The yard will need approximately 20,000 m2 of space with a shoreline of 200 m in length.

As the redevelopment of the port area progresses, it will be increasingly difficult to secure the necessary space for the caisson fabrication yard. In this connection, it is suggested that a new site for construction operations be provided in the area behind the Prince Vijaya Quay by filling it with nearly 2,210,000 m^3 of the dredged material to be produced during the construction of the Short-term Project.

Appendix 7-2-1 shows a plan, as an example, for work site development in the port area.

7-2-3 Relocation of Existing Facilities

1. Relocation of Existing Facilities

For construction of JCT No.3 and No.4 Berths, both of which are works of top priority, it is essential to relocate the existing facilities at the sites.

The facilities requiring relocation are located along the coastline between the Barge Repair Basin and the MCS's Jetty. Relocation of those facilities requiring a shoreline is an urgent requirement.

The proposed relocations including rehabilitation and rationalization should, in principle, be studied, designed in depth and constructed by SLPA.

For the following reasons, however, foreign technical and/or financial aid may be necessary for the timely completion of the reclamation project.

a) Modernization of the present facilities; and

b) Avoidance of the risk of suspending the reclamation work.

After a detailed site investigation and with due regard for the foregoing requirements, the works listed below should be included in the scope of work of the JCT No.3 and No.4 project. The locations of the existing facilities to be shifted and the new locations are shown in Fig. 7-2-3.

1) Widening and strengthening of Guide Jetty providing additional berthing facilities for work boats, fire fighting boats and tug boats;
2) Rehabilitation of Patent Slip;
3) Construction of five slipways at Pettah Warehouse 1 to replace the existing slip capacity at the Barge Repair Basin;
4) Remodeling Pettah Warehouse 1 in order to shift the existing machine factory and office from Barge Repair Basin;
5) The Maritime Construction Superintendent, Superintendent Harbor Craft, and Senior Master Tugs, are responsible for maintenance of the construction craft and harbour tugs, and must be shifted to the transit shed along Canal Basin No.9;
6) Rehabilitation of slipways beside Beira Lake for relocation of slipways existing at Barge Repair Shed and Barge Slips;
7) Shifting the dangerous cargo area to the northern part of Pettah Warehouse 3;
8) Shifting the yacht club to the northern part of Baghdad Warehourse 1;
9) Shifting the carpentry shop to the New Baira area;
10) Shifting the Navy Base to the Baghdad area.

The cost for the relocations was estimated at US$ 4.9 million by the Relocation Committee SLPA on 25 January, 1989. However, the budget given in Table 7-3-5 (a) will be subject to further study and review by the appointed Consulting Engineer.

2. Sunken Vessels

SLPA has a plan for salvaging sunken vessels in the water area shown in Fig. 7-2-4. The salvage operation should be completed by mid-1990 in order to avoid a serious delay in the reclamation work at the JCT No.3 Berth site.

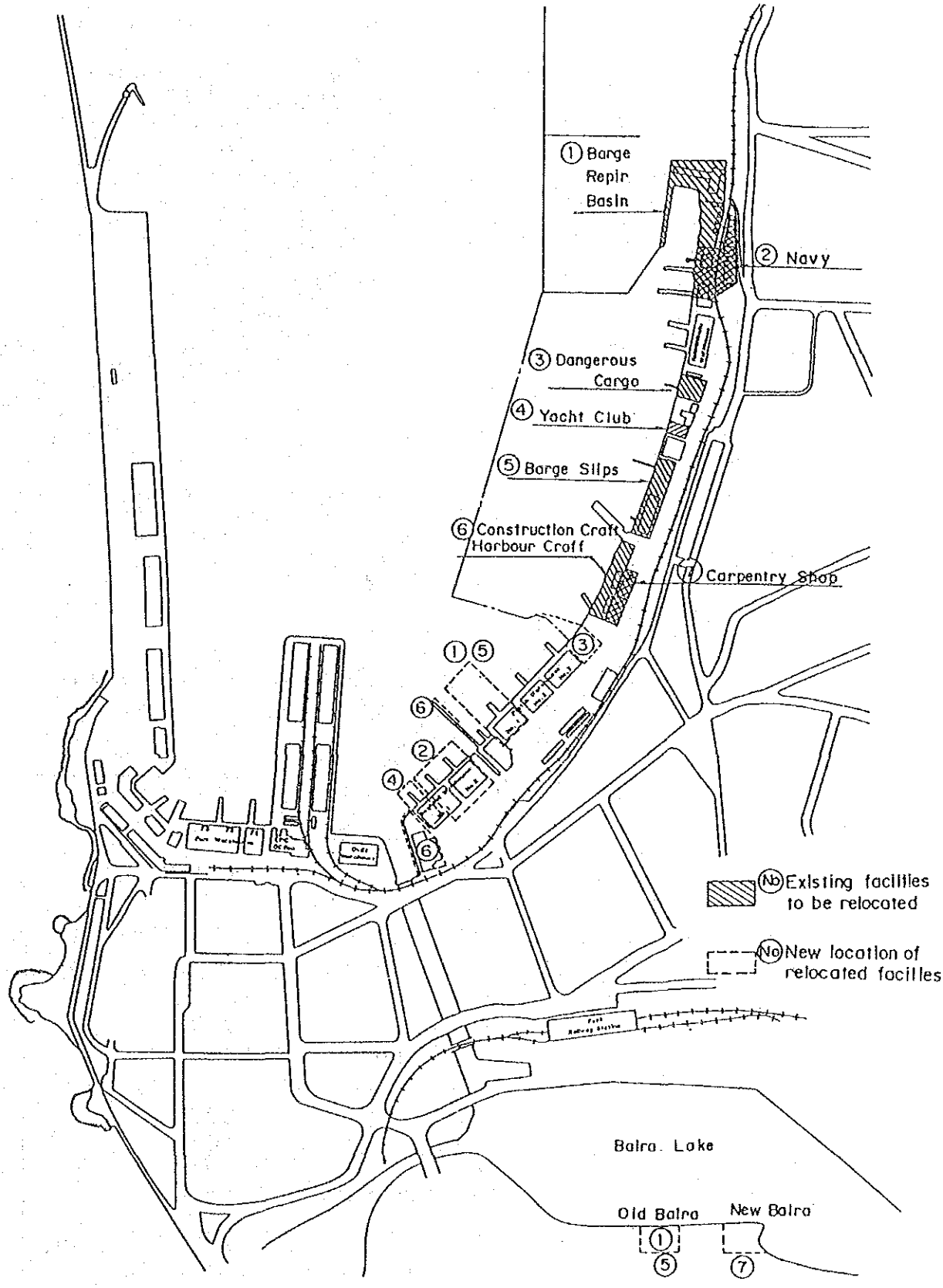
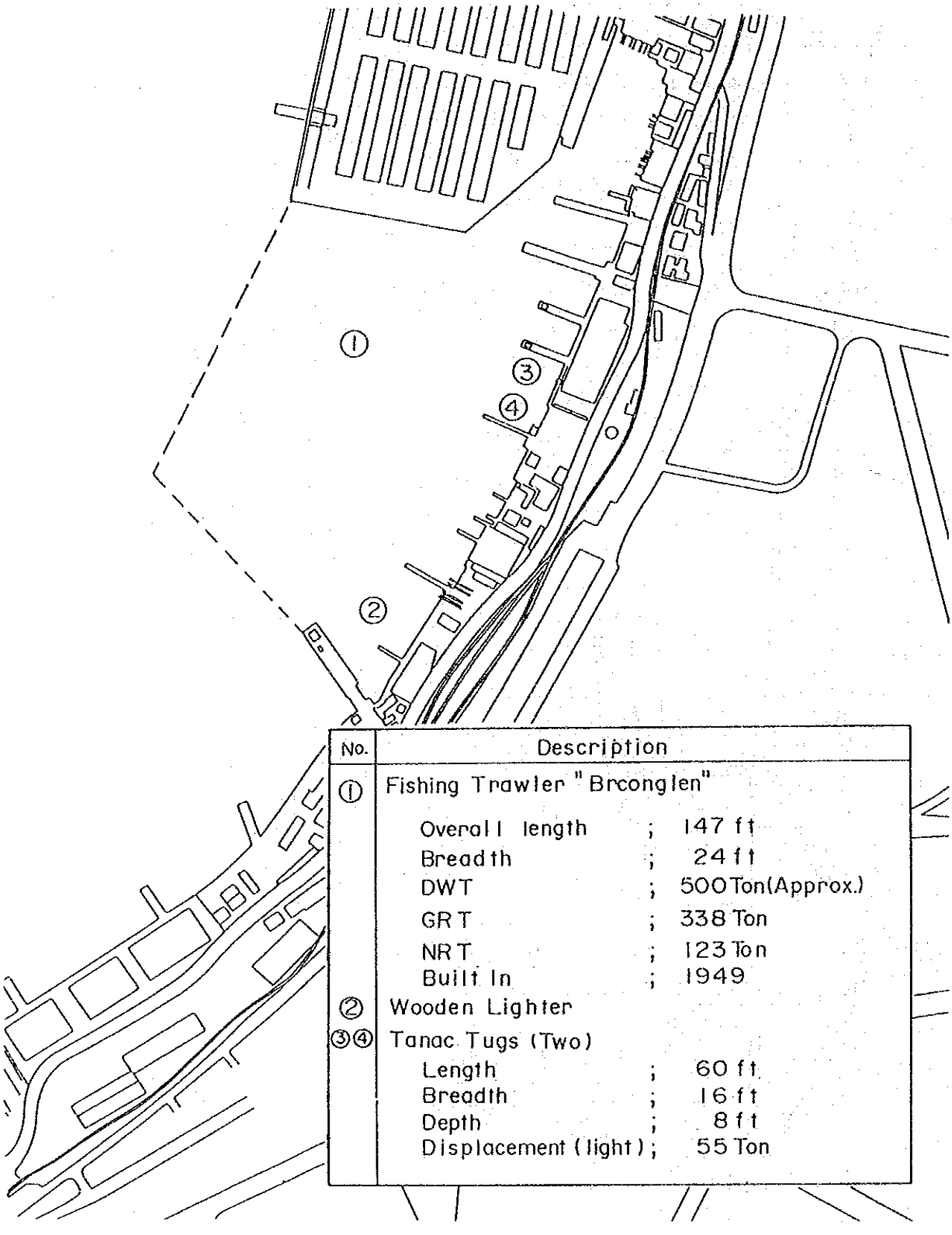


Fig. 7-2-3 Relocation Plan of Existing Facilities



No.	Description		
①	Fishing Trawler "Brconglen"		
	Overall length	;	147 ft
	Breadth	;	24 ft
	DWT	;	500 Ton (Approx.)
	GRT	;	338 Ton
	NRT	;	123 Ton
	Built In	;	1949
②	Wooden Lighter		
③④	Tanac Tugs (Two)		
	Length	;	60 ft
	Breadth	;	16 ft
	Depth	;	8 ft
	Displacement (light)	;	55 Ton

Fig. 7-2-4 Location of Sunken Craft

7-3 Estimation of Construction Cost

7-3-1 Basic Principles of Cost Estimation

The cost estimates for the Project have been prepared by applying the basic prices and rates obtained during the Feasibility Study period from November 1988 to February 1989 to the plants, equipment, materials and labor required for the Project construction. The cost estimation is also based on a comparative evaluation of the unit costs applied to the major items of work in the JCT No. 1 and No. 2 Container Terminal Projects and those applicable to the new Project.

(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. 33.03 = ¥ 125.50 (as of December 1988)

(2) All prices and rates inputted into the cost estimates are as of December 1988.

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

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

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

(6) A 10 % physical contingency allowance is provided in the cost estimates for construction, but the costs of container handling equipment and engineering services include no allowance for physical contingency. Nor is any price escalation allowed for in the cost estimates for construction, container handling equipment and engineering services.

7-3-2 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 Colombo.

A comparison of the costs of locally available construction labor and fuels in 1982 versus those in 1988 is provided in Table 7-3-1, in which an increase of over 30% is seen in the 1988 costs. Table 7-3-2 presents the survey results of the construction materials from local sources. Local production and supply of construction materials is outlined below.

(1) Riprap and Graded Rocks

Private firms operate quarries to supply 100 kg to 5-ton stones, gravel and quarry-run to the local construction industry to meet its demand. However, the production/supply capacities of the quarry operators are limited by their insufficient equipment. Moreover, their output is influenced largely by weather conditions and this necessitates planned stockpiling at construction sites. The average monthly supply of the quarry operators is about 10,000 m^3.

(2) Aggregate for Concrete

Quarry-run is used for coarse aggregates, since gravels from rivers are not obtainable in sufficient quantities to meet the construction industry demand. River sand is used for fine aggregates, but for the purpose of preserving the river beds only specialized firms are authorized to obtain river sand.

(3) Cement

The local production capacity of Portland cement is approximately 885,000 tons/year. Cement manufactures use clinker imported primarily from Malaysia and Indonesia. In 1986, about 560,000 tons of Portland cement were produced. For the implementation of massive engineering projects, however, imported cement has been provided with a view to proper control of supply and quality.

(4) Steel Products

Ceylon Steel Corporation produces steel bars, steel flat bars, binding wires, barbed wires and nails in an annual total quantity of nearly 45,000 tons, of which steel bars account for 1,000 to 3,000 tons a year depending on the demand of the construction market. However, major construction projects depend primarily on imported steel products.

(5) Materials for Reclamation

Laterite has been in wide use for filling on-shore works, but it is not suitable for marine reclamation projects. For port reclamation works, seabed sand and/or sand deposits at river mouths are considered suitable. However, prior authorization of the Coast Conservation Department is necessary for the use of sand from these sources.

(6) Concrete Products

Standardized concrete products, such as hume pipes for drainage and concrete intended for incorporation in kerbstones, side ditches, and lamp posts, are provided by the State Development and Construction Corporation.

(7) Corrosion of Steel Products

In view of the high corrosion rate of steel in tropical regions, adequate precautions should be taken against corrosion if steel is to be used for major structural members.

In Sri Lanka, particularly, damage done to major steel members by corrosion and other causes take considerable time to repair. A corrosion survey conducted on steel structural members during the JCT No. 1 Container Terminal Project showed a corrosion rate twice or three times as high as the Japanese standard value. As a result, the design for steel pipe piles in the JCT No. 1 and No. 2 Container Terminal Projects called for a corrosion rate three times higher than the Japanese standard. Other precautions taken against corrosion of structural steel members in the same projects included increased thickness for concrete members exposed to seawater and the provision of a concrete covering of 8 cm or more for the main reinforcing bars.

From the standpoint of minimizing steel corrosion, it is desirable to use hard concrete in the construction of the new quays which consist of a deck slab system supported on concrete piles. For the same reason, the use of reinforcing bars with epoxy coatings should be considered for the lower steel bars of the main beams of the deck slab system.

2. Cost of Construction Plants and Equipment

Basic prices have been obtained for the construction plants and equipment of appropriate types, capacities and performance characteristics selected to meet the particular requirements of the works to be executed.

Table 7-3-3 gives the costs of the major items of the required equipment.

3. Construction Costs of Various Works Involved

Using the basic prices and rates obtained in Section 1 and Section 2 above, the unit costs of the individual items of both onshore and offshore works have been calculated. Table 7-3-4 lists the typical unit costs of construction versus those used in the JCT No. 1 and No. 2 Container Terminal Projects.

In the table, the unit costs are expressed in U.S. dollars converted at the exchange rates in force as of the appropriate dates. The applicable exchange rates are as follows:

1982: US$ 1.00 = Rs. 20.68 = ¥238.80
December 1988: US$ 1.00 = Rs. 33.03 = ¥125.50

In December 1988, the Sri Lanka Rupees showed a 50% depreciation against the US Dollar, while the Japanese yen registered an appreciation of about 90% against the US currency. Table 7-3-4 shows the following:

(1) Those relatively simple types of work which depend largely on stones, fuels and other locally available materials (rubblework, sand filling of caissons, concreting, etc.) showed a cost increase or decrease of nearly 10%, reflecting the impact of the tendency of the Sri Lanka Rpees to depreciate against the US dollar.

(2) More complex types of work, such as bottom excavation, base course construction for pavements, and reclamation, registered a cost increase of 20 to 40% in terms of the US dollar but a cost reduction of 25 to 35% in terms of the Japanese currency.

(3) Formwork for concreting, reinforcing bars, prestressed

concrete piles, and asphalt pavements showed a cost increase of about 70% in terms of the US dollar as a result of the assumption made in the unit costs analysis that the major equipment and materials required in these types of work would be imported from Japan. However, the cost increase of about 70% compares favorably with the appreciation of nearly 90% which the Japanese yen registered against the US dollar in December 1988. Thus the net results is a cost reduction of some 10% in terms of the Japanese currency.

4. Foreign and Local Currency Components

The direct cost of construction is classified into the foreign and local currency components. The percentage distribution of the major items of equipment, materials and labor between the foreign and local currency components is shown below.

	Foreign	Local
	%	%
Rubble and other stones	0	100
Aggregates for concrete	0	100
Ready-mixed concrete and concrete products from local sources	0	100
Labor	0	100
Fuel and asphalt	0	100
Steel and reinforcing bars	100	0
Floating equipment and construction machinery	100	0
Formwork for concreting	70	30
Materials for temporary works and scaffolding	70	30

7-3-3 Project Cost

The construction cost of different types of facilities comprising the Short Term Project are given in Table 7-3-5 (a) to 7-3-5 (e).

The total cost of the Short-term Project is estimated at US$ 257,849,000 , which is broken down into the foreign currency component at US$ 215,732,000 and the local currency component at US$ 42,117,000.

Table 7-3-6 gives the annual investment plan for the six-year period from 1990 to 1995.

Table 7-3-1 Basic Prices of Local Workers and Fuel (Per day)

	Item	1988		1982		Inflation	
		① Rs	②US$	③ Rs	④US$	①/③	②/④
Local Worker (per day)	Unskilled	80	2.42	51.2	2.48	1.56	0.98
	Skilled	120	3.63	91.2	4.41	1.32	0.82
	Dump Truck Driver	120	3.63	91.2	4.41	1.32	0.82
	Operator	150	4.54	117.6	5.69	1.28	0.80
	Foreman	150	4.54	117.6	5.69	1.28	0.80
Fuel (per l)	Gasoline	13.5	0.41	10.0	0.48	1.35	0.85
	Diesel	8.13	0.25	6.0	0.29	1.36	0.86
	Marine Diesel	7.83	0.24	5.7	0.28	1.37	0.86

Note ; Conversion Rate 1988 ; US$ 1 = Rs. 33.03 = ¥125.5

1982 ; US$ 1 = Rs. 20.68 = ¥238.8

Table 7-3-2 Basic Prices of Construction Materials

Item	Unit	1988		1982		Inflation	
		① Rs	②US$	③ Rs	④US$	①/③	②/④
Graded rock (1,000-2,000kg)	cu.m	350	10.6	200	9.7	1.75	1.09
〃 (500kg)	〃	350	10.6	175	8.5	2.00	1.25
〃 (100-200kg)	〃	250	7.6	175	8.5	1.43	0.89
Crushed Stone (50-150mm)	〃	240	7.3	220	10.6	1.09	0.69
Mild Steel (Round)	ton	16,500	449.5	9,045	437.4	1.82	1.14
Cement (Bag)	〃	2,400	72.7	1,600	77.4	1.50	0.94
Fine Aggregate	cu.m	160	4.8	71	3.4	2.25	1.41
Concrete (σ ca = 180kg/cm²)	〃	1,810	54.8	1,416	68.5	1.28	0.80
〃 (σ ca = 240kg/cm²)	〃	1,925	58.3	1,592	77.0	1.21	0.76
Asphalt	ton	6,230	188.6	5,500	266.0	1.13	0.71
Concrete Products							
(1) Prestressed Concrete Bridge Beam	ton	3,417	103.5	(1985) 2,842	113.7	1.20	0.91
(2) Concrete Pipe ϕ1.5' × ℓ8'	Unit	950	28.8	(1985) 726	29.0	1.31	0.99

Note ; Conversion Rate 1988 ; US$ 1 = Rs. 33.03 = ¥125.5

1982 ; US$ 1 = Rs. 20.68 = ¥238.8

Table 7-3-3 Basic Cost of Construction Machinery

Discription		Basic Cost (US$/Day)			Remarks
		Foreign	Local	Total	
Backhoe	0.6m³	241.0	38.7	279.7	Including operator
Wheel Loader	1.3m³	132.0	22.8	154.8	〃
〃	2.2m³	234.6	36.6	271.2	〃
Dump Truck	5m³	119.8	45.0	164.8	〃
Crawler Crane	35ton	495.7	26.6	522.3	〃
〃	50ton	854.1	41.8	895.9	〃
Bulldozer	11ton	192.9	30.4	223.3	〃
Motor Grader	W=3.7m	220.4	23.5	243.9	〃
Diver Boat		964.8	36.9	1,001.7	Japanese Diver
Tug Boat	200HP	825.7	92.2	917.9	Local Crew
Crane Barge	35ton	993.0	67.3	1,060.3	〃
〃	50ton	1,351.3	82.5	1,433.8	〃
Anchor Boat	120HP, 10t	1,051.2	64.1	1,115.3	〃
Flat Barge	500ton	301.5	0	301.5	〃

Table 7-3-4 Unit Cost of Construction

Work Item	Description	Unit of QTY	①Unit Cost Master Plan	② Unit Cost JCT No. 1, No. 2	Comparison ①/②
Excavation for foundation	Seabed in harbour	m³	(US$) 8.1	(US$) 6.6	1.23
Graded rock (100-200kg)	Easy placing in harbour	m³	27.5	24.7	1.11
Graded rock (〃)	Placing between PC piles	m³	34.0	—	—
Armor rock (500~1,000kg)	Easy placing in harbour	m³	44.1	39.4	1.12
Armor rock (〃)	Placing between PC piles	m³	50.9	—	—
Sand filling (Sea sand)	Into concrete caisson chamber	m³	9.8	11.1	0.88
Shuttering work	Including assembly	m²	29.6	17.8	1.66
Steel bar	〃	ton	1,182.1	709.4	1.67
Concrete placing	σ sa=240kg/cm²	m³	78.0	117.6	0.66
Asphalt paving	Surface course	ton	236.5	139.3	1.70
Base course of paving	Crushed stone	ton	48.8	33.8	1.44
Prestressed concrete pile		m³	902.8	483.0	1.87
Reclamation	Sea sand	m³	6.2	4.3	1.44

Table 7-3-5 (a) Construction Cost of JCT No.3

Unit ; Thousand US$

Description		Quantity	UNIT	Construction Cost			Remarks
				Foreign	Local	Total	
Civil & Building Works	-13.5M Quaywall	330	m	16,422	5,041	21,463	
	South Revetment	220	m	750	811	1,561	
	Reclamation	1,400,000	m^3	8,434	973	9,407	
	Yard Paving	159,000	m^2	9,047	3,226	12,273	Including PC Slab for T/C
	Utilities	1	Sum	6,049	197	6,246	Water Supply Electricity
	Buildings	7,300	m^2	1,713	675	2,388	CFS, ADM Substation
	Relocation of Existing Facilities	1	Sum	2,710	2,168	4,878	Slipway Workshop
	Dredging	380,000	m^3	1,578	322	1,900	
	Sub total (1)			46,703	13,413	60,116	
Equipment Work	Container Crane	2	NOS	13,274	0	13,274	
	Transfer Crane	6	NOS	7,794	0	7,794	
	Tractor & Chassis	12	Set	1,746	0	1,746	
	Sub Total (2)			22,814	0	22,814	
Total				69,517	13,413	82,930	
Engineering Service		1	Sum	4,171	671	4,842	
Physical Contingency		1	Sum	4,670	1,341	6,011	10% of Sub Total (1)
Grand Total				78,358	15,425	93,783	

Table 7-3-5 (b) Construction Cost of JCT No.4

Unit ; Thousand US$

Description		Quantity	UNIT	Construction Cost			Remarks
				Foreign	Local	Total	
Civil & Building Works	-13.5M Quaywall	360	m	17,915	5,499	23,414	
	-9.0M Quaywall	170	m	4,909	1,467	6,376	
	Bulkhead	90	m	308	332	640	
	Reclamation	990,000	m^3	5,970	693	6,663	
	Yard Paving	86,000	m^2	4,893	1,746	6,639	Including PC Slab for T/C
	Utilities	1	Sum	3,267	106	3,373	Water Supply Electricity
	Dredging	250,000	m^3	1,038	212	1,250	
	Sub total (1)			38,300	10,055	48,355	
Equipment Work	Container Crane	2	NO	13,274	0	13,274	
	Transfer Crane	6	NO	7,794	0	7,794	
	Tractor & Chassis	12	Set	1,746	0	1,746	
	Sub Total (2)			22,814	0	22,814	
Total				61,114	10,055	71,169	
Engineering Service		1	Sum	3,667	503	4,170	
Physical Contingency				3,830	1,006	4,836	10% of Sub Total (1)
Grand Total				68,611	11,564	80,175	

Table 7-3-5 (c) New North Pier

Unit ; Thousand US$

	Description	Quantity	UNIT	Construction Cost			Remarks
				Foreign	Local	Total	
Civil & Building Works	Improvement of Quay Structure	380	m	1,596	369	1,965	Rail Foundation
	Revetment Type A	90	m	1,800	944	2,744	Vertical Wall
	Revetment Type B	390	m	2,223	2,574	4,797	Rock Mound
	Reclamation	280,000	m²	1,827	230	2,057	
	Yard Paving	45,750	m²	2,175	704	2,879	
	Utilities	1	Sum	1,740	57	1,797	Water Supply & Electric
	Warehouse & Office	12,800	m²	5,030	3,469	8,499	
	Sub-Total			16,391	8,347	24,738	
Equipment Work	Level Luffing Crane	2	NO	5,740	0	5,740	200t/H
	Belt Conveyor	350	m	1,400	0	1,400	2 Line
	Packer & Palletizer	6	NO	4,300	0	4,300	24t/H
	Wheel Loader	8	NO	960	0	960	2 m³
	Forklift	40	NO	1,300	0	1,300	2 ton
	Pallet and Others	1	Sum	400	400	800	
	Sub-Total			14,100	400	14,500	
Total				30,491	8,747	39,238	
Engineering Service				1,830	437	2,267	0% of Foreign 5% of Local
Physical Contingency				3,049	875	3,924	10% of Total
Grand Total				35,370	10,059	45,429	

Table 7-3-5 (d) Pipe Laying for Oil Handling

Unit ; Thousand US$

	Description	Quantity	UNIT	Construction Cost			Remarks
				Foreign	Local	Total	
Construction	Excavation and Backfilling	30,800	m³	717	80	797	Offshore
	Submarine Pipeline	700	m	3,944	438	4,382	
	Onshore Pipeline	1,000	m	(7,386)	(821)	(8,207)	CPC bear this Cost.
	Handling Equipment on Dolphin Berth	1	Sum	4,508	612	5,120	
	Dredging	320,000	m³	1,328	272	1,600	-13.5m
	Sub total			10,497	1,402	11,899	
Engineering Service				630	84	714	6% of Subtotal
Physical Contingency				1,050	140	1,190	10% of Subtotal
Total				12,177	1,626	13,803	

Note ; The construction cost of onshore pipeline will be about 9.52 million US$ including Engineering Service and Physical Contingency.

Table 7-3-5 (e) construction Costs

[Thousand US$]

	Description	Quantity	UNIT	Construction Cost			Remarks
				Foreign	Local	Total	
1	QEQ Rehabilitation						QCT No. 4, 5 PC T/C Track Water Supply Electricity
	Yard Paving	83.000	m²	4.723	1.684	6.407	
	Unilities	1	Sum	3.158	103	3.261	
	Sub total			7.881	1.787	9.668	
	Contingency			788	179	967	
	Engineering Service			473	89	562	
	Sub-Total			9.142	2.055	11.197	
2	Channel Dredging	1.260.000	m³	5.229	1.071	6.300	
	Navigation Buoy	3	NOS	288	0	288	
	Contingency			1.046	214	1.260	
	Total			6.563	1.285	7.848	
3	Improvement of Communication System						
	Equipment			2.043	0	2.043	
	Installation			500	57	557	
	Engineering			130	26	156	
	Contingency			240	20	260	
	Total			2.913	103	3.016	

Port Access Road

Unit : Thousand US$

	Description	Quantity	UNIT	Construction Cost			Remarks
				Foreign	Local	Total	
Civil & Building	Earthwork	113.000	m³	1.825	948	2.773	
	Paving Work	34.800	m²	1.506	327	1.833	
	Bridge and Structure	1	Sum	1.721	590	2.311	
	Building Work	1	Sum	829	231	1.060	Gate and Office
	Sub Total			5.881	2.096	7.977	
Others	Land Acquisition	1	Sum	0	1.514	1.514	
	Engineering Service	1	Sum	1.888	399	2.287	
	Contingency	1	Sum	1.179	1.068	2.247	
Total				8.948	5.077	14.025	

Reclamation of Crown Land

Unit : Thousand US$

	Description	Quantity	UNIT	Construction Cost			Remarks
				Foreign	Local	Total	
Civil & Building	Reclamation	640.000	m²	3.200	1.920	5.120	
	Soil Improvement	160.000	m²	4.800	1.600	6.400	360×440m
	Sub Total			8.000	3.520	11.520	
Others	Engineering Service			920	232	1.152	
	Contingency			1.210	518	1.728	
Total				10.130	4.270	14.400	

Table 7-3-6 Annual Investment Plan (Short Term)

Units Thousand US$

Description		1990			1991			1992			1993			1994			1995			Total		
		Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
JCT No. 3	Civil and Building	10.379	4.254	14.633	19.724	5.472	25.196	16.600	3.687	20.287										46.703	13.413	60.116
	Equipment				11.407	0	11.407	11.407	0	11.407										22.814	0	22.814
	Engineering Service	1.668	268	1.936	1.252	202	1.454	1.251	201	1.452										4.171	671	4.842
	Physical Contingency	1.401	402	1.803	1.401	403	1.804	1.868	536	2.404										4.670	1.341	6.011
	Sub-Total	13.448	4.924	18.372	33.784	6.077	39.861	31.126	4.424	35.550										78.358	15.425	93.783
JCT No. 4	Civil and Building				10.431	3.190	13.621	18.731	5.080	23.811	9.138	1.785	10.923							38.300	10.055	48.355
	Equipment							11.407	0	11.407	11.407	0	11.407							22.814	0	22.814
	Engineering Service				1.467	201	1.668	1.100	151	1.251	1.100	151	1.251							3.667	503	4.170
	Physical Contingency				1.149	302	1.451	1.149	302	1.451	1.532	402	1.934							3.830	1.006	4.836
	Sub-Total				13.047	3.693	16.740	32.387	5.533	37.920	23.177	2.338	25.515							68.611	11.564	80.175
New North Pier	Civil and Building				1.111	1.287	2.398	4.739	2.461	7.200	3.922	1.295	5.217	4.607	1.916	6.523	2.012	1.388	3.400	16.391	8.347	24.738
	Equipment													7.050	200	7.250	7.050	200	7.250	14.100	400	14.500
	Engineering Service				730	173	903	275	66	341	275	66	341	275	66	341	275	66	341	1.830	437	2.267
	Physical Contingency				610	175	785	610	175	785	610	175	785	610	175	785	609	175	784	3.049	875	3.924
	Sub-Total				2.451	1.635	4.086	5.624	2.702	8.326	4.807	1.536	6.343	12.542	2.357	14.899	9.946	1.829	11.775	35.370	10.059	45.429
Pipe Laying for Oil Handling	Civil				4.017	571	4.588	6.480	831	7.311										10.497	1.402	11.899
	Engineering Service				441	59	500	189	25	214										630	84	714
	Physical Contingency				315	42	357	735	98	833										1.050	140	1.190
	Sub-Total				4.773	672	5.445	7.404	954	8.358										12.177	1.626	13.803
QEQ Rehabilitation	Civil				3.940	893	4.833	3.941	894	4.835										7.881	1.787	9.668
	Engineering Service				284	54	338	189	35	224										473	89	562
	Physical Contingency				394	89	483	394	90	484										788	179	967
	Sub-Total				4.618	1.036	5.654	4.524	1.019	5.543										9.142	2.055	11.197
Channel Dredging	Civil							6.563	1.285	7.848										6.563	1.285	7.848
Communication	Equipment							2.330	82	2.412	583	21	604							2.913	103	3.016
T/C for JCT No. 1, 2	Equipment	2.598	0	2.598																2.598	0	2.598
Total		16.046	4.924	20.970	58.673	13.113	71.786	89.958	15.999	105.957	28.567	3.895	32.462	12.542	2.357	14.899	9.946	1.829	11.775	215.732	42.117	257.849

7-4 Towards Better Management and Operations

7-4-1 The Objectives of the Analysis

In the Port of Colombo, the present drastic increase in container throughput has caused a steady increase of waiting time for berthing (Fig. 7-4-1).

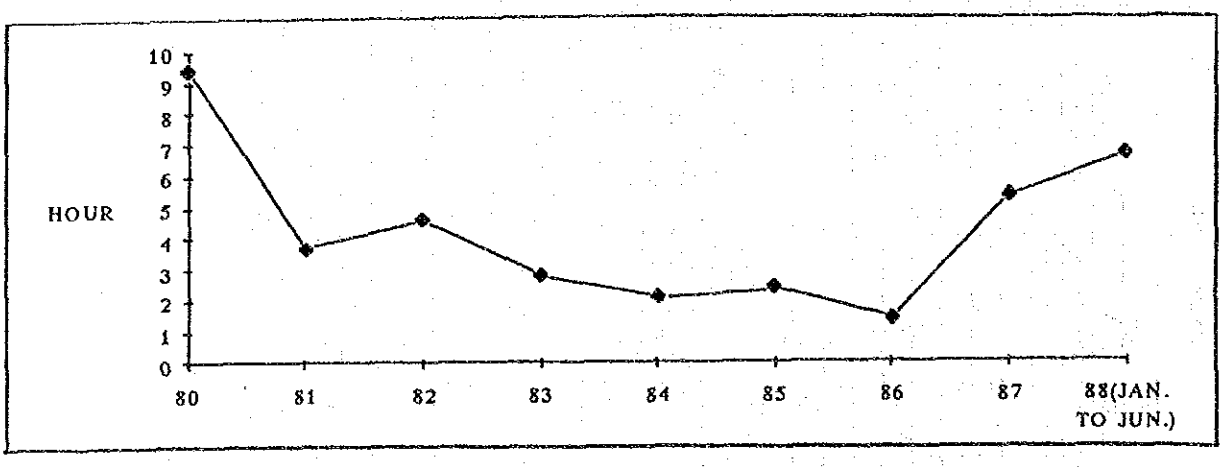


Fig. 7-4-1 Average Waiting Time of Container Vessels

Certainly, the main cause is the shortage of facilities at the port, but the contribution of management and operation practices should not be overlooked. Especially, before the completion of the new terminals (JCT No.3 and No.4), the port has to cope with increasing cargo traffic using the existing facilities. Therefore, the improvement of management and operations will be of prime importance. In order to establish higher productivity in operations and streamlined management, we recommend improvements in the existing management and operations in section 7-4-3, and we propose a plan for the management and operations of new terminals in section 7-4-4.

7-4-2 The Problems of the Existing Management and Operations

(1) Organization

It is essential to establish a more useful and attractive port in terms of both facilities and management/operations for the users such as shipping lines, shipping agents, forwarders, shippers, consignees, etc. in order to promote the increased use of the port and to gain a position as one of the main ports of the world. For that purpose, it is necessary to have a real-time, broad and systematic grasp of the users' needs and to consider their needs in the practical development and management/operations of the port.

It is also necessary to provide users with useful information and to promote the port aggressively.

The keener the competition among various ports, the more important these functions become. But there are no officers in charge of these activities within the organizational structure of SLPA.

(2) Management of Entry and Departure of Vessels

Concerning tugs, the present number owned by SLPA is sufficient, but the number in working condition does not seem to be sufficient because many of the tugs are overaged, and are being used beyond their normal service lives. And their horsepowers are too small to tug big vessels out of the port in stormy weather.

(3) Management of Berthing Facilities

i) Shifting of Containers between JCT and QCT

Many containers are shifted from JCT to QCT and vice versa (Table 7-4-1). This transport reduces the efficiency of cargo handling and requires over 60% additional transport charge compared with normal transport.

Table 7-4-1 Transfer of Containers between JCT & OCT in 1987

(Unit: Box)

	From JCT to QCT	From QCT to JCT	Trans. Total	Total Handled	Share Trans./Total
Total	7,337	6,279	13,616	341,652	4%
Average/month	611	523	1,135	28,471	4%

This situation is caused by the berth allocation. For some shipping lines entering this port, berth allocation is separated at JCT and QCT (Table 7-4-2). Since transshipment cargo occupies a large share of the total port cargo, this berth allocation structurally causes much shifting of containers between JCT and QCT.

Table 7-4-2 Main Shipping Lines by Quay

Shipping Lines	Quay
APL(main)	J
WAKL	J
BXCL	J
CSC	J/Q
CSL(Feed.)	Q
EVER GREEN	J
DSR(Main)	J
DSR(Feed.)	J/Q
UASC	J
YANG MING	J
SEA LAND	J
COBRA	Q
CSL COBRA(Feed.)	Q
MO	J/Q
GSL	Q
LLOYD TRES.	Q
NEDLL	Q
ARROW	Q
NYK	Q
HOEGH	Q
USSR	Q
SSL	Q
OTHERS	J/Q

LEGEND:Q QCT ,J JCT

ii) Excessive Priority to Vessels for Main Services and Particular Shipping Lines

At JCT when a vessel for main line service enters the port, vessels for feeder service conducting discharging/loading operations are forced to divert to mid-stream sometimes. This means these ships must pay extra port dues and change their schedules.

Besides, the excessive priority given to particular shipping lines in berthing allocation causes dissatisfaction against SLPA on the part of many other shipping lines.

iii) The Surplus of Barges

While the barge transport is decreasing rapidly, the number of barges has remained the same. This requires extra port management costs and prevents the re-development of facilities where the barges are moored.

(4) Management and Operations of Freight Handling Facilities and Cargo Delivery and Receiving

i) Shortage of container stacking yard at QCT

The container stacking yard is absolutely insufficient at QCT. There are 2,097 TEUs slots in the whole of QEQ and 1,450 TEUs at QCT. Unlike JCT, QCT's yard is not well organized due to the limited space with many hinderances such as offices, canteens, toilets, etc. Many containers are crowded on aprons or passages and dispersed here and there. Consequently, prime movers are obliged to slip through narrow and winding passages and carry containers a long distance between ship and staking yard. And the prime movers for discharging/loading and delivery/receiving cross each other. This situation makes container transport inefficient and dangerous.

ii) Long dwelling time of containers at QCT

The dwelling time of containers at QCT is longer compared with that at JCT. This makes the congestion of the stacking yard much worse.

iii) Shortage of space and functions of CFS

There is a shortage of CFS space. So part of the conventional warehouses and transit sheds in QEQ, BQ, Baghdad, Pettah, etc. are used for CFS work. But since almost all of them are old, limited and have low ceilings, they are not suitable as CFS.

At the CFS in QCT, since the seaside entrances are not in use, delivery is carried out in the daytime, and destuffing in the night time only at the landside entrances.

iv) Assignment of many trailers to CFS at JCT

12 trailers are assigned to the CFS at JCT for destuffing while additional trailers are needed at QCT.

v) Complicated procedures

The procedures concerning delivery and receiving cargos in the port are very complicated. Shippers and consignees have to submit many documents to many different offices (for details, please refer to Appendix 2-4-6 and Appendix 2-4-7).

(5) Loading and Discharging of Containers

i) Surplus and imbalance of employees

The number of employees is too many at the two terminals, especially at QCT. The formation of labour gangs of gantry

crane operation at QCT is also too big compared with those of other ports. Conversely there are not enough transfer crane operators at JCT and prime mover operators at QCT to move containers efficiently and safely.

ii) Shortage and frequent breakdown of equipment at QCT

At present since SLPA's prime movers and trailers are not sufficient, private companies' prime movers and trailers are used for the following operations at QCT; a) Transport of containers from ship to stacking yard and vice versa, b) Transfer of containers from QCT to JCT and vice versa. This hinders SLPA from continuous smooth operations and forces shipping agents and consignees/shippers to pay extra charges.

The shortage of prime movers and trailers in working condition is partly due to the insufficient number of prime movers and trailers but mainly due to frequent breakdowns. Only eleven of thirty trailers are working now. This is also true for transfer cranes at QCT. Now only two units are working. So many forklifts unsuitable for efficient operation of loaded containers are being used at QCT. Besides, the down time of gantry cranes at QCT is substantial as shown in Table 7-4-3.

Table 7-4-3 Record of Performance of Gantry Cranes at QCT

MONTH	NO. OF DAY WORKED	NO. OF HRS WORKED	NO. OF VESSELS HANDLED	NO. OF CONTAINERS HANDLED (TEU)	NO. OF CONTAINERS HANDLED/HR.	NO. OF HRS SERVICING	NO. OF HRS. BREAKDOWN FOR REPAIRS	NO. OF HRS. BREAKDOWN MINOR DEFECTS	NO. OF HRS. BREAKDOWN TOTAL
OCT '87	56	798.75	58	11,025	13.80	160.00	0.00	67.00	67.00
NOV '87	56	939.25	53	12,871	13.70	101.25	169.25	49.75	219.00
DEC '87	57	946.08	42	13,082	13.83	133.75	0.00	38.75	38.75
JAN '88	57	887.08	65	11,982	13.51	98.50	0.00	17.00	17.00
FEB '88	49	806.00	52	10,797	13.40	219.50	0.00	9.00	9.00
MAR '88	55	888.00	51	12,593	14.18	185.50	0.00	15.25	15.25
APR '88	52	776.50	57	10,463	13.47	166.00	0.00	21.75	21.75
MAY '88	48	734.66	52	10,347	13.82	46.00	137.25	16.08	153.33
JUN '88	49	777.66	38	10,966	14.10	9.00	160.25	18.00	187.25
JUL '88	56	948.42	54	12,066	12.72	8.50	74.08	39.75	113.83
AUG '88	61	973.00	54	12,271	12.61	50.50	67.50	18.00	85.50
SEP '88	53	819.42	51	11,372	13.88	41.00	67.00	45.83	112.83
TOTAL	648	10,344.82	627	140,335	13.57	1,239.50	684.33	356.17	1,040.50
AVE. PER GANTRY	27	431.03	26	5,847	13.57	51.65	28.51	14.84	43.35

The salty spray from breaking waves, bumpy pavement, SLPA's maintenance system, etc. are considered as causes of the frequent breakdowns.

iii) Sudden changes of on-carriers or ports of destination of containers.

Sudden changes of on-carriers or ports of destination of transshipment containers on the part of shipping lines are sometimes made very shortly before reloading. These changes bring additional work to SLPA.

iv) Inefficient planning system at QCT

At QCT, part of the plans are prepared by shipping agents, and all are taken care of manually. So it is difficult to prepare consistent plans rapidly.

v) Lack of flexibility of discharging/loading sequences
In the port, even when the first vessel and the on-carrier berth are next to each other, all containers to be reloaded from the first vessel to the on-carrier must pass through the stacking yard under the present system.

(6) Computer and Communication System

i) Insufficient communication system between SLPA and port users

The communication by telephone between SLPA and port users is poor due to a lack of telephone circuits.

And the effective range of VHF communication system between the port and vessels is about twenty miles, which is short compared with other ports in the world.

ii) Limited area covered by computer system

As for as the operation and management system, the SLPA computer system covers only operations at container terminals in the Port of Colombo and the system covers no other operation and management works such as operations at conventional terminals, management of vessel arrival/departure, etc. in the Port of Colombo and at other ports managed by SLPA.

iii) Unsatisfactory statistics system

The computer system is competent for processing statistics, but SLPA cannot folly utilize the potential of this system. In regard to statistics, the present system covers only vessel statistics. All cargo statistics are prepared by manual work. Concerning even vessel statistics, SLPA prepares few periodical and systematic statistics by computer such as daily, monthly and yearly statistics, statistics by ship type, route and shipping company, etc.

iv) Undeveloped computer network system

In the Port of Colombo, some shipping lines have already developed their own world-wide computer network systems and there is a possibility that it would be difficult for SLPA to establish a real-time network system with such organizations in the future without a rapid development of the overall SLPA computer system.

7-4-3 Recommendation on the Existing Management and Operations

(1) Creation of Port Promotion and Information Research Divisions

In order to promote port activities and grasp users need, SLPA should establish port promotion and information research divisions.

(2) Introduction of New Tugs with High Horsepower

In order to secure the safe management of the arrival/departure of vessels in the Port of Colombo, introduction of new tugs with high horsepower should be considered.

(3) Improvement of Berth Allocation

i) In order to prevent transshipment containers from being shifted between QCT and JCT, the first vessels and the on-carriers should be allocated to the same terminal whenever possible. In addition, improvement of the road between QCT and JCT, introduction of additional prime movers and trailers and reduction in charges on transfer of containers should be considered.

ii) Although the vessels for main services are rightfully given priority over the vessels for feeder services, feeders which are already discharging/loading should not be shifted from JCT to other berths so frequently.

iii) In order to ease congestion at QCT, SLPA should allocate to JCT as many vessels as possible.

(4) Establishment of Unification and Frexibility of Planning

i) In order to establish efficient and safe container operations, SLPA should prepare all container handling plans directly.

ii) In order to connect the first vessels with the on-carriers efficiently, the current planning system where all transshipment containers once rest in the stacking yard prior to reloading should be flexibilly re-considered depending on the circumstances.

iii) A closing time system for changes of on-carriers or ports of destination should be established to prepare firm loading plans in advance and promote quick dispatch of container vessels.

(5) Disposal of Surplus Barges

In order to save management and maintenance costs, and to redevelop facilities, surplus idle barges should be disposed of.

(6) Arrangement and Extension of Stacking Yard at QCT

In order to handle containers efficiently and safely and also to introduce computers in QCT operations, SLPA should organize and enlarge the stacking yard at QCT.

Effective ways and means, such as simplification of procedure and new methods of cargo inspection, should be developed to shorten the dwelling time of local containers and make the utmost use of stacking yard.

(7) Relocation of Labour Force

SLPA should reduce the staff of unprofitable sections and increase the staff for transfer crane and prime mover operations, planning of operations, etc.

(8) Equipment Reallocation and Maintenance System

Additional prime movers and trailers should be allocated to QCT and their spare parts should always be made available.

Two additional transfer cranes should be installed in JCT to shorten stevedoring hours.

Mutual use of equipment between QCT and JCT might also be considered. At QCT measures preventing the damage of equipment from the spray of breaking waves are also necessary.

(9) Conversion of Conventional Transitsheds into CFS

Conventional transitshed or warehouses should be converted into facilities suitable for stuffing/destuffing LCL cargo.

(10) Simplification of Procedures for SLPA

In order to not only prevent port users from submitting too many documents to different offices of SLPA but also promote the computerization at SLPA smoothly, SLPA should simplify the procedures for ships entry/departure and cargo operations.

(11) Installation of More Telephones and Telephone Circuits

In order to establish good connections between SLPA and port users and efficient operations and management in the ports, the installation of more telephones and circuits into SLPA should be considered.

(12) Development of New Computer System

In order to make the ports more attractive for port users by establishment of efficient operations and management at the ports, the development of new computer systems, such as a statistics system, vessel management system, network system, etc. should be considered. A draft scenario of the development of computer systems is shown in Appendix 7-4-1. New central computers with large memory and high processing speed, many terminals, and many system engineers, programming and operating stuff will be needed for this development.

7-4-4 Management and Operation Plan of New Terminals

(1) Organization

SLPA should manage and operate new terminals in an integrated way with the existing terminals. Additional division or sections are not necessary.

(2) Berth Allocation

In order to prevent containers from being transferred over a long distance between aprons and stacking points and to promote the quick dispatch of vessels, a preferential use system should be adopted.

(3) Operation System

With regard to JCT No.3/No.4 operations, 24 hours a day operation system in three shifts should be considered in order to maintain and improve the competitive nature of the port.

(4) Required Number and Qualifications of the Staff

Making the utmost use of the existing labour force through positive re-allocation of labouers to other division should be considered while maintaining cooperative relations with labour unions.

i) JCT No.3/No.4

The present practices of the number and qualifications of the staff concerning non-labour grade and labour grade at JCT No.1/No.2 can be applied to of JCT No.3/No.4.

However, it is considered necessary to increase the number of operators for gantry cranes and transfer cranes to lessen their continuous working and maintain productivity at a reasonable level.

For JCT No.3/No.4, new construction of a control room and terminal gate is not considered necessary. This will lead to substantial savings of labour.

ii) NNP

The standard number of workers required for the handling of bulk fertilizer will be as follows.

Table 7-4-4 Formation of Gang for Handling Fertilizer in Bulk

			NO. OF EQUIPMENT	NO. OF OPERATORS/ LABOURERS
LEVEL LUFFING CRANE	OPERATOR	1 / CRANE	1	1
BELT CONVEYER	OPERATOR	1 / CONVEYER	1	1
	LABOURER	1 / CONVEYER	1	1
PACKER	LABOURER	4 / PACKER	3	12
WHEEL LOADER	OPERATOR	1 / LOADER	4	4
FORK LIFT	OPERATOR	1 / FORK LIFT	9	9
PALLETIZER	OPERATOR	1 / PALLETIZER	3	3
	FOREMAN	1 / GANG		1
TOTAL				32 / GANG

7-5 Economic Analysis

7-5-1 General Approach

The purpose of this section is to appraise the economic feasibility of this project as presented in 7-1 from the viewpoint of the national economy.

This section focuses on whether the benefits of this project exceed those which could be derived from other investment opportunities in this country.

All benefits and costs in the economic analysis are evaluated using economic prices based on the border price concept.

There are various methods to evaluate the feasibility of this type of project. In this study, the Economic Internal Rate of Return (EIRR) based on a cost benefit analysis is used to appraise the feasibility of this project.

The procedure of the economic appraisal is summarized in Fig. 7-5-1.

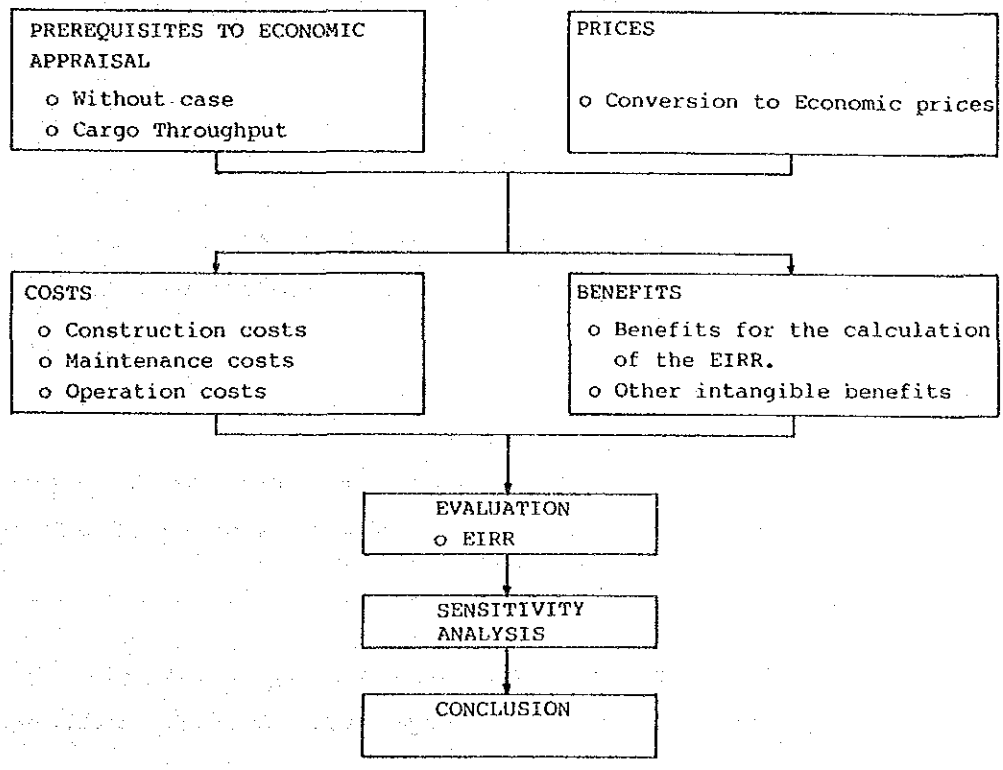


Fig. 7-5-1 Process of Economic Analysis

7-5-2 Prerequisites to the Economic Appraisal

(1) Without Case

A cost-benefit analysis is conducted on the difference between the with case in which an investment is made and the without case in Which no investment is made, that is, the benefits and costs arising from the proposed investment are compared.

We also examine whether or not the net benefits generated by the project exceed the opportunity cost of capital in Sri Lanka.

The without case is set as follows:

(a) No investment is made for this project.
(b) There will be no increase in the number of transshipment containers at Colombo Port after the number of handling containers reaches the capacity of JCT and QCT.
(c) Import fertlizer will continue to be packed in bags at present during the planning period.

(2) Cargo Throughput

(i) With Case

The cargo volume under the with case at Colombo Port during the planning period is forecast in Chapter 5.

(ii) Without Case

The volume of container transshipment cargo will not increase after it reaches the capacity of JCT and QCT in 1990.

The foreign trade container cargo will be increase irrespective of the capacity. Priority will be given to

the foreign trade containers, so the limited capacity will be appropriated for the foreign containers. Thus, the number of transshipment containers will decrease as the number of the foreign trade containers increases.

The present liquid bulk cargo facility at North Pier is assumed to finish its service life at the end of 1995.

The volume of break bulk cargo, dry bulk cargo, etc. is assumed to increase up to the full capacity of these handling facilities.

The cargo throughput under the without case is shown in Table 7-5-1.

Table 7-5-1 Cargo Throughput under the Without Case

		Unit	1990	1996	2001
Conventional Break Bulk	Export	Thousand tons	283	126	66
	Import	Thousand tons	2,271	2,542	2,557
	Total	Thousand tons	2,554	2,668	2,623
Container	Transshipment	Thousand TEUs	572	618	480
	Foreign Trade	Thousand TEUs	137	216	354
	Total	Thousand TEUs	709	834	834
Dry Bulk	Import	Thousand tons	370	488	688
Liquid Bulk	Export	Thousand tons	251	0	0
	Import	Thousand tons	1,971	2,000	2,000
	Total	Thousand tons	2,222	2,000	2,000
Coastal Trade	Outward	Thousand tons	38	38	38
	Inward	Thousand tons	187	187	187
Total	Non-Container Cargo	Thousand tons	5,371	5,381	5,536
	Container Cargo	Thousand TEUs	709	834	834

7-5-3 Economic Prices

(1) General

For the economic analysis, all prices must be expressed as economic prices.

In general, the construction cost, the operation cost and the repair cost are estimated at market prices. But in this report, for the estimation of these costs, import duties and turnover tax are excluded from traded goods, viz., the prices of traded goods are expressed as CIF prices. For non-traded goods, turnover tax, stamp duty and other duties are excluded. Therefore, these prices exclusive of personnel expenses are already expressed as economic prices, and thus require no conversion.

Labour is divided into skilled labour and unskilled labour. Skilled labour costs are estimated based on local market wages, and unskilled labour costs are estimated based on the value of the gross marginal product.

Economic prices for the labour costs are calculated by multiplying these costs by the conversion factor for consumption.

Since all the benefits are estimated at market prices, it is necessary to re-evaluate them from the economic point of view.

In this study, the conversion of benefits to economic prices is made using the Standard Conversion Factor and the Conversion Factor for Consumption.

(2) Standard Conversion Factor (SCF)

Import duties and export subsidies create a price differential between the domestic market and the international market.

The Standard Conversion Factor makes up for this price difference. The Standard Conversion Factor is obtained by the following formula.

$$SCF = \frac{\text{(Total Amount of Imports)} + \text{(Total Amount of Exports)}}{\left\{\begin{pmatrix}\text{Total Amount of}\\ \text{Imports}\end{pmatrix} + \begin{pmatrix}\text{Total Amount of}\\ \text{Import Duties}\end{pmatrix}\right\} + \left\{\begin{pmatrix}\text{Total Amount of}\\ \text{Exports}\end{pmatrix} - \begin{pmatrix}\text{Total Amount of}\\ \text{Export Duties}\end{pmatrix}\right\}}$$

In this report, the average SCF from 1981 to 1987 is adopted for the analysis.

The Standard Conversion Factor is calculated as 0.951. (Please refer to Appendix 7-5-1).

(3) Conversion Factor for Consumption (CFC)

This factor is used for converting the prices of consumer goods from market prices to international prices.

In particular, this is required to convent labour costs from market prices to international prices.

The Conversion Factor for Consumption is usually calculated in the same manner as the Standard Conversion Factor, replacing total imports and total exports by imports and exports of consumer goods.

However, due to the lack of required data, the Conversion Factor for Consumption cannot be directly calculated in this report. Thus, it is assumed as the same value as the Standard Conversion Factor.

(4) Conversion Factor for Labour

(i) Skilled Labour

For skilled labour, assuming that the market mechanism is functioning properly, the actual market wages are used. But as the data are in domestic prices, they are converted to international prices by multiplying by the Conversion Factor for Consumption.

$$\begin{pmatrix}\text{The Conversion Factor}\\ \text{for Skilled Labour}\end{pmatrix} = \begin{pmatrix}\text{Local market}\\ \text{wage rate}\end{pmatrix} \times \text{(CFC)}$$

$$= 1.0 \times 0.951$$

$$= 0.951$$

(ii) Unskilled Labour

For unskilled labour, the economic costs are calculated based on a simplified measure of the opportunity cost. As the wages paid to unskilled laborers by a project are usually above the opportunity cost, these market wages should not be used for the calculation of the economic value of the unskilled labour.

In this report, the marginal productivity of an unskilled labourer is assumed equal to the per capita GDP of the agriculture, livestock and fisheries sector (hereafter referred to as the agricultural sector).

The conversion factor for unskilled labour is calculated using the formula given below:

$$\begin{pmatrix}\text{Conversion Factor}\\ \text{for Unskilled Labour}\end{pmatrix} = \frac{\begin{pmatrix}\text{Per Capita GDP}\\ \text{of Agricultural Sector}\end{pmatrix}}{\begin{pmatrix}\text{Nominal Wage for}\\ \text{Unskilled Labour}\end{pmatrix}} \times \text{(SCF)}$$

Where, SCF: Standard Conversion Factor = 0.951

Working days per year = 290

Nominal wage for unskilled labour = 2.4 US$ per day

In this report, the average conversion factor for unskilled labour from 1982 to 1987 is adopted.

The conversion factor for unskilled labour is calculated as 0.747. (Please refer to Appendix 7-5-2).

7-5-4 Costs

(1) Construction Cost

The construction investment excluding personnel cost estimated at economic prices in Section 7-3 has to be divided into the categories of skilled labour, unskilled labour, foreign labor and equipment, materials cost and others.

The cost of laboureres excluding foreigners is converted into economic prices using the conversion factors for skilled labour and unskilled labour. (Please refer to Appendix 7-5-3). Table 7-5-2 shows the economic prices for the construction investment.

Table 7-5-2 Construction Cost at Economic Prices

(Unit: Thousand US$)

Project	Items \ Year	1990	1991	1992	1993	1994	1995	Total
JCT No.3	Equipment & Material Cost and Others	14,411	34,951	30,452	-	-	-	79,814
	Labour Cost	2,133	3,067	2,659	-	-	-	7,859
	Total	16,544	38,018	33,111	-	-	-	87,673
JCT No.4	Equipment & Material Cost and Others	-	13,990	34,029	22,124	-	-	70,143
	Labour Cost	-	1,278	2,406	1,436	-	-	5,120
	Total	-	15,268	36,435	23,560	-	-	75,263
New North Pier	Equipment & Material Cost and Others	-	2,575	6,346	4,705	12,921	10,350	36,897
	Labour Cost	-	720	1,178	843	1,180	635	4,556
	Total	-	3,295	7,524	5,548	14,101	10,985	41,453
Pipe Laying	Equipment & Material Cost and Others	-	4,392	6,484	-	-	-	10,876
	Labour Cost	-	686	1,030	-	-	-	1,716
	Total	-	5,078	7,514	-	-	-	12,592
QEQ Rehabilitation	Equipment & Material Cost and Others	-	4,664	4,579	-	-	-	9,243
	Labour Cost	-	501	474	-	-	-	975
	Total	-	5,165	5,053	-	-	-	10,218
Channel Dredging	Equipment & Material Cost and Others	-	-	5,431	-	-	-	5,431
	Labour Cost	-	-	1,134	-	-	-	1,134
	Total	-	-	6,565	-	-	-	6,565
Communication System	Equipment & Material Cost and Others	-	-	2,078	518	-	-	2,596
	Labour Cost	-	-	126	33	-	-	159
	Total	-	-	2,204	551	-	-	2,755
Transfer Crane for JCT No.1 & No.2	Equipment & Material Cost and Others	2,598	-	-	-	-	-	2,598
Total	Equipment & Material Cost and Others	17,009	60,572	89,399	27,347	12,921	10,350	217,598
	Labour Cost	2,133	6,252	9,007	2,312	1,180	635	21,519
	Total	19,142	66,824	98,406	29,659	14,101	10,985	239,117

(2) Operation, Maintenance and Repair Costs

The main items of the operation costs of this project are personnel, fuel and power expenses.

These costs are estimated based on the present operational data at Colombo Port.

The maintenance & repair cost per year for the cargo handling equipment of this project is assumed to be 4 percent of the original investment, and for the facilities of this project it is assumed to be 1 percent of the original investment.
Table 7-5-3 shows the operation and the maintenance & repair costs.

Total 7-5-3 Operation and Maintenance & Repair Costs

(Unit: Thousand US$)

year	1990	1991	1992	1993	1994	After 1995
Operation cost	26	154	382	655	999	1,072
Maintenance & Repair Cost	270	1,280	2,948	3,279	3,638	3,965
Total	296	1,434	3,330	3,934	4,637	5,037

7-5-5 Benefits

(1) Benefit items

Since the proposed development plan is an integrated project, different kinds of benefits associated with major sub-projects are identified. These are; i) savings in export industry investment arising from the container transshipment operation, ii) reduction of transport cost arising from the introduction of a bulk handling system for import fertilizer, and iii) reduction of handling costs and increase in port safety arising from the construction of the new oil terminal at Island Breakwater.

After Various discussions, items (i) and (ii) are adopted for the calculation of the benefits of this project in this study.

(2) Calculation of the Benefit

(i) Savings in export industry investment arising from the container transshipment operation.

To earn the necessary foreign currency, Sri Lanka has been investing a substantial amount of capital in export industries.

In Colombo Port, container transshipment has been increasing sharply, and the earnings of foreign currency associated with this operation are substantial for Sri Lanka's economy.

Assuming that foreign currency earnings through Colombo Port do not increase in the future, the equivalent amount of foreign currency would have to be obtained from alternative investments in export industries.

So, In this report, the potential savings of investment in export industries is one of the benefits of this project.

The process of calculating this benefit is shown in Fig. 7-5-2. Sri Lanka's main commodities for export are tea, rubber and coconuts, and therefore, these industries are chosen for the calculation of the potential investments.

The investments required at economic cost to produce each of the selected export commodities (per ton) are calculated by the cost of production which is provided in the annual report of the Central Bank of Sri Lanka in 1977.

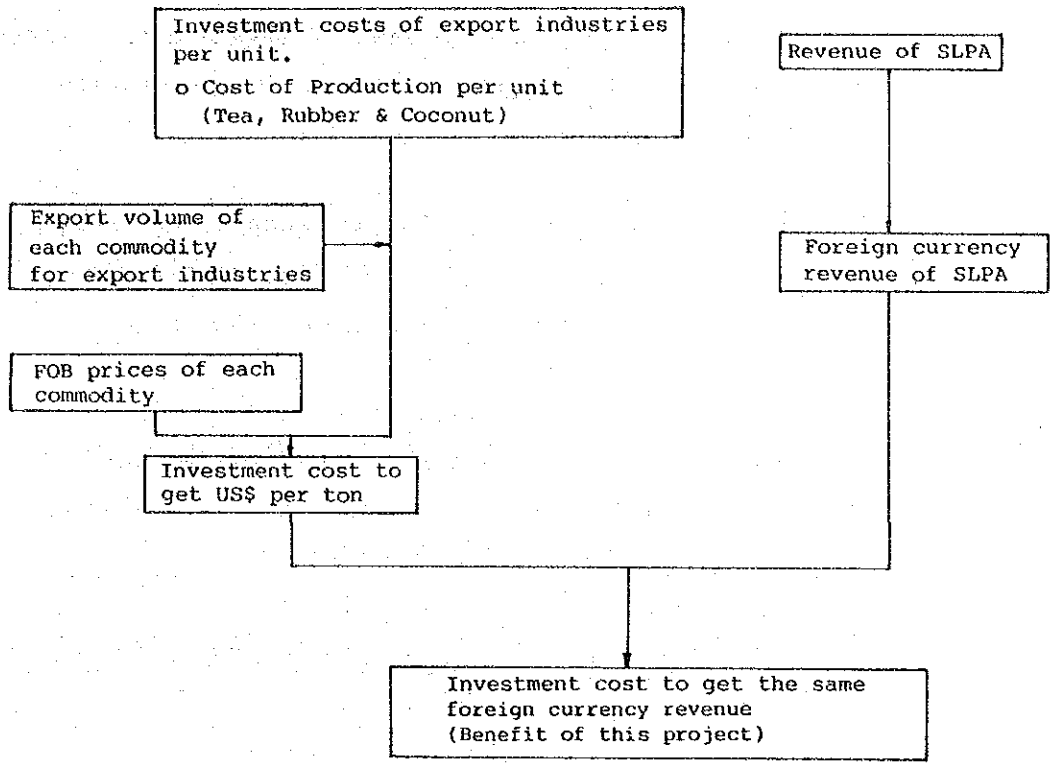


Fig. 7-5-2 Prosess of Calculating the Benefit of Savings in Export Industry Investment Arising from the Container Transshipment Operation

The investment at economic prices per ton of each commodity is shown in Table 7-5-4.

Table 7-5-4 Investment Cost for Economic Prices per ton of Export Industries

(US$/Ton)

Year	Investment Cost Per Ton		
	Tea	Rubber	Coconuts
1991	1,144	330	15
1992	1,144	330	15
1993	1,144	330	15
1994	1,144	330	15
1995	1,144	330	15
1996	1,144	330	15
After 1996	1,144	330	15

The foreign currency revenue of SLPA and the transshipment container throughput have a high correlation (Refer to Appendix 7-5-4).

The correlation equation between the foreign currency revenue and the throughput of the transshipment containers is expressed as follows.

$$Y = 0.0000932X + 17.612 \quad (r: 0.952)$$

where, Y: Foreign exchange earnings (Million US$)
X: Number of containers for transshipment (TEU)
r: Correlation coefficient

The results of the calculation are shown in Table 7-5-5.

Table 7-5-5 Foreign Exchange Earnings of SLPA

(Unit: Million US$)

Year	Foreign Exchange Earings of SLPA		Difference
	With Case	Without Case	
1990	70.9	70.9	0.0
1991	79.9	79.9	0.0
1992	88.8	80.1	8.7
1993	97.8	78.9	18.9
1994	106.7	77.6	29.1
1995	115.7	76.4	39.3
1996	124.6	75.2	49.4
1997	129.1	72.8	56.3
1998	129.1	70.7	58.4
1999	129.1	68.1	61.0
2000	129.1	65.3	63.8
2001	129.1	62.3	66.8
After 2001	129.1	62.3	66.8

It is assumed that the shares of the export cargo volume for the main export commodities under the Wihtout Case are the same as under the With Case.

The necessary investment for the increase per ton of the export cargo volume of the main commodities for export is shown in Table 7-5-6.

Table 7-5-6 Necessary Investment per Ton

Year	Tea		Rubber		Coconuts		Total
	Export Share per ton	Investment for Share per ton (US$)	Export Share per ton	Investment for Share per ton (US$)	Export Share per ton	Investment for Share per ton (US$)	Investment per Ton (US$/Ton)
1991	0.358	409.2	0.199	65.8	0.443	6.6	481.6
1992	0.353	404.1	0.199	65.8	0.448	6.7	476.6
1993	0.349	398.9	0.199	65.8	0.452	6.7	471.4
1994	0.345	394.5	0.199	65.8	0.456	6.8	467.1
1995	0.342	391.0	0.199	65.8	0.459	6.9	463.7
1996	0.338	387.1	0.199	65.8	0.463	6.9	459.8
1997	0.336	384.0	0.200	65.9	0.464	7.0	456.9
1998	0.332	380.1	0.200	66.0	0.468	7.0	453.1
1999	0.330	377.4	0.201	66.2	0.469	7.1	450.7
2000	0.327	374.4	0.202	66.6	0.471	7.1	448.1
2001	0.325	372.0	0.202	66.7	0.473	7.1	445.8
After 2001	0.325	372.0	0.202	66.7	0.473	7.1	445.8

The necessary investment (Once of the benefits of this project) for export industries to earn the foreign exchange equivalent to the foreign currency earnings of SLPA is shown in Table 7-5-7.

Table 7-5-7 Necessary Investment for Export Industries

Year	Difference of Foreign Exchange Earnings under the With Case and Without Case (Million US$)	Necessary Investment for Export Indutries (Benefit of this project) (Million US$)
1992	8.7	11.3
1993	18.9	24.4
1994	29.1	37.4
1995	39.3	50.1
1996	49.4	62.7
1997	56.3	71.0
1998	58.4	73.0
1999	61.0	76.0
2000	63.8	79.1
2001	66.8	82.4

Note: The F.O.B. Prices of the main export commodities in the planning period are assumed as follows:

Tea : 52.7 Rs/kg

Rubber : 24.3 Rs/kg

Coconuts: 9.7 Rs/kg

(ii) Ruduction of Transport Cost arising from the Introduction of a Bulk Handling System for Imprt Fertilizer

The packing style of import fertlizer in Sri Lanka is bags at present. In this project, the packing style of 85% of the fertlizer is changed from bags to bulk after 1996.

The cargo handling time of the fertlizer is reduced by the change of the packing style. Therefore, the vessel staying costs and the cargo handling costs are decreased. This is one of the benefits of this project.

The cargo handling conditions of fertilizer under the with case and the without case are shwn in Table 7-5-8.

Table 7-5-8 Condition of Cargo Handling for Fertilizer per Vessel at Colombo Port Under the With Case and the Without Case

	With Case	Without Case
Type of Packing	Bulk	Bags
Productivity of Cargo Handling	320 tons/h	100 tons/h
Type of Ship	Dry bulk carrier	General cargo ship
D.W.T. of Ship	20,000 DWT (12,600 GT)	*-1 10,000 DWT (6,900 GT)
Cargo Handling Volume per Ship	20,000 tons	10,000 tons
Staying Cost of a ship per day (Capital Costs and Running Costs)	8,685 US $	7,092 US $

*-1 Average of Conventional ships at Colombo Port from 1982 to 1987

The difference of vessel staying costs during the cargo handling for fertilizer under the with case and under the without case is calculated based on the values in Table 7-5-8.

The result of the calculation is shown in Table 7-5-9.

Table 7-5-9 Benefit of Changing from Bags to Bulk for Packing Style of Fertilizer

Year	Cargo Volume (tons)	Number of Vessels		Staying Cost at Berth		
		With Case (Vessels /year)	Without Case (Vessels /year)	With Case (1000US$/ year)	Without Case (1000US$/ year)	Difference (Benefit) (1000US$/ year)
1996	458,722	23	46	518.8	1,355.5	836.7
1997	473,135	24	47	535.0	1,398.1	863.1
1998	487,802	24	49	551.6	1,441.5	889.9
1999	502,713	25	50	568.5	1,485.5	917.0
2000	518,600	26	52	586.5	1,532.5	946.0
2001	533,872	27	53	603.7	1,577.6	973.9
After 2001	533,872	27	53	603.7	1,577.6	973.9

(iii) Benefits

From items (i) and (ii), the benefits of this project are shown in Table 7-5-10.

Table 7-5-10 Benefits of This Project

(Unit: 1000 US$)

Year	Benefit from (i)	Benefit from (ii)	Total Benefits
1992	11,300	0	11,300
1993	24,400	0	24,400
1994	37,400	0	37,400
1995	50,100	0	50,100
1996	62,700	837	63,537
1997	71,000	863	71,863
1998	73,000	890	73,890
1999	76,000	917	76,917
2000	79,000	946	79,946
2001	82,400	974	83,374
After 2001	82,400	974	83,374

7-5-6 Evaluation

(1) EIRR

The project life is assumed as 30 years. The project life of usual port development projects is generally between 20 years and 30 years.

From the calculation, the EIRR of this project is found to be approximatedly 21 %. (Please refer to Appendix 7-5-5).

(2) Sensitivity Tests

Sensitivity tests are made for 3 cases:

(a) The construction cost will increase by 10% (Case - 1).
(b) The cargo volume will decrease by 10 % (Case - 2).
(c) The construction cost will increase by 10 % and the cargo volume will decrease by 10 % (Case - 3).

The calculated EIRR is 20 % for (a), 17 % for (b) and 16 % for (c). (Please refer to Appendices 7-5-6, 7-5-7 and 7-5-8).

(3) Results

The opportunity cost of capital in developing countries ranges up to 8 % or more as shown Table 7-5-11.

It is a generally accepted criteria that a project with an EIRR of more than 10 % is economically feasible. For this project, the EIRR of all cases exceed 10 %, and hence the project is considered justifiable.

Table 7-5-11 Opportunity Cost of Capital in Developing Countries

Unit: Percent

Country	Opportunity Cost
India	10 - 12
Pakistan	10
Bangladesh	15
Nepal	8
Egypt	8
Sudan	8
Indonesia	6

Source: ODM

7-6 Financial Analysis

7-6-1 Purpose of the Analysis

The purpose of the study in this section is to examine the financial viability of the project and the financial soundness of SLPA. The viability of the project is analyzed based on the Financial Internal Rate of Return (FIRR) using the Discount Cash Flow Method. The financial soundness of SLPA is analyzed based on the projected financial statements.

7-6-2 System of SLPA's Finances

(1) Financial Principles

SLPA has the competence to obtain revenues from port operations, to raise funds for investments, to manage assets and to maintain adequate reserves as an autonomous public corporation managed on a self-paying basis.

(2) Fund Raising for Construction and Improvement of Ports

The funds for construction and improvement of ports by SLPA mainly consist of (a) loans from overseas financial institutions including the Overseas Economic Cooperation Fund (OECF) through the government (b) investments from the Consolidated Fund and (c) internal reserves. As for the basis of fund raising, it is prescribed in the SLPA Act that the Ports Authority may exercise the power to borrow money from any organization or institute within or outside Sri Lanka [Act 7.(1)(t)].

(3) Tariff

i) Principles of Determination of the Tariff

Basically the tariff of the port is cost oriented, and the present tariff structure has evolved over years with

increases added on as surcharges at different periods. However, the tariff structure of the neighbouring ports, especially the Port of Singapore and the Port of Madras, have been set to maintain the competitive nature of the ports, especially in regard to the rates on transshipment cargo.

The tariff may be revised with the approval of the Minister who shall, before giving his approval, consult the Minister of Finance.

ii) Charges on ships and cargoes

The charges of SLPA can be divided into charges on ships and charges on cargoes, and these can be subdivided into charges on port facilities and on services. On the other hand, SLPA's charges can be divided into three types of charges, that is charges on containers, conventional cargo (break-bulk) and bulk cargoes, from the viewpoint of cargo type.

The main charges for container operations at the Port of Colombo are summarized in Appendix 7-6-1. Port dues on cargo, tonnage and wharfage are charged only for local cargo and not for transshipment cargo.

In order to promote exports there are many commodity rebate systems, for example rebates for traditional exports such as tea, rubber, coconut products and ready-made garments. There are also volume incentive rebates for transshipment of containers of over 25,000 TEUs per calendar year and rebates for FCL in order to promote containerisation.

Compared with the charges levied by the ports of Singapore, Madras and Yokohama, the charges for transshipment container operations in Colombo are very economical (Table 7-6-1). The charges for break-bulk cargo operations and bulk cargo operations are shown in Appendix 7-6-2.

Table 7-6-1 Comparison of Port Changes on Ships and Transshipment Containers between Colombo and Other Main Ports

(UNIT:US$)

ITEMS	MAIN CHARGES	COLOMBO	SINGAPORE	MADRAS (INDIA)	YOKOHAMA (JAPAN)
DUES ON SHIP (25,000GRT OR 15,000NRT)	PORT DUES,ENTERING DUES	1,030	1,156	1,488	538
	LIGHT DUES	773			
	PILOTAGE	1,030		4,960	
	PROFESSINAL PILOTAGE FEE	80	493		473
	TUG CHARGES	584	1,192	1,543	5,186
	DOCKAGE	500	1,413	536	2,371
	TOTAL(PER VESSEL)	3,997	4,254	8,527	8,568
	PER GRT	0.16	0.17	0.34	0.34
	INDEX(COLOMBO=100)	100	106	213	214
DUES ON TRANSSHIPMENT CONTAINERS(20',LOADED)	STEVEDORING CHARGES	52	102	43	387
	WHARFAGE,EQUIPMENT CHARGES				51
	TOTAL(PER 20' CONTAINER)	52	102	43	438
	INDEX(COLOMBO=100)	100	196	83	842
EXCHANGE RATE(US$)		Rs. 33.033	S$ 1.946	Rs. 15.12	YEN 125.5
REMARKS	FREE TIME FOR TRANSSHIP(DAYS)	28	28	30	14
	SHIFTS	2	3	3	2
	HOLIDAYS(YEAR)	4	0		EVERY SUNDAY

CONDITIONS FOR ACCOUNTING CHARGES

VESSEL	25,000GRT,15,000NRT,35,000DWT,WEEKLY SERVICE
PILOT	2 HOURS AT ENTERING/DEPARTURE EACH
TUG	2 TUGS,1 HOUR AT ENTERING/DEPARTURE EACH
BERTHING TIME	10 HOURS(8:00～18:00)
SERVICE TIME	6 HOURS
GANTRY CRANE CYCLE TIME	30 BOXES/HOUR
TONNAGE OF CARGO PER CONT.	32 MT/20' CONTAINER
STEVEDORING CHARGES	DISCHARGING～STACKING～LOADING

7-6-3 The Financial Situation of SLPA

The revenue of SLPA has increased smoothly year by year and this increase is attributed to the increase of the cargo handled. Over 90 percent of the revenue of SLPA is generated from the activities at the Port of Colombo (Fig. 7-6-1). Concerning the share of revenue from port activities by ship and cargo, the latter is much higher than the former (Fig 7-6-2).

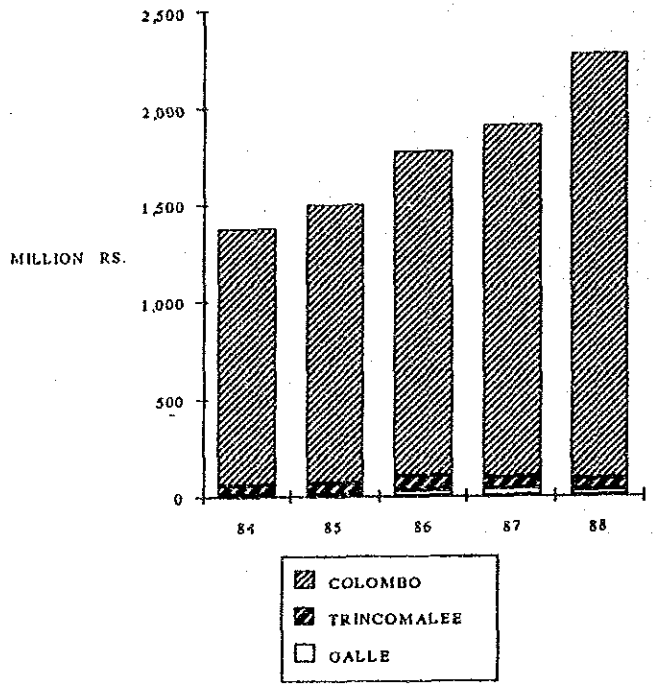


Fig. 7-6-1 Gross Revenue from Port Activities by Port

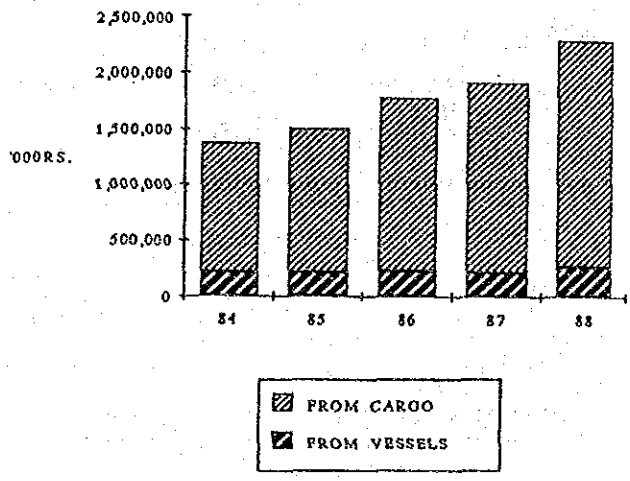


Fig. 7-6-2 Share of Revenue from Port Activities

The shares of expenditure by personnel expenses, administration, maintenance/repair, depreciation, interest on loans and taxes are shown in Appendix 7-6-3. The share of interest on loans has been increasing.

7-6-4 General Prerequisites of the Financial Analysis

(1) Scope of the Analysis

For the estimation of the financial soundness of SLPA, the finances of all of SLPA including Galle and Trincomalee are analyzed in this study.

(2) Project Life

Based on the same reasons as for the economic analysis, the project life for the financial analysis is determined as 30 years including 6 years of detailed design and construction

(3) Base Year

For the estimation, all costs, expenditures and revenues analyzed quantitatively here are indicated in prices as of December 1988 when the price survey was conducted. Neither inflation of prices nor the increases of nominal wages are considered during the project life.

(4) Cargo Handling Volume

Based on the cargo volume forecast and estimated cargo handling capacity, the annual cargo handling volume by cargo type are determined as shown in Appendix 7-6-4.

(5) Port Charges and Revenues

The revenue from port activities is calculated based on the current tariff of SLPA and the cargo handling volume presented in (4). But recommendations on the existing tariff may be made based on the results of this analysis, if necessary.

(6) Fund Raising

The funds necessary for the implementation of the projects are assumed to be raised as follows:

i) Foreign currency

Source : Loans from abroad
Interest rate : 10 % per annum. (re-lending rate from the government)
Repayment : 25 years including a grace period of 4 years

ii) Local currency

Source : Reserves of SLPA

Any cash shortage should be covered by short-term loans with an interest rate of 11 % per annum, in local currency. (*)

(*) The actual interest rate on short-term loans is 22% per annum. even at the lowest rate. But since this high rate includes changes in prices, we adopt 11% per annum. as the interest rate on short-term loans by deflating the actual rate by the changes implicit in the GNP deflator.

(7) Initial Investments

The initial investments of the short-term project are estimated in Chapter 7-3 and taxes are calculated in addition to these costs.

(8) Re-investments

The facilities and the equipment will be renewed based on their service lives. The expenditures for renewal are considered as re-investments. The service lives of each facility and equipment are shown in Appendix 7-6-5. The re-investments of

dredging will be made each 10 years.

The funds for re-investments are assumed to be raised from the reserves of SLPA.

(9) Maintenance, Repair and Operation Costs

The annual maintenance and repair costs for the cargo handling equipment are calculated as 4 per cent of the original construction or procurement costs. And these costs for the facilities except the equipment for handling cargoes are calculated as 1 per cent of the original construction or procurement costs.

The operation costs are the cost for the fuel of the equipment and craft and for water supply and electricity necessary for the operations of the port facilities. These costs are firstly calculated as 1 per cent of the original costs of equipment and buildings, and secondly coordinated in proportion to cargo volume.

(10) Personnel and Administration Costs

The personnel costs are estimated based on the required number of workers proposed in Chapter 7 of Part 4. The wages are set by rank considering the current standard and overtime pay are calculated in proportion to cargo volume.

The administration costs are estimated as 25 percent of the total personnel costs.

(11) Depreciation Costs

The annual depreciation costs of the facilities and equipment are calculated by the straight line method based on their service lives shown in Appendix 7-6-5. Residual values after depreciation are neglected.

(12) Repayment of Loans and Interest on Loans

The repayment of long-and short-term loans and the interest on these loans are calculated based on the fund raising plan presented in (6).

(13) Taxes

SLPA pays turnover tax, income tax and deemed dividend tax.

7-6-5 Methodology of Financial Analysis

(1) Viability of the Project

The viability of the project is analyzed using the Discount Cash Flow Method and appraised by the FIRR. The FIRR is a discount rate which makes the costs and the revenue during the project life equal, and it is calculated using the following formula:

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

n : Project life
Bi: Revenue in the i-th year
Ci: Cost in the i-th year
r : Discount rate

Here, the revenue and the cost are the difference between those under the "with" case and the "without" case. In this study, the "without" case is set as explained in Chapter 7 of Part 5. The revenues and the costs in this analysis cover the following items.

Revenue : operating revenue
Cost : investments (initial investments and re-investments);
maintenance, repair and operation costs;
personnel and administration costs

When the calculated FIRR exceeds the weighted average interest rate of the total funds for the investments of the project, the project is regarded as financially feasible.

(2) Financial Soundness of SLPA

The financial soundness of SLPA is appraised based on its projected financial statements (profit and loss statement, cash flow statement and balance sheet). The appraisal is made from the viewpoints of profitability, loan repayment capacity and operational efficiency, using the following ratios.

i) Profitability

Rate of return on net fixed assets:

$$\frac{\text{Net operating income}}{\text{Total fixed assets}} \times 100\ (\%)$$

This indicators shows the profitability of the investment which is presented as the net total fixed assets. It is necessary to keep the rate above the average interest rate of the total funds for the investment.

ii) Loan repayment capacity

Debt service coverage ratio:

$$\frac{\text{Net operating income before depreciation}}{\text{Repayment of and interest on long-term loans}}$$

This indicator shows whether the operating income can cover the repayment of and the interest on long-term loans, and must be more than 1.

iii) Operational efficiency

Operating ratio:

$$\frac{\text{Operating expenses}}{\text{Operating revenues}} \times 100\ (\%)$$

Working ratio:

$$\frac{\text{Operating expenses - depreciation cost}}{\text{Operating revenues}} \times 100\ (\%)$$

The operating ratio shows the operational efficiency of SLPA as an enterprise and the working ratio shows the efficiency of the routine operation of the port.

When the calculated operating ratio is less than 70 - 75 per cent, and the working ratio is less than 50 - 60 per cent, the operation of the port is efficient.

7-6-6 Evaluation

(1) Viability of the Project (Appendix 7-6-6)

The FIRR of this project is 8.7 % and exceeds the weighted average interest rate of funds during the project life (5.1%).

(2) Financial Soundness of SLPA (Table 7-6-2)

i) Profitability (Fig. 7-6-3)

The rate of return on net fixed assets is less than the average interest rate of the total funds till 1999, but after 2000 the rate of return exceeds the average interest rate.

ii) Loan repayment capacity (Fig. 7-6-4)

The debt service coverage ratio exceeds 1.0 from 1990 to 2019 except in 1995. There will be no problem with the repayment of the long-term loans using the annual operating revenues. But it is necessary to take short-term loans to

cover the cash outflow from 1991 to 2008.

iii) Operational efficiency (Fig. 7-6-5, Fig 7-6-6)

Both the operating ratio and the working ratio constantly keep favorable levels. The operating ratio is less than 65 % from 1990 to 2019 except from 1993 to 1998 and the working ratio constantly maintains a low level under 50 % after 1999.

Table 7-6-2 (1)

PROFIT AND LOSS STATEMENT (UNIT:1000US$)

ITEM	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
OPERATING REVENUE																														
PORT DUES ON SHIPS	9.380	10.318	11.247	12.147	13.118	14.168	15.585	16.384	17.182	17.526	17.701	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878	17.878
CHARGES ON CARGO																														
WHARFAGE	10.810	11.020	11.246	11.471	11.701	12.189	13.507	14.318	15.137	16.047	17.053	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076	18.076
TONNAGE	2.524	2.574	2.626	2.676	2.732	2.841	3.153	3.343	3.543	3.756	3.981	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220	4.220
PORT DUES ON CARGO	2.339	2.386	2.433	2.482	2.532	2.633	2.923	3.098	3.284	3.481	3.690	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911	3.911
TOTAL	15.672	15.980	16.305	16.631	16.964	17.643	19.583	20.756	22.004	23.324	24.724	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207	26.207
STEVEDORING CHARGES																														
LOCAL	34.315	35.001	35.701	36.415	37.144	38.629	42.879	45.451	48.179	51.069	54.133	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381	57.381
TRANSHIPMENT	12.533	14.863	16.716	18.889	20.987	23.084	25.140	26.145	27.191	27.191	26.647	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848	25.848
OTHERS	871	958	1.044	1.128	1.216	1.315	1.447	1.519	1.595	1.627	1.644	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660	1.660
TOTAL	47.719	50.823	53.462	56.433	59.329	63.009	69.465	73.116	76.965	79.887	82.424	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889	84.889
RENT	5.849	6.434	7.013	7.574	8.180	8.834	9.718	10.203	10.714	10.928	11.037	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146	11.146
TALLY & SECURITY	1.281	1.410	1.536	1.659	1.792	1.935	2.129	2.235	2.347	2.394	2.418	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442
OTHER OPERATING REVENUE	65	72	78	84	91	98	108	114	119	122	123	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124
TOTAL OPERATING REVENUE	79.987	84.842	89.641	94.526	99.474	105.687	116.583	122.791	129.331	134.181	138.427	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688
OPERATING EXPENSES																														
PERSONNEL EXPENSES	31.286	32.850	34.328	35.702	37.130	38.615	40.546	41.559	42.598	43.024	43.238	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455	43.455
ADMINISTRATION	5.319	5.585	5.836	6.069	6.312	6.565	6.893	7.065	7.242	7.314	7.351	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387	7.387
MAINTENANCE,REPAIR AND FUEL	6.478	6.803	7.487	11.004	13.320	13.853	15.315	15.698	16.090	16.251	16.332	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414	16.414
DEPRECIATION OF FIXED ASSETS	8.229	8.392	8.892	13.029	15.452	15.906	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217	17.217
AMORTIZATION OF DEFERRED ASSETS	23	23	248	1.357	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539	1.539
TOTAL OPERATING EXPENSES	51.336	53.653	56.771	67.161	73.753	76.377	81.509	83.078	84.886	85.345	85.676	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013	86.013
NET OPERATING INCOME	28.651	31.189	32.870	27.367	25.722	29.310	35.070	39.713	44.445	48.836	52.748	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675	56.675
NON-OPERATING REVENUES																														
INTEREST ON DEPOSIT	1.447	1.536	1.629	1.711	1.800	1.913	2.110	2.223	2.341	2.429	2.506	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583
OTHER NON-OPERATING REVENUES	960	1.018	1.076	1.134	1.194	1.268	1.399	1.473	1.552	1.610	1.661	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712	1.712
TOTAL NON-OPERATING REVENUES	2.407	2.554	2.698	2.845	2.994	3.181	3.509	3.696	3.893	4.039	4.167	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295	4.295
NON-OPERATING EXPENSES																														
INTEREST ON LONG-TERM LOANS	14.199	15.437	20.476	26.862	31.215	31.458	30.367	28.279	26.192	24.105	22.018	19.930	17.843	15.756	13.669	12.056	10.756	9.880	8.805	7.529	6.454	5.378	4.302	3.227	2.151	1.076	0	0	0	0
INTEREST ON SHORT-TERM LOANS	0	0	370	3.425	5.288	6.526	6.690	10.061	10.821	10.688	10.310	10.104	9.343	8.466	8.586	6.742	4.239	3.486	1.684	0	0	0	0	0	0	0	0	0	0	0
TOTAL NON-OPERATING EXPENSES	14.199	15.437	20.846	32.288	36.503	37.984	39.057	38.340	37.013	34.793	32.328	30.034	27.186	25.101	22.135	20.642	17.498	13.819	12.091	9.213	6.454	5.378	4.302	3.227	2.151	1.076	0	0	0	0
NET INCOME BEFORE TAX	16.839	18.305	14.722	-2.076	-7.787	-5.492	-469	5.069	11.525	18.081	24.587	30.936	33.784	35.869	38.834	40.328	43.472	47.051	48.879	51.757	54.516	55.592	56.668	57.743	58.819	59.894	60.970	60.970	60.970	60.970
BUSINESS TURNOVER TAX	3.798	4.030	4.258	4.490	4.725	5.020	5.536	5.833	6.143	6.374	6.575	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778	6.778
INCOME TAX	4.564	4.866	3.662	0	0	0	0	0	1.884	4.099	6.304	8.455	9.452	10.182	11.220	11.743	12.843	14.095	14.735	15.743	16.708	17.085	17.462	17.838	18.214	18.591	18.967	18.967	18.967	18.967
NET INCOME AFTER TAX	8.476	9.279	8.802	-6.566	-12.512	-10.512	-6.007	-783	3.498	7.610	11.708	15.703	17.554	18.909	20.837	21.869	23.852	26.177	27.366	29.236	31.030	31.729	32.429	33.127	33.827	34.526	35.225	35.225	35.225	35.225
DEEMED DIVIDEND TAX	2.119	2.320	1.700	0	0	0	0	0	975	1.902	2.927	3.926	4.389	4.727	5.209	5.452	5.963	6.544	6.841	7.309	7.757	7.932	8.107	8.282	8.457	8.631	8.806	8.806	8.806	8.806
NET INCOME AFTER PAYMENT	6.357	6.959	7.101	-6.566	-12.512	-10.512	-6.007	-783	2.524	5.707	8.781	11.777	13.166	14.182	15.628	16.356	17.889	19.633	20.524	21.927	23.272	23.797	24.321	24.846	25.370	25.894	26.419	26.419	26.419	26.419

CASH FLOW STATEMENT (UNIT:1000 US$)

ITEM	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CASH BEGINNING	20.110	17.158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.574	34.108	59.850	36.490	36.912	60.863	76.661	116.460	155.999	197.923
CASH INFLOW																														
OPERATING REVENUES	79.987	84.842	89.641	94.526	99.474	105.687	116.583	122.791	129.331	134.181	138.427	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688	142.688
LONG-TERM LOAN:	21.448	59.462	95.023	33.632	12.542	9.946	0																							
FUND MANAGEMENT	1.447	1.536	1.629	1.711	1.800	1.913	2.110	2.223	2.341	2.429	2.506	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583
TOTAL CASH INFLOW	102.882	145.839	186.287	129.871	113.817	117.546	118.693	125.015	131.672	136.610	140.932	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271	145.271
CASH OUTFLOW																														
INVESTMENT	93.146	87.176	123.889	41.715	16.725	14.084	2.676	2.295	248	1.523	6.100	3.913	10.561	3.196	17.541	2.595	483	19.368	9.536	4.265	3.901	3.355	50.982	31.723	8.719	15.396	2.676	2.984	0	1.080
LOAN PAYMENT																														
LONG-TERM LOAN REPAYMENT	3.773	3.778	9.655	8.817	8.817	19.580	19.596	19.596	19.596	19.596	19.596	19.596	19.596	19.596	16.193	13.308	11.795	10.756	10.756	10.756	10.756	10.756	10.756	10.756	10.756	10.756	0	0	0	0
SHORT-TERM LOAN REPAYMENT	0	0	3.368	31.139	48.073	59.326	78.999	91.460	98.369	97.166	93.729	91.857	84.935	84.952	76.969	78.050	61.287	38.540	31.692	15.312	0	0	0	0	0	0	0	0	0	0
TOTAL LOAN REPAYMENT	7.779	7.778	13.223	39.956	56.890	78.906	98.595	111.056	117.965	116.762	113.325	111.453	104.531	104.548	93.161	91.358	73.082	49.296	42.448	26.068	10.756	10.756	10.756	10.756	10.756	10.756	0	0	0	0
INTEREST ON LOANS																														
INTEREST ON LONG-TERM LOANS	14.199	15.437	20.476	26.863	31.215	31.458	30.367	28.279	26.192	24.105	22.018	19.930	17.843	15.756	13.669	12.056	10.756	9.880	8.805	7.529	6.454	5.378	4.302	3.227	2.151	1.076	0	0	0	0
INTEREST ON SHORT-TERM LOANS	0	0	370	3.425	5.288	6.526	6.690	10.061	10.821	10.688	10.310	10.104	9.343	8.466	8.586	6.742	4.239	3.486	1.684	0	0	0	0	0	0	0	0	0	0	0
TOTAL INTEREST ON LOANS	14.199	15.437	20.846	32.288	36.503	37.984	39.057	38.340	37.013	34.793	32.328	30.034	27.186	25.101	22.135	20.642	17.498	13.819	12.091	9.213	6.454	5.378	4.302	3.227	2.151	1.076	0	0	0	0
TAX	7.588	10.713	11.574	9.853	4.725	5.020	5.538	5.833	6.143	8.132	12.575	15.009	19.159	20.618	21.687	23.287	23.972	25.584	27.418	26.355	29.829	31.244	31.795	32.346	32.897	33.449	34.000	34.551	34.551	34.551
CASH EXPENSES	45.107	45.281	47.899	54.132	58.301	60.571	64.292	65.881	67.489	68.128	68.461	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796	68.796
TOTAL CASH OUTFLOW	105.814	106.365	217.426	177.944	173.144	196.545	210.158	223.362	229.838	230.338	232.790	230.205	230.222	222.239	206.557	183.811	176.963	160.583	136.697	119.736	119.529	166.631	146.848	121.319	129.473	105.472	105.731	163.347	104.407
CASH INFLOW-OUTFLOW	-2.852	-20.526	-31.139	-48.073	-59.327	-78.998	-91.460	-98.369	-97.166	-93.729	-91.858	-84.934	-84.952	-76.968	-78.050	-61.287	-38.540	-31.692	-15.312	8.574	25.534	25.742	-21.360	-1.578	23.951	15.798	39.798	39.536	41.923	40.863
CASH ENDING	17.158	-3.368	-31.139	-48.073	-59.326	-78.998	-91.460	-98.369	-97.166	-93.729	-91.857	-84.935	-84.952	-76.968	-78.050	-61.287	-38.540	-31.692	-15.312	8.574	34.108	59.850	38.490	36.912	60.863	76.661	116.460	155.999	197.922	238.786
CASH EXCESS	17.158	-3.368	-31.139	-48.073	-59.326	-78.999	-91.460	-98.369	-97.166	-93.729	-91.857	-84.935	-84.952	-76.968	-78.050	-61.287	-38.540	-31.692	-15.312	8.574	34.108	59.850	38.490	36.912	60.863	76.661	116.460	155.999	197.923	238.786
SHORT-TERM LOANS	0	3.368	31.139	48.073	59.326	78.999	91.460	98.369	97.166	93.729	91.857	84.935	84.952	76.968	78.050	61.287	38.540	31.692	15.312	0	0	0	0	0	0	0	0	0	0	0

OPERATING RATIO	64.20%	63.24%	63.33%	71.05%	74.14%	72.27%	69.51%	67.86%	65.48%	63.60%	61.69%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%	60.26%
WORKING RATIO	53.88%	53.32%	53.18%	55.82%	57.06%	55.86%	53.82%	52.38%	50.90%	49.63%	48.34%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%	47.14%
DEBT SERVICE COVERAGE RATIO	1.66	1.71	1.38	1.13	1.07	0.91	1.08	1.22	1.38	1.55	1.72	1.91	2.01	2.13	2.52	2.97	3.34	3.69	3.90	4.13	4.38	4.68	5.01	5.39	5.84	6.38				

Table 7-6-2 (2)

BALANCE SHEET(UNIT:1000 US$)

ITEM	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ASSETS																														
CASH & DEPOSITS	17,156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,574	34,108	59,850	38,490	36,912	60,663	76,661	116,460	155,989	197,925	238,786
OTHER CURRENT ASSETS	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775
TOTAL CURRENT ASSETS	30,931	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	13,775	22,349	47,883	73,625	52,265	50,687	74,438	90,436	130,235	169,764	211,698	252,561
FIXED ASSETS																														
TOTAL FIXED ASSETS	345,265	422,002	526,931	553,970	555,243	553,501	536,960	523,803	506,834	491,140	480,023	464,672	441,924	432,320	432,644	417,982	401,228	403,146	395,759	382,807	369,491	353,582	377,265	396,208	378,710	377,889	363,348	348,281	331,864	314,907
DEFERRED CHARGES	187	2,211	12,045	-12,335	10,796	9,257	7,718	6,412	4,873	3,334	1,795	2,303	10,846	10,870	9,331	7,792	6,253	4,947	3,408	1,869	330	838	9,381	9,405	7,866	6,327	4,788	3,482	1,943	404
TOTAL ASSETS	376,385	437,988	552,751	580,080	579,814	576,533	560,453	543,990	525,482	508,249	495,593	480,750	472,545	456,965	455,750	439,549	421,256	421,868	412,942	407,025	417,704	428,045	438,911	450,300	462,214	474,652	498,371	521,537	544,705	567,872
LIABILITIES & NET WORTH																														
LIABILITIES																														
CURRENT LIABILITIES																														
SHORT-TERM LOANS	0	3,368	31,139	48,072	58,326	73,989	91,460	98,369	97,126	93,729	91,257	84,935	84,952	76,967	72,850	61,287	38,548	41,692	15,312	0	0	0	0	0	0	0	0	0	0	0
OTHER SHORT LIABILITIES	8,682	7,316	5,363	0	0	0	0	0	2,159	6,000	9,231	12,381	13,841	14,909	16,429	17,195	18,806	20,640	21,577	23,052	24,466	25,017	25,569	26,120	26,671	27,222	27,774	27,774	27,774	27,774
LONG-TERM LOANS	130,182	181,846	267,014	291,829	295,554	285,920	266,324	246,728	227,132	207,536	187,940	168,344	148,748	129,152	112,959	99,651	87,856	77,100	66,344	55,588	44,832	34,076	23,320	12,564	1,808	0	0	0	0	0
TOTAL LIABILITIES	138,845	192,530	303,516	339,902	354,879	364,919	357,784	345,097	327,058	307,265	289,028	265,660	247,541	221,029	202,438	178,133	145,202	129,432	103,233	78,640	69,298	59,093	48,889	38,684	28,479	27,222	27,774	27,774	27,774	27,774
NET WORTH																														
CAPITAL EMPLOYED	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294	229,294
RETAINED EARNINGS	3,889	9,205	14,840	17,450	8,152	-7,188	-20,618	-29,637	-33,482	-34,017	-31,510	-25,981	-17,455	-7,541	3,390	15,187	26,871	43,509	58,891	77,184	95,940	115,661	136,486	157,477	179,071	192,242	214,885	238,051	261,219	284,386
NET INCOME AFTER TAX	6,357	6,959	5,101	-6,566	-12,512	-10,513	-6,007	-785	2,624	5,707	8,781	11,777	13,166	14,152	15,628	16,356	17,889	19,633	20,524	21,927	25,272	23,797	24,321	24,846	25,370	25,884	26,419	26,419	26,419	26,419
TOTAL NET WORTH	237,540	245,458	249,235	240,178	224,934	211,614	202,669	198,893	198,428	200,984	206,565	215,090	225,005	235,936	248,312	261,417	276,054	292,436	309,709	328,385	348,406	368,952	390,022	411,616	433,735	447,430	470,597	493,764	516,931	540,099
TOTAL LIABILITIES & NET WORTH	376,385	437,988	552,751	580,080	579,814	576,533	560,453	543,990	525,482	508,249	495,593	480,750	472,545	456,965	455,750	439,549	421,256	421,868	412,942	407,025	417,704	428,045	438,911	450,300	462,214	474,652	498,371	521,537	544,705	567,872
RATE OF RETURN ON NET FIXED ASSETS	8,291	7,391	6,243	4,941	4,631	5,301	6,513	7,581	8,611	9,641	10,991	12,201	12,651	13,111	13,101	13,561	14,131	14,061	14,321	14,811	15,341	16,031	15,021	14,521	14,931	15,001	15,601	16,271	17,121	18,001

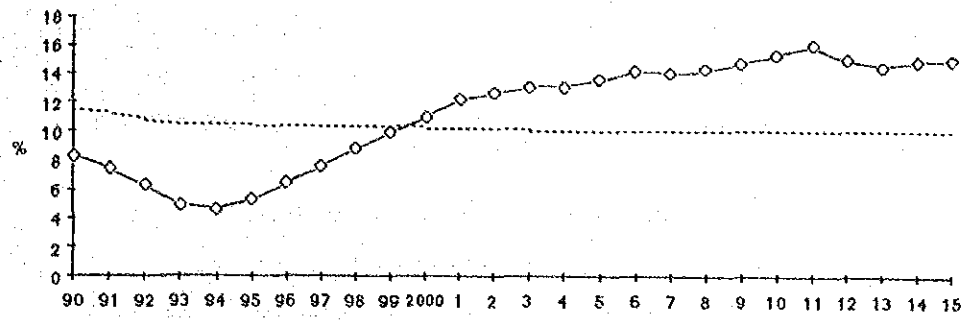


Fig. 7-6-3 Rate of Return on Net Fixed Assets

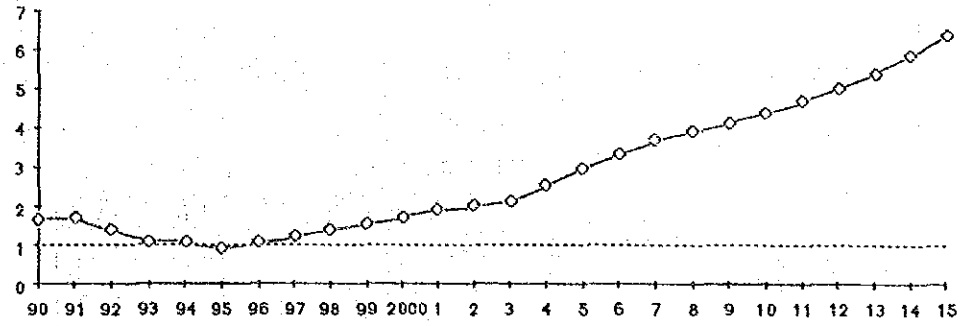


Fig. 7-6-4 Debt Service Coverage Ratio

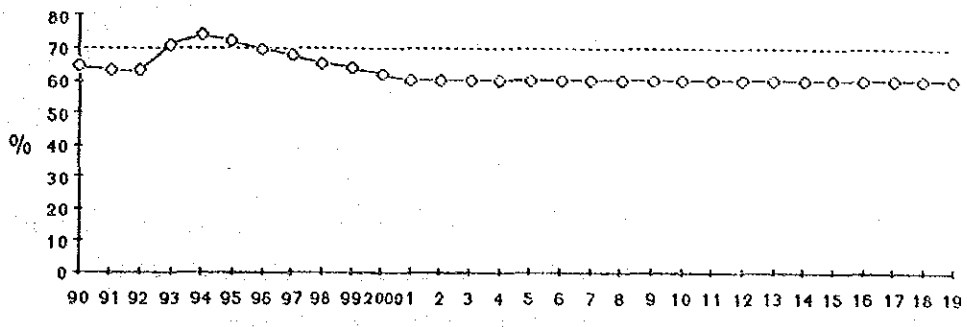


Fig. 7-6-5 Operating Ratio

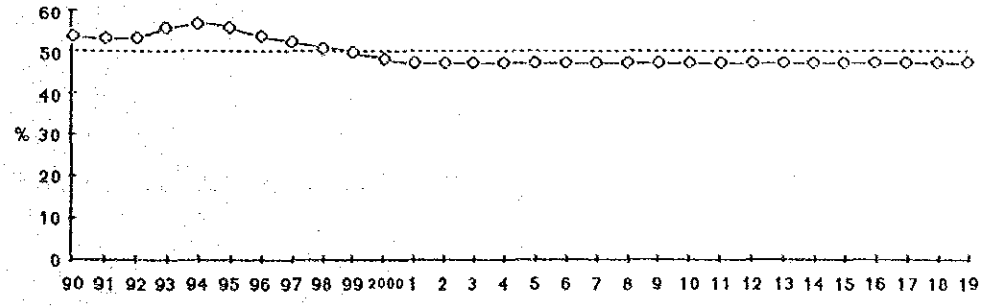


Fig. 7-6-6 Working Ratio

7-6-7 Sensitivity Analysis

Sensitivity analysis is made for the following four cases.

Case I : The project costs increase by 10%
Case II : The cargo volume decrease by 10%
Case III : The interest rate on long term loans is 7.5%
Case IV : The interest rate on long term loans is 5.0%

(1) Viability of the project

The FIRR of each case are as shown in Table 7-6-3.

Table 7-6-3 FIRR (Sensitive Analysis)

	CASE I	CASE II	CASE III	CASE IV
FIRR	7.42	7.20	8.68	
AVERAGE INTEREST RATE	5.1		3.8	2.5

The ratio of each case exceeds the weighted average interest rate of funds during the project life.

(2) Financial soundness of SLPA

The financial indicators of each case are shown in Appendix 7-6-7. Based on these indicators, there will be no major problems with the financial soundness of SLPA.

In case IV, the cash shortage is remarkably reduced and the short-term loans are unnecessary after 2001.

7-6-8 Conclusions

Judging from the above analysis, this project is financially feasible for SLPA.

However, it is recommended that the following measures be taken in

order to improve the financing during the project life in view of the current political situation, the economy and the cost of the future development of the ports in Sri Lanka, etc.

(1) The re-lending rate on the long-term loans from the government to SLPA should be kept as low as possible.

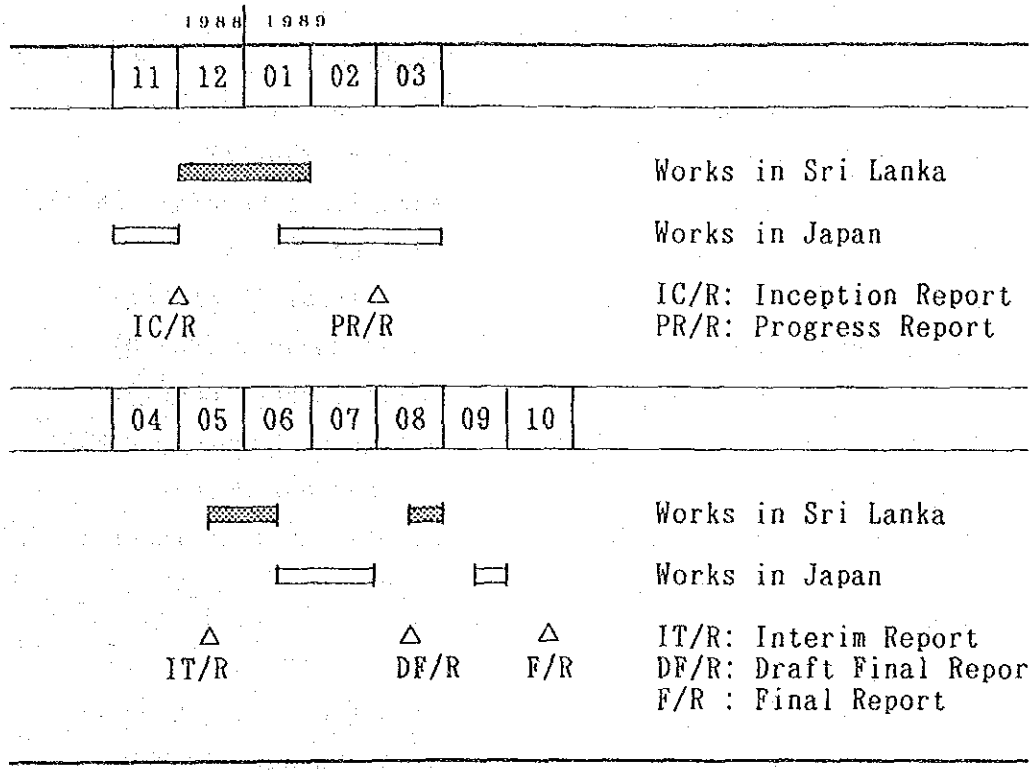
(2) SLPA should maintain its efforts to secure a sufficient cargo volume and to improve cargo handling efficiency from now on.

(3) In the present depreciation system of SLPA, the service lines of assets are set regardless of their materials or structure. This system should be improved to fit the actual service lives of assets.

APPENDIX

LIST OF APPENDIX

Overall Study Schedule



Team's Formation

Dr. Kazuo KUDO	Team Leader
Mr. Osamu KUNITA	Co-leader, Port Planning
Mr. Tomoo Amano	Cargo Forecast, Economic Analisys
Mr. Yoshio Yamauchi	Port Operation, Management, Financial Analisys
Mr. Sinichi Saga	Financial Analisys(JCT#3)
Mr. Michiro Isawa	International Container Traffic
Mr. Tosiro Ichizono	Design of Port Facilities
Mr. Hisasi Aono	Natural Conditions(Meteology, Oceanography)
Mr. Kenich Sasaki	Work Planning, Cost Estimate
Mr. Yosimitsu Suzuki	Natural Conditions(Survey, Soil)

Mr. Toshiyuki Iwama Coodination (JICA HEADQUARTER)

Counterpart

SLPA

First Visit Dec, 1988-Feb, 1989

Mr. Wimal Amarasekera	-	Chairman
Mr. K.S.C. de Fonseka	-	Managing Director
Mr. S.K.W. Dias	-	General Manager
Mr. C.D. Chinnakone	-	Additional General Manager
Capt. G.O. Henricus	-	Harbour Master
Mr. H.A. Wijegunawardena	-	Additional Chief Engineer
Mr. M. Ramanayake	-	Chief Manager (P,R&D)
Mr. W.A.W. Weerasinghe	-	Chief Finance Manager
Mr. G.P. Weerasinghe	-	Dy. Chief Manager (P,R&D)
Capt. S. Chinnaiah	-	Dy. Harbour Master
Mr. S.K. Malaviarachchi	-	Supdt. Civil Engineer (CPEP)
Mr. D.S.B. Hettiarachchi	-	Supdt. Civil Engineer (Maritime Development)
Mr. D.B. Ranasinghe	-	Manager (Control Room)
Mr. H.S.R. Perera	-	Data Processing Manager
Mr. R. Rajakumar	-	Asst. Manager (P,R&D)

Second Visit May-June, 1989 and Third Visit Aug, 1989

Mr. A. de Vass Gunawardena - Chairman

Mr.K.S.C.De.Fonseka	-	Managing Director
Mr.S.K.W.Dias	-	General Manager
Mr.C.D.Chinnakone	-	Addl. General Manager
Mr.M.Ramanaya ke	-	Chief Manager (PR&D)
Mr.H.A.Wijegunawardena	-	Chief Engineer (Ports)
Capt.S.Chinnaiah	-	Harbour Master
Mr.D.B.Ranasinghe	-	Chief Operation Manager
Mr.G.P.Weerasinghe	-	Dy.Chief Manager (P.R.& D).
Mr.S.K. Malawiarachchi	-	SCE (CPEP)
Mr.H.S.R.Perera	-	D.P.M.
Mr.H.Premaratne	-	Statistician
Dr. H.V.Dayananda	-	Lanka Hydraulic Institute(L.H.I)
Mr. H.Ratnaweera	-	L.H.I

Ministry of Trade & Shipping May, 1989

Hon. A.R. Munsoor, M.P., Minister of Trade & Shipping

Hon. Indradasa Hettiarachchi, M.P., Minister of State for Shipping.

Mr. Harsha Wickramasinghe, Secretary, Ministry of Trade & Shipping.

Mr. S.M.W. Kirinde, Secretary to the Ministry of State for Shipping.

Sri Lanka Ports Authority

Board of Directors

Mr. A. De Vass Gunawardena (B.A. Econ.)	- Chairman
Mr. F.A. Yaseen	- Vice Chairman
Mr. K.S.C. de Fonseka B.Sc. (Eng.) (Cey.) D.H.E. (Delft) C. Eng. M.I.C.E. (Lond.) F.I.E. (S.L.) Fellow E.D.I.	- Managing Director
Mr. Gamini Siriwardena, J.P.,	- Working Director
Mr. P. Weerasekera S.L.A.S. B.A. (Hons) (Cey.) Principal Collector of Customs	- Director
Mr. D.A. Peiris Deputy Director of Finance General Treasury	- Director
Mr. A. Mohan Pandithage	- Director
Mr. C.R.B. Fernando B.A. (Econ) D.A.I.P. (World Bank) D.S.I.M. (Delft) Director, Fisheries (Planning & Programming)	- Director -
Mr. G.A. Jokin, J.P.,	- Director
Mr. N.E.H.D. Talpawela, J.P., Attorney-at-Law	- - Secretary and Chief Law Officer
Mr. S.K.W. Dias B.A. (Cey) M.C.I.T. M.B.A. (I) Canada F.B.I.M. (Lond)	- General Manager
Mr. C.D. Chinnakone B.A. (Econ.)	- Addl. General Manager

Climate of Sri Lanka

1.1 MEAN TEMPERATURE

Degrees Celsius

Centre		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1. Anuradhapura	..	27.8	27.6	27.8	28.3	28.2	27.9	28.0	28.9	27.7	27.9	28.8	28.8
2. Badulla	..	23.4	23.6	23.7	23.7	23.9	23.4	23.6	24.6	23.5	23.5	23.5	24.2
3. Battocaloa	..	27.7	27.7	28.3	28.3	28.3	27.5	27.6	27.9	27.6	27.9	28.2	28.3
4. Colombo	..	27.3	27.3	27.5	27.7	27.8	27.5	27.3	27.8	27.1	27.4	27.5	27.8
5. Diyatalawa	..	20.1	20.4	20.4	20.7	20.5	20.3	20.6	21.0	20.0	20.2	20.0	20.1
6. Galle	..	26.6	26.6	26.7	27.0	27.0	27.9	26.9	27.3	26.7	25.4	26.9	27.6
7. Hambantota	..	27.2	27.2	27.2	27.5	27.3	28.1	27.0	27.6	27.4	27.1	27.5	28.0
8. Jaffna	..	27.7	27.8	28.0	28.3	28.4	28.0	28.1	28.6	26.8	n.a.	n.a.	n.a.
9. Katugastota	..	24.8	24.8	24.7	25.1	24.8	24.6	25.1	25.3	24.3	24.5	27.8	25.3
10. Kankesanturai	..	28.1	28.0	28.3	28.2	28.2	27.6	28.0	24.8	28.3	28.1	24.8	28.9
11. Katunayake	..	27.5	27.6	27.8	28.1	27.9	27.7	27.6	25.6	27.2	28.0	28.1	28.0
12. Kurunegala	..	27.6	27.7	27.6	28.0	27.6	27.3	27.3	28.1	26.8	26.7	27.0	28.0
13. Maha Illuppallama	..	27.6	27.3	27.6	28.1	28.1	27.3	27.7	28.5	27.4	27.7	28.1	27.0
14. Mannar	..	27.8	28.0	28.0	28.3	28.3	27.9	28.1	28.5	27.9	28.1	28.0	28.8
15. Mulathivu	..	—	—	—	—	—	28.5	28.7	28.9	25.0	28.6	28.7	29.7
16. Nuwara Eliya	..	15.6	15.7	15.4	15.8	15.6	15.6	15.7	16.5	15.6	15.8	15.9	16.1
17. Pothuvil	..	—	—	—	—	—	—	—	28.5	27.8	28.3	27.5	28.7
18. Puttalam	..	27.8	27.9	27.6	27.9	28.1	27.7	27.8	28.0	27.2	27.5	27.8	28.0
19. Ratmalana	..	27.1	27.2	26.8	27.4	27.6	27.4	27.5	27.6	27.5	27.8	n.a.	28.3
20. Ratnapura	..	27.6	27.8	27.4	27.6	27.7	27.4	27.5	28.2	27.2	27.3	27.6	28.9
21. Trincomalee	..	28.5	28.8	28.6	28.9	29.1	28.6	28.9	26.5	27.8	28.7	28.4	29.2
22. Vavuniya	..	27.8	27.4	27.8	28.1	27.8	27.6	28.0	28.8	27.7	n.a.	27.8	27.6

1.2 AVERAGE RAINFALL

Millimetres

District		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1. Colombo	..	2,107	3,425	2,418	2,575	2,121	2,389	2,922	2,024	3,015	3,006	2,182	2,448
2. Gampaha	..	-	—	—	n.a.	n.a.	n.a.	n.a.	n.a.	2,683	2,533	1,545	2,015
3. Kalutara	..	3,252	4,157	2,926	3,772	2,805	3,232	3,761	3,673	4,477	4,349	3,129	3,531
4. Galle	..	3,603	2,766	3,094	3,210	2,162	2,449	3,046	1,444	2,740	3,228	2,297	2,650
5. Matara	..	2,277	2,629	2,844	2,369	2,212	3,296	3,122	2,044	2,617	2,895	2,317	2,609
6. Hambantota	..	1,072	1,288	1,421	1,214	1,281	1,128	1,542	1,080	1,360	1,485	1,159	930
7. Monaragala	..	1,305	1,600	1,477	1,268	918	1,387	1,600	1,060	1,817	1,543	1,500	1,636
8. Badulla	..	1,381	1,605	1,424	1,641	1,194	1,364	1,464	1,353	2,338	1,977	2,484	2,318
9. Kandy	..	2,359	2,745	3,350	2,909	2,464	2,535	3,012	2,029	3,046	3,310	2,884	2,157
10. Matale	..	1,161	1,848	1,465	1,498	1,749	1,552	1,829	1,255	2,524	1,968	1,765	1,727
11. Nuwara Eliya	..	1,619	2,089	2,430	2,616	2,111	2,250	1,999	1,321	3,411	3,224	2,905	2,542
12. Kegalle	..	2,991	3,927	4,351	3,814	3,150	3,467	4,043	2,876	4,272	3,851	3,011	3,129
13. Ratnapura	..	2,250	2,413	2,345	2,706	2,193	2,430	4,244	2,186	3,642	2,557	3,124	2,561
14. Kurunegala	..	1,492	1,742	1,822	1,615	1,350	1,398	1,970	1,154	2,092	1,520	1,084	1,491
15. Puttalam	..	1,224	1,918	1,500	1,280	1,035	1,159	1,284	817	2,206	1,297	820	1,298
16. Trincomalee	..	939	1,102	1,256	1,348	773	1,418	1,501	1,185	2,277	1,244	1,749	1,190
17. Batticaloa	..	1,516	1,408	—	1,690	986	1,320	1,348	971	2,275	1,327	1,644	1,208
18. Ampara	..	1,469	1,315	1,284	1,304	1,119	1,609	1,384	1,098	1,829	1,620	1,920	1,148
19. Anuradhapura	..	1,201	1,681	1,265	1,246	1,117	1,142	1,177	1,255	2,046	1,299	1,191	1,055
20. Polonnaruwa	..	1,357	1,602	—	1,405	1,066	1,529	1,630	1,225	2,212	1,533	1,510	1,064
21. Jaffna	..	1,088	1,438	1,214	1,441	846	1,297	980	1,170	2,016	1,688	1,028	696
22. Killinochchi	..	—	—	—	—	—	—	—	—	—	—	—	—
23. Mullativu	..	—	—	—	n.a	n.a	n.a.	n.a.	n.a.	2,004	1,572	1,050	1,076
24. Mannar	..	961	1,210	1,052	1,200	643	956	920	791	1,445	714	942	930
25. Vavuniya	..	1,219	1,479	1,401	1,497	761	1,386	1,133	1,310	2,390	1,678	929	1,098

BASIC ECONOMIC INDICATORS

	1987	1988
Population		
Mid-year estimate Mn.	16·4	16·6
Growth rate %	1·5	1·4
National Income		
Rate of Growth of GDP% (In real terms)	1·5	2·7
Rate of growth of GNP% (In real terms)	1·6	2·5
Per Capita GNP (current prices) Rs.	10,598	11,939
US $	360	375
Sectoral Growth Rates (%)		
Agriculture, Forestry and Fishing	- 5·8	2·1
Mining and Quarrying	19·0	9·0
Manufacturing	6·8	4·7
Construction	1·8	1·5
Services	2·7	2·2
Investment and Savings As a percentage of Gross Domestic Product (at current market prices)		
Investment	23·3	23·1
Government	5·7	6·3
Domestic Savings	12·8	12·8
National Savings	15·3	14·8
Prices		
Colombo Consumers' Price Index %Change Dec. - Dec.	10·2	15·0
Average Annual % Change	7·7	14·0
%Change in Implicit GNP Deflator	6·8	11·5
Exchange Rates (Average)		
Rs./US $	29·44	31·81
Rs./SDR	38·10	42·76

		1987	1988
Trade			
Imports	Rs. Mn.	60,528	71,200
	SDR Mn.	1,589	1,665
Exports	Rs. Mn.	41,133	46,928
	SDR Mn.	1,080	1,097
Tea	,,	280	288
Rubber	,,	77	87
Coconut	,,	56	36
Garments and Textiles	,,	339	333
Petroleum Products	,,	68	53
Other Industrial Exports	,,	118	144
Balance of Payments (SDR Mn.)			
Trade Balance		- 525	- 574
Services Account		- 121	- 126
Private Transfers		242	262
Official Transfers		139	142
Current Account Balance		- 265	- 324
Overall Balance		- 72	- 101
Overall Debt Service Ratio %		27·7	28·8
Government Finance			
As a percentage of Gross Domestic Products			
Government Expenditure		32·5	34·4
Government Revenue		21·4	18·9
Current Account Surplus/ Deficit (-)		1·3	- 2·2
Budget Deficit (before grants)		11·1	15·5
Budget Deficit (after grants)		8·7	13·0
Money and Credit			
%Change M_1		18·4	29·1
%Change M_2		14·7	16·4
%Change in Domestic Credit		17·9	28·2
%Change in External Banking Assets (net)		- 5·0	- 44·8

Exchange Rates Since 16th November 1977(*a*)

(Rupees per 100 Units of Foreign Currency)

Date	U.S. Dollar		U.K. Pound Sterling		German Deutsche Mark		French Franc		Japanese Yen		Indian Rupee	
	Buying Rate	Selling Rate	Buying Rate	Selling Rate	Buying Rate	Selling Rate	Buying Rate	Selling Rate	Buying Rate	Selling Rate	Buying Rate	Selling Rate
1977 November 16	1597.00	1603.00	2900.00	2911.00	709.00	712.00	328.00	329.50	6.5070	6.5370	184.70	185.50
1977 December 31	1553.00	1559.00	2979.75	2990.75	741.00	744.00	331.45	332.95	6.4730	6.5030	184.60	185.40
1978 December 31	1549.00	1552.00	3164.05	3170.05	854.55	856.15	374.25	374.95	8.0290	8.0440	190.45	190.85
1979 December 31	1543.00	1546.00	3453.50	3459.50	899.20	900.80	385.65	386.35	6.4465	6.4615	193.80	194.20
1980 December 31	1798.50	1801.50	4266.55	4272.55	920.45	922.05	397.15	397.85	8.7475	8.7625	228.55	228.95
1981 December 31	2053.50	2056.50	3906.90	3912.40	906.05	907.25	357.75	358.25	9.3235	9.3365	220.41	220.85
1982 November 9	2092.50	2095.50	3466.55	3472.05	808.45	809.65	286.55	287.05	7.6550	7.6680	214.09	214.51
November* (10*b*)	2102.25	2103.75	*3500.02		*816.60		*289.11		*7.8026		*214.30	
December 31	2131.25	2132.75	3461.30		898.06		317.26		9.1228		215.97	
1983 December 31	2499.25	2500.75	3589.38		910.50		297.44		10.7124		235.31	
1984 December 31	2627.25	2628.75	3051.11		834.95		272.76		10.4973		211.92	
1985 December 31	2740.00	2741.50	3957.64		1110.74		361.67		13.6017		225.75	
1986 December 31	2851.25	2852.75	4179.61		1467.27		443.37		17.9371		216.45	
1987 January 31	2858.75	2860.25	4384.47		1601.06		480.02		18.7730		220.91	
February 28	2873.25	2874.75	4414.46		1575.66		473.05		18.7788		220.13	
March 31	2876.75	2879.75	4632.54		1597.25		479.51		19.6736		222.72	
April 30	2892.75	2895.75	4813.14		1617.80		484.84		20.7622		228.43	
May 31	2900.75	2903.75	4724.86		1594.20		478.25		20.1755		223.10	
June 30	2925.00	2928.00	4694.54		1599.18		479.24		19.9448		227.04	
July 31	2946.50	2949.50	4705.01		1587.81		477.18		19.5426		225.53	
August 31	2973.50	2976.50	4852.23		1639.75		490.92		20.9212		227.29	
September 30	3010.50	3013.50	4899.62		1637.13		491.84		20.5268		229.92	
October 31	3043.50	3046.50	5222.33		1755.55		521.63		21.9809		234.70	
November 30	3050.00	3053.00	5563.49		1857.61		544.28		23.0389		233.89	
December 31	3074.75	3077.75	5717.21		1928.26		569.36		24.9089		240.43	
1988 January 31	3080.75	3083.75	5488.87		1849.87		548.59		24.2420		235.42	
February 29	3083.50	3086.50	5474.33		1830.75		540.66		24.0865		236.50	
March 31	3088.25	3091.25	5796.37		1859.73		548.36		24.6982		237.81	
April 30	3093.00	3096.00	5801.72		1854.10		545.41		24.8524		233.11	
May 31	3098.00	3101.00	5770.34		1815.60		538.67		24.8656		231.74	
June 30	3129.50	3132.50	5358.08		1727.26		511.73		23.9520		222.82	
July 31	3198.50	3201.50	5524.80		1714.90		508.58		24.1327		224.80	
August 31	3284.50	3287.50	5550.05		1758.63		517.85		24.3498		230.04	
September 30	3297.50	3300.50	5555.35		1753.39		515.28		24.5407		226.88	
October 31	3295.00	3298.00	5844.69		1863.69		545.82		26.3089		221.14	
November 30	3295.75	3298.75	6091.67		1901.03		556.69		27.0599		220.08	
December 31	3301.75	3304.75	5907.86		1847.97		541.21		26.3102		218.48	

Source : Central Bank of Sri Lanka.

(*a*) From the mid-night of 15th November 1977, the Sri Lanka Rupee was allowed to float and daily buying and selling rates of major currencies for telegraphic transfers by commercial banks were announced by the Central Bank.

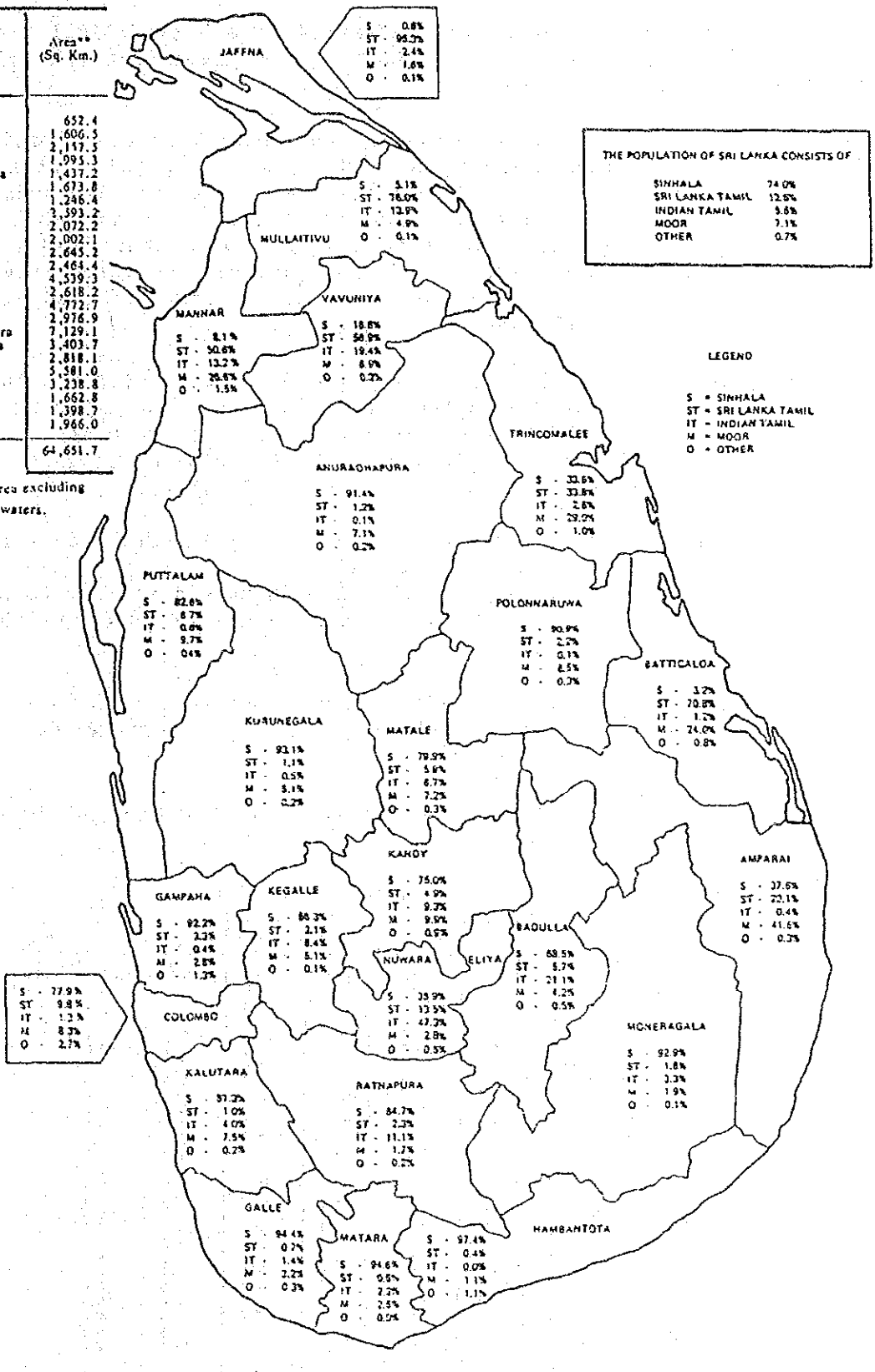
(*b*) From 10th November 1982, the Central Bank's foreign exchange transactions with commercial banks were carried out exclusively in U.S. Dollars and the spot buying and selling rates for the U.S. Dollar for transactions with commercial banks were announced by the Central Bank (in the morning of every working day.)

* From this date onwards Middle Rates are given for all major currencies except the U.S. Dollar.

A MAP OF SRI LANKA WITH THE ADMINISTRATIVE DISTRICTS SHOWING THE DISTRIBUTION OF POPULATION - 1981 CENSUS

		Area** (Sq. Km.)
1.	Colombo	652.4
2.	Kalutara	1,606.5
3.	Kandy	2,157.5
4.	Matale	1,995.3
5.	Nuwara Eliya	1,437.2
6.	Galle	1,673.8
7.	Matara	1,246.4
8.	Hambantota	2,393.2
9.	Jaffna	2,072.2
10.	Mannar	2,002.1
11.	Vavuniya	2,645.2
12.	Batticaloa	2,464.4
13.	Ampara	4,539.3
14.	Trincomalee	2,618.2
15.	Kurunegala	4,772.7
16.	Puttalam	2,976.9
17.	Anuradhapura	7,129.1
18.	Polonnaruwa	3,403.7
19	Badulla	2,818.1
20.	Monaragala	5,581.0
21.	Ratnapura	3,238.8
22.	Kegalle	1,662.8
23.	Gampaha	1,398.7
24.	Mullaithivu	1,966.0
		64,651.7

** Total land area excluding large inland waters.



CLASSIFICATION OF ROADS

Roads in Sri Lanka are classified in a hierarchical order as 'A', 'B', 'C', 'D' and 'E' Class Roads. The prevailing criteria for classification of roads are -

'A' Class - All roads comprising the network of trunk roads connecting the National Capital with the Administrative District Capitals and also connecting the District Capitals with one another. Also included in this category are other major roads which are paved and bitumen surfaced having a carriageway width over 7.32 meters and road platform width over 11.0 meters.

'B' Class - Main roads connecting other important towns to the District Capitals and also providing important links with the trunk road system. All 'B' Class roads are paved and bitumen surfaced having carriageway widths between 3.66 meters and 7.32 meters.

'C' Class - Other minor roads such as agricultural roads and local roads. These roads are single lane having carriageway widths of 3.66 meters and platform width of 5.5 meters and are generally paved and bitumen surfaced.

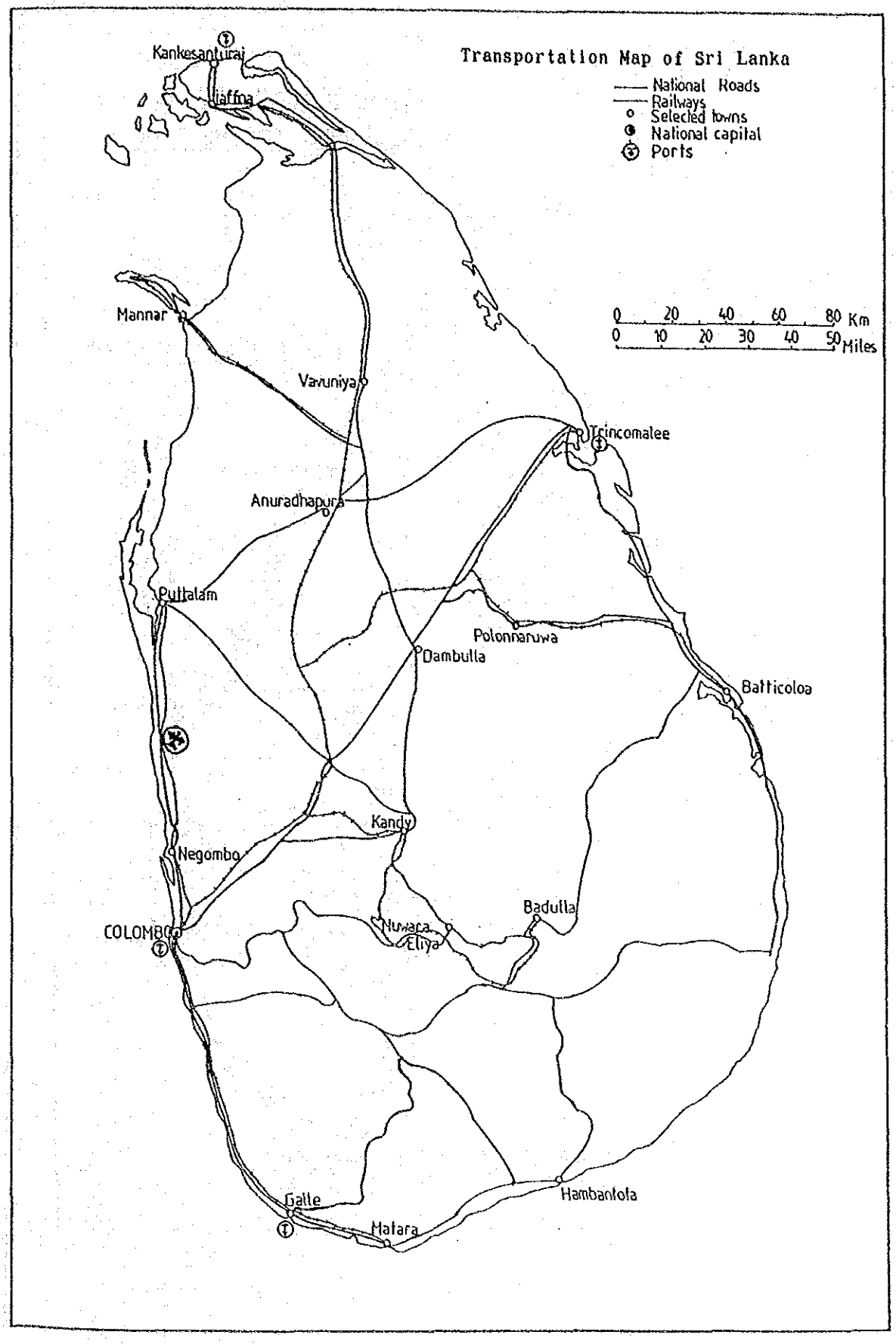
'D' Class - Gravelled roads having 2.44 meters to 3.05 meters travelled surface generally motorable during dry weather only.

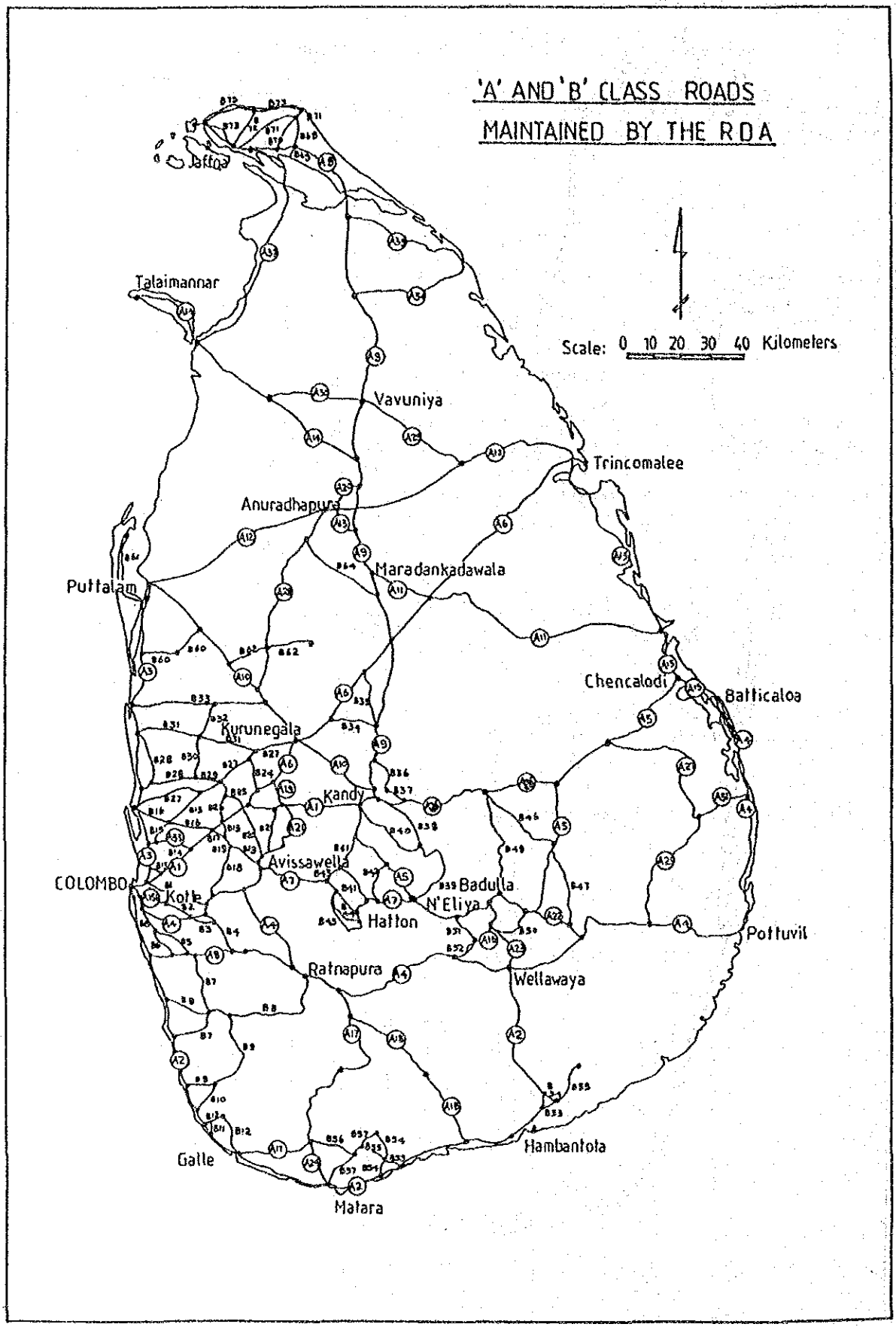
'E' Class - Bridle paths, generally non-motorable but some are jeepable.

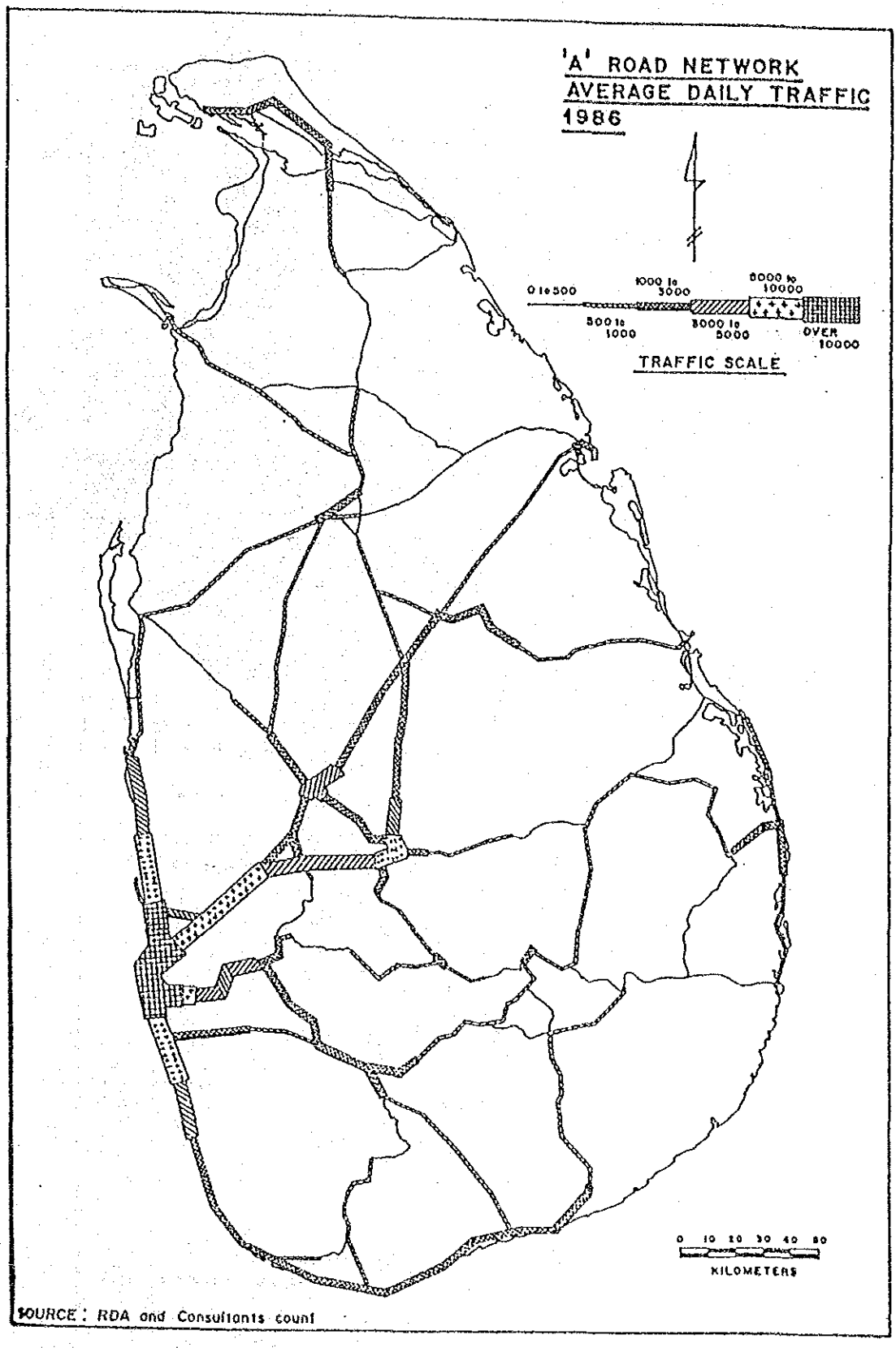
Appendix 1-5 Population by Religion

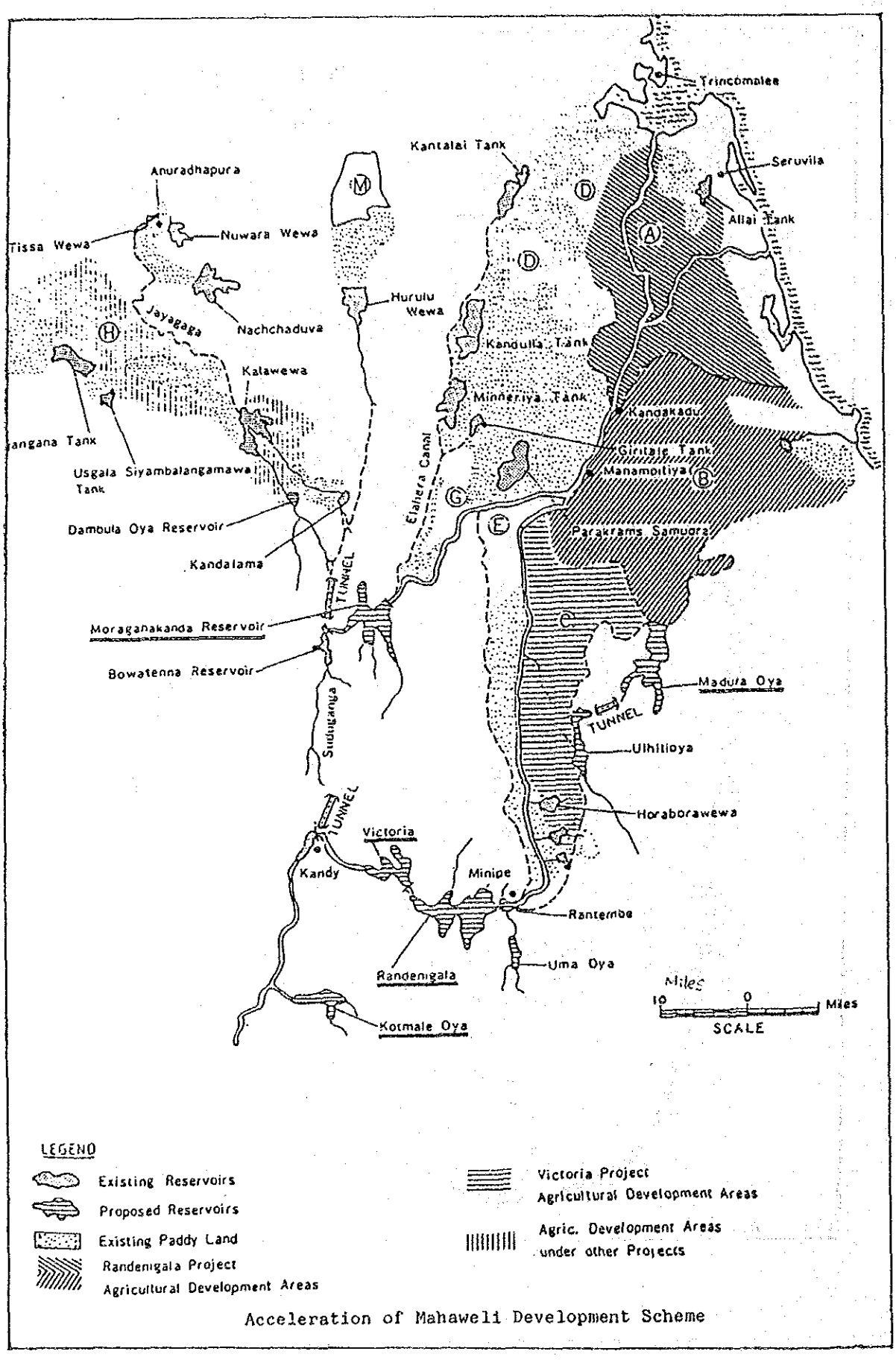
District	No. of Persons	Religion—Percent				
		Buddhist	Hindu	Muslim	Christian	Other
1. Colombo	1,698,322	70.8	7.6	10.0	11.4	0.2
2. Kalutara	827,189	84.4	4.5	7.6	3.5	0.0
3. Kandy	1,126,296	74.4	11.9	11.2	2.3	0.2
4. Matale	357,441	78.7	11.6	7.4	2.3	0.0
5. Nuwara Eliya	522,219	35.4	55.6	3.0	5.9	0.1
6. Galle	814,579	94.1	1.8	3.2	0.6	0.3
7. Matara	644,231	94.6	2.4	2.6	0.4	0.0
8. Hambantota	424,102	97.3	0.4	2.2	0.1	0.0
9. Jaffna	831,112	0.5	85.2	1.7	12.6	0.0
10. Mannar	106,940	3.0	26.7	28.1	42.1	0.1
11. Vavuniya	95,904	16.4	69.3	7.1	7.2	0.0
12. Batticaloa	330,899	2.7	66.3	24.1	6.8	0.1
13. Amparai	388,786	37.2	19.1	41.6	2.0	0.1
14. Trincomalee	256,790	32.3	31.8	29.5	6.1	0.3
15. Kurunegala	1,212,755	90.4	1.1	5.3	3.2	0.0
16. Puttalam	493,344	47.5	4.2	10.2	38.0	0.1
17. Anuradhapura	587,822	90.2	1.0	7.5	1.2	0.1
18. Polonnaruwa	262,753	89.9	2.0	6.7	1.3	0.1
19. Badulla	642,893	68.2	25.0	4.5	2.2	0.1
20. Monaragala	279,743	92.8	4.6	2.1	0.5	0.0
21. Ratnapura	796,468	84.6	11.9	1.9	1.6	0.0
22. Kegalle	682,411	85.3	7.7	5.4	1.6	0.0
23. Gampaha	1,389,490	71.1	1.9	3.4	23.5	0.1
24. Mullathivu	77,512	1.3	78.2	4.9	15.6	0.0
Total	14,850,001	69.3	15.5	7.6	7.5	0.1

Source: Department of Census and Statistics.


Transportation Map of Sri Lanka
National Roads
Railways
Selected towns
National capital
Ports
0 20 40 60 80 Km
0 10 20 30 40 50 Miles
Kankesanturai
Jaffna
Mannar
Vavuniya
Trincomalee
Anuradhapura
Puttalam
Polonnaruwa
Dambulla
Batticoloa
Kandy
Negombo
COLOMBO
Badulla
Nuwara Eliya
Galle
Matara
Hambantota


'A' AND 'B' CLASS ROADS
MAINTAINED BY THE RDA
Scale: 0 10 20 30 40 Kilometers
Jaffna
Talaimannar
Vavuniya
Trincomalee
Anuradhapura
Puttalam
Maradankadawala
Chencalodi
Batticaloa
Kurunegala
Kandy
COLOMBO
Kotte
Avissawella
Badulla
N'Eliya
Hatton
Pottuvil
Ratnapura
Wellawaya
Galle
Hambantota
Matara


'A' ROAD NETWORK
AVERAGE DAILY TRAFFIC
1986
0 to 500
500 to 1000
1000 to 3000
3000 to 5000
5000 to 10000
OVER 10000
TRAFFIC SCALE
0 10 20 30 40 50
KILOMETERS
SOURCE : RDA and Consultants count



Acceleration of Mahaweli Development Scheme

New Land Cultivated under Mahaweli Development Programme

Hectares

Item	Maha 1984/85	Yala 1985	Total 1985	Maha 1985/86	Yala 1986	Total 1986	Maha 1986/87	Yala 1987	Total 1987	Maha 1987/88 (*a*)	Yala 1988 (*a*)	Total 1988 (*a*)
System 'H' ..	23,309	18,319	41,628	24,298	21,225	45,523	24,965	13,058	38,023	24,847	14,307	39,154
Paddy ..	22,957	9,709	32,666	23,449	8,983	32,432	23,317	5,933	29,250	23,560	5,428	28,988
Other Crops ..	352	8,610	8,962	849	12,242	13,091	1,648	7,125	8,773	1,287	8,879	10,166
System 'B'	2,535	2,246	4,781	3,851	3,554	7,405	5,961	5,805	11,766	8,759	8,190	16,949
Paddy ..	2,472	2,061	4,533	3,686	3,463	7,149	5,120	5,479	10,599	8,368	7,722	16,090
Other Crops ..	63	185	248	165	91	256	841	326	1,167	391	468	859
System 'C'	7,545	4,857	12,402	9,358	7,868	17,226	10,139	9,588	19,727	14,164	4,154	18,318
paddy ..	6,086	4,827	10,913	7,945	7,782	15,727	9,057	9,480	18,537	12,420	4,090	16,510
Other Crops ..	1,459	30	1,489	1,413	86	1,499	1,082	108	1,190	1,744	64	1,808
System 'G'	3,258	2,106	5,364	3,315	2,731	6,046	3,279	2,709	5,988	4,507	3,109	7,616
Paddy ..	2,941	1,198	4,139	3,153	1,423	4,576	3,220	1,176	4,396	4,094	1,236	5,330
Other Crops ..	317	908	1,225	162	1,308	1,470	59	1,533	1,592	413	1,873	2,286
Total ..	36,647	27,528	64,175	40,822	35,378	76,200	44,344	31,160	75,504	52,277	29,760	82,037

(*a*) Provisional.

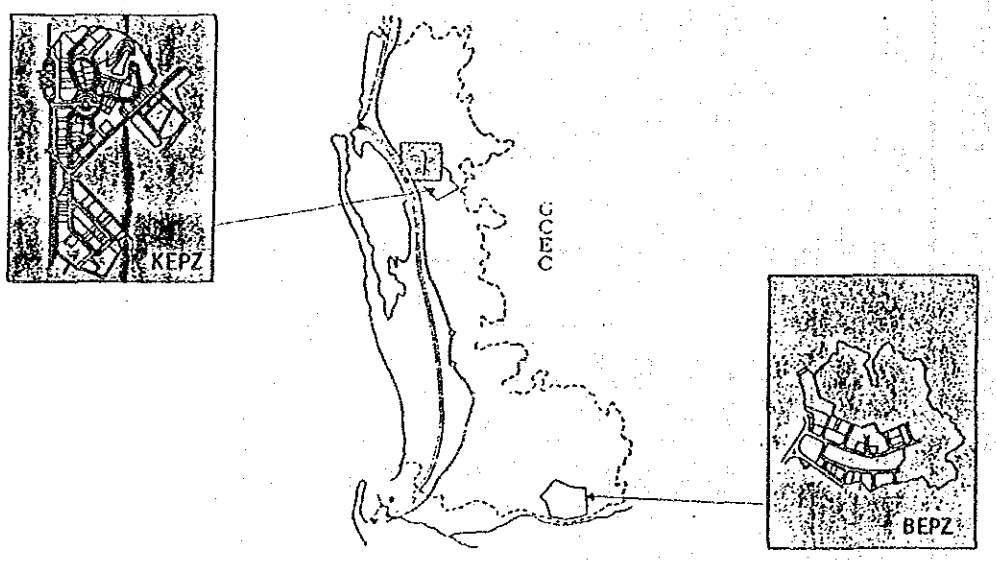
Source : Mahaweli Authority of Sri Lanka.

Investment Promotion Zones - Employment and Export Earnings 1987 - 1988

Category	1987		1988 (*a*)	
	Employment (End Dec.)	Gross Export Earnings (f. o. b.) Rs. Mn.	Employment (End Dec.)	Gross Export Earnings (f. o. b.) Rs. Mn.
1. Food, beverages and tobacco ..	641	147·0	796	199·3
2. Textile, wearing apparel and leather products ..	38,342	5,989·2	39,848	6,978·6
3. Wood and wood products (Including furniture) ..	56	4·0	77	6·2
4. Chemicals, petroleum, coal, rubber and plastic products ..	1,999	273·0	2,285	378·7
5. Non-metallic mineral products (Except petroleum and coal) ..	2,132	309·5	2,817	667·3
6. Fabricated metal products machinery and transport equipment ..	435	177·0	1,202	413·9
7. Products not elsewhere specified ..	3,333	424·7	3,680	497·1
8. Services (*b*) ..	3,805	209·8	3,921	405·2
Total ..	50,743	7,534·1	54,626	9,546·3

(*a*) Provisional.
(*b*) Excluding "Air Lanka Ltd".

Source : Greater Colombo Economic Commission.



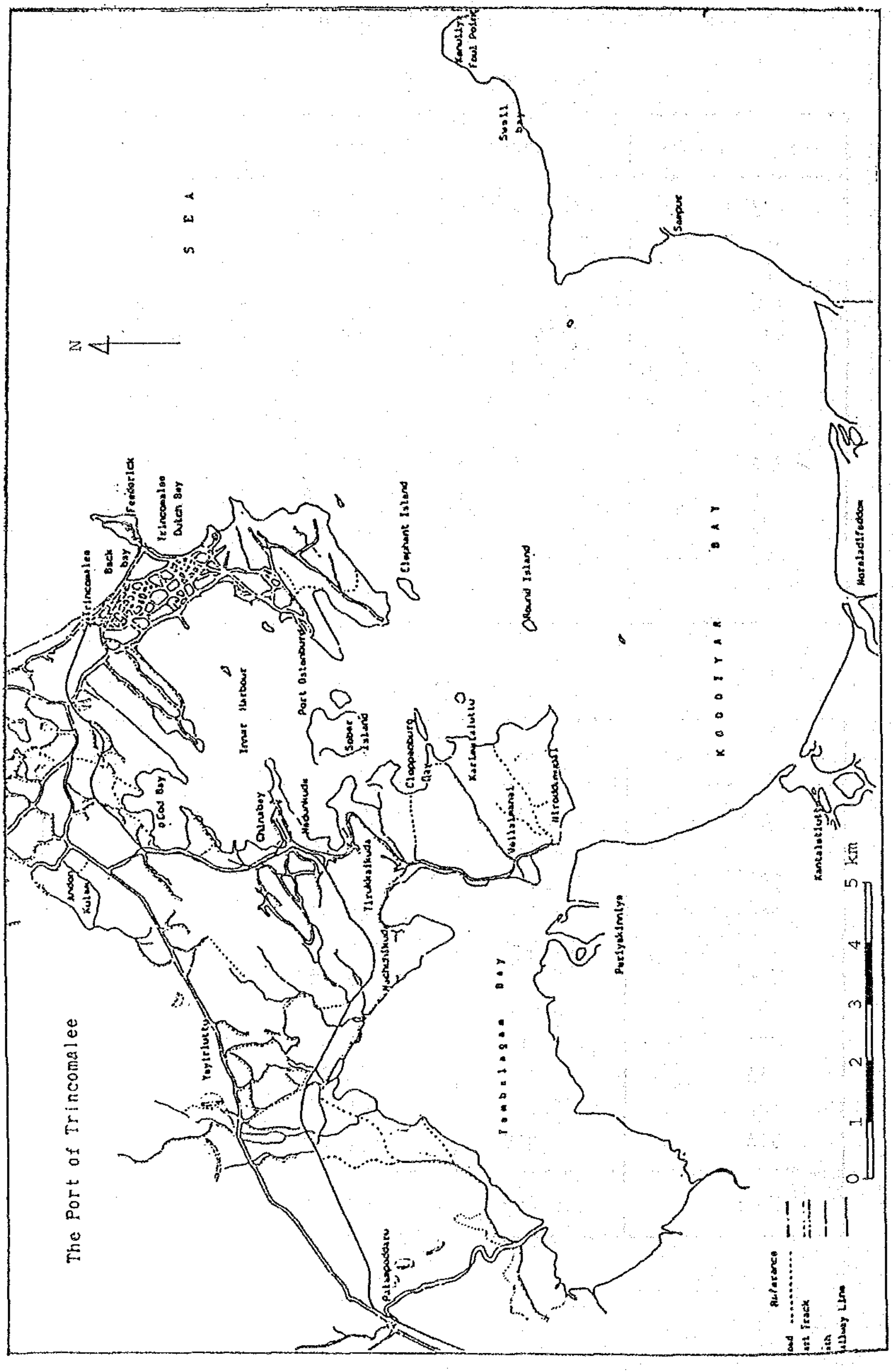
Air Line Statistics (Source: Department of Civil Aviation)

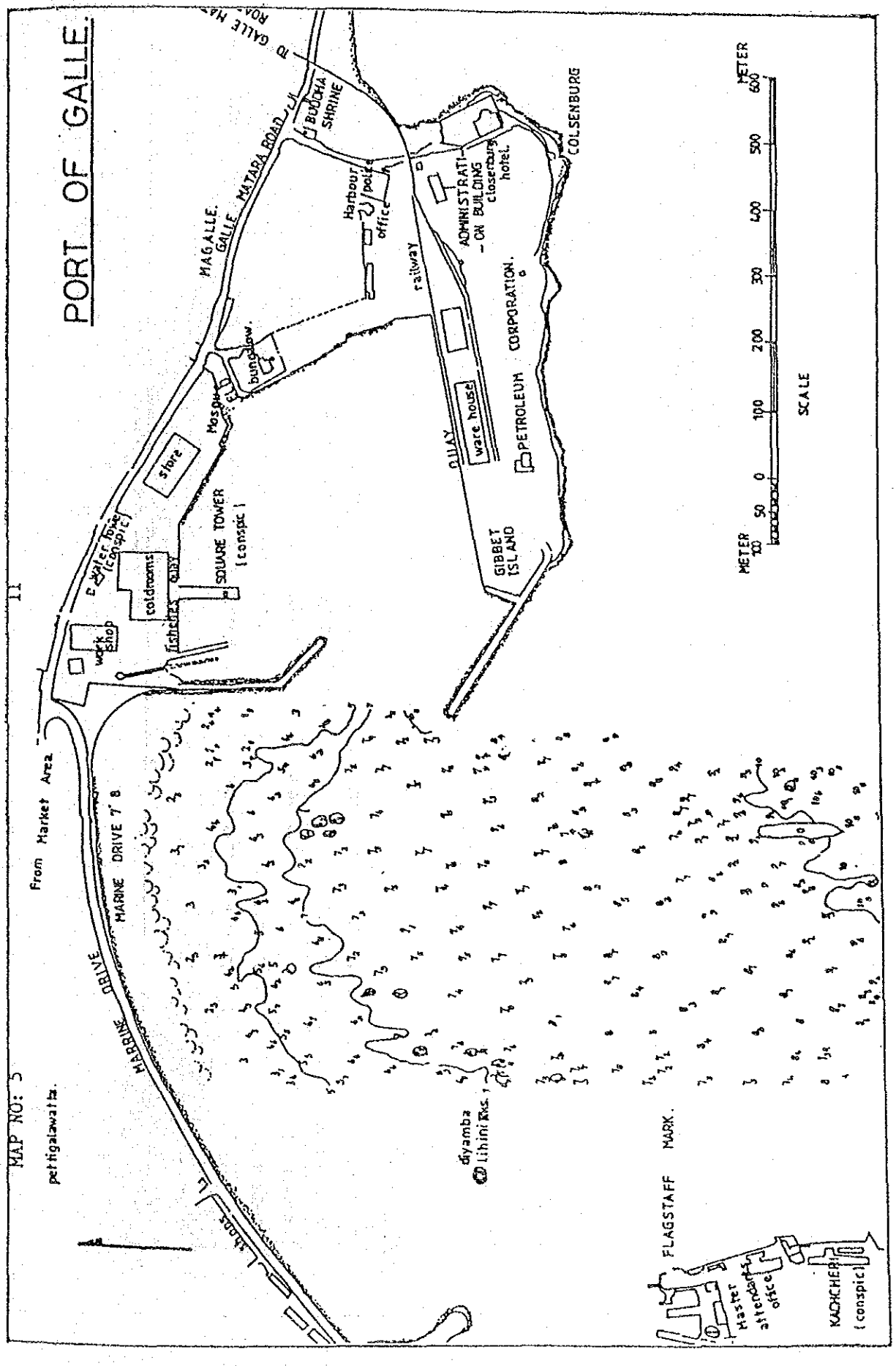
Out Bound

Name of airline	Passenger	Cargo(kgs)	Mail(kgs)
ALK	323,000	9,039,000	145,000
AFL	8,000	241,000	57,000
GFA	14,000	570,000	3,000
IAC	60,000	430,000	26,000
KAC	24,000	786,000	9,000
KLM	6,000	152,000	8,000
PIA	7,000	727,000	2,000
RNA	500	50	90
SIA	21,000	984,000	9,000
THA	25,000	1,260,000	11,000
UTA	13,000	1,000,000	3,000
Total	501,500	15,189,050	273,090

In Bound

Name of airline	Passenger	Cargo(kgs)	Mail(kgs)
ALK	348,000	3,400,000	200,000
AFL	8,000	130,000	40,000
GFA	9,000	92,000	5,000
IAC	57,000	448,000	46,000
KAC	20,000	456,000	17,000
KLM	7,000	318,000	9,000
PIA	6,000	314,000	12,000
RNA	500	3,000	100
SIA	31,000	670,000	55,000
THA	20,000	1,210,000	156,000
UTA	10,000	613,000	5,000
Total	516,500	7,654,000	545,100


The Port of Trincomalee
N
S E A
Foul Point
Trincomalee
Back bay
Trincomalee Dutch Bay
Elephant Island
Round Island
K O D D I Y A R   B A Y
Inner Harbour
Port Ostenburg
Sober Island
Cod Bay
Clappenburg Bay
Sampur
Tambalagam Bay
0 1 2 3 4 5 Km

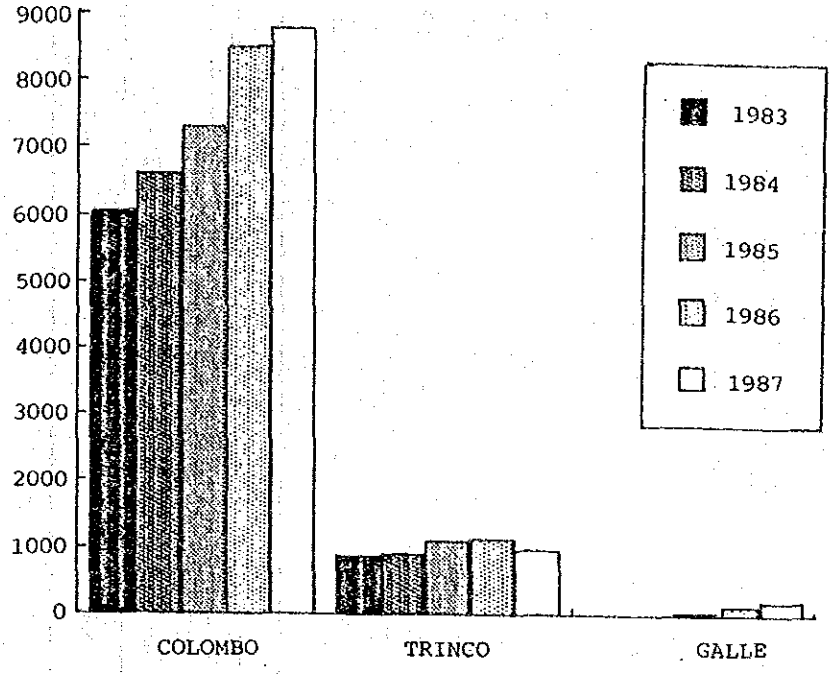

PORT OF GALLE.
MAP NO: 5
11
From Market Area
MARINE DRIVE 7' 8
MARINE DRIVE
TO GALLE HAR... ROAD
BUDDHA SHRINE
MAGALLE. GALLE MATARA ROAD
Harbour police office
railway
ADMINISTRATI-ON BUILDING
Closenburg hotel.
COLSENBURG
METER
600
500
400
300
200
100
0
50
100
SCALE
bungalow
Mosque
shore
Lighter tower (conspic)
coldrooms
QUAY
SQUARE TOWER (conspic)
workshop
fishery
QUAY
ware house
PETROLEUM CORPORATION.
GIBBET ISLAND
petrigalawatta
dyamba
Lihini Kks.
FLAGSTAFF
MARK.
Master attendant's office
KACHCHERI (conspic)

CARGO HANDLED AND THEIR PERCENTAGE DISTRIBUTION
BY TYPE OF CARGO

PORTS OF COLOMBO, TRINCOMALEE & GALLE - 1986 & 1987
('000 Tonnes)

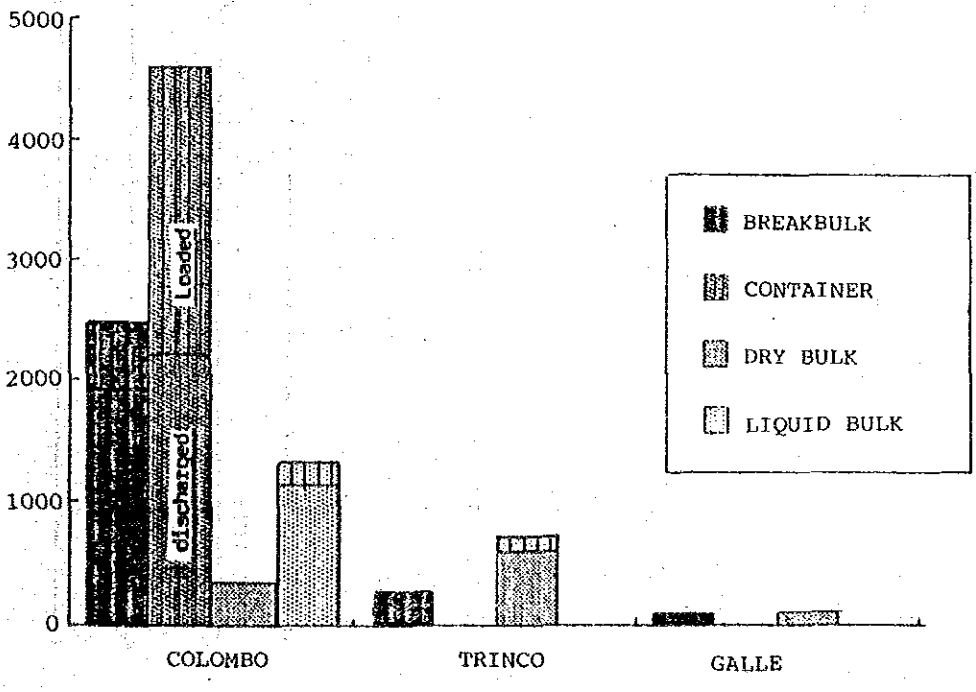
	1986								1987							
	Colombo	%	Trinco	%	Galle	%	Total	%	Colombo	%	Trinco	%	Galle	%	Total	%
Tonnage discharged:																
Break Bulk	1,944.3	33.4	15.1	2.0	51.6	30.6	2,011.0	29.8	1,947.4	33.9	7.7	1.3	106.0	46.9	2,061.0	31.4
Containerized	1,686.6	29.0	-	-	-	-	1,686.6	25.0	2,271.1	39.6	-	-	-	-	2,271.1	34.5
Dry Bulk	312.0	5.4	748.7	98.0	117.3	69.4	1,178.0	17.5	357.2	6.2	602.0	98.7	120.0	53.1	1,079.3	16.4
Liquid Bulk	1,871.9	32.2	-	-	-	-	1,871.9	27.7	1,162.2	20.3	-	-	-	-	1,162.2	17.7
T/T discharged	5,814.8	100.0	763.8	100.0	168.9	100.0	6,747.5	100.0	5,737.9	100.0	609.7	100.0	226.0	100.0	6,573.6	100.0
Tonnage Loaded																
Break Bulk	597.6	22.1	245.8	59.1	-	-	843.4	27.0	555.9	18.2	271.5	67.2	-	-	827.4	23.9
Containerized	1,793.2	66.3	-	-	-	-	1,793.2	57.5	2,338.7	76.4	-	-	-	-	2,338.7	67.5
Dry Bulk	-	-	170.5	40.9	-	-	170.5	5.5	-	-	132.7	32.8	-	-	132.7	3.8
Liquid Bulk	312.3	11.6	-	-	-	-	312.3	10.0	165.1	5.4	-	-	-	-	165.1	4.8
T/T loaded	2,703.1	100.0	416.3	100.0	-	100.0	3,119.4	100.0	3,059.7	100.0	404.2	100.0	—	-	3,463.9	100.0
Total Tonnage handled	8,517.8		1,180.1		168.9		9,866.9		8,797.6		1,013.9		226.0	-	10,037.5	

TOTAL CARGO HANDLED IN SRI LANKA '000 TONS



HANDLED VOLUME BY CARGO TYPE (IN 1987) IN SRI LANKA

'000 TONS



NO.OF SHIPS ARRIVED AND THEIR PERCENTAGE DISTRIBUTION BY G.R.T. GROUP

PORTS OF COLOMBO, TRINCOMALEE & GALLE - 1986 & 1987

G.R.T. GROUP	PORT OF COLOMBO				PORT OF TRINCOMALEE				PORT OF GALLE				TOTAL			
	1987		1986		1987		1986		1987		1986		1987		1986	
	No.of ships	%	No.of ships	%	No.of ships	%	No.of ships	%	No.of ships	%	No.of ships	%	No.of ships	%	No.of ships	%
Below 2000	482	20.6	453	18.1	220	74.3	115	52.3	60	72.3	30	50.8	762	28.1	598	21.5
2000 - 3999	242	10.4	273	10.9	01	0.3	51	23.2	06	7.2	21	35.6	249	9.2	345	12.4
4000 - 5999	188	8.0	146	5.8	04	1.3	03	1.4	02	2.4	03	5.1	194	7.1	152	5.5
6000 - 7999	187	8.0	230	9.2	-	-	01	0.4	11	13.3	03	5.1	198	7.3	234	8.4
8000 - 9999	343	14.7	366	14.6	21	7.1	08	3.6	04	4.8	02	3.4	368	13.6	376	13.5
10000 - 11999	177	7.6	279	11.1	05	1.7	12	5.5	-	-	-	-	182	6.7	291	10.4
12000 - 13999	178	7.6	179	7.1	05	1.7	02	0.9	-	-	-	-	183	6.7	181	6.5
14000 - 15999	121	5.2	127	5.1	10	3.4	01	0.4	-	-	-	-	131	4.8	128	4.6
16000 - 17999	93	4.0	157	6.3	02	0.7	03	1.4	-	-	-	-	95	3.5	160	5.7
18000 - and over	324	13.9	295	11.6	28	9.5	24	10.9	-	-	-	-	352	13.0	319	11.5
TOTAL SHIPS	2,335	100.0	2,505	100.0	296	100.0	220	100.0	83	100.0	59	100.0	2,714	100.0	2,784	100.0
TOTAL G.R.T. ('000)	22,330		24,257		1,475		1,287		224		129		24,029		25,673	
AVERAGE G.R.T. PER SHIP ('000)	9.6		9.7		5.0		5.9		2.7		2.2		8.9		9.2	

MILESTONES IN THE DEVELOPMENT OF THE PORT OF COLOMBO

1875	-	King Edward VII laid the foundation stone for the South West Breakwater.
1885	-	Completion of the 1285 metre South West Breakwater.
1898	-	Completion of the 335 metre North East Breakwater.
1906	-	Completion of the 814 metre Island Breakwater.
	-	Completion of the Dry Dock.
	-	Completion of Dredging upto 9 metres.
1909	-	Completion of Guide Pier (the first deep water alongside berth)
1912	-	Completion of 18 coaling jetties at the present New Container Terminal site.
1913	-	The Colombo Port Commission created to develop and maintain the Port.
1922	-	Completion of petroleum oil facilities.
1923	-	Completion of lighter quays, jetties and warehouses in Baghdad and Pettah areas.
1938	-	Completion of the Inner Dry Dock.
1956	-	Completion of 17 alongside berths and transit shed and warehouses.
1958	-	Cargo handling activities were nationalised and the Port (Cargo) Corporation established.
1967	-	Creation of the Port Tally & Protective Services Corporation.
1969	-	Commencement of construction of Container Terminal at Queen Elizabeth Quay.
1st Aug. 1979	-	The Sri Lanka Ports Authority was formed by unifying the Colombo Port Commission, the Port (Cargo) Corporation and the Port Tally Corporation.

March	1980	-	Master Plan for the Port of Colombo established with assistance from the Government of Japan.
1st Aug.	1980	-	His Excellency President, J.R. Jayawardene ceremonially inaugurated the New Container Terminal at Queen Elizabeth Quay.
19th March	1981	-	Japan Port Consultants appointed as Consultants to the Port of Colombo Expansion Project.
May	1982	-	Inauguration of the close-circuit T.V. Network by the Hon. Lalith Athulathmudali, Minister of Trade & Shipping.
Aug.	1982	-	Inauguration of the Rail Container Service by the Hon. Lalith Athulathmudali, Minister of Trade & Shipping.
Sept.	1982	-	Commissioning of the first Gantry Crane - TANGO 80 - by the Hon. Lalith Athulathmudali, Minister of Trade & Shipping.
17th Dec.	1982	-	Contract for the Construction of the New Container Terminal signed with M/S. PENTA-OCEAN/WAKACHIKU JOINT VENTURE of Japan.
May	1983	-	Commencement of Construction work on Stage I of the New Container Terminal.
		-	Commissioning of two Liebherr Gantry Cranes at Queen Elizabeth Quay Container Berth.
24th Oct.	1984	-	Inauguration of the Construction of Stage II Second fully equipped Container Terminal.
		-	Commissioning of four Hitachi Transfer Cranes at Queen Elizabeth Quay Container Berth.
2nd Aug.	1985	-	His Excellency President J.R. Jayawardene ceremonially inaugurated the First Berth of the 'JAYE' Container Terminal, providing fully computerised Container Handling operations.

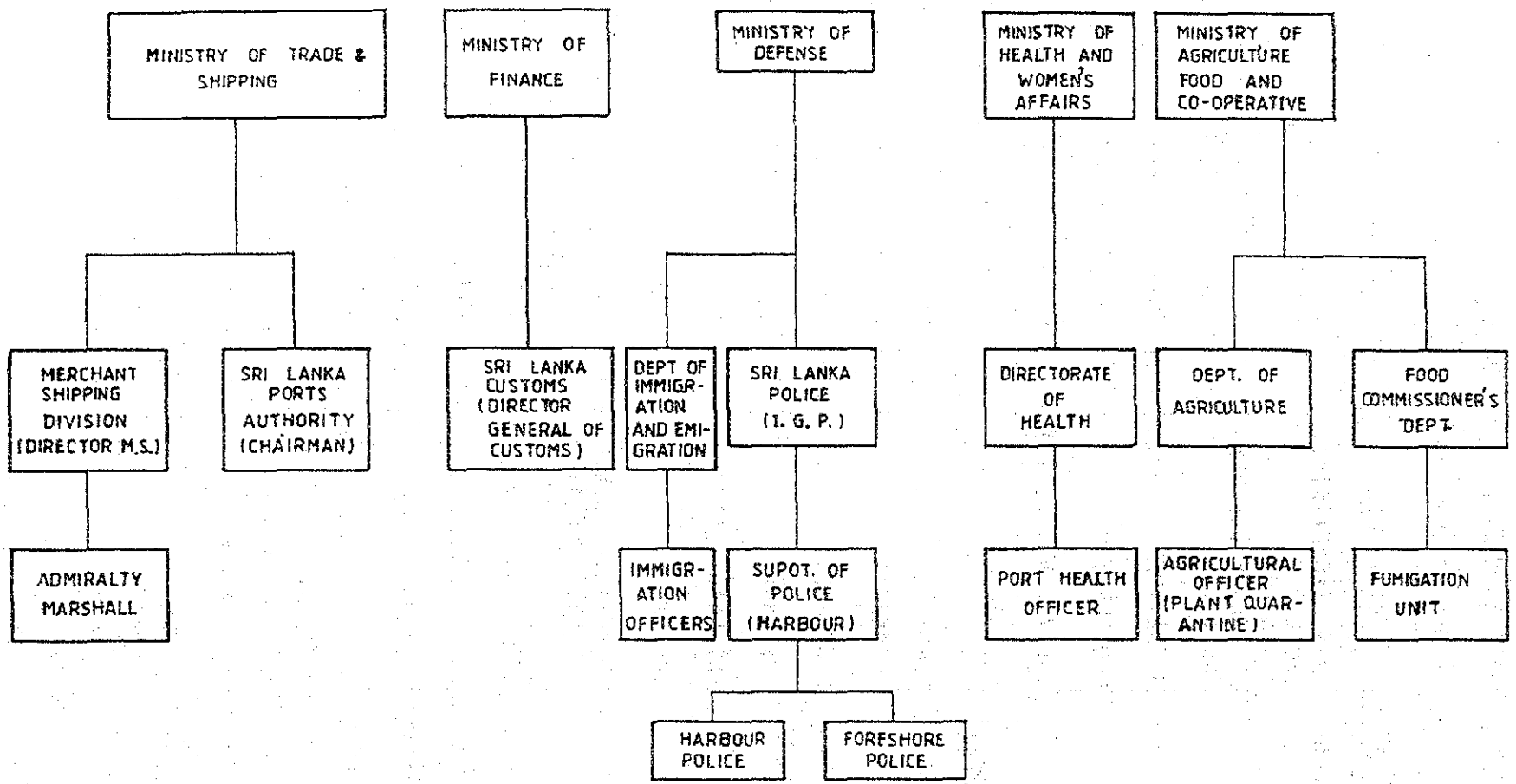
** ******** **

Appendix 2-2-1 Number of Employees of SLPA by Port and Division

(At Dec.31st each year)

PORTS	DIVISIONS	1985	1986	1987	1988
COLOMBO	ADMN. SECRETARIAT,				162
	LEGAL,				114
	TRAINING,				271
	KITCHEN & CANTEENS				
	SUB TOTAL	453	481	514	547
	OPERATIONS	8,589	7,487	7,881	7,695
	ENGINEERING	4,119	5,003	4,811	4,893
	TALLY AND SECURITY	1,679	1,738	1,970	1,995
	NAVIGATION	1,156	1,163	1,180	1,238
	FINANCE	671	670	693	719
	COMMERCIAL	413	419	413	415
	SUPPLIES	220	233	229	250
	PERSONNEL	131	142	125	147
	INTERNAL AUDIT	79	82	81	88
	MEDICAL	60	57	63	67
	PLANNING, RESEARCH & DEVELOPMENT	55	86	74	115
	TOTAL	17,625	17,561	18,034	18,169
GALLE		930	878	829	849
TRINCOMALEE		1,417	1,359	1,259	1,389
GRAND TOTAL		19,972	19,798	20,122	20,407

Appendix 2-2-2 Relationship Among the Agencies Operating Within the Port



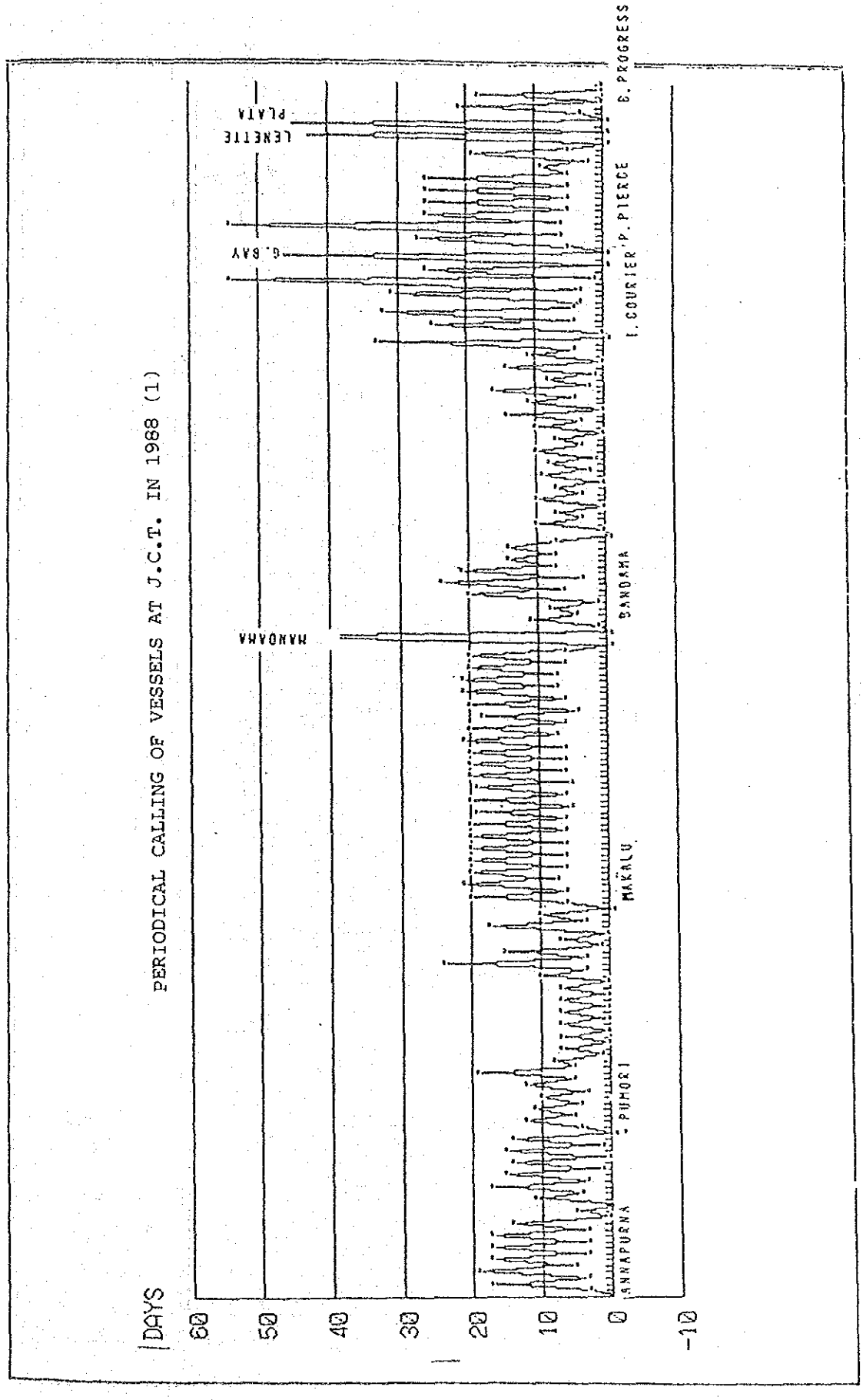
PRD/SK/112

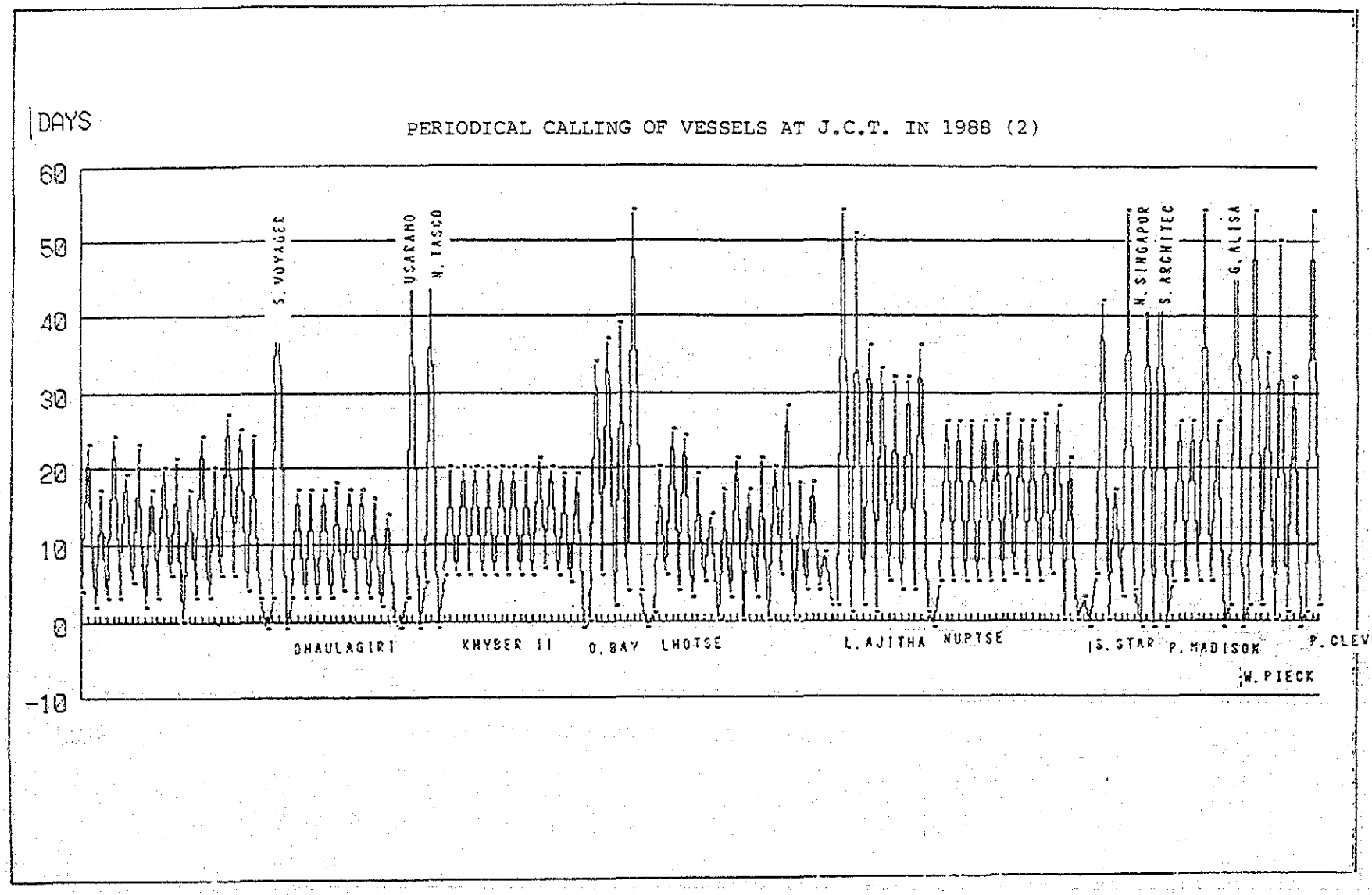
List of Warehouses

	Location	Number of Transit Sheds	Cubic Capacity (m^3)	Floor Area (m^2)
Quays	Queen Elizabeth Quay	3	129,130	17,650
	Bandaranaike Quay Coaster Berth	5	166,615	24,246
	Prince Vijaya Quay	3	89,706	12,264
Others	Chalmers Area	2	7,287	1,841
	Baghdad Area	3	35,553	9,721
	Pettah Area	3	30,441	7,672
	Kochchikade Area	5	43,095	9,765
	Beira Lake	2	92,866	14,262
	Canal Yard (Food Dept.)	1	30,794	73,416

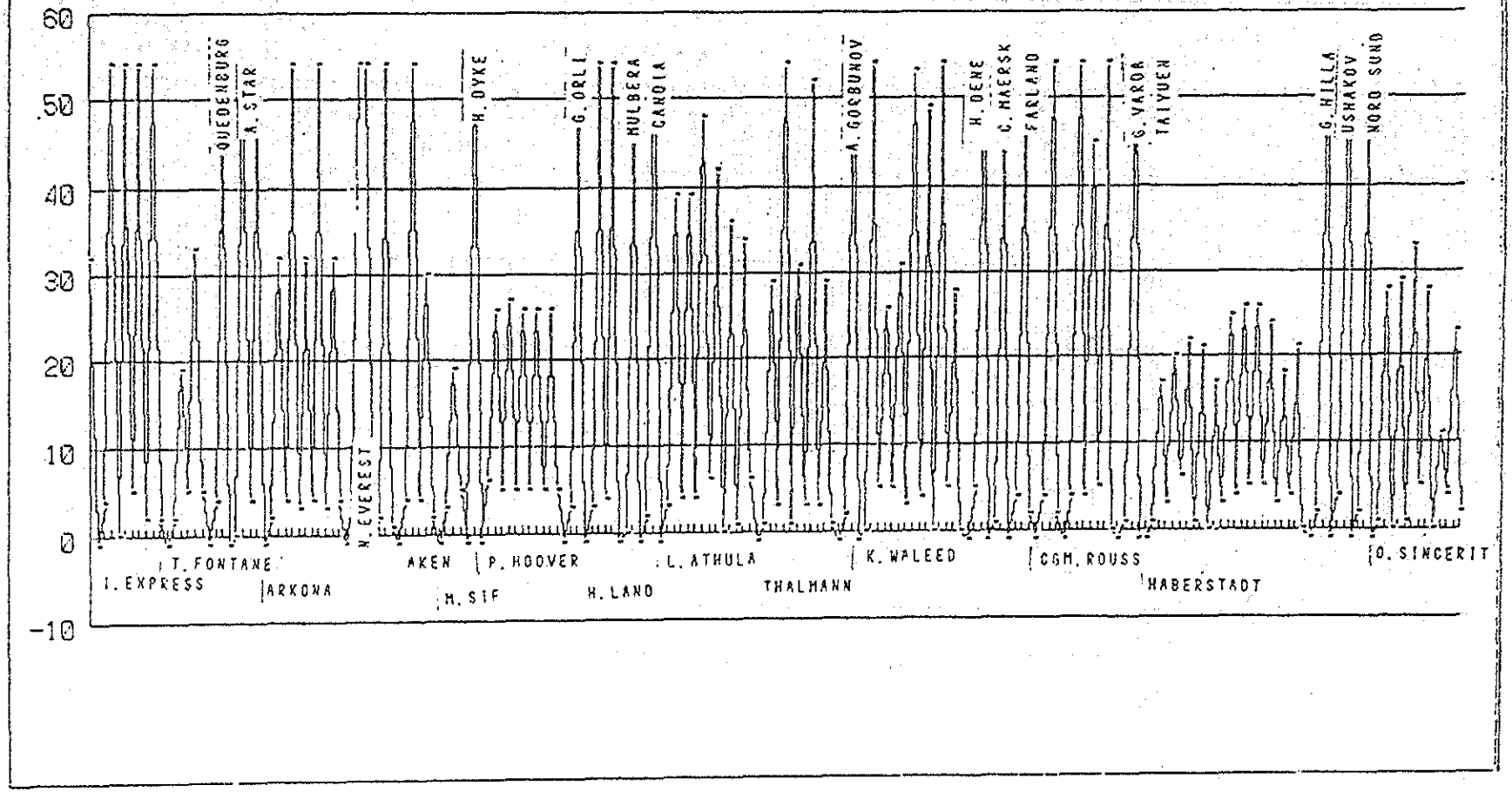
List of Mid-stream Berths

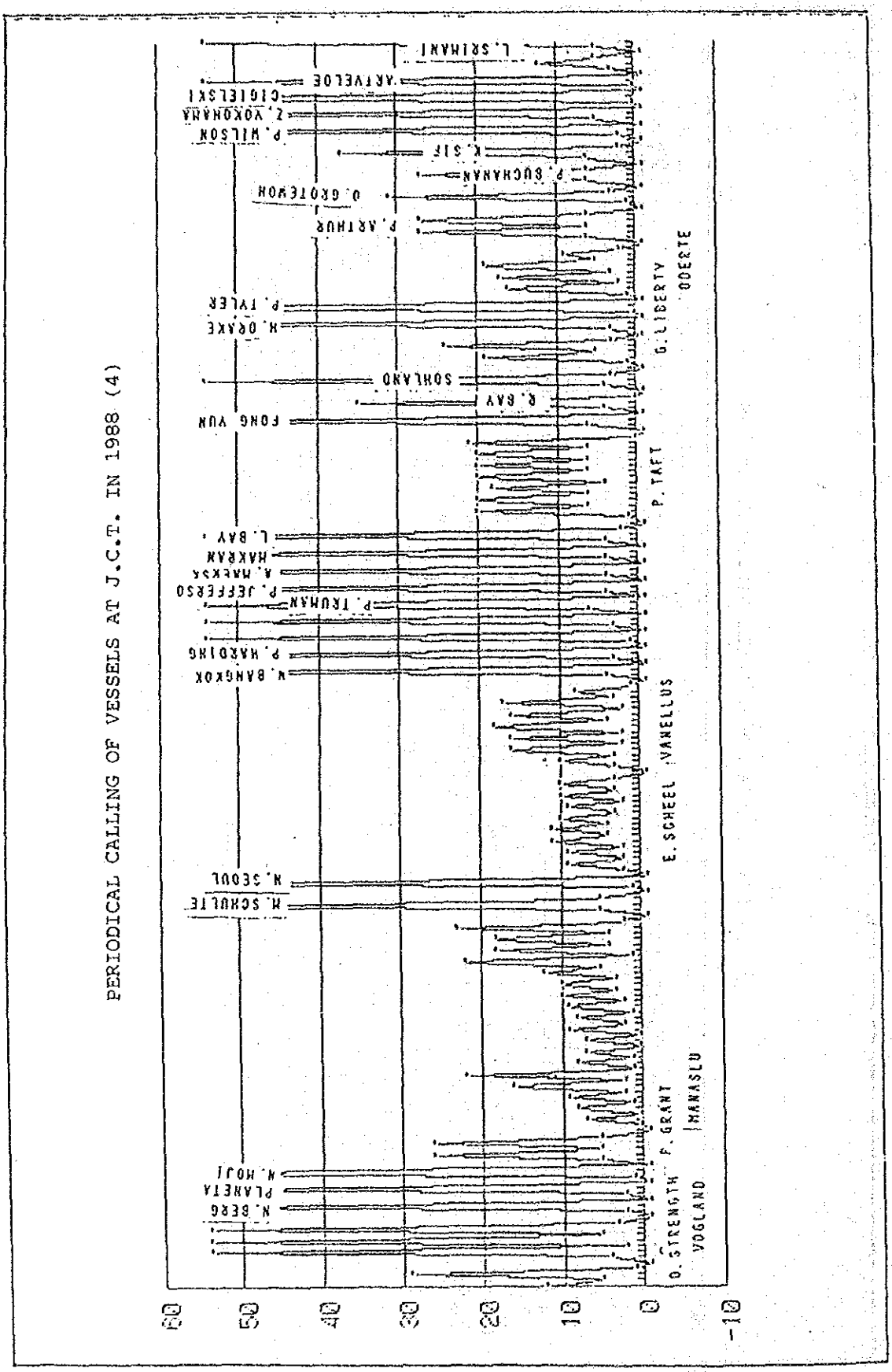
Berth No.	Berth Length in Metre	Depth in Metre	Mooring Capacity (D.W.T.)
SOUTH-WEST MONSOON (MAY TO OCTOBER)			
Buoy Berth No. 8	150	9.5	18,000
9	225	9.5	22,000
10	234	9.5	20,000
12	Unlimited	11.0	40,000
14	171	7.5	10,000
15 A	185	8.5	12,000
16 A	203	8.5	12,000
S2 A	95	6.7	4,000
S3	115	6.7	3,000
N1	186	8.0	10,000
NORTH-EAST MONSOON (NOVEMBER TO APRIL)			
Buoy Berth No. 12	225	10.0	30,000
13	274	10.3	30,000
14	171	11.0	40,000
17	244	8.0	12,000
18	214	9.5	18,000
19	229	10.3	30,000
21	153	6.5(L.H)	8,000
22	170	6.5(L.H)	8,000
23	177	7.5(L.H)	10,000
N1	186	8.0	10,000
S2 A	95	7.0	


PERIODICAL CALLING OF VESSELS AT J.C.T. IN 1988 (1)
DAYS
60
50
40
30
20
10
0
-10
ANNAPURNA
PUHORI
MAKALU
BANDAMA
MANOAHA
E. COURIER
P. PIERCE
E. PROGRESS
G. BAY
LENETTE
PLATA


DAYS
PERIODICAL CALLING OF VESSELS AT J.C.T. IN 1988 (2)
60
50
40
30
20
10
0
-10
S. VOYAGER
USARAMO
N. TASCO
N. SINGAPOR
S. ARCHITEC
G. ALISA
DHAULAGIRI
KHYBER II
O. BAY
LHOTSE
L. AJITHA
NUPTSE
IS. STAR
P. MADISON
P. CLEVELAN
W. PIECK

PERIODICAL CALLING OF VESSELS AT J.C.T. IN 1988 (3)




PERIODICAL CALLING OF VESSELS AT J.C.T. IN 1988 (4)
L.SRIHANI
ARIVELOE
CIGIELSKI
Z.VOKOHAMA
P.WILSON
K.SIF
P.BUCHANAN
O.GROTEWOH
P.ARTHUR
P.TYLER
H.ORAKE
SOHLAND
R.RAY
FONG YUN
L.BAY
HAKRAN
A.MAEKSK
P.JEFFERSO
P.TRUMAN
P.HARDING
N.BANGKOK
N.SEOUL
M.SCHULTE
N.BERG
PLANETA
N.MOJI
O.STRENGTH
F.GRANT
VOGLAND
MANASLU
E.SCHEEL
VANELLUS
P.TAFT
G.LIBERTY
ODERTE
60
50
40
30
20
10
0
-10

SURVEY ON BERTH PRODUCTION AT JCT AND QCT

(1) PRODUCTIVITY OF CONTAINER HANDLING AT J.C.T.

Number of containers handled at the two berths of J.C.T during the recent 6 months (from 01 Jan.~ 30 June 1988) were 211,194 TEUs, and the average berth occupany was 64%~93%.

There is a small decrease in the number of containers handled while the berth occupancy becomes great in the latter part of the observed period.

This means that 211,000 TEUs is the maximum value presently attained for one berth per year at J.C.T.

We observed the actual handling so that we may examine whether there are any solutions for increasing the productivity.

Fig A 2-3-4-1 is a result of the observation.

Mean cycle time of Gantry cranes is 1'48", but this is mixed result of different Gantries and different ships.

Some Gantries were concentrated in discharging, and the others were working for loading containers.

The gantries for discharging had clear peaks at 1'1o", as you can find in the figure, and the others for loading had mild peaks at 2'10".

As the Gantries have the same mechanical capacity, there must be some reasons for the differnce in handling speed.

According to a person in-charge of operation, there are some difficulties in feeding containers to a vessel which has sophisticated request for shipping order.

It is natural that the cause for low speed of Gantry cranes lies in the process of feeding containers, because the other Gantry Crane which concentrates in discharging does not have such a problem attaining a high speed of handling containers.

Contd....2/=

Considering 1'10" of cycle time is almost the ultimate value of the actual handling, our target for promotion of productivity can be the average cycle time of 1'48".

When we assume the two Gantries serve a vessel at the sycle time of 1'48" , they can handle 66 containers per hour.

In this case, the berth occupancy 65%, actual handling hours 90% and the efficiency 70% , then the monthly product per berth can be (0.65 * 0.9* 0.7* 30 days* 24 hrs.)* 66 = 19,460 UNITS.
This is equivalent to 233,500 UNITS per year per berth, or 350,000 TEUs if 40' containers are included at a ratio of 50%.

Comparing this to Fig A 2-7-3, the actual handling ratio per ship per berthing hour, if we take the value of 22 units/hour, one ship per berth, and berth occupancy 75%, the monthly production becomes (0.75* 30 days*24 hrs.) *22 units/hr. = 11,880 UNITS. This is equivalent to 142,000 UNITS per year, or 213,000 TEUs if 40' containers are included at a ratio of 50%.

From these values of handling ratio, we know that Gantry crane operation itself has enough capability for handling one and a half times the units of present performance.

The value of production per berthing per ship seems to have some relation with ship size also (see Fig A 2-3-4-6).

This implies that more Gantry cranes were assigned to bigger vessels or smaller vessels cannot attain much productivity.

The Fig A 2-3-4-2 also indicates the cycletime of Transfer cranes.

The average cycle time was 2'26" , although we know from the distribution that the Yard crane itself can attain a cycle time of 1'30" at their maximum average.

If we want to feed a Gantry at the rate of 33 UNITS per hour. number of yard cranes shall be (33)/(60'/2.43) = 1.33 per Gantry. The combination of one Gantry to two Yard cranes seems suitable, if Yard cranes do not have to travel nor remove boxes than required.

Contd....3/=

In actual cases, when one Yard crane travels, the other one cannot supply containers at the speed of a Gantry crane and it is very hard to recover the time lost. Because a Gantry crane or a ship has its own appropriate speed. Thus, the composition of one Gantry to three Transfer cranes is necessary.

We also obtained the data for Prime movers. Fig A 2-3-4-4 and 2-3-4-5 are the obtained data concerning Prime movers.

From the figure, we know that overall cycle time of container handling is around two minutes, and average Turn round period of Prime mover is 15'39".

If we want to feed a Gantry at the rate of 33 UNITS per hour, the Prime movers which bring two UNITS at a time shall be prepared (33/2)/(60' /15.65) = 5 nos. per Gantry crane, or 9 nos. for 40' containers.

We found from the observation, that at J.C.T. the causes for taking excessive time are,

(1) delay of feeding containers at Transfer crane side by travelling from one place to another or picking up one container after extra strokes,

(2) Shortage of Prime movers, and

(3) loss caused by combined feeding with other yards.

From all these informations, the target of 1.5 times of present number of handling containers, which become 300,000 TEUs per year per berth. seems possible to attain , if we are prepared for feeding containers smoothly to Gantries.

(2) PRODUCTIVITY OF CONTAINER HANDLING AT Q.C.T

It is observed that the traffic at Q,E.Q. is not smooth owing to narrowness of yards, many corners and uneven grounds.

At present, Q.C.T. has two Gantries and is handling 17,000 containers per month as a whole. This value is equivalent to 204,000 TEUs per year. We understand the value is the maximum value at this moment.

We observed the actual handling at QCT on 27th, December 1988. One of the Gantries handled only 8 containers because of delay in supplying containers. The other handled 25 units of 20' containers per hour. Fig A 2-3-4-8 is a result of the observation.

Average cycle time of 2'06" was obtained from one of the Gantries. This value may be promoted upto 1'50" because 35% were observed at the cycle time actually. The slow speed of Gantry of Q.C.T.comparing to J.C.T. is considered to be owing to small size of vessels.

On the other hand, the top loader's cycle time was rather amazing, because it handled containers at the cycle time of 1'50" on an average even faster than Gantry crane at Q.C.T.

This performance was possible because it did not have excessive travelling nor replacing containers. The top loader was only concentrating in loading containers to chasses.

Fig A 2-3-4-10 indicates that the Turn round period of chasses at Q.C.T. takes more time than J.C.T. This implies the course condition was bad as it was.

Fig A 2-3-4-9 shows that overall cycle time for feeding containers by (20' + 20') chasses.

This value would be the maximum productivity at present condition of Q.C.T.

In order to raise the value of handling capacities at berths of Q.C.T. the following measures will be necessary.

1. To provide good and sufficient stacking yards.
2. To provide smooth road with enough width.
3. To provide systematic, computerized operation.