No. 4

BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
THE DEVELOPMENT OF APIA PORT
IN
WESTERN SAMOA

AUGUST 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of the Government of Western Samoa, the Government of Japan has decided to conduct a basic design study on the Project for the Development of Apia Port and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Western Samoa a study team headed by Mr. Masataka Nagano, Supervisory Officer on Environmental Technology, Third Port Construction Bureau, Ministry of Transport, from March 28 through April 24, 1988.

The team had discussions on the Project with the officials concerned of the Government of Western Samoa and conducted a field survey in Apia Port. After the team returned to Japan, further studies were made, a draft report was prepared and a mission to explain and discuss it was dispatched to Western Samoa. As a result, the present report has been prepared.

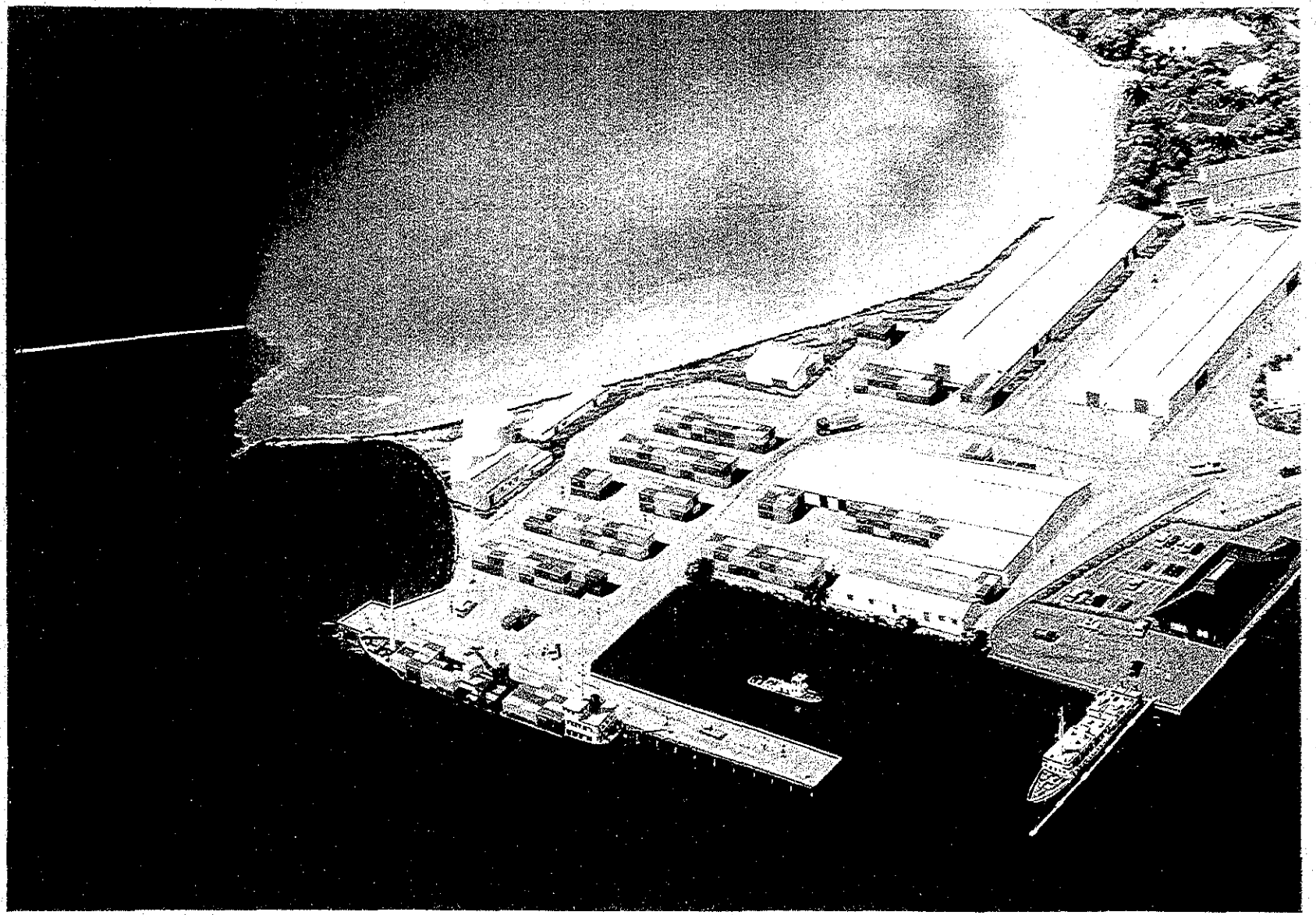
I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of Western Samoa for their close cooperation extended to the team.

August, 1988

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency



JAPANESE GRANT AID:
APIA PORT DEVELOPMENT PROJECT
AUGUST 1988

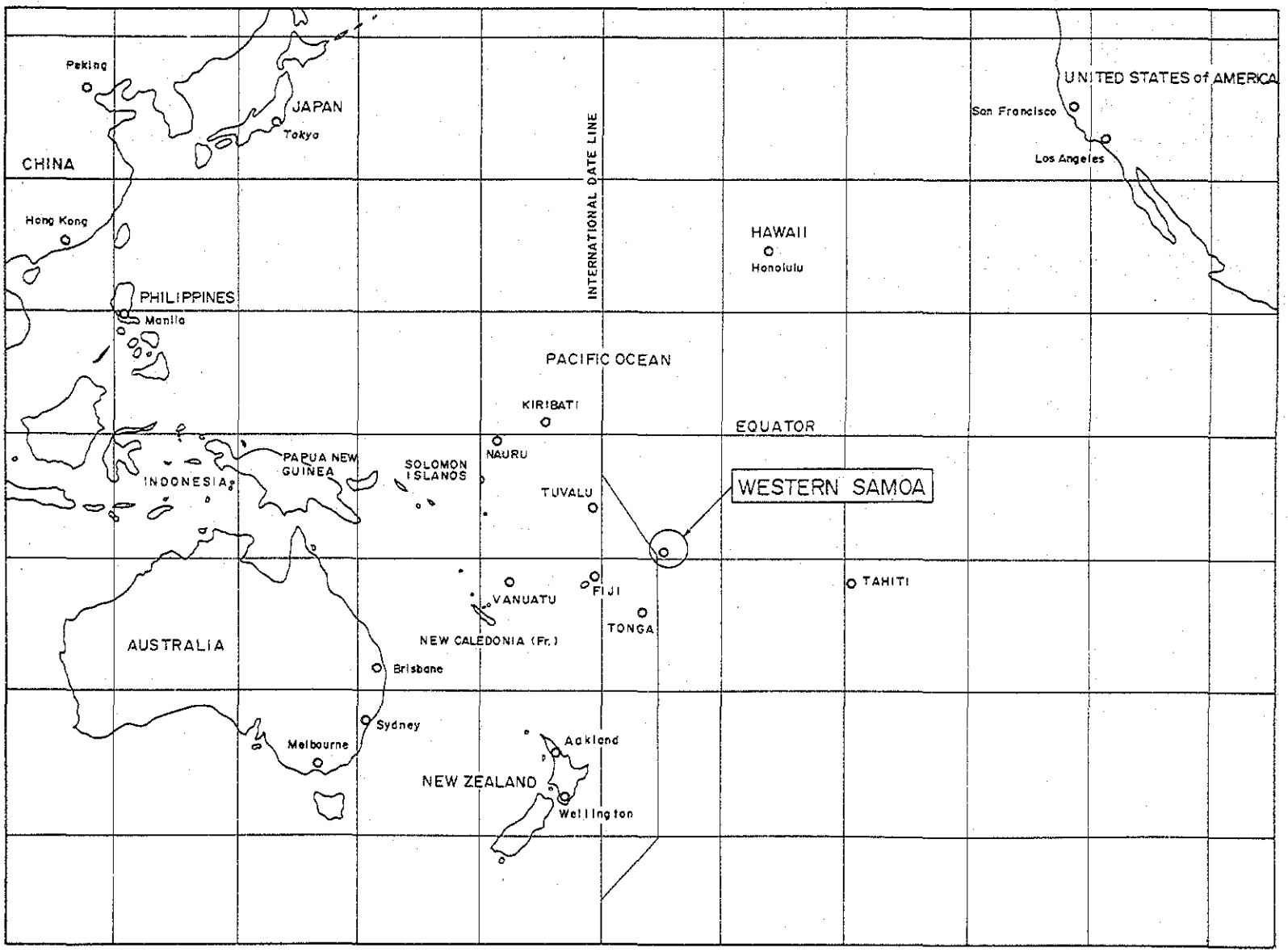


Fig. 1 Location of Western Samoa

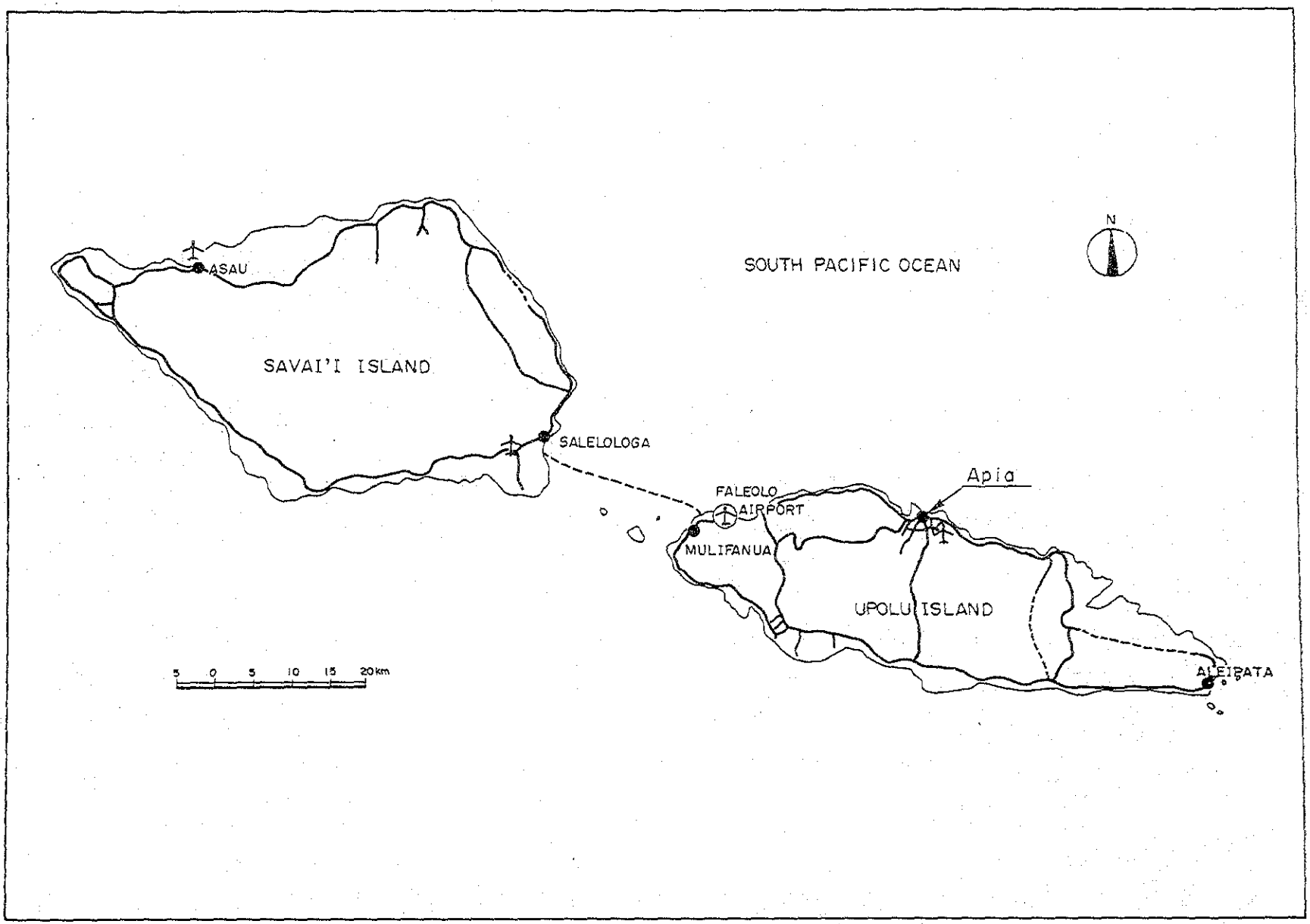


Fig. 2 Upolu Island and Savai's Island

SUMMARY

SUMMARY

Western Samoa is an archipelago located in the mid-South Pacific Ocean having an area of 2,936 sq. km and a population of 160 thousand. The economy of the country and the livelihood of its people are greatly dependent upon port activities due to its particular geographical characteristics.

The Sixth National Development Plan (1988 - 1990) of Western Samoa emphasizes strategically on investment in the manufacturing sector which is expected to yield immediate benefits from investment, as well as investment in primary sectors such as agriculture, forestry and fisheries, thereby promoting exports and bringing about economic growth.

For this purpose, Samoan policy for development of infrastructures focuses on development of land use, air transport and marine transport systems. With regard to marine transport, four particular targets have been highlighted; (1) upgrading of safety and efficiency of domestic and oversea marine transport; (2) development of facilities to improve efficiency in container handling at Apia Port; (3) introduction of efficient port management and operation system; and (4) training of personnel to raise their capabilities vis-a-vis managerial and operational systems and the facilities to be introduced by any project.

Among ports supporting marine transport in Western Samoa, Apia Port is the most significant, handling almost all foreign trade cargo for the nation (approximately 180 thousand tons per year), and is regarded as the very lifeline of the nations' livelihood. The main wharf of Apia Port was constructed as a wharf for general cargo handling purposes in 1966, when it was supplied with an 11-meter depth and 185-meter length for standard port function. However, after more than 20 years, a number of functional problems have arisen in the port facilities due to deterioration of structural members, an outdated mode for cargo handling, and degradation of safety functions. At the same time, serious problems have emerged from a shortage of budget and maintenance personnel, and from a lack of a controlling organization to take responsibility for integrated port management.

Recognizing these problems, the Government of Western Samoa requested the Government of Japan to conduct a comprehensive port development plan study in 1986. The Government of Japan acknowledged this request and undertook a study entitled "The Study on the Development of the Ports in Western Samoa" from January through September, 1987. As the result of this study, a "Master Plan" targeting the year 2005 has been established. Along these lines, regarding Apia Port, a "First Stage Plan" was prepared focusing on the resolution of existing bottlenecks, by for example repairing deteriorated facilities, modifying the layout to aid container handling and restoring the safety provision.

Based on the above background, the Government of Western Samoa requested the Government of Japan for a grant aid for a development project of Apia Port. Accepting this request, the Government of Japan determined to conduct a basic design study for the first stage development plan of the project. The Japan International Cooperation Agency organized a Study Team headed by Mr. Masataka Nagano, Supervisory Officer on Environmental Technology, the Third Port Construction Bureau, Ministry of Transport, Japan, and dispatched them to Western Samoa from March 28 through April 24, 1988. The Study Team discussed the request with the Government of Western Samoa, while conducting field surveys, data collection, and analysis of materials.

Based on the result of discussions with the officials of the Government of Western Samoa concerned, as well as on the assessment of the contents of the request by the government, the Study Team proposed the following program as a basic design for the project, and assessed it to be reasonable for grant aid.

(1) Repair of the Main Wharf : 185 m
(2) Expansion of the Main Wharf : 61.5 m x 18.0 m
(3) Expansion of the Container Yard : 2,000 m^2
(4) Ferryboat Terminal
  Quay Wall : 20 m long
  Dolphin : 50 m long
(5) Ferry Terminal Building : 522 m^2
(6) Breakwater : 100 m long

(7) New tugboat : 1(1600 Horse power, for assistance of large vessel in manoeuvring operations)

(8) Equipment for Management and Maintenance

Computer System : 1 set

Vehicles : 3 units

Length of term for the project is assumed to consist of the two parts below.

Detailed Design, Tender Documentation and Tender Award will take four and half months from the exchange of notes between the Government of Western Samoa and the Government of Japan.

The construction period will cover two fiscal years and require 16.5 months for completion.

In the first fiscal year, that is phase one of the Project, expansion of the main wharf width, repair of the main wharf, and construction of the new tugboat and supply of equipment for management and maintenance will be included as urgent items.
In the second fiscal year, phase two of the project, extension of the container yard and construction of the ferry terminal and breakwater are included.

The executing authority responsible for this project on the Western Samoa side is the Ministry of Transport (MOT), Western Samoa. While this authority implements the Project, a port authority is expected to be newly established for the management and operation of Apia Port as well as covering all other ports. Accordingly, in order that the authority be able to manage Apia Port efficiently and safely after completion of the project, MOT is requested to review the existing port management system and to improve the schemes of port management and cargo service substantially, before commencement of function of the new Port Authority.

On completion of this project, a number of direct effects are expected such as, reduction of demurrage costs, cost saving on cargo handling, and cost saving for consignees due to reduction in their waiting time.

Moreover, a number of indirect benefits are also expected in terms of improved safety in ship operation and in cargo handling, reducing ship accidents and facilitation of cargo handling work, as well as in terms of an increase of employment opportunities during the construction of the facilities, and making contributions to the national economy through stimulating related industries.

In addition to the above, a considerable impact would result, upgrading general technology in Western Samoa through technological transfer accompanied by introduction of new facilities and systems.

In conclusion, this project for the improvement of Apia Port can be justified and assessed as being completely appropriate, being one of the most significant projects to be performed under the Grant Aid Program of Japan.

CONTENTS

Abbreviations

ADB	Asian Development Bank
ADAB	Australian Development Assistance Bureau
DWT	Dead Weight Tonnage
GDP	Gross Domestic Product
GT	Gross Tonnage
LOA	Length Overall
MOT	Ministry of Transport
NZ	New Zealand
OECF	Overseas Economic Cooperation Fund
PFL	Pacific Forum Line
PWD	Public Works Department
Ro-Ro	Roll on Roll off
TEU	Twenty-foot Equivalent Unit
UNDP	United Nations Development Programme
US$	United States Dollar
WSSC	Western Samoa Shipping Corporation
WS$	Western Samoa Dollar (or Tala)
¥	Yen

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CHAPTER 1 INTRODUCTION

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(1) Objectives of survey

Western Samoa is located in the midst of the South Pacific Ocean, at 13-14 degrees south latitude and 171-173 degrees west longitude about 3,700 km south-southwest of Hawaii and 2,900 km north-northeast of Auckland.

The land area totals 2,936 sq. kilometers. Of this, the two major islands, Upolu (1,122 sq. kilometer) and Savaii (1,714 sq. kilometers), comprise 95 percent of the total land area. There are several other small islands.

Because of these geographical features, Western Samoa's economy and national livelihood are both heavily dependent on the activities of its ports and harbours, and development and maintenance of ports are essential to the social and economic growth of the country. Of the five domestic ports, Apia Port, situated in the northeastern part of Apia City, the capital of Western Samoa, assumes the greatest importance, handling virtually all cargo related to foreign trade (about 180,000 tons per year). Its main wharf was built over 20 years ago (in 1966) as a general cargo wharf. While the facilities have suffered from deterioration due to aging, need for modification of the wharf for containerization of cargos has also arisen, and an improvement of safety measures for ships calling at the port has grown in recent years.

Upon the request of the Government of Western Samoa, between January and September in 1987 the Government of Japan conducted a survey and study for a national development plan on the ports and harbours of Western Samoa. The study developed a Master Plan targeting on the year 2005, including a First-Stage Plan for urgent implementation.

On the basis of this proposed plan, the Government of Western Samoa requested for a Japanese grant aid.

The objectives of this basic design study on the request for a port improvement project for Apia consist of the following.

To obtain tangible information on the request from the Government of Western Samoa for grant aid and to grasp its background.

To examine the effects of the project and justify the request for grant aid.

To make a basic engineering design for selected items to be included in the project, optimizing the scope and size of each item.

(2) Dispatch of study mission

In recognition of the background and in response to the request described above, the Japan International Cooperation Agency organized a Basic Design Study Team (Appendix 1) led by Mr. Masataka Nagano, Supervisory Officer on Environmental Technology, the Third Port Construction Bureau, Ministry of Transport, and dispatched them to Western Samoa from March 28 through April 24, 1988.

After returning to Japan, the Study Team prepared a draft final report of the basic design for the grant project. The study mission again made another visit to Western Samoa from June 25 through July 5 to present the draft final report to the Government of Western Samoa.

During their stay in Western Samoa, Minutes of Discussions were exchanged with officials of the Government of Western Samoa (Appendix 2&3).

(3) Study items

While holding discussion meetings with officials of the Government of Western Samoa, the Study Team performed a survey of the following items:

1) Details of the requested project and its background;
2) Priority order of requested items;
3) Survey of the project site;
4) Examination of the present state of port facilities and their utilization;
5) Examination of the present scheme of administration and management in Samoan Ports;
6) Study of natural conditions;
7) Study on local conditions for construction works;
8) Scope of works to be undertaken by the Government of Western Samoa.

After returning to Japan, on the basis of the survey results, the Study Team performed a project study in detail on ; a layout plan, type of construction, investment cost, and management and operation system. Appropriateness of the project was justified by the study. This report presents the results of the project study by the Study Team.

CHAPTER 2 BACKGROUND OF THE PROJECT

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2.1 Outline of Western Samoa

(1) Socioeconomic situation

1) Industry

The GDP in 1985 was WS$ 98.6 million discounted into 1980 value, and the annual growth rate of real GDP during 1981-1985 was about 1.6 percent per annum. Per capita GDP was WS$ 622 in 1985. The main GDP share by industrial sector in 1983 comprised the following sectors:

Agriculture, Forestry and Fishery about 48%.
Public service and service sectors about 36%.
Manufacturing only 8%.

Main agricultural products consist of copra, talo, cocoa and bananas.
Main manufactured products are copra oil, beer, cigarettes, matches, soap and timber.

2) Trade

Western Samoa has a typical monoculture economy which is heavily dependent on the major products of copra, talo and cocoa, which together account for about 80 percent of total export value. However, as international prices of copra and cocoa have been falling, efforts are being made to raise export value by switching to high unit price products like coconut oil.
Basically, the trade balance of this country have persistently shown deficit. During the last several years, imports have amounted to three times export levels, despite various measures such as comparatively high import duties and restrictions on imports, and despite the stagnant economic growth.
The trade deficit is being compensated for by transfer revenue remitted from emigrants and from overseas workers, as well as by surpluses from capital account balance.

The government's financial balance have also shown great drop due to a sharp increase in expenditures for development. To make up for this situation, about 60 percent of fund procurement were made depending on foreign assistance.

(2) Transportation and traffic

In Western Samoa, marine and air transport play important role due to its geographical features.
Especially marine transport is indispensable for international trade as well as for domestic traffic between Upolu and Savaii islands. In addition, road transportation constitute basic measure in this country for national socioeconomic activities.

1) Road transport

Western Samoa has a road network of 2,000 km long, which is classified into four categories; Apia town roads, main (primary) roads, secondary roads and plantation/village access roads. In Upolu island all roads have been improved during the past decade. In Savaii, only the southern-coastal road between the Saleloga ferry terminal and Asau port have been sealed, while roads on the northern coast are unpaved.
The main cargo transport vehicles are trucks and pick-ups, being used to transport heavy cargos such as cement, cereals, and coconuts.
All bus and taxi services were operated by private parties and the registered number of buses and taxis were 192 and 351 respectively in 1985.

2) Air transport

Western Samoa has international airport at Faleolo and three domestic airports (Upolu: Fagalii, Savaii: Maota, Asau). Faleolo airport was improved in June 1987, by extension of its runway from 1,700 m to 2,700 m and by construction of terminal building and flight control tower with Japanese Grant Aid.

As a result of these improvements, large airplanes have been able to be accommodated, and tourism is expected to be enhanced by increase of air passengers, which in turn will contribute to the national economy by raising foreign currency income.
The number of passengers of domestic air transport is decreasing year by year, due to improvement of the ferry terminals at Mulifanua and Salelologa. Air services now carry less than 10% of the passengers by the ferry service (120,000 persons) between Upolu and Savaii islands.

(3) Marine transport and ports

1) Ports in Western Samoa

Because of its geographical features, Western Samoa's economy and individual livelihood depend heavily on port activities. At present, there are five sea ports, with the following functions:

Apia Port:

Handles virtually all types of cargo for international trade (about 180,000 tons). Also a ferry boat between Western Samoa and American Samoa is operated from this port.

Asau Port:

Serves as port for shipment of lumber produced in Savaii Island (3000 - 5000 tons a year)

Mulifanua Port, Salelologa Port:

Bases for domestic ferry service linking Upolu Island and Savaii Island (year-round passenger totals 120,000). Both harbours have been underwent improvement work in 1985 by assistance from Japan.

Aleipata Port:

Construction of this port was started about 10 years ago to replace the ferry terminal in Apia Port serving the American Samoa route. But it was already abandoned half way through construction.

2) Activity by Apia Port

Nine liners are in service through Apia Port, linking Western Samoa with South Pacific countries like New Zealand and Australia, the Far East including Japan, the United States and Europe. Most of them are operated by semi-container ships and Ro/Ro ships.

The shipping firm Pacific Forum Line (PFL) has been established in 1977 by member countries of the South Pacific Forum, for the purpose of providing liner network within the South Pacific region. Two container ships are in regular liner service to Apia Port.

PFL also undertakes harbour transport business at Apia Port, and the volume of cargo handled by PFL (including harbour transport business), amounts to 75 percent of the total cargo handled in Apia.

Ferry service between Pago Pago in American Samoa and Apia is operated by Western Samoa Shipping Corporation (WSSC), Western Samoa's public shipping corporation. Two round trips are made by the ferry each week, carrying 30,000-40,000 passengers a year.

As tramp services, conventional cargo vessels and oil tankers as well as passenger ships cruising the South Pacific make call at Apia Port several times a year.

2.2 National Development Plan Related to Port Development

The Sixth National Development Plan for 1988-1990 advocates the following three points as goals of development.

1) Economic growth in such field as major primary industries like agriculture, forestry, fisheries, and as various secondary industries.

2) Economic policy to enhance productivity of industries and steady growth of national economy.

3) Raising of manpower capability

The plan also calls for infrastructural development in such fields as land utilization, aviation services and marine transportation. Particularly shipping and port development are deemed to play the most important roles in domestic transport and international trade, and the following four themes are pointed out as major objectives of the port development program:

1) Improvement of safety and efficiency in shipping business for promotion of both internal and external trade.

2) Development of cargo handling facilities for safe and efficient operation of container cargo at Apia Port.

3) Introduction of port management system for more efficient stevedoring.

4) Training of personnel to cope with the facilities and technologies to be introduced as the improvement of port management and operation.

For implementation of the above development programs, interest has grown up in Western Samoa in assistance from Japan for port development.

2.3 Outline of Request of Western Samoa

In 1986, the Government of Western Samoa requested the Government of Japan to carry out a survey to prepare a comprehensive long-term port improvement plan. In response, the Government of Japan conducted an intensive survey and study to prepare a long-term national plan for the ports of Western Samoa during the period of January through September 1987. As a result of the survey, the Master Plan was worked out targeting the year 2005, with the First-Stage Plan for certain items being picked up from the Master Plan as of urgent implementation needs.

Subsequently in November 1987, the Government of Western Samoa requested the Government of Japan for grant aid to improve Apia Port.

Reviewing the progress of the situation, the Government of Japan dispatched a Basic Design Survey Team to Western Samoa, during the period of March 28 through April 24, 1988. The official request by the Government of Western Samoa for grant aid to improve Apia Port is principally the same as the contents of the above mentioned "First-Stage Plan" as shown below.

1) Construction of a 100 m long breakwater to improve calmness of waters in the inner basin during rainy season.

2) Extension of service life of the existing main wharf.

3) Replacement of the existing superannuated ferry terminal.

4) Expansion of cargo handling yard behind the main wharf.

5) Provision of tugboat.

6) Installation of lights on tanker buoys.

CHAPTER 3 OUTLINE OF APIA PORT

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Apia Port is a key port for marine transport in Western Samoa as explained in Chapter 2, and plays important roles both in international trade and in international ferry service to American Samoa (Pago Pago).

In this chapter, outline of the port facilities, present state of port activities, studies on ports and on-going projects and problems involved in port activities are described.

3.1 Port Status

(1) Harbour area

The harbour area of Apia Port is stipulated in Paragraph (2) of Article 28 in the Shipping Act as "All harbour sites, mooring banks, breakwaters and installations and buildings related to all sea areas and harbour within a radius of 2 nautical miles centered around the main wharf". Apia Port is managed by MOT and its organization is presented in Fig. 3.1.

(2) Role of Apia Port

Apia Port is playing many roles, but its primary importance is the function as an international trade port, handling almost all trade cargos through the Main Wharf.

1) International cargo trade (the Main wharf)
2) Importing oil products (the Buoy berth)
3) Ferry Transport service between Apia and Pago Pago (the Ferry terminal)
4) Tourism Services for cruising passenger lines (the Main wharf)

Items 1) and 2) are the most important for Apia Port, and item 3) is an indispensable local service for both passengers (30,000 to 40,000 persons per year) and cargo (general cargo, foods).

Recently, Western Samoa has gained a high reputation in tourism and the number of arriving tourist by large cruisers and by yachts are increasing. As the result, tourism is expected to contribute in earning a significant portion of the foreign currency income for the nation. This port is administrated by MOT, MOE and other ministries and problems have arisen in respect to coordination among these port related organizations for actual management and operation.

3.2 Port Facilities

(1) Main port facilities in Apia

Fig. 3.2 shows the location of Apia Port and the layout of its port facilities.

The land area of Apia port was built by reclaiming about 3ha of the lagoon in 1962. The main wharf is a pier of 185m long and 13m wide built in 1966 by Australia, supported by rows of H-shape piles (4 vertical piles and 2 battered piles per cross section). Upper portion of the piles standing above seabed is covered by reinforced concrete sleeve for protection from corrosion. In order to obtain necessary depth of water, the wharf was built about 50 m off the reclaimed land. The water depth at the time of construction was M. S. L. -11 m, and at present it is about -10 m due to accumulation of silt and sand. The wharf is connected to the reclaimed land by two bridges of piling piers and bankings at the center and the northern end of the wharf. Along east side of the wharf, a water area behind the wharf is used for mooring of tugboats and small ships.

In 1967, the water area in front of the wharf was excavated down to M. S. L. -11 m (36 feet) as a turning basin.

At land site, three warehouse buildings are under the management of MOT, besides, such buildings as customs office, police station, coconut oil tanks and cold storage house, quarantine office, ferry terminal house, etc. are located.

(2) Present state of Apia port facilities

Most of port facilities at Apia Port were built over 20 years ago, and progress of deterioration are now evident. Of these, state of major facilities and equipment under the management of MOT are presented as follows:

1) The main wharf

Considering the construction technology and construction equipment used at that time, this wharf was an outstandingly engineered structure. However, after many years use, the piles and accessories have been suffered from marked degree of damage and deterioration.

(a) H-shaped piles

The column piles for the main wharf are consisted of H-shaped steel piles driven down to base bedrock at -30 to -35 m deep. The column portions of the piles above the seabed are built in round or octagon shaped reinforced concrete sleeves. At present, such concrete sleeves are cracked or broken in many spots.

At the worst damaged spots, the sleeves concrete have come off, exposing the H-shape pile into sea.

For the most severely damaged piles, if they are left remained as they are damaged, bearing capacity of the piles will become so low that some sort of load limitation will have to be imposed for the use of the wharf in around 1995. Therefore, need for immediate repair and reinforcement work are recognized.

In 1983, by assistance from Australia, galvanic anodes (corrosion-preventive material) were mounted on the columns, though all of them were lost due to improper mounting method.

(b) Floor system

Damage on girders of floor deck is not apparent. The floor slabs are durable and no cracks or damage are noticeable.

(c) Wharf accessories

Curving bumpers show damage caused by ships' hulls contact. Rubber fenders are lost at several spot, and cracks are seen in many rubber body, as well as loosening and loss of bolts. Such defects in the rubber fenders were considered to be caused by pitching of berthing vessels at high sea season.

2) Ferry terminal

Presently, the ferry terminal is used as a base port for the "Queen Salamasina", the ferry boat linking Western Samoa to Pago Pago in American Samoa. Since mooring posts at the bow were damaged in 1986, bow of the ferry boat is tied only by means of anchor, without sufficient fixing force at the time of mooring. Concrete blocks on the south end of the ramp are in poor condition owing to cracking. Therefore, construction of new ferry mooring facilities is required for safety operation of the ferry.

On-land facility for ferry terminal is a barrack type cargo-sorting house only (about 160 square meters with roof only), without any passenger housing or parking lot. All ground are unpaved. Improvement of the terminal facilities is urged so that the terminal can serve as an international class ferry terminal.

3) Tugboat

Tugboats serves at Apia Port for following functions:

(a) Traffic of pilots for main vessels;
(b) Assistance for main vessels in turning around;
(c) Assistance for main vessels in berthing.

At present, a tugboat "Pualele" (425HP) is in operation, though its engine is in badly damaged condition (piston overheating) since February 1987. Despite repairs, the engine capacity is estimated at 2 to 3 tons only, less than half of that when it was built (tow power 6 t), resulting in lower operational efficiency and stability.

4) Warehouses and container yard

Though, there were four warehouses under the management of MOT (3,645 sq. m; 1,972 sq. m; 2,541 sq. m; and 2,486 sq. m respectively), the No. 2 warehouse was demolished away after fire in 1980.

No. 4 warehouse has been leased to the Copra Board and is seldom in use. No. 1 and No. 3 warehouses are now used as a container freight station.

The warehouses and the yards were projected originally for general cargo handling purposes, and in 20 years of time, almost all three quaters of cargoes have been containerized.

Forklifts have been already introduced for transport of containers and Paving of the yard, rearrangement of yards and warehouses are required for full-fledged containerization of Apia port.

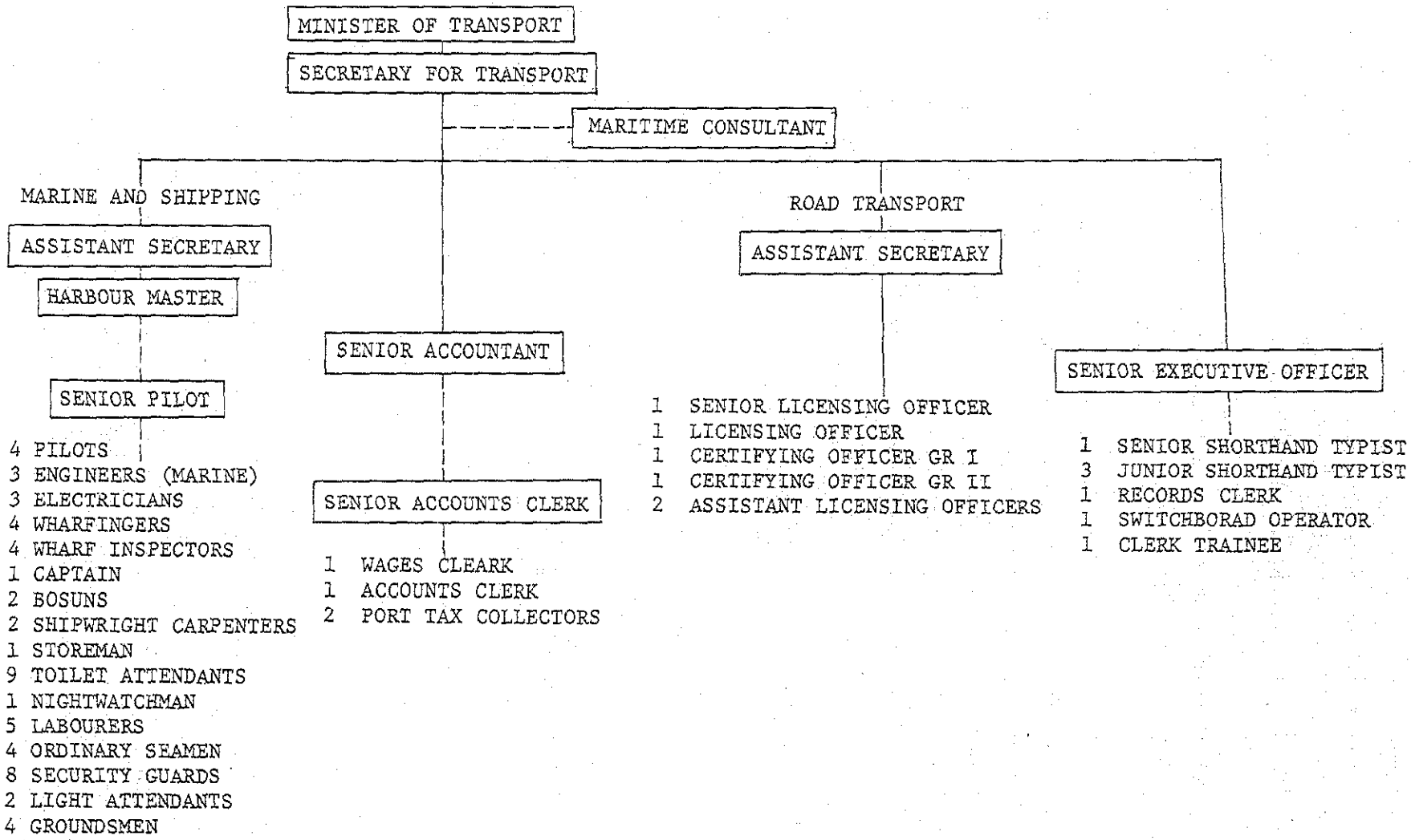
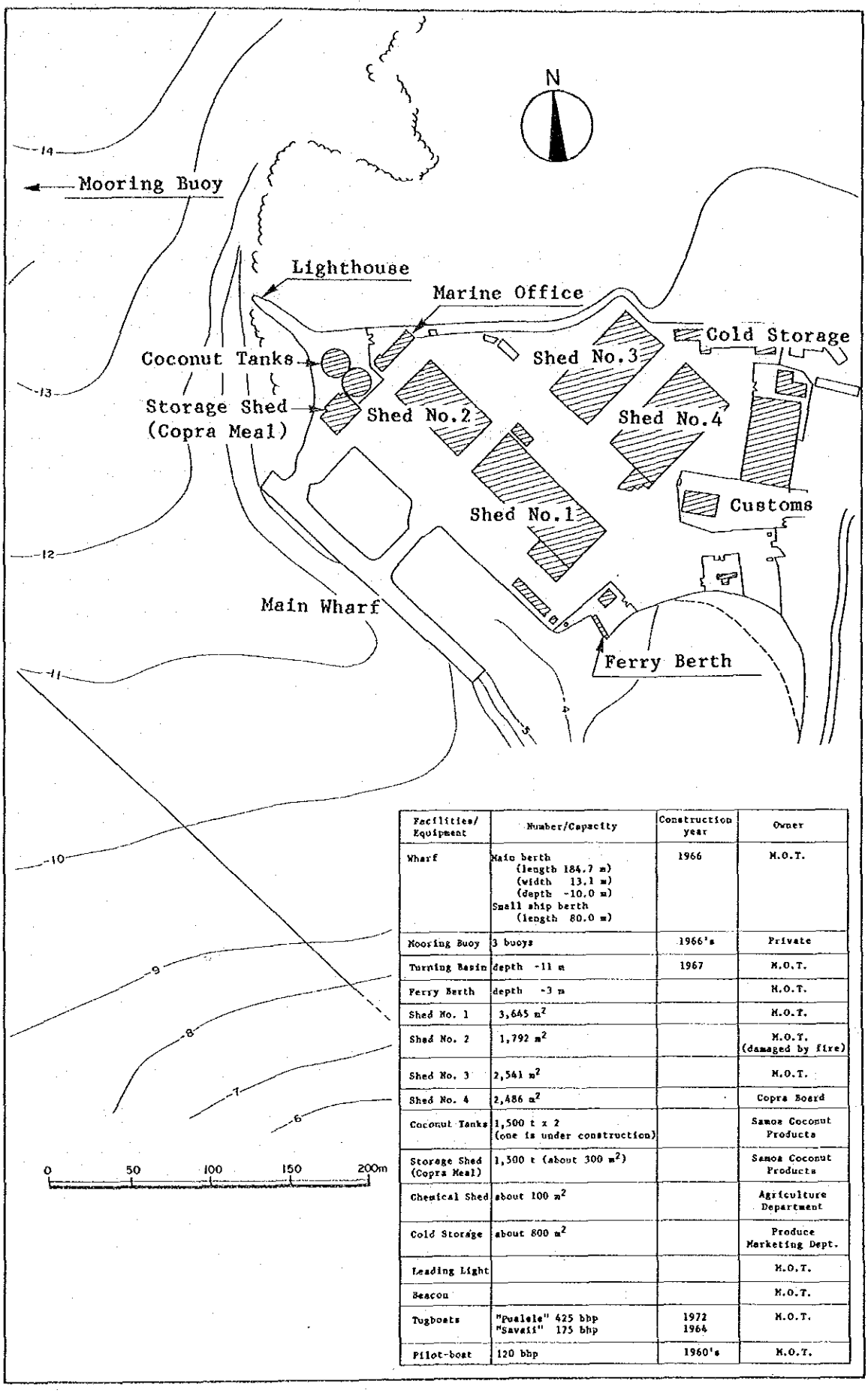


Fig. 3.1 Organization Chart : Ministry of Transport



Facilities/ Equipment	Number/Capacity	Construction year	Owner
Wharf	Main berth (length 184.7 m) (width 13.1 m) (depth -10.0 m) Small ship berth (length 80.0 m)	1966	M.O.T.
Mooring Buoy	3 buoys	1966's	Private
Turning Basin	depth -11 m	1967	M.O.T.
Ferry Berth	depth -3 m		M.O.T.
Shed No. 1	3,645 m^2		M.O.T.
Shed No. 2	1,792 m^2		M.O.T. (damaged by fire)
Shed No. 3	2,541 m^2		M.O.T.
Shed No. 4	2,486 m^2		Copra Board
Coconut Tanks	1,500 t x 2 (one is under construction)		Samoa Coconut Products
Storage Shed (Copra Meal)	1,500 t (about 300 m^2)		Samoa Coconut Products
Chemical Shed	about 100 m^2		Agriculture Department
Cold Storage	about 800 m^2		Produce Marketing Dept.
Leading Light			M.O.T.
Beacon			M.O.T.
Tugboats	"Pualele" 425 bhp "Savaii" 175 bhp	1972 1964	M.O.T.
Pilot-boat	120 bhp	1960's	M.O.T.

Fig. 3.2 Apia Port Facilities Map

3.3 Port Activities

(1) Container and general cargo

1) Vessel calls

Statistics on incoming ships (foreign trade) to Apia Port are published by two organizations. One source is the "Economic Statistics of Shipping" put out by the Statistics Bureau, and the other is the "Report on Trade, Commerce and Shipping of Western Samoa," released by the Customs Office. Of ships entering Apia Port, the first statistics excludes ferries, yachts and some merchant ships (mostly ships which need no stevedoring). The record amount to for 190-200 ships a year (Table 3.1). On the other hand, the latter source lists the number of yearly incoming ships as 470-480 and covers all incoming ships.

Breakdown of ships by size of less than 1,000 GT occupies 20 percent, and those of 1,000-5,000 GT occupies 50 percent, showing that percentage of medium and smallsized ships to occupy a higher portion, while large ships above 10,000 GT represents less than 10 percent occupancy. (Fig. 3.3)

The rate of use of berths is 50-60 percent including resting time by small ships.

2) Cargo volume

The volume of cargo handled by Apia Port is on the rise and totaled 181,000 tons in 1986 as compared to 133,000 in 1981. Breaking down into exports and imports, imports rose from 100,000 tons to 129,000 tons and exports from 33,000 tons to 52,000 tons. (Table 3.2)

Major items for import were petroleum products, food-stuffs (cereals, sugar, salt, meat, etc.), cement, steel and automobiles. For export, primary products such as coconut oil, copra meal, talo, etc. comprised the majority.

Import from New Zealand occupies about a 40 percent share topping the list, and when Australia is added, the share rises to 50-60 percent. According to the same table, exports to New Zealand also topped the list, with Europe and North America also retaining high percentages.

The number of containers handled in Apia was 10,200 TEU, including both incoming and outgoing (actual number being 5,100 TEU), in 1986. In the above figure, empty containers occupied 5% of import and 73% of export and average dwell time in Apia was estimated at 19 days.

3) Cargo handling

Cargo handling flow at the Main Wharf is illustrated in Fig. 3.4. Unloading and loading are carried out using ships' gear. Cargo removal from the wharf to yard are performed by forklifts of private stevedoring companies under control of shipping agents. Deliveries from the yard or to the yard are undertaken by transport companies upon instruction of shippers and consignees.

Charges for stevedoring and charges for port in relation to payer and recipient of payments are categorized as follows:

	(1)	(2)	(3)	(4)
Payer	Shipping company	Sender, consignee	Sender, consignee	Shipping company
Recipient	MOT	MOT	Land transportation company	Stevedore
Charges	Harbour duties Freight charges Wharf fee Lighting fee Pilot fee Wharf cleaning fee Tugboat service fee Storage	Storage Wharf fee (All payable in cash)	Domestic transportation fee	Freight charge Cargo handling fee

(2) Ferry service

Ferry service is operated to Pago Pago in American Samoa, about 80 nautical miles east of Apia, by the Western Samoa Shipping Corporation.

The Queen Salamasina (714GT) is now in service, and makes 2 round trips weekly.

Statistics on transport of cargo and passengers to American Samoa are given in Table 3.3.

Rates for passengers and cargo are as follows:

Passengers

Adults	Over 12 years old	WS$40
Children	3-11 years old	WS$20
Infants	Below age 2	WS$10

Freight WS$45/t or m^3

Table 3.1 Number of Calls by Type of Vessel

	1980	1981	1982	1983	1984	1985	1986
General Cargo	112	95	94	88	95	87	84
Container	16	15	30	46	46	34	42
Semi-Container	3	5	6	4	5	4	3
Roll-on/Roll-off	30	48	53	44	46	45	35
Passenger Cruise	9	9	9	4	7	7	--
Others (mainly Tankers)	22	18	21	29	24	19	21
Total	192	190	213	215	223	196	185

Source : Dept. of Statistics "Economic Statistics of Shipping"
Note : Excludes Ferries and Yachts

Table 3.3 Transportation between Apia and Pago Pago by Ferry

(1) Passengers

	1982	1983	1984	1985	1986
Outward	21,596	16,493	20,134	19,251	17,158
Inward	17,753	13,642	18,969	16,156	13,053
Total	39,349	30,134	39,103	35,407	30,211
(A.I.R)	--	0.77	1.30	0.91	0.85

(2) Cargo

	1982	1983	1984	1985	1986
Outward	2,073	2,379	3,052	3,291	2,581
Inward	3,672	3,817	8,026	7,922	6,705
Total	5,745	6,196	11,078	11,213	9,286
(A.I.R.)	--	1.08	1.79	1.01	0.83

(3) Trips

	1982	1983	1984	1985	1986
Outward	50	40	49	48	51
Inward	50	40	49	48	51

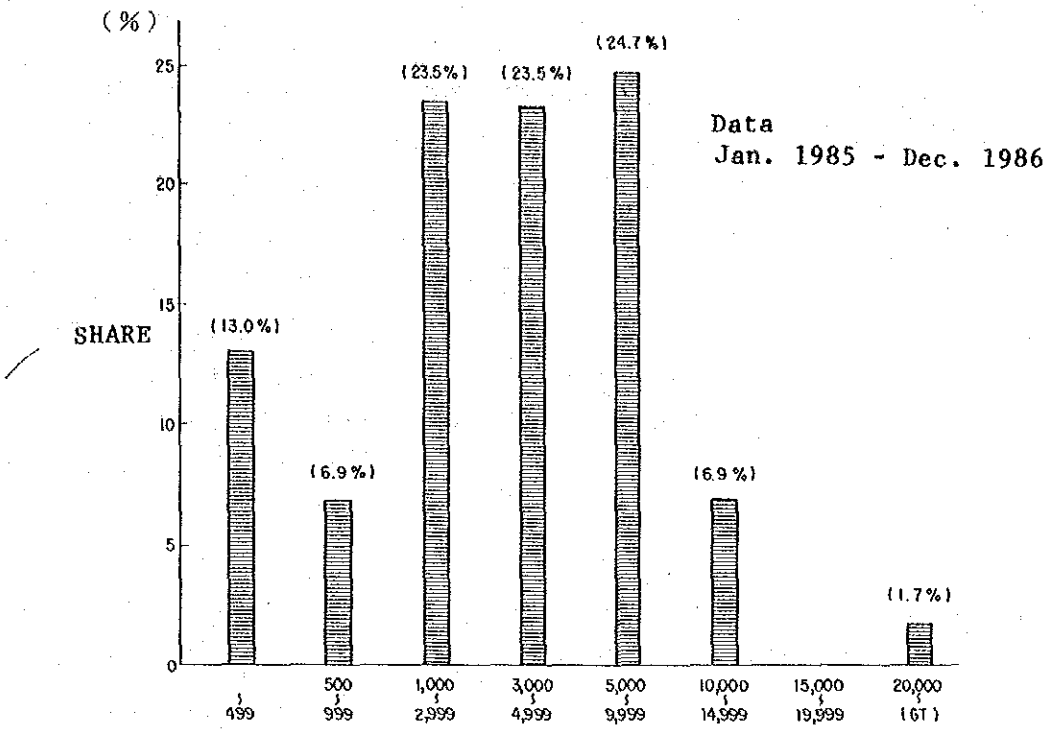
Source : Western Samoa Shipping Corporation
Note : 1. A.I.R. is Annual Increase Rate
2. The data of the Customs Department covers about 100 trips

Table 3.2 Total Cargo Volume at Apia Port

		1981	1982	1983	1984	1985	1986	Annual incr. (1981-1986)
Imports	Ceneral Cargo	70,607	89,483	91,516	80,396	102,164	105,694	1.084
	Oil Products	29,125*1	14,392*1	20,985	*2	23,960	23,074	0.954
	Total	99,732	103,875	112,501	-	126,124	128,768	1.052
Exports	Ceneral Cargo	33,117	40,148	35,260	45,816	43,970	38,070	1.028
	Coconut Oil	-	8,027	12,188	10,537	12,099	13,801	1.145
	Total	33,117	48,175	47,448	56,353	56,069	51,871	1.094
Total	General Cargo	103,724	129,631	126,776	126,212	146,134	143,764	1.067
	Oil	29,125	22,419	33,173	-	36,059	36,875	1.048
	Total	132,849	152,050	159,949	-	182,193	180,639	1.063
	Annual Increase Rate	-	1.14	1.05	-	1.07	0.99	-

*1 : Estimated From Total Volume of Oil Products
*2 : Unkonwn

Source : General Cargo : "Economic Statistics of Shipping" Dept. of Statistics
Western Samoa Shipping Corporation
Oil Products : Customs Dept.
Coconut Oil : Samoa Coconut Products



Source : Ministry of Transport

Fig. 3.3 Vessels Using Main Wharf by Vessel Size

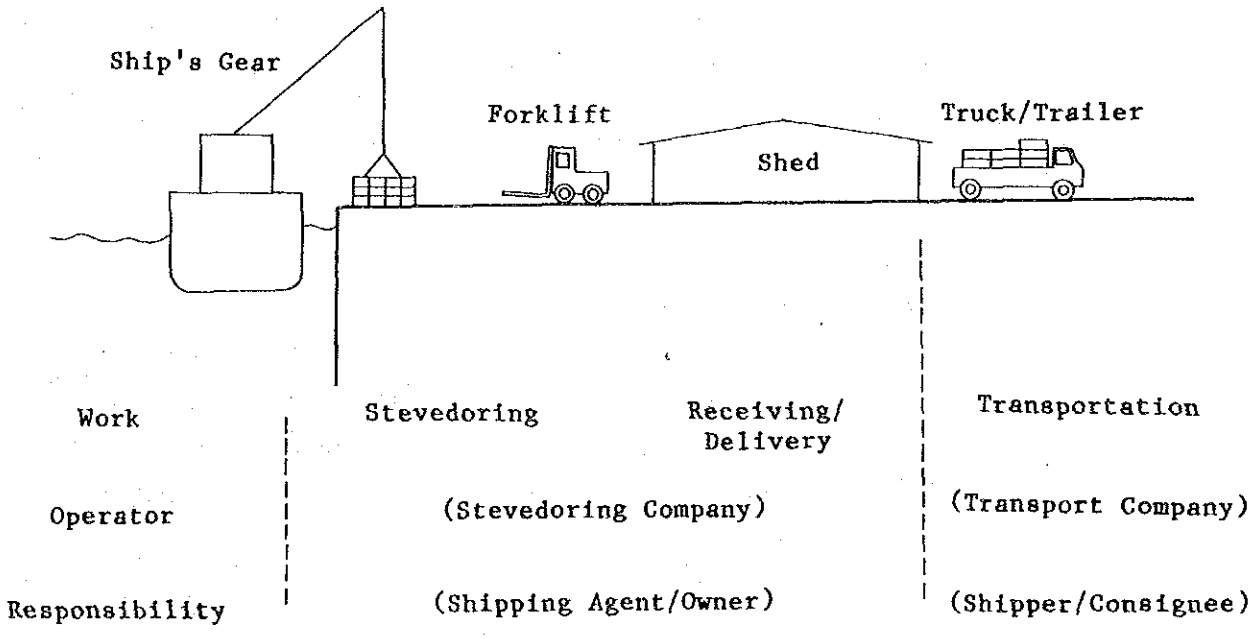


Fig. 3.4 Cargo Handling Flow

3.4 Study and Development Plan of Apia Port

In this section, some of studies already conducted and project plan now under contemplation are described.

(1) Port studies

Port studies of Apia Port had been carried out through the cooperation of many foreign countries.
The outline of these studies is summarized in Table 3.4.

(2) Port Development projects

1) Container park subproject

This project is under way by ADB for improvement of the container yards by expanding the marshalling yard and the freight station. This project plan has to be coordinated with the container yard expansion behind the Main wharf in the grant aid project.

(a) Items : Pavement (Heavy duty 16,000 m^2, Highway standard 6,500 m^2)
(b) Period : April, 1988 though January 1989.
(d) Supervision : P.W.D.

At present, P.W.D. is preparing the detail design.

2) New ferry boat project

A new ferry boat will be provided by grant aid from Japan to upgrade the domestic ferry services between Upolu and Savaii island, and is to be berthed at Apia Ferry Terminal.
Therefore, this project has some relation with the grant aid project.

(a) Size : 999 GT (Length 43.3 m, Draft 2.25 m)
(b) Period : To be Delivered in October, 1988
(c) Operation: W.S.S.C.

(3) Other projects

Police boat for patrolling the 200 mile economic maritime zone of Western Samoa is provided through cooperation of Australia, which is to be moored at south end in behind the main wharf.

A project titled "Establishment of Ship Maintenance Shop" is now progressing. The objective of this project is to improve safety and efficiency of sea transport through attaining self-sufficiency in ship repair and maintenance services. The project is designed to establish a ship maintenance shop through support of Japan (OECF) and the UNDP.

Table 3.4 Port Study on Apia Port

Name of the Study (Organization)	Period	Contents	Remarks
(1)The Study of the Main Wharf			
(NZ Navy)	Jul.-Aug.1966	Inspection of the Concrete Sleeve Underwater	
(Ministry of Foreign Arrairs,NZ)	Dec.1974	Deterioration of the Wharf by Corrosion	
(UK Navy)	Feb.1976	Inspection of Piles	Some Repair Works executed Dec.1983
(ADAB AUS)	Nov.1977	Proposal for Rehabilitation	
(2)The Apia Harbour	1974	Surge Problem and Relocation	
(Auckland Univ,NZ)			
(3)The Siltation of Apia Port (ESCAP)	Aug.1983	Assessment of the and Relocation	
(4)The Container Park Study (ADB)	May,1984	Improvement of the Container Yards	
(5)The Study on the Development of Pots in W.S. (JICA)	Jan.-Sep.1987	Master Plan and First Stage Plan of Ports in WS	

3.5 Problems in Apia Port

After the land the preparation by lagoon reclamation in 1962, in Apia Port, with assistance from Australia, the 185m long main wharf has been completed and thus this port has become a fully equipped international class harbour. However, after more than 20 years of services, some problems have arisen regarding this port's activities due to deterioration of its facilities, due to arrival of larger sized ships, due to increase of number of ships and due to containerization of marine cargo.

Followings sre some details of major problems involved in Apia port at present.

1) Deterioration of harbour facilities

- Deterioration of piles of the main wharf
- Deterioration of the ferry terminal

2) Delay of modernization of cargo handling

- Delay in coping with containerization of marine cargo

3) Delay in upgrading of safety measures

- Surging due to swell in rainy season in the harbour.
- Insufficient tugboat capability
- Lack of marker buoys on tanker buoys

4) Management system

- Inadequate port management organization and staff
- Shortage of budget for maintenance and repair of port facilities

CHAPTER 4 CARGO THROUGHPUT FORECAST

CHAPTER 4 CARGO THROUGHPUT FORECAST

Forecasts for throughput, vessel calls and ferry passengers which constitute the basic requirements for the development project for Apia Port to be executed by a grant aid from Japan have been extracted and are summarized in this chapter, from the Apia Port Master Plan as it is programmed targeted for the year 2005. A planning base for the Basic Design is also part of the forecast as explained below.

4.1 Total Cargo Volume

The total cargo volume for ports in Western Samoa has been estimated using two methods, a macromethod and micromethod. In the macromethod, cargo volume is forecast in correlation with GDP growth.

On the other hand, in the micromethod, the volume of each of the main commodites in a target year is forecast on the basis of individual growth rate.

The total volume of general cargo according to the microforecast is 330,300 - 352,300 tons. As the projected volume of general cargo by the macroforecast is 338,000 tons, this is within the range of the microforecast. In this report, the volume , 338,000 tons has been adopted as the planning base. Thus, in the year 2005, the total cargo throughput has been estimated to reach 403,600 tons: 338,000 tons of cargo in general and 65,600 tons of cargo on tankers. The cargo in general is estimated to be 2.3 times the volume of the 1986 figure (146,800 tons),with an annual growth rate of 4.5%.

4.2 Cargo Volume of Apia Port

The cargo volume to be handled at Apia Port in 2005 is estimated to be 318,000 tons occupying almost all the trade cargo of Western Samoa, except for 20,000 ton of timber exported from Asau, as shown in Table 4.1. Table 4.2 shows the cargo volume to be handled at each berth, assuming that petroleum products and ferry cargo also increase at the same growth rate as cargo in general.

Considering the present situation of containerization in Western Samoa and the world tendency toward increased containerization, container cargo in Western Samoa is expected to occupy at least 85 percent of import cargo and 70 percent of export cargo in the target year. The container cargo for Apia is forecast in 20 TEU to be 12,900 units for import and 3,200 units or export in the year of 2005, as shown in Table 4.3.

4.3 Number of Vessels Calling

With the results of the cargo volume forecast, the number of vessels calling at Apia is estimated to be 484 in 2005, as shown in Table 4.4.

Although the size of vessels which will call at Apia in the target year is expected to increase in average size along with an increase in cargo volume, the maximum size of vessels which will call at Apia thereafter will remain the same as at present. The maximum size of vessels which presently call at Apia is given below.

Vessel Type	Size (GRT)	Draft	Length
Cargo	10,000-11,000	9.1m	160 to 170m
Passenger	20,000-25,000	9.2 to 10.0m	200 tO 210m

Table 4.1 Cargo Volume by Commodity at Apia Port (2005)

	Commodity		Cargo Volume (Tons) 2005	1986
General Cargo	Import	Sugar	9,500	-
		Cement	17,600	-
		Steel Products	10,900	-
		Cereals	24,300	-
		Others	181,700	-
		Total	244,000	105,700
	Export	Copra Meal	10,500	-
		Cocoa	4,500	-
		Taro	8,000	-
		Other Fresh Products	10,000	-
		Others	41,000	-
		Total	74,000	38,100
	Total		318,000	143,800
Oil	Import	Oil Products	40,500	23,100
	Export	Coconut Oil	21,000	13,800
	Total		61,500	36,900
Total	Import		284,500	128,800
	Export		95,000	51,900
	Total		379,500	180,700

Note : data not available

Table 4.2 Cargo Volume Handled at Each Berth at Apia Port

	Berth Name		Cargo Volume (tons) 1986	2005
Import	Main Wharf (Generl Cargo)		99,000	228,500
	Ferry Terminal		6,700	15,500
	Buoy Berth		23,100	40,500
	Total		128,800	284,500
Export	Main Wharf	General Cargo	35,500	68,900
		Coconut Oil	13,800	21,000
	Ferry Terminal		2,600	5,100
	Total		51,900	95,000
Total	Main Wharf	General Cargo	134,500	297,400
		Coconut Oil	13,800	21,000
	Ferry Terminal		9,300	20,600
	Buoy Berth		23,100	40,500
	Total		180,700	379,500

Table 4.3 Container Cargo at Apia Port

	Import	Export	Total
TEU	12,900	3,200	16,100
Contaoner Cargo (A)(Tons)	194,200	48,200	242,400
General Cargo (B)(Tons)	228,500	68,900	297,400
A/B (%)	85	70	81.5

Table 4.4 Number of Vessel Calls

Apia Port	Main Wharf	310
	Buoy Berth	24
	Ferry	150
	Total	484
Asau Port	Total	16

Note : does not include yachts

4.4 Passengers and Cargo at Apia Ferry Terminal

(1) Passengers

The number of passengers using ferry between Western Samoa and American Samoa is estimated at 30 - 40 thousand a year on the basis of actual records in recent years. Passengers in 2005 are estimated to be almost the same as at present, assuming the following ferry service conditions as seen in Fig 4-1.

1) In 2005, for ferries, cargo service will dominate passenger services as at present.

2) Increase of the ferry service will be mainly due to increase of cargo transport.

The Ferry service in 2005 will increase up to 3 trips per week (150 trips per year) compared with two trips per week at present, as shown in the preceding Table 4.4. Therefore passengers on each voyage is counted at 200-260 in average. Assuming the ratio of incoming passengers and outgoing passengers to be 2:3 as at present. The number of passengers per trip in 2005 is estimated as below.

Incoming passengers : 80-104 (mean : 90 passengers)
Outgoing passengers : 120-156 (mean : 130 passengers)

(2) Cargo

Cargo on ferry in 2005 is estimated at 20,600 tons per year as shown in Fig 4-22, being almost doubling the record of 1986.
Referring to ratio of export and import cargo being 1:2 as at present import and export tonnage in 2005 is estimated as below.

Export 20,600 x 1/3 = 6,900 ton/year
Import 20,600 x 2/3 = 13,700 ton/year

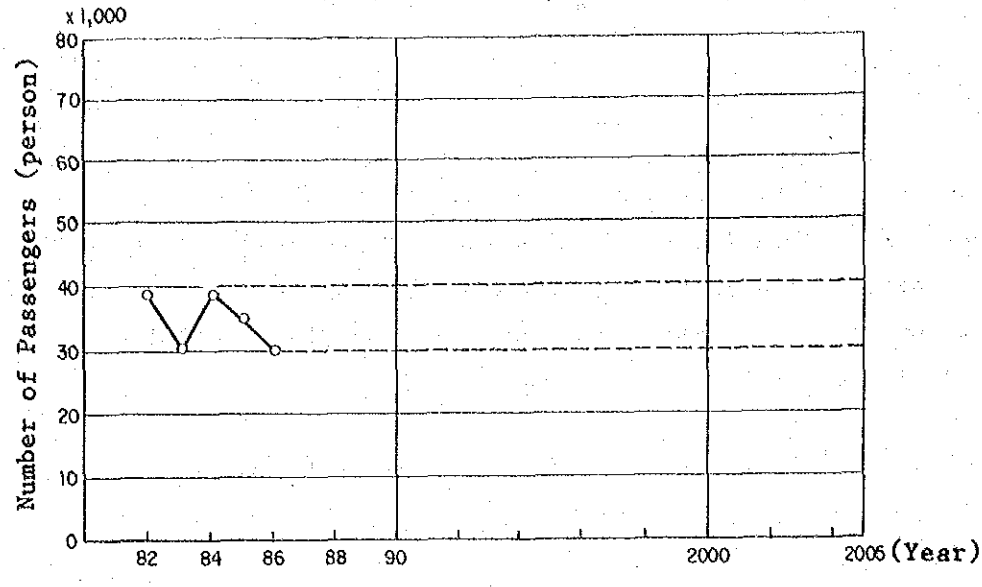


Fig. 4.1 Number of Passengers Using Ferry Boat Terminal

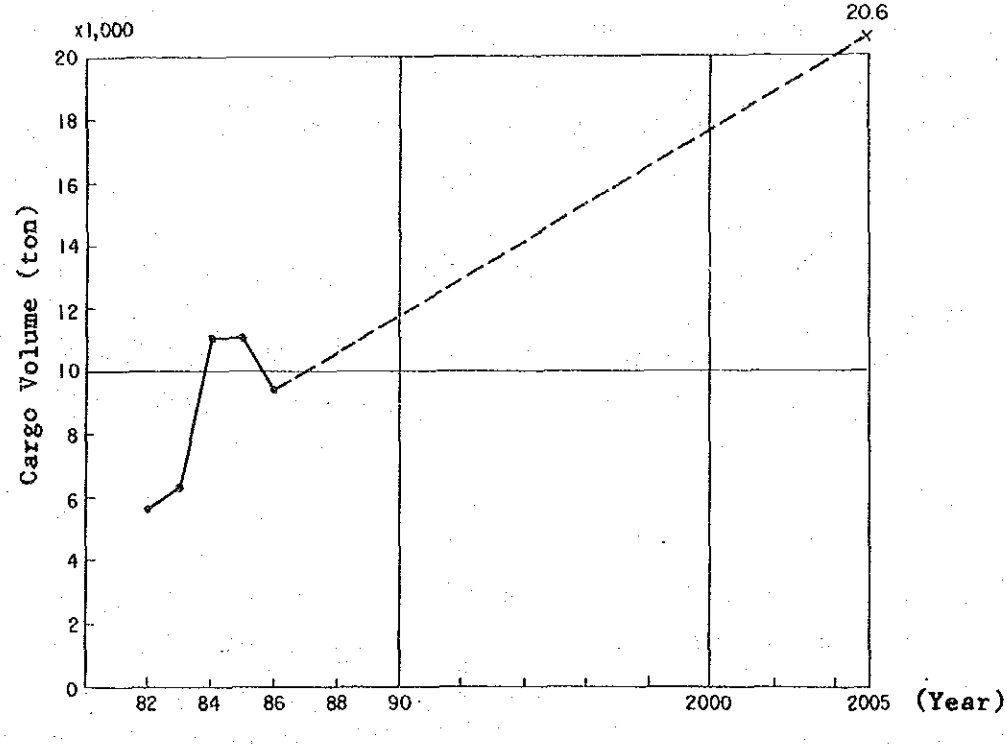


Fig. 4.2 Forecast on Cargo Handling in Ferry Terminal

CHAPTER 5 NATURAL CONDITIONS

CHAPTER 5 NATURAL CONDITIONS

In this chapter the natural conditions of the project site are presented as the basis for the detailed design to be given in the following chapters. Natural conditions cover such items as geological and topographical data, meteorological data, oceanographic data, as well as soil boring data. The bathymetric survey data and soil boring data obtained from the site survey during the basic design study are given in 5.4 in summarized form.

5.1 Topographical and Geological Conditions

The islands of Western Samoa are located at the north end of the Tonga-Kermadec Trench, the northeast side of the Marshall line, the boundary between the Australian plate and the Pacific plate. Thus the islands are often hit by earthquakes due to the seismic activities of the Circum-Pacific Earthquake Belt. Consequently, a coefficient of 0.15 is adopted for the design of structures.

All the islands are defined as volcanic islands. The last eruption was recorded at Savaii Island in 1911, though they are now inactive. Both Upolu Island and Savaii Island have central mountains ranging from east to west, and the elevation of their highest peaks are 1,116 m and 1,858 m respectively. Surface soil contains a large quantity of igneous rocks, but the soil is fertile. Around the islands, barrier reefs of coral extend to 2 km offshore in average. Parts of the reefs are covered by lava which has flowed into sea. There are many rivers on the islands with but a small quantity of discharge flow.

5.2 Meteorological Conditions

The climate of Western Samoa is typically tropical and oceanic (high temperatures and high humidity), having distinct rainy and dry seasons.

(1) Temperature

All year round, the monthly mean maximum temperature ranges from 29°C to 31°C and the mean minimum temperature ranges from 21°C to 24°C. The yearly average temperature ranges from 26°C to 27°C and few days below 20°C have been recorded in the flat land area.

(2) Precipitation

A year is divided into a rainy season from November through March and a dry season from April through October. The southern area of the islands receives from 5,000 mm to 7,000 mm of rain annually, and the northern area including Apia receives an average of 2,900 mm of rain annually, 70% of the rainfall being concentrated in the rainy season.

(3) Winds

Northeast and east winds blown by trade winds prevail throughout the year. The frequency of the occurrence of winds of 6.5 m/sec. or less is around 87%, and that of storm winds over 25 m/sec. is about 0.05%.

(4) Hurricanes

Hurricanes are born in vicinity of the Solomon Islands in the Southwest Pacific and proceed on their course toward the southeast and pass through the south side of the Samoa Islands generally. Strong hurricanes hit the Samoa Islands about once a year. Hurricanes of the maximum wind velocity over 40 m/sec. have been recorded three times to date, concentrating in the rainy season.

5.3 Oceanographic Conditions

(1) Currents

Western Samoa is located with in the band of the south subtropical current running from east to west. The current speed around the Samoa Islands ranges from 16 km to 20 km per day throughout the year. However Apia Harbour is not affected by the current because of offshore reef surrounding the harbour.

(2) Tides

In this harbour, tidal data have been recorded at the Tide Station in the Apia Harbour, and the following tides are defined.

Highest Astronomical Tide	(HAT)	+1.2 m
Mean High Water Spring	(MHWS)	+1.0 m
Mean High Water Neap	(MHWN)	+0.8 m
Mean Sea Level	(MSL)	+0.5 m
Mean Low Water Neap	(MLWN)	+0.2 m
Mean Low Water Spring	(MLWS)	±0.0 m (Chart Datum)
Lowest Astronomical Tide	(LAT)	-0.2 m

The tide table of Asau Harbour is as follows:

Mean High Water Spring	(MHWS)	+1.2 m
Mean High Water Neap	(MHWN)	+1.1 m
Mean Sea Level	(MSL)	+0.7 m
Mean Low Water Neap	(MLWN)	+0.4 m
Mean Low Water Spring	(MLWS)	+0.2 m
Chart Datum	(CD)	±0.0 m

(3) Waves (around Apia)

Apia Harbour is well protected during the season of the southeast trade winds, from April through October, since its port mouth opens to north. From November to March, northerly waves and swells enter the harbour through the wide entrance, and surge occurs in the inner harbour.
The following wave appearance rate is analyzed on the basis of wind data recorded at Apia and wave data recorded at a point offshore of Apia by the U.S. Navy.

Wave height	Over 1 m to 2 m	32 days
	Over 2 m to 3 m	16 days
	Over 3 m to 4 m	8 days
	Over 4 m	3 days

The maximum wave in offshore of Apia is estimated as below, on the assumption that the maximum hurricane recorded in the past 40 years proceeded on a course affecting Apia Port most seriously.

Direction	North
Wave height	7.0 m
Period	10 sec

(4) Siltation

Apia Harbour has two sources of sediment, the Vaisigano River and the Mulivai Stream, the main source being the former.
By comparison of sounding data of 1981 with that of 1987, the siltation volume in the turning basin in front of the main wharf (with a radius of 200 m) is estimated at 9,500 m^3/year, i.e. 7.5 cm/year in average, and the maximum siltation rate is estimated at 12 cm/year.

5.4 Field Investigation

(1) Objectives and contents of the field investigation

Objectives of the field investigation were to obtain the necessary data on subsoil conditions and sea depth for the basic design of the project. The areas covered by the investigation were the site of breakwater construction, the site around the main wharf, and the site around the ferry terminal.

1) Field investigation

The sites of investigation are shown in Fig. 5.1.
Bathymetric sounding and soil log boring were performed in the manner as given below.

(a) Breakwater construction site

Bathymetric survey: Area of 150 m x 150 m surveyed. Water depths were measured at the grid of 30 m x 20 m by sonic sounder.

Boring: Jet boring was conducted in two holes up to 10 meters in depth below the seabed.
S.P.T were conducted at 3 meter intervals.

(b) Around the main wharf

Bathymetric survey: Water area behind the Main wharf was surveyed at the grid of 10m x 10m.

Boring: Rotary borings in two holes with a total of 22 S.P.T and a total of 5 undisturbed samplings were conducted to the depth of 25 meters and 15 meters below the seabed respectively.

Resulting sea depth chart and jet boring log are shown in Fig. 5.2

(c) Around the ferry boat terminal

Boring: Rotary borings in two holes with a total of 8 S.P.T and one undisturbed sampling were carried out to the depth of 25 meters and 15 meters below the seabed respectively.

Resulting borehole log is shown in Fig. 5.3.

2) Laboratory soil tests

Laboratory soil tests were performed for estimation of settlement due to reclamation around the main wharf and ferry boat terminal, and for a stability check of the structure.

(2) Summary of the soil investigation

1) Breakwater construction site

From top of seabed to 1 m in depth, very loose silty fine sand is observed. Over 1 m in depth, the subsoil is composed of fine sand with 10 to 30% calcareous silt. Relative density becomes denser with depth. No soft silt or clay or loose sand layer affecting settlement and stability of the breakwater were observed within 10 m in depth.

2) Around the main wharf

From top of seabed to 1 m in depth, suspended calcareous silt and clay are deposited, drifting on seabed by current and wave conditions. Below this layer up to a depth of 22.30 m, the subsoil is composed of silt containing 20 to 30% fine sand. In this layer, an approximately 30 cm thick uncemented coral layer is included. In the water area behind the main wharf, coral appears at seabed in a range of about 30 to 40 m from land. This coral is classified as belonging to the same group as that existing in the east reef. Coral near the main wharf was dredged out during construction of the main wharf.

The thickness of coral layer varies by the location in a range of 0.5 m to 2.5 m. This coral layer cannot be regarded as a base rock because of its weak cementation. The average N value range in between 25 to 30, and compression strength does not exceed 100 kg/cm^2. The mechanical and physical properties of the sandy silt layer under the coral are examined below.

- Standard soil classification system: CL-ML & SM-SC
- N. valve: 0 to 19
- Density: 1.67 to 1.75 g/cc
- Specific gravity: 2.90 to 2.98
- Cohesive strength with depth: $Cu = 0.47 \cdot Z$ ($Z > 1.0$ in meter)
- Consolidation index: 0.37 to 0.60
- Coefficient of consolidation: 1.5 to 3.0 x 10^3 (cm^2/day)
- Coefficient of volume compressibility: 4.4 to 6.4 x 10^{-2} (cm^2/kg)

Surface layer of the basalt bedrock at the site is weathered and decayed within 1 to 2 m in depth by numerous fissures or is broken into boulder masses. Compressive strength of the basalt core is reported to be 300 kg/cm^2 and more.

3) Ferry boat terminal construction site

The upper coral layer stretches out from the land side to the center of the mooring dolphin. Beyond this line coral was removed by dredging.

Under the coral layer a sandy silt layer was observed down to 22.5 m to 23.5 m in depth to reach the bedrock layer. The mechanical and physical properties of the coral layer, sandy silt layer and the layer of bedrock are similar to those of the main wharf area.

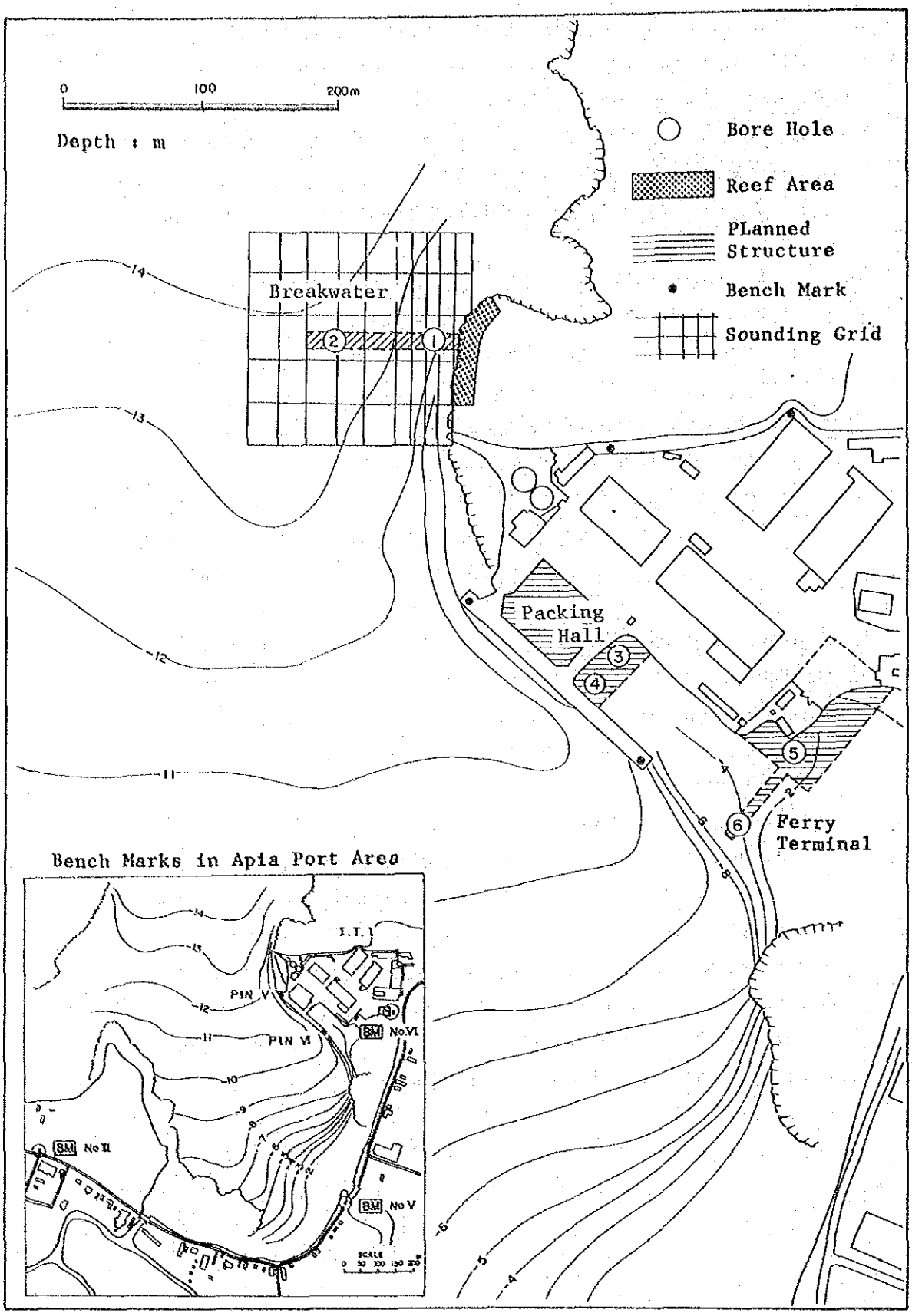


Fig. 5.1 Location of Study on Natural Conditions

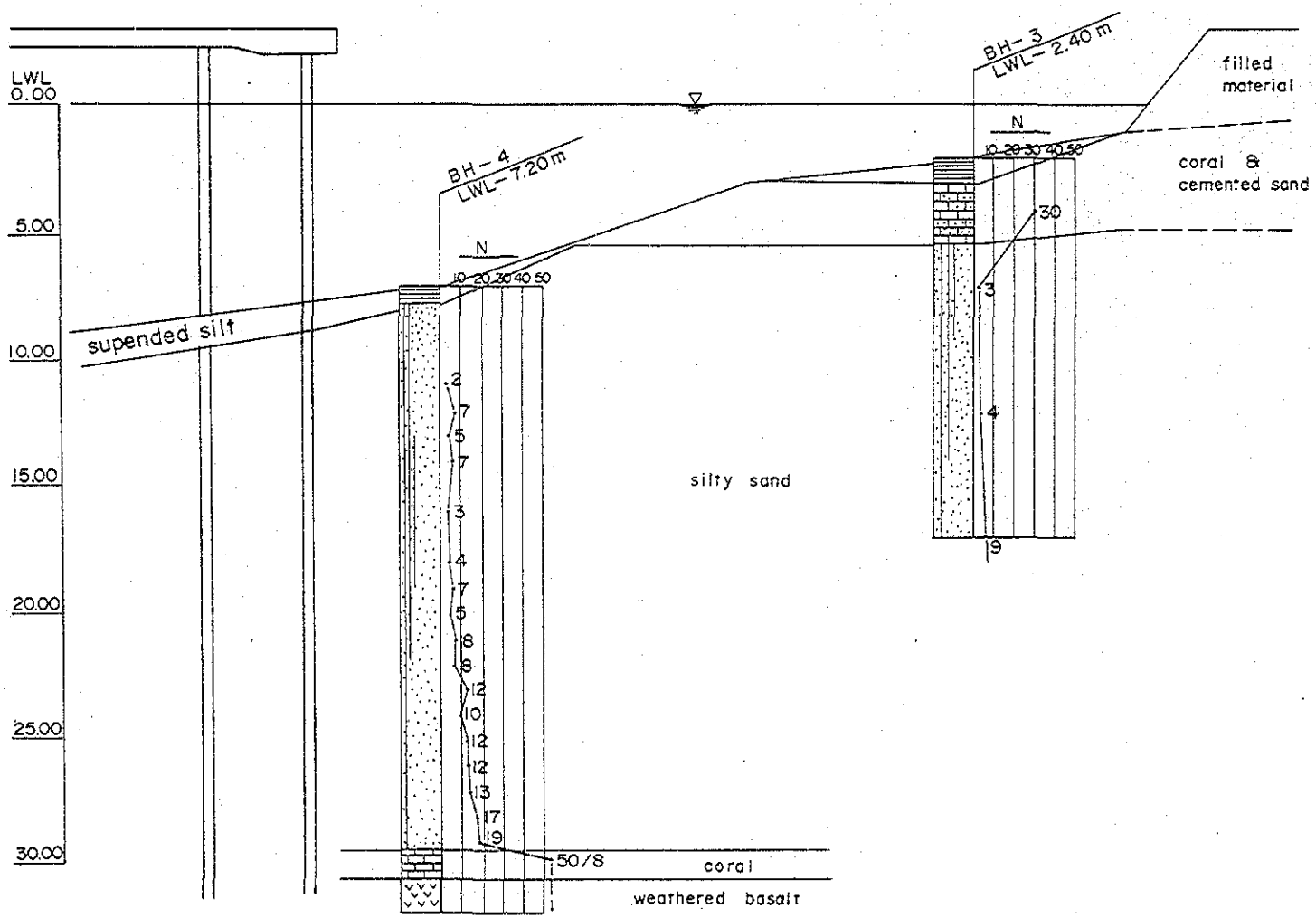


Fig. 5.2 Soil Profile (Main Wharf Area)

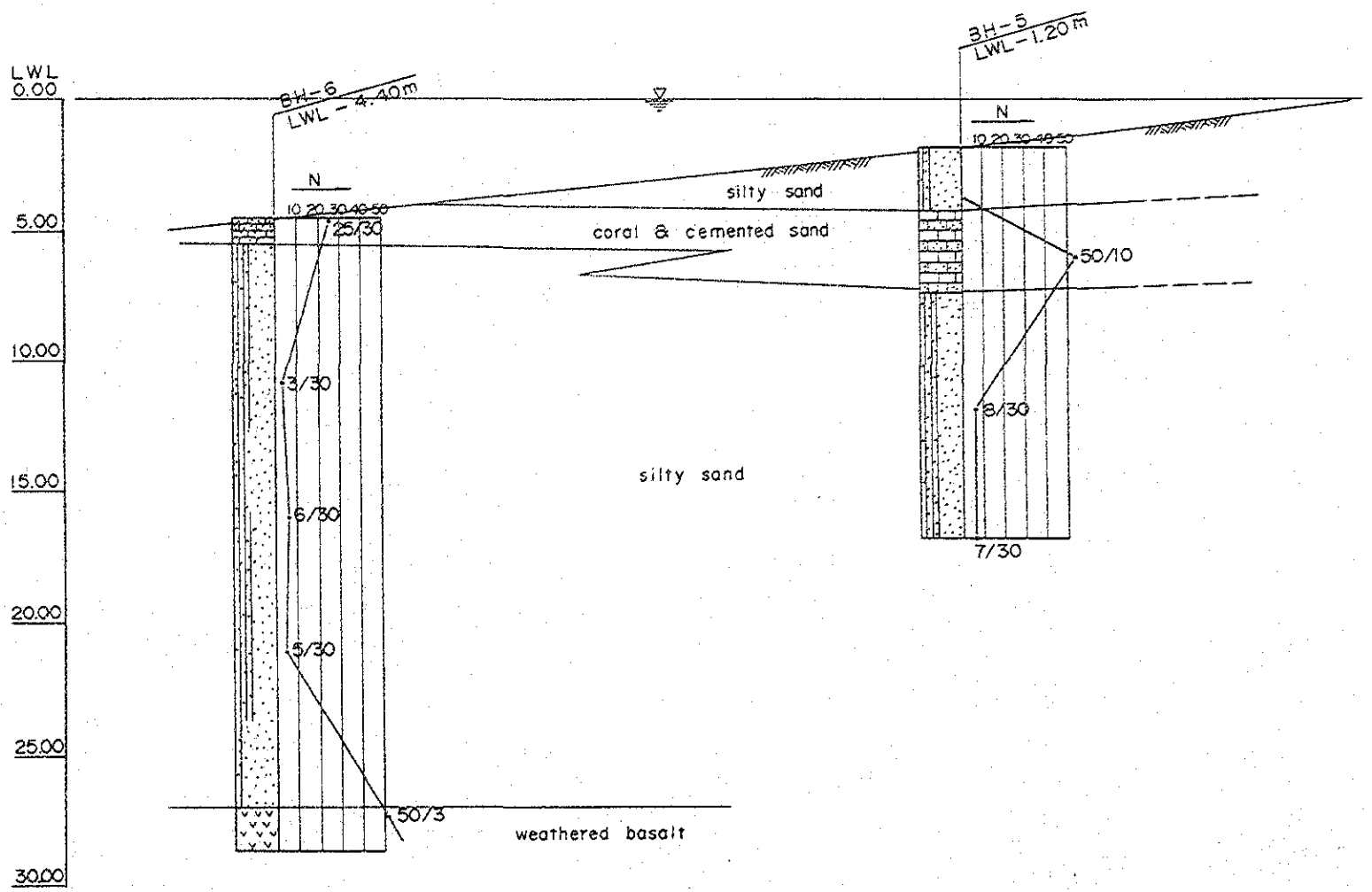


Fig. 5.3 Soil Profile (Ferry Boat Terminal)

CHAPTER 6 DEVELOPMENT PLAN FOR APIA PORT

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For the development of Apia port, the Master Plan targeting the year 2005 has been prepared by the Japanese Study Mission dispatched to Western Samoa by the Government of Japan, responding to the request of the Government of Western Samoa.

Also the First Stage Plan has been prepared for urgent items picked up from the Master Plan.
In this chapter, outlines of these plans are summarized in following sections.

6.1 Master Plan

The Master Plan for Apia Port has been designed in an effort to solve existing problems and to cope with increasing cargo in this port, by achieving the following objectives:

1) Improvement of cargo handling efficiency, especially in container stevedoring operations
2) Enhancement of ship operation safety
3) Promotion of safety by separating the land area for cargo handling and passenger services
4) Effective utilization of the land area
5) Extension of service life of the existing facilities
6) Improvement of calmness of waters of the basin
7) Improvement of management and operation of the port

Based on the items listed above, the Master Plan projected the facility improvement plan is as shown in Fig. 6.1.

One new berth is proposed in the plan for large vessels having taken into account the number of vessels calling, and considering specific topographic conditions of the port.

Table 6.1 Port Facilities in 2005 at Apia Port

Facility	Function	Dimention or Contents
1) Basins	(a) Turning basin	Diameter = 400m, Depth (D) =-11m
	(b) Mooring basin	D = -11m
2) Breakwater		Length (L) = 100m
3) Mooring facilities	(a) Main Wharf	Some repairs
	(b) New Wharf	L = 200-225m D = -11m Strength Sufficient for Containers
	(c) Ferry berth	L = 50m
	(d) Wharf for small vessels	Improvement of the coastline
	(e) Mooring buoys	(1) Installation of lights (2) Resiting offshore site
4) Storage	(a) Expansion of yard	Behind the main wharf
	(b) Container terminal	Area 263 slots
	(c) CFS	30m x 40m = 1,200 m^2
	(d) Maintenance shop	200 m^2
	(e) transit sheds	2,500 m^2
	(f) Coconut oil tanks and sheds	Replacement
5) Connecting roads		Based on the layout plan
6) Ferry terminal		710 m^2
7) Port management facilities	(a) Main office	1,500 m^2
	(b) Pilot office	200 m^2
8) Tugboats		Replace (2 boats)
9) Navigation aids	(a) Beacons	Improve
	(b) Lighthouse	Construction on the new the breakwater
10) Marina	(a) Pontoon	60m (20 yachts)
	(b) Clubhouse	450 m^2
	(c) Basin	D = -4m to -5m
11) Green area		

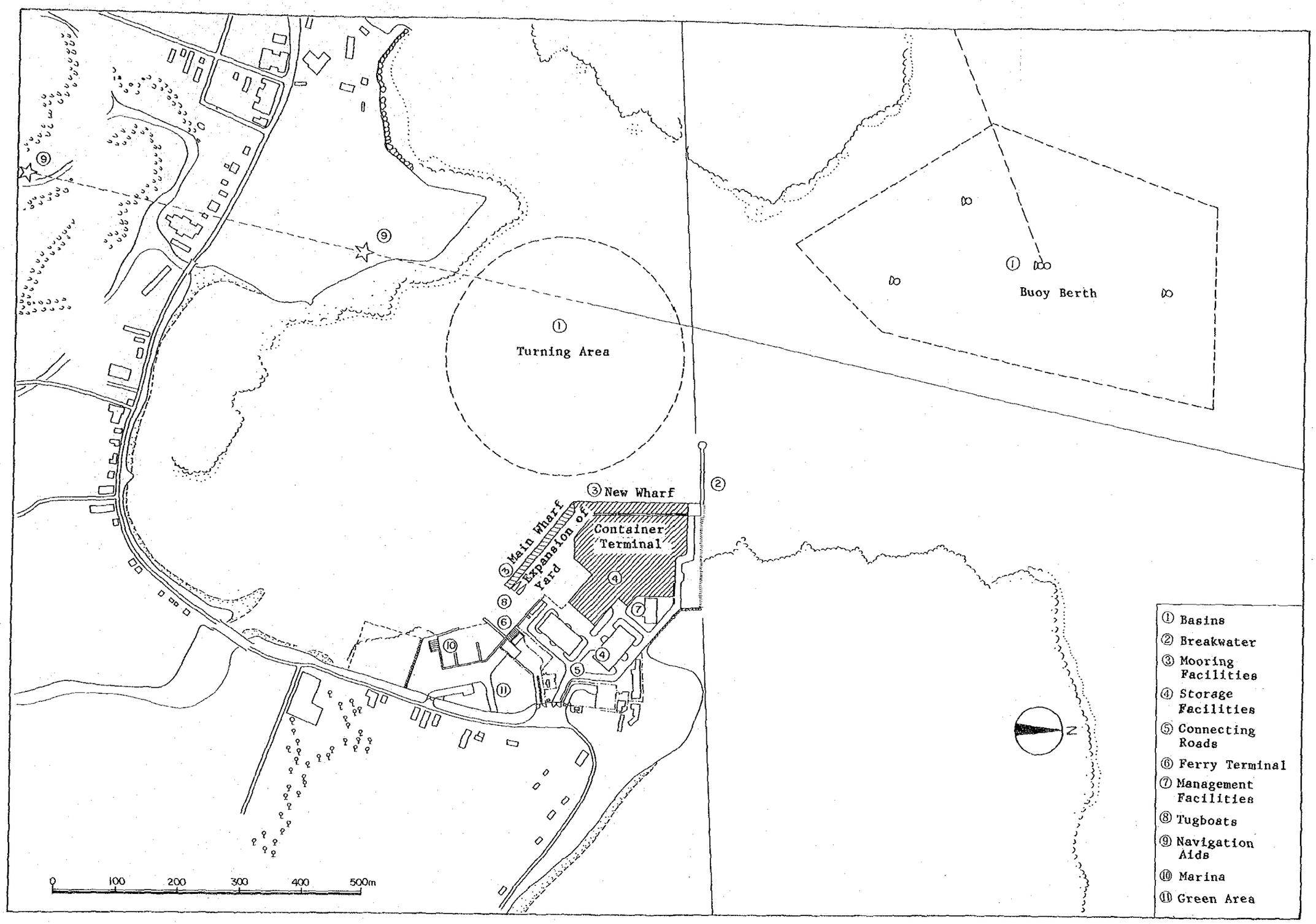

Fig. 6.1 Master Plan 2005 : Apia Port

6.2 First Stage Plan

The First Stage Plan has been prepared by selecting items from the Master Plan, in view of its urgency and immediate effects. (Fig 6.2)

1) A new 100 m long breakwater, to improve inner-harbour calmness achieving a 95 percent operating rate even during the rainy season.

2) Corrosion-resisting measures, for the extension of service life of the existing main wharf towards the target year.

3) Renewal of the ferry terminal, for improvement of port safety and stevedoring efficiency.

4) Expansion of the main wharf and container yards, to improve efficiency of container stevedoring and land use.

5) Provision of new tugboat and marker lights on tanker buoys for improvement of harbour safety.

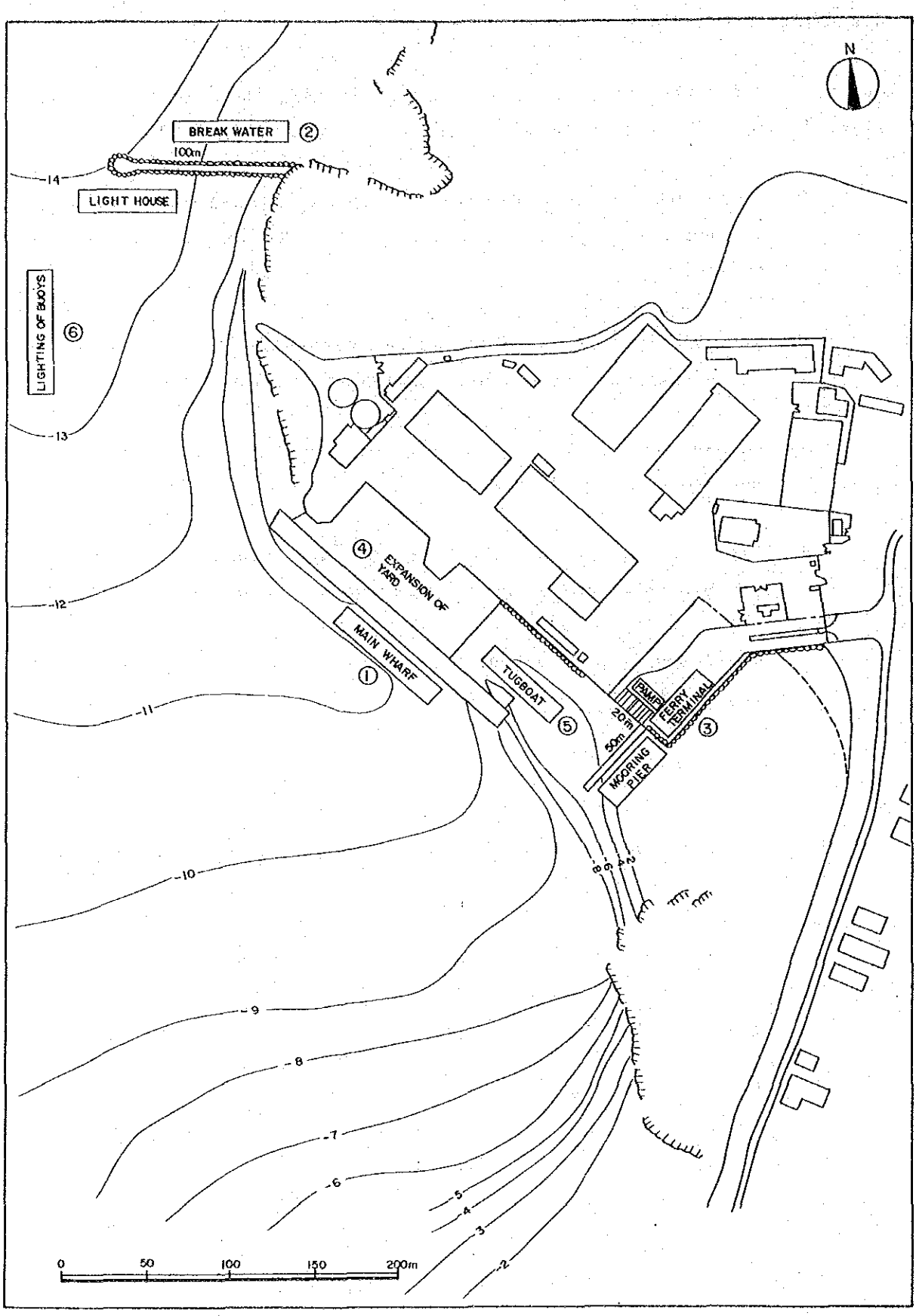

Fig. 6.2 First Stage Plan: Apia Port

6.3 Purpose of the Grant Aid Project for Apia Port

In view of the preceding plans for Apia Port, the grant aid project for the improvement of Apia Port has been programmed, pursuing the following targets:

(1) Modernization of Apia Port
(2) Upgrading of safety for vessels
(3) Improvement of port management

The background and measures to be taken for each target are explained below.

(1) Modernization of Apia Port

In Apia Port, the main wharf with a single berth is the only facility for ocean going vessels. This berth was constructed over twenty years ago for handling general cargos. Since then, every year, the rate of containerized cargo have been increasing, and today about 75% of the cargo passing through Apia Port is in containers. The port has tried to adapt itself to this change by the introduction of large forklifts for container handling, but, improvement of the port by rearranging the wharf layout and yard layout is required to meet the new demands in cargo handling.

In view of this requirement, the main wharf is planned to be widened to facilitate operation of large forklifts and operation of ramp for Ro-Ro ships. Also, the container yard is planned to be expanded to give direct access to the main wharf. These modifications are the primary objectives of the modernization program for Apia Port.

In addition, an improvement project for the existing container yard, with a plan to rearrange the yard layout, lay pavement and construct a drainage system, is under way having received financial aid from the ADB.

The ferry terminal which connects Apia to Pago Page in American Samoa has deteriorated because of aging. The quay has cracks and the mooring dolphin has already collapsed. The terminal building at present is no more than a shack. The ferry mooring facilities and terminal building will be improved to turn this terminal into an international class ferry terminal.

(2) Upgrading safety for vessels

Apia Harbour is the gate for international trade for Western Samoa, being crowded throughout a year with domestic as well as foreign vessels. Since the main wharf has been left without substantial repair and improvement work for more than twenty years since construction, as described above, damages or deterioration has resulted causing a lot of problems hindering efficient operation.

The only tugboat "Pualele" in Apia Port to help ocean going vessels in manouevering and mooring operations, is already twelve year old, and has lost half of its original 425 horse power. She has been suffering from frequent serious engine troubles often rendering her inoperable. Replacement of the tugboat is an urgent requirement.

Due to having received no repair for many years, fenders, curbings and other accessories have been damaged in the main wharf. Furthermore, it is feared that due to corrosion, the piling columns have lost much of their strength to resist loads. Therefore, it is also urgent to recover a suitable level of safety and strength for the column piles by repair and reinforcement.

Another serious problem is high waves that run into the harbour due to northeasterly prevailing winds during the rainy season from November through March. Since no breakwater is provided at the port mouth, such waves not only seriously disturb manouevering operations of vessels in the harbour but also damage both vessels and the quay by causing pitching of vessels.

As a solution, construction of a breakwater on the east side of the harbour entrance has been proposed. To upgrade calmness in the harbour and assure the safety of vessels in the harbour, construction of the breakwater is considered to be an urgent need.

(3) Improvement of management

MOT is generally responsible for the management of Apia Harbour. However, the present budget system does not allow for reservation of port operation income for maintenance purposes, and the budget for MOT allotted by the government is not sufficient to carry out necessary maintenance or improvement of the facilities. Introduction of an efficient management system, as well as an introduction of a maintenance and operation system with training and education of staff are particularly urgent requirements.

6.4 Projected Items under the Grant Aid

The items of work included in the Grant Aid Project by Japan for Apia Port consists of the following, with a view to attaining foregoing targets, based on study results from requests from Western Samoa, as well as on the results of field surveys, and on a study of expected benefits. More details of each item including scope and scale are presented in the following section 6.5.

1) Repair of the main wharf.
2) Expansion of the main wharf.
3) Extension of the container yard.
4) Ferry wharf and dolphin.
5) Ferry terminal building.
6) Breakwater and marker lights.
7) Tugboat.
8) Equipment for management and maintenance.

Fig. 6.3 shows the layout of the projected facilities.

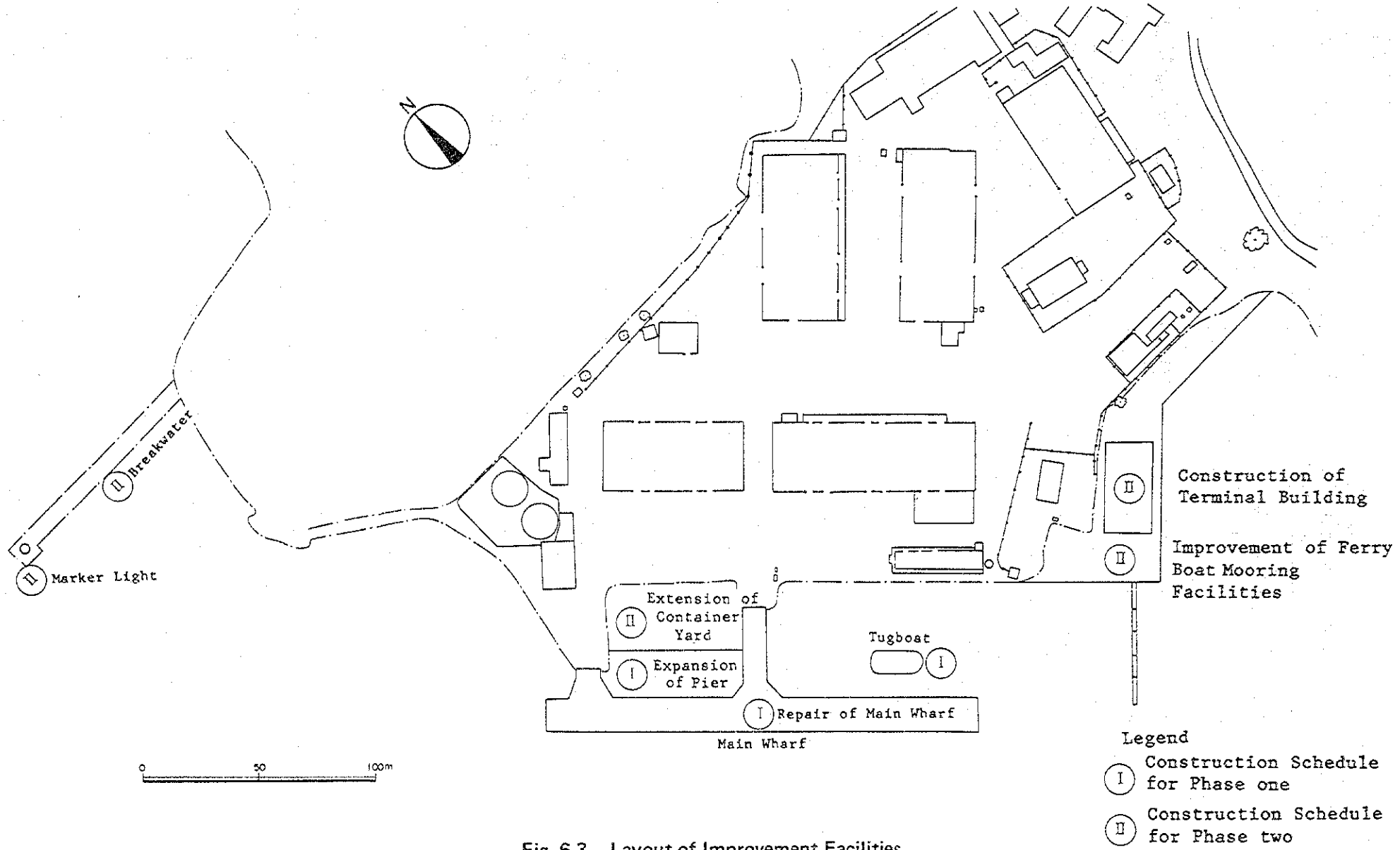

Fig. 6.3 Layout of Improvement Facilities