Chapter 5 PRESENT SITUATION ON ENVIRONMENT

A. General

1. Guayaquil is the capital of the Guayas Province, with a size of 208,801 km^2, a coast-line of 1,405 km, population of 3,034,000 of which, 76.3% inhabits urban areas and only 23.7% remain in rural areas. The principal rivers: Guayas, Babahoyo and Daule; at the time, approximately 90 percent of the total area authorized bordered the Guyas Estuary. Guayas River has a drainage basin of 35,243 km^2 and a discharge rate of 1,144 cubic meters per second (m^3/sec.).

2. Guayaquil is the main port of Ecuador, having the most severe social and provision of services problems. Has a population close to 2,000,000 inhabitants, sited in an urban area of 10,830 ha; only 40% of it is attended in basic services such as potable water, sanitary drain, fluvial drain, and solid waste collection. The most of the population is concentrated in the south west and south of the city, close to the Port. These settings were developed without planification or orientation.

3. Ecuador is increasingly aware of the need for preservation of natural areas and has taken commendable steps towards the establishment of national parks, national forests, and ecological reserves. In the Guyas Province, ahve been declare two Ecological Reserves: Manglares Churute, 1979, and Chongón-Colonche, 1979; and one protected Forest: Estero Salado, 1986.

4. Guayaquil is the busiest cargo port of Ecuador, receives the largest portion of all imports and ranks second in exports, Common imports include feritilizer, pesticides, cement, petroleum derivates, iron steel, wheat, paper, vehicles, machinery, and chemicals.

5. In order to know the actual use of the land surrounding the Port of Guayaquil, a SPOT satellite image (1,991) has been used to circle radius of two and ten km around the port (Figure I-5-1); to define the land coberture in the basin of direct impact of port activities (Figure I-5-2), and that of indirect impact (Figure I-5-3).

Figure I-5-1 Areas Comprised by Circles with Radius of 2 and 10 km from APG.

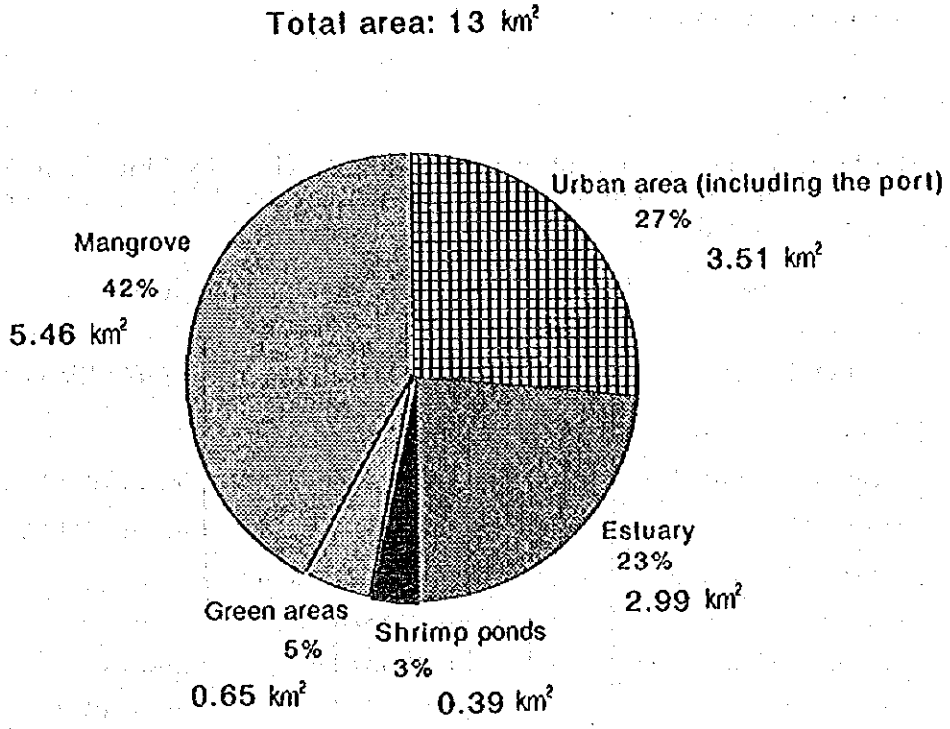


Figure I-5-2 Land Use in the 2 Km Radius from APG.

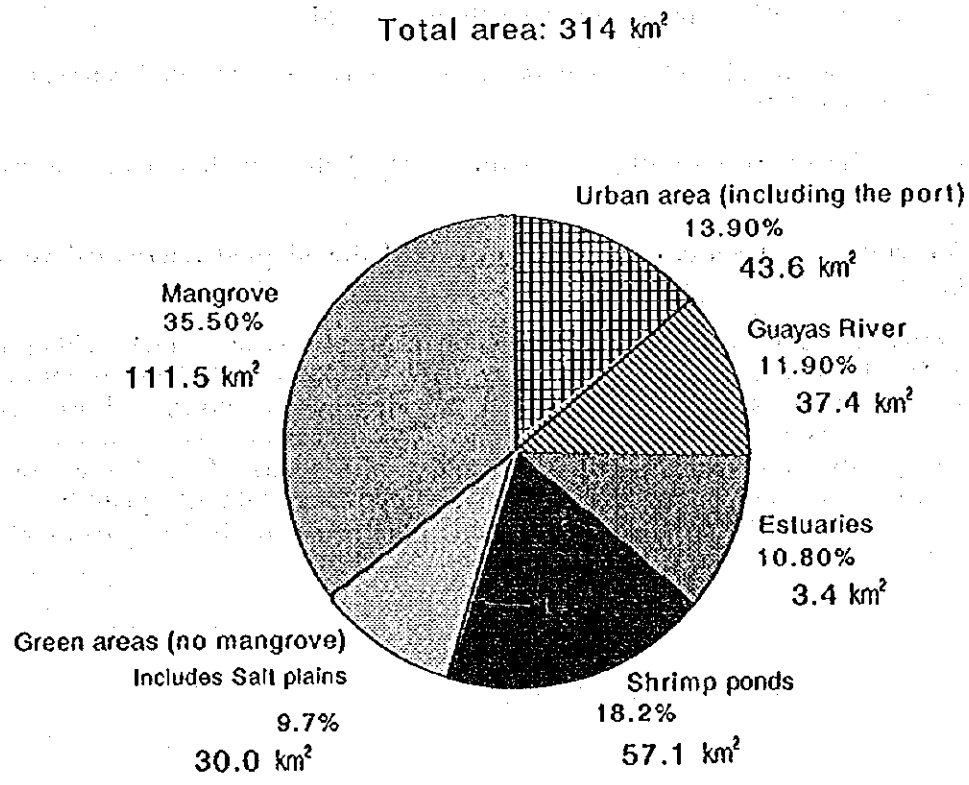


Figure I-5-3 Land Use in the 10 Km Radius from APG.

B. Environmental Component

1) Air Quality

6. The legal frame for air control in Ecuador is given by Ministerial Agreement N° 11,338. from 1,991. The numbers used as norm in Table I-5-1, derive from EPA's and international permitted limits for populated cities.

Table I-5-1 Permited Limits of Air Pollutants in Ecuador.

POLLUTANT	VALUE (NORM)	UNITS	OBSERVATIONS
Sedimented particles	1	mg/cm2/day	
Suspended particles	80	ug/m3/day	mean of 12 months
Sulfur Oxide	80	ug/m3/day	mean of 12 months
Carbon Monoxide	10	mg/m3/8 hours	
Ozone	200	ug/m3/hour	
Nitrogen Oxide	100	ug/m3/day	mean of 12 months
Lead	1.5	ug/m3/day	mean of 3 months

7. Continuos study of air dust and gasses between 1,976 and 1,985 carried out by IEOS in 3 places of Guayaquil, the reference level adopted is lower than the legal norm for suspension dust and sulfuric acid. It shows the following conclusions: as there were not national standards, different reference levels were used.

(1) 75 % of the samples of sedimentable dust, exceed the adopted reference level of 1 mg/cm^2/30 days.

(2) 35% of the samples of suspension dust, exceed the adopted reference level of 40 ug/m^3.

(3) Concentration of sulfuric gasses don't exceed the adopted reference level of 60 ug/m^3.

8. The transport to be considered consists on cars, busses and tracks either using gasoline or diesel, as well as ships in the port. The main external elements introduced in the air by transportation are: Carbon monoxide, hydrocarbons, Sulfuric oxides, Nitrogen oxides, Suspension solid matter, and lead. SOx are compounds user to establish air quality and changes. In Guayaquil, calculations of total transportation pollution have been made at ESPOL using the following data of quantity of SOx emmited by vehicles circulating at 35 km/h (Table I-5-2), showing that it reaches 607 Ton SOx/year (1986).

Table I-5-2 Estimated Emanations of SOx by Mobil Transportation in the City of Guayaquil, ESPOL, 1987.

VEHICLE	SOx emmited
Cars (gasoline)	0.12 g/km
Trucks (gasoline)	0.16 g/km
Trucks (diessel)	1.7 g/km
Ships	19.5 g/day

9. The permissible limits of lead in the atmosphere in Ecuador is 1.5 ug/m^3 air. In Guayaquil a study carried by IEOS in 1990, mean lead a concentration of 0.4926 ug/m^3 air was found. At present, Ecuadorian Government is encouraging citizens to us unleaded gasoline (less lead) through promotion, in order to prevent further lead pollution in the main gasoline (less lead) through promotion, in order to prevent further lead pollution in the main cities.

10. Big industrial activity in Guayaquil, produces a significant amount of particles and gasses disposed in the atmosphere with little or not regard to the quality of the emanations.

11. Wind velocity of Guayaquil averages 3.2 m/sec (1962-1978), with prevailing direction towards north-east, blowing air pollutants to the interior of the land.

12. The air quality has not been measured in the Port of Guayquil. Most of the dust in the city is produced by the industries. Because in the surroundings of the port there are not such activities, industrial dust may not be of major significance.

13. The air pollutants in the port area are those produced by the de diesel consumed by heavy trucks during transport, leaving and taking the cargo, as well as by port machinery and ships. APG personnel has counted the vehicles entering the port during one week, between 4th and 11th of March, 1993 (Table I-5-3)

Table I-5-3 Vehicles Counted Entering APG during One Week.

DAY	CARS	SMALL TRUCKS	BIG TRUCKS	TOTAL
1	236	41	436	713
2	1,158	99	1,067	2,324
3	405	59	680	1,144
4	352	64	428	844
5	690	31	450	1,171
6	967	192	1,138	2,297
7	857	178	1,277	2,312
8	99	27	257	383
TOTAL	4,764	691	5,732	11,187

14. At APG, solid waste is deposited in a place where is open burned; this wastes include plastics and ruber, producing dangerous black fumes, and deteriorating the air quality.

2) Water Condition

15. Ecuadorian Government, through, Ministerial Agreement Nº 2,144, from June, 1989, has established limits of tolerance of certain parameters for estuarine water bodies in all the territory (Table I-5-4).

Table I-5-4 Limits of Tolerance of Several Parameters in Estuarine Waters

PARAMETER	Presented as	VALUE (mg/l)
Chlorofenols	Chlorofenol	0.5
Difenil	active agent	0.001
Dissolved Ocigen	O.D.	60% Sat. No. less 5.0
Hydrogen Potential	pH	6.5 - 8.5
Hydrogen Sulfur	SH_2	0.0002 *
Ammonium	NH_3	0.1 *
Arsenic	As	0.1 *
Barium	Ba	0.1 *
Cadmium	Cd	0.01 *
Free Cianide	CN	0.05 *
Zinc	Zn	0.01 *
Residual Chlorus	Cl_2	0.1 *
Cooper	Cu	0.1 *
Chrome Hexav.	Cr^{+6}	0.01 *
Monohydric Fenols	Fenols	1.0 *
Wax and oil	Bisible film	Absence
Ferrum	Fe	0.1 *
Manganese	Mn	0.1 *
Mercury	Hg	0.01 *
Nickel	Ni	0.01 *
Chlorate Plaguicides	Active agent	0.001 *
Phosphorate Plaguicides	Active agent	0.05 *
Silver	Ag	0.01 *
Lead	Pb	0.01 *
Selenium	Se	0.01 *
Tenso-actives	Blue-metil actives	0.143 8
Temperature		Nat. cond. +3
Coliform Bacteria	NMP/100 cm^3	70 fecal coli.

Note: As defined by Ministerial Agreement Nº 2,144
* values defined by Lethal Concentration when at 96 hours of bioassay, 50% of the population dies.

16. Dumping on urban wastes and industrial effluents, and the increased use of agrochemical products are all contribution to the deterioration of water resources. In most instances, these wastes, as well as domestic sewage, are discharged directly into rivers and estuaries without any treatment. Polluted water is the primary carrier of disease along the coast and is also affecting the productivity of some shrimp hatcherises and glow--out ponds.

17. Many of the heald problems for instance diarrhea, gastroenteritis, typhoid, and tuberculosis--are directly related to environmental conditions. Contaminated water supplies, nonexistent or inadequate sewage systems, and absence of safe refuse disposal favor the spread of these and other diseases. In the Guayas province, roughly 40 percent of the people have sewage services, slightly more than one third use open-pit toilets, and the remainder have not visible means of waste water disposal.

18. Municipal studies performed in 1985 of domestic effluents in the Guayas River and Estero Salado, estimate a change production of 15,256 kg BOD/day. In emission of pollutant discharges to the Estero Salado, 1,265 ha are considered to be involved.

19. The coverage of drain System in Guayaquil had significant deterioration between 1982 and 1990. The 65% of the city area (9,630 ha) are covered by the municipal sewage system. This sewage water has overcome the acceptable levels for the river and estuaries.

20. The treatment of disposal waters of the city is inefficient, so, the industrial and domestic waste water mixes in the drain system and is deposited to the rivers with not previous treatment.

21. The drain system surrounding Guayaquil and it water quality not only receives the input of the city, but from other cities, towns and villages like Babahoyo, Quevedo, Vinces, Ventanas, Catarama, Yaguachi, Milagro, Samborondón, Daule, Balzar, El Empalme, and others.

22. The increasing use of agricultural chemicals is the concern to many, particularly those cultivating shrimp, since good water quality is essential to shrimp production. Ecuador has very weak regulations governing the use of these chemicals. There is an important list of active ingredients in agrochemicals imported by Ecuador. Roughly 40% of these imports are herbicides. Many chemicals banned or restricted in more developed countries are commonly used in Ecuador, and there are no system whereby users of these chemicals are licensed. Sewage water disposal in Guayas functions by sewage system for 36%; open pits for 28.6%, and no system for the 35.4% of the population (Table I-5-5).

Table I-5-5 Home Waste Water Disposal in Guayaquil (1990)

NUMBER OF HOMES	SEWAGE SYSTEM	%	OPEN PIT	%	NO SYSTEM	%
319,900	176,460	55.16	116,456	36.4	12,085	3.78

Source : INEC, Fundación Natura

23. The majority of the nation's industries are found in Guayas. There are around 1,746 large factories in Guayaquil. Over 70 percent of the industrial growth is attributable to small companies that produce foods and beverages, textiles, chemicals, petroleum derivates, and non-metallic minerals. There are plants for major industrial

projects, including petrochemical, ammonia--urea, and steel plants, as well as shipyards and automotive assembly plants. These industries can have significant impacts on ecosystem heald:

24. Many of these plants discharge directly into the Guayas Estuary, into nearby rivers or steams or into sewage systems that, in turn, empty into nearby bodies of water.

25. Some of the more dangerous effluents come from companies producing metals, batteries, radiators, chemicals, paints, paper and leather. Many discharge toxic heavy metals such as mércury, cooper lead, and iron. Other companies discharge petrochemicals that are toxic and adversely impact water quality and aquatic species. There are several potential sources of deterioration of the water quality by oil spills both at Guayas river and Estero Salado.

26. Autoridad Portuaria de Guayaquil (APG), uses 35,000 m^3 of water per month for the several needs; at present, APG, does not supply fresh water to ships; this potable water comes from the city water system. The used water is collected and transported by a interconected net of sewage water tubing. This liquid is finally pumped to a treatment system consisting of septic tanks and filtration chambers as shown in Figure I-5-4. Treated water apperars to be disposed "clear" in the estuary (no chemical or bacteriological analysis are performed on this effluent).

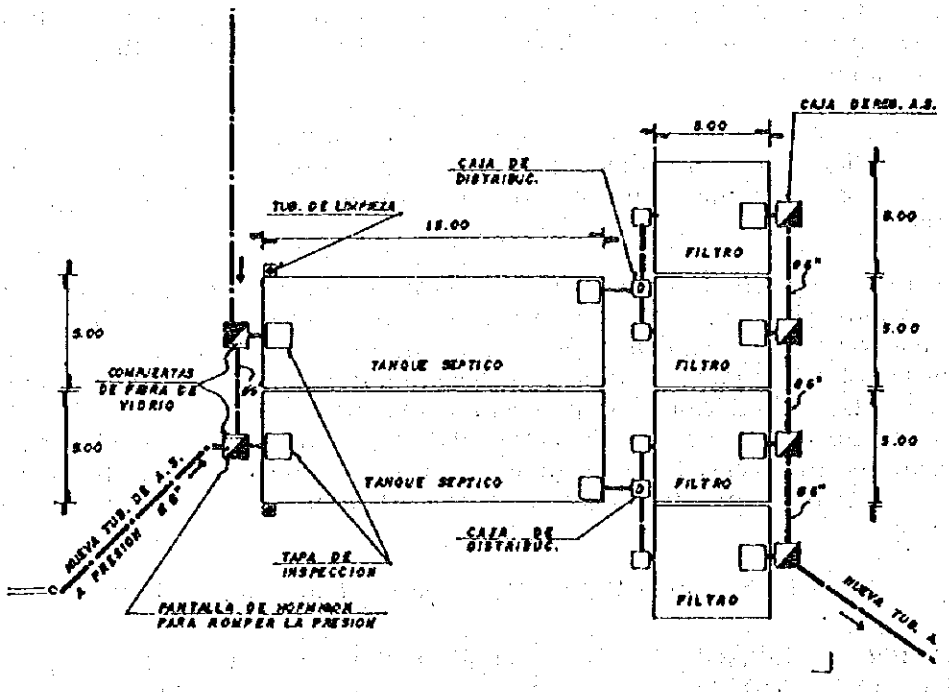


Figure I-5-4 Sewage Water Treatment System at A.P.G

Table I-5-6 Chemical Parameters Obtained in December 1,987 in Surface Waters off the Port of Guayaquil.

PARAMETER	VALUE (ug/l)
Ammonia	6
Nitrites+Nitrates	12
Total Dissolved Nitrogen	27
Inorganic Phosphorus	3
Total Dissolved Phosphorus	5
Silicate	79

Source: Coastal Resources Management Program, 1993.

27. Petroleum hydrocarbons in water have been studied in 1986 and 1989, and compiled by the Programa de Manejo de Recursos Costeros (PMRC), 1993 (Table I-5-7). These values are relatively low compared to other polluted areas, but fits within values established for natural marine environments (Parsons et al., 1988).

Table I-5-7 Hg Measurements in Water Samples around APG.

Site	HCa (ug/l)crisene	Reference
Rio Guayas and Estero Salado	0.1 - 2.8	INP, Solórzano 1986
Estero Salado	1.07 - 3.27	PMRC, 1989

28. In order to define present conditions of the water body surrounding the Port, a plan was established to cover all the water basing, sampling points in distance balance. Field work was performed the 24th of August of 1994, with variable tides. Six stations were covered using a boat provided of a sampling platform and work space (Figure I-5-5 Places for Sampling of Water of the Survey). The samplings were made either by instruments at the surface, and mainly with a Niskin Bottle that permits to obtain water samples from the desired depth,; parameters such temperature, salinity, dissolved oxigen and pH, were measured immediately, since the water samples for other analysis were properly fixed and transported in ice to the laboratory. Results are shown in Table I-5-8.

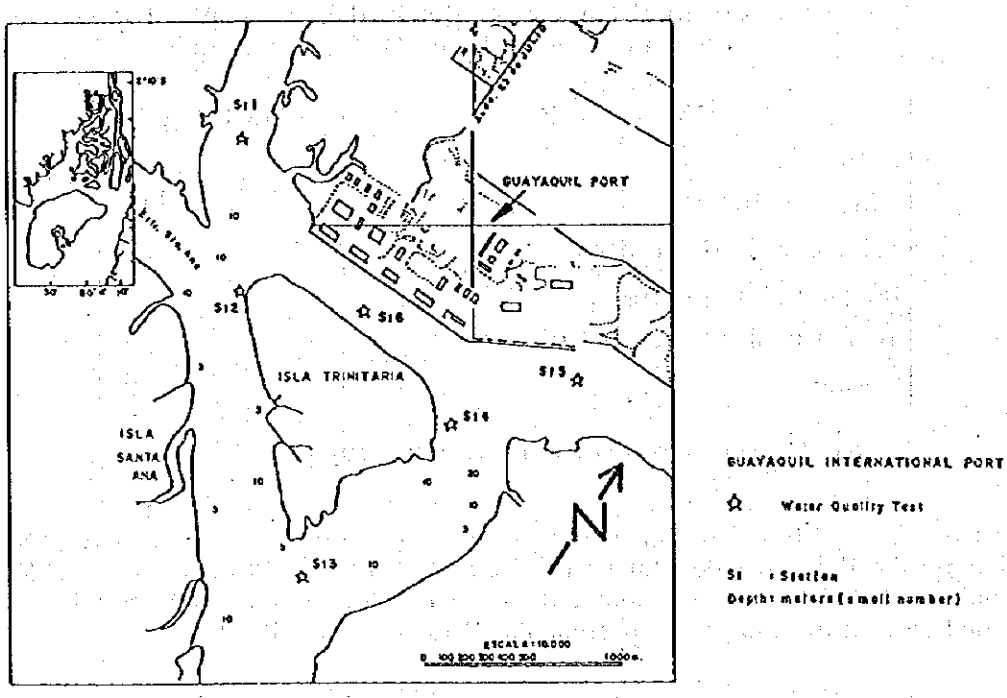


Figure I-5-5 Stations for Sampling of Water Quality Test

Table I-5-8 Values of Water Parameters of the survey

STATION	DEPTH m	TEMPERATURE °C	SALINITY ppt	pH	DISSOLVED OXYGEN ppm	COD ppm	TOTAL N ppm	TOTAL P ppm	SUSPENDED ppm
1	0.5	24.0	24	7.2	4.2	2.6	1.30	0.1	2.29
	2	23.5	25	7.7	3.8	5.0	1.01	0.13	2.34
	10	23.5	25	7.8	4.2	20.5	1.57	0.13	2.45
2	0.5	23.0	26	7.2	4.2	15.0	1.59	0.14	2.14
	2	25.0	25	7.8	4.2	10.0	1.86	0.15	2.30
	10	23.0	25	7.8	4.4	7.8	1.31	0.16	2.53
3	0.5	23.0	24	7.7	4.2	18.5	1.87	0.16	2.55
	2	24.0	23	7.8	4.4	15.0	1.88	0.14	2.41
	10	24.0	21	7.8	4.8	20.5	1.32	0.17	2.16
4	0.5	24.0	24	7.8	4.4	22.0	2.14	0.20	2.83
	2	23.7	24	7.8	4.0	21.5	1.86	0.17	2.38
	10	23.5	21	7.8	4.4	47.0	2.43	0.18	2.02
5	0.5	24.5	21	7.6	4.6	10.0	1.59	0.18	2.14
	2	24.0	21	7.8	4.5	6.5	1.88	0.18	2.28
	10	24.0	21	7.8	4.6	20.0	2.43	0.18	2.34
6	0.5	24.5	17	7.7	4.5	31.5	1.02	0.02	2.18
	2	24.0	18	7.9	4.8	42.0	1.80	0.80	2.57
	10	24.0	18	7.9	4.0	20.0	1.25	1.25	2.50

29. The body of water surrounding APG are relatively healthy. The average of DO (4.4 ppm) reflects a well oxigenated water considering that the saturation capacity is low because the temperature (24 C). The lowest value was found at the Estero del Muerto (St. 1), probably due to increase of demand by organic pullutants coming from upstream. The values of COD demonstrate a oxigen consumption accord to estuarine productive areas. Total Nitrogen and Phosphorus in the water showed to be very low compared to determinations made by the PMRC on December, 1987 at Estero Cobina (27 and 5 um/l, respectively). The data of present survey agrees with a similar one made at the Estero Salado (EMAG-BID 1984) (Table I-5-9). Suspended material existing in the water mainly consist of organic particles from mangrove production. Tidal flux promotes resuspension of sedimented material.

Table I-5-9 Survey made at Estero Cobina, 1984.

PARAMETER	VALUE
Temperature (°C)	27.4
Salinity (ppm)	18.8
DO (mg/l)	4.1
BOD (mg/l)	2.9
Total P (mg/l)	0.34
Total N (mg/l)	1.29

3) Bottom Condition

30. At the Estero Salado and Estero El Muerto, two estuaries limiting the east of Guayaquil, the riverbed conditions denote a cumulative accumulation of fine organic material in such volumes that complete biological recover is not possible.

31. In the sediments and benthic mollusks of the surroundings, some measurements of Hg concentrations have been made (Table I-5-10).

Table I-5-10 Hg Measurements in Sediment Samples around APG.

SITE	MATERIAL		Hg (ppm)	REFERENCE
Estero Salado	sediments	*	0.2 - 4.8	INP, 1988
Rio Guayas	sediments	*	0.2 - 4.8	INP, 1988
Estero Salado	Tagelus affinis	**	0.01 - 0.2	INP, 1986
Estero Salado	Ostrea columbiensis	**	0.01 - 0.7	INP, 1986

* Based on dry sample
** Based on wet sample

32. The Port Area has been determined as possessing chronic hydrocarbon pollution due to navigation activities. Petroleum hydrocarbons in sediments have been studied in similar areas, and compiled by the Programa de Manejo de Recursos Costeros (PMRC), 1993 (Table I-5-11).

Table I-5-11 Petroleum Hydrocarbons in Sediments around APG.

Site	HCs (ug/g)dry weight	Reference
Rio Guayas and Estero Salado	17.3 - 95	PMRC-Oviatt, 1988
Estero Salado	38 - 140	PMRC, 1989

33. From Samplings made for the same PMRC program at Estero Cobina, close to the port, some heavy metals have been quantified from the sediments (Table I-5-12).

Table I-5-12 Heavy Metals Concentration in December 1987 in Sediments around the Port of Guayaquil (ug/g dry sample).

ELEMENT	CONCENTRATION
Cooper	31.46
Nickel	19.0
Lead	11.3

34. Survey made on August, 1994 in the Port area (Figure I-5-6) for sediment analysis consisted on 6 stations distributed in the basin. Samples were collected from the bottom x=12 m using a Van-Veen grab from a boat anchored. The samples where acidified or fixed immediately on board to be transported in ice to the laboratory. The values are indicated in Table I-5-13, and show to be homogeneous within the sampling area.

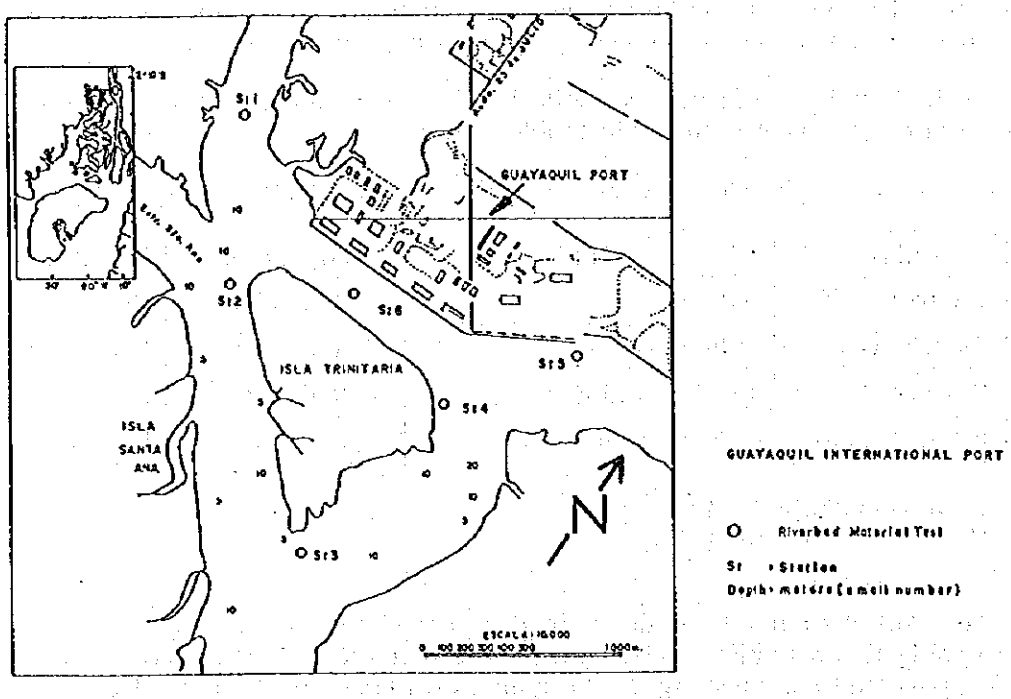


Figure I-5-6 Stations of Sampling for Riveted Material Test

Table I-5-13 Values of Surface Sediment Parameters of the Survey

STATION	DEPTH m	pH	IGNITION LOSS	SULPHIDRIC ACID ppm	TP ppm	TN ppm	COD ppm
1	10	6.8	81.2	0.26	1523	8100	124
2	14	7.0	93.2	0.20	1048	8100	160
3	15	7.4	86.7	0.30	1347	7100	180
4	13	7.4	84.3	0.22	1406	6300	181
5	11	7.4	89.4	0.36	1523	8500	166
6	10	7.4	87.9	0.13	1261	8800	171

35. Although there are not standards or limit values for this environment in Ecuador, the high values of organic material (represented by ignition loss), is representative of rich mangrove estuarine ecosystem, therefore, the amounts of total N, total P, and Oxygen Demand, fall between the normal characteristics of high biological productivity. Sulphidric Acid shows values of no severe pollution in the basin.

4) Noise

36. The noise in Guayaquil has been classified to be produced by fix and mobile sources. Fixed sources of noise in Guayaquil corresponds to industries in the surrounding of the city, mechanical workshops, saw-pits thermo-electric installations, entertainment saloons and others. Movil sources of noise constitute light and heavy vehicles, as well as airplanes (international airport is almost completely surrounded by city buildings).

37. The Instituto Ecuatoriano de Obras Sanitarias (IEOS), through some local agencies, carried a survey of audial pollution in several sectors of the city. For this study a basic criteria value was adopted of 55 dB (A) for the day, and 45 dB (a) for the night. APG is sited at the extreme south of the city, in a sector called Ximena. The results of the study (Table I-5-14) show that in this sector, the amount of noise exceding the adopted criteria is 19.6 dB (A). At the Maritime Port, noise is high due to heavy transport and machinery operations.

Table I-5-14 Noise (dB(A)) Levels in the South of Guayaquil (1990).

No. DATA	MEAN	ST. DEV.	MAX.	MIN
118	74.6	4.89	96	54

5) Vibration

38. The city of Guayaquil is sited in soft soil. The running of heavy trucks produce vibration on the civil structures. Other source of vibration on the city are airplanes flying at low altitude. There are now known values of vibration coefficients for the region.

6) Odor

39. Only in selected sites of the cities, that is in the interior most branches of the estuary, where the organic and chemical charge is high, sulfuric odors come out from the sediments at low tide. Certain industries (mainly food supplies) also produces characteristic odors.

7) Waste

40. Solid waste per capita in Guayaquil is calculated as 0.63 Kg/ind/day, making a total of over 1,450 tons of solid wastes discharged per day. Projected solid wastes for the year 2,000, are in the order of 2,600 tons/day. The waste recollection system is being improved recently; nevertheless because of education problems, much of these wastes are deposited in the river and estuary, causing severe negative effect on the water quality.

41. At APG, there is an internal system of solid waste collection. Around 30 m^3 of uncompacted solid waste is collected daily. the estimated composition is showed in Figure I-5-7. The collected material is piled up on land (within the limits of APG), and after some removal, usually is fired. From these wastes, 85 % comes from cargo activities, since only 15 % relates to human activities. Used lubricant oil is deposited in any open land, concrete or pavement available, without regard of any treatment. There is not collecting systems for used oil of the boats.

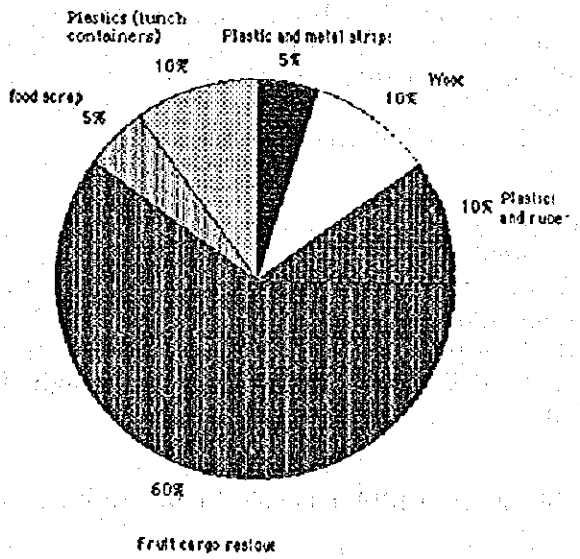


Figure I-5-7 Estimated Composition of Solid Wastes at APG.

8) Fauna

42. Within the macro fauna reported for the area of the Port, it can be mentioned species of mollusks (shells), crustaceans (shrimps and crabs), reptiles, and birds (Table I-5-15). From these, there are commercially important species shells (Anadara tuberculosa, A. grandis, A. similis, Mytella guyanensis, M. strigata, Crassostrea columbiensis) and crustaceans (Callinectes toxotes, Ucides occidentalis, Penaeus vannamei, P. occidentalis and P. stylirostris).

Table I-5-15 List of Animals Reported for the Area of APG

MOLLUSKS	*CRUSTACEANS*	*REPTILES*	*BIRDS*
Anadara tuberculosa	*Penaeus occidentalis*	*Iguana iguana*	*Pelecanus occidentalis*
Anadara grandis	*Penaeus californiensis*	*Boa constrictor*	*Phalacrocoran olivaceus*
Anadara similis	*Penaeus brevirostris*	*Icotea sp.*	*Fregata magnificens*
Mytella guyanensis	*Penaeus stylirostris*		*Leucophorix thula*
Mytella strigata	*Trachypenaeus byrdi*		*Eudocimus albus*
Crassostrea columbiensis	*Trachypenaeus faoea*		*Dendrocygna autumnialis*
Sphenia fragilis	*Xiphopenaeus riveti*		*Geranospiza caerulescens*
Lectopecten velero	*Callinectes toxotes*		*Larus cirrhocephalus*
Corbula amethistina	*Cardisoma crassum*		*Fluvicola ceimazura*
	Ucides occidentalis		*Actitis macularia*
			Dysthamnus mentalis
			Neochelidon tibialis

43. In the survey made in September 10, 1994, 4 hour walking along transects opened through the mangrove for topographical studies, permitted observe blue crabs in the muddy floor, as well as green iguanas on the mangrove trees and frigates pelicans and sea-gulls flying around. A domestic cat was also seen inside the mangrove area showing the influence of the city on the place. Ecological important species are the iguanas and birds as the change in the environment promotes loss of habitats and change in their range of distribution.

44. Lets call the attention to the shrimps, of which *is Penaeus vannamei* is the species more used for cultivation (Table I-5-16): Adult gravid females lay their eggs in the open sea; as they hatch, nauplii and larval stages move to the coasts and estuaries for food and refuge; spend their larval stages in the area where are captured for growth in shrimp farms. When juvenile and adult, the shrimps return to open and deeper waters. The role of mangrove areas in this cycle is to provide organic matter for the development of rich sources of food for this and other important commercial species.

Table I-5-16 Shrimp Production in Ecuador (metric tones of whole animal).

YEAR	PRODUCTION	ORIGIN SEA	CULTURED	% SEA	CULTURED
1985	36,228	6,023	30,205	16.6	83.4
1986	52,794	9,166	43,628	17.4	82.6
1987	79,883	10,730	69,153	13.4	86.6
1988	82,580	8,100	74,480	9.8	90.2
1989	77,703	7,640	70,663	9.8	90.2
1990	86,563	10,154	76,240	11.7	88.3
1991	125,865	13,587	112,278	10.8	89.2
1992	127,946	12,795	115,151	10.0	90.0

45. Shrimp industry in Ecuador holds 190,000 direct employments and is the second major good for exportation after the petroleum. Some of the product is natural captured with nets mainly in the Gulf of Guayaquil. The most of the product is cultivated in farms constructed in salt plains, arid zones and mangrove areas.

46. Four types of land are converted to shrimp ponds: mangroves, salt flats, low-lying agricultural land, and arid areas. 70 percent of the ponds are located in mangrove areas. In the Guayas Province, between 1969 and 1987, an area of 112,681 ha has been given in concessions for shrimp ponds (Figure I-5-8).

47. The shrimp mariculture industry has destroyed nearly all of the mangrove habitat in some estuaries. 70% of the land utilized belong to the Guayas Province, covering an area of 114,231 ha; such destruction of inter tidal habitat threatens to affect natural supplies of post larval shrimp used for the stocking ponds, and is likely to affect the abundance of important stocks of fish and shellfish. Moreover, loss of buffering action of coastal vegetation increases flooding and erosion, changes sedimentation patterns, and may reduce the ability of estuaries to absorb pollutants.

9) Flora

48. The main concern for the environmental aspect of the study is the existence of an area of 33 ha of mangrove in the site of the project. It is mangrove area, limiting Esteros El Muerto and Cobina, last remain of the natural floral coverage on land continuous to Guayaquil by the south (Figure I-5-9). This mangrove area supports a diverse community of vertebrate, invertebrate fauna, as well as accompanying flora. The mangrove and estuarine area are the temporal refuge and alimentary support for shrimp larvae. Written reports of the vegetation of that point are inexistant, but similar areas have been described listing species of algae adhered to mangrove roots (*Catenella repens, Bostrychia, Caloglossa*), epiphites (*Tillandsia usneoides*), and flowering plants as *Rhizophora harrisonii, R. mangle, Avicenia germinans, Languncularia racemosa, Conocarpus erecta, Salicornia fruticosa, Batis maritima, Heliotropium curassavicum and Criptocarpus pyriformes.*

49. On the 10th of September of 1994 (at low tide), a survey was made in the area of for direct observation of the forest. A transect of 600 m was adopted not for quantitative but qualitative evaluation. *Rhizophora harrisonii, R. mangle,* and *Avicenia* germinans, are the mangrove components of the forest with the tallest trees no higher than 8 m. *R. harrisonii* is the most abundant and dense towards the riber side. Flowering trees of *Salicornia fruticosa,* and *Batis maritima* were found in the surroundings of the mangrove, since brushes of *Criptocarpus pyriformes, Acacia spp,* and unidentified gramineans (grasses) were found in the surroundings and within the visited area.

50. Because of the destruction of mangrove for shrimp pond construction in the country, the Government and national institutions are imposing more regulations for the protection of the resource.

51. From the scenic point of view, Guayaquil posses various hills in the nearby with good views. Estuarine and mangrove area in also attractive of the Guayaquil and Port surroundings for recreation and entertainment.

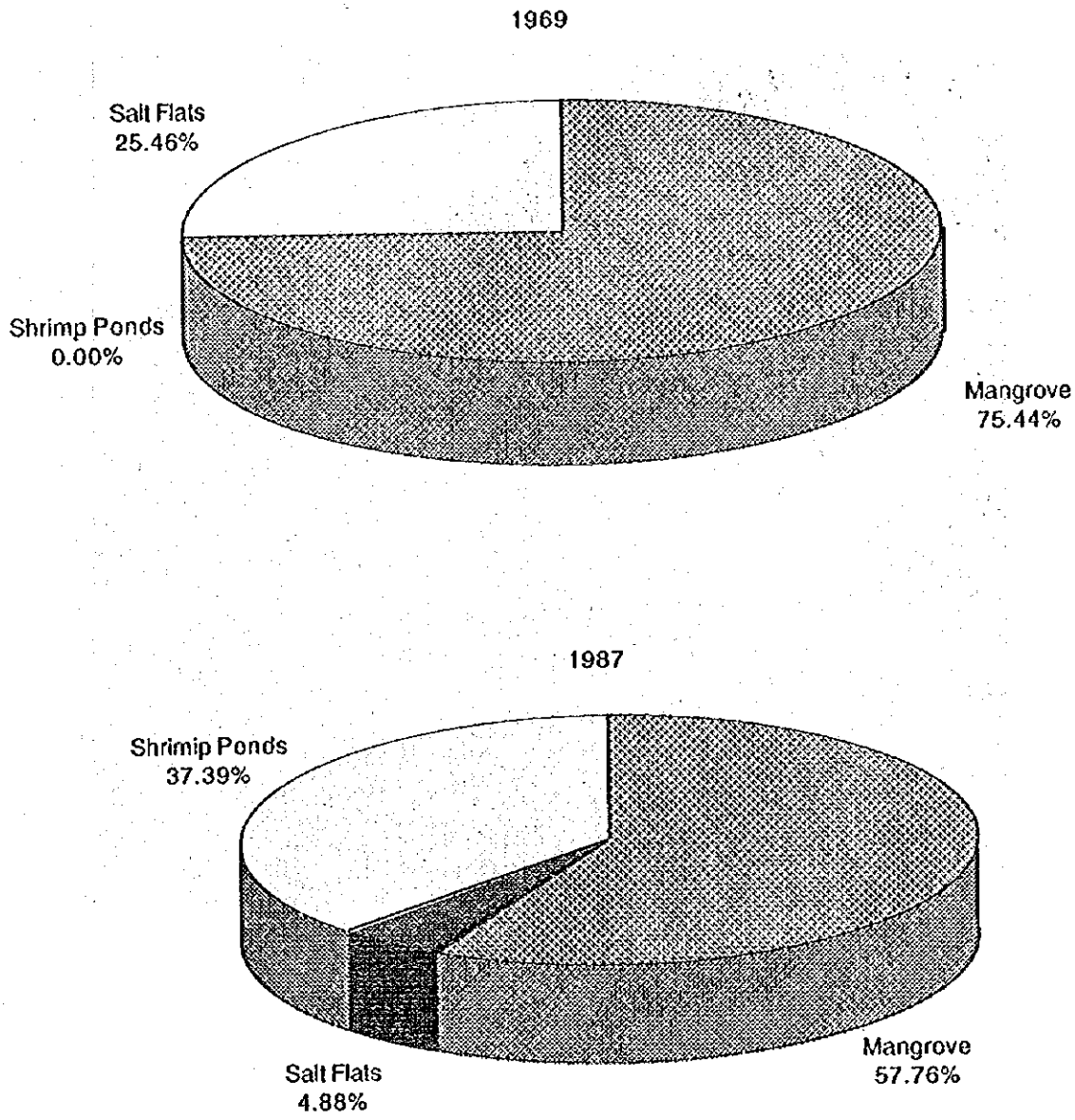


Figure I-5-8 Use of Land in the Coastal Region

Source: CLIRSEN, 1988

Figure I-5-9 Aerial photograph showing the mangrove area in the study site of APG.

Chapter 6 PORT FACILITIES AND LAYOUT

A. General

1) History

1. The Port of Guayaquil opened to international traffic on January 31, 1963. Previously to that, Guayaquil was becoming less accessible to navigation due to the increasing difficulties given by the river and the larger draft that had the vessels made for international traffic.

2. In 1941, several shipping lines stopped coming all the way to Guayaquil and reached only Puna Island; in 1942 the Government had to authorize this anchorage at Puna Island for vessels with 23.5 feet of draft and larger. From that Island, cargo and passengers were transported to Guayaquil in barges and small boats.

3. In 1946 the Government stated the urgent necessity of dredging the Guayas river and the construction of a port in a location accessible to navigation. While this happened, The country was starting international trade specially with banana, thus the need for a Port became greater.

4. A study on the location of the new port was conducted in 1951. As the result of the study the construction of the port was recommended at the water edge site of the Estero Salado.

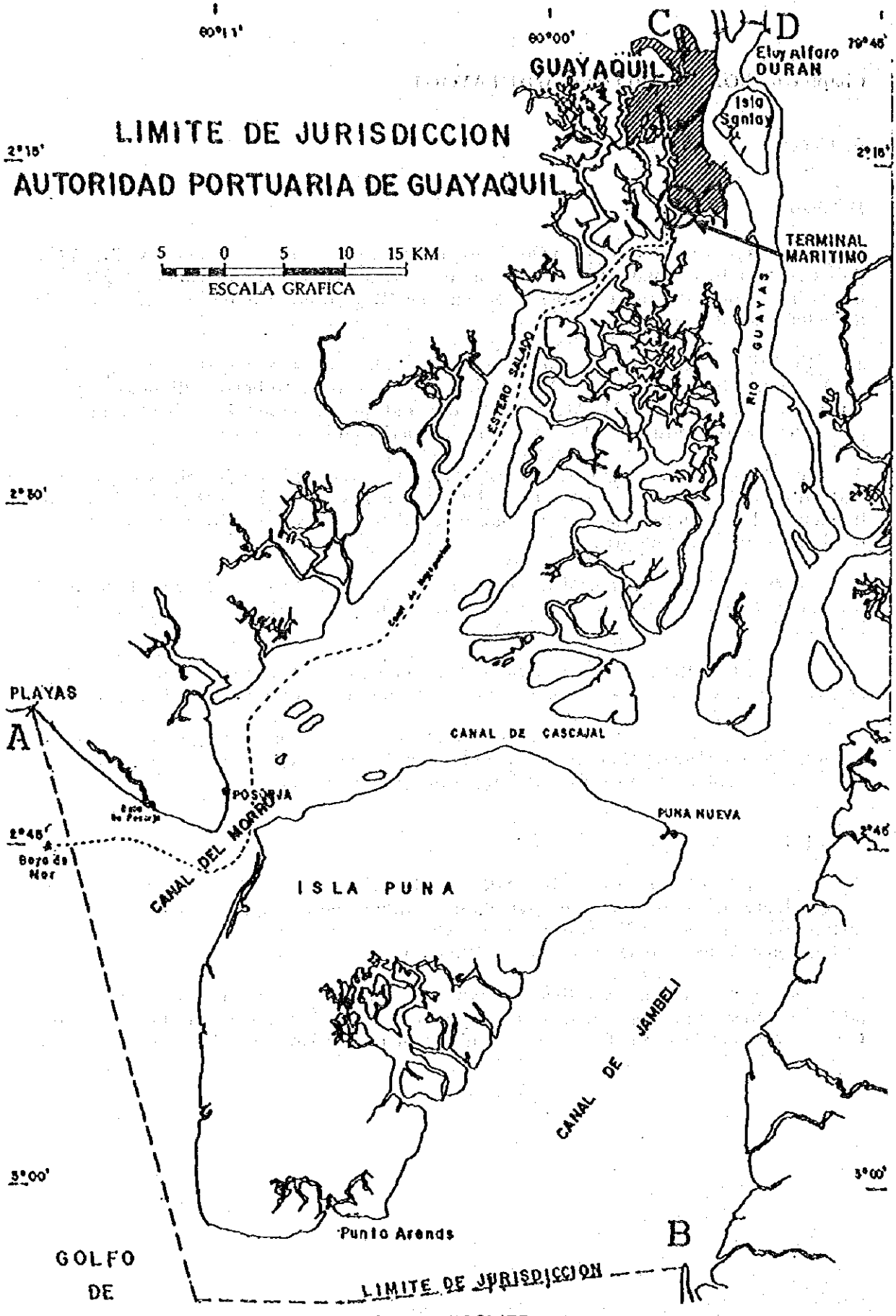
5. The Port Authority of Guayaquil was created in April of 1958 for administration and operation, which works in accordance with the Port Administrative Regimen Law.

6. At the end of the 1970s, with the rapid increase in import cargo as well as the progress of containerization in the world, new terminal was constructed. The new terminal for container and bulk handling was opened in 1980.

2) Jurisdiction Area

7. The limit of jurisdiction by APG is shown in Figure I-6-1. APG has the responsibility to control the ship navigation including the pilotage and the maintenance of the access channel in the water area between the line from A to B at the ocean side and the line from C to D at the Guayas River side.

8. The port terminal area that is owned by APG is approximately 250 ha. In addition, other land areas such as the area near the lock between the basin and the Guayas River, at Data for the pilot station and at Puna Island are also owned by APG.



Source; DIGMER

Figure I-6-1 Jurisdiction Area of APG

3) Terminal Area

9. Land area of the port terminal (approximately 250 ha) can be divided into the five categories listed below. Land use of the port terminal is shown in Figure I-6-2.

AREA A ; Old Port Area
AREA B ; Container Terminal Area
AREA C ; Bulk Terminal Area
AREA D ; Reserved Area
AREA E ; Mangrove Area

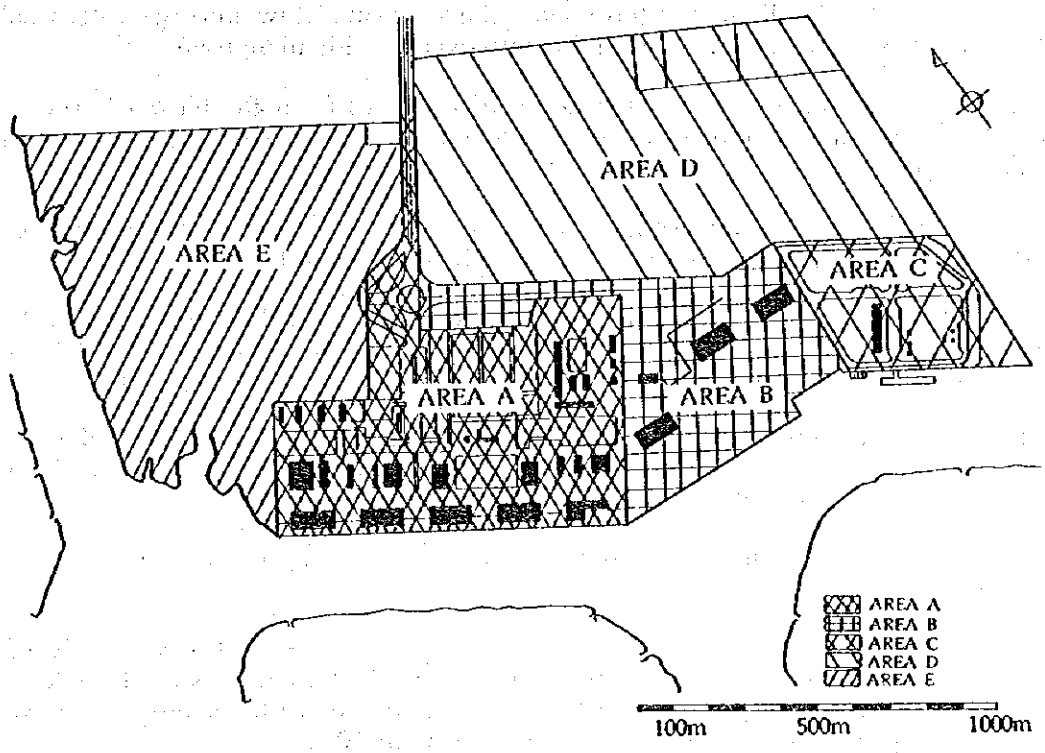


Figure I-6-2 Land Use of the Port of Guayaquil

10. AREA A (approximately 50 ha) was developed in 1958; the marginal wharf of about 925 m, warehouses and open sheds are located in this area. The main entrance gate, the administration office buildings and the maintenance shop are also located in this area.

11. AREA B was developed in 1980 and it is approximately 30 ha. This area is mainly used for container handling. There is a 555 m marginal wharf, container yard of more than 9 ha, and three warehouses for container cargo. The waterfront of approximately 160 m next to the existing wharf is reserved for future development.

12. AREA C was developed at the same time as AREA B. The area is approximately 17 ha and it is connected to a pier of 151 m in length. This area is designed for bulk cargo handling and silos, tanks and a warehouse as well as a bulk cargo loading/unloading system have been installed.

13. AREA D is approximately 80 ha and not fully arranged for utilization at present. The document stock building of APG is located there while an area of 3 ha is leased to port related organizations such as customs and the port captain.

14. AREA E is approximately 70 ha, most of which is covered with mangrove. The area along the access road to the port is used by the trucks waiting to enter the port.

4) Water Area

15. The water way named Estero Salado is used as the access channel to the port terminal. The length is about 50 miles (94 km) from the buoy at the ocean named "Boya de Mar" up to APG berths in the terminal. Many streams flow into the Estero Salado and both sides of its banks are almost totally covered with mangrove.

16. The quarantine area is designated at an area 3 miles from the terminal. The vessel stays at this area for quarantine and other procedures for entering the port as well as for waiting for berthing.

17. The basin located behind Trinitaria Island is very calm. Two routes, right side and left side of the island, are used for the approach to the wharf.

18. There is a water way connecting between APG basin and the Guayas River. A lock is installed in the water way to adjust the difference of the water level between the River and the basin and it is operated by APG.

19. The water area down-stream from the Rafael Mendoza Aviles Bridge at the Guayas River is included in the jurisdiction area of APG. But only oceangoing vessels to the private piers and small boats go up and down along the river.

20. At Estero Salado some small fishing boats are found but their number is not significant.

21. A Naval Base of Ecuador is located at the inner stream of the west side of the terminal. Naval Vessels stay at the base but the navigation of vessels from/to APG terminal does not reportedly affect naval operations. At a more inner area of this water-way there is a private pier with a depth of more than 10 m.

B. Layout of Port Facility at Terminal

1) General

22. Existing major port facilities were built in 1958 and in 1980. Conventional port facilities were constructed in 1958 while a container terminal and a bulk terminal were built in 1980. The layout of main port facilities is shown in Figure 5-3.

23. Total length of berths of the port is about 1,630 m and the design depth is 10 m for conventional. Berth dimensions are listed in Table I-6-1.

24. There are thirty-one warehouses, five silos and three tanks as listed in Table I-6-1. The total area of warehouses is approximately 10 ha. The capacity of silos and tanks is approximately 30,000 m^3 in total. Some of the warehouses are used together with one next to it. The physical condition of some warehouses is not very good.

25. An area of approximately 16 ha is used for open sheds. But it is often found that many cargoes are staying in areas not designated as a storage and/or a transit area because of shortage of space.

26. The total length of roads in the port is about 8,000 m. But some parts of roads are closed to traffic for security reasons.

27. The port has two gates, the main gate leads to the old port area and the other is to the container and bulk terminal. Another gate for private use is located at the east side of the port.

28. Main cargo handling equipment is as follows. A gantry crane with 40 ton capacity is installed at the container terminal. Two transtainers that can handle a container box of 40 feet and 30.5 tons work in the container yard. In the bulk terminal, unloading/loading equipment with the capacity of 200 ton/hour is installed. There is a crane with capacity of 75 tons at the apron of berth 2.

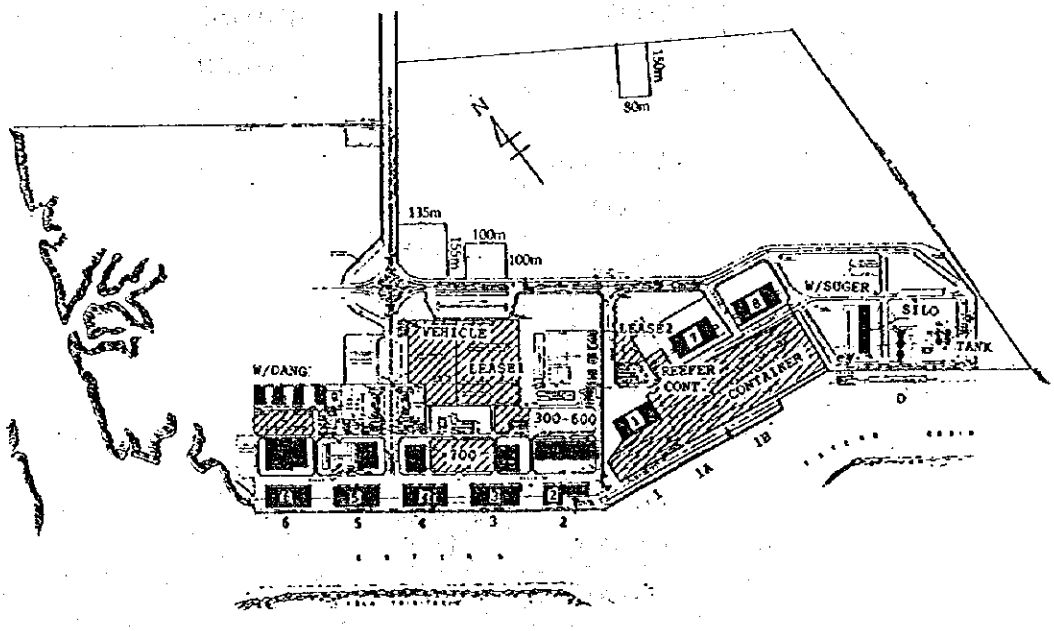


Figure I-6-3 Layout of Main Port Facilities

Table I-6-1 Main Port Facilities

Berth

UNIT: m

NAME	LENGTH	DEPTH (DESIGN)	APRON WIDTH	CONSTRUCTION
2	185.014	10.00	12.20	1958
3	185.014	10.00	12.20	1958
4	185.014	10.00	12.20	1958
5	185.014	10.00	12.20	1958
6	185.014	10.00	12.20	1958
1	185.000	10.00	30.20	1980
1A	185.000	10.00	30.20	1980
1B	185.000	10.00	30.20	1980
1D	155.000	10.00	15.00	1980

OPEN SHED
(under used)

No.	NAME	AREA (m^2)
1	300 - 600	8,000.00
2	700	15,120.00
3	VEHICLE	36,420.00
4	CONTAINER	92,374.00
5	REEFER CONT.	2,850.00
6	ABANDON CARGO	10,362.00
7	LEASED1	11,540.00
8	LEASED2	10,000.00
TOTAL		186,666.00

SILO/TANK

S-AT1	6,000
S-AT2	6,000
S-AT3	6,000
S-sm1	450
S-sm2	450
TANK1	4,000
TANK2	4,000
TANK3	4,000
TOTAL	90,900

WAREHOUSE

NAME	AREA (m^2)	
2	4,902.00	-
3	6,875.00	(125.00 × 55.00)
4	6,875.00	(125.00 × 55.00)
5	6,765.00	(123.00 × 55.00)
6	6,765.00	(123.00 × 55.00)
21	1,431.00	(53.00 × 27.00)
22	1,537.00	(53.00 × 29.00)
22/23	795.00	(53.00 × 15.00)
23	1,537.00	(53.00 × 29.00)
23/24	795.00	(53.00 × 15.00)
24	1,537.00	(53.00 × 29.00)
31	2,062.50	(75.00 × 27.50)
32	2,062.50	(75.00 × 27.50)
41	2,062.50	(75.00 × 27.50)
42	2,062.50	(75.00 × 27.50)
51	2,062.50	(75.00 × 27.50)
52	2,062.50	(75.00 × 27.50)
61	1,440.00	(80.00 × 18.00)
62	1,440.00	(80.00 × 18.00)
63	1,530.00	(85.00 × 18.00)
64	1,530.00	(85.00 × 18.00)
65	1,530.00	(85.00 × 18.00)
66	1,530.00	(85.00 × 18.00)
1	7,200.00	(120.00 × 60.00)
7	7,626.00	(123.00 × 62.00)
8	7,626.00	(123.00 × 62.00)
W/SUGGER	4,692.00	(138.00 × 34.00)
W/DANG1	1,498.00	(53.50 × 28.00)
W/DANG2	1,498.00	(53.50 × 28.00)
W/DANG3	1,498.00	(53.50 × 28.00)
W/DANG4	1,498.00	(53.50 × 28.00)
TOTAL	94,325.00	-

2) Old Port Area

29. The port facilities and buildings that are located in the area of the old port are as follows.

(1) marginal wharf of 925.07 m
(2) apron behind the wharf of 12.20 m width
(3) five warehouses next to the apron
(4) twenty warehouses at the opposite side of the road behind the warehouses next to apron
(5) four warehouses for dangerous cargo
(6) four open sheds
(7) open shed for abandoned cargo
(8) some maintenance shops
(9) some administration office buildings

30. The marginal wharf is divided into five 185.014 m-long berths, namely, berth No.2, 3, 4, 5 and 6. The design depth is 10.0 m. According to the result of the field survey conducted in this study the present depth is less than the design depth in part. The structure is reinforced concrete superstructure supported by reinforced concrete piles. Some parts of the curbstone are damaged.

31. The apron is only 12.20 m wide and the area between warehouses next to the apron is mostly used for loading and unloading work and cargo storage. At the apron in front of warehouse No.2, a crane with capacity of 75 tons has been installed.

32. The warehouses next to the wharf are named No.2, 3, 4, 5 and 6, corresponding to the berth number in front of each. Thus these warehouses have the function of transit sheds. Warehouse No.3, 4, 5 and 6 each have an area of 6,875 m^2 while No.2 has an area of 4,902 m^2. All of them are concrete and steel structure; parts of the roof of some warehouses are destroyed.

33. There is another group of warehouses: No.21, 22, 23, 24, 31, 32, 41, 42, 51, 52 61, 62, 63, 64, 65 and 66. The size of each warehouse ranges approximately from 1,500 m^2 to 2,000 m^2. The areas between No.22 and 23 and No.23 and 24 are covered with a roof and used as warehouses.

34. The warehouses for dangerous cargo are located at the northern edge of the port area. Total area of the four warehouses is 6,000 m^2.

35. The open shed No.700 is used for storage of machinery and heavy cargo. The open shed No.300 - 600 is divided into two blocks. One of them with about 5,000 m^2 is used as an open shed and another is used for an area of the maintenance shop. An area of 36,420 m^2 is used as an open shed for vehicles and an area of 11,540 m^2 is leased to a private company as a container yard.

36. Next to the warehouses for dangerous cargo, there is an open shed for abandoned cargo and disposal cargo. The area is 10,362 m^2.

37. The main maintenance shop is located near the container terminal. The old maintenance shop is located between warehouses No.61 and No.52 and the yard for maintenance of buoys is located next to the area of warehouses for dangerous cargo.

38. There are some administration buildings in this area. The main offices, a dining room and a hospital etc. are located outside and inside of near the main gate. Some administration buildings are located in container terminal and bulk terminal area.

3) Container Terminal

39. In the area of container terminal, the following facilities and equipments have been built or installed.

(1) marginal wharf of 555 m
(2) apron behind the wharf of 30.2 m wide
(3) a gantry crane with capacity of 40 tons
(4) container yard of 63,069 m^2.
(5) open shed for reefer container of 6000 m^2
(6) two container freight stations of 14,400 m^2 each
(7) one warehouse for general cargo of 7,200 m^2
(8) two transtainers with 30.5 tons-capacity

40. The wharf is divided into three 185 m-long berths: No.1, 1A and 1B. The design depth is 10.00 m.

41. The structure of wharf is reinforced concrete pile type similar to the berth in the old port. Some parts of the curbstones are broken and repair work is currently being done.

42. The width of the apron is 30.2 m and the rail with span of 15.25 m is laid across the total length of the wharf. A gantry crane with 40 ton capacity and 36 m out-reach runs on this rail.

43. The container yard can accommodate 6750 container boxes of 20 feet at the same time. It is found that three container boxes are put upon another. The pavement of some parts of the yard is not good for container handling and repair work is planned.

44. The reefer container yard is situated in this area. The capacity of this yard is for 30 reefer container boxes. The yard is used fully and a stay for more than two days is prohibited.

45. The two container freight stations are behind the container yard. The dimensions of the two are the same and each has eight doors for cargo transfer from/to a container box.

46. The warehouse for general cargo is located next to the container yard. Because of its vicinity, the warehouse is mostly used for container cargo.

47. Behind the APG's office building in this area, about 4,000 m^2 open space is used as a container storage yard. Some parts of this area are not specified for designated land use. On the other hand many container boxes are scattered in the open space in this area.

4) Bulk Cargo Terminal

48. The following facilities and equipment are located in the area of the bulk cargo terminal.

(1) pier of 151 m connected with trestle
(2) crane for loading/unloading
(3) three silos with the capacity of 6,000 m^3
(4) two small silos with the capacity of 450 m^3
(5) warehouse for sugar with the area of 4,692 m^2

49. These facilities are planned for handling of the import bulk cargo of grain such as wheat, maize, soy and sorghum and sugar for export.

50. The pier is the structure of the reinforced concrete pile type and its width and depth are 15.30 m and 10.00 m respectively. This pier is connected to the land with the trestle of 20.30 m length.

51. The capacity of the crane is 50 tons. The cargo handling system has the capacity of 200 ton/hour for grain unloading and for sugar loading. Annual handling capacity is designed for 412,170 tons of wheat handling.

52. The silos are prepared for grain storage. Total capacity of these silos is about 20,000 tons. Two other small silos of 450 m^3 each are located next to the silos above.

53. The tanks for vegetable oil have a capacity of 4,000 m^3, and a six inch diameter pipe is prepared for unloading.

54. Behind these facilities, an area of more than 5 ha, remains unused.

55. There is a mooring buoy of 45.56 m length and 3 m in width next to the pier. The tug boats and the boats for pilot are moored to this buoy.

5) Road and Parking Area

56. The alignment of roads in the port area is shown in Figure I-6-4 and the dimensions of each are listed in Table I-6-2.

57. A 60 m wide access road to gates is laid in the APG's land area. Many kinds of vehicles go through the main gate. Another gate connected to the container terminal is mainly used by the trucks for container cargo.

58. According to the APG's survey, the number of 11,187 vehicles passed through the main gate in a week from 17:00 on March 4, 1993 to 8:00 on March 11, 1993. The figure can be broken down into 4,764 cars, 691 small trucks and 5,732 large size trucks.

59. Roads E, A, B, T and H are the most frequently used. Road E is directly connected to the main gate and its width is 28.0 m. Road A (width: 28.0 m) is located behind the warehouses next to the apron and road B (8.0 m) is behind the warehouses of the second line. Road T (28.0 m) connects the container terminal and another gate through road H (22.0 m).

60. Road N and J are planned to provide access to the container yard, but there are fences at some sections of these roads for the security of cargo. Road M is used as a inner road of the container yard rather than the road as the network in the port area.

61. The parking areas are constructed outside the gates. One near the main gate has an area of about 3,600 m^2 and another near another gate has about 12,000 m^2. But many trucks are waiting to enter the port on the road outside of the parking area because of the shortage of capacity.

62. It often happens that the cargo and container boxes unloaded or loaded from/to vessels are placed on the road and many vehicles park on the roads in the port area.

63. All roads are covered by asphalt pavement but some sections require refilling.

64. Green belt zones are installed on roads E, H, and M. On road E, a monument is also displayed.

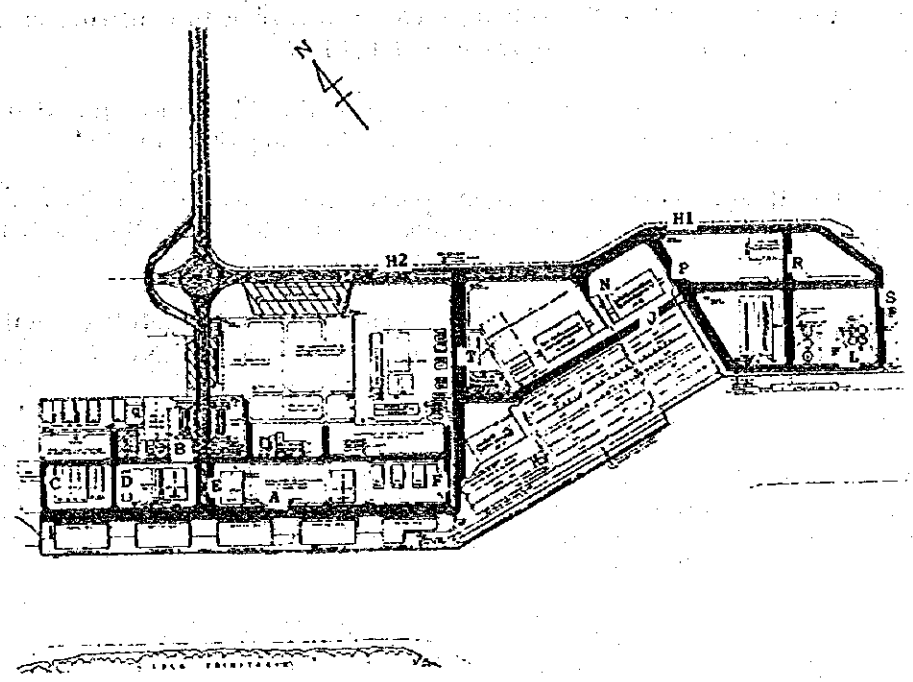


Figure I-6-4 Alignment of the Roads

Table I-6-2 Ports Roads

NAME	AREA(m²)	WIDTH(m)	LENGTH(m)	REMARKS
A	25,872.00	28.00	924.00	Behind Warehouse (Transit)
B	7,392.00	8.00	924.00	Behind the second line's warehouse
C	2,160.00	12.00	180.00	Connect between A and B
D	2,000.00	8.00	250.00	Connect between A and B
E	4,872.00	28.00	174.00	Connect between A and B
F	2,600.00	10.00	260.00	Connect between A and B
H1	40,000.00	32.00	1,250.00	From Gate 2 to Bulk terminal
H2	9,600.00	32.00	300.00	Approach to Gate 2
J	24,000.00	24.00	1,000.00	Through Container Y to Bulk T/not connected
ENT-G2	10,500.00	30.00	350.00	Approach to Gate 1
L	4,950.00	15.00	330.00	Behind Bulk Pier
N	4,350.00	25.00	174.00	Connect between Container Yard II/closed
P	3,700.00	10.00	370.00	Connect between Bulk Terminal and H
R	4,760.00	14.00	340.00	in Bulk Terminal
S	1,520.00	8.00	190.00	Connect between Bulk Terminal and H
T	15,400.00	28.00	550.00	Connect between Container Terminal and H
ENT-V	680.00	8.00	85.00	Entrance to Vehicle Shed
ENT-A	1,600.00	8.00	200.00	Entrance to Shed Leased to AGMARESA
ENT-D	1,200.00	8.00	150.00	Entrance to D/DEMAG
TOTAL	167,156.00	-	-	

Source: APG

7) Private Facilities

65. Some private piers are located in the water area controlled by APG. Those facilities are listed in Table I-6-3. When the private sector has a plan to construct or improve its facility, it is necessary to get the approval of DIGMER.

66. In case that the ship comes to the private pier, the APG pilot should be on board. And also the APG's tug boat gives assistance for berthing if requested.

67. On the handling cargo at these private piers, cargo handling statistics are submitted to APG. APG processes the data and submits it to DIGMER together with the data on the cargo through the APG berths.

68. As shown in Figure I-6-5, the piers of INDUSTRIAL MOLINERA, MOLINOS DEL ECUADOR, LA FAVORITA,TIMSA,SIPRESA,ECUAGRAN and GANGEL are located along the Guayas River; FERTISA is in Estero Muerto.

69. There are some other small private piers that are used for domestic transportation. For example, some other small piers are found along the Guayas River. These are used for passenger transportation to the opposite side of the river, cruising along the river, small cargo transportation to Galapagos Island etc..

Table I-6-3 Private Facilities

NAME	LOCATION	Ship size max	Length (m)	Width (m)	Depth (m)
INDUSTRIAL MOLINERA	Rio	20.000	89.0	7.2	10.0
MOLINOS DEL ECUADOR	Rio	20.000	9.5	9.5	9.7
LA FAVORITA	Rio	5.000	9.0	6.0	7.0
TISMA	Rio	10.000	18.8	5.5	7.0
SIPRESA	Rio	10.000	25.0	9.5	8.8
FERTISA	Estero Muerto	10.000	65.2	7.9	11.5
Muelle ECUAGRAN	Rio	20.000	-	-	7.0
Muelle CANGEL	Rio	5.000	-	-	9.0
Muelle PESQUERA HERNANDEZ	Canal de Moro	3.500	110.0 90.0	20.0 22.0	10.0 10.0

Source; DIGMER

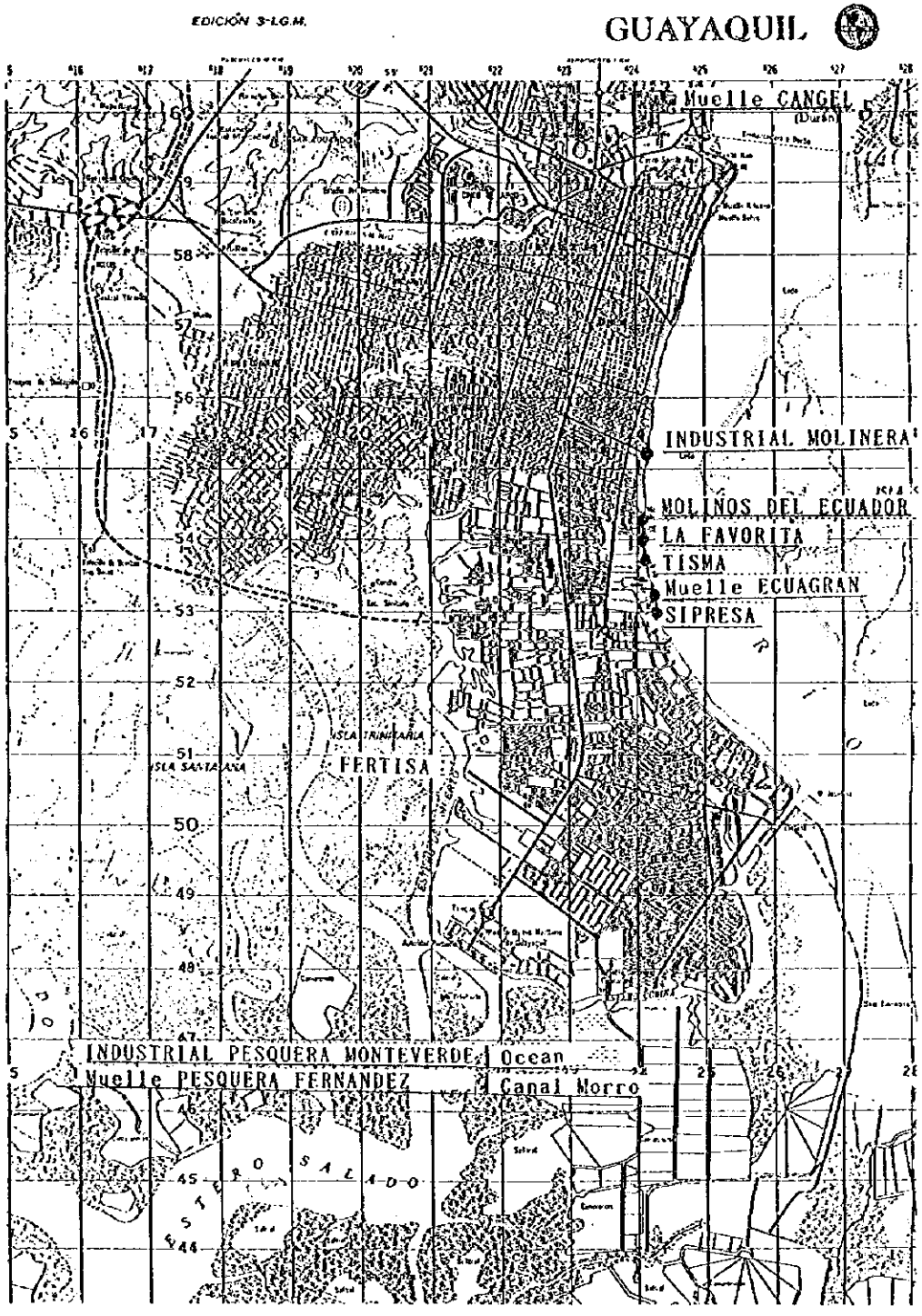


Figure I-6-5 Location of Private Facilities

C. Channel and Basin

70. The design dimensions of the basin in front of the wharf is 10.0 m deep and 122 m wide. According to DIGMER the depth of 10.0 m should be maintained between the headline of the wharf and the center line of the 122 m wide area, namely at a width of 61 m. According to the Pilot Division the present depth in front of berth No.2, 3, 4, 5 and D is about 29 feet(8.7 m). The result of the sounding survey is shown in Chapter 4. The basin area and surrounding area is shown Figure I-6-6.

71. The Port of Guayaquil has a long access channel in Estero Salado that is shown in Figure 5-7. There are 46 buoys positioned along the navigation route from "Boya de Mar" up to the terminal. According to APG's document the depth of the channel is 9.45 m and the width is 122 m.

72. The amplitude of the tide is approximately 2.0 m at the entrance of the channel and approximately 2.0 m at the berth according to APG's document. In this study the tide observation during 30 days was conducted and the result is described in Chapter 4.

73. The alignment of the channel runs approximately along the direction of the flow of Estero Salado, at almost all areas of which the velocity of the stream is low, less than 3 k't. Near Buoy No.22 and No.13, a velocity between 6 k't and 7 k't appears. Wave does not occur or only low wave appears. These oceanographic conditions do not significantly affect vessel navigation to the port.

74. The depth of the channel from the chart is described in Chapter 4. At the area between 0 km, namely, Boya de Mar, and 2 km from the buoy, between 13 km and 17.5 km and between 50 km and 60 km a depth of less than 9.45 m appears.

75. According to the Pilot Division and Hydrography and Dredging Division the lowest depth of 28 feet (8.5 m) appears at buoy No. 39. The ship with draft between 26 feet and 34 feet enters the port taking advantage of the high tide. They also pointed out that the critical areas for navigation are from buoy No. 5 to 12 and from No.33 to 39. The depth of these points is 33 feet (10 m) at high water level. They also say that the area between buoy No.36 to 62 is 28 feet (8.5 m) deep in M.L.L.W..

76. The sounding survey was conducted along the navigation route from the sea buoy to the port area in this study. Though the survey is along only one line, the result will give more information on the depth of the channel.

77. The quarantine area is designated between buoy No. 72 and 76. The depth of the area is more than 12 m in the chart. During quarantine procedure, the quarantine officer, the port captain and the other personnel concerned get on the ship and check the documents.

78. The responsibility of maintenance of the channel and basin belongs to APG, as are the dredging works which have been conducted by APG in recent years. The most recent dredging work was executed in 1990 in three parts of the channel. The design depth of the work is 9.3 m and 0.7 m of allowance and the width is 200 m at a part of the Pacific Ocean and 150 m at a part of Estero Salado.

79. A regular survey on the depth of the channel is not being conducted. The need for dredging is identified by experienced personnel.

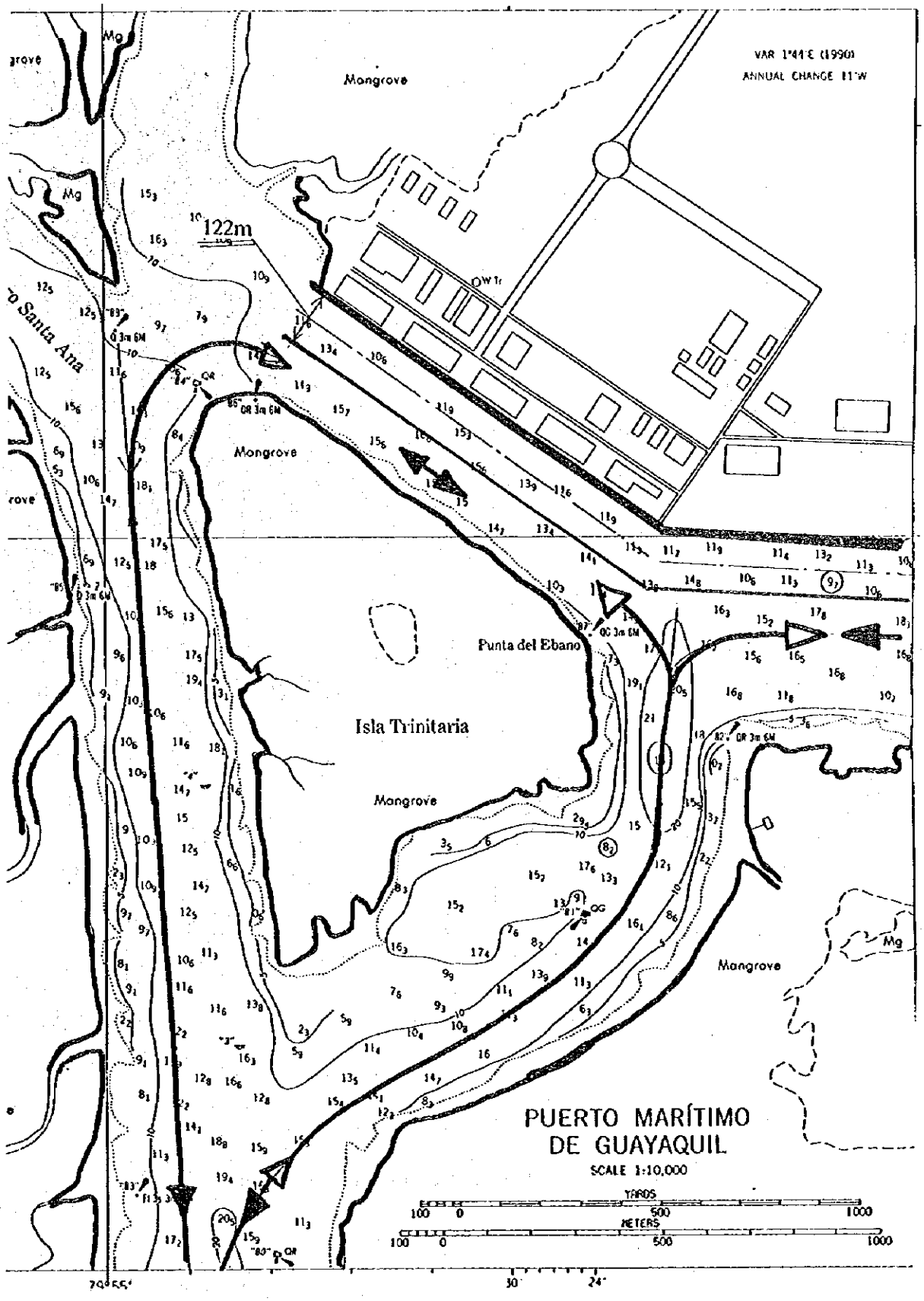


Figure I-6-6 Basin and Maneuvering Route

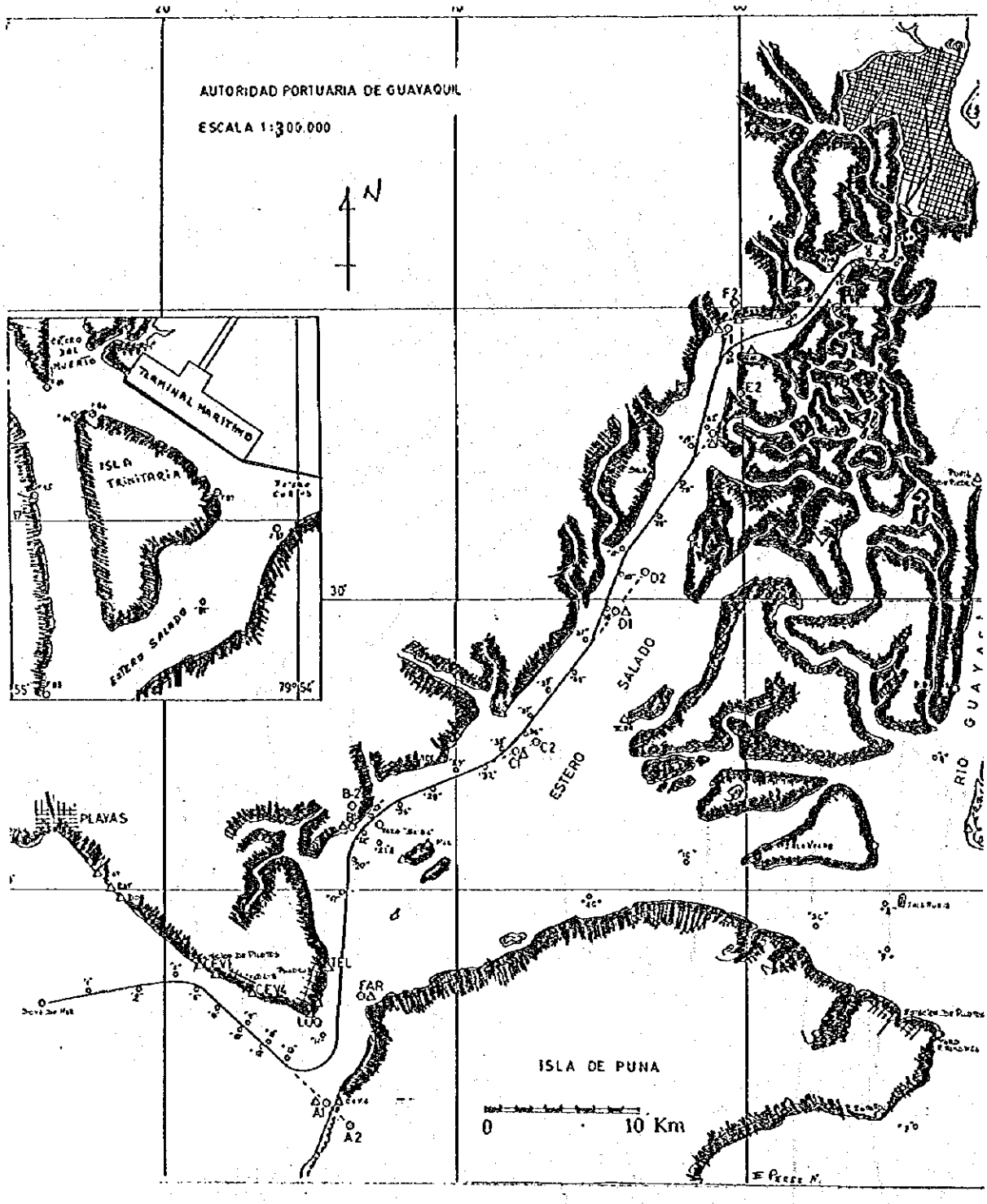


Figure I-6-7 Alignment of the Access Channel

D. Improvement Work under Planning by APG

80. The modernization of APG is one of the most important issues for APG. UNCEMP, which was established as the responsible organization for the modernization by the decision of CNNMP, works with the consultants contracted by IDB.

81. The work of UNCEMP consists of many items in which some expansion and/or improvement works of port facilities are included.

82. The recommendation on expansion and improvement of port facilities by UNCEMP is summarized as follows.

(a) necessity of berth
- (1) The warehouses next to berth 2, 3, 4, 5 and 6 interfere with smooth cargo handling and are almost not used.
- (2) The berths are not used for container, compared with berth 1, 1A and 1B because of the small depth of 27 - 30 feet and lack of a crane.
- (3) The construction cost of a new berth at the reserved area is not high.
- (4) The basin in front of berth 2, 3, 4, 5 and 6 should be deepened to accommodate the future ship size focusing 40 years after.
- (5) A berth suitable for container handling should be constructed.

(b) necessity of warehouse
- (1) The import cargo uses less warehouses than before.
- (2) Storage area for import/export container cargo is located in the port area and construction of warehouses for export cargo outside near the port is under consideration. This should be decided under the initiative of a concessionaire company.
- (3) The work should be selected between removal and selling of the warehouses to private companies and transfer to outside of the port and lease to a private companies. Number of warehouses to be removed is decided after study.

(c) berth
- (1) The container cargo should be also handled at the old port. And a gantry crane is necessary at the old port.
- (2) The berth should be reinforced and/or widened for installment of a gantry crane.

(d) gantry crane
- (1) 50,000 TEU container boxes are handled by one gantry crane at present. One more gantry crane is required for 130,000 TEU container cargo handling.
- (2) At first a new gantry crane of US$ 6.5 million should be installed at the container terminal.
- (3) A third gantry crane is situated after the related work.
- (4) The study on the necessity of more gantry cranes should be conducted.
- (5) The connection of rail between the old port and the container terminal is examined.

(e) conclusion

(1) Urgent Work

Transfer and/or removal of the warehouse No.2, 3, 4, 5, 6 for expansion of apron and container handling area Installment of a new gantry crane

(2) Next stage plan to be studied

Deepening of the channel

Deepening of the basin in front of berth 2, 3, 4, 5, 6 and reinforcement of berth

Installment of a 3rd crane and connection of rail for the crane

Berth construction suitable for container handling

83. Under this recommendation APG is preparing the implementation of the installment of a Gantry Crane at the Area of Berth 1 - 1B

84. On transfer and/or removal of warehouses, APG has the idea that the work should be executed after the full study on the future development of the port of Guayaquil.

85. In addition, APG also has the idea that a study on the following should be conducted from the wide and long-term point of view.

(1) Deepening of the channel

(2) Deepening of the basin in front of berth 2, 3, 4, 5, 6 and reinforcement of berth

(3) Installment of a 3rd crane and connection of rail for the crane

(4) Berth construction suitable for container handling

Chapter 7 ENGINEERING ASPECT

A. Structure of Existing Port Facilities

1) Dimensions and typical cross sections of existing port facilities

1. The plan of the Port of Guyaquil is shown in Chapter 6, and the dimensions of the existing port facilities are shown as below:

Table I-7-1 Demensions of Existing Facilities

Port Facility	Length	Water Depth (MLLW)	Number of Berth	Date of Completion
General cargo Berth	925.0 m	-10.67 m	5	1958 - 1980
Container Berth	555.0 m	-10.67 m	3	1980
Bulk cargo Berth	155.0 m	-10.67 m	1	1980

2. The structural types of the existing berths are the open-deck piers on the concrete piles, and their typical cross sections are shown in Figure I-7-1, I-7-2, I-7-3, respectively. As concerns the general cargo berth in Figure I-7-1, the cross section was estimated by the Study Team, because the existing berth differs from that in the Figure.

2) Conditions of Port Facilities

3. The current conditions of the existing facilities were inspected visually by the Study Team, and serious damages or impediments were not found on the existing berths, warehouses, and roads etc. The list of the inspection is shown in Table I-7-2.

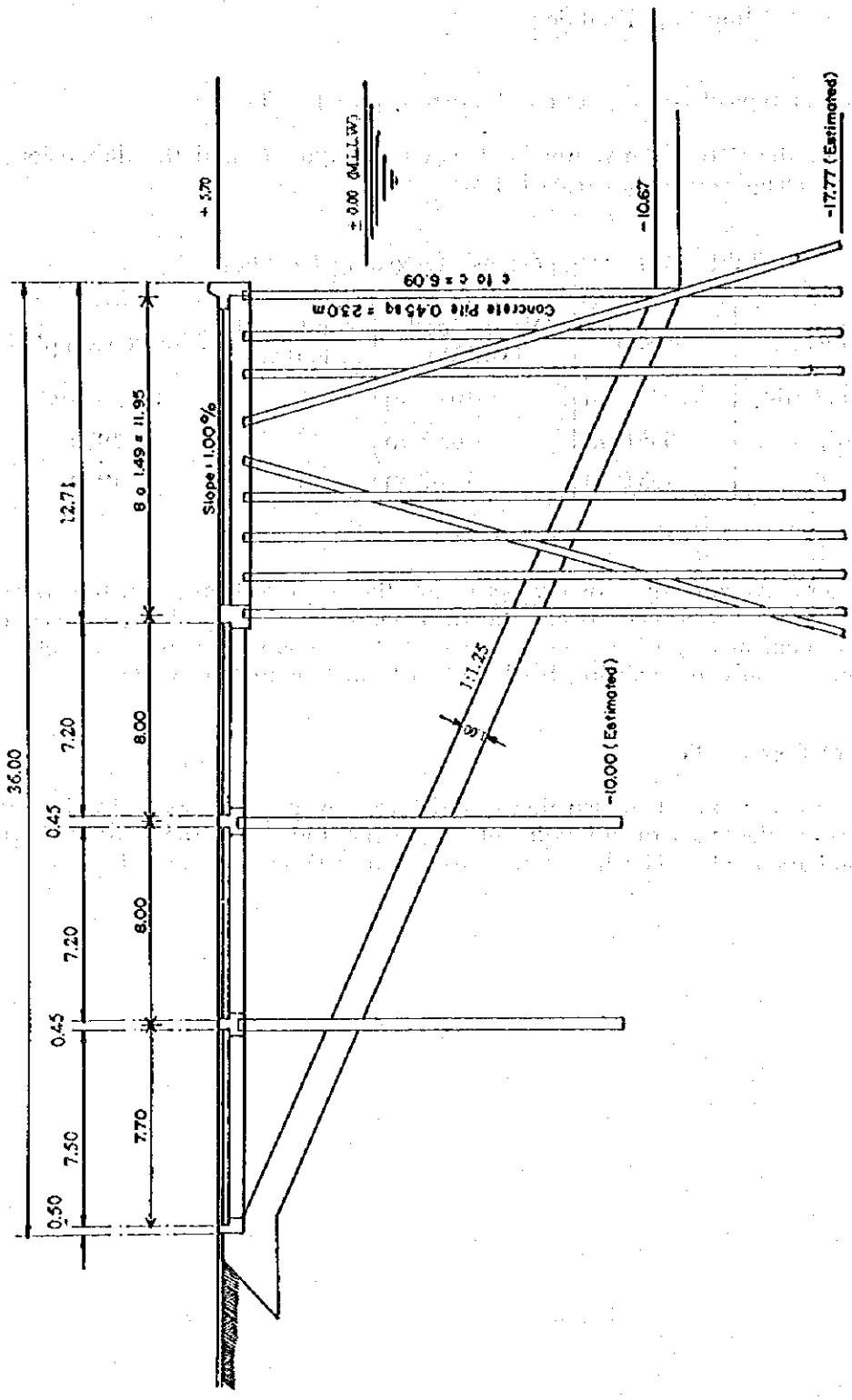


Figure I-7-1 Typical Cross Section of General Cargo Berth

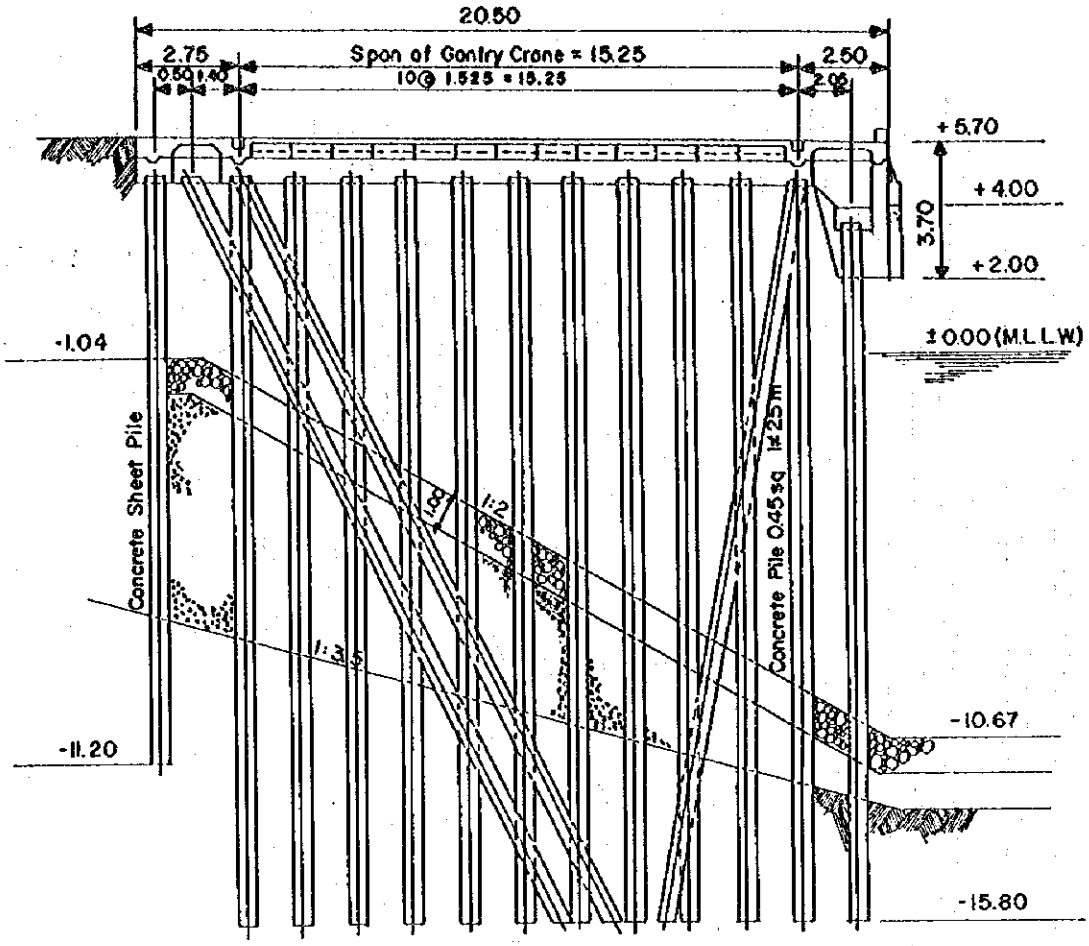


Figure I-7-2 Typical Cross Section of General Cargo Berth

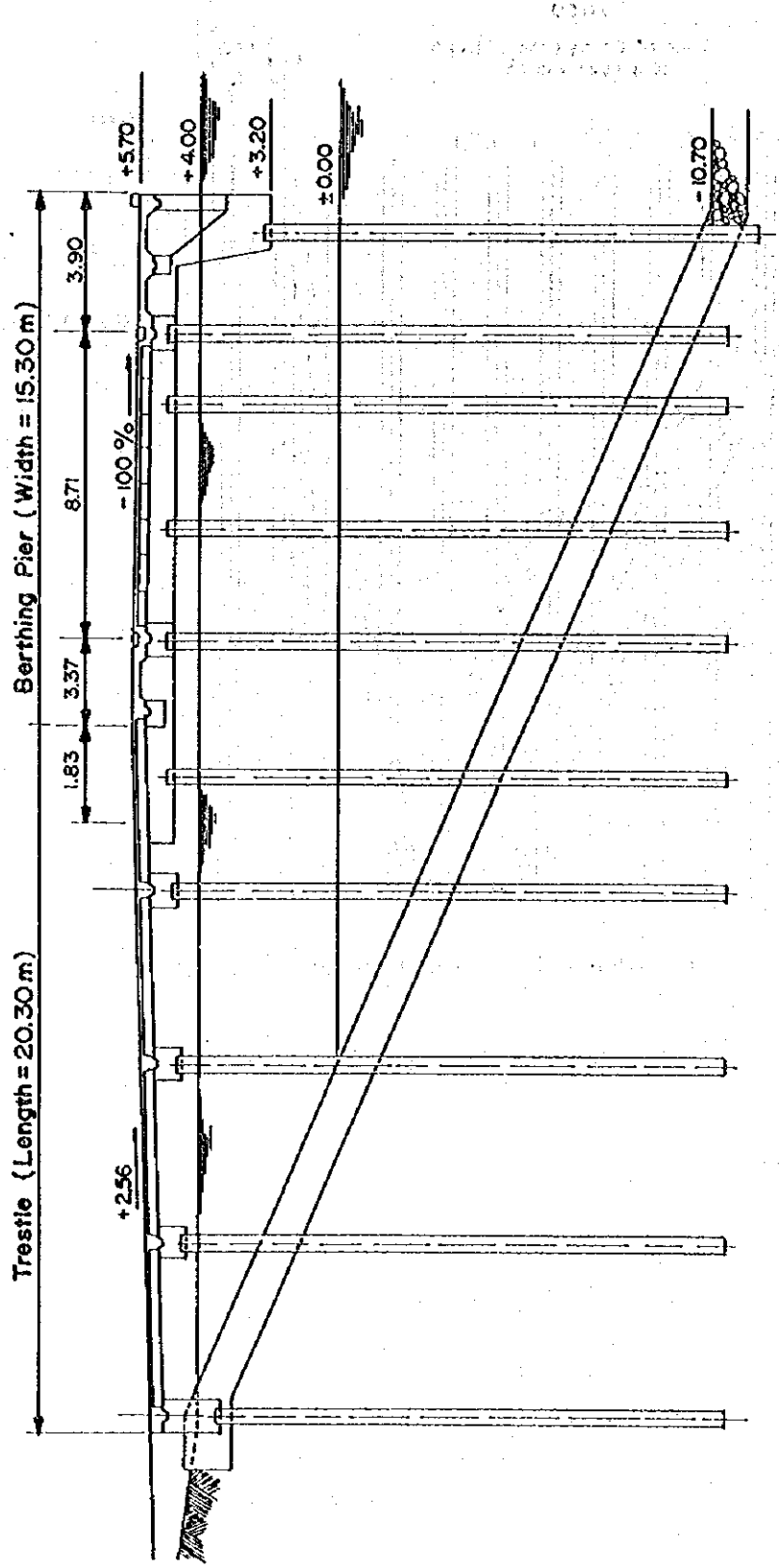


Figure I-7-3 Typical Cross Section of General Cargo Berth

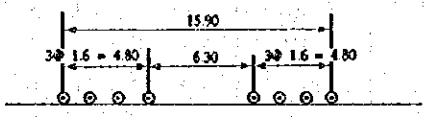
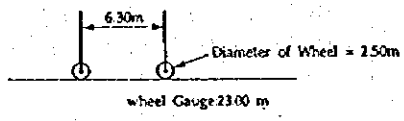
Table I-7-2 List of current conditions of port facilities
(as of September, 1994)

Facilities	Conditions	Remarks
Berth-2	Good on the whole	- There is a sinking of the pavement between Warehouse-2 and Container Berth, of 3.5 m^2 and 0.15 m deep.
Berth-3	Good on the whole	- There is 1 damaged concrete curb of 2 m long. - The cover at the water box is missing. - Apron Junction Gap located in the middle of Berth-3 is separated.
Berth-4	Good on the whole	- The Rubber Fender is missing. - There is a sinking of the pavement between Warehouse-4 & 5, of (4x4)m and 0.2 m deep.
Berth-5	Good on the whole	- There are three damaged spots along the concrete curb of 4 m long. - There is a sinking of the pavement between Warehouse-5 & 6, of 3x3 and 0.3 m deep.
Berth-6	Good on the whole	- The cover of the water box is missing. - There are two damaged spots along the concrete curb of 5.0 m long.
Container Berth	Good on the whole	- The rubber Fenders are too small. - The Concrete curb is partially damaged.
Marshaling Yard	Good on the whole	- The pavement has to be repaired partially.
Warehouse No. 2	Good on the whole	- The eaves are damaged.

3) Design Conditions

4. Design conditions of the container berth were noted in the drawing (WH-1S "General Arrangement Berth 1, 1A, and 1B, in 1975") and summarized in Table I-7-3.

Table I-7-3 Comparison of Design Conditions

Items	Container Berth in Guayaquil	Average in Japan
1) Live Load	5 t/m² (* 1)	Within the Crane : 1 t/m² Out of the Crane : 3 t/m²
2) Automobile	AASHTO, HS-20 or 40 ton Container Fork-lift or 20 ton Truck Crane	The same as in Guayaquil
3) Container Crane	1) Wheel Arrangement  Wheel gauge: 15.25 m Rail gauge: 15.15 m 2) Wheel Load 29,763 Kg at each rail with 25% impact	The same as in Guayaquil Generally, the Wheel load in Japan is more or less 40 ton
4) Straddle Carrier	1) Wheel Arrangement  2) Wheel Load (*2) The Wheel load is unknowns	
5) Berthing Impact	Vessels: 15,000 DW Velocity: 0.15 m/sec (normal)	Vessels: due to the planning Velocity: the same as in Guayaquil
6) Mooring Thrust and/ or Pull	50 tons per berth	15,000 G/T: 70 tons per one bollard 20,000 G/T: 70 tons per one bollard
7) Seismic Coefficient	No Criteria in the drawing	
8) Extra percentage of Allowable Stress in case of Earthquake	Dead Load + Seismic Force 33% up D.L. + 1/2 Live Load + S.F. 50% up D.L. + (D.L. + L.L) of Crane + S.F.50% up	D.L. + 2/1 Live Load + L;F, 50% up

Note: *1 Uniform Load of Container berth
Container size: 40 feet (12.19 m) x 8 feet (2.44 m)
Weight of full container : 17.3 t (Estimated)
Weight per 1 m² : 0.57 t
*2 Wheel Load of Container Crane
Total Weight on the rail in Guayaquil : 29.763 Kg/m x wheel base (15.9 m) = 473 t
Equivalent load of one wheel : 473 t/8 wheels = 59.13

5. As concerns the general cargo berth, no conditions or criteria were found in the drawings except the loading capacity of 2,929kg (approx. 3.0t) per square meters as found on the warehouse at the berth only.

B. Construction Work for Existing Facilities

1) General

6. The old Guayaquil Port located along the Guayas River had difficulties to maintain its water depth sufficiently in accordance with the advent of larger size vessels, so the new port financed by the World Bank was constructed at the deepest location of Estero Salado between 1955 and 1963. This sheltered location was chosen to avoid the construction of long break-waters, to facilitate large vessels and to realize an easy access to Guayaquil City.

7. The new port (the Guayaquil Port) was expanded by building the container terminal and bulk cargo terminal and modernizing the cargo handling activities. The container terminal is situated neighboring the general cargo terminal. The Guayaquil Port has a long access channel measuring about 90 km long and 122 m wide. It facilitates a maximum ship draft of 9.75 m.

8. APG has a port area of 95.4 hectares which are used for the port facilities. Besides, APG owns an undeveloped plain tract of 150 hectares.

Table I-7-4 Land Use Condition

Facility	Land Area (m^2)
Sheds and Warehouses	7,200
Open Storage Yard	244,000
CFS	14,400
Container Yard	63,070
Refrigerated Container Area	6,000
Others	619,330
Total	954,000

Existing berthing facilities are listed below:

Table I-7-5 Berthing Facilities at Guayaquil Port

Berth	Nos.	Total Length (m)	Apron width (m)	Water Depth (m)	Year of Const.
Container	3	555	30.5	-10	1980
General Cargo	5	925	12.2	-10	1963
Bulk Cargo	1	151	15.0	-10	1980
Small Crafts	1	46	-	-5	1980

2) Dredging

9. At Guayaquil Port, water areas designated as the port facility consist of water basin, inner channel and exterior channel. Special anchorages where ships may be held for quarantine or other inspection, or when queuing for service at the port, are not designated at the Guayaquil Port. Instead, the water area along the inner channel is available for the above purposes.

10. The Water basin in front of the berthing facilities is controlled by one-way traffic, and it is said that the ship's maneuverability is comparatively easy in spite of the long distance channel. On the other hand, water areas have to be dredged to maintain their depths.

11. Water areas are maintained by APG. Development of the channel and water basin are also planned and implemented by APG. But, ARMADA is interested in the water area development in the following manner.

- Development and maintenance of the water area should be implemented based on the coordination between APG and ARMADA.
- Water areas designated as the port facility are controlled for the navigation by APG except in emergency cases.

12. Dredging works were carried out four times after the construction of the Port of Guayaquil; 1961/60, 1967/68, 1974, 1989/90. The first one was the capital dredging in the year 1961/62 while the last one was done in the year 1989/90.

13. In 1986, the dredging work at the access channel and the water basin was planned by APG. Its original plan was as follows:

Table I-7-6 Planned Dredging Work (1986)

Year	Planned Area	Depth (m)	Width (m)	Length (m)	Dredged Vol. (m^3)
1990	Channel (1)	10.0	200	3,300	96,000
	Channel (2)	10.0	150	2,800	210,000
	Water Basin	10.0	230	2,500	

Note: * The dredger type is a trailer dredger (self-propelling trailing suction hopper dredger) with an estimated capacity of around 3,000 HP.

* Dumping areas are canal i.e. Estero Del Muerto that is 5 km from the Guayaquil Port as for "Water Basin" and the water area 7 km off Subida Alta apart from the channel as for "Channel" s respectively.

* Channel (1) is located 10 km deep into the channel from the entrance (between Buoy No. 2 and No. 5), and Channel (2) is 20 km deep into the channel (between Buoy No. 10 and Buoy No. 12). Above Channel (1) and Channel (2) are located at open sea. Water Basin means the water area in front of the wharves at Guayaquil Port.

14. Ecuador has not any kind of dredger and the last dredging was done by using a trailer dredger owned by the Belgian dredging company "Dredging International Co.". The trailer dredger was 3,000 HP equipped with a 2,000 m^3 hopper. Dredged areas included the inner channel, exterior bar and water basin in front of the wharves. The originally planned areas mentioned above were changed largely judging from the results of a bathymetric survey. Consequently, the dredged volume amounted to some 2.8 million cubic meters.

Table I-7-7 Actual Dredging Work (1990)

Year	Planned Area	Depth (m)	Width (m)	Length (m)	Dredging Vol. (m)
1989/90	Channel:	10.0	150	12,250	1,866,000
	Buoy 70-73			1,750	
	59-63			4,250	
	55-59			3,250	
	52-54			2,000	
	49-50			1,000	
	Channel:	10.0	150	4,250	290,000
	Buoy 59-63				
	Exterior Bar	10.0	150	4,250	315,000
	Buoy 9-12				
	Water Basin:	10.0	230	2,500	342,000
	Total				2,813,000

15. The total dredging cost was around US$5.38 million and the total cost was broken down as follows.

Table I-7-8 Dredging Cost

Dredging Cost	Amount
Direct Cost	US$ 3,643,000
Indirect Cost	1,192,400
(Mobilization, Demobilization Cost	928,300)
(Management Cost in Site	264,100)
Administration Cost	547,000
Total	US$ 5,382,400

16. So, the unit price of dredging is estimated to be some US$1.91 per one cubic meter as a whole. The above mobilization cost and demobilization cost are largely for the transportation cost of a trailer dredger and other equipment. As these costs are not proportionate to the dredging volume, the unit price is expressed below in general:

$$\text{Unit Price of Dredging} = \text{US\$ } 1.58 + \frac{\text{Mobilization Costs}}{\text{Dredging Volume}}$$

3) Berthing Facilities and Pavement

17. The general cargo terminal was evidently built in the early 1960s by a contractor from the USA. The land area behind the berths was constructed partly by reclamation: However the upper layers of soil foundation were weak and some settlements happened. The structural type of berthing facilities were designed as open type concrete deck with prestressed concrete piles. The apron has a 12.5 m width and is paved by portland cement concrete including its rear area (22.5 m). The berths have recently been equipped with V-shaped rubber fender system. The loading weight capacity at the general cargo terminal is 2,929 kg/m^2.

18. The container terminal was financed by the World Bank and constructed between 1980 and 1983. The main contractor was an American construction company having a local-based joint venture partner. The land area of the container terminal was reclaimed mostly by using the dredged materials from the water basin. Some settlements took place in those days, but it seems to be stable now. The structural type of berthing facilities is an open type concrete deck with prestressed concrete piles, the same as the general cargo berths. The apron (width: 30 m) including rail tracks (rail span: 15.25 m) for gantry crane is paved by portland cement concrete while the container yard is paved by asphalt concrete.

4) Buildings

19. There are six warehouses within the general cargo terminal. Warehouses are steel-framed one-story buildings of the propped portal type. The walls are made of concrete blocks and are finished with a coating of mortar and paint. The roofs are covered with corrugated steel plate and the floor is made of portland cement concrete. The rear-loading platform running the whole length of the warehouse has been adopted so trucks can be loaded or discharged without the use of fork-lift trucks. A crane is supposedly used to construct the framework and roofing of the warehouses which are relatively simple structures while the flooring and concrete block wall were mainly constructed labors.

20. There are two CFS at the container terminal measuring around 14,400 m^2 (120 m x 60 m 2 unit). Each CFS is a steel-framed one-story building with prefabricated dome. The walls are concrete blocks, the roofs are covered by prestressed concrete sheets and the floor is paved by portland cement concrete.

5) Maintenance

21. In general, although the port facilities and buildings at the general cargo terminal are ageing, they are well maintained and still in good condition.

22. At the container terminal, the pavement of the marshaling yard is almost gone, and some differential settlements were observed. So, the drainage system at the marshaling yard does not function properly and this might cause some damages to the container cargo during the rainy season.

23. The maintenance of the cargo handling machines supposedly has some problems and this adversely affects the cargo handling efficiency. As such, regular maintenance services are desirable to prevent the mechanical breakdowns of the machines. Following is a table showing the present condition of the cargo handling machines.

Table I-7-9 Present Condition of Cargo Handling Machines

Cargo Handling Machine	Operational	Out of Order	Total
Gantry Crane	1	-	1
Transfer Crane	2	1	3
Mobil Crane	4	1	5
Derrick Crane	-	1	1
Forklift, Toplifter	64	72	136
Tractor	12	7	19
Total	83	82	165

Chapter 8 PORT ACTIVITIES OF THE PORT OF GUAYAQUIL

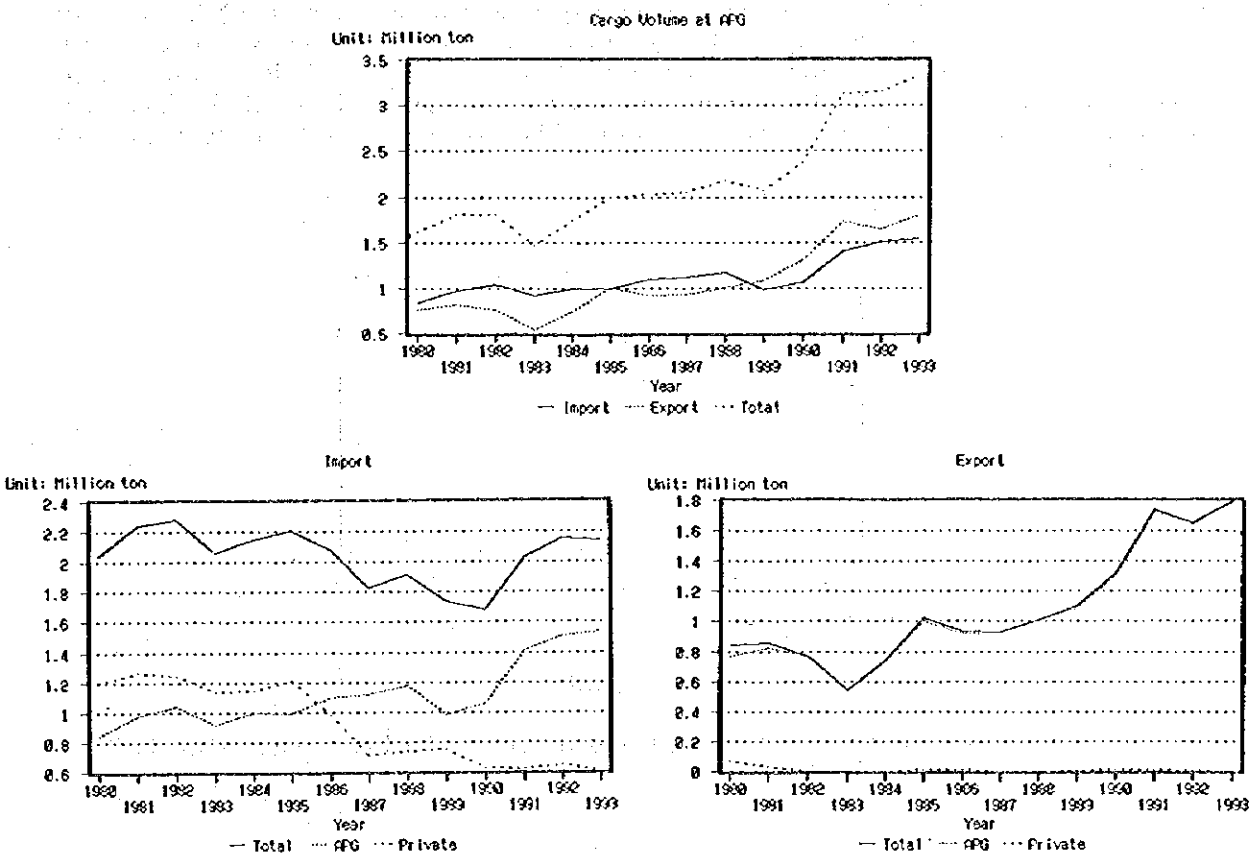
A. Handling Cargo

1) Cargo handled

1. Port Authority of Guayaquil has been the managing commercial port. The traffic data of commercial port consists of throughput at public ports and private berths. Figure I-8-1 shows the cargo volume in Guayaquil port and private berths.

2. Total cargo volume handled at the Guayaquil port (excluding private berths) was 3.3 million tons in 1993. The total cargo volume increased by 411,000 tons (1.25 times) from 1980 to 1985, and by about 1.3 million tons (1.65 times) from 1986 to 1993. Cargo volume in 1993 was 2.07 times larger than that in 1980.

3. Total cargo volume of Guayaquil port during the period was stagnant with an average annual growth rate of 5.7% in 1993. Negative growth in 1983 and in 1989 was attributable to export in 1983 and import in 1989. In 1983 export volume of banana and fish meal,decreased while in 1989 export volume of fuel & derivative and iron & steel decreased.



Source: DIGMER

Figure I-8-1 Cargo Volume (Included Private Berths) at Guayaquil Port

2) Commodity

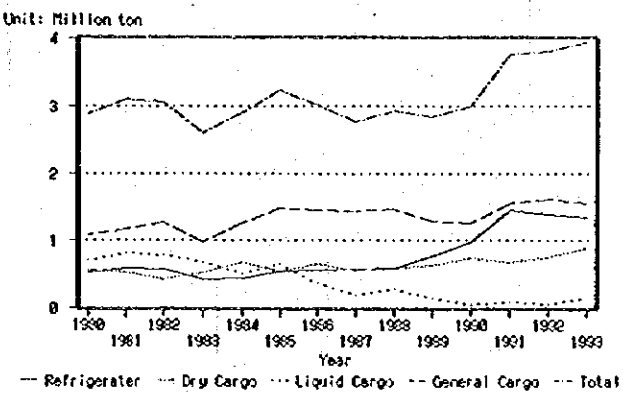
4. In import, wheat, chemical products, Iron & steel, fertilizer and paper & paper products are the five major commodities, which occupy about seven-tenths of imported cargo handling volume in Guayaquil port and private berths. This commodity trend has been maintained during the past thirteen years. Commodity trends from 1980 to 1993 are presented in Figure I-8-2.

5. Cargo handling volume of wheat, chemical products, iron & steel, fertilizer and paper & paper products are 444 thousand tons, 388 thousand tons, 264 thousand tons, 206 thousand tons and 205 thousand tons respectively in 1993. Annual growth rates of wheat, chemical products, iron & steel, fertilizer and paper & paper products are 2.6%, 4.9%, 0.3%, 6.9% and 8.4% respectively from 1980 to 1993.

6. In export, banana, fish & crustacea, coffee and cacao are the four major commodities, which occupy about 90 % of exported cargo handling volume. Cargo handling volume of these commodities are 1.3 million tons, 101,000 tons, 2,000 tons and 58,000 tons respectively. Annual growth rates of the four commodities are 8.1%, 21%, 6.4% and 13% respectively from 1980 to 1993.

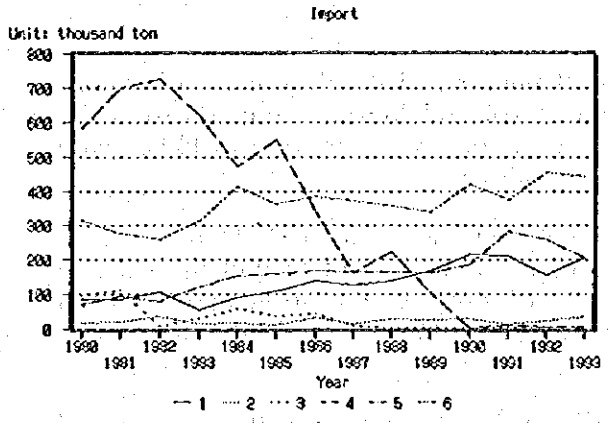
3) Package type

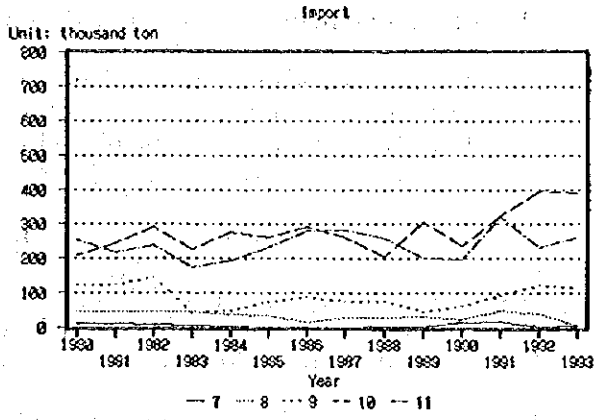
7. General cargo handling volume was the largest in package type in 1993. Share of general cargo was 39%. Refrigerated cargo followed with 34%, after which came dry cargo (23%) and liquid cargo(4%). Figure I-8-3 shows volume of liquid bulk cargo decreased from 1981. On the other hand, general cargo and dry bulk increased constantly. Refrigerated cargo increased from 1983 to 1991, but from 1991 to 1993 deceased slightly.

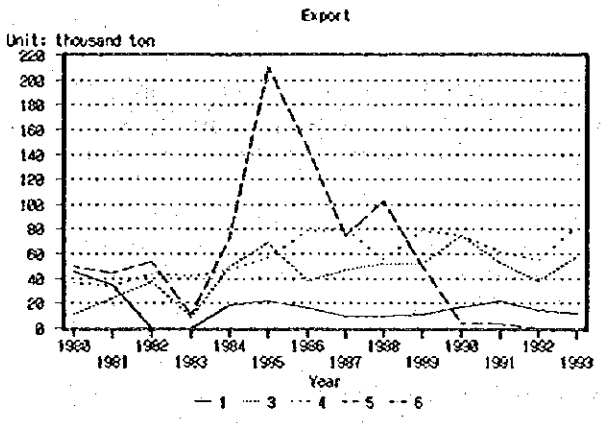


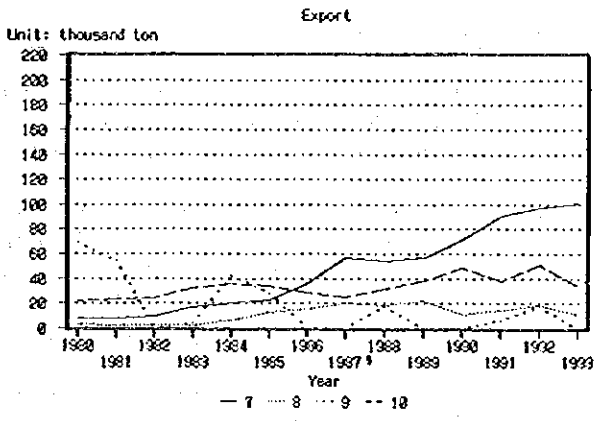
Source: DIGMER

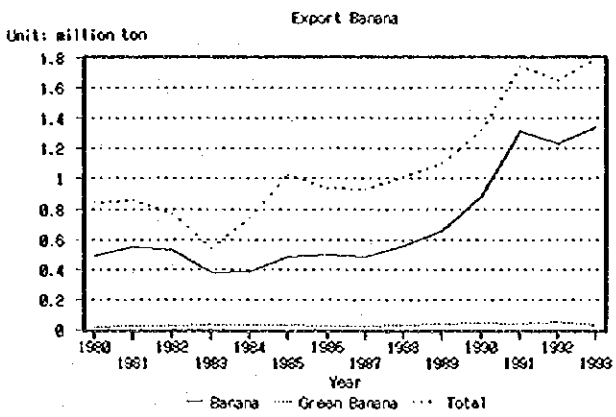
Figure I-8-3 Package Type of Cargo (Included Private Berths) at Guayaquil Port











Import
1 Fertilizers
2 Oat
3 Cement and construction material
4 Fuel and derivative
5 Paper and paper products
6 Wheat
7 Animal Oil
8 Vegetable Oil
9 Vehicles and machinery
10 Chemical products
11 Iron, steel and other material
12 Other products

Export
1 Sugar
2 Banana
3 Cacao
4 Coffee
5 Fishmeal
6 Sesame
7 Fish, crustaces and molluses
8 Wood and balsa wood
9 Molasses
10 Green banana
11 Other products

Source: DIGMER

Figure I-8-2 Main Commodity (Included Private Berths) at Guayaquil Port

4) Cargo movement of origin and destination

8. Figure I-8-4 shows the trend on the origin of import and the destination of export. Major countries of import are, the USA, Canada, Brazil and Mexico. Imports from the USA have been increasing annually with a growth rate of 2.8% from 1986 to 1993. Share of USA was 43% in 1993. Total share of three counties was 56%.

9. First major country of export is also the USA, but there was a slight decrease in the export volume from 1990 to 1993. Exports of Belgium, Second behind the USA in terms of volume, increased 1.7 times from 1990 to 1993 on the strength of banana exports, the export volume of which increased by 213,000 tons. The third country was Chile. Total share of three countries was 63%.

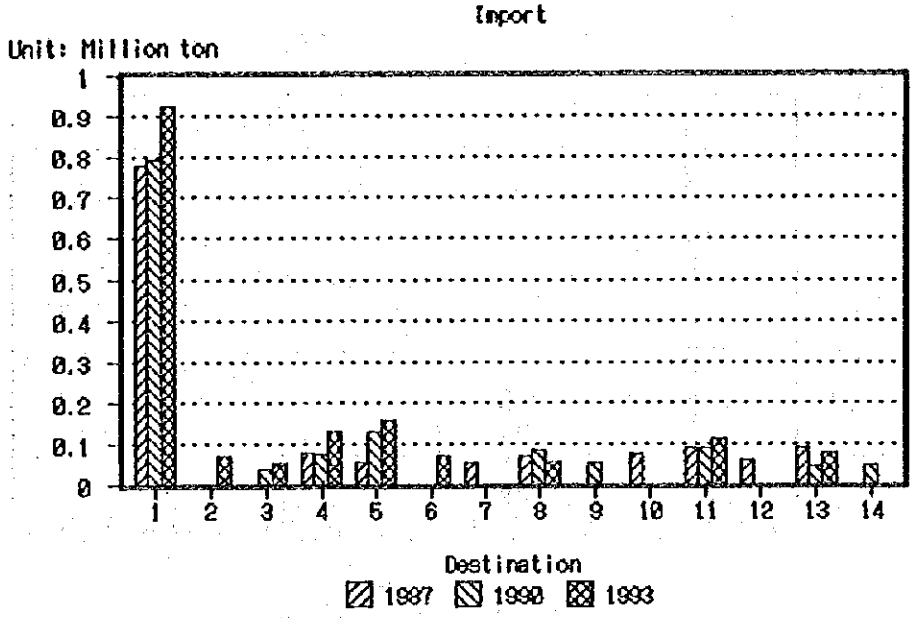
10. Figure I-8-5 shows cargo movement of destination to provinces from Guayaquil port. Main destination is Guayas province (74%), followed by Pichincha province (22 %) and Azuay province (3%).

5) Container cargo

11. The container cargo volume is 3.3 million tons, 78,551 No were handled in 1993, and the annual growth rate was 19% in weight and 16% in No from 1980 to 1993. The major commodities in containers are banana, coffee, chemical product, shrimp and cocoa.

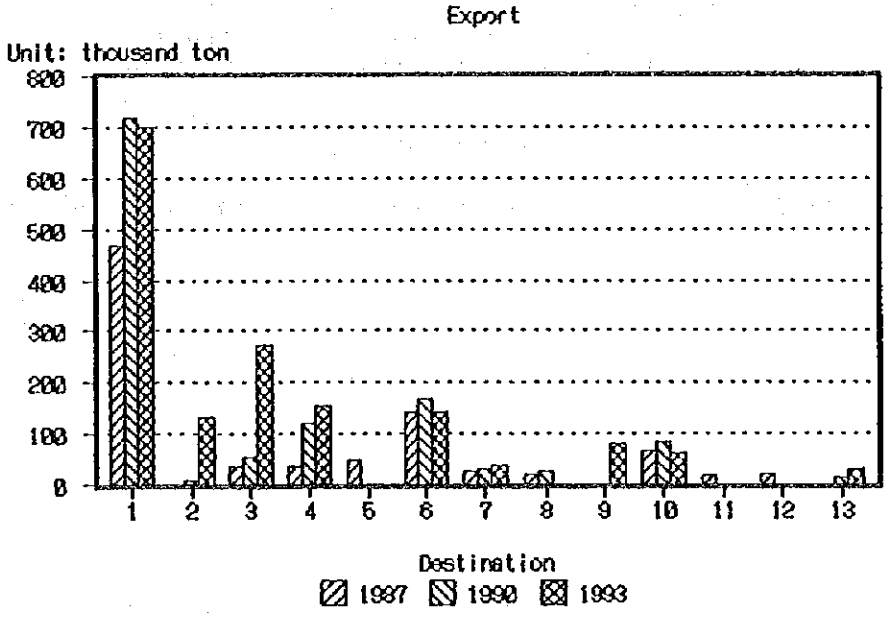
12. Ratio of containers (total 78,551 No) to total was 36%, of which 35% (37,208 No) in case of import and 37% (41,343 No) in case of export in 1993. Average weight of a container was approx. 15 tons/No. Summary of container cargo is shown in Table I-8-1. Figure I-8-6 illustrates the past records of container cargo by import and export operations. Since 1989 import was in excess of export.

13. Total container volume including empty was 126,627 No. Empty container was 38% of total container. Empty container of import was 1.4 times larger than that of export.



Import

1	USA	6	Colombia	11	Mexico
2	Australia	7	England	12	South Affrica
3	Belgium	8	Germany	13	Spain
4	Brazil	9	Guatemala	14	Venezuela
5	Canada	10	Japan		

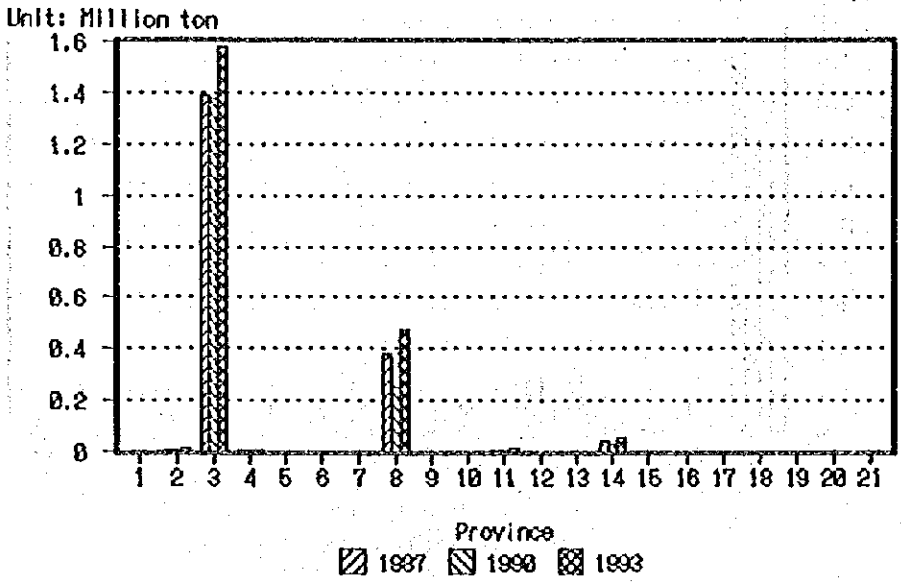


Export

1	USA	6	Germany	11	Panama
2	Argenrina	7	Holland	12	Peru
3	Belgium	8	Ireland	13	Spain
4	Chile	9	Italy		
5	Colombia	10	Japan		

Source: DIGMER

Figure I-8-4 Cargo Movement of O/D in International Trade



No	Province	No	Province	No	Province
1	Esmeraldas	8	Pichincha	15	Loja
2	Manabi	9	Cotopaxi	16	Napo
3	Guayas	10	Bolivar	17	Pastaza
4	El Oro	11	Tungurahua	18	Morona
5	Los Rios	12	Chimborazo	19	Zamora
6	Carchi	13	Canar	20	Galapagos
7	Imbabura	14	Azuay	21	Sin Datos

Source: DIGMER

Figure I-8-5 Cargo Movement of Destination to Each Provinces

Table I-8-1 Container Cargo at Guayaquil Port

Unit: No

	Full container			Empty container			Ground Total		
	Import	Export	Total	Import	Export	Total	Import	Export	Total
1980	8,138	3,859	11,997	1,461	3,640	5,101	9,599	7,499	17,098
1981	10,647	4,685	15,332	1,982	6,002	7,984	12,629	10,687	23,316
1982	12,791	5,908	18,699	2,529	7,516	10,045	15,320	13,424	28,744
1983	12,123	6,525	18,648	3,415	7,883	11,298	15,538	14,408	29,946
1984	17,418	9,707	27,125	4,409	10,585	14,994	21,827	20,292	42,119
1985	19,600	12,896	32,496	5,770	11,643	17,413	25,370	24,539	49,909
1986	21,551	13,212	34,763	6,814	12,720	19,534	28,365	25,932	54,297
1987	22,591	15,016	37,607	8,502	13,685	22,187	31,093	28,701	59,794
1988	19,553	15,285	34,838	8,558	11,578	20,136	28,111	26,863	54,974
1989	21,832	27,702	49,534	19,588	11,772	31,360	41,420	39,474	80,894
1990	25,298	33,800	59,098	25,352	12,581	37,933	50,650	46,381	97,031
1991	33,345	37,986	71,331	24,813	17,362	42,175	58,158	55,348	113,506
1992	36,498	36,599	73,097	22,371	19,658	42,029	58,869	56,257	115,126
1993	37,208	41,343	78,551	28,312	19,764	48,076	65,520	61,107	126,627

Source: DIGMER

	Cargo		Unit: ton	Container		Unit: ton	Containerization (%)		
	Import	Export	Total	Import	Export	Total	Import	Export	Total
1980	845,722	762,452	1,608,174	74,042	46,493	120,535	8.8	6.1	7.5
1981	979,851	821,073	1,800,924	103,559	57,314	160,873	10.6	7.0	8.9
1982	1,038,318	770,034	1,808,352	123,737	70,358	194,095	11.9	9.1	10.7
1983	919,845	542,715	1,462,560	127,088	78,705	205,793	13.8	14.5	14.1
1984	998,113	739,701	1,737,814	192,932	123,745	316,677	19.3	16.7	18.2
1985	994,103	1,004,033	1,998,136	236,388	187,031	423,419	23.8	18.6	21.2
1986	1,100,530	923,290	2,023,820	275,767	211,961	487,728	25.1	23.0	24.1
1987	1,116,379	923,290	2,039,669	294,762	251,577	546,339	26.4	27.2	26.8
1988	1,174,541	931,427	2,105,968	257,801	253,567	511,368	21.9	27.2	24.3
1989	982,481	1,089,602	2,072,083	295,144	483,398	778,542	30.0	44.4	37.6
1990	1,060,069	1,308,923	2,368,992	341,434	571,245	912,679	32.2	43.6	38.5
1991	1,412,767	1,725,141	3,137,908	477,120	639,096	1,116,216	33.8	37.0	35.6
1992	1,507,226	1,647,981	3,155,207	507,300	609,115	1,116,415	33.7	37.0	35.4
1993	1,538,371	1,792,304	3,330,675	539,243	668,353	1,207,596	35.1	37.3	36.3

Source: Anuario Estadistico, APG

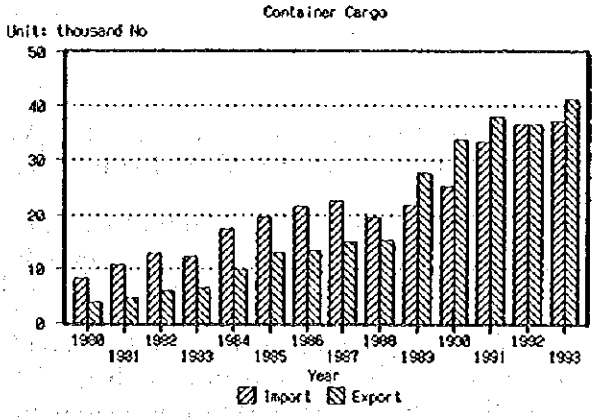


Figure I-8-6 Trend of Container Cargo in Guayaquil Port

6) Transhipment cargo

14. Transhipment cargo has increased recently according to the Port Authority of Guayaquil. APG cut down the handling tariff of transhipment for container by 22% for 20 foot containers and by 37 % for 40 foot containers in July 1994. These measure is expected to increase the volume of transhipment cargo.

15. Past data of transhipment has not took statistic because the form of cargo statistic did not increased an item of transhipment by DIGMER. Total volume of transhipment is unknown.

16. Origin and destination of transhipment shows the original document. For example, Container 20' was handled from California to Costa Rica. Valve (299 cartons) was handled from Italy to Colombia. Container (2 Nos) was handled from Chili to Mexico.

17. The past trend of transhipment cost is shown in Table I-8-2. Income generated by transhipment has not grown at a remarkable rate.

Table I-8-2 Income of Transhipment Cargo

	Unit: thousand sucre				Unit: thousand US$			
Unloading & Loading	1990	1991	1992	1993	1990	1991	1992	1993
Cargo	9,590	15,820	28,178	18,173	12	14	16	10
Container 20'	46,018	34,733	93,931	51,146	66	31	59	32
Container more than 20'	26,520	29,280	36,104	39,120	37	27	23	21
Total	82,128	79,833	158,213	108,439	115	73	98	63

Source: APG, 'Balance de Comprobacion'
'Diario Auxiliar de Cuentas Varias Correspondient'

B. Calling Vessel

1) Ship call

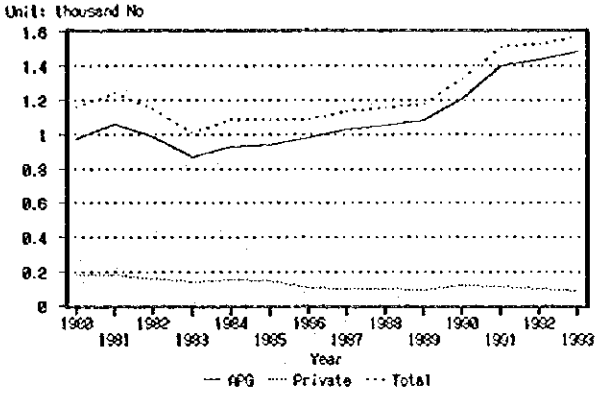
18. Table I-8-7 shows the number of vessels calling at Guayaquil port. In 1993, 1,479 vessels called, ship call increased by 614 calls (1.71 times) from 1984 to 1993. Annual growth rate was 5.5% between 1983 and 1993.

2) Vessel type and size

19. Table I-8-8 shows vessel size (including at private berth). Vessels from 150-159 m length represented the largest group. Vessel from 140-149 m have decreased since 1991.

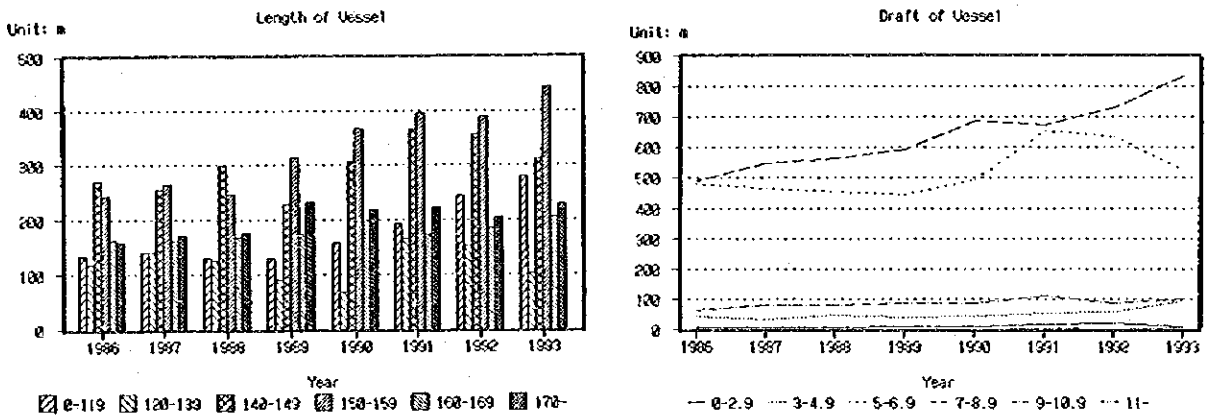
20. Ship call of draft 7-8.9 m increased annually; ship call in 1993 was 1.7 times larger than that in 1980. Ships with a draft 5-6.9 m followed, though this group has been decreasing since 1991. All others registered less than 100 ship calls.

21. Table I-8-9 shows share of cargo volume carried by Ecuadorian vessels. Cargo volume handled by Ecuador was 425,000 tons in import, 162,000 tons in export in 1993. Share was 20% in import and 9% in export, recently it shared to decrease.



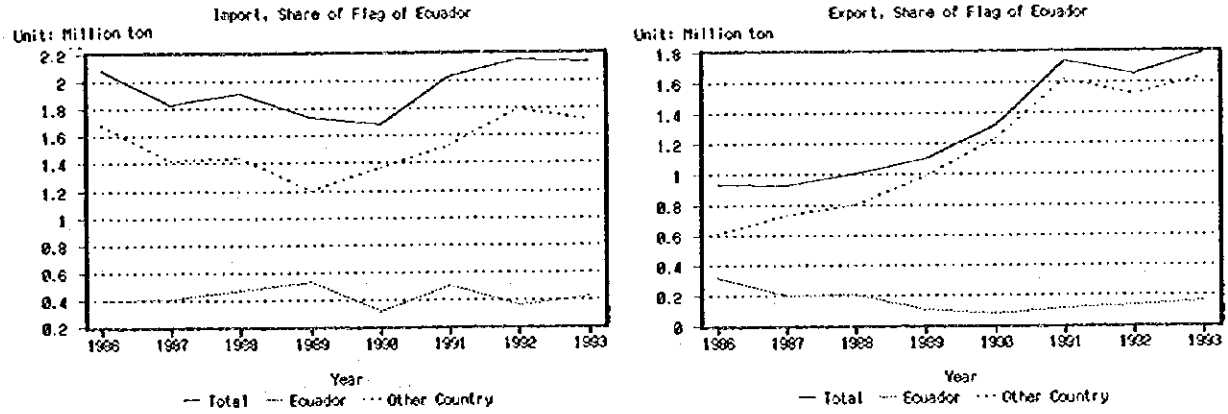
Source: DIGMER

Figure I-8-7 Ship Call in Guayaquil Port



Source: DIGMER

Figure I-8-8 Size of Vessel (Included Private Berths) at Guayaquil Port



Source: DIGMER

Figure I-8-9 Share of Flag of Ecuador

Chapter 9 UTILIZATION OF PORT FACILITIES

A. Utilization of Berth

1. The number of ships and the total staying time at each berth are reported in the annual statistics book of APG. The present situation and tendency of use of APG's wharf is analyzed with these data. In 1993, the number of ships and the time occupied by ships are listed in Table I-9-1. The cargo through each berth is also listed in the table.

Table I-9-1 The number of ships and staying time

	Number of Ships	Staying Time(hour)	Cargo Volume(ton)
Berth 2	145	6,705	413,111
Berth 3	149	6,269	366,066
Berth 4	165	6,233	293,892
Berth 5	148	6,591	282,321
Berth 6	144	6,383	282,507
Berth 1	250	6,206	424,455
Berth 1A	241	5,959	376,276
Berth 1B	162	6,613	517,318
Berth D	60	5,964	374,729
Total	1,464	6,324(mean)	3,330,675

Source; APG's Annual Report on Statistics

2. The time trend of the number of the ships at each berth and staying time by ships and cargo volume through each berth are shown respectively in Figure I-9-1 and Figure I-9-2.

3. The number of the ships at the berth in the old port shows a decreasing tendency from 1980 till 1984 but from 1985 till 1989 there is no marked fluctuation. In fact, in these four years, the number had been increasing. The staying time of ships had a similar tendency.

4. Since the construction of the container terminal in 1980, the number of ships at each berth is increasing. On the other hand the staying time does not display a clear tendency.

5. The number of ships at the bulk terminal does not have a clear tendency but the staying time of ships has been increasing.

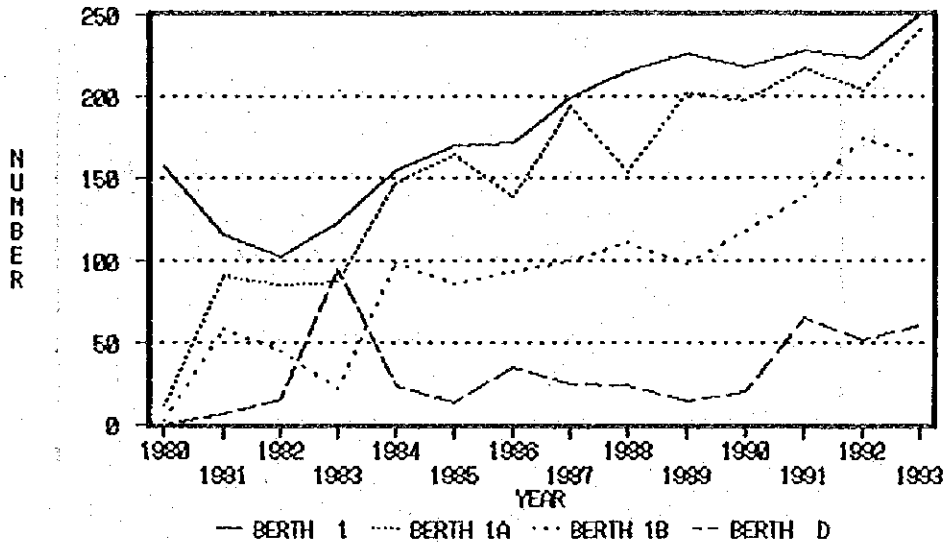
6. The cargo volume of import and export through each berth is shown in Figure I-9-3. Both import and export cargo are handled at every berth but export cargo exceeds the import cargo at berths 1, 1A and 1B. On the other hand the import cargo exceeds the export cargo in berth D for bulk cargo handling.

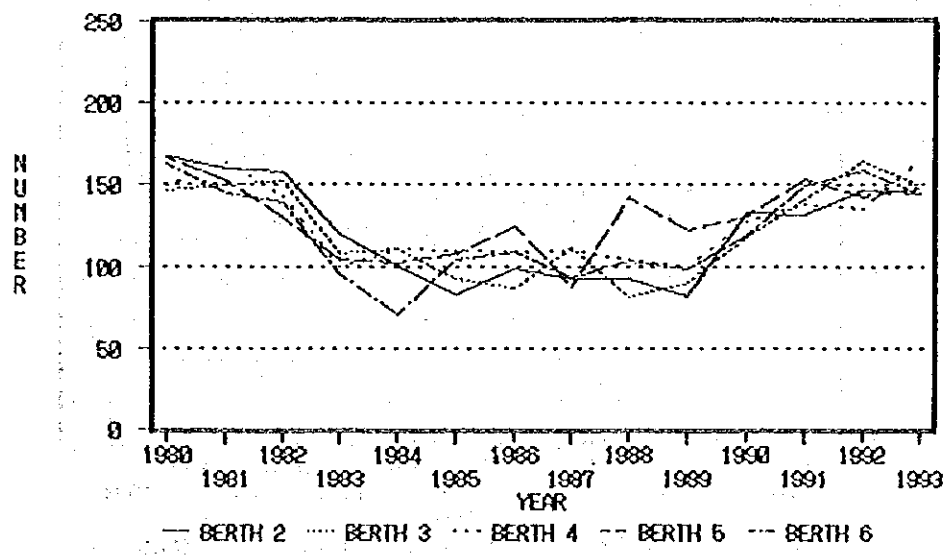
7. The berth occupancy ratio is a useful index to determine the extent of the utilization of berths and the port itself. The result that is calculated by dividing the berthing time of ships by one year is shown in Figure I-9-4. The occupancy ratio of each berth is more than 60% in almost all cases. Especially in 1992 all berths but 1A have a ratio of more than 80%. The port berth occupancy ratio as a whole was approximately 60% after 1980 till 1990, but after 1990, the ratio has increased, reaching 0.866 in 1991, 0.834 in 1992, and 0.722 in 1993.

8. The utilization of berth will be grasped from another point of view by dividing the figure of cargo volume by the number of ships or the staying time. The former indicates the average cargo volume of one ship and the latter indicates the average berth cargo volume per hour. Figures in recent years are shown in Figure I-9-5 and Figure I-9-6.

9. In addition to the berth analysis utilization as a whole, another analysis was conducted on the document prepared by the Operation Department. The document is prepared for the berth allocation twice, daily at 10:00 and at 16:00. The form consists of four parts. The first one and the second one cover information of existing ships at each berth and at the quarantine area. The third one provides information of the ship arrival at the entrance of the access channel and the fourth one gives information on ships which have left the port within the previous 24 hours.

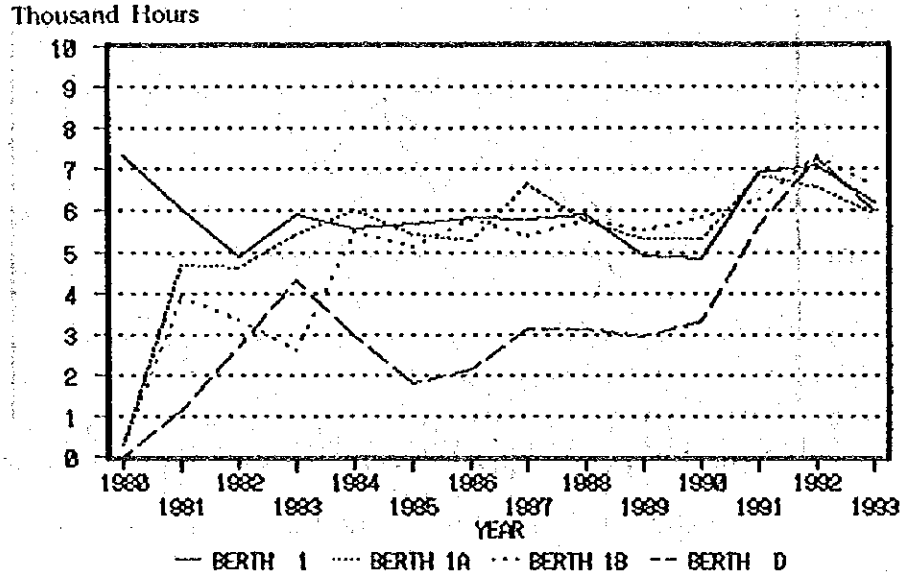
10. The analysis was performed on the data of July 1994. The result is shown in Figure I-9-7. According to the graph there seems to be a constant utilization of berths. There are fifteen days when ten vessels stay at berths in the port at the same time. Berth 1 and 1A are used every day and berth 5, 1B and D are used almost every day. Moreover, a ship is sometimes moored at the area covering two berths or protrudes from a berth.

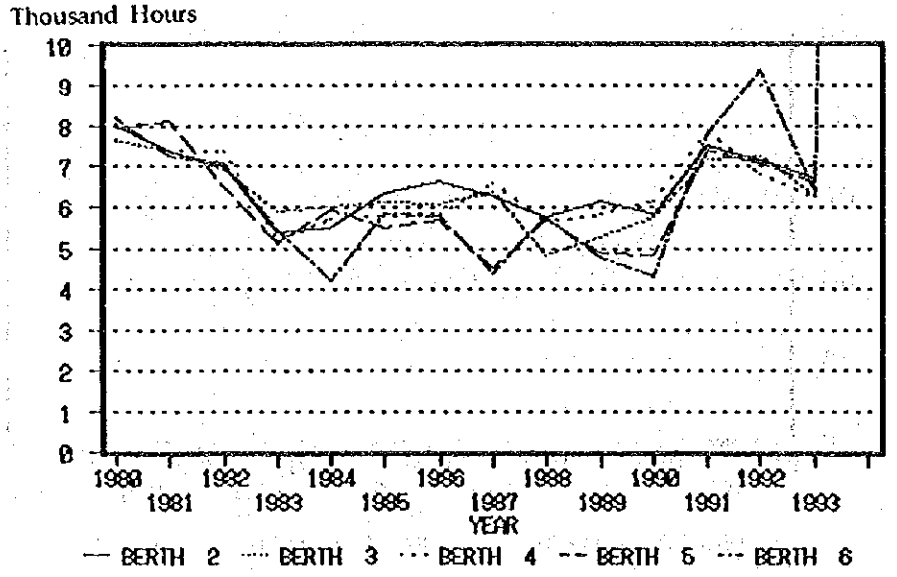




Source; APG's Annual Report on Statistics

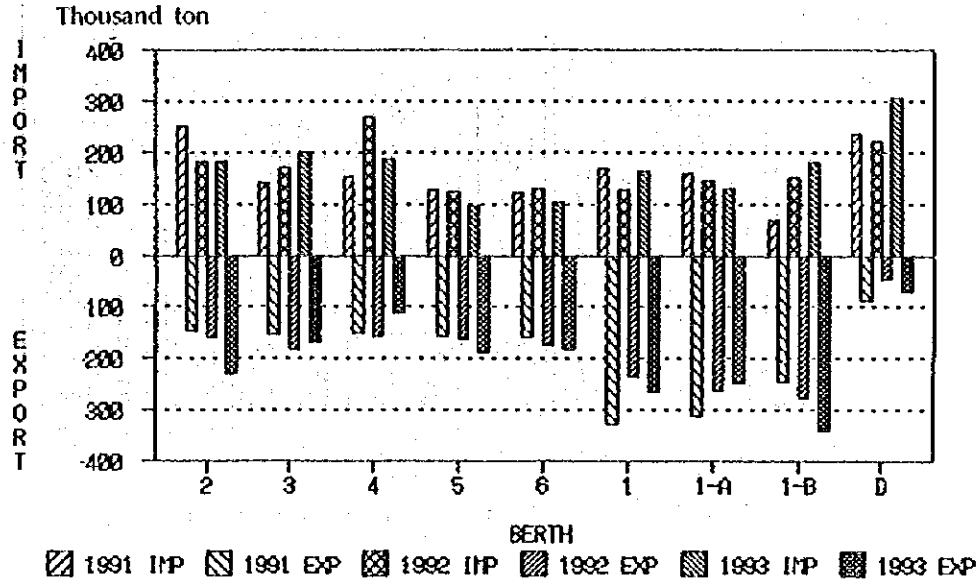
Figure I-9-1 The Number of Ships at Each Berth





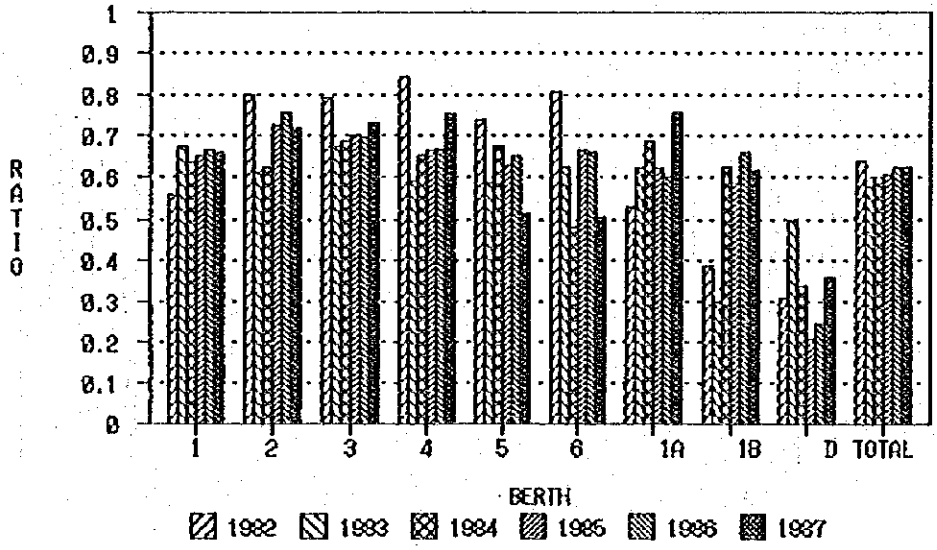
Source; APG's Annual Report on Statistics

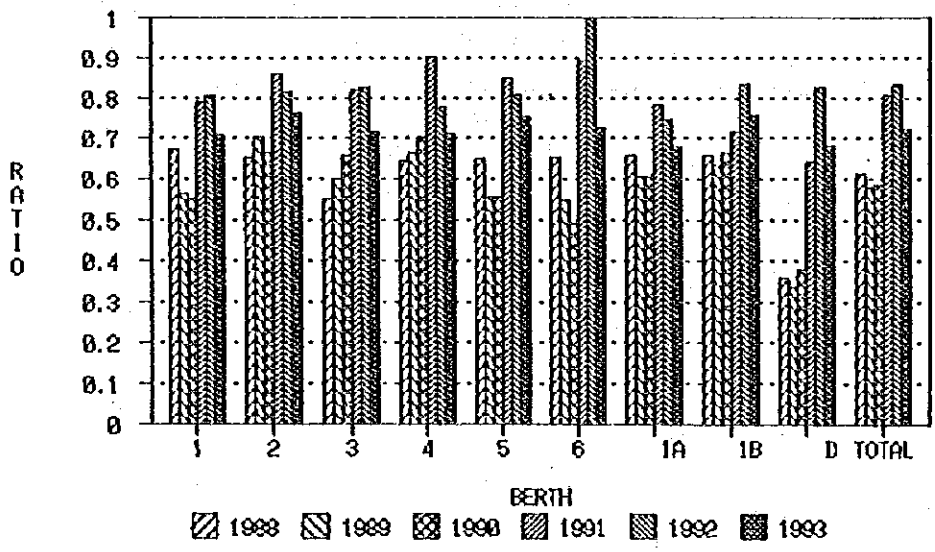
Figure I-9-2 Occupied Time by Ships at Each Berth



Source; APG's Annual Report on Statistics

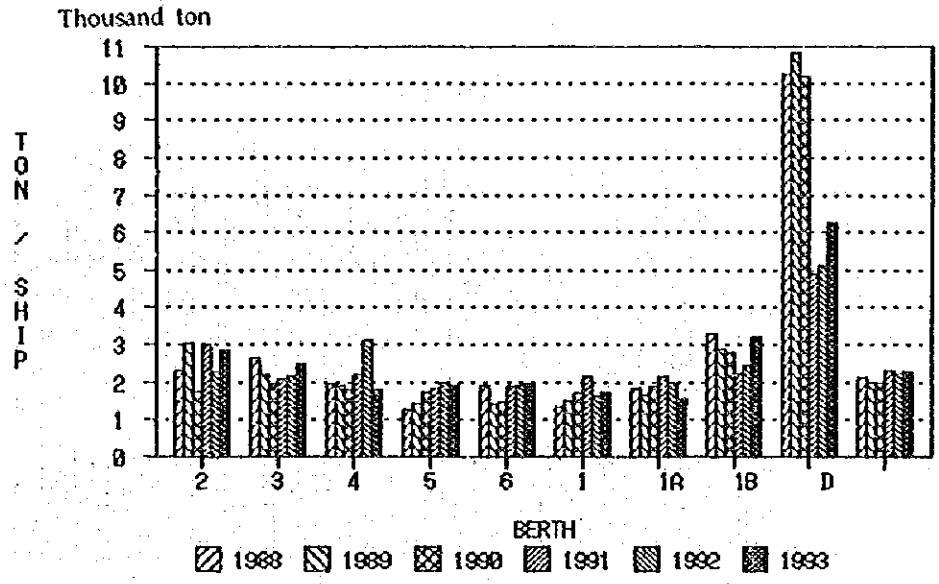
Figure I-9-3 The Volume of Cargo through Each Berth





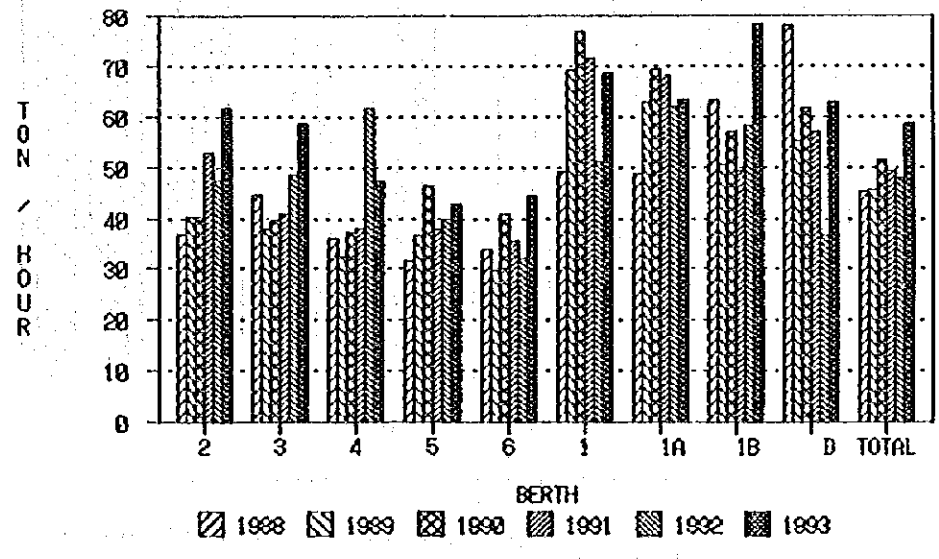
Source; APG's Annual Report on Statistics

Figure I-9-4 The Berth Occupancy Ratio at Each Berth



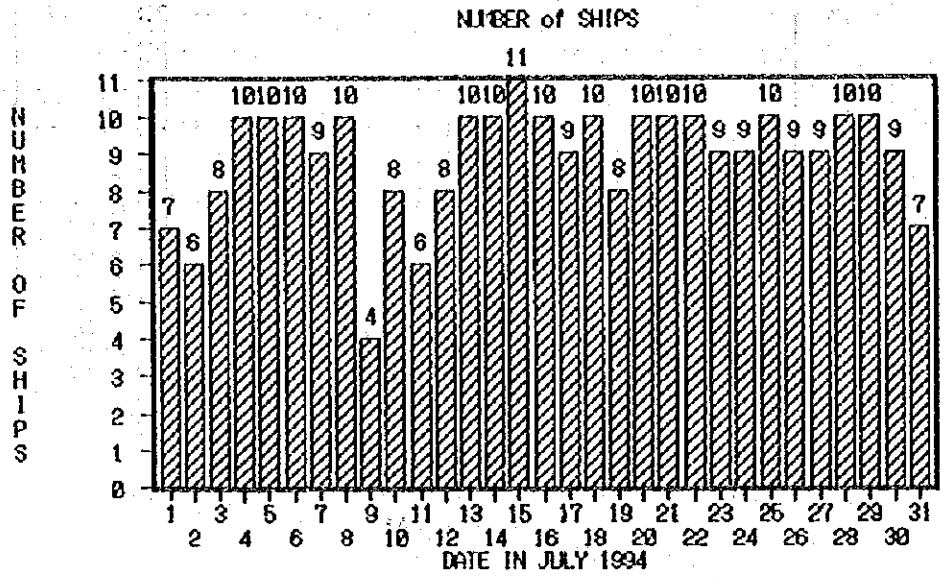
Source; APG's Annual Report on Statistics

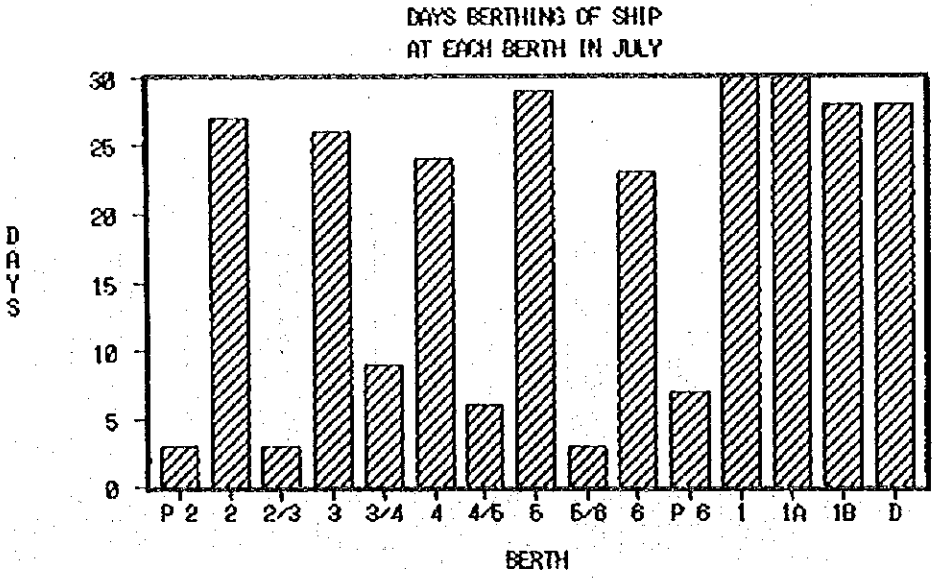
Figure I-9-5 Cargo Volume per Each Ship



Source; APG's Annual Report on Statistics

Figure I-9-6 Cargo Volume per Berthing Time





Source; Material by Operation Department

Figure I-9-7 Number of Ships in the Port and Days of on-Berth in July 1994

B. Warehouse and Open Shed

11. There are no statistical data on utilization of the warehouses and open sheds. Therefore general information on the utilization of warehouses is obtained through interviews with warehouse personnel. The warehouses in the port can be divided into four groups. The first one is the warehouse next to the apron. The second one is the group From No.21 to No.66. The third one is those in the container yard. The fourth one is the others such as for bulk and dangerous cargo. Warehouse No.3, No.31, No.32, No.51,No.52, No.61, No.8 are leased to private companies.

12. The first should be used as a transit shed because of its location. But it is said that those warehouses are scarcely used and for example No. 5 is used as a kind of office. No.3 is leased to a private company and it is used as the transit shed for the export of banana. Generally the banana stays at the warehouse for about 10 hours on average.

13. It seems that some of the second group ones are fully used and other ones are not often used. For example No.21 nd No.22 are used for urea storage and in front of them urea is packed into bags. No.31, 32 and 61 are leased to private sectors and those are used also as transit sheds for banana.

14. The warehouses in container yard are operated as a container freight station. Various kinds of cargo are stored. According to the officer in the warehouse, cargo stays at CFS for about 10 days on average.

15. According to a officer at the silo, the sugar warehouse and silos are fully used for storage of grains.

16. It seems that the open sheds for vehicles and reefer containers are rather busy. Compared to the warehouses and other open sheds, they seemed to be used well.

C. Navigational Operation in Channel

17. The operation on the tidal benefit consideration is adopted for navigation through the access channel. In case of a ship with draft of more than 32 feet, special permission is required; a ship with draft of more than 34 feet has never entered the port.

18. The entering/leaving ship with draft of less than 25 feet is able to sail in the channel at all times. In case of an entering ship with more than 26 foot draft, the time when it is able to enter the channel is restricted. According to the Pilot Division the following method of operation is adopted.

ship with draft from 32 to 34 feet ;
at the time between H.W. and 1 hour before H.W. at buoy No.5
ship with draft from 29 to 32 feet ;
at the time between H.W. and 2 hours before H.W. at buoy No.5
ship with draft from 26 to 28 feet ;
at the time between H.W. and 4 hours before H.W. at buoy No.5

19. The navigation pattern of entering ship is displayed in Figure I-9-8. This figure is prepared in order to obtain a general view of the navigational condition in the channel and so some modifications have been made. The vertical axis shows distance from buoy at the ocean and the horizontal axis shows the time after the low water at the ocean side. Along the vertical axis of the main buoys, depth in the chart and ordinary navigation speed by Pilot Division are described. According to the above mentioned, the ships with various drafts start at the entrance during permitted hours for each and will arrive at the port after approximately four hours. The depth of each point changes in accordance with the tidal level. The ship goes through the channel on the benefit of high tide as shown in the figure.

<note> The depth described is obtained from the chart and it is not intended to show the exact and present detail depth.

20. A ship with low speed sometimes is not able to go out of the channel within one tide. In such a case it anchors at buoy No.17 and waits for the next high tide.

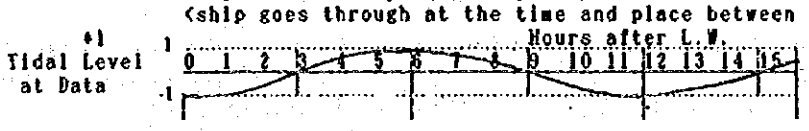
21. The area between buoy No.2 and No.8, buoy No.22 and No.23 is designated as a one way traffic area. When a ship goes through this area, the ship coming from the opposite direction must wait till the first ship leaves this area. The ship behind another ship needs to keep approximately one mile distance.

22. The areas from buoy No.8 to 12, from buoy No.22 to 23 and buoy No.69 to 74 near the quarantine area are the caution points for navigation. The first one is due to low water by rocks, the second one is due to the narrow channel and the third one is due to the narrow channel as well as the congestion from anchoring ships.

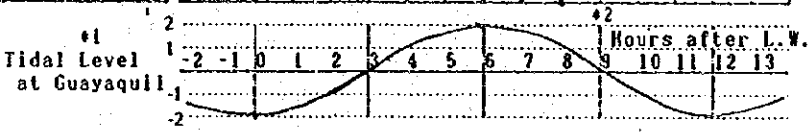
23. A pilot boards all ocean going ships at buoys No.1 or No.2. When the ship is leaving with the pilot who embarked on entering will also get on the ship.

Channel Condition and Modified Navigational Pattern

<figure shows depth(m) at place/time>
<ship goes through at the time and place between



DIST-ANS (m)	BUOY NO.	DEPTH from Chart *3	(m)	SP. (k) *4	IN	IN	IN	IN IN	IN IN IN	from 26' to 28' ----	from 29' to 32' ——	more than 32' - - - -							
0	0	8.5	-9.5	N	9	9	9	10	10	11	11	11	11	10	10	9	9	9	10
2	1	10.0	-12.0	N	11	11	11	12	12	13	13	13	13	12	12	11	11	11	12
4		10.0	-12.0	N	11	11	11	12	12	13	13	13	13	12	12	11	11	11	12
6	2	10.0	-12.0	N	11	11	11	12	12	13	13	13	13	12	12	11	11	11	12
8		10.0	-12.0	L	11	11	11	12	12	13	13	13	13	12	12	11	11	11	12
10	5	10.0	-12.0	L	11	11	11	12	12	13	13	13	13	12	12	11	11	11	12
12	8	10.0	-12.0	L	11	11	11	12	12	13	13	13	13	12	12	11	11	11	12
14	9	5.0	-10.0	N	8	8	8	8	9	9	10	10	9	9	8	8	8	8	8
16	12	5.0	-10.0	N	8	8	8	8	9	9	10	10	9	9	8	8	8	8	8
18	13	5.0	-10.0	N	8	8	8	8	9	9	10	10	10	9	9	8	8	8	8
20		9.8	-12.0	N	11	11	11	12	12	13	13	13	13	13	12	11	11	11	12
22	15	20.0	-20.0	N	20	20	20	21	21	22	22	22	22	22	21	21	20	20	20	21
24		20.0	-20.0	N	20	20	20	21	21	22	22	22	22	22	21	21	20	20	20	21
26		20.0	-20.0	N	20	20	20	21	21	22	22	22	22	22	21	21	20	20	20	21
28		20.0	-20.0	N	20	20	20	21	21	22	22	22	22	22	21	21	20	20	20	21
30	17	10.0	-20.0	N	15	15	15	16	16	17	17	18	17	17	16	16	15	15	15	16
32	20	10.0	-20.0	N	15	15	15	16	16	17	17	18	17	17	16	16	15	15	15	16
34		10.0	-20.0	N	15	15	15	16	16	17	17	18	17	17	16	16	15	15	15	16
36	23	20.0	-20.0	N	20	20	20	21	21	22	22	23	23	22	22	21	20	20	20	21
38		10.0	-16.0	N	13	13	13	14	14	15	15	16	16	15	15	14	13	13	13	14
40	28	10.0	-16.0	N	13	13	13	14	14	15	15	16	16	15	15	14	13	13	13	14
42	29	10.0	-16.0	N	13	13	13	14	14	15	15	16	16	15	15	14	13	13	13	14
44	32	10.0	-16.0	N	13	13	13	14	14	15	15	16	16	15	15	14	13	13	13	14
46	33	10.0	-16.0	N	14	13	13	14	14	15	16	16	16	15	15	14	14	13	13	14
48	37	10.0	-16.0	N	14	13	13	14	14	15	16	16	16	15	15	14	14	13	13	14
50	39	8.0	-10.0	N	10	9	9	10	10	11	12	12	12	12	11	10	10	9	9	10
52		8.0	-10.0	N	10	9	9	10	10	11	12	12	12	12	11	10	10	9	9	10
54	45	8.0	-10.0	N	10	9	9	10	10	11	12	12	12	12	11	10	10	9	9	10
56	48	8.0	-10.0	N	10	9	9	10	10	11	12	12	12	12	11	10	10	9	9	10
58		8.0	-10.0	N	10	9	9	10	10	11	12	12	12	12	11	10	10	9	9	10
60	51	8.0	-10.0	N	10	9	9	10	10	11	12	12	12	12	11	10	10	9	9	10
62		8.0	-10.0	N	10	9	9	10	10	11	12	12	12	12	11	10	10	9	9	10
64	54	8.0	-10.0	N	10	9	9	9	10	11	12	12	12	12	11	10	10	9	9	9
66	58	10.0	-12.0	N	12	11	11	11	12	13	14	14	14	14	13	12	12	11	11	11
68		9.5	-10.0	L	10	10	10	10	11	12	12	13	13	13	12	11	10	10	10	10
70	62	10.0	-22.0	L	17	16	16	16	17	18	19	19	19	19	18	18	17	16	16	16
72		10.0	-22.0	L	17	16	16	16	17	18	19	19	19	19	18	18	17	16	16	16
74		10.0	-22.0	L	17	16	16	16	17	18	19	19	20	19	19	18	17	16	16	16
76		10.0	-22.0	L	17	16	16	16	17	18	19	19	20	19	19	18	17	16	16	16
78		10.0	-22.0	L	17	16	16	16	17	18	19	19	20	19	19	18	17	16	16	16
80		20.0	-20.0	L	21	20	20	20	21	22	23	23	24	23	23	22	21	20	20	20
82		20.0	-20.0	L	21	20	20	20	21	22	23	24	24	23	23	22	21	20	20	20
84	69	12.0	-15.0	L	14	14	14	14	15	15	16	17	17	17	16	15	14	14	14	14
86		12.0	-15.0	L	14	14	14	14	15	15	16	17	17	17	16	15	14	14	14	14
88	72	12.0	-15.0	L	14	14	14	14	15	15	16	17	17	17	16	15	14	14	14	14
90		12.0	-15.0	L	14	14	14	14	15	15	16	17	17	17	16	15	14	14	14	14
92		12.0	-15.0	L	15	14	14	14	15	16	17	17	18	17	17	16	15	14	14	14
94		12.0	-15.0	L	15	14	13	14	14	16	17	17	18	17	17	16	15	14	13	14



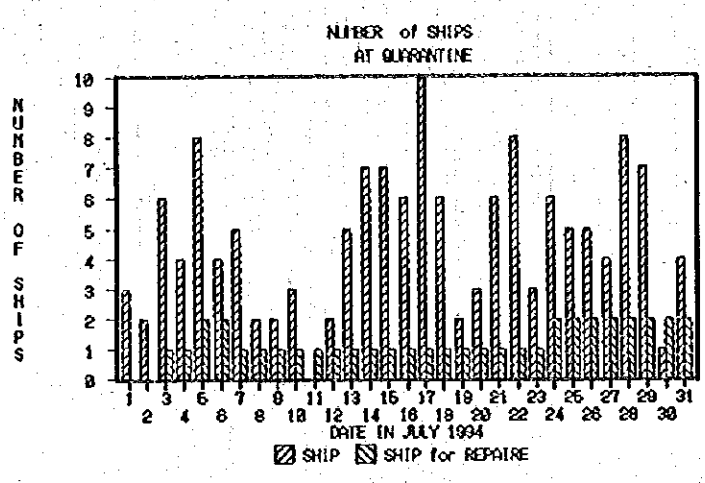
*1: tidal amplitude / about 2m at Data , about 4m at Guayaquil
*2: high tide at Guayaquil about 2 hours delay from that at Data
*3: according to Chart
*4: Speed of Ship/ N=normal speed, L=low speed ,according to PILOT
<note> this table is prepared under some assumptions.

Figure I-9-8 Modified Navigational Operation

D. Utilization of Quarantine and Basin

24. Quarantine area is located three miles from the port and it takes about 30 or more minutes to reach from the port. The number of ships staying at this area is grasped from the data from the Operation Division document. Figure I-9-9 shows the number of ships per day in July 1994. The figure is distributed from 0 to 10.

25. The access route to the berth is shown in Figure I-6-6 and ships sail at a speed between 4 and 6 k't in this area. The route to the berth, through right side of the island or its left side, depends on the tidal condition. The route of the opposite direction of the tidal flow is adopted. Tug boat service is required for every ship at berthing and leaving. The mooring method, head out or head in, also depends on the tidal condition.



Source; APG's Document for Daily Berth Allocation Meeting

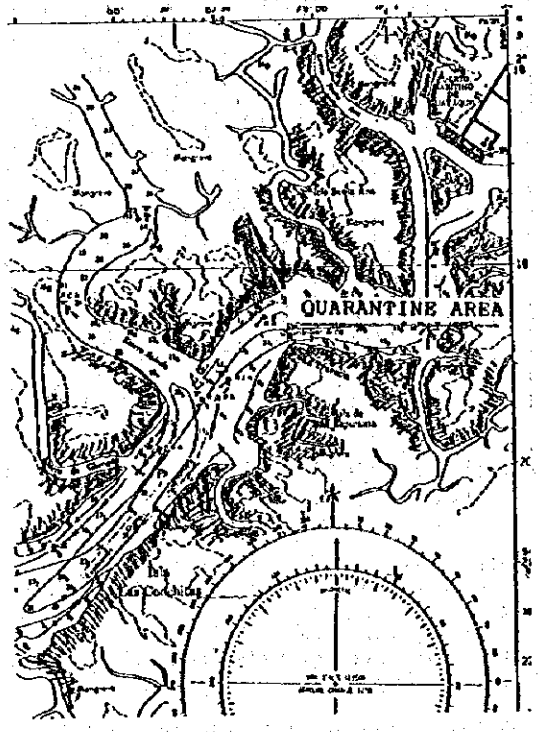


Figure I-9-9 Utilization of Quarantine

E. Access Road and Land/Water area use in the Vicinity

1) Access Road

26. The port terminal is connected to the road network in the City of Guayaquil as shown in Figure I-9-10. The cargo is transported from/to its hinterland through the circular road on the outskirts of the city named Perimetral with three lanes for each direction. The road has been almost completed except a part of the northern area.

27. Between this road and the port, a road with six lanes for each direction is laid. The overpass work is under construction with the completion date targeted for December 1994. APG has shared some of the construction cost of the road after the coordination among MOP, DIGMER and APG. After the completion of the work the traffic between the Perimetral and the port will be much improved.

28. The distance to the Rafael Mendoza Aviles Bridge from the port through the Perimetral Road is about 50 km and it ordinarily takes 40 minutes. The Bridge consists of two parts over the Guayas River and the Daule River. The traffic from the city area goes together at the Bridge and it sometimes takes much time through the bridge of 3 km in length. On the route to Daule, there is a bridge over the Daule River. The Bridge has two lanes for each direction and it does not take much time to pass across.

29. This road is connected to the trunk roads in the national wide road network. The cargo through the Port of Guayaquil is distributed on the network. The main roads are route 70 to Salinas, approximately 150 km from Guayaquil, route 70 and 35 to Cuenca, approximately 250 km from Guayaquil through Duran, Canar and Azogues, route 21 to Daule, approximately 40 km from Guayaquil, route 62, 25, 30 and 35 to Quito, 400 km from Guayaquil through Babahoyo, Quevedo and Sto.Domingo. The route 21, 9 and 40 connect Guayaquil and Manta over a distance of approximately 200 km. Route 70 and 25, connecting Guayaquil and Bolivar, is less than 200 km. The Port of Esmeraldas is located approximately 400 km from Guayaquil by way of route 62 and 25.

30. The condition of these roads is said to be good. For example, a paved road two lanes connects Guayaquil and Quito.

2) Land Use in the Vicinity of the Port

31. The port of Guayaquil is located in the southern end of Guayaquil and surrounding area is not used densely. Marked buildings and land use surrounding the port area are the Navy Base, private container yards and warehouses.

32. The approximately 30 ha area next to the eastern area of the port is owned by a port related private company and is used mainly as a container storage yard. The area is connected to the port area through an exclusive gate. The company also possesses a small pier at the water area named Estero Cobina between the APG's basin and the Guayas River. The company has a plan to expand the facilities. Along Estero Cobina some other small private piers are located.

33. Along the boundary of the reserved area of APG, a small road is laid. Beyond the boundary of the mangrove area, an Ecuadorian Navy base is located.

34. In front of the basin there is an island named Trinitaria of approximately 45 ha. Most of the island is covered with mangrove. In the other islands near the port many pools of the shrimp industry, one of the biggest industries of this region, are constructed.

The water is pumped up to the pool from Estero Salado so when the dredging work was executed in 1990 the control of the water quality was one of the most serious problems. And the Salitral area also appears in the islands.

35. Along the access road to the port some land use related to port activity is found. The main facilities are private container yards and warehouses.

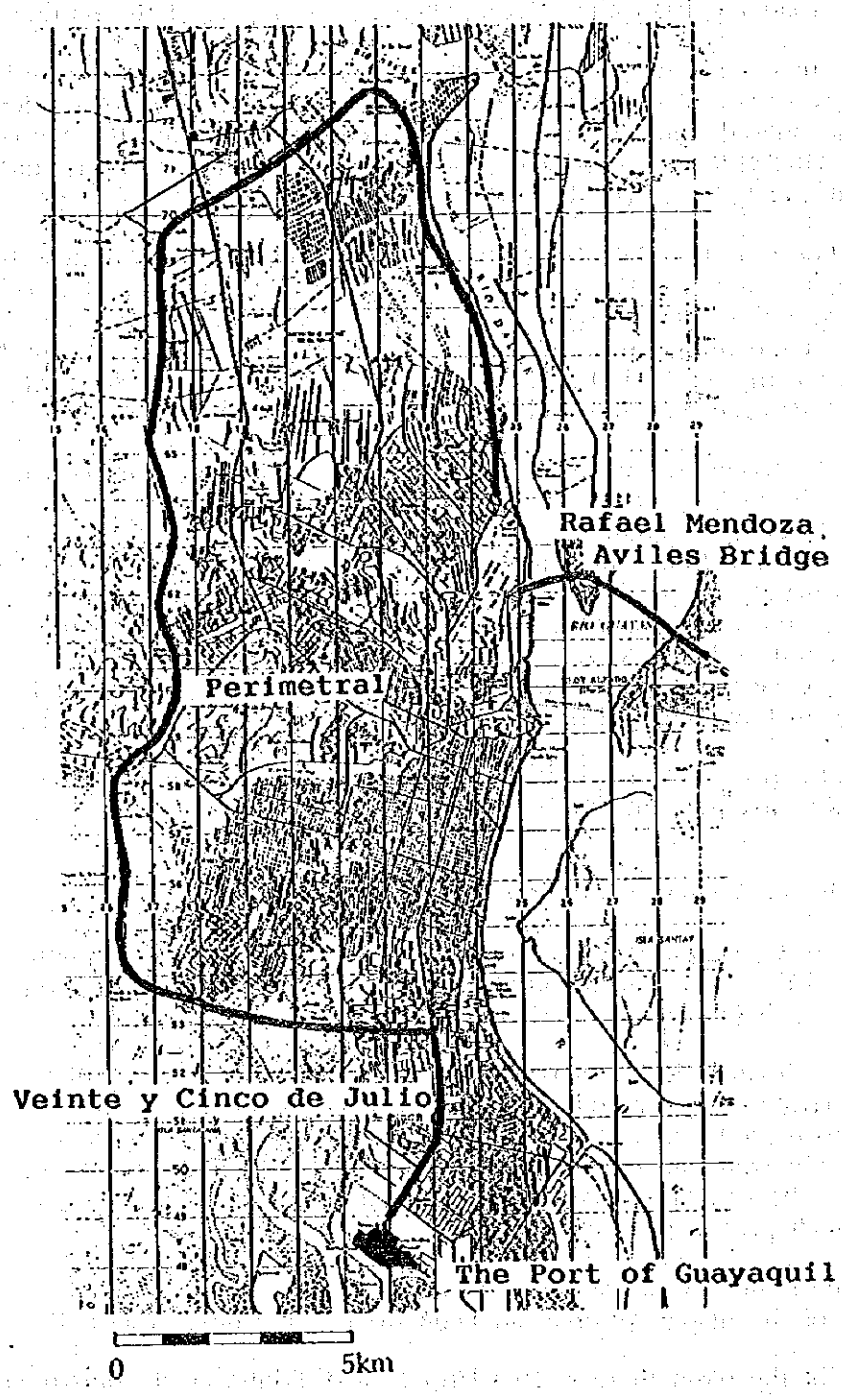


Figure I-9-10 Access Road to the port

Chapter 10 CARGO HANDLING SYSTEM

A. General

1) Vessel priority and berth allocation

1. The vessels for berthing are assigned according to the following priority in the port of Guayaquil. The berth allocation meeting is held twice a day, at 10:00 hrs and at 14:00 hrs, by APG's Operation Department and concerned agents. Berths are allocated based on the agent's application.

(1) Banana boat
(2) Passenger boat
(3) Hospital
(4) Military
(5) Others

2) Shift hours

2. Three shifts are adopted at the port of Guayaquil as follows;

First shift 08:00 - 17:00 (Meal Hour 12:00 - 13:00)
2nd shift 17:00 - 01:00 (Meal Hour 17:00 - 18:00)
3rd shift 01:00 - 08:00 (Meal Hour 07:00 - 08:00)

Every shift may continue working, on an over-time basis, even during meal time, if the ship is expected to complete the loading and/or discharging within a reasonable period of time.

3) Cut-off Time System for export cargo/containers

3. This System is to close recieving of export cargo/containers at some time on the previous day of the ship's arrival, while preparation for cargo/containers loading, i.e. palletizing of cargo, preparation for loading sequence list etc. can be done before the ship's arrival. With the historical reason and/or background, APG does not apply this System though it is quite common in the world to reduce ship's stay time in the port and to avoid interruption in cargo handling.

B. Labor Formation

1) Gang formation

4. Gang formations of stevedore gang and wharf gang in the port are shown below. Ship's stevedore gangs/labors are prepared by the ship's operator/agent. On the other hand wharf gangs/labors are prepared by APG.

Stevedore Gang
2 winchmen
8 stevedore
1 tallyman / total 11

Wharf Gang (shore handling)
1 foreman
3 longshoremen
1 tallyman
1 fork-lift operator / total 6

2) Labor union

5. All of the stevedore labors belong to the Syndicate (general cargo) which consist of 4 unions, 3 of them work together and the other works solely for a specific shipping line. Current number of syndicate members is said to be 435.

6. The banana loading stevedore labors are forming another independent Syndicate which consists of approximately 15 unions ; each union belongs to a respective banana farmer/exporter.

7. As of Jan.1,1994, the number of APG's shore workers is approximately 300 and each of them belong to the respective APG worker's union classified by their occupations. The occupations of shore workers in APG's organization are as follow:
wharf gang, crane operator, top-lifter operator, tractor operator, fork-lift operator, truck operator, shed/yard gang, bulk terminal worker

C. Cargo Handling

1) Type and size of ships

8. A ship with deep draft cannot enter the port of Guayaquil because of the long shallow channel that leads to the port. If this situation will not change in future, ship size will remain the same. The ship's type will also remain the same in case that the type of major commodities to be handled at ports along the West Coast of South America does not change. At present, only this port and Valparaiso (Chile) are equipped with container cranes.

9. Another reason which obstructs comtainerization in banana transportation is the extremely high per diem of the reefer container. Cost per day for 40 foot reefer container is US$ 20-25. On the assumption that the round voyage days for certain service route are 90 days, per diem for the 40 foot reefer container will be US$ 1,800 or more and this will burden the container ship operator heavily. Since the freight rate is not proportional to the transportation distance, the banana in reefer container is good for short transport (Dole- Guayaquil/Los Angeles) but not for long transport (Noboa-/Far-East, Dole-/Mediterranean). On the other hand, for the long transportation, refrigerated ship and/or multipurpose with reefer chamber is much more efficient than a reefer container.

10. There might be another chance to increase the ratio of container for the port if Sea-Land and Maersk, both well-known worldwide container ship operators, come as rumored.

2) Difficulty in cargo handling

11. Based on the above assumptions, the main difficulty for the port is the mixed stowage of containers and breakbulk cargo on the same ship. Although the current

arrangement of port facilities is divided into three types, one bulk berth, three container berths and five breakbulk general cargo berths, breakbulk cargo to and from the container ship must be handled at the container berth and containers to and from the conventional breakbulk ship must be handled at the breakbulk general cargo berth unless the loss time and the cost for the ship for shifting the berth are allowed.

12. In general, fundamental factors in raising port efficiency are Safety, Simplicity and Flexibility, however, the above condition at the port regretfully runs counter to both Safety and Simplicity.

13. Efficient utilization for the conventional breakbulk ship of the transit shed located adjacent behind the berth is indispensable, however, in this case, the berth is not assigned well in advance of the ship's arrival. This causes lack of space in the transit shed for the cargo to be discharged and less availability of pre arrangement for the cargo to be loaded because the parties concerned can hardly know in advance which berth will be allocated.

14. In the Transfer Crane System, yard tractor plays the important role of carrying containers between quay-side container crane and transfer crane in the yard. Spotting of the spreader onto the container or of the container onto the yard tractor is very easy when containers are handled with the regular type of container crane or bridge-type gantry crane on the ship's deck, however, in this case, so many multi-purpose and conventional breakbulk ships (non-cellular) are involved and containers on these ships are usually handled with Jib Crane (on-deck) and/or Crawler Crane (on the apron). Under such circumstances, because of the sway and twist of containers caused by use of such non-standardized container crane, spotting is very difficult, time consuming and sometimes will cause accidents. In contrast to the Transfer Crane System, in the Straddle Carrier System, the yard tractor is not involved and the straddle carrier always picks up containers, which were lain on the ground standing still with whatever type of gantry crane, directly from the ground. If ship size and type remain the same, Straddle Carrier System will be much more suitable for the port.

3) Container handling

15. Irrespective of the type, every ship being placed into the West Coast of South America is equipped with whatever type of ship's crane and the loading and discharging of containers take place with such crane.

16. In this port, regular type of container crane (Painer in 1984) is equipped, however, the ship operators prefer to use their own ship crane by reason of beeing more accustomed to it.

(a) Discharging

17. Most of the containers are unloaded from the ship with ship's crane onto APG (or APG leased) yard tractor/chassis at the apron and then carried to the Container Yard (CY).

18. At the CY, a storage-man informs the tractor driver of stacking location, where he records the address of the container on the storage-men bill (the storage-men bill is the only document to identify the movement of the container).

19. The container is stacked with the Yard Transfer Crane whenever it is in operation or with the APG Top-Lifter. Because of the random movement of the heavy top-lifter, pavement of CY is seriously damaged. The top-lifter is not suitable for use in the transfer crane area.

20. The container is delivered to the consignee by the request of the agent, whom by order of the consignee, passes the truck driver a truck's B/L. (document between the consignee and APG is only a truck's B/L)

21. Around 5 % of the import containers are delivered directly to the consignee at the ship's tackle.

(b) Loading

22. Together with the truck's B/L which is issued by the shipper, the truck comes to the APG In-Gate. Contents of the truck's B/L are as follows:
number of packages, commodity, customs code number for the commodity, ship's name, destination, agent's name, B/L's date, truck license number, container and seal number.

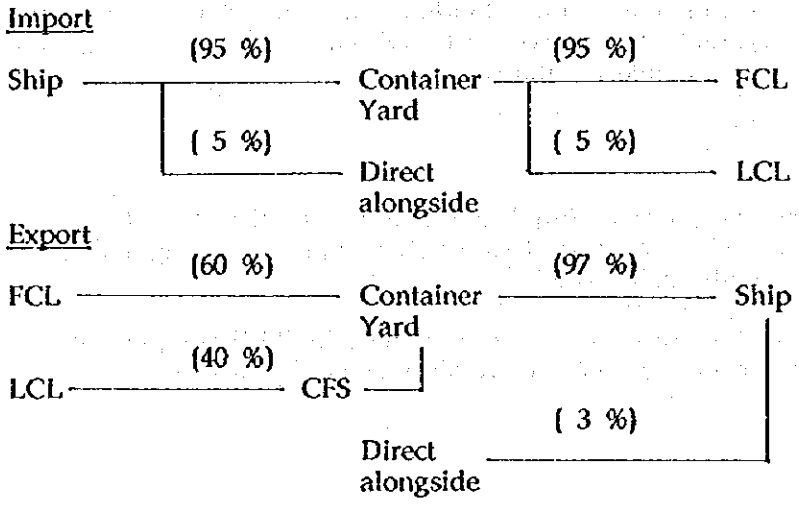
23. After APG have checked for the above items at the gate, the truck goes to the weighing scale located at next to the in-gate where the total weight of tractor and container is taken.

24. The tractor goes to CY where the storage-man informs the truck driver where to stack. The address of the stacked container is registered in the storage-man bill.

25. On the way back, the empty tractor is weighed again to calculate net container weight. The gate-man issues a weight certificate.

26. The following procedure, CY to ship, is in reverse order of the discharging.

(c) Container flow in the container terminal



(d) Days required to deliver import container

27. In this port, the days of free storage are set at 10 days and most of FCL containers are delivered within 10 days after the ship sails, however, almost 20% of the LCL cargo are remain undelivered on the 10th day.
Table of days required to deliver import containers, FCL and LCL respectively, is shown below.

Days required to deliver import containers

day after ship sails	FCL (%)	LCL (%)	day after ship sails	FCL (%)	LCL (%)
sailing day	2	3	10th	4	4
next day	5	6	11th	3	2
3rd	10	12	12th		2
4th	10	15	13th		4
5th	15	13	14th		2
6th	20	12	15th		3
7th	16	8	16 - 20		3
8th	10	5	21 - after		2
9th	5	4		100	100

4) Breakbulk cargo handling

(a) Discharging

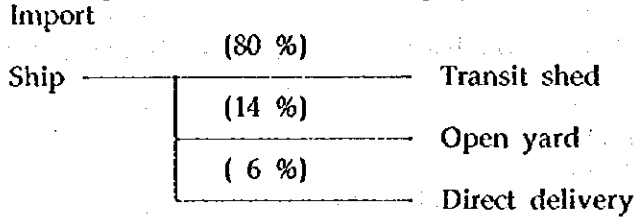
28. Though 80% of discharged cargo is passing through the transit shed, the shed directly behind the berth is not always ready for the ship's unloaded cargo. Under these circumstances the fork-lift running distance might be getting longer and in order to meet with the ship's winch cycle, more fork-lifts are required or the ship's winch cycle will be slow. This prevents an efficient and smooth breakbulk operation.

(b) Loading

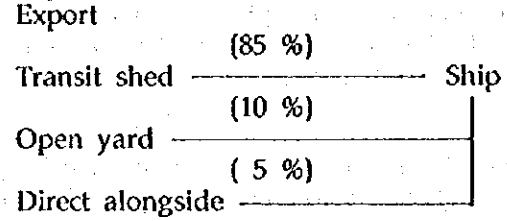
29. The above comments are also applicable to the loading.

(c) Breakbulk cargo flow

30. The imported cargo flow is displayed below.



31. Exported cargo flow is as follows.



5) Bulk cargo handling

32. At the bulk berth, Hitachi Unloader System is equipped. Under normal conditions this plant has an absorption capacity of 200 tons per hour but recently capacity has

dropped to between 100 to 110 tons. The band system has some problems and this plant is in need of new filters and 9 and 10 inch hoses.

33. Since last year, the demand for the silos has increased. The storage capacity in the silos depends on the electrolyte weight of the grain.

Wheat	7,000 tons
Maize	5,000 tons
Sorghum	5,500 tons
Oats	6,000 tons
Barley	6,000 tons
Soy bean	5,500 tons

34. The silos have lungs with a capacity of 400 tons, also, the silos have an anti explosive lighting system and a safety cord system. Each silo has one lateral entrance and 5 valves, the tunnel length is 100 meters.

35. There is almost no maintenance at the silos; an accident could occur at any moment.

36. Simultaneously with the Hitachi System, discharge of the cargo is possible with a bucket, capacity of which is 2 tons per lift and 30 lifts per hour.

6) Banana loading

37. Since 1988, banana has remarkably increased (a growth rate of 15% was seen in 1987/1988, 17% in 88/89, 35% in 89/90 and 48% in 1990/1991) accounting for 76% of the total export (basis M/T) in 1991. With an increase in the banana export and in order to bring more efficiency to the port operation, a higher efficiency in the banana handling will be required.

38. Since in most cases the banana is loaded on reefer ships or stuffed in reefer containers and then loaded on the container ships, APG grants the first priority to the banana ships.

39. During the field survey, 5 methods of the banana loading were observed as follow:

(1) container---------- container ship
(2) container---------- breakbulk ship
(3) on pallet---------- breakbulk ship
(4) box---palletizing on the apron---- breakbulk ship
(5) box---conveyer belt---------- breakbulk ship

amongst, in view of the productivity, (a) is the very best and (d) is the worst, while (c) is the ideal method to handle the banana, i.e. the banana boxes on pallet are pulled out from the truck bed with fork-lift, 3 pallets are packed in a banana cage (canasta), and then pulled up with ship's gear.

40. In 1993 the port total export of banana was 1,340,000 tons, out of which Dole's export was 630,000 tons (47 %), Noboa's was 144,000 tons (11 %) and total of the 2 leading exporters accounts for 58 % of the port total exports.

41. Compared with the other operations in the port, Dole is excellent with all operations belowed performed by themselves.

(cutting) - quality check(1) - packing - stuff into container - long haul to Dole's yard(*) in APG - quality check(2) - short haul to ship's tackle - load stevedoring

(*) Dole's yard in APG - leased area from APG is approximately 51,450 m^3 where 341 reefer plugs are installed now and has a plan to expand to 500 plugs. All cargo handling equipment is owned or leased by themselves. All labors belong to Dole and/or Dole Union.

42. Dole's ship is equiped with 2 bridge type ship's cranes on her deck and to meet with the sycle of the crane, 8 to 9 tractors are arranged per crane for the transportation between Dole's yard and ship's tackle.

43. The operation mode of the Dole ship is weekly, fixed day of the week service and currently she comes in the port every Wednesday. She is carrying around 350 x 40 footer per voyage out of which, 40 % is cut on Monday morning and carried to Dole's yard in the afternoon, another 40 % on Tuesday and 20 % is cut on the ship's arrival day. This allows the same effect as an application of the Cut-off Time System and gives them enough time to prepare for loading.

44. Banana package is 21 kgs per box and 48 boxes are stacked on one pallet. The 40 foot container has the capacity of 960 boxes. Approximately 20 tons of banana are transported in one 40 foot container.

45. Flow of the banana is as follows;

Breakbulk (60 %)	Pallet (30 %)
Container (40 %)	Box (70 %)

D. Container Handling Equipment

1) Container Crane (Gantry Crane)

46. A Peiner crane of 50 ton capacity was installed in 1984. Up to 1992, the crane was out of order for a total of about 20 days per year as a result of minor breakdowns. In November, 1993, a ship hit berth # 1 rendering the crane out of use for 30 days. In June, 1994, a ship again hit the crane: the crane was out of service for 24 days.

47. Current condition of the crane is normal but workable only on berth # 1-A because of the damage to the cable winding drum caused by the above accident in June, 1994.

48. For the APG's container crane usage, no definite data was given from APG but the usage of the crane seemed extremely low because the ship operators prefer to use their own equipped ship's crane. An outline of the container crane is shown in Table I-10-1.

Table I-10-1 Container (Gantry) Crane

Maker	Type	Year of Built	Capacity (ton)	Reach (m)	Clearance (m)	Condition
Peiner	VL40/50	1984	40	36	33	normal

2) Yard Transfer Crane (Transtainer)

49. Two Peiner transfer cranes were installed in 1984. Crane # 030 has been out of work for almost one year because of main motor trouble and the burning of 2 sub motors. Prior to 1993, Crane # 031 was out of service only 10 days per year including days for maintenance, but this year, the crane was out of service for 51 days due to motor trouble. Current condition is the best. An outline of the yard transfer cranes is shown in the Table I-10-2.

Table I-10-2 Yard Transfer Crane

Maker	Type	Year of Built	Capacity (ton)	Span	Clearance (m)	Condition
Peiner	PPG 40-23 #030	1984	40	6 + 1	1 over 3	poor
Peiner	PPG 40-23 #031	1984	40	6 + 1	1 over 3	good

3) Other equipment

50. APG has twenty yard tractors, fifty six yard chassises and twenty one forklifts. They are respectively listed in Table I-10-3, I-10-4 and I-10-5.

Table I-10-3 Yard Tractor

Maker	Type	Year of Built	Quantity			Condition
Ottawa	RO-RO	1984	2			good
			3			normal
			7			poor
		1988	6			good
			2			poor
Total			20	good	8	40 %
				normal	3	15 %
				poor	9	45 %

Table I-10-4 Yard Chassis

Maker	Type	Year of Built	Quantity			Condition
Fruhauf	40PPCFM	1983	8			good
			14			normal
	H2HO	1984	7			good
			5			poor
	M-NBJ		1			normal
			6			poor
			1			stolen
	H2HO40		1			good
			3			normal
			2			poor
	HHBO	1988	3			good
			6			normal
			1			stolen
Total			56(58)	good	19	34 %
				normal	24	43 %
				poor	13	23 %
				stolen	(2)	

Table I-10-5 Forklift Truck (for container handling)

Maker	Type	Year of Built	Capacity (ton)	Quantity		Condi-tion
Taylor	TYC800	1982	40	1		poor
Clark	Y-800	1983	40	1		good
Taylor	TYC800	1987	40	2		normal
				1		poor
Hyster	H-9203	1987	40	1		good
				1		poor
Caterpillar	V-900CH	1990	40	3		normal
				1		poor
Total				11		
				good	2	18 %
				normal	5	46 %
				poor	4	36 %
Caterpillar	V-300B	1987	14	6		poor
		1990	14	2		good
				1		normal
				1		poor
Total				10		

E. Breakbulk Cargo Handling Equipment

51. For breakbulk handling, a crane of 75-ton capacity is installed at the berth 2. Its dimensions are given in Table I-10-6. Other equipment for breakbulk is listed in Table I-10-7 and I-10-8 respectively.

Table I-10-6 Shore Crane (Fixed)(for breakbulk handling)

Maker	Type	Year of Built	Capacity (ton)		Condition
Clyde	X-221-1	1972	75		normal

Table I-10-7 Mobile Crane (for breakbulk handling)

Maker	Type	Year of Built	Capacity	Quantity	Condition
American	7650	1981	70	1	good
		1984	70	1	good
			70	1	poor
	5650		50	3	good
Demag		1988	50	1	good
Total				7	

Table I-10-8 Forklift Truck (for breakbulk handling)

Maker	Type	Year of Built	Capacity (ton)	Quantity	Condition
Caterpillar	AH-60	1976	27	1	good
	AH-40	1975	20	1	normal
				1	poor
Hyster	H-275H	1983	14	1	poor
Caterpillar	V-300B	1983		4	poor
		1988		4	normal
				2	poor
	V-225B	1983	10	3	good
				7	poor
	V-120B	1979	6	(8)	(*)
	V-130B	1983		3	good
				5	normal
				12	poor
Hyster	H-135XL	1987		7	normal
				9	poor
Yale	GDP-080	1986	4	1	good
				3	normal
		1987		1	good
				2	normal
				1	poor
	GTP-060	1986	3	7	good
				7	normal
				6	poor
Hyster	H-60XL	1987	3	8	good
				11	normal
				8	poor
		1988		2	good
				6	normal
				10	poor
Value	GLP-25	1988	2.5	11	good
				3	normal
	ELCO40AA	1984	2	2	normal
				8	poor
	ELCO40AA	1984	1.5	3	good
				1	normal
				1	poor
Total				162	
			good	40	25 %
			nonnal	52	32 %
			poor	70	43 %

Remark; Removed from book

F. Maintenance of the Equipment

52. In order to keep equipment in a safe and good working condition, maintenance for the cargo handling equipment is indispensable however, because of the scheduled Modernization and Privatization in the port, a new proposal to the management, the positive and planned maintenance, systematic purchase of the spare parts and the training of the mechanic staff were all frozen.

53. Minimum inspection of the equipment is executed periodically, however, this inspection consists simply of checking whether the equipment is workable or not; the proper preventive maintenance is not undertaken. In the worst case, parts are taken from one piece of equipment to make another one operational.

54. There are many spare parts that are in dead stock either because they have been damaged having been stored so long or because the machine for which they were bought does not exist any more.

55. APG applies following lives for their cargo handling equipments.

Container crane	20 years
Transfer crane	15 years
Top-lifter	20 years
Mobile crane	8 years
Tractor	8 years
Forklift truck	5 years