

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF TRANSPORT
PUBLIC WORKS DEPARTMENT
WESTERN SAMOA

No. 1

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR REHABILITATION AND IMPROVEMENT
OF
CYCLONE-DAMAGED PORTS AND FORESHORE PROTECTION
IN
WESTERN SAMOA

DECEMBER 1992

NIPPON TETRAPOD CO., LTD.

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BASIC DESIGN STUDY REPORT ON THE PROJECT FOR REHABILITATION AND IMPROVEMENT
OF CYCLONE-DAMAGED PORTS AND FORESHORE PROTECTION IN WESTERN SAMOA

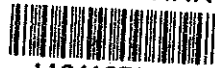
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NIPPON TETRAPOD CO., LTD.



PREFACE

In response to a request from the Government of Western Samoa, the Government of Japan decided to conduct a basic design study on the Project for Rehabilitation and Improvement of Cyclone-damaged Ports and Foreshore Protection and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Western Samoa a study team headed by Mr. Shoji Shimbo, Managing Director, Grant Aid Study & Design Department, JICA and constituted by the officials of the Ministry of Transport and the Ministry of Construction and members of Nippon Tetrapod Co., Ltd., from 25th June to 25th July, 1992.

The team held discussions with the officials concerned of the Government of Western Samoa and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Western Samoa in order to discuss a draft report and the present report was prepared.

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

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

December, 1992

A handwritten signature in black ink, reading "Kensuke Yanagiya". The signature is fluid and cursive, with a long horizontal stroke at the end.

Kensuke Yanagiya

President

Japan International Cooperation Agency

December, 1992

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Rehabilitation and Improvement of Cyclone-damaged Ports and Fore-shore Protection in Western Samoa.

This study has been made by Nippon Tetrapod Co., Ltd. (NTC), based on a contract with JICA, from June 19th to December 25th, 1992. Throughout the study, we have taken into full consideration of the present situation in Western Samoa, and have planned the most appropriate project in the scheme of Japan's grant aid.

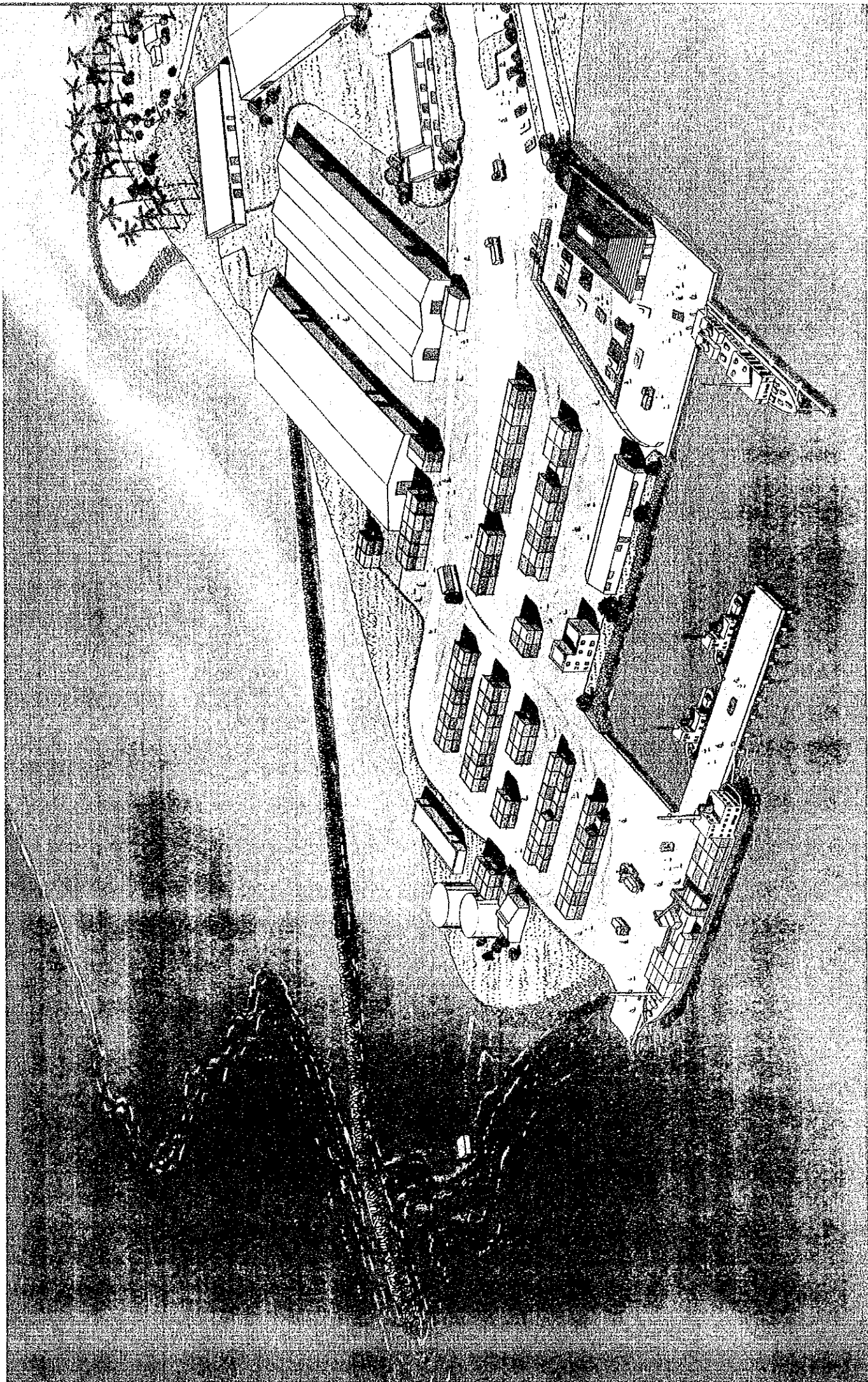
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, the Ministry of Transport and the Ministry of Construction. We also wish to express our deep gratitude to the officials concerned of the Ministry of Transport, the Public Works Department, JICA Western Samoa Office and the Embassy of Japan in New Zealand for their close cooperation and assistance during our study.

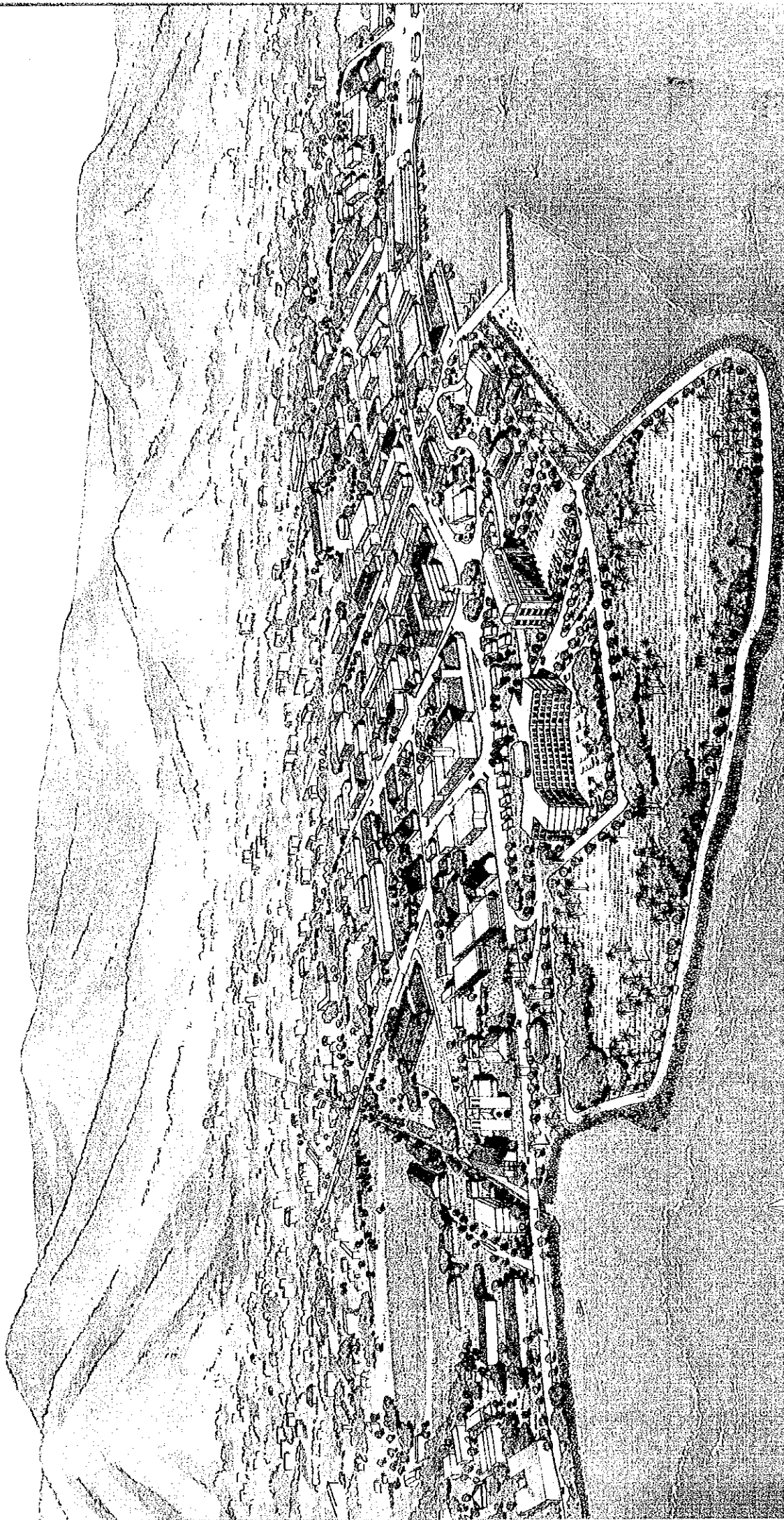
At last, we hope that this report will be effectively used for the promotion of the project.

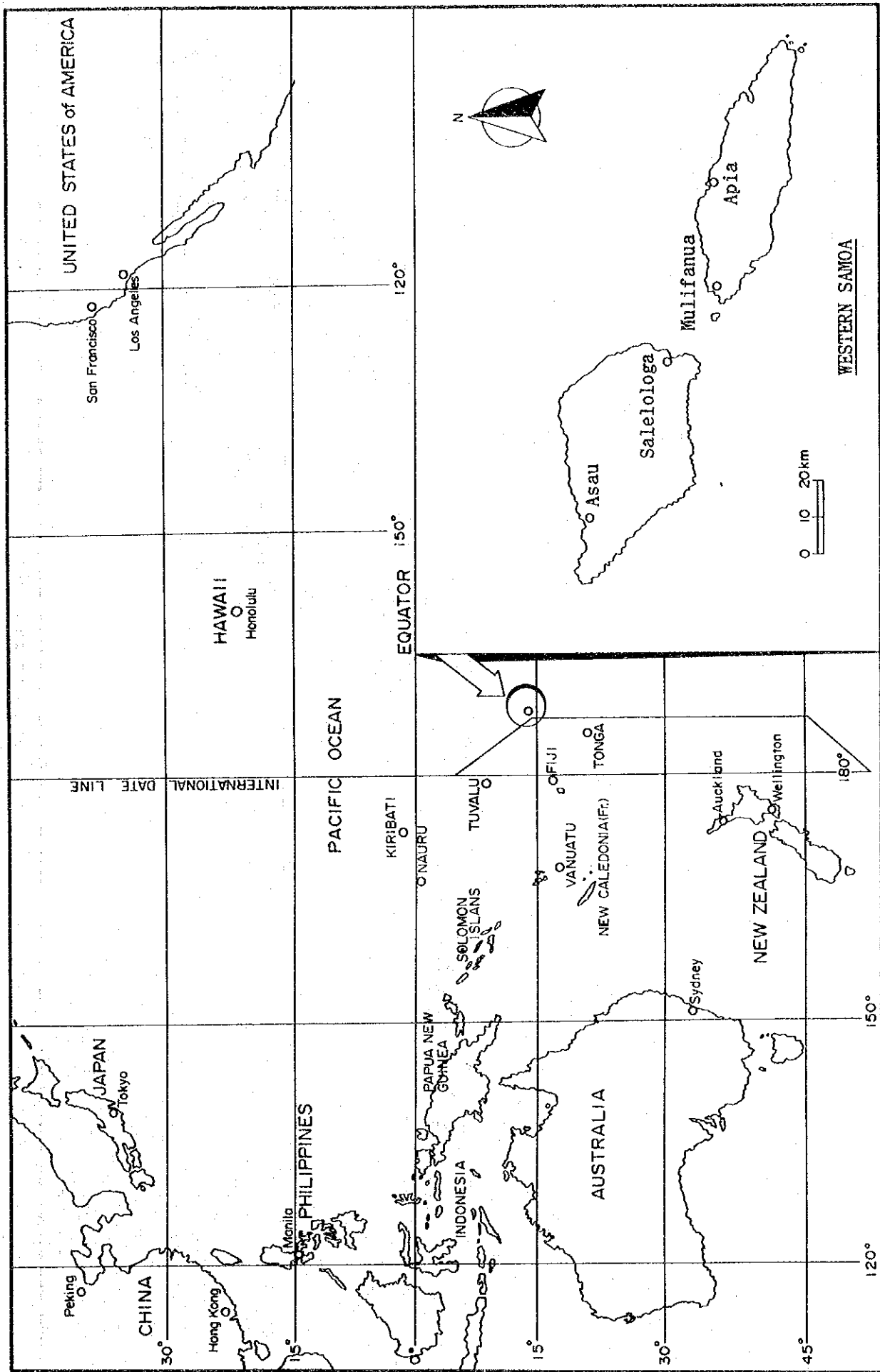
Very truly yours,



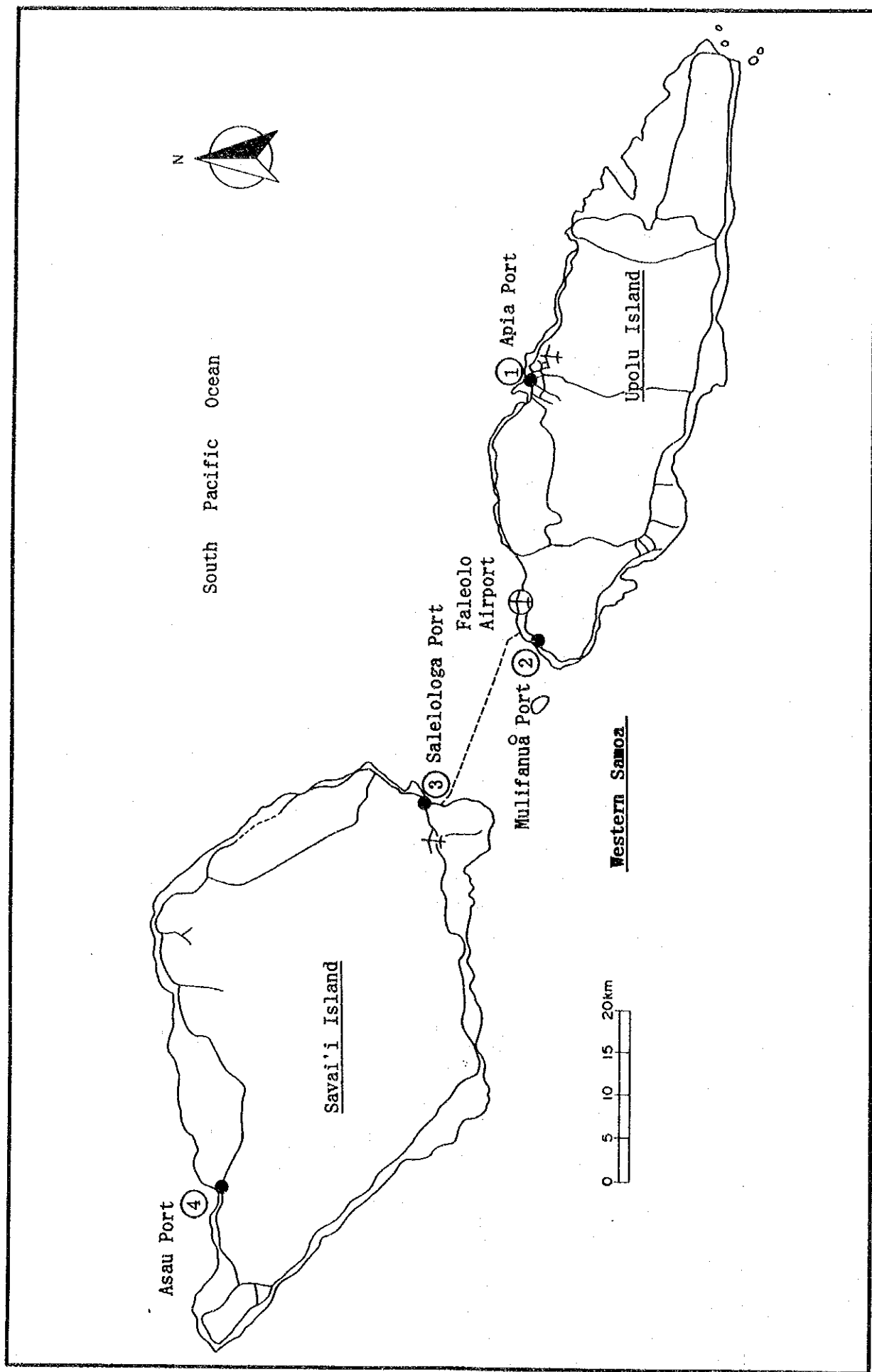
Hisanori KATO
Consultant Leader
Nippon Tetrapod Co., Ltd.





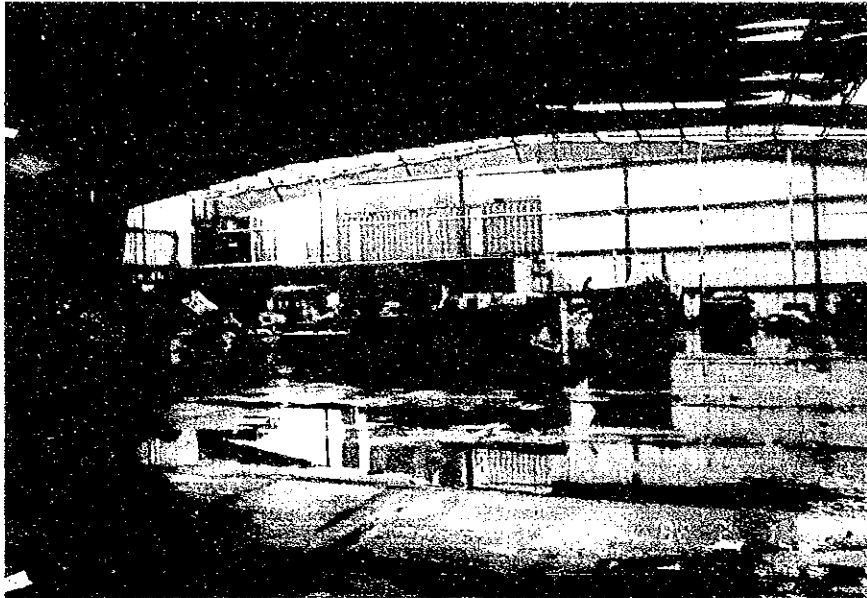


LOCATION OF WESTERN SAMOA



LOCATION OF FOUR PORTS

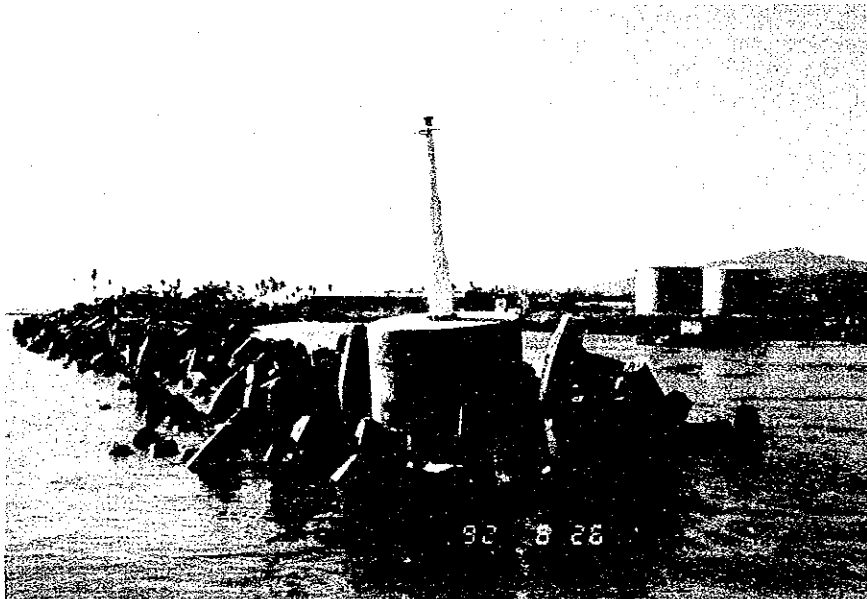
PHOTOS OF CYCLONE-DAMAGE



PORT FACILITIES

Apia Port

Shed No.1 has been damaged
unserviceable
with roof and wall
blown away.



The breakwater has
been damaged on its
head section.



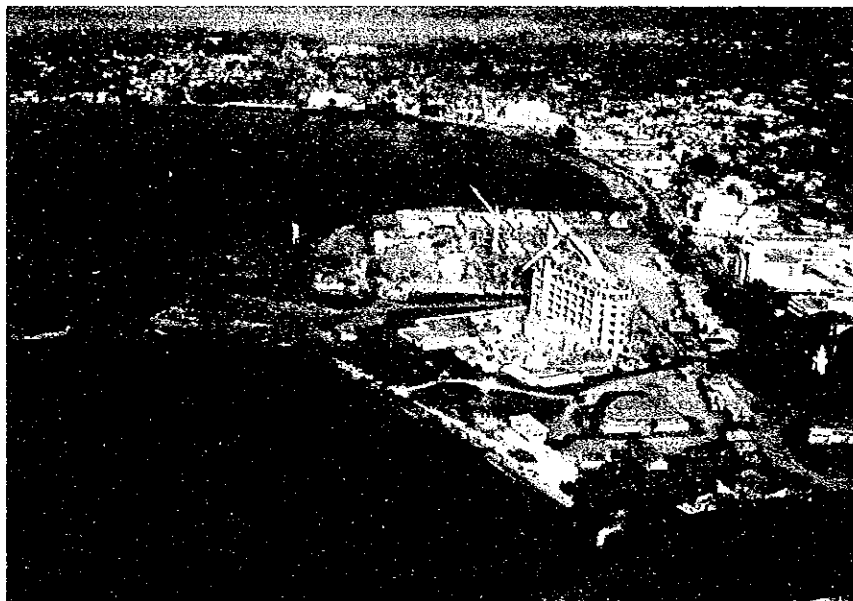
Salelologa Port

The terminal
building has been
damaged with its
roof totally blown
away.



FORESHORE PROTECTION

Wave over-topping
has caused serious
flooding damage to
Aggie Grey's Hotel.



The reclamation area
is being eroded
through damaged
revetment.



The revetment is not
high enough to
prevent wave over-
topping in front
of Kitano Tusitala
Hotel.

SUMMARY

SUMMARY

Western Samoa is an insular country located in the central South Pacific with a national land area of 2,936 km² and a population of about 160,000. Given its geographical condition, Western Samoa's national life and economic activities largely depend on maritime transportation, making ports crucial components of basic social infrastructure. While, Apia Harbour coastal area, where the capital of the country Apia City is located, accommodates numerous important governmental and commercial facilities and the rehabilitation and improvement of the foreshore protection facilities along Apia Harbour has been given a high priority together with the development of the Apia urban area.

Western Samoa was attacked by the large cyclone "Ofa" in February, 1990 which caused extensive damage making 25,000 people homeless. The port facilities which are the basis of sea transportation also sustained such heavy damages as collapse of breakwater and wharfs, siltation of a navigation channel and loss and damage of navigation aids, etc. Similarly, coastal roads and airports sustained serious damages. The rehabilitation of the damaged port facilities have been completed under Japanese grant aid programme in September 1992.

However, Western Samoa has been struck again by a large cyclone "Val" in December 1991 and sustained the same damages as those in the previous year on basic infrastructure such as ports, foreshore protection, etc. Total cost of the damages is estimated at about 300 million US\$. The port facilities have sustained serious damages in Apia, Mulifanua, Salelologa and Asau and in the case of Apia Port which is the key port for both domestic and foreign trade, safe and efficient port operation must be urgently restored, demanding the urgent implementation of rehabilitation works. While the foreshore protection facilities along Apia Harbour are substantially insufficient in safety and function of preventing wave over-topping and have sustained serious damages at cyclones causing flooding damage to the facilities behind.

From this background, the Government of Western Samoa made a request to the Government of Japan for a grant aid to restore the port facilities and Apia Harbour foreshore protection.

In response to the request by the Government of Western Samoa, the Government of Japan decided to carry out the basic design of the project and the Japan International Cooperation Agency (JICA) sent the Study Team to Western Samoa for a period of 31 days from June 25th to July 25th, 1992 to conduct a field study. In the course of the study period, the Study Team collected data and information required, and discussed with officials of the Government of Western Samoa. The draft final report was presented and discussed in Western Samoa from 7th to 20th October, 1992.

Based on the results of the field study and the discussions with the officials of the Government of Western Samoa, the optimal basic design consisting of the following project components has been worked out through due consideration of the request of the Government of Western Samoa. The implementation of the project is divided into two phases and the project components requiring urgent restoration are included in the first phase.

(1) Port Facilities	
Phase I	Phase II
1. Apia Port <ul style="list-style-type: none"> - MOT Office - Main Wharf Area <ul style="list-style-type: none"> Shed No. 1/Shed No.4 Main Wharf: Rubber/Wooden Fenders Wharf Light, Curbing Leading Beacon - Ferry Terminal Area <ul style="list-style-type: none"> Terminal Building Ferry Ramp: Curbing, Dolphin 	1. Apia Port <ul style="list-style-type: none"> - Breakwater
2. Mulifanua Port <ul style="list-style-type: none"> Terminal Building Leading Beacons Channel Dredging 	
3. Salelologa Port <ul style="list-style-type: none"> Terminal Building Revetment 	

(2) Foreshore Protection Facilities	
Phase I	Phase II
Section A-B : MOT office to Vaisigano River	Section E'-F: Bus Terminal to HRPP Office
Section B-C : Vaisigano River to Mulivai Stream	Section F-G : HRPP Office to Apia Observatory
Section C-D : Mulivai River to Sandy Beach on Reclamation Area	
Section D-E : Beach Sandy on Reclamation Area	

The implementation of the project will be required 3 months for detailed design and 10 months for construction works for the first phase and 3 months for detailed design and 11 months for construction works for the second phase.

The executing agencies of this project are Ministry of Transport (MOT) and Public Works Department (PWD). Both agencies have sufficient experiences and staffs to operate and administer the project facilities and no difficulty is expected for efficient utilization and adequate maintenance.

Benefits expected to be brought about by implementation of this project are listed below :

by restoration of the port facilities

- (1) Improvement of efficiency and safety in port operation and management
- (2) Improvement of safety of navigation and

by improvement of the foreshore protection

- (1) Improvement of safety of the facilities along Apia Harbour
- (2) Improvement of the foreshore protection and resulting reduction of maintenance cost
- (3) Prevention of erosion on reclamation area

Apia Port handles about 200,000 t of foreign cargoes, and Mulifanua and Salelologa Ports carries 270,000 passengers a year. While, the area along Apia Harbour accommodates the most important governmental and private facilities. The rehabilitation of cyclone-damaged facilities in Apia, Mulifanua and Salelologa Ports will recover efficient and economical sea transportation while the rehabilitation of the foreshore protection will improve safety of the onshore facilities.

The urgent restoration of the port facilities and improvement of the foreshore protection are considered to be essential for recovery of the national life and economic activities of Western Samoa and, therefore, the urgent implementation of the project as a grant aid assistance of the Government of Japan is judged to be highly significant and appropriate.

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Abbreviations

ADB	Asian Development Bank
AIDAB	Australian International Development Assistance Bureau
CDL	Chart Datum Line
DP7	Seventh Development Plan
EN	Exchange of Notes
FS	Feasibility Study
GDP	Gross Domestic Product
HRPP	Human Right Protection Party
IDA	International Development Association
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
MOT	Ministry of Transport
PFL	Pacific Forum Line
PSIP	Public Sector Investment Programme
PWD	Public Works Department
Ro-Ro	Roll on Roll off
UNDP	United Nations Development Programme
US\$	United States Dollar
WSSC	Western Samoa Shipping Corporation
WS\$	Western Samoa Dollar (or Tala)
¥	Japanese Yen

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background of the Request

Western Samoa is an insular country located in the central South Pacific with a national land area of 2,936 km² and a population of about 160,000. Given its geographical condition, Western Samoa's national life and economic activities largely depend on maritime transportation, making ports crucial components of basic social infrastructure. While, Apia Harbour coastal area accommodates numerous important governmental and commercial facilities and the foreshore protection facilities along Apia Harbour need rehabilitation and improvement against frequent cyclone damages.

Western Samoa was attacked by the large cyclone "Ofa" in February, 1990 which caused extensive damage making 25,000 people homeless. The port facilities which are the basis of sea transportation also sustained such heavy damages as collapse of breakwater and wharfs, siltation of a navigation channel and loss and damage of navigation aids, etc. Similarly, coastal roads and airports sustained serious damages. The damaged port facilities have been rehabilitated under Japanese grant aid programme.

Western Samoa has been struck again by a large cyclone "Val" in December 1991 and sustained the damages on natural resources, basic social infrastructure, public and private structures as well as the lives and livelihood of the people. Total cost of the damages is estimated at about 330 million US\$. The port facilities have sustained serious damages in Apia, Mulifanua, Salelologa and Asau and in the case of Apia Port which is the key port for both domestic and foreign trade, safe and efficient port operation must be urgently restored, demanding the urgent implementation of rehabilitation works. While the foreshore protection along Apia Harbour has been damaged with the armour stones displaced and backfill scoured and most of the facilities along the coast have been damaged by heavy wave over-topping and flooding.

From this background, the Government of Western Samoa made a request to the Government of Japan for a grant aid to restore the port facilities and Apia Harbour foreshore protection.

1.2 Dispatch of the Study Team

In response to the request by the Government of Western Samoa, the Government of Japan decided to carry out the basic design of the project and the Japan International Cooperation Agency (JICA) sent the Study Team headed by Mr. Shoji Shimbo, Managing Director, Grant Aid Study & Design Department, JICA, to Western Samoa for a period of 31 days from June 25th to July 25th, 1992 to conduct a field study. In the course of the study period, the Study Team collected data and information required, and discussed with officials of the Government of Western Samoa. The basic direction of the project has been discussed and agreed as described in Minutes of Discussion signed on July 3rd, 1992. The further study was made in Japan and this draft final report was prepared and presented from 7th to 20th October, 1992 in Western Samoa.

The objectives of the study are to work out the basic design for the restoration project requested by the Government of Western Samoa through detailed study on the background, scope and effect of the project. The study team conducted the following studies to formulate an adequate project plan.

- 1) confirmation of project background and contents of the request
- 2) confirmation of project priorities
- 3) inspection on project sites
- 4) confirmation of cyclone damages to port and foreshore protection facilities
- 5) natural condition survey (topography, sounding, etc.)
- 6) study on availability of local construction material and equipment
- 7) scope of works to be borne by the Government of Western Samoa

The present report presents the results of project study on the project components, facility layout, structural design, management system and overall project suitability based on the above study.

The list of the Study Team members, study schedule, list of main interviewees and the Minutes of Discussion are attached in the Appendices of this report.

CHAPTER 2

BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2.1 Outline of Western Samoa

2.1.1 Geographical Conditions

Western Samoa is located between latitude 13°S and 14°S and between longitude 171°W and 173°W at almost the centre of the South Pacific Ocean, some 3,700 km SSW of Hawaii and 2,900 km NNE of Auckland.

Western Samoa has a total national land area of 2,936 km² with the two main islands of Upolu (1,122 km²) and Savaii (1,714 km²) accounting for 95% of the total land area and a few small islands comprising the remainder. The islands are protected from rough seas by coral reefs which are more developed around Upolu Island than Savaii Island. Both the main islands are of volcanic origin. Savaii Island has a thin deposit layer and many lava outcrops especially in the northern coastal areas, and its population of some 40,000 is only one-third of that of Upolu Island, mainly because of the poor land fertility.

2.1.2 Socioeconomic Conditions

1) Industry

The GDP of Western Samoa in 1990 was 138 million WS\$ in 1982 price and the growth rate from 1987 to 1990 was, affected by the cyclone "Ofa", -0.9% as shown in Table 2-1. The GDP per capita in 1990 was 873 WS\$. Population growth is shown in Table 2-2.

Table 2-1 GDP 1987-1990 AT CURRENT AND CONSTANT PRICES
WS\$ million

	1987	1988	1989	1990	+%pa
GDP at current prices	218	240	254	266	6.9
GDP at constant 1982 prices	142	142	145	138	-0.9

Source : Prime Minister's Department

The GDP share by sector in 1990 showed a predominant 45% for agriculture, forestry and fisheries followed by 35% for service, mainly public service sector. The industrial sector accounted for only 12%. Main agricultural products are copra, taro, cocoa and banana while main industrial products are coconut oil, beer, tobacco, match, soap and sawn timber.

Table 2-2 POPULATION, 1961-1986

Year	Total population	Average annual growth during intercensal period
1961	114,427	3.3%
1966	131,377	2.8%
1971	146,627	2.2%
1976	151,983	0.7%
1981	156,349	0.6%
1986	157,158	0.1%
1991*	159,862	0.3%

* Preliminary count from 1991 Census of population
Source : Prime Minister's Department

2) Trade

Economy of Western Samoa is a typical monoculture economy which is dependent on export of such agricultural products as copra, taro and cocoa with exports of these three products accounting for about 75% of total export value. Reflecting fluctuations in recent international market prices, copra, taro and coconut cream have increased export share, while cocoa shows decreasing trend as shown in Table A-2-1 of Appendix. Balance of trade has been mostly in red and the import value for the last three years exceeded the export value by more than four times despite relatively high import duties, restrictions on import items and stagnation of economic growth.

Structural trade deficit is compensated for by transfer of money from Western Samoans working abroad and also by capital account surplus. Government budget shows a large deficit due to steady increase of expenditure in development projects. In 1992/93 year budget, some 60% of development funds are met by foreign assistances to ease a burden of the Government of Western Samoa.

2.2 Related Development Plan

2.2.1 National Development Plan

Western Samoa's long term development objectives have been set out in Seventh Development Plan (DP7) and remained essentially the same for the last several Plan periods as follows.

- Sustained economic growth
- Improved quality of life for all Samoans
- Greater degree of national self-reliance
- Improved regional balance
- Equitable distribution of socio-economic opportunities.
- Protection of the environment

DP7 defines basic development strategies and development projects are presented in Public Sector Investment Programme (PSIP).

DP7 has stressed high importance to reduce the vulnerability of the economy and infrastructure to natural disaster, in particular cyclones.

The gross domestic product in the DP6 period (1988-90) was 22% larger than that in 1987, at current prices, but 2.8% smaller in constant-price. The cyclone "Ofa" is estimated to have reduced GDP by about 5%.

Further, implementation of DP7 will be delayed since investment will be spent predominantly for rehabilitation from the damages caused by the large cyclones "Ofa" and "Val" in 1992.

In the Strategy Plan all these factors have been considered and development expenditure by Government has been planned at WS\$ 242 million over the Plan period (at constant 1991 prices) as shown in Table A-2-2 of Appendix. This is equivalent to 29% of projected GDP. The actual development expenditure during DP6 period is shown in Table 2-3.

Table 2-3
SIXTH DEVELOPMENT PLAN
ACTUAL DEVELOPMENT EXPENDITURE, 1988-1990
(WS\$ Million at constant 1987 prices)

	Actual expenditure			Total DP6 period			
	1988	1989	1990	Local	Extnl	Total	Share
Economic sector	7.1	20.6	10.1	10.2	27.6	37.8	20%
Infrastructure	27.5	28.5	63.3	36.1	83.2	119.3	63%
Social services	10.8	10.1	11.3	2.3	29.9	32.2	17%
Total	45.4	59.2	84.7	48.6	140.7	189.3	100%

Source : Prime Minister's Department

Main ongoing projects are planned in the first year of DP7 period as follows.

- Several road improvement projects (loans funds: WS\$ 11.6 million).
- Afulilo Hydroelectric Power Project (WS\$ 11.8 million).
- Chinese-funded Government Administration Building (WS\$ 10.4 million).
- Second ADB Telecommunications Project (WS\$ 15.3 million).

To make up for the shortage of government development budget, external assistances of bilateral and multilateral sources during 1992/93-1994/95 are expected as in Table A-2-3 of Appendix. The past external assistances of various sources in 1988-89 is also shown in Table A-2-4 of Appendix.

The development funds for the projects related to this particular project are allocated in Public Sector Investment Programme (PSIP) as shown in Table A-2-5 of Appendix.

2.2.2 Restoration Plan of Cyclone Damages

Cyclone "Val" developed to the southeast of Tuvalu and moved in a south and south-east direction causing severe damages to the Samoa Islands over a period of four days. Cyclone Val was characterized by exceptionally high sustained winds of 35 m/sec with gusts up to 67 m/sec in all directions. The cyclone crossed Savaii Island and passed to the south of Upolu Island.

(1) Damage Caused by Cyclone Val

The Final Damage Assessment Report for Cyclone Val prepared by the Government estimates the total damage at about WS\$ 713 million (US\$300 million) with about 50% of the damage to buildings, dwellings and other structures and about 30% the damage to primary industry as detailed in Table 2-4. 12 persons lost their lives during the cyclone.

The cost of damage to the coastal protection works is estimated for the works to restore the facilities to the previous condition which would suffer the same damages by cyclone. The request for Japanese grant aid by the Government of Western Samoa reestimated the rehabilitation cost at about 15.4 million WS\$ to improve the facilities stable against cyclone waves and to prevent serious wave over-topping.

(2) Impact of Cyclone Val on the Economy

Western Samoa's economic performance has suffered major setbacks from the devastating effects of Cyclones Ofa and Val though the economic reforms were successfully supported since the mid 1980's, by external grants and strong growth in tourist receipts and private remittances.

Consequently, real GDP fell by nearly 5% in 1990, and is estimated to decline by as much as 10 to 12% in 1992, reflecting a major decline in exports and an increase in imports.

International response to emergency relief needs was quick with initial supplies of foods, construction materials, medical supplies, etc.

Table 2-4 CYCLONE VAL DAMAGE COST ESTIMATE - SECTORAL SUMMARY

Sector	Estimated Cost WS\$ million
Roads	31
Major Bridges	3
Water Supply	5
Apia Surface Drainage Project	minor
Coastal Protection Works	6
Buildings and Dwellings	330
Airports	3
Ports	18
Sea Transport	1
Power Supply	11
Postal and Telecommunications	4
Primary Industry (Agriculture)	201
Education	13
Health	20
Fire Services	2
Environment, Parks and Reserves	65
Total	713

Source: Final Damage Assessment Report, National Disaster Council, Government of Western Samoa

National Disaster Council (NDC) chaired by the Minister of Finance administers the relief operation and as of mid-March 1992, foreign governments and international aid agencies indicated about US\$ 6 million to emergency rehabilitation work as shown in Table A-2-6 of Appendix.

At a meeting held in July 1992 between Government of Western Samoa and its Development Partners, the assistances for rehabilitation plan from the damages caused by cyclone "Val" have been discussed and adjusted.

The major participants are Australia, Canada, Japan, New Zealand and U.S.A. as Bilateral Donors and World Bank and Asian Development Bank as Multilateral Financial Institutions.

2.2.3 Apia Port Development Plan

(1) Apia Port Master Plan

Apia Port is located on the east reef of Apia Bay as shown in Fig. 2-1 and Japanese grant aids were provided twice for development and rehabilitation of the port.

A Master Plan for development of Apia Port has been prepared for a target year of 2005 by the Japanese Study Mission in 1987 in response to a grant aid request by the Government of Western Samoa. The First Phase Plan of this Master Plan consists of those project components requiring urgent implementation.

The Apia Port Master Plan has been prepared taking the following requirements/conditions into consideration in order to solve the current problems and to meet an increasing demand for cargo handling.

1. Improvement of cargo handling efficiency, especially for container cargoes.
2. Improvement of navigational safety.
3. Improvement of safety by means of separating cargo and passenger areas and by other means.
4. Efficient use of available land area.
5. Obsolescence of the existing facilities
6. Natural conditions (geography, currents and waves).
7. Efficient administration and operation of port

Based on the consideration of the above factors, the improvement of port facility is proposed in the Master Plan as listed in Table 2-5 and shown in Fig. 2-2.

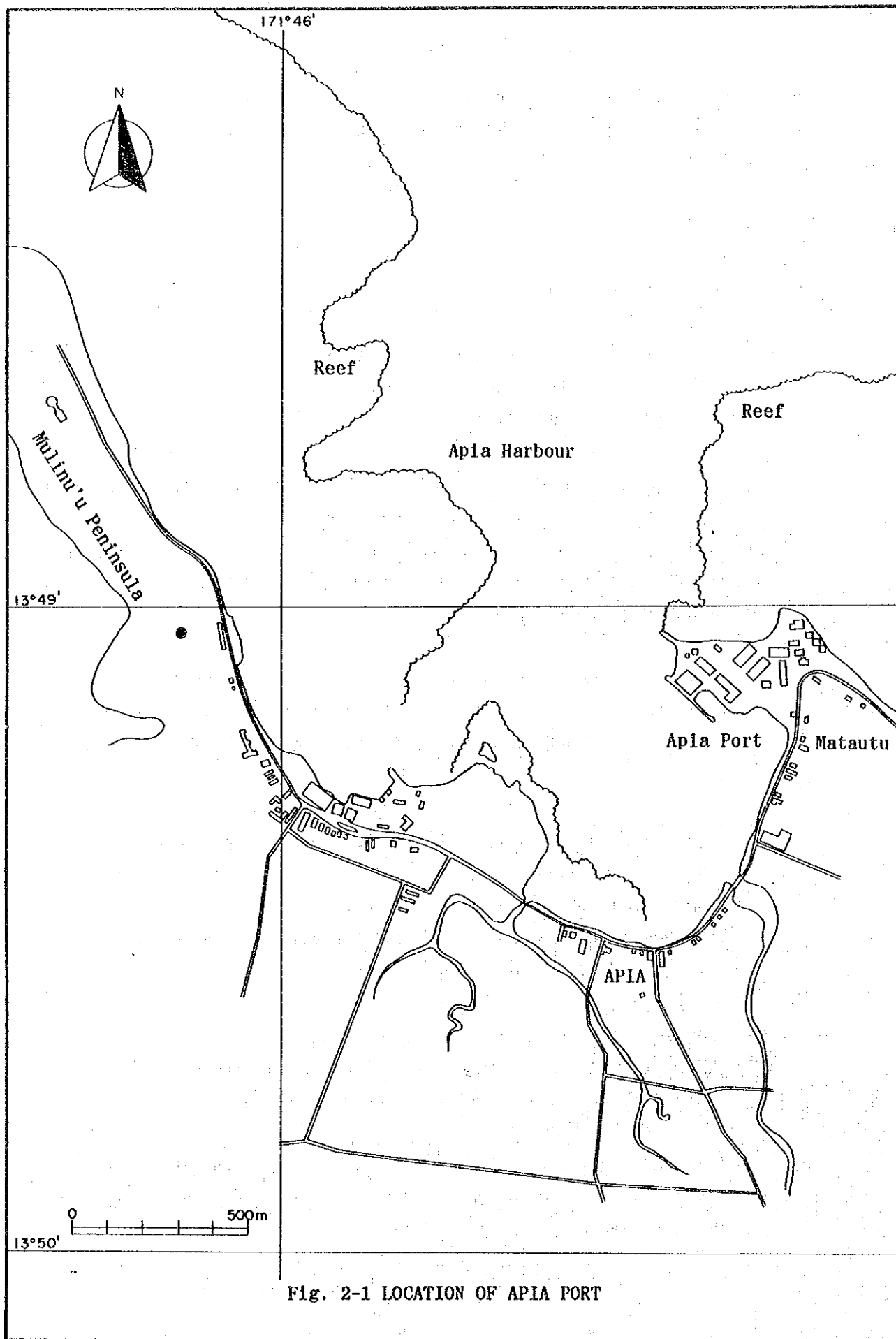


Fig. 2-1 LOCATION OF APIA PORT

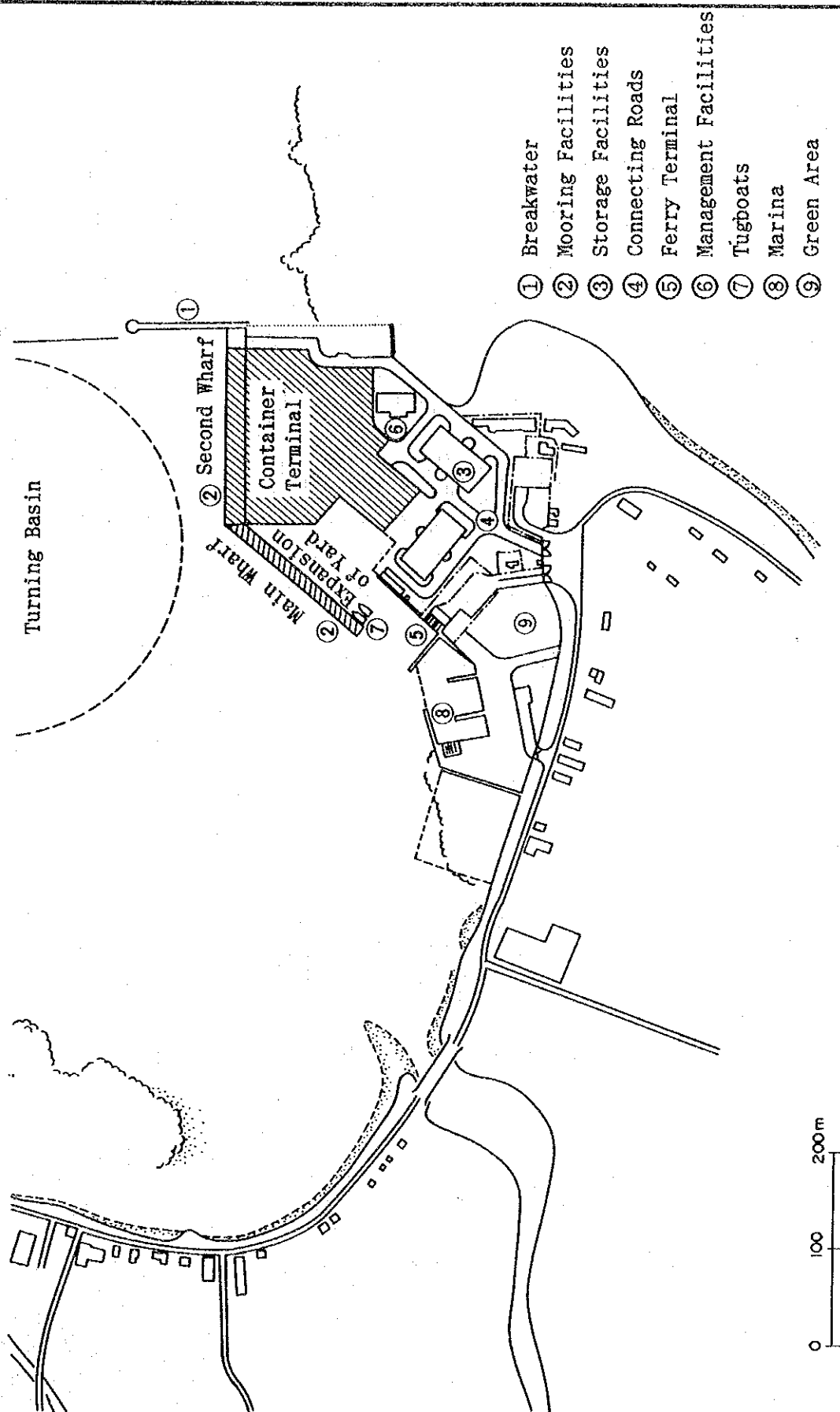


Fig. 2-2 MASTER PLAN, APIA PORT

Table 2-5 APIA PORT MASTER PLAN

Facility	Function	Dimension or Contents
1) Basins	(a) Turning basin (b) Mooring basin	Diameter = 400 m, Depth (D) = -11 m D = -11 m
2) Breakwater		Length (L) = 100 m
3) Mooring facilities	(a) Main Wharf (b) New Wharf (c) Ferry berth (d) Wharf for small vessels	Minor repairs L = 200 - 225 m D = -11 m L = 50 m Improvement for the coastline
4) Storage	(a) Expansion of yard (b) Container terminal (c) CFS (d) Maintenance shop (e) Transit sheds (f) Coconut oil tanks and she	Behind the main wharf Area 263 slots 30 m x 40 m = 1,200 m ² 200 m ² 2,500 m ² Replacement
5) Ferry Terminal		710 m ²
6) Port management facilities	(a) Main office (b) Pilot office	1,500 m ² 200 m ²
7) Tugboats		Replace (2 boats)

(2) Short Term Development Plan of Apia Port

Based on the Master Plan described in the previous section, the Government of Western Samoa requested the Government of Japan a grant aid assistance for the first phase plan of the Apia Port Master Plan.

Those project components requiring urgent implementation have been selected to form the First Phase Plan of the Apia Port Master Plan as shown in Fig. 2-3 and their expected effects are as follows.

1. Construction of a new breakwater (100 m long) with a lighthouse to minimize wave in a rainy season.
2. Application of anti-corrosion measure to the steel piles of the existing main wharf to extend its service life.
3. Improvement of the ferry terminal to increase safety and efficiency of ferry operation.
4. Expansion of the container yard to improve container handling operation.
5. Introduction of a new tug boat and a provision of lighting to tanker buoys to secure navigational safety.

The Project commenced in March, 1989 and consisted of the following major components as shown in Table 2-6.

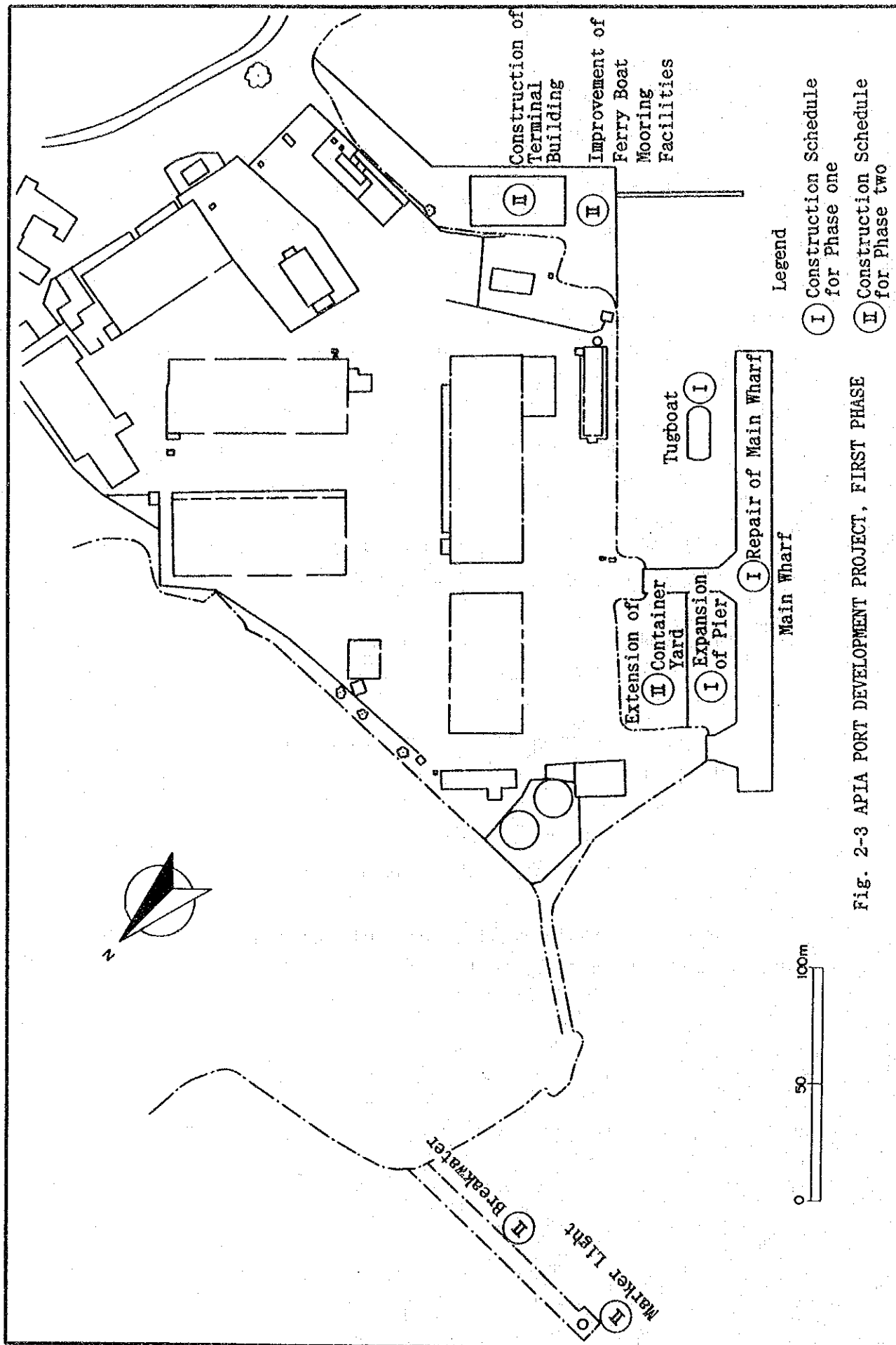


Fig. 2-3 APiA PORT DEVELOPMENT PROJECT, FIRST PHASE

Table 2-6 APIA PORT DEVELOPMENT PROJECT

Facilities	Contents
1. Repair of the main wharf	185 m
2. Expansion of the concrete deck of the main wharf	61.5 m x 18.0 m
3. Expansion and heavy duty pavement of the container yard	2,000 m ²
4. Ferry terminal mooring facilities	
- wharf	20 m
- mooring dolphin	50 m
5. Ferry terminal building	522 m ²
6. Breakwater with a marking light	100 m
7. New tug boat	1 (1,600 PS)
8. Port management equipment	
- 3 ton truck	1 (repair work and transportation)
- pick-up truck	1 (patrol and transportation)
- 4 wheel drive	1 (supervision of port operation) vehicle
- computer system	1 set (port statistics & accounting)

(3) The Projects for Rehabilitation of Cyclone-damaged Ports

Western Samoa was attacked by the large cyclone "Ofa" in February, 1990 and port facilities sustained such heavy damages as collapse of breakwater and wharfs, siltation of a navigation channel and loss and damage of navigation aids, etc.

The Government of Western Samoa made a request to the Government of Japan for a grant aid to restore the port facilities and to introduce the quarry plant to supply stone material for the road restoration works.

The project plan was worked out consisting of the following components as shown in Table 2-7 and illustrated in Fig. 2-4.

(1) Port Facilities

Table 2-7 REHABILITATION OF CYCLONE-DAMAGED PORTS PROJECT

Facilities	Contents
1. Apia Port	
Causeway	88 m
Seawall	235 m
Breakwater	265 m
Pilot/Work Boat	2 Nos.
Navigation Aids	2 Nos.
Marine Office	215 m ²
Wooden Fender	90 m
2. Mulifanua Port	
Dredging	32,000 m ³
Ferry Ramp	24 m
-3.5 m Wharf	40 m
Seawall	150 m
Navigation Aids, Beacon	2 Nos.
Marking Post	11 Nos.
3. Salelologa Port	
Navigation Aids, Beacon	2 Nos.
Marking Light	1 No.
Marking Post	8 Nos.
4. Navigation Aids	
Aleipata	
Lighthouse	1 No.
Apolima	
Lighthouse	1 No.
Malua Reef	
Lighthouse	1 No.

The rehabilitation of Shed No. 1 has been shelved due to further damages caused by the cyclone "Val".

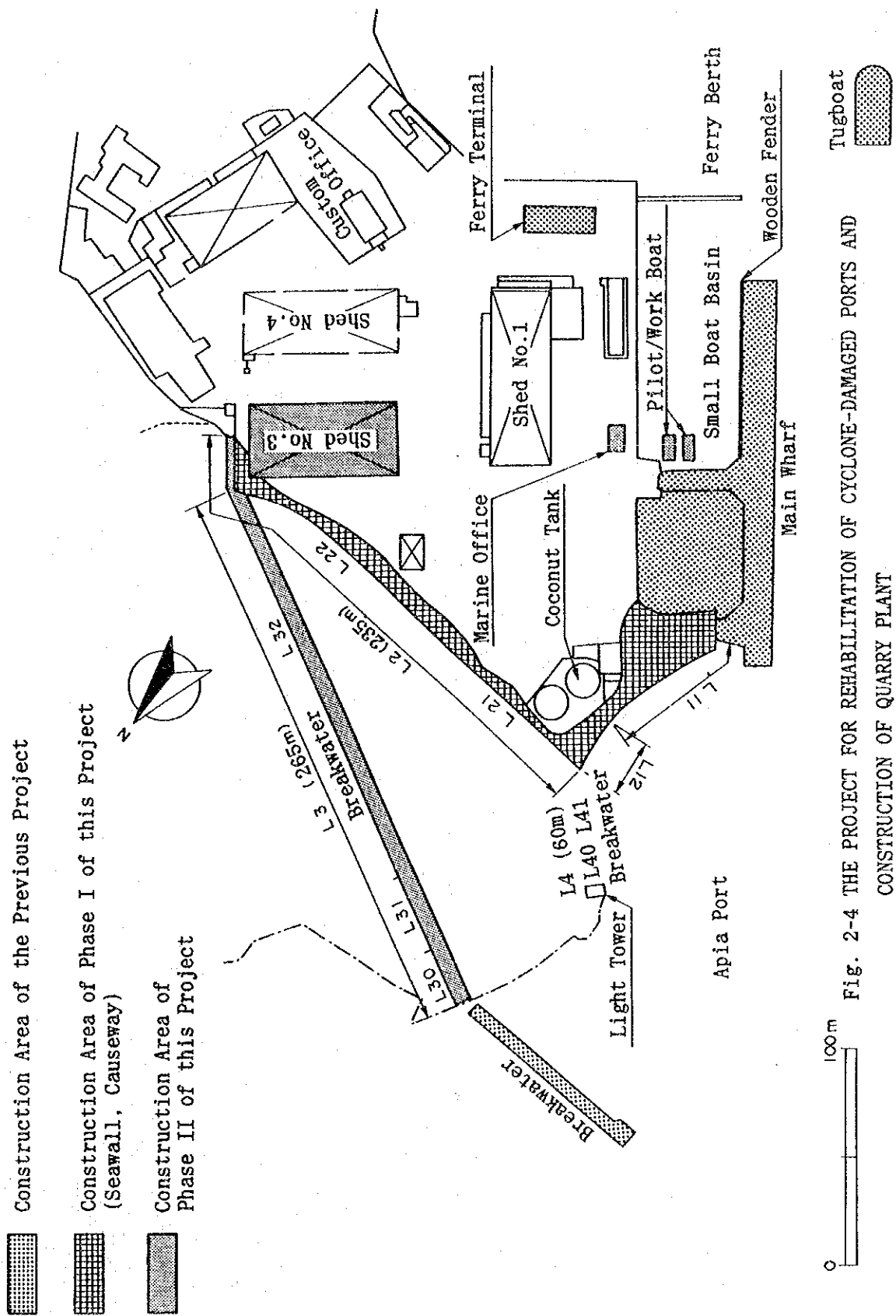


Fig. 2-4 THE PROJECT FOR REHABILITATION OF CYCLONE-DAMAGED PORTS AND
CONSTRUCTION OF QUARRY PLANT

(2) Quarry Plant

The quarry plant consisted of the equipment listed in Table 2-8.

Table 2-8 EQUIPMENT OF QUARRY PLANT

Equipment	Capacity	Quantity
1. Drills	63-90 m/m	2 Nos.
2. Bulldozer	35 ton	1 No.
3. Crusher	100 t/h	1 No.
4. Generator	270 KVA	1 No.
5. Wheel-loader (for raw rock)	2.4 cu-m	2 Nos.
6. Dump Trucks	12 ton	4 Nos.
7. Wheel-loader (for crushed stone)	1.7 cu-m	1 Nos.
8. Pick-up Trucks	1 ton	2 Nos.
9. Station Wagon	4,000 cc	1 No.

The construction works commenced in March 1991 and completed in September 1992.

2.2.4 Apia City Development Plan

The projects closely related to the rehabilitation of Apia Harbour Foreshore Protection are summarized in the following.

(1) Central Apia Area Development

- Implementation agency : Public Works Department/Department of Lands & Environment
- Project objectives :
 - To prepare a proper physical plan for Urban Apia
 - To reduce traffic congestion on Beach Road and Central Apia
 - To provide adequate public facilities in Central Apia
- Estimated total cost : WS\$ 6.4 million
- Description : The project is proposed to construct internal roads in Central Apia to reduce traffic congestion on Beach Road, relocation of the Savalalo market, construct a commercial pedestrian mall to be leased initially for those shops and stalls at the Reclaimed Area, construct adequate parking facilities, and allocate a public open space for recreation purposes as illustrated in Fig. 2-5.
- Project duration : 3 years

(2) Sewerage System - Apia Urban Area

- Implementation agency : Public Works Department

- Project objectives : To establish a piped sewerage system in the Apia Urban Area.

To conserve environmental sanitation and minimize health hazards and pollution of inshore marine waters and surface water through systematic disposal of sullage and wastewater.

- Estimated Total cost : WS\$ 50 million as follows:

Stage I - WS\$ 20 million

Stage II - WS\$ 15 million

Stage III - WS\$ 15 million

- Description : The proposed project envisages the development of a staged implementation programme for a conventional sewerage system for the central urban area consisting of sewerage discharge into the deep ocean well beyond the west reef off Mulinuu. Stage I comprises the most critical area and covers the low-lying areas of central Apia bounded by Vaiusu Bay, Vaitele Street, Togafuafua Road and Beach Road, including the National Hospital and Mulinuu peninsula.

- Project duration : 8 years commencing in FY 1993/94 as follows:

Stage I - 3 years

Stage II - 2-1/2 years

Stage III - 2-1/2 years

(3) Urban & Regional Planning Act

Project objectives

- To provide the framework for the establishment of the Apia Municipal Authority (AMA)
- To provide a framework for future planned development for maximum projection of the environment and effective use of natural resources

Estimated total cost

- WS\$ 0.06 million

(4) Leone Bridge

Project objectives

- To minimize traffic congestion in Central Apia, vehicle operation costs and road maintenance

Estimated total cost

- WS\$ 0.7 million

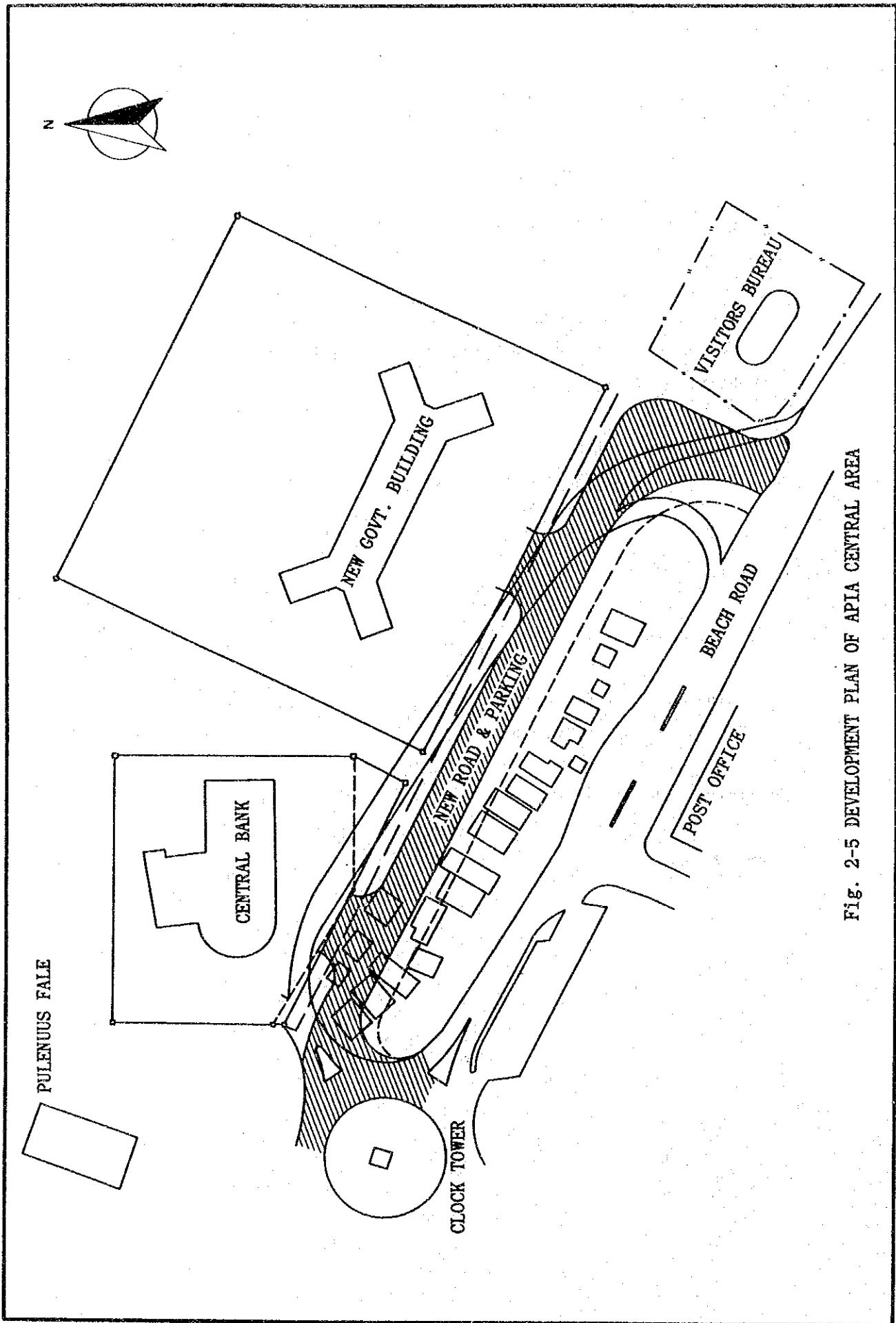


Fig. 2-5 DEVELOPMENT PLAN OF APIA CENTRAL AREA

2.3 Outline of Port and Foreshore Protection Facilities

2.3.1 Port Facilities

Marine and air transportation play an important role in Western Samoa due to country's geographical conditions. Marine transportation in particular is essential, not only for foreign trade but also to maintain vital link between Upolu and Savaii Islands.

(1) Ports in the Country

Economy and national life of Western Samoa depend on marine transportation due to its geographical conditions. Four major ports are outlined below and shown in Fig. 2-6 - Fig.2-10.

Apia Port

Handles almost all the foreign trade (approximately 180,000 tons) and also provides a ferry service connecting Western Samoa and American Samoa as shown in Table 2-9 - Table 2-11.

Asau Port

Ceased timber export and handles oil only.

Mulifanua and Salelologa Ports

Provide domestic ferry service connecting Upolu and Savaii Islands for about 270,000 passengers/year as shown in Table 2-12 and were improved by Japanese assistance in 1985.

(2) Activities of Apia Port

Apia Port is connected with such other countries in the South Pacific as New Zealand and Australia and with Far Eastern countries, including Japan, U.S.A. and Europe, by 9 liner services of semi-

container and Ro-Ro ships. In the South Pacific region in particular, the Pacific Forum Line (PFL) established in 1977 by member countries of the South Pacific Forum to facilitate marine transportation in the region provides a shipping service to Apia Port with 2 container ships.

A regular ferry service (approximately 2 trips/week) is provided by the Western Samoa Shipping Corporation (WSSC) between Apia Port and Pago Pago Port in American Samoa which carries 30,000 - 40,000 passengers/year.

Irregular services are provided by cargo vessels and oil tankers, and passenger boats cruising the South Pacific call at Apia Port several times a year.

The activities of Apia Port are outlined as follows.

- 1) The number of ship's call 190 - 200/year.
- 2) The annual cargo volume is about 180,000 tons, of which 150,000 tons are handled through the main wharf. And 20,000 tons and 10,000 tons are handled through a buoy berth and a ferry wharf respectively.
- 3) The number of passengers handled through the ferry wharf is 30,000 - 40,000 in a year.

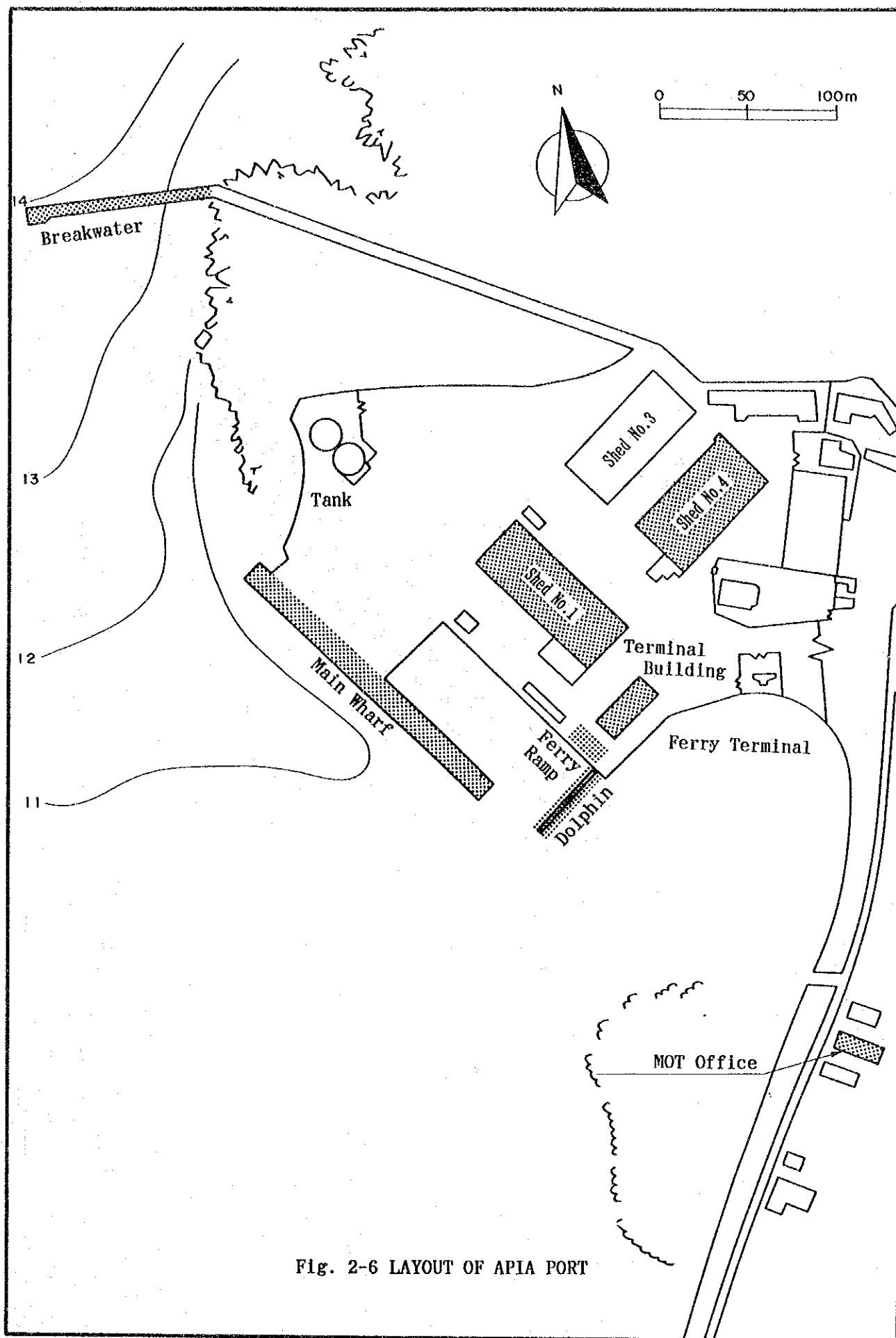


Fig. 2-6 LAYOUT OF APIA PORT

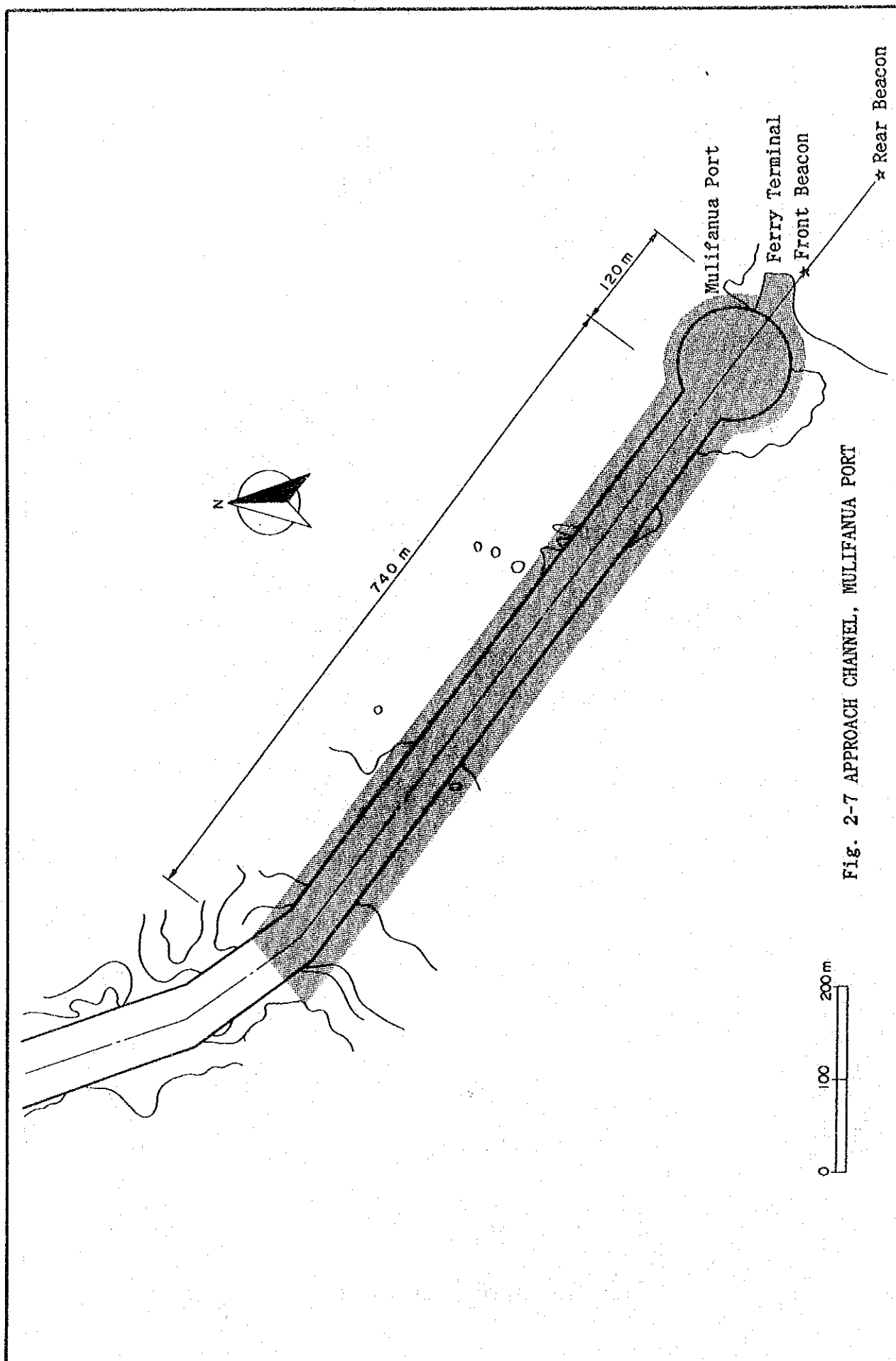


Fig. 2-7 APPROACH CHANNEL, MULIFANUA PORT

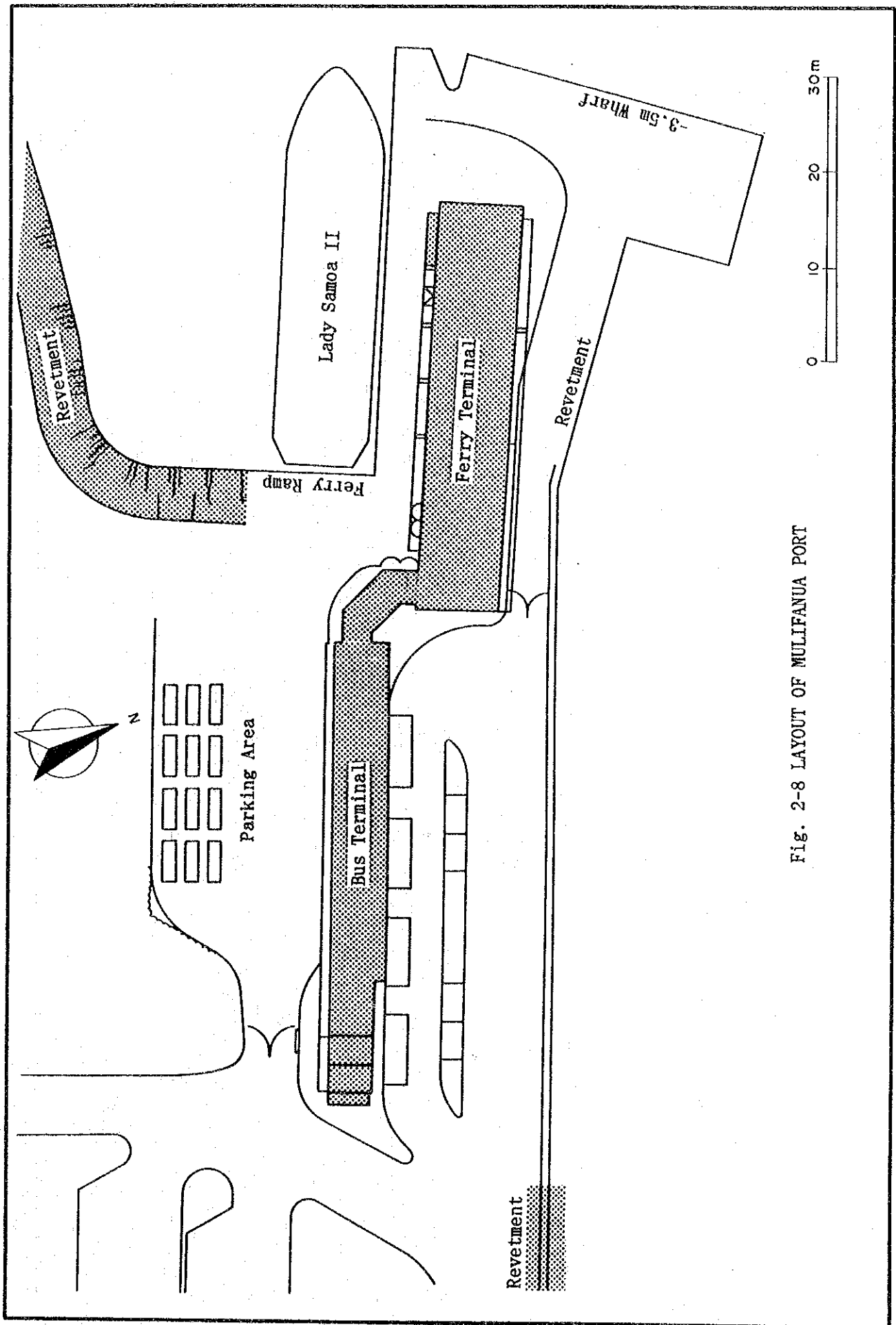


Fig. 2-8 LAYOUT OF MULIFANUA PORT

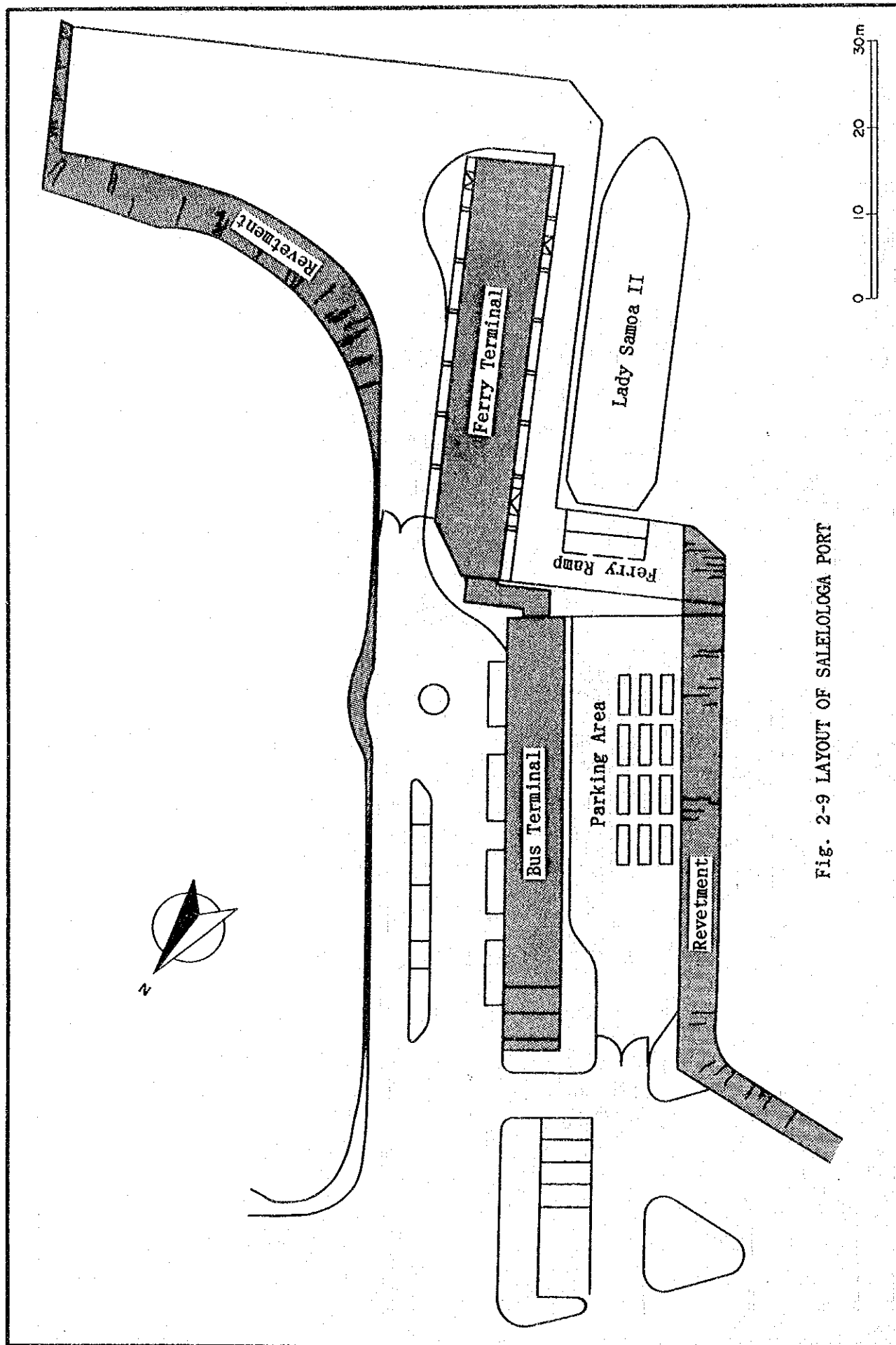


Fig. 2-9 LAYOUT OF SALELOOGA PORT

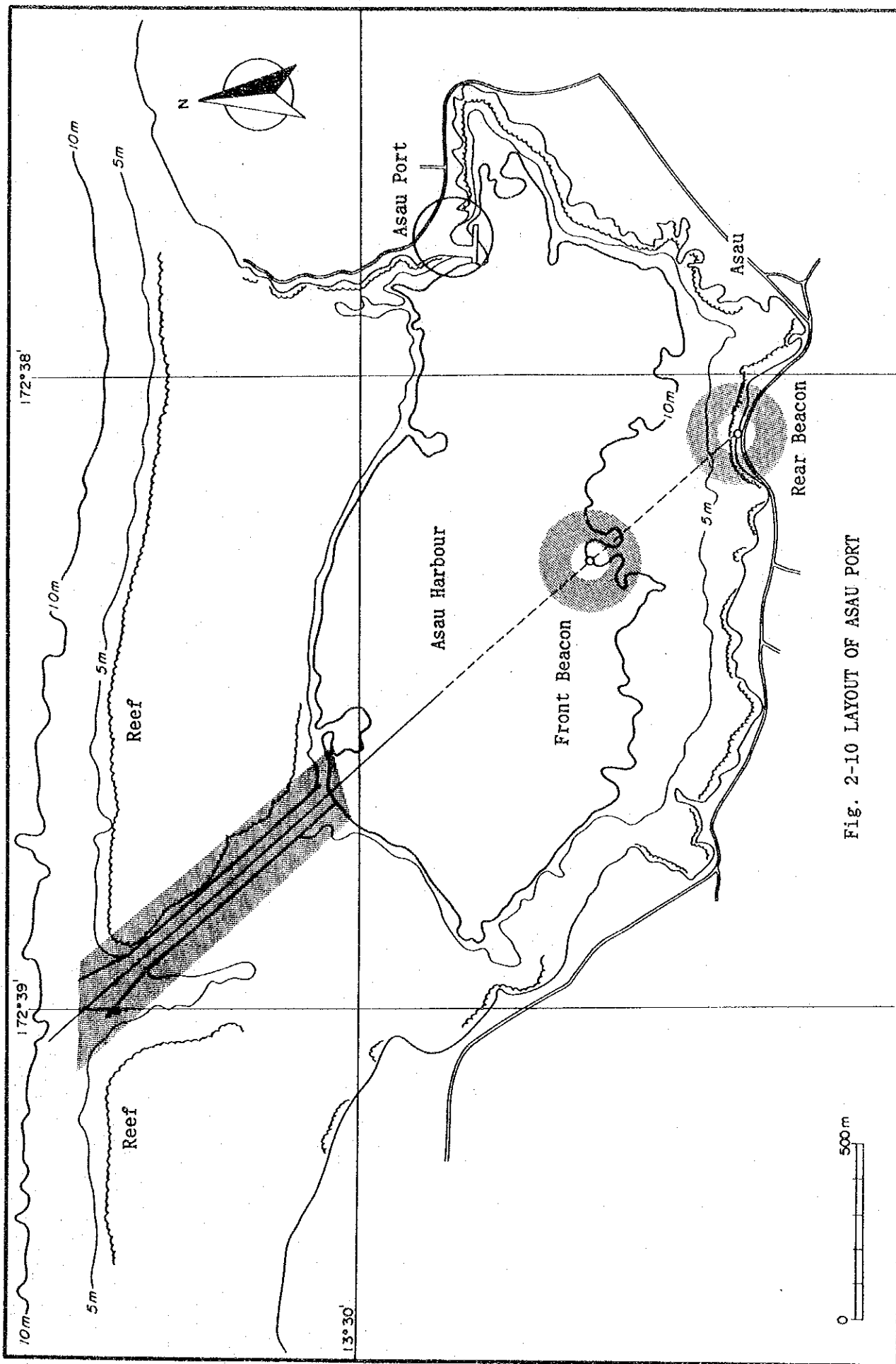


Fig. 2-10 LAYOUT OF ASAU PORT

Table 2-9 NUMBER OF CALLS BY TYPES OF VESSEL

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
General Cargo	112	95	94	88	95	87	84	81	62	46	45	29
Container	16	15	30	46	46	34	42	50	32	73	77	104
Semi-container	3	5	6	4	5	4	3	1	-	-	-	-
Roll-on/Roll-off	30	48	53	44	46	45	35	27	45	23	7	27
Passenger Cruise	9	9	9	4	7	7	-	6	5	5	-	4
Others (mainly Tankers)	22	18	21	29	24	19	21	9	15	21	11	20
TOTAL	192	190	213	215	223	196	185	174	159	168	140	184

Source : Department of Statistics "Economic Statistics of Shipping"

Note : Excludes Ferries and Yachts

Table 2-10 TOTAL CARGO VOLUME AT APIA PORT (t)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Import	General Cargo	70,607	89,483	91,516	80,396	102,164	105,694	139,196	110,029	104,883	144,752
	Oil Products	29,125*1	14,392*1	20,985	*2	23,960	23,074	39,076	20,713		
	Total	99,732	103,875	112,501	-	126,124	128,168	178,272	130,742		
Export	General Cargo	33,117	40,148	35,260	45,816	43,970	38,070	36,767	22,171		
	Coconut Oil	-	8,027	12,188	10,537	12,099	13,801	NA	NA		
	Total	33,117	48,175	47,448	56,353	56,069	51,871	-	-		
Total	General Cargo	103,724	129,631	126,776	126,212	146,134	143,764	175,963	132,200		
	Oil	29,125	22,419	33,173	-	36,059	36,875	-	-		
	Total	132,849	152,050	159,949	-	182,193	180,639	-	-		
	Annual Increase	-	1.14	1.05	-	1.07	0.99	-	-		
	Rate (%)										

* 1: Estimated From Total Volume of Oil Products

* 2: Unknown

General Cargo : "Economic Statistics of Shipping" Dept. of Statistics

Western Samoa Shipping Corporation

Oil Products : Customs Dept.

Coconut Oil : Samoa Coconut Products

Table 2-11 TRANSPORTATION BETWEEN APIA AND PAGO PAGO BY FERRY

(1) Passengers

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Outward	21,596	16,493	20,134	19,251	17,158	13,019	11,055	4,971	14,411	13,715
Inward	17,753	13,642	18,969	16,156	13,053	11,958	10,051	4,041	11,386	11,567
Total	39,349	30,134	39,103	35,407	30,211	24,977	21,106	9,012	25,797	26,519

(2) Cargo (t)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Outward	2,073	2,379	3,052	3,291	2,581	2,656	2,451	1,215	1,253	2,571
Inward	3,672	3,817	8,026	7,922	6,705	3,913	4,320	1,774	1,334	3,767
Total	5,745	6,196	11,078	11,213	9,286	6,569	6,771	2,989	2,587	6,338

(3) Trips

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Outward	50	40	49	48	51	95	95	97	81	143
Inward	50	40	49	48	51	95	95	97	81	143

Source : Western Samoa Shipping Corporation

Table 2-12 DOMESTIC FERRY SERVICE, NUMBER OF PASSENGERS/VEHICLES CARRIED

	1987	1988	1989	1990	1991
Passengers	274,375	281,590	136,176	277,171	268,782
Vehicles	15,889	20,451	13,057	-	-

Source : Western Samoa Shipping Corporation

2.3.2 Foreshore Protection Facilities

The structure of revetment in Western Samoa is, favoured with shallow reefs surrounding most part of the country's coast, rather simple with low crown height using basalt rocks locally available. However, the Capital of the country, Apia City area along Apia Harbour is provided a foreshore protection to protect a political and economical nucleus of the country.

Apia City is also a center of tourism receiving about 50,000 tourists a year. Beach Road running along Apia Harbour accommodates a daily traffic of about 20,000 vehicles. The section requested for rehabilitation of foreshore protection is shown in Fig.2-11 and provided with a revetment armoured with basalt rocks of about 500 kg except for the section in front of Kitano Tusitala Hotel where a vertical concrete wall is provided. However, all the revetments along the section requested are insufficient in both stability and function of sea defence. Existing condition of the foreshore protection is outlined in the following.

Section A - B Apia Port to Vaisigano River

The northern half is sheltered by the newly constructed breakwater and fronted with sandy beach while the southern half is armored with a low rubble slope. The southern half is relatively deep in the frontage allowing larger waves and the armour stones are dislodged scattering and subsiding in the sandy beach. Elevation of the seawall is not high and almost the same as that of the road behind.

Number of facilities behind the section are 15 including

Harbor Light Hotel,
Government Printing Office,
Office of Ministry of Transport,
Waterfront Restaurant,

Section B - C Vaisigano River to Mulivai Stream

This section directly faces open sea allowing deep sea waves to penetrate in and plunge on the revetment and is provided with well worked revetment to protect important facilities lining behind. The section was damaged by two cyclones and restored by government and private funds. There used to be benches and tables on the promenade between the revetment and the road but were damaged by the cyclones and had been removed. The section in front of Aggie Grey's Hotel was damaged and restored on its own fund.

Number of facilities behind the section are 22 including

Aggie Grey's Hotel,
Australian High Commission,
New Zealand High Commission,
Japan International Cooperation Agency,

Around the Reclamation Area

Section C - D Mulivai Stream to the outer end of the reclaimed area
and Section D - E The outer end of the reclaimed area to the fisherman's
wharf

The reclamation area was constructed with dredged materials when Apia Port was constructed in 1966. The original structure of the revetment is conjectured to be that of the undamaged section joining Beach Road at the east end. The crown width is 2 m, crown height is as the same as the ground level behind and the slope is 1 : 1.5. The other section are seriously damaged with armour stones scattering and backfill soured. The outer end of the area has totally lost backfill as the area dug for launching the washed up ferry "Queen Salamasina" was left not back-filled. Most part of the reclamation area is underutilized with western end developed for a fishery harbour under Japanese grant aid programme. Recent development in this area is two large building projects of government office.

Number of facilities behind the section are 8 including

Western Samoa Visitors Bureau

New Government Office

Central Bank

Fisheries Centre

Nelson Public Library, Pacific Room

Fish market

Section E - F The New Market to the Apia Weather Observatory

The revetment from the bus terminal to Godinet Restaurant is a vertical wall type. The crown height is low about 50 cm from the road level and the water depth in front is relatively deep allowing heavy wave overtopping. The following section to the end of Mulinu Peninsula is shallow in the front shore fronted with sandy beach and is protected with armour stones same as the other sections. The land area behind is vulnerable to flooding damage and is considerably low in utilization. Mulinu Road runs about 50 m inland for this section being free from wave damage. Two important public facilities of Radio Station and Apia Observatory are located in this narrow land strip and sustains serious damages at cyclones.

The land area around the observatory is low fronted with narrow beach and protected with armour stone revetment and jetties. Dredging operation of sand in immediate west of the observatory caused serious erosion and it has been restricted at present.

Number of facilities behind the section is 27 including

Kitano Tusitala Hotel

Le Godinet Beachfront Hotel

Apia Weather Observatory

Fale Fono (Parliament House)

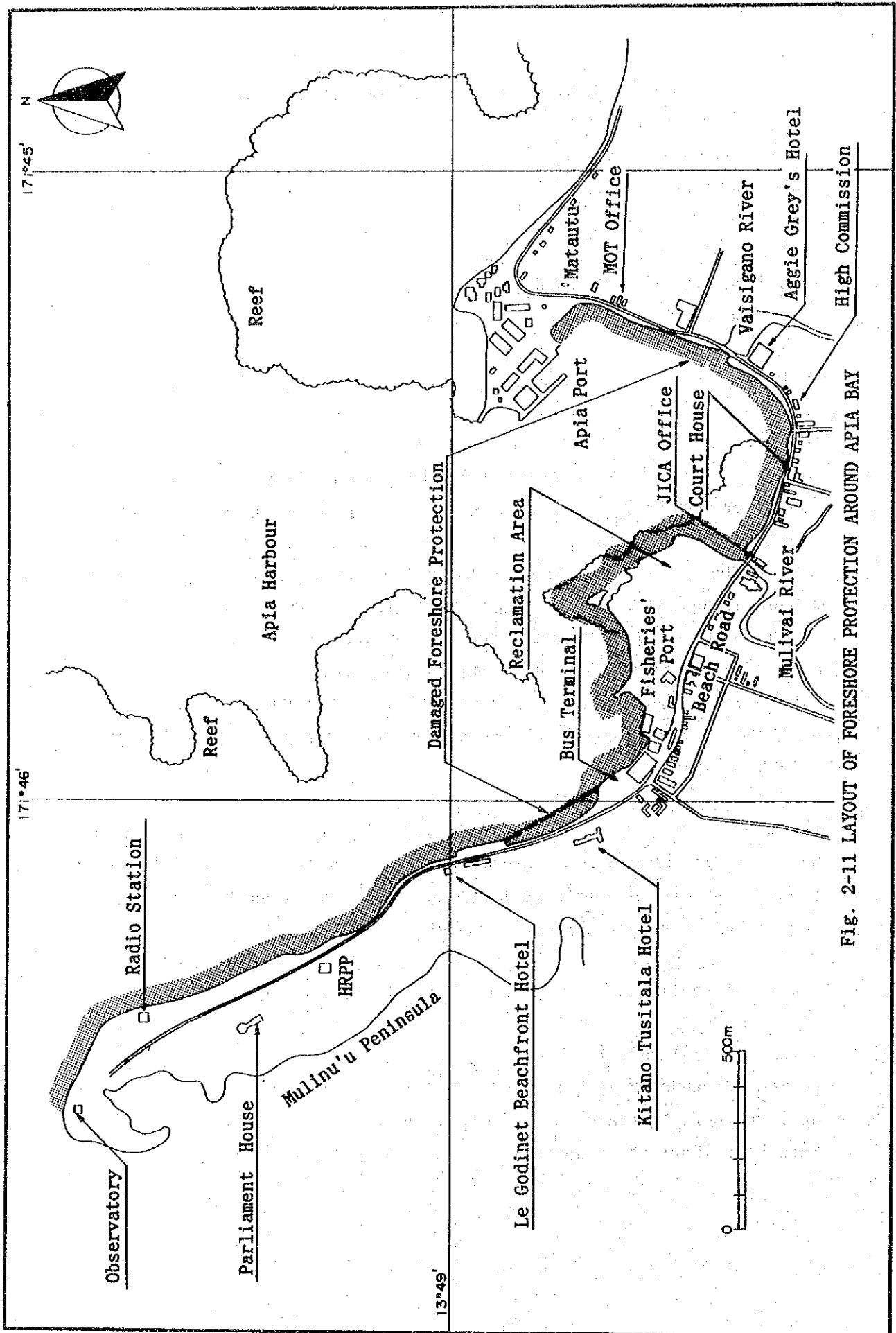


Fig. 2-11 LAYOUT OF FORESHORE PROTECTION AROUND APIA BAY

2.4 Background of the Request

Western Samoa has been struck again by the cyclone "Val" in December 1991 in the midst of recovering from serious damages caused by the cyclone "Ofa" over the country in February 1990. The damages caused by the cyclone "Val" is estimated at about 330 million US\$. National Disaster Council held the first meeting immediately after the cyclone on 11th December 1991 and resumed urgent relief actions by making good use of experiences gained in the previous cyclone. The first request for external disaster relief was, though delayed with damage caused to a telecommunication system, made on 14th December after approval of the cabinet. Responses to the request were very quick and urgent relief of foods, medicines, construction materials, etc. amounted at about 11 million US\$. The governmental organizations such as Public Work Department, Electric Power Corporation and Posts and Telecommunications Department provided emergency relief services and tried to keep normal services.

In April 1992, the Prime Minister, the Honorable Tofilau Eti Alesana visited Japan and requested Japanese grant aid for rehabilitation and improvement of cyclone-damaged port and Apia Harbour foreshore protection. Overall rehabilitation plan has been worked out by World Bank Mission with assistance of Asian Development Bank and Australia International Development Aid Bureau in June and in July donor meeting was held and assistance programmes have been discussed for adjustment and finalization of assistances of donor countries and donor organizations.

CHAPTER 3

OUTLINE OF THE CYCLONE-DAMAGED AREA

CHAPTER 3 OUTLINE OF THE CYCLONE-DAMAGED AREA

3.1 Outline of Cyclone "Val"

According to the weather maps obtained from the Fiji Meteorological Service, the tropical low pressure born off Tuvalu Island on 4th December 1991 changed its course to the south and while gradually growing crossed Savaii Island on 7th December and headed for American Samoa.

As it passed Western Samoa, the cyclone "Val" was still growing and, the central air pressure was around 970 mb which is not particularly strong compared to typhoons attacking Japan from time to time. The main characteristic of the cyclone "Val", however, was its wind velocity which was almost the strongest ever recorded in the century and most of the damages were caused by the wind.

The available meteorological data were mostly observed at Apia and sorted by the New Zealand Meteorological Service. According to the wind record for 6th to 9th December, the maximum gust velocity recorded was 49 m/sec and wind velocity of 30 m/sec or more continued about 4 days. In Savaii, where the eye of cyclone crossed, the maximum gust velocity was recorded as 67 m/sec indicating the scale of cyclone as ranked as the largest.

3.2 Outline of Cyclone Damages

3.2.1 Damages of Port Facilities

The damages sustained by port facilities are detailed in the following.

(1) Apia Port

1) Office Building of Ministry of Transport

Office of Ministry of Transport has been damaged on its roof and wall on the first floor by strong wind. The first floor of the building used to be rented by WSSC but as it was not repaired

after the damages caused by cyclone "Ofa", they moved out. The building has sustained serious damages on roof, wall, window, floor, ceiling, toilet, lighting, etc. and resulting leakage of rain water has damaged office utilities unserviceable. The wall on the first floor has been displaced from the supporting beam by wind pressure exposing the building to unpredictable sudden collapse. The ground floor is also damaged on walls and windows and leakage of rain water damaged electric services out of service.

Main Wharf Area

2) Shed No.1

Shed No. 1 was damaged by Cyclone "Ofa" and the restoration work planned in the previous project was shelved due to financial reason to cover further damages caused by cyclone "Val" and is requested to be included in this project. The shed has been seriously damaged on its roof and wall blown away by strong wind. Ventilators, gutters, down pipes and a canopy have been either lost or broken beyond repair. Steel shutters have been damaged out of service on rail and frame. All the doors louvers have been broken and lightings and partition walls are mostly damaged. the house for transformer and toilet has also damaged.

3) Shed No.4

The shed No. 4 has also been seriously but less damage than the shed No.1. The shed has been used for storing such cargoes as concrete blocks, etc. which are free from rain water damage and pilferage but its utilization was low. Pacific Forum Line leased the shed No.1 but now using the shed No.4. the shed is of the same structure as the shed No.1 and has been damaged in the same way but to lesser extent. the damages are mainly on roof, wall, ventilators, gutters and down pipes. All the steel shutters have been blown away and three shutters are closed with corrugated tin plates. Lightings inside the shed are damaged out of service.

4) Telecommunication System

The telecommunication system damaged by rain water leakage is out of service and antennae has been bent and blown away.

5) Main Wharf

The most essential facility of Apia Port, Main Wharf has been damaged on fendering systems in front and at the back, lightings and curblings.

Almost all of the front fenders are lost or torn causing damage to ship's hull in berthing and mooring.

Four rear wooden fenders have been repaired in the previous project but 27 remainders have been either broken or seriously damaged causing difficulty to tug boats and the other small ships.

All the lighting towers have been blown away endangering safety of cargo handling operation at night.

The curbing are lost or damaged endangering safety of cargo handling equipment working on the deck.

6) Gate House

A gate house has been totally blown away.

7) Breakwater

The breakwater is a sloped rubble mound type covered with concrete blocks. It has subsided for its head section and the light tower installed at the end has leaned seawards. The water area behind the breakwater is to be disturbed with transmitting waves through subsided section at cyclone.

8) Leading Beacon

The leading beacons showing the approach channel to Apia Port was damaged on its lanterns and supporting towers. Navigation aids are absolute necessity for safety of ships calling the port.

9) Tug Boat

Tug boat Pualele has collided Main Wharf and sustained minor damages on its hull.

Ferry Terminal Area

10) Terminal Building

Though the damage to the building is less serious than most of others, it has sustained damages on interior lightings by strong wind and rain blowing in through between canopy and wall top. Office and shop were damaged by rain in the same manner. the roof was exposed to strong wind and the fixing bolts have been loosened to significant extent.

11) Ferry Ramp

Concrete curbing of the ferry ramp were displaced or dislodged by scratching motion of access steel ramp of ferries. The mooring dolphins installed in front of the ferry ramp were damaged by collision of ships on their concrete superstructure with the reinforcing steel bars exposed. And steel piles have been displaced to some extent. All lights in car park area have been blown away.

(2) Mulifanua Port

1) Terminal Building

The asbestos roof, down pipes, louvers and windows are partly damaged. The ceiling of the harbour master's room is damaged by rain water. All the speakers of public addressing system are damaged by rain water. Water pump and plumbing requires repair to cope with frequent suspension of water supply and low water pressure. The wall and door of toilets on the ground floor were damaged unserviceable.

2) Revetment

The rubble slope of the access road to the ferry terminal has been damaged.

3) Navigation Aids

The inner beacon installed offshore has been cracked on its supporting concrete tower in danger of collapse.

Leading beacons installed on land were damaged for both front and rear beacons with lamps for both beacons out of operation. The turning basin has been silted and spare floating buoys are placed to temporarily mark the shallow area.

4) Approach Channel

The turning basin of approach channel to the port has been silted up endanger safe operation of ferry boat.

(3) Salelologa Port

1) Terminal Building

The ferry terminal building at Salelologa Port is of the same structure as that in Mulifanua. It has sustained far serious damages than the latter the cyclone track was closer to Savali Island. Most of roofing materials have been blown away is temporarily covered with vinyl sheet. The down pipes and louvers have been partly damaged. Also, ceiling boards and partition walls in office rooms have been damaged by rain water blown in by strong wind. The aluminum handrail on the deck are partly lost. All the speaker of public addressing system have been damaged unserviceable by rain water. Water pump and plumbing, wall and door of toilets were damaged unserviceable in the same way as Mulifanua Port.

2) Revetment

East and west revetments have been damaged on their rubble slope, backfill and pavement for total length of about 250 m. Fence installed along the revetments have blown down.

(4) Asau Port

1) Shed

The shed located at the back of wharf was completely blown away with steel frame bent down on the ground.

2) Access Road

Access to the wharf has been washed away at the back of the wharf and the rubble slope and backfill protecting the access was washed away.

3) Navigation Aids

The channel markers installed on both sides of the entrance channel to Asau Port were lost by waves. Top marks of front H shaped steel pile beacon were lost and rear beacon of steel truss structure has been blown down.

3.2.2 Damages to Foreshore Protection Facilities

The area along Apia Bay accommodates various important facilities for governmental and private activities such as government offices, banks, schools, churches, hotels, markets, a radio station, a weather observatory, etc. These facilities are protected with armour stone revetment, however, it is not sufficient in its stability and function to prevent wave over-topping. Cyclone waves damaged the revetment by dislodging armour stones, scouring backfill, washing trees and boulders and flooding most of buildings behind.

The foreshore protection, lacking basic technical requirements, have sustained damages at every cyclone and is expected to sustain the same damages in the case that it is restored to the original section. The existing revetment has not been designed through adequate engineering consideration and in rehabilitation work, its stability and function to prevent wave over-topping should be thoroughly taken into consideration.

Interview survey was conducted to the facilities lining along Beach and Mulinu Roads to facilitate an adequate design and the extents of damages have been confirmed.

Section A - B Apia Port to Vaisigano River

The section from the Office of Ministry of Transport to Visigano River is damaged with armour stones dislodged and scattered. Crown height of the seawall is not high enough as the same as that of the road behind allowing heavy overwash. The southern half is fronted with sand discharged from Visigano River and is shallow in foreshore preventing larger waves reaching to the revetment and as there are not many important facilities behind serious damages as in the next section are not reported.

At the cyclone "Val", the initial relief operation was disturbed by trees and boulders washed up by waves. Some buildings adopt elevated floor to avoid flooding damage in this section where the ground level is considerably low.

Section B - C Vaisigano River to Mulivai Stream

The east end of the section in front of Aggie Grey's Hotel directly faces open sea allowing deep sea waves penetrate in through the approach channel of the Apia Port with less dissipating effect of breaking and diffraction. Therefore, the elevation of revetment and road is set as the highest among the sections under consideration while the next section is set lower with waves breaking over shallow reef in front water area. The section was damaged by two cyclones and restored to the previous section by government and private funds however the crown height of the revetment and weight of armor stone are not enough. This section sustained serious damages on armour stones, backfill and road and further the same trouble as in the section A-B caused by washed up trees and boulders disturbed the busiest traffic in the city. Aggie Grey's Hotel was seriously damaged by wave over-topping in front and flooding of Vaisigano River at the back.

Section C - D Mulivai Stream to the outer end of the reclaimed area

The other section, directly facing open sea, is seriously damaged with armour stones scattering and backfill soured. The armour slope of this section has totally collapsed except for 200 m section from eastern joint to Beach Road. The backfill is escaping even under normal wave condition resulting in serious erosion of the reclamation area.

The outer end of the area of about 12000 m² has totally lost backfill as the area dug for launching the ferry "Queen Salamasina" stranded at the time of cyclone "Ofa", was left not backfilled.

Two high rise buildings are under construction in the reclamation area as below;

- Central Bank of Samoa

6 stories

Construction cost : 30,000,000 WS\$

Fund : Central Bank of Samoa

Schedule of Commence : 1991 January

Completion : 1992 December

Residents : Minister of Finance, Staffs of Ministry,
Central Bank of Samoa

- New Government Building

7 stories

Construction cost : 20,000,000 WS\$

Fund : People's Republic of China

Schedule of Commence : 1991 July

Completion : 1993 November

Residents : Prime, Cabinet Member, Staffs of Ministry
of Foreign Affairs

The building of Central Bank of Samoa is designed with the ground floor elevated 1.5 m from the ground level and rubble mound surrounding it. While, the new government building is designed to minimize flooding damage by using the ground floor as a parking area. The land area in front of these buildings is, as serious flooding is expected, planned to be developed as a park.

The reclamation area was flooded about 50 cm at the time of cyclone "Val" and more damages are expected to occur after completion of these buildings if an adequate foreshore protection is not provided.

Section D - E The outer end of the reclaimed area to the fisherman's Wharf

The section is fronted with coral sand beach with armour stones placed on the top of slope. The government office and other buildings are located behind and an adequate foreshore protection is required.

Section E - F The New Market to the Apia Observatory

The revetment in front of Bus Terminal is a steep slope of armour stones and about 10 small shops are built on its shoulder. Though the revetment has sustained minor damage, all these shops were seriously damaged at the time of cyclone "Val".

The following section from the bus terminal to Godinet Restaurant is a vertical wall type. The crown height is low about 50 cm from the road level and the water depth in front is relatively deep allowing heavy wave over-topping. The concrete parapet of the revetment was partly broken and the land area behind were flooded about 30 cm deep. The next section is a vertical stone wall about 20 cm high from the road level and is insufficient in function of preventing wave over-topping.

The following section from HRPP office to the end of Mulinuu Peninsula is shallow in the front shore fronted with sandy beach and is protected with armour stones. Since there are not many important facilities behind. Two important public facilities of Radio Station and Apia Observatory which, are to play important roles at the time of emergency, are located in the low laying westernmost area of this section. The observatory has sustained serious damages with one shore side building destroyed and past records washed away.

3.3 Contents of the Request

The contents of the request of the government of Western Samoa for Japanese grant aid assistance are outlined as shown in Tables 3-1 and 3-2.

Table 3-1 CONTENTS OF THE REQUEST ON PORT FACILITIES

Port Facilities	
(1) Apia Port a) MOT Office b) Shed No.1 c) Shed No.4 d) Communication System e) Main Wharf f) Gate House g) Breakwater h) Leading Beacon i) Tug Boat j) Ferry Terminal Bldg. k) Ferry Ramp	(2) Mulifanua Port a) Terminal Bldg. b) Revetment c) Leading Beacon d) Approach Channel (3) Salelologa Port a) Terminal Bldg. b) Revetment/Fence (4) Asau Port a) Shed b) Access Road c) Navigation Aids

Table 3-2 CONTENTS OF THE REQUEST ON FORESHORE PROTECTION FACILITIES

Section	Length
Section A-B : From Apia Port to the Vaisigano River Bridge adjacent Aggie Grey's Hotel.	500 m
Section B-C : From the Vaisigano River to Mulivai stream	650 m
Section C-D : From Mulivai Stream to the outer end of the reclaimed area.	550 m
Section D-E : From the reclaimed area to fishermen's Wharf behind the New Market.	400 m
Section E-F : From the New Market to the Observatory at the end of Mulinuu peninsula.	1,900 m
Total length of the works is approximately 4 km.	

CHAPTER 4

CONTENTS OF THE PROJECT

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4.1 Objectives of the Project

Western Samoa has sustained serious damages caused by the cyclone "Ofa" in February, 1990 and again in December, 1991 as detailed in the previous chapter. The Government of Western Samoa made an urgent request to foreign governments and international assistance organizations for disaster restoration.

The port facilities damaged by the cyclone "Ofa" have been rehabilitated in September 1992 under Japanese grant aid though some facilities have sustained further damages by the cyclone "Val". The port functions have been curtailed especially on safe cargo storage and transport of ferry passengers. The present project intends to work out a rehabilitation and improvement plan of damaged port facilities and Apia Harbour foreshore protection, thereby contributing to a quick recovery of the Western Samoan economy from the damage caused by the cyclone.

4.2 Examination of the Request

4.2.1 Appropriateness of the Project

Contents of the request for the rehabilitation and improvement of the port and foreshore protection facilities damaged by the cyclone "Val" are basically judged to be appropriate for a grant aid project of the Government of Japan as discussed in the subsequent section, the Examination on Contents of the Request.

(1) Port Facilities

The restoration of the original functions of the port facilities through the implementation of the project will have the following effects.

- 1) In Apia Port, navigation of ship, berthing operation, cargo handling, cargo control, ferry transport and port management will become more efficient and safer.
- 2) Restoration of the normal ferry service in Mulifanua and Salelologa Ports will relieve inconvenience of ferry passengers and improve safety of navigation and onshore facilities.

(2) Foreshore Protection

- 1) Safety of the facilities and their activities behind the foreshore protection will be improved by elevating the crown height of the revetment.
- 2) Stability of the foreshore protection will be improved against cyclone waves and the maintenance cost will be reduced.
- 3) Erosion around the reclamation area will be prevented by reconstructing the revetment.

The rehabilitation and improvement works of the foreshore protection along Apia Bay have been included in DP7 as important sea defense facilities for Apia City, the capital of the country.

In view of urgency and publicity of the planned restoration works, this project is recommended to be implemented under a Japanese grant aid at the earliest possible opportunity for recovery of the Western Samoa economy.