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THE DEVELOPMENT PROJECT OF

THE PORT OF CALLAO

IN THE REPUBLIC OF PERU

FINAL REPORT

NOVEMBER 1983

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

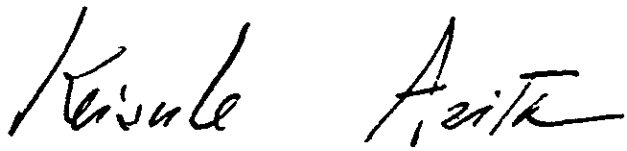
In response to the request of the Government of the Republic of Peru, the Government of Japan decided to conduct a study on the Development Project of the Port of Callao and entrusted it to the Japan International Cooperation Agency (JICA). The JICA sent to Peru a survey team headed by Mr. Shinya Izumi, Director of the Overseas Coastal Area Development Institute of Japan in July 1982.

The team had discussions with the officials concerned of the Government of Peru on the Project, and conducted a field survey. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to all the officials concerned of the Government of the Republic of Peru for their close cooperation extended to the team.

November 1983



Keisuke Arita
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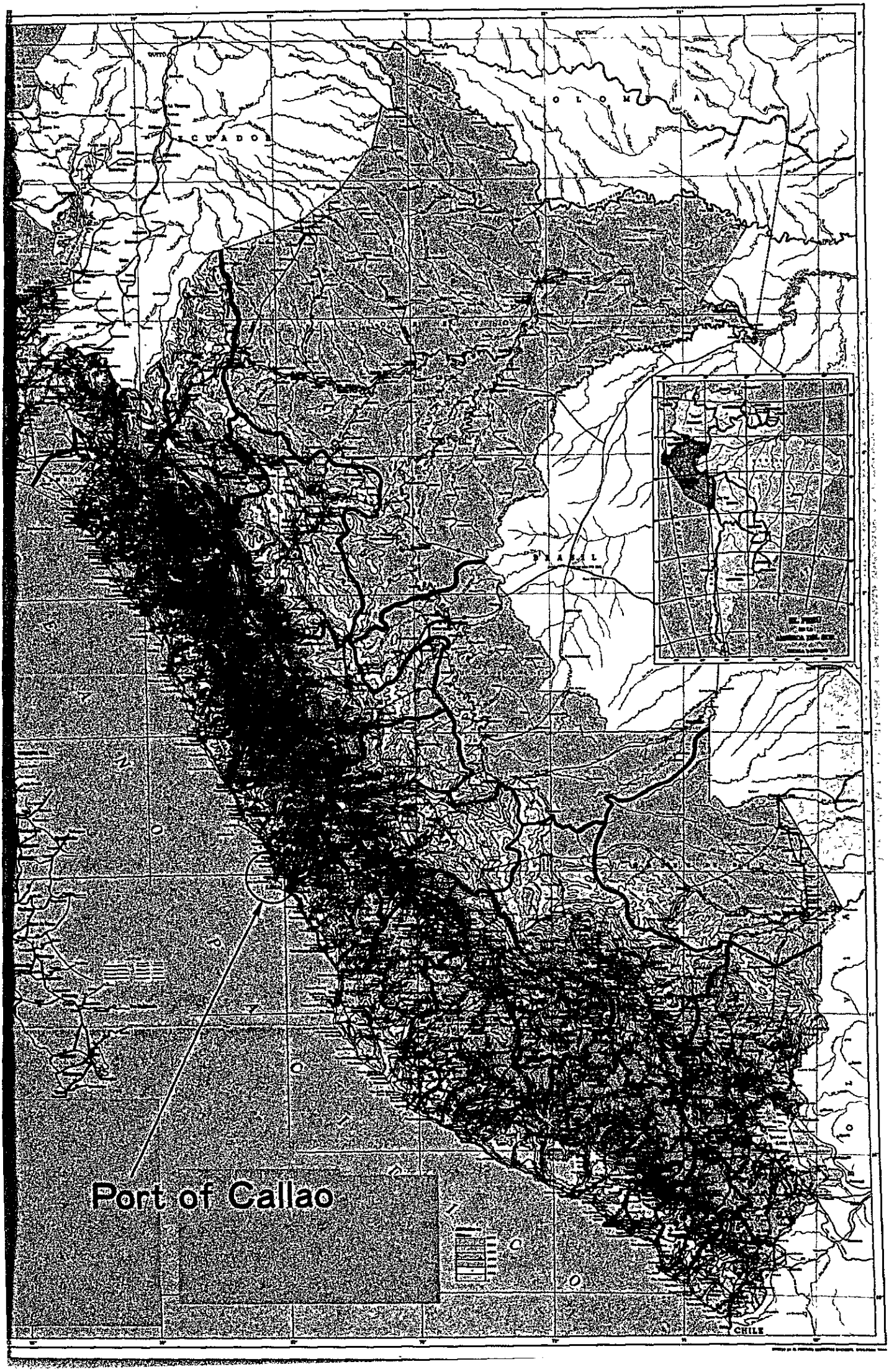
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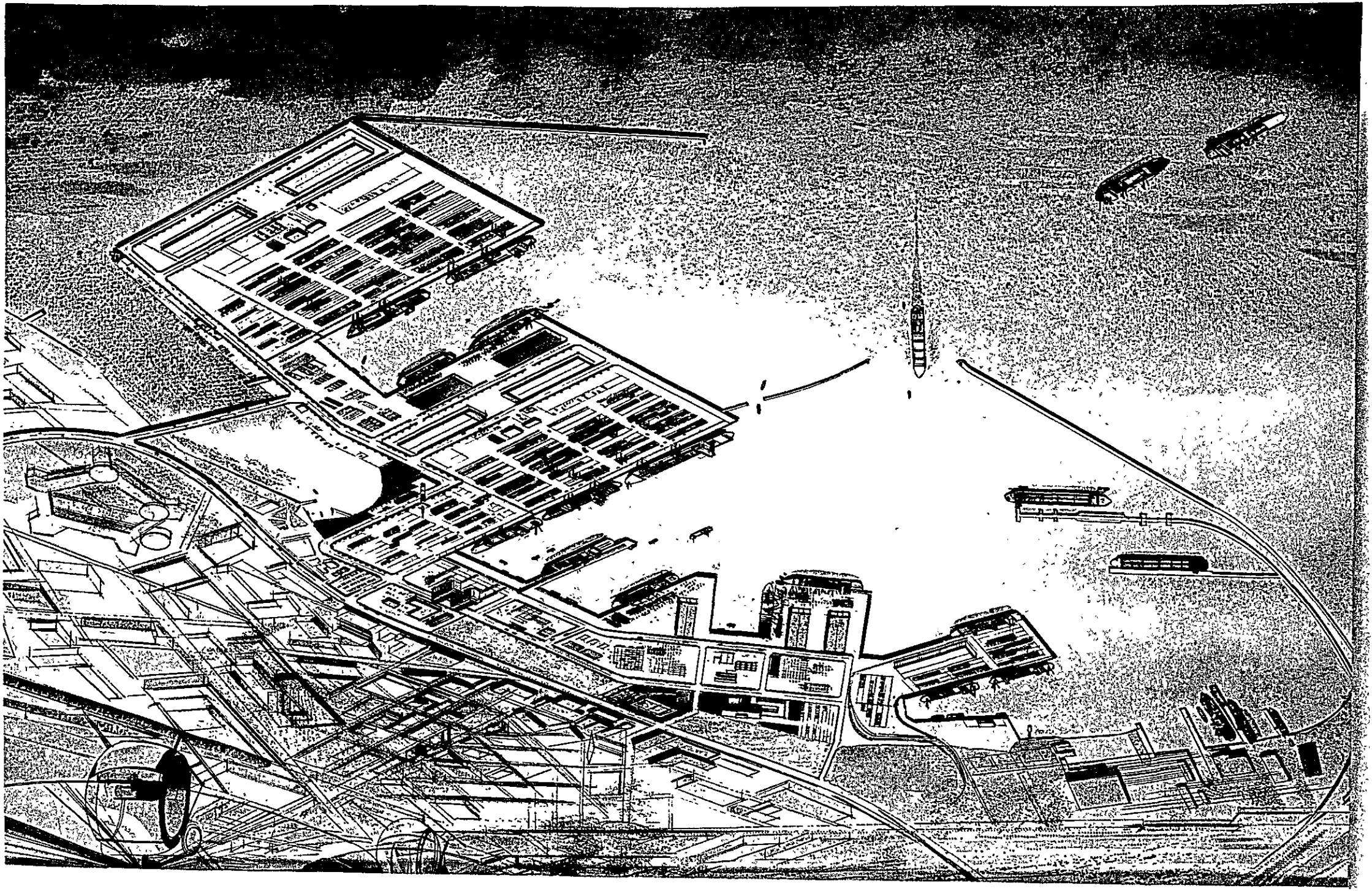


CONTENTS

APPENDIX

LIST OF TABLES

LIST OF FIGURES

CONCLUSION AND RECOMMENDATION

CONCLUSION

1. Necessity of Port Development

Callao Port has supported the development of the metropolitan sphere of Lima and played a central role in the marine transport system of the Republic of Peru and is expected to perform a vital mission in the future as a facility basic to the growth of the nation, particularly the metropolitan sphere of Lima.

But the port is suffering from long ship waiting times for such reasons as the shortage of port facilities in the light of the growing volume of port cargoes, the aging of port facilities and the inadequacy of the cargo handling system. Further, it is faced with the necessity to renovate its transportation through containerization, to cope with the increase of ship size and to undertake several other steps.

Under these circumstances, it is important to accelerate the development of Callao Port, making basic port plan principles of the needs to respond to the modernization of marine transportation, to strengthen distribution functions, to take a safety measures and to harmonize with the local community.

2. Master Plan

The master plan for Callao Port has the year 2000 as its target and by that time, about 15 million tons of port cargo are expected to be handled by the existing port and the waters to its south. The existing port will be redeveloped and its obsolete facilities modernized in order to rationalize port management, and at the same time a large container wharf will be constructed on the south side of the present port to cope with the beginning of full-scale container transportation. As of the year 2000, there will be a total of 20 berths including eight for the general cargo wharf, five for the container wharf and two for the grain wharf. Besides, necessary roads and storage and other facilities will be constructed and parks and greens will be provided for the purpose of integration with historical facilities, such as Castillo Real Felipe.

The amount of investment necessary to realize this plan is about 550 million U.S. dollars (price as of 1982).

3. Short-Term Port Development Plan

(1) Port Plan

The short-term development plan with 1987 as the target year is an effort to meet the needs of containerization and to make up for shortages in facilities. The volume of cargoes in the target year is about 8,400,000 tons including such foreign trade cargo as general cargoes, grains and ores these representing about 77% of all.

Facilities to be constructed under the short-term development plan include a berth for the container wharf, a berth for the grain wharf and related cargo handling equipment. The construction of these will cost about 100 million U.S. dollars (price as of 1982) including foreign funds representing approximately 70%. A construction period, including the period of detailed

design, of at least 4.5 years is necessary before they can be put to use.

(2) Economic and Financial Analyses

The construction of a container wharf does not merely mean adding a container handling function to the port but it means the increased importance of Callao Port among the ports of countries on the west coast of South America and Callao's assumption of a central role in that region. The construction of a grain wharf will ease the present ship waiting at the port and greatly contribute to the reduction of import cost. In economic analysis, evaluation is made by the internal rate of return (IRR). Benefits included in this are the reductions in ships' waiting cost, in the cargo handling cost, and in the land transportation cost, while expenses included are the facility construction costs. The internal rate of return, using 19 years as the period of economic calculation, is 19.53%. This shows that the short-term development plan is advantageous from the view-point of the national economy.

In financial analysis, the soundness of finances is analyzed by financial statements from the standpoint of management by ENAPU, the project authority in the event the project is executed, and the profitability of the project itself is analyzed by the method of discount cash flow. Analysis by financial statements assumes four cases for fund raising and two cases for operation cost and a total of eight cases come under study. If part of the project funds are raised from own capital, a fund shortage may occur during the construction period but if all the funds are raised by loans, there is no difficulty raising the necessary funds and the revenue/expenditure state and the state of assets are sound. Thus, the results of the analysis show that there are no detriments to the execution of the short-term development plan at Callao Port.

The profitability of the project itself is IRR = 35.31% in terms of internal rate of return. This indicates that this project is viable.

4. Operation of Container Terminal

A container terminal is best operated by a single organization that can carry out everything from receipt of goods to shiploading, or the reverse procedure, in an integrated manner. At Callao Port, it is assumed that ENAPU will have a container terminal office and operate the terminal under an integrated system of cargo handling. A container terminal office must have four divisions comprising 12 sections employing a total of about 110 desk workers (white collar) and about 120 field workers (blue collar).

To be able to smoothly receive marine container transportation, it is necessary to ratify international legal arrangements, such as the Customs Convention on Containers and the Customs Convention on the International Transport of Goods Under Cover of TIR Carnet and, at the same time, improve on related Peruvian laws and regulations.

RECOMMENDATIONS

1. Our proposed port plan for Callao Port has been prepared by studying the past development of the cities, industries and transportation in the hinterland, including nearby ports, and by assuming future socio-economic conditions in this country, future trends of world trade and future trends of container transportation. However, the economy always changes and not only the Peruvian economy but also the port activities of Callao itself are under the profound impact of the world economy. It is, therefore, important always to keep track of future economic changes and make necessary revision of the port plan or take other steps so that Callao Port can contribute to the development of the metropolitan sphere of Lima.

2. A port cannot efficiently function by the development of mooring, storage and other physical facilities alone. It can smoothly function only by developing various port controlling and operating functions as well as these facilities. To ensure the uninterrupted growth of Callao Port, it is necessary to develop roads between the port and the hinterland and improve the port cargo handling system.

3. The short-term development plan for Callao Port consists of construction within the boundaries of the port where work will be restricted in many ways. Thus, difficulties are expected to arise in both port operation and construction. Particularly during the period of construction, port users and constructionists must always coordinate on the details of port operation and the conduct of construction and together seek to prevent the deterioration of port functions.

4. The development of Callao Port requires reinforcement of the ENAPU technical staff. The amount of work in the sectors of survey, planning, design, construction and operation is expected to further increase in the future. Some aspects of these sectors can be trusted to outsiders including consultants. But in view of the quality and quantity of future technical work of Callao Port, there are likely to be cases where outside consultants, etc. must be guided in accordance with ENAPU's own technical judgment and evaluation. It is urgently necessary to establish a system that can make this possible.

SUMMARY

SUMMARY

1. Present Conditions of Callao Port

Callao Port adjoins the capital city of Lima and its hinterland includes the metropolitan sphere which is better developed than any other part of Peru. The road and railway transport systems are formed around the metropolitan sphere and the socio-economic activities of the metropolitan sphere are closely linked to its vicinities. Callao Port is the nation's largest foreign trade port handling about 25% (annual cargo volume: seven million tons) of the national total of imports and exports. It not only functions as a commercial port supporting the socio economic activities of the area centered around the metropolitan sphere of Lima but is also partially used as a naval port and a fishing port.

Callao Port is calm as it is protected from southerly swells by San Lorenzo Island on the southwestern front and La Punta Peninsula on the south side. Besides, the tidal current is faint and the port is hardly affected by winds. What is more, securing large water depths is relatively easy.

The cargo volume currently handled at Callao Port almost equals the maximum volume which can be handled using the present port facilities. ENAPU is looking into a way to deal with increasing container traffic at No. 5 wharf. However, a plan for constructing a modern, full-scale container wharf has not yet been introduced. Due to a shortage of berths for general cargo vessels and grain carriers, congestion has become a factor. And, whereas the working lifespan for a wharf may average fifty years, most of Callao's wharfs are older than this. From the viewpoint of efficient management, this port facility deterioration will likely have a negative effect on efforts to meet the various needs of the modern society.

2. Basic Priorities for Development of Callao Port

Approximately 27% of Peru's population and 64% of it's industry are concentrated in the Lima metropolitan sphere. The government is taking a policy of decentralization, but it is reasonable to assume that socio-economic activities in the Lima metropolitan sphere will continue to expand. The area is likely to develop as Peru's largest urban corridor. Callao Port serves to support these activities as import cargoes, mainly daily necessities, and export cargoes, such as minerals, pass through. Unless there are sufficient port facilities for handling these cargoes, both ships and cargoes will be overloaded. This will cause an inflation of imported goods and a decline in competitive power for exporting goods to the international markets. The expansion of the distribution function is the number one priority for the port in the Lima metropolitan sphere.

There are several possible alternatives for expanding distribution at the ports of metropolitan Lima. One is to expand this aspect of the existing Callao Port. Another is to share this function with neighboring ports. The Japanese Study Team, having considered the scale of Callao Port's hinterland, the existing land transportation systems, and natural conditions has judged that the former alternative to expand Callao Port be selected. The top priorities for future development of Callao Port are:

1) To prepare facilities for dealing with modernizations in marine transportation specifically

containerization and larger ships,

2) To strengthen distribution by redevelopment and reinforcement of existing wharfs, and improvement of cargo handling systems;
3) To insure the safety of harbor workers, and the security of ships and cargoes;
4) To create harmony with the port community's inhabitants and regional and historical landmarks.

3. Forecast on Volume of Cargoes to be Handled at Callao Port

The following three cases were assumed as economic models for forecasting the volume of port cargoes:

Case I Where the gross domestic product (GDP) growth rate is 6.37% from 1981 to 1990 and 6.00% from 1990 to 2000. These growth rates are the aims of the National Development Plan.

Case II Where the GDP growth rate is set at 2.2% for 1982 in view of recent economic trends. It is set at 4.0% for 1983 in anticipation of a gradual recovery to the level of the average economic growth rate of the past three years and set at 5.0% after 1984.

Case III Where the GDP growth rate is the same for 1982 and 1983 as in Case II and is set at 4.0% after 1984.

For forecasting volume, cargoes were classified into general cargoes, container cargoes, grains, minerals and petroleum products. An estimation of volume was made for each type of cargo.

The future volume of general cargoes was estimated separately for import cargo and export cargo. The volume of import general cargoes is closely related to the scale of production and consumption in the hinterland. Therefore, this volume was estimated by a correlation analysis with the gross domestic product. The export general cargoes consist mainly of mining and fishery products. First, an assessment of coming trends in the industries that produce these commodities was made. Then, by commodity, future volumes of these cargoes were forecast. The volume of container cargoes was forecast by multiplying the estimated percentages of containerization for import and export cargoes by the volume of general cargoes. The volumes of imported grains and exported minerals were forecast using the relationship between their demand and supply. Table 1 shows estimated volumes of cargoes (by main commodity) handled at Callao Port in each target year. The cargo volume of Case II was used as the base for calculation of necessary port facilities, because the GDP growth rate in Case II was considered the most reasonable.

4. Master Plan for Callao Port

(1) Strategy of Plan

The basic idea behind the development of Callao Port will be materialized by establishing a system for the control and operation of the port and improving the port facilities. Definite measures necessary to accomplish the purpose are as follows.

1) Expansion of development space: The present port contains little room for development. Hence, the necessity to develop new port space.
2) Development of container wharf: Facilities will be developed and the cargo handling

Table 1 Estimated Volume of Cargoes Handled at Callao Port

Unit: 1,000 tons

Case	Year	General cargoes			Container cargoes			Imported grains	Exported mining products	Petroleum products					Total
		Import	Export	Total	Import	Export	Total			Import	Export	Domestic-trade Import	Domestic-trade Export	Total	
	1981	1,487	591	2,078	97	73	170	1,101	1,411	94	238	1,425	113	1,870	6,630
I (6.37%, 6.00%)	1987	1,739	677	2,416	519	415	934	1,368	1,461	137	238	2,064	113	2,552	8,731
	1990	1,691	572	2,263	1,037	729	1,766	1,658	1,782	165	238	2,483	113	2,999	10,468
	2000	1,378	620	1,998	3,545	1,319	4,864	2,562	2,252	295	238	4,447	113	5,093	16,769
II (5%)	1987	1,547	640	2,187	462	392	854	1,368	1,641	122	238	1,841	113	2,314	8,364
	1990	1,447	531	1,978	887	676	1,563	1,658	1,782	141	238	2,131	113	2,623	9,604
	2000	1,073	561	1,634	2,759	1,192	3,951	2,562	2,252	230	238	3,471	113	4,052	14,451
III (4%)	1987	1,488	629	2,117	444	385	829	1,368	1,641	117	238	1,772	113	2,240	8,195
	1990	1,352	514	1,866	828	655	1,483	1,658	1,782	132	238	1,993	113	2,476	9,265
	2000	910	531	1,441	2,340	1,129	3,469	2,562	2,252	195	238	2,950	113	3,496	13,220

system improved to make the port accessible to large full-container ships. In the future, it will be developed into a nucleus container port for the west coast of South America.

3) Development of special wharfs by type of cargo: Special wharfs for grains and minerals will be expanded to increase the efficiency of cargo handling and make the quick dispatch of ships possible.
4) Securing of sheltered waters: Calm waters will be secured by constructing breakwaters to assure safety and increase the efficiency of cargo handling.
5) Conduct of redevelopment: The redevelopment of the sites of old facilities and the relocation of buildings, etc. obstructing the flow of land traffic in the port area will be conducted to develop Callao Port into a modern port.
6) Coordination with city plan: The port plan will be coordinated with historical naval facilities, Castillo Real Felipe, etc. which lie in the vicinity. Also, the city plan for Callao City will be fully respected.
7) Selection of optimum scale and time of investment: A phased plan will be prepared not only to minimize the total amount of investment but also to achieve maximum effect with minimum investment.

(2) Scale of Master Plan

To be able to smoothly handle the cargo volume anticipated for 2000, it is necessary to rationalize the port cargo handling system and modernize the existing facilities and, at the same time, construct new facilities that can cope with the qualitative change of transportation including container transport and the increase of ship size. As for space for facility development, waters on the north side of the present port involve many restrictions to development because of the presence of the Rimac River and the naval port. Meanwhile, waters on the south side are calm and can be developed in one with the existing port. Thus, the waters on the south side of the present port are proposed as space for new development.

The wharf plan for the year 2000 by the types of major cargo items is as follows: For the general cargo wharf, eight quay berths with a water depth of 10 m will be secured in consideration of possible shift to container cargoes, improvement of the cargo handling system and redevelopment of facilities. For the container wharf, four berths (each length: 300 m) with 12 m depth are proposed in consideration of the trends in container wharf development at the ports of countires on the west coast of South America. For the grain wharf, two berths with 12 m depth are proposed so that they can cope with increasing ship size.

The space necessary in the year 2000 comprises 90 ha of land for the container wharf, open storage yards, roads and others and waters for channels and anchorage.

Table 2 Wharves proposed in the Master Plan

Type	Cargo volume (1,000 tons)	Number of berths	Berth length (m)	Water depth (m)	Ship size (DWT)	Cargo handling equipment
General cargo berths	1,634	8 (1)	185 ~ 200	10	15,000	Ship's Gear
Container-berth	3,951	large 4 small 1 (1)	300 185	12 10	30,000 15,000	Container Crane 2 per berth Mobile Crane 2 per berth
Grain berths	2,567	2	250	12	60,000	Pneumatic unloader 400 t/hr 2 per berth
Mineral berths	2,252	2 (2)	200	10	20,000	Ship loader 800 t/hr 1 per berth
Petroleum berths	4,052	3 (2)	250	12	35,000	Ship's pump
Total	14,451	20				

Note: In "number of berths" column, number of each parenthesis represents number of existing
In numeral outside parentheses shows total number of berths.

(3) Master Plan

When planning a port, a number of alternatives are prepared and, by comparing from various points of view, the best of them is selected.

Three alternatives are proposed. They are each characterised by room for future expansion, maneuverability, time to supply facilities and phased construction. (Fig. 1)

These three alternatives are evaluated from the view-points of convenience, safety, economy, flexibility of plan and environmental protection. From the results of the evaluation (Table 3), Alternative Plan (C) has the fewest problems of all. Thus, Alternative Plan (C) is selected as the best. The master plan for Callao Port with 2000 as the target year is as indicated in Fig. 2.

(4) Construction Plan

The master construction plan attends to the following:

1) Supplying facilities in accordance with the increase of cargo volume.
2) Minimizing the impact of port construction on current port activities.
3) Levelling construction investments.

A construction plan based on these principles is shown in Fig. 3. Under the master plan, construction will be performed in four stages. The capacity of handling general cargoes may sometimes be temporarily smaller than the cargo volume. This will be coped with by not only increasing the efficiency of cargo handling but also by such methods as using the container wharf.

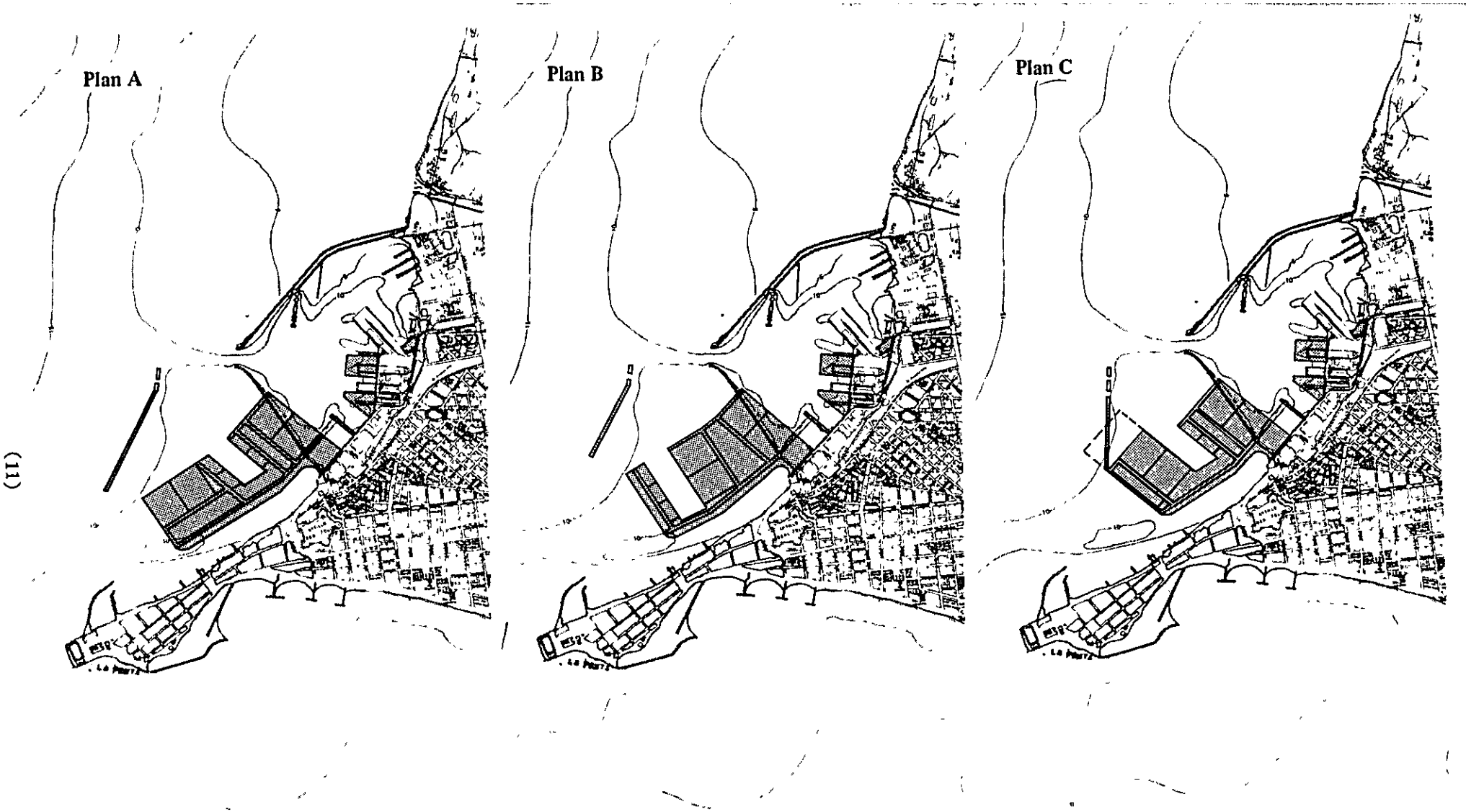


Fig. 1 Alternative Master Plan

Fig. 2 Master Plan

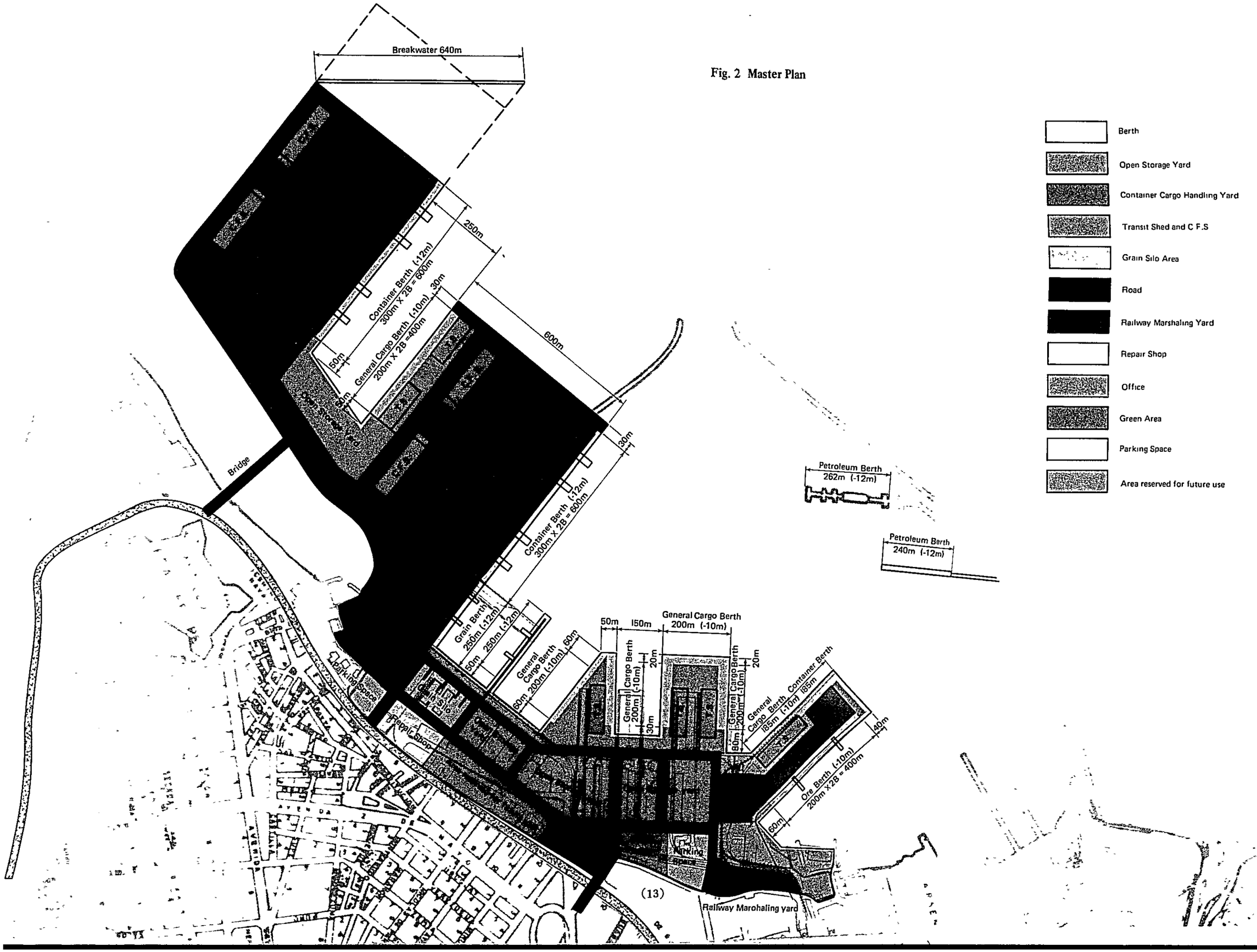


Table 3 Evaluations of Alternative Plans

Items of evaluation		Evaluation		
		Plan A	Plan B	Plan C
Convenience	Maneuvability of ship	○	◎	◎
	Land use	○	○	○
	Operation of the facilities	○	◎	○
Safety	Calmness of waters within the port	○	◎	◎
	Emergency measures	◎	◎	○
Economy	Total construction costs	○	○	◎
	Investments by stage	○	△	◎
Flexibility of planning	Measures for anticipated future change	△	△	◎
	Future development	◎	◎	○
Environment preservation	Effects on social environment	○	○	◎
	Effects on natural environment	○	○	○

Note: Ranking of evaluation ◎ Excellent
○ Ordinary
△ Some problems

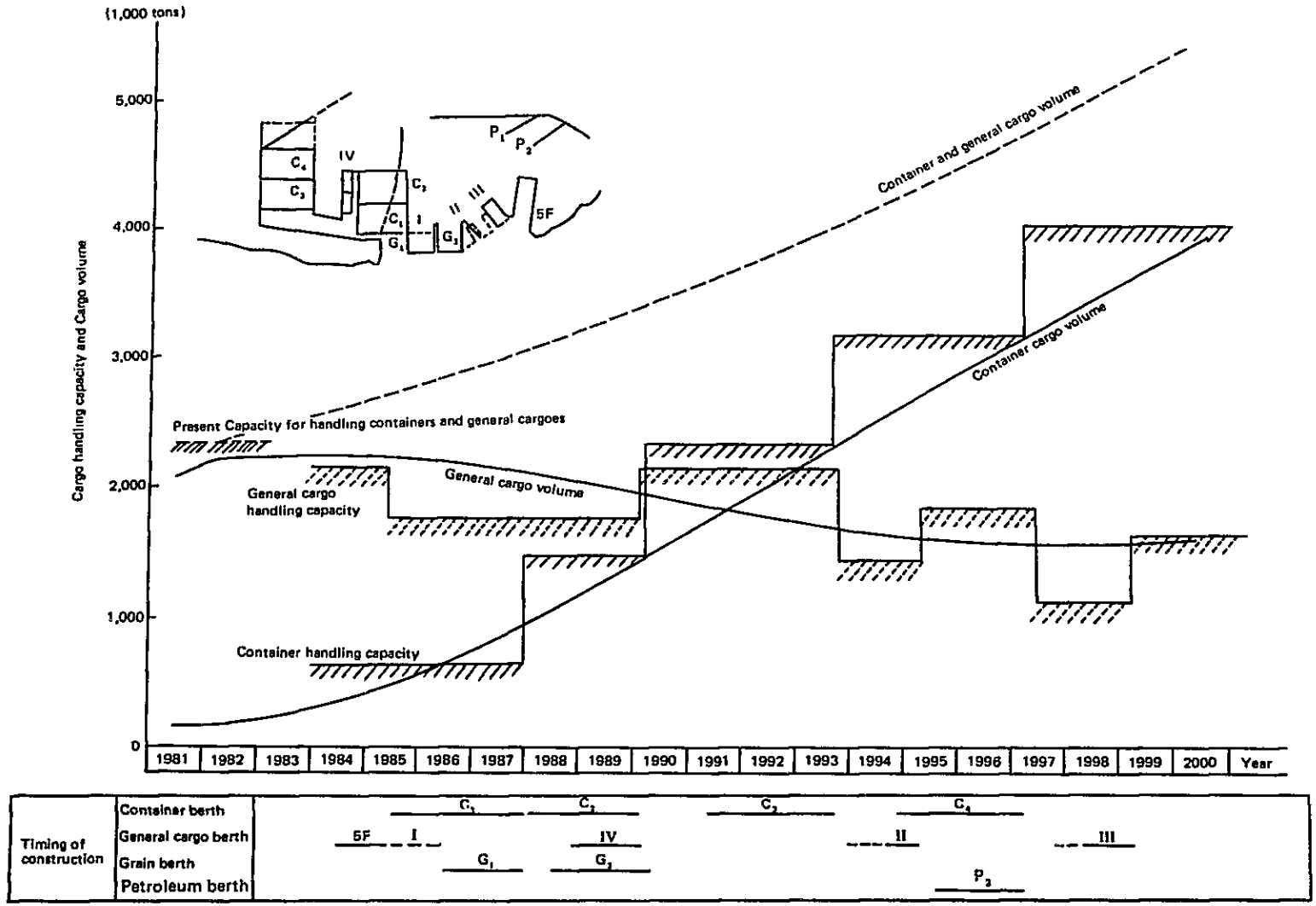


Fig. 3 Stage Plan for Constructing Berths of the Master Plan

5. Short-term Development Plan for Callao Port

(1) Target for Short-term Development Plan

The major goals for Callao Port by 1987 include supplement of facilities and improvement of operations.

With regard to the facilities, notable problems include a shortage of facilities to adequately handle the large volume of cargo as well as obsolescence of the facilities that do exist. Of these two problems, the shortage of facilities is more acute.

In particular, there is a pressing need for further development of container wharves and grain wharves.

The container cargo handling capacity of berth No. 5B will soon be pushed to the limit, while at the same time, large container vessels are unable to gain access to the berth.

As for grain cargoes, in addition to the problem of ship congestion in the port, there are also obstacles to the entrance for large grain cargo ship.

Fewer general cargo berths are now needed due to continuing progress of containerization. However, the present facilities must be maintained at their same level for the time being.

(2) Short-term Development Plan

In preparing the short-term development plan the factors to be considered include: (a) effective handling of containers, (b) minimizing investment, (c) smooth shifting to the next plan, and (d) quick completion of the project. Of course, consideration must also be given in terms of design and construction to protecting the reclamation from settlement.

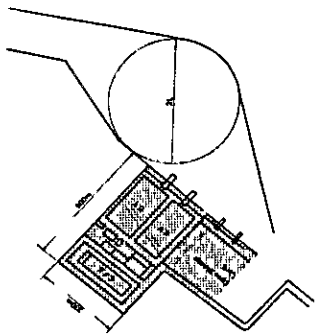
Container berths and grain berths that must be constructed under the short-term development plan can, from their configuration in the master plan, be more economically constructed from the base of the southern breakwater and this is more efficient for the use of the port.

The following two alternatives may be conceived for the short-term development plan:

Alternative Plan A stressed the rational control and operation of the container terminal and smooth transition to the next plan while Alternative Plan B is anomalous but stresses the minimizing of construction investment and early readiness for utilization. (Fig. 4)

Both alternatives satisfy their requirements but it is the amount of investment that finally decides which plan to choose. Considering the amount of ENAPU's past construction investments, Alternative Plan B seems to be the more acceptable to ENAPU. Thus, this alternative is proposed as the short-term development plan. (Fig. 5)

Plan A



Plan B

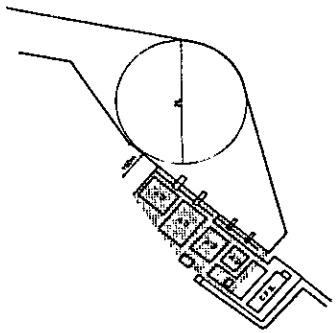


Fig. 4 Alternative Short Term Plans

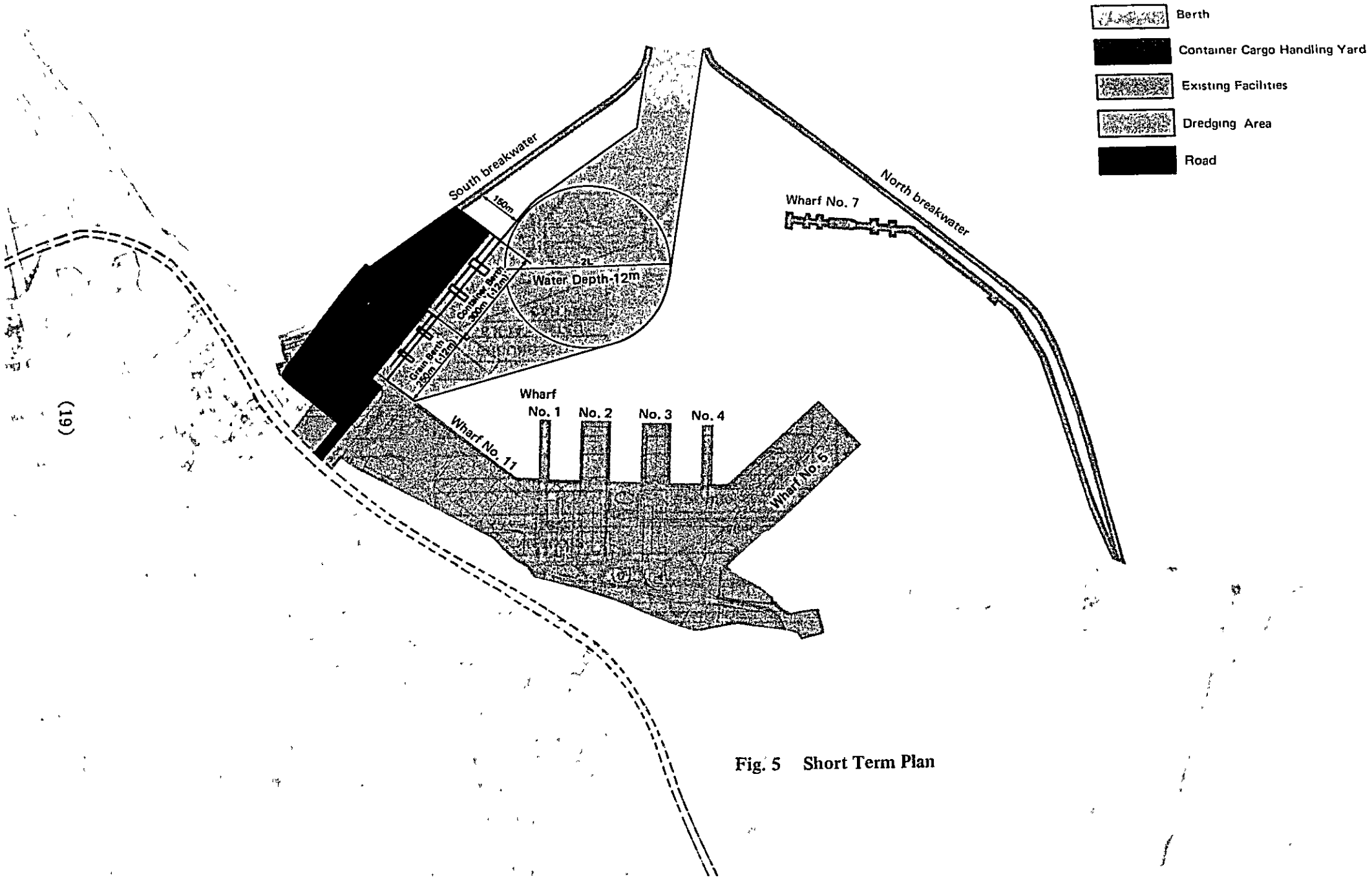
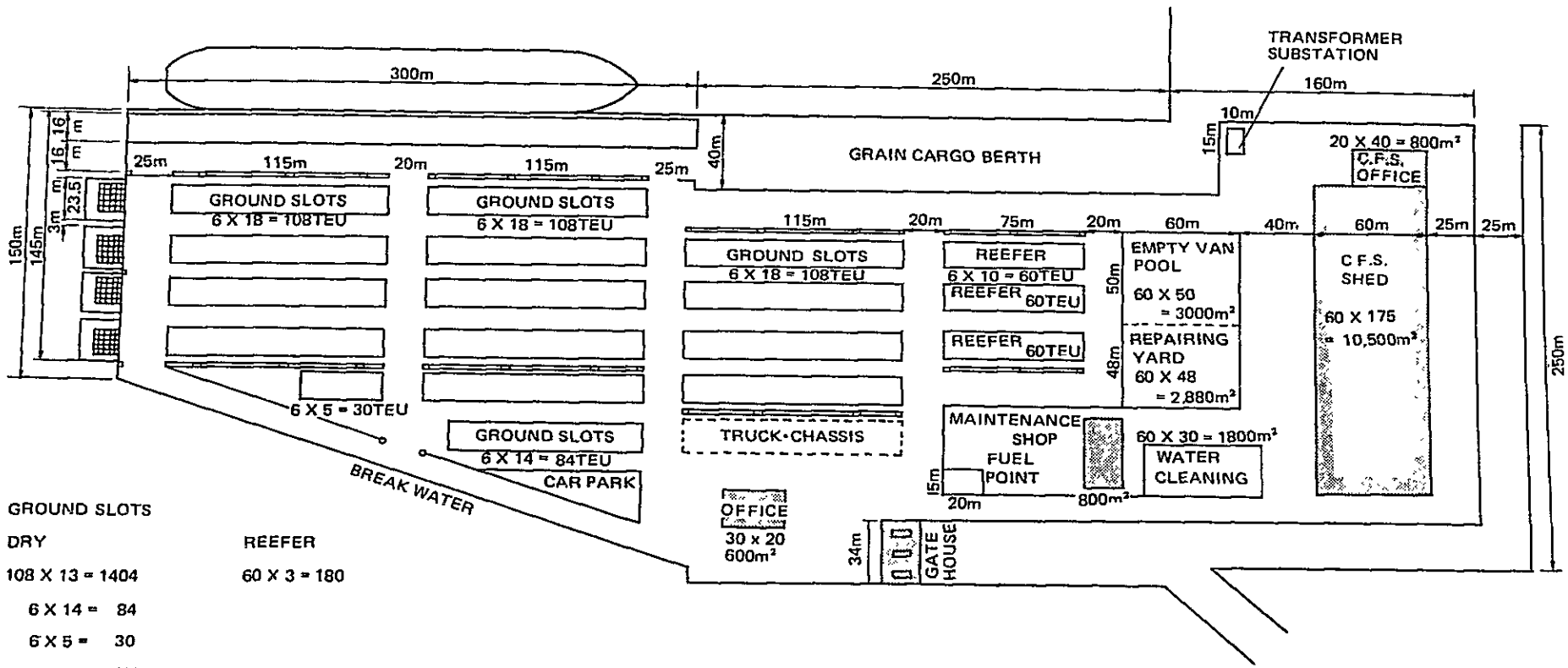


Fig. 5 Short Term Plan



GROUND SLOTS

DRY	REEFER
108 X 13 = 1404	60 X 3 = 180
6 X 14 = 84	
6 X 5 = 30	
1518	
1518 X 2.5 = 3,795TEU	180 X 2 = 360TEU
1518 X 3 = 4,554	

Fig. 6 Layout of Container Terminal Plan (B)

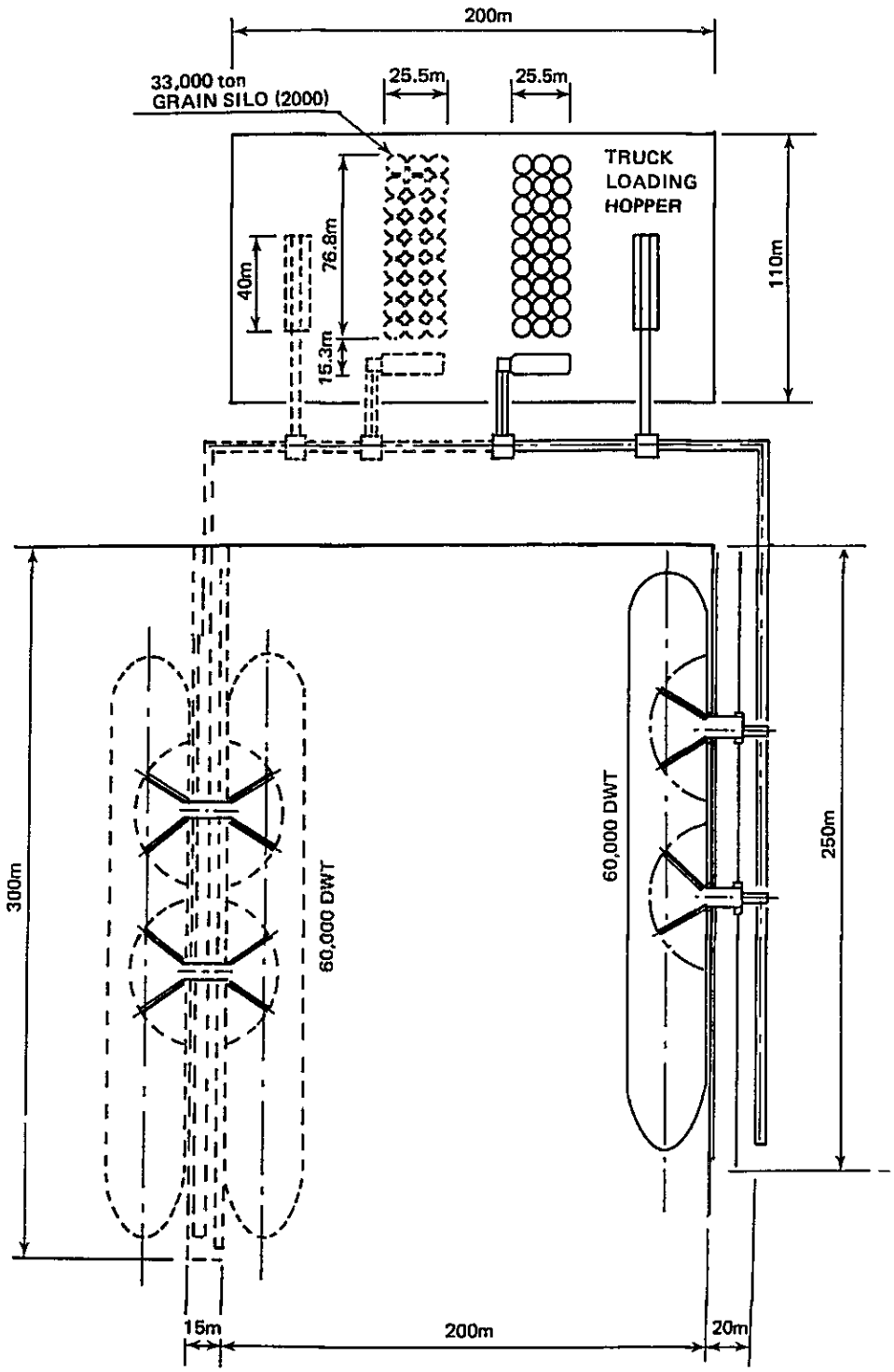


Fig. 7 Grain Terminal Plan

6. Operation of the Container Terminal

(1) Operating Organization

It is desirable for the container terminal to be operated under the integrated responsibility setup of a single organization charged with everything from receipt of goods to ship loading or from ship unloading to delivery of goods. This is absolutely necessary to enable the following characteristics of container terminal operation to be brought into full play:

1) Highly efficient work by a small staff as the result of mechanization and work simplification.
2) Rational work based on preliminary work planning prior to the entry of ships.
3) Cost reduction through the rapid handling of mass cargoes.
4) Decrease of short-quantity accidents and damages to cargoes as the result of containerization.
5) Reduction of ship operating cost (through curtailment of port stay).

Judging from the present conditions of Callao Port, it will be appropriate for the container terminal office to be created at this port by ENAPU to operate the container terminal centrally as the port's container terminal organization.

This operation requires the service of a sufficient number of proficient office and field workers and the provision of a complete system for the repair of cargo handling equipment.

The container terminal office must have four divisions comprising 12 sections and be manned by 111 desk workers (white collar) and 124 field workers (blue collar).

(2) Operation of Container Terminal

Work at the container terminal consists of the following:

1) Container ship work	:	Container loading/unloading of ships.
2) Container yard work	:	Keeping and sorting of containers at the yard and their haulage into or out of the yard.
3) Gate work	:	Receipt or delivery of containers
4) Container CFS work	:	Van stuffing/unstuffing of small-lot cargoes and their custody
5) Cargo handling paper work	:	Relevant documents
6) Maintenance of containers and cargo handling equipment	:	Maintenance and repair of containers and equipment

In these duties for example the yard planner, who directs container yard work, must perform the following duties:

He must prepare a yard plan so that containers can be efficiently deposited in the limited space of the container yard and be delivered uninterruptedly. Specifically, his duties include assignment of yard slots for containers, preparation of yard location plans, preparation of sequence check lists for landing cargoes, preparation of check lists for shift reloading, preparation of delivery schedules and preparation of dispatch orders.

(3) Container Handling Plan for Wharf No. 5

The operation of Wharf No. 5 in the event that it is turned into a container wharf is studied

under the condition of using the cargo handling equipment which ENAPU currently possess. If the B berth of Wharf No. 5 is used as a container berth, a marshalling yard of about 9,000 m^2 can be secured in its immediate rear. It can hold 990 TEU (stacks averaging 2.5) and mainly containers for export cargoes will be kept there. Container storage yards will be secured in A, B, C and D areas indicated in Fig. 8. The operation system will be of the transtainer formula combining the mobility of top lifters and side loaders with the effective use of space by the multi-decker stacking by transtainers. Side loaders will be used in A and D areas, transtainers in B area and top lifters in C area and the marshalling yard. The total container storage capacity of all areas, including the marshalling yard, is 3,772 TEU.

As for container yard working hours, work will be done on a two-shift basis at the beginning, switching to three shifts when work increases. As necessary personnel for this work, the work control division must be manned by 10 at day and five at night while the field work division must be manned by 45 at day and 37 at night.

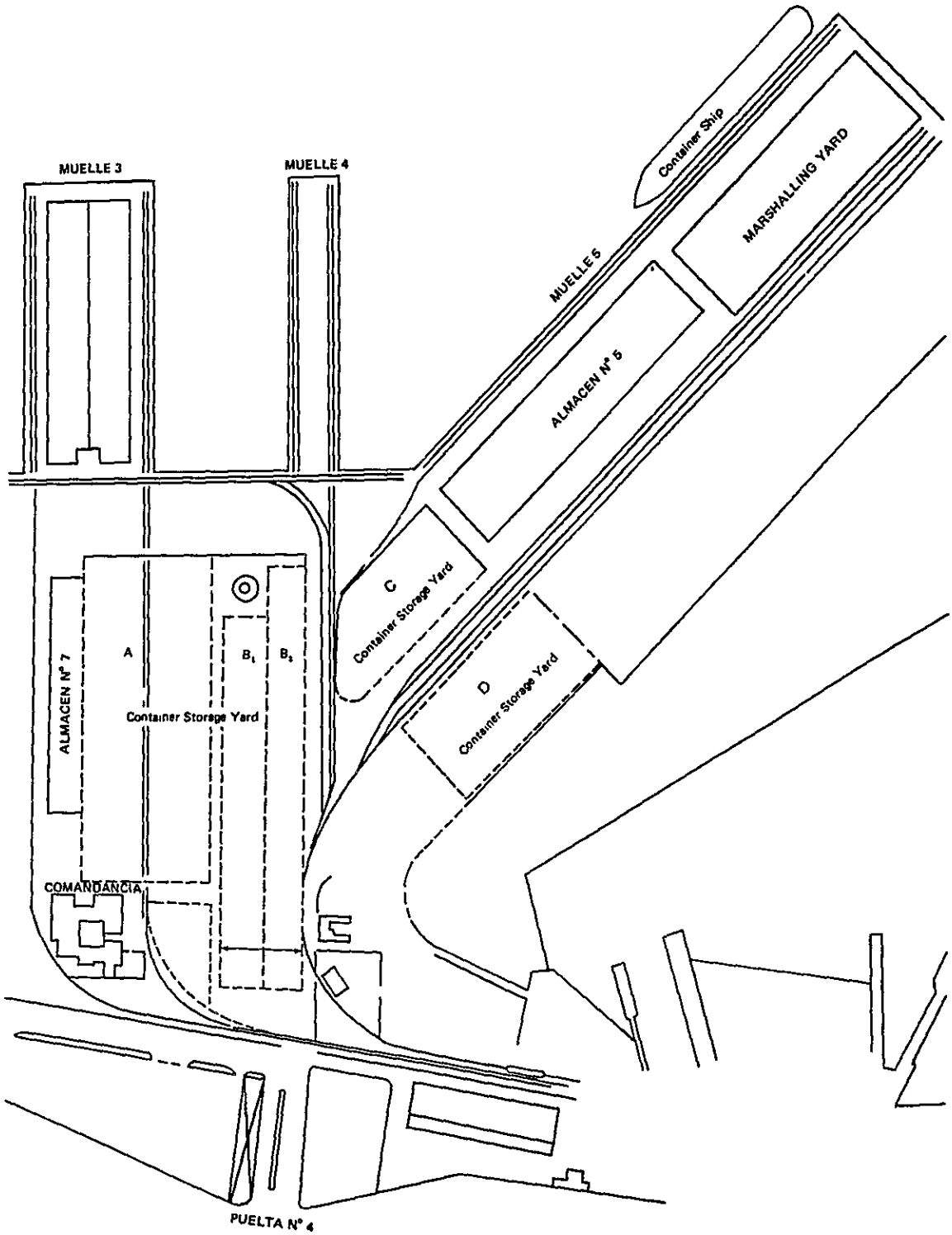


Fig. 8 Container Handling Plan at No. 5 Wharf

7. Design, Construction and Cost Estimate

(1) Design

Construction under the short-term development plan must be executed in the port within a brief period of time while ordinary port activities continue. Since the construction will take place in the port, the effect of waves is hardly considered in planning the construction. Yet, the fact that the foundation ground is soft, the area is in a seismic zone, the securing of a work base is difficult and the domestic procurement of such construction materials as steel pipe piles and steel pipe sheet piles is difficult must be carefully considered in designing and planning construction.

As the structural form of quays, four different types: concrete caisson type, steel sheet pile cellular cofferdom type, steel pipe pile supported platform and walled steel pipe pile type have been comparatively studied. Finally, the walled steel pipe pile quay structure has been chosen over the steel pipe pile supported platform. The sections of the container wharf and the grain wharf are shown in, Fig. 9 and Fig. 10.

Land in the rear of wharves will be secured by reclamation of soft ground. This gives rise to the problem of settlement of reclaimed land after the start of use. The settlement of reclaimed land and its settling speed are estimated on the basis of results of a geological survey. As indicated in Fig. 11, settlement will finally amount to more than 1 m if reclamation is carried out on the present ground. Therefore, we propose a design wherein settlement can be held to about 30 cm by replacing soft ground to a depth of −13 m with superior sand.

(2) Construction and Cost Estimation

Climate in the area of Callao Port is generally mild and work at the construction site will be only slightly affected by weather. Since, however, most construction work takes place in the limited space of the port where ordinary port activities continue, it is necessary to plan construction carefully so that it may not interfere with the port activities.

A drag suction dredger must be used to obtain materials for reclamation use since there is no choice but to collect them from waters exposed directly to off-sea swells. Meanwhile, a cutter suction dredger must be used for the reclamation itself. Thus, it is necessary to use these two dredger types.

The other necessary types of large construction equipment, are the pile driving barge and the grab dredger. The cutter suction dredger to be used will be brought from the west coast of the United States while the drag suction dredger will be brought from Europe. It is further assumed that other construction equipment will be procured from the west coast of the United States.

It is assumed that construction materials that cannot be procured in Peru will be procured from Japan and other foreign countries.

Construction must be performed at a considerable rate because the facilities must be provided for use soon. Yet, since construction must be done as economically as possible, the work schedule is as indicated in Fig. 12.

The period of construction is four years and six months: namely, a year for engineering service, including the bidding time, and three years and six months for construction.

The construction cost is estimated by the price levels of August 1982 and does not include taxes for imported materials and equipment.

The construction cost for the short-term development plan is about 100 million dollars, as indicated in Table 4. The foreign portion represents 70% of this total.

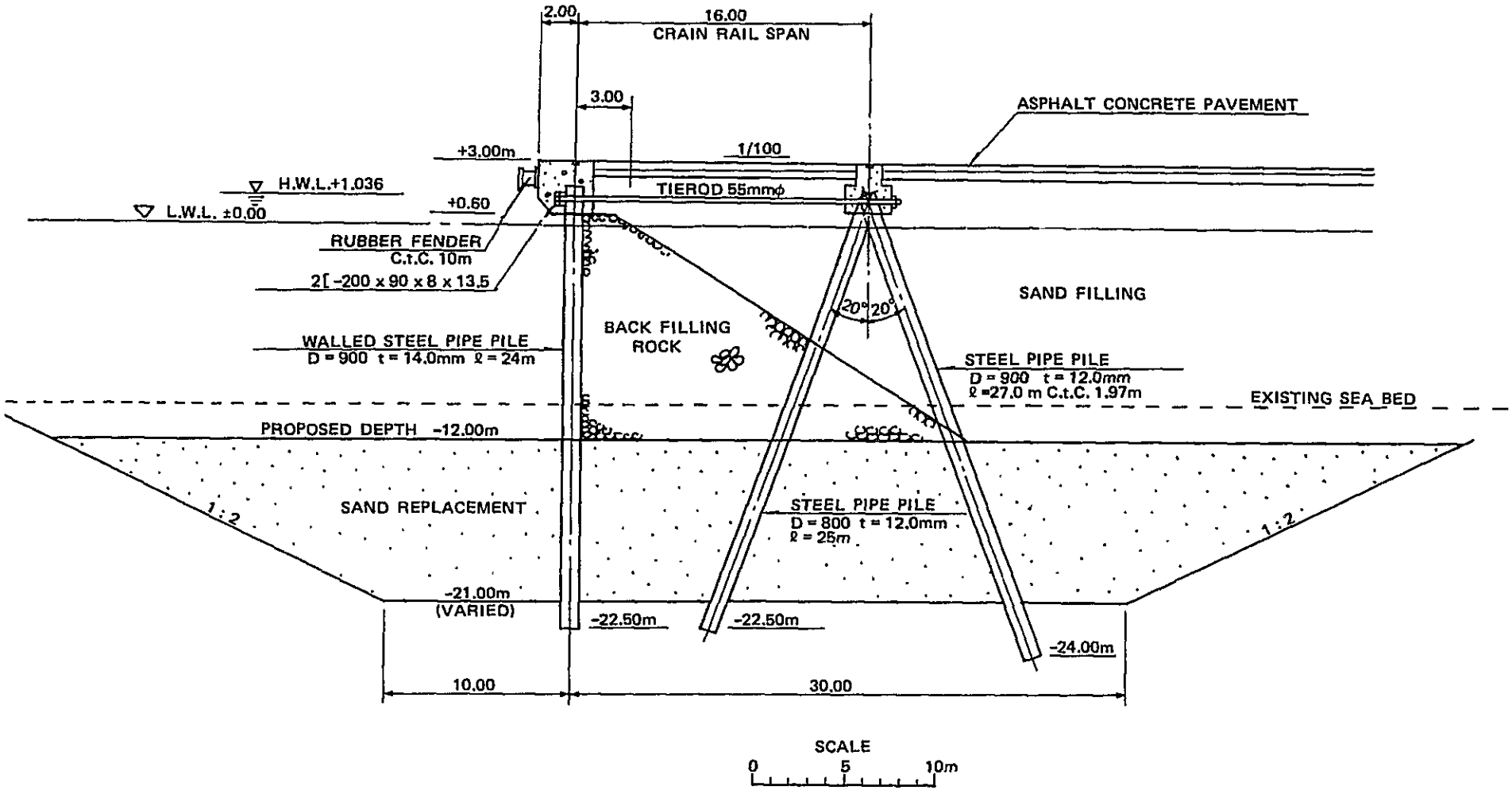


Fig. 9 Container Berth Quay Wall (Walled Steel Pipe Pile Type)

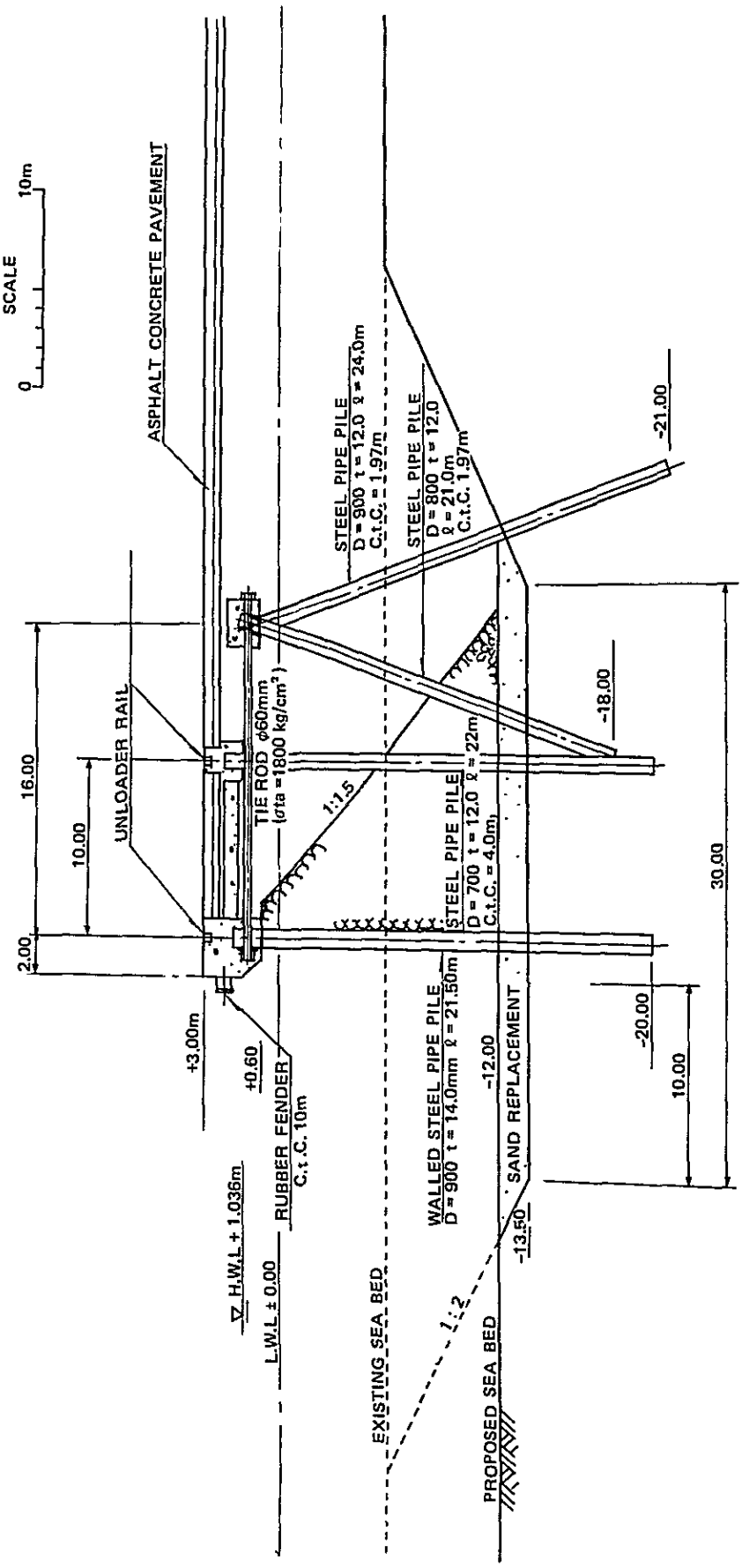


Fig. 10 Grain Berth Quay Wall

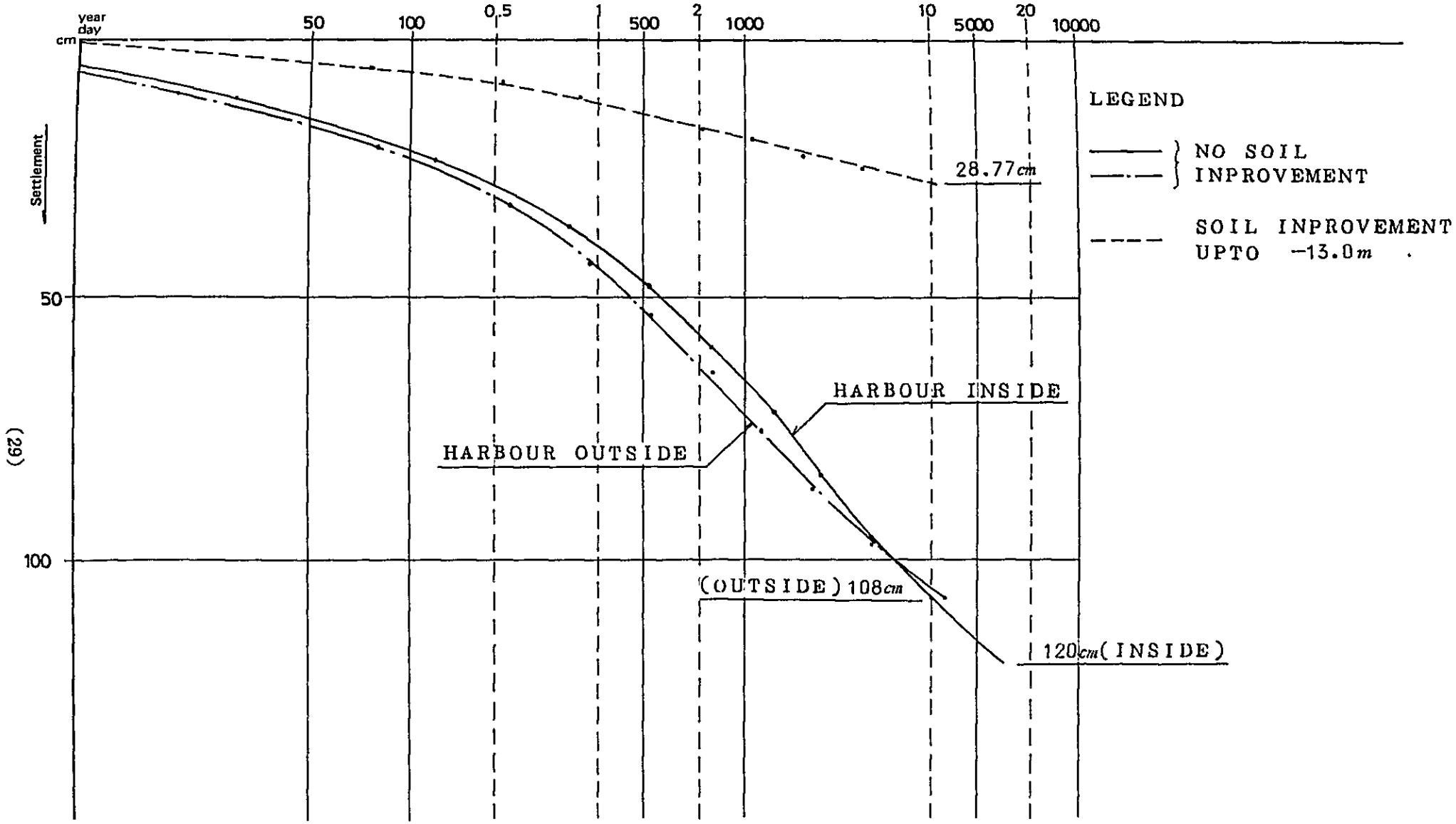
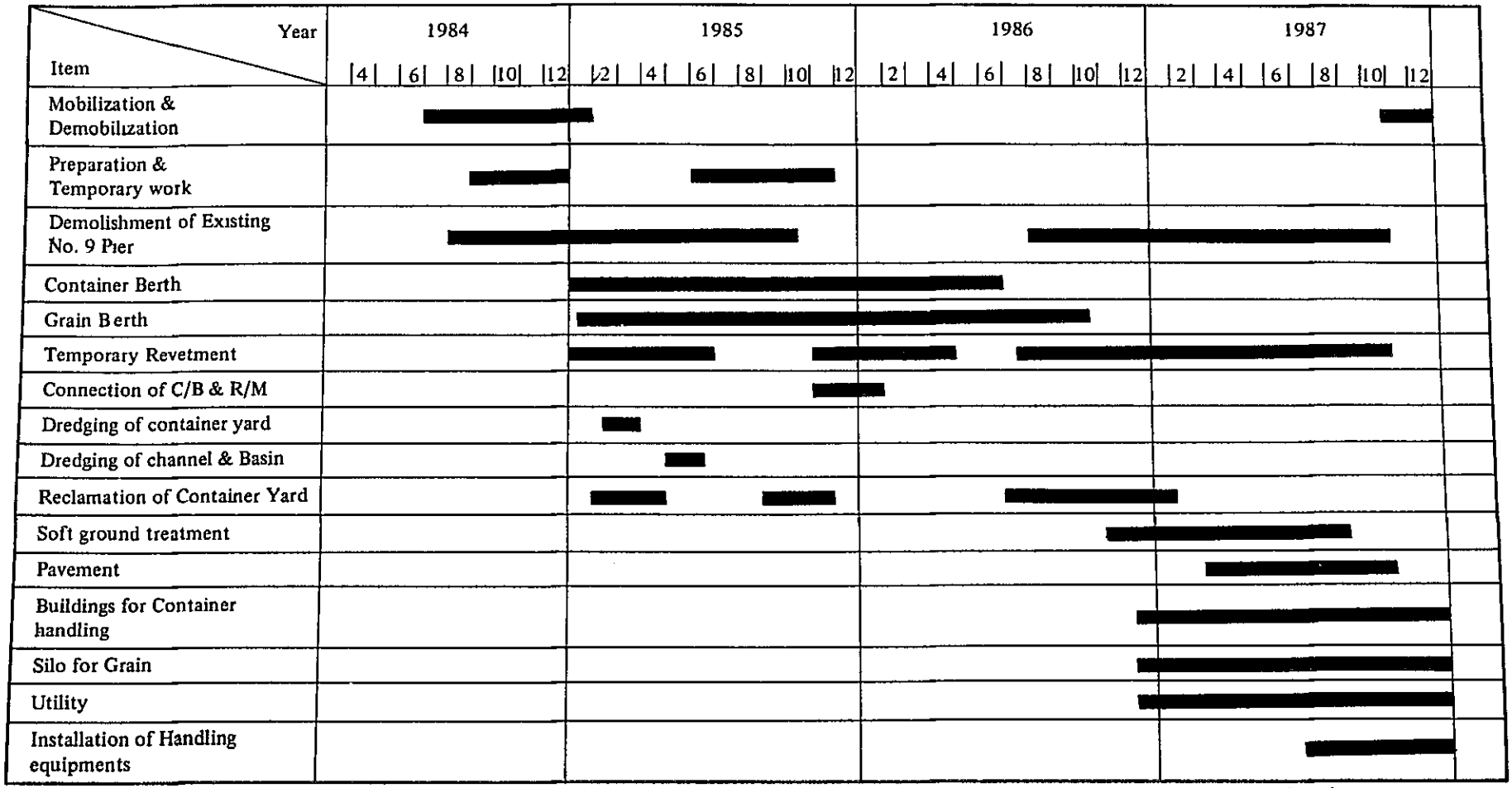


Fig. 11 Estimation of Settlement of Reclamation

Fig. 12 Construction Schedule of Short Term Development Plan



NOTE: Assuming that tendering for construction needs 3 months, engineering services for the Project such as detailed design and preparation of tender documents must start at least 12 months before commencement of construction work.

Table 4 Construction Cost of Short Term Development Plan

(Unit: 1,000 US$)

Item	Unit	Short Term Development Plan				Unit	Alternative (Plan A)			
		Quantity	F/C	L/C	Total		Quantity	F/C	L/C	Total
Mobilization & Demobilization	L.S		7,637	–	7,637	L.S		7,637	–	7,637
Preparation & Temporary work	L.S		2,831	1,711	4,542	L.S		4,680	2,080	6,760
Demolishment of Existing No. 9 Pier	L.S		2,386	964	3,350	L.S		2,386	964	3,350
Container Berth Quaywall	m	300	6,203	1,681	7,884	m	300	6,096	1,681	7,777
Grain Berth Quaywall	m	250	4,526	1,488	6,014	m	250	4,504	1,488	5,992
Revetment	m	–	–	–	–	m	230	1,396	1,624	3,020
Temporary Revetment	m	* 470	1,382	1,547	2,929	m	830	5,037	5,861	10,898
Connection of C/B & R/M	m	20	205	30	235	m	20	205	30	235
Dredging of Container Yard	m^3	441,720	980	150	1,130	m^3	579,260	1,126	197	1,323
Dredging of Channel & Basin	m^3	636,000	1,145	185	1,330	m^3	636,000	1,029	185	1,214
Reclamation of Container Yard	m^3	1,853,973	5,775	1,341	7,116	m^3	3,205,115	9,346	2,356	11,702
Soft Ground Treatment	m^2	9,600	196	69	265	m^2	19,200	392	138	530
Pavement	m^2	157,650	432	5,234	5,666	m^2	202,120	402	5,524	5,926
Buildings for Container Handling	L.S		–	3,589	3,589	L.S		–	3,701	3,701
Silo for Grain	set	1	5,921	5,834	11,755	set	1	5,921	5,834	11,755
Utility	L.S		1,508	642	2,150	L.S		1,508	642	2,150
Handling Equipments	L.S		20,062	–	20,062			20,062	–	20,062
(Sub Total)			(61,189)	(24,465)	(85,654)			(71,727)	(32,305)	(104,032)
E/S			2,784	1,499	4,283			3,381	1,820	5,201
Contingency			6,027	3,670	9,697			7,607	4,846	12,453
Total			70,000	29,634	99,634			82,715	38,971	121,686

*Including reinforcement of south breakwater

8. Economic Analysis

In this economic analysis, the relation between project costs and benefits from the execution of the project is evaluated by the internal rate of return (IRR) with respect to, the "with" case, where the short-term development plan for Callao Port is executed, and the "without" case, where it is not. It is assumed that, in the "without" case, the cargo volume which is in excesses of the present cargo handling capacity of Callao Port will be transported via San Martin. The project costs are the cost of developing facilities under the short-term development plan while the benefits consist of, the amount saved by shortening the ship waiting time, the decrease in expenses of cargo handling, the decrease in expenses of shipping services, the decrease in expenses of cargo storage services and the decrease in expenses of land transportation. The period of IRR calculation is 23 years, the period of construction added to the project life.

The IRR obtained from these benefits and costs is 19.53%. It can be concluded that, economically, this project is considered feasible enough in view of the Peruvian social discount rate of 13%.

9. Financial Analysis

9-1 Method of Financial Analysis

The aim of this Financial Analysis is to study the soundness of the financial affairs for Callao Port based on the Financial Statements, the profitability of the Project itself based on the discount cash flow method, and the reasonableness of the project execution from the managerial position of the executing agency, ENAPU S.A..

9-2 Analysis of Financial Statements

Estimated financial statements (revenue and expenditure, source and application of funds and balance sheets) for Callao Port from the year 1981, whoch was established as the initial year of reckoning when the accounts for Callao Port were settled, to the year 2006 when the project life is to terminate, are used to analyse revenues and expenditures, the conditions of fund raising and the financial status.

Four different fund raising scenario's where assumed and for each of these, 2 variations for the operating expenses in the financial statements, producing the following 8 cases, which were studied.

(1) 8 Cases studied:

Case	Foreign/Local Portion	Methods of fund raising	Operating expenses
Case-A1	Foreign Portion	50% self-finance, 50% long term loan from Foreign Bank at an interest of 4.25%/annum. Repayment period 25 yrs including 7-years' grace period.	Present operating expenses for Callao Port (Type A)
	Local Portion	100% self-finance	
Case-A2	Foreign Portion	The same as Case-A1	– ditto –
	Local Portion	50% self-finance, 50% long term loan from domestic bank at an interest of 12%/annum. Repayment period 17 yrs including 4 years' grace period.	
Case-A3	Foreign Portion	100% long term loan from Foreign Bank at an interest of 12%/annum. Repayment period 17 yrs including 4 years' grace period.	– ditto –
	Local Portion	100% long term loan from domestic bank at an interest of 17%/annum. Repayment period 17 yrs including 4 years' grace period.	
Case-A4	Foreign Portion	100% long term loan from Foreign Bank at an interest of 4.25%/annum. Repayment period 25 yrs including 7 years' grace period	– ditto –
	Local Portion	100% long term loan from domestic banks at an interest of 12%/annum. Repayment period 17 yrs including 4 years' grace period	
Case-B1		(Foreign Portion) (Local Portion) The same as Case-A1.	Operating expense is 10% more than that for Type A (Type B)*
Case-B2		(Foreign Portion) (Local Portion) The same as Case A2	– ditto –
Case-B3		(Foreign Portion) (Local Portion) The same as Case-A3	– ditto –
Case-B4		(Foreign Portion) (Local Portion) The same as Case-A4	– ditto –

In view of the fact that Callao Port is a major entity of ENAPU, an additional 10% of the operating expenses assumed under Type A were included under Type B to cover the share of the ENAPU administrative expenses which might be born by Callao Port, including the interest payment on loans, from which the ports are presently exempt.

(2) Financial Statements for 8 Cases

Judging from the results of the study on the summarized statements for revenue and expenditure, source and application of funds and the balance sheets for the above 8 cases, there are no difficulties for any of the cases in relation to revenues and expenditures and financial status. However, in the source and application of funds, Case −1 and 2 for both types A and B will see a shortage of funds during the construction period from 1985 to 1987, as these cases adopted self-financing to cover parts of the fund raising. Particularly for type B, cumulative net current assets (current assets minus current liabilities) will dip well into the red for the period from 1987 to 1988 (Case-B1: −25 and −14 mil. US$, Case-B2 −13 and −4 mil. US$). As execution of the project is expected to bring in high operating profits shorting from the year 1988, the red figures for cumulative net current assets for both cases will disappear after the year 1989 to move smoothly into the black. It will be reasonable to rely on loans for fund raising during the construction period.

As discussed above since using long-term loans will achieve a highly profitable financial status, the execution of the project at an early date is awaited.

The factor responsible for the excellent condition of revenues and expenditures is that the project execution will increase the container cargo, which has a high profit margin, and decrease the volume of the general cargoes by 600,000 tons, which incur a high cost.

Construction of the new grain wharf will favorably increase the volume of grains to 1,000,000. That is another factor contributing to the excellent condition mentioned above.

9-3 Discount Cash Flow Analysis

The above mentioned financial analysis covers all business of the executing body, including the project. In the present analysis, the so-called financial rate of return (FRR) is sought, using the discount cash flow method, in order to assess if profitability of the project is reasonable when compared to the construction cost.

The FRR is sought based on Type B operating expenses for the period from 1983, the first year of reckoning, to 2006, when the project life terminates. The FRR is 35.31%.

In this analysis, the above earning rate is that before interest payment and depreciation, and however the FRR, including deductions for loan interests and depreciation, is a reasonable 15 – 20%.

Accordingly, it is clear that the project execution is feasible in this analysis. The results of a sensitivity analysis of the FRR for fluctuations in the revenues, expenditures, and construction costs are shown below.

Table 6 FRR by Sensitivity Analysis (Case B)

Case	Project Cost	Revenue	Expenditure	FRR
1	±0.1%	±0%	±0%	35.31%
2	±0%	−10%	±0%	19.48%
3	+10%	±0%	+10%	20.57%
4	+10%	−10%	+10%	11.04%

CHAPTER 1

Outline of Survey

CHAPTER 1. OUTLINE OF SURVEY

1-1 Purpose of Survey

(1) Background of Survey

Callo Port's response to containerization has become urgently necessary with the recent sudden increase of container cargoes and the growing demand for the call of container ships.

Thereupon, the ENAPU S.A. (Empresa Nacional de Puertos S.A.), the port administrator, studied this response from 1979 and has established a plan to modernize and expand the maritime infrastructure of Callao (Plan de Modernización y Ampliación de la Infraestructura del Terminal Maritimo del Callao; to be referred to hereafter as "provisional plan") with 1985 as the target year. The immediate response consists of using Wharf No. 5 for a container berth and reorganizing the existing facilities behind Wharf No. 5 and Wharves Nos. 3 and 4 as container stockyards. Construction is already underway in accordance with this plan.

However, the plan is not the study of the entire Callao Port but a strictly provisional plan designed merely to provide facilities relative to the handling of container cargoes. Since no plan from the long-term, comprehensive point of view is available, it is necessary to prepare a basic plan for the improvement of Callao Port. In this planning, there can be the idea to limit the functions of Callao Port to container and general cargoes only and leave the functions for mineral ores, wheat and petroleum to such nearby ports as Huacho and San Martin. There is also the idea to concentrate as many and as varied functions on Callao Port as possible.

Furthermore, some of the facilities of Callao Port are more than 50 years old and the redevelopment of these facilities is necessary. In this aspect of port management, modernization from the view-point of rationalized cargo handling is in demand.

This survey is aimed at reviewing the present situation of Callao Port both qualitatively and quantitatively and plan for the future of the port so as to meet long-term socio-economic requirements.

(2) Purpose of Survey

Callao Port is the largest port in Peru and forms the sea approach to the metropolitan sphere of Lima. With the increase of port cargoes, notably container cargoes, it must now modernize its facilities and become a port that can match the economic development of the nation. The purpose of this survey is to decide a basic plan to improve Callao Port for the target year of 2000 in view of these present conditions and decide a short-term improvement plan with 1987 as the target year for facilities requiring immediate improvement and make a feasibility study concerning this plan.

1-2 Composition of Survey Term

(1) Method of Survey

The survey team analyzed and assessed information gained in data collection in Peru and field exploration, exchanged views on it with ENAPU officials and drafted a plan. The main contacts used for data collection were as follows:

Empresa Nacional de Puertos S.A.	(ENAPU S.A.)
Ministerio de Transportes y Comunicaciones	
Instituto Nacional de Planificacion	
Ministerio de Industria, Turismo e Integración	
Ministerio de Economía, Finanzas y Comercio	
Ministerio de Pesquería	
Ministerio de Agricultura	
Ministerio de Energía y Minas	
Corporación de Desarrollo del Callao	
Instituto Nacional de Estadísticas	(INE)
Empresa Nacional de Comercialización de Insumos	(ENCI)
Asociación de Exportadores	(ADEX)
Aduana	
Asociación Marítima	
Banco Central de Reserva	
Bank of Tokyo	
Cámara de Comercio de Lima	
Cámara Peruana de la Construcción	(CAPECO)
Comisión Controladora del Trabajo Marítimo	(CCTM)
Confederación Nacional de Comerciantes	(CONACO)
Agencia Marítima COSMOS S.A.	(COSMOS)
Compania Peruana de Vapores S.A.	(CPV)
Custom Agent	
Delta Line	
Empresa Nacional de Ferrocarriles S.A.	(ENAFER S.A.)
Dirección General de Hidrografía y Navegación – Ministerio de Marina	
Hierro Perú	
Organizacion Oficial del Japon Para el Comercio Exterior	(JETRO)
Kuroiwa-Kogan-INGS. ASOC.	(KKV-Consultores)
Kawasaki Kisen Kaisha, LTD.	(K LINE)
Minero Perú S.A.	
Minero Perú Comercial	(MINPECO)
Nippon Yusen Kaisha, LTD.	(NYK LINE)
Servicio Nacional de Meteorologia e Hidrologia	(SENAMHI)
Empresa Siderúrgica del Perú	(SIDERPERU)
Consejo Peruano de Usuarios del Transporte Internacional de Carga	(COPERUT)
The Overseas Economic Cooperation Fund	(OECF)

The World Bank (IBRD)
Inter-American Development Bank (IDB)

In planning for Callao Port, the team inspected the following other ports:
Salaverry Port
Chimbote Port
Supe Port
Huacho Port
San Martin Port
Matarani Port

(2) Survey Team

The socio-economic field survey took about two months from July 16 to September 11 in 1982 while the field survey on natural conditions took about four months from July 23 to November 15 of the same year. The team was composed as follows:

Mr. Shinya IZUMI (Team Leader)
Director, Planning,
The Overseas Coastal Area Development Institute of Japan (OCDI)
Mr. Hirooki MATSUSAKI (Port Planning)
OCDI
Mr. Hajime EGUCHI (Traffic Forecast)
OCDI
Mr. Satoshi TANAMI (Container Terminal Planning and Terminal Operation)
OCDI
Mr. Makoto NAMATAME (Structural Disign)
OCDI
Mr. Takashi TACHIKAWA (Construction and Cost Estimate)
OCDI
Mr. Hiroaki OZASA (Economic Analysis and Natural Condition)
OCDI
Mr. Noboru TANIGAWA (Financial Analysis)
OCDI
Mr. Hiroshi TAGUCHI (Leader of the Natural Condition Survey Team)
Kokusai Kougyou Company Ltd. (KOKUSAI)
Mr. Kunio SASAKI (Soil Investigation)
KOKUSAI
Mr. Kunio YOSHIOKA (Hydrographic Investigation)
KOKUSAI
Mr. Takao KAIBARA (Coordinator to the Team)
The Japan International Cooperation Agency (JICA)

1-3 Counterparts

The development project of Callao Port was studied under Governor Gustavo Ballon Z.B. and President Carlos Revera A. of ENAPU S.A..

The ENAPU S.A. counterparts were as follows:

Ing. Ricardo Valencia Menegotto
Gerente Tecnico

Ing. Roy Legoas Montejo
Jefe Oficina Estudios Técnicos y Económicos

Ing. Freddy Romero Vásquez
Jefe División de Planeamiento

Ing. Felipe Alvarado Pisa
Jefe División de Obras

CHAPTER 2
Present Conditions of Callao Port

CHAPTER 2. PRESENT CONDITIONS OF CALLAO PORT

2-1 Outline

Callao Port is the foreign trade port for the metropolitan Lima area, and it is the foremost foreign trade port in Peru. The cargo volume handled there in 1981 amounted to 6,712,000 tons (foreign trade: 5,092,000 tons, domestic trade: 1,620,000 tons), about 20% of the national total.

In 1981, the leading export commodity was mineral products (61% of export cargoes), followed by petroleum and metal industry products. As for imports, grain accounted for nearly half the total (47.5%), while the remainder included fertilizers, chemicals, metal industry products and machine parts.

The domestic trade carried out at Callao consists mainly of incoming cargoes, 94.6% of which are petroleum products from the northern provinces.

A total of 1,800 ships called at this port in 1981.

Their average size was 10,100 DWT for general cargo ships, 17,600 DWT for grain ships, 10,700 DWT for ore carriers and 18,100 DWT for oil carriers.

As can be seen from Fig. 2-1, Callao Port is sheltered by north and south breakwaters. The south side of the port area is a commercial port, the north side is a naval harbor, and between the two is a fishing port. Thus, Callao Port is a composite port that combines three functions.

Port facilities at Callao include nine wharves: Wharves Nos. 1 ~ 4 in the center area, wharf No. 5 on the north side, Wharf No. 7 adjoining the north breakwater, Wharf No. 9 extending north from the base of the south breakwater and Wharves Nos. 10 and 11 in the southernmost section.

There is one approach channel.

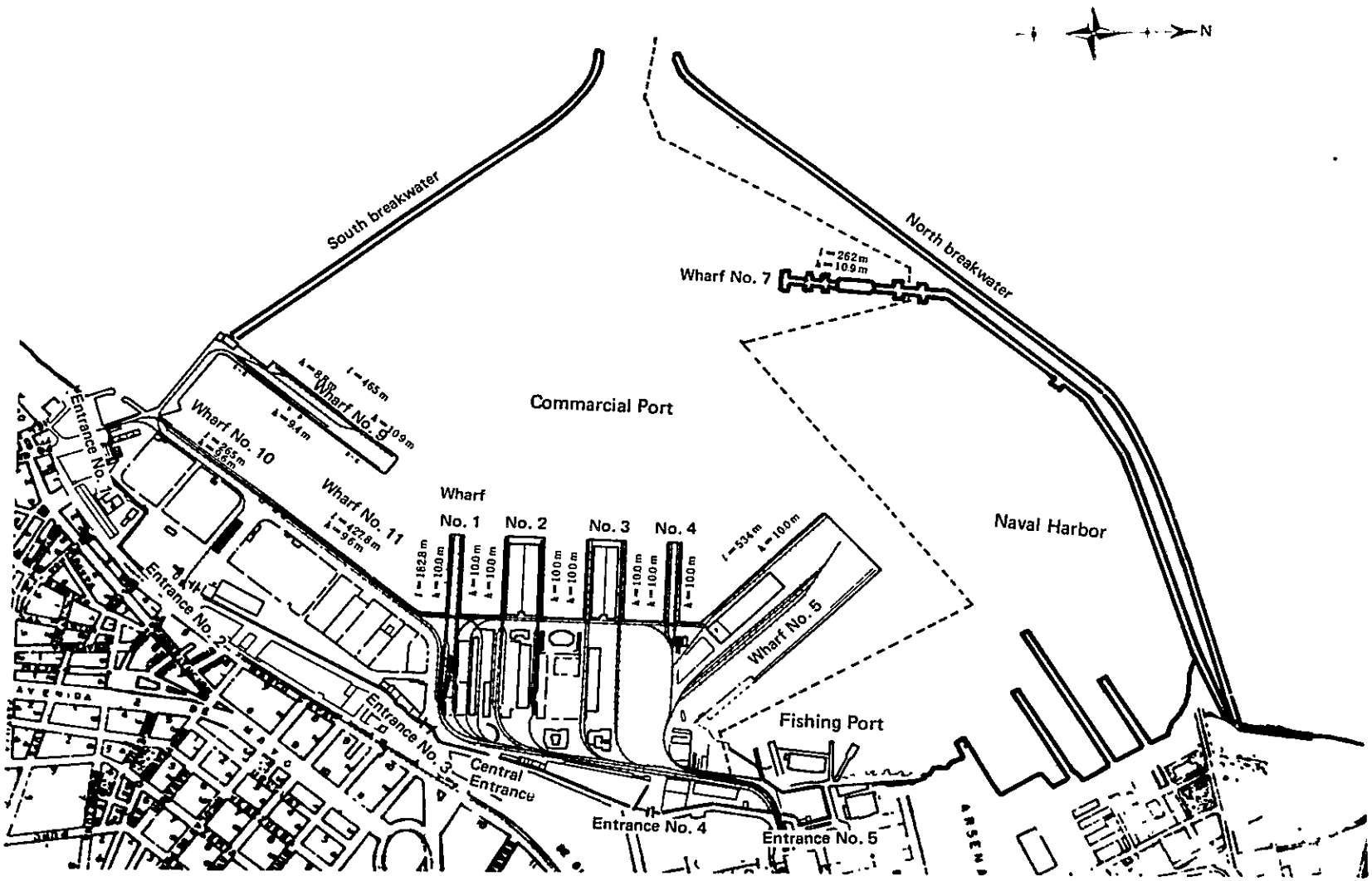


Fig. 2-1 Port of Callao

2-2 Present Condition of Port Facilities

(1) Outer Facilities

The protective facilities are comprised of a northern breakwater and a southern breakwater, as indicated in Table 2-1. The anchorage is covered by these two breakwaters and its designated water depth is −10.5 m. The port has one approach channel having a width of 180 m, a length of 1,050 m and a designated water depth of −10.5 m.

Table 2-1 Breakwaters

Name	Length	Crown height	Structure type	Year constructed
North breakwater	Approx. 2,100 m	+4.5 m	Rubble mound	not clear
South breakwater	Approx. 1,100 m	+2.0 m	Rubble mound	not clear

(2) Berthing facilities

Berthing facilities are as indicated in Table 1-2.

Table 2-2 Mooring Facilities

Name	Length	Apron Width	Water depth	Structure type	Year of completion	Cargo handled
A quay, Wharf No.1	183 m		-10.5 m	Pier of RC concrete pile type	1939	General Cargoes
B " " "	"		"	"	"	"
A " " No.2	"		"	"	"	"
B " "	"		"	"	"	"
A " " No.3	"		"	"	"	"
B " " "	"		"	"	"	"
A " " No.4	"		"	"	"	"
B " " "	"		"	"	"	"
A " " No.5	185		"	Pier of PS concrete pile type	1968	"
B " " "	"		"	"	"	"
C " " "	183		"	"	1971	Ores
D " " "	185		"	"	"	"
E " " "	"		"	"	1968	(Partly used by the navy)
A " " No.7	262		"	Dolphin pier of PS concrete pile type	"	Petroleum
B " " "	"		"	"	"	"
A " " No.9	180		"	Pier of RC concrete pile type	"	General Cargoes
B " " "	"		"	"	"	"
C " " "	"		"	"	"	"
D " " "	"		-7	"	"	For small crafts
E " " "	90		-6	Stone masonry type	1970	"
C " " No.10	145		-5.5	"	"	"
D " " "	"		"	"	"	"
A " " No.11	180		-10.5	Pier of RC concrete pile type	1939	Grains
B " " "	80		"	"	"	"
C " " "	180		"	"	"	"

(3) Freight handling facilities

The freight handling facilities are as indicated in Table 2-3.

Table 2-3 Open Storage Yards and Transit Sheds

As of January 1983

Name	Position	Area (m^2)
ZONA No. 1	10-D	7,700
ZONA No 2		10,200
ZONA No. 3-A	10-C	14,700
ZONA No. 3	10-D	16,700
ZONA No. 4	11-A	26,400
ZONA No. 34	11-B	6,900
ZONA No. 6	Wharf No. 3	11,600
Sub-total		94,200
ANEXO No. 1	11-C	3,400
ANEXO No. 2	Wharves Nos. 2 and 3	3,000
ANEXO No. 5	" Nos. 4 and 5	4,200
ANEXO No. 6	fishing port	6,900
ANEXO No. 7	Wharves No. 2 and 3	6,800
ANEXO No. 8	Wharf No. 2	5,400
ANEXO No. 9	11-C	6,100
ANEXO No. 9B	"	2,700
ANEXO No 11	"	7,000
Sub-total		45,500
ALMACEN No. 1	Wharf No. 2	5,600
ALMACEN No. 2	"	5,600
ALMACEN No. 3	Wharf No. 3	4,500
ALMACEN No 4	"	"
ALMACEN No. 5	5-A	7,300
ALMACEN No. 6	Wharves Nos. 2 and 3	2,300
ALMACEN No. 7	Wharf No. 3	3,700
ALMACEN No. 8	No. 2	3,600
ALMACEN No. 9	11-C	3,800
ALMACEN No. 10	11-A	3,900
ALMACEN No. 11	11-C	3,900
Sub-total		48,700
Temporary Container yeard	11-B, C	10,400
Container yeard	Wharves Nos. 4 and 5	40,000
Sub-total		50,400
Grain silo	11-A	Storage capacity 26,730 tons

(4) Cargo handling equipment

The main cargo handling equipment used by the port are as follows:

Table 2-4 Cargo Handling Equipment

Grain pneumatic unloaders		
Machine # 1	Nominal capacity 200 t/h	Used from Jan '75
Machine # 2	do.	do.
Machine # 3	Nominal capacity 300 t/h	Used from Mar '73
Length of rails	300 m	
Container side loaders		
Three	Rated load 21 t	Used from Jan '83
Two	" " 33 t	do.
Container top lifters		
Three	Rated load 33 t	Used from Mar '83
Container transtainers		
Two	Rated load 35 t	Used from Jun '83

(5) Water and Oil supply facilities

Water is obtained from four wells at the port. Two hydrants are available to each berth.

Oil is piped to Wharf No. 4, from these barges supply it to waiting ships.

(6) Electric Power Supply Facilities

A 60 KW 60 Hz high tension line is connected to the entrance of the port area, and from there electric power is distributed at 10 KV to several port area substations. The substations then supply power throughout the port area, at 220 V or 440 V, via an underground wiring system.

(7) Port Traffic Facilities

There are six road entrances into the port: a central entrance and entrances Nos. 1 ~ 5 (See Fig. 2-1). The road leading to the central entrance is the main road and is the widest of all. Cargo distribution is handled mainly at entrances Nos. 2 ~ 4, with the entrance closest to each cargo handling facility used as required. The width of roads in the port is between 9 ~ 18 m, and the pavement is damaged at many points.

The railway enters the port area via Entrance No. 5. Within the port the railway forms an extensive network. However, the port area railway system is not properly maintained, probably because it has lost much of its economic value, and now accounts for less than 3% of the cargo transportation to and from the port.

2-3 Port Activities

2-3-1 Handling of Port Cargoes

The volume of cargoes handled at Callao Port in 1981 was 6,712,000 tons, as indicated in Table 2-5. This represents an increase by 1.6 times over the 4,232,000 tons of a decade ago (1971). The volume of cargoes has steadily increased during the last three years under the free trade economic policy but has not reached the high of 1975 – 1976. Cargoes at the port can be classified by commodity into four broad types: general cargoes including metal industry products, fertilizers, chemicals and processed fishery products; minieral products such as zinc, lead and copper; grains such as wheat and maize; and domestically produced and consumed petroleum, transported from the northern provinces of Peru. A breakdown of cargo items handled at Callao Port in 1981 is shown in Fig. 2-2. As can be seen, foreign trade import and export represented 3/4 of the total cargo volume handled at Callao, of which imports accounted for 55%, and exports for 45%. As for imports, grains were the most important commodity with a 47.5% share, while mineral products were the leading export with a 61.0% share.

Handling of container cargoes at Callao Port is done mainly by ship derricks. The number handled in 1981 was 24,500, as indicated in Table 2-6, and the container cargoes totaled 170,000 tons. The volume of container cargoes represented about 8% of the volume of general cargoes. As indicated in Table 2-7, 94% of the number of containers were 20' containers.

Table 2-5 Trend of Volume of Cargoes Handled at Callao Port

Unit: 1,000 tons

Type / Year	General Cargoes (Foreign Trade)			Exported minerals	Imported grains	Petroleum (export, import and domestic)	Domestic Transportation (excluding petroleum)	Grand Total
	Import	Export	Total					
1960	514	437	951	419	281	1368	184	3203
1961	639	631	1270	438	342	1469	173	3692
1962	700	706	1406	397	335	1532	180	3850
1963	752	653	1405	477	378	1466	185	3911
1964	789	664	1453	545	389	1599	120	4106
1965	1013	558	1571	621	415	1593	96	4296
1966	1196	529	1725	647	458	1670	45	4545
1967	1053	574	1627	615	434	1662	63	4401
1968	893	599	1492	708	455	1295	34	3984
1969	880	541	1421	845	585	1141	39	4031
1970	895	534	1429	785	520	1134	31	3899
1971	983	503	1486	910	561	1246	29	4232
1972	1086	658	1744	1113	630	910	51	4448
1973	988	291	1279	979	621	1189	49	4117
1974	1352	283	1635	1106	473	1186	25	4425
1975	2473	599	3072	1177	678	2204	60	7191
1976	2133	935	3068	1204	463	2389	102	7226
1977	873	500	1373	1106	849	2398*	-	5726
1978	707	777	1484	1000	683	409*	-	3576
1979	789	1048	1838	1137	817	1318	143	5253
1980	1334	740	2074	1378	1156	1411	125	6144
1981	1585	664	2248	1411	1101	1870	82	6712

Note: * The 1977 and 1978 figures for petroleum do not include domestic transportation for lack of necessary data.

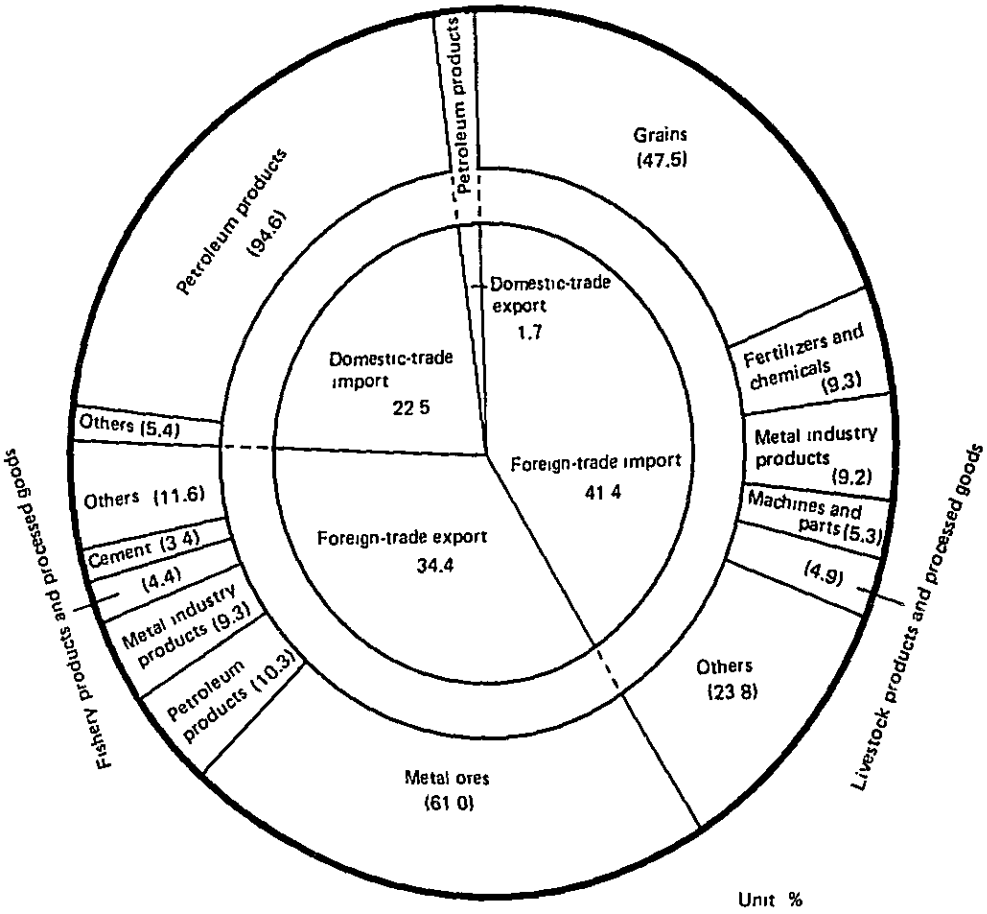


Fig. 2-2 Composition of Volume of Cargoes Handled at Callao Port by Commodity (1981)

Table 2-6 Number of Containers Handled

Year / Month	1979	1980	1981	1982
January	569	1,004	1,272	2,287
February	505	978	1,004	2,270
March	500	N.A.	1,436	3,031
April	553	"	1,189	3,513
May	665	"	2,141	2,617
June	579	"	2,335	2,944
July	881	1,741	2,726	2,679
August	741	1,799	2,348	3,405
September	856	1,637	2,605	2,824
October	1,022	2,015	2,403	2,843
November	835	1,694	2,562	
December	824	1,744	2,562	
Total	8,530		24,547	

Source: ENAPU

Table 2-7 Container Cargo Items (1981)

Item	Number of containers handled			TEU conversion			Volume of cargo handled (tons)	Weight per container (t/TEU)
	Loaded	Empty	Total	Loaded	Empty	Total		
Import	14,041	91	14,708	14,708	95	14,803	96,555	6.6
Export	6,046	4,369	10,415	6,335	4,577	10,912	73,383	11.6
Total	20,087	4,460	24,547*	21,043	4,672	25,715	169,938	8.1

Notes: *) Composition of container size: 10' - 1%, 20'-94%, 40'-5%

Source: ENAPU

2-3-2 Statistics of the Ships Calling at the Port

The quays of this port have generally been specialized for use as general cargo, mineral ore, petroleum or grain quays. In this sense, 1A ~ 5B and 9A ~ 9E are general cargo berths, 5C ~ 5E are mineral are berths, 7A ~ 7B are petroleum berths and 11A ~ 11C are grain berths.

A total of 1,760 ships called at Callao Port during 1981. Of these, 1,120 used general cargo berths, 280 used mineral ore berths, 210 used petroleum berths and 150 used grain berths.

The distribution of ships (that called at Callao) according to their size is shown in Fig. 2-3. The predominant size of general cargo ships calling at the port was in the range of 10.000 ~ 15,000 DWT. Although both 10,000 ~ 15,000 DWT as well as 25,000 ~ 30,000 DWT ships made use of the grain berth, it is assumed that this berth handled mainly the latter category of ships while the 11 B.C. berth handled the smaller 10,000 ~ 15,000 DWT class ships, mainly carrying general cargo. As for the mineral ore berths, these mainly handle, 10,000 ~ 15,000 DWT ships. The petroleum berths handle two distinctly different categories of ships: Small size ships of 1,000 DWT or less and large size ships of 25,000 ~ 35,000 DWT.

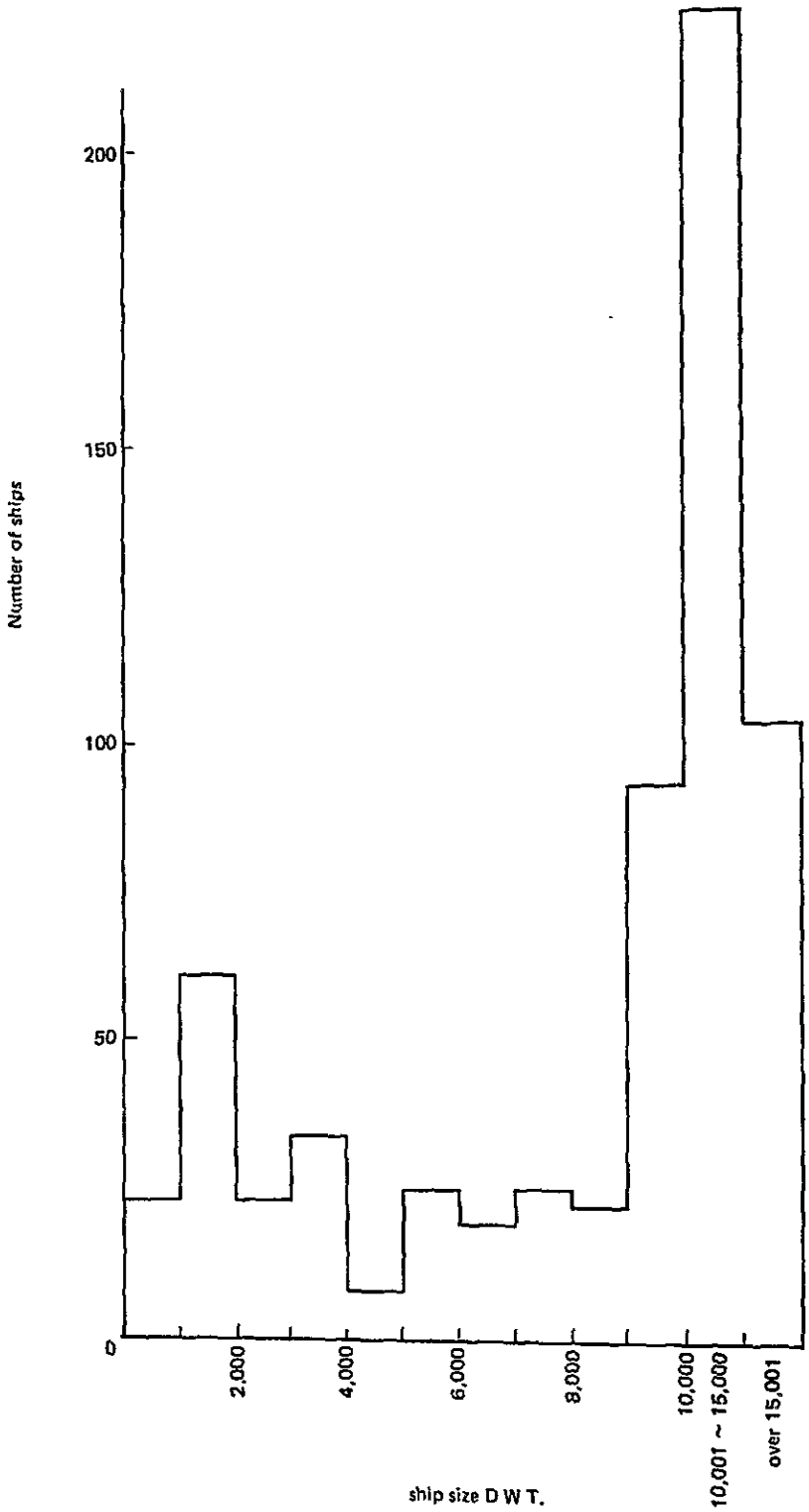


Fig. 2-3 (1) Number of Ships by Ship Size (General Cargo Berth)

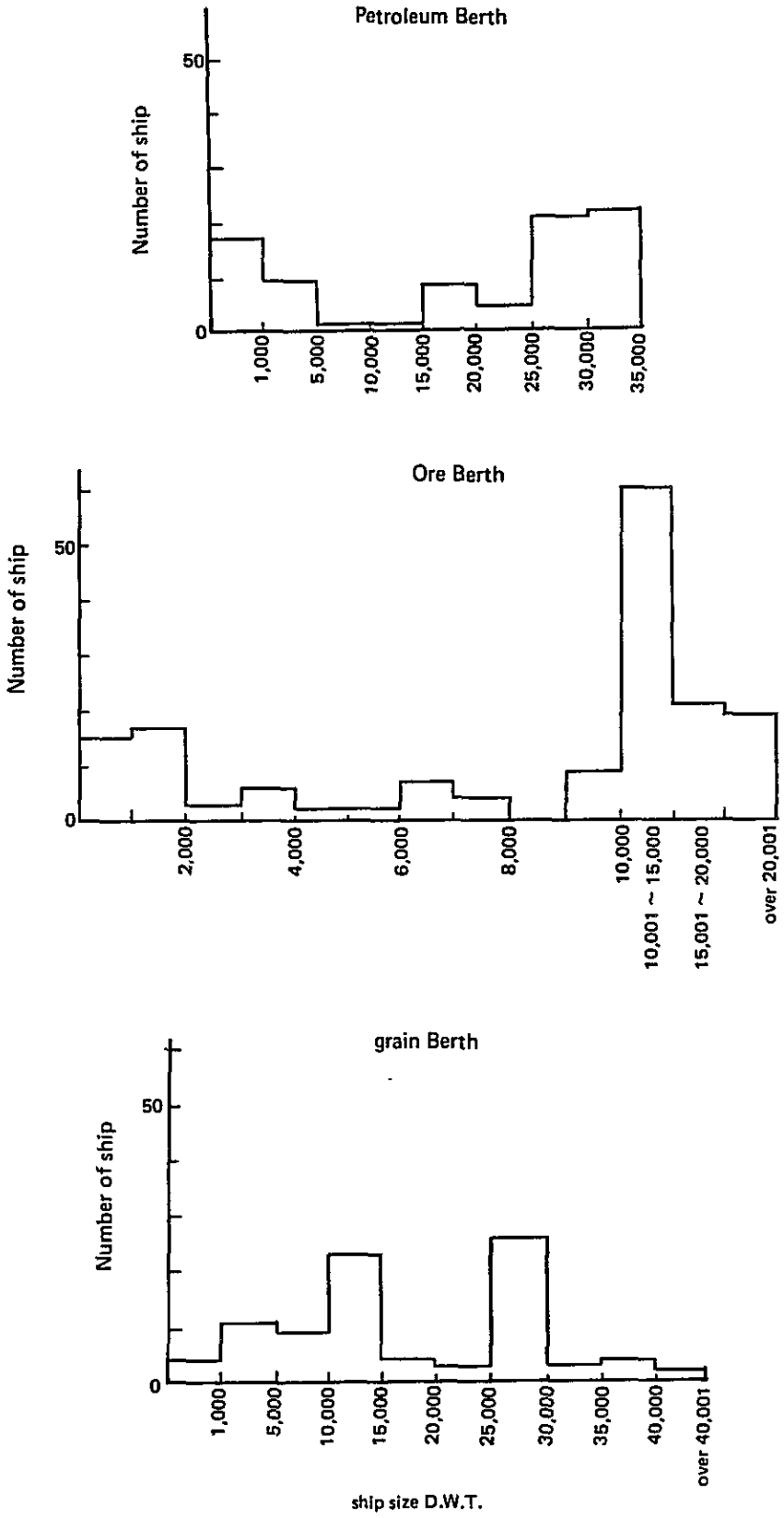


Fig. 2-3 (2) Number of Ships by Ship Size