REPORT ON CONSTRUCTION PLAN
OF
SUBIC SHIP REPAIR YARD
IN
THE REPUBLIC OF PHILIPPINES

May, 1976

JAPAN INTERNATIONAL COOPERATION AGENCY

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Preface

In compliance with the request of the Government of the Republic of Philippines, the Government of Japan decided to make a feasibility study of the Subic Shiprepair Project as a part of Japan's overseas technical cooperation programmes, and this study was conducted by the Japan International Cooperation Agency (JICA).

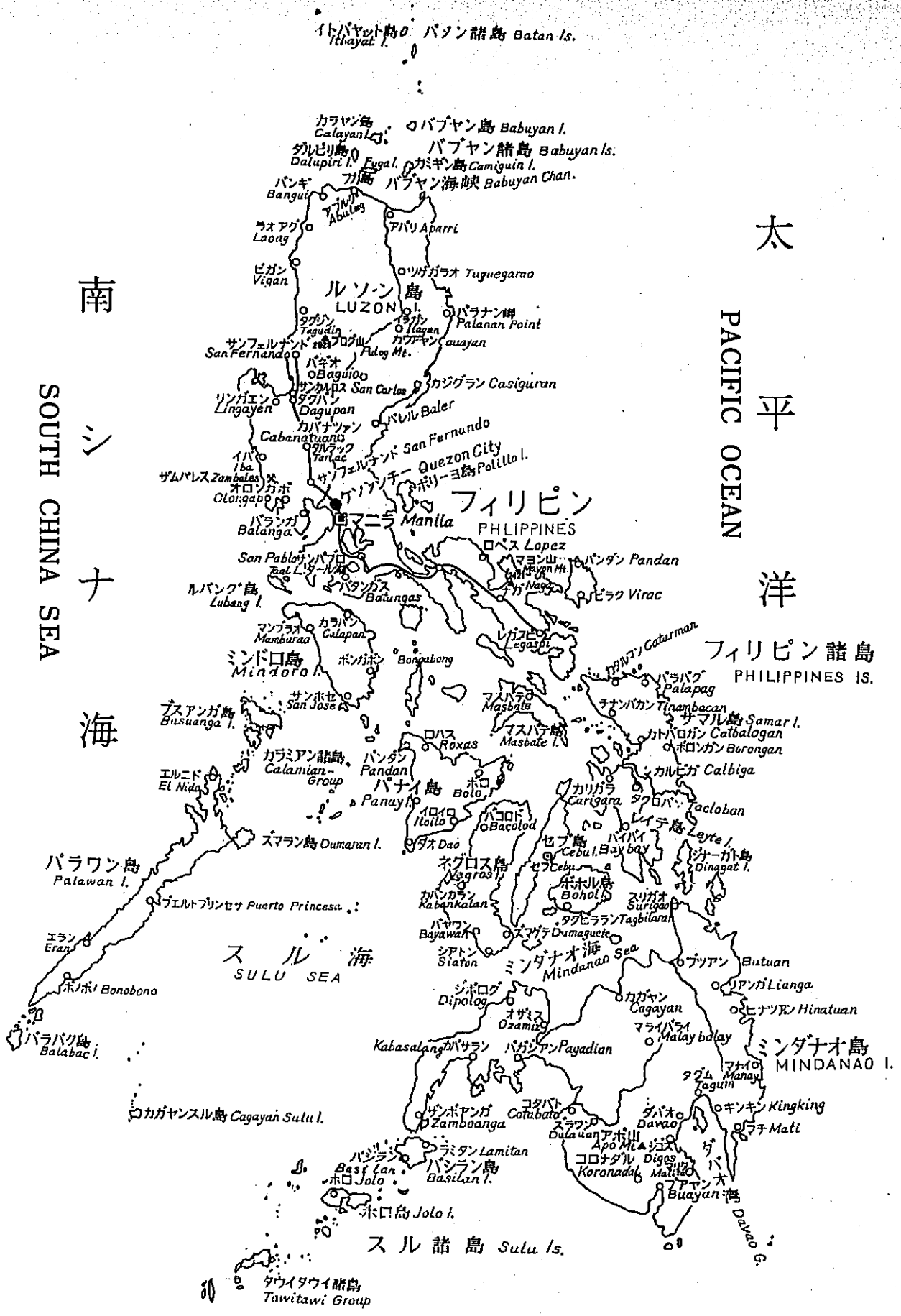
JICA organized and dispatched a survey team consisting of six (6) experts, headed by Mr. K. Fukagawa, Special Assistant, Administration Division, Ship Bureau, Ministry of Transport, to the Philippines from January 19th to February 17th 1976 to carry out the field investigation for its technical and economic feasibility. The results of the survey has been carefully reviewed, and then complied into the report herewith.

It is my great pleasure if the report would make a contribution to the improvement of the maritime industries in the Philippines, and further if the friendly relations between our two countries which are happily existing so far would be promoted through technical cooperation.

On this occasion I wish to express my sincere gratitude to the authorities of the Government of the Republic of Philippines, and other authorities concerned, for the kind cooperation extended to the Team.

May, 1976

Shinsaku Hogen
President
Japan International Cooperation Agency
Tokyo, Japan


南シナ海
SOUTH CHINA SEA
太平洋
PACIFIC OCEAN
フィリピン
PHILIPPINES
フィリピン諸島
PHILIPPINES IS.
ルソン島
LUZON I.
ミンダナオ島
MINDANAO I.
スル海
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スル諸島 Sulu Is.
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イトバヤット島 Itbayat I.
バタン諸島 Batan Is.
カラヤン島 Calayan I.
バブヤン島 Babuyan I.
バブヤン諸島 Babuyan Is.
ダルピリ島 Dalupiri I.
Fuga I.
カミギン島 Camiguin I.
バブヤン海峡 Babuyan Chan.
バンギ Bangui
アブリグ Abulog
ラオアグ Laoag
アパリ Aparri
ビガン Vigan
ツゲガラオ Tuguegarao
タグジン Tagudin
イラガン Ilagan
パラナン岬 Palanan Point
サンフェルナンド San Fernando
ブログ山 Buleg Mt.
カワヤン Cauayan
バギオ Baguio
サンカルロス San Carlos
カシグラン Casiguran
リンガエン Lingayen
ダグパン Dagupan
バレル Baler
カバナツアン Cabanatuan
タルラック Tarlac
サンフェルナンド San Fernando
イバ Iba
ザムバレス Zambales
オロンガポ Olongapo
ケソンシティー Quezon City
ポリリョ島 Polillo I.
バランガ Balanga
マニラ Manila
San Pablo サンパブロ
タール火山 Taal V.
バタンガス Batangas
ルバング島 Lubang I.
ロペス Lopez
マヨン山 Mayon Mt.
パンダン Pandan
ナガ Naga
ビラク Virac
カラパン Calapan
マンブラオ Mamburao
ボンガボン Bongabong
レガスピ Legaspi
カタンドゥアネス Catanduanes
ミンドロ島 Mindoro I.
サンホセ San Jose
ブスアンガ島 Busuanga I.
マスバテ Masbate
チナンバカン Tinambacan
パラパグ Palapag
サマル島 Samar I.
カトバロガン Catbalogan
ボロンガン Borongan
ロハス Roxas
マスバテ島 Masbate I.
カラミアン諸島 Calamian Group
パンダン Pandan
エルニド El Nido
パナイ島 Panay I.
ボロ Bolo
カリガラ Carigara
タクロバン Tacloban
イロイロ Iloilo
バコロド Bacolod
レイテ島 Leyte I.
ダオ Dao
セブ島 Cebu I.
バイバイ Bay bay
ジナーガト島 Dinagat I.
ズマラン島 Dumaran I.
パラワン島 Palawan I.
ネグロス島 Negros I.
セブ Cebu
ボホル島 Bohol I.
スリガオ Surigao
プエルトプリンセサ Puerto Princesa
カバンカラン KabanKalan
タクビラン Tagbilaran
バヤワン Bayawan
ズマゲテ Dumaguete
エラン Eran
シアトン Siaton
ブツアン Butuan
ボノボノ Bonobono
ジポログ Dipolog
リアンガ Lianga
カガヤン Cagayan
ヒナツアン Hinatuan
オザミス Ozamis
マライバライ Malaybalay
バラバク島 Balabac I.
カバサラン Kabasalan
パガジアン Payadian
マナイ Manay
タグム Tagum
カガヤンスル島 Cagayan Sulu I.
コタバト Cotabato
キンキン Kingking
ザンボアンガ Zamboanga
ダバオ Davao
マチ Mati
スラワン Dulauan
アポ山 Apo Mt.
ジゴス Digos
ラミタン Lamitan
バシラン島 Basilan I.
コロナダル Koronadal
マティ Matiao
バシラン Basilan
ホロ Jolo
ホロ島 Jolo I.
ブアヤン Buayan
ダバオ湾 Davao G.
タウイタウイ諸島 Tawitawi Group

CONTENTS

1. Introduction

1-1 Objectives and History of Survey

The Government of the Philippines has been making efforts for economic development under the 4-Year Development Plan. They expect foreign assistances for the accomplishment of the 4-Year Development Plan.

At present, the increase of employments is taken up as an important theme of the 4-Year Development Plan. The Government plans to construct a repairing dock for 300,000 D/W ton ships (maximum) at Cabangan Point in Subic Bay (Zambales of the Island of Luzon) under the policy of promoting labor intensive type industries. The Government has requested for assistances from Japan.

In response to the request from the Government of the Philippines, the Japanese Government requested Japan International Cooperation Agency to dispatch a survey team to the field and to carry out a feasibility survey on the Subic ship repair yard construction plan.

1-2 Members of Survey Team

The members of the survey team are listed below.

Director	Katsuhide Fukagawa	Special Assistant to the Director of the Administration Division, Ship Bureau, Ministry of Transport
	Ryoji Tojima	Deputy Director, Machinery Division, Ship Bureau, Ministry of Transport
	Mitsutoyo Okada	Special Assistant of Technology Division, Ship Bureau, Ministry of Transport
	Tsunehiro Kamiyama	Sub-Chief of Administration Division, Ship Bureau, Ministry of Transport
	Makoto Yamamoto	Overseas Shipbuilding Cooperation Center, The Shipbuilding Research Center of Japan.
	Tokukiyo Hirai	Social Development Cooperation Department, Japan International Cooperation Agency

The Philippine counter-part consisting of the following members cooperated with the Japanese survey team.

Counter-part

Capt. Victrino A. Basco	Deputy Administrator, Planning Maritime Industry Authority (MARINA)
Capt. Hermenigildo Domingo	Director, Shipbuilding, Ship Repair Office (MARINA)
Mr. Abelardo Viray	Director, Manpower Development Office (MARINA)
Lt. Jose Roilo Golez	Director, Shipping Operation Office (MARINA)
Cdr. Casiano Mendoza	Director, Research & Statistics Office (MARINA)
Atty, Procopio Vergel de Dios, Jr.	Chief Legal Counsel, Board Secretary (MARINA)
Mr. Manuuel Salientes, Jr.	Development Management Staff Office of the President (DMS)

1-3 Survey Period

Survey period: January 19th (Mon.), 1976 - February 17th (Tues.), 1976 (30 days)

1-4 Schedule and Activities of Survey Team

Date	Activities	Remark
January 19th (Mon.)	Departure from Tokyo: 9:20 (JL Flight No. 741) Arrival in Manila: 12:40	Meeting with Director Yoshida of JICA Manila Office
January 20th (Tues.)	Japanese Embassy in the Philippines MARINA (Maritime Industry Authority)	Meeting with Secretary Takahashi and economic co-operation mission Respect visit to Administrator Tanseco; discussion with counter part (Capt. Basco and others) on schedule etc.

Date	Activities	Remark
January 21st (Wed.)	MARINA DMS (Development Management Staff Office of the President) NEDA (National Economic and Development Authority)	Question and answer session with Capt. Domingo and others on present and future of marine transportation and shipbuilding industry; request for materials Question and answer session with Mr. Salientes, Jr. and others on recent Philippine economy; request for materials Meeting with Deputy Director General A. M. Locsin and others
January 22nd (Thur.)	MARINA	Question and answer session on predicted demand; request for materials
January 23rd (Fri.)	MARINA	Question and answer session on site conditions and construction plan; request for materials
January 24th (Sat.)	PPA (Philippine Port Authority) CDCP (Construction and Development Corporation of the Philippines)	Question and answer session on prospect of ocean trade volume and port development plan etc. Question and answer session with civil engineering and construction company at the field on current state of civil engineering and building; request for preparation of questionnaires
January 25th (Sun.)	Rest	

Date	Activities	Remark
January 26th (Mon.)	Survey of Subic Site (Manila - Subic) Subic City Office Local substation	Accompanied by Capt. Domingo; visit to meteorological abservation station; questions to residents near site Talked with Mayor Dongal Guevara on their opinion etc. Explanation on current and planned power supply by Mr. M. B. Paguio
January 27th (Tues.)	Olongapo Municipal Technical school (Subic - Mariveles) BASECO (Bataan Shipbuilding & Engineering Co.) EPZA (Export Processing Zone Authority)	Plant inspection and questionnaire survey Questions and answers with Mr. Manriquez on current state and prospect
January 28th (Wed.)	Mariveles - Manila	
January 29th (Thur.)	Meeting Departure from Manila at 12:30 (PL Flight No. 137) Arrival in Iloilo at 13:30 PNB (Philippine National Bank) IDECO (Iloilo Dock & Engineering Co.)	Accompanied by Capt. Domingo Meeting on financial conditions in the Philippines Discussion on current state of shipbuilding and repairing plant inspection and questionnaire survey

Date	Activities	Remark
January 30th (Fri.)	Departure from Iloilo at 7:15 Arrival at Cebu at 8:00 Cebu Shipyard ISECOR PNB	 Discussion on current state of shipbuilding and repairing, plant inspection and questionnaire survey Inspection Meeting
January 31st (Sat.)	Departure from Cebu at 11:15 Arrival at Cagayan de Ola at 12:05 PSC (Philippine Sinter Co.)	 Discussion on current state and plan of construction; plant inspection
February 1st (Sun.)	Cagayan de Oro - Iligan NSC (National Steel Co.)	 Visit to power plant Meeting with Superintendent of N.S.C.
February 2nd (Mon.)	N.S.C. (National Steel Co.) Iligan - Cagayan de Oro PICMAW (Philippine Iron Construction & Marine Works, Inc.)	Explanation from Superintendent and plant inspection Discussion on ship repairing and shipbuilding plan etc. and plant inspection, questionnaire survey
February 3rd (Tues.)	Departure from Cagayan de Oro at 16:55 (PL Flight No. 146) Arrival at Manila at 18:15	

Date	Activities	Remark
February 4th (Wed.)	MARINA	Questions and answers after field inspection, confirmation of materials requested
February 5th (Thur.)	MARINA ADB (Asia Development Bank) Japanese Embassy in the Philippines	Study of materials and discussion Exchange of opinions on current projects and assessment techniques in the Philippines Respect visit to Ambassador Sawaki
February 6th (Fri.)	Toyo Construction Co. MARINA	Confirmation of materials requested and discussion Study of materials and discussion
February 7th (Sat.)	Manila - Batangas Dynamarine Co. POACO Oxygen Plant	Discussion on plans etc. and inspection of field Inspection
February 8th (Sun.)	Rest	
February 9th (Mon.)	DPWTC (Department of Public Works, Transportation & Communication)	Questions and answers with Mrs. Landicho etc. on economic analysis of this project and request for materials Study of civil engineering works
February 10th (Tues.)	Inspection of related industries around Manila	

Date	Activities	Remark
	EEI (Engineering Equipment Inc.)	Inspection of casting, machining.
	AG & P (Atlantic, Gulf & Pacific Co.)	Inspection of casting, machining and civil engineering work.
	EIS (Engineer Island Shipyard)	Inspection of ship engine repairing. (Accompanied by Mr. Viray)
	HPI (Horiron Philippines Inc.)	Inspection of casting and machining. Study of equipment cost.
February 11th (Wed.)	MARINA	Analysis of materials & discussion
	PTC (Philippino Telephone Co.)	Discussion on current state and plan of communication around Subic
	Magsaysay Lines Inc.	Information from Capt. M. K. Alfelor on current state and prospect of repairing work of Philippine ocean liners
	JETRO	Discussion on economic conditions in the Philippines
February 12th (Thur.)	MARINA	Analysis of materials and discussion
February 13th (Fri.)	MARINA	Study on equipment expense etc. in conference room
	NPC (National Power Co.)	Information on current state and plan of power supply around Subic
	Gratitude party sponsored by Survey Team (at Swiss Inn)	

Date	Activities	Remark
February 14th (Sat.)	Japanese Embassy in the Philippines	Interim report to Secretary Takahashi
February 15th (Sun.)	Rest	
February 16th (Mon.)	Official Residence of Ambassador MARINA	Interim report to Ambassador Sawaki Interim report to the Philippine
February 17th (Tues.)	PHILSA (Philippine Shipbuilders Association, Inc.) Departure from Manila 14:30 (JAL 746) Arrival in Tokyo 20:40	Information from Cap. B. P. Mata (Director) on current state of ship repairing and opinion on this project

2 . View and Recommendations

2-1 Benefits for National Economy

The Republic of Philippines is an ocean country consisting of about seven thousand islands. Their marine transportation and shipbuilding industries are for behind other countries in spite of their heavy dependence on marine transportation. Currently, the Philippines have only one repairing dock for ships above 10,000 G. T. Ocean liners entering Philippine ports must depend mostly on oversea docks for repairing. Dock construction is necessary also for the smooth operation of these ocean liners.

On the other hand, the Government of the Philippines has been working to increase employments, to promote regional development and industrialization and to obtain (save) foreign currencies under the 4-Year Development Plan. It is judged that this project complies with these policies and that it should contribute to the economic development of the Philippines because of its labor intensive feature and its large effects on foreign currency accumulation (saving). The team calculated the ERR (economic rate of return) of this project to evaluate its contribution to the Philippine economy. The result was considerably high, namely, about 25%.

2-2 Technological Soundness

This project requires internationally top-level technology and highly efficient management ability since sufficient international competitive ability is essential for expanding domestic and oversea markets.

On the other hand, a study on the current state of the shipbuilding industry in the Philippines indicates that it does not have sufficient potential in this field. However, powerful enterprises of advanced shipbuilding countries with rich experience and technology in this field are to participate in this project and to provide assistances in management, technology and marketting. Therefore, no special obstacle is found.

2-3 Financial Soundness

A financial analysis indicates that this project is not highly profitable. For example, more than seventeen years and ten years are required to collect the initial investment and to cover accumulated deficits, respectively. If the payment of long-term loans is possible, this project should be considered as sound in view of the use of equipments with long service life, such as a large dock and a wharf, and

high contribution to the national economy.

2-4 Recommendations

(1) This project is to be managed by a government-financed company. However, it is to operate like a private enterprise under the self-supporting accounting system.
According to the result of business analysis, various business data are not necessarily satisfactory from the standpoint of a private enterprise. It requires not only the constant efforts of a new company, but also the active support of the Government to manage this project successfully.

(2) Long-term and low-interest funds are essential for this project. A considerably large loan is required during the first several years of operation. The payment of principals and interests is one of the large factors oppressing the management. For this reason, the Government must provide long-term and low-interest loans not only for equipment funds, but also for operation funds.

(3) This project has sufficiently large demand, if viewed macroscopically, but is subjected to minor seasonal fluctuations in business conditions. To cope with them, some side jobs, such as the production of marine structures, bridges, large pressure vessels, should be considered like other similar projects.

(4) Under this project, workers and engineers are to be educated and trained mainly by a new company. The emphasis of training should be placed not only on specialized skills, but also on management techniques.
The qualitative improvement of shipbuilding and repairing engineers is important in view of the large contribution of the ship repairing industry, including medium-sized and small ships, to the national economy in the Philippines. Shipbuilding courses should be opened at universities and high schools with capable teachers to improve the foundation for educating and training engineers.

(5) Fostering of Related Industries

Various kinds of machineries are mounted on ships. Since quick and efficient ship repairing is important, it is essential to improve the system of repairing special machineries, such as navigation instruments, and to foster and develop related parts-manufacturing and machining enterprises.

Concerning some special business, such as dirty oil disposal, specialized enterprises should be fostered in consideration of demand.

(6) Improvement of Related Infra-structure

The related infra-structure, including roads, power, water and communication, must be improved. At present, no cost and execution assignment has been made, since infra-structure improvement must be made at a right time since it has large effects on a plant construction plan.

According to a trial calculation, the infra-structure improvement required for this project will cost about one million dollars (300 million yen).

3 . Project Plan

3-1 Background of Project Plan

3-1-1 Necessity

The Republic of Philippines is an ocean country consisting of more than 7,000 islands. Their foreign trade and domestic trade depend heavily on marine transportation. For this reason, the Government has given high priority to the development of marine transportation industry. However, the deficit of marine transportation in foreign trade amounted to 617 million dollars in 1974. This tendency is expected to grow if no change is made. For this reason, the improvement of marine industry, such as the increase of ocean liners, is an urgent problem.

Approximately 150 ocean liners of the Philippine flag (approximately 730,000 G.T.) were in operation in 1974. Additionally, numerous large ships are chartered by Philippine operators. However, there is only one repairing dock (10,000 G. T. type) for them. Most of the ships must be repaired in Formosa, Hongkong or Singapore etc. This not only results in the loss of foreign currencies, but also inhibits the smooth operation of foreign and domestic ships. Philippine crewmen have been working on an increasing number of foreign ships. The construction of a repairing base for ocean liners is an important task from the view point of the marine transportation policy and the foreign currency policy.

On the other hand, manufacturing industry plays an only minor role in the national economy of the Philippines. It accounts for only 20.8% of the G.N.P. and 10.4% of the employments. In the Philippines, the rapid increase of labor population, rapid urbanization and delayed industrial development have resulted in an extremely low employment rate. Since this has become a large social problem, the emphasis of industrialization has been laid on the promotion of industries offering larger employments. The Government has attached importance to local developments to correct the gap between the Manila area and the provinces. These industries are to be fostered as the trunk industries of regional economy.

3-1-2 Government's Policies

Generally, shipbuilding and repairing industries have large employment absorbing ability among heavy industries. Especially, ship repairing industry is a labor intensive type industry. Since labor cost accounts for a large part of repairing cost, it has a possibility of developing as a promising industry with good

international competitive ability. Additionally, it is expected to give large effects on the related industries because of its close connection with peripheral industries.

The Government declared the promotion of shipbuilding and repairing industries in the 4-Year Development Plan in view of the characteristics of repairing industry and the marine transportation, employment and foreign currency policies.

"The industrial plan also lays emphasis on the Development of engineering good industries, including and repair in the next few years."

To accomplish this objective, Maritime Industry Authority (MARINA) has been newly organized within the Department of Public Works, Transportation & Communication (DPWTC). MARINA has been assigned to the preparation of a 10 year shipbuilding plan.

Additionally, the Presidential Decree No. 666 was promulgated in March, 1975. It announced the following tax advantages to the shipbuilding and repairing industries.

1) Exemption from import duties and taxes

The importation of shipbuilding and repairing machines, equipments and materials is exempt from the payment of customs duty and compensating tax if their domestic availability is judged as insufficient.

2) Accelerated depreciation

Industrial plants and equipments may, at the option of the shipbuilder and ship repairer, be depreciated for any number of years between five years and the expected economic life.

3) Exemption from contractor's percentage tax

The gross receipts derived from shipbuilding and ship repairing activities are exempt from the Contractor's Tax for ten years if they are reinvested for the expansion and modernization of shipbuilding and repairing equipments.

The Government promotes the development of shipbuilding and repairing industries with these assistances.

3-2 Market Study

3-2-1 Competitive Ability

The Philippine Government lays emphasis on the development of shipbuilding and repairing industries from the view point of its marine transportation policy and employment policy. The Government plans to use this project for the construction

of a pioneer yard for the Philippine shipbuilding industry. Since the Philippine shipbuilding and repairing industries are still at the cradle stage, they have numerous problems to be solved. On the other hand, they have many advantages, including site advantages, the rich availability of low labor forces and Governmental assistances. For this reason, they will have sufficient competitive ability and make a large contribution to the Philippine economy as long as they are managed adequately with financial, technological and operational assistances from power enterprises of advanced shipbuilding countries.

(1) Site Advantage

The west coast of the Philippines is a major route between Middle East, Western Europe, Australia and South East Asia, Far East. Foreign ships engaged in these routes can be prospective customers. Furthermore, tankers operating in Middle East - Far East can finish gas freeing during sailing before docking. As a result, their non-operating days can be decreased. A repairing dock in the Philippines has a strategic position for large tankers.

(2) Repairing Cost

Generally, repairing does not allow as much mechanization and labor-saving as shipbuilding, and depends heavily on manual operations. For this reason, wages account for 65% - 70% of total repairing cost in Japan. It is not an overstatement to say that the competitive ability in cost in determined by the wage level of workers. Table 3-1 compares the average wages in manufacturing industry in Japan, Singapore, Korea and the Philippines. It shows that the wage level in Singapore, Korea and the Philippines is 20, 14 and 11, respectively, when the Japanese level is assumed as 100.

The wage level in the Philippines is 52% of that in Singapore. In other words, the Philippines have an extremely large advantage from the view point of cost competition.

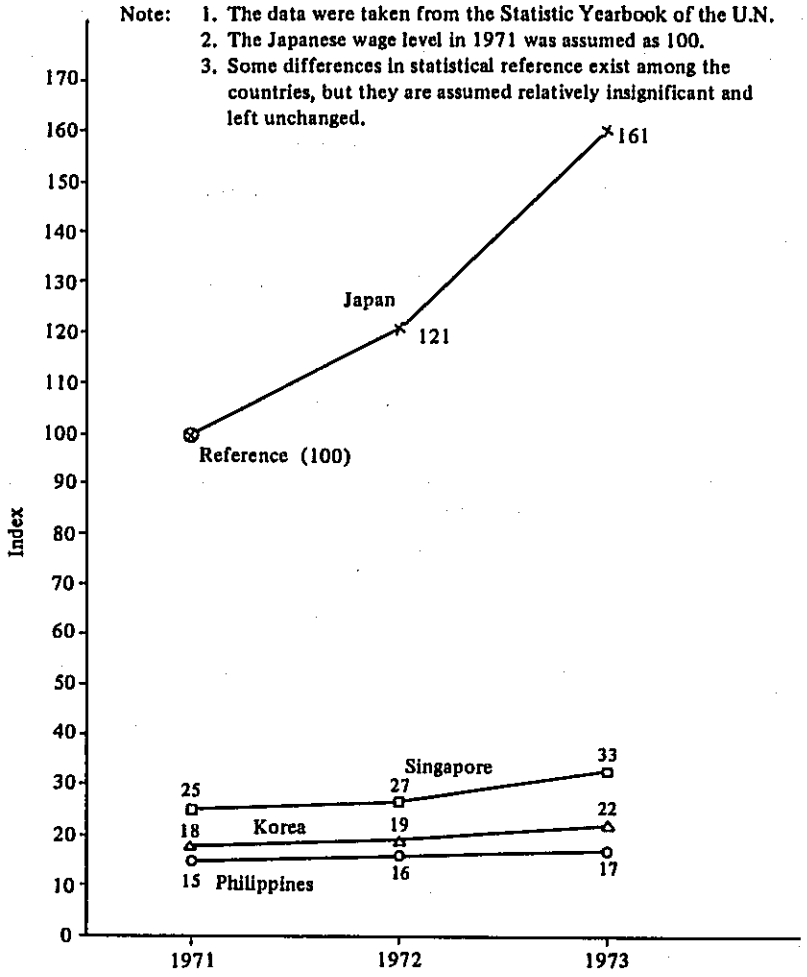
(3) Ship Repairing Market in the Philippines

Almost no repairing dock above 10,000 G.T. exists in the Philippines, as stated before. On the other hand, the Philippine marine transportation industry owns twelve ships above 10,000 G.T. in 1974. Additionally, the market can be expanded to the ships above 10,000 G.T. chartered by Philippine operators and foreign ships with Philippine crewmen. In other words, basic demand can be easily secured within the domestic market.

(4) Governmental Assistances

The tax advantages include the exemption from import duties and taxes, the exemption from compensating tax, accelerated depreciation and the exemption from contractor's percentage tax.

Table 3-1 Yearly Change of Wages in Manufacturing Industry



Note) 1. The data were taken from the statistic Yearbook of the U.N.

2. The Japanese wage level in 1971 was assumed as 100.

3. Some differences in statistical reference exist among the countries, but they are assumed relatively insignificant and left unchanged.

3-2-2 Prediction of Demand

(1) General

The following assumptions were made according to the flow chart of Fig. 3-2 for predicting the demand for this project.

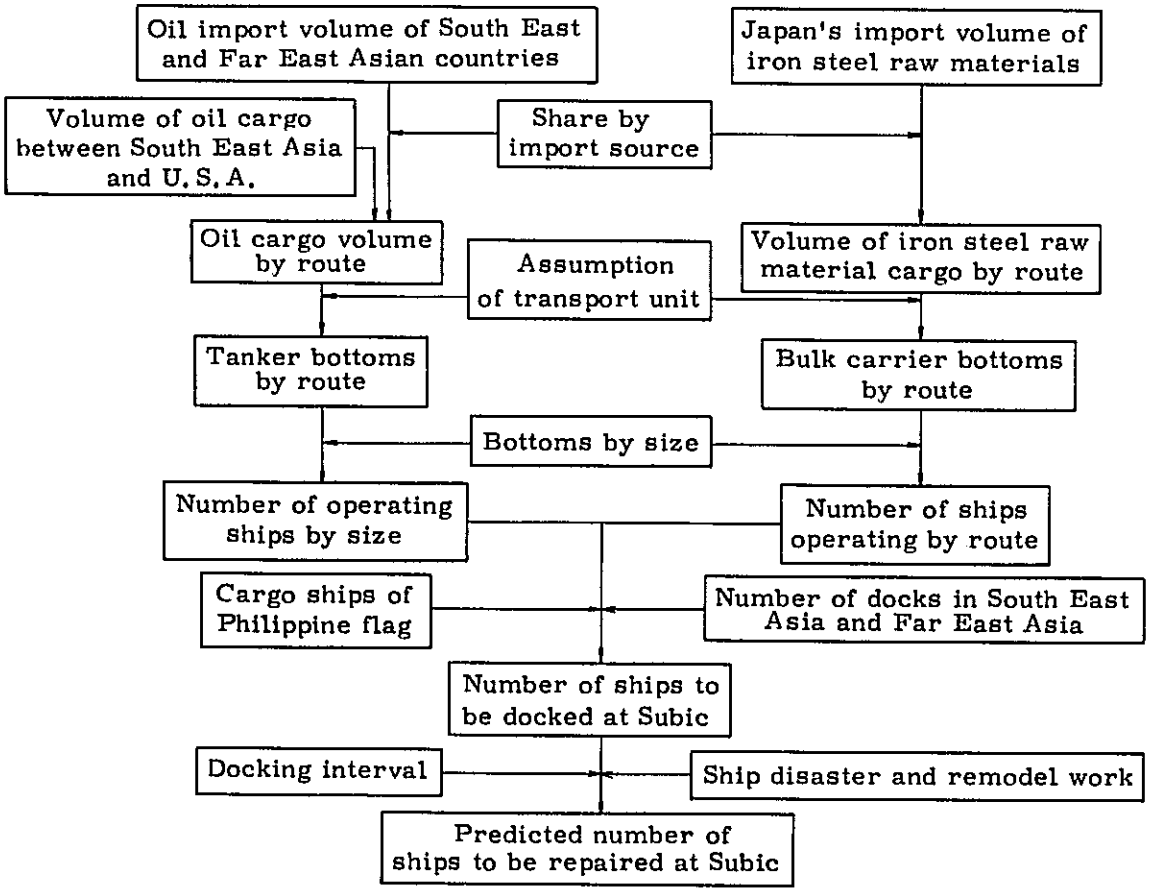
a) The demand for repairing is predicted from the volume of ocean cargo carried to South East Asia and Far East via the west coast of the Philippines.

b) The volume of oils, iron ores and raw material coals was used for the prediction.

c) Among the ships engaged in the transportation of dry cargo to the Philippines, only the ships above 10,000 G. T. and of the Philippine flag were considered for this project.

d) The target year of demand prediction is 1985, when a dock under this project begins full operation.

Fig. 3-2 Flow Chart for Predicting Repairing Demand



(2) Result of Prediction

a) Marine cargo volume

Table 3-3 gives the predicted volume of marine cargo passing along the west coast of the Philippines in 1985. The figures were obtained on the basis of the GNP growth rate in each country.

Table 3-3 Volume of major cargo passing the Philippine west coast

	Importing country	Import volume(million dollars)
Oil	Japan	391
	Korea	61
	Formosa	20
	Hongkong	15
	Philippine	20
	U. S. A.	18
	Total	525
Iron ores, coal	Japan	205
Total		730

Remark : 1 Japan's import volumes were obtained by referring to the proposal of the Industrial Structure Council.

2 Korea's figure was estimated by referring to the long-range economic plan of the Economic Planning Authority of Korea.

3 The figures of Formosa and Hongkong were obtained by assuming their GNP growth rate as 7%.

4 The figure of the Philippines in based on a report prepared by the Philippines.

5 The U.S.A.'s import volume from South East Asia was predicted on the basis of the data of the Shipbuilders Association of Japan.

b) Bottoms in Operation

Table 3-4 gives the predicted bottoms in operation. They were obtained by assuming a transport unit for each route. Transport unit can be expressed by the following equation using sailing distance, speed, cargo handling period, annual operating day and cargo occupation rate as parameters.

$$\text{Transport unit} = \frac{\text{Annual operating days}}{\frac{\text{Sailing distance} \times 2}{\text{Speed} \times 24} + \text{Cargo handling period}} \times \text{Cargo occupation rate}$$

Some speed lowering (3 knots for tankers, 1 knot for bulk carriers in 1980 and 1 knot for tankers alone in 1985) was assumed to cope with the recent excessive availability of bottoms.

Table 3-4 Bottoms in operation (limited to the west coast of the Philippines)

Classification	Bottoms (1000 D/W)
Tanker	82,690
Bulk carrier	29,560
Total	112,250

c) Number of operating ships by size

The ratio of each ship size in 1985 was predicted in consideration of the ratio of each ship size in 1974, ordered ships and ship ages etc. Table 3-5 gives the predicted number of ships operating along the west coast of the Philippines. Concerning the ships engaged in the transportation of dry cargo to the Philippines, the 10-year shipbuilding plan of the Philippine Shipbuilders Association was referred to.

Table 3-5 Number of operating ships by ship size

Size classification		Number of operating ships
Small ship	$10,000^{G.T.} \sim 49,000^{D.W.}$	720
Medium-sized ship	$50,000^{D.W.} \sim 99,000^{D.W.}$	331
Large ship	$100,000^{D.W.} \sim 199,000^{D.W.}$	278
Very-large ship	$200,000^{D.W.}$	166
Total		1,495

d) Demand for this project

In estimating the demand, it was assumed that all the ships in operation are repaired at docks in South East Asia and Far East Asia. Table 3-6 gives the predicted number of ships to be repaired at Subic obtained in consideration of the number of existing ship repairing docks in these areas and domestic conditions.

Table 3-6 Number of ships to be docked

Size classification	Number of ships to be docked
Very-large ship	7
Large ship	8
Medium-sized ship	10
Small ship	32
Salvage work	6
T o t a l	63

Remark 1. Salvage work was assumed to be 10% of the number of ships to be docked.

(3) Evaluation

According to the result of the prediction, sixty-three ships can be docked at Subic in 1985. It was studied whether this demand is sufficient for maintaining the dock in full operation. The result is shown below.

Table 3-7 Operating rate of dock

Classification	Number of ships	Number of days	Total number of days in dock
Very large ship	7	6	42
Large ship	8	5.5	44
Medium-sized ship	10	5	50
Small ship	32	5	160
Salvage work	6	7.5	45
T o t a l	63		341

Generally, the operating rate of a repairing is 85% (about 310 days). Therefore, sufficient demand for a Subic repairing dock is predicted in 1985.

Table 3-8 Repairing Docks in South East Asia and Far East

Ship size	Small ship		Medium-sized ship		Large ship		Very large ship	
Average dead weight tonnage	20,000 ~ 30,000D. W.		60,000 ~ 80,000D. W.		125,000~140,000D. W.		200,000~300,000D. W.	
Dock capacity	15,000 ~ 35,000G. T.		36,000 ~ 70,000G. T.		71,000~120,000G. T.		121,000~	
Japan	Hakodate	G. T. 18,500	Nippon Kokan	G. T. 68,000	Mitsui	G. T. 96,100	Hakodate	G. T. 135,000
	Hakodate	17,100	Ishikawajima Harima	55,000	Mitsui	80,000	Ishikawajima Harima	161,000
	Ishikawajima Harima	16,800	Ishikawajima Harima	43,300	Mitsubishi	110,000	Ishikawajima Harima	150,000
	Hitachi	25,000	Tsuneishi	55,000	Mitsubishi	96,000	Nippon Kokan	350,000
	Hitachi	24,000	Utsumi	37,000	Mitsubishi	85,000	Mitsui	175,000
	Hitachi	20,000	Hitachi	69,000	Tsuneishi	116,000	Hitachi	175,000
	Hitachi	20,000	Koyo	50,000	Hitachi	79,000	Kawasaki	270,000
	Nippon Kokan	20,000	Koyo	65,000	Ishikawajima Harima	91,000	Koyo	150,000
	Mitsubishi	20,000	Sasado	37,600	Imahari	80,000	Mitsubishi	165,000
	Mitsubishi	22,000	Mitsubishi	57,500			Mitsubishi	250,000
	Mitsubishi	32,000					Saseho	180,000
	Mitsubishi	20,000						
	Mitsubishi	25,000						
	Kawasaki	30,000						
	Mitsui	27,700						
	Sanoyasu	25,000						
	Onomichi	21,000						
	Koyo	17,000						
	Kanda	25,000						
	Oshima	20,000						
	Raijima	24,000						
	Saseho	16,000						
	Saseho	17,000						
	Namura	17,000						
Hongkong		D. W.		D. W.				
	HUD	35,000	INC	100,000				
	HUD	35,000						
	HUD	25,000						
Singapore		D. W.		D. W.		D. W.		D. W.
	KEPPEL	30,000	JSL	90,000	*KEPPEL	150,000	JSL	300,000
	KEPPEL	40,000	SEMBAWANG				HRD	300,000
	SEMBAWANG	30,000		100,000			*HRD	400,000
							SEMBAWANG	400,000
							*MSHI	400,000
Korea				D. W.		D. W.		D. W.
			KOREA S.	60,000	*HMD	150,000	*HMD	700,000
			*SAMSUNG	100,000	*KOREA S.	150,000	*KOREA S.	500,000
Formosa		D. W.		D. W.				
	TAIWAN	20,000	TAIWAN	70,000				
Malaysia						D. W.		D. W.
					*MALAYSIA	140,000	*MALAYSIA	400,000
Philippines								D. W.
							*SNSI	300,000
T o t a l		31		16		13		20

Remarks 1. Dock capacity is given in G. T. in Japan and D. W. in other countries.

2. The docks marked with * are being planned or being constructed.

3-3 Brief Description of Area Under Project

3-3-1 Comparative Study of Proposed Sites

To be selected for the construction of a large ship repairing dock, a site must meet the following conditions.

(a) It must have a channel with sufficient water depth for applicable ships and sufficient water surface for mooring and anchoring. It must be protected well from winds and waves.

(b) When a site is to be reclaimed, dredging must be easy. Dredged sediments must be adequate for reclamation and have good bearing force of a heavy structure, such as a dry dock. Construction cost must be low.

(c) Industrial foundation, including roads, water supply and power supply, should be available or should be easily made available. It should be easy to obtain sufficient labor forces and make connections with related industries.

(d) It should comply with the industrial development plan of the Philippines, should be close to a main ship route and attractive for inviting customers.

Six sites (Lingayen, Subic, Mariveles, Manila (Cavite), Batangas and Iloilo) were selected and compared. It was judged that Subic is the best site.

Proposed Site	Evaluation	Rank
Lingayen Gulf	° Lingayen Gulf is 43 km wide at the mouth and 55 km deep. It is large enough for the entering and anchoring of large ships, but is not protected sufficiently from frequent typhoons. ° Some adequate sites are found in the gulf, but they require large construction cost because of either heavy dredging or breakwater construction. ° Industrial foundation facilities are extremely in poor conditions. Labor forces will be insufficient at some sites because of small population. Almost no related industry can be expected. ° It is close to a main ship route. However, it is far from Manila and inconvenient for carrying materials etc.	5

Proposed Site	Evaluation	Rank
Subic Bay	° Subic Bay is 4 km wide at the mouth and 12 km deep, which is sufficient for ship sailing. It is naturally protected from typhoons by the high mountain ranges lying on the west and the east. ° A located at the deepest part of the bay is being considered. It is adequate for reclamation and has a sufficiently large mooring basic with adequate water depth. It will allow a most desirable layout and has sufficient space for expansion. ° Industrial foundation facilities are not specially inconvenient, except communication facilities. It takes only 3.5 hours to Manila by land route and is relatively convenient for obtaining materials and for contact with related industries. ° Since it is close to the SRF base of the U.S.A., surplus and skilled labor forces can be obtained with relative ease.	1
Mariveles Harbor	° Mariveles Harbor is 2.3 km wide at the mouth and 3 km deep. Since it is faced with open sea, it is directly exposed to waves from open sea during abnormal weather. ° Since Mariveles has a export work designated district, industrial foundation facilities are in good conditions. However, a dock site is limited to an extremely narrow range. The proposed site is characterized by rocky ground and the presence mountains coming to the beachline. Since rocks must be excavated to prepare a site, it will require large cost for civil engineering work. It imposes large restrictions on layout and gives almost no room for future expansion. Breakwater construction is unavoidable and requires large cost.	3

Proposed Site	Evaluation	Rank
Mariveles Harbor	° The export work district has various light industries, but hardly and industry related to shipbuilding. It must depend on Manila for such industries as well as for materials. Baseco Shipyard, the largest in the Philippines, exists. ° They are enthusiastic about a new shipbuilding division. ° It is not easy to obtain sufficient labor forces locally. It will require large expenditure for welfare facilities, such as houses, and raise many labor control problems.	
Manila Bay (Cavite District)	° Cavite district in the south of Manila City is a cape projecting into Manila Bay. Although it forms a small bay, it is shallow to a great distance. Extremely high cost will be required for dredging a channel for large ships. ° Since it is close to Manila City, it is convenient for securing labor forces, obtaining materials and for connections with related industries. However, this site is undesirable in view of the polity of avoiding excessive industrial concentration in Manila.	4
Batanges Bay	° Batanges Bay is 7.4 km wide at the mouth and 17.6 km deep. The entire bay has extremely large water depth and gives no problem for sailing. However, it is difficult to obtain an anchoring place. ° This bay is protected well from waves caused by typhoons etc. Shell Oil's refinery exists on the east coast of the bay, where VLCC berth. However, large restrictions are imposed for obtaining an economical layout for this project. ° Batanges City is located at 90 km in the south of Manila. It is closest to Manila among all the proposed	

Proposed Site	Evaluation	Rank
Batanges Bay	sites, except Cavite. It is convenient for obtaining materials and benefits of related industries. Batanges City with considerably large population will provide considerable labor forces, though not sufficient. The closeness to Manila will facilitate employment. ° Industrial foundation facilities are quite inferior to the other proposed sites.	
Iloilo Port	° Iloilo Port is located in the south of Panay Island existing in the south of the Island of Luzon. Since it is sharply deviated from the main ship route, it will not be attractive for ship owners. However, many local medium-sized and small shipyards exist at Iloilo Port and ship repairing industry for coasters is prosperous. ° Iloilo Port is strait port that is formed between Panay Island and Guimaras Island. It is exposed to strong tidal flow and shallow to a great distance. It requires heavy dredging work to allow the entry of large ships. This means large construction cost. ° Since it is far from Manila, it is of difficult access. It is the poorest of all the proposed sites since neither materials, nor related industries are locally available.	6

3-3-2 Brief Description of Proposed Construction Site

(1) General

The proposed site for a ship repairing dock is located at the deepest part of Subic Bay. It is formed by a small point (called as Cabangan Point) and a narrow sand beach. A plant is to be constructed by reclaiming the front sea. Cabangan Point is located at 1 km in the west of the downtown of Subic City. It is connected with Subic City by an approximately 6 meter wide city highway connected to a national highway passing Subic City.

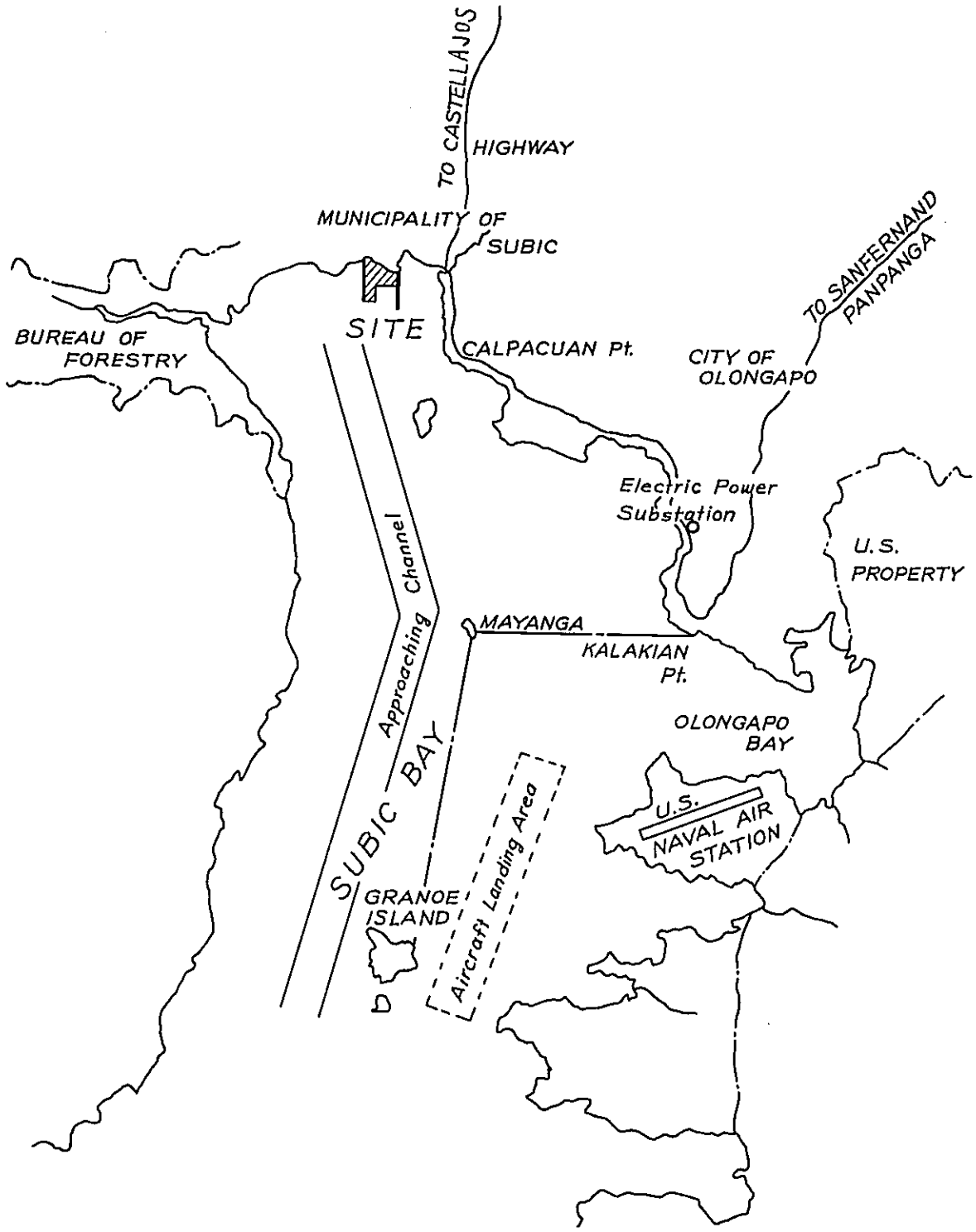
Subic City has the population of about 28,000 and no special industry. It is a resort town for Olongapo City. Olongapo City is located at 130 km in the northwest of Manila (3 hours by car) and has the population of about 200,000. Its major industries are sight-seeing and the U.S. Navy's ship repairing base. It has relatively good educational facilities, including colleges and high schools. About 30,000 Philippine workers and about 7,000 American naval men and civilians used to be employed at the U.S. Navy Ship Repairing Base. However, the number of Philippine repairing workers is said to have decreased from 8,000 (at the peak) to 3,000 because of the sharp decrease of warships calling at this base. It takes about 30 minutes by car from the proposed site to Olongapo City. It is easy to obtain experienced labor forces. The local officers concerned have extremely large hope on this project as a solution for the disemployment of these workers.

(2) Geographical conditions of Subic Bay

Subic Bay is about 4 km wide at the mouth and about 12 km deep. Grande Island exists at the mouth, while Mayanga Island and Pequena Island exist in the northern part of the bay. Since Subic Bay is surrounded by mountains, it is protected relatively well from winds and waves. The eastern part of the bay, which is surrounded by Grande Island, Manaya Island, Kalaklan Point and Peninsula, is used by the U.S. Navy Ship Repairing Base for anchoring and aircraft landing. It has a floating dock for aircraft carriers and a pier.

To enter Subic Ship Repair Yard, ships sail at 2 km in the west of Grande Island to the north to reach Cabangan Point. The approach channel is about 30m ~ 50m deep and the anchoring basin is about 25m deep. They are adequate for the approaching and anchoring of large ships.

Fig. 3-9 Subic Bay & Location of Proposed Site



(3) Meteorological Conditions

The Philippine Islands belong to the tropical zone. Their weather is characterized by high temperature, high humidity, heavy rainfall and frequent typhoons

According to the observation at Cubi Point in Subic Bay, the annual average temperature is 27.8°C and the average monthly temperature remains almost unchanged (about ±4°C) throughout a year. The maximum temperature is recorded in March ~ May and the minimum temperature is recorded in January ~ February.

The weather in the west part of Luzon Island is characterized by an obvious distinction of a rainy season and a dry season. The dry season begins in November and lasts until April, while the rainy season begins in May and lasts until October. June, August and September account for the most part of the rainfall at Cubi Point. Monthly rainfall depth exceeds 1,000 mm, occasionally. Since rain falls intermittently, various measures can be taken easily.

It is said that about twenty typhoons land the entire Philippine territory. Three ~ four typhoons land monthly in June ~ October.

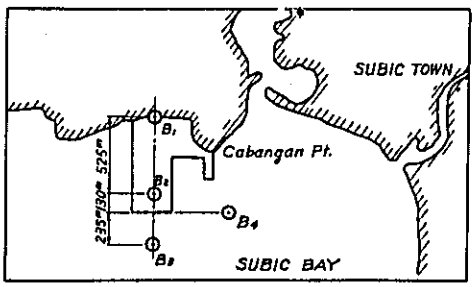
Generally, a typhoon has effects on the area within 200 Km from the center. Since crane operation must be stopped and ships must be guarded at an approach of a typhoon, typhoon observation must be continued throughout a year.

Typhoon observation is being carried out at the proposed site in consideration of the large importance on plant layout. The wind direction data differ slightly from those obtained at Cubi Point. The dominant wind direction throughout a year is south-north. South wind prevails during daytime, while north wind prevails at night. Winds exceeding 8 m/sec. are relatively infrequent. Winds exceeding 10 m/sec. accounted for about 1% annually.

(4) Geological Conditions

To improve the accuracy of structure designing and cost estimates, a geological survey is being carried out at four points around the site.

Fig. 3-10. Locations of boring investigation



Boring No.	Ground height	Excavation length
B_1	+ 1.30m	20.75m
B_2	- 3.00m	30.80m
B_3	- 3.70m	29.90m
B_4	- 11.80m	31.40m

The surveyed area consists of a ground part (small point with exposed rocks and narrow sand beach) and a submarine part. Some flat land lying behind the sandy beach is covered with fine earth similar to Kanto Loam. The water depth increases rapidly up to the -15m level from the beachline, and then gradually to the deepest part (-30m) at the center.

Fig. 4-11 (Simplified Soil Profile of B_1-B_3 Line shows the geology of B_1-B_2-B_3, where a dock is to be constructed. A 8 ~ 12m thick gravel stratum exists in the shallow part. It consists of coral remains of large grain size. The N value is 15 ~ 40 at B_1, 20 ~ 50 at B_2 and below 15 at B_3. A 2 ~ 5m thick fine earth stratum exists at B_1 and B_3 below the gravel stratum. The N value is mostly below 3 ~ 10. Then, 2 ~ 7m thick sandy soil stratum lies under the fine earth stratum. The N value is 26 ~ 30 at B_1 and B_2, but below 10 at B_3. A fine earth stratum and a base, which are expected to become a bearing stratum, are found at 15m in a shallow sea area and at 30m in a deep sea area. The N value of the fine earth stratum is above 25. The base consists of hard andesite.

Main structures, such as a dock, are supported by a gravel stratum, but its function as bearing force is occasionally doubtful because of large density differences. For this reason, it may be necessary to drive bearing piles into the lower fine earth stratum and the base. Since the lower fine earth stratum seems to be adequate as cut-off stratum, temporary coffering and sheet piles should be driven up to -28m.

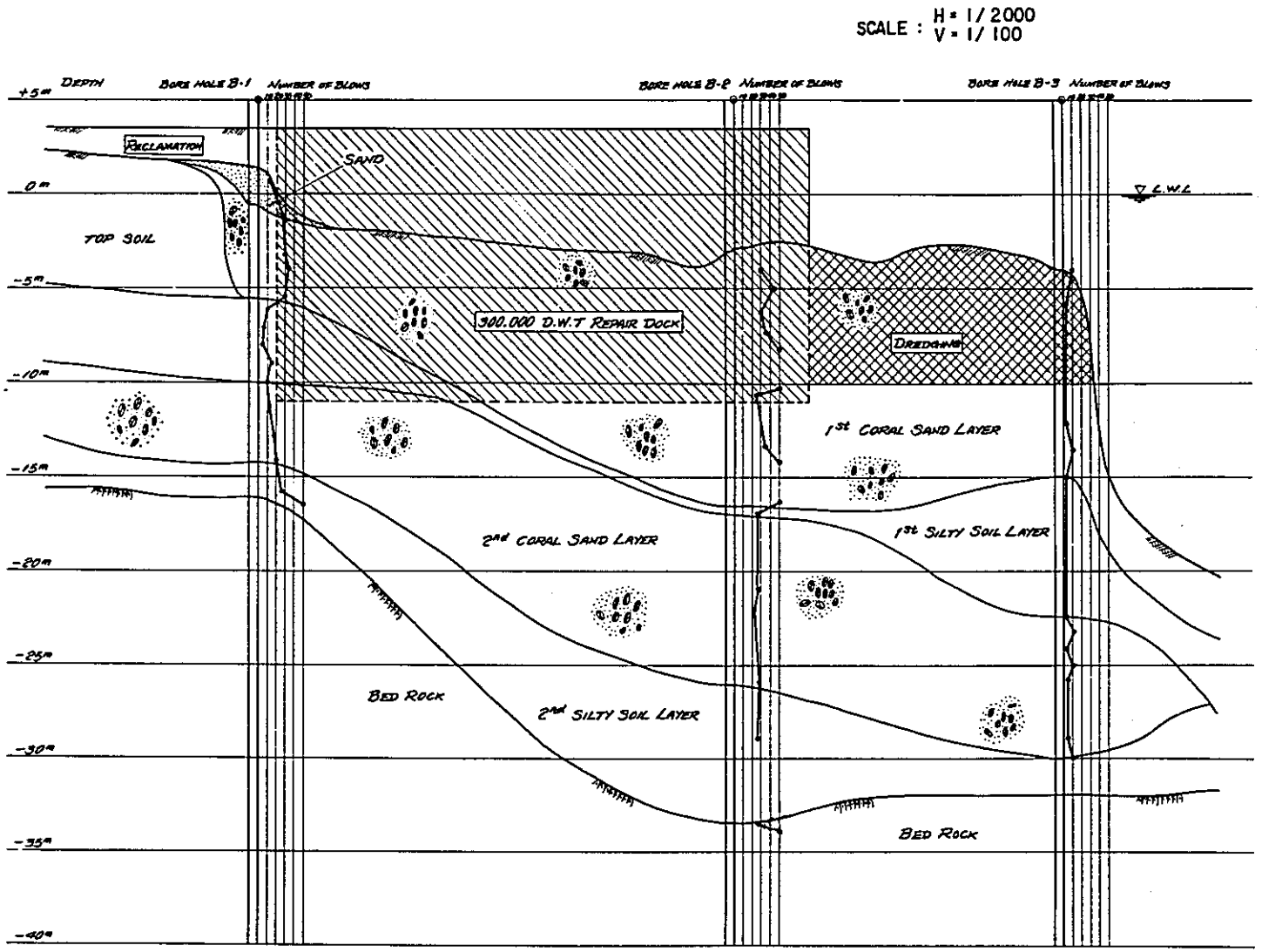
(5) Infrastructure

Easy availability of power, water and repairing materials and good communication facilities and roads are important for the construction of a repairing plant. Since the proposed site is close to Olongapo, no special problem in related facilities was found.

a) Power

Olongapo Substation has the capacity of 100,000 KVA. It receives power (primary voltage, 230 KV) from power plants at Bataan etc. and transforms it into 69 KV and 13.8 KV. The current demand for power (mostly for the U.S. Navy Repairing Base) is approximately 40,000 KVA. The substation's capacity is sufficient for the new demand (10,000 KVA) created by the new ship repair yard even if the additional demand (10,000 KVA) for a sugar plant being planned is considered. Currently, power (69 KV) is transmitted from Olongapo Substation to a point at 2km from the proposed site. For this reason, power can be secured relatively easily.

Fig. 3-11 Simplified Soil Profile of Boring Line



b) Roads

A national highway runs from Manila to Subic via Olongapo. It takes about 3.5 hours by car. A municipal highway (about 1.5km) runs from the downtown of Subic to the proposed site, but it is too narrow for large trucks. Since the width expansion of this road will require eviction and bridge reinforcement, a new road (about 3.5km) leading to the national highway must be constructed.

c) Water

This repairing yard consumes clear water at the rate of 1000t/day. The possible water sources are Cayuay River, spring water and a well. A well seems to be the best in view of costs and the rate of consumption. No promising water source was discovered by a test excavation at the site. However, a promising water source exists on the west side of the site. Therefore, it seems to be the best to continue test excavation around the site and obtain water from a well.

d) Communication

Currently, Olongapo City has a 500-line telephone station, but Subic City has no telephone. Microwave method is used for communication from Olongapo to Manila and to foreign countries via Manila. Nine such lines are currently available. The 500 lines in Olongapo City are currently operated manually, but they are to be improved into 3,000 automatic lines until Oct. 1976. There is a plan to install 500 manual lines in Subic. Since telephone station operation in Subic City may be begun after this project, a plan to lead telephone lines, including telex lines, to Olongapo Telephone Station should be considered.

e) Labor Forces

Subic City and Olongapo City have the population of 28,000 and 200,000 respectively. Sufficient potential labor forces seems available since no special industry, except the U.S. Base, exists around these cities. The number of repairing workers employed at the U.S. Repairing Base is said to have decreased from 8,000 (at the peak) to 3,000. Therefore, it is possible to secure workers with experience in ship repairing.

f) Related Industries

Currently, Subic City and Olongapo City have no related industry for supplying materials or repairing machines. This project must depend on the industries around Manila. It is also necessary to foster these industries around the site in the near future.

g) Others

This project depends heavily on the repairing of foreign ships. Inspections by foreign shipping associations are necessary for repairing class boat. Lloyd's

Register of Shipping (Great Britain), American Bureau of Shipping (U.S.A.), Bureau Veritas (France) and Japan Harbor Transportation Service already exist in Manila.

3-3-3 Evaluation

The proposed site, namely, Cabangan Point in Subic Bay, has good geographical conditions and infrastructure. However, sufficient measures must be taken to prevent sea pollution by plant drainage in view of the fact that the area around the site is a beautiful resort place.

3-4 Facility Plan

3-4-1 Scale

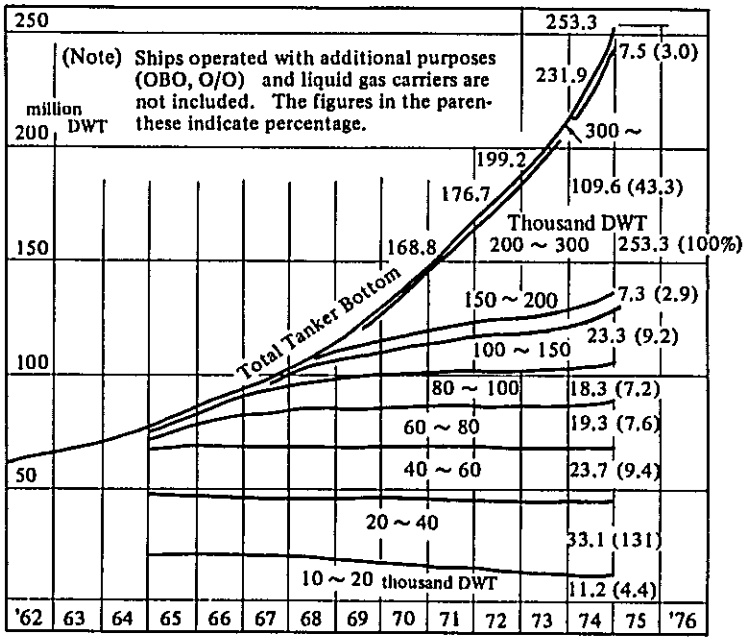
It has been determined that the scale of this project should be 300,000 D.W.T. in consideration of the following factors.

a) The west coast of the Philippines is a convenient location for repairing large tankers engaged in oil transport to Middle East ~ South East Asia and the Far East since their gas free period can be effectively used. The result of the prediction of the demand shows that this project should be planned for large tankers. Therefore, this dock should be large enough for the largest tankers sailing through the Malacca Strait.

b) Very large tankers above 200,000 D.W.T. account for 46.3% of the tanker bottoms in operation. Furthermore, 200,000 ~ 250,000 D.W.T. tankers are said to be of handy size. This dock should be large enough for very large tankers in view of the fact that tankers above 150,000 D.W.T. carry 55% of the crude oils imported to Japan.

c) The profitability of this dock is increased by securing sufficient capacity for very large tankers.

Table 3-12 Transition of world's tanker bottoms by size (The data were obtained from J. I. JACOBS's materials. Tankers above 10,000 D.W.T. alone are included.)



3-4-2 Basic Policy

Subic Ship Repair Yard is expected to perform the role of a pioneer yard of the Philippines shipbuilding industry with such effects as acquisition of foreign currencies through repair of foreign vessels, economy of the foreign currencies through the repair service to the Philippines shipping trade and absorption of employment, and the basic policy for execution of the facility project is set forth in the following.

a) The repair plant has been tested in a direction to reduce the initial investment as far as practicable since it will take much time to recover the invested capital.

b) Since this plant is planned exclusively for ship repairing, sufficient workers and equipments must be secured to meet the demand during a peak period. On the other hand, some types of workers become idle during a dull period. To solve this problem, spare land has been secured to leave possibilities for the fabrication of ocean structures and large pressure vessels etc.

c) A wharf and mooring facilities have been secured to facilitate smooth dock rotation and to shorten repairing period.

d) Sufficient pollution control measures are to be taken since the site is close to a beautiful bathing resort.

3-4-3 Brief Description of Facilities and Equipments

(1) Basic Plan

a) The site area is to be 158,000 m^2. The site is to be prepared by using 1 million m^3 of dredge. The ground height is to be 3.2m above 0 reference point.

b) Efficient dock rotation is to be realized by allowing three ships to moor at the same time. To lower initial investment, a pier and a dolphin are to be used for two ships.

c) The dock is to be 350m x 65m x 13m, which is sufficient for a 300,000 D.W.T. ship and a space for self propelled painting scaffold.

d) Two dock side cranes (30t) are to be provided. Although they are too small for the propeller and shaft works of a VLCC, this disadvantage is disregarded because of the low frequency of such work. Two cranes can be used together or a floating crane can be depended on for such purposes.

e) A repairing plant consists of a main building (150m x 35m x 12m - 17m) and an affiliated building (150m x 15m x 7m). The main building is to have shaft, finishing, machining, pipe-making, electric, iron work shops etc., while the affiliated building is to have a warehouse and a material storage.

f) Neither oxygen generator, nor acetylene generator is to be installed. They are to be obtained from the outside.

g) To control pollution, an equipment for treating waste water from living and from washing engine parts is to be installed.

h) A well will be used for service water and industrial water, and water tanks (500t for service water, 2,000t for industrial water) are to be installed.

(2) Specifications of Main Facilities

a) Dredging and reclamation

Total site		158,000 m^2	
Dredging	Sand	650,000 m^3	used for reclamation.
	Coral	350,000 m^3	

b) Revetment

- 5m	revetment	250m
- 3m	"	100m

- 2m revetment 360m
- 1m " 80m

c) Wharf About 700m
Water depth -9m

d) Dock, Dimensions 350m x 65m x 13m
Structure Concrete pile foundation, reinforced concrete
Accessories Water supply and draining facilities
Flap type gate
Fixed and remote-controlled block
Docking and undocking equipments
Travelling scaffold
Access tower
2 30T jib cranes

e) Pier and Dolphin
Dimensions; 25m x 160m (Dolphin 20m x 25m)
Structure; Obliquely intersecting steel pipe pile standard
Accessories; Mooring equipments
1 20T/10T jib crane

f) Office, dining room and locker room
Office 16 x 65 x 2 floors ≒ 2,000 m^2
Canteen, locker room 20 x 100 x 1 floor ≒ 2,000 m^2

g) Repairing plant
Structure; Steel skeleton, concrete floor
Dimensions (Main building) 35m x 150m x 17m (girder height)
(") 35m x 150m x 12m (girder height)
(Affiliated building) 15m x 150m x 7m (girder height)

h) Machines and Equipments
i) Machining machines
Lathe 6' x 2
10' x 1
12' x 1
45' x 1
Face lathe 1500 ø x 1
Radial drilling machine x 1

	Milling machine	1500 ϕ x	1
	Horizontal boring machine	x	1
	Slotter	x	1
	Surface grinder	x	1
	Tool and cutter grinder	x	1
	Cylindrical grinder	x	1
	Sawing machine	x	1
	Dynamic balancing machine	x	1
	Valve plate grinder	x	1
ii)	Iron working machines		
	1000T hydraulic press	x	1
	6.5 ~ 200T shearing	x	1
	Bending roller	x	1
	Desk-top drilling machine	x	1
	Grinder	x	1
iii)	Pipe working machines		
	4" pipe bender	x	1
	High-speed cutter	x	1
	Hydraulic tester	x	1
iv)	Welding machines		
	AC welder	x	300
	Gouging machine	x	4
	Argon welder	x	2
	Automatic welder	x	2
	Engine welder	x	2
v)	Main engine maintenance		
	200t jack	x	1
	Chemical cleaning equipment	x	1
	Field boring machine	x	1
vi)	Transport vehicles		
	3T side fork lift	x	2
	3T fork lift	x	2
	5T fork lift	x	2
	7.5T fork lift	x	1
	80T boggie	x	1
	10T truck	x	1
	4T truck	x	1

i) Power Equipments

i) Air (compressor)

Building; 160m

Machine; 450KW x 80 m^3/min x 1

220KW x 40 m^3/min x 2

ii) Oxygen and acetylene distribution plant

iii) Power

a) Receiving station Building 375 m^2 x 1

Machinery Transformer 69KV/6,600V x 3ϕ x 7,500KVA

b) Secondary substation

Building 60 m^2 x 5

iv) Water

Water receiving tank: 500 m^3 for service water and

2000 m^3 for other uses

Compressed water conveying equipments

Compressed water conveying equipments for fire extinguishing

Water purifying equipments

j) Vessels

i) Tugboat	3,000 HP x 2	
	2,000 HP x 2	
ii) Working craft	35 HP x 2	
iii) Traffic craft	120 HP x 1	
iv) Slush craft	500 m^3 x 1	

k) Piping

i) Service water	150 mm (dia.)	4,000 m
	100 mm (dia.)	4,000 m
Other water	200 ~ 300 mm (dia.)	1,500 m
ii) Gas, oxygen, air etc.		
	25 ~ 100 mm (dia.)	2,000 m

l) Road

Asphalt pavement 3,500 m

3-4-4 Plant Layout

A dock and a mooring wharf are arranged in south-north direction to minimize the effects of winds.

A repairing plant, a material yard and a work skid are arranged conveniently for material transportation. Spare land for bridge or pressure vessels fabrication is left on the east side of the plant to normalize the volume of work.

The plant layout is shown in Fig. 3-13.

3-5 Cost Estimates

1) Since the project involves an enormously large volume of works, macroscopic figures were obtained on the basis of the construction cost of large ship yard in Japan. At the same time, costs were estimated by accumulating the estimates of quantities and unit prices on the basis of the unit price table submitted by the association of the local constructors.

2) Concerning construction machines, purchasing and chartering costs were shown in dollar portion while labor cost at the field was given in peso portion.

3) The rate of annual inflation was assumed to be 7.5% and considered in yearly costs. The wharf height was assumed to be 3.2m according to residents' information. Initial cost was lowered as far as possible by simplifying an office, a canteen and other facilities not connected directly with production.

Wharf height should be studied further by obtaining more data before actual construction.

A reserve fund is included for an incinerator, an oil collecting equipment and tree-planting around the plant.

Fig. 3-13 Ship Repair Yard Lay-out

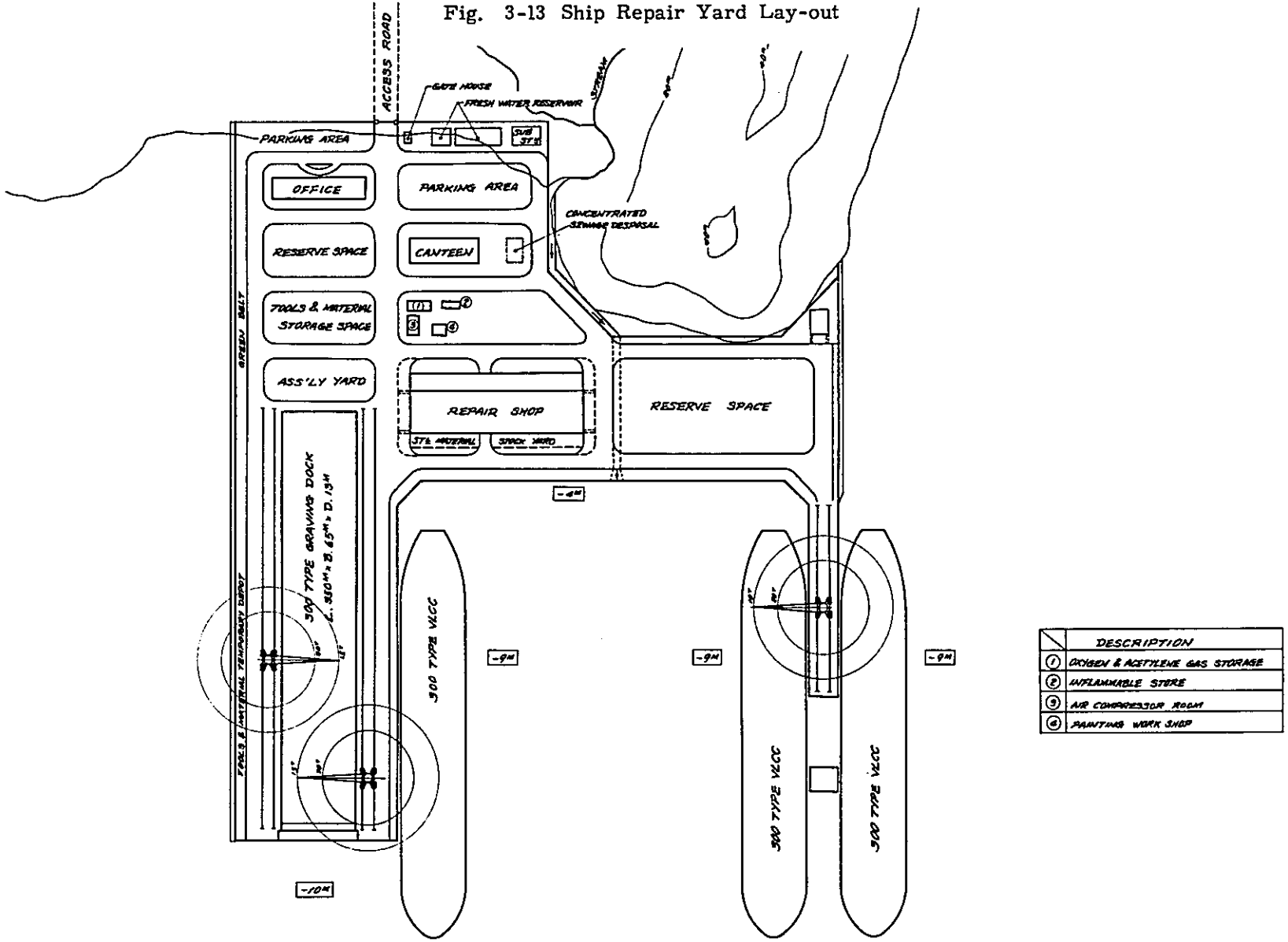


Table 3-14 Cost Estimate (Summary)

		PORTION		PORTION		TOTAL	
		Million yen	Million dollars	Million yen	Million dollars	Million yen	Million dollars
I	Civil engineering work	4,134	13.78	5,999	20.00	10,133	33.78
II	Building work	212	0.71	1,394	4.64	1,606	5.35
III	Incidental facilities of dock	1,050	3.50	268	0.89	1,318	4.39
IV	Incidental facilities of wharf	228	0.76	57	0.19	285	0.95
V	Jib crane	1,112	3.71	149	0.50	1,261	4.21
VI	Electric equipments	773	2.58	200	0.67	973	3.25
VII	Piping in yard	436	1.45	364	1.21	800	2.66
VIII	Vessels	1,284	4.28	58	0.19	1,342	4.47
IX	Power equipments	158	0.53	26	0.09	184	0.62
X	Producing equipments	1,760	5.86	296	0.99	2,056	6.85
	T o t a l	11,147	37.16	8,811	29.37	19,958	66.53
XI	Consultant fee	700	2.33	100	0.33	800	2.66
XII	Reserve fund	260	0.87	240	0.80	500	1.67
XIII	T/A Fee (initial)	300	1.00			300	1.00
	Grand Total	12,407	41.36	9,151	30.50	21,558	71.86

Table 3-15 Cost Estimate (Detailed) - 1

Unit: Million dollars

			1976		1977		1978		1979		1980	
			$ Portion	₱ Portion	$ Portion	₱ Portion	$ Portion	₱ Portion	$ Portion	₱ Portion	$ Portion	₱ Portion
I	Civil engineering work	Ground preparation			1.18	1.13	0.83	0.77	0.23	0.24		
		Road pavement						0.74		0.54		
		Revetment				0.72		0.40		0.12		
		Wharf					1.19	1.12	0.62	0.60		
		Pier									1.19	1.63
		Dock			2.99	3.85	4.23	6.13	1.33	2.00		
		T o t a l			4.17	5.70	6.24	9.16	2.18	3.50	1.19	1.63
II	Building work	Repairing shop					0.28	0.42	0.09	1.26	0.22	1.00
		Office					0.09	0.21	0.03	0.63		
		Others						0.23		0.90		
		T o t a l					0.37	0.86	0.12	2.79	0.22	1.00
III	Incidental works of dock	Water supply and draining facilities					0.50	0.05	1.53	0.16		
		Dock gate					0.15	0.12	0.27	0.21		
		Block etc.							0.25	0.23		
		Docking and undocking equipments							0.32	0.04		
		Others							0.31	0.07	0.17	0.02
		T o t a l					0.65	0.17	2.68	0.71	0.17	0.02
IV	Incidental facilities of wharf	Mooring equipments							0.08	0.03	0.18	0.07
		Accesstower							0.01	0.02	0.03	0.03
		Others							0.17	0.02	0.29	0.02
		T o t a l							0.26	0.07	0.50	0.12
V	Jib crane	Dock side					1.17	0.17	1.27	0.16		
		Pier									1.27	0.17
		T o t a l					1.17	0.17	1.27	0.16	1.27	0.17
VI	Electric equipments	Power receiving equipments					0.33		0.08			
		High voltage line					0.14	0.05	0.13	0.10		0.09
		Secondary transformation					0.32	0.01	0.32	0.01	0.09	0.02
		Secondary line					0.18	0.01	0.57	0.13	0.20	0.07
		Others							0.27	0.16		0.03
		T o t a l					0.97	0.07	1.32	0.40	0.29	0.20
VII	Piping in yard	Water tank, water feeding equipments					0.21	0.17	0.12	0.20		
		Supply of service water and industrial water					0.28	0.02	0.07	0.34	0.07	0.08
		Discharging equipments					0.32	0.11	0.26	0.22		

Table 3-15 Cost Estimate (Detailed) - 2

Unit: Million dollars

			1976		1977		1978		1979		1980	
			$ Portion	₱ Portion	$ Portion	₱ Portion	$ Portion	₱ Portion	$ Portion	₱ Portion	$ Portion	₱ Portion
		Air, oxygen, gas							0.10	0.06	0.02	0.01
		T o t a l					0.81	0.30	0.55	0.82	0.09	0.09
VIII	Vessels	Tugboat					2.00		2.17			
		Working craft					0.02			0.03		
		Others					0.06		0.03	0.16		
		T o t a l					2.08		2.20	0.19		
IX	Power equipments	Compressor							0.32	0.03	0.12	0.01
		Oxygen, acetylene							0.08	0.04		
		T o t a l							0.40	0.07	0.12	0.01
X	Producing equipments	Overhead crane					0.17		0.59	0.10	0.12	0.02
		Machining machine					0.13		0.62	0.04	0.46	0.02
		Others					0.53	0.10	2.93	0.61	0.32	0.10
		T o t a l					0.83	0.10	4.14	0.75	0.90	0.14
	Yearly expenditure for construction				4.17	5.70	13.11	10.82	15.11	9.46	4.76	3.39
XI	Consultant fee				1.12	0.08	0.55	0.12	0.47	0.10	0.19	0.03
XII	Reserve fund				0.23	0.20	0.30	0.27	0.20	0.20	0.13	0.13
XIII	T/A Fee						1.00					
Grand total					5.52	5.99	14.97	11.21	15.78	9.76	5.08	3.55

4 . Construction Schedule

4-1 Plan

This plan was prepared on the assumption that a prospect of funds becomes certain in April - May, 1976.

Construction work is to be begun in 1977.

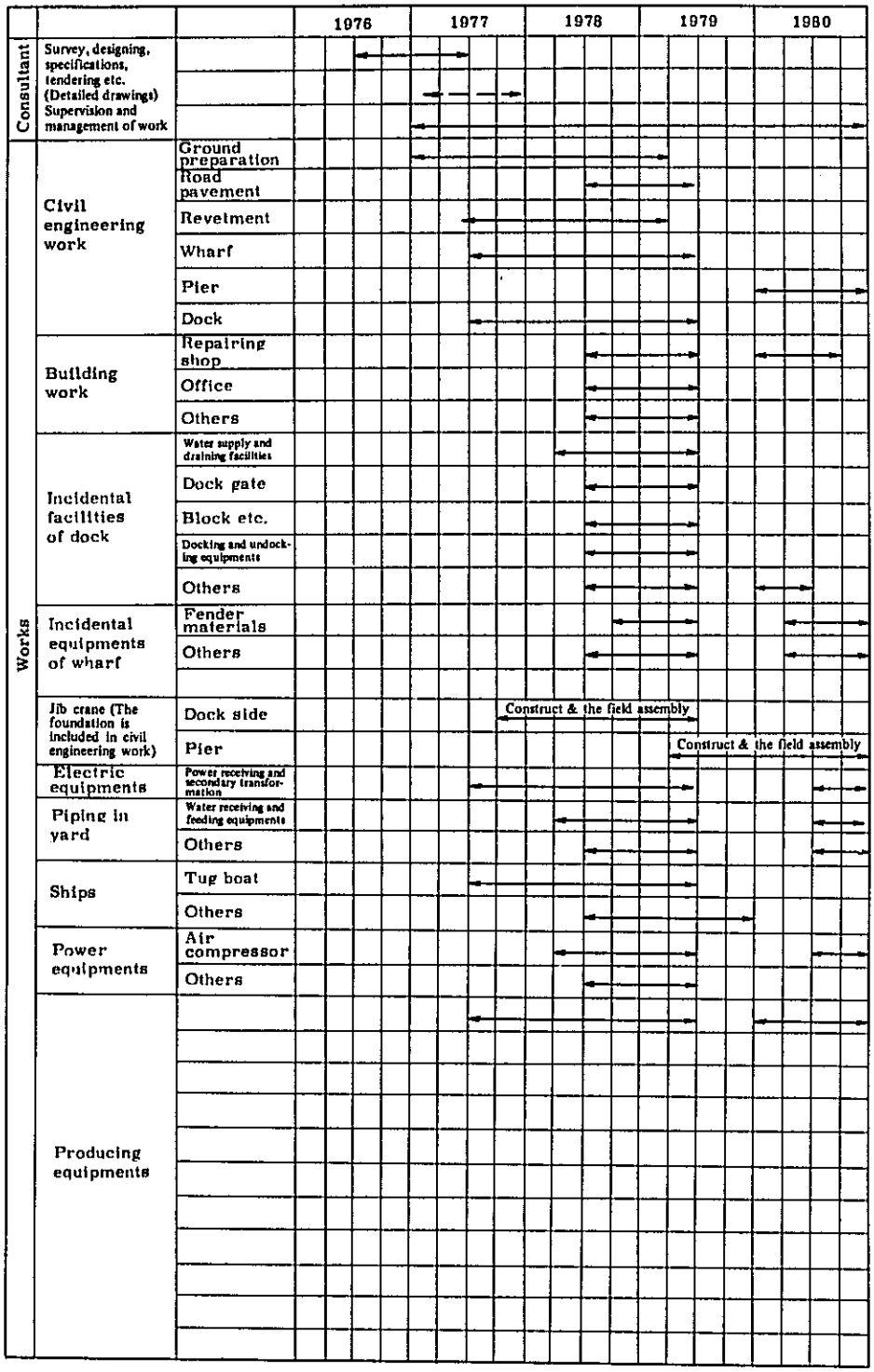
It is to be completed in 1980.

Plant operation is to be begun in 1979. Since the amount of work is small at the beginning, operation is to be begun at the completion of major equipments. The plan is summarized in the following table.

Year of plan	Calendar Year	
-3	1976	
		3rd quarter — New company to be founded (See Chapter 6.)
		Infra structure to be begun
-2	1977	1st quarter — Construction work to be begun
-1	1978	
1	1979	2nd quarter — Dock to be completed — Infra structure work to be completed
		Operation to be begun
2	1980	4th quarter — Construction work to be completed
3	1981	

The plan of each work is shown in the subsequent pages.

Table 4-1 Table of Construction Schedule



4-2 Orderer of Construction Work

The foundation of S.N.S.I. (Subic National Shipyard Inc.) was approved on January 23. S.N.S.I. is to order the construction work.

Several of the companies are able to perform large-scale civil engineering work. Since such a large repairing dock has never been constructed in the Philippines, they have no experience with such work. Sufficient guidance and assistances must be provided by Japan for the entire course of work, including planning, designing, construction, management.

4-3 Execution of Construction Work

The national policy of the Philippines demands to use domestic products and labor forces as far as possible. The following items seem to be difficult to obtain in the Philippines.

1) Civil engineering machines

a) Dredger (Several large dredgers are currently in operation in the Philippines, but all of them are reserved for long-range plans, such as a port construction project. Therefore, it is difficult to obtain them whenever necessary.)

b) Pile driver (Current available machines (floating crane and driving head on floating craft) are in efficient. They are in efficient and do not allow oblique driving.)

c) Excavator — No excavator is available.

d) Batcher plant — Some plants exist. However, a plant must be constructed for this project in view of demand and supply timing and blending ratio problems.

e) Others — Neither large bulldozers, nor crusher plant will be available at the field.

2) Civil engineering materials

a) Sheet pile — Several thousand sheet piles and steel piles are required for wharf, temporary coffering and dock construction. Steel piles are partly worked at the field, but the others will not be locally available.

b) Tie rod — They are not available at the field.

c) Steel reinforcing bar — High-tension reinforcing bars are not available at the field.

d) Rail — They are not available at the field.

3) Building materials

The following materials will be unavailable at the field.

a) Steel skeleton materials — Shape steel etc.

b) Air conditioning equipments

4) Materials for incidental work of dock

a) Water supply and draining equipments (Pumps, valves)

b) Docking and undocking equipments (Winch, wire, fender etc.)

5) Incidental work of wharf

a) Mooring equipments (Wire, anchor chain etc.)

b) Machineries (Winch, capstan etc.)

6) Crane

a)	Jib crane for dock	30t
b)	Jib crane for pier	20t
c)	Overhead crane in plant	80t
d)	"	20t
e)	"	10t
f)	"	5t
g)	"	3t

7) Materials for electric equipments

a) Transformer

b) Some wires

c) Set of power receiving and accessory equipments

8) Vessels

a) 3,000 HP tugboat

b) 2,000 HP "

9) Producing equipments

a) Various machineries (Compressor, Machining machine, hydraulic press, painting machine etc.)

4-4 Consulting

4-4-1 Consulting Services for Construction Work

Such a large dock has never been constructed in the Philippines. Consultants should have experience in the construction of a large shipbuilding and repairing dock. The major consulting services are listed below.

a) Geological survey
b) Equipment layout designing
c) Estimate of construction cost
d) Basic planning and basic designing
e) Preparation of tender specifications
f) Contract procedure
g) Supervision of field works
h) Engineering and financial management related to works
i) Specifications of consultant fee

4-4-2 Specifications of Consultant Fee

		(Unit 1,000$)
	$ Portion	Peso Portion
Geological survey expense		
Personnel expense	$ 73	
Local laborer cost		$ 27
Designing expense		
Expense for dock	$330	
Expense for electric equipments	$ 50	
Expense for discharging	$ 40	
Expense for main machineries	$ 70	
Others	$800	
Total	$1,290	
Office construction		$ 40
Supervision of field works (181 month)	$800	
Travelling expense (Tokyo Manila, 60 times)	$ 40	
Lodging expense (181 month)		$227

Philippine consultants			$ 40
Miscellaneous expense		$100	
Ground total	US	$2,300	$334

4-5 Fund Plan

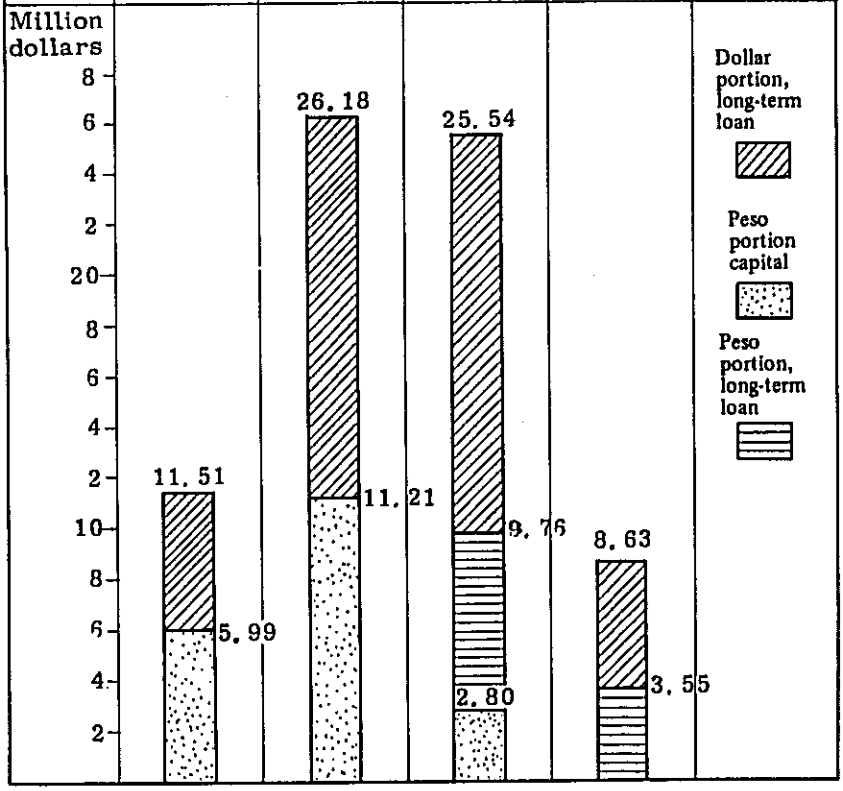
Capital	20,000	thousand	dollars
Long-term loan	51,860	"	"
Total	71,860	"	"

Fig. 4-2 (Fund Schedule Table) shows the distribution of the capital and long-term loans.

Fig. 4-2 Fund Schedule Table

(Unit: Million dollars)

Year	1977	1978	1979	1980	Total
$Portion	5.52	14.97	15.78	5.08	41.36
₱Portion	5.99	11.21	9.76	3.55	30.50
Total	11.51	26.18	25.54	8.63	71.86



5 . Project Control and Management Plan

5-1 Control and Management Body

5-1-1 Merger of Philippine Government and Powerful Enterprises of Advanced Shipbuilding Countries

No Philippine enterprise has had sufficient technology and capitals for executing this project. Therefore, a new control and management body must be organized for this project. The Philippine Government has promoted this project by giving high priority both in its policies and systems. "The Subic National Shipyard, Inc.," financed completely by a governmental bank (Philippine National Bank), was founded in January, 1976. The capital of this new company is 200,000,000 pesos, of which 25,000,000 pesos have already been paid.

Thus, the Philippine Government has made steady efforts. However, this project requires the technical and financial participation by powerful enterprises of advanced shipbuilding countries. As soon as the Philippine Government obtains a prospect of financing the total investment (72,000,000 U.S. $) of this project, it is either to invite capital participation by poweful enterprises of advanced shipbuilding countries or to found a new company between S. N. S. Inc. and powerful enterprises of advanced shipbuilding countries. In any event, a joint venture with the capital of 20,000,000 U.S. $ (60% from Philippine Government and 40% from partner) is to manage this project. It is expected to be founded during the latter part of 1976.

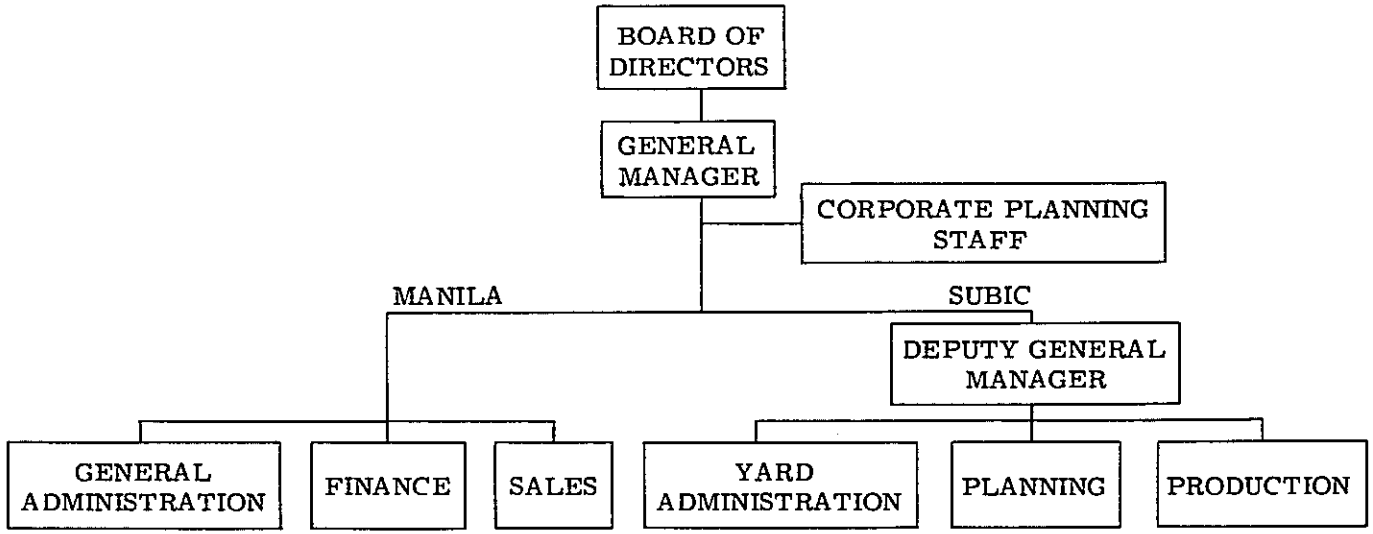
5-1-2 Organization of New Company

The new company is to have a board of directors in compliance with the Corporation Law in the Philippines. The ratio of Philippine directors and foreign directors will be 6:4 according to the capital ratio and the Investment Incentive Act.

The head office of the new company should be located in Manila for obtaining foreign and domestic customers. The head office should smoothly obtain ship repairing orders and purchase materials while making close contact with the plant in Subic.

The organization shown in Fig. 5-1 is recommended for the new company.

Fig. 5-1 Proposed Organizational Structure of the New Shiprepair Company



5-2 Personnel Plan

5-2-1 Employment Plan

Basically, some well-experienced foreign experts should be employed for management, clerical jobs, engineering and indirect works for the first four years of operation to ensure smooth starting. However, the number of foreign experts should be decreased as the Philippine employees' management and engineering abilities improve. No foreign expert will be necessary for direct works.

As Table 6-2 shows, the rumber of employees will be 754 in the first year of operation, but will be gradually increased according to the increase of production (repairing). It will be 1,590 in the 17th year.

The following worker plan is recommended.

Worker Plan

Workers assigned to	iron works	20%
"	painting, cleaning	15%
"	pipe and wood works	15%
"	transportation, scaffolds	15%
"	machines, finishing, electric work	20%
"	ship fixtures, dock worker	10%
"	maintenance	5%
		100%

The employment possibility is sufficient in the entire country, as described in 2-4. It raises no problem especially around Subic City since former employees at the U.S. Navy Ship Repairing Base in Olongapo can be obtained.

Table 5-2 Personnel Plan

Operating year	Manager	Clerk, engineer	Indirect worker	Direct worker	Total
-2(1977)	6(3)	14(2)	15(5)		35(10)
-1(1978)	9(4)	41(6)	20(10)		70(20)
1(1979)	30(14)	115(11)	55(45)	554	754(70)
2(1980)	30(14)	115(11)	80(45)	797	1,022(70)
3(1981)	30(12)	120(8)	90(30)	895	1,135(50)
4(1982)	30(10)	120(5)	99(15)	991	1,240(30)
5(1983)	30(8)	125(2)	99(10)	991	1,245(20)
6(1984)	30(8)	125(2)	103(10)	1,025	1,283(20)
7(1985)	30(8)	130(2)	108(10)	1,080	1,348(20)
8(1986)	30(8)	130(2)	110(10)	1,098	1,368(20)
9(1987)	30(8)	130(2)	110(10)	1,104	1,374(20)
10(1988)	30(8)	130(2)	114(10)	1,140	1,414(20)
11(1989)	30(8)	130(2)	116(10)	1,156	1.432(20)
12(1990)	30(8)	130(2)	118(10)	1,178	1,456(20)
13(1991)	30(8)	130(2)	121(10)	1,213	1,494(20)
14(1992)	30(8)	130(2)	123(10)	1,235	1,518(20)
15(1993)	30(8)	130(2)	127(10)	1,271	1,558(20)
16(1994)	30(8)	130(2)	127(10)	1,271	1,558(20)
17(1995) and sub-sequent years	30(8)	130(2)	130(10)	1,300	1,590(20)

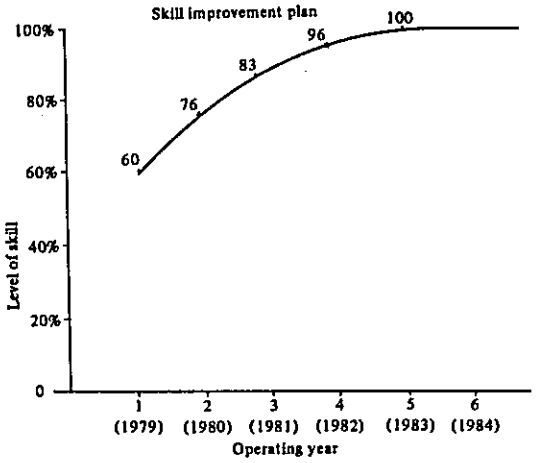
Note 1. The figures in the parentheses indicate the number of foreign experts.

2. Indirect worker: Supervisor, foreman, warehouse man, guard etc.

5-2-2 Training Plan

(1) Skill improvement plan

The average skill of workers is expected to be about 60% at the beginning of operation. The target is to raise it to 100% by the 5th year. This will probably be realized by the following method.



(2) National Manpower Skills Training Center

There are many public and private vocational training skills in the Philippines. Most of them are poorly equipped and are not expected to offer sufficient training in skills. However, some are equipped well and offer high standard education. Especially, National Manpower Skills Training Center of the Ministry of Labor has good equipments in some fields. If capable teachers can be obtained, this center can be used for well-organized and well-planned worker training for this project.

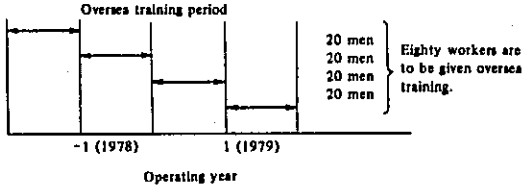
(3) Training at new company

Training within the new company will be play a central role as in other large enterprises in the Philippines.

On-the-job training by skilled workers from advanced shipbuilding countries at the initial stage of operation will be most adequate.

(4) Oversea training

Training in advanced shipbuilding countries is not necessarily effective. However, field training in large ship repairing for a fixed period (6 month ~ 1 year) in advanced countries will be quite effective if training objectives are clearly identified and trainees' abilities, specialization and future are considered.



5-3 Pollution Control Measures

5-3-1 General

Unlike other manufacturing industries, ship repairing industry produces only an extremely small amount of pollution sources. The environment around the plan will hardly be polluted if a slight amount of pollution sources is treated. Since a bathing beach belonging to a sanatorium exists near the plant, the major attention should be directed to sea water pollution.

The pollution control measures of this project are to be planned in compliance with the pollution control regulations currently enforced in the Philippines (R. A. 3931 An Act Creating the National Water and Air Pollution Control Commission, P.D. No. 600 Prevention and Control of Marine Pollution, HPCG/CG7 Rules and Regulations for Prevention, Containment, Abatement and Control of Marine Pollution). All the possible measure should taken in such fields that are not covered sufficiently by the current Philippine regulations. The pollution control measures listed below will be necessary for this project.

5-3-2 Pollution Sources and Control Measures

(1) Water pollution

(a) Oil containing water: The oil containing water discharged from a tanker's slop tank will be treated by a company offering such services, as in Japan. Such a company must be fostered since none exists in the Philippines at present. Oil containing water will also be discharged from an engine room, a bilge etc. at the rate of 1,000 tons/year. It is to be stored temporarily in an oil ighter (included in the equipments in 4-4-3) and treated by a specialized company.

(b) Washing water: It is estimated that about 200 tons of waste water is produced annually by washing boilers, ships etc. It is to be stored temporarily in steel plate containers (made in the yard) and treated either by another specialized company or internally by a waste water treatment system to be described.

(c) Waste water from chemical washing of engine parts: About 100 tons of waste water will be produced from a chemical washing plant within the repairing plant. Since it is produced within the plant, it will never leak outside. The waste liquid is to be treated. The water content is to be discharged into sea, while residue will be left to a specialized company.

(d) A ship being repaired is to be surrounded by an oil fence in anticipation of oil leakage due to some mistakes in valve operations etc.

Oil skimmers and oil adsorbing mats are to be provided to ensure quick recovery after oil leakage.

(e) Waste water from living

Waste water from living is gathered in a joint treatment tank. It is discharged after treatment.

(2) Air pollution

Exhaust gas attributable to fuel combustion in boilers will not raise any problem since they are of small industrial type.

(3) Vibrations and noise

Vibrations are generated by no machine and hardly by any operation in the plant.

Noises will be generated by tipping and derusting with a pneumatic hammer. They will not be so important since no residential district exists near the plant.

(4) Treatment of industrial waste

Sludges are to be incinerated by a specialized company. Sand obtained by sand-blasting, accumulated mud and other wastes causing no secondary pollution are carried to a designated place for disposal.

5-4 Materials Availability and Related Industries

Unlike New Shipbuilding industry, ship repairing industry does not require a large amount of materials. Special parts are generally available among spares on a ship. They can also be obtained through an agent of an oversea maker in Manila.

The plant is to keep a fixed amount of common parts, such as hull plates, packings and screws.

Under this project, the plant is to depend on import for about 80% of materials at the beginning. The dependence on imported materials is to be decreased gradually.

Concerning subcontracting, there are numerous medium-sized and small enterprises related to ship repairing near Manila. They are engaged in steel material working, engine disassembling and repairing, casting, navigation instrument repairing, insulation work, electric equipment repairing and material testing etc. They can be fostered and used.

5-5 Production Plan

5-5-1 Predicted Sales

The potential demand for this project was analyzed and predicted in 4-2-2. Table 6-3 shows the sales that is predicted by making the following assumptions and by considering such potential demand. The operation of the first year is to be begun in the middle of a year. Therefore, the amount of ship repairing work in 1979 is less than 1/2 of the potential demand.

(1) Average sales per ship (Price in 1975)

VLCC	$427,000
Large ship	$280,000
Medium-sized ship	$173,000
Small ship	$107,000
Salvage work	$347,000

(2) Operating rate of dock

Operating year	1979	1980	1981	1982	1983	1984	1985 and subsequent years
Operating rate of dock	40%	60%	70%	80%	80%	83%	85%

(3) Decrease of sales during initial years

It is assumed that the sales during the first three years should be 85% (1st year), 90 (2nd year), 95% (3rd year) of the estimated sales due to the lack of employees' skills etc.

(4) It is assumed that the unit price of sales given in (1) increased at the annual rate of 7.5% in anticipation of the international price of ship repairing cost.

Table 5-3 Yearly Number of Ships Repaired and Sales

Sales in million dollars

Work		(1) 1979		(2) '80		(3) '81		(4) '82		(5) '83		(6) '84		(7) '85		(8) '86	
		Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales
Very large ship	200,000 ~ 299,000 DWT	-	-	3	1.66	5	3.13	6	4.25	6	4.57	6	4.91	7	6.16	7	6.62
Large ship	100,000 ~ 199,000 DWT	2	0.64	5	1.81	6	2.46	7	3.25	7	3.50	7	3.76	8	4.62	8	4.96
Medium-sized ship	50,000 ~ 99,000 DWT	4	0.69	8	1.79	8	2.03	9	2.59	9	2.78	9	2.99	9	3.22	11	3.84
Small ship	10,000 GT ~ 49,000 DWT	9	1.09	24	3.31	26	4.06	27	4.78	27	5.14	28	5.73	27	5.94	23	5.67
Salvage work		-	-	2	0.89	3	1.53	4	2.30	5	3.09	6	3.99	6	4.29	7	5.38
Total		15	2.42	42	9.46	48	13.22	53	17.17	54	19.07	56	21.37	57	24.21	56	26.47

Work	(9) '87		(10) '88		(11) '89		(12) '90		(13) '91		(14) '92		(15) '93		(16) '94		(17) '95 ~	
	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales	Number of ships	Sales
Very large ship	7	7.11	8	8.74	8	9.40	8	10.10	9	12.21	9	13.13	10	15.68	10	16.86	11	19.94
Large ship	8	5.34	8	5.74	9	6.94	10	8.28	10	8.91	11	10.53	12	12.35	12	13.28	12	14.27
Medium-sized ship	11	4.54	12	5.33	12	5.73	13	6.67	14	7.72	15	8.89	15	9.56	15	10.27	15	11.04
Small ship	23	5.84	21	5.74	20	5.87	18	5.68	16	5.43	14	5.11	11	4.31	11	4.64	10	4.53
Salvage work	7	5.78	7	6.21	7	6.68	7	7.18	7	7.72	7	8.30	7	8.92	7	9.59	7	10.31
Total	56	28.61	56	31.75	56	34.61	56	37.91	56	41.99	56	45.96	55	50.82	55	54.64	55	60.09

Table 5-4 Financial Calculation (cost plan) - 1

Cost plan / Items	(-2) 1977	(-1) 1978	(1) 1979	(2) 1980	(3) 1981	(4) 1982	(5) 1983	(6) 1984	(7) 1985	(8) 1986
1. Labor expense (employee)	0.13	0.42	1.03	1.57	1.59	1.56	1.56	1.66	1.82	1.96
2. Labor expense (indirect worker)	0.07	0.19	0.72	1.29	0.98	0.60	0.48	0.52	0.58	0.62
3. Labor expense (Direct worker)			0.32	0.99	1.20	1.43	1.53	1.71	1.93	2.11
4. Secondary labor expense	0.03	0.09	0.28	0.49	0.46	0.41	0.40	0.44	0.49	0.52
5. Indirect expense	0.03	0.10	0.68	1.56	1.88	2.21	2.43	2.67	2.97	3.23
6. Material cost			0.38	1.66	2.31	3.00	3.34	3.74	4.24	4.63
7. Miscellaneous expense			0.12	0.47	0.66	0.86	0.95	1.07	1.21	1.32
8. Training expense (in foreign countries)		0.05	0.11	0.06						
9. Training expense		0.10	0.21	0.11						
10. Transportation expense		0.01	0.03	0.05	0.04	0.03	0.02	0.02	0.02	0.02
11. Technical assistance fee			0.04	0.14	0.20	0.26	0.29	0.32	0.36	0.40
12. Sales commission			0.05	0.19	0.26	0.34	0.38	0.43	0.48	0.53
13. Fixed asset tax		0.03	0.06	0.42	0.69	0.76	0.74	0.71	0.69	0.66
T o t a l	0.26	0.09	4.02	9.03	10.27	11.47	12.11	13.30	14.29	16.01

Table 5-4 Financial Calculation (cost plan) - 2

Cost plan / Items	(9) 1987	(10) 1988	(11) 1989	(12) 1990	(13) 1991	(14) 1992	(15) 1993	(16) 1994	(17) 1995	(18) 1996
1. Labor expense (employee)	2.10	2.27	2.43	2.62	2.81	3.02	3.25	3.49	3.75	4.03
2. Labor expense (indirect worker)	0.67	0.73	0.79	0.85	0.92	0.99	1.08	1.16	1.26	1.35
3. Labor expense (Direct worker)	2.28	2.53	2.76	3.02	3.34	3.66	4.06	4.45	4.79	5.14
4. Secondary labor expense	0.56	0.62	0.67	0.73	0.79	0.85	0.93	1.00	1.09	1.17
5. Indirect expense	3.48	3.79	4.11	4.46	4.88	5.29	5.78	6.22	6.75	7.26
6. Material cost	5.01	5.56	6.06	6.64	7.35	8.05	8.90	9.56	10.52	11.31
7. Miscellaneous expense	1.43	1.59	1.73	1.89	2.10	2.30	2.54	2.73	3.00	3.23
8. Training expense (in foreign countries)										
9. Training expense										
10. Transportation expense	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05
11. Technical assistance fee	0.43	0.48	0.52	0.57	0.63	0.68	0.76	0.82	0.91	0.97
12. Sales commission	0.57	0.63	0.69	0.76	0.84	0.92	1.02	1.09	1.20	1.29
13. Fixed asset tax	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.43	0.42
T o t a l	17.19	18.81	20.37	22.12	24.22	26.31	28.82	31.01	33.75	36.24

Table 5-4 Financial Calculation (cost plan) - 3

Cost plan / Items	(19) 1997	(20) 1998	(21) 1999	(22) 2000	(23) 2001	(24) 2002	(25) 2003	(26) 2004	(27) 2005	(28) 2006
1. Labor expense (employee)	4.34	4.67	5.01	5.39	5.79	6.23	6.70	7.20	7.73	8.32
2. Labor expense (indirect worker)	1.46	1.57	1.69	1.81	1.95	2.09	2.24	2.41	2.59	2.79
3. Labor expense (direct worker)	5.53	5.95	6.39	6.87	7.39	7.94	8.54	9.18	9.86	10.60
4. Secondary labor expense	1.26	1.36	1.46	1.57	1.68	1.81	1.95	2.09	2.25	2.42
5. Indirect expense	7.81	8.39	9.02	9.70	10.42	11.21	12.05	12.95	13.92	14.96
6. Material cost	12.16	13.07	14.05	15.10	16.24	17.45	18.76	20.17	21.68	23.31
7. Miscellaneous expense	3.47	3.73	4.01	4.31	4.63	4.98	5.35	5.76	6.19	6.65
8. Training expense (in foreign countries)										
9. Training expense										
10. Transportation expense	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09
11. Technical assistance fee	1.05	1.13	1.21	1.30	1.40	1.50	1.62	1.74	1.87	2.01
12. Sales commission	1.39	1.50	1.61	1.73	1.86	2.00	2.15	2.31	2.48	2.67
13. Fixed asset tax	0.41	0.40	0.40	0.39	0.38	0.37	0.37	0.36	0.35	0.35
T o t a l	38.91	41.79	44.89	48.22	51.80	55.65	59.79	64.24	69.02	74.17

5-5-2 Cost Prediction

The details of production costs were calculated under the following assumption and are shown in Table 5-4. The production cost of the first year is assumed to be 1/2 of the annual necessary expense because the operation is limited to six months.

(a) The cost of materials is 17.5% of sales.

(b) Indirect expense was estimated as a function of sales ratio, equipment capacity ratio, clerk-technician ratio etc.

(c) Expenses are 5% of sales.

(d) 1.5% of annual sales is allotted to technical consultant fee.

(e) 2% of sales is allotted to sales commission.

(f) 1.25% of the book value at the end of a preceding year is allotted to fixed asset tax to be paid to Subic City.

(g) Labor expenses were calculated on the basis of the company organization described in 5-1-2 and the employment plan discussed in 5-2-1. The wage for locally employed direct and indirect workers is 23.3 p (8 hours/day) including various allowances. Labor expenses were assumed to increase at the average rate of 7.5%.

(h) Secondary labor expenses are assumed to be 15% of labor expenses.

5-6 Financial Analysis

5-6-1 Loss and Profit Prediction

The profitability and fund working etc. of this project were calculated on the basis of the sales prediction (Table 5-3) and the cost prediction (Table 5-4). Table 5-5 is the predicted loss and profit calculation, Table 5-6 is the predicted fund statement and Table 5-7 is the predicted balance sheet.

Note that the following assumptions were made.

(1) Amortization was used according to the durable years of each asset. The residual book value was assumed to be 10% (Table 5-8).

(2) The interest of long-term loans is assumed to be 4.25% on the average. The payment plan is as shown in Table 5-9. (7 year deferment and 18 year payment)

(3) The interest of short-term loans is assumed to be 12.0% on the average.

Table 5-5 Financial Calculation (Loss and Profit Calculation and Recovery Calculation) - 1 (Unit/Mil. dollar)

Loss and profit calculation and recovery calculation	(-2) 1977	(-1) 1978	(1) 1979	(2) 1980	(3) 1981	(4) 1982	(5) 1983	(6) 1984	(7) 1985	(8) 1986
Loss and profit from business										
Sales			2.42	9.46	13.22	17.17	19.07	21.37	24.21	26.47
Cost	0.26	0.99	4.02	9.03	10.27	11.47	12.11	13.30	14.79	16.01
Profit before depreciation	-0.26	-0.99	-1.60	0.43	2.94	5.70	6.96	8.07	9.42	10.46
(Profit rate)	(0.0)	(0.0)	(-66.2)	(4.5)	(22.2)	(33.1)	(36.4)	(37.7)	(38.9)	(39.5)
Depreciation expense			0.72	2.62	3.00	3.03	3.07	2.83	2.49	2.49
Operating profit	-0.26	-0.99	-2.32	-2.19	-0.06	2.67	3.89	5.24	6.94	7.97
Profit rate	(0.0)	(0.0)	(-95.8)	(-23.1)	(-0.4)	(15.5)	(20.4)	(24.5)	(28.6)	(30.1)
Profit outside business										
Interest received										
Interest on deposit										
Miscellaneous profit										
Expense outside business										
Interest paid (operation)										
Interest paid (equipments)										
Interest of long-term loan		0.38	1.29	2.02	2.20	2.20	2.20	2.20	2.18	2.11
Interest of short-term loan (operation)	0.02	0.13	0.42	0.80	0.99	0.99	0.99	0.99	0.94	0.68
Interest of short-term loan (equipment)		0.02	0.13	0.37	0.68	0.85	0.77	0.49	0.16	
Depreciation of operation expense			0.36	0.36	0.36	0.36	0.36			
Miscellaneous loss			0.03	0.12	0.16	0.22	0.24	0.27	0.30	0.33
Regular business tax			0.07	0.28	0.40	0.51	0.57	0.64	0.73	0.79
Exempted value of business tax			0.07	0.28	0.40	0.51	0.57	0.64	0.73	0.79
Business tax to be paid										
Profit before tax	-0.28	-1.52	-4.56	-5.86	-4.45	-1.95	-0.66	1.29	3.35	4.84
Tax										
Regular corporation tax										
Exempted value of corporation tax										
Corporation tax to be paid										
Profit distribution										
Pure interest after tax	-0.28	-1.52	-4.56	-5.86	-4.45	-1.95	-0.66	1.29	3.35	4.84
Profit reserve										
Dividend										
Internal reserve	-0.28	-1.52	-4.56	-5.86	-4.45	-1.95	-0.66	1.29	3.35	4.84
Cumulative total of surplus (internal reserve)	-0.28	-1.81	-4.56	-10.42	-14.87	-16.82	-17.48	-16.19	-12.85	-8.01
Cumulative total of surplus (total)	-0.28	-1.81	-4.56	-10.42	-14.87	-16.82	-17.48	-16.19	-12.85	-8.01
Recovery calculation										
Cumulative total of depreciation expense			0.72	3.33	6.33	9.36	12.43	15.26	17.75	20.23
Reinvestment				0.10	0.25	0.47	0.77	1.09	1.43	1.80
Cumulative total of surplus	-0.28	-1.81	-4.56	-10.42	-14.87	-16.82	-17.48	-16.19	-12.85	-8.01
Cumulative total of recovery	-0.28	-1.81	-3.84	-7.18	-8.79	-7.93	-5.83	-2.02	3.47	10.43
Year of complete recovery of investment	----	----	----	----	----	----	----	----	----	----

Table 5-5 Financial Calculation (Loss and Profit Calculation and Recovery Calculation) - 2 (Unit/Mil. dollar)

Loss and profit calculation and recovery calculation	(9) 1987	(10) 1988	(11) 1989	(12) 1990	(13) 1991	(14) 1992	(15) 1993	(16) 1994	(17) 1995	(18) 1996
Loss and profit from business										
Sales	28.61	31.75	34.61	37.91	41.99	45.96	50.82	54.64	60.09	64.60
Cost	17.19	18.81	20.37	22.12	24.22	26.31	28.82	31.01	33.75	36.24
Profit before depreciation	11.42	12.94	14.23	15.79	17.77	19.64	22.00	23.62	26.34	28.36
Profit rate)	(39.9)	(40.7)	(41.1)	(41.6)	(42.3)	(42.7)	(43.2)	(43.2)	(43.8)	(43.9)
Depreciation expense	2.53	2.56	2.58	2.61	2.63	2.66	2.69	2.60	1.74	1.37
Operating profit	8.90	10.38	11.65	13.19	15.13	16.98	19.31	21.02	24.60	26.99
Profit rate	(31.0)	(32.7)	(33.6)	(34.7)	(36.0)	(36.9)	(37.9)	(38.4)	(40.9)	(41.7)
Profit outside business										
Interest received										
Interest on deposit	0.05	0.49	0.98	1.06	1.08	1.25	1.60	2.13	2.87	3.83
Miscellaneous profit										
Expense outside business										
Interest paid (operation)										
Interest paid (equipments)										
Interest of long-term loan	2.00	1.88	1.75	1.63	1.51	1.39	1.26	1.14	1.02	0.90
Interest of short-term loan (operation)	0.23									
Interest of short-term loan (equipment)										
Depreciation of operation expense										
Miscellaneous loss	0.36	0.40	0.43	0.47	0.53	0.57	0.64	0.68	0.75	0.81
Regular business tax	0.86	0.95	1.04	1.14	1.26	1.38	1.52	1.64	1.80	1.94
Exempted value of business tax	0.86	0.95								
Business tax to be paid			1.04	1.14	1.26	1.38	1.52	1.64	1.80	1.94
Profit before tax	6.36	8.60	9.41	11.00	12.92	14.90	17.48	19.68	23.90	27.18
Tax										
Regular corporation tax		2.43	3.29	3.85	4.52	5.21	6.12	6.89	8.36	9.51
Exempted value of corporation tax										
Corporation tax to be paid		2.43	3.29	3.85	4.52	5.21	6.12	6.89	8.36	9.51
Profit distribution										
Pure interest after tax	6.36	6.17	6.12	7.15	8.40	9.68	11.36	12.79	15.53	17.67
Profit reserve										
Dividend		4.52	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Internal reserve	6.36	1.65	0.12	1.15	2.40	3.68	5.36	6.79	9.53	11.67
Cumulative total of surplus (internal reserve)	-1.65		0.12	1.27	3.66	7.35	12.71	19.50	29.04	40.70
Cumulative total of surplus (total)	-1.65		0.12	1.27	3.66	7.35	12.71	19.50	29.04	40.70
Recovery calculation										
Cumulative total of depreciation expense	22.76	25.32	27.90	30.51	33.14	35.81	38.50	41.10	42.84	44.21
Reinvestment	2.20	2.62	3.08	3.58	4.11	4.68	5.29	5.95	6.66	7.42
Cumulative total of surplus	-1.65		0.12	1.27	3.66	7.35	12.71	19.50	29.04	40.70
Cumulative total of recovery	18.91	22.70	24.94	28.20	32.70	38.48	45.92	54.66	65.23	77.50
Year of complete recovery of investment	----	----	----	----	----	----	----	----	----	17.50

Table 5-5 Financial Calculation (Loss and Profit Calculation and Recovery Calculation) - 3 (Unit/Mil. dollar)

Loss and profit calculation and recovery calculation	(19) 1997	(20) 1998	(21) 1999	(22) 2000	(23) 2001	(24) 2002	(25) 2003	(26) 2004	(27) 2005	(28) 2006
Loss and profit from business										
Sales	69.44	74.65	80.25	86.27	92.74	99.70	107.17	115.21	123.85	133.14
Cost	38.91	41.79	44.89	48.22	51.80	55.65	59.79	64.24	69.02	74.17
Profit before depreciation	30.53	32.86	35.36	38.05	40.94	44.05	47.39	50.97	54.83	58.98
(Profit rate)	(43.9)	(44.0)	(44.0)	(44.1)	(44.1)	(44.1)	(44.2)	(44.2)	(44.2)	(44.2)
Depreciation expense	1.41	1.46	1.50	1.56	1.61	1.67	1.74	1.80	1.88	1.96
Operating profit	29.12	31.40	33.86	36.50	39.33	42.38	45.65	49.17	52.95	57.02
Profit rate	(41.9)	(42.0)	(42.1)	(42.3)	(42.4)	(42.5)	(42.5)	(42.6)	(42.7)	(42.8)
Profit outside business										
Interest received										
Interest on deposit	5.00	6.43	8.16	10.23	12.67	15.54	18.94	23.04	27.86	33.40
Miscellaneous profit										
Expense outside business										
Interest paid (operation)										
Interest paid (equipments)										
Interest of long-term loan	0.77	0.65	0.53	0.41	0.28	0.16	0.06	0.01		
Interest of short-term loan (operation)										
Interest of short-term loan (equipment)										
Depreciation of operation expense										
Miscellaneous loss	0.87	0.93	1.00	1.08	1.16	1.25	1.34	1.44	1.55	1.66
Regular business tax	2.08	2.24	2.41	2.59	2.78	2.99	3.22	3.46	3.72	3.99
Exempted value of business tax										
Business tax to be paid	2.08	2.24	2.41	2.59	2.78	2.99	3.22	3.46	3.72	3.99
Profit before tax	30.40	34.01	38.08	42.65	47.78	53.52	59.98	67.30	75.55	84.76
Tax										
Regular corporation tax	10.64	11.90	13.33	14.93	16.72	18.73	20.99	23.56	26.44	29.66
Exempted value of corporation tax										
Corporation tax to be paid	10.64	11.90	13.33	14.93	16.72	18.73	20.99	23.56	26.44	29.66
Profit distribution										
Pure interest after tax	19.76	22.11	24.75	27.72	31.05	34.79	38.99	43.75	49.11	55.09
Profit reserve										
Dividend	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Internal reserve	13.76	16.11	18.75	21.72	25.05	28.79	32.99	37.75	43.11	49.09
Cumulative total of surplus (internal reserve)	54.46	70.57	89.32	111.04	136.09	164.88	197.87	235.61	278.72	327.81
Cumulative total of surplus (total)	54.46	70.57	89.32	111.04	136.09	164.88	197.87	235.61	278.72	327.81
Recovery calculation										
Cumulative total of depreciation expense	45.63	47.08	48.59	50.14	51.75	53.42	55.16	56.96	58.84	60.80
Reinvestment	8.23	9.11	10.06	11.08	12.17	13.34	14.61	15.96	17.42	18.99
Cumulative total of surplus	54.46	70.57	89.32	111.04	136.09	164.88	197.87	235.61	278.72	327.81
Cumulative total of recovery	91.85	108.53	127.84	150.11	175.68	204.96	238.42	276.61	320.14	369.62
Year of complete recovery of investment	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++

Table 5-6 Financial Calculation (Funds Statement) - 1

(Unit/Mil. dollar)

Funds Statement	(-2) 1977	(-1) 1978	(1) 1979	(2) 1980	(3) 1981	(4) 1982	(5) 1983	(6) 1984	(7) 1985	(8) 1986
Income and expenditure of working funds										
Operating income			1.57	6.99	11.90	15.78	18.40	20.57	23.22	25.68
Operating expenditure	0.36	1.29	4.48	9.13	10.39	11.54	12.23	13.45	14.91	16.13
Income outside business										
Interest received										
Interest of deposit										
Miscellaneous income										
Expenditure outside business	0.02	0.13	0.45	0.92	1.15	1.20	1.22	1.26	1.25	1.02
Interest paid										
Interest of short-term loan (operation)	0.02	0.13	0.42	0.80	0.99	0.99	0.99	0.99	0.94	0.68
Business tax										
Corporation tax										
Dividend										
Miscellaneous loss			0.03	0.12	0.16	0.22	0.24	0.27	0.30	0.33
Income and expenditure difference of working funds	-0.38	-1.42	-3.36	-3.06	0.36	3.04	4.95	5.86	7.06	8.53
Income and expenditure of equipment funds										
Expenditure of equipment funds	11.51	26.58	26.97	11.11	3.04	3.28	3.27	3.02	2.69	2.48
Expenditure for equipments	11.51	26.18	25.54	8.73	0.15	0.22	0.30	0.32	0.34	0.37
Interest paid										
Interest on long-term loan		0.38	1.29	2.02	2.20	2.20	2.20	2.20	2.18	2.11
Interest on short-term loan (equipments)		0.02	0.13	0.37	0.68	0.85	0.77	0.49	0.16	
Income and expenditure difference of equipment funds	-11.51	-26.58	-26.97	-11.11	- 3.04	-3.28	-3.27	-3.02	-2.69	-2.48
Income and expenditure of funds										
Income										
Capital paid	11.51	8.49								
Long-term loan		17.69	25.54	8.63						
Short-term loan (operation)	0.38	1.42	3.36	3.06						
Short-term loan (equipments)		0.40	1.43	2.48	2.67	0.23				
Total income	11.89	28.00	30.33	14.17	2.67	0.23				
Expenditure										
Payment of long-term loan									0.98	2.40
Payment of short-term loan (operation)									0.70	3.65
Payment of short-term loan (equipment)							1.68	2.85	2.69	
Total expenditure							1.68	2.85	4.37	6.05
Loan balance										
Long-term loan		17.69	43.23	51.86	51.86	51.86	51.86	51.86	50.88	48.48
Short-term loan (operation)	0.38	1.80	5.16	8.22	8.22	8.22	8.22	8.22	7.53	3.87
Short-term loan (equipment)		0.40	1.83	4.31	6.99	7.22	5.54	2.69		
Total of short-term loan	0.38	2.20	6.99	12.53	15.21	15.44	13.76	10.91	7.53	3.87
Total loan balance	0.38	19.89	50.22	64.39	67.07	67.30	65.62	62.77	58.40	52.35
Increase or decrease of current deposit										
Current deposit balance										

Table 5-6 Financial Calculation (Funds Statement) - 2

(Unit/Mil. dollar)

Funds Statement	(9) 1987	(10) 1988	(11) 1989	(12) 1990	(13) 1991	(14) 1992	(15) 1993	(16) 1994	(17) 1995	(18) 1996
Income and expenditure of working funds										
Operating income	27.86	30.65	33.61	36.76	40.56	44.57	49.12	53.30	58.18	63.02
Operating expenditure	17.35	18.97	20.55	22.33	24.43	26.57	29.04	31.29	34.00	36.50
Income outside business	0.05	0.49	0.98	1.06	1.08	1.25	1.60	2.13	2.87	3.83
Interest received										
Interest of deposit	0.05	0.49	0.98	1.06	1.08	1.25	1.60	2.13	2.87	3.83
Miscellaneous income										
Expenditure outside business	0.59	0.40	7.38	10.81	11.52	12.35	13.23	14.33	15.28	16.97
Interest paid										
Interest of short-term loan (operation)	0.23									
Business tax				1.04	1.14	1.26	1.38	1.52	1.64	1.80
Corporation tax			2.43	3.29	3.85	4.52	5.21	6.12	6.89	8.36
Dividend			4.52	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Miscellaneous loss	0.36	0.40	0.43	0.47	0.53	0.57	0.64	0.68	0.75	0.81
Income and expenditure difference of working funds	9.97	11.78	6.66	4.68	5.70	6.90	8.45	9.81	11.77	13.37
Income and expenditure of equipment funds										
Expenditure of equipment funds	2.40	2.30	2.21	2.12	2.04	1.96	1.88	1.80	1.73	1.66
Expenditure for equipments	0.40	0.43	0.46	0.49	0.53	0.57	0.61	0.66	0.71	0.76
Interest paid										
Interest on long-term loan	2.00	1.88	1.75	1.63	1.51	1.39	1.26	1.14	1.02	0.90
Interest on short-term loan (equipments)										
Income and expenditure difference of equipment funds	-2.40	-2.30	-2.21	-2.12	-2.04	-1.96	-1.88	-1.80	-1.73	-1.66
Income and expenditure of funds										
Income										
Capital paid										
Long-term loan										
Short-term loan (operation)										
Short-term loan (equipments)										
Total income										
Expenditure										
Payment of long-term loan	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88
Payment of short-term loan (operation)	3.87									
Payment of short-term loan (equipment)										
Total expenditure	6.76	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88
Loan balance										
Long-term loan	45.60	42.71	39.83	36.95	34.07	31.19	28.31	25.43	22.55	19.67
Short-term loan (operation)										
Short-term loan (equipment)										
Total of short-term loan										
Total loan balance	45.60	42.71	39.83	36.95	34.07	31.19	28.31	25.43	22.55	19.67
Increase or decrease of current deposit	0.82	6.59	1.56	-0.33	0.78	2.07	3.69	5.13	7.16	8.83
Current deposit balance	0.82	7.41	8.97	8.64	9.42	11.49	15.17	20.30	27.47	36.30

Table 5-6 Financial Calculation (Funds Statement) - 3

(Unit/Mil. dollar)

Funds Statement	(19) 1997	(20) 1998	(21) 1999	(22) 2000	(23) 2001	(24) 2002	(25) 2003	(26) 2004	(27) 2005	(28) 2006
Income and expenditure of working funds										
Operating income	67.75	72.83	78.29	84.16	90.48	97.26	104.56	112.40	120.83	129.89
Operating expenditure	39.20	42.10	45.22	48.58	52.19	56.06	60.23	64.72	69.54	74.72
Income outside business	5.00	6.43	8.16	10.23	12.67	15.54	18.94	23.04	27.86	33.40
Interest received										
Interest of deposit	5.00	6.43	8.16	10.23	12.67	15.54	18.94	23.04	27.86	33.40
Miscellaneous income										
Expenditure outside business	18.32	19.65	21.15	22.81	24.67	26.75	29.06	31.65	34.56	37.82
Interest paid										
Interest of short-term loan (operation)										
Business tax	1.94	2.08	2.24	2.41	2.59	2.78	2.99	3.22	3.46	3.72
Corporation tax	9.51	10.64	11.90	13.33	14.93	16.72	18.73	20.99	23.56	26.44
Dividend	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Miscellaneous loss	0.87	0.93	1.00	1.08	1.16	1.25	1.34	1.44	1.55	1.66
Income and expenditure difference of working funds	15.23	17.50	20.08	23.00	26.29	29.99	34.21	39.07	44.59	50.75
Income and expenditure of equipment funds										
Expenditure of equipment funds	1.59	1.53	1.48	1.42	1.38	1.34	1.32	1.37	1.46	1.57
Expenditure for equipments	0.82	0.88	0.95	1.02	1.09	1.17	1.26	1.36	1.46	1.57
Interest paid										
Interest on long-term loan	0.77	0.65	0.53	0.41	0.28	0.16	0.06	0.01		
Interest on short-term loan (equipments)										
Income and expenditure difference of equipment funds	-1.59	-1.53	-1.48	-1.42	-1.38	-1.34	-1.32	-1.37	-1.46	-1.57
Income and expenditure of funds										
Income										
Capital paid										
Long-term loan										
Short-term loan (operation)										
Short-term loan (equipments)										
Total income										
Expenditure										
Payment of long-term loan	2.88	2.88	2.88	2.88	2.88	2.88	1.90	0.48		
Payment of short-term loan (operation)										
Payment of short-term loan (equipment)										
Total expenditure	2.88	2.88	2.88	2.88	2.88	2.88	1.90	0.48		
Loan balance										
Long-term loan	16.79	13.91	11.03	8.14	5.26	2.38	0.48			
Short-term loan (operation)										
Short-term loan (equipment)										
Total of short-term loan										
Total loan balance	16.79	13.91	11.03	8.14	5.26	2.38	0.48			
Increase or decrease of current deposit	10.76	13.09	15.73	18.70	22.03	25.77	30.98	37.22	43.13	49.18
Current deposit balance	47.05	60.15	75.87	94.57	116.60	142.37	173.35	210.57	253.71	302.88

Table 5-7 Financial Calculation (Balance Sheet) - 1

(Unit/Mil. dollar)

Balance sheet	(-2) 1977	(-1) 1978	(1) 1979	(2) 1980	(3) 1981	(4) 1982	(5) 1983	(6) 1984	(7) 1985	(8) 1986
Assets										
Floating assets	(0.10)	(0.40)	(1.71)	(4.27)	(5.70)	(7.15)	(7.93)	(8.89)	(10.01)	(10.92)
Cash deposit										
Accounts receivable			0.85	3.31	4.63	6.01	6.67	7.48	8.47	9.26
Work in process	0.10	0.40	0.86	0.96	1.07	1.14	1.26	1.41	1.53	1.66
Advance										
Fixed assets	(11.51)	(37.69)	(62.51)	(68.62)	(65.78)	(62.97)	(60.20)	(57.69)	(55.55)	(53.43)
Tangible asset	11.51	37.69	59.93	66.15	63.82	61.75	59.71	57.65	55.55	53.43
Land	2.31	4.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65
Other equipments			29.73	51.78	58.02	55.83	53.77	51.68	49.56	47.41
Construction in process	9.20	33.04	24.55	8.73	0.15	0.22	0.30	0.32	0.34	0.37
Intangible fixed asset			2.59	2.47	1.96	1.22	0.49	0.04		
Deferred account	( )	( )	(1.45)	(1.08)	(0.72)	(0.36)	( )	( )	( )	( )
Operating cost			1.45	1.08	0.72	0.36				
Total assets	11.61	38.08	65.67	73.97	72.20	70.48	68.14	66.58	65.55	64.35
Liabilities										
Floating liabilities	(0.38)	(2.20)	(6.99)	(12.53)	(15.21)	(15.44)	(13.76)	(11.90)	(9.93)	(6.76)
Accounts payable										
Account payable										
Long-term loan payment within a year								0.98	2.40	2.88
Short-term loan	0.38	2.20	6.99	12.53	15.21	15.44	13.76	10.91	7.53	3.87
Tax reserve										
Fixed liabilities	( )	(17.69)	(43.23)	(51.86)	(51.86)	(51.86)	(51.86)	(50.88)	(48.48)	(45.60)
Long-term loan		17.69	43.23	51.86	51.86	51.86	51.86	50.88	48.48	45.60
Total liabilities	0.38	19.89	50.22	64.39	67.07	67.30	65.62	62.77	58.40	52.35
Capitals										
Capital	11.51	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Legal reserve										
Surplus	(-0.28)	(-1.81)	(-4.56)	(-10.42)	(-14.87)	(-16.82)	(-17.48)	(-16.19)	(-12.85)	(-8.01)
Profit brought forward from previous term		-0.28		-4.56	-10.42	-14.87	-16.82	-17.48	-16.19	-12.85
Profit of this term	-0.28	-1.52	-4.56	-5.86	-4.45	-1.95	-0.66	1.29	3.35	4.84
Total of capitals	11.23	18.19	15.44	9.58	5.13	3.18	2.52	3.81	7.15	11.99
Total of liabilities and capitals	11.61	38.08	65.67	73.97	72.20	70.48	68.14	66.58	65.55	64.35
Cumulative total of tangible fixed asset and depreciation expens			0.43	2.36	4.62	6.92	9.25	11.64	14.08	16.57

Table 5-7 Financial Calculation (Balance Sheet) - 2

(Unit/Mil. dollar)

Balance sheet	(9) 1987	(10) 1988	(11) 1989	(12) 1990	(13) 1991	(14) 1992	(15) 1993	(16) 1994	(17) 1995	(18) 1996
Assets										
Floating assets	(12.65)	(20.50)	(23.24)	(24.28)	(26.69)	(30.40)	(36.02)	(42.76)	(52.08)	(62.76)
Cash deposit	0.82	7.41	8.97	8.64	9.42	11.49	15.17	20.30	27.47	36.30
Accounts receivable	10.01	11.11	12.11	13.27	14.70	16.08	17.79	19.12	21.03	22.61
Work in process	1.82	1.98	2.16	2.37	2.58	2.83	3.06	3.33	3.58	3.85
Advance										
Fixed assets	(51.30)	(49.16)	(47.04)	(44.93)	(42.82)	(40.73)	(38.65)	(36.70)	(35.67)	(35.06)
Tangible asset	51.30	49.16	47.04	44.93	42.82	40.73	38.65	36.70	35.67	35.06
Land	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65
Other equipments	45.25	43.09	40.93	38.79	36.65	34.51	32.39	30.40	29.32	28.65
Construction in process	0.40	0.43	0.46	0.49	0.53	0.57	0.61	0.66	0.71	0.76
Intangible fixed asset										
Deferred account	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Operating cost										
Total assets	63.95	69.66	70.28	69.21	69.52	71.13	74.66	79.46	87.75	97.82
Liabilities										
Floating liabilities	(2.88)	(5.31)	(7.21)	(7.87)	(8.66)	(9.47)	(10.52)	(11.41)	(13.05)	(14.33)
Accounts payable										
Account payable										
Long-term loan payment within a year	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88
Short-term loan										
Tax reserve		2.43	4.33	4.99	5.78	6.59	7.64	8.53	10.17	11.45
Fixed liabilities	(42.71)	(39.83)	(36.95)	(34.07)	(31.19)	(28.31)	(25.43)	(22.55)	(19.67)	(16.79)
Long-term loan	42.71	39.83	36.95	34.07	31.19	28.31	25.43	22.55	19.67	16.79
Total liabilities	45.60	45.15	44.17	41.94	39.85	37.78	35.95	33.96	32.71	31.12
Capitals										
Capital	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Legal reserve										
Surplus	(-1.65)	(4.52)	(6.12)	(7.27)	(9.66)	(13.35)	(18.71)	(25.50)	(35.04)	(46.70)
Profit brought forward from previous term	-8.01	-1.65		0.12	1.27	3.66	7.35	12.71	19.50	29.04
Profit of this term	6.36	6.17	6.12	7.15	8.40	9.68	11.36	12.79	15.53	17.67
Total of capitals	18.35	24.52	26.12	27.27	29.66	33.35	38.71	45.50	55.04	66.70
Total of liabilities and capitals	63.95	69.66	70.28	69.21	69.52	71.13	74.66	79.46	87.75	97.82
Cumulative total of tangible fixed asset and depreciation expens	19.10	21.65	24.24	26.84	29.48	32.14	34.83	37.44	39.18	40.55

Table 5-7 Financial Calculation (Balance Sheet) - 3

(Unit/Mil. dollar)

Balance sheet	(19) 1997	(20) 1998	(21) 1999	(22) 2000	(23) 2001	(24) 2002	(25) 2003	(26) 2004	(27) 2005	(28) 2006
Assets										
Floating assets	(75.50)	(90.72)	(108.75)	(129.91)	(154.59)	(183.20)	(217.25)	(257.77)	(304.44)	(357.42)
Cash deposit	47.05	60.15	75.87	94.57	116.60	142.37	173.35	210.57	253.71	302.88
Accounts receivable	24.31	26.13	28.09	30.19	32.46	34.89	37.51	40.32	43.35	46.60
Work in process	4.14	4.45	4.78	5.14	5.53	5.94	6.39	6.87	7.38	7.94
Advance										
Fixed assets	(34.47)	(33.89)	(33.33)	(32.79)	(32.28)	(31.78)	(31.31)	(30.86)	(30.44)	(30.05)
Tangible asset	34.47	33.89	33.33	32.79	32.28	31.78	31.31	30.86	30.44	30.05
Land	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65
Other equipments	28.00	27.37	26.74	26.13	25.54	24.96	24.40	23.86	23.33	22.84
Construction in process	0.82	0.88	0.95	1.02	1.09	1.17	1.26	1.36	1.46	1.57
Intangible fixed asset										
Deferred account	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Operating cost										
Total assets	109.97	124.62	142.08	162.70	186.86	214.98	248.56	288.62	334.88	387.47
Liabilities										
Floating liabilities	(15.60)	(17.02)	(18.62)	(20.40)	(22.39)	(23.62)	(24.69)	(27.01)	(30.16)	(33.66)
Accounts payable										
Account payable										
Long-term loan payment within a year	2.88	2.88	2.88	2.88	2.88	1.90	0.48			
Short-term loan										
Tax reserve	12.72	14.14	15.74	17.52	19.50	21.72	24.21	27.01	30.16	33.66
Fixed liabilities	(13.91)	(11.03)	(8.14)	(5.26)	(2.38)	(0.48)	( )	( )	( )	( )
Long-term loan	13.91	11.03	8.14	5.26	2.38	0.48				
Total liabilities	29.51	28.05	26.76	25.66	24.77	24.10	24.69	27.01	30.16	33.66
Capitals										
Capital	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Legal reserve										
Surplus	(60.46)	(76.57)	(95.32)	(117.04)	(142.09)	(170.88)	(203.87)	(241.61)	(284.72)	(333.81)
Profit brought forward from previous term	40.70	54.46	70.57	89.32	111.04	136.09	164.88	197.87	235.61	278.72
Profit of this term	19.76	22.11	24.75	27.72	31.05	34.79	38.99	43.75	49.11	55.09
Total of capitals	80.46	96.57	115.32	137.04	162.09	190.88	223.87	261.61	304.72	353.81
Total of liabilities and capitals	109.97	124.62	142.08	162.70	186.86	214.98	248.56	288.62	334.88	387.47
Cumulative total of tangible fixed asset and depreciation expens	41.96	43.42	44.92	46.48	48.09	49.76	51.49	53.30	55.18	57.13

Table 5-8 Plan of Equipment Depreciation (Amortization)

(Unit: Mil. dollar)

	Equipment items	Investment	Durable years	Yearly depreciation					
				1979	1984	1989	1994	1999	2004
1	Ground reclamation, preparation and dredging	5.65	-	-	-	-	-	-	-
2	300,000 ton dry dock	20.52	45	0.17	0.41	0.41	0.41	0.41	0.41
3	Wharf, revetment	7.61	50	0.03	0.14	0.14	0.14	0.14	0.14
4	Building	5.35	35	0.02	0.14	0.14	0.14	0.14	0.14
5	Incidental equipments of dock	5.34	15	0.02	0.32	0.32	0.30	-	-
6	Jib crane	4.20	15	0.04	0.25	0.25	0.21	-	-
7	Electric equipments	3.24	30	0.02	0.10	0.10	0.10	0.10	0.10
8	Piping in plant	2.67	15	0.03	0.16	0.16	0.13	-	-
9	Vessel (tugboat, barge)	4.47	16	0.06	0.25	0.25	0.25	-	-
10	Power equipments	0.61	15		0.04	0.04	0.04	-	-
11	Producing equipments	6.85	15	0.03	0.41	0.41	0.38	-	-
12	Reserve fund	1.67	45	0.01	0.03	0.03	0.03	0.03	0.03
13	Engineering fee	2.67	5	0.19	0.35	-	-	-	-
14	Technological assistance fee	1.00	5	0.10	0.10	-	-	-	-
	T o t a l	71.86	-	0.72	2.69	2.25	2.12	0.82	0.82
	Working equipment expense (maintenance, repairing, etc.)	24 years until 2004 15.97	5	-	0.14	0.33	0.48	0.69	0.99
	T o t a l	87.83	-	0.72	2.83	2.58	2.60	1.50	1.80

Table 5-9 Financial Calculation (Long-term loan payment plan) - 1

(Unit/Mil. dollar)

Long-term loan payment plan

Name	Item	(-2) 1977	(-1) 1978	(1) 1979	(2) 1980	(3) 1981	(4) 1982	(5) 1983	(6) 1984	(7) 1985	(8) 1986
(Capitals)											
Capital	Payment	11.51	8.49								
	Cumulative total	11.51	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Total	Payment	11.51	8.49								
	Cumulative total	11.51	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
(Loans)											
Long-term low-interest loan	Loan		17.69	25.54	8.63						
	Interest payable										
7 years deferment, 18 year payment	Loan balance at year end		17.69	43.23	51.86	51.86	51.86	51.86	51.86	50.88	48.48
	Payment									0.98	2.40
Interest 4.25%	Interest		0.38	1.29	2.02	2.20	2.20	2.20	2.20	2.18	2.11
Total	Loan		17.69	25.54	8.63						
	Interest payable										
	Loan balance at year end		17.69	43.23	51.86	51.86	51.86	51.86	51.86	50.88	48.48
	Payment									0.98	2.40
	Interest		0.38	1.29	2.02	2.20	2.20	2.20	2.20	2.18	2.11

Table 5-9 Fiancial Calculation (Long-term loan payment plan) - 2

Long-term loan payment plan (Unit/Mil. dollar)

Name	Item	(9) 1987	(10) 1988	(11) 1989	(12) 1990	(13) 1991	(14) 1992	(15) 1993	(16) 1994	(17) 1995	(18) 1996
(Capitals)											
Capital	Payment										
	Cumulative total	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Total	Payment										
	Cumulative total	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
(Loans)											
Long-term low-interest loan	Loan										
	Interest payable										
7 years deferment, 18 year payment	Loan balance at year end	45.60	42.71	39.83	36.95	34.07	31.19	28.31	25.43	22.55	19.67
Interest 4.25%	Payment	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88
	Interest	2.00	1.88	1.75	1.63	1.51	1.39	1.26	1.14	1.02	0.90
Total	Loan										
	Interest payable										
	Loan balance at year end	45.60	42.71	39.83	36.95	34.07	31.19	28.31	25.43	22.55	19.67
	Payment	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88
	Interest	2.00	1.88	1.75	1.63	1.51	1.39	1.26	1.14	1.02	0.90

Table 5-9 Financial Calculation (Long-term loan payment plan) - 3

Long-term loan payment plan

(Unit/Mil. dollar)

Name	Item	(19) 1997	(20) 1998	(21) 1999	(22) 2000	(23) 2001	(24) 2002	(25) 2003	(26) 2004	(27) 2005	(28) 2006
(Capitals)											
Capital	Payment										
	Cumulative total	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Total	Payment										
	Cumulative total	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
(Loans)											
Long-term low-interest loan	Loan										
	Interest payable										
7 years deferment, 18 year payment	Loan balance at year end	16.79	13.91	11.03	8.14	5.26	2.38	0.48			
Interest 4.25%	Payment	2.88	2.88	2.88	2.88	2.88	2.88	1.90	0.48		
Total	Interest	0.77	0.65	0.53	0.41	0.28	0.16	0.06	0.01		
	Loan										
	Interest payable										
	Loan balance at year end	16.79	13.91	11.03	8.14	5.26	2.38	0.48			
	Payment	2.88	2.88	2.88	2.88	2.88	2.88	1.90	0.48		
	Interest	0.77	0.65	0.53	0.41	0.28	0.16	0.06	0.01		

(4) It is assumed that 65% of sales is received before the end of a year and 35% in the following year. It is also assumed that 10% of production cost is paid in the preceding year and 90% in this year.

(5) The enterprise tax is 3% of sales. However, the 100% exemption from enterprise tax for the first ten years was assumed according to the Presidential Decree No. 666.

(6) The income tax is 35% of profit before tax. However, the benefit for the registered enterprises under the Investment Incentive Act (See Chapter 2) and the system of bringing the cumulative deficits of the first ten years forward to the next six years were used.

(7) 1.25% of sales is allotted to miscellaneous loss for typhoons etc.

(8) After deficit becomes zero, 30% dividends (max) are assumed.

5-6-2 Financial Analysis

(1) Drawing of financial plan

Fig. 5-10 shows the initial investment curve, the long-term loan balance curve, the short-term loan curve, the working fund loan balance curve and the pure profit curve obtained on the basis of the preceding tables. This project is to be executed with the following plan under the conditions and assumptions stated before.

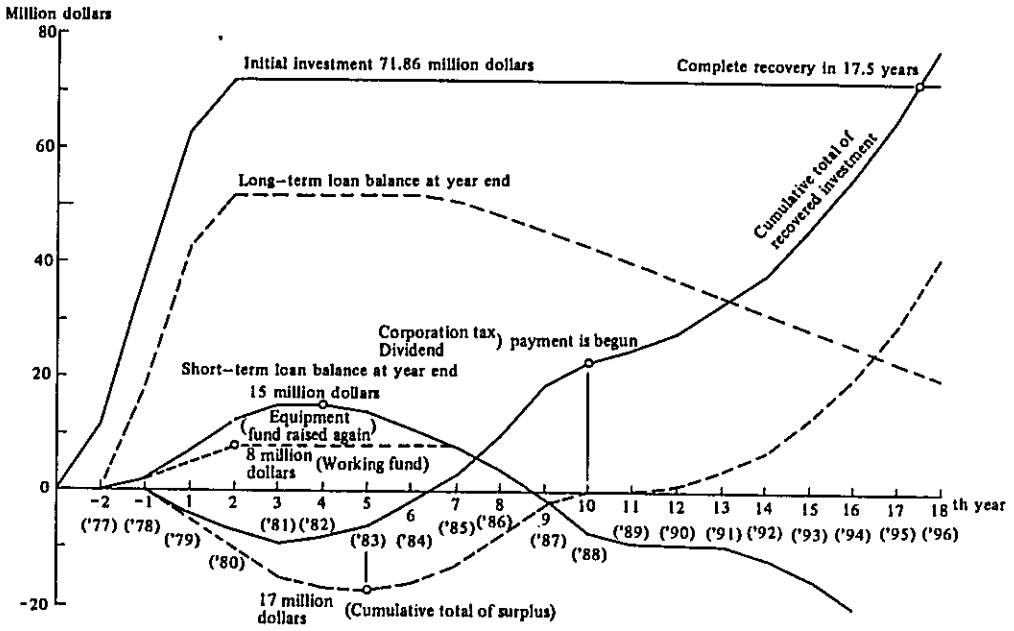
a) Initial investment is to be recovered in 17.5 years after the beginning of operation.

b) Short-term loans reach the highest level (15 million dollars) in the 4th year of operation.

c) Cumulative deficit reaches the highest level (17 million dollars) in the 5th year of operation.

d) Cumulative deficit is become zero in the 10th year of operation. Dividend payment and corporation income tax payment are to be begun this year.

Fig. 5-10 Predicted Financial Plan



(2) Various business ratios (viewed from credit analysis)

a) Long-term debt service coverage Cash income from net sales/long-term debt payment

Operating year	A.D.	Ratio
7	1985	23.69
8	1986	10.70
9	1987	9.67
10	1988	10.64
15	1993	17.06
20	1998	25.29
25	2003	55.03

b) Long-term debt/ equity ratio

Operating year	A.D.	Ratio
1	1979	2.80
2	1980	5.41
3	1981	10.11
4	1982	16.31

Operating year	A.D.	Ratio
5	1983	20.58
10	1988	1.62
15	1993	0.66
20	1998	0.11
25	2003	-

c) Creditors / owners equity ratio

Operating year	A.D.	Ratio
1	1979	0.76/0.24
2	1980	0.87/0.13
3	1981	0.93/0.07
4	1982	0.95/0.05
5	1983	0.96/0.04
10	1988	0.65/0.35
15	1993	0.48/0.52
20	1998	0.23/0.77
25	2003	0.10/0.90

d) Interest service coverage (Cash income from net sales/Interest paid)

Operating year	A.D.	Ratio
1	1979	1.22
2	1980	3.46
3	1981	5.41
4	1982	7.17
5	1983	8.36
10	1988	16.30
15	1993	39.98
20	1998	112.05
25	2003	1742.67

5-6-3 FRR Analysis

(1) General

The benefits and expenses of a project can be grasped as yearly flow during the period of a project. Generally, expenses alone arise at the stage of construction. Benefits arise after the completion (before the completion in the case of this project) and management and maintenance expenses are required. The difference between benefits and expenses in each year is the pure benefit of a project.

If benefits exceed expenses, a project gives position benefits. Therefore, pure benefits must be compared with construction expenses to judge whether a project is worth executing. Here, the internal rate of return method, which is one of the methods with time consideration, is adopted. Financial rate of return is calculated from the standpoint of a project (an enterprise, here).

$$\sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t} = 0$$

B_t : Benefits on t th year

C_t : Costs on t th year

i : Internal rate of return

Here, B_t and C_t are benefits and costs on each year. Currently, there is no established theory in the world (and in Japan) for identifying B_t and C_t. The result i significantly depends on the items included in B_t and C_t.

(2) Conditions

Here, benefits and costs are defined as given below.

Benefits = Ship repairing sales - cost - miscellaneous losses

Costs = Initial investment t reinvestment - residual book value.

Therefore, benefits include the interests of long-term loans, taxes and profits (dividends).

Two cases were assumed for the FRR analysis. In Case I, Table 5-3, Table 5-4 and Table 5-5 are used for the values of all the items included in benefits and expenses. (In other words, about 7.5% annual increase is assumed for sales, labor expense, material expense etc.) In Case II, no increase in sales, labor expense etc. is assumed. An analysis assuming no increase will clarify the original nature of a project, while an analysis assuming some increase will show how a project works in a real economic society.

Since the facilities of this project have extremely long service life (45 years in the case of dock), 30 years were assumed for n.

(3) Calculation Results

Table 5-11 shows the calculation result of Case I (assuming 7.5% increase), while Table 5-12 shows the result of Case II (assuming no increase). They are summarized below.

Items to be coverd by pure benefits	Rate of price increase (%)	FRR (%)
Interest on long-term loan	7.5	13.6
Taxes Profits (dividend) etc.	0	5.7

Table 5-11 Financial Rate of Return - Case I

Year		Cost		Benefit			Net cash flow (3)-(4)-(5)-(1)-(2)	Pure current value Discount rate	
		Initial Investment (1)	Reinvestment (2)	Sales (3)	Production cost (4)	Miscellaneous losses (5)		13.5%	14.0%
1	1977	11.51					(11.77)	(10.37)	(10.32)
2	78	26.18					(27.17)	(21.09)	(20.91)
3	79	25.54		2.42	4.02	0.03	(27.17)	(18.58)	(18.34)
4	1980	8.63	0.10	9.46	9.03	0.12	(8.42)	(5.07)	(4.99)
5	81		0.15	13.22	10.27	0.16	2.63	1.40	1.37
6	82		0.22	17.17	11.47	0.22	5.26	2.46	2.40
7	83		0.30	19.07	12.11	0.34	6.42	2.65	2.57
8	84		0.32	21.37	13.30	0.27	7.48	2.71	2.62
9	85		0.34	24.21	14.79	0.30	8.78	2.81	2.70
10	86		0.37	26.47	16.01	0.33	9.76	2.75	2.63
11	87		0.40	28.61	17.19	0.36	10.66	2.65	2.52
12	88		0.43	31.75	18.81	0.40	12.11	2.65	2.51
13	89		0.46	34.61	20.37	0.43	13.34	2.57	2.43
14	1990		0.49	37.91	22.12	0.47	14.83	2.52	2.37
15	91		0.53	41.99	24.22	0.53	16.71	2.50	2.34
16	92		0.57	45.96	26.31	0.57	18.50	2.44	2.27
17	93		0.61	50.82	28.82	0.64	20.75	2.41	2.24
18	94		0.66	54.64	31.01	0.68	22.28	2.28	2.11
19	95		0.71	60.09	33.75	0.75	24.88	2.24	2.06
20	96		0.76	64.60	36.24	0.81	26.79	2.13	1.95
21	979		0.82	69.44	38.91	0.87	28.84	2.02	1.84
22	98		0.88	74.65	41.79	0.93	30.55	1.88	1.71
23	99		0.95	80.25	44.89	1.00	33.41	1.82	1.64
24	2000		1.02	86.27	48.22	1.08	35.95	1.72	1.55
25	01		1.09	92.74	51.74	1.16	38.69	1.63	1.46
26	02		1.17	99.70	55.65	1.25	41.63	1.55	1.38
27	03		1.26	107.17	59.79	1.34	44.79	1.47	1.30
28	04		1.36	115.21	64.24	1.44	48.17	1.39	1.23
29	05		1.46	123.85	69.02	1.55	51.82	1.32	1.16
30	06	(30.05)	1.57	133.14	74.17	1.66	85.80	1.92	1.68
Total								0.78	(2.52)

Note 1. (30.05) of the initial investment column is residual book value.

2. ( ) indicates a negative value.

3. The fitures are given in million dollars.

$$FRR = 13.5\% + 0.5\% \times \frac{0.78}{0.78 + 2.52} = 13.6\%$$

Table 5-12 Financial Rate of Return - Case II

Year		Cost		Benefit			Net cash flow (3)-(4)-(5)-(1)-(2)	Pure current value	
		Initial Investment (1)	Reinvestment (2)	Sales (3)	Production cost (4)	Miscellaneous losses (5)		Discount rate 5.5%	Discount rate 6.0%
1	1977	10.09			0.23		(10.32)	(9.78)	(9.74)
2	78	21.43			0.80		(22.23)	(19.97)	(19.78)
3	79	19.21		1.81	3.01	0.02	(20.43)	(17.40)	(17.15)
4	1980	6.07	0.07	6.59	6.34	0.08	(5.97)	(4.82)	(4.73)
5	81		0.10	8.56	6.76	0.11	1.59	1.22	1.19
6	82		0.13	10.35	7.05	0.13	3.04	2.20	2.14
7	83		0.17	10.69	6.95	0.13	3.44	2.36	2.29
8	84		0.17	11.15	7.12	0.14	3.72	2.42	2.33
9	85		0.17	11.75	7.38	0.15	4.05	2.50	2.40
10	86		0.17	11.95	7.44	0.15	4.19	2.45	2.34
11	87		0.17	12.01	7.45	0.15	4.24	2.35	2.23
12	88		0.17	12.40	7.58	0.16	4.49	2.36	2.23
13	89		0.17	12.57	7.65	0.16	4.59	2.29	2.15
14	1990		0.17	12.81	7.72	0.16	4.76	2.25	2.11
15	91		0.17	13.20	7.86	0.17	5.00	2.24	2.09
16	92		0.17	13.44	7.94	0.17	5.16	2.19	2.03
17	93		0.17	13.83	8.08	0.17	5.41	2.18	2.01
18	94		0.17	13.83	8.09	0.17	5.40	2.06	1.89
19	95		0.17	14.15	8.18	0.18	5.62	2.03	1.86
20	96		0.17	14.15	8.17	0.18	5.63	1.93	1.76
21	97		0.17	14.15	8.16	0.18	5.64	1.83	1.66
22	98		0.17	14.15	8.15	0.18	5.65	1.73	1.57
23	99		0.17	14.15	8.14	0.18	5.66	1.65	1.48
24	2000		0.17	14.15	8.14	0.18	5.66	1.56	1.40
25	01		0.17	14.15	8.13	0.18	5.67	1.49	1.32
26	02		0.17	14.15	8.12	0.18	5.68	1.41	1.25
27	03		0.17	14.15	8.11	0.18	5.69	1.34	1.18
28	04		0.17	14.15	8.11	0.18	5.69	1.27	1.11
29	05		0.17	14.15	8.10	0.18	5.70	1.21	1.05
30	06	(20.16)	0.17	14.15	8.09	0.18	25.87	5.19	4.50
Total		56.80	4.38	346.74	213.05	4.38	88.29	1.75	(1.83)

Note 1. (20.16) of the initial investment column is residual book value.

2. ( ) indicates a negative value.

3. The figures are given in million dollars.

$$FRR = 5.5\% + 0.5\% \times \frac{1.75}{1.75 + 1.83} = 5.7\%$$

5-6-4 Assessment

(1) Assessment of Predicted Financial Plan

As Fig. 5-10 shows, it became clear that this project is operatable under the assumptions stated before. A few indices are studied and assessed here.

a) Years required for investment recovery

It became clear that the initial investment of this project can be recovered in 17.5 years after the beginning of operation. This is never short when compared with other industrial projects. However, it is not necessarily too long in the case of ship repairing industry since it uses extremely costly and infrastructure life facilities (dock) with long service life. In other countries, the period required for recovering the investment for a dock of 300 ~ 400 thousand D/W is 15 years (M. Co.) or 14 years (S. Co.), for example.

b) Maximum cumulative deficit

The cumulative deficit reaches 17 million dollars in the 5th year of operation. It is acceptable since it is below the capital (= 20 million dollars).

c) Year of starting dividend distribution

With this project, dividends can be distributed from the 10th year of operation. It is generally said that such a period should not exceed ten years. This project barely meets this standard.

(2) Assessment of Various Business Ratios

a) Debt service coverage

It shows that the company will become free from long-term debt from about the 10th year. If the subsequent business profit ratio is adequate, the company may obtain additional funds from long-term loans or company bonds etc.

b) Long-term debt / equity ratio

Its capital status becomes sound in the 9th ~ 10th year. New investments will be possible after 11th ~ 12th year.

c) Creditors / owners equity ratio

The owners equity ratio will exceed 30% and continue to rise after the 10th year. It is generally said that a company with the owners equity ratio exceeding 0.5 is in good status. This enterprise will reach good status in the 15th year.

d) Interest service coverage

It shows the surplus ability for interest payment and should be as high as possible. When it reaches certain level, additional borrowed capitals should be

introduced to increase owned capital profit rate. A new financial policy will become necessary in 10th ~ 15th year.

(3) Assessment of Financial Rate of Return

The method of calculating the financial rate of return was explained in 5-3-3. The result was 5.7% when no price increase was assumed. The result was 13.6% when some realistic price increase (annual rate of 7.5%) was assumed.

These results indicate that this project is not highly profitable, but feasible.

5-7 Sensitivity Analysis

5-7-1 General

The preceding discussion is based on many conditions and assumptions. Among these conditions and assumptions, the following two are expected have the largest effects on results and are unknown at present.

(1) Annual rate of price increase (Sales, wages, material costs).

(2) Average interest rate of long-term loans

Concerning (1), 7.5% was assumed in the preceding discussion. It was assumed that prices, such as sales, wages and material costs, increased at a rate equal to the increase rate of Japan's GNP deflator. Japan's GNP deflator was determined on the basis of the long-range prediction of the Japan Economic Research Center. Japan's GNP deflator was used because the prices increases in Japan are expected to be reflected considerably in ship repairing sales and materials cost.

However, the increase rate of Japan's GNP deflator is predicted to be slightly below 7.5% when a new technique based on the recent economic trend in Japan is used. On the other hand, the average rate GNP deflator increase in South East Asian countries is said to be about 6.5% (Table 5-13).

Here, the results obtained by assuming 6.5% for annual rate of price increase are also studied in consideration of the economic trend in the Philippines discussed in Chapter 2.

Table 5-13 Estimated Rate of GNP (GDP) Deflator Rise

(Unit : %)

	O E C D				Japan Economic Research Center (Prediction)	
	1959/60 ~ 72/73	1974	1975(Estimate)	1976(Predicted)	1975-80	1980-85
Advanced countries	4.1	12.2	10.75	8.0	6.8	5.6
U.S.A.	3.0	10.3	9.0	6.75	6.0	5.0
Western Europe	4.6	11.0	13.5	9.5	6.3	5.3
Japan	5.3	21.1	7.0	5.5	8.7	6.1
	Japan Economic Research Center					
	1960 - 1970	1970 - 1975 (Estimate)				
South East Asia South West Asia	1.8	11.8			6.5	6.5
Africa	2.7	10.3			6.5	6.5
Near Middle East	1.9	10.0			7.0	7.0
Middle and South America	3.0	8.5			8.0	8.0
Developing countries	2.4	10.0			7.1	7.2
World	3.0	9.6			6.9	6.0

The average interest rate of long-term loans was assumed to be 4.25% in the preceding discussion in view of the fact that this is one of the national projects being planned with governmental enthusiasm and that ship repairing facilities have long service life and infrastructural nature in the Philippines.

Here, the results obtaining by assuming 3%, 5% and 7% were also studied.

5-7-2 Sensitivity Analysis

(1) Method

Two factors (average rate of price increases and average interest rate long-term loans) are taken up on the basis of the preceding discussion. Various levels are set for them, as shown in Table 5-14. A type of sensitivity analysis is to be made for various combinations.

Table 5-14 Factors and Levels of Sensitivity Analysis

Case	A_1	A_2	A_3	A_4	B_1	B_2	B_3	B_4
Average rate of price increase (%)	7.5	7.5	7.5	7.5	6.5	6.5	6.5	6.5
Average interest rate of long-term loans (%)	3.0	4.25	5.0	7.0	3.0	4.25	5.0	7.0

(Note) Case A_2 has been taken up in the preceding discussion.

The following financial indices were taken up for the present sensitivity analysis.

(1) Period required for recovery of investments (Number of years required for recovering initial investments)

(2) Maximum cumulative deficit

(3) Year for beginning dividend distribution.

(4) FRR (Benefits after interests and taxes are used.) Here, benefits and costs are defined as below.

Benefits = Income and expenditure balance of working funds + dividend - interests of long-term loans - interests of short-term loans + credit sales + work in process - floating liabilities.

Costs = Equipment expenditure - residual book value.

(2) Result

The results of sensitivity analysis are given in Table 5-15, Fig. 5-16, Fig. 5-17 and Fig. 5-18.

Table 5-15 Summary of Results

Case	A				B			
	A_1	A_2	A_3	A_4	B_1	B_2	B_3	B_4
Average rate of price increase (%/year)	7.5				6.5			
Average interest rate of long-term loan (%/year)	3.0	4.25	5.0	7.0	3.0	4.25	5.0	7.0
Period required for investment recovery (years)	17.0	17.5	17.6	18.2	18.6	19.0	19.2	20.1
Maximum cumulative deficit (million dollars)	13.80 4	17.48 5	19.96 5	27.93 6	14.34 5	18.46 5	21.12 6	30.34 7
Year of starting dividend distribution (year)	8	10	11	13	9	11	12	15
Dividend rate (%)	7	23	28	4	8	21	21	1
Year of starting dividend distribution converted into 30% dividend (year).	8.8	10.2	11.1	13.9	9.7	11.3	12.3	16.0
f r r (%)	10.0	9.6	9.3	8.3	8.8	8.2	7.9	6.7

Note: 1. The figures in the lower row for "maximum cumulative deficit" indicate the year in which it occurs.

2. The benefits in the frr calculation include neither interests (interests of long-term and short-term loans etc.), nor taxes (enterprise tax, corporation tax etc.).

Fig. 5-16 Yeat of Investment Recovery and Year of First Dividend Distribution

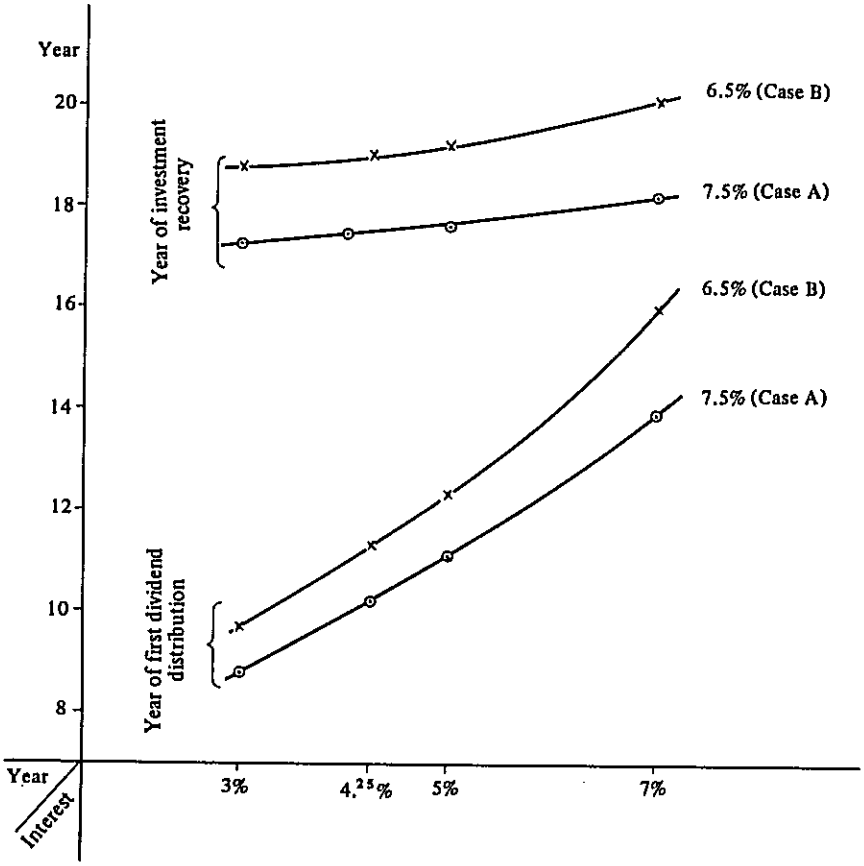


Fig. 5-17 Cumulative Deficit

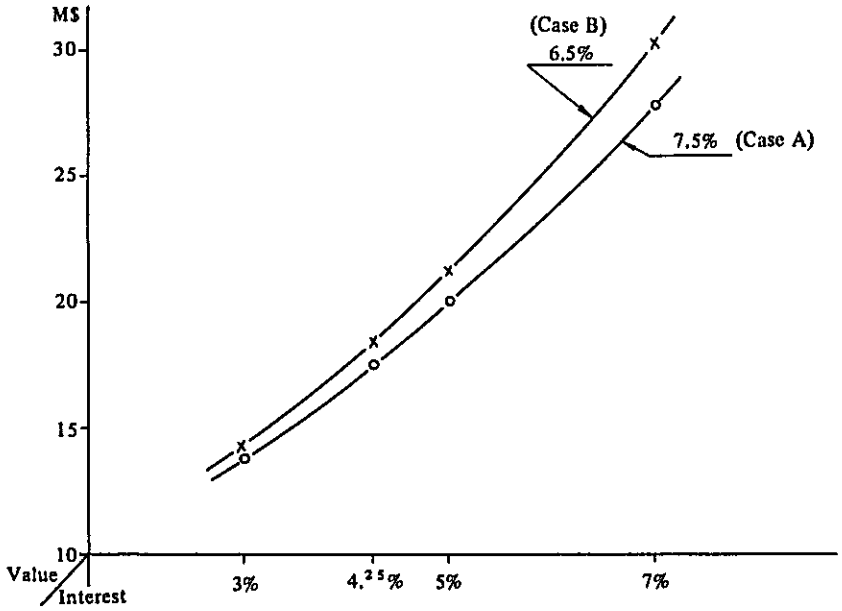
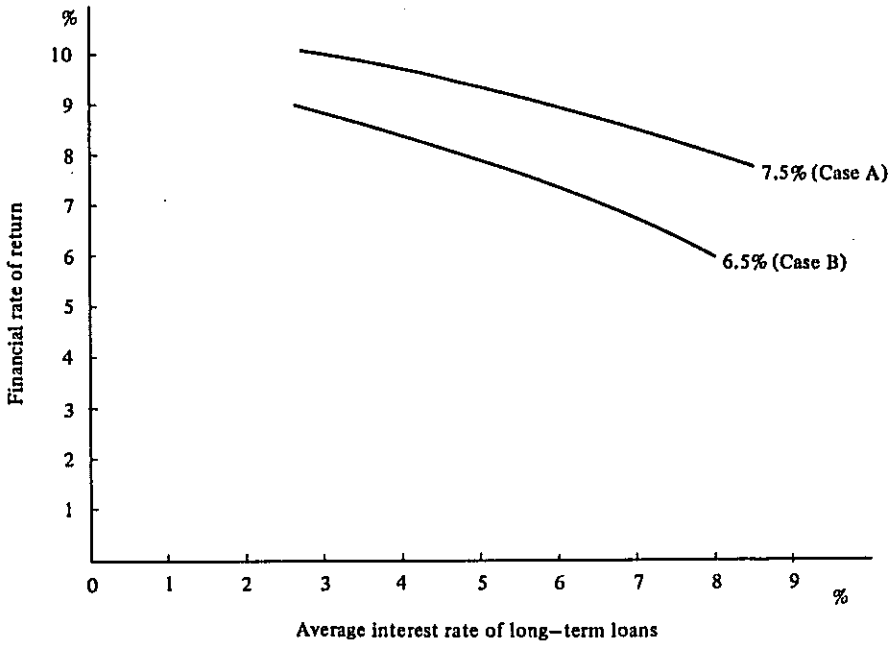


Fig. 5-18 Financial rate of return



5-7-3 Assessment

(1) Criteria for Assessment

The nature of this project is studied here from the standpoint of an enterprise. The following criteria are set for the indices discussed previously.

Period required for recovery of investment ..... Approximately 15 years

Maximum cumulative deficit ..... Less than capital

Year of starting dividend distribution ..... Not more than 10 years

FRR ..... Plus (positive)

Even more strict criteria should be applied to purely private projects. Since the Philippine Government is interested in the contribution of this project to national economy, it will be sufficient for this project to be financially sound.

(2) Assessment

The results of the analyses are studied here in reference to these criteria.

The following conclusion can be obtained concering the year of starting dividend distribution. In Case A (rate of price increase: 7.5%), the average interest rate of long-term loans should be 4.1% and 4.9% to start dividend distribution in the 10th year and the 11th year, respectively. In Case B (rate of price increase: 6.5%), the average interest rate should be 3.6% and 4.1% to start dividend distribution in the 10th year and the 11th year, respectively.

The following conclusion can be obtained concerning maximum cumulative

deficit. In Case A, the average interest rate of long-term loans must to 5.0% or below to keep the maximum cumulative deficit below the capital (=20 million dollars). In Case B, it should be 4.7% or below.

Concerning the number of years required for recoverying investments, 17.6 years and 19.2 years are required in Case A and Case B, respectively, if the average interest rate is 5%.

Since the benefits considered for FRR calculation are pure profits after interest and tax payment, the obtained financial rate of return must cover dividends and internal reserve. In any event, the FRR is extremely low.

In sum, this project is financially sound if loans of considerably long-term and low interest rate are used as funds will be capable of returning the long term loans and paying the taxes and imposts. However, the profits as an enterprice (new company) will be extremely small.

6 . Contribution to National Economy

6-1 General

The construction and operation of a ship repair yard in the Philippines are enterprise activities, as discussed in the preceding chapter. This chapter discusses what benefit such enterprise will bring about to the national economy and what is the size of the benefit against the cost. This project is expected to bring about the following basic benefits.

(1) Obtaining (saving) foreign currencies

(a) The Philippines will obtain foreign currencies by repairing foreign ships. They will also save foreign currencies by repairing Philippine ships at this yard instead of foreign docks.

However, a part of material costs and a part of wages for foreign employees will flow out of the Philippines.

(b) The costs of tank cleaning for tankers (including Philippine tankers) will also go to other Philippine companies. The will be addition foreign currencies to the Philippine.

(c) Additional foreign currencies can be obtained from the sight-seeing and lodging expenses of crew and supervisers (foreign) of ships to be repaired.

(2) Effective use of labor forces

(a) About 1,600 Philippine workers will be employed at this plant. This project newly offer these employment opportunities. Those workers who already have a job will obtain higher wages at the plant. Jobless workers will obtain income. (For the subsequent calculation, wages for Philippine workers will not be considered since they overlap with the sales from ship repairing.)

(b) Numerous skilled workers and unskilled workers will be employed during the four year construction period.

(3) New market for domestic raw materials

Ship repairing industry is said to have a large plain below it. It is expected to have extremely large effects on the related industries. The dependence on imported raw materials will be lowered gradually in the course of this project.

(4) Others

The construction of a dock in subic will either decrease or prevent various useless expenditures attributable to the congestion around Manila.

This complies with and promotes the Government is economic policy of

dispersing industries and regional development.

It will indirectly bring about benefits to commercial and agricultural activities.

6-2 Economic Analysis

6-2-1 Basic Policy

(1) This project was analyzed and evaluated from the view point of national economy by directing attention to foreign currency since it is one of the most important themes of the Philippines economy.

(2) Pure current value, benefit/cost ratio and internal rate of return were used as indices for evaluating this project.

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{(1 + r)^t}$$

$$B/C = \sum_{t=1}^{n} \frac{B_t}{(1 + r)^t} \Big/ \sum_{t=1}^{n} \frac{C_t}{(1 + r)^t}$$

$$\sum_{t=1}^{n} \frac{B_t - C_t}{(1 + i)^t} = 0 \quad —$$

NPV : Pure current value

B/C : Benefit/cost ratio

B_t : Benefits of 7th year

C_t : Costs of 7th year

r : Discount rate

i : Internal rate of return

(3) Benefits and costs were calculated with the maximum possible quantitative expression without overlapping with the previously discussed benefits. The costs for improvement of related infrastructure (access road, transmission line, telephones etc. See 4-3-2.) were considered as sunk cost and excluded from the costs of this project since they must be improved by the Government in the future regardless of this project (Especially, an access road will probably be used for public service.) The income from sight-seeing and lodging expenses of crew and supervisors etc. is excluded from the benefits of this project since it is small.

Benefits = Ship repairing sales + tank cleaning sales - cost (foreign currency to flow out)

Costs = Initial investment + reinvestment - residual value

(4) Benefits and costs were calculated with the following assumptions.

(a) Concerning the foreign currencies included in benefits and casts, the figures were multiplied by 1.2 (shadow foreign exchange rate coefficient) because of the difference between the official rate and the actual rate of peso.

(b) Concerning the labor expense of unskilled workers, 50% of the market price was used as shadow price.

(c) Of the investment, 10% of the costs for locally purchased materials and the wages for skilled workers becomes commodity tax and income tax. It was subtracted as transfer payment.

(d) Tank cleaning sales was assumed to consist of slop discharging, sludge discharging, labor expense and tugboat expence etc. The following unit prices were assumed.

	Unit price of sales (as of 1975)	
VLCC	40	thousand dollars/ship
Large ship	26	"
Medium-sized ship	20	"
Small ship	15	"

(e) The result of chapter 6, namely, 7.5% annual increase of sales and expenses, was assumed for the benefit and cost calculation.

6-2-2 Results

The calculation results are given in Table 6-1 ~ Table 6-3. They are summarized below.

	Discount rate		
	15 %	20 %	25 %
NPV	65.0 M$	19.93 M$	-1.58 M$
B/C	2.17	1.39	0.97
IRR	24.6 %		

Table 6-1

1. Investment

(Unit: Million Yen)

Year		Initial Investment					Sub-Total	Re-Investment					Sub-Total	Grand Total
		$ Portion		₱ Portion				$ Portion		₱ Portion				
		Equipment	Shadow Price	Materials	Skilled Labor	Un-skilled Labor		Equipment	Shadow Price	Materials	Skilled Labor	Un-skilled Labor		
1977	1	5.52	6.62	3.83	1.20	0.42	12.07							12.07
78	2	14.97	17.96	7.16	2.24	0.78	28.14							28.14
79	3	15.79	18.96	6.23	1.95	0.68	27.81							27.81
1980	4	5.08	6.10	2.27	0.71	0.25	9.33	0.03	0.04	0.01	0.04	0.01	0.10	9.43
81	5							0.05	0.06	0.02	0.05	0.01	0.14	0.14
82	6							0.07	0.08	0.03	0.08	0.01	0.20	0.20
83	7							0.09	0.11	0.04	0.11	0.02	0.28	0.28
84	8							0.10	0.12	0.04	0.11	0.02	0.29	0.29
85	9							0.11	0.13	0.04	0.12	0.02	0.31	0.31
86	10							0.12	0.14	0.04	0.13	0.02	0.33	0.33
87	11							0.13	0.16	0.05	0.14	0.03	0.38	0.38
88	12							0.14	0.17	0.05	0.15	0.03	0.40	0.40
89	13							0.14	0.17	0.05	0.16	0.03	0.41	0.41
1990	14							0.15	0.18	0.06	0.17	0.03	0.44	0.44
91	15							0.17	0.20	0.06	0.19	0.03	0.48	0.48
92	16							0.18	0.22	0.07	0.20	0.04	0.53	0.53
93	17							0.19	0.23	0.07	0.21	0.04	0.55	0.55
94	18							0.21	0.25	0.08	0.23	0.04	0.60	0.60
95	19							0.22	0.26	0.08	0.25	0.05	0.64	0.64
96	20							0.24	0.29	0.09	0.27	0.05	0.70	0.70
97	21							0.26	0.31	0.10	0.29	0.05	0.75	0.75
98	22							0.28	0.34	0.10	0.31	0.06	0.81	0.81
99	23							0.30	0.36	0.11	0.33	0 6	0.86	0.86
2000	24							0.32	0.38	0.12	0.36	0	0.93	0.93
01	25			(32.28)			(32.28)	0.34	0.41	0.13	0.38		0.99	(31.29)
Total		41.36	48,63	19.49	6.10	2.03	45.07	3.84	4.61	1.44	4.28	0.79	11.12	56.19
				(32.28)										
%				63.9%	22.2%	13.9 x 0.5		35%		13%	39%	13% x 0.5		
Taxes & Customs excluded		0%		0%	10%	0%		10%		10%	10%	0%		

2. Benefit

Table 6-2

(Unit: Million Yen)

Year	$ In-flow			Total	Shadow Price	$ Out-flow							Total	Shadow Price	Scrap Value	Benefit
	Sales	Indirect Tank Cleaning	Sales Sight Seeing etc.			Japanese Labor Cost C & M	Japanese Labor Cost Worker	Materials	Training expenses	Training Fee	Technical Assist. Fea	Sales Commission				
1977 1						0.02	0.02						0.04	0.05		△0.05
78 2						0.08	0.05	(80%)	0.05	0.10			0.28	0.34		△0.34
79 3	1.57	0.02		1.59	1.91	0.18	0.21	0.24	0.11	0.21	0.04	0.05	1.04	1.25		0.66
1980 4	6.99	0.61		7.60	9.12	0.27	0.38	1.06	0.06	0.11	0.14	0.19	2.21	2.66		6.46
81 5	11.90	0.86		12.76	15.31	0.24	0.27	1.48			0.20	0.26	2.45	2.94		12.37
82 6	15.78	1.12		16.90	20.28	0.20	0.14	1.92			0.26	0.34	2.86	3.43		16.85
83 7	18.40	1.24		19.64	23.57	0.15	0.10	2.14			0.29	0.38	3.06	3.67		19.90
84 8	20.57	1.39		21.96	26.35	0.16	0.11	(70%) 2.09			0.32	0.43	3.11	3.73		22.62
85 9	23.22	1.57		24.79	29.75	0.17	0.12	2.37			0.36	0.48	3.50	4.20		25.55
86 10	25.68	1.72		27.40	32.88	0.19	0.13	2.59			0.40	0.53	3.84	4.61		28.27
87 11	27.86	1.86		29.72	35.66	0.20	0.14	2.81			0.43	0.57	4.15	4.98		30.68
88 12	30.65	2.06		32.71	39.25	0.22	0.15	3.11			0.48	0.63	4.59	5.51		33.74
89 13	33.61	2.25		35.86	43.03	0.23	0.16	(50%) 2.42			0.52	0.69	4.02	4.82		38.21
1990 14	36.76	2.46		39.22	47.06	0.25	0.17	2.66			0.57	0.76	4.41	5.29		41.77
91 15	40.56	2.73		43.29	51.95	0.27	0.18	2.94			0.63	0.84	4.86	5.83		46.12
92 16	44.57	2.99		47.56	57.07	0.29	0.20	3.22			0.68	0.92	5.31	6.37		50.70
93 17	49.12	3.30		52.42	62.90	0.31	0.21	3.56			0.76	1.02	5.86	7.03		55.87
94 18	53.30	3.55		56.85	68.22	0.34	0.23	3.82			0.82	1.09	6.30	7.56		60.66
95 19	58.18	3.91		62.09	74.51	0.36	0.25	4.21			0.91	1.20	6.93	8.32		66.19
96 20	63.02	4.20		67.22	80.66	0.39	0.26	4.52			0.97	1.29	7.43	8.92		71.74
97 21	67.75	4.52		72.27	86.72	0.42	0.29	4.86			1.05	1.39	8.01	9.61		77.11
98 22	72.83	4.85		77.68	93.22	0.45	0.31	5.23			1.13	1.50	8.62	10.34		82.88
99 23	78.29	5.22		83.51	100.21	0.48	0.33	5.62			1.21	1.61	9.25	11.10		89.11
2000 24	84.16	5.61		89.77	107.72	0.52	0.35	6.04			1.30	1.73	9.94	11.93		95.79
01 25	90.48 *32.46	6.03		128.97	154.76	0.56	0.38	6.50			1.40	1.86	10.70	12.84		141.92
Total	987.71	64.07		1,051.78	1,262.11	6.95	5.14	75.41	0.22	0.42	14.87	19.76	122.77	147.33	1,114.78	
$ Portion %	100%	100%				30%	30%	80% - 50%	100%	100%	100%	100%				
Taxes & Customs Excluded	0%	0%				0%	0%	20%	0%	0%	0%	0%				

Table 6-3

3. Profit Net Present Value (Unit: Million Yen)

Year		Undiscounted		N.P.V. at 15%		N.P.V. at 20%		N.P.V. at 25%	
		Investment	Benefit	Investment	Benefit	Investment	Benefit	Investment	Benefit
1977	1	12.07	(0.05)	10.50	(0.04)	10.06	(0.04)	9.66	(0.04)
78	2	28.14	(0.34)	21.28	(0.26)	19.54	(0.24)	18.01	(0.22)
79	3	27.81	0.66	18.29	0.43	16.09	0.38	14.24	0.34
1980	4	9.43	6.46	5.39	3.69	4.55	3.12	3.86	2.65
81	5	0.14	12.37	0.07	6.15	0.06	4.97	0.05	4.05
82	6	0.20	16.85	0.09	7.28	0.07	5.64	0.05	4.42
83	7	0.28	19.90	0.11	7.48	0.08	5.55	0.06	4.17
84	8	0.29	22.62	0.09	7.39	0.07	5.26	0.05	3.80
85	9	0.31	25.55	0.09	7.26	0.06	4.95	0.04	3.43
86	10	0.33	28.27	0.08	6.99	0.05	4.57	0.04	3.04
87	11	0.38	30.68	0.08	6.59	0.05	4.13	0.03	2.64
88	12	0.40	33.74	0.07	6.31	0.04	3.78	0.03	2.32
89	13	0.41	38.21	0.07	6.21	0.04	3.57	0.02	2.10
1990	14	0.44	41.77	0.06	5.90	0.03	3.25	0.02	1.84
91	15	0.48	46.12	0.06	5.67	0.03	2.99	0.02	1.62
92	16	0.53	50.70	0.06	5.42	0.03	2.74	0.01	1.43
93	17	0.55	55.87	0.05	5.19	0.02	2.52	0.01	1.26
94	18	0.60	60.66	0.05	4.90	0.02	2.28	0.01	1.09
95	19	0.64	66.19	0.04	4.65	0.02	2.07	0.01	0.95
96	20	0.70	71.74	0.04	4.38	0.02	1.87	0.01	0.83
97	21	0.75	77.11	0.04	4.10	0.02	1.68	0.01	0.71
98	22	0.81	82.88	0.04	3.83	0.01	1.50	0.01	0.61
99	23	0.86	89.11	0.03	3.58	0.01	1.35	0.01	0.53
2000	24	0.93	95.79	0.03	3.35	0.01	1.20	0.00	0.45
01	25	(31.29)	141.92	(0.95)	4.31	(0.33)	1.49	(0.12)	0.54
Total		56.19	1,114.78	55.76	1120.76	50.65	70.58	46.14	44.56
Profit N.P.V.		1,058.59		65.00		19.93		(1.58)	

Internal Rate of Return = 24.6%

6-3 Assessment

6-3-1 Method and Criteria of Assessment

Pure current value, benefit/cost ratio and internal rate of return were used for assessment. The major emphasis was laid on pure current value and benefit/cost ratio to study the soundness of this project for national economy. The internal rate of return will also be studied for comparison with other projects (especially from the view point of the Philippine Government.)

The following criteria will be used for assessment.

	Criteria
NPV	· A project is acceptable if NPV is positive after discount of capital opportunity cost
B/C	· A project is acceptable if B/C exceeds 1 after discount of capital opportunity cost.
IRR	· A project is acceptable if IRR exceeds capital opportunity cost though IRR is used mainly for comparison with other projects.

Strictly speaking, capital opportunity cost should be social opportunity cost indicating social critical productivity of capital in the case of economic analysis. Since this is difficult to estimate, 15% is assumed as discount rate in consideration of the interest rate of public bonds in the Philippines (Short-term securities 10 - 14%, effective rate 16 - 18%).

(According to the economists at the World Bank, capital opportunity cost is 8 - 15% in most of the developing countries.)

6-3-2 Assessment

(1) Pure current value

The pure current value after capital opportunity cost discount (interest rate = 15%) is 65.0 million dollars. Therefore, this project in acceptable.

(2) Benefit/cost ratio

The benefit/cost ratio after capital opportunity cost (interest rate = 15%) is 2.17. Since it exceeds 1, this project is acceptable.

(3) Internal rate of return

The economic rate of return of this project is 24.6%. Since it is higher than the assumed social opportunity cost (discount rate = 15%), this project is acceptable from this standpoint also.

It is said that the National Economic & Development Authority of the Philippines has the social discount rate of 15% as their own guide line. Since the ERR of this project far exceeds the NEDA's guide line. Therefore, this project will have considerably high priority in the Philippines.

Attached Materials

(1) LIST OF SCHOOLS THAT OFFER BSMT, ANS & AME

ASSOCIATE IN NAUTICAL SCIENCE

	Graduates
Concord Technical Institute	115
Central Technical Institute	22
University of Visayas	46
Feati University	615
Philippine Maritime Institute	1,155
Iloilo Maritime Academy	1,679
Philippine Merchant Marine School	498
Cebu Central Colleges	772
Misamis Technical Institute	-
	4,902

ASSOCIATE IN MARINE ENGINEERING

University of Visayas	-
Western Technological Institute	345
Misamis Technical Institute	-
Feati University	209
Iloilo Maritime Academy	1,301
Namei Polytechnic Institute	51
Cebu Central Colleges	560
Philippine Maritime Institute	390
Cebu Institute of Technology	20
	2,876

Bachelor of Science in Marine Transportation

Philippine Merchant Marine Academy	187
Philippine Merchant Marine School	NA
Cebu Central Colleges	NA
Iloilo Maritime Academy	NA
Concord Technical Institute	NA
University of Visayas	NA
	187

graduates

NAME OF SCHOOLS	'74-75	'73-74	'72-73	'71-72	'70-71	TOTAL
PHIL. MERCHANT MARINE ACA Location: Fort Bonifacio, Rizal						
a) Marine Transportation	52	18	35	42	40	187
PHIL. MERCHANT MARINE SCH Location: Raon Street Quiapo, Manila						
a) Nautical Science	72	218	102	51	55	498
b) Marine Transportation	-	-	-	-	-	-
CEBU CENTRAL COLLEGE Location: Cebu City						
a) Nautical Science	50	242	200	180	100	772
b) Marine Engineering	150	120	100	180	30	580
c) Marine Transportation	-	-	-	-	-	-
WESTERN INSTITUTE OF TECH Location: La Paz, Iloilo City						
a) Marine Engineering	152	117	20	39	17	345
PHIL. MAR TIME INSTITUTE Location: David Street Escolta, Manila						
a) Nautical Science		200	157	418	380	1155
b) Marine Engineering		71	34	151	134	390
ILOILO MARITIME ACADEMY Location: Iloilo City						
a) Associate in Nautical Science	20	472	467	471	249	1679
b) Associate in Marine Engineering	450	359	172	198	122	1301
c) Bachelor of Science in Marine Transportation	-	-	-	-	-	-

graduates

NAME OF SCHOOLS	'74-75	'73-74	'72-73	'71-72	'70-71	TOTAL
FEATI UNIVERSITY Location: Helios Street Sta. Cruz, Manila						
a) Bachelor of Science in Marine Transportation	-	-	-	-	-	-
b) Associate in Nautical Science	-	198	131	87	90	615
c) Associate In Marine Engineering	-	63	60	47	39	209
CEBU INSTITUTE OF TECH, Location: Rizal Avenue Cebu City						
a) Associate in Marine Engineering	-	4	6	5	5	20
MISAMIS TECHNICAL INSTITUTE Location: Banadero, Ozamiz City						
a) Associate in Marine Engineering	-	-	-	-	-	-
b) Associate in Nautical Science	-	-	-	-	-	-
CONCORD TECHNICAL INSTITUTE Location: Espana Street Cebu City						
a) Associate in Nautical Science	-	34	19	38	34	115
b) Associate in Marine Transportation	-	-	-	-	-	-
CENTRAL TECHNICAL INSTITUTE Location: Masbate, Masbate						
a) Associate in Nautical Science	7	3	3	3	6	22

graduates

NAME OF SCHOOLS	'74-75	'73-74	'72-73	'71-72	'70-71	TOTAL
UNIVERSITY OF VISAYAS Location: Cebu City						
a) Associate in Nautical Science	-	46	-	-	-	46
b) Associate in Marine Engineering	-	-	-	-	-	-
c) Bachelor of Science in Marine Transportation	-	-	-	-	-	-
NAMEI POLYTECHNIC INSTITUTE Location: 123 A. Mabini Mandaluyong, Rizal						
a) Associate in Marine Engineering	20	10	10	4	7	51
b) Bachelor of Science in Naval Architecture	9	9	9	7	6	40

(2) PRESIDENTIAL DECREE NO. 666

PROVIDING FOR INCENTIVES TO THE SHIPBUILDING AND SHIP REPAIR INDUSTRY

WHEREAS, shipping plays a vital role in the economic development and growth of the country;

WHEREAS, the promotion and maintenance of an adequate Philippine merchant fleet depend upon the adequacy of supporting shipbuilding and ship repair facilities;

WHEREAS, the absence of adequate investment incentives had deterred the expansion and modernization of existing shipyards and/or the development of new shipyard facilities;

WHEREAS, to accelerate the development of shipbuilding and ship repair industry such incentives are imperative and necessary;

NOW, THEREFORE, I, FERDINAND E. MARCOS, President of the Philippines, by virtue of the powers in me vested by the Constitution, do hereby order and decree as follows:

SECTION 1. Shipbuilding and ship repair yards duly registered with the Maritime Industry Authority shall be entitled to the following incentive benefits:

a) Exemption from import duties and taxes. The importation of machinery, equipment and materials for shipbuilding, ship repair and/or alteration, including indirect import, as well as replacement and spare parts for the repair and overhaul of vessels such as steel plates, electrical machinery and electronics parts, shall be exempt from the payment of customs duty and compensating tax; Provided, however, That the Maritime Industry Authority certifies that the item or items imported are not produced locally in sufficient quantity and acceptable quality at reasonable prices, and that the importation is directly and actually needed and will be used exclusively for the construction, repair, alteration, or overhaul of merchant vessels and other watercrafts; Provided, further, That if the above machinery, equipment, materials and spare parts are sold to non-tax exempt persons or entities, the corresponding duties and taxes shall be paid by the original importer; Provided, finally, That local dealers and/or agents who sell machinery, equipment, materials and accessories to shipyards for shipbuilding and ship repair are entitled to tax credits, subject to approval by the Maritime Industry Authority, equivalent to the total

tariff duties and compensating taxes paid for said machinery, equipment, materials and accessories.

b) Accelerated depreciation. Industrial plant and equipment may, at the option of the shipbuilder and ship repairer, be depreciated for any number of years between five years and the expected economic life.

c) Exemption from contractor's percentage tax. The gross receipts derived by shipbuilders and ship repairers from shipbuilding and ship repairing activities shall be exempt from the Contractor's Tax provided in Section 91 of the National Internal Revenue Code during the first ten years from registration with the Maritime Industry Authority, provided that such registration is effected not later than the year 1990; Provided, That any and all amounts which would otherwise have been paid as contractor's tax shall be set aside as a separate fund, to be known as "Shipyard Development Fund", by the contractor for the purpose of expansion, modernization and/or improvement of the contractor's own shipbuilding or ship repairing facilities; Provided, That, for this purpose, the contractor shall submit an annual statement of its receipts to the Maritime Industry Authority; and Provided, further, That any disbursements from such fund for any of the purposes hereinabove stated shall be subject to approval by the Maritime Industry Authority.

d) Registration required but not as Public Utility. The business of constructing and repairing vessels or parts thereof shall not be considered a public utility and no Certificate of Public Convenience shall be required therefor. However, no shipyard, graving dock, marine railway or marine repair shop and no person or enterprise shall engage in the construction and/or repair of any vessel, or any phase or part thereof, without a valid Certificate of Registration and license for this purpose from the Maritime Industry Authority, except those owned or operated by the Armed Forces of the Philippines or by foreign governments pursuant to a treaty or agreement.

SECTION 2. The Maritime Industry Authority shall, in consultation with the Board of Investments and the Department of Finance, promulgate rules and regulations together with the procedures and guidelines for the proper and efficient implementation of the above provisions.

SECTION 3. Any violation of the tax exemption privileges or incentives provided for in this Decree, as well as the terms and conditions for the grant thereof, shall result in forfeiture of all the tax exemptions and incentives

granted herein and the shipbuilder, ship repairer, contractor or importer shall be subject to two hundred percent of all the taxes affected by the particular violation.

SECTION 4. Any provision of law, decree, executive order, or rules and regulations inconsistent with this Decree is hereby repealed or modified accordingly.

SECTION 5. This Decree shall take effect immediately.

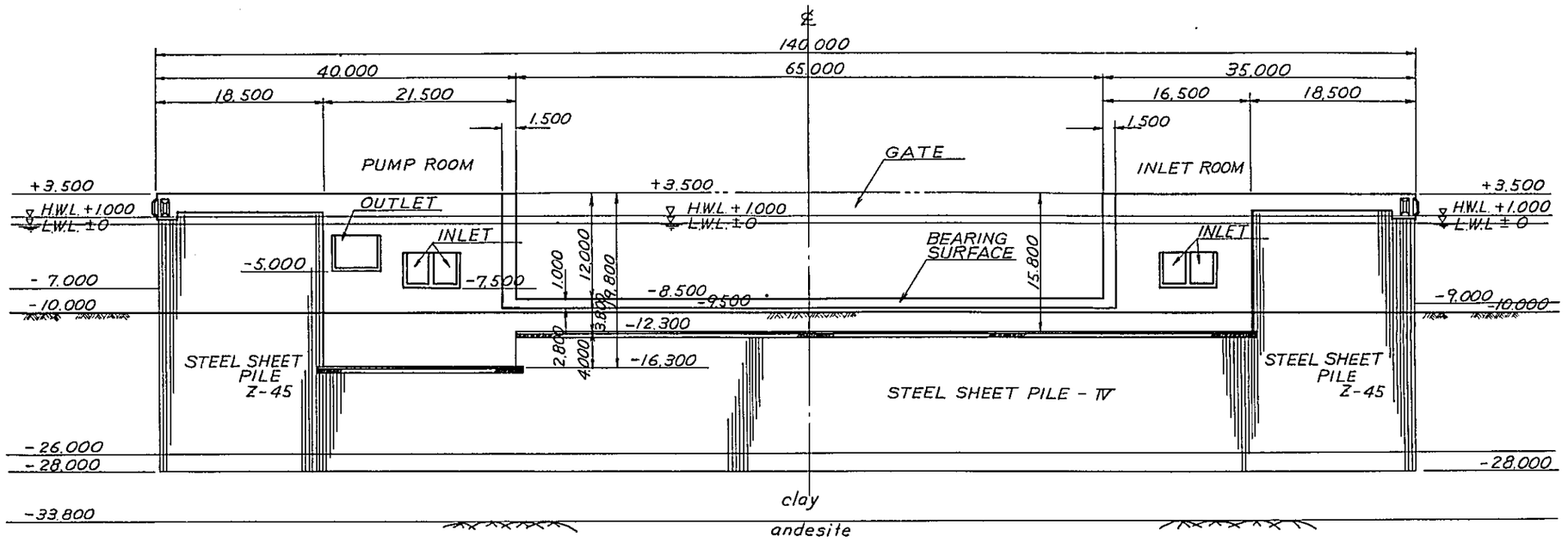
Done in the City of Manila this 5th day of March, in the year of our Lord, nineteen hundred and seventy-five.

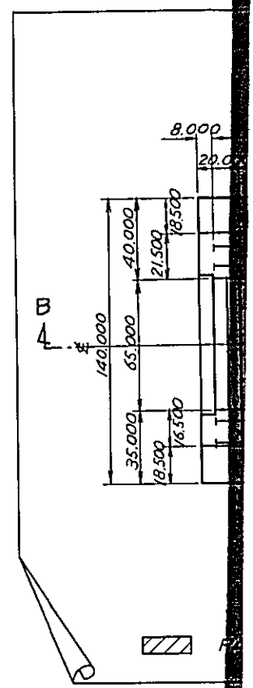
(SGD.) FERDINAND E. MARCOS
President of the Philippines

By the President:

(SGD.) ALEJANDRO MELCHOR
Executive Secretary

FRONT VIEW





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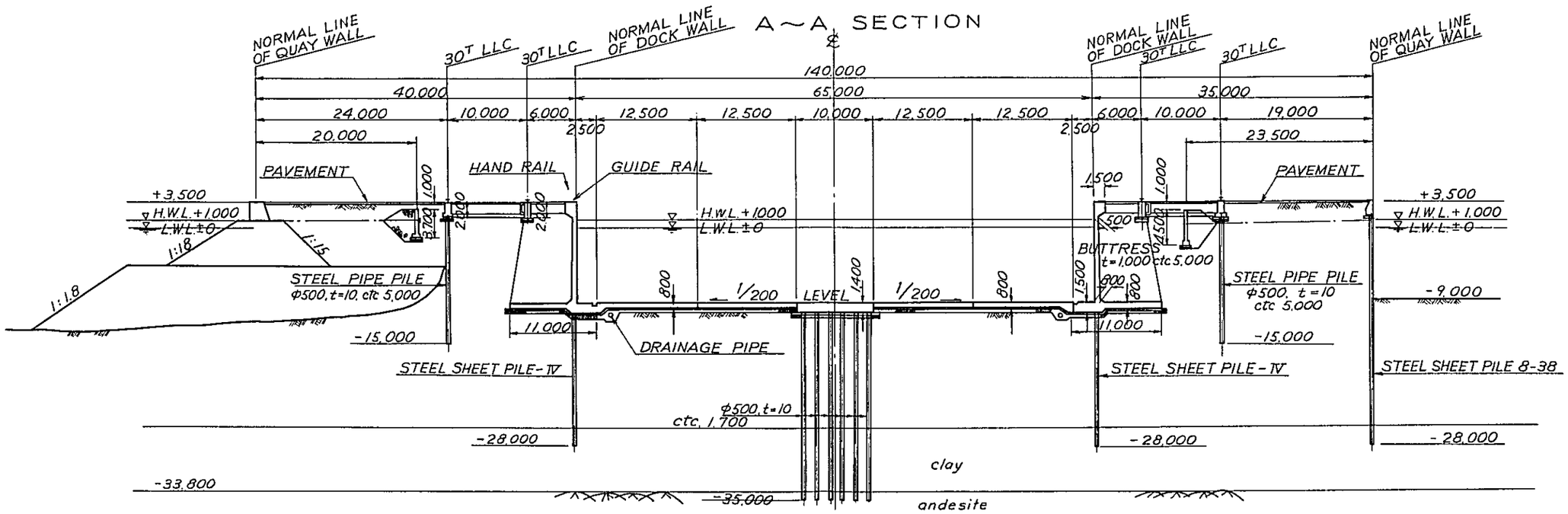

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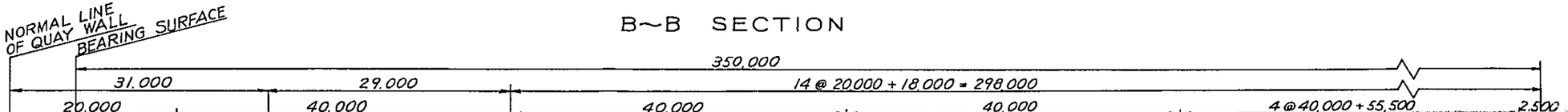
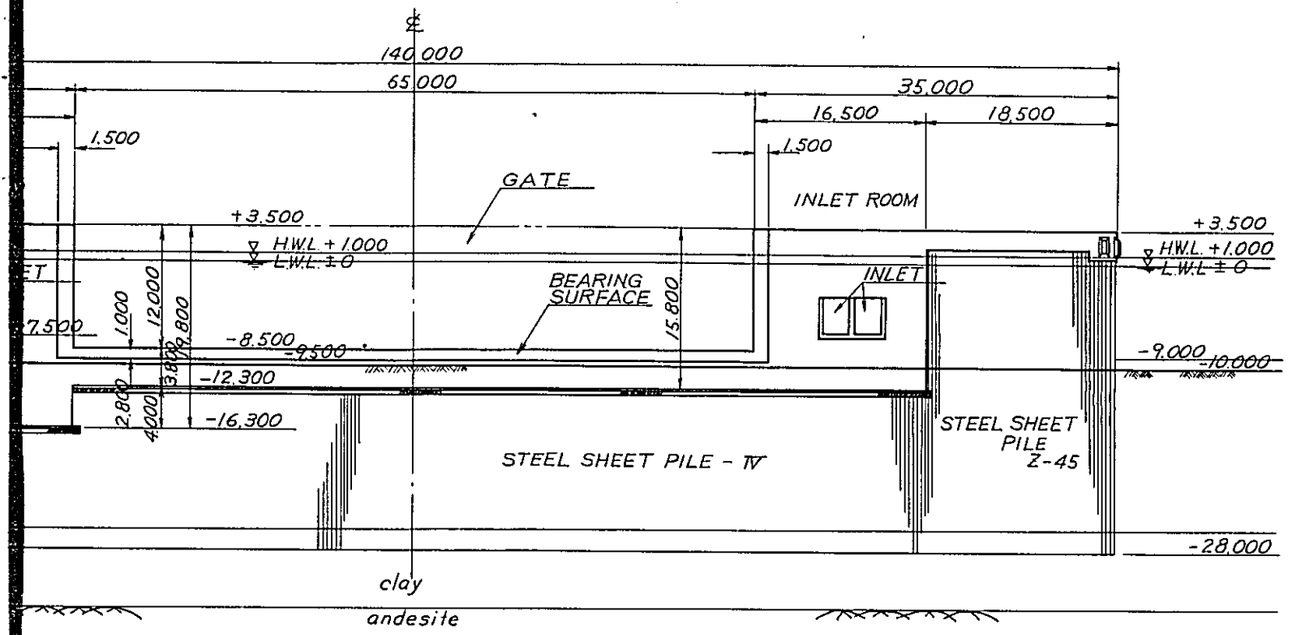
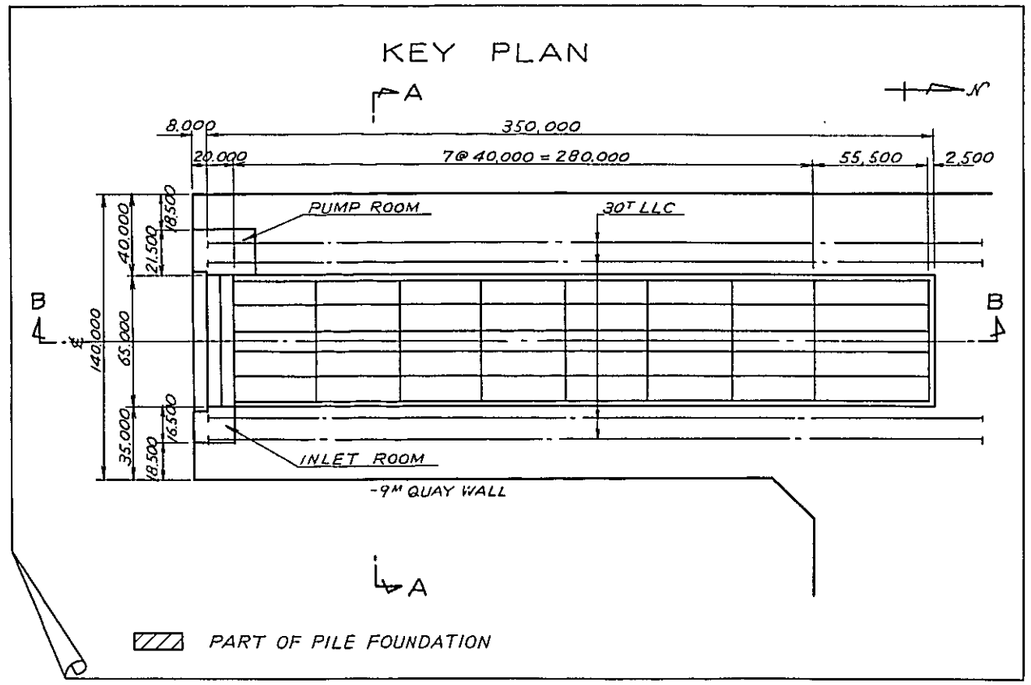


FRONT VIEW



KEY PLAN



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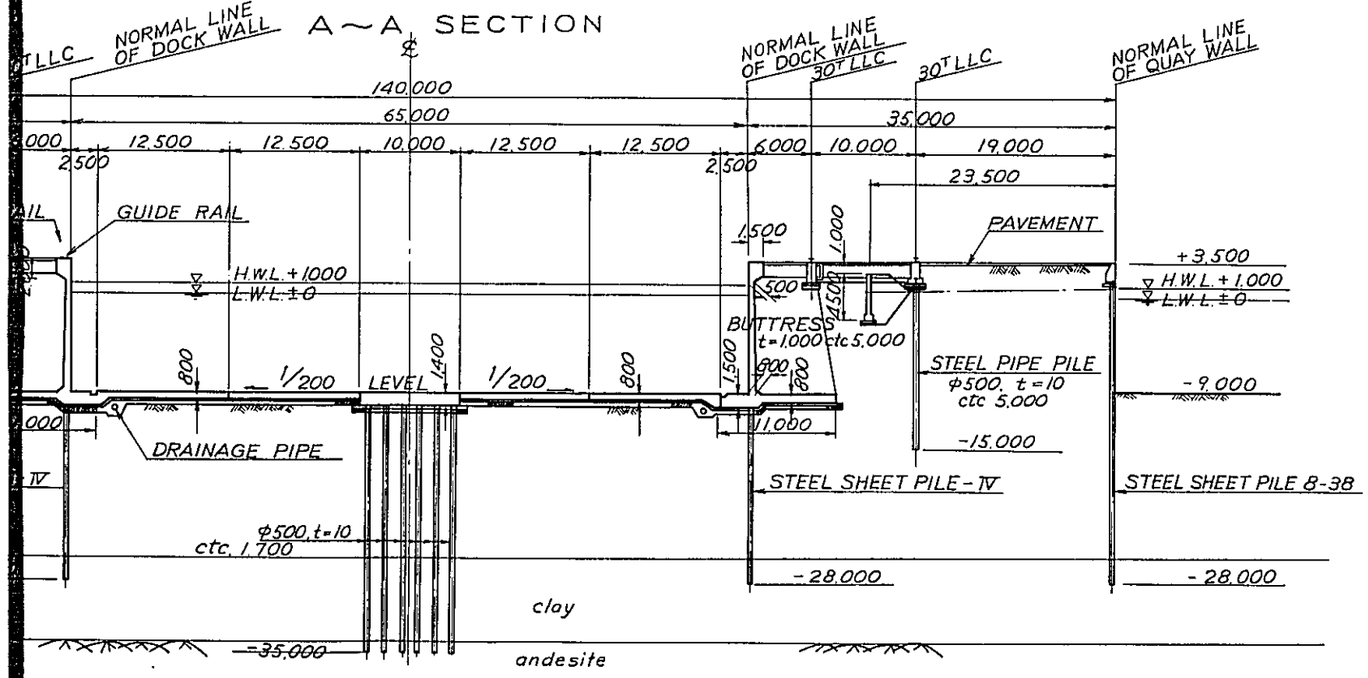

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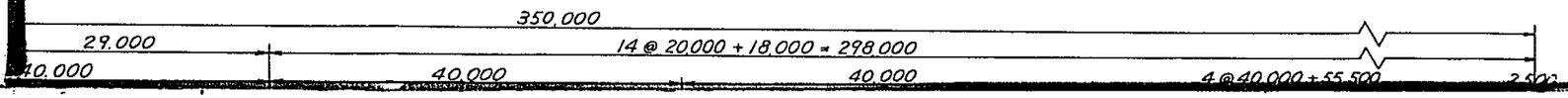
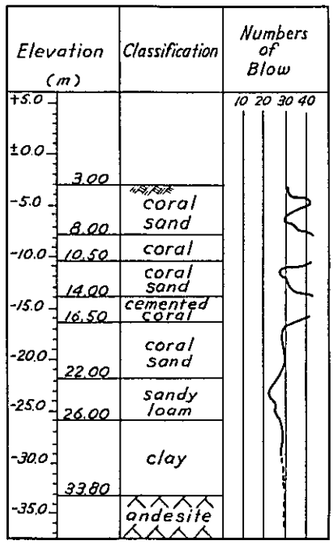
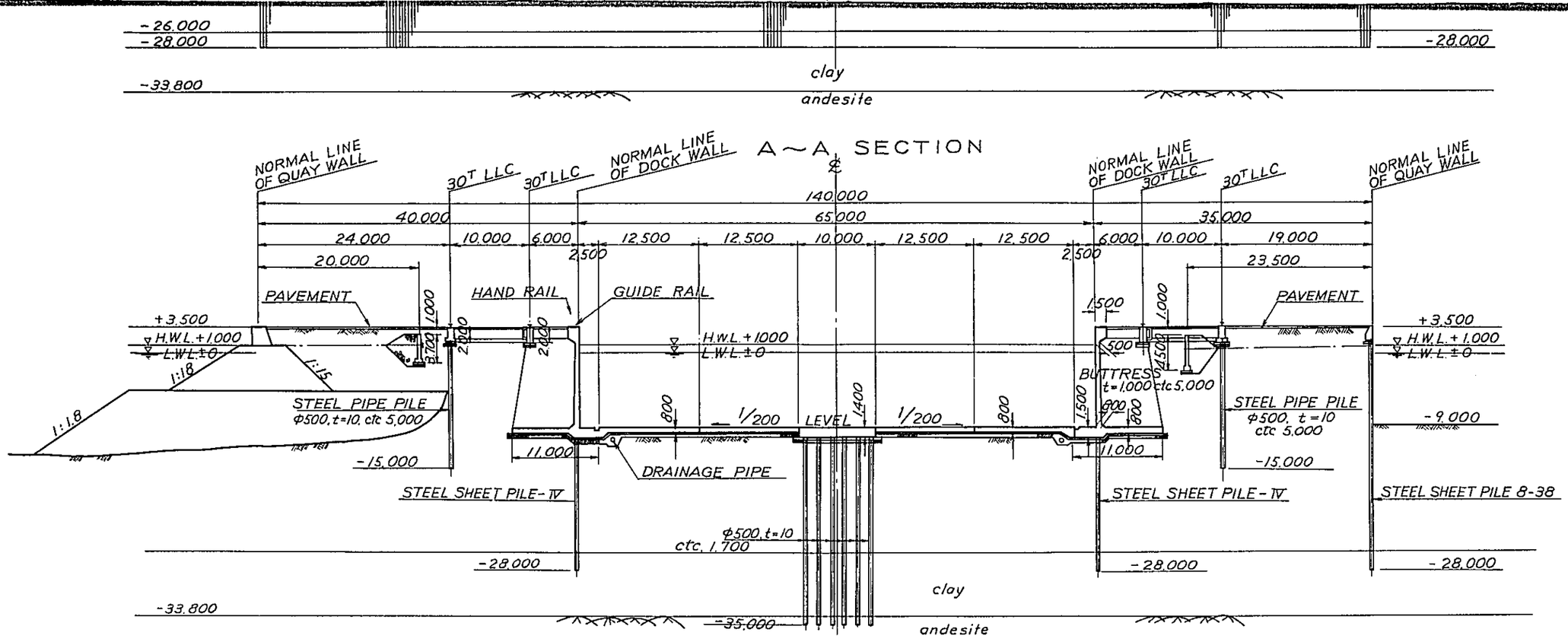
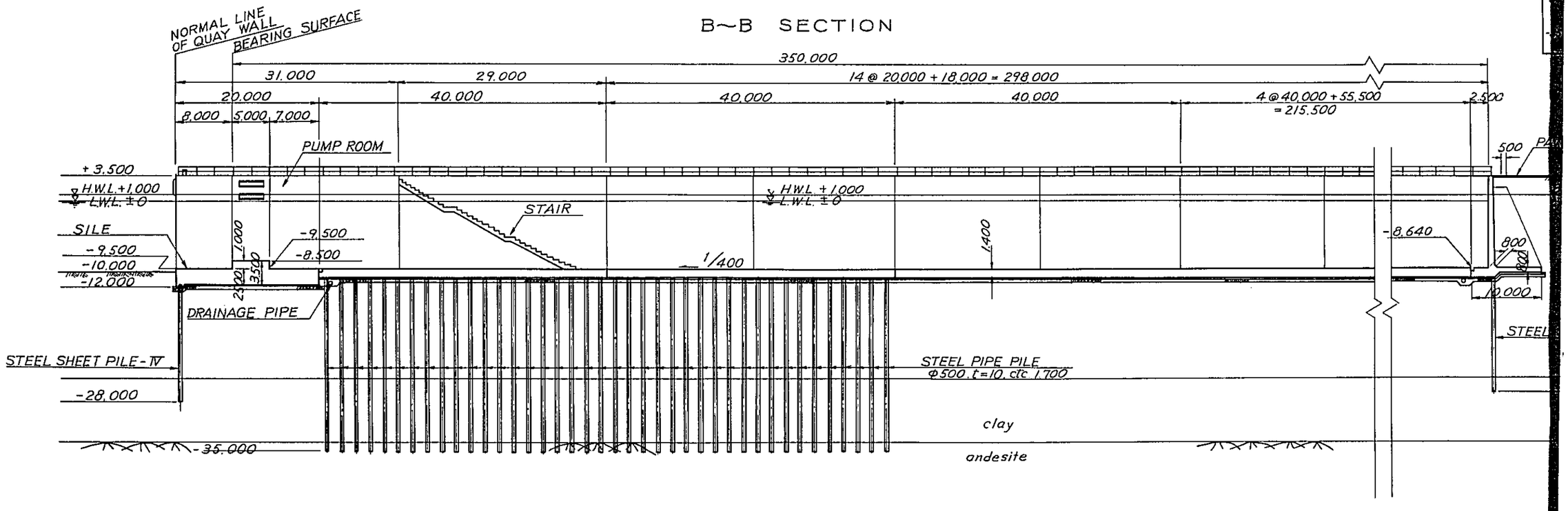


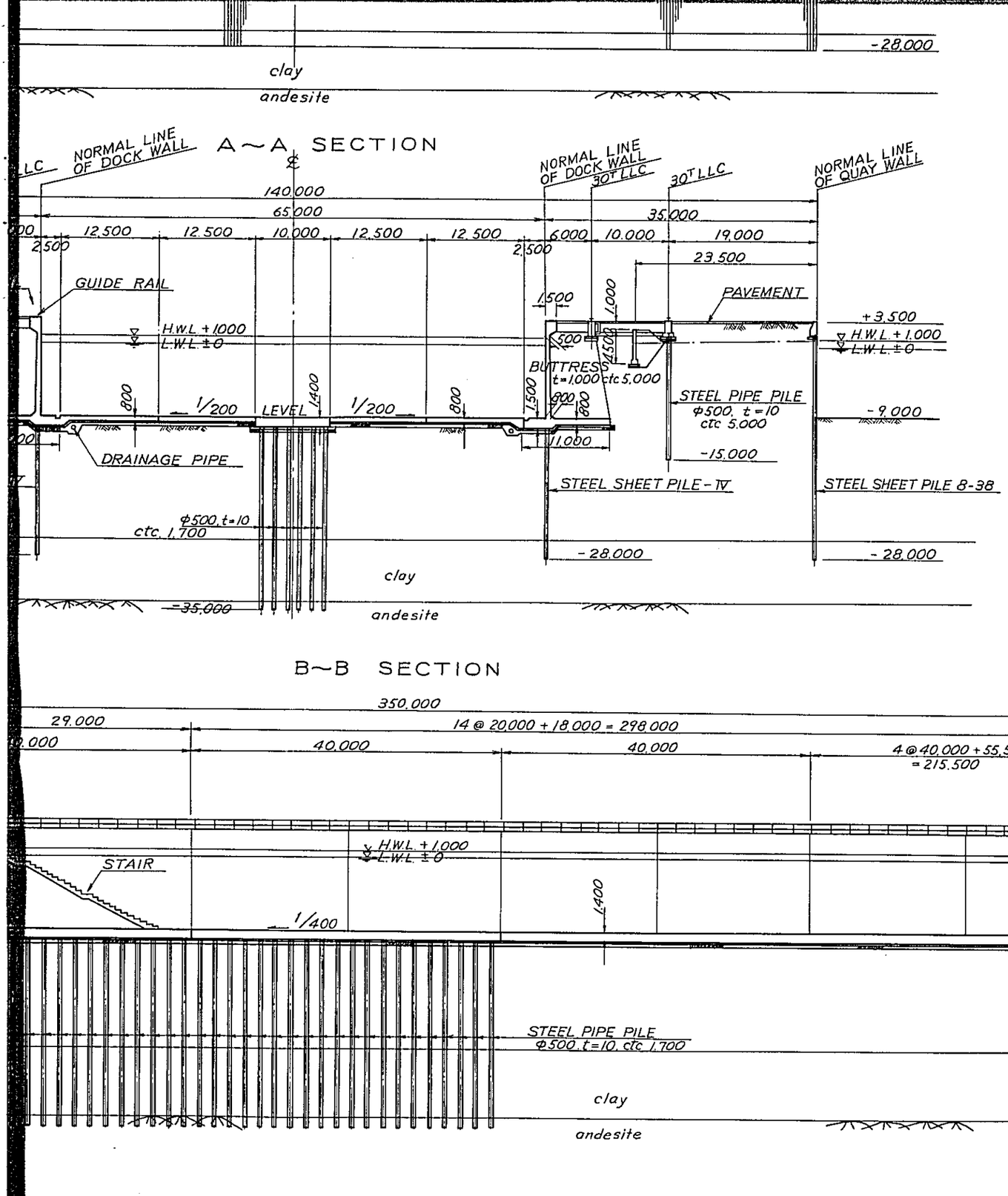
SOIL PROFILE
(B - 2)

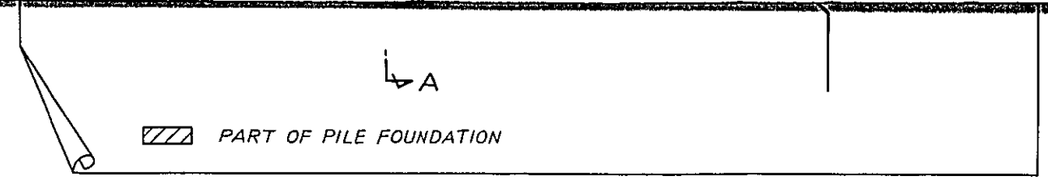


※ WE USED BORING NO. B-2 FOR ALL DOCK SITE.

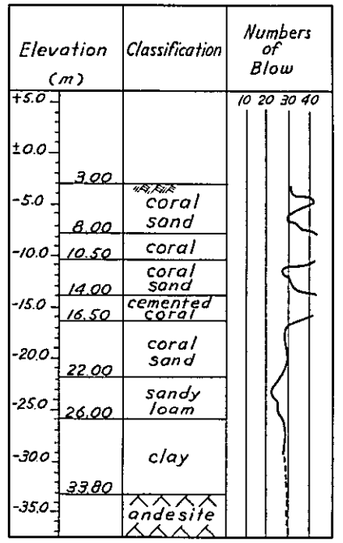

-26.000
-28.000
-33.800
clay
andesite
-28.000
PAR
A~A SECTION
NORMAL LINE OF QUAY WALL
30T LLC
30T LLC
NORMAL LINE OF DOCK WALL
NORMAL LINE OF DOCK WALL
30T LLC
30T LLC
NORMAL LINE OF QUAY WALL
140.000
40.000
65.000
35.000
24.000
10.000
6.000
12.500
12.500
10.000
12.500
12.500
6.000
10.000
19.000
20.000
2.500
2.500
23.500
PAVEMENT
HAND RAIL
GUIDE RAIL
PAVEMENT
+3.500
H.W.L.+1.000
L.W.L.±0
1:1.8
1:1.5
1:1.8
STEEL PIPE PILE
φ500, t=10, ctc 5.000
-15.000
H.W.L +1000
L.W.L ±0
800
1/200
LEVEL
1400
1/200
800
BUTTRES
t=1.000 ctc 5.000
1500
600
800
STEEL PIPE PILE
φ500, t=10
ctc 5.000
-15.000
+3.500
H.W.L.+1.000
L.W.L.±0
-9.000
11.000
DRAINAGE PIPE
11.000
STEEL SHEET PILE-IV
STEEL SHEET PILE-IV
STEEL SHEET PILE 8-38
φ500, t=10
ctc, 1.700
-28.000
-28.000
-28.000
clay
-33.800
-35.000
andesite


B~B SECTION
NORMAL LINE OF QUAY WALL
BEARING SURFACE
350.000
31.000
29.000
14 @ 20.000 + 18.000 = 298.000
20.000
40.000
40.000
40.000
4@40.000+55.500
=215.500
2.500
8.000
5.000
7.000
PUMP ROOM
500
+3.500
H.W.L.+1.000
L.W.L.±0
STAIR
H.W.L.+1.000
L.W.L.±0
SILE
-9.500
-10.000
-12.000
1000
-9.500
-8.500
1400
-8.640
800
1/400
350
2500
10.000
DRAINAGE PIPE
STEEL SHEET PILE-IV
STEEL PIPE PILE
φ500, t=10, ctc 1.700
-28.000
clay
-35.000
andesite



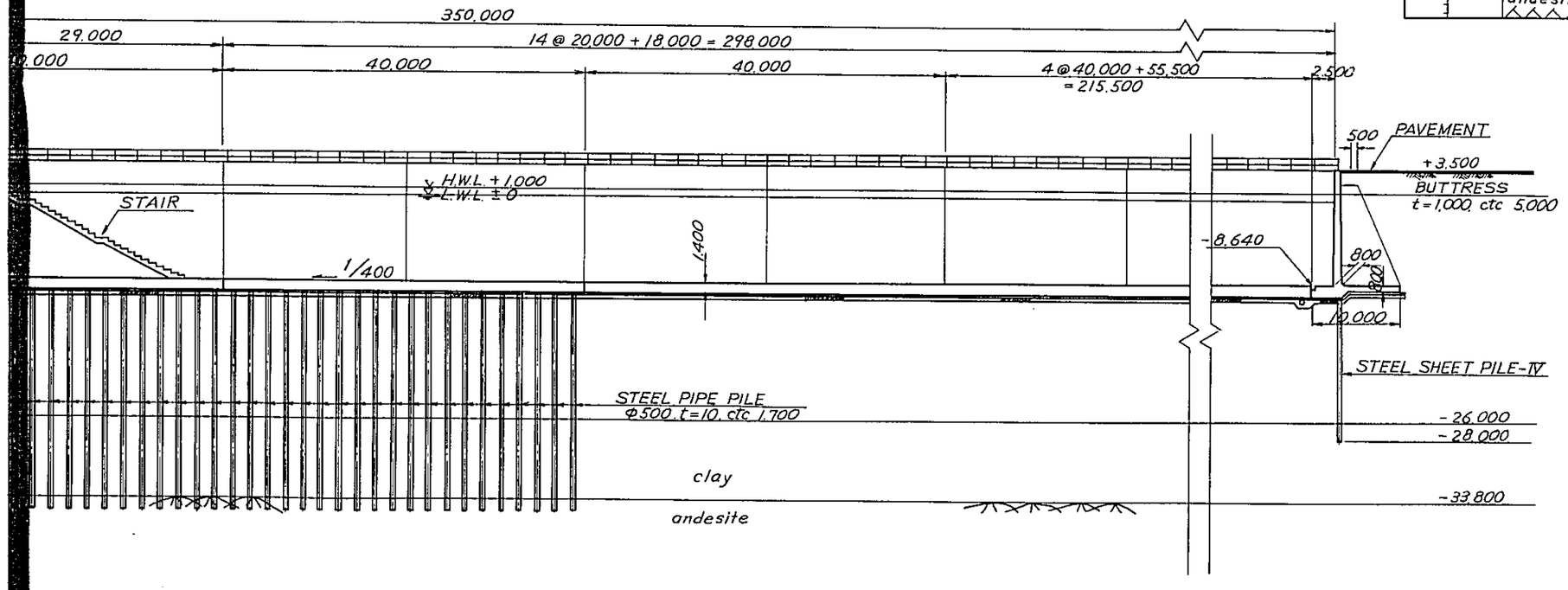


SOIL PROFILE
(B - 2)



※ WE USED BORING NO. B-2 FOR ALL DOCK SITE.

B~B SECTION



SHIP REPAIR YARD PROJECT
IN ZAMBALES, PHILIPPINE

GENERAL DIMENSION OF DOCK

1974. 10. 15

SUBIC SHIP REPAIR YARD

(4) PLAN OF SHIP REPAIR YARD (DRAFT)

OHC : OVERHEAD CRANE