab Bucket (4 cu.m for fertilizer)	no.		13,000																								
h. 2-way Doser (for fertilizer on board)	no.		70,000																								
i. Movable Hopper (15 cu.m for fertilizer at apron)	no.		100,000																								
j. Belt Conveyor (for bagged cargo)	no.	3	15,000								45	45		45	45												
k. Forklift Trucks (15 ton type for heavy cargo)	no.	1	100,000								100	100		100	100												
3. Tug Boat (1,500 p.s.)	no.		2,100,000																								
Subtotal								1,460	1,460		685	685		2,145	2,145												
<b>C. Engineering Services (8% of "A" + 3% of "B")</b>														90	360	450	180	719	899	90	360	450	360	1,439	1,798		
<b>D. Physical Contingency (10 % of "A" + "B" + "C")</b>														83	562	645	161	1,260	1,420	65	431	496	309	2,252	2,562		
<b>Grand Total ("A" + "B" + "C" + "D")</b>														913	6,182	7,095	1,769	13,855	15,625	720	4,739	5,459	3,402	24,776	28,178		

Table-3.5-4 Project cost for Short-term plan

Description	Unit	Quantity	Unit cost (US\$)	Amount (1,000/US\$)								
				Total	1998	1999	2000	2001	2002	2003	2004	
<b>A. Construction Cost</b>												
<b>1. Civil Works</b>												
a. Dredging of Approach Channel	cu.m	239,400	10	2,394							2,394	
b. Dredging of Basin	cu.m	822,000	10	8,220					8,220			
c. Land Reclamation (Container Yard)	cu.m	750,000	11	8,250				8,250				
d. Land Reclamation (Bulk Cargo Yard)	cu.m		11									
e. Land Reclamation (Pond)	cu.m	58,000	11	638			638					
f. Revetments (Container and Bulk Berths)	Lm	420	2,310	970				970				
g. Revetments (Pond)	Lm	560	800	448				448				
h. Container Yard	sq.m	75,015	65	4,876				1,219	2,438	1,219		
i. Bulk Cargo Yard	sq.m		58									
j. Empty Container Yard Open Storage & Parking Area	sq.m	5,017	58	291				73	145	73		
k. Roads	sq.m	10,013	77	771				193	385	193		
<b>2. Main Port Facilities</b>												
a. Container Berth (-10.5 m)	Lm	170	48,424	8,232				4,116	4,116			
b. Container Berth (-9.0 m)	Lm	70	43,265	3,028			1,514	1,514				
c. Renovation of the New Quay (-9.0 m)	Lm		14,000									
d. Accessories of New Quay (-9.0 m)	Lm		2,100									
e. General Cargo Berth (-9.0 m)	Lm		31,215									
f. General Cargo Berth (-8.5 m)	Lm		30,279									
g. Bulk Cargo Berth (-8.5 m)	Lm		30,279									
h. Extension of Breakwater	Lm		17,757									
i. Navigation Aids	unit	2	90,000	180			180					
j. Cement Silo (25,000 ton)	unit		1,598,000									
k. Bitumen Tank (9,000 ton)	L.S		3,270,000									
l. Reefer Container Facilities	L.S	1	93,000	47						47		
<b>3. Building Works</b>												
a. Administration Office	sq.m	1,500	500	750					375	375		
b. 1 Maintenance Workshop	sq.m	1,000	400	400					200	200		
b. 2 Machinery/Equipment	L.S	1	60,000	60					30	30		
b. 3 Service Truck	unit	1	45,000	45					23	23		
c. 1 Container Repair Facility	sq.m	600	450	270					135	135		
c. 2 5 ton Hoist Crane	unit	2	280,000	560					280	280		
c. 3 Others	L.S	1	69,000	70					35	35		
d. 1 Container Fumigation Facility	sq.m	51	350	18					9	9		
d. 2 Machinery/Equipment	L.S	1	50,000	50					25	25		
e. 1 Container Cleaning Facility	sq.m	51	350	18					9	9		
e. 2 Machinery/Equipment	L.S	1	10,000	10					5	5		
f. Customs Office	sq.m	50	400	20					10	10		
g. Gate House	unit	4	15,000	60					30	30		
h. Generator House	sq.m	180	400	72					36	36		
i. Renovation of Exist. Shed (No.3)	sq.m	10,000	30	300					150	150		
j. Truck Scale	unit	2	60,000	120					60	60		
k. CFS	sq.m	125	400	50						50		
l. Demolition of Sheds (No.5) Railway	L.S		100,000									
<b>4. Utilities</b>												
a. Power Supply	L.S	1	1,860,000	1,000					500	500		
b. Lighting System	L.S	1	186,000	130					65	65		
c. Water Supply	L.S	1	300,000	180					90	90		
d. Sewerage	L.S	1	200,000	120					60	60		
e. Computer System	L.S	0	5,643,000	1,000						1,000		
f. Yard Fence	Lm	860	50	43						43		
h. Fire Fighting System	L.S	1	200,000	100					50	50		
Subtotal				43,792			2,332	16,783	17,528	7,149		
<b>B. Procurement/Installation of Equipment</b>												
<b>1. Container Handling Equipment</b>												
a. Gantry Crane (30.5 ton type)	no.	2	7,000,000	14,000							14,000	
b. Transfer Crane (30.5 ton R1G)	no.	6	1,650,000	9,900							9,900	
c. Top-loader (45 ton type)	no.		550,000									
d. Tractor (for Yard)	no.	7	90,000	630							630	
e. Chassis (for Yard (20'-40'))	no.	6	30,000	180							180	
f. Forklift Truck (2 - 4 ton type)	no.	2	25,000	50								50
<b>2. Other Cargo Handling Equipment</b>												
a. Tractor (for transport)	no.	3	30,000	90			60		30			
b. Trailer (for transport)	no.	3	15,000	45					45			
c. 1 Forklift Trucks (3 ton type)	no.	4	30,000	120								120
c. 2 -ditto- (5 ton type)	no.	3	55,000	165								165
d. 1 Mobile Crane (100 ton type)	no.		1,800,000									
d. 2 -ditto- (200 ton type)	no.		3,200,000									
e. Pneumatic Unloader (200 t/hr, for cement)	no.		4,000,000									
f. Belt-conveyor (200 t/hr, for cement)	L.S		1,500,000									
g. Grab Bucket (4 cu.m for fertilizer)	no.		15,000									
h. 2-way Dozer (for fertilizer on board)	no.		70,000									
i. Movable Hopper (15 cu.m for fertilizer at apron)	no.		100,000									
j. Belt Conveyor (for bagged cargo)	no.		15,000									
k. Forklift Trucks (15 ton type for heavy cargo)	no.		100,000									
3. Tug Boat (1,500 p.s.)	no.	2	2,100,000	4,200			4,200					
Subtotal				29,380			4,260		75	24,710	335	
<b>C. Engineering Services (8% of "A" + 3% of "B")</b>				4,385		1,827	731	731	731	365		
<b>D. Physical Contingency (10 % of "A"+"B"+"C")</b>				7,756		183	732	1,751	1,833	3,222	34	
<b>Grand Total ("A"+"B"+"C"+"D")</b>				85,312		2,010	8,055	19,265	20,167	35,447	369	

Table-3.5-5 Foreign and local currency portion of the project cost for Short-term plan

Description	Unit	Quantity	Unit cost (US\$)	Amount (1,000 US\$)			Ratio		Unskilled Labor	
				Total	Local	Foreign	Local (%)	Foreign (%)	(%)	Amount
<b>A. Construction Cost</b>										
<b>1. Civil Works</b>										
a. Dredging of Approach Channel	cu.m	239,400	10	2,394	168	2,226	7	93	2	48
b. Dredging of Basin	cu.m	822,000	10	8,220	575	7,645	7	93	2	164
c. Land Reclamation (Container Yard)	cu.m	750,000	11	8,250	3,878	4,373	47	53	12	990
d. Land Reclamation (Bulk Cargo Yard)	cu.m		11				47	53	12	
e. Land Reclamation (Pond)	cu.m	58,000	11	638	300	338	47	53	12	77
f. Revetments (Container and Bulk Berths)	Lm	420	2,310	970	340	631	35	65	12	116
g. Revetments (Pond)	Lm	560	800	448	157	291	35	65	12	54
h. Container Yard	sq.m	75,015	65	4,876	1,707	3,169	35	65	12	585
i. Bulk Cargo Yard	sq.m		58				35	65	12	
j. Empty Container Yard Open Storage & Parking Area	sq.m	5,017	58	291	102	189	35	65	12	35
k. Roads	sq.m	10,013	77	771	193	578	25	75	12	93
<b>2. Main Port Facilities</b>										
a. Container Berth (-10.5 m)	Lm	170	48,424	8,232	1,399	6,833	17	83	8	659
b. Container Berth (-9.0 m)	Lm	70	43,265	3,028	454	2,574	15	85	8	242
c. Renovation of the New Quay (-9.0 m)	Lm		14,000				15	85	8	
d. Accessories of New Quay (-9.0 m)	Lm		2,100				10	90	5	
e. General Cargo Berth (-9.0 m)	Lm		31,215				15	85	8	
f. General Cargo Berth (-8.5 m)	Lm		30,279				15	85	8	
g. Bulk Cargo Berth (-8.5 m)	Lm		30,279				15	85	8	
h. Extension of Breakwater	Lm		17,757				35	65	12	
i. Navigation Aids	unit	2	90,000	180	9	171	5	95	1	2
j. Cement Silo (25,000 ton)	unit		1,598,000				15	85	8	
k. Bitumen Tank (9,000 ton)	L.S		3,270,000				10	90	8	
l. Reefer Container Facilities	L.S	1	93,000	47	5	42	10	90	8	4
<b>3. Building Works</b>										
a. Administration Office	sq.m	1,500	500	750	150	600	20	80	10	75
b. 1. Maintenance Workshop	sq.m	1,000	400	400	60	340	15	85	8	32
b. 2. Machinery/Equipment	L.S	1	60,000	60		60		100		
b. 3. Service Truck	unit	1	45,000	46		46		100		
c. 1. Container Repair Facility	sq.m	600	450	270	54	216	20	80	10	27
c. 2. 5 ton Hoist Crane	unit	2	280,000	560		560		100		
c. 3. Others	L.S	1	69,000	70		70		100		
d. 1. Container Fumigation Facility	sq.m	51	350	18	4	14	20	80	10	2
d. 2. Machinery/Equipment	L.S	1	50,000	50		50		100		
e. 1. Container Cleaning Facility	sq.m	51	350	18	4	14	20	80	10	2
e. 2. Machinery/Equipment	L.S	1	10,000	10		10		100		
f. Customs Office	sq.m	50	400	20	4	16	20	80	8	2
g. Gate House	unit	4	15,000	60	9	51	15	85	8	5
h. Generator House	sq.m	180	400	72	11	61	15	85	8	6
i. Renovation of Exist. Shed (No.3)	sq.m	10,000	30	300	60	240	20	80	10	30
j. Truck Scale	unit	2	60,000	120	12	108	10	90	5	6
k. CFS	sq.m	125	400	50	10	40	20	80	10	5
l. Demolition of Sheds (No.5) Railway	L.S		100,000				95	5	40	
<b>4. Utilities</b>										
a. Power Supply	L.S	1	1,860,000	1,000	50	950	5	95	2	20
b. Lighting System	L.S	1	186,000	130	13	117	10	90	5	7
c. Water Supply	L.S	1	300,000	180	36	144	20	80	10	18
d. Sewerage	L.S	1	200,000	120	24	96	20	80	10	12
e. Computer System	L.S	0	5,643,000	1,000	50	950	5	95	2	20
f. Yard Fence	Lm	860	50	43	9	34	20	80	10	4
h. Fire Fighting System	L.S	1	200,000	100	20	80	20	80	10	10
<b>Subtotal</b>				43,792	9,864	33,928	23%	77%	8%	3,349
<b>B. Procurement/Installation of Equipment</b>										
<b>1. Container Handling Equipment</b>										
a. Gantry Crane (30.5 ton type)	no.	2	7,000,000	14,000		14,000		100		
b. Transfer Crane (30.5 ton RTG)	no.	6	1,650,000	9,900		9,900		100		
c. Top-loader (45 ton type)	no.		550,000					100		
d. Tractor (for Yard)	no.	7	90,000	630		630		100		
e. Chassis (for Yard (20'-40'))	no.	6	30,000	180		180		100		
f. Forklift Truck (2 - 4 ton type)	no.	2	25,000	50		50		100		
<b>2. Other Cargo Handling Equipment</b>										
a. Tractor (for transport)	no.	3	30,000	90		90		100		
b. Trailer (for transport)	no.	3	15,000	45		45		100		
c. 1. Forklift Trucks (3 ton type)	no.	4	30,000	120		120		100		
c. 2. -ditto- (5 ton type)	no.	3	55,000	165		165		100		
d. 1. Mobile Crane (100 ton type)	no.		1,800,000					100		
d. 2. -ditto- (200 ton type)	no.		3,200,000					100		
e. Pneumatic Unloader (200 t/hr, for cement)	no.		4,000,000					100		
f. Belt-conveyor (200 t/hr, for cement)	L.S		1,500,000					100		
g. Grab Bucket (4 cu.m for fertilizer)	no.		13,000					100		
h. 2-way Dozer (for fertilizer on board)	no.		70,000					100		
i. Movable Hopper (15 cu.m for fertilizer at apron)	no.		100,000					100		
j. Belt Conveyor (for bagged cargo)	no.		15,000					100		
k. Forklift Trucks (15 ton type for heavy cargo)	no.		100,000					100		
<b>3. Tug Boat (1,500 p.s.)</b>	no.	2	2,100,000	4,200		4,200		100		
<b>Subtotal</b>				29,380		29,380		100%		
<b>C. Engineering Services (8% of "A" + 3% of "B")</b>				4,385	877	3,508	20%	80%		
<b>D. Physical Contingency (10 % of "A" + "B" + "C")</b>				7,756	1,074	6,682	14%	86%	4%	335
<b>Grand Total ("A" + "B" + "C" + "D")</b>				85,312	11,815	73,498	14%	86%	4%	3,684

Table-3.5-6 Annual disbursement schedule of the project cost for Short-term plan (1/2)

(1,000 US\$)

Description	Unit	Quantity	Unit cost (US\$)	1998			1999			2000			2001										
				Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total								
<b>A. Construction Cost</b>																							
<b>1. Civil Works</b>																							
a. Dredging of Approach Channel	cu.m	239,400	10																				
b. Dredging of Basin	cu.m	822,600	10																				
c. Land Reclamation (Container Yard)	cu.m	750,000	11										3,878	4,373	8,250								
d. Land Reclamation (Bulk Cargo Yard)	cu.m		11																				
e. Land Reclamation (Pond)	cu.m	58,000	11							300	336	638											
f. Revetments (Container and Bulk Berths)	Lm	420	2,310																				
g. Revetments (Pond)	Lm	560	800											157	291	448							
h. Container Yard	sq.m	75,015	65											427	792	1,219							
i. Bulk Cargo Yard	sq.m		58												26	47	73						
j. Empty Container Yard Open Storage & Parking Area	sq.m	5,017	58											48	145	193							
k. Roads	sq.m	10,013	77																				
<b>2. Main Port Facilities</b>																							
a. Container Berth (-10.5 m)	Lm	170	48,424																				
b. Container Berth (-9.0 m)	Lm	70	43,265							227	1,287	1,514	227	1,287	1,514								
c. Renovation of the New Quay (-9.0 m)	Lm		14,000																				
d. Accessories of New Quay (-9.0 m)	Lm		2,100																				
e. General Cargo Berth (-9.0 m)	Lm		31,215																				
f. General Cargo Berth (-8.5 m)	Lm		30,279																				
g. Bulk Cargo Berth (-8.5 m)	Lm		30,279																				
h. Extension of Breakwater	Lm		17,757																				
i. Navigation Aids	unit	2	90,000							9	171	180											
j. Cement Silo (25,000 ton)	unit		1,598,000																				
k. Bitumen Tank (9,000 ton)	L.S		3,270,000																				
l. Reefer Container Facilities	L.S	1	93,000																				
<b>3. Building Works</b>																							
a. Administration Office	sq.m	1,500	500																				
b. 1 Maintenance Workshop	sq.m	1,000	400																				
b. 2 Machinery/Equipment	L.S	1	60,000																				
b. 3 Service Truck	unit	1	45,000																				
c. 1 Container Repair Facility	sq.m	600	450																				
c. 2 5 ton Hoist Crane	unit	2	280,000																				
c. 3 Others	L.S	1	69,000																				
d. 1 Container Fumigation Facility	sq.m	51	350																				
d. 2 Machinery/Equipment	L.S	1	50,000																				
e. 1 Container Cleaning Facility	sq.m	51	350																				
e. 2 Machinery/Equipment	L.S	1	10,000																				
f. Customs Office	sq.m	50	400																				
g. Gate House	unit	4	15,000																				
h. Generator House	sq.m	180	400																				
i. Renovation of Exist. Shed (No.3)	sq.m	10,000	30																				
j. Truck Scale	unit	2	60,000																				
k. CFS	sq.m	125	400																				
l. Demolition of Sheds (No.5) Railway	L.S		100,000																				
<b>4. Utilities</b>																							
a. Power Supply	L.S	1	1,860,000																				
b. Lighting System	L.S	1	184,000																				
c. Water Supply	L.S	1	300,000																				
d. Sewerage	L.S	1	200,000																				
e. Computer System	L.S	0	5,643,000																				
f. Yard Fence	Lm	860	50																				
h. Fire Fighting System	L.S	1	200,000																				
Subtotal										536	1,796	2,332	5,801	10,982	16,783								
<b>B. Procurement/Installation of Equipment</b>																							
<b>1. Container Handling Equipment</b>																							
a. Gantry Crane (30.5 ton type)	no.	2	7,000,000																				
b. Transfer Crane (30.5 ton RTG)	no.	6	1,650,000																				
c. Top-loader (45 ton type)	no.		550,000																				
d. Tractor (for Yard)	no.	7	90,000																				
e. Chassis (for Yard (20'-40'))	no.	6	30,000																				
f. Forklift Truck (2 - 4 ton type)	no.	2	25,000																				
<b>2. Other Cargo Handling Equipment</b>																							
a. Tractor (for transport)	no.	3	30,000																				
b. Trailer (for transport)	no.	3	15,000																				
c. 1 Forklift Trucks (3 ton type)	no.	4	30,000																				
c. 2 -ditto- (5 ton type)	no.	3	55,000																				
d. 1 Mobile Crane (100 ton type)	no.		1,800,000																				
d. 2 -ditto- (200 ton type)	no.		3,200,000																				
e. Pneumatic Unloader (200 t/hr. for cement)	no.		4,000,000																				
f. Belt-conveyor (200 t/hr. for cement)	L.S		1,500,000																				
g. Grab Bucket (4 cu.m for fertilizer)	no.		13,000																				
h. 2-way Dozer (for fertilizer on board)	no.		70,000																				
i. Movable Hopper (15 cu.m for fertilizer at apron)	no.		100,000																				
j. Belt Conveyor (for bagged cargo)	no.		15,000																				
k. Forklift Trucks (15 ton type for heavy cargo)	no.		100,000																				
3. Tug Boat (1,500 p.s.)	no.	2	2,100,000																				
Subtotal													4,260	4,260									
C. Engineering Services (8% of "A" + 3% of "B")										365	1,462	1,827	146	585	731	146	585	731					
D. Physical Contingency (10% of "A" + "B" + "C")										37	146	183	68	664	732	595	1,157	1,751					
Grand Total ("A" + "B" + "C" + "D")										402	1,608	2,010	750	7,305	8,055	6,542	12,723	19,265					

Table-3.5-6 Annual disbursement schedule of the project cost for Short-term plan (2/2)

(1,000 US\$)

Description	Unit	Quantity	Unit cost (US\$)	2002			2003			2004			Total			
				Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	
<b>A. Construction Cost</b>																
<b>1. Civil Works</b>																
a. Dredging of Approach Channel	cu.m	239,400	10				168	2,226	2,394				168	2,226	2,394	
b. Dredging of Basin	cu.m	822,000	10	575	7,645	8,220							575	7,645	8,220	
c. Land Reclamation (Container Yard)	cu.m	750,000	11										3,878	4,373	8,250	
d. Land Reclamation (Bulk Cargo Yard)	cu.m		11													
e. Land Reclamation (Pond)	cu.m	58,000	11										300	338	638	
f. Revetments (Container and Bulk Berths)	Lm	420	2,310										340	631	970	
g. Revetments (Pond)	Lm	560	800										157	291	448	
h. Container Yard	sq.m	75,015	65	853	1,585	2,438	427	792	1,219				1,707	3,169	4,876	
i. Bulk Cargo Yard	sq.m		58													
j. Empty Container Yard Open Storage & Parking Area	sq.m	5,017	58	51	94	145	26	47	73				102	189	291	
k. Roads	sq.m	10,013	77	96	289	385	48	145	193				193	578	771	
<b>2. Main Port Facilities</b>																
a. Container Berth (-10.5 m)	Lm	170	48,424	700	3,416	4,116							1,399	6,833	8,232	
b. Container Berth (-9.0 m)	Lm	70	43,265										454	2,574	3,028	
c. Renovation of the New Quay (-9.0 m)	Lm		14,000													
d. Accessories of New Quay (-9.0 m)	Lm		2,100													
e. General Cargo Berth (-9.0 m)	Lm		31,215													
f. General Cargo Berth (-8.5 m)	Lm		30,279													
g. Bulk Cargo Berth (-8.5 m)	Lm		30,279													
h. Extension of Breakwater	Lm		17,757													
i. Navigation Aids	unit	2	90,000										9	171	180	
j. Cement Silo (25,000 ton)	unit		1,598,000													
k. Bitumen Tank (9,000 ton)	L.S		3,270,000													
l. Reefer Container Facilities	L.S	1	93,000	5	42	47							5	42	47	
<b>3. Building Works</b>																
a. Administration Office	sq.m	1,500	500	75	300	375	75	300	375				150	600	750	
b.1 Maintenance Workshop	sq.m	1,000	400	30	170	200	30	170	200				60	340	400	
b.2 Machinery/Equipment	L.S	1	60,000		30	30		30	30					60	60	
b.3 Service Truck	unit	1	45,000		23	23		23	23					46	46	
c.1 Container Repair Facility	sq.m	600	450	27	108	135	27	108	135				54	216	270	
c.2 5 ton Hoist Crane	unit	2	280,000		280	280		280	280					560	560	
c.3 Others	L.S	1	69,000		35	35		35	35					70	70	
d.1 Container Fumigation Facility	sq.m	51	350	2	7	9	2	7	9				4	14	18	
d.2 Machinery/Equipment	L.S	1	50,000		25	25		25	25					50	50	
e.1 Container Cleaning Facility	sq.m	51	350	2	7	9	2	7	9				4	14	18	
e.2 Machinery/Equipment	L.S	1	10,000		5	5		5	5					10	10	
f. Customs Office	sq.m	50	400	2	8	10	2	8	10				4	16	20	
g. Gate House	unit	4	15,000	5	26	30	5	26	30				9	51	60	
h. Generator House	sq.m	180	400	5	31	36	5	31	36				11	61	72	
i. Renovation of Exist. Shed (No.3)	sq.m	10,000	30	30	120	150	30	120	150				60	240	300	
j. Truck Scale	unit	2	60,000	6	54	60	6	54	60				12	108	120	
k. CFS	sq.m	125	400				10	40	50				10	40	50	
l. Demolition of Sheds (No.5) Railway	L.S		100,000													
<b>4. Utilities</b>																
a. Power Supply	L.S	1	1,860,000	25	475	500	25	475	500				50	950	1,000	
b. Lighting System	L.S	1	186,000	7	59	65	7	59	65				13	117	130	
c. Water Supply	L.S	1	300,000	18	72	90	18	72	90				36	144	180	
d. Sewerage	L.S	1	200,000	12	48	60	12	48	60				24	96	120	
e. Computer System	L.S	0	5,643,000					50	950	1,000			50	950	1,000	
f. Yard Fence	Lm	860	50				9	34	43				9	34	43	
h. Fire Fighting System	L.S	1	200,000	10	40	50	10	40	50				20	80	100	
Subtotal				2,535	14,993	17,528	992	6,157	7,149				9,864	33,928	43,792	
<b>B. Procurement/Installation of Equipment</b>																
<b>1. Container Handling Equipment</b>																
a. Gantry Crane (30.5 ton type)	no.	2	7,000,000					14,000	14,000					14,000	14,000	
b. Transfer Crane (30.5 ton RTG)	no.	6	1,650,000					9,900	9,900					9,900	9,900	
c. Top-loader (45 ton type)	no.		550,000													
d. Tractor (for Yard)	no.	7	90,000					630	630					630	630	
e. Chassis (for Yard (20-40'))	no.	6	30,000					180	180					180	180	
f. Forklift Truck (2 - 4 ton type)	no.	2	25,000							50	50			50	50	
<b>2. Other Cargo Handling Equipment</b>																
a. Tractor (for transport)	no.	3	39,000		30	30								90	90	
b. Trailer (for transport)	no.	3	15,000		45	45								45	45	
c.1 Forklift Trucks (3 ton type)	no.	4	30,000							120	120			120	120	
c.2 ditto (5 ton type)	no.	3	55,000							165	165			165	165	
d.1 Mobile Crane (100 ton type)	no.		1,800,000													
d.2 ditto (200 ton type)	no.		3,200,000													
e. Pneumatic Unloader (200 t/hr, for cement)	no.		4,000,000													
f. Belt-conveyor (200 t/hr, for cement)	L.S		1,500,000													
g. Grab Bucket (4 cu.m for fertilizer)	no.		13,000													
h. 2-way Dozer (for fertilizer on board)	no.		70,000													
i. Movable Hopper (15 cu.m for fertilizer at apron)	no.		100,000													
j. Belt Conveyor (for bagged cargo)	no.		15,000													
k. Forklift Trucks (15 ton type for heavy cargo)	no.		100,000													
3. Tug Boat (1,500 p.s.)	no.	2	2,100,000											4,200	4,200	
Subtotal					75	75	24,710	24,710		335	335		29,380	29,380		
<b>C. Engineering Services (8% of "A" + 3% of "B")</b>				146	585	731	73	292	365				877	3,508	4,385	
<b>D. Physical Contingency (10 % of "A" + "B" + "C")</b>				268	1,565	1,833	106	3,116	3,222			34	34	1,074	6,682	7,756
<b>Grand Total ("A" + "B" + "C" + "D")</b>				2,949	17,218	20,167	1,171	34,276	35,447			369	369	11,815	73,498	85,312