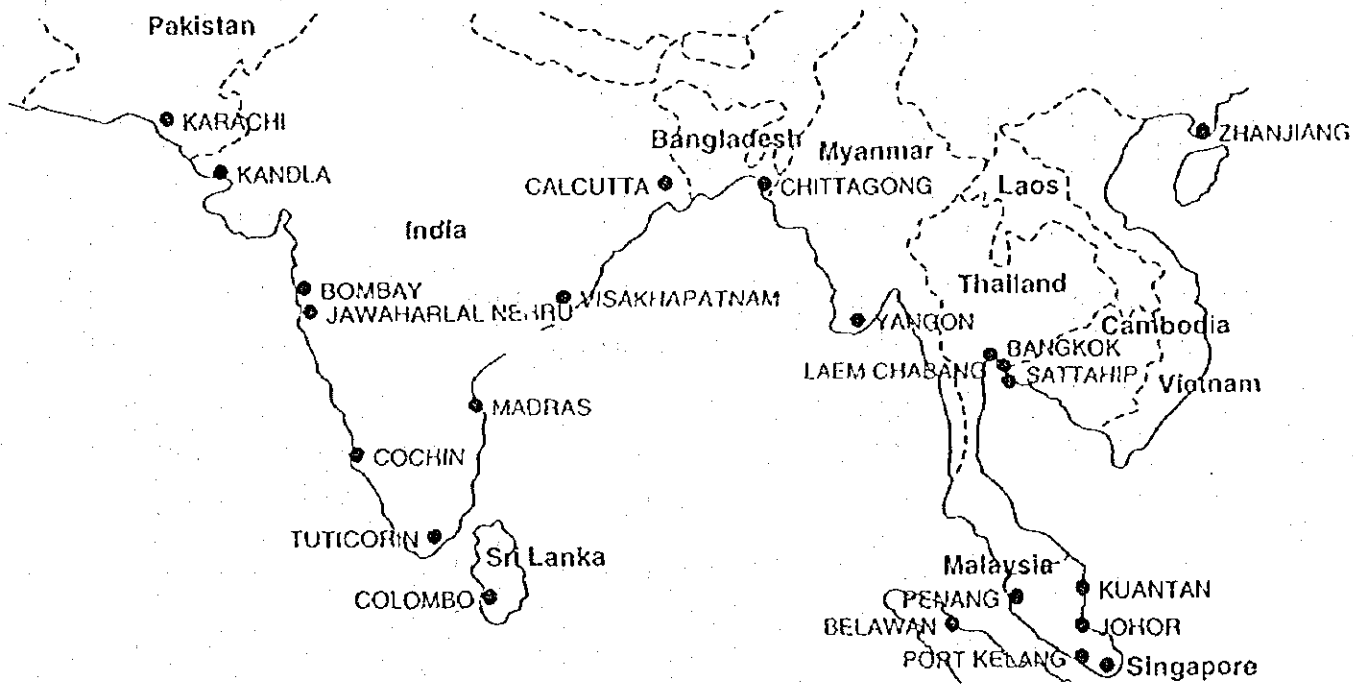
## 2.3 Development of South Asian Ports

111. Significant increases have been recorded in the volume of containers handled at ports in the South Asian region. FIGURE 2.3.1 shows the location of container ports in south Asia and the following FIGURE 2.3.2 indicates container cargo throughput in the region's ports, which shows a sharp increase in 1993 at Indian ports and Sri Lankan port.

**FIGURE 2.3.1 Location of Container Ports in South Asia**



### 2.3.1 Indian Ports

112. There are eleven major ports in India of which eight are container ports . Six major ports (Kandla, Bombay, Jawaharlal Nehru, Marmagao, New Mangalore and Cochin) are on the west coast (Arabian sea), and five major ports (Tuticorin, Madras, Vishakhapatnam, Paradip and Calcutta/Haldia) are on the east coast (Bay of Bengal). TABLE 2.3.2 shows Commodity-wise Cargo Traffic in 1994 and FIGURE 2.3.3 and FIGURE 2.3.4 show share of cargo and container cargo volume in Indian ports, respectively. FIGURE 2.3.5 and FIGURE 2.3.6 show trends of container throughput in the Indian container ports. TABLE 2.3.3 and TABLE 2.3.4 show Indian Port facilities and container port facilities, respectively.

113. In order to attract private investment along with modern technology, the process of privatization of port facilities has already started with the announcement of the new economic policy.

114. Port productivity has improved in recent years and there have been significant improvements in the average ship turnaround time and in output per ship berth day. In contrast to port productivity, labour and equipment productivity levels are still low due to surplus labour in ports, outdated equipment and operational constraints.

115. Container throughput in major Indian ports increased by nearly 23% in the 1994/1995 financial year, in comparison to the corresponding figures in the 1993/94 period. Indian ports' throughput for fiscal years(1993-1995) are showen in TABLE 2.3.5.

**TABLE 2.3.5 Indian Ports' Throughput for Fiscal Years (1993-1995)**

| Port | 1993-1994 | 1994-1995 | % change |
|---|---|---|---|
| Bombay | 427,600 | 486,993 | 13.9 |
| Jawaharial Nehru | 173,000 | 244,070 | 41.0 |
| Madras | 163,087 | 200,540 | 22.9 |
| Calcutta | 102,018 | 112,032 | 9.8 |
| Cochin | 66,000 | 86,450 | 30.1 |
| Tuticorin | 48,110 | 57,000 | 18.5 |
| Kandla | 28,459 | 51,250 | 80.0 |
| Total | 1,008,345 | 1,238,335 | 22.8 |

*Source : Containerisation International, October 1995*

*Note : Other port throughputs include: Visakhapatnam-11,145TEU, New Mormagao-1,168TEU, New Mangalore-868TEU*

(1) Bombay Port

116. Bombay Port has a huge land area, which is nearly one twelfth of the city area. The Trust is the landlord of scrap yards, factories and other city facilities. Bombay city has been developed on a peninsula so that the land area is very limited and real estate prices are high, for example US$ 3 million per square meters.

117. Tidal range is nearly 15 feet. Prince's Dock and Victoria Dock were built in the 1880's. Indira Dock was completed in 1914, whose entrance lock is 228m long, 30.5 m wide, 9.1m deep. The port has only one container terminal called Ballard Pier built in 1972 on the extended arm to te south of Indira Dock. The Pier has two quay side cranes. The depth of the Ballard Pier is 9.1m, however, maintenance dredging is difficult due to the heavy use of the berth. (see FIGURE A2.3.1)

118. Container yard has a capacity of 5,000 TEUs with an area of 14-15 ha. Total capacity of all container yards is about 23,000 TEUs. Old cotton warehouses have already lost their cargo but cannot be demolished due to the lease contract to private companies. This area may be very advantageous for city use. Other idle spaces are identified.

119. The Port has restriction on its capacity owing to the Government policy that Jawaharlal Nehru port is to be developed for container traffic and cargo transport to Bombay should be decreased. This policy was established in 1982 when JNPT was approved. Proposed capacity of Bombay Port is 6.5 million metric tons except oil, in which container traffic is 1 million tons, i.e. 100,000 TEUs. However, actual cargo traffic is 12 million tons except oil in 1994-5 including 487,000 TEUs of containers.

120. Therefore, it is difficult to get approval from the Government for investment in port facilities. Oil related facilities funded by ADB are only an exception to the regulation. Container yard facilities are procured by private enterprises. The Trust is afraid that they have no way to replace the present facilities in case of their failure, i.e. two quay cranes, three rubber tyred gantries and five top lifters.

121. It is difficult to receive approval for reclamation of the sea in front of Bombay due to adverse effects on city traffic. Emphasis is placed on the improvement of productivity of cargo handling, of which 30 workers are assigned as a gang, namely, 13 for on shore, 8 on ship and 9 for supervising. Transhipment ports of containers are Colombo, Singapore, and Dubai, whose share are shown below.

| | |
|---|---|
| Colombo---------- | 36 % |
| Singapore ---------- | 25 % |
| Direct---------- | 5 % |
| Dubai/Sharjah---------- | 34 % |

122. The Bombay port has plans to provide 5 RTGs at the stackyard to be developed at ID behind berths Nos. 2 to 5. The existing 5 TLTs which are meant for RCD operations are also

proposed to be replaced by more versatile reach stackers. With the rationalisation of cargo handling methods (e.g. computerisation etc.) efficiency is likely to improve in the future.

123. Forecast of future container demand by Bombay Port Trust are

1995-96 ---------- 500,000TEU
1996-97 ---------- 520,000TEU
1999-2000 ---------- 650,000TEU

(2) Jawaharlal Nehru Port

124. Jawaharlal Nehru Port is located on the east coast of the Bombay bay, however it takes an hour by boat, and three hours by truck. The distance from Bombay by road is 80km. The port entered into operation in May 1989 with three container berths, two bulk berths and a multi purpose berth. (see FIGURE A2.3.2)

125. Development of the port was financed by the World Bank, which funded about one third of the total cost, and by some Gulf countries. Holland assisted the Port Trust in mainly dredging. Bombay Port Trust and Kandla Port Trust also funded the development, 20 million Rps and 500 million Rps respectively. Total cost for the development of the port was 10 billion Rps. (300 million US dollars). Bombay Port Trust provided two billion Rps and Kandla 500 million Rps.

126. Container berths have a total length of 690 meters with a depth of 13.5 meters, however, maximum permissible draft of vessel is 12 meters in case of high tide due to the depth of the approach channel, which is about 11 meters.

127. There are four quay side cranes with a capacity of 13 rows reach, that is 32 meters. The latest one entered into service from May 1995. Troubles in rubber tired gantry cranes, forklifts and toplifters are often reported, whereby productivity of container handling is less than expected.

128. The Jawaharlal Nehru Port Trust (JNPT) will shortly invite an international tender on the BOT basis to develop two additional container berths of 450 meters along the present three berths. The total cost is estimated at around 4.5 billion Rps including land reclamation of 20 hectares and container handling equipment. Scenario of BOT has two options, i.e. new two berths are developed under BOT and others remain with JNPT. The second option is that all berths including the present three are to be operated by a BOT contractor.

129. Bulk facilities could remain with JNPT if the second option were adopted. Maintenance dredging is the responsibility of JNPT and financed by port dues. Container throughput in 1994 is a half of Bombay, about 250,000TEUs. Container yards has a total of 3,816 ground slots. The Port has a wide space to be developed so that there is no restriction to the expansion of container yards and CFS.

130. Problems in Jawaharlal Nehru Port are winds during monsoon and transportation to Bombay. Taking into account troubles in handling facilities, advantages of Jawaharlal Nehru Port

are less than expected at this moment.

(3) Cochin Port

131. Ernakulam Wharf has nine berths inclusive of two container berths (-10.7m in depth), Q8 and Q9. Two gantry cranes were completed and entered into service from January 1995, with which the container throughput in 1995 may exceed 100,000 TEUs this year. (see FIGURE A2.3.3)

132. Five major commodities of the port are 1) Garments, 2) Marine products, 3) Cashew nuts, 4) Spices, and 5) Coir, coconut fiber. Oil refinery will increase its capacity to 10.5 million tons from 7.5 million at present.

133. New direct line is now under negotiation with a shipping line which will enter into service from next January, between Cochin and Europe. Containers are conveyed to/from following ports:

| | |
|---|---|
| Colombo---------- | 55 % |
| *Direct/Dubai (via Bombay)* ------ | 25 % |
| Singapore ---------- | 20 % |

134. New port development at Vallarpadam has recently been proposed, where the land is owned by the port trust. Two berths with four gantry cranes are planned at the first stage. According to the F/S, container traffic is projected as 5,800 TEUs - 175,000 TEUs in 1995 and 116,000 TEUs - 349,000 TEUs, in 2005. The design draft of receiving vessel is about minus 12.5 meters and the cost for the first stage is 2,906 million Rps. Proposed new Vallarpadam terminal will receive a container vessel of 54,000 DWT, carrying capacity of 4,300 TEUs, with two berths of 300 meters each and two quay side gantry cranes.

135. The road connection from the present port area in Willing Island to Vallarpadam has not been completed yet. Even if it is completed, the road connection between two terminals will deviate far from a straight line. Cochin Port Trust invited an international tender for the new port development about one and half years before, however, no satisfactory quotation was obtained.

136. The new port development will take time so that the conversion of a general cargo berth into a container berth is most probable. Ongoing schemes included in the 8th Plan (1992-1997) are the following:

1. Full-fledged Container Terminal aided by ADB
2. Development of South End reclamation
3. Housing for staff
4. New administration Block
5. Procurement of a dredger
6. Two Nos.30/35 ton Bollard pull tugs
7. Fire fighting facilities

8. Increasing power supply capacity
9. Replacement of cargo handling equipments, flotilla etc.

137. Important new schemes are the following:

1. Deepening of COT channel
2. Replacement of three nos. wharf cranes
3. Procurement of a dynamic disc skimmer
4. Replacement of Mobile Cranes, Forklift Trucks etc.

(4) Madras Port

138. Madras Port has a container terminal with a capacity of 175,000 TEUs in the existing 600m long container berth (see FIGURE A2.3.4). Due to the rapid growth in container traffic, a container berth with a length of 380m is extended by another 290m. Further extension of container berth is planned as follows.

Existing Container berth length: 600 meters (two berth)
Proposed extension of container berth: 290 meters
Additional equipment: 2 Nos. Container quay Crane
2 Nos. Rubber Tyred Gantry Crane other Infrastructure facilities like CFS, CPY etc.
Estimated cost of the project: approx. Rs.156 cores

139. Presently, a new berth is being built on the extension to the present berths, which is expected to have a capacity of 300,000 TEUs/year. Moreover, Madras Port Trust conducted a forecast of container traffic as follows:

**TABLE 2.3.5 Forecast of Container Traffic at Madras Port**

| Particulars | Estimate | Actual | 1994-95 | 1995-96 | 1996-97 | 1997-98 | 2000 |
|---|---|---|---|---|---|---|---|
| Container Cargo (1,000 Tons) | 1,350 | 1,609 | 1,500 | 2,000 | 2,500 | 3,000 | 4,500 |
| Loaded Container (TEUs) | 112,500 | 131,124 | 135,000 | 180,000 | 225,000 | 270,000 | |
| Empty Container (TEUs) | 12,500 | 31,963 | 15,000 | 20,000 | 25,000 | 30,000 | |
| Total (TEUs) | 120,000 | 163,087 | 150,000 | 200,000 | 250,000 | 300,000 | 150,000 |

*Source : Walk Through, 1995, Madras Port Trust*

(5) Calcutta/Haldia Port

140. The total container traffic at Calcutta/Haldia Port in 1994-1995 was 117,777 TEUs, a 15 % increase from 102,018 TEUs in 1993-94. The total container ship calls are 289 ships of which 226 were feeder vessels plying between two relay Ports of Colombo and Singapore. Share of the two ports is as follows.

**TABLE 2.3.6 Relay Ports**

| Port | 1993-94 | 1994-95 |
|---|---|---|
| Colombo | 19% | 16% |
| Singapore | 81% | 84% |

*Source:Container Handling Report 94-95, Calcutta Port Trust*

141. Six berths in Neraji Subhas Dock and Two berths in Kidderpore Docks are used for container handling at Calcutta Port. A project to develop full container facilities at Berth D of Netaji Subhash Dock has been sanctioned by the Government of India. An additional 192m berth is also under construction. (see FIGURE A2.3.5)

142. Two container berths, length 219m, depth 13.7m, is served by one 30t container gantry crane at Haldia Port. One additional 35t container gantry crane, two 35.5t rubber-tyred yard gantries, twelve 45t yard tractors and 20 yard chassis (20ft/40ft) are to be acquired. A further berth (Berth 11) is under construction and available for leasing. There is a proposal to lease out waterfront space and back-up area for 3 more berths in the first dock arm to enterprises for construction, maintenance and operation of these berths. The Port's investment at Haldia between 92/93 and 96/97 is Rs.1,430 million. The port intends to more than double this investment in the next five years.(FIGURE A2.3.6)

(6) Visakhapatnam Port

143. Containers are handled at Berth EQ5, accommodating vessels up to 168m loa, 10.0m depth for self-sustaining container vessels (see FIGURE A2.3.7). One multipurpose berth in the inner harbour is under construction. There are plans to construct another multipurpose berth in the outer harbour and develop the container yard by 1997. One 45t reach stacker will be procured.

(7) Tuticorin Port

144. Containers can be handled at the general cargo berths and an area of 10,000m$^2$ is available alongside the berths for storing containers. Additional open space has been made available for stuffing and destuffing of containers. There is a proposal for deepening the approach channel to a depth of 9.14m. (see FIGURE A2.3.8)

(8) Kandla Port

145. One container berth at the port has been equipped with container handling facilities.

Vessels use own gear to load/discharge. Container yard can accommodate 3,000 TEUs and there are thirty electric points for sixty reefer containers. Stuffing and destuffing facilities are available. There is a container freight station with a capacity of 10,000t. (see FIGURE A2.3.9)

### 2.3.3 Pakistan : Karachi Port

146. The Islamic Republic of Pakistan has a current population of approx. 120 million, eight million of which reportedly live in Karachi. There are a total of 28 berths, 17 at East Wharf and 11 berths at West Wharf including 4 berths at Juna Bunder Wharf (see FIGURE A2.3.10). During 1993/94 total approximate throughput at the Karachi Port was 22.6 million metric tons including more than 500,000TEU, representing 65% of the dry general cargo tonnage.

147. As the trend toward containerization of general cargo began, the container vessel size and calling frequency increased. Over the past 10 years, the number of container vessels calling Karachi has increased by 150% while general cargo vessel calls declined by 33%.

148. According to the JICA report(The Study on National Transport Plan in the Islamic Republic of Pakistan, 1994), container cargo volume is forecast as 779,000TEU in 1997/98 and 1,429,000TEU in 2005/06. World Bank report(1995) projected that container movements will be 697,000 TEU in 1997/98 and 962,000 TEU by 2002/03. Zoning Plan is presented in three phases: Near Term Plan(1993-2003), Mid Term(2003-2013) and Long Term(2013-2023). Near Term Plan proposes the construction of the two proposed dedicated container terminal at West Wharf berth(proposed by APL) and East Wharf Berth(proposed by PMS). These facilities will increase the general cargo handling capacity of the port by up to 600,000 TEU per year. Mid Term Plan propose the construction of two additional dedicated container berths and deepening of the Upper Harbour from 9.1 to 10.7m.

### 2.3.4 Bangladesh: Chittagong Port

149. The Port of Chittagong is located 9 nautical miles from the river mouth of Karnafli on the Bay of Bengal. Maximum draft is limited to 7.3 - 9.1m by berth and deep draft vessels have to wait for the flowing tide. Night time voyage is limited to vessels under 173.2m (inward) and 164.4m (outward). Seventy percent of the import cargo and 25% of the export cargo pass through Chittagong Port. The largest vessel is Max LOA 186m, Max. Draft 9.1m (Vessels exceeding limits may lighten at outer anchorage area about 3 km from the Karnaphuli estuary). Accommodation and Container & Ro/Ro Facilities are as follows:

| Quays | Length (m) | No. of Berths | Depth (m) | Remarks |
|---|---|---|---|---|
| No. 1-No.11 | 1,779 | 11 | 8.5 | Conventional |
| No.12-No.13 | 298 | 2 | 9.0 | Conventional |
| No.14-No.17 | 708 | 4 | 8.5 | Conventional |
| Jetties | - | 3 | 8.5 | |
| Oil Jetties | - | 2 | 10.0 | |

Container and Ro/Ro Facilities

| | |
|---|---|
| Container storage yard: | 82,450m²(3,808 TEUs) |
| Straddle carriers: | 4 units |
| Refrigerated container lot: | 90 electric points |
| Ro/Ro ramp: | available on new multi-purpose berth |

150. Since the introduction of container cargo in 1976, the cargo volume has rapidly increased especially in the five years from 1983/84 to 1988/89 with an average annual growth rate of 38%. A typical characteristic of the Port of Chittagong is that imports are 6 to 15 times larger than exports excluding the import of crude oil and petroleum.

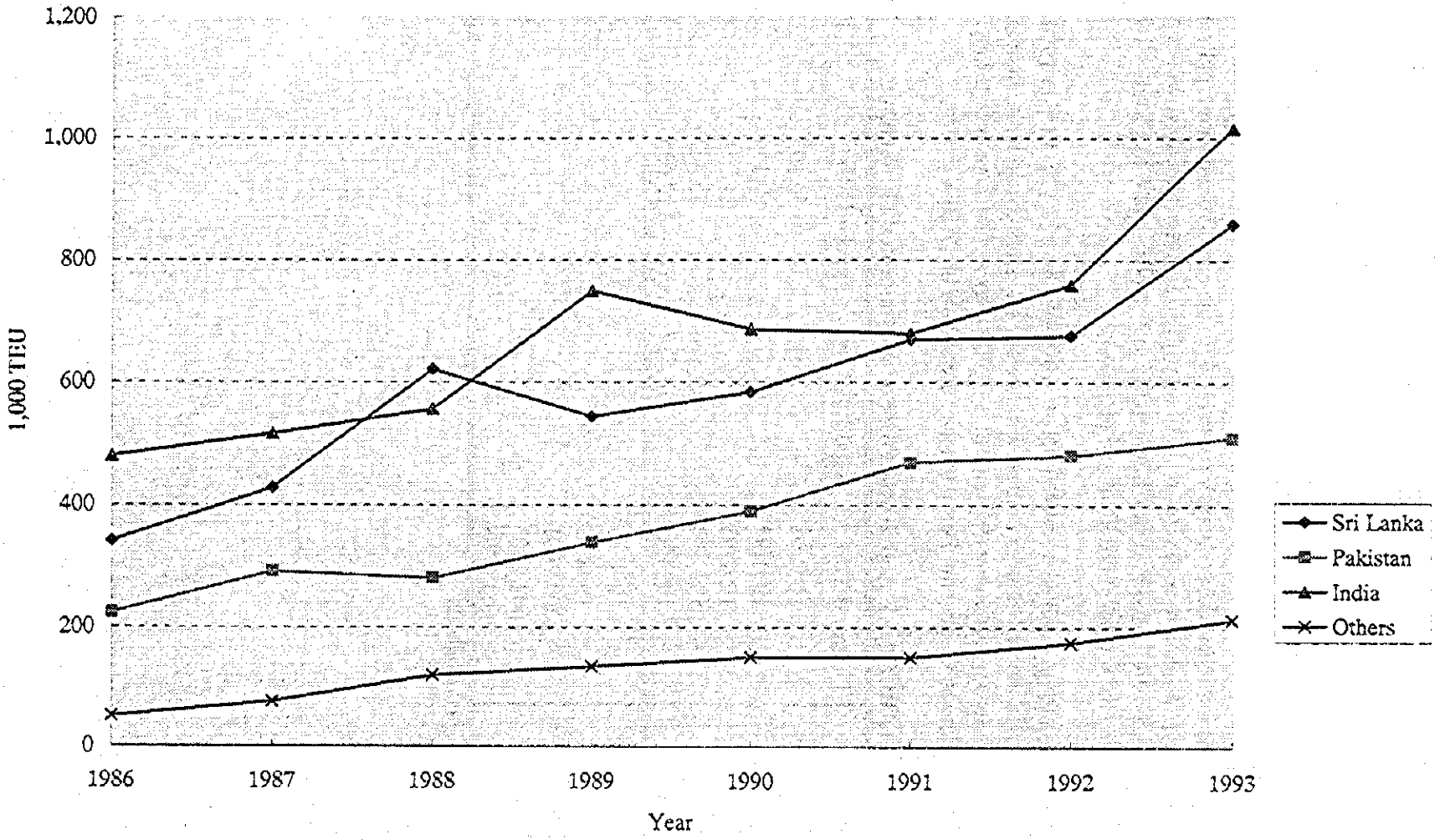
151. Chittagong Port handled 174,958TEUs in 1993/94 and 227,172TEUs in 1994/95. The acquisition of rail-mounted gantry cranes is anticipated. The storage and terminal areas will be expanded to allow for an annual capacity of 110,000TEU.Actual container throughput and container forecasts by Chittagong Port Authority are shown in TABLE 2.3.7.

**TABLE 2.3.7 Actual and Forecast of Container Throughput**

| | Financial Year | Import(TEUs) | Export(TEUs) | Total(TEUs) |
|---|---|---|---|---|
| Actual | 1990/91 | 50,752 | 50,592 | 110,281 |
| | 1991/92 | 61,172 | 60,154 | 121,326 |
| | 1992/93 | 76,236 | 74,251 | 150,487 |
| | 1993/94 | 89,396 | 85,562 | 174,958 |
| | 1994/95 | 114,537 | 112,635 | 227,172 |
| Forecast | 1996/97 | | | 259,000 |
| | 1998/99 | | | 318,000 |
| | 2000/2001 | | | 378,000 |
| | 2002/2003 | | | 439,000 |
| | 2004/2005 | | | 509,000 |

*Source : Chittagong Port Authority*

**FIGURE 2.3.2 South Asian Container Throughput by Region 1986/93**




*Source : World Container Port Demand to 2010, Ocean Shipping Consultants Ltd.*
*International Containerisation Year Book 1995*

## TABLE 2.3.2 Commodity-wise Cargo Traffic in Indian Ports(1994)

(Unit: 1,000 Tonnes)

| PORT | POL CRDUE + PRODUCTS | IRON ORE | FERTILIZER FINISHED | FERTILIZER RAW MATERIALS | COAL THERMAL | COAL COOKING | CONTAINER TONNAGE | CONTAINER TEUs | OTHERS | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| CULCUTTA | 1,623 | 0 | 156 | 76 | 0 | 0 | 1,399 | 96 | 1,915 | 5,265 |
| HALDIA | 7,073 | 0 | 68 | 141 | 3,427 | 2,001 | 87 | 6 | 530 | 13,333 |
| PARADIP | 345 | 1,518 | 256 | 0 | 3,594 | 1,252 | 0 | 0 | 1,362 | 8,327 |
| VISAKHAPATATNAM | 8,905 | 5,231 | 683 | 835 | 2,551 | 4,029 | 81 | 9 | 3,280 | 25,604 |
| MADRAS | 10,944 | 4,536 | 856 | 288 | 5,791 | 83 | 1,606 | 162 | 2,438 | 26,704 |
| TUTICORIN | 463 | 0 | 205 | 138 | 3,812 | 0 | 405 | 48 | 1,677 | 6,748 |
| COCHIN | 6,047 | 0 | 53 | 385 | 0 | 0 | 426 | 71 | 708 | 7,690 |
| NEW MANGLORE | 646 | 7,061 | 106 | 55 | 0 | 0 | 15 | 2 | 748 | 8,633 |
| MORMUGAO | 2,099 | 15,748 | 141 | 0 | 0 | 0 | 10 | 2 | 719 | 18,719 |
| BOMBAY | 20,621 | 0 | 52 | 876 | 0 | 0 | 5,413 | 428 | 3,783 | 31,173 |
| J.N.P.T. | 0 | 0 | 855 | 23 | 0 | 0 | 2,077 | 177 | 433 | 3,565 |
| KANDLA | 18,157 | 34 | 824 | 370 | 0 | 45 | 730 | 51 | 4,340 | 24,551 |
| TOTAL | 76,923 | 34,128 | 4,255 | 3,187 | 19,175 | 7,410 | 12,249 | 1,052 | 21,933 | 180,312 |

*Source : Major Ports of India 1993-1994, Indian Ports Association*



**FIGURE 2.3.3 Share of Cargo Volume by Major Ports**

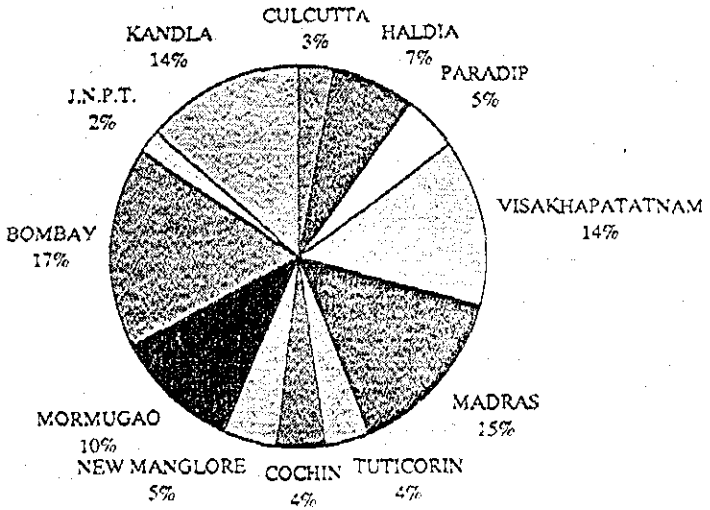



**FIGURE 2.3.4 Share of Container Cargo Volume in Major Ports**

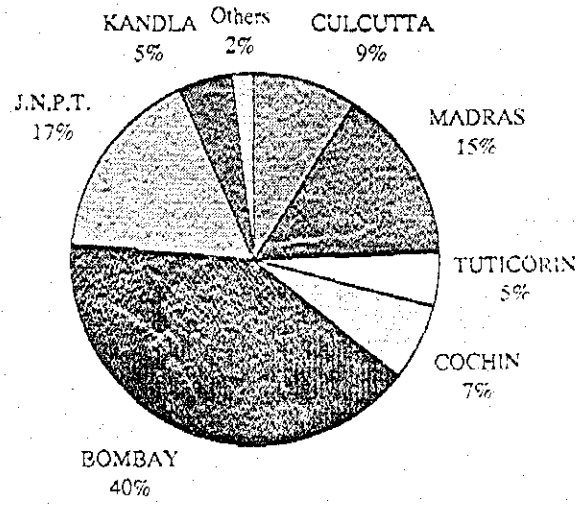


**TABLE 2.3.4 Container Cargo Facilities in Indian Container Ports**

| PORT | NO.OF BERTHS | VESSEL SIZE (IN DWT) | EQUIPMENT | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | QUAY SIDE GANTRY | YARD GANTRY CRANES | TOPLIFT TRUCKS | TRACTORS | FORKLIFTS | TRAILERS |
| CALCUTTA | 3 | 20,000 | - | 3 x 35.5 T (RTG) | 2 x 35 T<br>1 x 25 T | 17 | 2-8 T<br>32-2 T | 14 |
| HALDIA | 1 | 40,000 | 1 x 30 T | 1 x 30 T (Rail Mounted) | - | 4 | 8 | 5 |
| MADRAS | 2 | 20,000 to 45,000 | 2 x 35.5 T (RTG)<br>2 x 40 T | 4 x 35.5 T<br>4 x 40 T | 2 x 35 T<br>3 x 25 T<br>2 x 40 T | 34 | 6 | 40 |
| COCHIN | 2 | 20,000 to 30,000 | 2 x 35.5 T | 4 x 35.5 T (RTG) | 3 x 35 T | 2-20 T<br>20-30 T | 20 | 40 |
| J.N.P.T. | 3 | 60,000 | 3 x 35.5 T | 8 x 35.5 T<br>1 x 35.5 T (Rail Mounted) | - | 38 | - | 136 |
| BOMBAY | 7 | 42,000 | 2 x 35.5 T | 3 x 35.5 T (RTG) | 2 x 35 T<br>3 x 25 T | 40-20' CONT.<br>3 -40' CONT. | - | - |

*Source : Major Ports of India 1993-1994, Indian Ports Association*

## 2.4 Development of the Ports of Singapore and Hong Kong

### 2.4.1 Port of Singapore

152. Container traffic through the Port of Singapore has reached 12 million TEUs in 1995, a growth of 15 % from the previous year. Transhipment traffic from the Indian ports is reported to have increased by 19 %. The port is believed to be carrying out the most efficient port operations in the Asia and Pacific region.

153. The Port of Singapore Authority (PSA) operates six terminals, i.e. Tanjong Pagar Terminal, Keppel Terminal, Brani Terminal, Pasir Panjang Terminal, Sembawang Terminal and Jurong Port. Container terminals are Tanjong Pagar, Keppel and Brani Terminals, whose productivity is said to be around 100 containers per hour although a maximum productivity of 180 containers per hour was recorded.

154. *Profile of container terminals and cargo handling equipment is as shown in Table 2.4.1.*

**TABLE 2.4.1 Container Terminals**

| | Tanjong Pagar Terminal | Keppel Terminal | Brani Terminal |
|---|---|---|---|
| Size | 83 ha | 96 ha | 80 ha |
| Draft | 9.4 - 13 m | 10 - 13.6 m | 12- 15 m |
| Berths | 7 main, 1 feeder | 6 main, 6 feeder (2 additional feeder berths) | 6 main, 3 feeder |
| Quay Cranes | 28 | 33 | 31 |
| Yard Cranes | 207 (shared) | | 101 |
| Prime movers | 347 (shared) | | 143 |
| Chassis | 343 (shared) | | 146 |
| Ground Slots | 35,000 | | 15,000 |
| Reefer | 1,372 points by end 1995 | | 704 points 1344 by 1996 |
| Capacity | 8.2 million TEUs | | 5.5 m TEUs |

Source: Port of Singapore Authority

**New Container Terminal at Pasir Panjang**

155. The capacity of the existing container terminals is estimated at 13.7 million TEUs and will be exceeded by 1997. To accommodate the increase in container cargo throughput, PSA is building a new container terminal, Pasir Panjang, by reclaiming land, which is about 7 km from the west gate of the present three container terminals. Development of this new terminal was commenced in 1993 and operations are expected to start in 1998 with five berths. Whole completion of Phase I is expected in 2000.

156. The second phase commenced in 1995 and the first two berths will be completed in 2001. An additional 16 berths will be entered into service by 2009. When the two phases are completed, there will be a total of 26 berths and a capacity of 18.3 million TEUs, which is about 1.3 times of the present capacity of the Port of Singapore. (See Figure 2.4.1)

157. In planning the new terminal, a berth is designed to handle 700,000 TEUs per annum. Brani Terminal was designed to handle about 600,000 TEUs per berth annum. Cost of Phase I is estimated at about S$2 billion, which is S$250 million per berth, and the cost of Phase II is assessed at S$5 billion, or S$280 per berth.

158. Outline of the new terminal is shown in Table-2.4.2

**TABLE 2.4.2 New Container Terminal at Pasir Panjang**

| | PHASE I | PHASE II |
|---|---|---|
| Terminal Area | 127 ha | 222.6 ha |
| Berths | 8 | 18 |
| Handling Capacity | 5.4 million TEUs | 12.9 million TEUs |
| Start of Reclamation | Sep. 1993 | 1995 |
| Completion Milestone | First 5 berths by 1998 | First 2 berths by 2001 |
| Completion | 2000 | 2009 |
| Estimated Cost of Development | more than S$2 billion | some S$5 billion |

*Source: Port of Singapore Authority*

159. Since the development of Phase I and Phase II is on-going, further development, Phase III and IV, is envisaged in the east wing of the Phase II development. There will be a total of 49 berths after the completion of all phases, having a capacity of 36 million TEUs, which is about three times of the existing capacity.

| Phase of Development | No. of Berths |
|---|---|
| I | 8 |
| II | 18 |
| III | 14 |
| IV | 9 |
| Total: | 49 |

160. PSA is planning to introduce Automated Guide Vehicles (AGVs) to Pasir Panjang Terminal operations. That system aims at unmanned fully automated operations to cope with the current tight manpower situation and to achieve very high turnover of the terminal. Yard operations will be carried out with Overhead Bridge Cranes instead of ordinary rubber tyred gantry cranes.

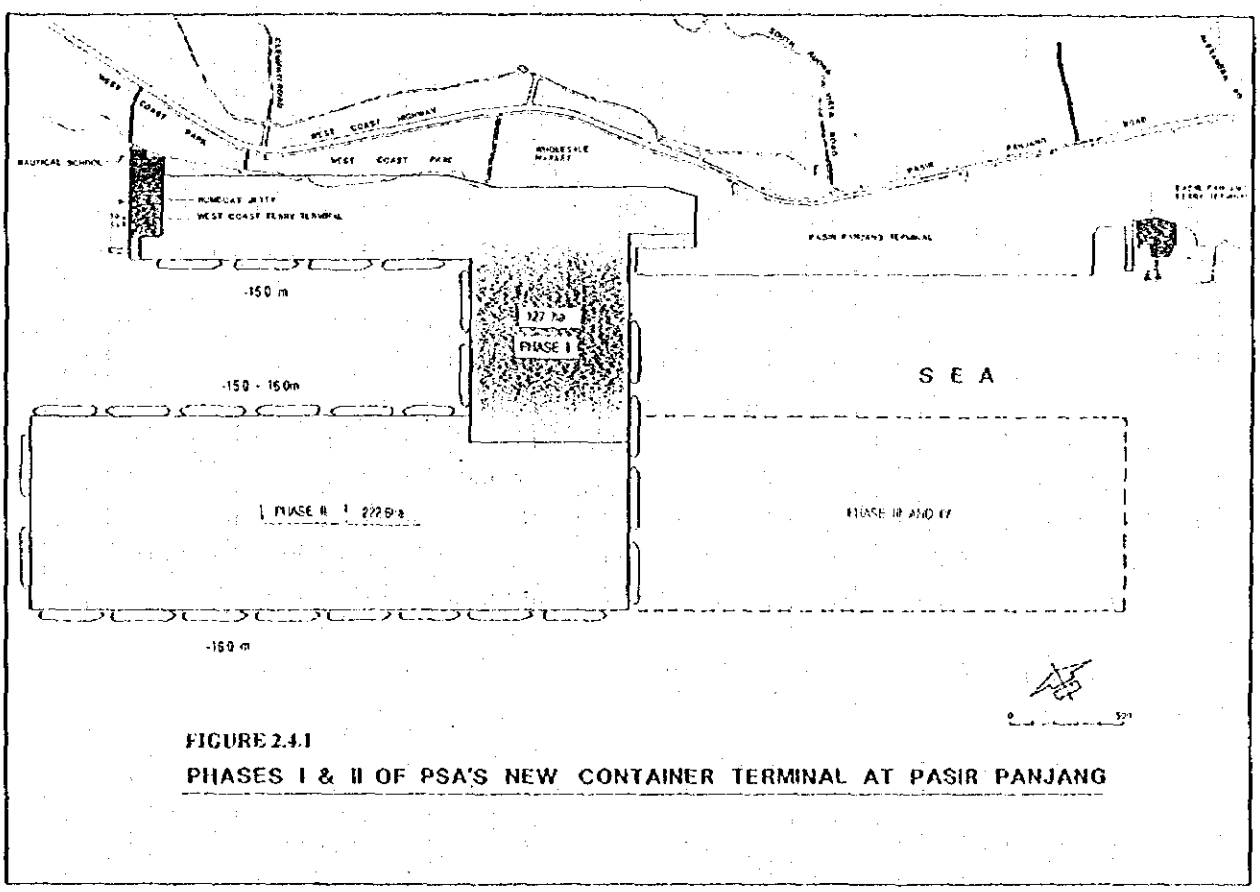



FIGURE 2.4.1
PHASES I & II OF PSA'S NEW CONTAINER TERMINAL AT PASIR PANJANG

### 2.4.2 Development Plan of the Port of Hong Kong

#### (1) Summary

161. Centering on Victoria Harbor, the port of Hong Kong has been developed as a naval, passenger, ferry and cargo port since the 1840s.

162. With the development of containerization that began in the 1960's, the number of container ships requesting that their cargoes be handled at Hong Kong increased. As there was not enough space to allow for a large construction project in the Victoria Harbor area, construction of a new container port was started on reclaimed land in the Kwai Chung district of the Kowloon Peninsula. Since the first terminal came on stream in 1972, the volume of container cargo being handled at the port of Hong Kong has been steadily increasing. The container cargo volume of 11,050,000 TEUs registered in 1994 is among the world's largest handled by a single port.

163. The remarkable growth of Hong Kong's container terminal is closely associated with the increase in the volume of cargoes imported and exported by foreign companies (including Hong Kong-based ones) that have made economic inroads into the economic development zone in the Huanan area while taking advantage of China's open foreign trade policy. Today, approximately 80 percent of the container cargoes handled at the port of Hong Kong is shipped to and from China.

164. At the port of Hong Kong, container cargoes are handled by container terminals, mid-stream operations and river trade. The mid-stream operation is a domestic trade transportation between buoyed berths and shore wharves accomplished largely by the use of barges. The river trade is foreign trade transportation between Hong Kong and ports on the Pearl River. Of the total container volume of 11,050,000TEUs in 1994, 66 percent was handled by container terminals, 26 percent by mid-stream operations and 8 percent by river trade. Table 2.4.2(1) shows the volume of container cargoes handled during a recent four year period.

**TABLE 2.4.2(1) Container Cargoes Handled at the Port of Hong Kong** (in 1000 TEUs)

| | 1991 | 992 | 1993 | 1994 |
|---|---|---|---|---|
| Container Terminal | 4,514 | 5,079 | 5,797 | 7,278 |
| Mid-stream Operation | 1,573 | 2,461 | 2,797 | 2,839 |
| River Trade | 74 | 432 | 610 | 933 |
| Total | 6,161 | 7,972 | 9,204 | 11,050 |

### (2) Present Facilities at the Container Terminal

165. The container port of Hong Kong, which is situated in Kwaichung in the western part of the Kowloon Peninsula, has been developed and operated by four private companies: Hong Kong International Terminal Ltd. (HIT), Modern Terminals Ltd. (MTL), Sealand Orient Terminals Ltd. (Sealand) and COSCO-HIT Terminals Ltd. (CHT).

166. Unlike the governments of other Southeast Asian countries, the government of Hong Kong (more specifically the Port Development Bureau) does not participate in the development of the container port itself, instead confining itself to the formulation of basic plans covering siting, the number, length and depth of berths, the area of yards, the time of construction, and the invitation of tenders for the right of development. The aforementioned private companies are the successful bidders who paid development premiums to the government. They have been carrying out land reclamation, facility construction and other development work using the funds they have raised on their own. They are also controlling and managing the operation of the container terminals.

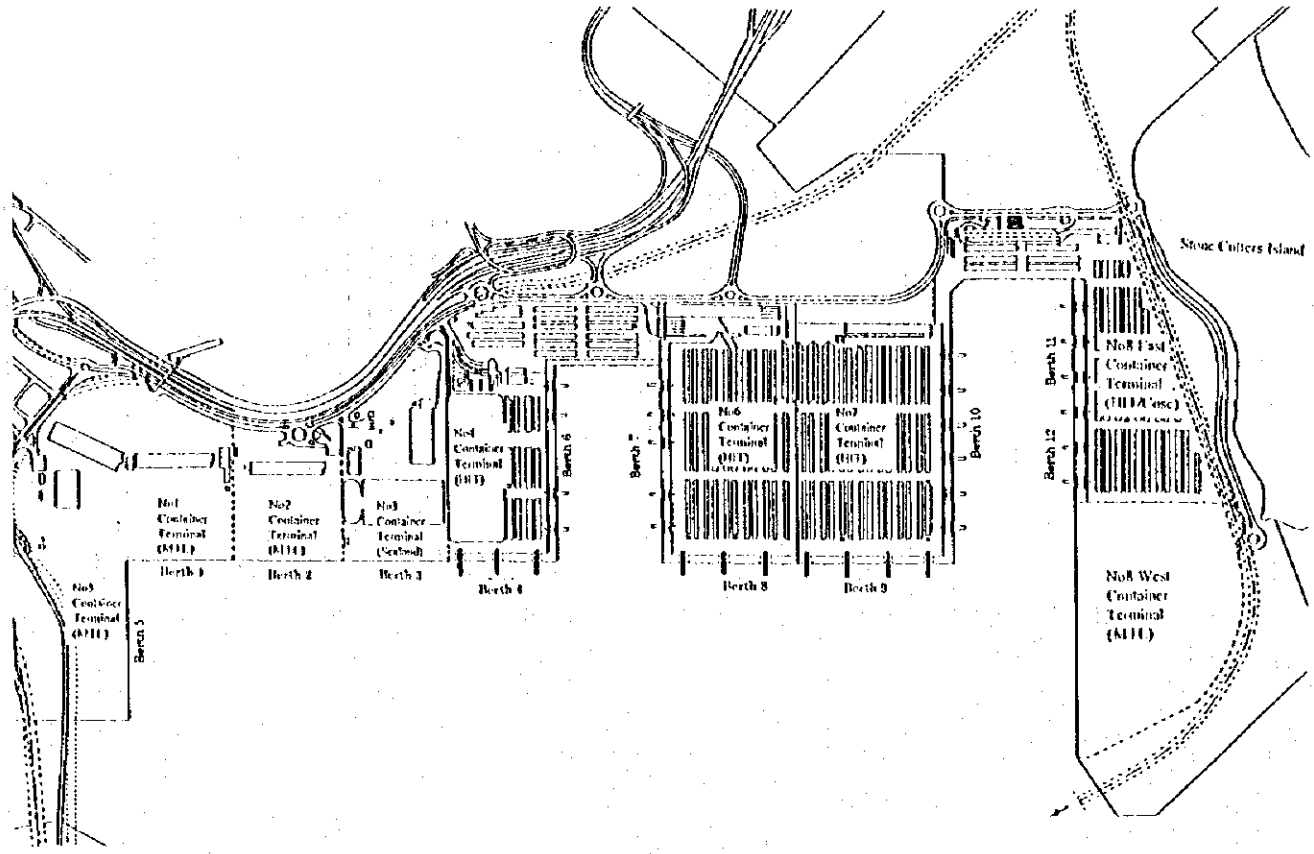
167. At present, eight container terminals are in operation. Table 2.4.2(2) show their main facilities, whereas Fig. 2.4.2.1 shows their layouts.

**TABLE 2.4.2(2) Main Facilities at Hong Kong's Container Terminals**

| | HIT | MTL | SEALAND | CHT |
|---|---|---|---|---|
| Constructed in | 1974 | 1969 | 1972 | 1991 |
| Terminal in Use | CT4.6.7. | CT1.2.5.8W | CT3 | CT8E |
| No. of Berths | 10 | 5 | 1 | 2 |
| Water Depth of Berth (m) | CT4.:12.2<br>CT6:12.2<br>CT7:14.0 | CT1/2:12.2<br>CT5:12.2<br>CT8W:14.5 | CT3:12.2 | CT8E:14.5 |
| Length of Berth (m) | CT4:880<br>CT6:955<br>CT7:1,151<br>(Berge Berth:306) | CT1/2:610<br>CT5:475<br>CT8W:740 | CT3:305 | CT8E:640 |
| Terminal Area (Ha) | 90.5 | 85 | 16.7 | 30 |
| Container Crane | 30 | 22 | 3 | 8 |
| Yard Crane | RTG:92<br>RMG:12 | RTG:72<br>RMG:7 | RTG:9 | RTG:27 |
| Distribution Center | HIT Distributin CFS: 21000sm Asi Terminla | | | |

Note: RTG = Rubber-tired transfer crane RMG = Rail-mounted gantry crane

**FIGURE 2.4.2 Layout of container terminals in Kwai Chung District**




**(3) New Container Terminal Development Plan**

168. The development of port facilities in Hong Kong has been carried out as a part of the Port and Airport Development Strategy (PADS) proposed in 1989. Economic changes in Hong Kong and other countries have necessitated reviews of the development plan for port facilities which was originally based on the data of 1988. The results of the first and second reviews made in 1992 and 1995 were reflected in the First and Second Reviews of the Port Development Strategy.

169. The Second Review estimates that the volume of cargo handled at the port of Hong Kong will increase at an annual rate of 6.7 percent between 1992 and 2011. This volume is expected to reach 349 million tons (3.4 times greater than in 1992) in 2011. Especially, it is estimated that the volume of container cargoes will increase at an annual rate of 7.6 percent over the same period of time, reaching 31.8 million TEUs (4.0 times greater than in 1992) in 2011. (TABLE 2.4.1(4))

170. Based on the conclusion of this review, No. 9 container terminal, with four berths, will be constructed at Tsing Yi between 1998 and the middle of 1999 and Nos. 10 to 13 container terminals, with seventeen berths, will be constructed on the island of Lan Tao between 1999 and 2004. Although the companies undertaking the development, control and operation of the No. 9 container terminal have been decided upon by inviting tenders, its development has fallen greatly behind schedule because of the stiffening in the relationship between Great Britain and China.

171. In addition, it is planned that port facilities for the mid-stream operations and river trade will be constructed in the vicinity of the foreign trade container terminals between 1995 and 2008. Table 2.4.2(3) show the development plan for these port facilities and Fig. 2.4.2.3 shows the development site therefor.

**Table 2.4.2(3) Outline of the Container Terminal Development Plan**

| | | Terminal | Number of Berths | Operator | Berth Length (m) | Area of Terminal (Ha) | Construction Schedule |
|---|---|---|---|---|---|---|---|
| Container Terminal for Ocean Going Vessels | Tsing Yi | CT9 | 1<br>2<br>1 | MTL<br>TWC<br>HIT | 1,280 | 60 | 1996-99 |
| | Lantawu Port | CT10 | 4 | | | | 1996-98 |
| | | CT11 | 4 | | | | 1997-99 |
| | | CT12 | 5 | | | | 1998-01 |
| | | CT13 | 4 | | | | 2000-03 |
| Cargo Working Area for Mid-stream Cargo | Stonecutter Island | | | | 390 | | 1995-97 |
| | Lung Kwu Tan | | | | 4,000 | | 2003-06 |
| | Tseung Kwan O Area 131 | | | | 2,000 | | 2000-03 |
| | East of CT10 | | | | 600 | | 2000-02 |
| | East of CT12 | | | | 1,000 | | 2000-03 |
| | Northshore lantau | | | | 1,200 | | 1998-01 |
| Container Terminal for River Trade Cargo | Tuen Mun Area 38 | | | | 3,000 | | 1996-98 |
| | Northshore Lantau | | | | 2,000 | | 2000-02 |

Source: The Second Review of Port Development Strategy (Port Development Barod of Hong Kong; Oct. 1995)
Note: TWC; Tsing Yi Cinsortium (Jardine Matheson-led)

**TABLE 2.4.2(4) Projected Trends of Port Container Throughput**

(million TEUs)

| Year | 1992 | 1995 | 2001 | 2006 | 2011 |
|---|---|---|---|---|---|
| Throughput | 8.0 | 12.7 | 2.1 | 27 | 32 |

## 3. The Port of Colombo

### 3.1 Port Facilities

#### 3.1.1 Port Infrastructure

Historical Development of Port Facilities

172. The development of the Port of Colombo began in the mid-1870s with the construction of the South-West Breakwater to provide safe anchorages for ocean-going steam boats. The Harbour Board was established in 1882 and the S-W Breakwater was completed in 1884. Construction of two other breakwaters, North-East and North-West Breakwaters, began in 1894 and was completed in 1906. Since then, the basic configuration of the port has remained unchanged for 90 years.

173. The Harbour Board was succeeded by the Colombo Port Commission in 1913. After World War II, alongside berths -Queen Elizabeth Quay, Bandaranaike Quay, Prince Vijaya Quay, South Pier, North Pier and Coastal Berths- were constructed to adopt to the change in cargo handling from lighterage to alongside berthing operations.

174. Coping with the containerization of seaborne cargo, the port extended Queen Elizabeth Quay to furnish a container terminal during the period from 1969 to 1980. The construction of a full size container berth, Jaya No.1, was started in 1982 and service commenced in 1985. Three other full size container berths have since been constructed and operations commenced in 1987 (Jaya No.2), in 1994 (Jaya No.3) and in 1996 (Jaya No.4). Chronicle of the development of the port of Colombo is shown in Table 3.1.1.

Berthing Facilities

175. Alongside berthing facilities are listed in Table 3.1.2 and their locations are shown in Figure 3.1.1. The port has a total quay length of about 4,900 meters with the maximum draft of 14 meters at Jaya Container Terminal. Single Point Buoy Mooring was constructed in 1987 about 9 km away from the shore to accommodate a crude oil tanker.

Breakwaters

176. Three breakwaters were built during the period from 1875 to 1906 and a sheltering arm was attached to the S-W Breakwater during 1907-1912. All three breakwaters have a concrete block structure, where about 30 ton cubes are piled up on the rubble mound deposits. Length of each breakwater is:

| | |
|---|---|
| South-West Breakwater | 1,284 m |
| Extension arm from the S-W | 550 m |
| North-West Breakwater | 809 m |
| North-East Breakwater | 305 m |

**TABLE 3.1.1 Chronicle of the Development**

| | |
|---|---|
| *1875-1884* | *South-West Breakwater was constructed (1,284 m).* |
| *1882* | *The Harbour Board was created.* |
| *1894-1898* | *North-East Breakwater was constructed (305 m).* |
| *1898-1906* | *North-West Breakwater was constructed (809 m)* |
| *1907-1912* | *Outside Sheltering Arm from the South-West Breakwater was constructed (550 m).* |
| *1913* | *The Colombo Port Commission (CPC) was created.* |
| *1950-1954* | *Sixteen alongside berths were constructed - Queen Elizabeth Quay (QEQ), Bandaranayake Quay, Prince Vijaya Quay, South Pier, North Pier and Coastal Berths.* |
| *1958* | *The Port (Cargo) Corporation was founded.* |
| *1967* | *The Port Tally and Protective Services Corporation was formed.* |
| *1969-1980* | *Extension of QEQ for a container terminal was carried out by the Colombo Port Personnel (L300, D12.8m, Area 3.2ha).* |
| *1979* | *The Sri Lanka Ports Authority (SLPA) was constituted.* |
| *1982-1985* | *Jaye Container Terminal (JCT) Berth No.1 was constructed (L300m, D12m, Area 9.75ha).* |
| *1984-1987* | *JCT Berth No.2 was constructed (L332m, D13m, Area 9.94ha).* |
| *1991-1994* | *JCT Berth No.3 was constructed (L330m, D13.5m, Area 15.4ha).* |
| *1993-1995* | *JCT Berth No.4 was constructed (L330m, D14m, Area 10.2ha).* |

*Source: Sri Lanka Port Authority*

## TABLE 3.1.2 Berthing Facilities

| Quay | | Length (m) | Draft (m) | Remarks |
|---|---|---|---|---|
| Queen Elizabeth Quay | 1 | 200 | 9.2 | |
| | 2 | 200 | 9.8 | |
| | 3 | 192 | 10.1 | |
| | No.4/5 | 190 | 9.8 | 3 Quay Cranes |
| | No.5/6 | 243 | 10.8 | (No.4-6 Berths) |
| Bandaranayake Quay | 1 | 163 | 6.5/8.5 | |
| | 2 | 181 | 9.5 | |
| | 2A | 125 | 10.0 | |
| | 3 | 194 | 9.0 | |
| | 4 | 194 | 8.5 | |
| | CB1 | 99 | 6.1 | |
| | CB2 | 94 | 4.8 | |
| Jaya Terminal | No.1 | 300 | 12.0 | 5 Quay Cranes |
| | No.2 | 332 | 13.0 | (No.1-2 Berths) |
| | No.3 | 330 | 13.5 | 6 Quay Cranes |
| | No.4 | 330 | 14.0 | (No.3-4 Berths) |
| | EX(N) | 172 | | |
| | EX(S) | 180 | 9.0 | 1 Quay Crane |
| Guide Pier | 1 | 196 | 7.9 | |
| | 2 | 167 | 9.2 | |
| North Pier | | 294 | 10.4 | |
| South Pier | | 234 | 9.5 | |
| Prince Vijaya Quay | 1 | 150 | 9.2 | |
| | 2 | 188 | 9.5 | |
| Single Point Buoy | | | 28.0 | Offshore |
| Total | | 4,948 | | |

GENERAL PLAN OF COLOMBO PORT

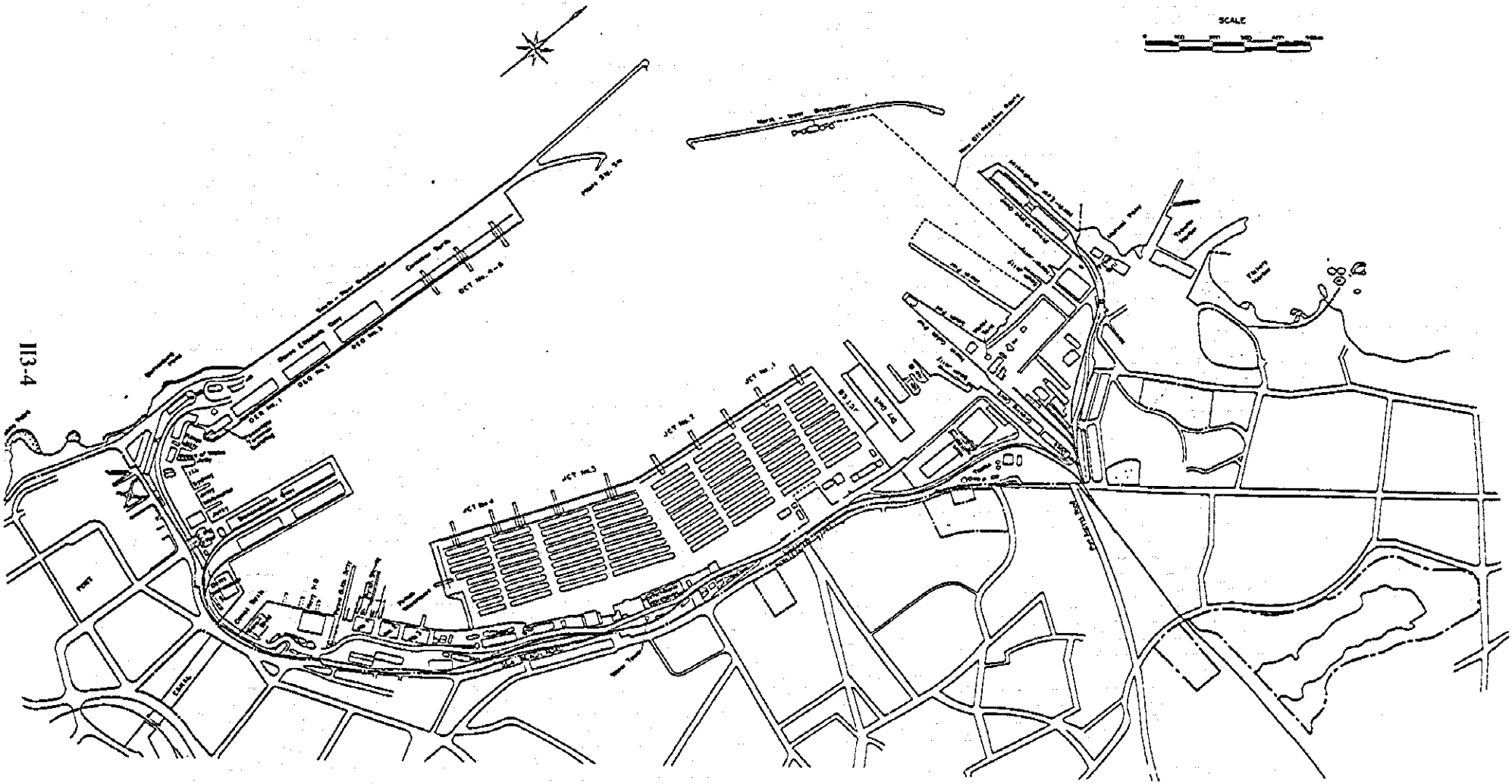


FIGURE 3.1.1 Port of Colombo

### 3.1.2 Cargo Handling Facilities

177. The following are the results of the investigation of the present state of the main cargo handling facilities in the Port of Colombo, including container yards, warehouses, container freight stations and loading and unloading machines.

#### (1) Container Yards

178. Container yards of the Port of Colombo are located in the two container terminals; one is the Queen Elizabeth Container Terminal (QCT) and the other is in the Jaya Container Terminal (JCT). The QCT yard has an area of approximately 7.9 hectares, as a result of several expansions since the completion of its construction in 1982. The JCT yard has an area of approximately 32.7 hectares, as a result of four phases of expansion between 1985, when it was constructed with technical assistance and loans from Japan, and 1996.

179. Designed as a full-fledged container terminal for international trade, the JCT has an overall berth length of 1260 m and a adequate breadth of 350 m. The QCT is built on a long but narrow area, with an overall berth length of 1000 m and a breadth of 120 m. Regarding the expansion of the QCT, several plans, including the rehabilitation of the Queen Elizabeth Quay (QEQ), have been proposed. Among the development projects of the port of Colombo, redevelopment of QCT is one of the important issues which requires the most urgent attention.

180. The main specifications, such as approximate size and the number of ground slots, of the container storage yards in the Port of Colombo, are given in Table 3.1.2.(1).

**Table 3.1.2(1) Outline of Container Storage Yards**

(1) JCT Storage Yards (As of 31 Dec. 1995)

| Terminal Number | Area approximate | Number of Ground Slots (Designed) | | | Average Number of Ground slots per Unit Area | Number of Ground Slots (Registered) |
|---|---|---|---|---|---|---|
| | | Dry Container | Reefer Container | Total | | |
| | (Ha) | (TEU) | (TEU) | (TEU) | (TEU/Ha) | (TEU) |
| JCT Nos 1&2 | 16.5 | 4,092 | 144 | 4,236 | 257 | 4,053 |
| JCT Nos 3&4 | 16.2 | 4,014 | 210 | 4,224 | 261 | 3,615 |
| JCT Other | - | - | - | - | - | 2,541 |
| JCT Summary | 32.7 | 8,106 | 354 | 8,460 | 259 | 10,209 |

(2) QCT Storage Yards (As of 31 Dec. 1995)

| Terminal Number | Area approximate | Number of Ground Slots (Designed) | | | Average Number of Ground slots per Unit Area | Number of Ground Slots (Registered) |
|---|---|---|---|---|---|---|
| | | Dry Container | Reefer Container | Total | | |
| | (Ha) | (TEU) | (TEU) | (TEU) | (TEU/Ha) | (TEU) |
| QCT Nos.4-6 | 5.9 | 1,300 | - | 1,300 | 220 | 1,300 |
| QEQ Nos.2-3& | 2.0 | 400 | - | 400 | 200 | 400 |
| Total | 7.9 | 1,700 | - | 1,700 | 215 | 1,700 |

Source: Sri Lanka Ports Authority

### (2) Warehouses and Container Freight Stations

181. Table 3.1.2(2) shoes the size and functions of warehouses and container freight stations(CFS) in the Port of Colombo.

182. Built before the beginning of the containerization age in the 1960s, almost all warehouses are old and going to be removed or re-built as a part of berth rehabilitation programs.

183. Most of the facilities currently used as container freight stations used to be warehouses for break-bulk or bulk cargoes, except Nos. 1 and 3 CFSs at the JCT. Nos. 1 and 3 CFSs at the JCT were built as a part of the construction project of the JCT, and are the only proper CFSs in the port of Colombo. They are now used mainly for the de-stuffing of imported LCL cargoes.

184. Container cargoes for export are stuffed at the inland container depots of private companies in the neighborhood of the port of Colombo and delivered as FCL cargoes into container terminals in the port.

**TABLE 3.1.2(2) CFS and Cargo Warehouses**

| No | Facility Name | | Area approximate (sq.m) | Functions |
|---|---|---|---|---|
| 1 | QCT Container Freight Station | (No1) | 150×30 | Distaffing for General Import Cargo |
| 2 | | (No2) | 150×30 | Distaffing for General Import Cargo |
| 3 | BQ No1 Warehouse | (No1) | 140×30 | Storage of General Cargo |
| 4 | | (No2) | 140×30 | Storage of General Cargo |
| 5 | | (No3) | 160×360 | Storage of General Cargo |
| 6 | | (No4) | 160×30 | Storage of General Cargo |
| 7 | JCT Container Freight Station | (No1) | 120×40 | Distaffing for General Import Cargo |
| 8 | | (No2) | 110×35 | Distaffing for Dangerouscargo |
| 9 | | (No3) | 60×35 | Distaffing for General Import Cargo |
| 10 | | (No4) | 60×40 | Distaffing for General Import Cargo |
| 11 | Restowing Warehouse (PVQ) | | 60×90 | Restowing Cargo and Customs inspection |
| 12 | PVQ Warehouse | (No1) | 120×30 | Storage of General Cargo |
| 13 | | (No2) | 130×30 | Storage of General Cargo |
| 14 | Delft Warehouse | | 70×45 | Storage of General Cargo |

Source: Sri Lanka Ports Authority

### (3) Container Handling Equipment

185. As at the end of December 1995, the container terminals of the Port of Colombo have a total of 14 container cranes and 30 rubber mounted transfer cranes (RTCs).

186. JCT Nos. 1 and 2 terminals have a total of five Panamax-type container cranes and 15

one-over-three RTCs. JCT Nos. 3 and 4 terminals have a total of five Over-Panamax-type container cranes and 15 one-over-three RTCs.

187. JCT-CBS has one container crane but JCT-CBN has none. Therefore, vessels berthing at JCT-CBN use their own ship gears to handle container cargoes. These two feeder vessel berths use the container yard of JCT Nos. 1 to 4 terminals.

188. QCT No. 4 and QCT Nos. 5 and 6 terminals have a total of three Panamax-type container cranes and use top lifters and side loaders to handle cargoes in the yard.

189. Tables 3.1.2.(3) and 3.1.2.(4) show the main specifications of the container handling equipment of the container terminals of the Port of Colombo.

**TABLE 3.1.2(3) Container Handling Equipment**

(1) JCT Container Crane (As of 31 Dec. 1995)

| Berth No | Number of Equipment | Type of Crane | Capacity (Ton) | Outreach (m) | Backreach (m) | Rail Span (m) | Lifting Height | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Abv.TOR (m) | Bel.TOR (m) |
| JCT Nos 1&2 | 5 | Self-traversing Trolley Gantry Type | 35.5 | 38.1 | 16.0 | 16.0 | 29.3 | 13.0 |
| JCT Nos 3&4 | 5 | Self-traversing Rope-trolley, Travelling | 41.0 | 44.5 | -2.0 | 30.0 | 34.0 | 13.0 |
| JCT Feeder Berth | 1 | Rope-trolley, Travelling Gantry Type | 41.0 | 38.1 | 16.0 | 10.0 | 29.3 | 13.0 |

(2) QCT Container Crane (As of 31 Dec. 1996)

| Berth No | Number of Equipment | Type of Crane | Capacity (Ton) | Outreach (m) | Backreach (m) | Rail Span (m) | Lifting Height | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Abv.TOR (m) | Bel.TOR (m) |
| QCT Nos 4&6 | 3 | Rope-trolley, Travelling Gantry Type | 35.5 | 35.0 | 10.6 | 27.0 | 24.5 | 13.7 |

Source: Sri Lanka Ports Authority

## TABLE 3.1.2(4) Container Yard Equipment

(1) JCT Transfer Crane

| Berth No | Number of Equipment | Type of Crane | Capacity (Ton) | Max. Life (m) | Stacking Height | Wheel Base (m) | Number of Raws (Cont.+Tr) |
|---|---|---|---|---|---|---|---|
| JCT Nos 1&2 | 15 | Rubber Tired Dantry Type | 35.5 | 12.5 | 1 over 3 | 22.7 | 6+1 |
| JCT Nos 3&4 | 15 | | 41.0 | 15.2 | 1 over 4 | 22.7 | 6+1 |

(2) QCT / QEQ Container Handling Equipment

| Berth No | Type of Crane | Model | Capacity | Number of Equipment | Remarks |
|---|---|---|---|---|---|
| QEQ Nos 2&6 | Container Handling Forklift | Mitsubishi FD150 | 15.0 | 1 | Ladon Container Handling |
| | | Mitsubishi FD250 | 25.0 | 4 | |
| | | Mitsubishi FD400 | 40.0 | 7 | |
| | | Mitsubishi FD420 | 42.0 | 4 | |
| | | Mitsubishi FD280 | 28.0 | 1 | |
| | | TCM FD60 Z7 | 6.0 | 3 | Empty Container Handling |
| | | Mitsubishi FD35 | 3.5 | 8 | |
| | | | 2.5 | 51 | |

*Source: Sri Lanka Ports Authority*

190. Non operation time of the container handling equipment caoused by troubles, repairs and maintenance is shown in Table A3.1.2(1). The preventive maintenance system employed at the Port of Colombo keeps its container handling facilities in much better condition than other developing countries. Very few operational problems were observed.

### (4) Other Cargo Handling Equipment

191. Table A3.1.2(2), shows the lists and specifications of cargo handling equipment in the port of Colombo.

## 3.2 Navigation

### 3.2.1 Geographical feature of Colombo approaches

192. The land near Colombo is low-lying and does not show up far to seaward, although in exceptionally clear weather Adam's Peak and the other mountains of Sri Lanka may be visible from a great distance.

(Landmarks)
193. The buildings in that part of the city at the S end of the harbor and known as The Fort will be seen at a distance of 20 km off shore. There are several prominent high buildings in The Fort including a conspicuous white monument to Buddha Jayantha Chaitiya, standing on four yellow curved legs, at an elevation of 82 m, and the offices of the National Mutual. On the W side of The Fort and 90 m within Galbokka Point stands Colombo Lighthouse; a circular stone tower 15 m in height, painted black and white in checkers.

Saint James Church, with twin towers, and Saint Lucia's Cathedral, with a dome, both stand about 2.8 km NE of Colombo Lighthouse.
At the NE corner of the harbor a flour mill, 64 m high, is marked by red air obstruction lights and a water tower, 35 m high, stands on the waterfront 1.9 km NE of Colombo Lighthouse.

All Saints' Church, with a tall spire, stands about 1.9 km E of the lighthouse and the City Hall, with a white dome, 1.9 km farther E.
Two steel framework radio masts, 82 m high, stand about 4.7 km ESE of Colombo Lighthouse; both exhibit red air obstruction lights.

(Current)
194. The current off Colombo is variable, its rate seldom exceeding half a knot. But near shoal water it usually sets N at a rate of one and a half knots during the NE monsoon.

(Offshore features)
195. A dangerous wreck, whose position is approximate, lies in the approaches to Colombo Harbor, 9.3 km WNW of Colombo Lighthouse. It is marked on its S side by a light-buoy(green).

Galua Rock, also known as Drunken Sailor Rock, is a shoal with a minimum depth of 1.2 m lying about 830 m WSW of Colombo Lighthouse; it has two rocky heads over which the sea breaks during the SW monsoon. A buoy(red conical) is moored 460 m W of the W head.

Para Gala, also known as Tartar Rock, is a pinnacle rock, with a depth of 5.8 m, lying 920 m NW of Colombo Lighthouse. It is steep to and never breaks and is marked on its W side by a buoy(red conical, cone topmark).

Kelani Gara, a narrow bank with a minimum depth of 16.5 m lies with its S end 3.2 km WNW of Colombo lighthouse.

Ona Gala, a narrow ridge, lies with its S end 6 km N of Colombo lighthouse with a minimum depth of 6.4 m over a head named Galwala near its N end ; there is a foul patch 1,300 m SW of Galwala; light-buoy(red-can, white flashing) is moored about 550 m SW of the S end of the shoal.

(Tanker mooring buoy)
196. A tanker mooring buoy is situated 8.3 km NW of Colombo lighthouse.
A submarine pipe line is laid in an ESE direction from the buoy to the root of North East breakwater.

(Anchorages)
197. Vessels arriving off Colombo should anchor in Negombo Waiting Area off Negombo Point in the vicinity of position 7° 11'.5 N, 79° 45'E or in Panadura Waiting Area off Panadura S of 6° 43'N until instructed to proceed to the anchorage off the harbor entrance. There are no designated anchorages off the harbor entrance and the roadstead is very crowded.

(Entering the port practice)
198. Pilotage is compulsory for all merchant vessels except those exempted by the Master Attendant. A vessel intending to enter the port picks a pilot up about 2 to 3 km NNW of SW breakwater lighthouse, approaching the position, when possible, on a SE course. It proceeds an access fairway about 2 km long to the W entrance.

199. The fairway, in 1995, was maintained at -13 m in depth and is scheduled to deepen a leg of 2 km long by 300 m wide at the outer entrance and 530 m wide at the bend close off the W entrance, in <320° > direction from the end of SW breakwater lighthouse, at -15 m in depth in course of 1995.
The fairway is curved at angle of <15° > at 200 m seaward of the W entrance by projected ends of NW and SW breakwaters.

200. Vessels may enter and leave port by whichever entrance is more convenient subject to the depth limitation for the N entrance. At night vessels should pass midway between the red and green lights on the breakwater-ends. A squat up to one meter can be experienced within the port.

201. Vessels are not permitted to navigate the harbor, or to lie at mooring with less than 0.6 m under their bottoms save by special sanction of the Master Attendant.

### 3.2.2 Layout of breakwaters and wharves

202. Colombo Port is artificially formed by three breakwaters which enclose an area between N side of The Fort and Mutwal Point.
The depth with the exception of the northern area of a line extending from SW corner of Jaya Container Terminal to the SE end of NW breakwater has been dredged to -14 m, and the above-mentioned northern area is scheduled to dredged at -14 m within 1995.

(Breakwaters)
203. SW breakwater, built of concrete blocks, extends NNE from the shore at the S end of Colombo Port; about 460 m S of the outer end of this breakwater an arm extends 190 m NNE; there is a landing jetty at this arm where the port signal station and pilot station are sited together. The signal station maintains a day watch but the pilot station maintains a 24 hour watch. NW breakwater, is detached and protects the port between the end of SW breakwater and NE breakwater which extends 370 m W from Mutwal Point. Lights are exhibited from the ends of these breakwaters.

(West Entrance)
204. The W entrance, between SW and NW breakwaters, is about 235 m wide (actual navigable width for large vessels drawing over 10 m is 180 m) and dredged to -13 m(planned to -14m in 1995). There is a disturbed swell across this entrance during the SW monsoon. It has been reported (1985) that under these conditions the recommended approach is 145° .
A current, setting N along the coast, up to one and a half kn may be experienced off the entrance, particularly during the NE monsoon. This results in an E set across the W entrance; also reported present during the SW monsoon.

(North Entrance)
205. The N entrance between NW and NE breakwaters is just over 185 m wide with a limiting depth of -10.5 m in the approaches. An -8.5 m rock lies close outside this entrance, 185 m N of the end of NE breakwater.

(Piers and Jetties)
206. Prince Vijaya Quay, 330 m long, capable of accommodating two large cargo vessels with alongside depth of -7.5 to -9.5 m (1994), is situated on the S side of NW breakwater.

207. North and South Piers extend W from the E side of the harbor about 280 m and 370 m, respectively, S of Prince Vijaya Quay. Only the S side of North Pier can be berthed. A floating dock, with a buoy (special,can) close W, is moored on South Pier, at the inner end. A light is exhibited from a post at the end of North Pier.

208. The area between North and South Piers is known as the Oil Dock and can be closed by a boom. It has been dredged to -11 m (1990) and planned to -14 m in 1995. North Pier, 390 m long, has a maximum draught of 10.3 m with a berth length of 180 m. South Pier, 270 m long, can accommodate vessels with a maximum draught of 9.5 m.

209. North Guide Pier, on the S side of South Pier, can accommodate two vessels with depth alongside from -7.5 m to -9.5 m. The entrance to the two dry-docks is situated at the E end this pier, and vessels berthed at it have to be moved clear when other vessels are entering or leaving the dry docks. Coconut oil can be loaded at North Guide Pier by pipeline from storage tanks ashore. Between North Guide Pier and Jaya Container Terminal there are three dry docks.

210. Jaya Container Terminal, situated on the E side of the port opposite the W entrance, is a

container terminal consist of three berths, 960 m in length, dredged to -14 m. Construction of a fourth berth, 330 m in length, for container and an additional 150 m quay for feeder vessels is in progress close S of the terminal.

211. Block Jetty, on which there is a flagstaff, and a guide jetty for Patent Slip are situated S of the container terminal.
A light is exhibited from the head of the guide pier.

212. Bandranaike Quay, about 140 m in width, extends NNE for 420 m from the S side of the port; there are berths for deep-draught vessels on each side of this pier and across the head.
A light is exhibited from a white mast situated about 280 m S of the root of Bandranaike Quay.

213. Queen Elizabeth Quay, about 1,200 m in length, is situated W of Bandranaike Quay and forms the E side of the S part of SW breakwater; there are two berths for container vessels, No.4 and No.5, with depths alongside of -10.3 m and -12.8 m, respectively, at the N end of the quay: four other berths for ocean-going vessels with depth of -9 m to -12.8 m alongside the central part: and berths for small vessels at the S end of the quay.

214. NW breakwater, a oil jetty, 90 m in length and dredged to -11 m, is located on the E side of NW breakwater. A submarine pipe line from this jetty to shore is to be re-laid at 2.3 m below the sea bed in the latter of 1996.

(Mooring berths)
215. There are several berths for small vessels along the S and E sides of the port.
Local crafts are berthed on the S side of the port inside the berths for small vessels: they lie to their own anchor.

(Maneuvering basin)
216. Vessels' maneuvering basin at the port inside is in between the W entrance and JCT quay, an area of about 700 m in diameter, which utmost possible limit of stopping distance and turning space for large vessels such as Pana-max and huge tanker, in particular, after narrow negotiating the W entrance.

### 3.2.3 Administration

(General)
217. Navigation Division of SLPA is a sole executive body on maritime affairs, and controls over following matters: pilotage, berthing, tug service, navigational safety and preventing sea pollution, fire-preventing/fighting, certification of mariner's competency, navigational regulations, shipping information, communication with vessels, maintaining of navigational aids, building/maintaining and operating of port crafts, and even launches, ship chandlers as well.

218. Organization structure of Navigation Division and the number of personnel in service are shown in Table 3.2.1

**TABLE 3.2.1 Number of Personnel in Service in Navigation Division**

| Section / As of | M.Office | S.W.O | E.H.C. | S.M.T. | S.H.C. | P.F.B. | Total |
|---|---|---|---|---|---|---|---|
| 1 May,1991 | 124 | 312 | 323 | 254 | 456 | 130 | 1,599 |
| 12 Dec,1992 | 124 | 310 | 322 | 254 | 455 | 130 | 1,595 |
| | | | | Strength | | | |
| 1 May,1991 | 88 | 222 | 205 | 199 | 321 | 124 | 1,159 |
| 12 Dec,1992 | 88 | 215 | 200 | 189 | 300 | 117 | 1,109 |

Source: SLPA

*M.Office : Including senior harbor safety officer, Master in charge of fire float, Master of floating craft (Lighthouse vessel), Inspector of coastal lighthouse, Secretary, and Assit. admin. manager with each staff.*

*S.W.O. : Ship weight officer*

*E.H.C. : Engineer harbor craft*

*S.M.T. : Supdt. of harbor crafts*

*P.F.B. : Port firebrigade*

(Traffic regulations at the port)

219. There is no written regulations related to the subject, and leave the issues to the pilots' circumstantial judgement.

However, the following fundamental issues are in force by the orders of Harbor Master.

1) Pilotage is compulsory for all vessels entering/leaving Sri Lankan ports.

2) All vessels are expected to maneuver at a safe speed when approaching Sri Lankan ports and carry out advice given by the pilot.

3) All vessels that are not berthing within 24 hours are required to anchor off Panadura Point which is 15 miles(28 km) S of Colombo Lighthouse. Other vessels are permitted to anchor W of SW breakwater, in an area N of Colombo Lighthouse and S of SW breakwater lighthouse(R). Vessels are not permitted to anchor in any other area.

4) Vessels carrying dangerous cargo may drift approximately 15 to 20 miles(28 km to 37 km) off shore waiting for berthing instructions.

5) An approach fairway is presently under construction and all vessels deeply drawing will be obliged to proceed on the fairway under pilot's advice.

6) Vessel movement in the port, with the exception of car carriers, is being carried out up to 25 to 30 kn (12 to 15 m/s) wind velocity depending on the sea state, type of the vessel and the allocated berth etc.

(Pilotage system)

220. Fifteen licensed pilots in service are permanently stationed at Navigation Division of SLPA. Among those 15 pilots, three to four at Colombo and one at Galle are on-duty at each pilot station everyday. (The duty pilot at Galle is dispatched from Colombo by one month rotation.)

221. The service shift of duty pilots at Colombo is one day (24 to 12 h) in service followed by two days off, thus, the average working days of each pilot through the year are assumably 120 to 130 days.

222. Pilots have studied abroad in India, Australia or UK and have exensive expericence in boarding ocean-going vessels. All have obtained international master mariner license with the exception of two. An age structure of the pilots in active service is in between 38 to 58, and the age limit is 60.

223. Pilots board, under normal weather/sea condition, incoming vessels at about 3 km WNW of SW breakwater light, and leave outgoing vessels off the pilot station. If requested by a captain, the pilot leaves the vessel at SW breakwater outside.

**3.2.4 Navigational aids**

224. Navigational aids are under control of the Inspector Coastal Light attached to Harbor Master.

The existing Lights at the Port area are as follows:

Galbokka Light [Fl(3)10s 26m 25M] is located 90 m E of Galbokka Pt., a circular stone tower 15 m in height painted black and white in checkers, is the most conspicuous navigational aid for all approaching vessels toward Colombo.

SW Breakwater Light [F.R. 17m 12M] stands at the end of SW breakwater showing the western side of the W entrance, its intensity is, reportedly, barely distinguishable in a light background of the container terminal at night.

NW breakwater S Light [Fl.G.3s 13m 10M] stands at the S end of NW breakwater marking the W entrance with the red light mentioned above.

NW Breakwater N Light [Fl.R.3s 13m 10M] stands at the N end of NW breakwater marking the N entrance.

NE Breakwater W Light [F.G&R. 13m 10M] stands at the end of Prince Vijaya Quay marking the N entrance by its green light with the red light of NW breakwater N end, also indicating shallow water close off the breakwater by red light of its easterly semicircle.

North Pier Light [F.R.] stands at the end of North Pier(for oil tanker).

225. The intensity of those lights are not enough under the circumstances either of the bright

lights of JCT in background or poor visibility owing to frequent passing showers.

226. Maritime buoyage system of The International Association of Lighthouse Authorities (IALA), which widely adopted among maritime nations and being introduced throughout a region of The Indian Ocean, hasn't be carried out in this country so far, and existing marks at this port are the exact opposite from international standard in terms of classification by color.

227. However, an installation project more marks is about to commence under the same project of the W channel dredging, i.e. four lateral lighted buoys for both boundaries of the channel, one W cardinal lighted buoy for NW breakwater, and a sector light on NW breakwater by which lead incoming vessels on the center of the channel.
These new marks are to conform to IALA maritime buoyage system "A", equipped with solar battery and are scheduled to be in use within Nov. 1995.

228. Consequently, after installation of those new lighted buoys, the buoyage system of the Port of Colombo will be mixed with "A"(newly installed lighted buoys) and "B"(existing lights of breakwaters), by which mariners would be thrown into confusion. Accordingly, replacement of the existing lights with distinguishable brighter "A" lights should be followed as soon as possible.

**3.2.5 Tug fleet**

229. Four maneuvering tug boats are kept on duty at all times.
A project of replacing old tugs with 45 t bollard pull ones is in progress under SLPA, and two of such tugs have already been in service.
Tenders have been called for the third one and offers are being evaluated at present. Budgetary allocation have been requested for another tug to be built in the latter half of 1996.

230. Usually, two tugs attend to an incoming large vessel, waiting at breakwaters inside and commence assisting the vessel when her speed reduced under two kn. For an outgoing large vessel, two tugs attend to her as well, and after turning her head to the entrance, the station of tugs is dismissed. The actual working hour from stand-by to finish per one operation is assumed within one hour at longest.
A list of existing tug fleet in service is shown in Table 3.2.2

**TABLE 3.2.2 Existing harbor tugs in SLPA**

| TUG' name | LxBxD | GT | B.pull | E.(ps) | Sp'd | Propul. | Built | Equip. | Service |
|---|---|---|---|---|---|---|---|---|---|
| GOTAIMBARA | 39.0x10.5x4.3 | 549 | 30 | 3300 | 13 | T/S | 1972 | - | CMB |
| MAHASEN | 32.5x8.4x3.3 | 265 | 30 | 2600 | 12 | T/S | 1980 | K/N | CMB |
| SINHABAHU | 32.5x8.4x 3.3 | 265 | 30 | 2600 | 12 | T/S | 1980 | K/N | CMB |
| NEELAMAHA | 32.5x8.4x 3.3 | 265 | 30 | 2600 | 12 | T/S | 1980 | K/N | CMB |
| AIRAWANA | 36.6x10.5x4.5 | 440 | 40 | 3600 | 12 | T/S | 1989 | - | CMB |
| RAJA | 32.0x9.8x4.0 | - | 45 | - | 12 | - | 1993 | - | CMB |
| NANDHINITRA | 38.0x11.3x4.0 | 416 | 20 | 1965 | 11 | T/S | 1965 | - | TRICO |
| GOTAIMBARA | 39.0x10.5x4.3 | 549 | 30 | 1972 | 13 | T/S | 1972 | T/R | TRICO |
| YASABHA | 30.5x8.7x4.0 | 375 | 19 | 1920 | 11 | T/S | 1963 | - | TRICO |

*Key: T/S Twin screws, T/R Twin Rudders, K/N Kort's Nozzle, CMB Colombo, TRICO Trincomalee*
*Source: SLPA*

### 3.2.6 Weather/sea conditions

231. An old (1937 to 1966) but for 30 years statistics related to the subject, which derived from WMO's data, is found in "West Coast of India Pilot" issued by UK Navy. (see Table 3.1.2) Besides, the same issue is precisely described in the relating chapter of this report based on a field work of the team.

232. According to the comments of officials concerned, the conditions are summarized as follows:

- During SW monsoon period (June to September) heavy swell is experienced off Colombo Port. Average height of swell is approximately two and a half m up to three m in this period with average wind speed of 25 kn (13m/s) and reach 30 to 35 kn (15 to 18 m/s). Owing to the prevailing winds a slight swell is generated off JCT in this period.
- During NE monsoon period (October to February) N'ly swell is experienced up to approximately two m with wind speed up to about 20 kn (10 m/s). The wind usually rises in the afternoon, reaches its peak by 1800/1900 hours and dies down by late night.
- An expert at the weather of the port stated that the wind directions throughout the year are as follows;

| | | | |
|---|---|---|---|
| May | to | Sept. | SW |
| Sept. | to | Nov. | light winds in various directions |
| Nov./Dec. | to | Mar. | NE |
| Mar. | to | May | light winds in various directions |

Summing up the captioned information mentioned above, the wind roses off the port are shown in Fig.3.2.2.

### 3.2.7 Accidents in the last five years

233. According to a statement of Harbor Master's Division, the serious accidents in this period were as follows:

M.V.NORASIA MUBHARAKU (Owner;Arabian Maritime Lines, Flag;UAE, Built;1987, Type;FC, DWT;34,380, TEU;2,097, Sp'd;17.0, LxBxD;201.5x28.4x11.0,) on 16th June, 1992, made a nearly head on collision with JCT-2 and resulted serious damage to either of the quay or her bulbous bow. Although the exact state of the accident is not clarified, the accident is, reportedly, due to her over-high speed at even lowest engine running (assumable eight to nine kn) of "Harbor Slow" mode and impossibility of making engine astern under such a high speed by sequence control program of her computer system, in addition, her anchors couldn't be dropped by the bridge control system as well.

M.V.IRON LINK; on 5th March, 1994, while berthing to Bandranaike Quay No.4, she made contact with a shore portable crane, caused collapsing the crane and damaging the adjacent building. The crane was scrapped due to the said accident.

M.V.MERCS HABARANA; on 6th June, 1994, while leaving Coastal Berth No.1 being towed by a tug, the vessel swung in the opposite direction and her stern made contact with the new boat house pier.

234. The distinctive features of the above accidents can be found in the spots at quay side and on the stages of berthing/unberthing vessels.
Although its difficult to conclude straightforwardly the true cause of accidents, a precise examination into the past facts is most important.

235. Based on past experience, an accident involves a variety of complex factors. However, with he exception of unavoidable causes such as unusual natural conditions, most of the factors can be enclosed by proper countermeasures that lead to minimizing accidents.

236. Accordingly, the weather/sea conditions, the features of the waterway/turning basin, the traffic regulations including the pilotage system, the navigational aids, other safety back-up facilities such as tug fleet, the maneuverability of coming vessels in near future and the availability of necessary navigational information, should be taken in account to improve the existing port and to create a promising port.

### 3.2.8 Principal factors to be considered for the new port

#### (1) Possible size of mother container vessels

#### *A. Under keel clearance (UKC)*

237. A necessary UKC by which prevent a vessel contact with the seabed can be determined from the following factors:

a. a tendency of nearly parallel sinking with slight trim by the heads known as squat, which appears under sailing shallow water,

b. a resultant vertical movements of vessels from pitching, rolling and heaving,

c. accuracy of chart datum,

d. weather/sea conditions such as air pressure effect to the sea level, a tidal level, a water density change, sedimentation/drift sand, and ground obstacles.

238. A proper quantity of UKC for safe sailing a shallow channel is not obtain from straightforward adding of the above factors. Regarding the W channel, the most important factor is resultant up & down moves of a vessel due to swell and waves attaining a maximum height of four m or more off the port during the SW monsoon period. According to the accepted experience is that a combined pitching/heaving amount is considered to a half height of the swell/waves i.e. about two m off the port, and other factors of negligible importance, included in this limit.

239. Europe Maritime Pilot Association (EMPA) suggested before on the UKC of calling vessels at Rotterdam, Antwerp and Amsterdam as follows:

| | | |
|---|---|---|
| UKC at open sea passage | 20% | or more of the draft |
| " off ports fairway | 15% | " |
| " at ports inside | 10% | " |

However, the updated criteria at Europort are, reportedly, reduced five percent from the above to cope with the latest situation of increasing large vessels calling.

| | | |
|---|---|---|
| UKC at open sea passage | 15% | or more of the draft |
| " off ports fairway | 10% | " |
| " at port inside | 5% | " |

240. Also, UNCTAD's handbook, "Port Development Volume", enumerates three factors to be considered for planning channel depth i.e.:

a. the transit times of vessels along the fairway, both with and against the tidal direction, and the relationship of these times to the tidal cycle;

b. the nature of the sea or river bed which, if of soft silt, for instance, might lead to a decision to reduce the designed UKC for vessel using the channel;

c. the vessel draught; upon entering an approach channel, the load-line draught of the vessel is modified by such factors as water density changes, which may occur along the length of the channel, the effect of squat and of wave action causing the pitch and roll of the vessel,and, mentioned as an example; a general cargo vessel drawing nine m at sea would squat 50 cm in narrow channel; pitching would require about a half the wave height in additional draught, and rolling somewhat less. Thus, allowing 50 cm for UKC if the channel bed is soft, it might be assumed, for preliminary planning purposes, that a vessel drawing nine m might require some 10.5 m of dredged depth in an approaching channel. A greater depth would be necessary where the channel bed was hard. As suggested above, a minimum clearance of one to one and a half m might be taken as appropriate for most vessels.

241. Summing up, a sound UKC at the channel from off Port to the W entrance should be

regarded as two meters, and after completion of dredging up to - 15 m at the channel and up to -14 m at the within the port. Then, the possible deepest draught of a vessel would be 13 m (15m-2m). (including allowance for offshore pipeline laid from the oil berth ashore, too)

**B. Width of fairway**

242. Fairway widths depend on the size of vessel to be catered for and physical conditions of the site. According to the latest studies, in a well marked fairway, the total width of full-depth channel required for one lane traffic may be comprised; on straight reaches, maneuvering lane of twice the vessel beam plus 1.8 times the beam for bank clearance each side and supposed drift. Thus, for a typical Post-Panamax vessel(300 m L, 40 m B), a total width of about 270 m(6.8B or 0.9 L) would at least be required.

243. At bends in the channel, greater widths are required than on straight stretches because of the tendency of vessels to drift on turning. An additional width, depending upon the radius of curvature of the bend by approximately equal to the beam of vessels, will be required in order to allow for the projected width of vessels negotiating the bend. This feature of projected width will also occur on straight reaches of fairway subject to the action of cross-winds and currents,. which will also cause vessels to drift.

244. As this report mentioned in 3.1.1, the W channel dredging work is about to commence for 2,000 m long and 300 m wide at the stretch, 530 m wide at the bend off the W entrance, in <320· > direction from the end of SW breakwater lighthouse, up to -15 m depth.
After completion of the said work in the course of this year, the width of the new fairway itself would be capable for transit Post-Panamax vessels.

**C. Channel alignment**

245. The maneuverability of a vessel moving in a confined waterway of limited depth is impaired two ways:
a. because the vessel takes longer to respond to the helm, owing to the effects of shallow water; and
b. because the proximity of the sides of the channel tends to cause the vessel to be drawn towards them.

246. This attraction or suction experienced by the vessel towards the sides of the channel also applies between vessels when passing.
Where there are changes of direction in the alignment of a channel these limitation on vessel's maneuverability must therefore be taken into account. The radii of bends must be as large as is practical, and the bend close proximity of the crucial point such as the entrance must be as far away as practical.

**D. Width of entrance**

247. Although desired width of entrance is same as that of the fairway, it should be compatible with safe negotiation for large vessels and inside calmness for middle/small vessels. Taking into consideration accommodating incoming large container vessels in future, the width should be planned wider than 6-7 times breadth of the max vessel.

**E. Mancuvering area within the port**

248. Maneuvering capability of small to medium-sized vessels is generally good, and upon entering port they will often maneuver and stop under their own power.
For large vessels the situation is different, because of their much longer stopping distance and their lack of course control during the stopping maneuver, they will generally not be allowed to stop under their own power. This may already apply to vessels of approximately 50,000 DWT and over. This means that such vessels, as long as no tugboats control is available, have to maintain a certain minimum speed through the water at which there is still sufficient rudder control available. This speed is about three to four kn, sometimes slightly more. The above is of particular importance where large vessels with dangerous cargoes are concerned, for example, crude oil, and product tankers, liquid gas carriers, etc.

249. The slowing down and stopping length then required within the port boundaries, i.e. in relatively sheltered water with little or no currents, is determined by the entrance speed of larger vessels, the time required to tie up the tugboats and to maneuver them into position; and the actual stopping length.

250. Consequently, the desired length of inner channel is one and a half km at its shortest to allow the port to be able to recieve supposed large vessels under acceptable standards of navigation safety. The slowing down and stopping length can be decreased to the extent that the vessel's entrance speed can be decreased. The latter can be attained by limiting it to a certain maximum cross currents, vertical and horizontal tide as well as sea conditions.

251. According to an observation of vessels stopping maneuver at the W entrance during August to October 1995, their stopping distances fall under one and a half L to three L of the vessels with an entrance passing speed of four to six kn, without tied tugboats in most cases.

252. The diameter of the turning basin should be equal to or greater than two L of the supposed largest vessels with the essential condition that effective tugboats are available.
Consequently the largest vessels to be accommodated in the existing conditions would be Panamax vessels such as Evergreen R class, of which 295 m L, 34 m B, equipped with powerful 47,000 ps engine & effective bow-thuster, provided that any engine trouble will not occur.

## 3.3 Ship Traffic

### 3.3.1 Calling Vessels

(1) Trends of Calling Vessel

253. Total number of calling vessels has decreased slightly as the trend towards large-sized vessels increases (see TABLE 3.3.1). Size of container vessels has increased gradually in the passed decade (see TABLE 3.3.2).

**TABLE 3.3.1 Ship Arrivals**

| | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|
| Conventional Cargo | 1,074 | 949 | 894 | 670 | 740 | 778 | 768 | 763 | 677 |
| Dry Bulk Carrier | 259 | 190 | 203 | 223 | 189 | 199 | 193 | 209 | 196 |
| Oil Tanker | 190 | 151 | 165 | 154 | 119 | 138 | 145 | 160 | 130 |
| Barge Carrier(Lash/See Bee) | 5 | 9 | 1 | 2 | 4 | 4 | 1 | 2 | 3 |
| Roll on Roll off | 71 | 103 | 115 | 92 | 108 | 145 | 133 | 159 | 132 |
| Container Ship(fully Cellular) | 555 | 563 | 616 | 1,056 | 1,279 | 1,344 | 1,556 | 1,761 | 1,786 |
| Semi Container Ship | 305 | 297 | 287 | 310 | 357 | 274 | 251 | 196 | 195 |
| OBO Carrier | 1 | 1 | 1 | 0 | 3 | 1 | 6 | 0 | 0 |
| Passenger Ship | 21 | 16 | 18 | 11 | 13 | 13 | 31 | 27 | 40 |
| Passenger/Cargo Ship | 4 | 6 | 2 | 5 | 8 | 4 | 7 | 1 | 8 |
| Other | 20 | 50 | 25 | 25 | 27 | 29 | 26 | 45 | 84 |
| Total | 2,505 | 2,335 | 2,327 | 2,548 | 2,847 | 2,929 | 3,117 | 3,323 | 3,251 |

Source: SLPA

**TABLE 3.3.2 Average Gross Tonnage of Calling Vessels**

Unit : 1,000 Tons

| | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|
| Conventional Cargo | 6.4 | 5.8 | 6.1 | 7.4 | 7.0 | 6.6 | 6.4 | 6.4 | 6.6 |
| Dry Bulk Carrier | 12.3 | 13.4 | 13.9 | 13.6 | 14.1 | 13.5 | 11.9 | 12.3 | 10.8 |
| Oil Tanker | 13.4 | 11.4 | 10.1 | 8.4 | 11.4 | 11.3 | 12.6 | 11.3 | 12.0 |
| Barge Carrier(Lash/See Bee) | 19.6 | 26.9 | 2.0 | 16.0 | 23.0 | 13.8 | 0.0 | 5.0 | 7.3 |
| Roll on Roll off | 8.4 | 15.2 | 12.4 | 13.1 | 17.3 | 21.7 | 24.2 | 25.8 | 30.7 |
| Container Ship(fully Cellular) | 13.1 | 13.1 | 13.0 | 17.7 | 18.0 | 17.9 | 18.1 | 19.5 | 20.9 |
| Semi Container Ship | 10.1 | 10.1 | 11.6 | 9.8 | 10.7 | 11.7 | 10.9 | 11.3 | 11.2 |
| OBO Carrier | 30.0 | 11.0 | 35.0 | 0.0 | 26.7 | 6.0 | 17.0 | | 0.0 |
| Passenger Ship | 17.5 | 12.9 | 12.1 | 14.6 | 15.5 | 10.9 | 11.8 | 10.4 | 14.5 |
| Passenger/Cargo Ship | 10.0 | 6.5 | 5.5 | 9.8 | 7.0 | 6.8 | 3.0 | 10.0 | 14.4 |
| Other | 4.3 | 9.3 | 5.7 | 4.5 | 10.4 | 9.8 | 14.5 | 9.6 | 9.7 |
| Total | 9.7 | 9.7 | 9.9 | 12.8 | 13.6 | 13.8 | 14.1 | 15.2 | 16.4 |

Source: SLPA

(2) Ship sizes of Calling Vessels at the Port of Colombo

254. From records of the Statistic Section, SLPA, the number of vessel calls (DWT and draft size) in 1994 are shown in TABLE 3.3.3- TABLE 3.3.4 and FIGURE 3.3.1-FIGURE 3.3.2. Moreover, appendix FIGURE A3.3.1- FIGURE A3.3.5 show other distribution graphs.

**TABLE 3.3.4 Distribution of Ship Sizes (DWT) in 1994**

| DWT / Type of Ship | <2,000 | 2,000-4,999 | 5,000-9,999 | 10,000-14,999 | 15,000-19,999 | 20,000-24,999 | 25,000-29,999 | 30,000-34,999 | 35,000-39,999 | 40,000-44,999 | 45,000-49,999 | >49,999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Container | 26 | 117 | 513 | 170 | 136 | 213 | 103 | 207 | 66 | 298 | 99 | 83 |
| Conventional | 177 | 132 | 130 | 98 | 120 | 24 | 4 | 4 | 2 | 7 | 1 | 4 |
| Bulk | 6 | 4 | 47 | 42 | 42 | 15 | 34 | 14 | 7 | 6 | 3 | 5 |
| Ro Ro | 1 | 1 | 25 | 71 | 22 | 7 | 9 | 0 | 5 | 6 | 1 | 1 |
| Other | 415 | 38 | 33 | 24 | 4 | 15 | 6 | 24 | 4 | 5 | 2 | 52 |
| Total | 625 | 292 | 748 | 405 | 324 | 274 | 156 | 249 | 84 | 322 | 106 | 145 |

*Source: SLPA*

**TABLE 3.3.4 Distribution of Vessel Drafts in 1994**

| Metres / Type of Ship | <5.0 | 5.0-5.9 | 6.0-6.9 | 7.0-7.9 | 8.0-8.9 | 9.0-9.9 | 10.0-10.9 | 11.0-11.9 | 12.0-12.9 | >12.9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Container | 162 | 121 | 352 | 290 | 226 | 291 | 422 | 162 | 1 | 4 |
| Conventional | 248 | 76 | 100 | 90 | 108 | 57 | 16 | 4 | 0 | 4 |
| Bulk | 36 | 27 | 45 | 35 | 34 | 27 | 16 | 1 | 3 | 1 |
| Ro Ro | 12 | 0 | 11 | 47 | 61 | 11 | 7 | 0 | 0 | 0 |
| Other | 431 | 36 | 32 | 44 | 24 | 10 | 20 | 7 | 5 | 13 |
| Total | 889 | 260 | 540 | 506 | 453 | 396 | 481 | 174 | 9 | 22 |

*Source: SLPA*

FIGURE 3.3.1 Distribution of Ship Sizes (All Type)

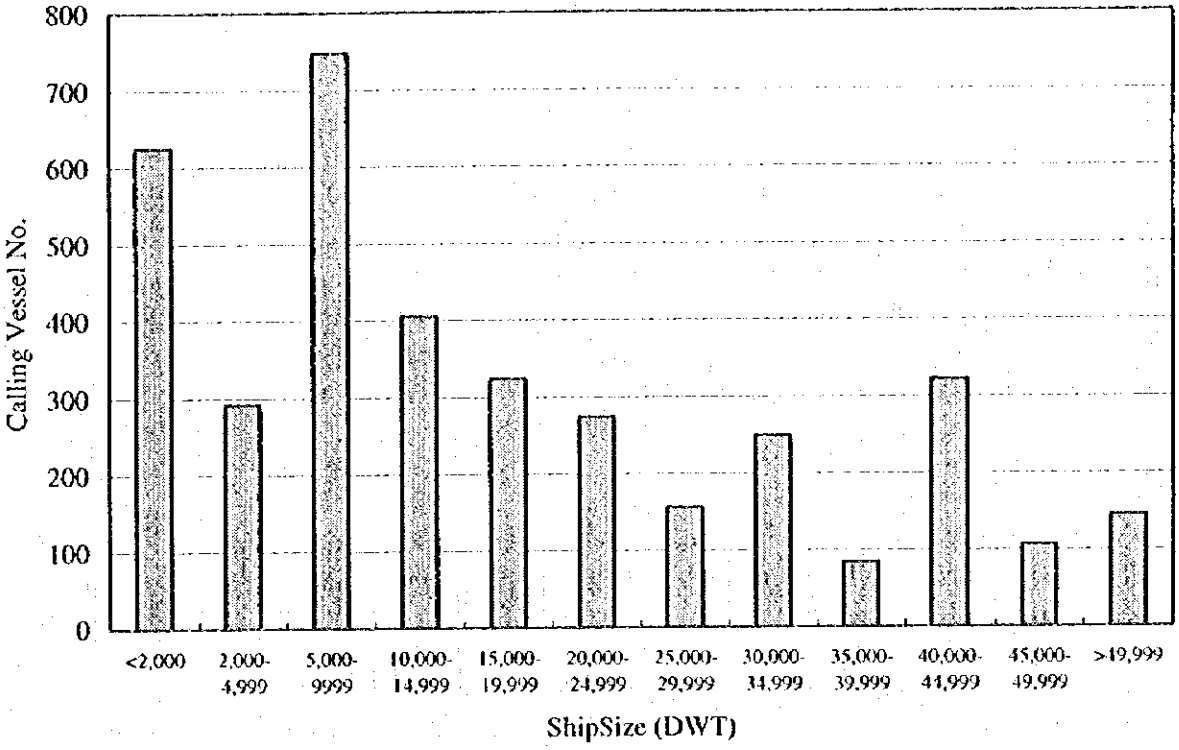
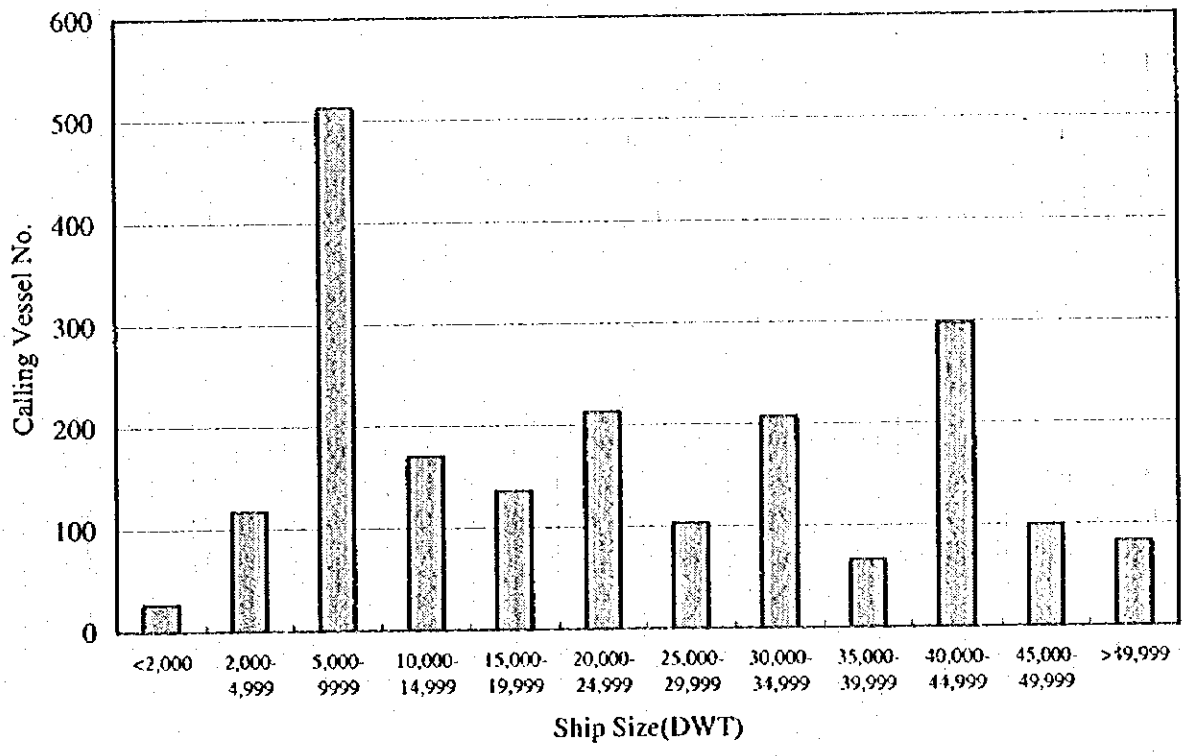



FIGURE 3.3.2 Distribution of Ship Sizes (Container)



## 3.4 Cargo Traffic

### 3.4.1 Outline of Cargo Throughput

255. The volume of cargo handled in the Port of Colombo has steadily increased up to 1992 except for 1989, which was caused by withdrawal of APL. Since 1992 the transhipment cargo throughput has increased sharply due to the Indian government's policy of liberalization. In 1994 the total volume of cargo reached about 16 million tons, which is 2.4 times as much as the volume of ten years ago. This increase has been caused mainly due to the high growth of transhipment cargo, which has dramatically increased after the completion of Jaya Container Terminal No.1 in 1985 and Jaya Container Terminal No.2 in 1987.Trends of domestic, transhipment and coastal service cargo volume are shown in Table 3.4.1 and Figure 3.4.1.

### 3.4.2 Domestic Cargo

256. The major commodities imported are cement, fertilizer, sugar, rice, iron/steel and liquid bulk such as crude/fuel oil. In general, handling volumes of these major cargo have increased except for rice and fertilizer.

257. The major commodities exported are tea, rubber, coconut products and liquid bulk cargo such as refined/black fuel oil and chemical naphtha. Among these major cargoes, break bulk cargo throughput of tea, rubber and coconut products have decreased, which illustrates recent progress of containerization in these cargoes. Trends of export/import cargo by main commodity are shown in Table A3.4.1 and Table A3.4.2.

### 3.4.3 Container Cargo

258. Trends of container cargo throughput by the type of services are shown in Table 3.4.2 and Figure 3.4.2. The ratio of transhipment among the total container throughput has been about 70% since 1987, in which Jaya Container Terminal No.2 was completed.

259. Trends of containerization ratio in domestic cargo are shown in Table 3.4.3 and Figure 3.4.3. The containerization ratio in export cargo has reached about 90% and is reaching a saturation point, while the ratio on import cargo is still growing.

260. Trends of volume and number of domestic containers are shown in Table 3.4.4. The average import/export volume per TEU for laden containers are calculated at 13.7 and 12.0 thousand ton per TEU respectively. The ratio of empty containers in import cargo has been decreasing, while the ratio of empty containers in export cargo has been generally increasing.

**TABLE 3.4.1 Trends of Cargo Throughput by Type of Service(Port of Colombo)** *('000 tons)*

| Type of Services | | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Domestic | Import | 4,176 | 4,274 | 4,454 | 4,622 | 4,704 | 4,455 | 4,908 | 4,893 | 5,284 | 5,945 | 6,311 |
| | Export | 1,206 | 1,407 | 1,453 | 1,201 | 1,213 | 1,186 | 1,349 | 1,344 | 1,126 | 1,322 | 1,558 |
| | Total | 5,381 | 5,681 | 5,907 | 5,823 | 5,918 | 5,641 | 6,257 | 6,237 | 6,409 | 7,267 | 7,869 |
| Transhipment | Discharged | 579 | 791 | 1,179 | 1,800 | 2,646 | 2,267 | 2,524 | 2,612 | 2,560 | 3,424 | 3,942 |
| | Loaded | 605 | 772 | 1,168 | 1,813 | 2,627 | 2,282 | 2,528 | 2,601 | 2,531 | 3,367 | 3,893 |
| | Total | 1,184 | 1,564 | 2,347 | 3,613 | 5,274 | 4,548 | 5,052 | 5,213 | 5,091 | 6,791 | 7,835 |
| Coastal Service | Discharged | 72 | 94 | 179 | 195 | 181 | 173 | 203 | 223 | 235 | 215 | 194 |
| | Loaded | | | 60 | 16 | 13 | 6 | 32 | 101 | 120 | 141 | 116 |
| | Total | 72 | 94 | 239 | 210 | 194 | 179 | 235 | 323 | 355 | 356 | 310 |
| Total | Discharged | 4,827 | 5,159 | 5,812 | 6,617 | 7,532 | 6,895 | 7,635 | 7,728 | 8,079 | 9,584 | 10,447 |
| | Loaded | 1,811 | 2,179 | 2,681 | 3,030 | 3,853 | 3,473 | 3,909 | 4,046 | 3,776 | 4,830 | 5,567 |
| | Total | 6,638 | 7,338 | 8,492 | 9,646 | 11,385 | 10,368 | 11,544 | 11,773 | 11,855 | 14,414 | 16,014 |

*Source: Port Statistics, Sri Lanka Ports Authority*

*Note: Exclusive of Restowing & Transfer of Cement in Bulk*

**FIGURE 3.4.1 Trends of Cargo Throughput by Type of Handling (Port of Colombo)**

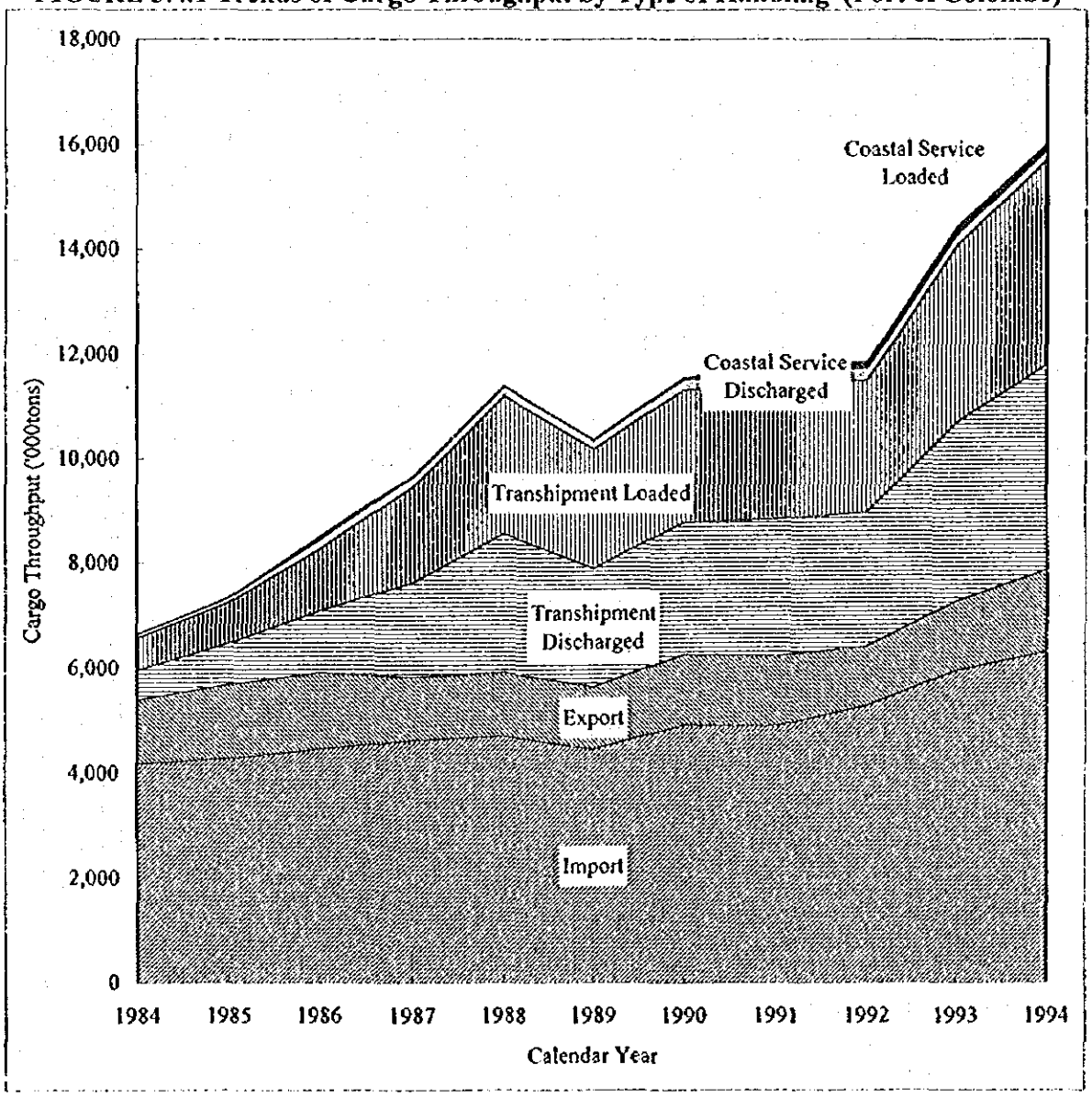


**TABLE 3.4.2 Trends of Container Cargo Throughput (Port of Colombo)**

| Type of Handling | | Unit | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Domestic | Import | '000tons | 438 | 526 | 578 | 651 | 761 | 933 | 973 | 1,176 | 1,400 | 1,628 |
| | Export | '000tons | 506 | 648 | 659 | 652 | 761 | 821 | 844 | 887 | 1,031 | 1,193 |
| | Subtotal | '000tons | 944 | 1,174 | 1,237 | 1,303 | 1,522 | 1,755 | 1,817 | 2,063 | 2,431 | 2,821 |
| | | '000TEU | 103 | 121 | 129 | 135 | 159 | 173 | 188 | 212 | 252 | 288 |
| | | *Share* | *48%* | *35%* | *30%* | *22%* | *29%* | *30%* | *29%* | *32%* | *30%* | *30%* |
| Transhipment | | '000tons | 1,308 | 2,306 | 3,373 | 5,212 | 4,503 | 4,959 | 5,160 | 5,083 | 6,767 | 7,791 |
| | | '000TEU | 113 | 220 | 300 | 486 | 385 | 411 | 470 | 451 | 591 | 666 |
| | | *Share* | *52%* | *65%* | *70%* | *78%* | *71%* | *70%* | *71%* | *68%* | *70%* | *70%* |
| Total | | '000tons | 2,251 | 3,480 | 4,610 | 6,515 | 6,025 | 6,714 | 6,977 | 7,146 | 9,198 | 10,612 |
| | | '000TEU | 216 | 341 | 429 | 621 | 544 | 584 | 658 | 663 | 842 | 954 |

*Source: Port Statistics, Sri Lanka Ports Authority*

*Note: Exclusive of Restowing*

**FIGURE 3.4.2 Trends of Container Cargo Throughput by Type of Handling (Port of Colombo)**

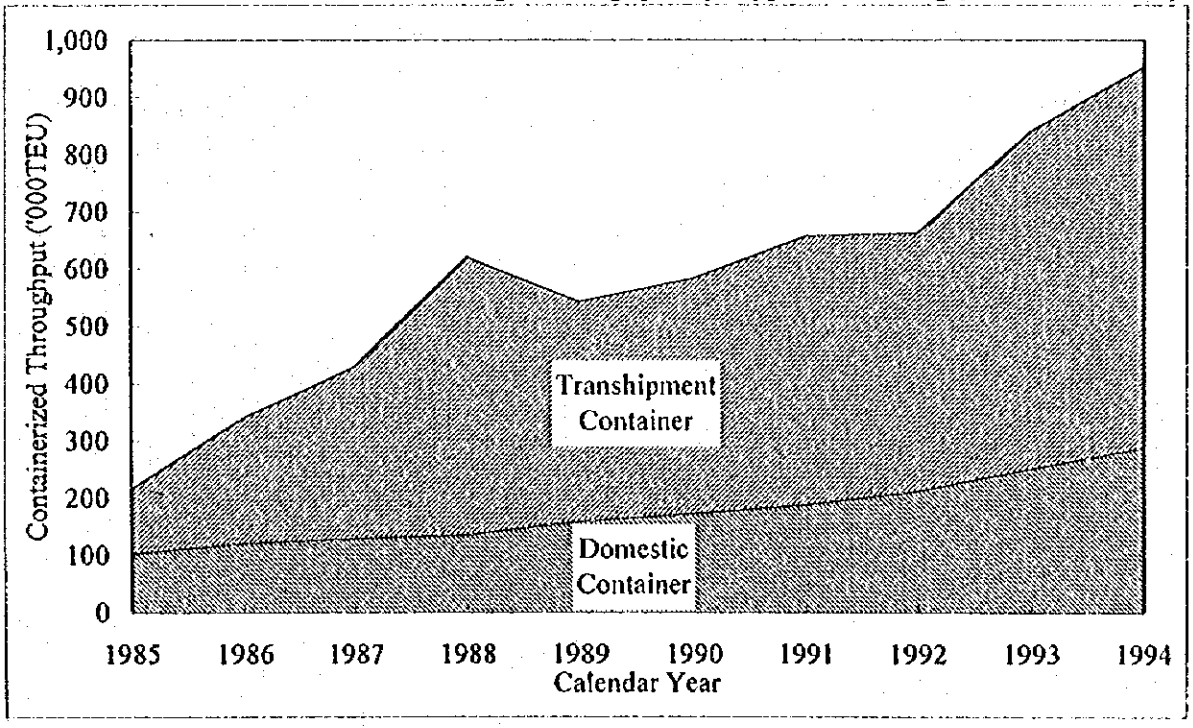


**TABLE 3.4.3 Trends of Containerized Ratio in Domestic Cargo**

| | | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume of | Import | 339 | 370 | 438 | 526 | 578 | 651 | 761 | 933 | 973 | 1,176 | 1,400 | 1,628 |
| Container Cargo | Export | 383 | 470 | 506 | 648 | 659 | 652 | 761 | 821 | 844 | 887 | 1,031 | 1,193 |
| *('000 ton) (1)* | Total | 722 | 841 | 944 | 1,174 | 1,237 | 1,303 | 1,522 | 1,755 | 1,817 | 2,063 | 2,431 | 2,821 |
| Volume of | Import | 1,500 | 1,715 | 2,001 | 1,932 | 1,676 | 1,985 | 1,655 | 1,683 | 1,620 | 1,563 | 1,820 | 1,767 |
| Break Bulk Cargo | Export | 815 | 746 | 683 | 494 | 387 | 322 | 307 | 354 | 303 | 162 | 106 | 163 |
| *('000 ton) (2)* | Total | 2,314 | 2,461 | 2,684 | 2,426 | 2,063 | 2,307 | 1,962 | 2,037 | 1,923 | 1,726 | 1,926 | 1,930 |
| Containerization | Import | 18 | 18 | 18 | 21 | 26 | 25 | 32 | 36 | 38 | 43 | 43 | 48 |
| Ratio (%) | Export | 32 | 39 | 43 | 57 | 63 | 67 | 71 | 70 | 74 | 85 | 91 | 88 |
| *(1)/((1)+(2))*100* | Total | 24 | 25 | 26 | 33 | 37 | 36 | 44 | 46 | 49 | 54 | 56 | 59 |

*Source: Port Statistics, Sri Lanka Ports Authority*

*Note: (2) includes volume of break bulk Cargo handled at Ports of Colombo, Trincomalee & Galle*
*Exclusive of Restowing*

**FIGURE 3.4.3 Trends of Containerization Ratio in Domestic Cargo**

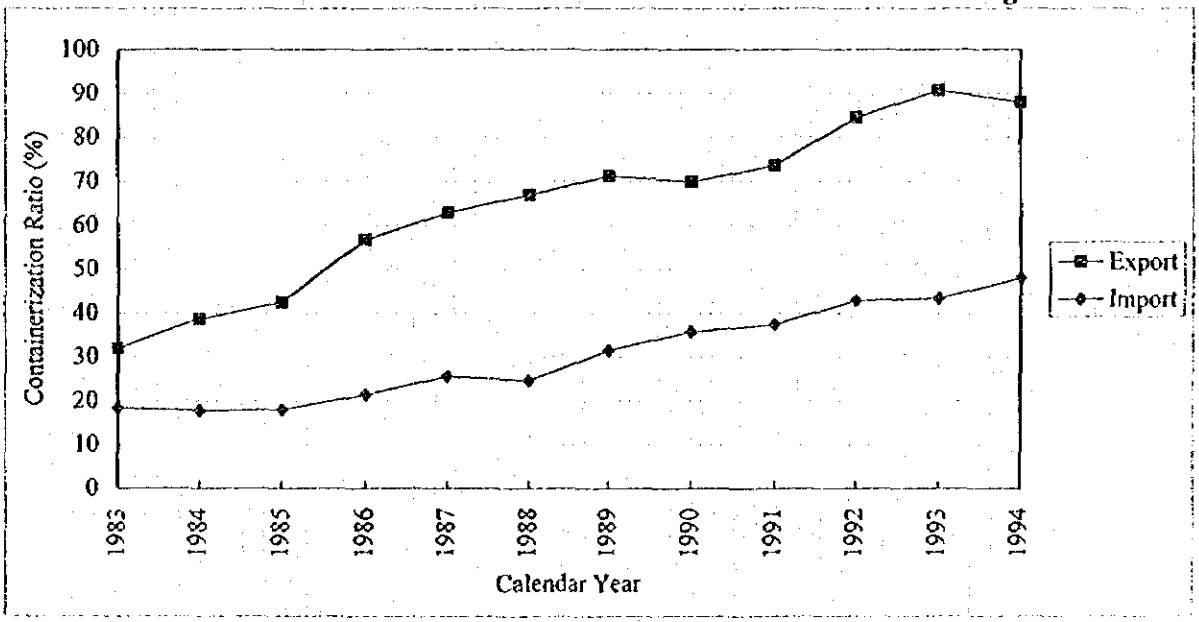



**TABLE 3.4.4 Trends of Volume and Number of Domestic Container**

| | | | Unit | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Import | Volume | | '000tons | 438 | 526 | 578 | 651 | 761 | 933 | 973 | 1,176 | 1,400 | 1,628 | |
| | Laden | Number (1) | TEU | 33 | 38 | 42 | 48 | 55 | 67 | 71 | 84 | 103 | 122 | |
| | | Volume / TEU | '000tons/TEU | 13.2 | 13.7 | 13.7 | 13.6 | 13.8 | 14.0 | 13.6 | 14.0 | 13.6 | 13.3 | 13.7 |
| | Empty | Number (2) | TEU | 20 | 22 | 23 | 21 | 23 | 21 | 24 | 23 | 25 | 24 | |
| | | (2) / (1) | % | 59.5 | 57.3 | 54.9 | 43.3 | 42.4 | 31.4 | 33.3 | 27.7 | 23.9 | 19.3 | |
| Export | Volume | | '000tons | 506 | 648 | 659 | 652 | 761 | 821 | 844 | 887 | 1,031 | 1,193 | |
| | Laden | Number (1) | TEU | 41 | 51 | 54 | 54 | 60 | 67 | 72 | 77 | 92 | 103 | |
| | | Volume / TEU | '000tons/TEU | 12.3 | 12.6 | 12.3 | 12.1 | 12.6 | 12.4 | 11.7 | 11.5 | 11.2 | 11.6 | 12.0 |
| | Empty | Number (2) | TEU | 10 | 9 | 10 | 13 | 20 | 19 | 21 | 28 | 32 | 40 | |
| | | (2) / (1) | % | 23.2 | 17.9 | 19.4 | 24.0 | 33.3 | 28.0 | 29.0 | 36.6 | 35.2 | 38.9 | |

*Source: Port Statistics, Sri Lanka Ports Authority*

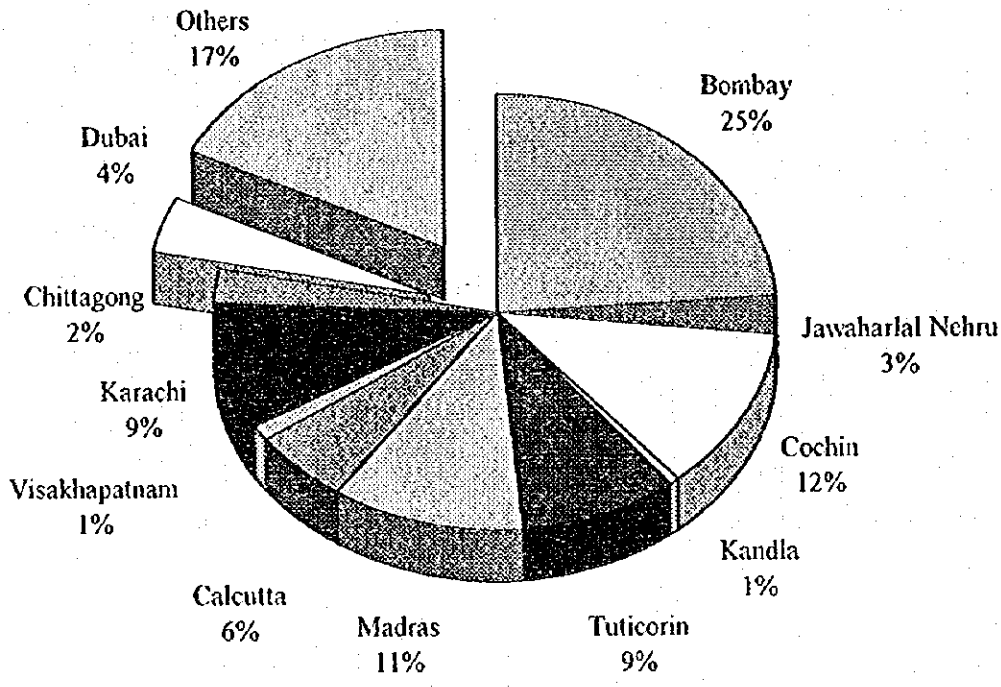
*Note: Exclusive of Restowing*

### 3.4.4 Transhipment

261. The transhipment container cargo handled in the Port of Colombo account for nearly 70% of the total container volume from 1989 to 1994. Though the transhipment container cargo leveled of from 1987 to 1992, has increased rapidly because of rapid growth in Indian cargo since 1993.

262. According to Origin/Destination Survey of Container Cargo(1994) conducted by SLPA, 78% of the total transhipment container cargo is transported from/to South Asian ports. Furthermore, 67% of total transhipment container is transported from/to Indian Ports. At the port of Colombo, the transhipment volumes are given as TEU movements - that is, each transhipment container passing through the port is counted twice, for both discharge and loading. However, FIGURE 7.2.4 counts the number of incoming and outgoing containers from/to regional ports.

**FIGURE 3.3.4 Share of Transhipment Container Cargo by Ports (1994)**




*Source : Statistics Section, SLPA*

### 3.5 Container Cargo Flow

263. Details of container flows were investigated from the view point of analyzing the capacity of container handling facilities. The investigated data are shown as follows.

#### 3.5.1 40' and 20' Container Ratio

264. Table 3.5.1 shows the quantity and ratio of 40 and 20 foot containers handled at the Colombo Port between 1981 and 1994. The ratio of 40-foot containers increased year by year and reached 30 percent in 1994.

**TABLE 3.5.1 Total Discharging and Loading Containers by Size (from 1981 to 1994 in the Colombo Port)**

| YEAR | (1) Number of Containers | | | | (2) Percentage of 20' and 40' Containers | | | |
|---|---|---|---|---|---|---|---|---|
| | TOTAL HANDLING(Box) | | | | TOTAL HANDLING(%) | | | |
| | 20' | 40' | OTHER | BOXES | 20' | 40' | OTHER | BOXES |
| 1981 | 52,708 | 3,368 | 52 | 56,128 | 93.9 | 6.0 | 0.1 | 100.0 |
| 1982 | 95,258 | 5,413 | 71 | 100,742 | 94.6 | 6.4 | 0.1 | 100.0 |
| 1983 | 116,053 | 15,245 | 93 | 131,391 | 88.3 | 11.6 | 0.1 | 100.0 |
| 1984 | 149,717 | 18,966 | 129 | 168,812 | 88.7 | 11.2 | 0.1 | 100.0 |
| 1985 | 161,069 | 29,415 | 237 | 190,721 | 84.5 | 15.4 | 0.1 | 100.0 |
| 1986 | 203,832 | 72,155 | 0 | 275,987 | 73.9 | 26.1 | 0.0 | 100.0 |
| 1987 | 250,588 | 92,387 | 113 | 343,088 | 73.0 | 26.9 | 0.0 | 100.0 |
| 1988 | 293,495 | 166,023 | 1,307 | 460,825 | 63.7 | 36.0 | 0.3 | 100.0 |
| 1989 | 312,776 | 119,049 | 416 | 432,241 | 72.4 | 27.5 | 0.1 | 100.0 |
| 1990 | 337,957 | 127,767 | 826 | 466,550 | 72.4 | 27.4 | 0.2 | 100.0 |
| 1991 | 359,138 | 153,653 | 1,347 | 514,138 | 69.9 | 29.9 | 0.3 | 100.0 |
| 1992 | 385,057 | 144,015 | 1,188 | 530,260 | 72.6 | 27.2 | 0.2 | 100.0 |
| 1993 | 457,517 | 198,492 | 1,730 | 657,739 | 69.6 | 30.2 | 0.3 | 100.0 |
| 1994 | 517,805 | 225,553 | 1,658 | 745,016 | 69.5 | 30.3 | 0.2 | 100.0 |
| | | | | | | | | |

*Source: Sri Lanka Port authority, Statistics Section*

### 3.5.2 Ratio of Empty Containers

265. Table 3.5.2 shows the quantity and ratio of empty containers handled at the Port of Colombo between 1981 and 1994. The ratio of the empty containers loaded and unloaded is approximately 18 percent in 1994.

**TABLE 3.5.2 Ratio of Empty Containers**

(TEUs)

| Year | Total(TEUs) | | | Total Percent | |
|---|---|---|---|---|---|
| | Laden | Empty | | Laden | Empty |
| 1981 | 44,331 | 15,140 | 59,471 | 75 | 25 |
| 1982 | 79,654 | 26,466 | 106,120 | 75 | 25 |
| 1983 | 113,735 | 32,955 | 146,690 | 78 | 22 |
| 1984 | 145,132 | 42,595 | 187,727 | 77 | 23 |
| 1985 | 165,874 | 58,392 | 224,266 | 74 | 26 |
| 1986 | 270,059 | 78,083 | 348,142 | 78 | 22 |
| 1987 | 353,924 | 81,694 | 435,618 | 81 | 19 |
| 1988 | 518,816 | 109,669 | 628,485 | 83 | 17 |
| 1989 | 446,195 | 105,615 | 551,810 | 81 | 19 |
| 1990 | 502,198 | 93,167 | 595,365 | 84 | 16 |
| 1991 | 531,121 | 138,367 | 669,488 | 79 | 21 |
| 1992 | 531,507 | 144,269 | 675,776 | 79 | 21 |
| 1993 | 691,539 | 166,859 | 858,398 | 81 | 19 |
| 1994 | 802,415 | 170,227 | 972,642 | 82 | 18 |

*Source: Sri Lanka Port Authority, Statistics Section*

### 3.5.3 Ratios of Transshipped and Domestic Containers

266. Table 3.5.3 shows the quantities and ratios of transhipment and domestic (Import and Export) containers handled at the Colombo Port between 1981 and 1994.

267. The ratio of transhipment of containers has been stable at approximately 70 percent since 1987, whereas that of the Import and Export containers has been a little under 30 percent.

**TABLE 3.5.3 Transhipment Ratio**

(TEUs)

| YEAR | DOMESTIC | | TRANSHIPMENT | | RE-STOWING | TOTAL |
|---|---|---|---|---|---|---|
| | TOTAL | % | TOTAL | % | TOTAL | |
| 1981 | 49,987 | 84.1 | 7,820 | 13.1 | 1,664 | 59,471 |
| 1982 | 70,983 | 66.9 | 32,261 | 30.4 | 2,876 | 106,120 |
| 1983 | 77,109 | 52.6 | 65,801 | 44.9 | 3,780 | 146,690 |
| 1984 | 93,379 | 49.7 | 88,105 | 46.9 | 6,243 | 187,727 |
| 1985 | 105,484 | 47.0 | 114,388 | 51.0 | 4,394 | 224,266 |
| 1986 | 120,950 | 34.7 | 220,456 | 63.3 | 6,736 | 348,142 |
| 1987 | 129,076 | 29.6 | 300,222 | 68.9 | 6,320 | 435,618 |
| 1988 | 135,439 | 21.6 | 485,501 | 77.2 | 7,545 | 628,485 |
| 1989 | 158,980 | 28.8 | 385,217 | 69.8 | 7,613 | 551,810 |
| 1990 | 173,048 | 29.1 | 410,772 | 69.0 | 11,545 | 595,365 |
| 1991 | 188,183 | 28.1 | 469,519 | 70.1 | 11,786 | 669,488 |
| 1992 | 211,931 | 31.4 | 451,213 | 66.8 | 12,632 | 675,776 |
| 1993 | 251,899 | 29.3 | 590,654 | 68.8 | 15,845 | 858,398 |
| 1994 | 289,475 | 29.8 | 665,840 | 68.5 | 17,327 | 972,642 |

*Source: Sri Lanka Port Authority, Statistics Section*

### 3.5.4 Numbers of Containers Handled Per Ship

268. Table 3.5.4 shows the numbers of container ships called at the Port of Colombo between 1987 and 1994 together with the average number of containers handled by each ship.

269. The average number of containers handled for each ship was 500 TEUs for main vessels and 400 TEUs for feeder vessels. The figure for main vessels varied with berth. The figure at the JCT terminal was approximately 500 TEUs whereas that at the QCT terminal was approximately 300 TEUs.

**TABLE 3.5.4 Average Number of Boxes/TEUs per Ship Call**

| Year | Calling Ships | Total Boxes | Total Teus | Number of Boxes Per Ship | Number of TEUs Per Ship |
|---|---|---|---|---|---|
| 1987 | 825 | 343,088 | 435,618 | **416** | **528** |
| 1988 | 915 | 460,825 | 628,485 | **504** | **687** |
| 1989 | 1,374 | 432,241 | 551,810 | **315** | **402** |
| 1990 | 1,643 | 466,550 | 595,365 | **284** | **362** |
| 1991 | 1,657 | 514,138 | 669,488 | **310** | **404** |
| 1992 | 1,831 | 530,260 | 675,776 | **290** | **369** |
| 1993 | 2,036 | 657,739 | 858,398 | **323** | **422** |
| 1994 | 2,071 | 745,016 | 972,642 | **360** | **470** |

*Source: Sri Lanka Ports Authority*

### 3.5.5 Number of Containers Handled at Berths.

270. Table 3.5.5 shows quantities and ratios of containers handled at the each berth of the Port of Colombo.

271. In 1994, only Nos. 1 and 2 terminals of the JCT were operated as full container berths. Having no quay crane, No. 3 terminal and the Cross Berth of the JCT forced the ships to use their own gear for loading and unloading.

272. The number of containers handled at all the JCT terminals in 1994 totalled 620,000 TEUs(64 percent) whereas that of containers handled at all berths of the QCT and QED totalled 250,000 TEUs (26 percent) which makes the total of the JCT, QCT and QED 870,000 TEUs (90 percent).

273. When too many container ships call at the Port of Colombo, loading and unloading are done using one or more conventional berths. The number of containers handled at the

conventional berths in 1994 was as high as 100,000 TEUs (10 percent), reflecting the congestion in the container terminals at the JCT, QCT and other terminals.

274. When the No. 3 terminal of the JCT became operational as a full container berth in 1995, the number of containers handled at the conventional berths between January and June was decreased to 200,000 TEUs (5 percent) which is half of the percentage in 1994.

**TABLE 3.5.5 Container Loaded/Discharged at each Berth**
***(from 1994 to July 1995)***

(TEUs)

| NAME OF BERTH | 1994 | | 1995 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | TOTAL | % | JAN | FEB | MAR | APR | MAY | JUN | TOTAL | % |
| JCT-1 | 262,985 | 27.0 | 21,589 | 21,026 | 23,465 | 18,553 | 18,884 | 19,686 | 123,203 | 23.5 |
| JCT-2 | 243,819 | 25.1 | 20,535 | 18,588 | 22,490 | 21,294 | 20,072 | 22,279 | 125,258 | 23.9 |
| JCT-3 | 45,731 | 4.7 | 12,395 | 16,418 | 17,754 | 17,124 | 16,178 | 16,904 | 96,773 | 18.5 |
| JCT-4 | 0 | 0.0 | 0 | 243 | 3,049 | 3,472 | 4,604 | 1,925 | 13,293 | 2.5 |
| JCT-CB | 69,078 | 7.1 | 7,070 | 2,662 | 2,933 | 3,975 | 4,013 | 4,599 | 25,252 | 4.8 |
| **Sub Total** | **621,613** | **63.9** | **61,589** | **58,937** | **69,691** | **64,418** | **63,751** | **65,393** | **383,779** | **73.3** |
| QCT-4 | 121,836 | 12.5 | 11,717 | 9,716 | 9,100 | 8,937 | 10,178 | 10,561 | 60,209 | 11.5 |
| QCT-5 | 9,418 | 1.0 | 701 | 903 | 484 | 264 | 0 | 4,319 | 6,671 | 1.3 |
| QCT-6 | 118,024 | 12.1 | 9,992 | 8,560 | 11,491 | 8,833 | 8,631 | 3,556 | 51,063 | 9.8 |
| **Sub Total** | **249,278** | **25.6** | **22,410** | **19,179** | **21,075** | **18,034** | **18,809** | **18,436** | **117,943** | **22.5** |
| QEQ-1 | 2,550 | 0.3 | 222 | 72 | 26 | 39 | 0 | 827 | 1,186 | 0.2 |
| QEQ-2 | 4,335 | 0.4 | 286 | 0 | 81 | 530 | 0 | 226 | 1,126 | 0.2 |
| QEQ-3 | 4,062 | 0.4 | 387 | 0 | 0 | 149 | 432 | 16 | 981 | 0.2 |
| PVQ-1 | 6,045 | 0.6 | 0 | 18 | 0 | 503 | 365 | 271 | 1,157 | 0.2 |
| PVQ-2 | 21,700 | 2.2 | 1,804 | 400 | 0 | 164 | 10 | 381 | 2,759 | 0.5 |
| BQ-1 | 7,227 | 0.7 | 0 | 0 | 0 | 0 | 404 | 29 | 433 | 0.1 |
| BQ-2 | 1,603 | 0.2 | 0 | 0 | 15 | 0 | 0 | 21 | 36 | 0.0 |
| BQ-3 | 2,084 | 0.2 | 0 | 0 | 38 | 74 | 22 | 0 | 134 | 0.0 |
| BQ-4 | 4,274 | 0.4 | 0 | 280 | 0 | 0 | 658 | 226 | 1,164 | 0.2 |
| BQ-CB | 45 | 0.0 | 15 | 17 | 3 | 0 | 0 | 36 | 71 | 0.0 |
| SP-1 | 1,963 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| SP-2 | 41,665 | 4.3 | 0 | 701 | 0 | 1,482 | 0 | 998 | 3,181 | 0.6 |
| GP-1 | 242 | 0.0 | 159 | 0 | 0 | 0 | 0 | 0 | 159 | 0.0 |
| GP-2 | 3,961 | 0.4 | 1,986 | 170 | 991 | 1,542 | 2,653 | 2,001 | 9,346 | 1.8 |
| OJ | 0 | 0.0 | 0 | 5 | 4 | 0 | 0 | 0 | 9 | 0.0 |
| **Sub Total** | **101,756** | **10.5** | **4,859** | **1,663** | **1,164** | **4,483** | **4,544** | **5,032** | **21,745** | **4.2** |
| **Grand Total** | **972,647** | | **88,858** | **79,779** | **91,930** | **86,935** | **87,104** | **88,861** | **523,467** | |

*Source: Sri Lanka Port Authority(Statistis Section)*

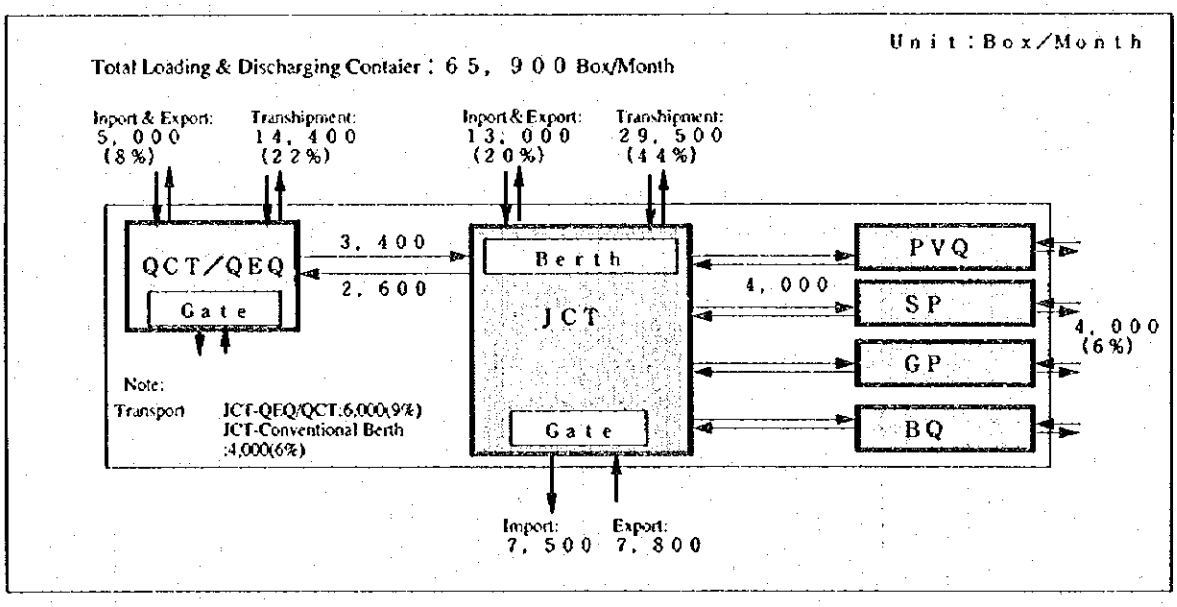
### 3.5.6 Inter-terminal Container Transportation

275. Fig.3.5.1 shows the numbers of containers moved between the terminals and berths of the Colombo Port during the three months from May to July 1995. The following two factors are main reasons for the inter-terminal and inter-berth transportation of containers.

276. The first cause is that larger main vessels and their feeder vessels are moored at the JCT, while smaller main vessels and their feeder vessels are moored at the QCT. When imbalance in transhipped cargo arises between the main and feeder vessels at each terminal, therefore, transport of containers between the JCT and QCT ensues. Between May and July 1995, an average of 6,000 boxes of containers per month , which account for 5 percent of all containers handled at the Colombo Port, were transported between JCT and QCT.

277. The second cause is that the calling of larger main vessels at the JCT concentrates on weekends, which resultin a shortage of berths to accommodate feeder vessels. As a consequence some of the feeder vessels scheduled to call at the JCT are forced to load and unload at Guide Pier, South Pier, Prince Vijaya Quay and Bandaranaike Quay instead. The containers thus loaded and unloaded are transported from or to the container yard at the JCT terminal. Between May and July, 1994, an average of 4,000 boxes, 6 percent of all containers handled at the Port of Colombo, were transported between the JCT and other berths each month.

**FIGURE 3.5.1 Container Transportation within the Port of Colombo in May-July, 1995**



### 3.5.7 Ratio of LCL Containers

278. Table 3.5.6 shows the quantity and ratio of LCL containers handled at Colombo Port between January and December 1994. Because of the limited CFS capacity, LCL containers are used mostly for import cargoes. As a rule, SLPA does not accept export cargoes in LCL containers.

In 1994, LCL containers were 3290 TEUs, only 1.5 percent of containerised domestic cargoes. Presumably, this low percentage is due to the considerable development of inland container depots owned by private companies and the development of the direct FCL delivery system from exporting companies.

279. Table 3.5.7 lists the private companies' inland container depots in and around the Port of Colombo.

**TABLE 3.5.6 LCL Container Throughput and LCL Container Ratio (1994)**

| | F.C.L. (Domestic Cargo) | | L.C.L | |
|---|---|---|---|---|
| MONTH | TOTAL FCL (Box) | TEUs | TOTAL LCL (Box) | TEUs |
| JAN | 12,727 | 16,413 | 223 | 276 |
| FEB | 12,483 | 16,026 | 125 | 157 |
| MAR | 14,193 | 18,314 | 201 | 258 |
| APR | 13,109 | 16,927 | 233 | 300 |
| MAY | 14,316 | 18,642 | 177 | 231 |
| JUN | 14,616 | 19,189 | 180 | 226 |
| JUL | 15,037 | 19,853 | 711 | 886 |
| AUG | 14,040 | 18,363 | 213 | 276 |
| SEP | 15,228 | 20,060 | 173 | 221 |
| OCT | 15,024 | 19,378 | 154 | 201 |
| NOV | 14,749 | 19,060 | 113 | 143 |
| DEC | 15,057 | 19,401 | 92 | 112 |
| TOTAL | 170,579 | 221,626 | 2,578 | 3,290 |
| | 98.5 | 98.5 | 1.5 | 1.5 |

*Source: Sri Lanka Ports Authority, Statistic Section*

## TABLE 3.5.7 Inland Container Freight Stations

| Name of CFS/CD Location | Distance orm Por Km | Land Area (Sq meter) | W/House Space (sq meter) | Related Lines | Activities |
|---|---|---|---|---|---|
| 1.ABC(Pvt)Ltd. Mulleriyawa | 8 | 16000 | - | Agents, K'Line | Returning of emptycontainers belonging to various shipping lines Container repair |
| 2.ACE Containers(Pvt)Ltd. Wattala Katunayake | 8 30 | 52000 10000 | 600 185 | Nedlcyd Line, Baltic, Lloyd, Triestino | Tee, Garment-Consolidation work Container repair |
| 3.Asha Agencies Lnland Container Terminal. Kelaniya | 8 | 20300 | 3400 | Yang Ming Lin S.C.I. | Consolidation work |
| 4.Bartleet Freighters Ltd. Wattala | 6.4 | 4050 | 650 | For all lines | Rubber Contr. Frt STN for returning of Mty containers |
| 5.Cargo Boat Despatch Co., Ltd. Container Depot. Welisara | 10 | 12000 | 465 | Hanjin | Consolidation work |
| 6.Ceyhous Limited Colombo 5 | 6.4 | 8100 | 4890 | | Air/Sea Consolidators |
| 7.Ceylon Ocean Lines Container Service Ltd. Kelaniya | 16 | 13100 | 450 | P.O.L. | Containers |
| 8.Ceylon Shipping Lines Ltd. Orugodawatta | 6 | 40500 | 1132 | Agent C.S.C. | Consolidators-R/E B.W.H operators |
| 9.East-West Container Ltd. Peliyagoda | 7.2 | 40500 | 1132 | Various lines | Consolidation work-Tea Suger transshipment |
| 10.Interocean Container Depo Wattala | 9.6 | 12150 | 380 | Various lines | Consolidation work |
| 11.Maritime Agencies FCS. Mattakkuliya | 3.2 | 600 | 625 | Agents-NYK, Hoegh, CMA | Consolidators-rubber, Tea, Disiccated Coconut, Fiber |
| 12.Mclaren's Container Depot Welisara | 9 | 20300 | 380 | Unidel, and Other Lines | Garment Container repair |
| 13.SLPA Orugodawatte | 2.5 | 18200 | 1670 | Various lines | import and Mty containers |

*Source: Sri Lanka Port Authority*

### 3.6 Terminal Operations

#### 3.6.1 Functions of JCT and QCT

280. The current container terminals of the Port of Colombo consist of six JCT berths and two QCT berths, or a total of eight berths.

281. JCT Nos. 1~4 berths, with water depths ranging from 12 m to 14.5 m, receive oceangoing vessels of 30,000 GRT to 50,000 GRT which circumnavigate the world or connect with Europe, North America or East Asia. Feeder vessels which tranship containers to these vessels berth at JCT-CBN and JCT-CBS berths (water depth: 9.0 and 7.0 m) and JCT Nos. 1~4 berths. When many oceangoing vessels call at the container terminals simultaneously, JCT berths are fully utilized, making the berthing of feeder vessels there impossible. In such a case, feeder vessels berth at the conventional berths at GP, SP, PVQ, BQ, etc., for cargo handling.

282. In January 1996, JCT No. 4 terminal (water depth: 14.5 m) and JCT-CBS berth (water depth: 7.0 m) started operation. However, the shortage of feeder vessel berthing capacity at JCT, compared to the oceangoing vessel berth capacity, still persists.

283. QCT No. 4 terminal (water depth: 10.8 m) and QCT Nos. 5 and 6 terminals (water depth: 12.6 m) accommodate 10,000 GRT~30,000 GRT oceangoing vessels plying East Asia, Africa, the Near and Middle East, the Mediterranean and Indo-European routes as well as feeder vessels which tranship containers to these oceangoing vessels. QCT No. 4 berth and QCT Nos. 5 and 6 berths mainly accommodate feeder vessels and oceangoing vessels, respectively. The oceangoing and feeder vessel berthing capacities at QCT are balanced.

#### 3.6.2 Berth Allocation

284. The ship agents of container vessels which call at the Port of Colombo are expected to declare to the container terminal manager ship names, estimated time of arrival(ETA) and number of containers handled by 96 hours (4 days) before the ships' ETA. Based on such declaration, the terminal manager allocates berths and informs the ship agents of the allocation. The allocation is made twice a week and the result is confirmed at a joint meeting between terminal managers and ship agents. The ship agents need to declare the final time of arrival at least 24 hours before ETA for confirmation. If the actual arrival is delayed by six hours or more beyond the confirmed arrival time, the vessel concerned loses the priority right to use the allocated berth.

285. Each ship agent of container vessels which berth at JCT and QCT is allocated berths at either terminal in consideration of the ship size and cargo transhipment between oceangoing and feeder vessels. Therefore, dayly and weekly berth allocation is limited to that within either JCT or QCT terminal. However, if berth allocation for feeder vessels cannot be made in the same terminal, allocation is made straddling JCT and QCT.

### 3.6.3 Yard Operation

(1) Allocation of Yard Equipment

286. At JCT, which uses RTCs as container handling equipment in the yard, three RTCs and five prime movers are dedicated for one container crane in the loading and discharging operation.

(2) Yard Layout

287. Both JCT and QCT pre-allocate ground slots for export containers, import containers and transhipment containers. The slots for transhipment containers are sub-allocated by ship agent.

(3) Stacking Plan for Transhipment Containers

288. Transhipment containers are separately stacked on different ground slots in the order of ships handled by ship name, destination port and weight class. The group of containers categorized into these minimum elements is reffered to as a stacking lot. Generally, stacking lots for containers which are discharged from feeder vessels for the transhipment to oceangoing vessels are small because destination ports of oceangoing vessels extend to several countries, each lot containing only a few boxes. On the other hand, stacking lots for containers discharged from oceangoing vessels for the transhipment to feeder vessels are large because destination ports of feeder vessels usually concentrate into one for each vessel, each lot holding several tens of boxes.

### 3.6.4 Hours of Operation

289. The Port of Colombo container terminals adopt a 2-shift working system and operate 21.15 hours a day and 364 days a year, except for May Day (May 1). Table 3.6.1 shows the details of the working hours and breaks.

290. The Report on the Study for Enhancement of Port Management (Stage 1, February 1995) recommends the adoption of a 3-shift working system to improve the cargo handling productivity. However, the SLPA management is not inclined to adopt the recommendation primarily because it would extend the commuting hours in the City of Colombo to 10:00~11:00 p.m., which the current public transport system is poorly equipped to handle.

**TABLE 3.6.1 Container Terminal Operation Hours**

| | | | Beginning | Ending | Hours |
|---|---|---|---|---|---|
| Operation Days per Year | | | | | 364 |
| Working Hours | | Day Shift | 7:30 | 16:30 | 9:00 |
| | | Night Shift | 16:30 | 6:30 | 15:00 |
| Breaks | Meal Break | Day Shift | 12:00 | 12:30 | 0:30 |
| | | Night Shift | 21:00 | 21:30 | 0:30 |
| | Tea Breaks | Day Shift | 15:00 | 15:15 | 0:15 |
| | | Night Shift | 23:00 | 23:15 | 0:15 |
| | | | 2:00 | 2:15 | 0:15 |
| Net Working Hours per Day | | | | | 21:15 |

*Source: Sri Lanka Ports Authority*

### 3.6.5 Performance of Container Terminal Operations

#### (1) Ship waiting time for berthing

291. Table 3.6.2 lists the ships called and their average waiting time for berthing, berthing and turn around time in the Colombo Port between 1987 and 1995. The berth waiting time, which is one of the main criteria for evaluating the performance of port operations, of container and conventional cargo ships has followed similar trends. The berth-waiting time became very long between 1988 and 1989 when the berth capacity was insufficient to cope with the increasing number of calling ships. The congestion was relieved when 2 berths of the JCT came on stream in 1990. The berth-waiting time remained shortened for some time. However, the congestion of the port of Colombo resumed as the volume of cargoes increased. The berth-waiting time began to increase again between 1993 and 1994. Especially in 1994, the port services to calling ships were at the worst, with the average berth-waiting time for container ships exceeding 20 hours. The berth-waiting time has been improved since the start of No. 3 berth terminal in May 1995.

292. The congestion of the port of Colombo has been reflected on the occupancy ratio (BOR) of each berth. Table 3.6.3 shows trends in the BOR of the Port of Colombo, whereas Fig. 3.6.1 shows trends in the BOR and containing ships' berth-waiting time at the JCT and QCT.

## TABLE 3.6.2 Waiting Time and Turn-round Time (from 1987 to 1995)

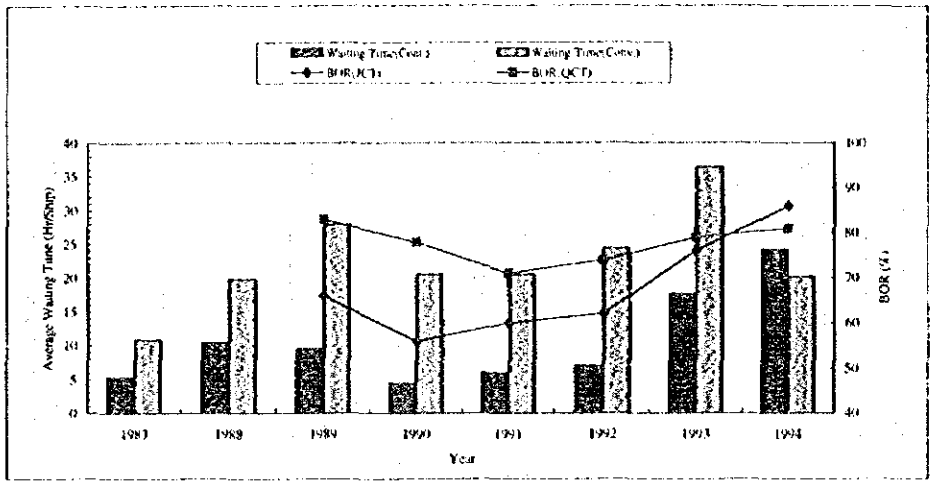
| Year | Container Ships | | | | | | Ships Other Than Container Ships | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No of Ship Call | Avg Waiting Time Per Ship | Avg Service Time Per Ship | Avg Turn-Round Time Per Ship | Avg Tonnes Per Ship/Hour At Berth | Avg Tonnes Per Ship/Hour In Port | No of Ship Call | Avg Waiting Time Per Ship | Avg Service Time Per Ship | Avg Turn-Round Time Per Ship | Avg Tonnes Per Ship/Hour At Berth | Avg Tonnes Per Ship/Hour In Port |
| 1987 | 825 | 5.3 | 29.1 | 34.4 | 179 | 152 | 1,052 | 10.9 | 99.1 | 110.0 | 27 | 25 |
| 1988 | 915 | 10.5 | 34.2 | 44.7 | 199 | 152 | 946 | 19.9 | 108.9 | 128.8 | 29 | 25 |
| 1989 | 1,374 | 9.6 | 23.2 | 32.8 | 181 | 128 | 726 | 28.0 | 137.6 | 165.6 | 27 | 23 |
| 1990 | 1,643 | 4.5 | 19.0 | 23.5 | 209 | 169 | 757 | 20.5 | 119.4 | 139.9 | 33 | 28 |
| 1991 | 1,657 | 6.0 | 20.0 | 26.0 | 206 | 159 | 794 | 20.5 | 120.2 | 140.7 | 33 | 28 |
| 1992 | 1,831 | 7.0 | 18.4 | 25.4 | 209 | 151 | 794 | 24.4 | 117.5 | 141.9 | 27 | 23 |
| 1993 | 2,036 | 17.6 | 22.5 | 41.8 | 193 | 104 | 591 | 36.6 | 104.2 | 144.2 | 37 | 27 |
| 1994 | 2,071 | 24.2 | 27.9 | 53.7 | 187 | 97 | 503 | 20.1 | 120.5 | 143.6 | 36 | 31 |
| 1995 | | | | | | | | | | | | |
| JAN | | 18.9 | 25.3 | 45.9 | 206 | 113 | | 29.3 | 119.7 | 152.8 | 34 | 26 |
| FEB | | 13.4 | 20.2 | 35.4 | 263 | 150 | | 27.4 | 126.3 | 156.8 | 37 | 30 |
| MAR | | 7.6 | 33.9 | 43.7 | 157 | 122 | | 13.7 | 83.0 | 102.6 | 46 | 37 |
| APR | | 13.6 | 27.1 | 41.4 | 200 | 131 | | 12.3 | 84.1 | 99.1 | 36 | 31 |
| MAY | | 18.7 | 28.4 | 49.6 | 187 | 107 | | 14.0 | 121.8 | 142.0 | 29 | 25 |
| JUN | | 9.7 | 25.0 | 36.6 | 229 | 157 | | 6.2 | 115.6 | 124.9 | 33 | 31 |
| | | | | | | | | | | | | |
| 1995 | TOTAL | 13.7 | 26.7 | 42.1 | 207 | 130 | | 17.2 | 108.4 | 129.7 | 36 | 30 |

*Source:Sri Lanka Port Authority,Statistic Section*

## TABLE 3.6.3 Berth Occupancy Ratio of each Berth

| YEAR | MONTH | Q.E.Q | Q.C.T | B.Q | J.C.T C.B | J.C.T | P.V.Q | G.P | S.P | OVERALL AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1989 | | 77 | 66 | 85 | 56 | 83 | 76 | 34 | 93 | |
| 1990 | | 78 | 56 | | 77 | 66 | 76 | 36 | 83 | 72 |
| 1991 | | 83 | 60 | 89 | 61 | 71 | 80 | 27 | 88 | |
| 1992 | | 82 | 62 | 86 | 76 | 74 | 82 | 7 | 92 | 67 |
| 1993 | | 88 | 76 | 84 | 62 | 79 | 87 | 40 | 92 | 78 |
| 1994 | | 84 | 86 | 89 | 71 | 81 | 84 | 50 | 87 | 81 |
| 1995 | 1 | 88 | 91 | 91 | 70 | 80 | 88 | 89 | 99 | 87 |
| | 2 | 92 | 78 | 88 | 86 | 82 | 79 | 84 | 60 | 83 |
| | 3 | 83 | 74 | 92 | 81 | 80 | 82 | 70 | 97 | 82 |
| | 4 | 83 | 83 | 86 | 72 | 85 | 68 | 57 | 83 | 80 |
| | 5 | 81 | 83 | 76 | 91 | 83 | 68 | 67 | 95 | 80 |
| | 6 | 90 | 74 | 89 | 65 | 84 | 72 | 86 | 97 | 84 |
| | 7 | 59 | 85 | 78 | 55 | 83 | 72 | 67 | 85 | 75 |
| | 8 | 85 | 76 | 89 | 69 | 81 | 89 | 52 | 99 | 81 |
| | Sum | 83 | 81 | 86 | 74 | 82 | 77 | 72 | 89 | 82 |

**FIGURE 3.6.1 Comparison of Waiting Time and BOR**




### (2) Container Handling Productivity

293. In the discussion of the container handling productivity of terminals, ship-wise productivity (gross productivity) and crane-wise productivity (net productivity) must be considered separately.

1) Gross Productivity

294. Gross productivity is an indicator of the number of containers loaded to or unloaded from a container ship per unit time. Usually it is determined by dividing the number of containers loaded to or unloaded from a container ship by its berthing time. Table 3.6.6 shows the actual gross productivity at the JCT and QCT in July 1995.

295. The type of loading/unloading facilities (container cranes or ship gears) is the first factor which significantly affects gross productivity. Gross productivity varies greatly with the type of loading/unloading facilities.

296. The second factor affecting gross productivity is the number of cranes installed for the loading/unloading operation at a berth. Gross productivity differs markedly between the container berths of Singapore or Hong Kong where one ship can always use three or four container cranes and berths with lower number of crane availabilities. The maximum number of cranes available for a ship calling the Port of Colombo is 2.5 at Nos. 1 and 2 berths and 3.0 at Nos. 3 and 4 berths of the JCT AND 1 or 2 at the QCT.

297. The third factor affecting gross productivity is the efficiency in utilization of available cranes. How effectively they are used is important. Even high-speed cargo-handling facilities cannot raise gross productivity if preparation for the commencement of operation, shift-change and meal break times are long. If bay plans and seaquence for loading and unloading operation

are inappropriate, some cranes will interfere with others to decrease the number of cranes that can really serve the purpose. In the case of the JCT, the number of cranes in effective use with one ship is 1.9 when two cranes are installed and 2.4 when three cranes are installed for one berth.

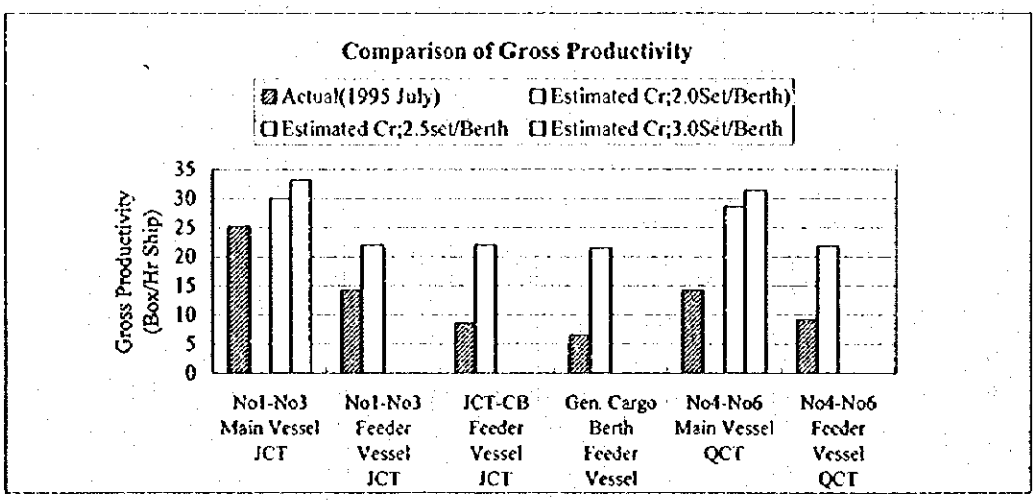
298. The forth factor is the productivity of each crane, which will be elaborated on later. As has been mentioned, equipment, operation management, skill and many other factors affect gross productivity. The possible extent of improvement in the cargo handling gross productivity that might result from the provision of an appropriate number of container cranes and the optimization of operation management was estimated as shown in Table 3.6.4 and Fig. 3.6.2..

**TABLE 3.6.4 Container Handling Gross Productivity**

| Group | | Berth No | Average Number of Container Handled (Box/Ship) | Actual Productivity (1995 July) (Box/HrShip) | Estimated Productivity (Box/Hr Ship) Number of Container Crane(Set/Berth) 2 | 2.5 | 3 |
|---|---|---|---|---|---|---|---|
| JCT | Main Vessel | No1-No3 | 414 | 25.2 | - | 29.9 | 33.1 |
| | Feeder Vessel | No1-No3 | 303 | 14.2 | 22.0 | - | - |
| | | JCT-CB | 300 | 8.5 | 22.0 | - | - |
| | | Gen. Cargo Berth | 225 | 6.5 | 21.4 | - | - |
| QCT | Main Vessel | No4-No6 | 273 | 14.2 | - | 28.6 | 31.4 |
| | Feeder Vessel | No4-No6 | 275 | 9.1 | 21.8 | - | - |

*Source: 1995 july Container terminal Operation data of the Port of Colombo*

**FIGURE 3.6.2 Comparison of Gross Productivity**



2) Net Productivity

299. Fig. 3.6.3 show the cranewise or net productivity of the terminals. One of the main factors affecting the net productivity is the specifications of container cranes (such as lifting and traversing speeds). Another factor is the experience and skill of crane operators. The container cranes of at least the JCT in the Port of Colombo may not be classed as the best ones but are comparable to those at the ports of Singapore and Hong Kong. Still, there is some room for improving the skill of the crane operators. (Details are shown in Appendix Table A3.6.5)

300. The third factor is if yard and loading/unloading operations at the container terminal are efficiently integrated or, in other words, if yard operation does not interfere with loading and unloading work.

301. The net productivity at the JCT in the port of Colombo averages 17 to 18 containers per hour and crane for main vessels and 14 to 15 containers per hour and crane for feeder vessels. This difference is largely due to the difference in ship size. The feeder vessels sailing between the Port of Colombo and ports on the Indian subcontinent are small. Many container ships are retrofit from general cargo ships. Loading and unloading with these ships must be carried out with great care because cargoes are likely to break loose in them.

302. The net productivity at the QCT is 14 to 15 containers per hour and crane, with no significant difference found between main and feeder vessels. It will be difficult to raise the net productivity of the port of Colombo without improving the existing top-lifter container handling system.

303. The net productivity achieved by using ship gear at the JCT-CB and conventional berths (SP, GP, PVQ, BQ, etc.) is 6 to 8 containers per hour and crane.

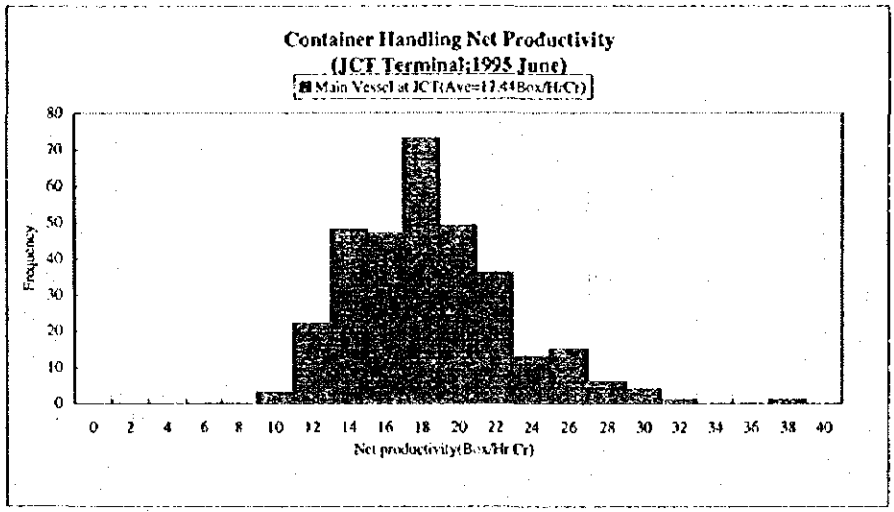
**(3) Performance of yard Operation**

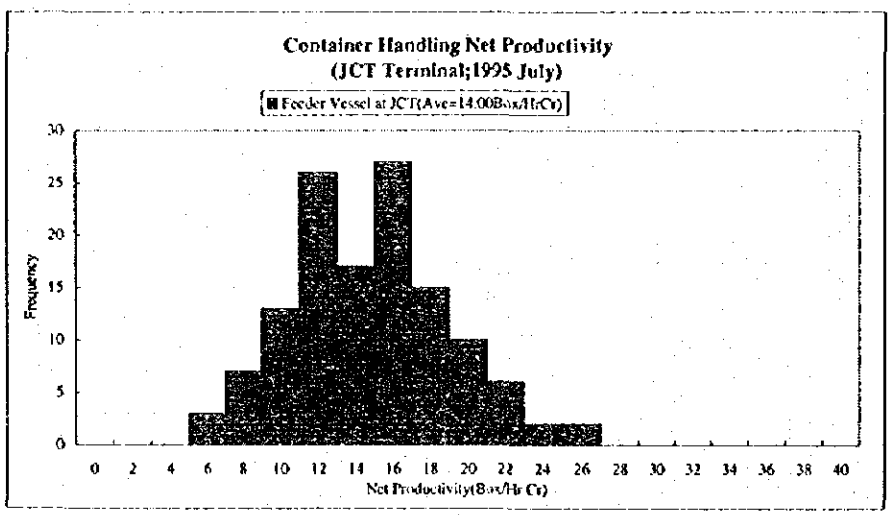
304. Container dwelling time in the yard and container stacking height or container yard occupancy ratio(YOR) are the most typical indices of yard operation performance.

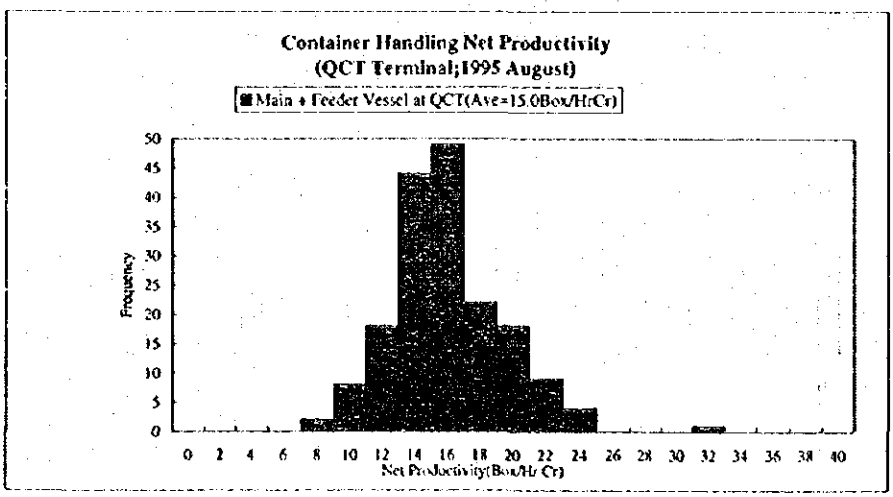
305. Actual dwelling time at the JCT terminal between May and July 1995 is listed in Appendix Table A 3.6.6.

306. The dwell time of import and export containers were 8.4 days and 4.8 days respectively, with that of transshipment containers standing at 7.4 days. The container dwelling time at JCT averages 6.99 days. This dwelling time is approximately 1.0 day shorter than that found by the preceding mission (Study for enhancement of port management) in December 1994.

## FIGURE 3.6.3 Container Handling Net Productivity in the Port of Colombo



### 3.6.6 Labour Force

(1) Grades of Employees

307. Employees of the SLPA consist three grades, Executive grade, Non-Labour grade and Labour grade. Non-Labour grade and Labour grade comprise the following kinds of employees.

1) Non-Labour grade
   a) Non-staff grades including supervisory, clerical and allied grades.
   b) Non-Labour minor staff
   c) Drivers and cleaners
   d) Non-executive security staff

2) Labour grade
   a) Operational Labour
   b) Engineering labour
   c) Navigation labour

(2) Change of the Number of Employees

308. TABLE 3.6.4 shows change of the number of employees working in the SLPA (by division). The grand total number decreased by 16.2% in 1994 compared with 1990. Concerned with each division, the numbers of employees in commercial division, medical division and secretariat / administrative increased 0.7% - 10.6% in 1994 compared with 1990 . The ones in the other divisions decreased by 0.2% - 29.1%.

309. TABLE 3.6.5 shows change of the number of employees working in the SLPA (by grade). The number of employees in Executive grade increased by 13.1% in 1994 compared with 1990. The one in Non-labour grade decreased by 3.6%, in Labour grade, decreased by 9.4%. The total number decreased by 6.4%.

(3) Labour Force Comparison

310. TABLE 3.6.6 shows comparison of labour force between the Port of Colombo and the Port of Singapore. The number of employees working in the Port of Singapore Authority (PSA) increased by 4.7% in 1994 compared with 1990. However, PSA has the achievement that they reduced 30.2% of employees from 10,198 persons in 1981 to 7,115 persons in 1990. Though the number of employees of the SLPA has been decreasing from 1990, the SLPA keeps employees of more than twice as many as PSA in 1994. Concerned with the figures of container cargo volume per employee, the figures of PSA are more than twenty times as many as the ones of SLPA.

(4) Personnel Arrangement at Container and Conventional Terminals.

311. To show a typical pattern of personnel arrangement in container terminal operation by the SLPA, personnel arrangement at QCT is shown in TABLE A3.6.7, and the number of employees in QCT is shown in TABLE A3.6.8. Likewise, to show a typical pattern of personnel arrangement in conventional terminal operation by the SLPA, personnel arrangement at QEQ is shown in TABLE A3.6.9, and the number of employees in QCT is shown in TABLE A3.6.10.

**TABLE 3.6.5 SLPA Employees (Total)**

| Year | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| SLPA Employees | 19,818 | 18,046 | 17,487 | 17,254 | 16,617 |

**TABLE 3.6.6 The Number of SLPA Employees by Grade (Colombo Port)**

Unit: persons

| Grade | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Executive | 397 | 386 | 387 | 383 | 449 |
| Increasing Rate | 100.0% | 97.2% | 97.5% | 96.5% | 113.1% |
| Non Labour | 6,761 | 6,831 | 6,964 | 6,590 | 6,518 |
| Increasing Rate | 100.0% | 101.0% | 103.0% | 97.5% | 96.4% |
| labour | 9,272 | 9,734 | 8,830 | 8,871 | 8,404 |
| Increasing Rate | 100.0% | 105.0% | 95.2% | 95.7% | 90.6% |
| Total | 16,430 | 16,951 | 16,181 | 15,844 | 15,371 |
| Increasing Rate | 100.0% | 103.2% | 98.5% | 96.4% | 93.6% |

*Note: Increasing Rate means the ratio compared with 1990.*

**TABLE 3.6.7 Labour Force Comparison**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| NO of Employees (Unit: persons) | | | | | |
| (1) SLPA (Colombo Port) | 17,860 | 16,243 | 15,813 | 15,624 | 15,109 |
| (2) PSA total | 7,115 | 7,131 | 7,094 | 7,170 | 7,447 |
| Rate1=(2)/(1) | 39.8% | 43.9% | 44.9% | 45.9% | 49.3% |
| Container Cargo Volume (Unit: '000TEU) | | | | | |
| (3) The Port of Colombo | 584 | 658 | 663 | 842 | 954 |
| (4) The Port of Singapore | 5,134 | 6,245 | 7,399 | 8,877 | 10,255 |
| Rate2=(4)/(3) | 879.1% | 949.1% | 1116.0% | 1054.3% | 1074.9% |
| Container Cargo Volume / Employee (Unit: TEU/person) | | | | | |
| (5) The Port of Colombo | 33 | 41 | 42 | 54 | 63 |
| (6) The Port of Singapore | 722 | 876 | 1,043 | 1,238 | 1,377 |
| Rate3=(6)/(5) | 2206.7% | 2161.8% | 2487.6% | 2297.4% | 2180.9% |

## 3.7 Port Management

### 3.7.1 Organization of the SLPA

(1) Port Management in Sri Lanka

312. In Sri Lanka, Majority of port activities are undertaken by the Sri Lanka Ports Authority (the SLPA). There are many other organizations operating within the port. To say it roughly, merchant shipping and supervision of the SLPA is undertaken by Ministry of Shipping, Ports, Rehabilitation & Reconstruction (MSPRR). Customs are undertaken by Ministry of Finance. Port Police and Immigration Office are undertaken Ministry of Defense. Quarantine (human) is undertaken by Ministry of Health and Women's Affairs. And Quarantine (plants) and Fumigation are Ministry of Agriculture, Food and Co-operative. The relationship among these organizations is shown in FIGURE 3.7.1.

313. The SLPA carries out almost all activities in the ports (see Part 3, chapter 5, TABLE 5.1.1). Only some stevedoring work is undertaken by the agents of shipping companies when the SLPA cannot manage to provide enough gangs as in the case of fertilizer handling.

(2) Port Activities managed and operated by the SLPA

314. The SLPA is a statutory body created under the Sri Lanka Ports Authority Act. The major port activities managed and operated by the SLPA provided in the Act are summarized as follows;

1) Providing efficient and regular port service such as:
- stevedoring
- shipping and transhipping
- landing and warehousing
- supply water, fuel and electricity to vessels
- handling petroleum, petroleum products and lubricating oils
- pilotage and mooring vessels
- ship repairs

(Among the above, supply of fuel to vessels is actually undertaken by Ceylon Petroleum Corporation, and ship repairs for outside user are presently carried out by Colombo Drydocks Ltd.)

2) Providing tally and protective services

3) Regulating and controlling navigation

4) maintaining, improving, developing and promoting the use of ports

5) Coordinating and regulating all activities within port excluding the functions of the Customs

6) Establishing and maintaining navigation aids on and off the cost

7) Replacing assets, making new investments and establishing and maintaining an adequate general reserve.

(2) Organization Structure of the SLPA

315. Organization structure of the SLPA is shown FIGURE 3.7.1. Functions of each division are as follows.

1) Operations Division
- To provide services for stevedoring, lighterage, shipping, transhipping, landing and warehousing of cargo.
- Operation and management of container terminals
- Supply of fresh water to ships, hiring out of cargo handling equipment
- Other services incidental thereto.

2) Engineering Division
- To maintain and improve all civil engineering structures, roads, paved areas, maritime facilities.
- To acquire, assemble and maintain plant / machinery and floating craft required for operational activities and provide all other engineering services to meet the needs of the port authority.

3) Finance Division
- To carry out the financial management of the port authority by directing and coordinating the work of the accounting staff and by designing and maintaining accounting systems adequate to the needs of the organization.

4) Navigation Division
- To carry out piloting of ships in and out of harbor, berthing of ships, providing services of tugs and floating cranes.
- Harbor safety and preventing sea pollution, services of Port Fire brigade in and out of harbor, fire safety.
- Issue of Certificates of Competence to Masters, Mates and Coxswains, licensing of boats, launches, ship chandlers, ship repairers.
- Navigational rules and regulations, shipping information to the public and shipping agents, monitoring messages to and from ships.
- Craft building and repairs, controlling of marine craft and providing and maintaining coastal lighthouse services for navigational purposes around the island.

5) Personnel Division
- To manage and control recruitment, determine terms and conditions of service of all personnel including labour and non-labour grade, maintain good and proper industrial relations and provide adequate welfare facilities.

6) Commercial Division
- To ensure proper documentation as well as the systematic delivery of import cargo after recovery of wharfage charges, rent and other charges according to the tariff.
- Speedy checking of service certificates for billing on stevedoring services.
- Maintenance of bonding services.
- Disposal of claims from importers.
- Sale of uncleared cargo, unserviceable assets and old equipment by auction of tender.
- Registration of clearing agencies and wharf clerks operating in the Port.
- Provision of regular tally services on vessels.
- Drawing up of cargo stowage plans and bay plans.
- Surveying of bad order cargo on vessels.

7) Security Division
- To protect and safeguard the property of the port authority, all cargo, ashore and afloat.
- Provide on board security services, warehouse security, security at the port in / out gates and stores units and to ensure the safety of navigation.
- To prevent all crime, offenses, breaches of law, nuisances affecting property and persons.
- To apprehend disorderly and suspicious persons within the premises of the port authority.
- To control the entry of persons and vehicles to the port by issuing Identity Badges / Port Entry Permits.
- To prevent unauthorized entry to the port by blacklisting the defaulters of the port regulations, control and regulate the traffic of pedestrians and vehicles within the port.
- Sea patrolling of the sheltered water area and the out-harbour.

8) Planning, Research & Development Division (PR & D Division)
- To provide planned development of the ports coming under the purview of the port authority.
- To implement such developments and carry out research with a view to optimizing the efficiency of the organization and setting up efficient management information systems for decision making.

9) Internal Audit Division
- To review and appraise the soundness, adequacy and application of accounting procedures and financial controls in the organization and ascertain the extent of compliance with established policies, systems, programs and procedures of such financial controls.

10) Supplies Division
- To effect purchases (local and foreign) and supply all plant / machinery equipment,

spares and all other general stores items required for the operational activities of the ports and their maintenance.

11) Medical Division
- To organize, manage and provide medical services and facilities to personnel of the port authority.

12) Training Division (SLPA Training Institute)
- To provide systematic training to meet the requirements of the port authority and administer and control SLPA Training Institute.

13) Secretary's Office and Legal Division
- To attend to all legal matters and matters related to Board of Directors of the port authority. The chief law officer also functions as the secretary to the board of directors.

14) Administrative Secretary's Office
- To coordinate the day-to-day administration work of the port authority and attend to all matters pertaining to real estate of the port authority and the allocation of SLPA quarters.

316. The decision making system of SLPA basically lies in the Board of Directors. The Minister in charge of Ports appoints the Chairman and five other Directors of whom one is appointed as the Managing Director. Among remaining three Directors one is the Principal Collector of Customs, one is a representative of the General Treasury nominated by the Minister in charge of Finance, and the last one is a representative of the Ministry in charge of Fisheries nominated by the Minister in charge of Fisheries.

317. However, the Minister in charge of Ports has the power, when necessary, to give the Authority general or special directions in writing and the Authority has to give effect to these directions.

### 3.7.2 Financial Management

(1) Management Body

318. SLPA has an independent accounting system and therefore subsidies are not given from the Government.

319. The following Divisions of SLPA are in charge of the financial management of the Port Authority.(shown in TABLE 3.7.1)

(2) Budget

320. Annual budget is decided according to the following procedure.

1) Making of the annual budget plan (mainly coordinated by Planning, Research & Development Division).
2) Examination and approval by the Board of Directors meeting (late in September).
3) Presentation of budget plan to Ministry of Shipping, Ports, Rehabilitation & Reconstruction, Ministry of Treasury and Auditor General.

(3) Procurement

321. The process of procurement is provided by the Purchase Regulations of SLPA. A circular from the Ministry of Finance and Planning provided the limits of tender amount in 1989, and it was revised in July 1994 as shown in TABLE 3.7.2.

322. Procurement generally takes 6 -12 months to clear by the Tender Board. Purchasing of imported spare parts often take a long time.

**3.7.3 Financial Conditions**

323. SLPA prepares the financial statements, "Profit and Loss Account" and "Balance Sheet".

(1) Operational Efficiency

324. A summary of the Profit and Loss Account report of the Port of Colombo (1990 - 1994) is shown in TABLE 3.7.3. Through the analysis of the Profit and Loss Account, operational efficiency of the Port of Colombo is envisaged as follows.

Operating Ratio:

Operating Cost / Operating Revenues X 100 (%)

Working Ratio:

(Operating Cost - Cost of Depreciation) / Operating Revenues X 100 (%)

325. The operating ratio shows the operational efficiency of the organization as an enterprise, and the working ratio shows the efficiency of the routine operations of the port.

326. When the calculated operating ratios are less than 70 - 75 %, and the working ratios are less than 50 - 60 %, the operations of port are deemed efficient.

327. As shown in TABLE 3.7.3, the operating ratios are from 54.1% to 67.6%. Therefore, it is recognized that the operation in the port of Colombo by SLPA is efficient.

328. However, the operating ratios has been increased year by year since 1990. An average increased rate of the operating ratios is 5.73%. If the ratio rises following this trend, it will exceed 70% in 1995, which deems the port operations inefficient.

329. The working ratios are from 44.4% to 56.4%. Therefore, the routine operations of the port are also efficient. However, in the same way as the condition of the operating ratios, the working ratios also has been increasing gradually since 1990. An average increase in the rate of the working ratios is 6.20%. If there is no change in the trend, the working ratios will be over 60% in the near future, and the routine operations will be deemed as inefficient, too. It is considered that the following conditions caused an increase of the operating and working ratios.

a) An increase of payroll

330. Total operating cost in 1994 has increased by 90.45% since 1990. While, total operating revenues have increased by 52.35% since 1990, an increasing rate of cost is higher than one of revenues.(shown in TABLE 3.7.3) Under these conditions, operating and working ratios increase.

331. FIGURE 3.7.2 shows conditions of details of operating cost from 1990 to 1994. Cost of Depreciation has increased by 75.39% since 1990, cost of administration has increased by 146.73%, payroll(Overtime and Wages, salaries & allowances) has increased by 119.84%. The rate of payroll/total operating cost was 56.65% in 1990. In 1994 it has been increased to 65.39%. As payroll occupies more than half of total operating cost, an increase of it has a marked and harmful influence on operating and working ratios.

b) An increase of cost of depreciation

332. As mentioned above, cost of depreciation has been increased since 1990. As the volume of the assets of SLPA is increasing, it is considered that cost of depreciation will increase. If assets can not produce enough profit, operating ratio will increase in the future.

(2) Profitability

333. Balance Sheet of the Port of Colombo (1990 - 1994) is shown in TABLE 3.7.4. When analyzing the Balance Sheet, profitability of the Port of Colombo is envisaged as follows.

Rate of Return on Net Fixed Assets:

Net Operating Income / Total Fixed Assets X 100 (%)

334. This indicator shows the profitability of the investments, which are presented as net total fixed assets. It is necessary to keep the rate above the average interest rate of the funds for investments.

335. As shown in TABLE 3.7.4, the rates of return on net fixed assets are from 7.9% to 14.3%. The rates have been decreasing year by year since 1990. This means profitability of the

Port of Colombo is brought to a lower level. At the level 1994, assuming that SLPA invests in the Port of Colombo, it is necessary that rate of interest of the funds for investment is lower than 7.9%.

### 3.7.4 Tariff

(1) Tariff Structure

336. The current tariff was made when SLPA was created by the merger of three independent organizations in 1979. It is structured by the items shown in TABLE 3.7.5, set by previous three organizations.

**TABLE 3.7.5 Tariff structure**

| Tariff Items | The name of organization which covered the tariff items |
|---|---|
| Wharfage, Service ancillary to wharfage, Rent, Port facilities & Services, Navigation dues | The Colombo Port Commission |
| Discharging & loading, Handling of containers, Lash barge operations | The Port Cargo Corporation |
| Tally & protective services | The Port Tally and Security Corporation |
| Transhipping & reshipping cargo, Other services, Discharging & loading at the Ports of Galle and Trincomalee | Newly added when SLPA was created. |

(2) Revision of Tariff

337. SLPA has revised tariff irregularly. When SLPA revises a tariff, examination is made by Tariff Review Committee(Chairman: Additional General Manager. Members: Commercial Manager, Chief Financial Manager, Harbour Master, Chief Operation Manager, Chief Engineer, Chief Internal Auditor). Approval by Ministry of Shipping, Ports, Rehabilitation & Reconstruction and Ministry of Finance is finally necessary. SLPA revised the tariff of transhipment container handling on the 10th June, 1995. The other tariffs have not been revised since the approval of the present tariff in 1987.

**FIGURE 3.7.1 Relationship among the Organizations Operating within the Port and Organization Structure of the SLPA**

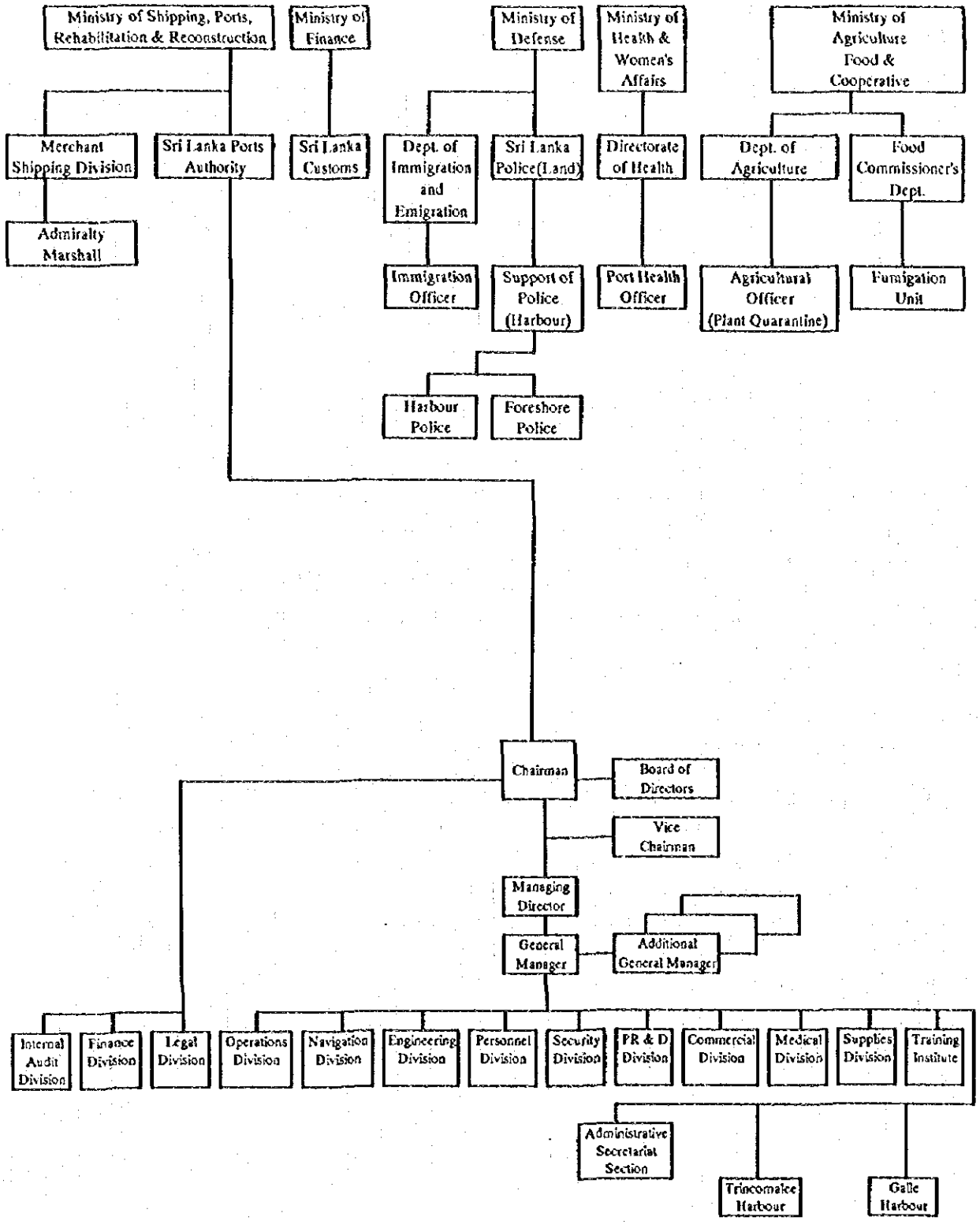


**TABLE 3.7.1 Divisions in Charge of the Financial Management**

| Name of Division | Function |
|---|---|
| Fiance Division | (1) Directing and coordinating the work of the accounting staff.<br>(2) Designing and maintaining accounting systems adequate to the needs of the organization. |
| Supplies Division | Purchasing (local and foreign) and supplying all plant / machinery equipment, spares and all other general stores items required for the operational activities of the Ports and their maintenance. |
| Planning, Research & Development Division (Financial Planning & Research Dpt.) (Management Information System Dpt.) | (1) Researching with a view to optimizing the efficiency and profitability of port finance.<br>(2) Setting up an efficient management of information system for financial decision making. |

**TABLE 3.7.2 Procurement Procedures through Tender (from 28th Oct, 1994)**

| Name of Tender Board | Amount (Thous Rs.) | Tender Board Member | |
|---|---|---|---|
| | | Chairman | Members |
| <Supply of Stores> | | | |
| Tender Board "A" | <500 | Chief Engineer | Finance Manager, Supplied Manager |
| Tender Board "B" | <500 | Add. General Manager | Deputy Chief Engineer, Finance Manager |
| Central Tender Board | <5,000 | Managing Director | Chief Engineer, Chief Finance Manager |
| Ports Authority | <10,000 | | |
| Ministry Tender Board | >10,000 | | |
| Cabinet Tender Board | >20,000 | | |
| <Works and Services> | | | |
| Tender Board "D" | <500 | Chief Engineer | Finance Manager, Deputy Chief Engineer |
| Central Tender Board | <5,000 | Managing Director | Chief Engineers |
| Ports Authority | <10,000 | | |
| Ministry Tender Board | >10,000 | | |
| Cabinet Tender Board | >20,000 | | |

*Note: From Purchase Regulations, SLPA*

## TABLE 3.7.3 Summarised Profits & Loss account 1994 (Port of Colombo)

Unit:Thous Rs.

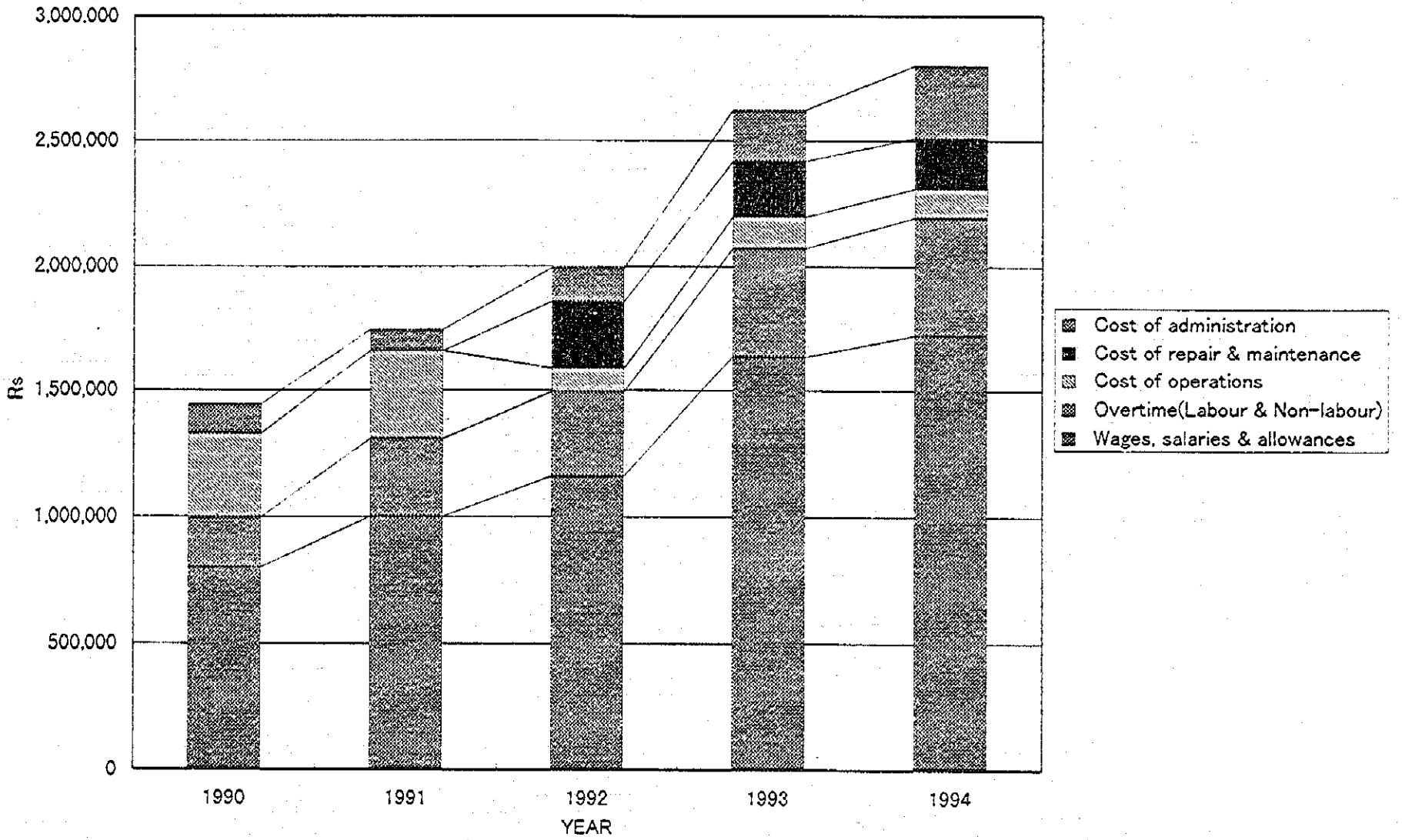
| ITEM | YEAR | | | | |
|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 |
| Operating Revenues | | | | | |
| Revenue from port activities | 3,083,236 | 3,267,983 | 3,601,623 | 4,338,092 | 4,617,769 |
| Other revenue | 174,948 | 340,996 | 270,460 | 398,982 | 345,947 |
| Total Operating Revenues | 3,258,184 | 3,608,979 | 3,872,083 | 4,737,074 | 4,963,716 |
| Operating Cost | | | | | |
| Wages, salaries & allowances | 800,719 | 1,001,189 | 1,160,112 | 1,639,455 | 1,727,048 |
| Overtime(Labour & Non-labour) | 197,262 | 308,048 | 334,420 | 434,065 | 466,920 |
| Cost of operations | 330,710 | 353,308 | 94,815 | 125,912 | 116,566 |
| Cost of repair & maintenance | unknown | unknown | 269,553 | 220,921 | 201,272 |
| Cost of administration | 117,601 | 87,236 | 135,011 | 204,551 | 290,155 |
| Cost of Depreciation | 315,310 | 315,808 | 309,981 | 349,553 | 553,025 |
| Total Operating Cost | 1,761,602 | 2,065,589 | 2,303,892 | 2,974,458 | 3,354,986 |
| Net Operating Income (NOI) | 1,496,582 | 1,543,390 | 1,568,191 | 1,762,616 | 1,608,730 |
| NOI before Depreciation | 1,811,892 | 1,859,198 | 1,878,172 | 2,112,169 | 2,161,755 |
| Other Income & Cost | | | | | |
| Fund Management Income | 831 | 1,494 | 1,349 | 2,456 | 3,388 |
| Interest on Foreign Loans | 273,229 | 282,213 | 385,496 | 524,724 | 790,733 |
| Net Income | 1,224,184 | 1,262,671 | 1,184,044 | 1,240,348 | 821,385 |
| Tax | | | | | |
| B.T.T & Defence levy | 168,732 | 181,546 | 198,983 | 218,114 | 248,772 |
| Income Tax | 453,159 | 506,759 | 397,117 | 496,118 | 97,449 |
| Deemed Dividend Tax | 144,107 | 110,165 | 92,565 | 145,600 | 110,585 |
| Total Tax | 765,998 | 798,470 | 688,665 | 859,832 | 456,806 |
| Net Income after Tax | 458,186 | 464,201 | 495,379 | 380,516 | 364,579 |
| Transfer to Loan Redemption Reserve | 543,390 | 109,191 | 332,141 | 527,704 | 53,402 |
| Adjustment in respect of prior years | | | | | |
| Adjustment Income | 140,423 | 0 | 73,775 | 226,262 | |
| Adjustment Cost (transfer) | 0 | 271,253 | 0 | 0 | 266,027 |
| Investment (to Colombo Dry docks Ltd) | | | 131,115 | 0 | |
| Balance Profit | 291,544 | 375,300 | 481,198 | 560,272 | 605,421 |
| Operating Ratio | 54.1% | 57.2% | 59.5% | 62.8% | 67.6% |
| Working Ratio | 44.4% | 48.5% | 51.5% | 55.4% | 56.4% |

## TABLE 3.7.4 Balance Sheet <The port of Colombo>

Unit.Thous Rs.

| ITEM | YEAR | | | | |
|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 |
| Assets | | | | | |
| Current Assets | 2,481,313 | 2,644,743 | 2,350,581 | 2,749,161 | 3,690,866 |
| Goods in stock | 285,931 | 352,439 | 301,517 | 354,981 | 400,147 |
| Goods in transit | 109,143 | 119,180 | 217,343 | 100,076 | 407,150 |
| Net debtors & accrued revenue | 800,686 | 1,152,542 | 1,037,582 | unknown | unknown |
| Net Trade debtors & accrued revenue | unknown | unknown | unknown | 965,069 | 1,105,329 |
| Non Trade debtors & advance payments | unknown | unknown | unknown | 467,893 | 430,382 |
| Loans & advances to employees | 197,139 | 234,846 | 272,435 | 343,571 | 705,679 |
| Investments in Treasury Bills | 896,225 | 757,984 | 473,668 | unknown | unknown |
| Call deposits in Bank of Ceylon | 148,000 | 1,000 | 20,600 | unknown | unknown |
| Investments in Treasury Bills & call deposits | unknown | unknown | unknown | 496,477 | 600,925 |
| Prepayments and other receivable | 13,645 | 15,127 | 14,651 | 16,206 | 25,046 |
| Cash in transit | 1,761 | 3,195 | 4,464 | unknown | unknown |
| Cash at Bank and in hand | 28,783 | 8,430 | 8,321 | 4,888 | 16,208 |
| Current Accounts to Trincomalee & Galle | 482,908 | 544,484 | 614,526 | 712,524 | 795,323 |
| Fixed Assets | 10,489,128 | 11,571,273 | 13,098,013 | 16,477,715 | 20,441,567 |
| Property, operational craft, plant & equip. | 10,114,861 | 9,889,422 | 9,772,749 | 10,268,912 | 11,979,045 |
| Capital work-in-progress | 374,267 | 1,681,851 | 3,325,264 | 6,208,803 | 8,462,522 |
| Investments | 166,703 | 169,374 | 40,800 | 43,823 | 46,818 |
| Investments in Company shares | 152,140 | 152,140 | 21,025 | 20,925 | 20,925 |
| Other long-term Investments | 14,563 | 17,234 | 19,775 | 22,898 | 25,893 |
| Total Assets | 13,620,052 | 14,929,874 | 16,103,920 | 19,983,223 | 24,974,574 |
| Liabilities & Capital | | | | | |
| Current Liabilities | 917,092 | 1,197,943 | 1,263,705 | 2,122,597 | 3,614,728 |
| Creditors & Accrued charges | 238,602 | 542,098 | 650,864 | 872,596 | 1,773,677 |
| Deposits | 112,500 | 101,948 | 139,830 | 561,967 | 1,335,902 |
| Funds | 49,858 | 67,731 | 65,316 | 104,434 | 176,212 |
| Privision for income Tax | 399,137 | 355,355 | 266,869 | 386,451 | 168,330 |
| Provision for claims | 2,888 | 2,238 | 2,045 | 5,333 | 3,806 |
| Deemed Dividend Tax | 114,107 | 128,573 | 138,781 | 191,816 | 156,801 |
| Fixed Liabilities | 2,416,661 | 3,252,686 | 3,922,931 | 6,188,124 | 9,588,793 |
| Long-term Loan (Japanese loans) | 2,416,661 | 3,252,686 | 3,922,931 | 6,188,124 | 9,588,793 |
| Contributed Capital | 7,540,050 | 7,540,050 | 7,540,050 | 7,540,050 | 7,540,050 |
| Equity capital | 461,914 | 461,914 | 461,914 | 461,914 | 461,914 |
| Other capital | 7,078,136 | 7,078,136 | 7,078,136 | 7,078,136 | 7,078,136 |
| Reserves and Provisions | 2,746,249 | 2,939,195 | 3,377,234 | 4,132,452 | 4,231,003 |
| Capital reserve | 804,577 | 804,577 | 804,577 | 952,990 | 952,990 |
| Port development reserve | 557,024 | 557,024 | 557,024 | 557,024 | 557,024 |
| Loan redemption reserve | 1,091,206 | 1,200,397 | 1,532,537 | 2,060,241 | 2,113,643 |
| Other reserves and provisions | 1,898 | 1,898 | 1,898 | 1,925 | 1,925 |
| Retained earnings | 291,544 | 375,299 | 481,198 | 560,272 | 605,421 |
| Total Liabilities & Capital | 13,620,052 | 14,929,874 | 16,103,920 | 19,983,223 | 24,974,574 |
| Rate of Return on Net Fixed Assets | 14.3% | 13.3% | 12.0% | 10.7% | 7.9% |

FIGURE 3.7.2 Cost Breakdowns



### 3.8 Bottlenecks of the Port of Colombo

#### 3.8.1 Channel and Basin

(1) Curved Fairway and Narrow Entrance

338. Though the width of the West Entrance between South-West Breakwater (S-W) and North-West Breakwater (N-W) is 240 meters and the width between the Extension Arm and N-W Breakwater is 225 meters, actual navigational width is about 180 meters at the depth of minus 10 meters and about 125 meters at the depth of minus 15 meters. This width of 125 meters is 3.9 times (3.9B) of the breadth of a Panamax vessel and 3.1 times (3.1B) of that of a typical post Panamax vessel. Taking into account that drifts caused by currents and strong South-West waves, the present entrance is too narrow to cater to post Panamax vessels.

339. As the surface water in the channel and basin often becomes muddy while a deep draft vessel is stirring up the sea bed silt, it is highly probable that siltation occurs in the approach channel and turning basin in the port. After the completion of capital dredging to -15 meters, maintenance dredging will be indispensable.

(2) Stopping Distance

340. The distance between the entrance and Jaya Terminal is about 1,000 meters, which is three times (3L) the length of a Panamax vessel. Since approaching ships cannot reduce their speed under 6 knots to pass the narrow entrance, they drive full astern immediately after passing through the entrance and stop in the middle of the turning basin. Entering vessels are required to conduct very careful and critical maneuvering. Although modern container vessels have powerful engines and they can stop in a short distance, 3L is not enough for a stopping distance in an emergency case. An appropriate stopping distance will be five times (5L) the length of a Panamax vessel.

(3) Under keel clearance of approaching channel

341. Maximum draft of approaching vessels should be around 13 meters after the completion of dredging to minus 15 meters. Crucial point is where the pipeline is laid across the channel at a depth of minus 16 meters. For further deepening of the channel, modification of the pipeline is unavoidable.

(4) Depth of Turning Basin

342. JCT #3 is reportedly 13.5 meters deep, however, a diver reported siltation in front of the quay. While the material of the seabed is soft silt and no damage was reported, maneuverability of ship is deteriorated by little under keel clearance.

(5) North Channel

343. North channel is available to vessels with a draft up to 9 meters. It is planned to deepen the channel to minus 12 meters so that eleven meter draft ship can use the channel. However, the sea bed of the outside of the North entrance is rather hard (N-Value: 30-40), so that the dredging of that part will be very costly and time consuming. It was reported that the excavation of a pipeline ditch of 200 meters long and 5 meters wide in 1987 involved replacing cutter blades on more than 10 occasions. Boring survey in January 1996 has also shown the hard bed rock in the north sea of Prince Vijaya Quay .

(6) Wave Disturbance to Smaller Vessels

344. It is sometimes difficult for small feeder vessels berthing at JCT No.1 and No.2 to handle containers when strong S-W monsoon waves are coming in from the West (Main) entrance or N-E monsoon waves are coming in from the North entrance.

**3.8.2 Harbour Services**

(1) Ship Traffic Management

345. Ship berthing/leaving and cargo handling operations are not coordinated in a proper manner which results in unnecessary waiting time for approaching and leaving vessels. Leaving ship is sometimes blocked by an approaching vessel which also results in unnecessary waiting time for another approaching vessel.

(2) Pilot Services

346. Pilot boats sometimes face difficulties in going out of the port because of rough monsoon waves. In such a case, big vessels have to enter the port without a pilot, which means that pilot services are not available when they are in most need. In addition, pilot services are not flexible enough to cope with changes of departure/arrival time.

(3) Traffic Control

347. Owing to the lack of harbour radar, ship traffic is not controlled. Communication equipment is also poor so that ship operations are difficult. A ship freeze caused by leaving or approaching vessels brings unnecessary ship waiting. Regulations should be examined and efforts should be made to reduce such freeze hours.

348. Only the West entrance is available for deep draft vessels. Ship approach is not permitted when an out going ship is in motion, which obliges approaching ships to wait even if berth is available.

### 3.8.3 Terminals and Roads

(1) Slender Container Yard

349. QEQ was designed for conventional cargo handling so that the width of the quay is not adequate for container handling. Grand slots of Queen Elizabeth Container Terminal are 1,780 TEUs compared with 9,120 TEUs of JCT.

(2) Salty Water Spray

350. QEQ receives water spray in S-W monsoon season, which causes the corrosion of cargo handling equipment as well as container boxes in stacks. Since blocks outside of the S-W Breakwater have sunk over the course of many years, additional blocks should be placed in the near future if the outside of QEQ is not reclaimed as part of further port development.

(3) Inter-terminal Transportation

351. Inter-terminal transportation between JCT and QCT is somehow 6,000 TEUs a month recently but it was about 9,000 TEUs before the opening of JCT #3. Transportation was carried out by private truck companies at the cost of shipping lines. While SLPA gave shipping lines a rebate of $4 per TEU, inter-terminal transportation is a very heavy burden for port users in terms of cost and time.

352. Transportation between QCT and JCT is unavoidable due to the fact that a) JCT cannot accommodate all of the feeder vessels, b) QCT cannot cater to deep mother vessels so that QCT is mainly used for feeder vessels, and c) sometimes JCT is not appropriate for smaller feeder vessels due to wave disturbance.

(4) Trucks Queue on Road

353. Trucks are queuing on the inter-terminal port road. Queuing trucks are waiting not only for the receipt of cargo but also for a consignee without any particular contract or for documentation. This queue causes road congestion in the port. Truck pool near the Port will be in urgent need.

(5) Railway Connection

354. Rail is used for transportation of bulk, such as lime stone, fertilizer, clinker and petroleum products. Few containers are transported by rail. Disadvantages of rail transportation are said to be in additional requirements for loading/unloading and frequent delays of rail services. However, rail services should be utilized for container transportation to reduce the load on city traffic. Appropriate facility, such as rubber tyred gantry crane for railway yard, may be necessary for future development.

### 3.8.4 Container Operations

(1) Berthing Arrangements

355. Feeder vessels are suffering from berthing delays caused by the shortage of feeder berths and the second priority given to feeder vessels. Mother vessels are given first priority so that feeder vessels are obliged not only to wait a long time for berthing but also to interrupt cargo handling and to shift to conventional berths.

356. Unforeseen waiting for berthing, unreliable information, incredible fluctuation in productivity and poor coordination were often observed in 1993/1994 at the Port of Colombo. Lack of confidence in operations of the Port obliges feeder operators to leave the port of Colombo and sell transhipment services at the port of Singapore.

357. More mother vessels are scheduled to call at Colombo on weekends than weekdays due to the fact that the port tariff has no discrimination in charges on the weekend and weekday.

(2) Hidden Cost besides the Tariff

358. Hidden cost of the port is said to be about US$ 24 - 30 per TEU, consequently the total cost per TEU reaches about US$ 95 (68+24~30) for a 20 footer. Singapore gives a volume discount, which is from 19 - 24 percent according to annual throughput of an operator, to vessel operators so that the total cost at the port of Singapore is about US$ 110 (140-28~34) for a 20 footer in a 72 hours connection case. It is said that Singapore is cheaper than Colombo in case a shipping line is handling more than 100,000 TEUs per annum and a container is kept less than 48 hours.

359. Details of hidden cost are:

- Inter-terminal transportation;
- Lashing/Unlashing;
- Ship crane operator charge, required at conventional berths;
- Customs overtime, required for the inspection of transhipment operations;
- Cargo tally;
- Hatch cover moves;
- Extra operation of the change of spreaders from 20' to 40';
- Labour incentives, paid to the union;
- Penalty of US$ 10 on the wrong direction of a container.
- Vessel planners charge, required at JCT to cover the cost of SLPA vessel planners;
- Labour standby charge, required for standby hours, for example an arrival at 9 am is charged from 7.30 am;

- Vessel detention, no operations from 0630 to 0730 officially, but from 0600 to 0830 hours actually; and

- Shifting of vessels; required in order to accommodate main line vessels.

(3) Productivity of Cargo Handling

360. Coordination of container handling is so poor that idle time of quay crane operations is caused by the lack of pick-up trailers. Productivity of container handling fluctuates widely and the average is about 16 moves per hour compared with 26 moves at Singapore (A shipping line's view).

(4) Customs

361. Customs inspection kills the advantage of container transportation because 40-50 per cent of import containers are unstuffed in the port area for inspection. However, they should be examined at each destination or at inland container depots. If customs inspection is carried out at the outside of port, shippers can avoid the cost of unstuffing twice. Also the dwelling time of containers can be lessened and congestion of yards can be reduced.

**3.8.5 *Others***

(1) Inland Container Depots

362. Taking into account the shortage of container yards inside the port, the development of inland depots is a means to increase the capacity of the port. Present inland container depots are however not enough to cater to import/export containers and relax the congestion of the container yard in the port.

(2) Piracy

363. Piracy is also a problem for vessels approaching to the port of Colombo, especially when vessels are being anchored outside of the port. However, piracy has been reduced considerably together with a decline in waiting time.

FIGURE 3.8.1

364. Problems and obstacles identified in the port are illustrated in Figure 3.8.1.

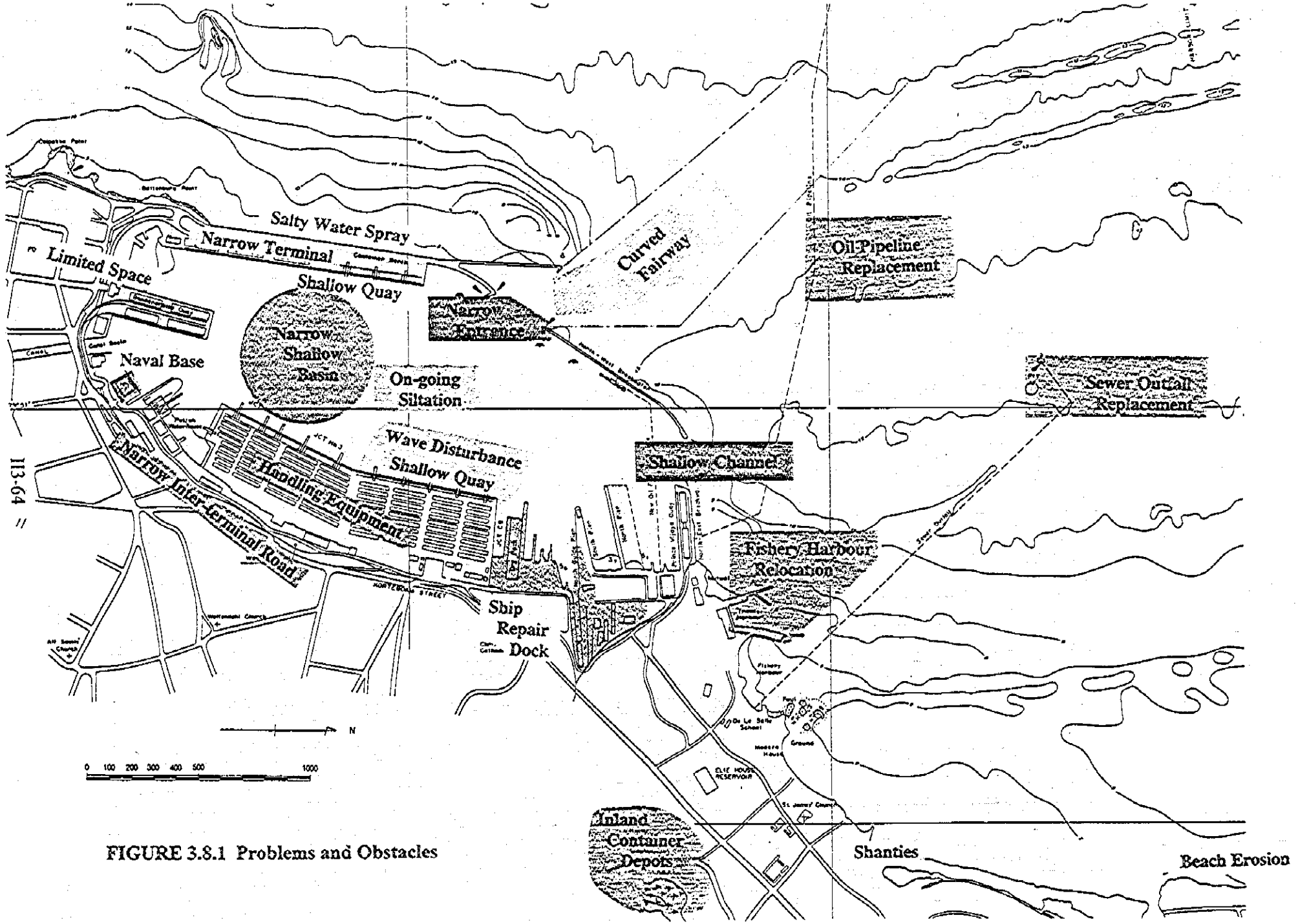



FIGURE 3.8.1 Problems and Obstacles

## 4. Natural Conditions

### 4.1 Winds

#### 4.1.1 Wind Roses

365. FIGURE A.4.1.1(1) and A.4.1.1(2) show wind roses illustrating frequency distributions of annual and seasonal occurrences of wind directions and speeds. For more detailed grasp of the wind occurrences in the port, a comparison was made between annual and seasonal wind occurrences in the morning (0000 to 0900 hours) and in the afternoon (1200 to 2100 hours). These figures also show wind roses illustrating the comparison results. TABLE A.4.1.1(1) and A.4.1.1(2) show the frequency distributions of wind speed occurrences by wind directions. These figures and tables have been prepared from wind observation records during 1979 - 84 (taken at 3-hour intervals) obtained at the Pilot Station (anemometer installed at 53.5 ft above the sea surface) built at the Southwest Breakwater in the Port of Colombo.

366. As can be seen from the wind roses, the dominant wind direction all the year round is WSW followed by SW. Seasonally, NNE and NE are dominant during the NE monsoon season (December to February) and NW also shows a high frequency of occurrence. In the SW monsoon season (May to September), SSW, SW and WSW are the prevailing directions and this season has a higher degree of concentration of wind directions. In March and April --- the intermonsoon period of transition from the NE to the SW monsoon season --- E and W winds prevail. During the October - November period of transition from the SW to the NE monsoon, on the other hand, southwesterly winds are rather dominant, although this cannot be said positively.

367. For comparison of winds occurrences in the morning and in the afternoon, it can be noted that during the NE monsoon season and the two intermonsoon periods, wind directions in the morning differ from those in the afternoon: winds are rather easterly in the morning and rather westerly in the afternoon. In terms of wind speed, strong winds of 5.0 m/sec or upward showed a higher frequency of occurrence in the afternoon. In the SW monsoon season, on the other hand, WSW and SW winds prevail both in the morning and in the afternoon, exhibiting no appreciable variation in speed and directions.

#### 4.1.2 Characteristics of Strong Winds

368. According to wind data shown in TABLE 4.1.1 which were obtained at the Southwest Breakwater, Pilot Station (elevation: 80 ft above the sea level) in 1963-75, and at the tip of the Southwest Breakwater (elevation: 53.5 ft above the sea level) during 1977-84, strong winds had S to W directions during the late Southwest monsoon season in September and October and W to NW directions during the early part of the same season. They seldom had day-long duration.

369. Weibull distributions of strong winds ($\geq$ 40 miles/hr) indicate that wind velocities of 30-year and 50-year return periods are 81 miles/hr (36 m/sec) and 85 miles/hr (38 m/sec), respectively, as shown in FIGURE 4.1.1.