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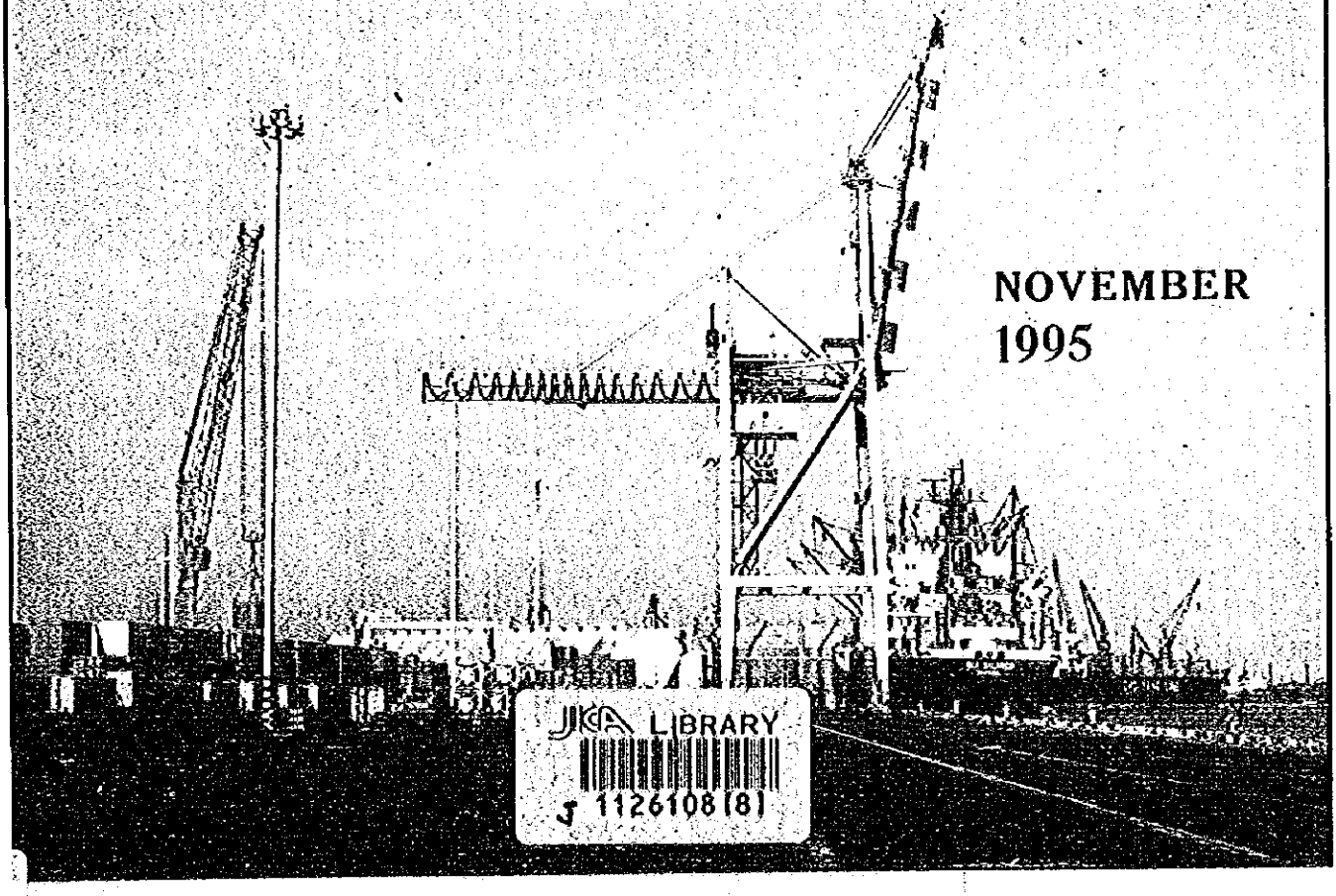
NO. 32

FINAL REPORT

THE STUDY ON THE MASTER PLAN FOR THE PORT OF GUAYAQUIL IN THE REPUBLIC OF ECUADOR

(SUMMARY)



NOVEMBER
1995

THE OVERSEAS COASTAL AREA DEVELOPMENT INSTITUTE OF JAPAN

NIPPON KOEI CO., LTD.

FINAL REPORT

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(SUMMARY)

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(August, 1994)

PREFACE

In response to a request from the Government of the Republic of Ecuador, the Government of Japan decided to conduct a Study on the Master Plan for the Port of Guayaquil and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Ecuador a study team headed by Mr. Hajime Kawate, Executive Director of the Overseas Coastal Area Development Institute of Japan and composed of members from this institute and the company, Nippon Koei Co., Ltd, three times between July 1994 and November 1995.

The team held discussions with the officials concerned of the Government of Ecuador, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Ecuador for the close cooperation they extended to the team.

November 1995

Kimio FUJITA
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

November 1995

Mr. Kimio FUJITA
President
Japan International Cooperation Agency

Sir,

It is my great pleasure to submit the Final Report for the Study on the Master Plan for the Port of Guayaquil in the Republic of Ecuador.

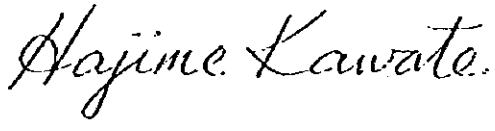
This report is the outcome of works between July 1994 and November 1995 including three field surveys during the period. The work was undertaken by the Overseas Coastal Area Development Institute of Japan (OCDI) and Nippon Koei Co., Ltd as per the contract with the Japan International Cooperation Agency (JICA).

Based on the findings of these surveys and utilizing data and information collected, and along the line of the scope of work which was agreed upon by both governments, the report is formulated to cover the following subjects;
(1) To formulate a mater plan for the Port of Guayaquil up to the year 2010,
(2) To conduct a feasibility study of a short-term improvement plan for the Port of Guayaquil for the period up to the year 2003.

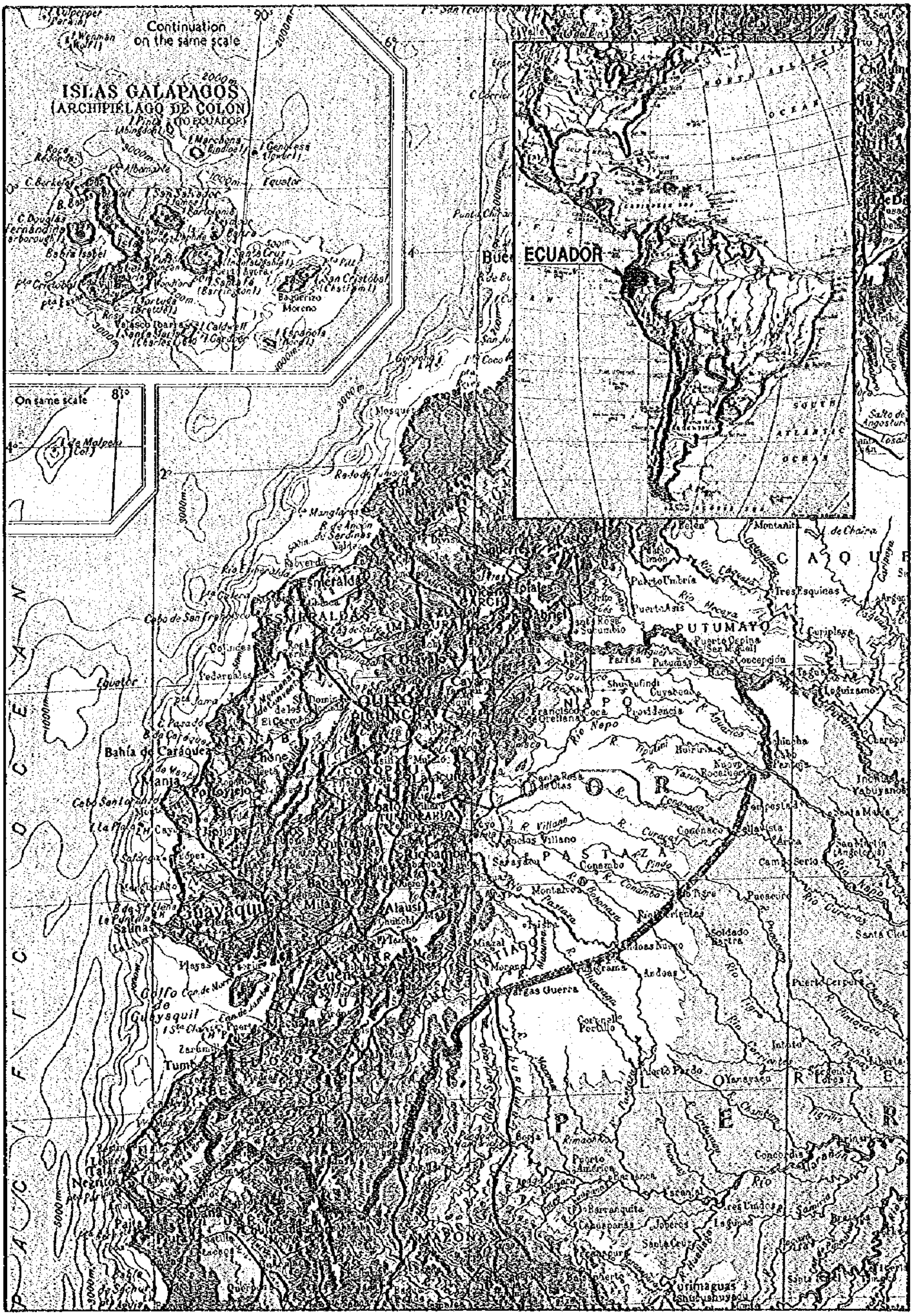
On behalf of the study team, I would like to express my deep appreciation to the Government of Ecuador, the Port Authority of Guayaquil and other authorities concerned for their thoughtful cooperation and assistance and for the heartfelt hospitality which they extended to the study team during our stay in Ecuador.

I am also greatly indebted to the Japan International Cooperation Agency, the Ministry of Foreign Affairs, the Ministry of Transport and the Embassy of Japan in Ecuador for giving us valuable advice and assistance at every step in the whole course of the study.

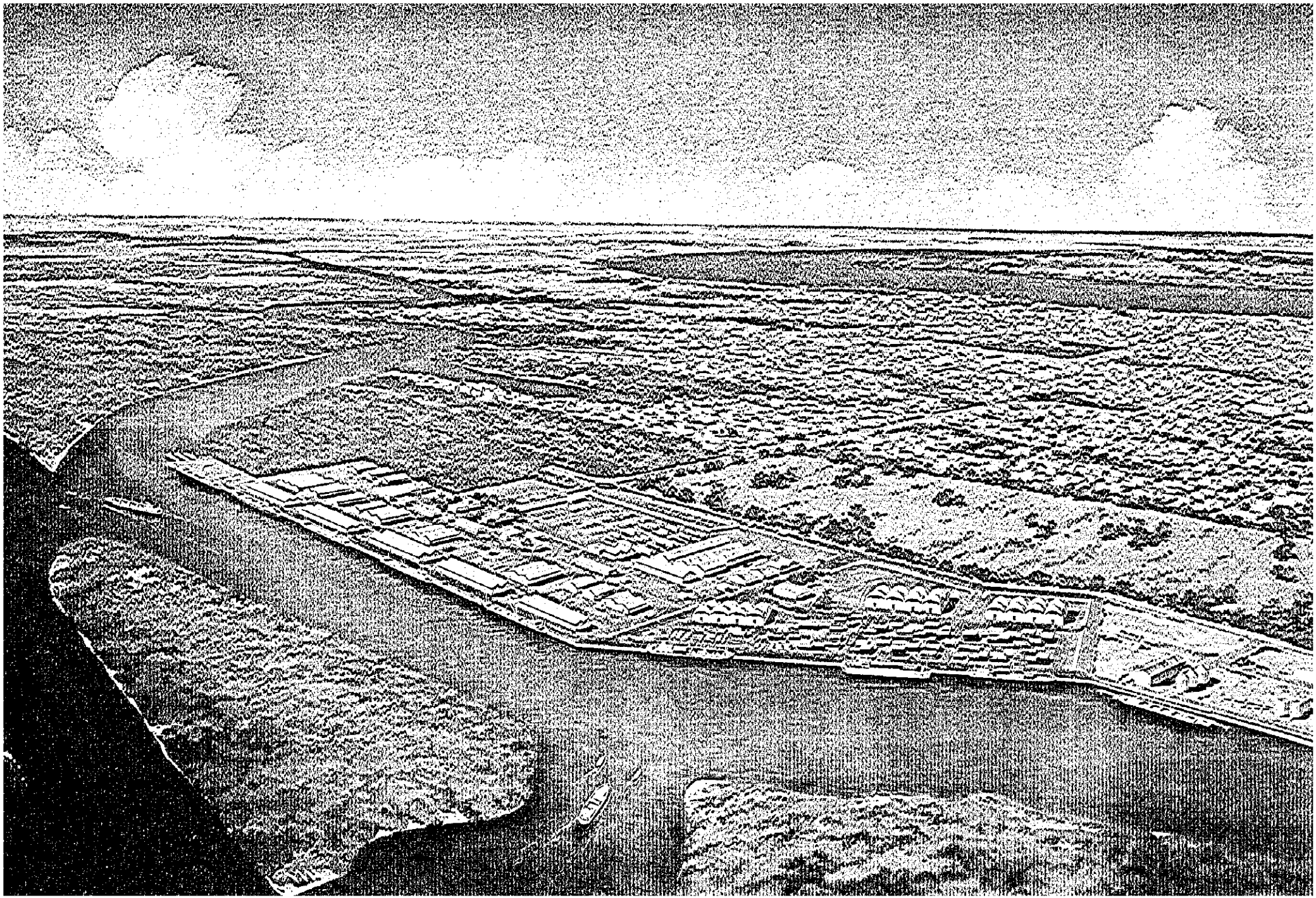
Yours faithfully,



Hajime Kawate
Leader, Team for the Study on the Master Plan for the Port of Guayaquil in Republic of Ecuador



Location Map



CONTENTS

PREFACE

LETTER OF TRANSMITTAL

ABBREVIATIONS

EXECUTIVE SUMMARY

SUMMARY

PRESENT SITUATION 1
OUTLINE OF THE REPUBLIC OF ECUADOR 1
PRESENT SITUATION OF THE PORT OF GUAYAQUIL 3

MASTER PLAN 5
TARGET OF DEVELOPMENT 5
DEMAND FORECAST 6
LONG TERM DEVELOPMENT PLAN 11
PRELIMINARY DESIGN AND ROUGH COST ESTIMATION 23
BASIC CONCEPT OF PORT MANAGEMENT 24
CARGO HANDLING SYSTEM 25

FEASIBILITY STUDY 26
TARGET OF PLANNING 26
CARGO VOLUME FORECAST 26
SHORT TERM PLAN 27
DESIGN AND COST ESTIMATION 31
ECONOMIC ANALYSIS 34
FINANCIAL ANALYSIS 35
ENVIRONMENT IMPACT ASSESSMENT 36

CONCLUSION AND RECOMMENDATION 39
CONCLUSION 39
RECOMMENDATION 41

ABBREVIATIONS
ABREVIATURAS

APG	Port Authority of Guayaquil Autoridad Portuaria de Guayaquil
ASEAPG	Syndical Association of Employees Asociación Sindical de Empleados
B/L	Bill of Lading Conocimiento de Embarque
BANS	New Scotland International Bank Banco Internacional de Nueva Escocia
BOR	Berth Occupancy Rate Tasa de Ocupación del Muelle
BOT	Build, Operate and Transfer Construcción, Operación y Transferencia
CEDEGE	Guayas River Basin Development Research Committee Comisión de Estudios para el Desarrollo de la Cuenca del Río Guayas
CFS	Container Freight Station Estación de Flete de Contenedores
CIF	Cost, Insurance and Freight Costo, Seguro y Flete
CNMMP	National Committee of Merchant Marine and Harbor Consejo Nacional de Marina Mercante y Puertos
CONADE	National Committee of Development Consejo Nacional de Desarrollo
CONAM	National Committee of State Modernization Consejo Nacional de Modernización del Estado
CONAZOFRA	National Committee of Free Zones Consejo Nacional de Zonas Francas
CPU	Central Processing Unit Unidad Procesamiento Central
CY	Container Yard Patio de Contenedores
CBT	Dry Bulk Terminal Terminal a Granel Seco
DIGMER	General Affairs of Merchant and Littoral Marine Dirección General de la Marina Mercante y del Litoral
DWT	Dead Weight Tonnage Tonelaje de Peso Muerto
EIA	Environmental Impact Assessment Evaluación del Impacto Ambiental
EIRR	Economic Internal Rate of Return Tasa Interna de Retorno Económico
EPZ	Export Processing Zone Zona de Procesamiento de Exportación
ESC	Complementary Services Enterprise Empresa de Servicios Complementarios
ETD	Estimated Time of Departure Hora Estimada de Salida
FAO	Food and Agriculture Organization of the United Nations Organización de Alimentos y Agricultura de las Naciones Unidas
FCL	Full Container Load Carga de Contenedor Lleno
FEU	Forty-foot Equivalent Unit Unidad Equivalente a 40 pies
FIRR	Financial Internal Rate of Return Tasa Interna de Retorno Financiero

FOB	Free on Board Libre a Bordo
GDP	Gross Domestic Products Producto Interno Bruto
GRT	Gross Register Tonnage Tonelaje de Registro Bruto
GT	Gross Tonnage Tonelaje Bruto
GYE	Port of Guayaquil Puerto de Guayaquil
HHW	Highest High Water Nivel Más Alto del Agua
HP	Horsepower Caballos
IC	Integrated Circuit Circuito Integrado
IDB	International Development Bank Banco Internacional de Desarrollo
IEE	Initial Environmental Examination Examen Ambiental Inicial
IEOS	Ecuadorian Institute of Sanitary Matters Instituto Ecuatoriano de Obras Sanitarias
INEC	National Institute of Statistics and Census Instituto Nacional de Estadísticas y Censos
INEFAN	Ecuadorian Institute of Forestal and Natural Areas Instituto Nacional Ecuatoriano de Forestación y Áreas Naturales
INERHI	Ecuadorian Institute of Hydraulic Resources Instituto Nacional Ecuatoriano de Recursos Hidráulicos
JICA	Japan International Cooperation Agency Agencia de Cooperación Internacional del Japón
KWH	Kilowatt-hour Kilovatios-hora
LCL	Less than Container Load Menos que la Carga del Contenedor
LLW	Lowest Low Water Nivel Más Bajo del Agua
LOA	Length Overall Longitud Total
LSI	Large-scale Integration Integración de Gran Escala
M/O or O/M	Maintenance and Operation, or Operation and Maintenance Mantenimiento y Operación, u Operación y Mantenimiento
MAG	Ministry of Agriculture and Livestock Ministerio de Agricultura y Ganadería
MHW	Mean High Water Pleamara Media
MICIP	Ministry of Industry, Commerce, Integration and Fishery Ministerio de Industrias, Comercio, Integración y Pesca
MLW	Mean Low Water Bajamar Media
MLWS	Mean Low Water Spring Nivel Medio de Bajamar Equinoccial
MSL	Mean Sea Level Nivel Medio del Mar
NPV	Net Present Value Valor Neto Actual

OCC	Opportunity Cost of Capital Costo de Oportunidad del Capital
OCDI	The Overseas Coastal Area Development Institute of Japan Instituto de Desarrollo del Área Costera del Exterior del Japón
ODA	Official Development Assistance Asistencia Oficial para el Desarrollo
OECF	Overseas Economic Cooperation Fund Fondo de Cooperación Económica del Exterior
OP	Port Operator Operador Portuario
OPB	Port Operator of Ship Operador Portuario de Buque
OPC	Port Operator of Cargo Operador Portuario de Carga
OR	Official Record Registro Oficial
PNB	National Program of Banana Programa Nacional del Banano
QC	Quality Control Control de Calidad
RO-RO	Roll-on Roll-off Embarque y Desembarque por Tracción Propia
SOAPG	Institution's Workers Union Sindicato de Obreros de la Institución
TB	Gross Tonnage Tonelada Bruta
TBR	Gross Register Tonnage Tonelada Bruta Registrada
TEU	Twenty-foot Equivalent Unit Unidad Equivalente a 20 pies
TM	Metric Tons Toneladas Métricas
UNCEMP	Coordination and Execution Group of Port Modernization Plan Unidad Coordinadora y Ejecutora del Plan de Modernización de Puertos
UNCTAD	United Nations Conference on Trade and Development Conferencia de las Naciones Unidas sobre Comercio y Desarrollo
ZOFREE	Esmeraldas Free Zone Zona Franca de Esmeraldas

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Study on the Master Plan for the Port of Guayaquil in the Republic of Ecuador

July 1994 - November 1995
Counterpart: Port Authority of Guayaquil

Background and Objectives of the Study

1. The port of Guayaquil is located in the most inner part of the Gulf of Guayaquil, the mouth of which opens on the southern coast facing the Pacific Ocean with a very vast extension. The city of Guayaquil which contains the port area of Guayaquil is the most populated in the Republic of Ecuador and is situated about 300 km southwest of Quito, the capital of the Republic of Ecuador.

2. Thanks to the economic activities of this adjacent big city and the very blessed natural conditions of the port, the port of Guayaquil thrives as the biggest and most active port in the Republic of Ecuador.

3. In recent years, the volume of cargoes handled at the port of Guayaquil has shown a strong tendency to increase. By the latest figure obtained, the cargo volume through the port is about 3 million tons per year and this represents 70% of the total cargo volume through four commercial ports in the country.

4. The present container terminal of the port was rather newly developed in the beginning of the 1980's. But the cargo volume through the ports in the Republic of Ecuador is rapidly increasing.

5. With such a rapid growth in the cargo volume, it is estimated that the cargo volume at the port of Guayaquil will exceed the capacity of the port in the near future.

6. Under these conditions, the Government of the Republic of Ecuador requested the Government of Japan to carry out the Study. For the preliminary study and the arrangement of the scope of the Study, JICA has sent a preparatory study team to the Republic of Ecuador and both sides have agreed on the Scope of Work for the Study.

7. Based on the Scope of Work agreed on between both sides, the study aims to formulate a master plan for the Port of Guayaquil up to the year 2010, and to conduct a feasibility study of a Short Term plan for the Port of Guayaquil for the period up to the year 2003.

Method of the Study

8. For the Master Plan, cargo volume in 2010 are forecasted in the two cases relating the increase ratio of GDP, an actual rate base and a planning rate base. On the other hand, two different levels in cargo handling efficiency are selected as basis for calculation of required number of berths in these two cases. With such conditions the two layout plans are prepared through examination on some varied cases in future cargo volume, cargo handling efficiency and location of each terminal.

9. The Short Term Plan with a target year of 2003 is formulated under the framework of the Master Plan, with actual growth rate of GDP and assuming container terminal to

be located at the existing area of the Master Plan considering the policy of APG. The Short Term Plan is evaluated from various viewpoints including important factors such as of the national economy, financial situation of APG and environment.

Outline of the Projects

10. The basic target of the development of the port of Guayaquil up to the target year of the Master Plan is identified as follows.

(1) the core of distribution of international trading cargo
(2) the core of regional and economic development

11. In order to accomplish the target, the development and planning of the port of Guayaquil should be based on the following eight subjects.

(1) to realize the modernization of port activity
(2) to cope with the increasing trend of foreign trade and growing trend of containerization
(3) to assist the promotion of exports
(4) to support industrial development in Guayas Province and in Ecuador
(5) to maintain efficiency with regard to port management
(6) to offer good service to port users
(7) to consider the environment surrounding the port including mangrove area
(8) to obtain economic and financial soundness including appropriate investment

12. Under the framework of the Master Plan considering the policy of APG, the Short Term Plan with a target year of 2003 is proposed as summarized in the table below.

	Master Plan		Short Term Plan	
Target Year	2010		2003	
Cargo Handling Efficiency	High	Medium	Gradually progress	Rapid Progress
Required Number of Berth				
Container terminal	3	3	2	2
Multi-Purpose terminal	9	10	8	7
Bulk terminal	1	1	1	1
Main Facilities to be Developed	Container berth (185 m × 1) Multi-purpose berth (185 m × 4) Related work road and pavement	Container berth (220 m × 3) Multi-purpose berth (185 m × 2) Related work road and pavement	Container berth (185 m × 1) Multi-purpose berth (185 m × 1) Related work road and pavement	Container berth (185m × 1) Related work road and pavement
Project Cost (Million sucres)	200,214	240,631	78,119	55,784

Evaluation

13. The Economic Internal Return Rate (EIRR) calculated based on the countable benefit is 24.7 per cent and the Financial Internal Return Rate (FIRR) is 25.4 per cent. So, the project is judged as being feasible, both economically and financially.

14. Some technical problems are found in the water area in front of the berths on maintaining the navigable depth, but these are of no importance. Soil conditions of the area concerned present no problem. Furthermore, the EIA revealed no unfavorable impact, thus the execution of this project will cause no problems for the environment.

15. When considering important factors which would affect this project, it can be duly said that this proposed project should be implemented in a deliberate and well harmonized way with the general movement of modernization.

Recommendation

16. To ensure the smooth implementation of this proposed plan of the port of Guayaquil, the Study Team recommends the following items. The measures which have been already implemented or planned according to the modernization program by APG may be included. However, these items are mentioned for further promotion of them.

(1) Proper application of privatization
(2) Establishment and utilization of information system
(3) Upgrading of APG's technical function
(4) Establishment of environmental policy
(5) Reinforcement of personnel policy and training system
(6) Systematic and flexible planning and project implementation
(7) Establishment of effective maintenance system
(8) Reinforcement of port promotion
(9) Regional development

Members

The counterpart members and the study Team personnel are as follows:

Counterpart Members

Mr. Nelson Ricaurte	General Manager
Mr. Fernando Cabrera Toala	General Manager
Mr. Ruben Armendariz	Chief, Operation Department
Mr. Guido Becerra Mendoza	Chief, Technical Department
Mr. Daniel Enriquez	Chief, Administration Department
Mr. Enrique Schaffry	Chief, Financial Department
Mr. Luis Lazo Briones	Assistant Manager
Mr. Jose Valarezo Valarezo	Chief, Planning Division
Ms. Delia Bastidas Bohorques	Chief, Financial Control Division
Mr. Jorge Valdez Garcia	Supervision Section
Mr. Antonio Miranda Lamilla	Chief, Accounting Section
Mr. Carlos Reyes Oña	Chief, Statistics Section

Japanese Study Team

Mr. Hajime KAWATE	Leader of the Study Team
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Mr. Teruo SUETUGU	Regional Development
Mr. Masato YAMASHITA	Demand Forecast/Economic Analysis
Mr. Kenichiro SHISHIKURA	Cargo Handling System
Mr. Yoichi NISHIOKA	Management and Operation/Financial Analysis
Mr. Noboru MURAI	Design of Port Facilities
Mr. Fujio SAIGUSA	Construction Method/Cost Estimation
Mr. Seiju IKEDA	Natural Condition
Mr. Fernando Arcos CORDERO	Environmental Survey
Mr. Satoru TSUNEYAMA	Coordination
Ms. Yoko MATHUZAKI	Interpreter

SUMMARY

PRESENT SITUATION

OUTLINE OF THE REPUBLIC OF ECUADOR

1.Ecuador is located in the northern part of South America facing the Pacific Ocean and crossing the equator. The population reached 9.6 million in 1990 and its growth rate from 1982 to 1990 is about 2.3%. The area of the country is 280,000 km².

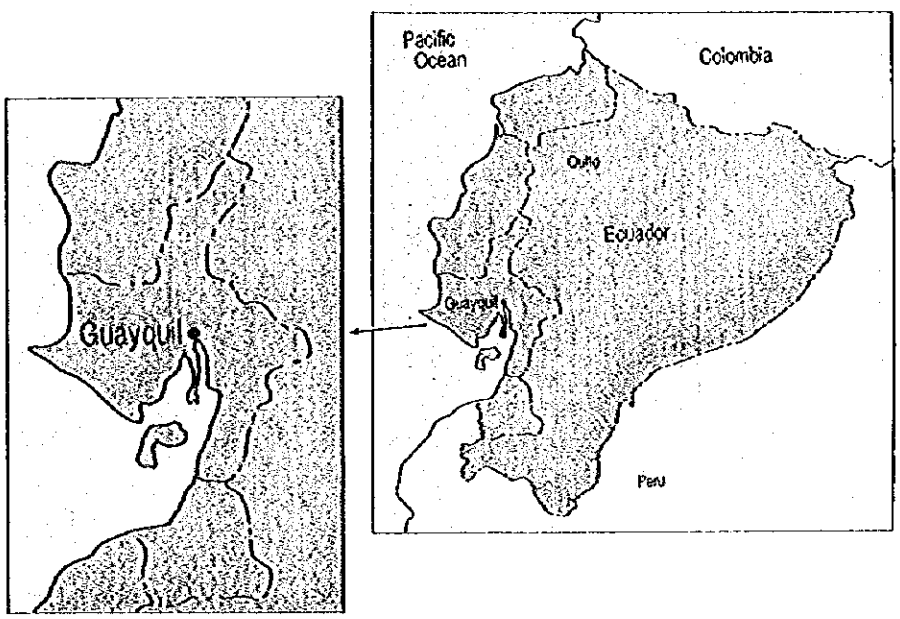


Figure - 1 Location of the port of Guayaquil in Ecuador

2. Gross Domestic Product of Ecuador is 274 billion sucres in 1993. Annual growth rate of GDP between 1980 and 1993 is 2.4%. GDP in 1987 was negatively affected by the earthquake which forced the interruption of petroleum exports.

3. Among sectors, Agriculture, Manufacturing, Commerce, Service and Petroleum have large shares, 17%, 15%, 15%, 14% and 14% respectively.

4. The FOB of export in 1993 is US$ 2,940 million and import is US$ 2,562 million. The share of primary commodities such as crude petroleum, banana and shrimp in export is more than 80% and the share of manufactured goods is 17.6% in 1993. In case of import, shares of primary material, capital goods and consumer goods are 36.7%, 36.9% and 22.8% respectively.

5. Agenda for Development (Agenda para el Desarrollo), which is Action Plan of the National Government for the year 1993-1996 was approved by the president on June 3, 1993. There are five major objectives in the second edition of the Agenda revised in 1994:

(1) to improve social welfare
(2) to improve public service
(3) to modernize the State
(4) to increase productivity and production
(5) to obtain macro-economic stability and dynamize the economy

6. To advance strongly the process of modernization of the State, the CONAM was established in 1992 and UNCEMP was organized in 1993 to modernize the ports in Ecuador.

7. Meanwhile, laws and institutional scheme aiming at promotion of export, Export Processing Zone (Zona Franca) and Maquila, have been established in recent years.

8. Four commercial ports, the port of Esmeraldas, Manta, Guayaquil and Bolivar are located along the Pacific Ocean. Four independent port authorities are established and manage the ports respectively. The cargo volume through these four ports has increased steadily in these years and reached 2.6 million tons in import and 3.2 million tons in export in 1993.

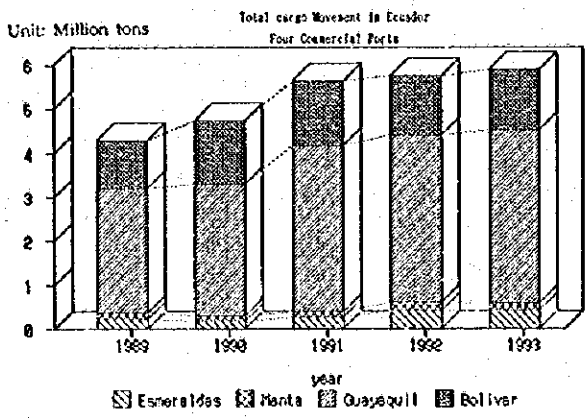


Figure - 2 Total Cargo Movement in Ecuador: Four Commercial Ports

9. The ports for petroleum handling are located at Balao and La Libeltad and 12 million tons of petroleum were handled in 1993.

10. The population of the city of Guayaquil, the capital of Guayas Province, amounts to over 2 million, equivalent to 26% of that of Ecuador. The activities of industry and commerce are concentrated in the Province as shown in Figure - 3.

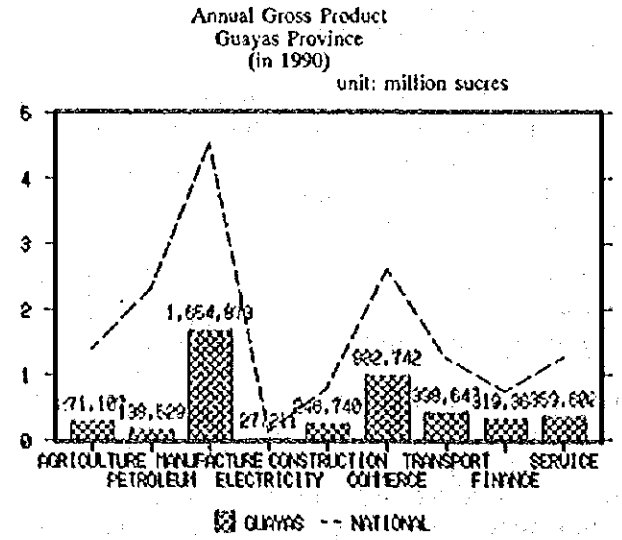


Figure - 3 Gross Products in Guayas Province

PRESENT SITUATION OF THE PORT OF GUAYAQUIL

11. The port of Guayaquil was originally located at the inner part of the Guayas river but was transferred to the present site in 1958. The expansion project for container handling and bulk was executed in 1980.

12. The port consists of a conventional terminal, container terminal and bulk terminal. There are 925 m wharf with depth of 10.5 m, 555 m, container berth and 155 m bulk berth. The area of about 100 ha is used for port activities, port facilities such as transit sheds, warehouses, container yard and so on are found here.

13. The port is located far inside of the Guayaquil Gulf which shows U-shaped morphology with a mouth opened toward South to the Pacific Ocean. Inside the gulf many islands, shoals and marshes of wild mangrove forest are spread and many estuaries are found.

14. The port of Guayaquil is connected to the Pacific Ocean through 94 km access channel, Estelo Salado. The design depth of the channel is 9.45 m but sedimentation has been gradually progressing.

15. The cargo volume through the port is 3.9 million tons in 1993 which is equivalent to 67% of the cargo volume through four commercial ports. Major commodities of import in 1993 are wheat, chemical products and iron/steel and those of export are banana, fish/shrimp and coffee. The major trade partners are the USA, Canada, Brazil, Belgium and Chile.

16. The share of cargo through the port of Guayaquil consumed and used is 74% and other cargo is transported to almost all provinces including Pichincha Province where the capital, Quito, is located.

17. The number of ship calls in 1993 amounts to 1,464 and the berth occupancy ratio, which was approximately 0.6 in the 1980s, shows over 0.7 in 1993.

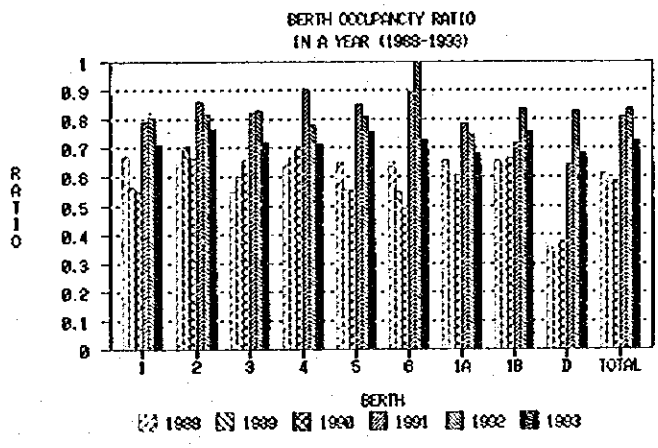


Figure - 4 The Berth Occupancy ratio at Each Berth

18. The Port Authority of Guayaquil is the managing body of the port of Guayaquil and approximately 1,250 persons are employed. The present organization is shown in Figure - 5 but the restructuring of organization is under consideration according to modernization program.

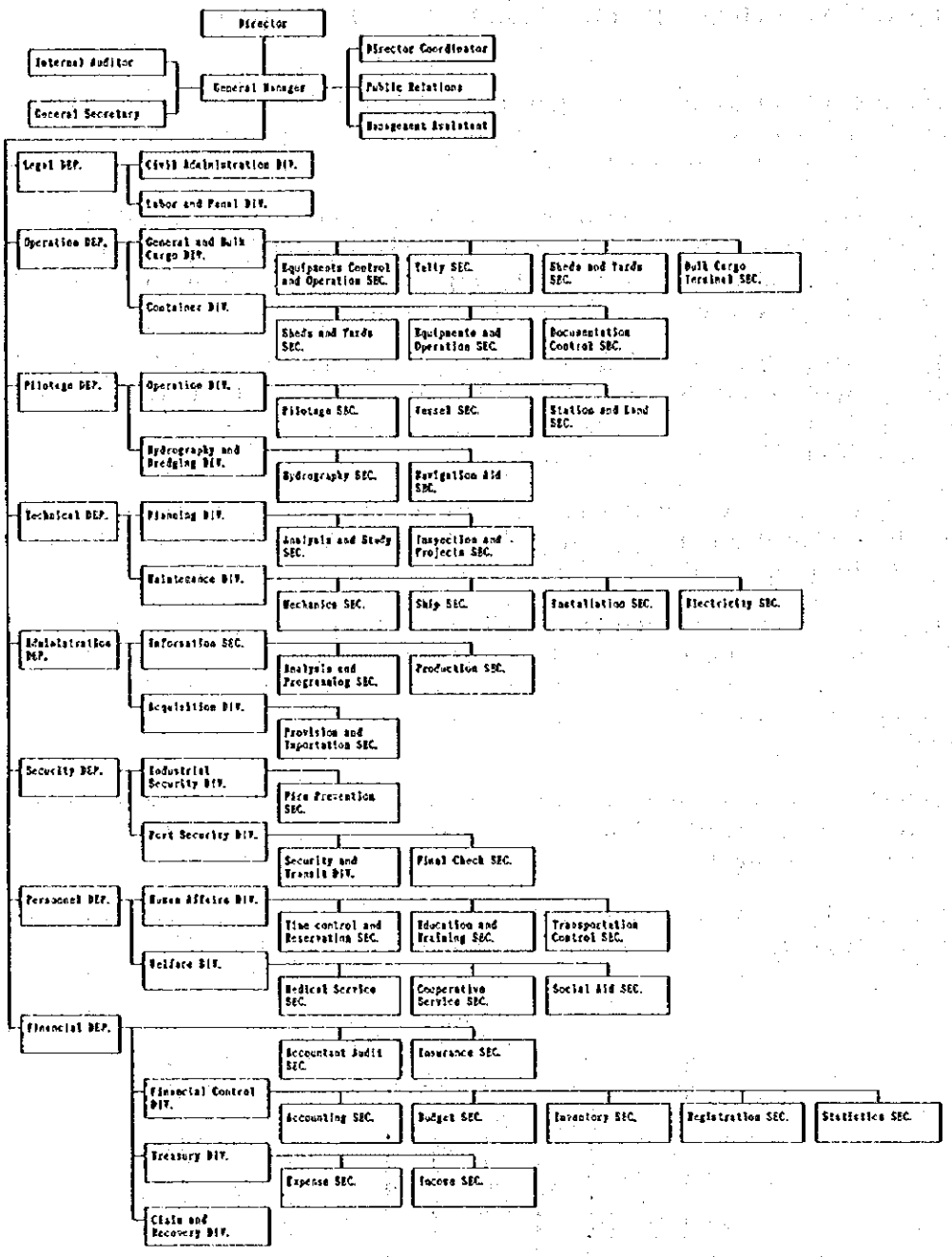


Figure - 5 Organization Chart of APG

19. APG is financially independent from Central Government getting no subsidy. In 1993, operation revenue is 62,704 million sucres and operating expense, 54,895 million sucres so net operating income results 7,809 million. On the other hand, the difference between non operation revenue and expense shows a deficit. The net income after contribution becomes -3,485 million sucres.

20. One of the most important subjects concerning the port of Guayaquil is modernization including measurement for containerization, improvement of cargo handling and privatization in port service.

MASTER PLAN

TARGET OF DEVELOPMENT

21. The Master Plan up to 2010 will be prepared taking into consideration modernization program by APG which aims at improvement of cargo handling efficiency, privatization and so on.

22. Four commercial ports are expected to play roles as the core of foreign trade and infrastructure for economic activity in their respective areas. The port of Guayaquil in particular is expected to serve as the main gateway port of Ecuador.

23. The basic target of the development of port of Guayaquil up to the target year of the Master Plan is identified as:

(1) the core of distribution of international trade
(2) the core of regional and economic development

24. In order to achieve the target, the development and planning of the port of Guayaquil should be base on the following eight subjects:

(1) to realize modernization of port activity
(2) to cope with the increasing trend of foreign trade and growing trend of containerization
(3) to assist the promotion of exports
(4) to support industrial development in Guayas Province and in Ecuador
(5) to maintain efficiency with regard to port management
(6) to offer good service to port users
(7) to consider the environmental surroundings of the port including mangrove area
(8) to obtain economic and financial soundness including appropriate investment

25. Almost 26% of the national population reside in Guayas Province and the manufacturing sector has the highest gross product, while the gross product of tertiary industry such as commerce, finance and service is also high. Furthermore, the number of maquila companies located in Guayas Province has double in the last two years to 24, which represents half of the total. This suggests that the hinterland of the port of Guayaquil has high potential for development in future.

26. The development of the port of Guayaquil should be planned according to the strategy for introducing port related industry and leading regional development. It is thus necessary to consider the relationship between regional development and port activity (See Figure - 6).

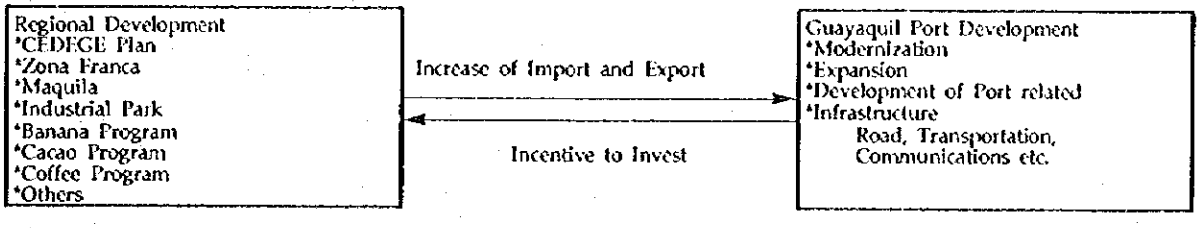
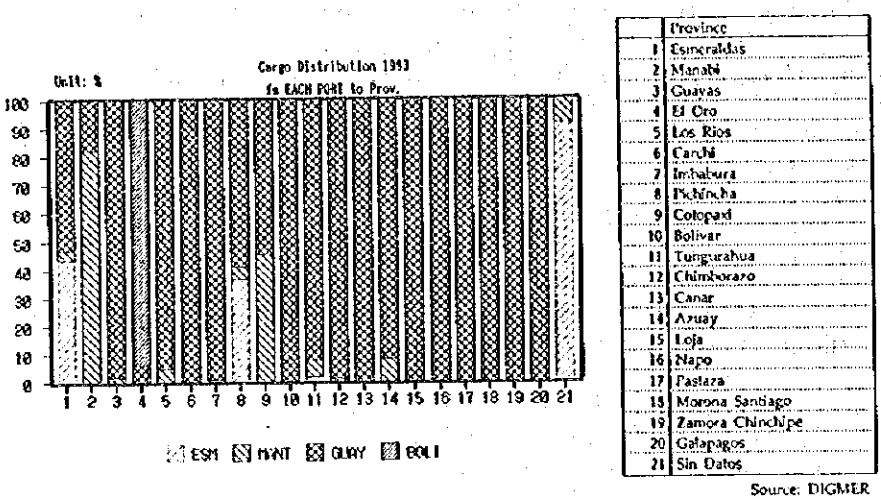


Figure - 6 The Relationship between the Regional Development and the Development of Guayaquil Port

DEMAND FORECAST

27. The destination of the foreign import cargo passing through the port of Guayaquil spreads to almost all provinces while almost all imported cargo is transported from the port of Guayaquil. This shows that the hinterland of the port of Guayaquil is the entire nation. Therefore the future cargo demand for the port of Guayaquil is forecasted based on the activity in the whole country.



Source: DIGMER

Figure - 7 Cargo Distribution from Each Port to Provinces

28. The population in 2010 was estimated through INEC as 14.89 million which is 1.4 times larger than in 1993.

29. There are no authorized figures of GDP up to 2010. Each successive government has prepared the growth rate of GDP as a target of economic activity of Ecuador but actual rate has been often less than the target. In the study cargo volumes in 2010 are forecasted for two cases, an actual rate base and a planning rate base:

Case 1: Actual rate base
3% (1993-2003)
4% (2004-2010)
Case 2: Planning rate base
5.5% (1993-2010)

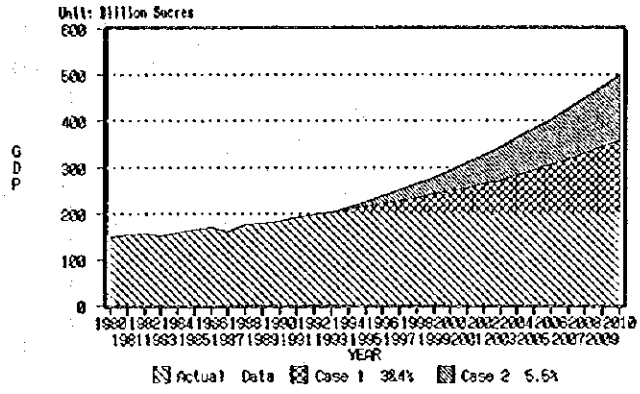


Figure - 8 Historical Growth of GDP

30. The result of macro forecast in Case 1 is:

Time trend analysis		
	import	1,996,000
	export	2,990,000
	total	4,986,000 ton
GDP correlation analysis		
	import	3,050,000
	export	4,969,000
	total	8,019,000 ton

31. On the other hand, cargo volume in micro forecast is based on future population or GDP by each commodity using past trends. In case of banana, future demand is forecasted based on demand of banana in the world, productivity of banana and interviews with National Banana Program.

32. The forecasted cargo volume in 2010 in Case 1 by each type of cargo is shown in Table - 1 and Table - 2. The total volume of cargo through the port of Guayaquil in 2010 amounts to 6,572,000 tons. This consists of 3,731,000 tons export cargo and 2,841,888 tons import cargo. This figure is used as the cargo volume in 2010 in Case 1 with reference to the result of the macro forecast.

33. As the forecasted container cargo in 2010 will be General Cargo and Banana from the result of Table-1 and 2, containerization in future is estimated using a logistic curve analysis. According to the estimation, 80% of import cargo and 62% of export cargo with potentiality to be containerized will be containerized.

34. This means that container cargo volume in 2010 will become 3,374,000 tons, which is 2.8 times greater than the volume in 1993. The transhipment container cargo is estimated as 1,350 TEU based on assumed cargo flow among surrounding countries because there are no sufficient data. The composition of container cargo is shown in Table - 3.

Table - 1 Summary of Import Cargo at Guayaquil Port by Case 1 in 2010

Unit: Ton

No	Commodity	G. Cargo	Solid Bulk	Liquid Bulk	Bag Cargo	Total
1	Wheat		248,000			248,000
2	Sugar				195,000	195,000
3	Cereals		142,000			142,000
4	Vegetable Oil			30,000		30,000
5	Paper and Derivative	464,000				464,000
6	Materials and Minerals		150,000			150,000
7	Construction Material		17,000			17,000
8	Manure and Fertilizer		235,000			235,000
9	Chemical Product	535,000				535,000
10	Iron. Steel		325,000			325,000
11	Vehicle and Machinery		85,000			85,000
12	Merchandise and Other	190,000				190,000
13	Manufacturing and Met.	173,000				173,000
14	General Cargo	52,000				52,000
	Total	1,414,000	1,202,000	30,000	195,000	2,841,000

Table - 2 Summary of Export Cargo at Guayaquil Port by Case 1 in 2010

Unit: Ton

No	Commodity	G.Cargo	Solid Bulk	Liquid Bulk	Bag Cargo	Banana	Total
1	Banana					2,520,000	2,520,000
2	Green Banana					80,000	80,000
3	Coffee	124,000					124,000
4	Cacao and Derivat.	100,000					100,000
5	Rice, Cereals				2,000		2,000
6	Sugar				22,000		22,000
7	Molasses	11,000					11,000
8	Fruit, Vegetables	76,000					76,000
9	Wood and Balsa		46,000				46,000
10	Fish, Shellfish	229,000					229,000
11	Fishmeal	1,000					1,000
12	Materials and Minerals		60,000				60,000
13	Chemical Product	6,000					6,000
14	Canned Food	165,000					165,000
15	Manufacturing	6,000					6,000
16	General Cargo	33,000					33,000
17	CEDEGE Project	250,000					250,000
	Total	1,001,000	106,000	0	24,000	2,600,000	3,731,000

Table - 3 Summary of Container Cargo by Case 1 in 2010

Unit: ton

Year 2010	Import	Export	Total
Refrigerator for Banana	-	1,267,000	1,267,000
General Cargo	1,131,000	976,000	2,107,000
Total	1,131,000	2,243,000	3,374,000
Containerized Cargo	1,414,000	3,601,000	5,015,000
Percentage of Containerization	80%	62%	67%

Remarks: Container of import; 14.20 ton/No, Container of export; 16.39 ton/No, Total 15.33 ton/No between 1992 and 1993.

Container	Import Unit: No	Export Unit: No	Total Unit: No	Import Unit: TEU	Export Unit: TEU	Total Unit: TEU
Full						
Banana 40 ft	0	70,000	70,000	0	140,000	140,000
General 20 ft	43,000	37,000	80,000	43,000	37,000	80,000
General 40 ft	37,000	30,000	67,000	74,000	60,000	134,000
Total	80,000	137,000	217,000	117,000	237,000	354,000
Empty						
Banana 40 ft	35,000	0	35,000	70,000	0	70,000
General 20 ft	7,000	41,000	48,000	7,000	41,000	48,000
General 40 ft	13,000	28,000	41,000	26,000	56,000	82,000
Total	55,000	69,000	124,000	103,000	97,000	200,000
Full+Empty						
Banana 40 ft	35,000	70,000	105,000	70,000	140,000	210,000
General 20 ft	50,000	78,000	128,000	50,000	78,000	128,000
General 40 ft	50,000	58,000	108,000	100,000	116,000	216,000
Total	135,000	206,000	341,000	220,000	334,000	554,000

35. Finally the cargo volume in 2010 by each cargo type is forecasted as shown in Table - 4.

Table - 4 Cargo Volume by Cargo Type by Case 1 in 2010

Unit: Ton

Package Type	Import	Export	Total
General Cargo	284,000	25,000	309,000
Solid Bulk	577,000	106,000	683,000
Grain Bulk	390,000	0	390,000
Fertilizer Bulk	235,000	0	235,000
Liquid Bulk	30,000	0	30,000
Bag Cargo	195,000	24,000	219,000
Banana Box Cargo	0	1,333,000	1,333,000
Container Banana 40 foot	0	1,267,000	1,267,000
Container General Cargo 20 foot	565,000	557,000	1,122,000
(Container Terminal 20 foot)	(334,000)	(329,000)	(663,000)
(Multi-terminal 20 foot)	(231,000)	(228,000)	(459,000)
Container General Cargo 40 foot	565,000	419,000	984,000
(Container Terminal 40 foot)	(334,000)	(248,000)	(582,000)
(Multi-terminal 40 foot)	(231,000)	(171,000)	(403,000)
Total	2,841,000	3,731,000	6,572,000

36. The number of ship call in 2010, by ship type, is forecasted based on cargo volume and future average cargo volume per ship estimated using past trends. It is thought that the second generation container ship will call the port at the stage of the Master Plan.

Table - 5 Standard Ship by Case 1 in 2010

Ship Type	DWT (ton)	Handled Volume (ton/ship)	Cargo Volume (ton)	Ship Calls (No)
Mix Type Ship	12,000	2,600	3,639,000	1,400
Grain Bulk	26,000	14,000	390,000	30
Liquid Bulk	9,000	2,600	30,000	10
FC Banana & GC	12,000	1,360 TEU	210,000 TEU	160
FC G.Cargo	20,000	320 TEU	207,700 TEU	650
Total				2,250

Source: APG, modified by JICA Study Team
Remarks: DWT; Dead Weight Ton, FC; Full Container (TEU includes empty container.) Above data is including transhipment cargo.

37. The cargo volume in Case 2 is forecasted following the same procedure as in Case 1. The result of the cargo volume forecast in Case II is shown in Table - 6. The number of ship call in 2010 by Case 2, by ship type, is shown in Table - 7.

Table - 6 Cargo Volume by Cargo Type by Case 2 in 2010

Unit: Ton

Package Type	Import	Export	Total
General Cargo	396,000	30,000	426,000
Solid Bulk	630,000	106,000	736,000
Grain Bulk	390,000	0	390,000
Fertilizer Bulk	235,000	0	235,000
Liquid Bulk	30,000	0	30,000
Bag Cargo	195,000	24,000	219,000
Banana Box Cargo	0	1,332,000	1,332,000
Container Banana 40 foot	0	1,268,000	1,268,000
Container General Cargo 20 foot	793,000	601,000	1,394,000
(Container Terminal 20 foot)	(528,000)	(400,000)	(928,000)
(Multi-terminal 20 foot)	(265,000)	(201,000)	(466,000)
Container General Cargo 40 foot	793,000	551,000	1,344,000
(Container Terminal 40 foot)	(528,000)	(367,000)	(895,000)
(Multi-terminal 40 foot)	(265,000)	(184,000)	(449,000)
Total	3,462,000	3,912,000	7,374,000

Table - 7 Standard Ship by Case 2 in 2010

Ship Type	DWT (ton)	Handled Volume (ton/ship)	Cargo Volume (ton)	Ship Calls (No)
Mix Type Ship	12,000	2,600	3,861,000	1,490
Grain Bulk	26,000	14,000	390,000	30
Liquid Bulk	9,000	2,600	30,000	10
FC Banana	12,000	1,360 TEU	210,000 TEU	160
FC G.Cargo	20,000	320 TEU	308,700 TEU	970
Total				2,660

Source: APG, modified by JICA Study Team
Remarks: DWT; Dead Weight Ton, FC; Full Container (TEU includes empty container.)

LONG TERM DEVELOPMENT PLAN

38. Required number of berth depends on cargo volume and cargo handling efficiency. two scenarios are adopted to forecast the cargo volume, Case 1 and Case 2.

39. Concerning cargo handling efficiency, the target in 2010 was set up under some assumptions with limited data because there are not sufficient data. Because improvement of cargo handling efficiency is largely dependent on progress of modernization program by APG, a case in which efficiency improves to only have the target of half level is also examined.

40. Here four cases are adopted as follows. The index of 1/2 in the name shows the difference of cargo volume and A/B difference of cargo handling efficiency. The required number of berth is calculated in Case 1A and 1B to identify difference between high and medium cargo handling efficiencies. In addition Case 2B for maximum required number of berth is examined. For other facilities the requirements are calculated as Case 1 and Case 2.

Table - 8 Cases of Caluculation

name of case	small cargo volume	large cargo volume
high efficiency	Case 1A	Case 2A
medium efficiency	Case 1B	Case 2B

41. The present design depth of the channel, 9.45 m, is adopted as the depth of the access channel in the Master Plan taking into consideration progress of sedimentation, requirement of maintenance dredging, environmental aspects and tendency of shipping in this area.

42. The standard ship dimension is assumed as 19,000 DWT for container ships, 17,000 DWT for conventional type ships and 20,000 DWT for bulk ships.

43. The cargo handling efficiency is shown in Table - 9. The improvement of efficiency is assumed 1.2 to 1.9 times the present level in case of multi-purpose terminal in Case 1A.

44. The utilization of berth will be improved from the viewpoint of functional separation.

Table - 9 Cargo Handling Efficiency in 2010

High Level

Cargo Parameter(high)	<Container terminal> Banana	General	<Multi-Purpose Terminal> Con-tainer	Conven-tional	Banana	<Bulk Terminal> Grain	Liquid
Handling Capacity ton(box)/Hr	50	20	112.50	65.00	137.87	160.00	160.00
(Ratio-2010/1993)	(1.09)	(2.00)	(1.25)	(1.25)	(1.53)	(1.45)	(1.78)
Working Time /Berthing Time	0.81		0.81		0.74	0.81	
(1993-2010/Hr)	(6-4.5)		(6-4.5)		(9.6-6.3)	(6-4.5)	
Cargo Volume /Berthing Time	41	16	91	53	102	130	130
(Ratio-2010/1993)	(1.18)	(2.17)	(1.35)	(1.35)	(1.88)	(1.58)	(1.93)

Note: ton; for Multi-Purpose Terminal, Bulk Terminal
box; for Container Terminal

Medium Level

Cargo Parameter(medium)	<Container terminal> Banana	General	<Multi-Purpose Terminal> Con-tainer	Conven-tional	Banana	<Bulk Terminal> Grain	Liquid
Handling Capacity ton(box)/Hr	48	15	101.25	58.50	113.94	135.00	125.00
(Ratio-2010/1993)	(1.04)	(1.50)	(1.13)	(1.13)	(1.27)	(1.23)	(1.39)
Working Time /Berthing Time	0.81		0.81		0.74	0.81	
(1993-2010/Hr)	(6-4.5)		(6-4.5)		(9.6-6.3)	(6-4.5)	
Cargo Volume /Berthing Time	39	12	82	48	84	100	102
(Ratio-2010/1993)	(1.13)	(1.63)	(1.22)	(1.22)	(1.56)	(1.33)	(1.50)

Note: ton; for Multi-Purpose Terminal, Bulk Terminal
box; for Container Terminal

45. The result of calculation is as follows:

Case 1A
- Container terminal 3
- Multi-purpose terminal 9
- Bulk terminal 1

Case 1B/2B
- Container terminal 3
- Multi-purpose terminal 10
- Bulk terminal 1

Note: Berth occupancy rates
- container berth : 0.6
- multipurpose berth : 0.7

Table - 10 Required Number of Berth in 2010 for Case 1A

Case 1A	<Container terminal>		<Multi-Purpose Terminal>			<Bulk Terminal>		
cargo Parameter	Banana	General	Con-tainer	Conven-tional	Banana	Grain	Liquid	
Cargo Volume ton(box)/year	105,000	141,665	860,563	1,446,000	1,333,000	390,000	30,000	
Cargo Volume /Berthing Time	41	16	91	53	102	130	130	
Required Berthing Time (hour)	2,585	8,718	9,415	27,380	13,110	3,000	231	
Calculated Number of Berth	0.49	1.66	1.54	4.47	2.14	0.49	0.04	
Required Number of Berth	3 (2.15)		9 (8.14)			1 (0.53)		13

Table - 11 Required Number of Berth in 2010 for Case 1B

Case 1B	<Container terminal>		<Multi-Purpose Terminal>			<Bulk Terminal>		
cargo Parameter	Banana	General	Con-tainer	Conven-tional	Banana	Grain	Liquid	
Cargo Volume ton(box)/year	105,000	141,665	860,563	1,446,000	1,333,000	390,000	30,000	
Cargo Volume /Berthing Time	39	12	82	48	84	110	102	
Required Berthing Time (hour)	2,692	11,624	10,461	30,422	15,864	3,556	295	
Calculated Number of Berth	0.51	2.21	1.71	4.96	2.59	0.58	0.05	
Required Number of Berth	3 (2.72)		10 (9.25)			1 (0.63)		14

Note: ton; for Multi-Purpose Terminal, Bulk Terminal
box; for Container Terminal

46. In Case 2A and 2B cargo volume is larger than Case 1B, but an additional is not required. Therefore the required number in Case 2B is the same as Case 1B.

47. Other facilities are calculated based on parameters set up with reference to present situation of port of Guayaquil and similar port plannings. The result of case 1 is as follows:

Container terminal		
Width of apron	40	m
Container Yard	93,030	m^2
CFS	7,427	m^2
Attache area	7,000	m^2
Terminal gate	7	lanes
Multi-purpose terminal		
Width of apron	30	m
Transit shed	17,474	m^2
Sorting yard	4,566	m^2
Warehouse	15,274	m^2
Open shed	35,131	m^2

48. In Case 2A and 2B, the result is as follows:

Container terminal		
Width of apron	40	m
Container Yard	120,000	m^2
CFS	10,500	m^2
Attache area	7,000	m^2
Terminal gate	8	lanes
Multi-purpose terminal		
Width of apron	30	m
Transit shed	19,400	m^2
Sorting yard	5,000	m^2
Warehouse	29,700	m^2
Open shed	42,000	m^2

49. The number of cars for planning the required lanes of road is calculated as 1,132 and required number of lanes is four.

50. Land area which APG possesses is approximately 250 ha including the area not utilized for port activities. There are port facilities with enough capacity such as warehouse and transit shed.

51. Under such a situation, the layout plan is prepared taking the following matters into consideration:

(1) sufficient utilization of the port area
(2) functional separation
(3) high efficiency of cargo handling
(4) rational transportation in port area
(5) environmental preservation
(6) utilization of existing facilities

52. The land use and layout plan will be determined mainly based on the layout of berth because there is sufficient space for other facilities. A key point is whether the

container terminal will be planned at existing area or at the western expansion area. Alternative layout plans are drawn for each case (See Table - 12) and Zoning Plan is shown in Table - 13. These general layouts are compared from such points of view as functional separation, utilization of existing facilities, continuity of present port, use of reserved area, size of investment, future expansion for containerization and flexibility according to the progress of modernization.

53. As a result, it is recommended in Case 1A that the container terminal is planned at an existing site and in case 1B at a western expansion area. The layout plans for both cases are drawn in Figure - 9 and Figure - 10.

54. It is recommended that the land which APG possesses should be utilized for port related activities such as Zona Franca.

55. As a result of IEE for the related environmental factors in the Master Plan, the environmental impact has been evaluated to be small and/or negligible.

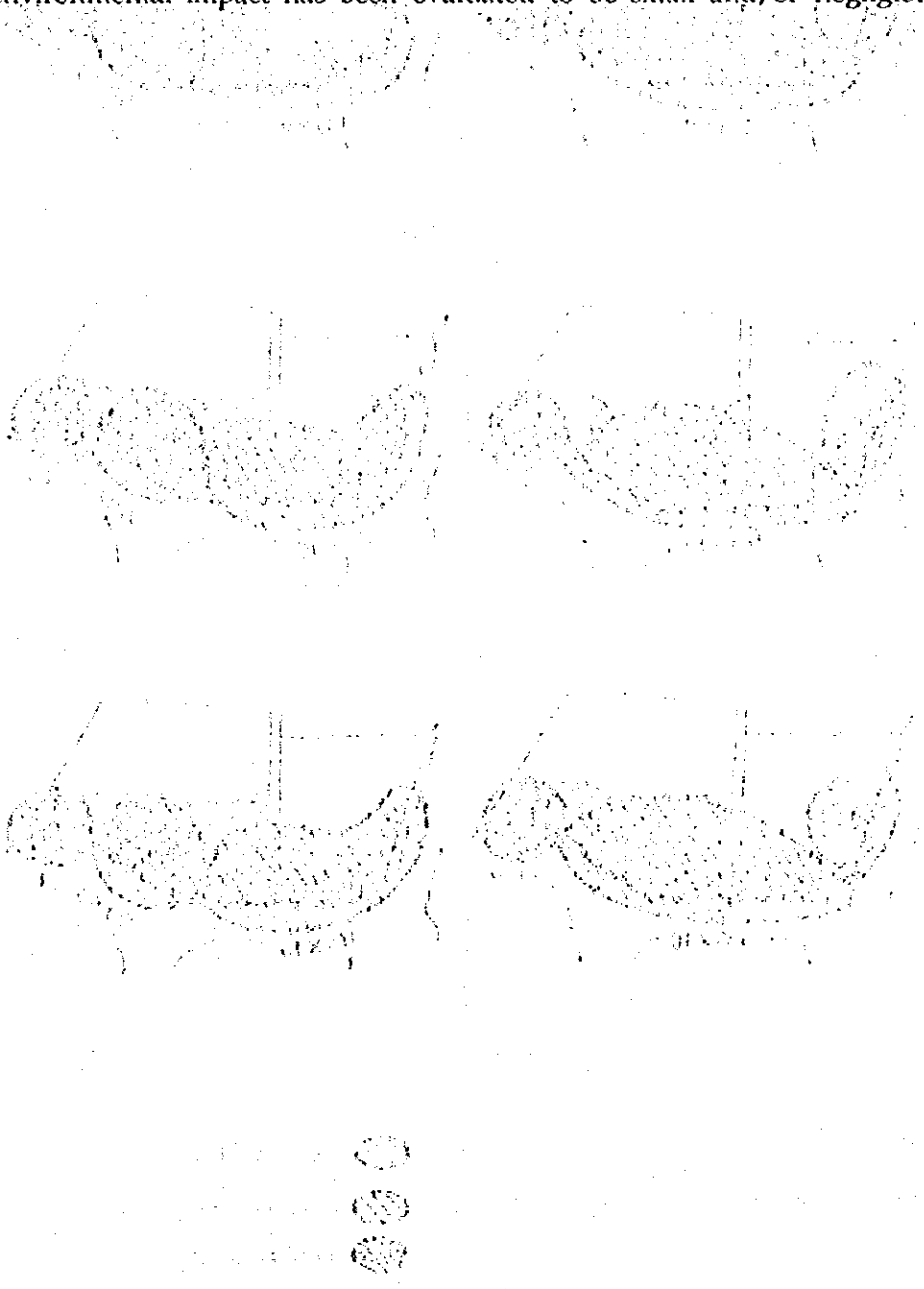
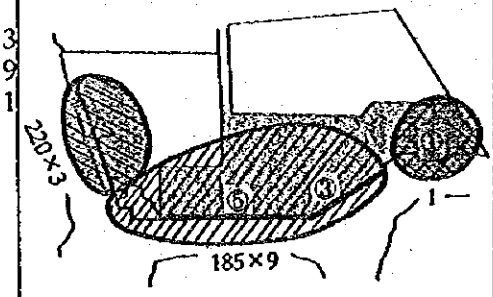
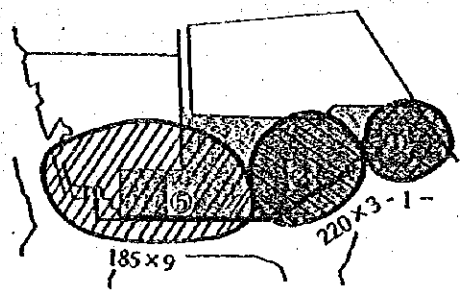
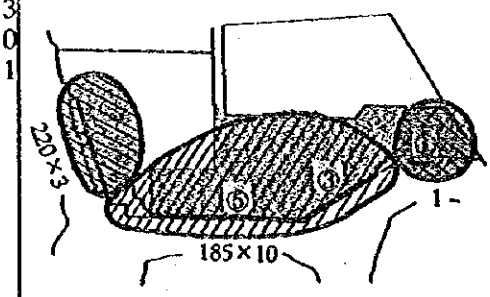
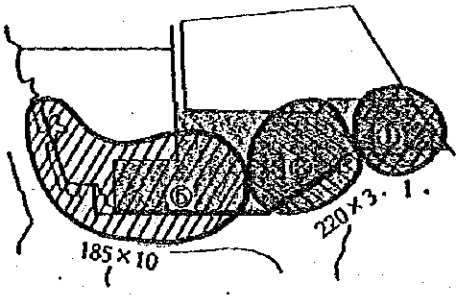
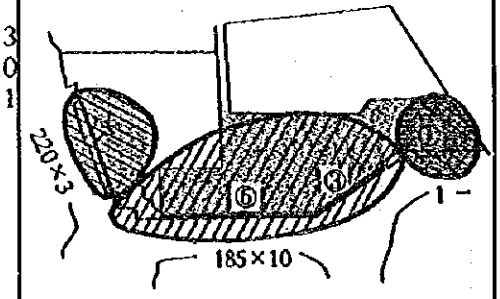
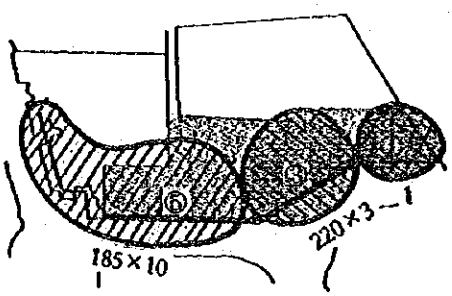


Table - 12 Berth Layout

	Zoning Plan 1	Zoning Plan 2
Container Terminal	at western expansion area	at present container terminal
Multi-purpose terminal	at present port area	at present terminal and western expansion area
Case 1A Container 3 Multi-p. 9 Bulk 1		
Case 1B Container 3 Multi-p. 10 Bulk 1		
Case 2B Container 3 Multi-p. 10 Bulk 1		

Note:

——— : existing berth
⑤ : number of existing berths
185×10 : length of berth x number of berth in 2010

Container terminal
Multipurpose terminal
Bulk terminal

Table - 13 Comparison of Zoning Plan

Items	Zoning Plan 1	Zoning Plan 2
functional separation	○	
utilization of existing facilities		○
continuity of present port		○
use of reserved area	○	
size of investment		○
future expansion for containerization	○	
flexibility for progress of modernization		○

note: ○ advantage

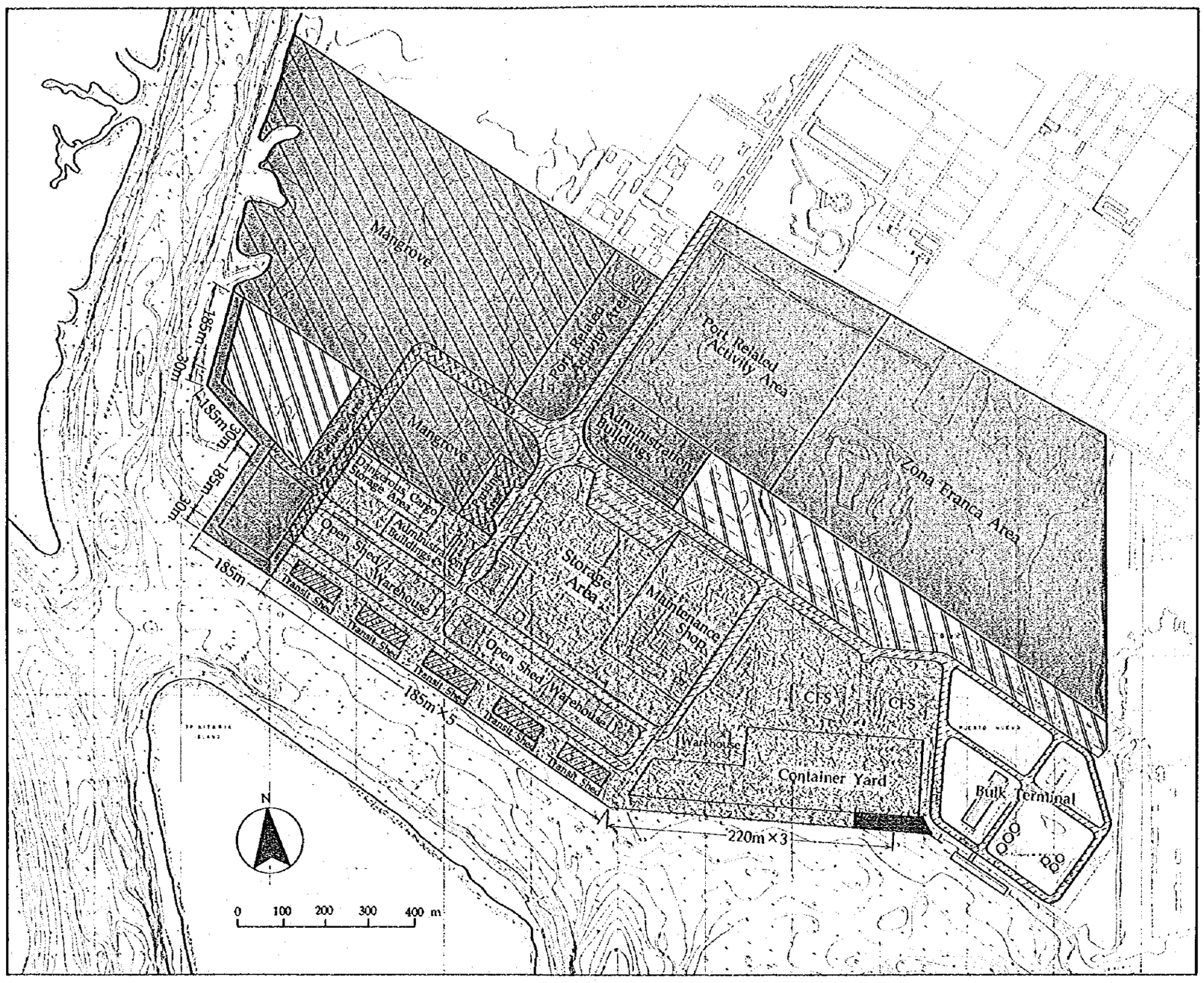
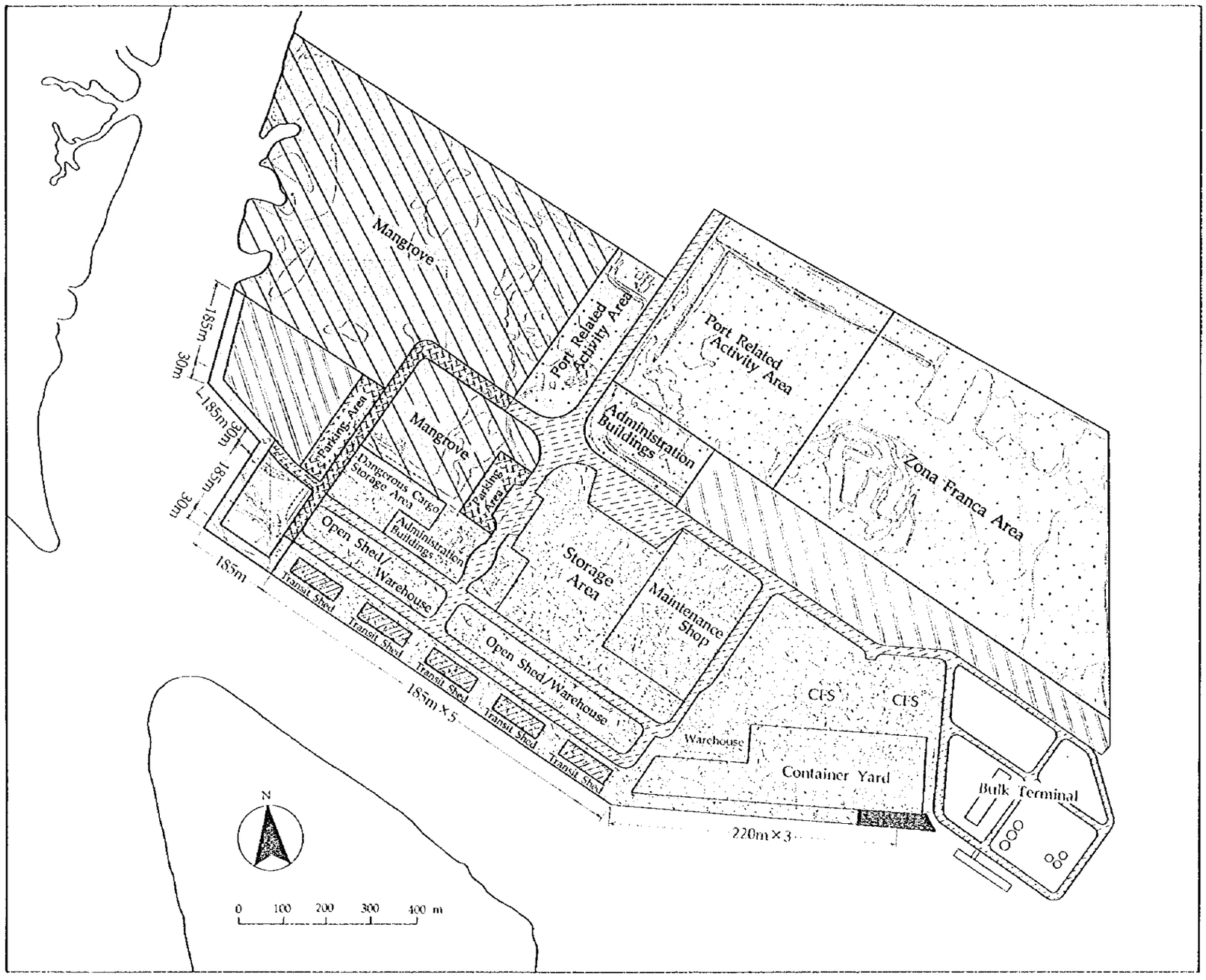
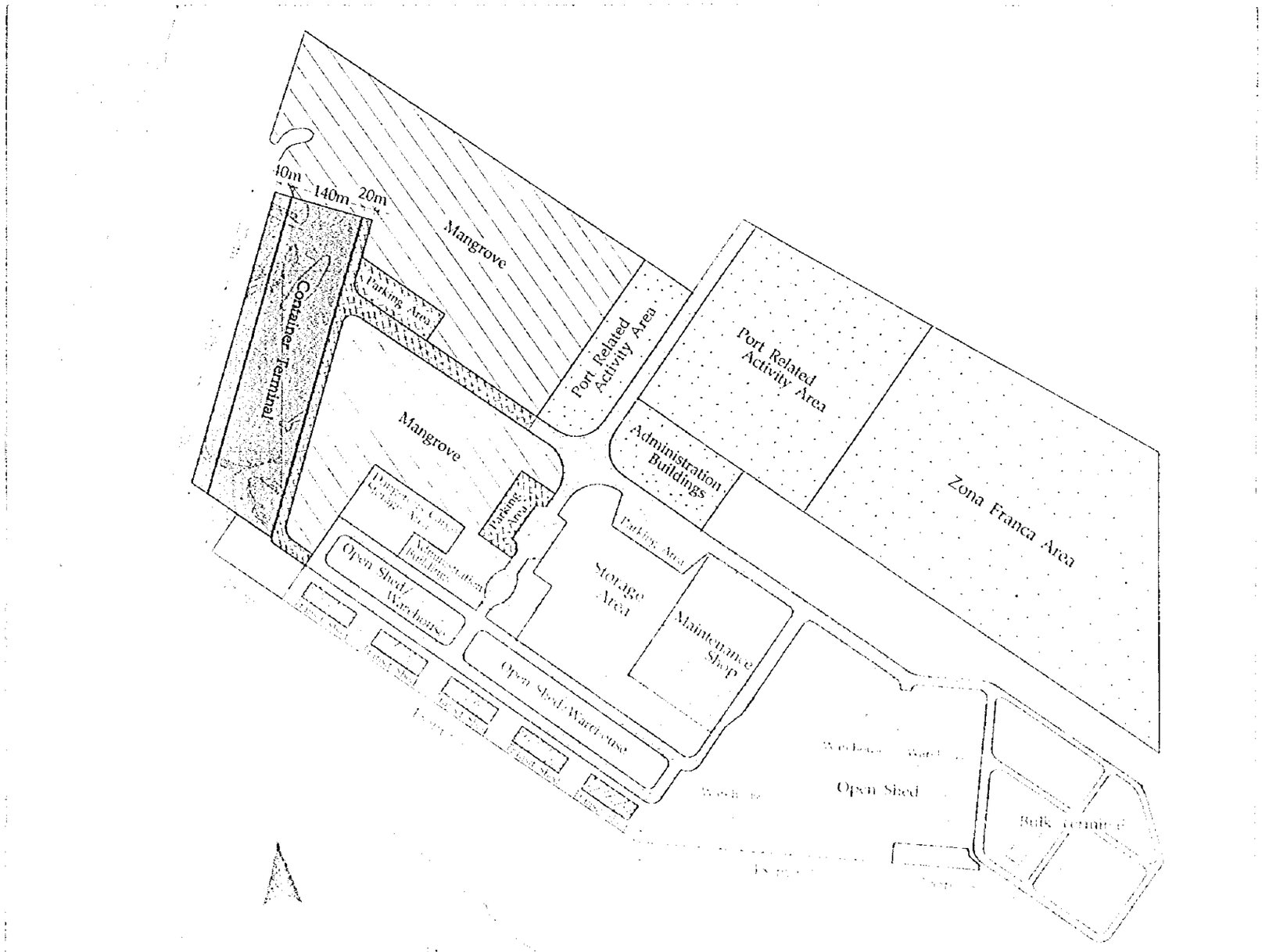


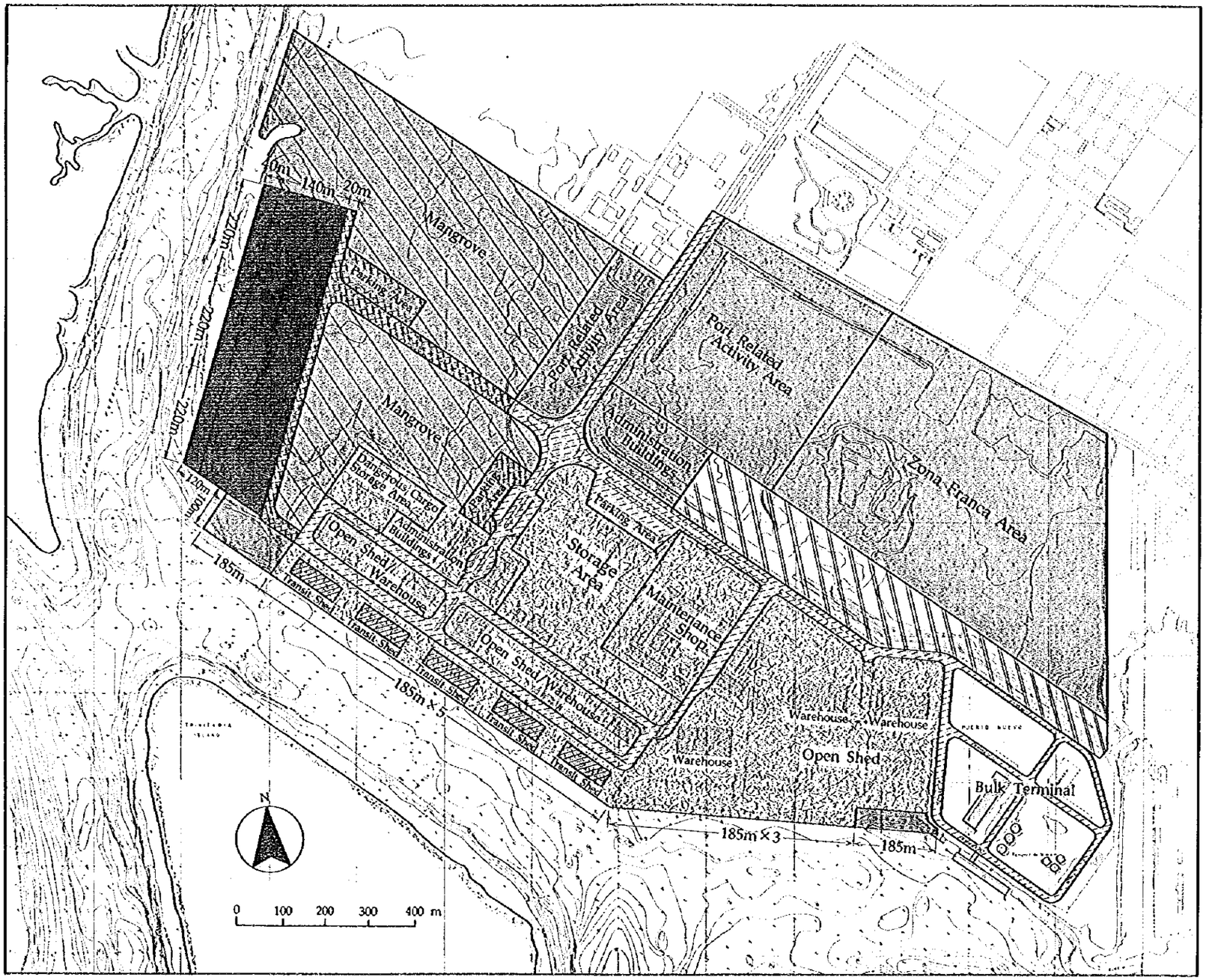
Figure - 9 Layout Plan for Case 1A



Container Terminal
Multi-Purpose Terminal
Bulk Terminal
Road and parking Area
Port Related Activity Area
Mangrove Area
Reserved Area
New Development
Rehabilitated Facilities
Remained Facilities/Area

Figure - 9 Layout Plan for Case 1A


40m
140m
20m
Container Terminal
Parking Area
Mangrove
Port Related Activity Area
Port Related Activity Area
Administration Buildings
Zona Franca Area
Mangrove
Parking Area
Storage Area
Open Shed/ Warehouse
Maintenance Shop
Open Shed
Bulk Terminal



Container Terminal
Multi-Purpose Terminal
Bulk Terminal
Road and parking Area
Port Related Activity Area
Mangrove Area
Reserved Area
New Development
Rehabilitated Facilities
Remained Facilities/Area

Figure - 10 Layout Plan for Case 1B

PRELIMINARY DESIGN AND ROUGH COST ESTIMATION

56. In the Master Plan the engineering condition is set up as follows:

Datum level	MLSW
Crown height	5.7 m as same as existing berth
Depth of basin	10.5 m (11.0 m in case of container berth planned at a western expansion area)
Surcharge on apron	3 ton/m²
Soil condition	Gravel/Sand (-9~-14m) Sand (-14m~)
Seismic coefficient	0.15
Pile capacity safety factor	2.5, 3.0: ordinary 1.5, 2.5: out of ordinary

57. Comparing several types, the open-deck on the concrete piles is recommended.

58. The construction cost for the Master Plan is roughly estimated as 200,214 million sucres in Case 1A and 240,631 million sucres in case 1B.

Table - 14 Project Cost of the Master Plan

Case 1A (Zoning Plan 2) (Unit:Thousand Sucres)

Facilities	Total
Container Terminal:	22,589,643
Wharf	22,130,625
Reclamation	95,382
Pavement	173,900
Dredging	189,736
Multi-Purpose Terminal:	99,235,118
Water Basin	4,394,880
Reclamation	3,174,618
Wharf	89,332,070
Parking Lot	658,000
Pavement	1,217,300
Road	458,250
Service Boats Area:	291,200
Pontoon	291,200
Administrative Zone:	658,000
Parking Lot	658,000
Sub-Total	122,773,961
Utilities	4,596,774
Cargo Handling Equipment:	55,431,452
Gantry Crane	39,715,200
Straddle Carrier	8,296,064
Toplifter(42ton)	1,702,400
Toplifter(18ton)	772,800
Tractor Head	3,150,740
Chassis	909,040
Folklift(7.5ton)	405,096
Folklift(4.0ton)	480,112
Sub-Total	60,028,226
Total Cost	182,802,187
Engineering Service	8,031,480
Physical Contingency	9,381,114
Grand Total	200,214,781

Case 1B (Zoning Plan 1) (Unit:Thousand Sucres)

Facilities	Total
Multi-Purpose Terminal:	22,589,643
Wharf	22,130,625
Reclamation	95,382
Pavement	173,900
Dredging	189,736
Multi-Purpose Terminal:	36,290,335
Wharf	15,528,345
Revetment	1,990,900
Reclamation	1,254,644
Pavement	848,021
Road	130,425
Transit Shed	15,880,000
New Container Terminal:	94,607,206
Water Basin	4,459,392
Reclamation	2,613,594
Wharf	71,035,140
Container Yard	7,980,600
CFS	6,622,500
Parking Lot	658,000
Pavement	1,170,300
Road	67,680
Service Boats Area:	2,680,280
Pontoon	291,200
Revetment	2,389,080
Administrative Zone:	658,000
Parking Lot	658,000
Sub-Total	156,825,464
Utilities	6,988,221
Cargo Handling Equipment:	55,431,452
Gantry Crane	39,715,200
Straddle Carrier	8,296,064
Toplifter(42ton)	1,702,400
Toplifter(18ton)	772,800
Tractor Head	3,150,740
Chassis	909,040
Folklift(7.5ton)	405,096
Folklift(4.0ton)	480,112
Sub-Total	62,419,673
Total Cost	219,245,137
Engineering Service	9,853,628
Physical Contingency	11,532,531
Grand Total	240,631,296

BASIC CONCEPT OF PORT MANAGEMENT

59. Basic concept of port management depends on the progress of modernization program which is under consideration by APG. The privatization is planned to be introduced to port operation, but even in the course of progressing some important points of the program such as detailed procedure, the possible extent of its realization, and the time of execution seems to be unclear and not to be foreseeable at the present.

60. The following measures are pointed out for realizing an adequate port management system at the stage of the Master Plan through reviewing present situation in port management.

(1) APG should develop a financial strategy to ensure financial soundness.
(2) The tariff structure and the procedure of imposition should be as simple as possible.
(3) Inner organization of executive department should be simplified and streamlined through training of middle-ranked staff, establishment of clear criteria for promotion, sharing information and so on.
(4) Through training, employees should gain fully professional knowledge, leadership ability, skill to operate port equipments and so on the present situation for understanding correctly the present situation of the port as well as managing and operating the port always properly considering problems may happen to occur at any time in future.
(5) An adequate cargo handling plan and arrangement system for ships calling port should be established.
(6) A rational berth allocation control system using computers should be introduced for efficient utilization of berth.
(7) For full utilization of computer system, training on computer system and preparation of a manual for use of computer is required.
(8) Statistics which are useful for developing port activity should be enriched in a well organized structure. And for utilization of information, it is expected to diffuse them by adequate means such as monthly report. Computer training for stuff in statistic section is required.
(9) Strategy focused on the targets in the future should be made for port promotion.
(10) Procedure of purchase of goods such as materials, spare parts should be simplified.

61. The methods of privatization are shown in Table - 15. In case of developing country Case A-3 or B-1 is recommended considering the national interest and the hinterland development.

Table - 15(a) Methods of the Privatization

Case	Land		Port facilities		
	Ownership	Operation	Construction	Ownership	Operation
A	public	public	public	public	A-1,A-2,A-3
B	public	private	public	public	B-1,B-2
C	public	private	private	private	private
D	private	private	private	private	private

Table - 15(b) Methods of Privatization

Case	Stevedoring	Shore-side cargo handling	Operation of facilities
A-1	public	public	public
A-2	private	public	public
A-3	private	private	public
B-1	private	private	public/private
B-2	private	private	private

CARGO HANDLING SYSTEM

62. There are many points to be improved in the present cargo handling system of APG. Through participation of the private sectors, modern cargo handling system should be introduced.

63. Main measures for improvement are as follows:

(1) privatization of port operation
(2) improvement of berth allocation method
(3) introduction of cut off system
(4) operation as a by each berth
(5) effective use of transit shed

64. Cargo handling equipment should be prepared considering that many multi-purpose type ships which call at the port of Guayaquil. Main points on improvement of cargo handling equipment are as follows:

(1) introduction straddle carrier system for container handling at container terminal as well as multi-purpose terminal
(2) replanning of container yard
(3) widening of apron at multi-purpose terminal
(4) establishment of maintenance system

65. Full introduction of computer system and establishment of adequate documentation system are necessary for modernization of cargo handling.

FEASIBILITY STUDY

TARGET OF PLANNING

66. Under the framework of Case 1A of the Master Plan considering the policy of APG, the Short Term Plan with a target year of 2003 is proposed aiming at the followings:

(1) Progress of modernization
(2) Increased productivity and capacity of the port by improvement of cargo handling
(3) Increased capacity of the port by construction of additional required berths
(4) Establishment of appropriate port management system and efficient operation system
(5) Strengthening of the role as main gateway port of Ecuador
(6) Identification of scale and substance of the physical development project as intermediate step of development, in achieving proposed goal of the Master Plan
(7) Appropriate investment
(8) Environmental consideration

CARGO VOLUME FORECAST

67. Total cargo volume through the port of Guayaquil in 2003 was forecasted as 5.028 million tons which consists of 2.159 million tons in import and 2.869 million tons in export.

Table - 16 Cargo Volume by Cargo type in 2003

Cargo type	Import	Export	Total
General Cargo	242,000	31,000	273,000
Solid Bulk	493,000	83,000	576,000
Grain Bulk	331,000	0	331,000
Fertilizer Bulk	162,000	0	162,000
Liquid Bulk	23,000	0	23,000
Bag Cargo	146,000	19,000	165,000
Banana Box Cargo	0	1,207,000	1,207,000
Container Banana 40 foot	0	932,000	932,000
Container General Cargo 20 foot	381,000	380,000	761,000
(Container terminal 20 foot)	(174,000)	(173,000)	(347,000)
(Multi-terminal 20 foot)	(207,000)	(207,000)	(414,000)
Container General Cargo 40 foot	381,000	217,000	598,000
(Container terminal 40 foot)	(174,000)	(99,000)	(273,000)
(Multi-terminal 40 foot)	(207,000)	(118,000)	(325,000)
Total	2,159,000	2,869,000	5,028,000

68. Container cargo volume is estimated as 3.771 million tons and transhipment container is estimated as 1,050 TEU.

Table - 17 Container Cargo in 2003

Unit: No

	Import	Export	Total
Banana 40 feet	0	52,000	52,000
Full Container Ship 20 feet	14,000	11,000	25,000
Full container Ship 40 feet	12,000	7,000	19,000
Empty Banana 40 feet	26,000	0	26,000
Empty 20 feet	2,000	12,000	14,000
Empty 40 feet	3,000	8,000	11,000
Transhipment 20 feet	580	580	1,160
Transhipment 40 feet	235	235	470
(Sub Total)	(57,815)	(90,815)	(148,630)
Multi Ship 20 feet	15,000	14,000	29,000
Multi Ship 40 feet	13,000	9,000	22,000
Empty 20 feet	3,000	16,000	19,000
Empty 40 feet	3,000	11,000	14,000
(Sub Total)	(34,000)	(50,000)	(84,000)
Total	91,815	140,815	232,630

SHORT TERM PLAN

69. It is assumed that cargo handling efficiency will improve gradually up to 2010. Under such an assumption 2 container berths, 8 multi-purpose berths and 1 bulk berth are required in 2003.

70. Though existing berths are classified by function (three container berths, five conventional berths and one bulk berth), but in reality, various types of cargo are handled at each berth. For example containers are handled at several different berths, but based on the volume and container handling efficiency, only one berth would be necessary if a system of functional separation were adopted. At the stage of Short Term Plan port operation will be improved to realize the functional separation among terminals, requiring two additional berths to be constructed. One will be used as a container berth and the other as a multi-purpose berth.

71. The planned berth length is the same as at present assuming that the ship size forecasted for the short term plan will remain unchanged.

72. The requirement of other port facilities is calculated as follows. It is not necessary to construct other facilities than these because the present capacity is sufficient.

Container terminal
- Number of Berth ; 3 (185 m in length)
- Apron ; 40 m in width
- Container Yard ; 56,550 m²
- CFS ; 3,614 m²
- Attached Area for Other Facilities ; 7,000 m²
- Terminal Gate ; 4 lanes

Multi-purpose terminal
- Number of Berth ; 8
- Apron ; 30 m in width
- Transit Shed ; 14,330 m²
- Sorting area ; 3,850 m²
- Warehouse ; 21,100 m²
- Open shed ; 32,330 m²

73. The facilities to be constructed in the Short Term Plan are as follows;

(1) 185 m container berth
(2) 185 m multi-purpose berth
(3) reclamation work accompanying the berth construction
(4) capital dredging to depth of 10.5 m accompanying the berth construction
(5) pavement work
(6) removal and installment of pontoon

74. The case in which cargo handling efficiency reaches the target even in 2003 was also prepared as Case Y (case mentioned above is Case X) because APG intends to make every effect to improve efficiency. In Case Y, only one berth is required.

75. The layout plans for berths to be constructed are shown in Figure - 11. Standard layout plan of a container terminal is also shown.

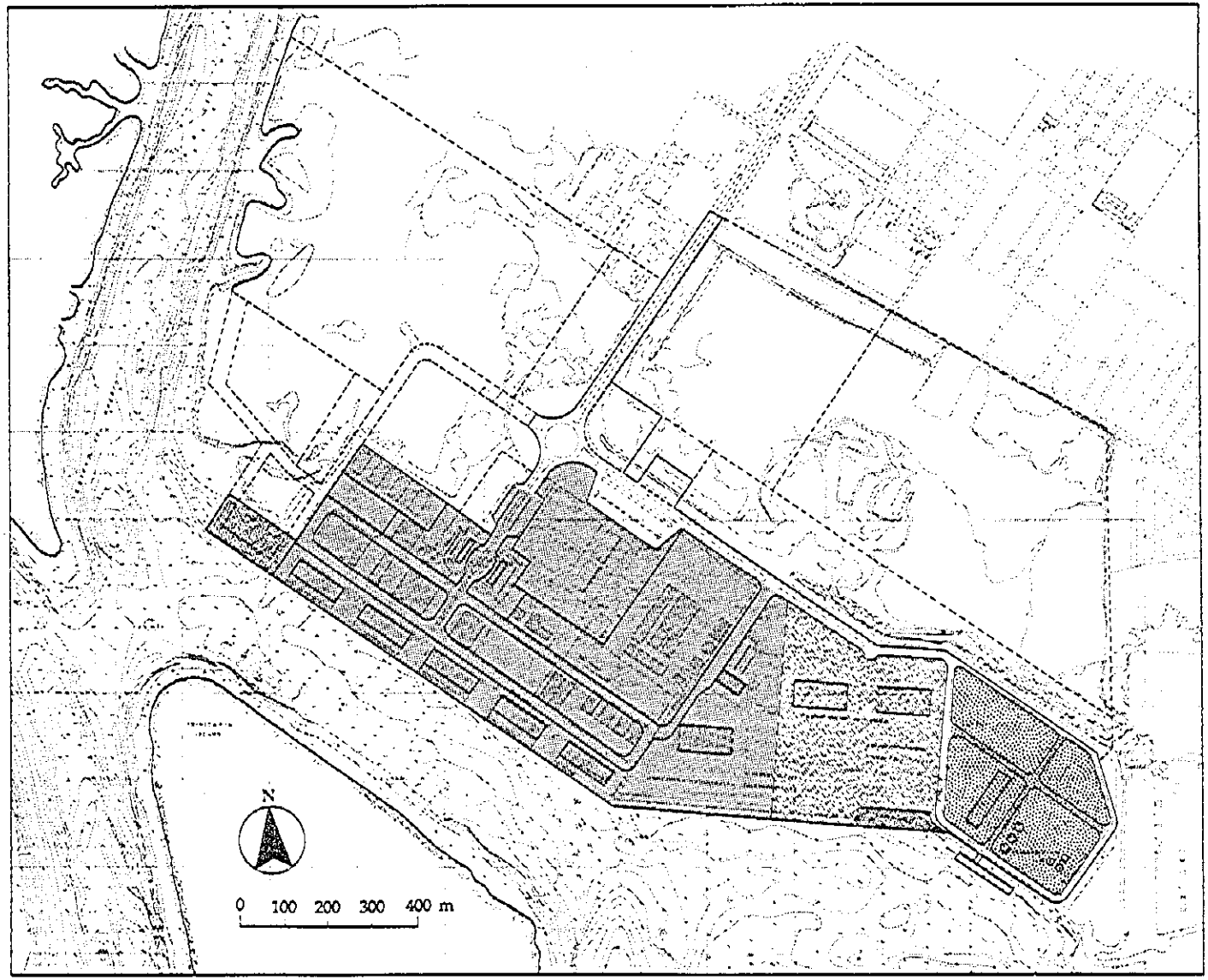


Figure - 11 Short Term Plan in Case X <Container Berth>

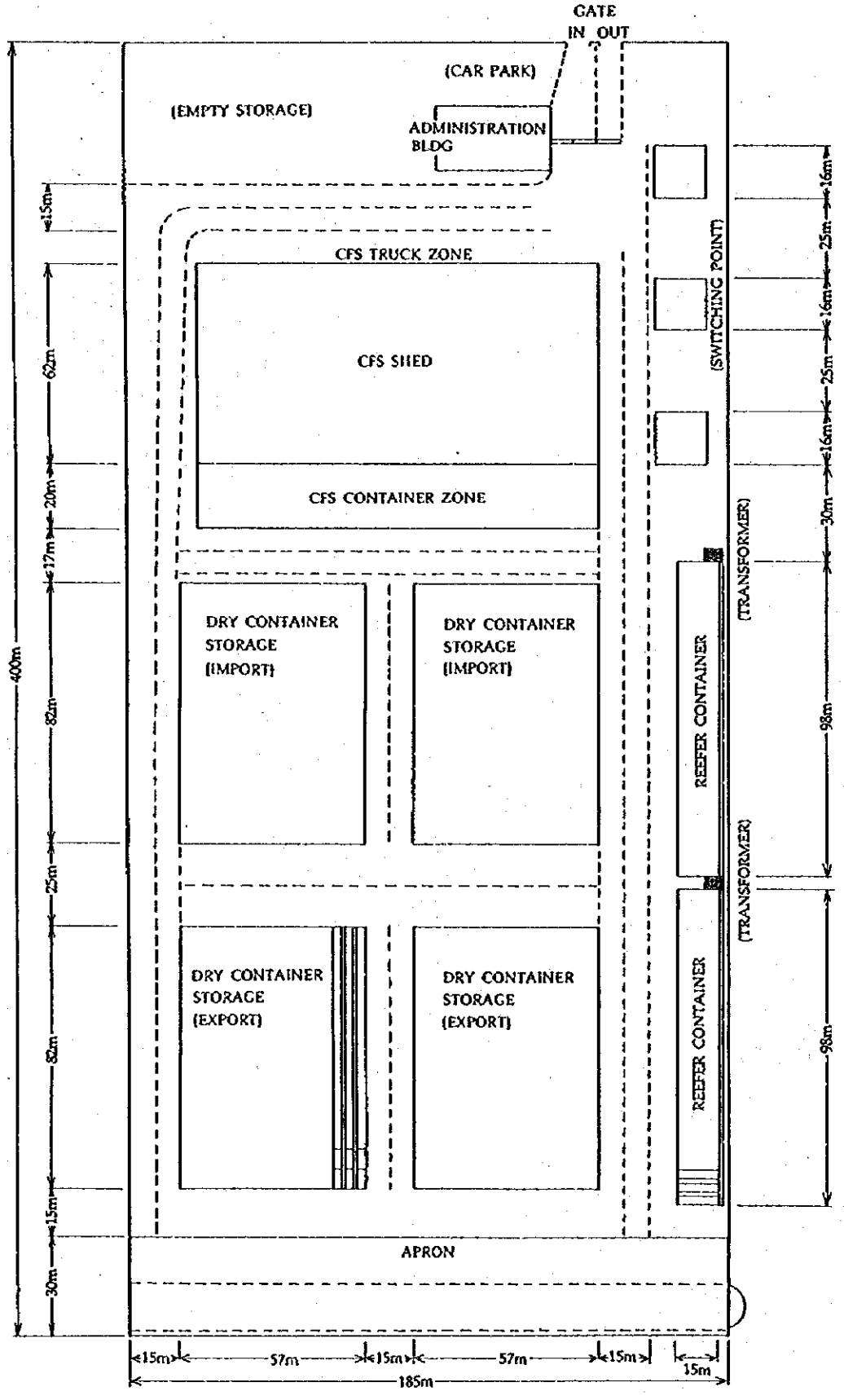


Figure - 12 Layout Plan of Container Terminal

DESIGN AND COST ESTIMATION

76. A typical cross section has been presented in the Master Plan and the required volume of main materials is calculated for a container berth at reserved area and a multi-purpose berth next to berth No.6.

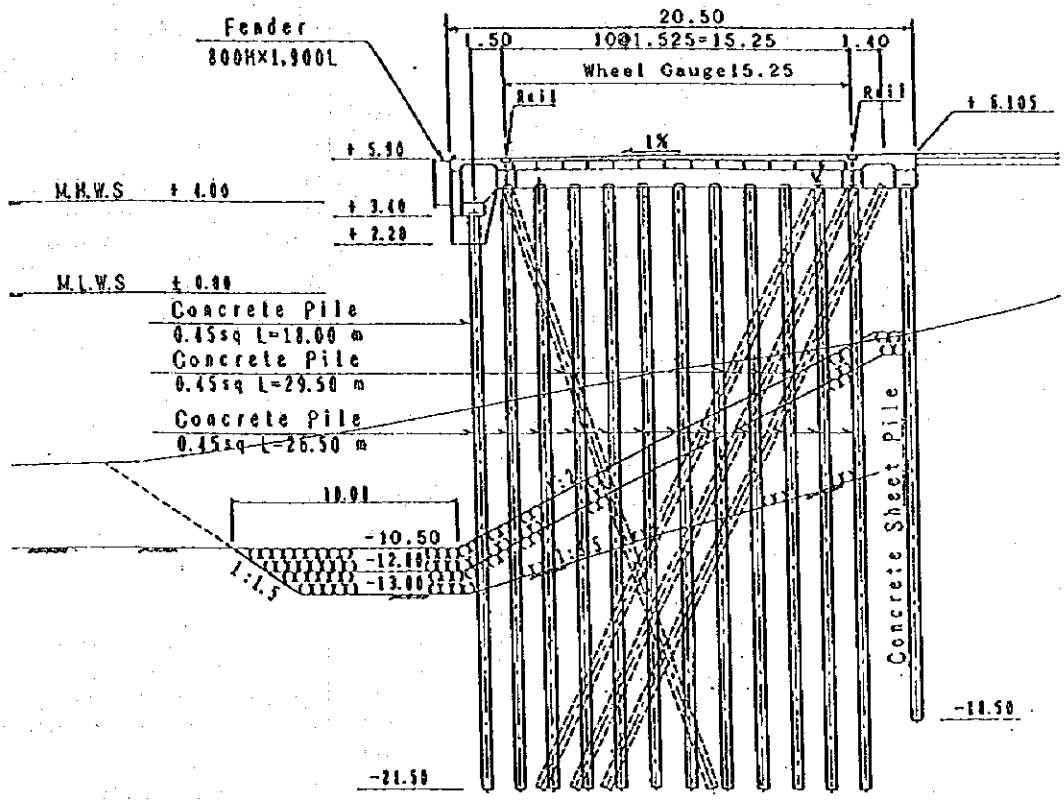


Figure - 13 Standard Cross Section

Table - 18 Quantity of Main Materials

1) Container Berth (Depth: -10.5 m, Length: 185 m)

Facilities	Items	Unit	Q'ty	Remarks
Berth	Concrete for Beams and Slabs	m^3	3,800	
	Reinforcement	t	420	
	Pre-stress Concrete Piles	Pieces	925	Size is 0.45 m sq. L = 18.0 ~ 29.5 m
	Amor Stone	m^3	7,215	Weight = approx. 1,000 kg/piece
	Core Stone	m^3	19,795	Weight = approx. 500 kg/piece
	Dredging	m^3	48,655	
	Crane Rail	t	30	Rail Weight = 78 kg/m
	Concrete Curb	m^3	14	Height = 0.3 m, Width = 0.24 m
	Rubber Fender	Pieces	19	Height = 0.80m, Length = 1.90m
	Bollard	Pieces	7	Width = 1.13 m, Max. Diameter = 0.60 m, Thickness = 32 m/m
Bulk Head	Concrete Sheet Piles	Pieces	380	Width = 1.00 m L = 11.00 m
	Backfilling	m^3	14,800	
	Surface Pavement	m^2	3,600	

* Q'ty indicates net value of materials

2) Multi-Purpose Berth (Depth: -10.5 m, Length: 185 m)

Facilities	Items	Unit	Q'ty	Remarks
Berth	Concrete for Beams and Slabs	m^3	2,683	
	Reinforcement	t	370	
	Pre-stress Concrete Piles	Pieces	494	Size is 0.45 m by 0.45 m L = 24.0 ~ 28.0 m
	Amor Stone	m^3	5,550	Weight = approx. 1,000 kg/piece
	Core Stone	m^3	11,840	Weight = approx. 500 kg/piece
	Dredging	m^3	32,930	
	Crane Rail	t	30	Rail Weight = 78 kg/m
	Concrete Curb	m^3	14	0.3 × 0.24 × 185m = 14 m^3
	Rubber Fender	Pieces	19	H = 0.8 m, L = 1.35 m
	Bollard	Pieces	7	Width = 1.13 m, Max. Diameter = 0.60 m, Thickness = 32 m/m
Bulk Head	Concrete Sheet Piles	Pieces	185	L = 12.0 ~ 23.5 m
	Backfilling	m^3	19,425	

* Q'ty indicates net value of materials

77. The construction period is estimated as three years, from 2000 to 2003 as shown in Figure - 14.

78. Project cost are estimated as follows:

Case X ; 78.1 million sucres
foreign portion ; 49.5 million sucres
local potion ; 28.6 million sucres
Case Y ; 55.8 million sucres
foreign portion ; 40.8 million sucres
local portion ; 15.0 million sucres

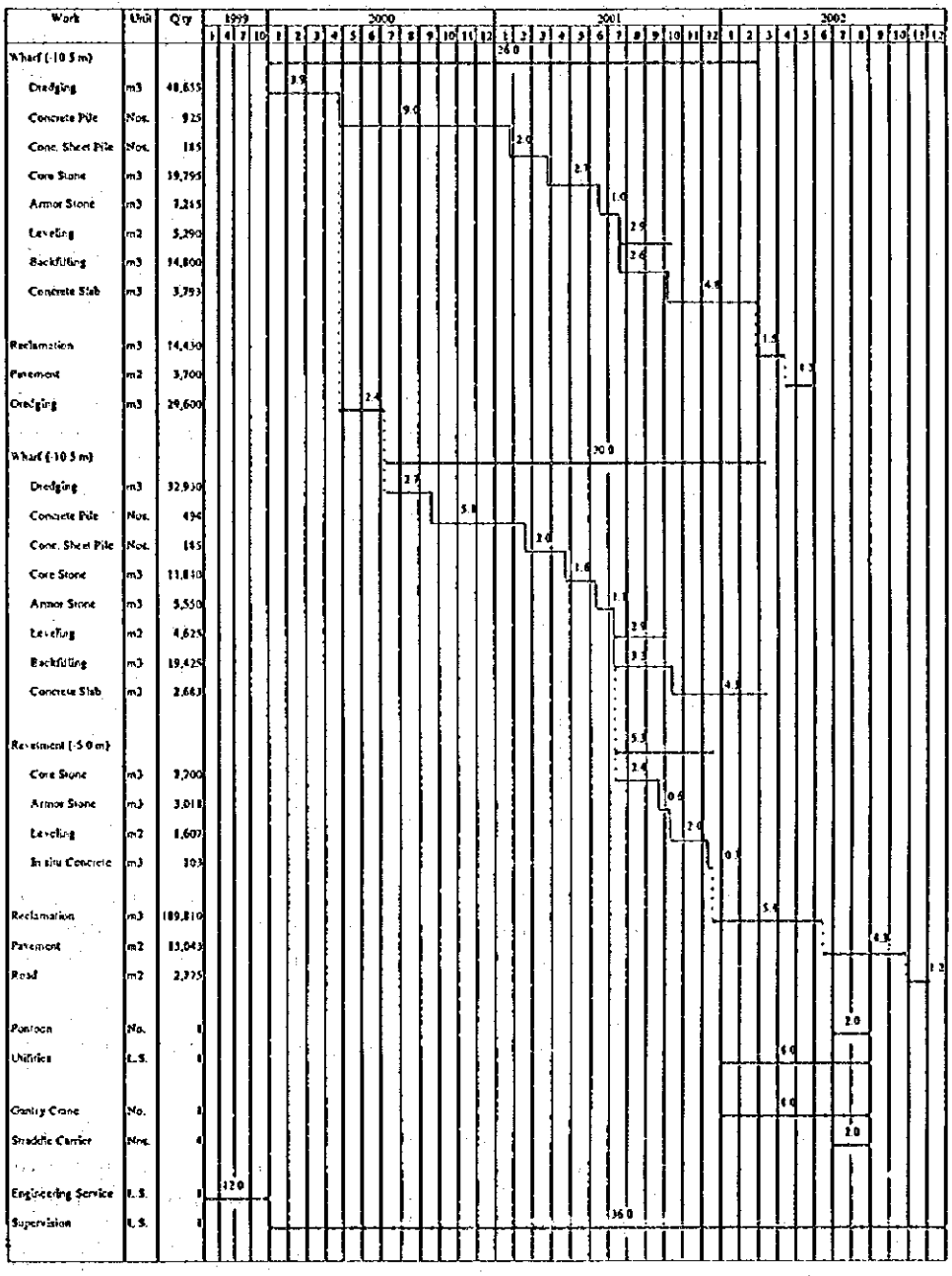


Figure - 14 Construction Schedule

ECONOMIC ANALYSIS

79. The purpose of the economic analysis is to evaluate the Short Term Plan from the view points of national economy. The economic internal rate of return (EIRR) based on cost-benefit analysis is used to appraise the feasibility of this project.

80. The economic benefits of the Project have been quantified on the basis of a "with" and "without" the project comparison. The savings in berth waiting costs and savings in time cost of cargo are analyzed as the quantifiable economic benefits of the project.

81. In the without case, the cargo except grain and liquid bulk is handled through eight berths not separated among cargo types. In the with case, one container berth and one multi-purpose berth are constructed and cargo handling efficiency is improved under the conditions of functional separation between container terminal and multi-purpose terminal. As a result of computer simulation 2,040 of ship's staying day are saved in 2003 by the project implementation in Case X.

82. Savings in ship waiting time should be retained by Ecuador in the form of reduced demurrage charge trade or as elimination of congestion surcharge for liner operation in the EIRR calculation. In this study 50% of the savings attributed to foreign ship operators is assumed to return to Ecuador while 100% of savings for Ecuadorian ship operators will accrue to the Ecuadorian economy. In addition, total benefits to Guayaquil port is estimated at 60% of saving in costs of container and general cargo vessels based on the composition of calling vessels.

83. Savings in time cost of cargo result from the decrease of required time for procedure in import and export. This means that shippers gain back invested capital earlier and opportunity of investment will increase.

84. The resulting EIRR is 24.7%, which shows that the Short Term Plan is feasible from the viewpoint of national economy.

Table - 19 EIRR Sensitive Analyses (Case X)

	Benefit	Construction Cost	EIRR (%)
1	100 %	100 %	24.7
2	90 %	100 %	22.2
3	100 %	110 %	21.9
4	90 %	110 %	19.6

85. In order to check EIRR when conditions change, sensitivity analyses are made for three alternatives, 10% decrease of benefit, 10% increase of cost, and 10% decrease of benefit and 10% increase oft. Even in the worst case the result shows that the project is feasible.

86. On the other hand, in Case Y, EIRR is 16.4% which means that the project in Case Y is also feasible.

87. The project will produce other economic benefits besides these two factors such as promotion of regional economic development, increase in employment opportunities and income and reduction of cargo damaged and accidents at the port. Considering these benefits, the feasibility of the Short Term Plan increases.

FINANCIAL ANALYSIS

88. The purpose of the financial analysis is to examine the viability of the project and the financial soundness of the project.

89. The viability of the project is analyzed using the Financial Internal Rate of Return (FIRR) by means of the discount cash flow method.

90. The financial soundness of the project is appraised based on its projected financial statements (Profit and Loss Statement, cash Flow Statement and Balance Sheet). The appraisal is made from the viewpoint of profitability, loan repayment capacity and operational efficiency.

91. Revenues from port activities are calculated based on the tariffs as of May 1995 using the forecasted cargo volume, estimated standard ship dimension and assumed cargo handling time.

92. The cost of the project consists of investment cost and operational cost. The operational cost is estimated by each component such as personnel cost, administration cost, maintenance and repair cost, depreciation and contribution to related agencies.

93. On the basis of the above mentioned, the resulting FIRR of the Short Term Plan, Case X, is 25.4%.

94. It is assumed that 75% of the fund for the project is raised by loan from abroad with 3% interest rate and 30 year loan period and the remainder is by loan with 36% interest rate and 8 year period based on lending practices of financial institutions in Ecuador and the financial situation of APG. Therefore, FIRR(25.4%) of the Short Term Plan, Case X, is feasible from a financial view point when composed with the weighted average interest rate of funds(11.25%) in this case.

95. In order to check the FIRR when basic project conditions change, sensitivity analyses are made for some alternatives, decrease of income, increase of construction cost, and decrease of income and increase of construction cost. Even in the worst case the result shows that the project is feasible.

Table - 20 FIRR Sensitive Analyses (Case X)

	Project Costs	Revenues	Operation Costs	FIRR
1	100%	100%	100%	25.4%
2	ditto	ditto	110%	24.9%
3	ditto	90%	100%	20.0%
4	ditto	ditto	110%	19.5%
5	110%	100%	100%	23.3%
6	ditto	ditto	110%	22.9%
7	ditto	90%	100%	18.5%
8	ditto	ditto	110%	17.8%

96. Rate of return on net capital in projected financial statement exceeds the weighted average interest rate throughout the entire project period except at the beginning of the project. Both of operation ratios and working rations are shows positive figure.

97. The result of analysis shows that the project is feasible from the financial viewpoint.

98. On the other hand, FIRR in Case Y is 27.6 % of which means that the project in Case Y is also feasible.

ENVIRONMENTAL IMPACT ASSESSMENT

99. The government of Ecuador published the basic policy on environment in June 1994. In the policy the government gives priority to the solution to the environmental problems that affects or threatens some geographical regions such as mangrove ecosystem, Gulf of Guayaquil, Cities of Quito, Guayaquil. On the other hand, special attention shall be paid to hydrocarbon activities, industries and activities generating dangerous and toxic waste in the main cities and transportation sector.

100. There is no regulation or procedure on EIA for port development. At any rate, the impact to the environment by this project is considered small and negligible. However, EIA was conducted because the environmental issue is one of the most important subjects in Ecuador.

101. Result of IEE in the Master Plan are shown in Table - 21. EIA was conducted in the feasibility study for the following six components.

(1) waste disposal
(2) waste oil treatment
(3) mangrove forest
(4) air pollution
(5) water pollution
(6) noise and vibration

102. The impact on the above six components has been evaluated while the impact on other components is thought to be small and/or negligible based on IEE. In conclusion, the impact of the Short term Plan on the surrounding environment is small and negligible as long as the adequate work method is adopted. On the other hand, the economic effect of the project will largely contribute to the growth of the region and Ecuador as a whole.

Table - 21 Environmental Scoping for the Port Development Plan

Component	Impact	chec
<Social environment>		
Settlement		
Economic Activity		
Traffic / Public Facilities	Traffic to/from port	neg.
Community		
Cultural Property		
Rights of water utilization etc.		
Health and Sanitation	Disposal of waste	EIA
Waste	Generate from ship/port	EIA
hazards		
<Natural environment>		
Topography and Geology	Reclamation/dredging	neg.
Erosion		
Groundwater		
Hydrological situation	Reclamation/dredging	neg.
Coast and Ocean	Reclamation/dredging	neg.
Flora and Fauna	Expansion in mangrove area	EIA
Whether		
Landscape	No big facilities/change	neg.
<Pollution>		
Air Pollution	From ship/car/others	EIA
Water Pollution	From ship/port area/construction	EIA
Soil Contamination		
Noise and Vibration	From car from/to port	EIA
Ground subsidence		
Offensive Odor	From cargo handling / dredging	neg.

EIA ; to conduct next step examination in the stage of feasibility study
neg ; impact to be supposed is nothing or negligible small

Table - 22 Result of EIA for 6 Components

Component	Result of Evaluation
Waste Disposal	No significant impact Introducing city treatment system is recommended
Oil Treatment and Disposal	Not serious if adequate collecting and treatment system is introduced
Mangrove Forest	No significant impact
Air Pollution by Traffic	No significant impact
Water Pollution by Dreading	No significant impact Adequate work method should be adopted Monitoring should be implemented during work
Noise and Vibration by Traffic	no significant impact

CONCLUSION AND RECOMMENDATION

103. The Study Team has formulated this report based on the findings and materials obtained through its own activities of the project, the discussions with counterparts and interviews with many people related to this project and by repeated discussions within the team to solve some of the special problems. While detailed explanation of results of the study are expressed in the main parts of the text of the report, issues which are assumed to be most useful for considering the implementation of this proposed project are summarized here for the readers' convenience.

CONCLUSION

104. Having paid most attention to ensure progress of the ports modernization program which is one of the most important national policies in the Republic of Ecuador now in progress, the Study Team has formulated the Master Plan for the Port of Guayaquil up to the target year 2010, has conducted a feasibility study of a short-term improvement plan within the framework of the Master Plan and has examined the possibilities of the plans for developments of container terminals, multi-purpose terminals and other important port related facilities in accordance with the scope of work of the team.

105. Total cargo volume calculated by using a future economic framework forecasted with actual facts and figures concerning the economic growth in Ecuador acquired during the period of the study will be 6,572,000 tons in which container cargo volume will be 3,374,000 tons in 2010. For meeting these demands derived from the increase of cargo in the future, the enlargement and improvement of port facilities are essential together with a gradual improvement of efficiency in handling cargo as well.

106. The necessary number of berths estimated by the team taking account of the improvement of efficiency in cargo handling as a given condition is:

3 container berths
10 multi-purpose berths
1 bulk berth

107. According to the estimation stated above and taking the full utilization of the existing usable facilities as the premise for planning, the main projects proposed by the Master Plan in this report are:

Extension and full equipment of the container berths
Additional installment of 3 multi-purpose berths
Development of access roads

108. For activating the local economy while keeping pace with conservation of the environment, some important measures closely related to the development of the port such as the settlement of Export Proceeding Zone by utilizing the neighboring open spaces possessed by the APG, conservation of the mangrove forests surrounding the port area and so on are also proposed in this report.

109. The cost needed for the development of the port is estimated to be 200,214 million sucres.

110. As mentioned earlier, the importance of modernization and privatization and the improvement of administrative organization must not be underestimated. Management of port works and above all, efficiency in handling cargo for the future development of port activities of Guayaquil is required. Without these, smooth implementation of port improvement will be difficult. Recommendations concerning the above are also expressed in this summary.

111. In the Short Term Plan, assuming that inadequately combined and disordered movements of cargo handling would be gradually improved, the following development works will be needed up to 2003:

1 container berth
1 multi-purpose berth

In the present plan, these two additional berths are to be constructed next to the existing berths, and with the same specifications. Other facilities such as sheds and warehouses will remain sufficient up to this time.

112. The cost for construction works is estimated as follows:

For the construction of 1 container berth 22,589 million sucres for the construction of 1 multi-purpose berth, including the cost for reclamation of the areas located behind 19,228 million sucres.
Within the total sum of cost combined the above two and the related work, the portion in foreign currency is estimated to be 49,483 million sucres, and in domestic currency 28,636 million sucres.

113. The Economic Internal Return Rate (EIRR) calculated based on the countable benefit is 24.7 per cent and the Financial Internal Return Rate (FIRR) is 25.4 per cent. So, the project is judged as being feasible, both economically and financially.

114. Some technical problems are found in the water area in front of the berths on maintaining the navigable depth, but these are of no importance. Soil conditions of the area concerned present no problem. Furthermore, the EIA revealed no unfavorable impact and thus the execution of this project will cause no problems for the environment.

Table - 23 Overall Evaluation

Case X

Item	Result	Remarks
Engineering Aspect	Good	Many existing facilities are used. Berth construction sites are all in good condition for construction.
Economic Feasibility	Good	EIRR is good. Project greatly contributes to foreign trade throughout nation.
Financial Feasibility	Good	FIRR is good. Project has profitability.
Environmental Aspect	Good	Project has no significant environmental impact and contributes to local and national economy and social stability.

115. The case in which cargo handling efficiency makes rapid progress is almost the same. The project can be selected according to the progress of modernization program.

116. When considering important factors which would affect this project, it can be duly said that this proposed project should be implemented in a deliberate and well harmonized way with general movements of modernization.

RECOMMENDATION

117. To ensure the smooth implementation of this proposed plan of the port of Guayaquil, the Study Team recommends the following items. The measures which have been already implemented or planned according to the modernization program by APG may be included. However these items are mentioned for further promotion of them.

1) Proper Application of Privatization

118. The ultimate objective of introduction of privatization into port operation is to maximize economic return in port activity for both the public and private sectors by removing possible inefficiency of public sector and entrusting a greater part of port activities to the private sector.

119. Commercialization of port functions and activities should be selected within the fields where the activities of the private sector can be fully controlled under the APG or other related administrative authorities. The effects of commercialization can be fully realized without any negative impact to sound performance of the port.

120. The fields to be commercialized should be planned and arranged appropriately as to guarantee the necessary conditions under which the free market system can be fully activated.

121. In principle, ownership of the land and water areas as well as the basic port facilities should be retained by APG.

122. Basic port facilities and major cargo handling equipment should be open for public use, in principle, but can be leased out to the private sector on a contract basis for exclusive use under appropriate conditions.

123. Practice of commercialization should be introduced gradually based on capability of the private sector at each step, and at the rate of grading up of the productivity intended in the scheme and also as to secure the proper improvement of total administration activity.

2) Establishment and Utilization of Information System

124. Modern and easy access information system should be introduced. This can serve as the most important base data for making port plans and supporting daily work in various kinds of activities of APG and other organizations concerned.

125. Systematic collection and compilation of data and information on various port activities is a basic requirement for sound and effective port administration. The management system for APG port statistics seems to be insufficient as a whole, any thus there will be much need for APG to improve the present information system in its arrangement and practice.

126. Port statistics are required for planning, administration, management, operation, budgeting, accounting and auditing. They should cover most essential facts and figures of the port activities on:

(1) organization and personnel affairs
(2) cargo handling
(3) ship movements
(4) facility conditions

(5) engineering management
(6) maintenance
(7) other related important fields

127. It is also very important that the structure of statistics be well balanced as to be effectively used for making any management or development plans in the future through cross references among each part of data and information.

128. In light of current situation of APG port statistics system and its practice, all statistics records should be well maintained in good condition for easy access of users, and renewed annually or monthly if necessary, to ensure the updated information can be accessed.

3) Upgrading of APG's Technical Function

129. In order to carry out future port development and maintenance work appropriately, APG will be expected to improve its functions with respect to technical aspects.

130. On such improvement, it is suggested that:

(1) Closer coordination is to be made between the technical department and other related ones.
(2) Technical standards and common criteria reflecting on recent world-wide trends is to be prepared.
(3) To the educational program to upgrade ability of engineers is to be emphasized.

131. Past engineering records of APG contain a variety of useful information. However, if these records are not given to those who need them, utilization of such records will be limited to only those who know of their existence. To avoid such inconvenience and ensure that technical information is shared with all concerned, a technical reference system that stores these records orderly and allows access at any time should be established.

4) Establishment of Environmental Policy

132. Environmental issues cover a wide scope and the preparation of an environmental strategy should be comprehensive, covering technical know-how and institutional frame. Some basic elements in drafting an environmental strategy are listed below.

(1) Clear understanding of the present situation of environment
(2) Estimation and forecasting of the impact and future situation
(3) Possible countermeasure to prevent the impact
(4) Process to acquire social consensus
(5) Coordination with other organizations concerned

133. There are many kinds of environmental components related to the port. The water front zone, in particular, has various features from the environmental viewpoint. So, one of the most important issues in the first stage is clearly understanding the environment of the port in question.

134. When planning port development projects, careful consideration should be given to the possible effects which may happen during the port construction stage as well as operation stage. If degradation of environment is forecasted, countermeasures should be taken to prevent the environmental burden.

135. Results of environmental analysis sometime remains at a qualitative level. The evaluation of projects is often relative and decisions should be made through social consensus.

136. Environmental issues cover a wide scope, thus, the countermeasures to the issues should be examined and carried out through coordinated efforts of related organizations.

137. The function of collecting information, understanding and evaluating what is happening and what will happen in the port, know-how on necessary countermeasures for environmental problems should be carried out by APG.

5) Reinforcement of Personnel Policy and Training System

138. It is important that APG make efforts to recruit young talented specialists such as engineers and economists. On the other hand, the managing staff are required to have sufficient experience in port management and administration.

139. A designed personnel policy and training system are essential to encourage positive contribution and upgrade capability of APG staff. In order to support the personnel policy of APG, the following measures need to be carefully examined and applied under the "appoint the right person to the right position" principal.

(1) establishment of proper personnel evaluation and transfer system
(2) introduction of steady and encouraging promotion system
(3) provision of attractive positions for able technocrats
(4) creation of positive incentive mechanism built in the salary/wages system

140. The core purpose of staff training is:

(1) to give them full knowledge and understanding both on technological and functional requirements of the ports, and thus
(2) to make them cost-conscious and efficient in conducting their duty and assignment.

6) Systematic and Flexible Planning and Project Implementation

141. The system of port planning should be established. It is necessary that the nation-wide port development policy should be authorized at first and under the policy the plan of each port should be prepared.

142. In order to realize the proposed schemes of the plans, it is essential to secure active utilization of the plans through such efforts by APG as promoting full understanding on the plan, securing adequate financial support with proper budgetary arrangements and reviewing periodically the plan according to the actual situation of the country and region.

143. All the facilities specified in the Master Plan reflect on the forecast data of cargo demand together with type of cargo. However actual figures may deviate from the forecasts due to changes in various social and economic factors. Although a detailed study to cope with the situation is required in such an occasion, following countermeasures may be useful for being ready at any time of necessity in the future.

(1) review of cargo forecast based on the latest data
(2) review of the Master Plan
(3) review of the implementation schedule

(4) review of the progress of modernization program
(5) review of the improvement of cargo handling efficiency

144. The Short Term Plan is implemented mainly based on the assessment of the progress of modernization program and the improvement of cargo handling efficiency. On the other hand, after the implementation of the Short Term Plan, the Master Plan should be reviewed including the necessity of constructing a new port in the outer area of Guayaquil Bay.

7) Establishment of Effective Maintenance System

145. There are several structures and facilities which require periodical maintenance work while some of them require urgent rehabilitation.

146. Maintenance work on the structure can be divided into two categories, the routine maintenance and the urgent rehabilitation. The former consists of preventive measures and required measures which case is minor, however the latter consists of corrective measures against large scale damage and required cost is large. Past experiences reveal that if preventive maintenance is appropriately performed at adequate intervals of time, maintenance cast can be minimized.

147. In case of the Port of Guayaquil, maintenance of channel depth is one of the most important issues. Therefore, regular sounding survey and implementation of maintenance dredging should be done timely according to the result of the survey.

8) Reinforcement of Port Promotion

148. Port promotion or sales is one of the most important fields of activities for attracting port users. However, APG does not seem very active in conducting this assignment. Since competition among the neighboring ports or other transportation modes of handling cargo will be much tighter in future, the following actions by APG are recommended in securing adequate level of revenue from users.

(1) Establishment of port promotion strategy focusing on most effective target groups of clients.
(2) Under the systematic action program, APG staff should call for sales at shipping companies or shippers and point out the real merits of utilizing the Port of Guayaquil.
(3) It is useful for effective sales activities to prepare an attractive brochure in which the sales points including various advantages and merits for the target users are explained plainly.
(4) To hold seminars to introduce the Port of Guayaquil to shippers of various countries is another effective way to assist promotion activities.
(5) Establishment of organization of wide-range of supporting groups composed of both public and private sectors.

9) Regional Development

149. As is commonly understood, a port is dependent on the various activities in its hinterland or surrounding areas. At the same time, such activities relating to the ports can not run well without the necessary port functions. In this sense, the promotion of regional development with a port as its core is considered vital in maximizing economic and social benefits expected from the port activities.

150. The port of Guayaquil is located in Guayaquil City which is the most important industrial and commercial center in Ecuador. The development of this area would have the greatest influence on the nation's economic growth in future.

151. The City of Guayaquil, together with the Guayas Province area, is strongly expected to be developed for increasing the production both in agriculture and in industry in this area. For this purpose, the APG should maintain a close relationship with the municipal and other related local and national organizations as well as port related private firms to coordinate its development projects with the overall development of the area.

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