Present
Wave Direction : WSW
Wave Period : 7.0 sec

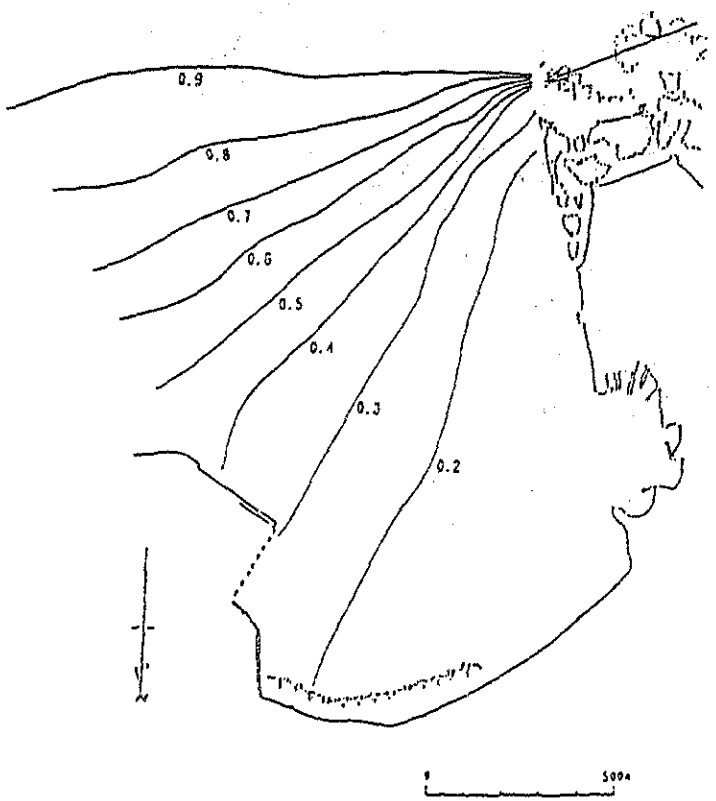


Fig. 2-8 Wave Height Ratio

Present
Wave Direction : W
Wave Period : 7.0 sec

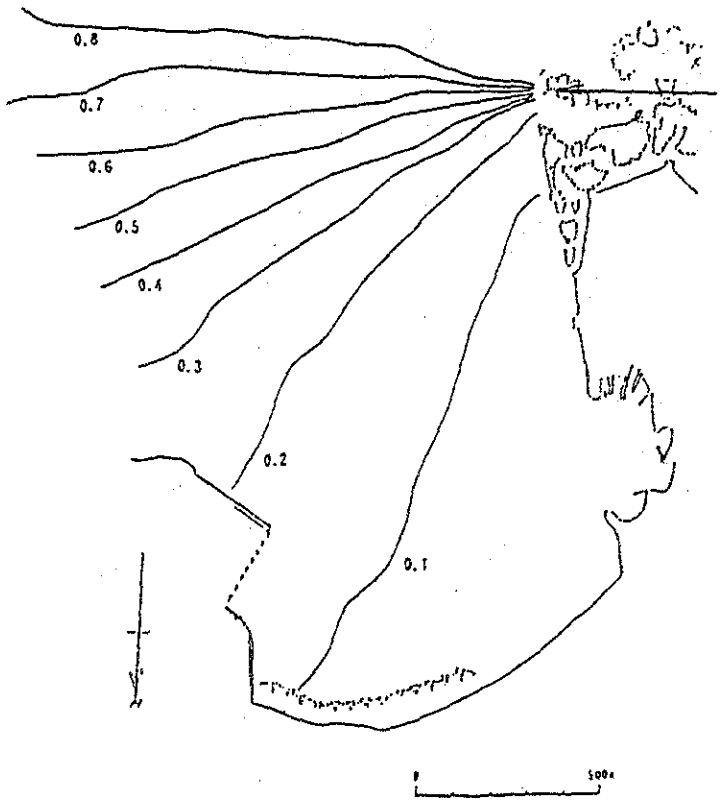


Fig. 2-9 Wave Height Ratio

Urgent Plan
Wave Direction : S 7.9°W
Wave Period : 13.0 sec

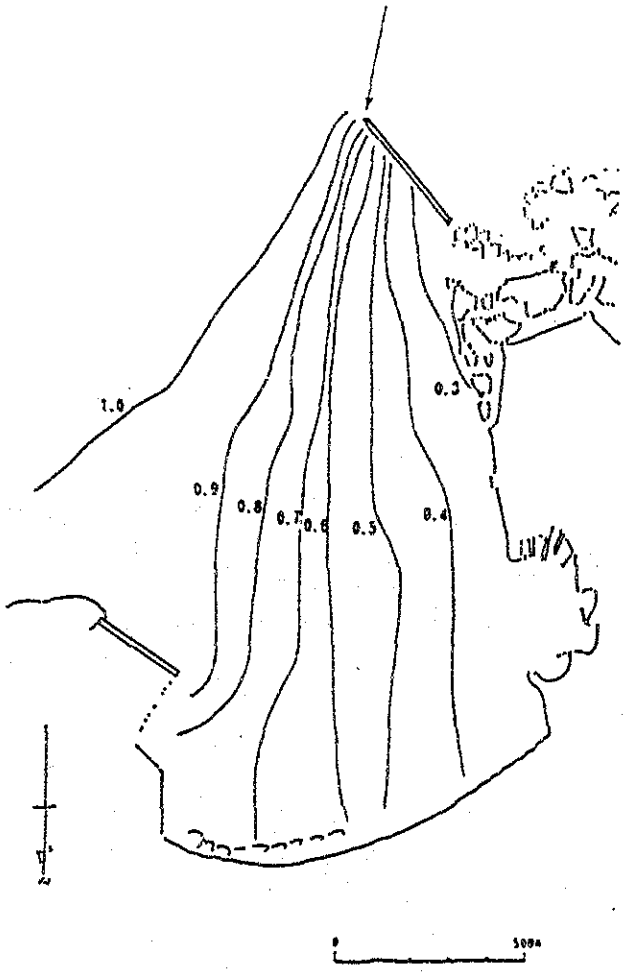


Fig. 2-10 Wave Height Ratio

Urgent Plan
Wave Direction : SE
Wave Period : 7.0 sec

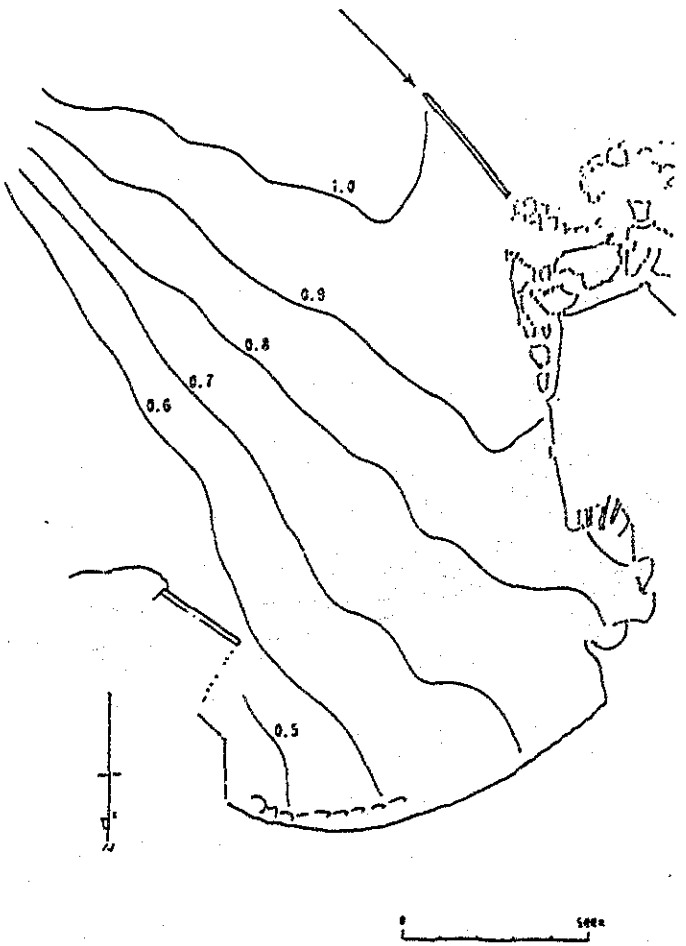


Fig. 2-11 Wave Height Ratio

Urgent Plan
Wave Direction : SSE
Wave Period : 7.0 sec

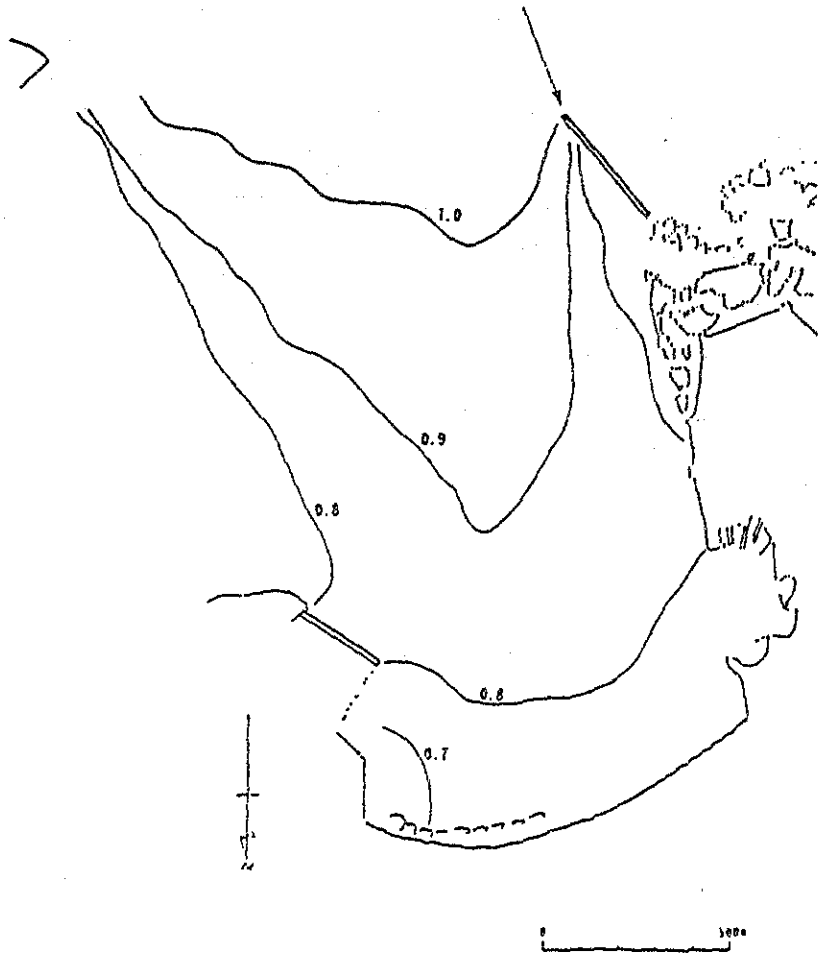


Fig. 2-12 Wave Height Ratio

Urgent Plan
Wave Direction : S
Wave Period : 7.0 sec

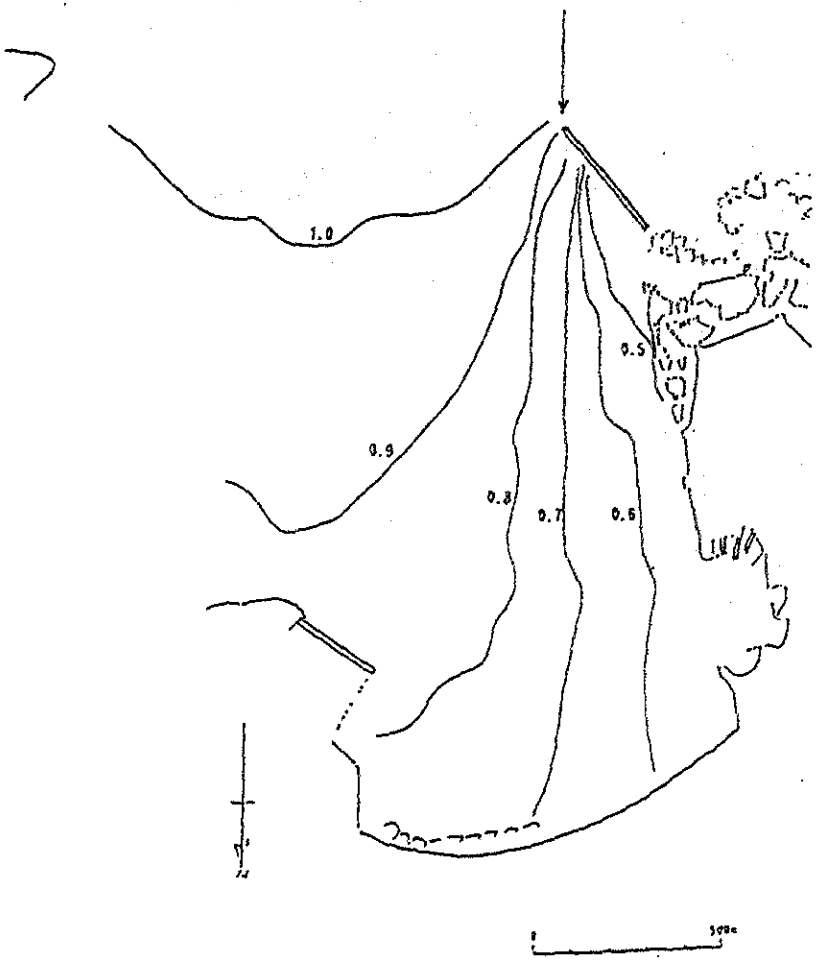


Fig. 2-13 Wave Height Ratio

Urgent Plan
Wave Direction : SSW
Wave Period : 7.0 sec

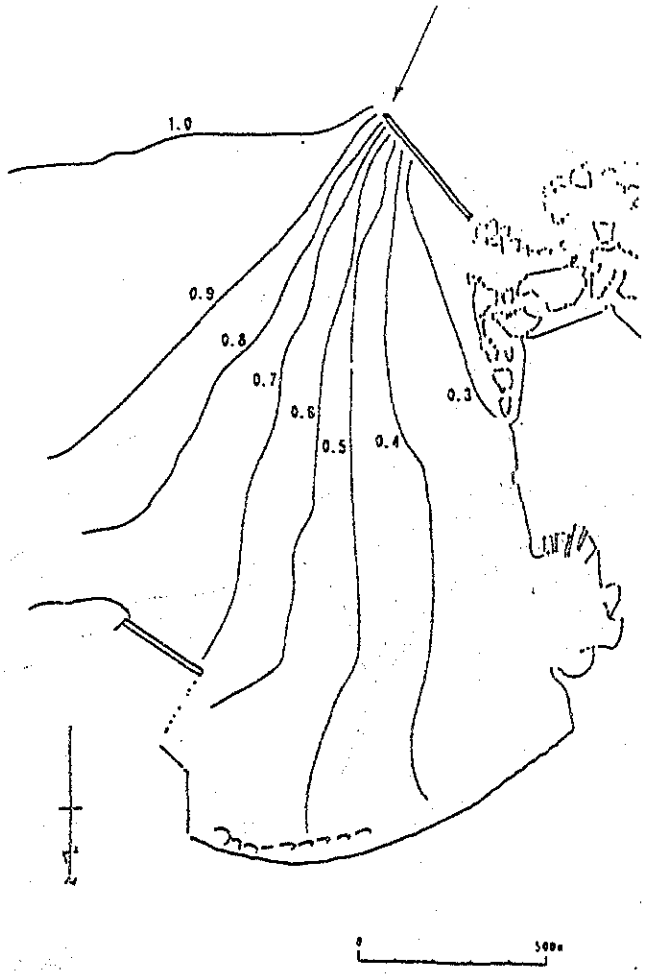


Fig. 2-14 Wave Height Ratio

Urgent Plan
Wave Direction : SW
Wave Period : 7.0 sec

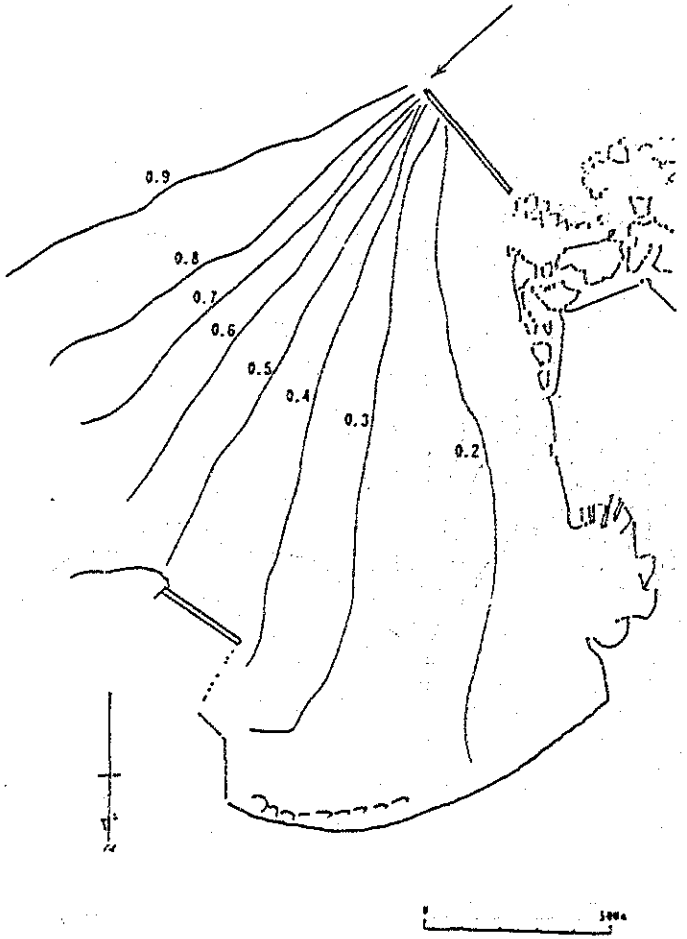


Fig. 2-15 Wave Height Ratio

Urgent Plan
Wave Direction : WSW
Wave Period : 7.0 sec

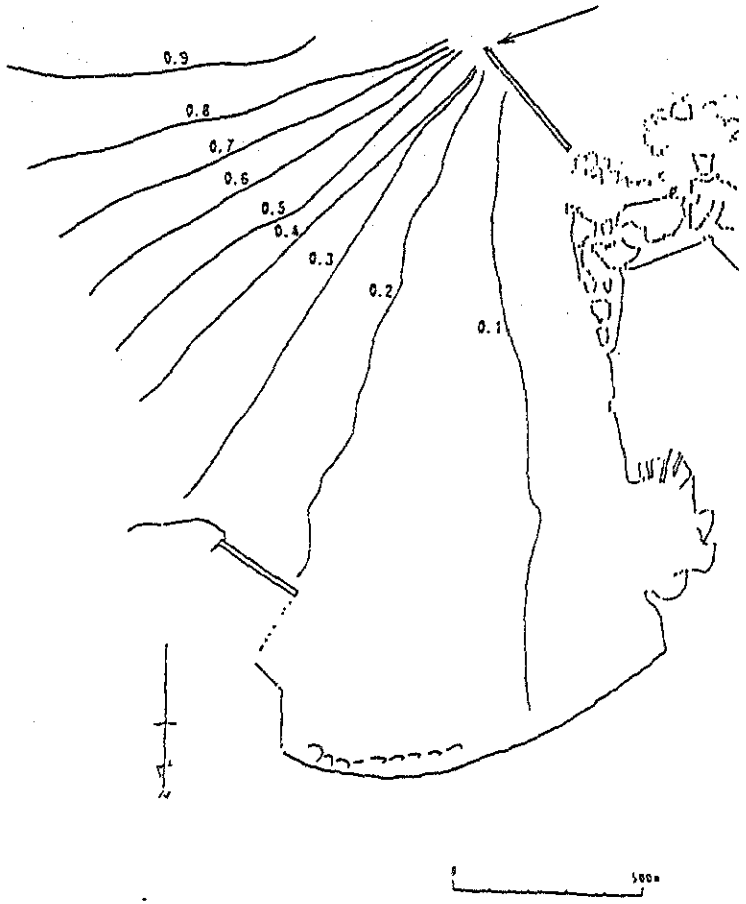


Fig. 2-16 Wave Height Ratio

Urgent Plan
Wave Direction : W
Wave Period : 7.0 sec

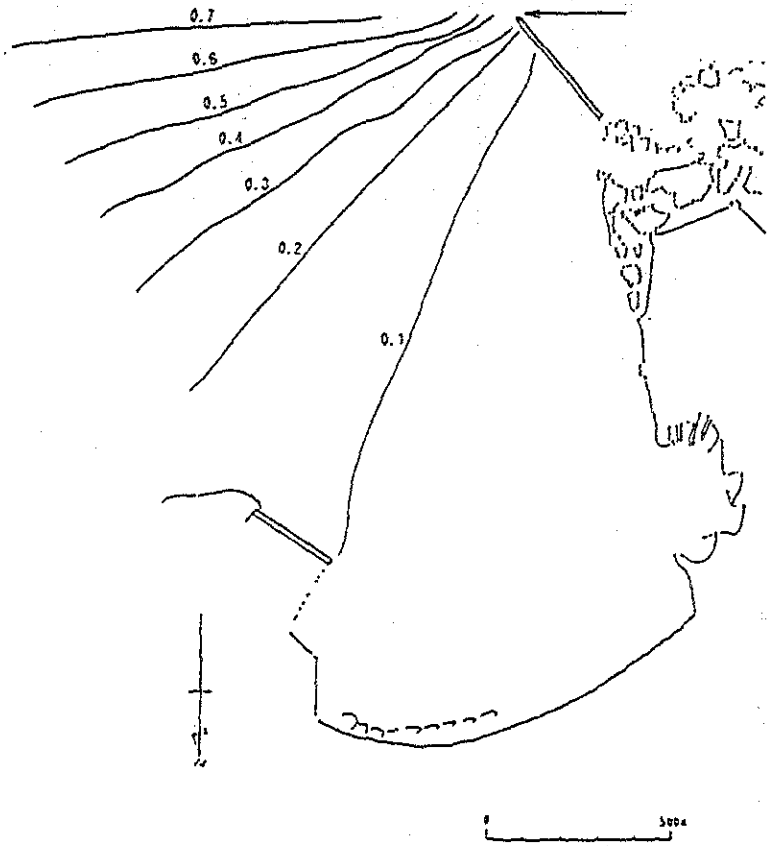


Fig. 2-17 Wave Height Ratio

2-2 Structural Design

(1) Design Conditions

As stated in Subsection 2-1, the Urgent Plan consists of the construction of a 350-m extension of the Southwest Breakwater offshore of the Fort Walls.

The design included analyses of the following factors:

1) Layout of breakwater
2) Impacts on surrounding topography and marine ecology
3) Design Criteria
4) Structural Type of Breakwater
5) Design and construction method and cost

Evaluation of the breakwater layout included the following fators:

1) Environmental conditions
2) Calmness in the harbour basin and ship maneuverability
3) Construction and maintenance costs

The following design conditions and paramenters have been established on the basis of the analyses and evaluation noted above as well as the results of field surveys and investigations.

1) Tide level

Mean High Water Level	: + 0.6 m
Mean Sea Level	: + 0.34 m
Mean Low Water Level	: + 0.10 m
Datum Level	: ± 0.00 m

2) Waves

The design wave characteristics with a 50-year return period have been established as follows.

Direction	Height(Ho')	Height(H1/3)	Period
W - S	5.5 m	5.1 m	9.5 sec

3) Water depth and sea bottom condition

The design water depths range from -4.0 m to -14.0 m. The site of the first 270-m-long section of the proposed breakwater is scattered with outcrops of the bedrock and the remaining 80-m section will rest on a suitable foundation formed by a sand layer of 2 m in thickness.

(2) Design

1) Selection of Structural Type of Breakwater

In the selection of the various structural types listed below, they were weighed against one another with regard to the following factors:

- Layout
- Environmental and service conditions
- Construction problems and construction time and cost
- Availability of construction materials from local sources
- Relative ease of maintenance

List of evaluated Structural Types of Breakwater

- Breakwaters
  - Sloping Breakwaters
    - Rubble Mound Breakwater
    - Concrete Block Type Sloping Breakwater
  - Upright Breakwaters
    - Caisson Type Upright Breakwater
    - Concrete Block Type Upright Breakwater
    - Cellular Concrete Block Type Upright Breakwater
    - Mass Concrete Type Upright Breakwater
  - Composite Breakwaters
    - Caisson Type Composite Breakwater
    - Concrete Block Type Composite Breakwater
    - Cellular Concrete Block Type Composite Breakwater
    - Mass Concrete Type Composite Breakwater
  - Breakwater Armoured with Wave Dissipating Concrete Blocks
  - Special Breakwater

After an indepth analysis of the factors noted above, the sloping breakwater was selected for detailed analysis.

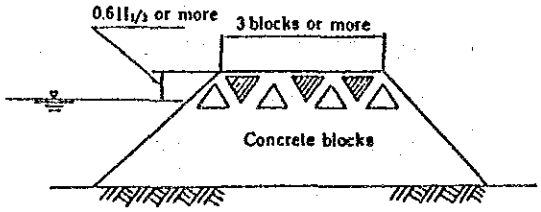
2) Design of Mound Breakwater

(a) Crown Height

The crown height of breakwaters should be equal to not less than about 0.6 times the design significant wave height above the mean spring high water level and should have an extra height to prevent considerable wave overtopping. With due regard for this point, the crown height of +5.0 m above the Datum Level has been taken for design purposes.

(b) Crown Width

The crown width should be equal to the width of three or more irregular concrete blocks installed in a row as shown below.



Crown Width of Sloping Breakwater

(c) Weight of Armor Concrete Block

The weight of concrete blocks covering the seaward faces of the rubble mound exposed to wave force was obtained by Hudson's formula.

$$W = \frac{\gamma_r H^3}{K_D (Sr - 1)^3 \cot \alpha} = 13.45\,t < 14.19\,t$$

where W : Minimum weight of rubbles or concrete blocks (ft)

γ_r : Unit weight of rubble or block in air (tf/m^3)

Sr : Specific gravity of rubble or block in sea water

α : Angle of the slope to horizontal plane (degrees)

H : Wave height (m)

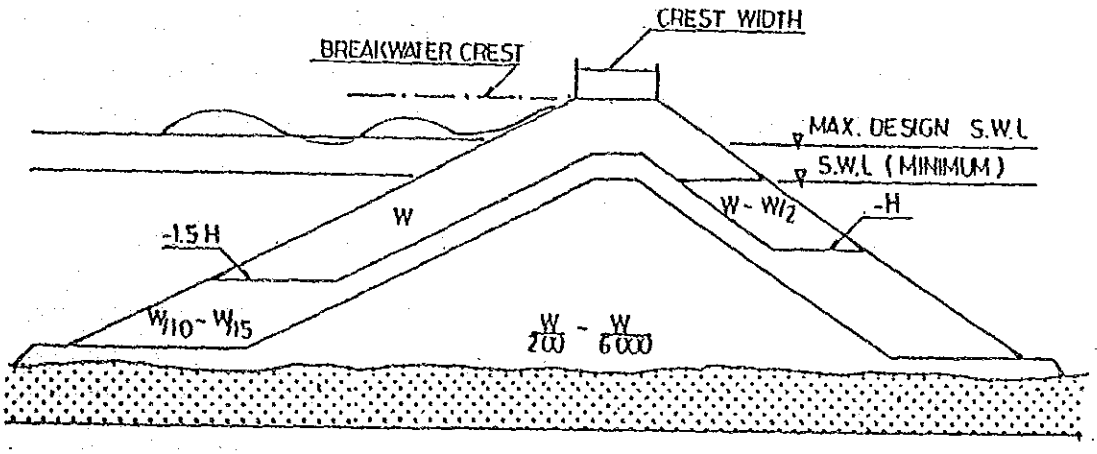
K_D : Constant determined by the armoring material and damage rate.

As a result of the calculations, the weight of 16 tons was taken for the concrete armor blocks to protect the seaward faces of the rubble mound. For the breakwater tip, provision is made for placing 25-ton concrete block armor stones.

On the other hand, armor stones of 4 to 6 tons each will be placed on the landward section of the breakwater for concrete blocks in the central part of the structure and an extra height provided for the crown level.

The weight of armor below the sea water level

The weight of armor unit below the sea water level is determined from the values recommended by the Coastal Engineering Research Center, Department of Army Corps of Engineers, USA as shown below.



The Plan view and typical cross section of the breakwater are shown in Figs. 3-2-1 and 3-2-2, respectively.

3 Implementation Schedule

Looking toward the Indian Ocean, Galle Bay is exposed to southerly swells more than 0.5 meter high all the year round. Moreover, wind waves of 1.5 m or more in height reach the bay from S to SW directions during the five southwest monsoon months (April to September).

Wind speeds of 10 m/sec or more and significant wave heights of 0.3 to 0.5 m or more are generally considered critical physical conditions which render harbour works and other marine construction activities impractical. By this standard, the proposed breakwater works in Galle Port will be affected to a greater or lesser degree throughout the year.

The numbers of days available for construction operations as determined on the basis of wave heights in and around the port are as indicated in Table 3-1. In this table, the wave heights of less than 1.5 m are considered to permit construction activities to be carried out, though with reduced efficiency, without interruptions.

Table 3-1 Days Available for Construction Operations

Season		Wave Height				Days Available for Construction Operations
Month	Total days	~0.49 m	0.5 m ~0.99 m	1.0 m ~1.49 m	1.5 m~	
		Ⓐ	Ⓑ	Ⓒ	Ⓓ	Total days of Ⓐ~Ⓒ
March April	61	-	17 days (27.5%)	33 days (54.0%)	11 days (18.5%)	50 days
May ~ September	153	-	-	8 days (5.0%)	145 days (95.0%)	8 days
October November	61	-	9 days (15.0%)	28 days (45.0%)	24 days (40.0%)	37 days
December February	90	-	45 days (51.25%)	44 days (48.75%)	-	90 days
Total	365	-	72 days (19.7%)	113 days (31.0%)	183 days (49.3%)	185 days

The available days in the tabulation are for offshore or coastal construction operations. For shore works the number of available days is assumed to be increased by nearly 80 days, which may vary depending on the type of work.

With due consideration given to the severe marine conditions, the implementation schedule has been established as shown in Table 3-3-2 on the following assumptions:

1) The first monsoon season will be devoted to activities, such as site preparation, opening of quarries, stockpiling of armor stones, and construction of a temporary yard and jetty for unloading armor stones. These operations are estimated to take five months, during which time all floating equipment will be mobilized.
2) During October to April construction crews will work on two shifts 12 hours a day and seven days a week.
3) Maximum use of the existing port area will be made for the production and storage of concrete blocks.

Table 3-2 Implementation Schedule

Description	Months														
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
I. Construction Works				———	———	———	———	———	———	———	———	———	———	———	
1. Mobilization and Preparation				———	———										
2. Manufacturing of Concrete Blocks						———	———	———	———	———	———	———	———		
3. Transportation of Stones					———	———	———	———	———	———	———	———	———	———	
4. Offshore Works						———	———	———	———			———	———	———	
5. Demobilization														———	
II. Engineering Services	———	———	———	———	———	———	———	———	———	———	———	———	———	———	

4 Cost Estimate

4-1 Basic Principles of Cost Estimation

The cost estimates of the project have been prepared by applying the basic prices and rates obtained during the Feasibility Study period from October 1990 to November 1990 to the plants, equipment, materials and labor required for the Project construction.

(1) The estimated construction cost consists of foreign and local currency components. The exchange rates used in the cost estimation are:

US$1.00 = Rs.40.37 = ¥130.60 (Quotation as of Nov. 1990)

(2) All prices and rates inputted into the cost estimates are as of November 1990.

(3) No allowance is made for the import duties applicable to the materials, equipment and construction plants to be imported into Sri Lanka from other countries.

(4) No allowance is made for the transaction tax (BTT) assessable on materials and fuels obtained from local sources.

(5) The contract tax applicable to construction contracts is not included in the cost estimates.

4-2 Estimation of Cost

(1) Basic Prices and Local Supply Capacity for Materials and Labor

In addition to a survey conducted on the prices and rates for locally available labor, fuels and construction materials, an investigation was undertaken to determine the supply capacities of these items with particular reference to major recent development projects in Galle and Colombo.

Table 4-1 Daily Wage Rates of Local Workers and Fuel Price

	Item	Daily Wage Rate & Fuel Price (Rs.)
Local Woker	Unskilled	90
	Skilled	120
	Foreman	225
	Crane Operator	160
	Driver	120
	Concrete Worker	120
	Small boat Skipper	140
	Crew	120
Fuel (Per 1)	Gasoline	25
	Light Oil	11
	Heavy Oil	10.6

Table 4-2 Unit Prices of Construction Materials

Item	Unit	Unit Price (Rs.)
Graded rock (100kg - 6.0t)	Cu.m	390
Crushed Stone (50 - 100 mm)	"	600
Fine Aggregate	"	200
Cement (Bag)	ton	4000

4-3 Construction Cost

The construction cost of the Southwest Breakwater comprising the Urgent Plan project is broken down in Table 4-3.

The total cost of the Urgent Plan of the project is estimated at US$22,933,000.

The cost estimates are based on the following preconditions:

(1) A concrete block casting yard and a materials storage area shall be provided within the existing port area.

(2) The 100-m-long west end of the existing wharf structure shall be made available for free use of the contractor for unloading construction materials.

(3) Floating plants shall be allowed free anchorage within the harbour basin during the monsoon seasons.

Table 4-3 Construction Cost for Urgent Plan

Description	Quantity	Unit	Construction Cost (US$)
Southwest Breakwater	350 m	m	24,417,000
Engineering Services		Sum	1,516,000
Grand Total			22,933,000

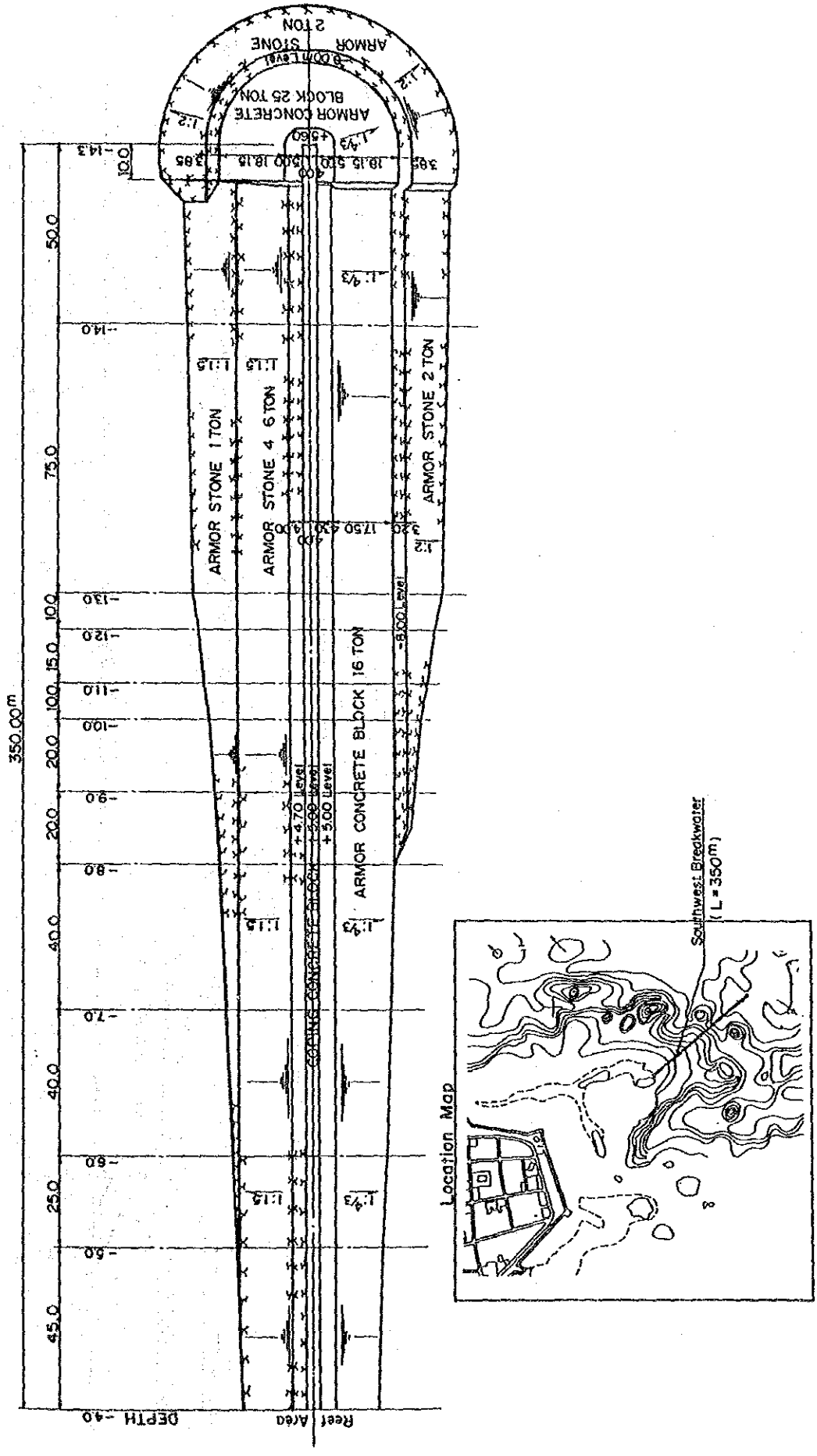


Fig. 4-1 Plan of Southwest Breakwater

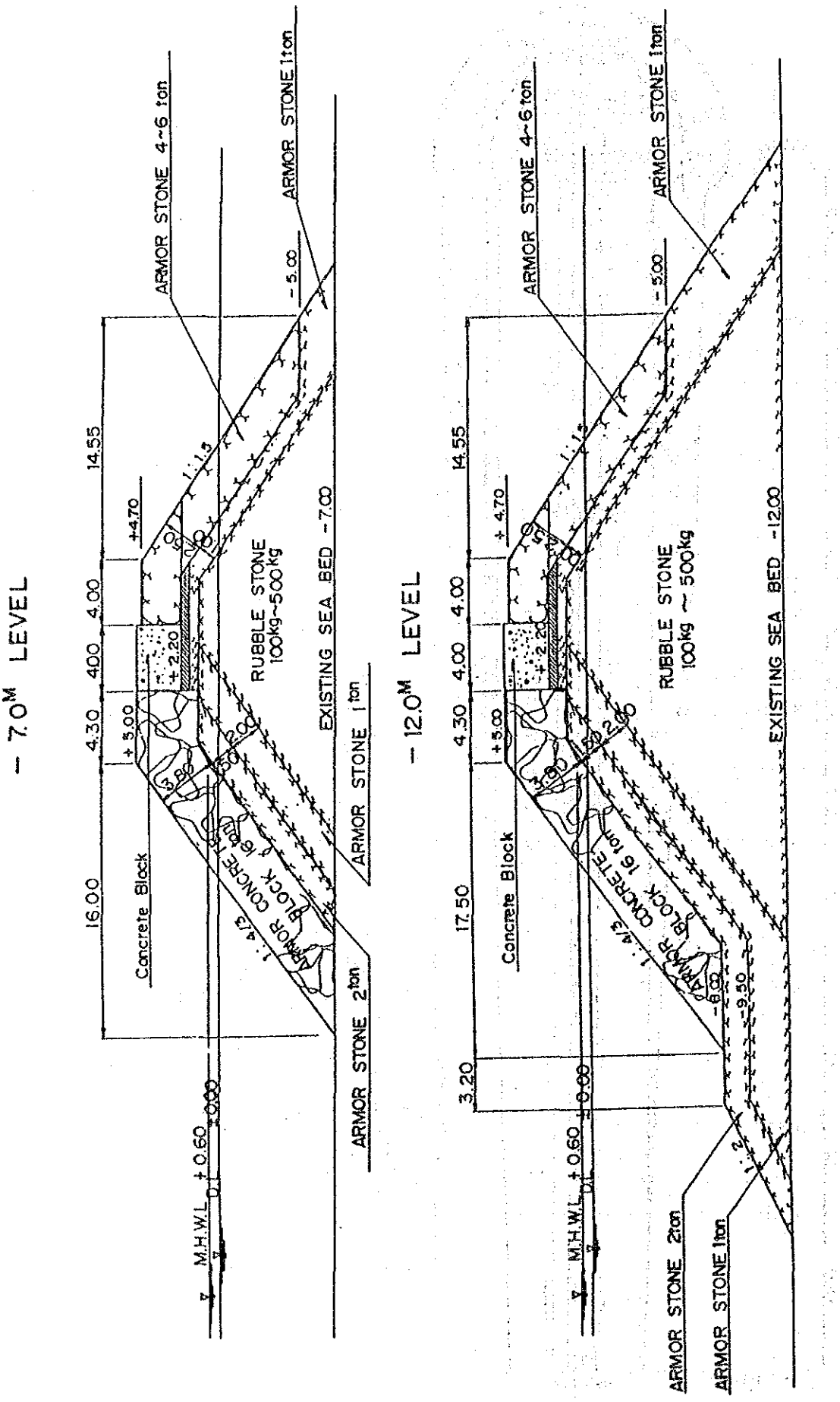


Fig. 4-2 Typical Cross Section of Southwest Breakwater

5 Project Evaluation and Conclusion

The port of Galle, which is managed and operated by the Sri Lanka Ports Authority (SLPA), is one and only port as an entrance of seaborne traffic to the province. As the regional development of the Southern Province is one of the most important projects in Sri Lanka, the improvement of the safety and the maneuverability of the Port of Galle is of urgent necessity from the viewpoint of alleviating the regional differential of livelihood between Colombo and the Province and answers the policy of the Government of Sri Lanka.

Effects of this project is evaluated basically as follows:

- -Elimination of the shortage of subsistence commodities for the Southern Province;
- -Stabilization of prices of subsistence commodities in the province;
- -Improvement of the level of living for the residents in the province;
- -Stabilization of the people's livelihood of the province.

As mentioned above, there are substantial benefits to the residents in the Southern Province resulting from this project. Some of which can be evaluated quantitatively to some extent, as is examined below;

Firstly, the capacity of facilities for handling cargoes at the Port of Galle at present is about 150,000 tons except clinker and the potential cargo volume, which is calculated based on current demand and supply data of the hinterland of the Port of Galle, is also more than 150,000 tons. On the other hand, the actual cargo volume handled at the port in 1988 and 1989 were less than 50,000 tons. Therefore, it can be expected that the cargo volume will increase by at least 100,000 tons. According to the increase of cargo volume handled at the port, the employment opportunity of port labors will also increase.

Secondly, the benefit in terms of improving the level of living due to the easement of the regional differential of retail prices of rice can be calculated based on the following assumption:

- -Higher living expenses of residents in the Southern Province due to the price differential between Colombo and the province will be

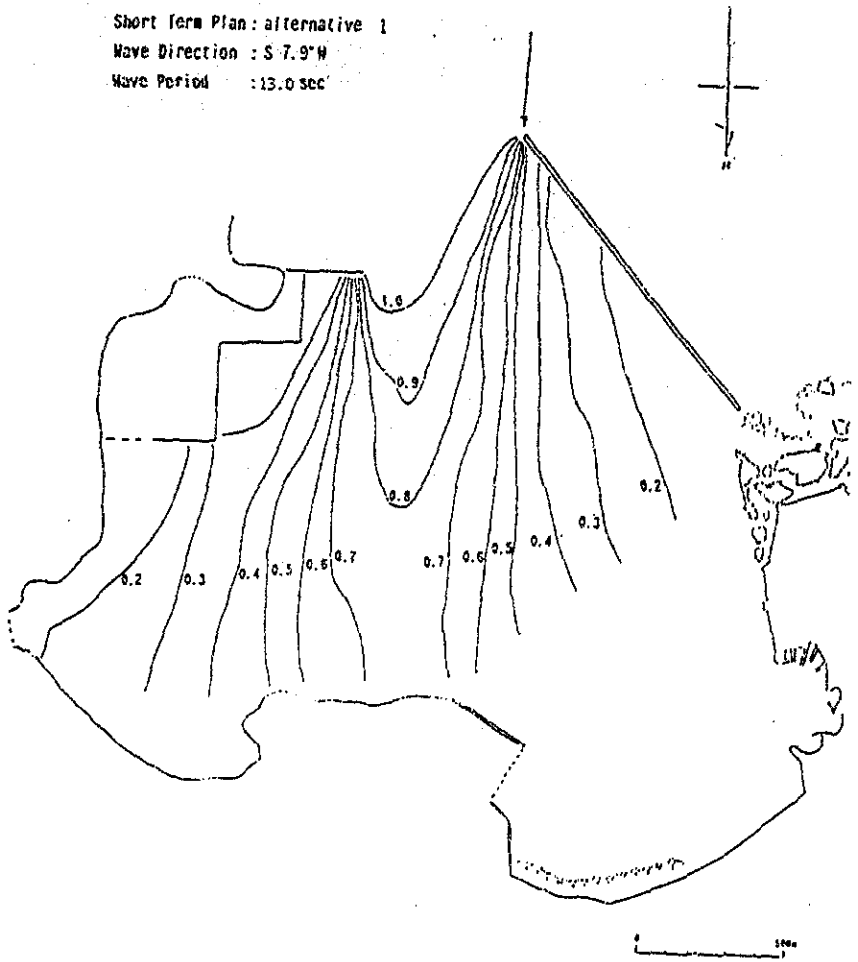
dissolved;

-The population of the Southern Province is about 2.1 million, 12.5% of Sri Lanka's population, at present;

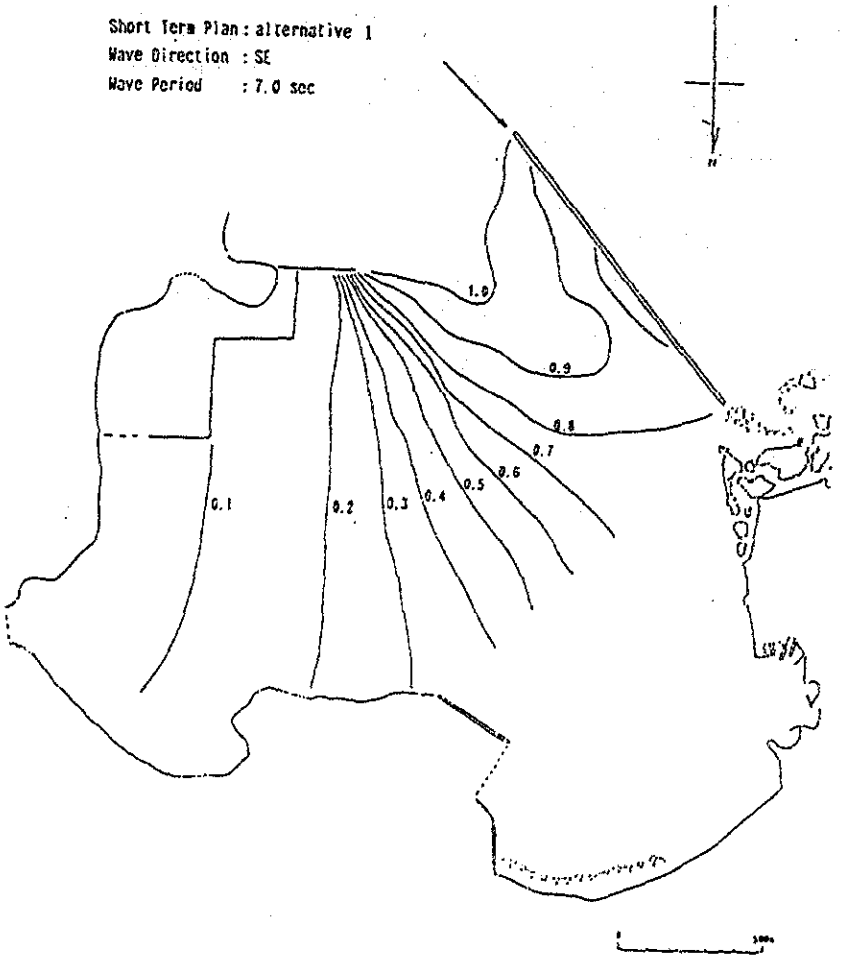
-Per capita consumption of rice in the Southern Province is about 100 kg per annum.

Above benefit will be about Rs. 150 million per annum.

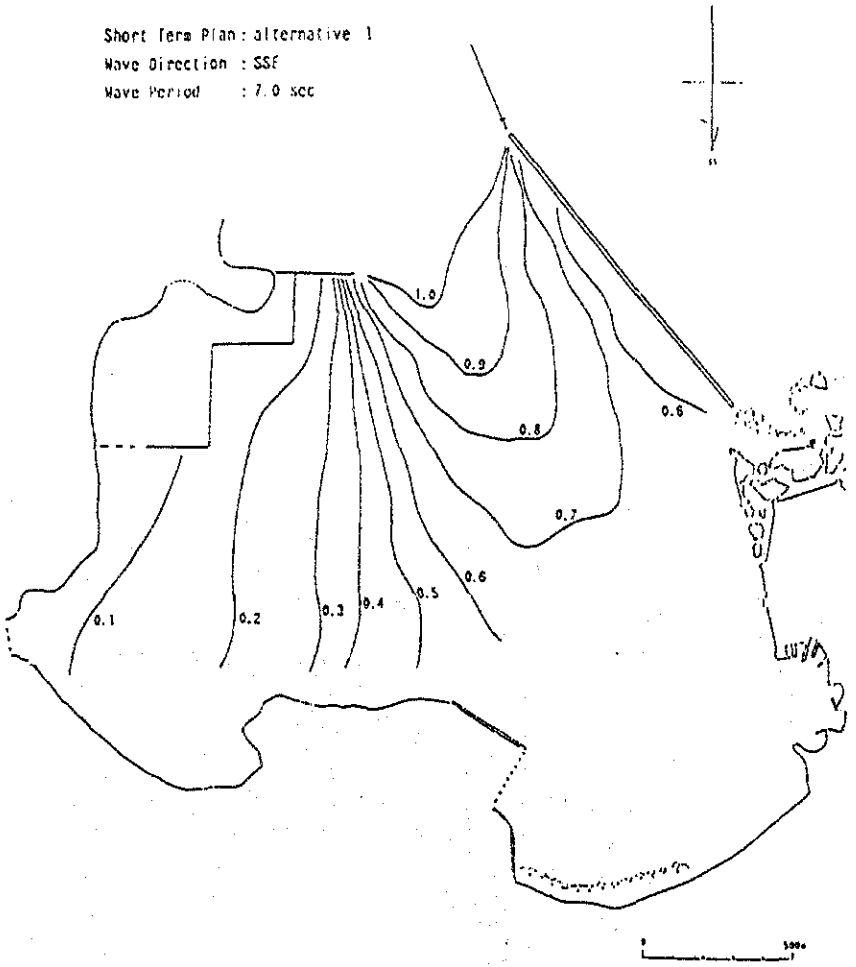
Many kinds of good effects are generated by the implementation of this project as mentioned above and this project is expected to contribute greatly to the improvement of life of residents in the Southern Province. Therefore, It can be judged appropriate to implement this Urgent Plan as soon as possible.



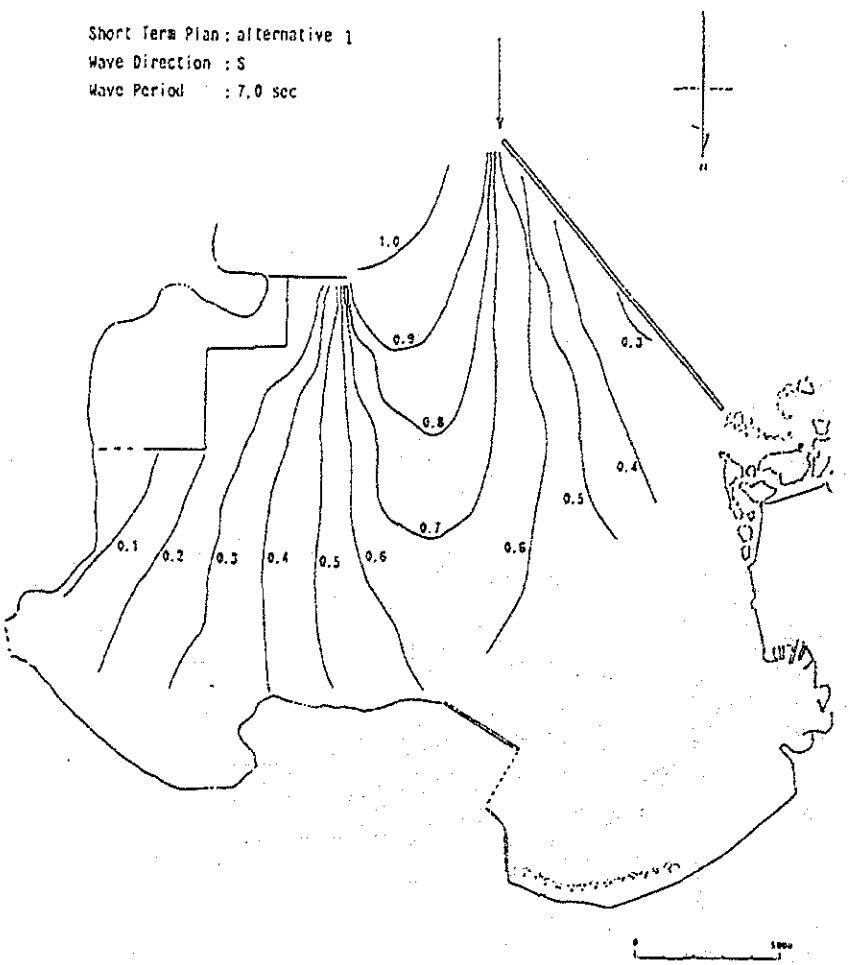
Appendix III-2-1(1) Wave Height Ratio



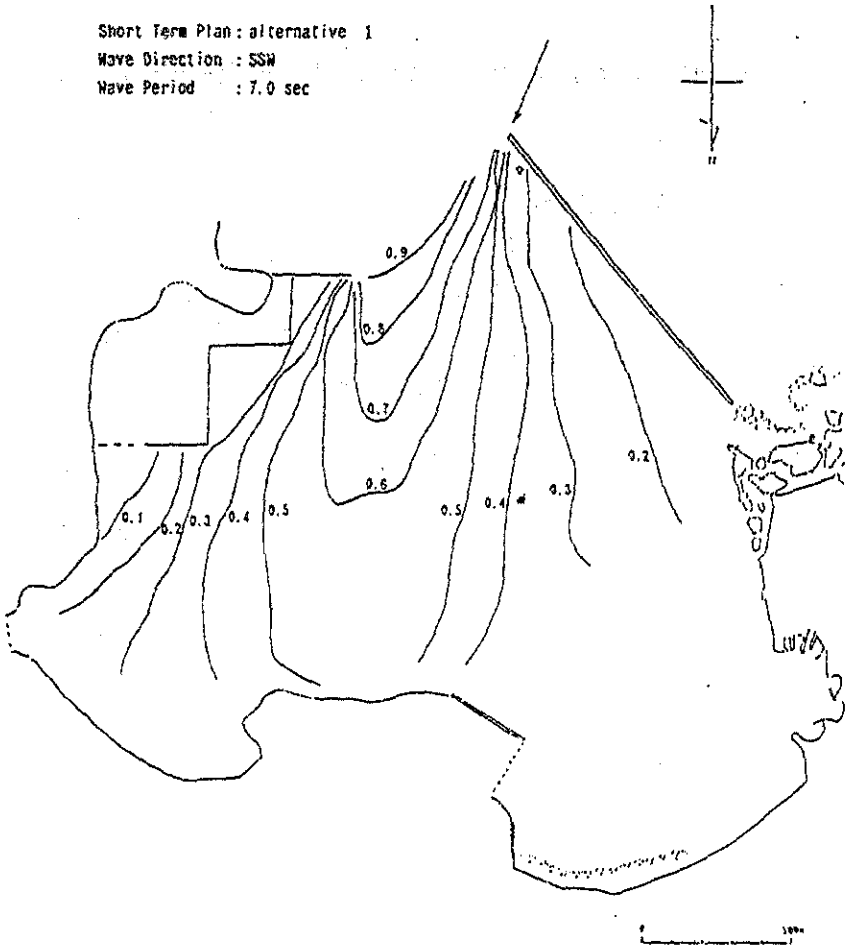
Appendix III-2-1(2) Wave Height Ratio



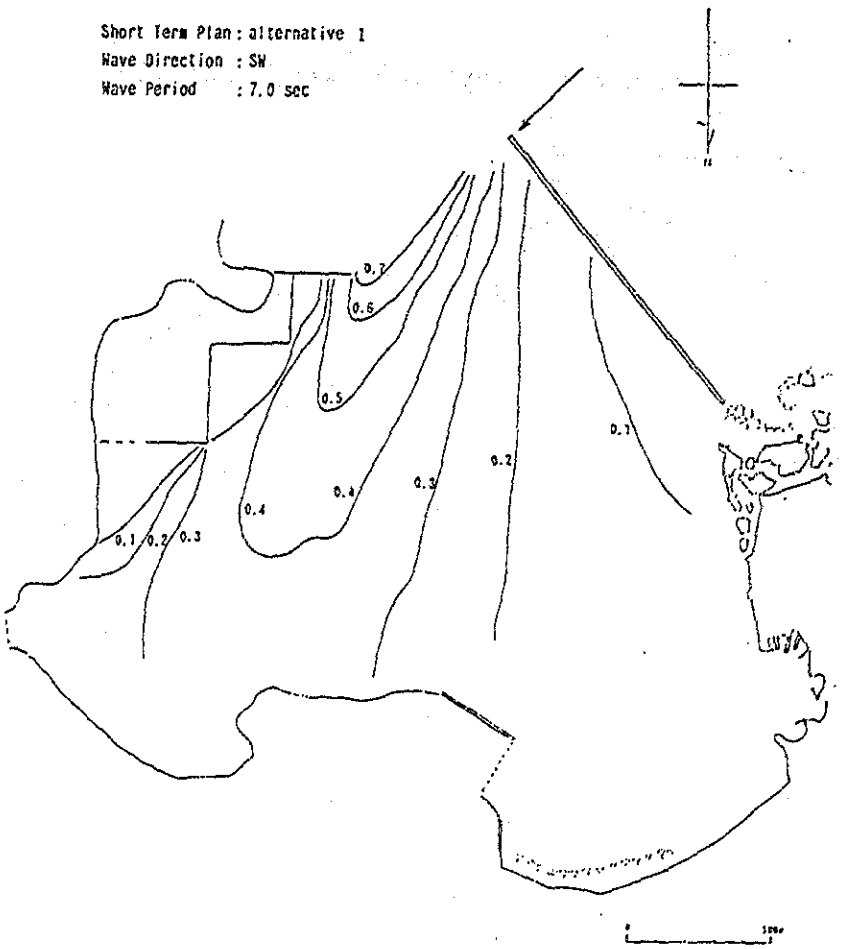
Appendix III-2-1(3) Wave Height Ratio



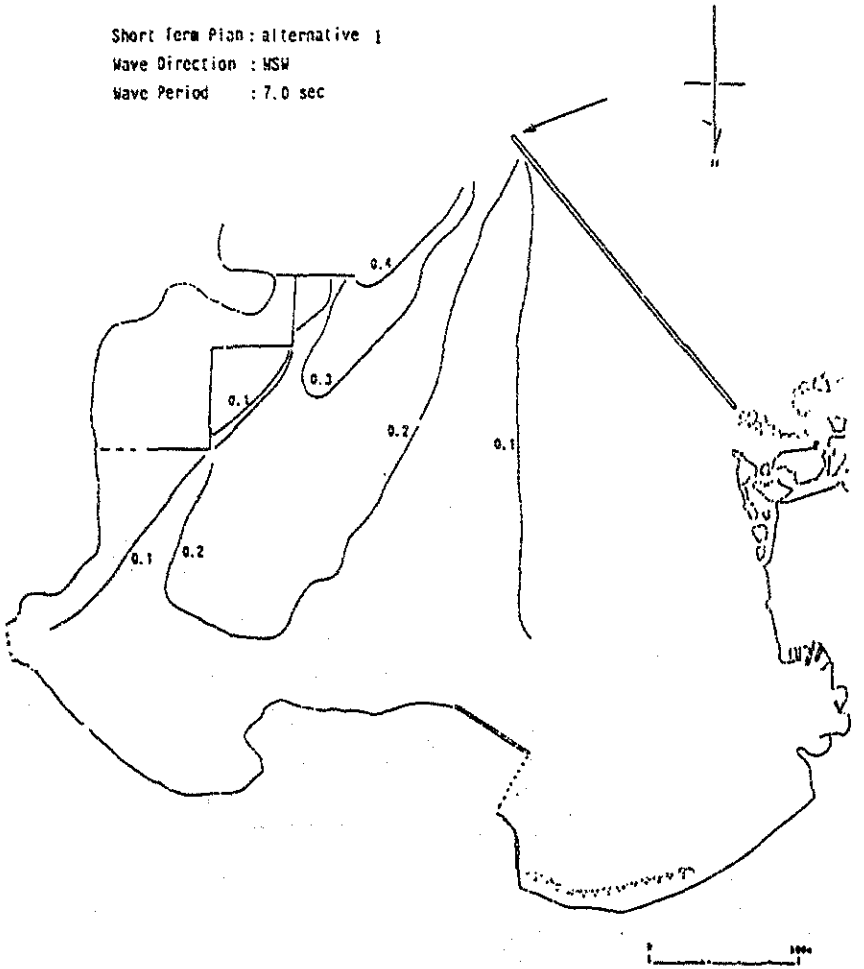
Appendix III-2-1(4) Wave Height Ratio



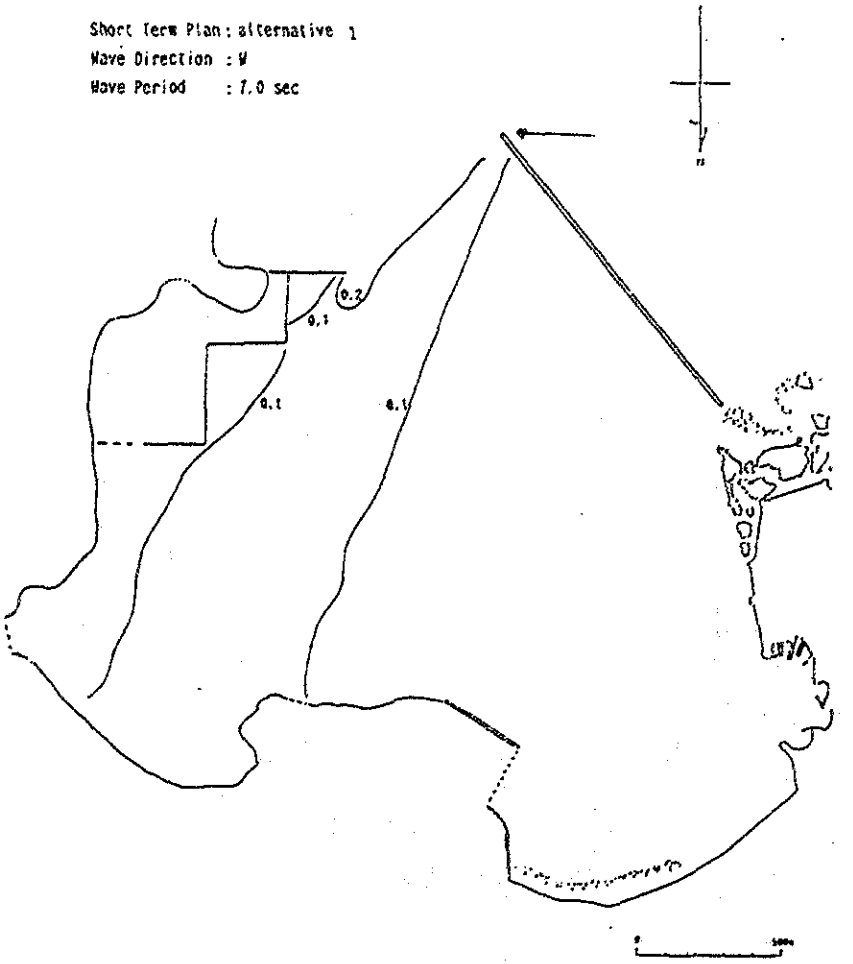
Appendix III-2-1(5) Wave Height Ratio



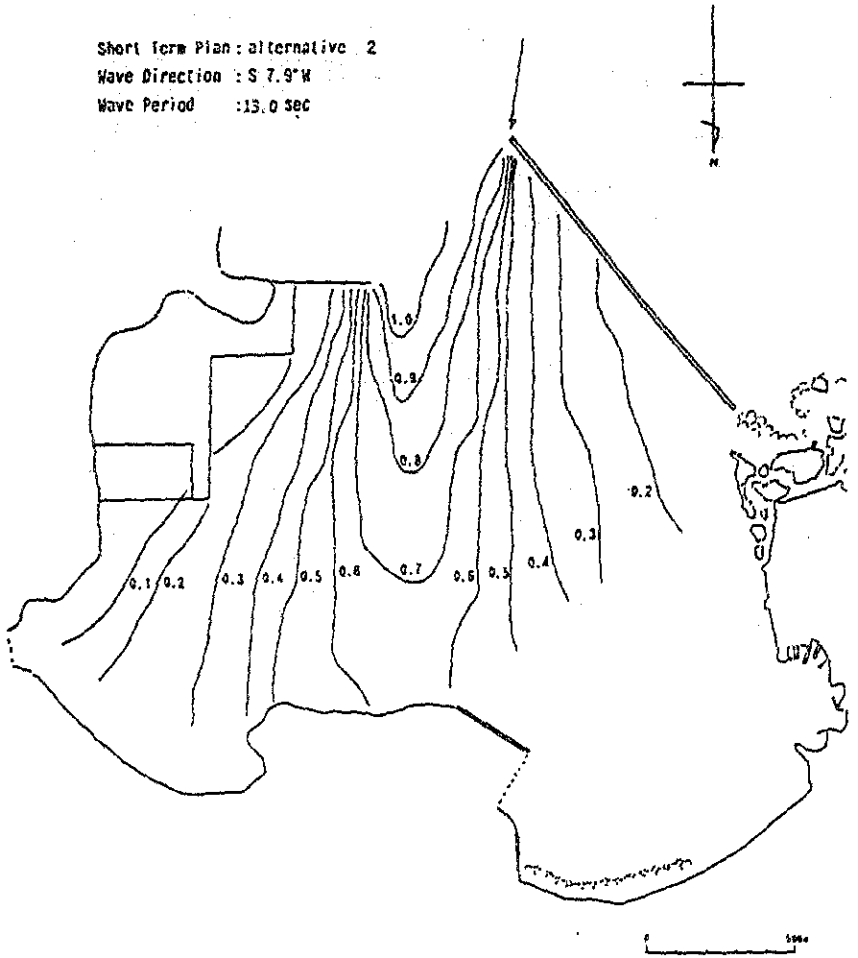
Appendix III-2-1(6) Wave Height Ratio



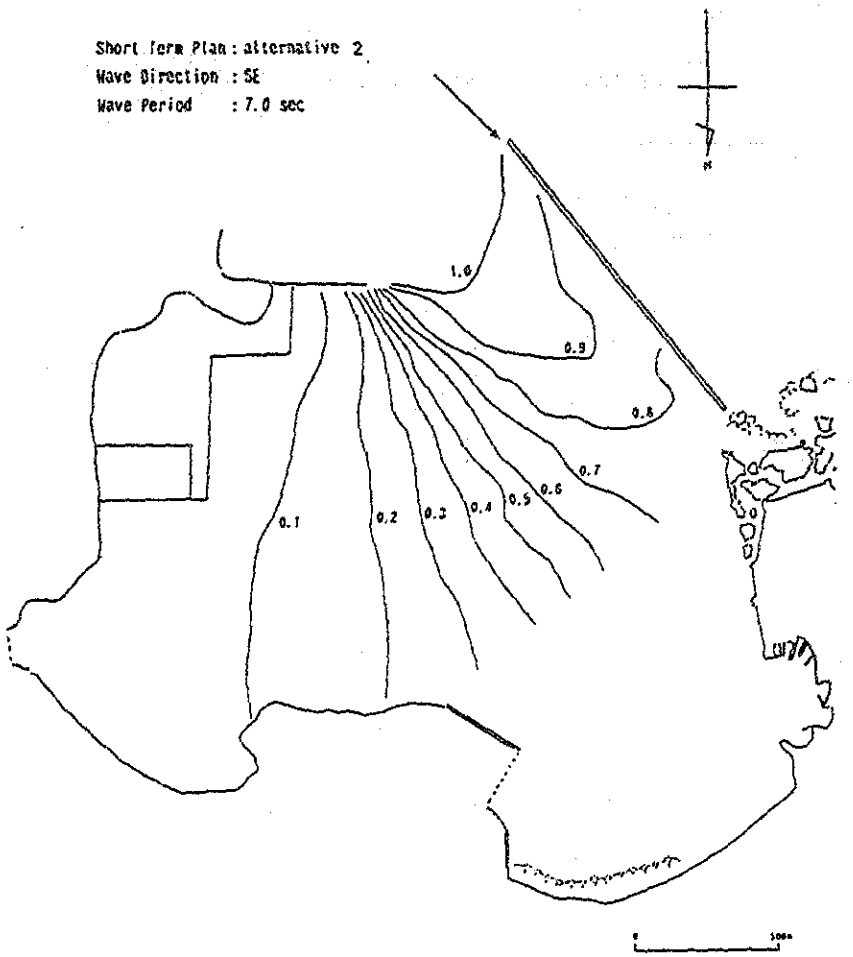
Appendix III-2-1(7) Wave Height Ratio



Appendix III-2-1(8) Wave Height Ratio



Appendix III-2-2(1) Wave Height Ratio



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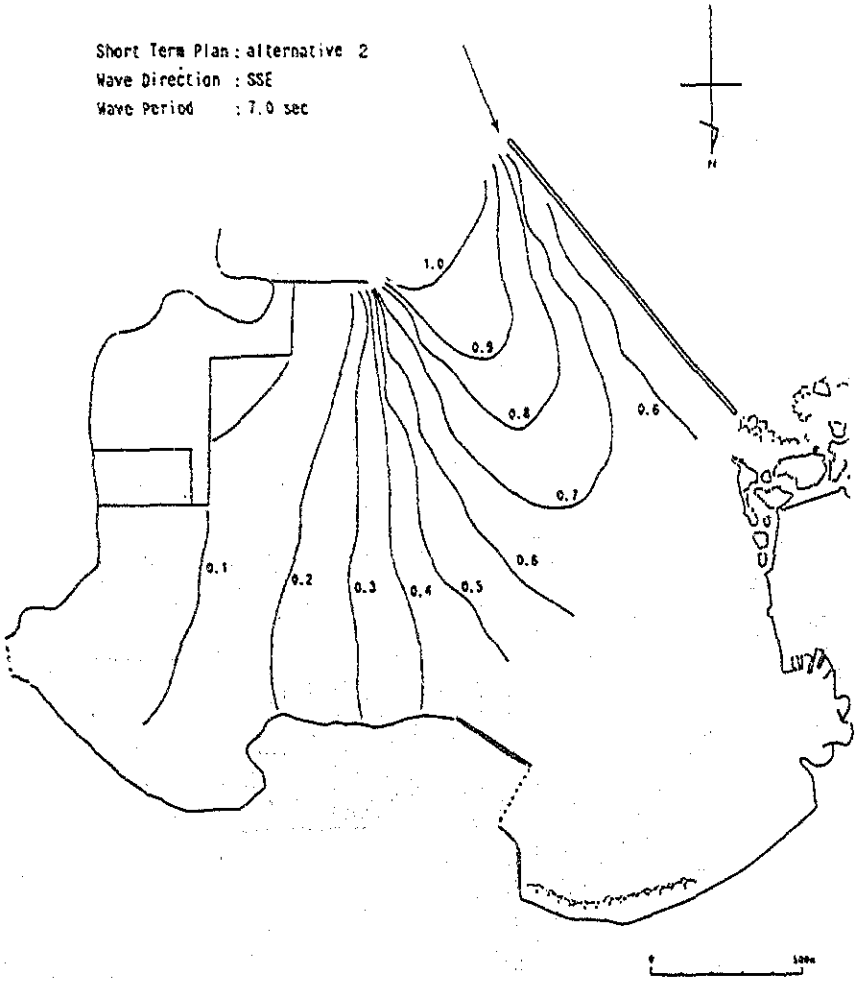
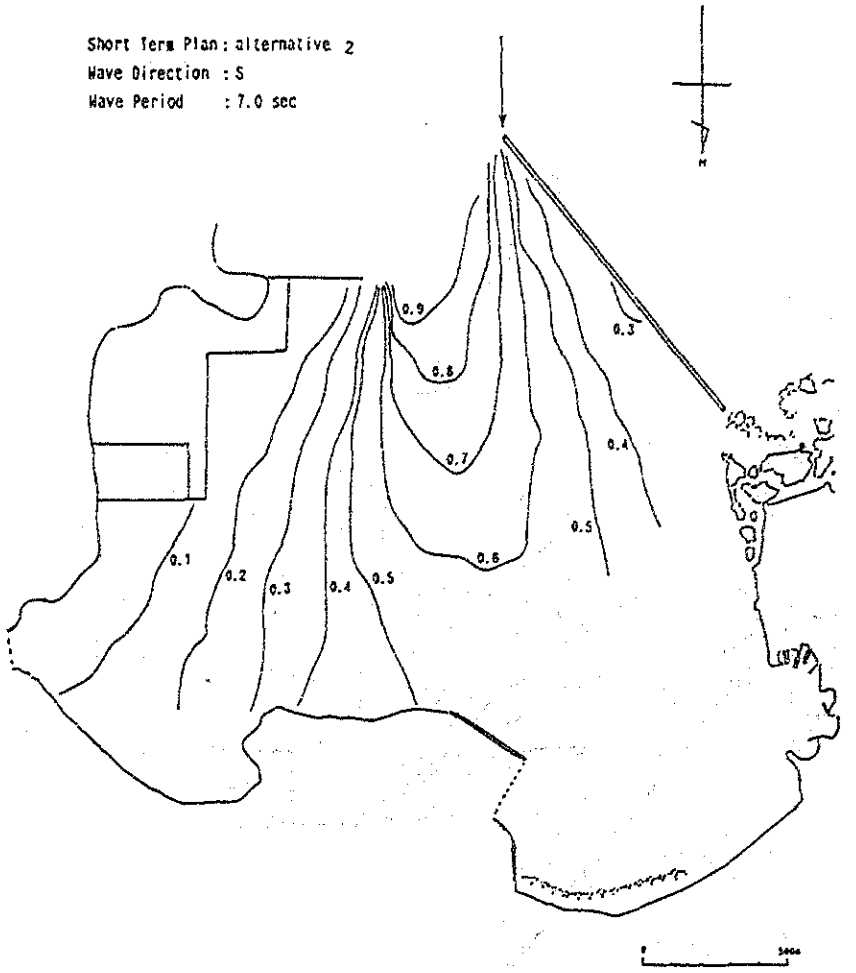
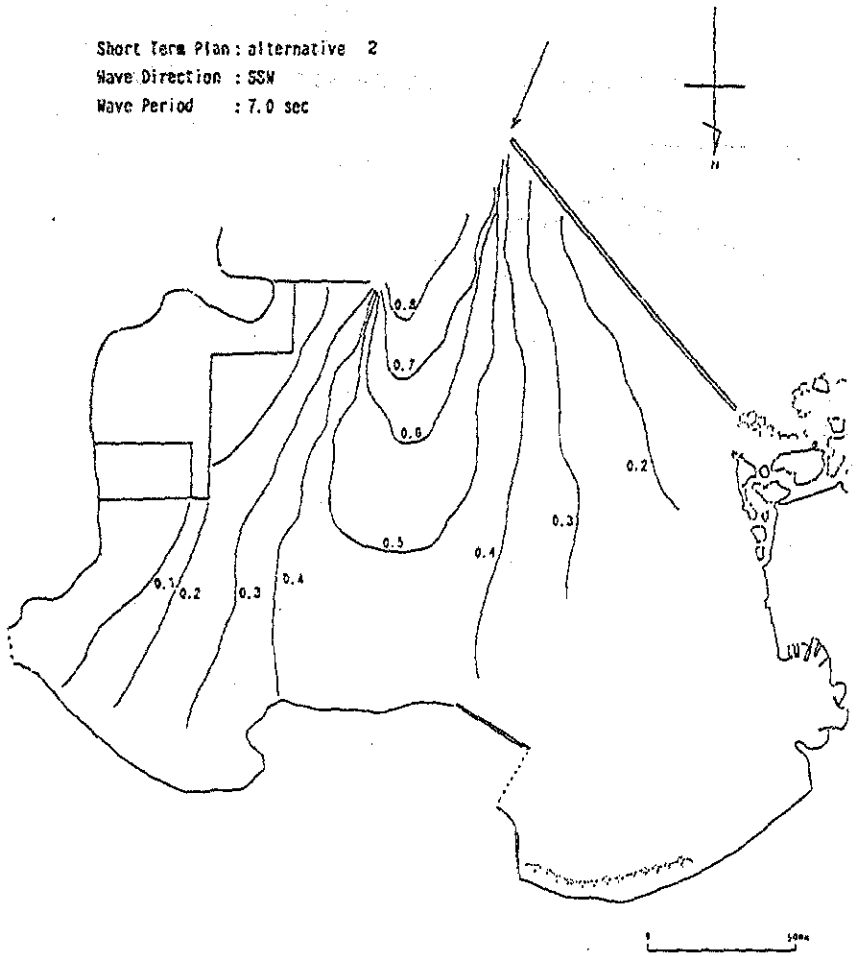


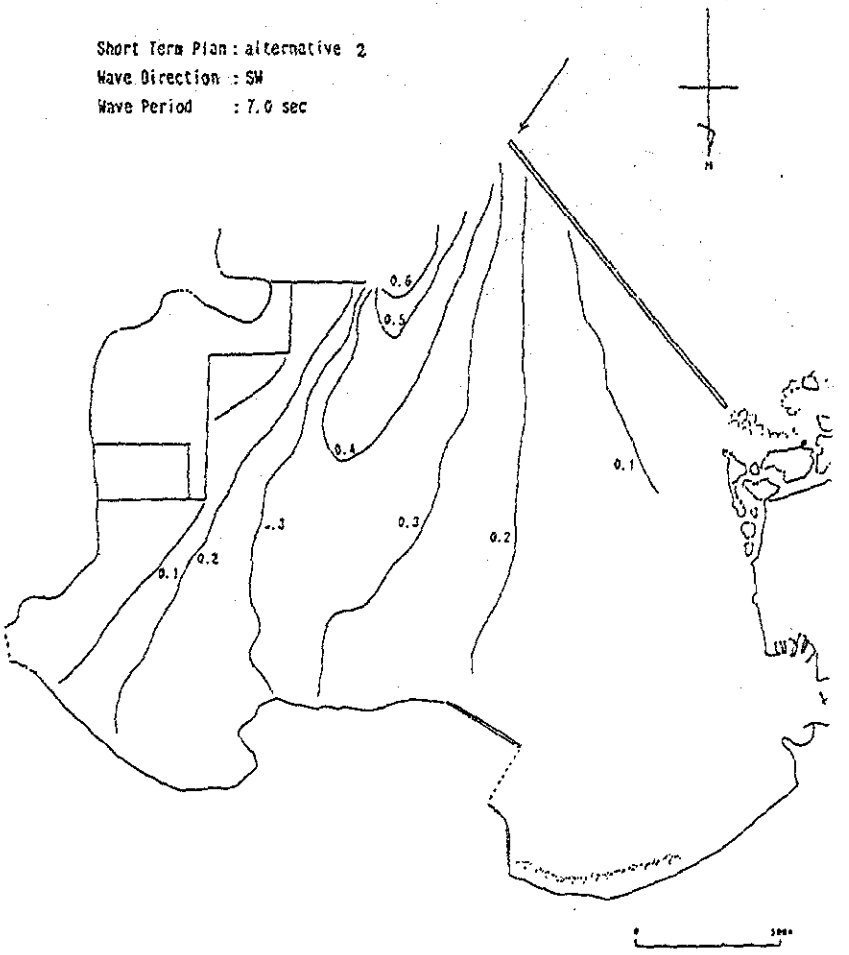
Appendix III-2-2(3) Wave Height Ratio



Appendix III-2-2(4) Wave Height Ratio



Appendix III-2-2(5) Wave Height Ratio



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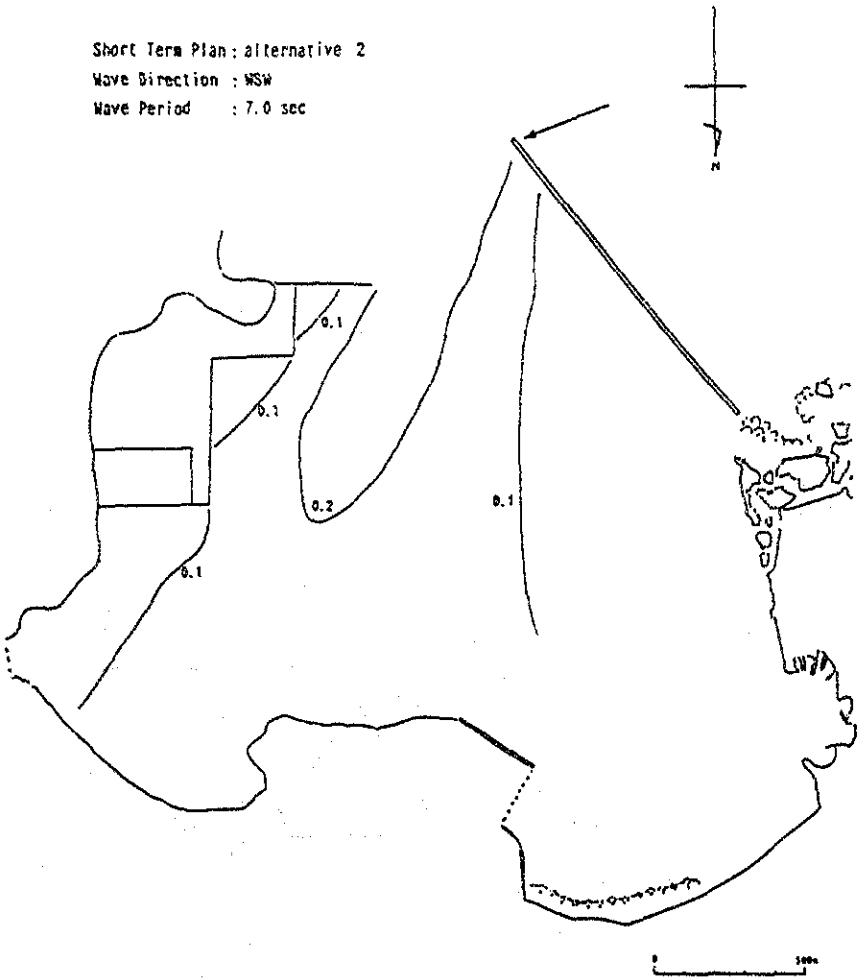

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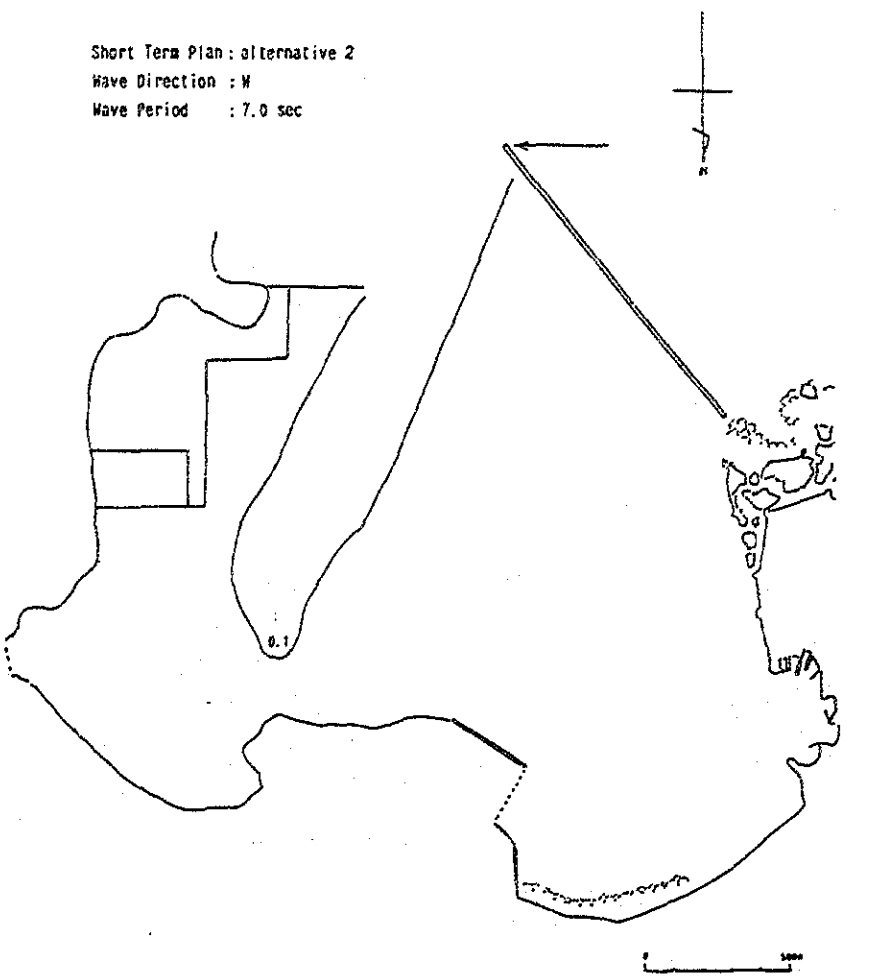


Appendix III-2-2(8) Wave Height Ratio

Appendix III-2-3 Coefficient of Diffraction for Wind Wave and Swell

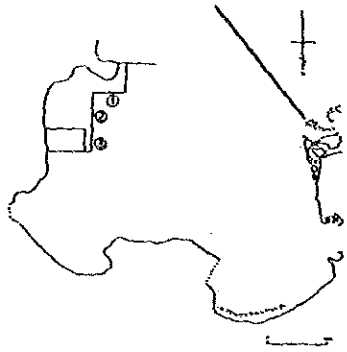
Alternative 1

Direction / Point	SW	SSW	S	SSW	SW	WSW	W	S 9.7°W (Swell)
1	0.11	0.16	0.21	0.20	0.13	0.07	0.03	0.24
2	0.11	0.16	0.21	0.21	0.14	0.07	0.03	0.24
3	0.07	0.10	0.11	0.10	0.06	0.03	0.02	0.16

Points of Calmness Estimation

Alternative 2

Direction / Point	SW	SSW	S	SSW	SW	WSW	W	S 9.7°W (Swell)
1	0.06	0.08	0.12	0.12	0.08	0.05	0.02	0.14
2	0.06	0.09	0.13	0.15	0.11	0.07	0.03	0.17
3	0.08	0.11	0.17	0.21	0.18	0.13	0.08	0.23



Points of Calmness Estimation

Appendix III-2-4 Construction Cost of Short Term Plan 1 and 2

Unit : Thousand US$

	Description	Plan 1			Plan 2		
		Quantity	Unit	Cost	Quantity	Unit	Cost
Construction of Civil and Building	Dredging Rock Material	422,000	m3	29,521	422,000	m3	29,521
	〃 Other Material	1,163,000	〃	6,598	1,148,000	〃	6,513
	Southwest Breakwater	1,200	m	77,518	1,200	m	77,518
	East Breakwater	250	〃	21,401	350	〃	29,962
	Container Berth (-14.0M)	350	〃	25,891	330	〃	24,412
	Feeder Berth (- 9.0M)	170	〃	6,280	170	〃	11,789
	General/Bulk Cargo Berth (-12.0M)	280	〃	19,611	280	〃	19,611
	Oil Berth (-7.5M)	120	〃	4,425	120	〃	4,425
	Revetment	480	〃	12,588	630	〃	14,715
	Reclamation (Yard and Road)	2,530,000	m3	22,188	2,980,000	m3	25,254
	Pavement (Yard and Road)	283,000	m2	19,172	326,000	m2	22,059
	Bridge	60	m	2,402	60	m	2,402
	Navigation Aids	1	Sum	692	1	Sum	692
	Administration Building	800	m2	920	800	m2	920
	Transit Shed	4,000	〃	2,044	4,000	〃	2,044
	Maintenance Shop	1,000	〃	747	1,000	〃	747
	C.F.S.	2,025	〃	1,024	2,000	〃	1,024
	Cleaning Facilities	400	〃	249	400	〃	249
	Utilities (Water Supply)	1	Sum	2,615	1	Sum	2,615
	〃 (Electric Supply Computer System	1	〃	6,104	1	〃	6,104
	Sub-Total (1)			261,920			282,576
Procurement	Container Cargo Handling Equipment	1	Sum	22,514	1	Sum	22,514
	Cargo Handling Equipment for General/Bulk Cargo	1	〃	972	1	〃	972
	For Oil Berth	1	〃	130	1	〃	130
	Port Service Vessels (Tug-Boat)	1	〃	6,482	1	〃	6,482
	Sub-Total (2)			30,098			30,098
	Total (1) + (2)			292,018			312,674
	Engineering Service	1	Sum	16,807			17,988
	Physical Contingency (1) × 6%	1	Sum	15,715			16,954
	Tax			10,072			10,788
	Grand Total			334,612			358,404

Appendix III-6-1 Calculation of Land Transportation Costs

Land Transportation Costs 1 (Economic Prices)

No.	Items	Unit	Market Prices	Economic Prices	Remarks
①	Truck Body	Rs	780,000	624,000	7T Truck
②	Tires	Rs	48,000	27,907	6 Nos.
③	Fuel (Diesel)	Rs/liter	9.85	6.78	
④	Lubricant	Rs/liter	28.00	26.67	
⑤	Depreciation Cost	Rs/year	140,400	112,320	① x 0.9 / 5
⑥	Maintenance Cost	Rs/000km	432	409	
⑦	Driver's Wages	Rs/month	4,620	4,375	
⑧	Insurance	Rs/year	6,000	4,800	① / 130
⑨	Spare Parts	Rs/year	58,500	46,800	① x 0.075
⑩	Overhead	Rs/year	10,000	9,180	

Source: Transport Studies & Planning Center, Colombo motor dealers, Ceylon Petroleum Corporation, Ceylon Tire Corporation, Sri Lanka Central Transport Board, Private bus & truck operators, Register of Motor Vehicles, Central Bank of Sri Lanka and Government Gazette

Land Transportation Costs 2 (Economic Prices)

(Unit: Rs/000km)

No.	Items	Operation Costs	Remarks
⑪	Tires	558	② / (50,000 / 1,000)
⑫	Fuel (Diesel)	1,898	③ x 280
⑬	Lubricant	107	④ x 4
⑭	Depreciation Cost	2,246	⑤ / (50,000 / 1,000)
⑮	Maintenance Cost	409	⑥
⑯	Driver's Wages	1,050	⑦ / (50,000 / 12 / 1,000)
⑰	Insurance	96	⑧ / (50,000 / 1,000)
⑱	Spare Parts	936	⑨ / (50,000 / 1,000)
⑲	Overhead	184	⑩ / (50,000 / 1,000)
⑳	Total	7,484	

Note: Average tire life is to be 50,000 km.
Fuel and lubricant consumption are to be 280 liters/000km and 4 liters/000km, respectively.
Average annual driving distance is to be 50,000 km.
Distance between Colombo and Galle is 120 km.

Appendix III-6-2 Economic Prices of Construction Costs

(Unit: '000US$)

No.	Description	Construc-tion Costs (Market Prices)	Foreign Currency				Local Currency					Overall Conversion Factor	Construction Costs (Economic Prices)
			Total	Traded Goods	Other Items	Transfer Items	Non-traded Goods	Skilled Labour	Unskilled Labour	Transfer Items	Total		
				1.000	1.000	0.000	0.918	0.947	0.474	0.000			
1	Dredging	1,320	91.72%	16.64%	74.92%	0.17%	8.20%	0.00%	0.00%	0.08%	8.28%	0.991	1,308
2	Rock Dredging	5,904	74.82%	5.25%	69.52%	0.05%	21.12%	3.48%	0.37%	0.21%	25.18%	0.976	5,764
3	Southwest Breakwater	15,303	74.45%	1.78%	72.65%	0.02%	18.71%	5.45%	1.20%	0.19%	25.55%	0.973	15,091
4	East Breakwater	4,280	77.01%	1.78%	75.21%	0.02%	18.71%	2.90%	1.20%	0.19%	22.99%	0.975	4,172
5	Container Wharf	25,891	67.45%	32.87%	34.25%	0.33%	18.27%	11.20%	2.90%	0.18%	32.55%	0.959	24,822
6	Wharf for Feeder	6,280	66.43%	32.86%	33.23%	0.33%	19.29%	11.19%	2.90%	0.19%	33.57%	0.958	6,015
7	General Cargo Wharf	16,882	64.84%	32.87%	31.64%	0.33%	20.85%	11.20%	2.90%	0.21%	35.16%	0.956	16,145
8	Transitional Part	2,728	64.05%	32.88%	30.85%	0.33%	21.62%	11.22%	2.90%	0.22%	35.95%	0.956	2,607
9	Oil Berth	4,424	70.86%	32.86%	37.67%	0.33%	14.89%	11.21%	2.89%	0.15%	29.14%	0.962	4,256
10	North Revetment	1,388	53.41%	16.06%	37.19%	0.16%	31.94%	4.11%	10.23%	0.32%	46.59%	0.913	1,268
11	South Revetment	11,199	71.95%	34.40%	37.20%	0.34%	13.62%	4.10%	10.20%	0.14%	28.05%	0.928	10,396
12	Reclamation	22,118	87.58%	2.08%	85.48%	0.02%	8.22%	2.12%	2.00%	0.08%	12.42%	0.981	21,688
13	Pavement	19,171	61.52%	20.61%	40.70%	0.21%	36.02%	1.60%	0.50%	0.36%	38.48%	0.961	18,430
14	Access Bridge	2,402	70.14%	40.10%	29.64%	0.40%	24.82%	4.21%	0.58%	0.25%	29.86%	0.968	2,325
15	Administration Building	920	19.76%	11.42%	8.22%	0.11%	56.73%	14.90%	8.05%	0.57%	80.24%	0.896	824
16	Transit Shed	2,044	15.17%	11.40%	3.66%	0.11%	61.18%	14.92%	8.12%	0.61%	84.83%	0.892	1,823
17	Maintenance Shop	747	15.03%	11.37%	3.54%	0.11%	61.34%	14.85%	8.16%	0.61%	84.97%	0.892	666
18	C.F.S.	1,024	20.02%	11.43%	8.48%	0.11%	56.37%	14.94%	8.11%	0.56%	79.98%	0.896	918
19	Cleaning Facilities	249	15.03%	11.24%	3.67%	0.11%	61.47%	14.85%	8.03%	0.61%	84.97%	0.892	222
20	Water Supply	2,615	89.86%	71.77%	17.37%	0.72%	5.46%	3.94%	0.69%	0.05%	10.14%	0.982	2,568
21	Electric Supply	6,104	89.87%	71.78%	17.38%	0.72%	5.44%	3.93%	0.70%	0.05%	10.13%	0.982	5,994
22	Navigation Aids	692	71.35%	55.77%	15.03%	0.56%	11.77%	10.11%	6.65%	0.12%	28.65%	0.943	653
23	Handling Equipment 1	19,085	100.00%	99.01%	0.00%	0.99%	0.00%	0.00%	0.00%	0.00%	0.00%	0.990	18,896
24	Handling Equipment 2	4,531	97.81%	96.85%	0.00%	0.97%	0.01%	2.19%	0.00%	0.00%	2.20%	0.989	4,482
25	Port Service Vessles	6,482	100.00%	99.02%	0.00%	0.99%	0.00%	0.00%	0.00%	0.00%	0.00%	0.990	6,418
26	Engineering Service	10,587	78.64%	0.00%	78.64%	0.00%	0.00%	21.36%	0.00%	0.00%	21.36%	0.989	10,467
27	Physical Contingency	9,233	70.67%	23.41%	47.03%	0.23%	19.87%	6.51%	2.75%	0.20%	29.33%	0.961	8,877
	Total	203,805	75.37%	33.31%	41.73%	0.33%	15.90%	6.37%	2.20%	0.16%	24.63%	0.967	197,095

Appendix III-6-3 Disbursement Schedule (Economic Price)

(Unit: '000 US$)

No.	Description	1992	1993	1994	1995	1996	1997	Total
1	Dredging	0	336	352	324	296	0	1,308
2	Rock Dredging	0	1,283	1,603	1,502	1,376	0	5,764
3	Southwest Breakwater	0	2,447	3,263	3,263	3,263	2,855	15,091
4	East Breakwater	0	1,397	2,220	555	0	0	4,172
5	Container Wharf	0	0	5,319	10,638	8,865	0	24,822
6	Wharf for Feeder	0	0	0	0	6,015	0	6,015
7	General Cargo Wharf	0	0	6,458	9,687	0	0	16,145
8	Transitional Part	0	0	1,044	1,563	0	0	2,607
9	Oil Berth	0	0	0	0	4,256	0	4,256
10	North Revetment	0	242	952	74	0	0	1,268
11	South Revetment	0	1,982	7,811	603	0	0	10,396
12	Reclamation	0	3,614	8,434	8,434	1,205	0	21,688
13	Pavement	0	0	0	9,615	8,815	0	18,430
14	Access Bridge	0	0	0	0	2,325	0	2,325
15	Administration Building	0	0	0	177	647	0	824
16	Transit Shed	0	0	0	0	1,823	0	1,823
17	Maintenance Shop	0	0	0	0	666	0	666
18	C.F.S.	0	0	0	197	721	0	918
19	Cleaning Facilities	0	0	0	0	222	0	222
20	Water Supply	0	0	0	947	1,621	0	2,568
21	Electric Supply	0	0	0	2,209	3,786	0	5,994
22	Navigation Aids	0	0	0	0	653	0	653
23	Handling Equipment 1	0	0	0	7,558	11,338	0	18,896
24	Handling Equipment 2	0	0	0	0	4,482	0	4,482
25	Port Service Vessels	0	0	0	3,209	3,209	0	6,418
26	Engineering Service	2,619	1,744	1,744	1,744	1,744	872	10,467
27	Physical Contingency	0	1,156	2,358	2,534	2,332	497	8,877
	Total	2,619	14,201	41,558	64,833	69,660	4,224	197,095

Appendix III-6-4 Replacement Investment Schedule

('000 US$)

Year	Water Supply	Electric Supply	Navigation Aids	Handling Equipment 1	Handling Equipment 2						Engineering Service	Contingency	Total
					Tractor & Trucks	Chassis	Fork Lift	Packer & Hopper	Equip. for Oil Berth	Service Vessels			
1997													0
1998													0
1999													0
2000													0
2001					2,065						121		2,186
2002													0
2003													0
2004													0
2005													0
2006					2,065	597					157		2,819
2007													0
2008													0
2009		5,994					1,264				427	360	8,044
2010													0
2011			371		2,065						143	22	2,601
2012													0
2013													0
2014													0
2015													0
2016	2,568			18,896	2,065	597		428	129	6,418	1,829	154	33,084
2017													0
2018													0
2019													0
2020													0
2021					2,065						121		2,186
2022		5,994					1,264				427	360	8,044
2023													0
2024													0
2025													0
2026	-1,284	-4,497		-9,448			-948	-214		-3,209			-19,600

Appendix III-7-1 Handling Volume in Galle Project

YEAR	TRANSHIP ('000TEU)	LOCAL ('000TEU)	TOTAL ('000TEU)	BULK ('000TON)	Liquid ('000TON)
1997	190	36	226	397	36
1998	225	43	268	421	42
1999	225	43	268	421	42
2000	225	43	268	421	42
2001	225	43	268	421	42
2002	225	43	268	421	42
2003	225	43	268	421	42
2004	225	43	268	421	42
2005	225	43	268	421	42
2006	225	43	268	421	42
2007	225	43	268	421	42
2008	225	43	268	421	42

The same volume after 2008

Appendix III-7-4 Comparison of Port Charges

ITEMS	MAIN CHARGES	QABOOS	FUJAIRAH	FAKKAN	KHALID	RASHID	SINGAPORE	COLOMBO
DUES ON VESSEL	Port Dues, Entering Dues	974	817	899	736	715	1,156	1,030
	Light Dues		245	266	750			773
	Pilotage	831	545	510	450	420	493	1,110
	Moorings	78	150	109	20	16		587
	Tugs	571	817	1,289	381	736	1,192	
	Berthings		163	180	109	245	1,413	500
	Total (Per Vessel)	2,455	2,738	3,252	2,446	2,132	4,254	3,997
	Per GRT	0.10	0.11	0.13	0.10	0.09	0.17	0.16
	Index (Qaboos=100)	100	112	132	100	87	173	163
DUES ON TRANSHIPMENT CONTAINER(20' Loaded/Import)	Loading/Discharging	39	114	123	123	125	102	52
	Other Charges							
	Total (Per 20')	39	114	123	123	125	102	52
	Index (Qaboos=100)	100	294	315	315	322	262	133
UNSTUFFING CHARGE	Per 20'	52	95	131	131	54		
	Free Time	3(30)	20(30)	15(30)	15(30)	20(20)	(28)	(28)
	Over Time Surcharge	18	41	54	54	41		
EXCHANGE RTATE (US$)		0.385	3.67	3.67	3.67	3.67	1.946	33.033

CONDITIONS FOR CALCULATION OF CHARGES

VESSEL	:25,000 GRT, 15,000 NRT, 35,000 DWT, Weekly Service
PILOT	:2 hours for entering/departure each
TUG	:2 Tugs, 1 hour for entering/departure each
BERTHING TIME	:10 hours (8:00 - 18:00)
SERVICE TIME	:6 hours
CYCLE TIME OF CRANE	:30 Boxes/Hour
TONNAGE PER CONTAINER	:32 MT Per 20'

These charges are calculated based upon the present port tariff of each port.

Appendix III-7-2 Main Charges for Container Operations

Legend: (A) Shipping agents
(C/S) Consignees or Shippers

Charges of shifting containers from one unit to another unit (A)

01 Loaded	20'	34.90	US $
	40'	52.30	"
02 Empty	20'	26.50	"
	40'	39.75	"

Charges of supply of electricity (A)

20'	1.00	US $	per hour
40'	1.80	"	

Stevedoring charges (A)

01 Transhipment (all inclusive) 20' 51.50 US $
40' 76.50 "
※ Loading ton carriers) is free of these charges
02 Import / Export (ship-stacking) 20' 106.70 US $
40' 160.05 "

Charges of stuffing / destuffing (A)

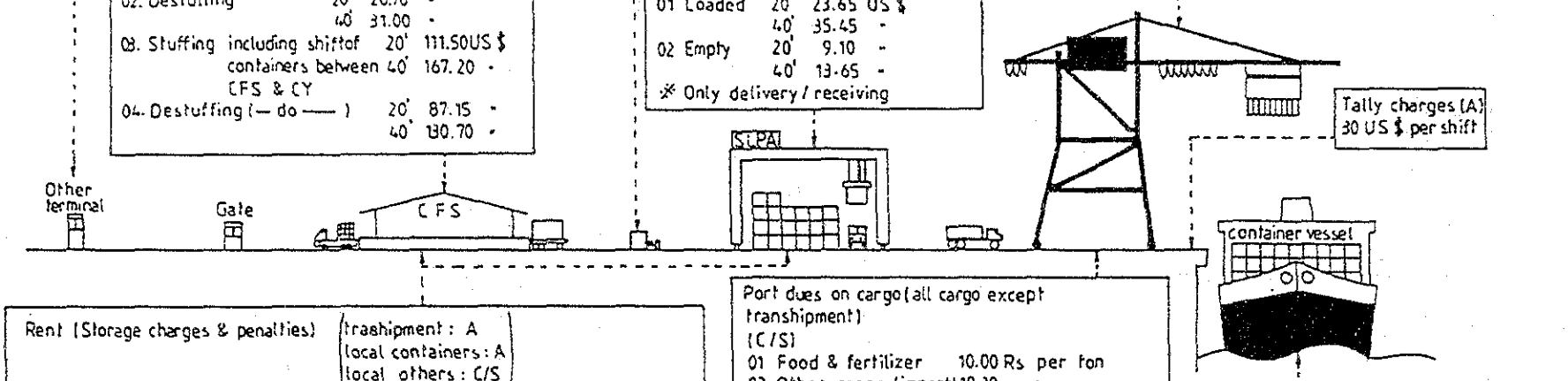
01. Stuffing	20'	11.20	US $	
	40'	16.80	"	
02. Destuffing	20'	20.70	"	
	40'	31.00	"	
03. Stuffing including shiftof containers between CFS & CY	20'	111.50	US $	
	40'	167.20	"	
04. Destuffing (— do —)	20'	87.15	"	
	40'	130.70	"	

Charges of mounting / demounting to / from chassis (A)

01 Loaded	20'	23.65	US $
	40'	35.45	"
02 Empty	20'	9.10	"
	40'	13.65	"

※ Only delivery / receiving

Tally charges (A)
30 US $ per shift



Rent (Storage charges & penalties) (transhipment : A, local containers : A, local others : C/S)

01. Free time
(1) import 3 clear days (free of sat. sun. & holidays)
(2) export 7 "
(3) empty containers 3 "
(4) transhipment 28 normal days

02. Charges (in the case of the storage periods excessing the free time)

				20'		40'	
(1) Import / Export	1 ~ 7 days	6	Rs per ton. day				
	8 ~ 14 "	12	"				
	15 ~ 21 "	18	"				
	22 ~	24	"				
(2) Empty container	1 ~ 31 days	6.95	US $ per day			13.85	US $ per day
	32 ~	20.75	"			41.50	"
(3) Transhipment							
(1) Loaded		5.20				10.40	"
(2) Empty	1 ~ 31 days	2.10	"			4.15	"
	32 ~ 45	6.95	"			13.85	"
	46 ~	20.75	"			41.50	"

Port dues on cargo (all cargo except transhipment) (C/S)

01 Food & fertilizer	10.00	Rs	per ton
02 Other cargo (import)	10.30	"	"
03 " (export)	10.00	"	"
04 Bulk cargo (except petroleum)	5~5.15	"	"
05 Cars (import)	103.00	Rs	per each
(export)	100.00	"	"

Tonnage (all cargo except transhipment) (A)
0.35 US $ Per ton

Wharfage (all cargo except transhipment) (C/S)

01 Export tea	20.00	Rs	per ton
02 " coconuts products	24.00	Rs	per ton
03 Tinned food electric goods etc	0.0412	CIF value	
04 Textiles (import)	77.25	Rs	per ton
(export)	75.00	"	"
05 Others (import)	41.20	"	"
(export)	40.00	"	"

Port dues on ship (A)

01 Entry dues (except outside harbour)	4.12	US $	per 100 G_T
02 Pilotage	4.12	"	"
03 Light dues	3.09	"	"
04 Professional pilotage fees			
~ 30,000 DWT AM6	23.90	US $	per movement
PM 6-AM 6	35.85	"	
above 30,000 DWT AM6-PM6	31.85	"	
PM6-AM6	47.78	"	
05 Dockage alongside	0.20	US $	per 100 G_T hour
06 Tug charges	145.98	US $	per tug movement

Appendix III-7-3 Main Charges for Conventional Cargo Operations

Legend: (A) Shipping agents
(C/S) Consigrees or shippers

Folklift charges (C/S)
(except direct delivery / receiving)

1. Up to 1 ton per package / pallet	Free	
2. Over 1 ton per package / pallet		
(1) Food & fertilizer	11.00 Rs	per ton
(2) Others	11.33	"

Hire of folklift (A) or (C/S)
(direct delivery / receiving)

1.	Folklift up to 2.5 tons		710/40 Rs	US$ per shift
2.	"	2.5~10	285/16	per lift
3.	"	10~15	495/28	"
4.	"	15~25	745/42	"
5.	"	25~	990/56	"

Stevedoring charges (A)

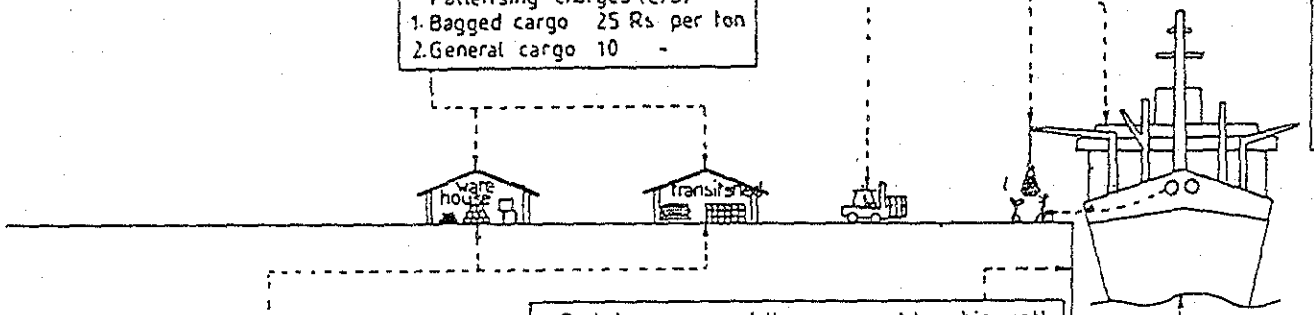
1. Import		
(1) Bagged cargo without shift gang	3.15	US$ per ton
(2) " by shift gang	5.20	"
(3) Others	3.65	"
2. Export	3.60	"
3. Bulk cargo	0.32~7.80	"

Palletising charges (C/S)

1. Bagged cargo	25 Rs	per ton
2. General cargo	10	"

Tally charges (A)

1. Discharging		
(1) Bagged cargo	0.20 US$	per ton
(2) Others	0.40	"
2. Loading	0.35	" (M/T)
	0.40	" (W/T)



Rent (storage & penalties) (Transhipment: A / others: C/S)

1. Free time		
(1) Import	3	clear days
(2) Export	7	clear days
(3) Transhipment	28	normal days
2. Charges (in the case of the storage periods exceeding the free time)		
(1) Import/ Export 1~7 days	6	Rs. per ton day
8~14	12	"
15~21	18	"
22~	24	"
(2) Transhipment 29 days~	24	Rs per ton day

Port dues on cargo (all cargo except transhipment) (C/S)

1. Food & fertilizer	10.00 Rs	per ton
2. Other cargo (import)	10.30	"
3. " (export)	10.00	"
4. Bulk cargo (except petroleum)	5~5.15	"
5. Cars (import)	103.00 Rs	per each
(export)	100.00	"

Tonnage (all cargo except transhipment) (A)
0.35 US $ per ton

Wharfage (all cargo except transhipment) (C/S)

1. Export tea		20.00 Rs.	per ton
2. " coconuts products		24.00	
3. Tinned food, electric goods, etc		0.0412	C I F value
4. Textiles	(import)	77.25 Rs	per ton
	(export)	75.00	"
5. Others	(import)	41.20	"
	(export)	40.00	"

Port dues on ship (A)

1. Entering dues (except outside harbour)		4.12 US$	per 100 G/T
2. Pilotage		4.12	"
3. Light dues		3.09	"
4. Professional pilotage fees			
~30.000 DWT	AM6~PM6	23.90 US$	per movement
	PM6~AM6	35.85	"
above 30.000 DWT	AM6~PM6	31.85	"
	PM6~AM6	47.78	"
5. (1) Dockage alongside		0.20 US$	per 100 G/T hour
(2) Buoy berth		0.62 US$	per 100 G/T day
6. Tug charges		145.98 US$	per tug movement

Appendix III-7-5 Revised Construction Cost of Galle Port

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost				F.Total	L.Total	Total
			Foreign	Local	D.T.Tax	Imp. Tax			
Dredging for Channel	1,099,000	m3	12,532	3,864	492	132	14,036	4,998	19,034
Contingency			752	232	30	8			
Engineering Service			752	193	47	0			
Southwest Breakwater	1,200	m	57,710	19,808	2,326	212	64,635	24,900	89,535
Contingency			3,463	1,188	140	13			
Engineering Service			3,463	990	223	0			
East Breakwater	165	m	11,797	3,379	455	42	13,213	4,321	17,534
Contingency			708	203	27	2			
Engineering Service			708	169	44	0			
SUB-TOTAL			91,884	30,027	3,783	409	91,884	34,219	126,102
Dredging for Basin	486,000	m3	15,608	4,115	592	159	17,481	5,420	22,901
Contingency			936	247	36	10			
Engineering Service			936	206	57	0			
East Seawall	85	m	4,683	1,542	187	17	5,245	1,946	7,191
Contingency			281	93	11	1			
Engineering Service			281	77	18	0			
Container Berth	350	m	17,463	8,428	777	1,520	19,559	11,863	31,421
Contingency			1,048	506	47	91			
Engineering Service			1,048	421	73	0			
Feeder Berth	170	m	4,172	2,108	188	369	4,673	2,948	7,621
Contingency			250	126	11	22			
Engineering Service			250	105	18	0			
General Cargo Berth	280	m	12,694	6,917	588	1,151	14,217	9,577	23,794
Contingency			762	415	35	69			
Engineering Service			762	346	55	0			
Oil Berth	120	m	3,135	1,200	133	260	3,511	1,861	5,372
Contingency			188	77	8	16			
Engineering Service			188	65	13	0			
Revetment	480	m	8,800	3,788	378	68	9,856	4,713	14,569
Contingency			528	227	23	4			
Engineering Service			528	189	36	0			
Reclamation	2,530,000	m3	19,371	2,747	664	71	21,698	3,892	25,588
Contingency			1,162	165	40	4			
Engineering Service			1,162	137	65	0			
Pavement	283,000	m²	11,794	7,378	575	382	13,209	9,258	22,467
Contingency			708	443	35	23			
Engineering Service			708	369	54	0			
Bridge	60	m	1,684	718	72	201	1,888	1,093	2,980
Contingency			101	43	4	12			
Engineering Service			101	36	7	0			
Light Beacon & Guide	1	Sum	214	85	9	26	240	132	372
Contingency			13	5	1	2			
Engineering Service			13	4	1	0			
Light Buoy	12	Nos.	280	113	12	34	314	175	489
Contingency			17	7	1	2			
Engineering Service			17	6	1	0			
Administration Bld.	800	m²	182	738	28	15	204	867	1,071
Contingency			11	44	2	1			
Engineering Service			11	37	2	0			
Transit Shed	4,000	m²	310	1,734	61	34	347	2,031	2,378
Contingency			19	104	4	2			
Engineering Service			19	87	5	0			
Maitenance Shop	1,000	m²	112	635	22	12	125	744	869
Contingency			7	38	1	1			
Engineering Service			7	32	2	0			
C.F.S.	2,025	m²	205	818	31	17	230	962	1,192
Contingency			12	49	2	1			
Engineering Service			12	41	3	0			
Cleaning Facilities	400	m²	37	212	7	4	41	248	290
Contingency			2	13	0	0			
Engineering Service			2	11	1	0			
Utilities(Water Supply)	1	Sum	2,350	265	78	259	2,632	659	3,291
Contingency			141	16	5	16			
Engineering Service			141	13	8	0			
Ut. (Electric e.t.c.)	1	Sum	5,485	619	183	604	6,143	1,539	7,682
Contingency			329	37	11	36			
Engineering Service			329	31	18	0			
SUB-TOTAL			121,608	49,119	5,286	5,513	121,608	59,026	181,537
TOTAL			213,492	79,145	9,079	5,922	213,492	94,147	307,639
Container Crane	2	Nos.	12,963	0	389	994	13,741	1,422	15,163
Engineering Service			778	0	39				
Transfer Crane	5	m²	6,122	0	184	470	6,489	672	7,161
Engineering Service			367	0	18				
Tractor & Trucks	1	Sum	2,087	0	63	395	2,212	464	2,677
Engineering Service			125	0	6				
Chassis	1	Sum	603	0	18	114	639	134	773
Engineering Service			36	0	2				
Fork Lift	1	Sum	273	0	8	21	289	30	319
Engineering Service			16	0	1				
Top Lifter (40ton)	2	Nos.	1,005	0	30	77	1,065	110	1,176
Engineering Service			60	0	3				
Packer & Hopper	1	Sum	347	86	13	27	368	132	500
Engineering Service			21	5	1				
Tug Boat	1	Sum	6,482	0	194	149	6,671	363	7,234
Engineering Service			389	0	19				
Equip. for Oil Berth	1	Sum	117	13	4	9	124	27	151
Engineering Service			7	1	0				
SUB-TOTAL			31,799	105	993	2,256	31,799	3,354	35,153
GRAND TOTAL			245,291	79,250	10,072	8,178	245,291	97,501	342,792

Appendix III-7-6 Service Life & Depreciation Rate

	Service Life (Years)	Depreciation Rate (%)
Breakwater	100	1%
Quaywall	100	1%
Bridge	100	1%
Pavements	50	2%
Office Building & Furniture	20	5%
Warehouse	20	5%
Light House	20	5%
Water Tank	20	5%
Crane, Hoist & Winch	20	5%
Weighing Machine	20	5%
Tug	20	5%
Buoy	15	7%
Jetty & Shipway	13.3	7.5%
Communication Equipment	13.3	7.5%
Electrical Fitting	13.3	7.5%
Fire Fighting Equipment	13.3	7.5%
Medical & Welfare Equipment	13.3	7.5%
Office Equipment	13.3	7.5%
Passenger Craft Pontoon	13.3	7.5%
Plant Machinery & Repair Yard	13.3	7.5%
Diesel Pumping Set	13.3	7.5%
Forklift Truck	13.3	7.5%
Dump Truck	13.3	7.5%
Harbour Mooring	10	10%
Lighter	10	10%
Barge	10	10%
Trailor	10	10%
Dredger	10	10%
Launch & Boat	7	14%
Computer	7	14%
Vehicle	5	20%
Tractor	5	20%
Engineering Equipment	4	25%
Miscellaneous Equipment	4	25%

Appendix III-7-7 Handling Volume in Sri Lanka

YEAR	TRANSHIP ('000TEU)	LOCAL ('000TEU)	TOTAL ('000TEU)	BULK ('000TON)	LIQUID ('000TON)
1991	600	210	810	2,882	991
1992	764	215	979	2,838	1,010
1993	764	220	984	2,793	1,029
1994	956	240	1,196	2,748	1,049
1995	1,052	250	1,302	2,737	1,153
1996	1,054	270	1,324	3,157	1,262
1997	1,244	362	1,606	3,485	1,413
1998	1,279	369	1,648	3,579	1,538
1999	1,299	389	1,688	3,605	1,665
2000	1,299	389	1,688	3,605	1,796
2001	1,319	409	1,728	3,605	1,934
2002	1,319	409	1,728	3,605	1,934
2003	1,339	429	1,768	3,605	1,934
2004	1,339	429	1,768	3,605	1,934
2005	1,359	449	1,808	3,605	1,934

The same volume after 2005

Appendix III-7-8 Revised Construction Cost of Each Terminal in Colombo Port

JCT No.3 Construction Revised Cost

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost		
			Foreign	Local	Total
Quaywall	330	m	20,269	8,296	28,565
South Revetment	220	m	926	1,125	2,050
Reclamation	1,400,000	m3	10,410	2,186	12,596
Yard Paving	159,000	m²	11,166	5,147	16,313
Utilities	1	Sum	7,466	925	8,391
Building	7,300	m²	2,114	1,057	3,171
Relocation	1	Sum	3,345	3,085	6,429
Dredging	380,000	m3	1,948	589	2,536
Container Crane	2	No.	16,384	1,474	17,857
Transfer Crane	6	No.	9,620	865	10,485
Tractor & Chassis	12	Set	2,155	194	2,349
Total			85,802	24,941	110,743

JCT No.4 Construction Revised Cost

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost		
			Foreign	Local	Total
Quaywall	360	m	22,023	9,042	31,066
South Revetment	170	m	6,035	2,427	8,461
Bulhead	90	m	379	460	839
Reclamation	990,000	m3	7,339	1,550	8,889
Yard Paving	86,000	m²	6,015	2,783	8,798
Utilities	1	Sum	4,016	497	4,514
Building	0	m²	0	0	0
Dredging	250,000	m3	1,276	387	1,663
Container Crane	2	No.	16,318	1,468	17,786
Transfer Crane	6	No.	9,581	862	10,443
Tractor & Chassis	12	Set	2,146	193	2,339
Total			75,129	19,670	94,799

NNP Construction Revised Cost

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost		
			Foreign	Local	Total
Improvement of Quay	380	m	2,027	656	2,683
Revetment Type A	90	m	2,286	1,418	3,704
Revetment Type B	390	m	2,824	3,559	6,383
Reclamation	280000	m3	2,321	504	2,825
Yard Pavement	45750	m²	2,763	1,152	3,915
Utilities	1	Sum	2,210	272	2,482
Wharehouse & Office	12800	m²	6,389	5,029	11,418
Level Luffing Crane	2	No	7,291	656	7,947
Belt Conveyer	350	m	1,778	160	1,938
Packer & Palletizer	6	No	5,462	491	5,953
Wheel Loader	8	No	1,219	110	1,329
Forklift	40	No	1,651	149	1,800
Pallet & Others	1	Sum	508	559	1,067
TOTAL			38,730	14,715	53,445

Pipe Line Construction Revised Cost

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost		
			Foreign	Local	Total
Excavation & Backfilling	30,800	m3	911	186	1,096
Submarine Pipeline	700	m	5,010	1,018	6,028
Onshore Pipeline	1,000	m	-	-	-
Handling Equipment	1	Sum	5,726	1,308	7,034
Dredging	320,000	m3	1,687	504	2,191
TOTAL			13,334	3,015	16,349

Others Construction Revised Cost

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost		
			Foreign	Local	Total
QEQ Rehabilitation					
Yard Paving	83,000	m²	5,999	2,702	8,701
Utilities	1	Sum	4,011	493	4,504
Total			10,010	3,195	13,205
Channel Dredging	1,260,000	m3	6,811	2,047	8,859
Navigation Buoy	3	No.	375	34	409
Total			7,186	2,081	9,268
Improvement of Communication Systen					
Equipment			2,563	231	2,793
Installation			627	171	799
Total			3,190	402	3,592

Colombo Port Revised Investment Plan

(Unit: 1,000 US$)

	1991			1992			1993			1994			1995			1996		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
JCT No.3	14,726	6,822	21,548	35,993	10,113	47,106	34,083	8,005	42,088									
JCT No.4				14,286	5,408	19,695	35,464	9,368	44,832	25,379	4,893	30,272						
New North Pier				2,684	2,067	4,751	6,158	3,571	9,729	5,264	2,188	7,452	13,733	3,867	17,601	10,891	3,022	13,913
Pipe Laying for Oil Handling				5,226	1,220	6,447	8,107	1,794	9,902									
SEQ Rehabilitation				5,057	1,812	6,868	4,954	1,583	6,537									
Channel Dredging							7,186	2,081	9,268									
Communication							2,551	321	2,872	838	81	719						
T/C for JCT No.1 JCT No.2	2,845	256	3,101															
Total	17,570	7,078	24,649	64,247	20,420	84,867	98,504	26,724	125,228	31,281	7,163	38,444	13,733	3,867	17,601	10,891	3,022	13,913

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