4.2.2 Operation and Administration Plan

(1) Port Facilities

Since there will be no increase in scale and function of the port facilities to be restored in this project, the present organization and budget of the MOT need no change to run the port after restoration works.

(2) Foreshore Protection Facilities

The foreshore protection facilities will be rehabilitated or improved in the project and the maintenance works will be minimized. The present system of the Public Works Department will not require any reinforcement or reform.

4.2.3 Relevant Projects

The damages caused by the cyclones spread over the country and DP7 has incorporated the rehabilitation works from these damages. The damages caused by the cyclone were estimated and are summarized in " Final Damage Assessment Report for Cyclone Val", 6-9 December, 1991. NDC requested urgent assistances to the donor countries and assistance agencies. In response to the request, World Bank had the mission to work out the rehabilitation plan by taking into account the national development plan and on-going projects and submitted "Cyclone Val Infrastructure Rehabilitation Needs Assessment Report" in June, 1992. In July, 1992, the donor meeting was held in Apia and rehabilitation plans have been examined and adjusted for implementation to avoid duplication.

(1) Port Improvement

1) Port Facilities

There is no on-going project closely related to this particular project.

(2) Foreshore Protection

The revetments protecting the roads damaged by the cyclones are rehabilitated under World Bank's assistance.

The foreshore protection facilities along Apia Bay has never been provided with a foreign assistance and are not included in any other projects.

As described in Chapter 2, there are several projects under planning related to this projects and these plans shall be taken into consideration in designing the rehabilitation of foreshore protection.

1) The Development of the Apia Urban Area

The plan includes relocation of Savalalo Market which is located adjacent to the revetment to be rehabilitated in this project. The plan is scheduled to commence in 1993 and shall be reflected in this project.

2) Sewerage System-Apia Urban Area

Waste water from Apia City is discharged crossing the foreshore protection and the location of existing and planned sewerage pipes shall be taken into consideration in this plan.

4.2.4 Examination of Contents of the Request

All the facilities proposed for rehabilitation in the request are examined here from viewpoints of their importance, urgency and effectiveness in order to assess the necessity of their rehabilitation and improvement.

(1) Port Facilities

- **Apia Port**

1) Office Building of Ministry of Transport

The main office of Ministry of Transport is endangered of unexpected collapse under strong wind due to displacement of the wall on the first floor and has been seriously damaged on its roof and wall. The resulting leakage of rain water has damaged electric services in the office. Temporary repairs have been done to the first floor but both floors are seriously affected by cyclone damages and about 20 office staffs working for port, airport and road are suffering troubles in daily administration works. The first floor of the office has been temporarily repaired by the government to accommodate increased staffs but it could collapse by cyclone wind.

The office building needs urgent rehabilitation works in order to avoid further damage and collapse and to restore efficient port management and administration.

Main Wharf Area

2) Shed No. 1/No. 4

Shed No. 1 was damaged by the cyclone "Ofa" and planned to be restored in the previous grant aid project. However, it has sustained further damage by the cyclone "Val" before commencing the restoration work resulting in exclusion of the work out of the scope. Shed No. 4 was not damaged by the cyclone "Ofa" but damaged by the cyclone "Val".

After the cyclone "Val", Shed No.1 is used for storing disused concrete blocks because of heavy damage, and Shed No. 4 used for storing cargoes.

Shed No.4 is used by covering cargoes with tarpaulin or placing them under the limited area free from rain water. The cargoes stored in the sheds are exposed to rain water and pilferage through broken roof and doors. To secure security of and prevent damage to cargoes urgent rehabilitation is required.About 70 % of cargoes handled in Apia Port are containerized and the containerization rate is expected to steadily increase. Container boxes can be advantageously placed near Main Wharf for shipment and container cargoes be stuffed/unstuffed in a covered shed in a innermost part of container yard to streamline the movement of cargoes, handling equipment, related traffic, etc. Through consideration of rehabilitation cost and flow of cargoes and cargo handling equipment, Shed No. 4 is planned to be fully rehabilitated and Shed No.1 is planned to be demolished and converted to a container yard.

3) Telecommunication System

Since a wireless communication system is absolute necessity for safe and efficient port operation, the damaged equipment has already been replaced with a new system under New Zealand grant aid. Therefore, the telecommunication system is excluded from the project scope.

4) Main Wharf

Fendering system

Most of the rubber fenders installed in the frontage of Main Wharf have dropped or been torn off and as a temporary measure tires are suspended. Lack of fenders allows ships direct contact to anchor bolts of the broken fenders causing serious damages to ship's hull. Load to Main Wharf is restricted due to corrosion of the supporting piles. Berthing impact not buffered with fenders could damage the corroded piles. Fendering system of wooden pile plus rubber fender is installed at the back of Main Wharf for tug boats and the other small vessels. The piles were broken at the time of the cyclone "Ofa" and replacement work was done in the previous project. Further damages have been caused to the piles during the cyclone "Val" and the similar damages are likely to occur at inclement weather.

Most of the curbings installed along the front edge of Main Wharf have been displaced or lost by impact of cargo handling equipment and ships and safety of cargo handling operation is imperiled.

All the wharf lights installed along the back edge of the wharf deck have been blown away. Safety of cargo handling operation at night is not maintained.

Main Wharf is the most important facility in the port and urgent rehabilitation is required to ensure safe berthing and cargo handling operations.

5) Gate House

The gate house is a key facility to keep security in the port area and is attended by 2-3 inspectors. It has been totally blown away but its restoration has been already done by PWD.

6) Breakwater

Breakwater has been constructed under Japanese Grant Aid Programme "Apia Port Development Project" and damaged by cyclone waves larger than the design wave dimensions. The breakwater has subsided on its head section where higher waves attacked and the water area behind is disturbed by transmitting waves. Main Wharf is located immediately behind the breakwater and disturbance of the front water area affects efficiency and safety of cargo handling operation. The breakwater also shelters the ferry terminal and the revetment from cyclone waves. The damage caused by the cyclone is likely to expand by high waves and therefore the urgent rehabilitation, reflecting the larger design wave dimensions generated by the recent large cyclones, is required.

7) Leading Beacon

The leading beacons showing the approach channel to Apia Port was damaged on its lanterns by rain water with the day marks blown away by strong wind. Temporary repairs have been done but luminous intensity and reliability are considerably lost. A full scale rehabilitation to meet the original specifications noted on a marine chart shall be urgently implemented to secure safety of night navigation by taking into consideration obsolescence of the facilities and recent developments nearby affecting visibility.

8) Tug Boat

Tug boat Pualele sustained minor damage on its bulwark and it has been already repaired by MOT.

Ferry Terminal Area

9) Terminal Building

Small area of the roof of the ferry terminal building was blown away and has already been repaired. However, fixing bolts of the roof have been loosened to significant extent and shall be tightened to prevent further damages.

Office and shop were damaged by rain water blown in through between canopy and wall top and requires countermeasures against rain water.

10) Ferry Ramp

All the lighting towers in car park area were blown away and have already restored by MOT.

The dolphin has sustained damage on its concrete superstructure with the reinforcing steel bars exposed and rehabilitation work covering the steel bars with concrete is urgently required to prevent further corrosion.

Concrete curbings of the ferry ramp have been displaced or dislodged and shall be repaired by taking into consideration the present usage.

- **Mulifanua Port**

1) Terminal Building

The ferry terminal building at Mulifanua Port has sustained similar but less damages than that in Salelologa Port and causes serious inconvenience to ferry passengers. The roof, windows, toilet, elcctric services and plumbing system shall be repaired to the original conditions.

2) Revetment

The rubble slope armouring the access road to the port has been partly washed away. Since the damages were minor and occurred before the completion of the previous grant aid project to the revetment, they have already restored under the previous project.

3) Leading Beacons

The inner beacon installed in the sea has been cracked on its concrete tower in danger of collapse. Leading beacons installed on land have been damaged for both front and rear beacons imperiling safety of night navigation. Four spare floating buoys are used for marking water area silted up by cyclone waves.

Urgent rehabilitation work to the beacons and supplement of floating buoys are required.

4) Approach Channel

The navigation channel connects ferry terminals in Mulifanua and Salelologa Ports. The turning basin of Mulifanua Port has been

silted up with about 10,000 m^3 of sand near the wharf. The turning area is reduced to half and ferry maneuvering becomes risky at low tide and under strong wind. The berthing area in front of the ramp has been also silted up and ferry operation is restricted.

To recover safe and efficient operation of a ferry boat, a dredging work to restore the original channel depth shall be urgently carried out.

- Salelologa Port

1) Terminal Building

The ferry terminal building at Salelologa Port has sustained serious damages and causes serious inconvenience to ferry passengers. Especially, the damaged roof, if left unrepaired, will cause further secondary damage by rain water and wind.

Urgent restoration works similar to those in Mulifanua Port shall be planned to prevent further damages and release ferry passengers from inconvenience.

2) Revetment

The revetments have been damaged on their rubble slope, backfill and pavement. To prevent further damages to the access road, parking area, terminal building and ferry ramp, urgent restoration work shall be planned.

- Asau Port

1) Shed

The shed has not been fully utilized due to reduction of general cargoes requiring a covered shed. The port used to handle timber and oil but at present receives one tanker a month. From this background, the rehabilitation work to the shed is not considered to be of high necessity.

2) Access Road

The damages to the access to the wharf and its side rubble slope were minor and for urgent need of securing safe access to the wharf, MOT has already completed the rehabilitation work.

3) Navigation Aids

The channel markers installed on both sides of the entrance channel, the front beacon and rear beacon have been already rehabilitated by MOT.

(2) Foreshore Protection Facilities

Divisions of the section under consideration for rehabilitation and improvement have been changed from those in the request as shown in Fig. 4-1.

1) Section A - B MOT Office to Vaisigano River

Though fronted with shallow sandy beach, the section sustained overwash and flooding damages as the elevation of the revetment is not high enough. To protect the facilities behind such as restaurants, hotels, markets, etc., the existing revetment shall be elevated and drainage system be provided along the back of the revetment.

2) Section B - C Vaisigano River to Mulivai Stream

This section is well worked and maintained however the crown height of revetment is not enough to prevent wave over-topping. The section protects various important facilities of the country and the promenade is provided behind the revetment for tourists and local people. The revetment will be rehabilitated and improved through appropriate engineering consideration.

3) Section C - D Mulivai Stream to the Sandy Beach

To prevent erosion and flooding damage to the government offices, the foreshore protection shall be urgently rehabilitated and improved. The land area in front of these building is planned to be utilized for public purposes and this will be reflected to determine the height of the revetment. The outer end of the reclamation area is subjected to higher waves and larger armour stones will be used to ensure the stability against cyclone waves.

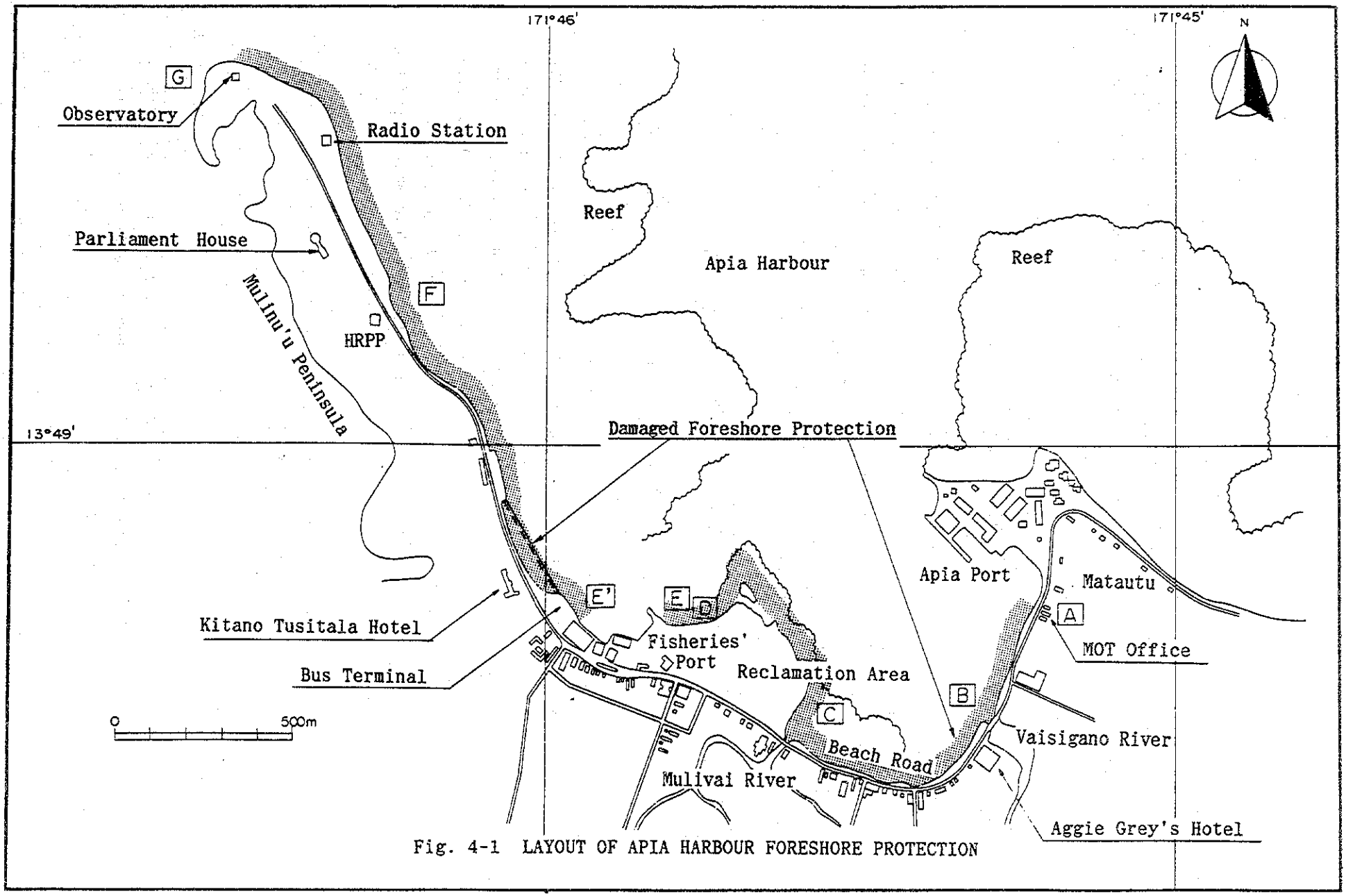


Fig. 4-1 LAYOUT OF APIA HARBOUR FORESHORE PROTECTION

4) Section D - E The Sandy Beach

The existing sandy beach will be preferably kept as it is to meet the future utilization of this area as public purposes. Rubble mound to prevent overwash shall be constructed along the shoulder of the beach.

5) Section E' - F Bus Terminal to HRPP Office

For the section in front of Kitano Tusitala Hotel where a vertical wall is provided, the Government of Western Samoa plan to reclaim the front water area and the front face of reclaimed area will be armoured with rubble slope under this project. While, for the section fronted with sandy beach, the same design as that in the section A-B will be adopted.

6) Section F - G HRPP Office to the Apia Observatory

The land area behind this section is very low making it difficult to construct a full scale revetment against flooding and wave overtopping and is not necessarily highly utilized. The road runs inland away from the shore in this section. The facilities behind the road are not many and have not sustained serious damages. Therefore, the lowest priority has been given to this section. However, the important public facilities of Radio Station and Apia Observatory, playing important role at the time of emergency like cyclone, are located between the road and the shore. The revetments will be installed around two facilities.

According to the results of the examination, the contents of the project have changed as follows.

1) Port Facilities

- In Asau Port, all the facilities proposed for rehabilitation have been either already restored or become unnecessary and excluded out of the project scope.

- In Apia Port, the telecommunication system, gate house and tug boat have been already rehabilitated by MOT and have been excluded out of the project scope.

2) Foreshore Protection Facilities

The entire section proposed for rehabilitation has been redivided in the different manner as follows.

- Section A-B proposed in the request included the sandy beach section adjacent to Apia Ferry Terminal. This sandy beach from the east end of Apia Ferry Terminal to MOT Office is i) sheltered by the port facilities from offshore waves, ii) preferable to be left as a natural sandy beach, and iii) planned to be developed as a marina in the master development plan. Through consideration of these, the beach section has been excluded from the scope of project.

- In the reclamation area, Point D is set at the outer end. This point has been shifted to the eastern end of sandy beach near a fishery harbour, while Point E remains unchanged.

- The section E-F has been subdivided into two sections from the east end of Bus Terminal to HRPP Office and from HRPP Office to Apia Observatory at the end of Mulinuu Peninsula. For the section in front of Kitano Tusitala Hotel, the Government of Western Samoa plan to reclaim shallow water area in order to provide land area for widening the coastal road and construction of public facilities and the revetment will be constructed along new faceline shown in Fig. 4-1.

4.2.5 Strategy of Project Planning

The project has been justified to be appropriate of its urgency of rehabilitation and expected effectiveness through the above examination. Both Ministry of Transport and Public Works Department have sufficient experience, work force and financial backup in administering and operating the facilities planned in this project. High publicity of port and foreshore protection

facilities as basic social infrastructure well meet the principles of Japanese grant aid assistance. Thus, the project will be further examined and planned for the basic design toward realization under Japanese grant aid programme.The port facilities will be planned focusing on early recovery from curtailed conditions of port operation after the cyclone "Val" according to the following basic strategies.

a) Importance, urgency and effectiveness of each facility shall be thoroughly examined.
b) Damaged facility shall be restored to the previous conditions in its scale and function.

While, the foreshore protection facilities will follow the strategies below.

a) Damaged facility shall be restored to the previous conditions by taking into consideration stability and function to prevent wave over-topping.
b) Recent and planned developments shall be reflected in assessing importance of the facilities to be protected by the foreshore protection.

The contents of the project have been changed following the results of examination in the preceding section.

4.3 Outline of the Project

4.3.1 Executing Agency and Management System

1) Port Facilities

All ports in Western Samoa are under the control of the Shipping Department, Ministry of Transport with about 120 staff members, including the Director of Shipping (served by Secretary of Ministry of Transport), of which 20 staff members are assigned to sea duties. In addition, a marine consultant is provided by the Government of New Zealand though being vacant at present.

The routine works of the Shipping Department include collection of port charges, adjustment of user's priority, maintenance of facilities, berth allocation, supervision of cargo handling operation, operation of tug boats, supervision of related private facilities, implementation of minor maintenance works, administration of its staffs, etc.

The organization of the Ministry of Transport and Shipping Department are shown in Fig. 4-2 and Fig. 4-3 respectively. Any reinforcement to the present organization after the project is not required.

2) Foreshore Protection

The PWD consists of 7 departments, with a total of about 240 staffs as shown in Fig. 4-4. The Civil Department consists of the Construction Section, Design Section and Quarry Section with about 80 staff members.

On completion of the construction of the planned foreshore protection, the facilities will be operated by the staffs the Civil Department.

Since the structure of facilities to be restored in this project is a rubble slope type, special maintenance works is not required.

The organization of the Civil Department is divided to sections responsible for each district as shown in Fig. 4-5 and the foreshore protection facilities will be maintained by the section for Upolu Central.

4.3.2 Outline of the Planned Facilities

Detail of the planned port and foreshore protection facilities are described in Chapter 5, and the outline are shown in Tables 4-1 and 4-2.

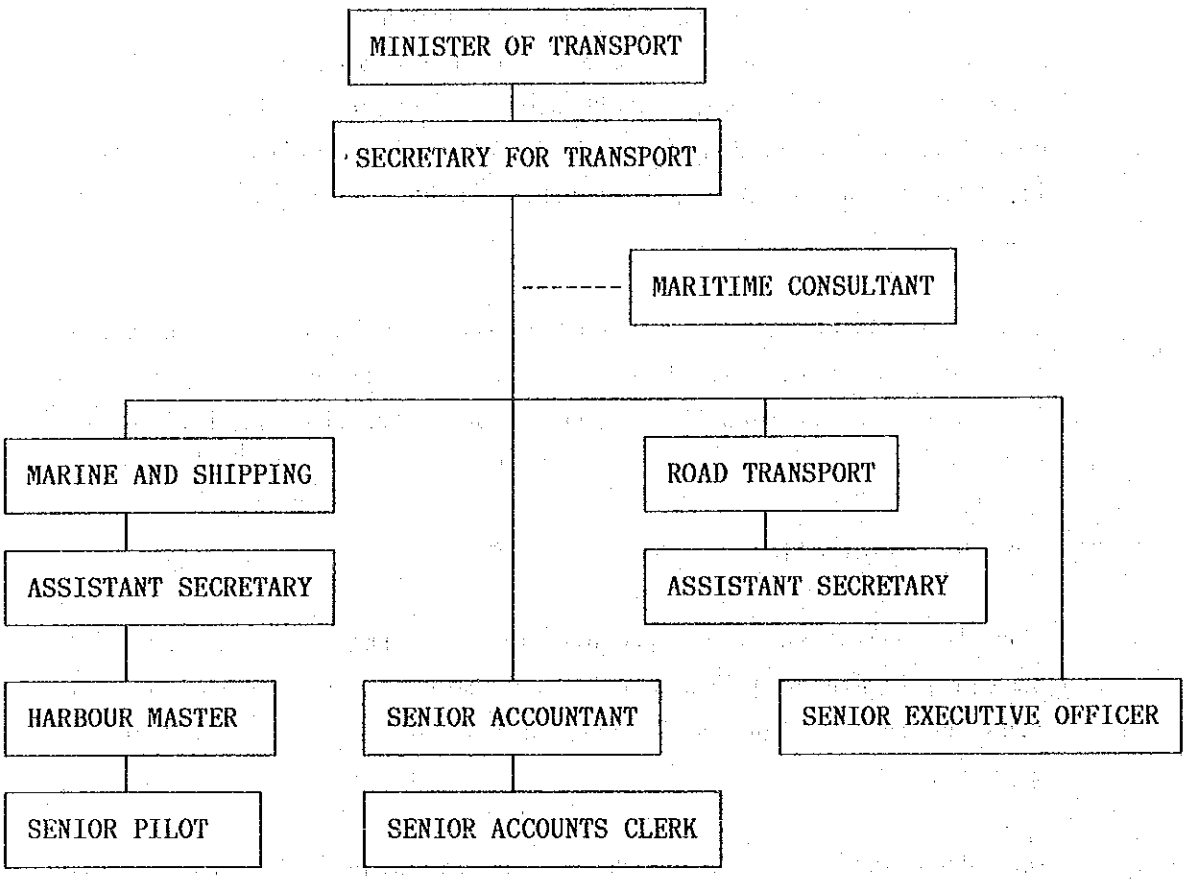


Fig.4-2 ORGANIZATION CHART, MINISTRY OF TRANSPORT

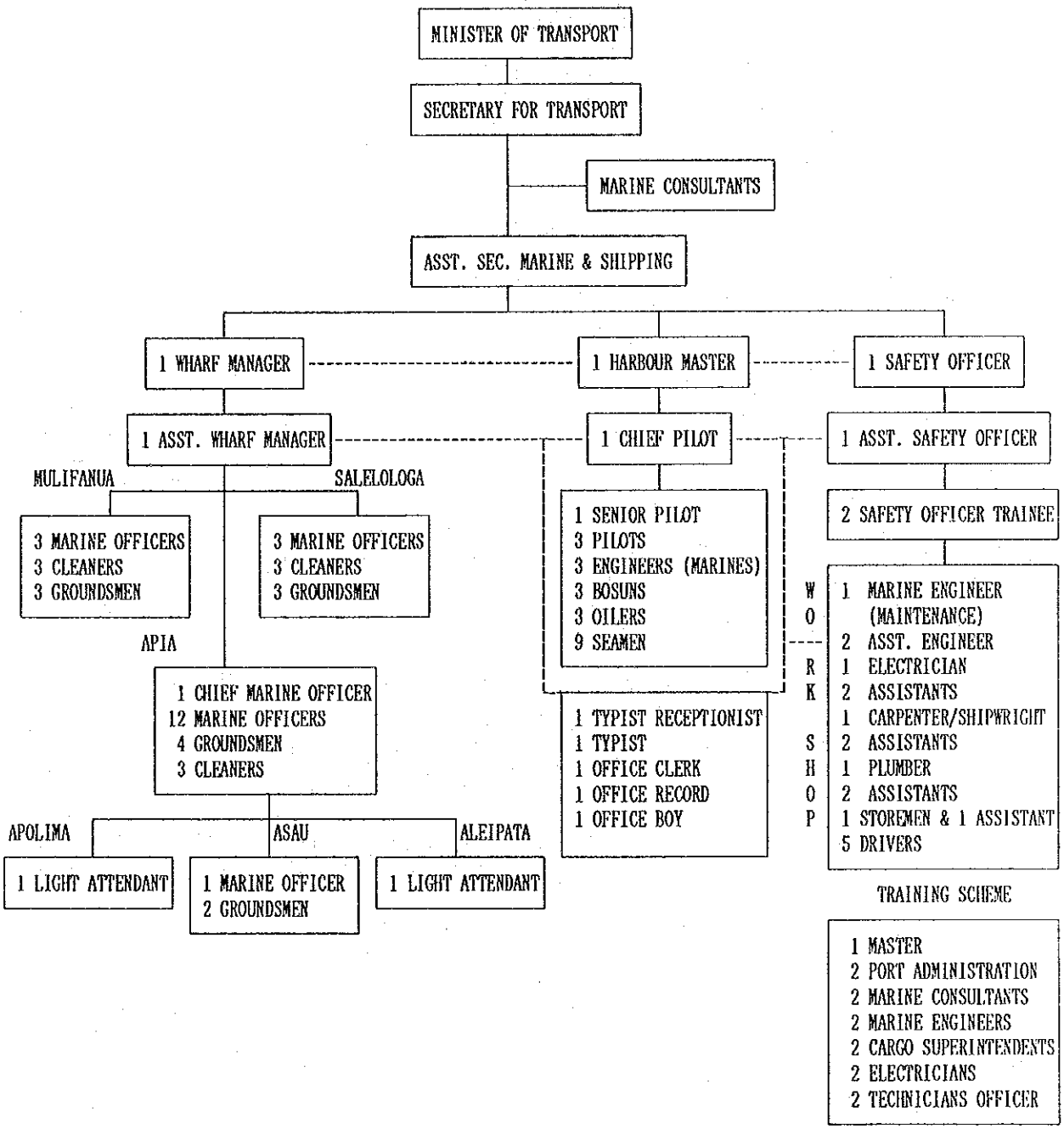


Fig.4-3 ORGANIZATION CHART, MINISTRY OF TRANSPORT, MARINE AND SHIPPING

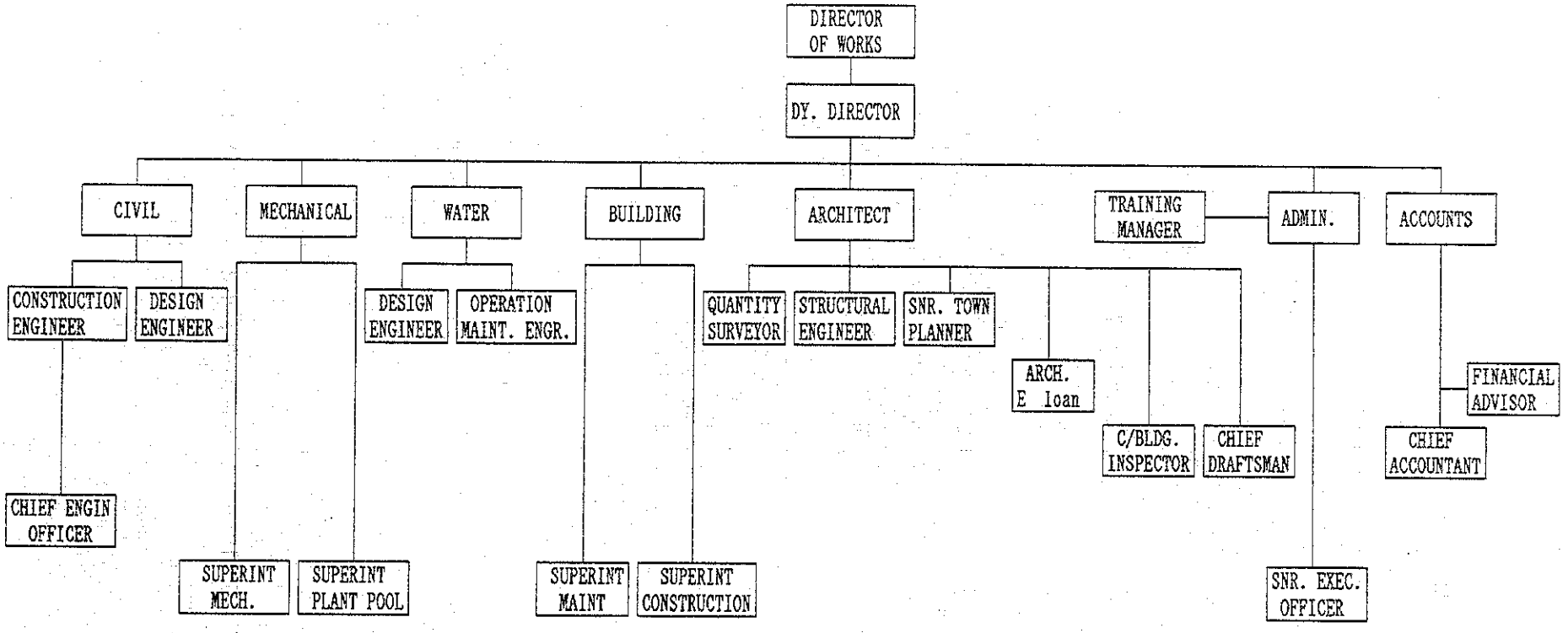


Fig.4-4 ORGANIZATION CHART, PUBLIC WORKS DEPARTMENT

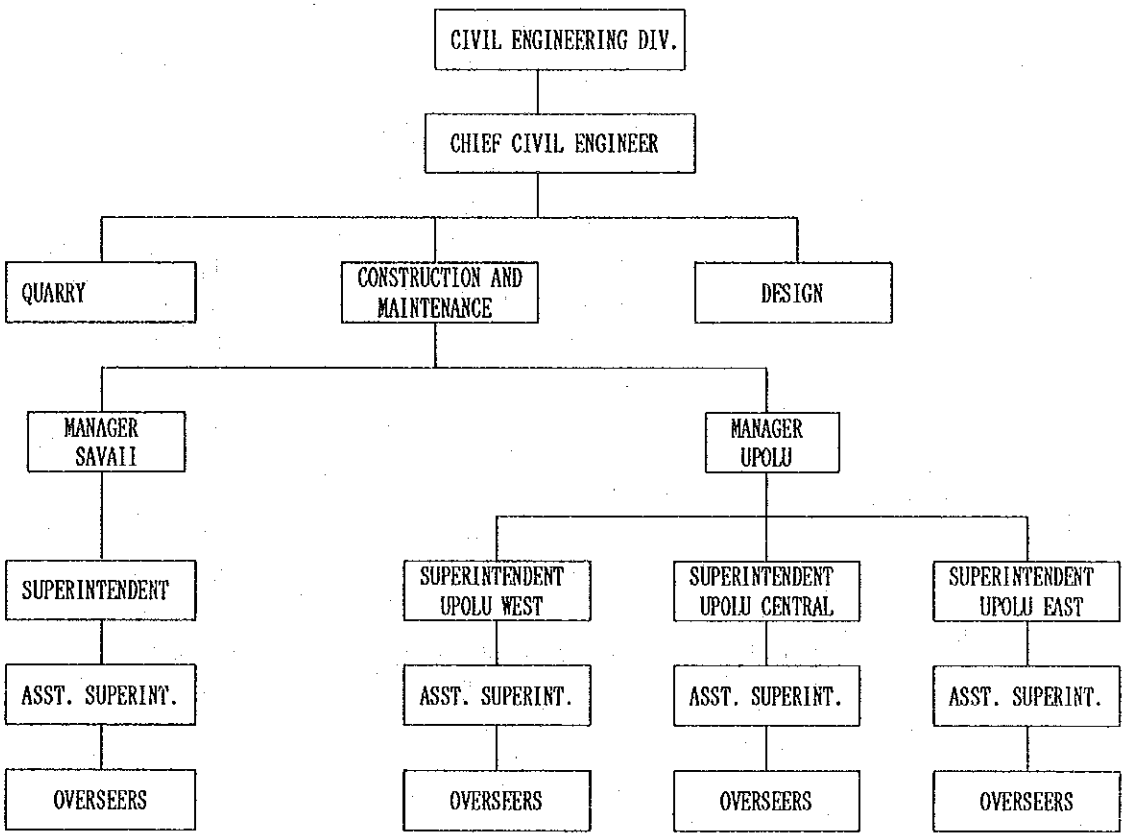


Fig.4-5 ORGANIZATION CHART, CIVIL ENGINEERING DIVISION, PWD

Table 4-1 OUTLINE OF THE PLANNED PORT FACILITIES

Facilities	Contents	
1. Apia Port		
MOT Office	Restoration	810 m^2
Shed No.1	Removal/Pavement	2,600 m^2
Shed No.4	Restoration	2,230 m^2
Main Wharf		
Rubber Fender	Restoration	41 Nos.
Wooden Fender	Restoration	70 m
Wharf Light	Restoration	10 Nos.
Curbing	Restoration	160 m
Breakwater	Improvement	100 m
Leading Beacon	Reconstruction	2 Nos.
Terminal Building	Restoration	520 m^2
Ferry Ramp		
Dolphin	Restoration	1 No.
Curbing	Restoration	2 Nos.
2. Mulifanua Port		
Terminal Building	Restoration	840 m^2
Leading Beacon	Restoration	3 Nos.
Channel Dredging	Restoration	9,800 m^2
3. Salelologa Port		
Terminal Building	Restoration	800 m^2
Revetment	Restoration	240 m

Table 4-2 OUTLINE OF THE PLANNED FORESHORE PROTECTION FACILITIES

Section	Distance
Section A-B : MOT Office to Vaisigano River	300 m
Section B-C : Vaisigano River to Mulivai Stream	700 m
Section C-D : Mulivai River to Sandy Beach on Reclamation Area	700 m
Section D-E : Beach Sandy on Reclamation Area	150 m
Section E'-F: Bus Terminal to HRPP Office	1,115 m
Section F-G : HRPP Office to Apia Observatory	350 m
(Radio Station)	(100)m
(Observatory)	(250)m

4.3.3 Administration and Operation Plan

The present project intends to work out a rehabilitation and improvement plan of damaged by the cyclone as described in section 4.2.2. Though the present organization and budget of MOT and PWD do not need any significant change, further reinforcement of maintenance system after the restoration works is required with a view of the following.

(1) Port Facilities

Shipping Department of Ministry of Transport is assisted by port operation expert dispatched by the government of New Zealand and has own electric expert for maintaining navigation aides, etc. However, the expert covering civil and architecture is not assigned and Public Works Department provides assistance.

The routine inspection and maintenance works are required by organizing an inspection team including a civil engineer and an architect with PWD.

(2) Foreshore Protection Facilities

Since the structure of revetments to be restored in this project is a rubble slope type, special maintenance works are not required. However, routine inspection and maintenance of facilities are essential to ensure revetments protecting various important facilities of the country. Blockade of drainage to drain over-topped sea water should be given a special attention.

Since the toe of revetment is a part under heavy fluctuations of sea bed by waves, urgent supplement of rubble stones is required in the case that rubble stones sink by scouring.

4.4 Technical Cooperation

This project is to restore the cyclone-damaged facilities to the previous conditions before the cyclone and does not include any expansion of the existing facilities nor construction of new facilities. All the existing facilities are efficiently operated and administered by both Ministry of Transport and Public Works Department and any technical cooperation is not required after the project. Ministry of Transport and Public Works Department receives experts of various engineering fields from Australia and New Zealand. The Government of Japan provides technical assistance of 9 members of senior volunteer and Japan Overseas Cooperation Volunteer working for Public Works Department.

CHAPTER 5

BASIC DESIGN

CHAPTER 5 BASIC DESIGN

5.1 Design Policies

In this chapter, the results of basic design study on the project components which have been judged to be necessary in the preceding chapters are presented in regards to the structural type, sectional drawings and construction methods.

In the basic design, the following basic policies are taken into consideration, in addition to the request of the Government of Western Samoa, the conditions of damages, the restoration plan and the local construction conditions:

1) The restoration works should not disturb the daily port operation.

2) The structures should be simple in type, be quickly constructed and be easily maintained by the local workers.

3) The damaged port facilities should be restored to the conditions before the cyclone. While, the foreshore protection facilities should be rehabilitated by taking stability and function to prevent wave over-topping into consideration .

4) Utilization of local materials and manpower should be maximized while the construction cost and period should be minimized through the consideration of local condition of technical skill.

5) In designing, Japanese codes and standards shall be followed for port and foreshore protection facilities.

5.2 Design Conditions

In this section, the design conditions of the project components are discussed as the basis for the basic design to be given in the following sections.

5.2.1 Tide and Current

(1) Current

Western Samoa is located within 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 Port is not affected by the current because of offshore reef surrounding the harbour.

(2) Tide

Tidal data have been recorded at the Tide Station in Apia Port, 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

In determining the crown height of revetment, the storm tide must be taken into account. The storm tide are in general caused by atmospheric air depression and wind set up. From the past records of cyclones and abnormal tides, 1.0 meter of wind-set-up and barometric tide is added to the ordinary tide as a storm tide.

The storm tide is calculated as follows ;

where,

: Storm tide
: Atmospheric air depression (70 hPa)
: Wind speed (40 m/sec)
: coefficient (0.01)
: coefficient (0.0002)

Furthermore, wave-set-up caused by waves breaking over a reef must be considered in design and will be described in the course of determining the crown height of each section of the foreshore protection because this kind of wave-set-up is determined by such various parameters as equivalent deepwater waves, seabed slope, wave steepness and depth of water, which change place to place.

5.2.2 Waves

(1) Wave Hindcast

The waves generated by the cyclone "Val" have been hindcast by a computer simulation and its results are shown in Table 5-1 together with the past hindcast results:

Table 5-1 RESULTS OF WAVE HINDCAST

Project Name	Cyclone	Offshore Wave		
		Direction	Ho	To
Rehabilitation and Improvement of Ports and Foreshore Protection	Val	N	10.9m	12.5 sec
Rehabilitation of Ports and Construction of Quarry Plant	Ofa	N	8.6m	12.0 sec
Apia Port Development	Model	N	7.0m	10.0 sec

In the above comparison, wave dimensions which have been given in the Project for the Development of Apia Port are based on the assumption that the largest cyclone recorded in the past 40 years takes a course affecting Apia Port most seriously. Cyclone tracks are shown in Fig. 5-1.

Tracks of cyclone "Val" and "Ofa" are shown in Fig 5-1. Figs.5-2 (1) and (2) show time series of wind velocity and direction and wave dimensions based on the calculation results of wave hindcast.

From these figures, these two cyclones are characterized as below:

1) Cyclone "Ofa" passed to the west of Western Samoa, while cyclone "Val" directly attacked the Savai'i Island. In regard to the size of the cyclones, it is reported that the central atmospheric pressure of "Ofa" was not so low but its radius was relatively large, and in contrast with this, the cyclone "Val" was relatively small in radius with low central atmospheric pressure.

2) Therefore, "Val" generated extremely strong wind in the central area of cyclone, and caused serious damages crossing over the Savai'i Islands as mentioned above. In regard to the waves, on the other hand, since the stormy area of "Val" was relatively small, the maximum wave height was larger but its duration was relatively short.

3) In contrast with the above, since "Ofa" passed far from the Western Samoa, its wind velocity was recorded lower than "Val". Since the stormy area of "Ofa" was large, the hourly changes of wave dimensions were relatively small and the peak of high waves continued for approximately 12 hours, with wave direction changing from NNE to NNW.

4) From the above, it can be seen that cyclone "Ofa" was possible to have more influences upon the stability of structures than cyclone "Val" because the duration of high offshore waves was longer allowing higher waves over a reef at high tides. While, the wave height at cyclone "Val" was relatively high but its duration was short.

(2) Design Deepwater Wave

Fig. 5-3 shows the results of calculation of the probability of wave occurrence based on the statistical analysis of the hindcast results of the past 12 cyclones for the period from 1950 to 1991.

Through the consideration of Fig 5-3, 50 year wave, which is usually adopted in Japan, is adopted as the design deepwater wave for the port facilities, and 75 year wave for the foreshore facilities, which protects many important buildings in the country against cyclone waves. Waves coming in the directions from NNE to NNW most affect the project site in Apia Bay and these waves are adopted as the design deepwater waves. These wave dimensions are shown in Table 5-2.

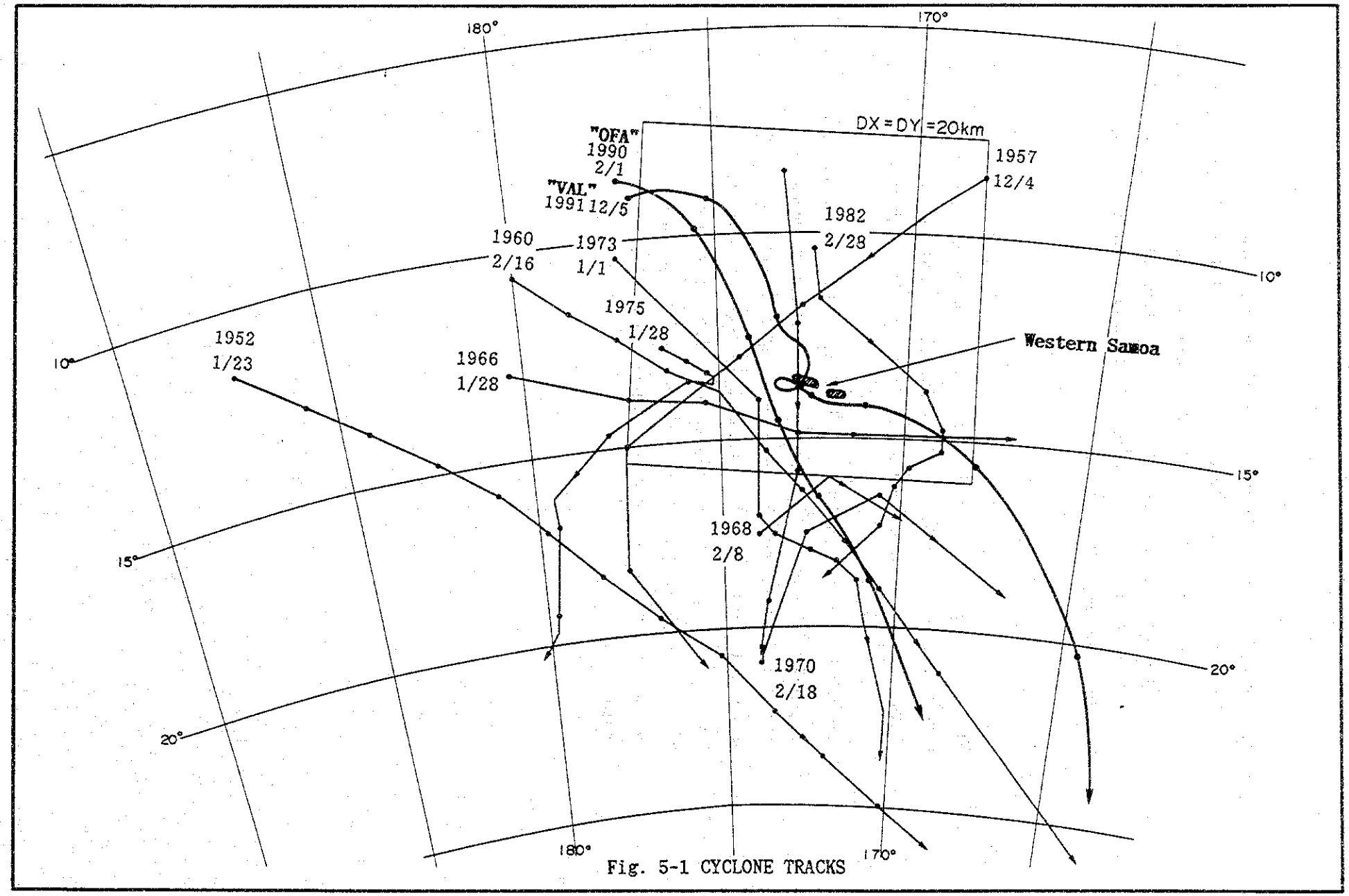


Fig. 5-1 CYCLONE TRACKS

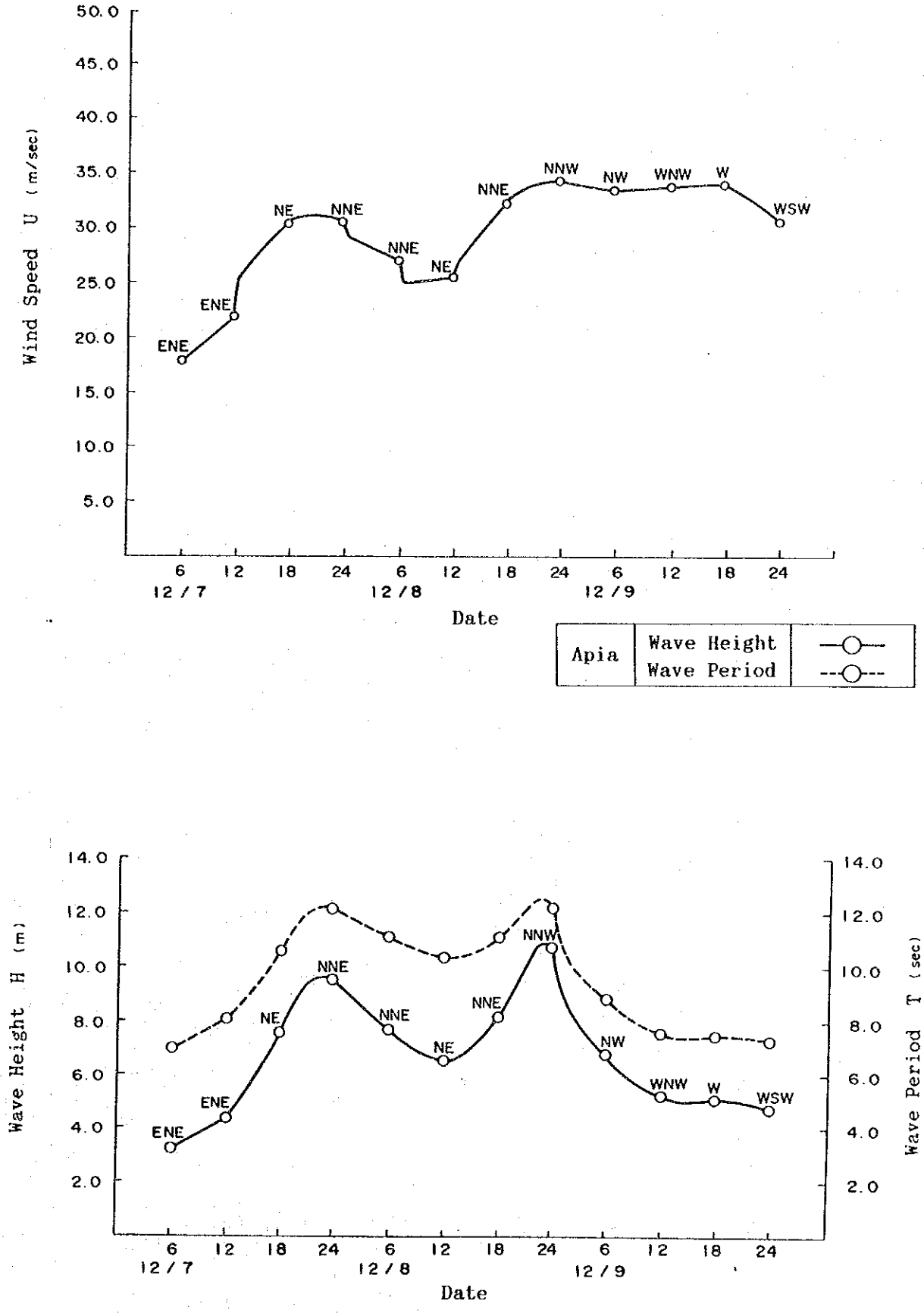
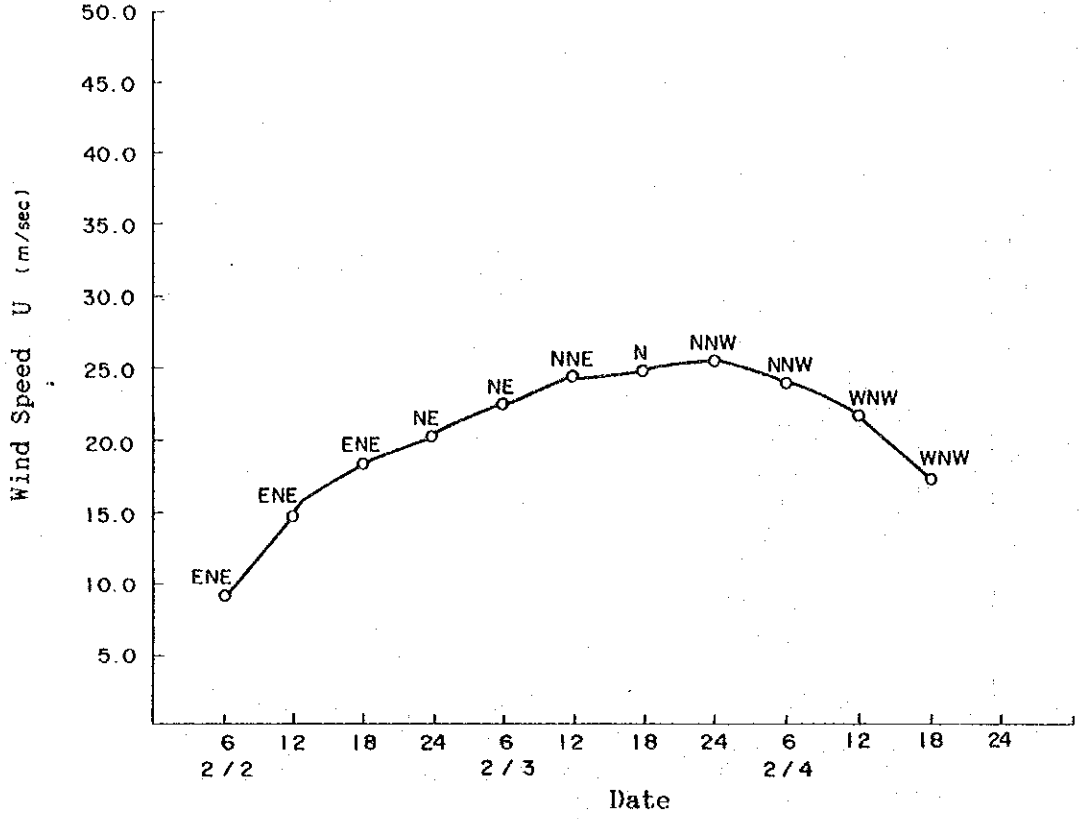
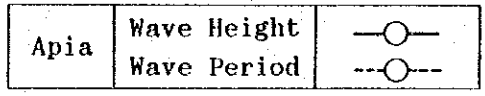


Fig. 5-2(1) TIME SERIES OF WIND AND WAVES (VAL)





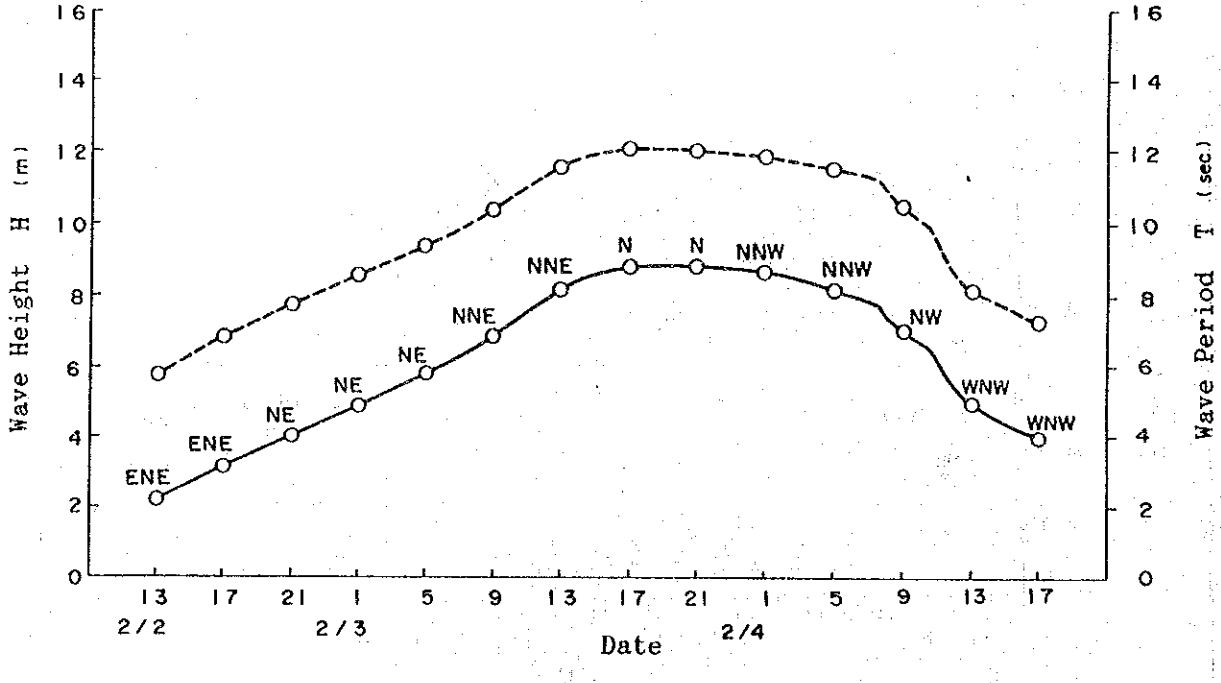


Fig. 5-2(2) TIME SERIES OF WIND AND WAVES (OFA)

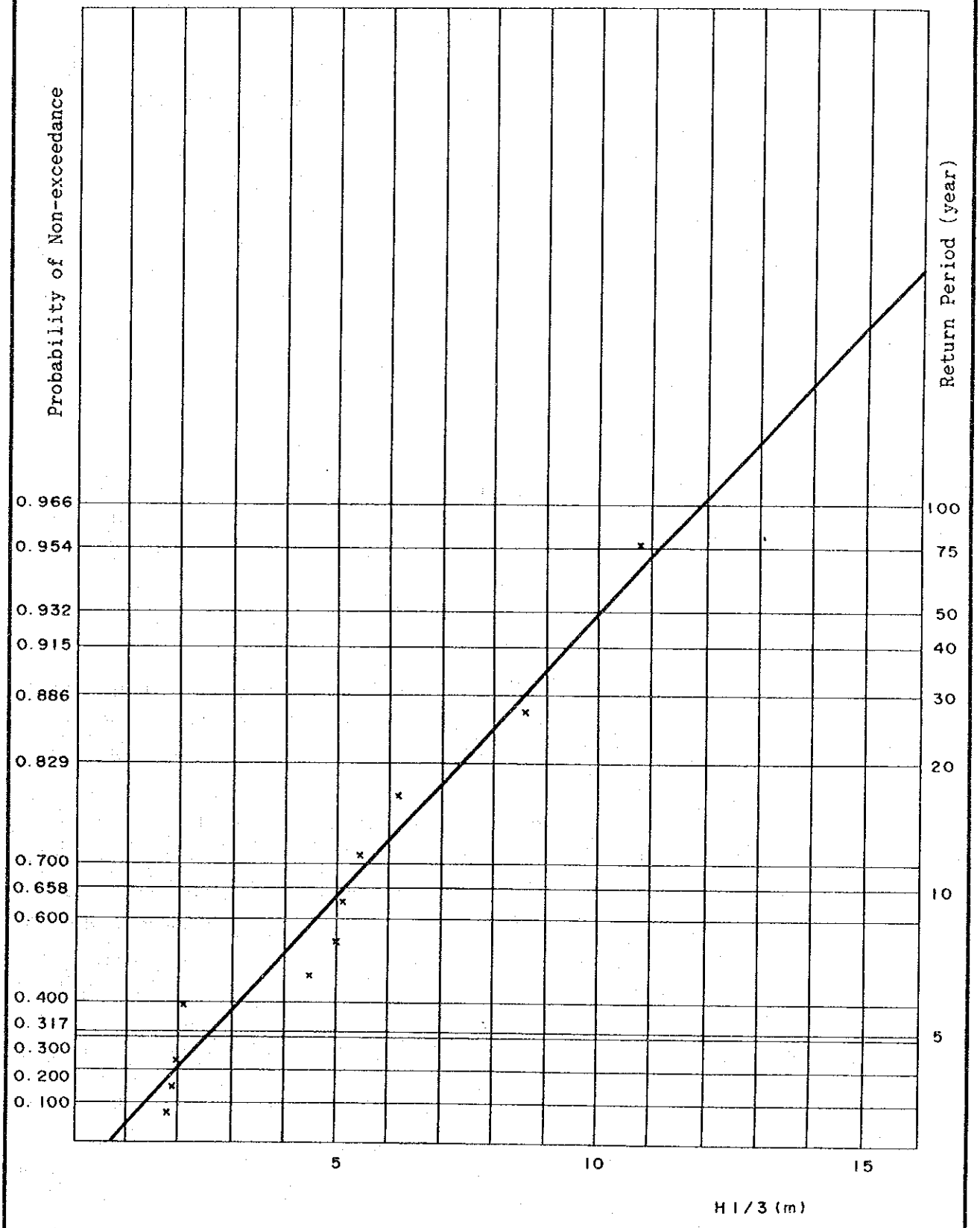


Fig. 5-3 RETURN PERIOD

Table 5-2 DESIGN OFFSHORE WAVE

	Port Facilities	Foreshore Protection Facilities
Direction	NNE,N,NNW	NNE,N,NNW
Height	10.0 (m)	11.1 (m)
Period	12.5 (sec)	12.5 (sec)

(3) Design Wave

1) Calculation of wave deformation

Results of Bathymetric Survey at Apia Port, Mulifanua Port and Asau Port are shown in Figs. 5-4(1), 5-4(2), 5-5(1), 5-5(2) and 5-6 respectively.

Design waves in the shallow area are given by calculating the wave deformation of design deepwater wave in the shallow area by using the energy equilibrium equation under the above results.

Design waves for the foreshore protection facilities in Apia, Mulifanua and Salelologa Ports are determined by calculating the wave breaking at the reef edge and wave deformation over the reef flat. Fig. 5-7 shows design locations for foreshore protection and the calculation results are shown in the Table 5-3.

Table 5-3 DESIGN WAVE

	Apia Port Breakwater	Mulifanua Port	Salelologa Port	Apia Harbour Development					
				A-B	B-C	C-D	D-E	E-F	F-G
Design Wave Height ($H_{1/3}$)	6.0 m	1.0 m	0.7 m	1.4 m	2.1 m	1.9 m	1.7 m	1.0 m	1.2 m

2) Calculation of wave breaking and wave deformation over the reef flat

Heights of design waves are determined by calculating the wave breaking and wave deformation of the equivalent deepwater wave.

Calculation procedure is outlined as follows using the model shown in Figs. 5-8.

- Deformation due to wave breaking (section a - b)

  In this section, change of wave height and mean sea level due to wave breaking must be considered. These wave deformation can be determined by using the theory of Gohda model. This theory takes into consideration the effect of the change of mean sea level due to the radiation stress and surf beat.

- Wave deformation over a reef flat (section b - c)

  Wave deformation over a reef flat can be given by using experimental formula established by Takayama.

(4) Siltation

Apia Port 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 requiring a maintenance dredging possibly once in 10 years.

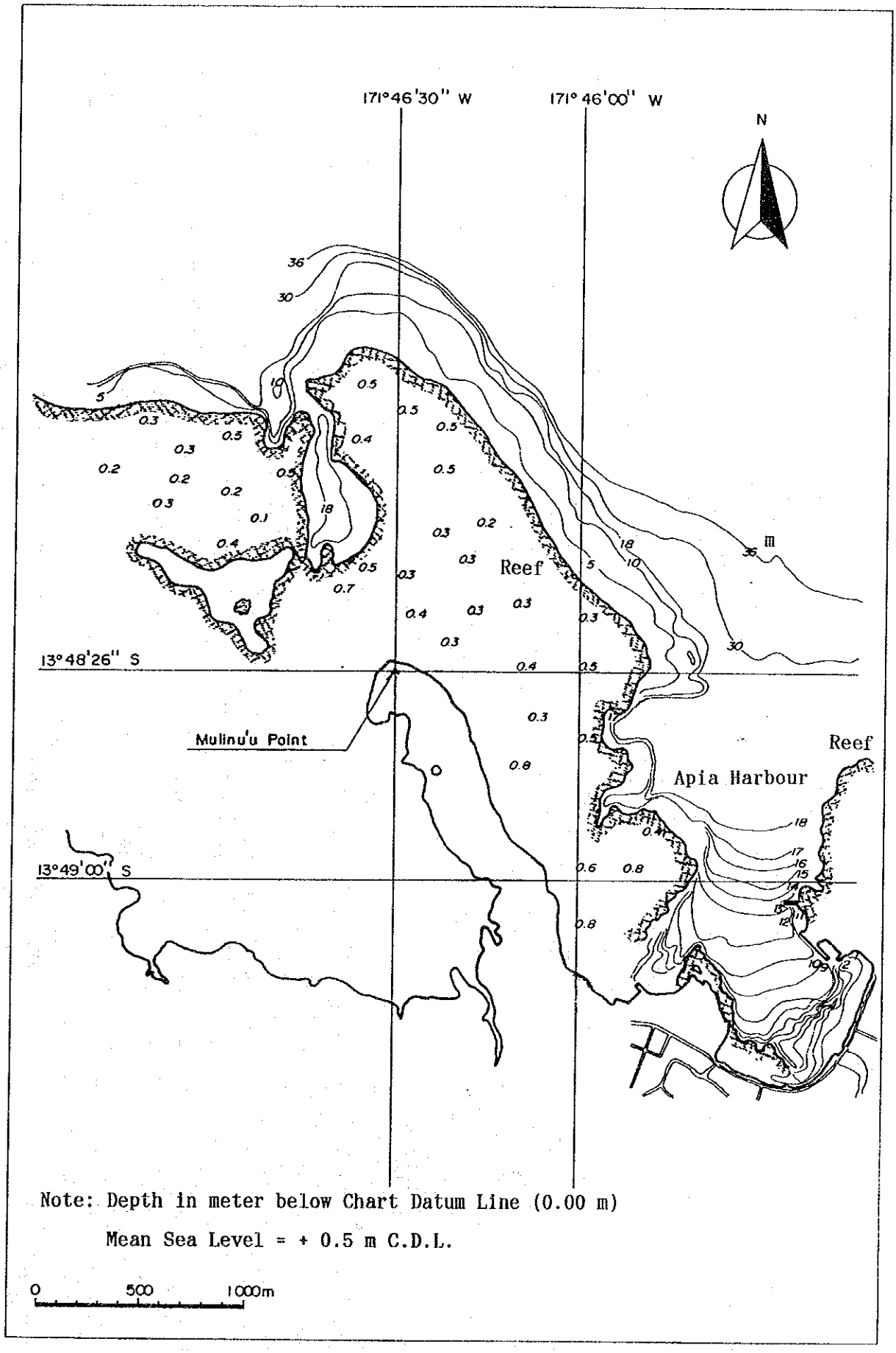


Fig. 5-4(1) RESULTS OF BATHYMETRIC SURVEY AT APIA PORT

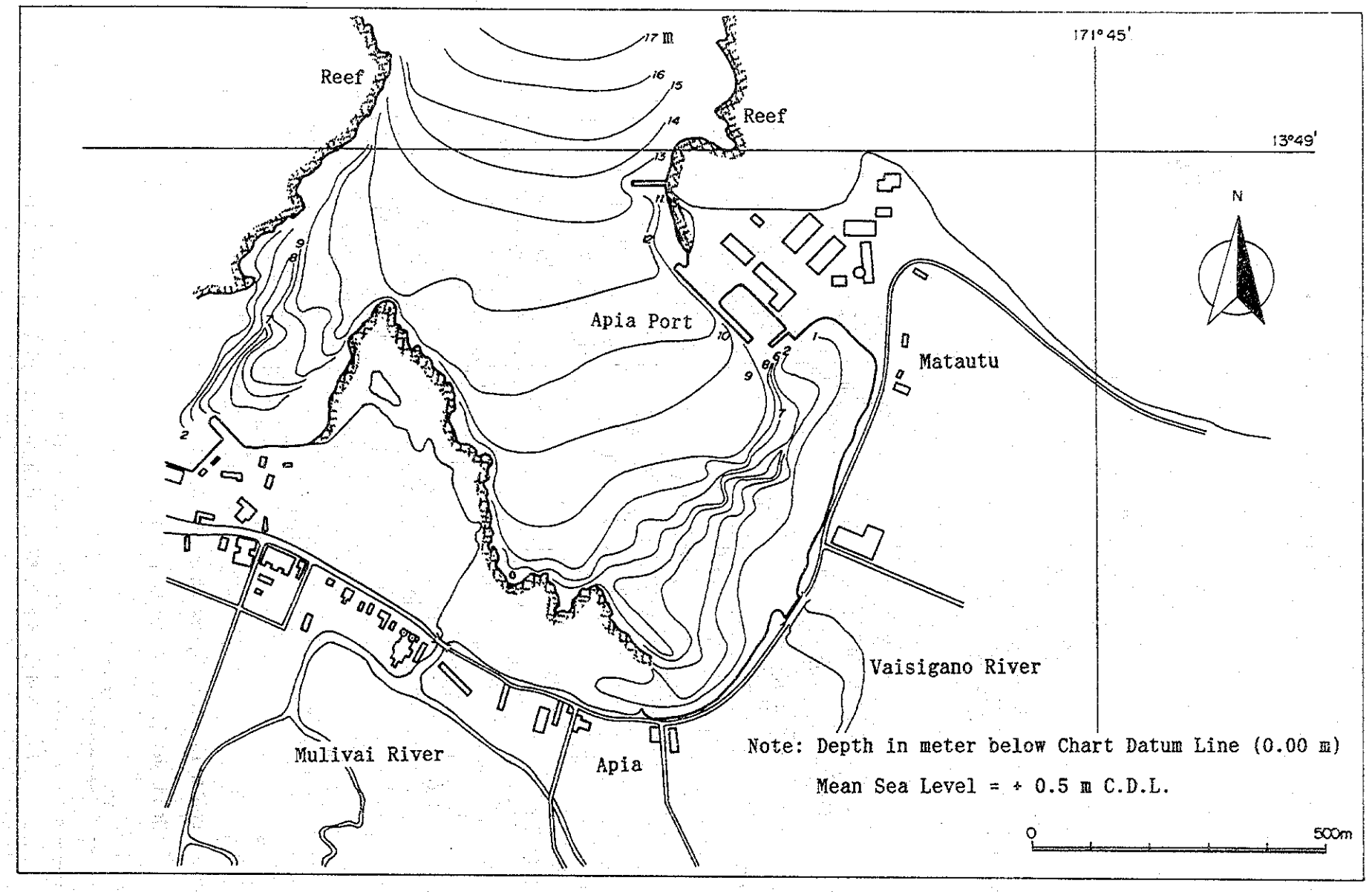


Fig. 5-4(2) RESULTS OF BATHYMETRIC SURVEY AT APIA PORT

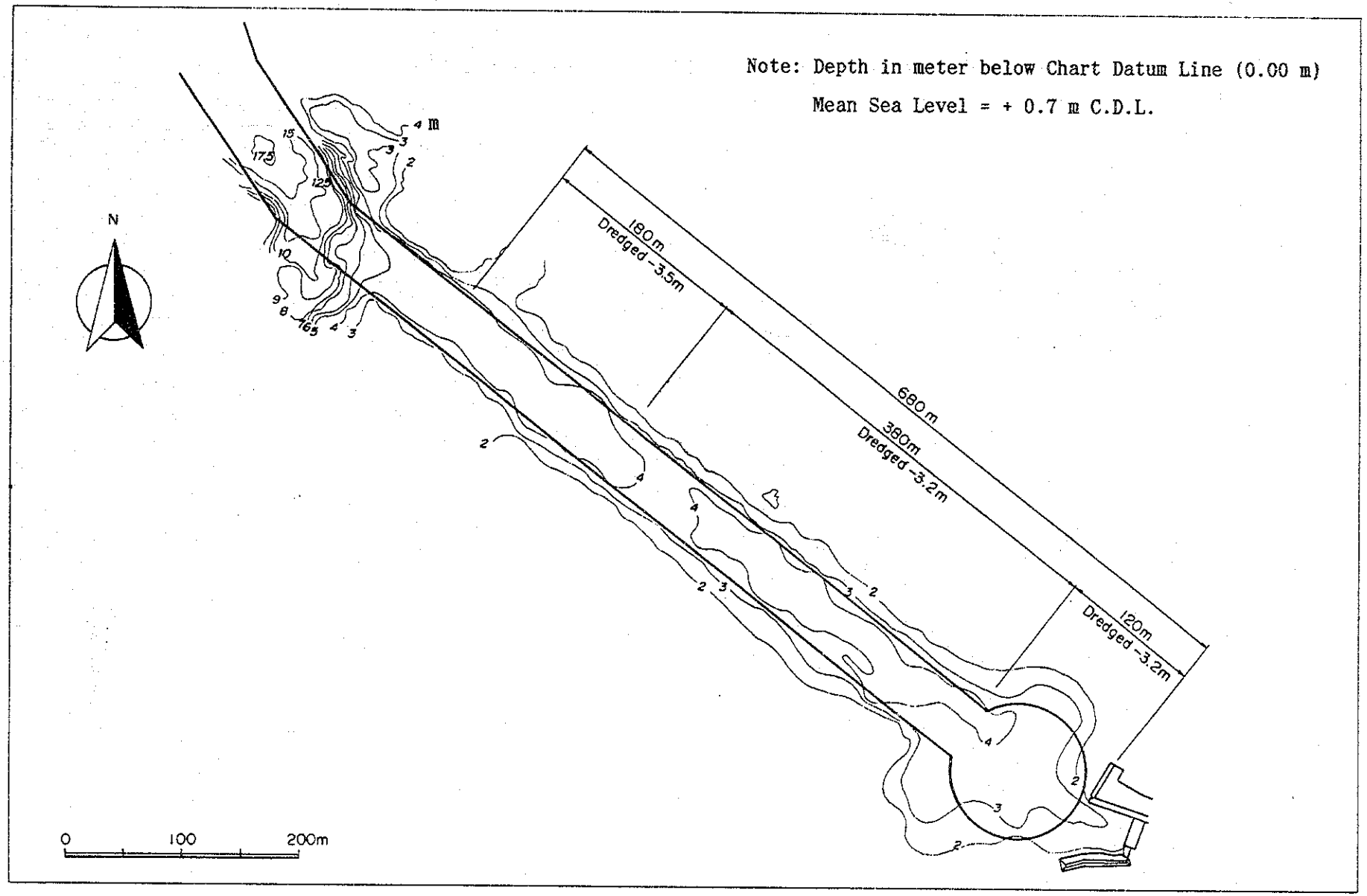


Fig. 5-5(1) RESULTS OF BATHYMETRIC SURVEY AT MULIFANUA PORT

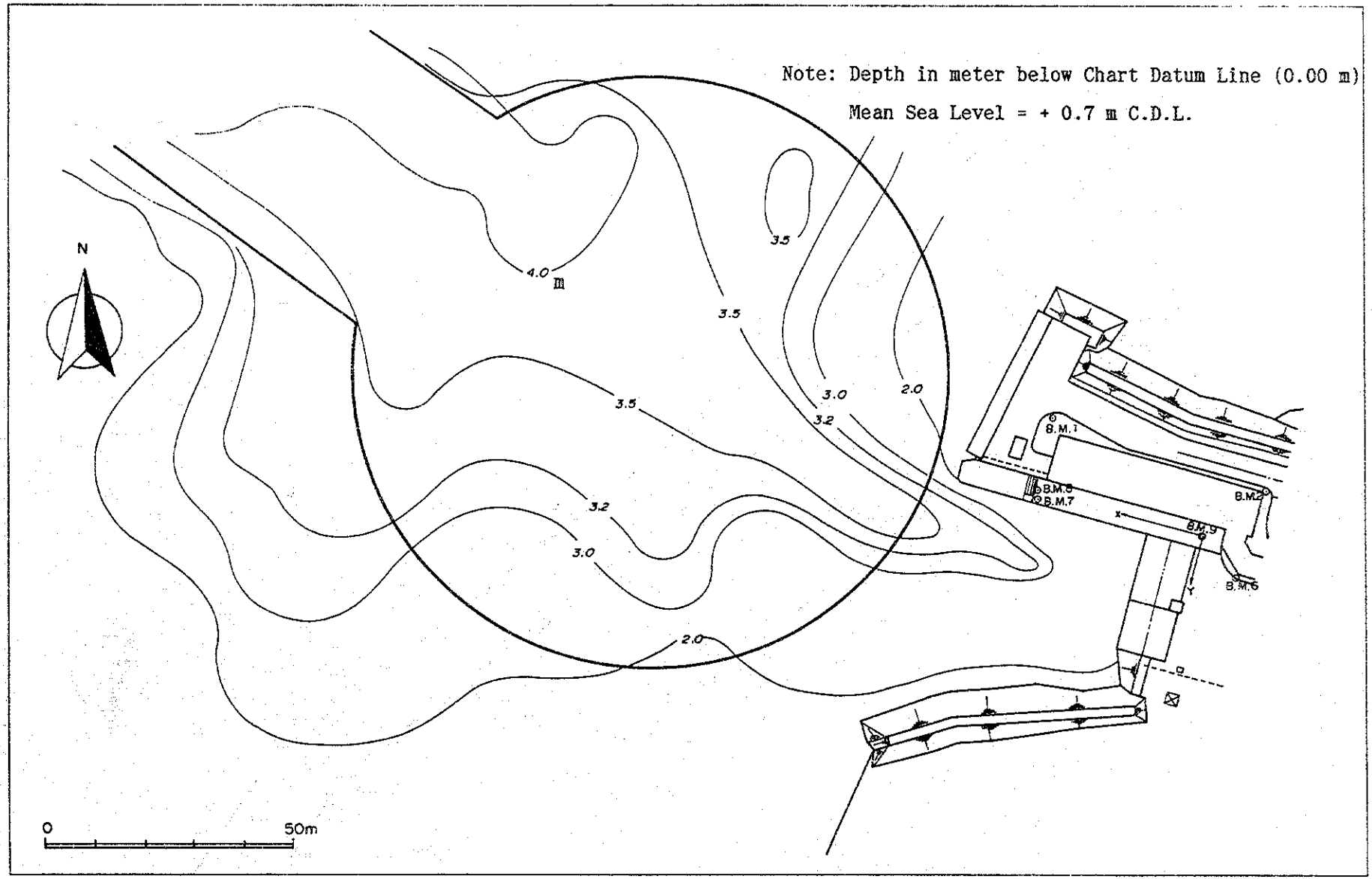


Fig. 5-5(2) RESULTS OF BATHYMETRIC SURVEY AT MULIFANUA PORT

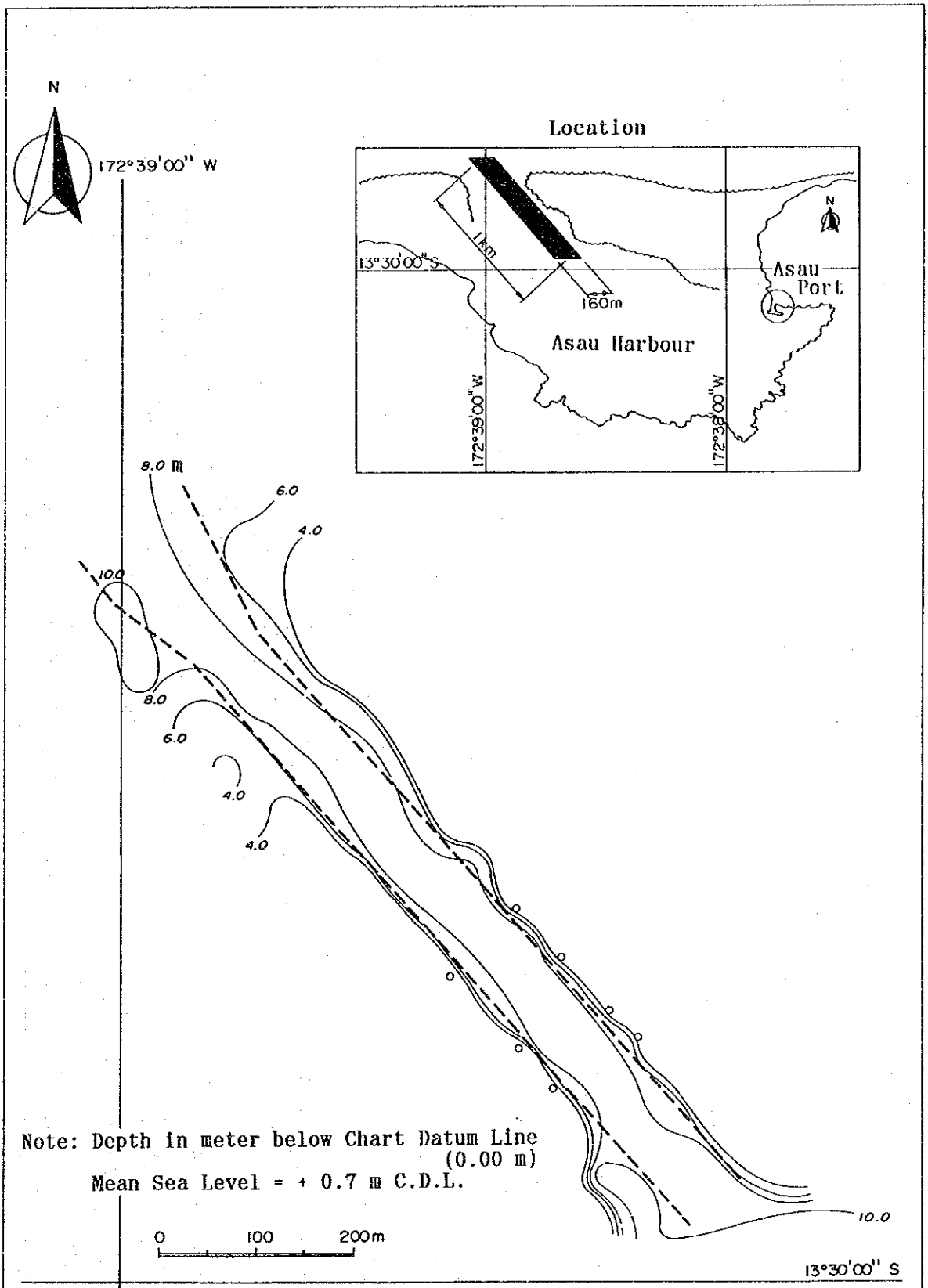


Fig. 5-6 RESULTS OF BATHYMETRIC SURVEY AT ASAU PORT

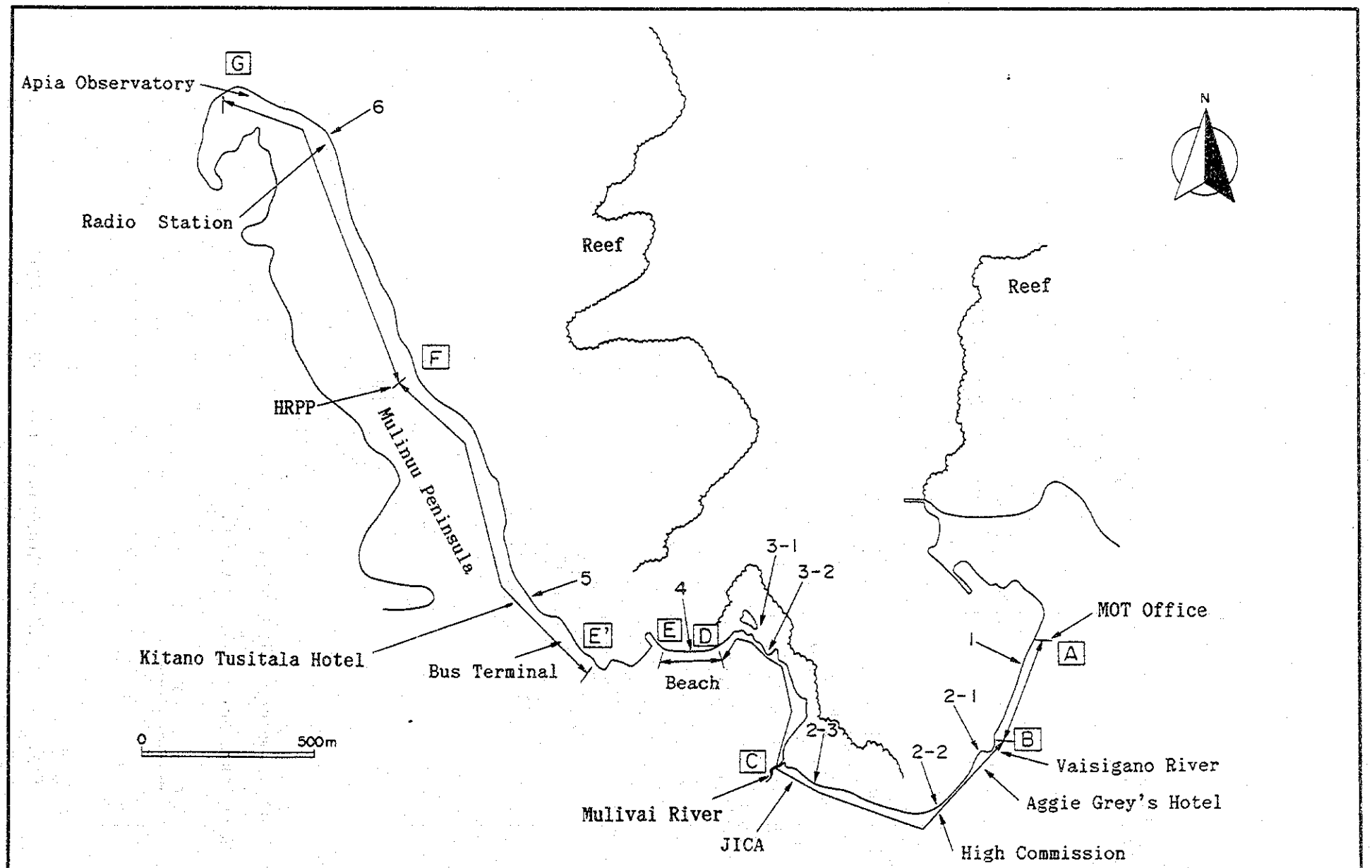
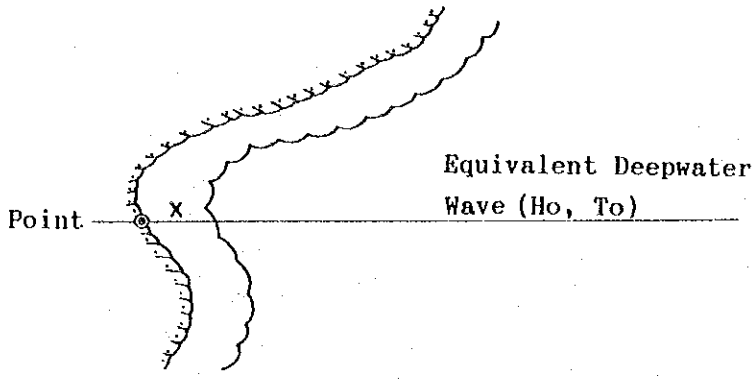
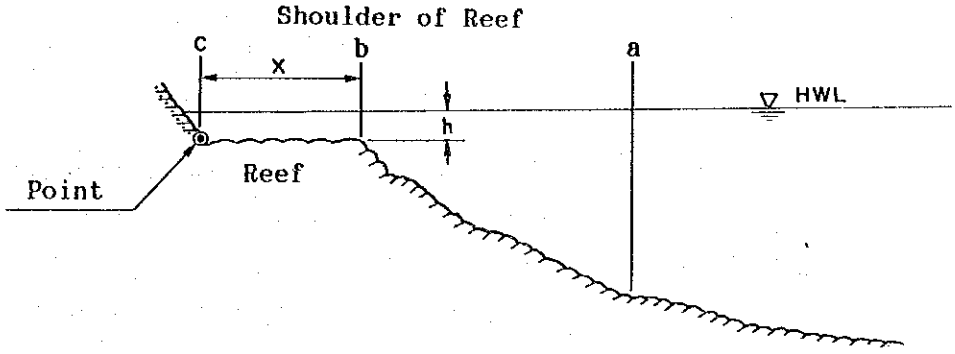


Fig. 5-7 DESIGN LOCATIONS OF FORESHORE PROTECTION



Plan of Reef



Section of Sea Bottom

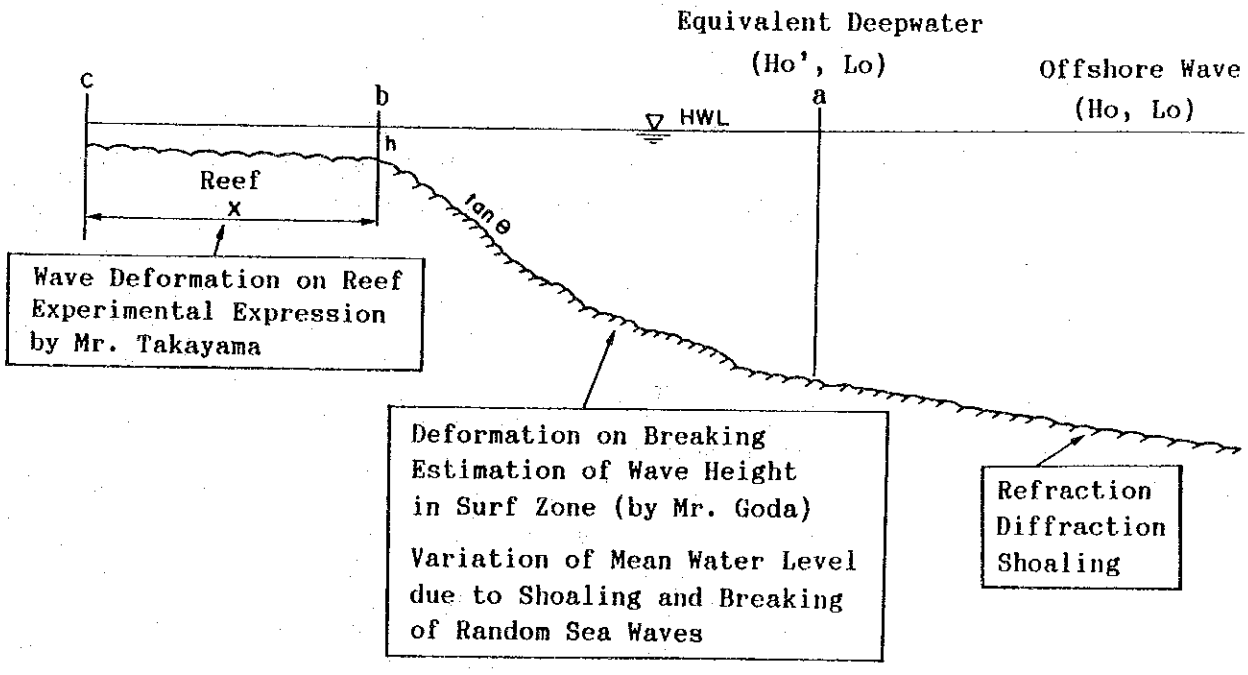


Fig. 5-8 SKETCH OF WAVE DEFORMATION

5.2.3 Earthquake

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 of M7 due to the seismic activities of the Circum-Pacific Earthquake Belt. In 1917, a strong earthquake of M8.3 was observed about 200 km south of Western Samoa. Therefore, a seismic factor of 0.15 is adopted for the design of structures.

5.2.4 Wind

Design velocity of wind has been taken at 50 m/s in Western Samoa, but the Government of Western Samoa changed it by considering the serious damages due to the exceptionally strong wind of cyclone "Val" and established the new design wind velocity of 55 m/s. Therefore, this new value is adopted in this project.

5.3 Basic Plan

5.3.1 Outline of the Planned Facilities

- Facilities to be restored

  The facilities to be rehabilitated under the present project are the followings as discussed in the previous chapter.

OUTLINE OF THE PLANNED PORT FACILITIES

Facilities	Contents	
1. Apia Port		
MOT Office	Restoration	810 m^2
Shed No.1	Removal/Pavement	2,600 m^2
Shed No.4	Restoration	2,230 m^2
Main Wharf		
Rubber Fender	Restoration	41 Nos.
Wooden Fender	Restoration	70 m
Wharf Light	Restoration	10 Nos.
Curbing	Restoration	160 m
Breakwater	Improvement	100 m
Leading Beacon	Reconstruction	2 Nos.
Terminal Building	Restoration	520 m^2
Ferry Ramp		
Dolphin	Restoration	1 No.
Curbing	Restoration	2 Nos.
2. Mulifanua Port		
Terminal Building	Restoration	840 m^2
Leading Beacon	Restoration	3 Nos.
Channel Dredging	Restoration	9,800 m^2
3. Salelologa Port		
Terminal Building	Restoration	800 m^2
Revetment	Restoration	240 m

OUTLINE OF THE PLANNED FORESHORE PROTECTION FACILITIES

Section	Distance
Section A-B : MOT office to Vaisigano River	300 m
Section B-C : Vaisigano River to Mulivai Stream	700 m
Section C-D : Mulivai River to Sandy Beach on Reclamation Area	700 m
Section D-E : Beach Sandy on Reclamation Area	150 m
Section E'-F: Bus Terminal to HRPP Office	1,115 m
Section F-G : HRPP Office to Apia Observatory	350 m
(Radio Station)	(100)m
(Observatory)	(250)m

5.3.2 Design of Port Facilities

- Apia Port

(1) MOT Office

1) Restoration Works

Most part of ceiling, wall and floor of the first floor are damaged.

The scope of restoration work shall be as follows.

a) Partition wall shall be reinforced and interior materials shall be changed.

b) Toilet and ceiling light facilities on the first floor shall be restored to recover a function as an office.

c) Roof and outside wall which are seriously damaged shall be fully repaired to prevent rain water leakage.

d) The damaged ceiling of the ground floor by rain water shall be restored.

2) Design Conditions

a) Floor Area 812.74 m2

b) Design Code Reference

- Structural design criteria refer to the Japanese standards while New Zealand standards will be used for the electrical work in view of maintenance convenience.

- Material to be used

Concrete	: FC 180 - 240 kgf/cm2
Reinforcing steel bars	: SD30 (JIS)
Yield Strength	: 3,000 kgf/cm2
Steel	: SS41 (JIS)
Strength	: 2,400 kgf/cm2
Timber	: laminated wood

- Design Loads

Seismic Load : Zone C of the seismic zoning map of New Zealand standards

$$V = CISMR \times Wt$$

where,

C : Seismic Coefficient, C = 0.1
I : Important Coefficient, I = 0.3 (public building)
SM : Structural Materials, SM = 1.0 (RC)
R : Risk Factor, R = 1.1
Wt : Weight

$$V = 0.1 \times 1.3 \times 1.0 \times 1.1 \; Wt = 0.15 \; Wt$$

Wind Load : Reference Wind Velocity, V = 55 m/sec
Wind Velocity, Vs = S1 x S2 x V

where,

S1 : Topographical Correction Factor, 1.0
S2 : Ground Surface, Building Height and Building Size Factor, 1.0
Vs = 1.0 x 1.0 x 55 = 55 m/sec

c) Plumbing Design Standards

- Sanitary Units

The sanitary units used in the toilets will be selected pursuant to Uniform Plumbing Code.

- Water Supply

Water supply to the building will be made by branching out from the nearby water main.

d) Electricity Design Standards

Power supply of single phase 230 V will be made to the building from the existing sub-station.

(2) Shed No. 1

1) Restoration Works

Considering the increase of container ratio of cargo and examination of required shed area, shed No.1 shall be demolished and the floor area shall be converted to a container yard.

However, the existing power substation housing the switchboard for main wharf and toilet located at north end of shed No. 1 shall be left and restored. This room shall be roofed by color tin plate and the walls shall be painted using the insulating paint.

Substation and toilet	:	45.75 m2
Container yard	:	2,720.00 m2

2) Design Conditions

Wind Load	:	55 m/sec
Forklift Load	:	56 tonf

3) Structural Plan

<Container Yard>

Reinforced Concrete pavement	25 cm thick
Base course	20 cm thick
Sub-base course	20 cm thick

(3) Shed No. 4

1) Restoration Works

Damaged roofs, walls, lights and steel shutters shall be restored. The broken shutters on the south side are temporarily closed by corrugated tin sheets. These doors are not used as an access to the shed any more, and shall be closed and walled by color tin sheets.

(4) Main Wharf Rubber Fenders

1) Restoration Plan

All the rubber fenders are cracked or torn off and shall be restored.

2) Structural Plan

As the existing rubber fenders are fixed horizontally due to shortage of thickness of front concrete beam of the wharf, most of those were seriously damaged by movement of ship during cyclone. The new fenders of a pair of 400 H type covered with front steel pad shall be installed vertically.

(5) Wooden Fenders

1) Restoration Plan

The existing wooden fenders for small boats located at the back of the main wharf are damaged by collision of boats during cyclone. Most of wooden piles and beams are broken and deformed. The 70m section except the 10m section which has been restored in the previous Project shall be restored in this project.

2) Structural Plan

H-shaped steel piles instead of wooden pile shall be used as vertical piles. Wooden beams with rubber plate shall be fixed to rear concrete beam of the main wharf with bolts.

(6) Wharf Lights

1) Restoration Plan

10 Nos. of wharf lights which were located along the back edge of the wharf and blown away by strong wind shall be restored.

2) Structural Plan

The light with 1,000 W capacity shall be installed on top of pole of 5 m length.

(7) Curbings

1) Restoration Plan

Curbings for the section of 164 m length except the section of 20 m for ramp area located at the front center of the wharf shall be restored.

2) Structural Plan

The section of new curbings shall be the same as the existing back side curbings of the wharf.

(8) Breakwater

1) Restoration Plan

The total length of 100 m including the subsided head section shall be restored. In execution, a part of existing blocks and rubble mound shall be moved in order to give space enough to secure thickness of new blocks. The light tower located at the tip of breakwater has been inclined by cyclone waves and its base concrete shall be reconstructed and the tower shall be replaced plumb.

2) Design Conditions

- Water level	HWL	=	+ 1.0 m
	LWL	=	+ 0.0 m
- Design wave	H1/3	=	6.0 m
	T1/3	=	12.5 sec
- Design depth	h	=	- 14.5 m

3) Structural Plan

The structural type of rubble slope covered with concrete blocks the same as the existing breakwater shall be adopted.

The crown height is set at + 4.6 m above LWL which is 0.6 times of H1/3 from HWL (+1.0 m above LWL). The grade of slope is 1 : 1.5 for both offshore and port sides. Each slope has step and the elevations of step are - 9.0 m for offshore side which is 1.5 times of H1/3 below LWL and - 6.5 m for port side which is deeper than 1.0 time of H1/3 below LWL the same as the existing elevation. 20 ton concrete blocks are adopted by considering severe conditions at head section of breakwater and of long wave period requiring larger blocks.

The calmness of water area behind the breakwater is calculated by computer simulation for different lengths of 100 m (T=8.0 & 12.5 sec.) and 150 m (T=12.5 sec.) and results are shown in Appendix Fig.A-5-11. As shown in the figure, the difference of wave height ratio is not significant.

(9) Beacon

1) Restoration Plan

The towers of both front and rear beacons are damaged by strong wind and the capacity of lanterns is deteriorated. Therefore, the front beacon shall be reconstructed at the same place and the rear beacon shall be reconstructed in a higher place to give a clearer visibility.

2) Design Conditions

Luminous range of lanterns shall be as follows, which are the same as those written in the Chart.

Luminous range : front --- 10 miles
rear --- 20 miles

The height of tower is set at 11 m to be conspicuous from the deck of ships.

The design wind speed is 55 m/sec.

3) Structural Plan

Considering working conditions for tower of the rear beacon to be erected high on the mountain, steel truss tower structure is adopted. Day marks shall be installed on the frontage of the tower.

(10) Ferry Terminal Building

1) Restoration Plan

The upper open area of ceiling of the office and shop shall be covered with tin sheet to prevent rain blowing into.

As the screws fixing the roof of stainless color steel sheets have been loosened, a tightening work shall be implemented.

(11) Mooring Dolphin

1) Restoration Plan

As a surface concrete of superstructure of the mooring dolphin has spalled off due to the collision by ship during cyclone, concrete covering work shall be conducted. Also, the lantern installed at the tip of the dolphin has been blown away, and a new lantern with the capacity of luminous range of 1 miles shall be installed at the same position.

2) Structural Plan

Concrete with 20 cm thickness shall be cast.

(12) Curbings at Ferry Ramp

1) Restoration Plan

Damaged 2 Nos. of curbings at the ferry ramp shall be restored.

- Mulifanua Port

(1) Ferry Terminal Building (838.15 m2)

1) Restoration Plan

Damaged roofs, gutters, window frames, louver, interior and partition walls, toilet facility and lights shall be restored. Color tin sheets shall be used for roofing materials in preference of easier maintenance work. To relieve inconvenience to use toilet due to suspension of water supply, water tank with capacity of 5 t shall be installed.

(2) Dredging at Turning Basin

1) Restoration Plan

The turning basin in Mulifanua Port has been silted by cyclone waves. To recover normal ferry services, a dredging work shall be carried out to restore design depth of -3.2 m. Total volume of sand to be dredged is calculated at 9,800 m3 based on the results of bathymetric survey.

2) Dredging Design Section

Dredging work shall be carried out by a crane mounted on pontoon. The depth and width of extra dredging are as follows.

Extra dredging depth	:	0.5 m
Extra dredging width	:	4.0 m
Grade of slope	:	1 : 2

Dredged materials shall be discharged and dumped at reclamation area located to the south of the ferry ramp.

(3) Beacon

1) Restoration Plan

Damaged two lanterns of beacons on land shall be replaced with new ones with luminous range of 2 miles.

The concrete tower of inner beacon in sea has been cracked and shall be covered with 20 cm thick reinforced concrete.

- Salelologa Port

(1) Ferry Terminal Buildings

1) Restoration Plan

The roof has been seriously damaged and shall be restored with color tin sheets as in Mulifanua Port. Damaged louvers, interior and partition walls, toilet facility, lights and gutters shall be restored. 5 t water tank shall be installed as in Mulifanua Port.

(2) Revetment and Fence

1) Restoration Plan

All the revetment section of 150 m on east side and 90 m on west side shall be restored with fence erected for 140 m section.

2) Design Conditions

- Water Level

HHWL = + 2.2 m
HWL = + 1.2 m
LWL = + 0.2 m

- Design Wave

H1/3 = 0.7 m
T1/3 = 12.5 sec.

- Design Depth

h = - 1.2 m

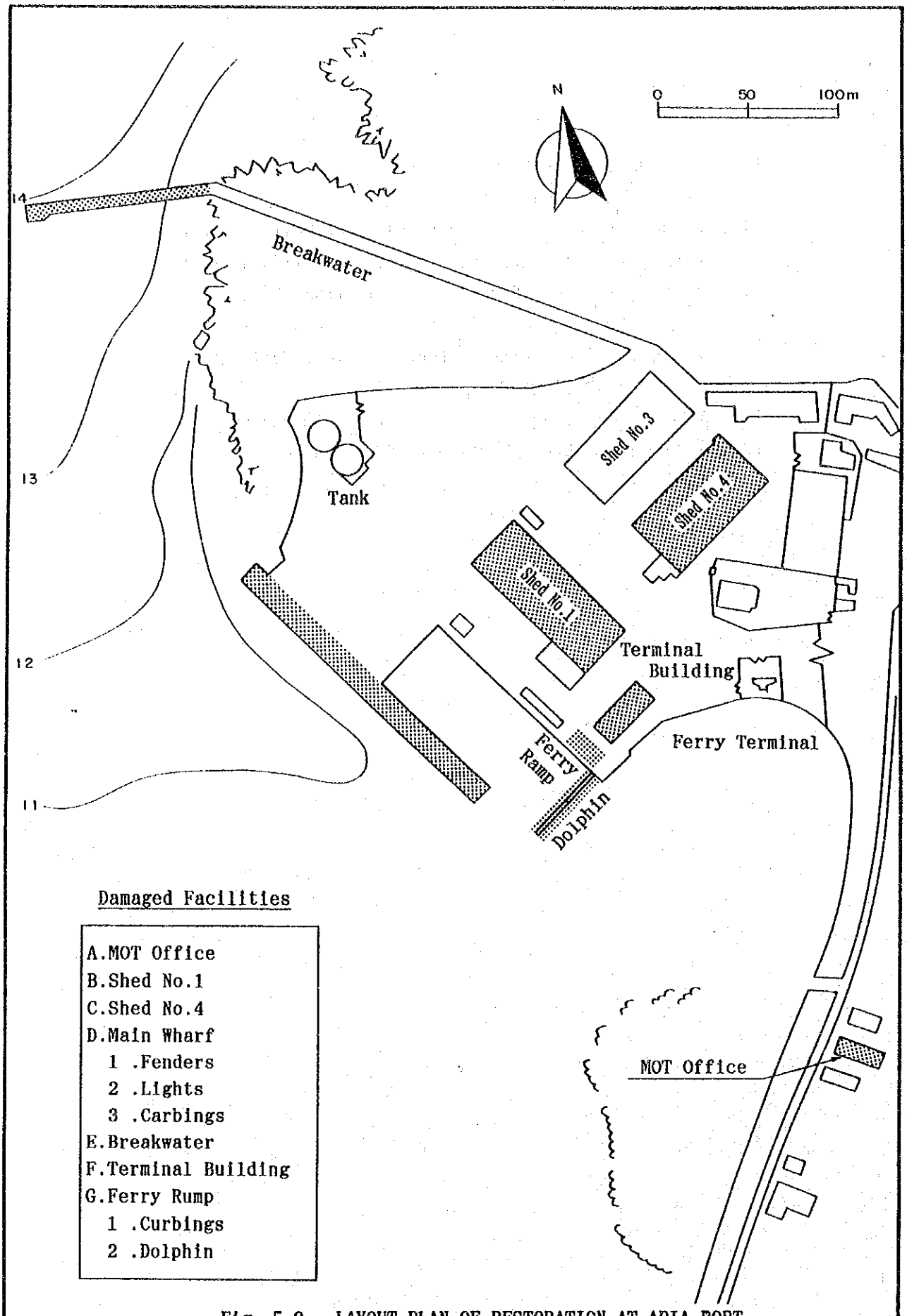
3) Structural Design

Rubble slope structure same as the existing one shall be adopted. The crown height is set at + 2.8 m which is 0.8 times $H_{1/3}$ above HHWL to meet the condition that the waves shall not over flow. The required weight of armour stone is 500 kg/piece.

(4) Design Drawings

Design layout plans and cross sections for main facilities which shall be restored at Apia, Mulifanua and Salelologa Ports in this Project are shown as follows.

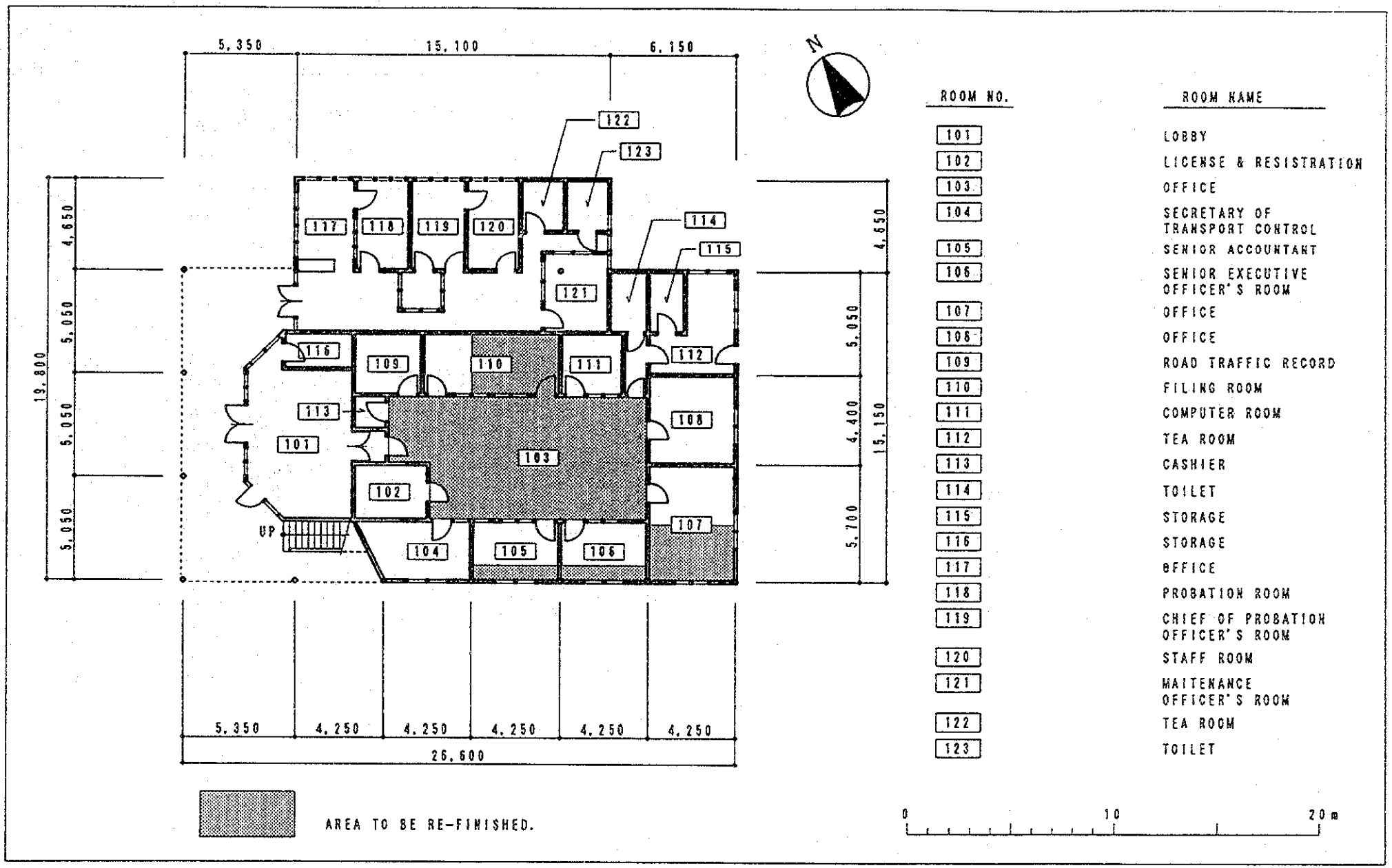
Fig. 5-9 Layout Plan of Restoration at Apia Port
Fig. 5-10 Ground Floor Plan of MOT Office
Fig. 5-11 First Floor Plan of MOT Office
Fig. 5-12 Elevations of MOT Office (1)
Fig. 5-13 Elevations of MOT Office (2)
Fig. 5-14 Layout Plan of Shed No.1
Fig. 5-15 Layout Plan and Elevations of Substation Room of Shed No.1
Fig. 5-16 Elevations of Shed No.4
Fig. 5-17 Typical Cross Section of Rubber Fender (front side)
Fig. 5-18 Typical Cross Section of Wooden Fender (back side)
Fig. 5-19 Typical Cross Section of Curbing at Main Wharf
Fig. 5-20 Typical Cross Section of Breakwater
Fig. 5-21 Cross Section of Tower of Beacon
Fig. 5-22 Layout Plan of Ferry Terminal Building at Apia Port
Fig. 5-23 Typical Cross Section of Mooring Dolphin
Fig. 5-24 Ground Floor Plan of Ferry Terminal Building at Mulifanua Port



Damaged Facilities

A.MOT Office
B.Shed No.1
C.Shed No.4
D.Main Wharf
  1 .Fenders
  2 .Lights
  3 .Carbings
E.Breakwater
F.Terminal Building
G.Ferry Rump
  1 .Curbings
  2 .Dolphin

Fig. 5-9 LAYOUT PLAN OF RESTORATION AT APIA PORT



ROOM NO.	ROOM NAME
101	LOBBY
102	LICENSE & RESISTRATION
103	OFFICE
104	SECRETARY OF TRANSPORT CONTROL
105	SENIOR ACCOUNTANT
106	SENIOR EXECUTIVE OFFICER'S ROOM
107	OFFICE
108	OFFICE
109	ROAD TRAFFIC RECORD
110	FILING ROOM
111	COMPUTER ROOM
112	TEA ROOM
113	CASHIER
114	TOILET
115	STORAGE
116	STORAGE
117	OFFICE
118	PROBATION ROOM
119	CHIEF OF PROBATION OFFICER'S ROOM
120	STAFF ROOM
121	MAITENANCE OFFICER'S ROOM
122	TEA ROOM
123	TOILET

Fig. 5-10 GROUND FLOOR PLAN OF MOT OFFICE

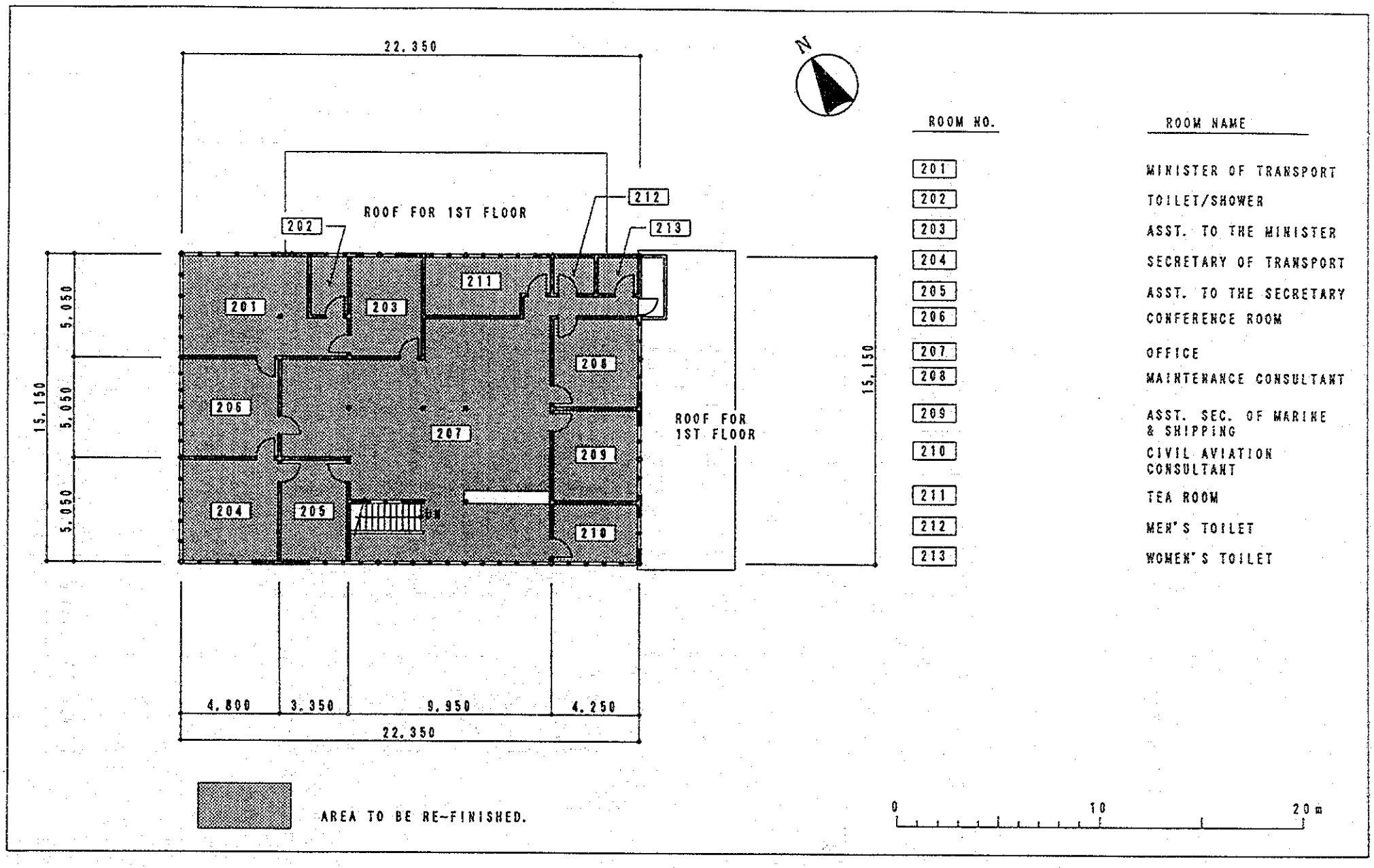
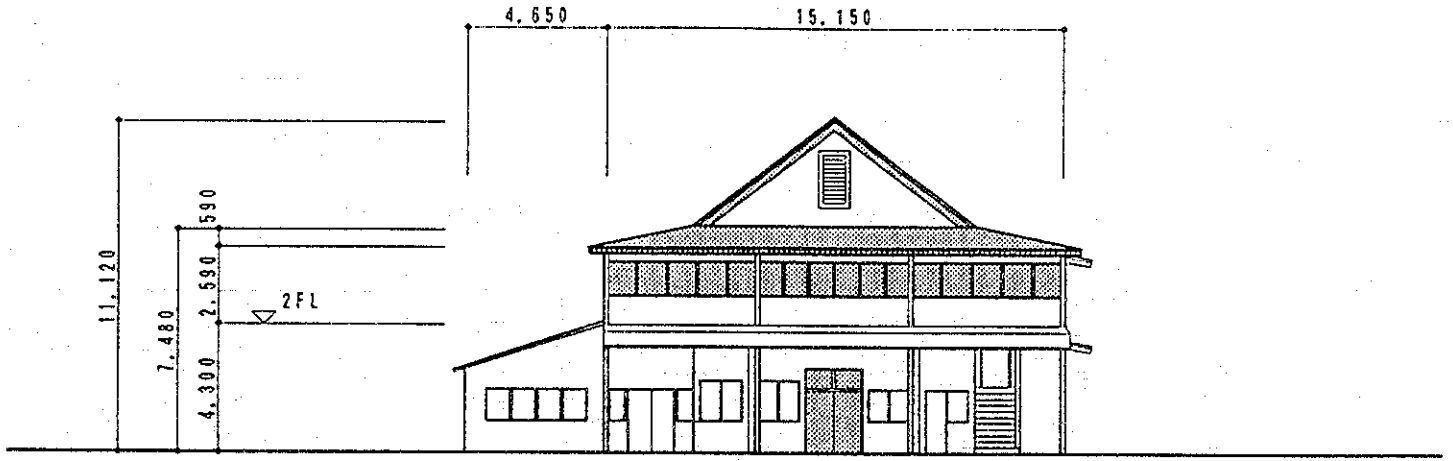
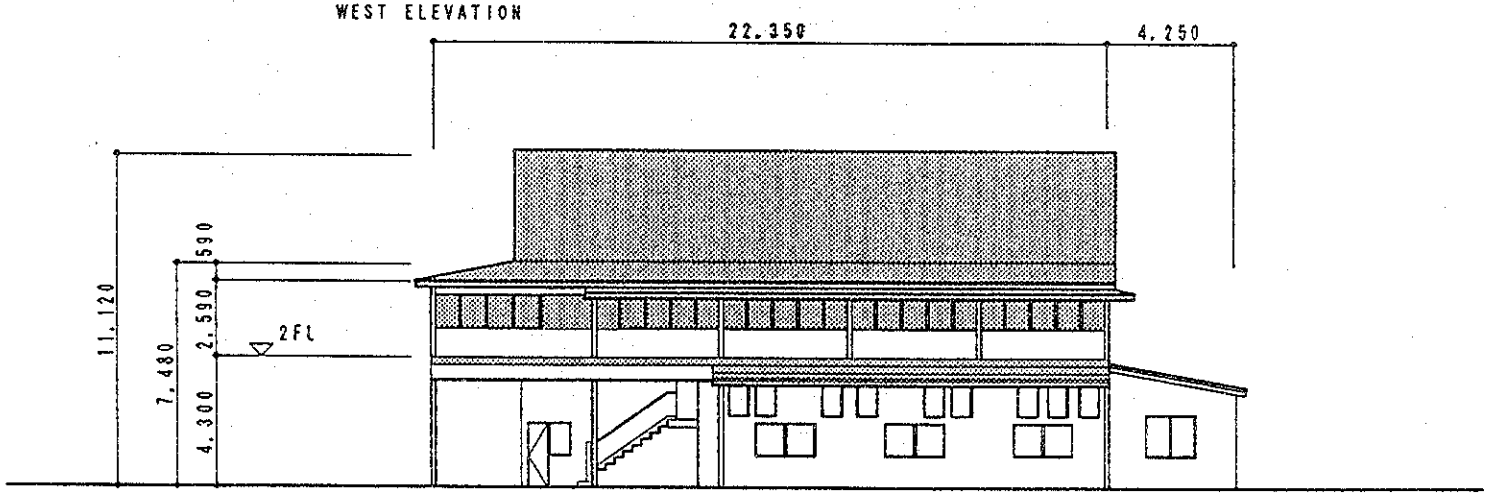


Fig. 5-11 1ST FLOOR PLAN OF MOT OFFICE



WEST ELEVATION



SOUTH ELEVATION

AREA TO BE RE-FINISHED.

0 10 20 m

Fig. 5-12 ELEVATIONS OF MOT OFFICE (1)

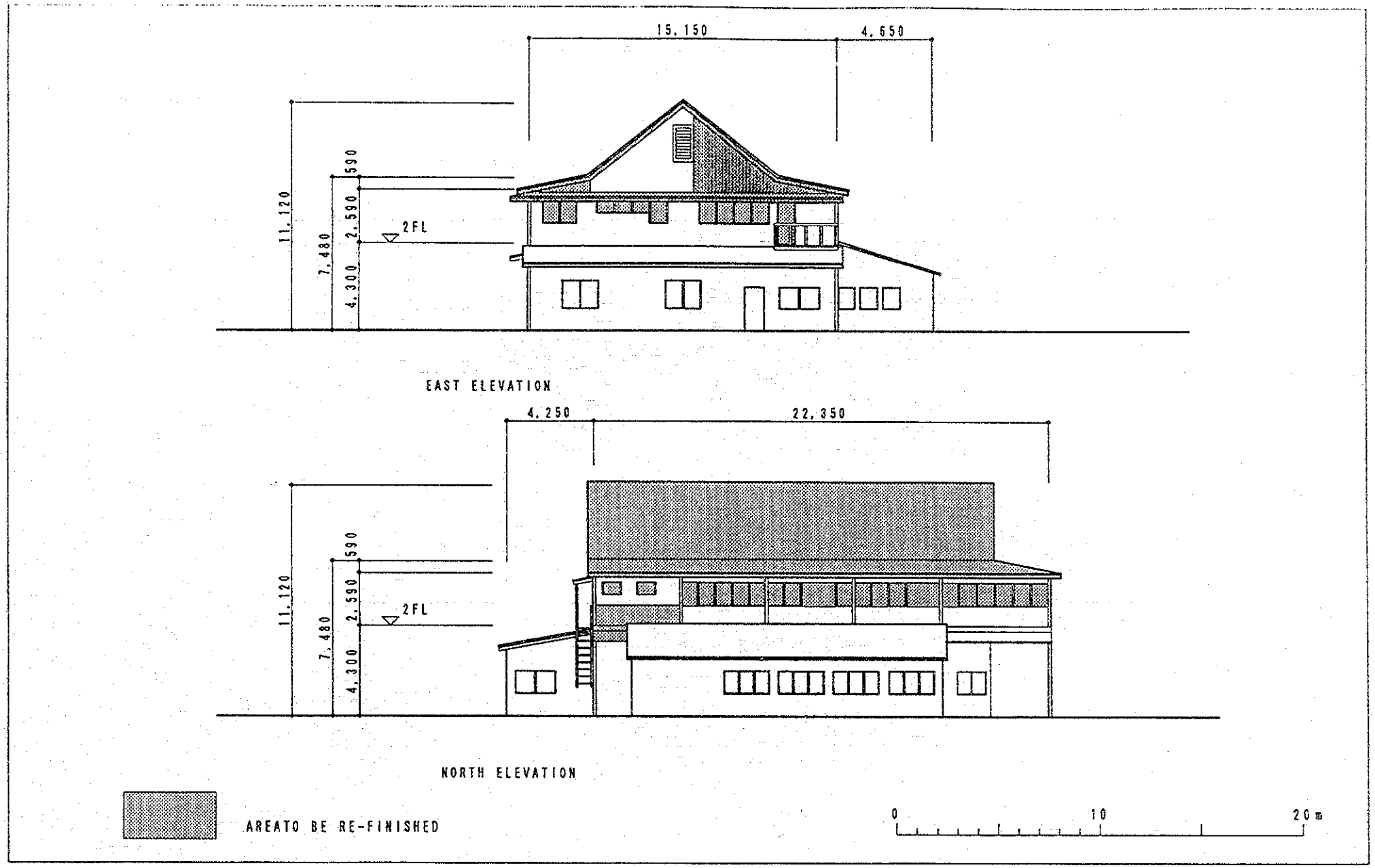


Fig. 5-13 ELEVATIONS OF MOT OFFICE (2)

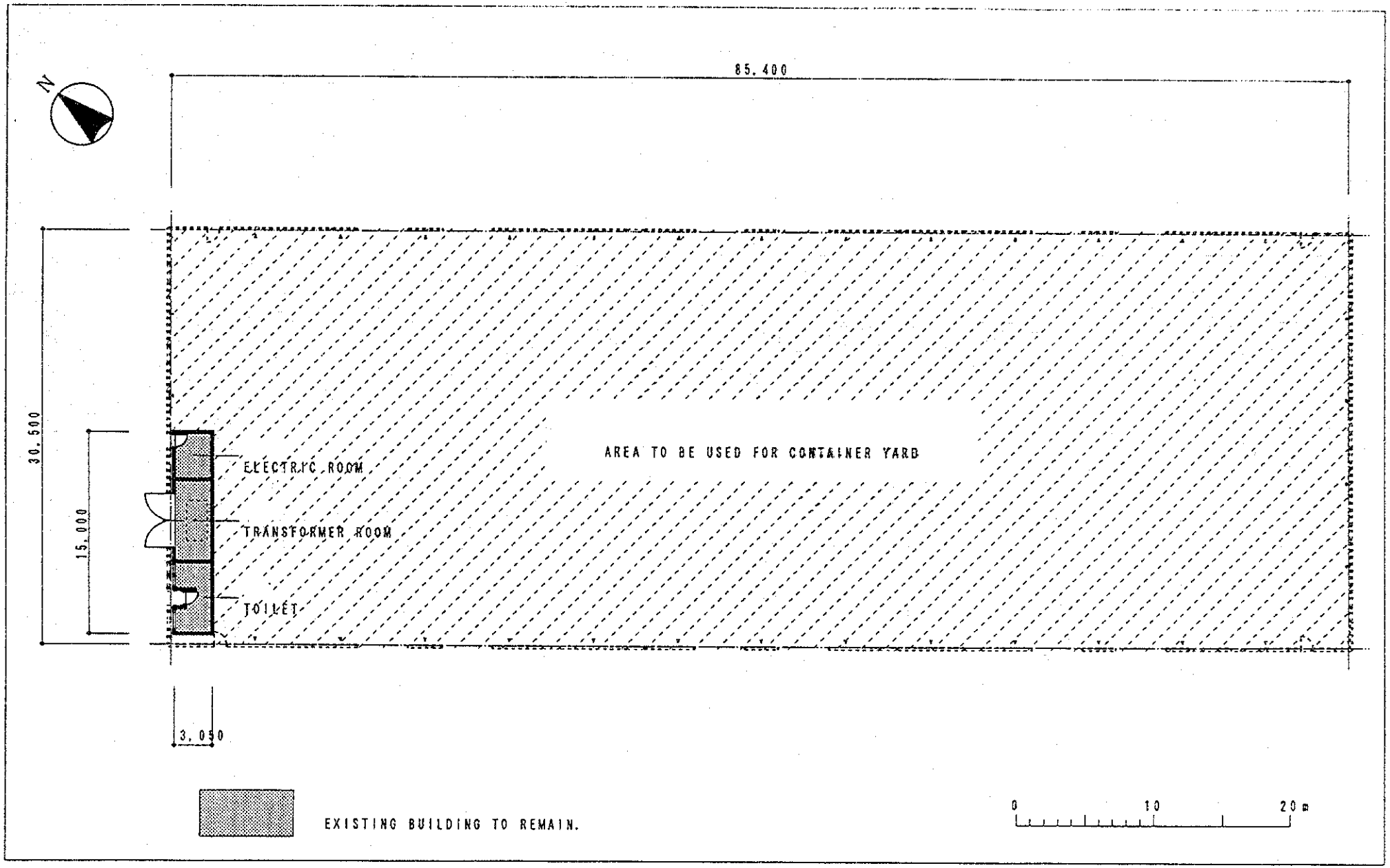


Fig. 5-14 LAYOUT PLAN OF SHED NO.1

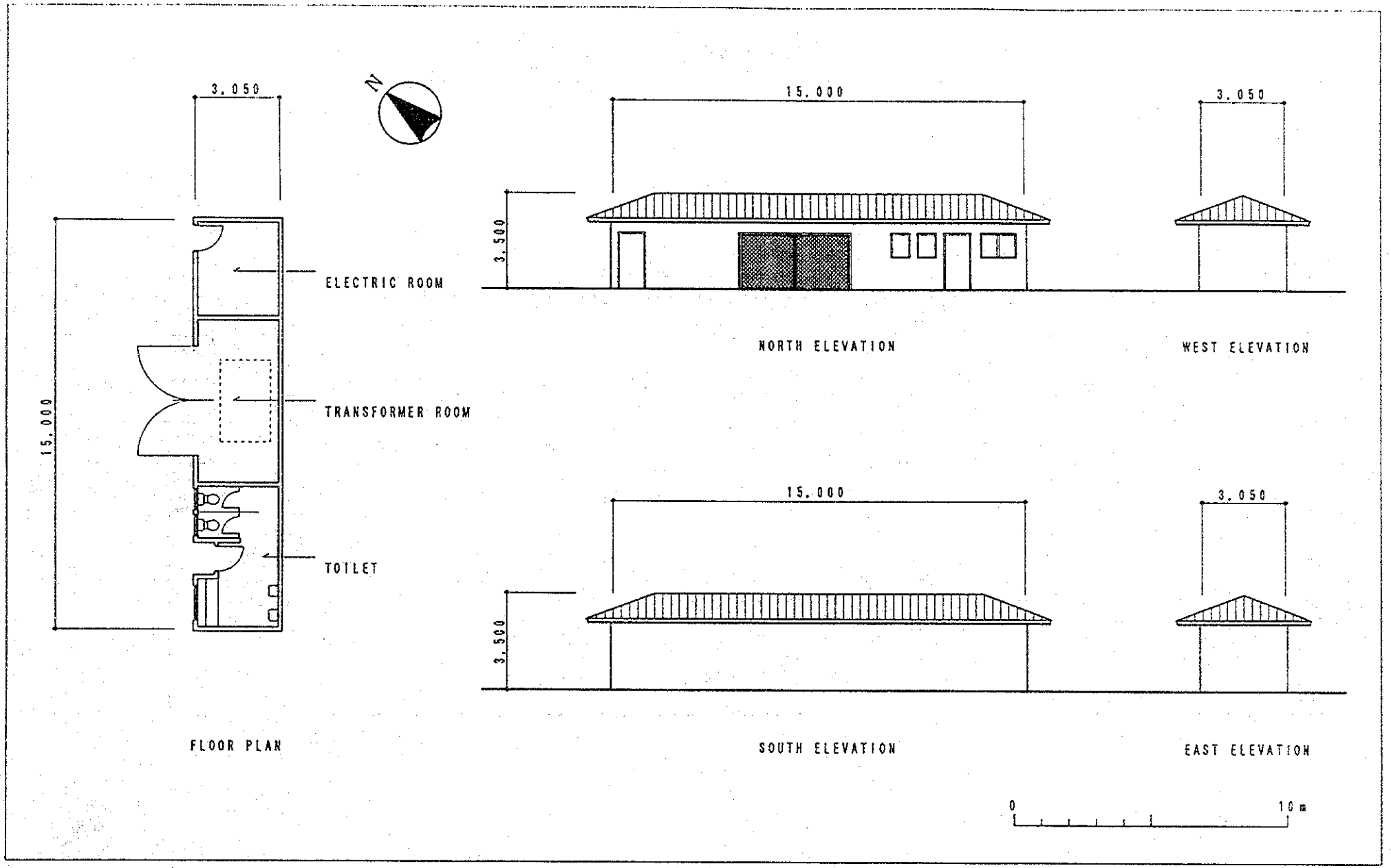


Fig. 5-15 LAYOUT PLAN AND ELEVATIONS OF SUBSTATION ROOM OF SHED NO.1

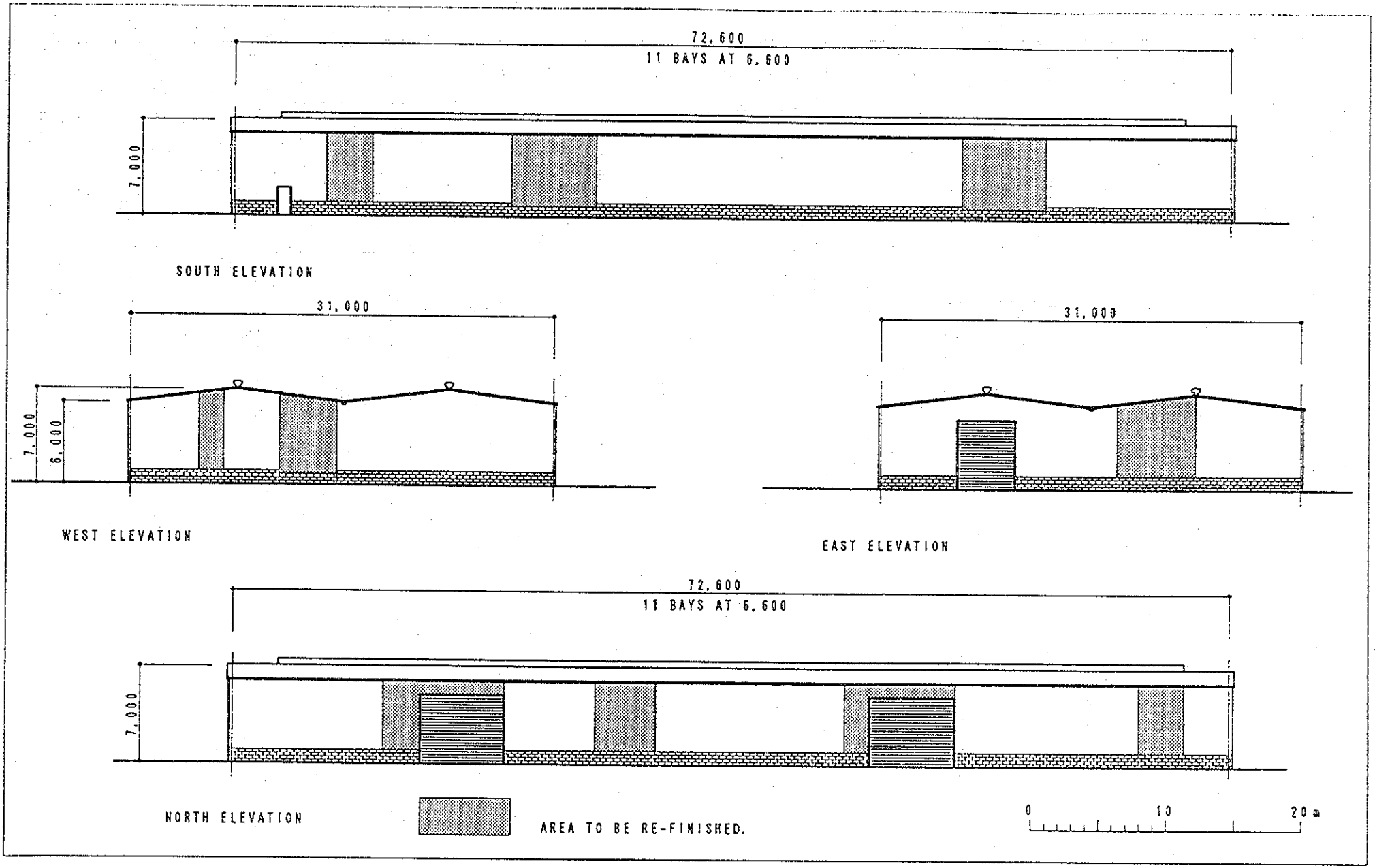


Fig. 5-16 ELEVATIONS OF SHED NO.4

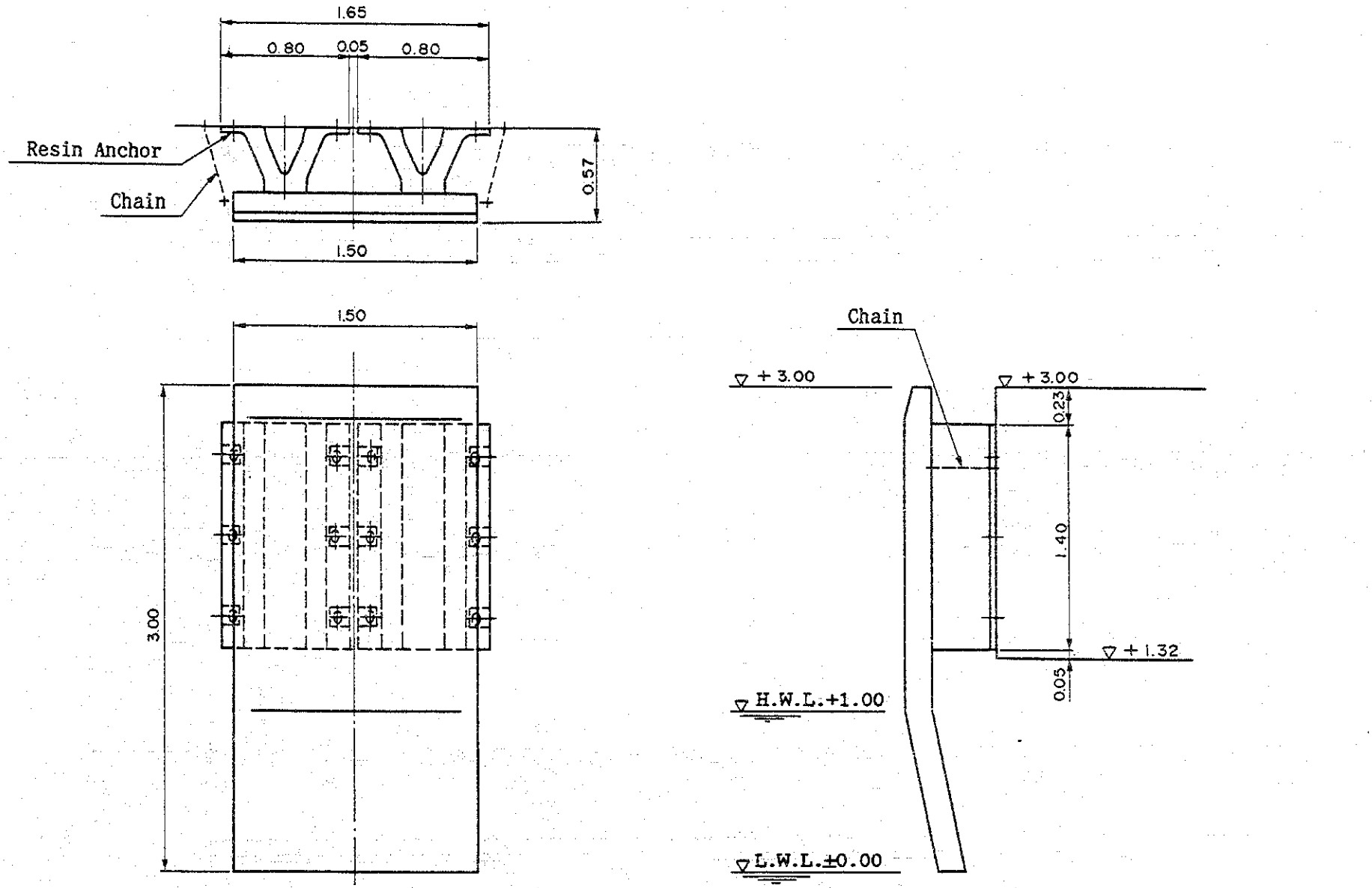


Fig. 5-17 TYPICAL CROSS SECTION OF RUBBER FENDER (FRONT SIDE)

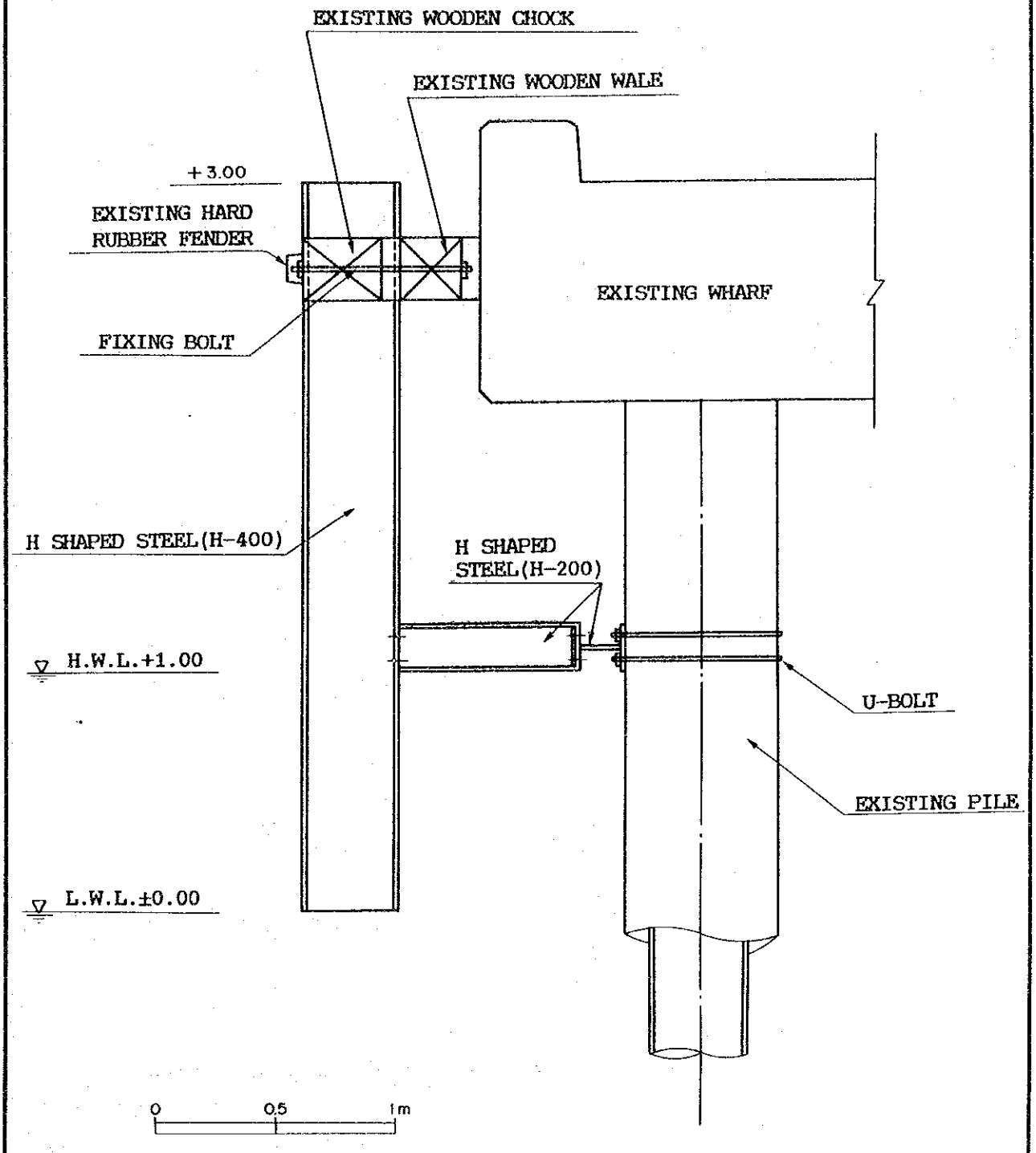


Fig. 5-18 TYPICAL CROSS SECTION OF WOODEN FENDER (BACK SIDE)

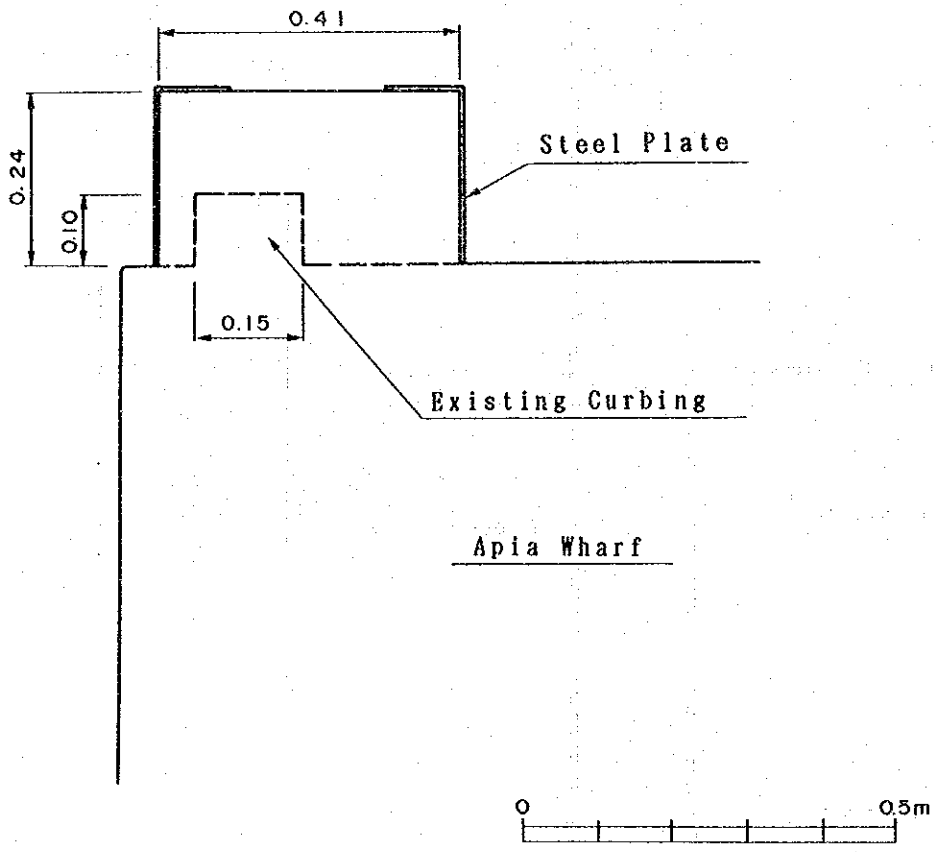
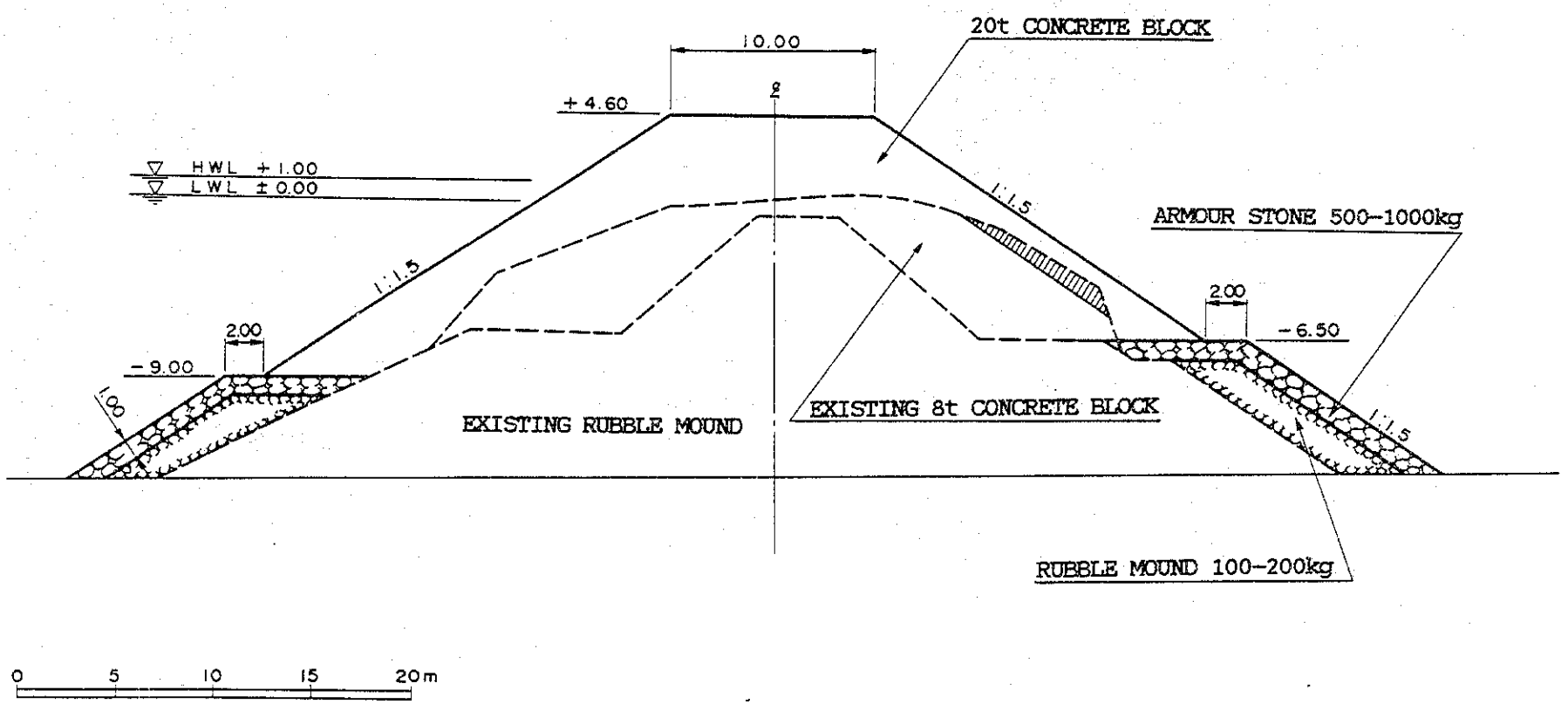


Fig. 5-19 TYPICAL CROSS SECTION OF CURBING AT MAIN WHARF



Note: ▨ This area shall be removed and replaced.

Fig. 5-20 TYPICAL CROSS SECTION OF BREAKWATER

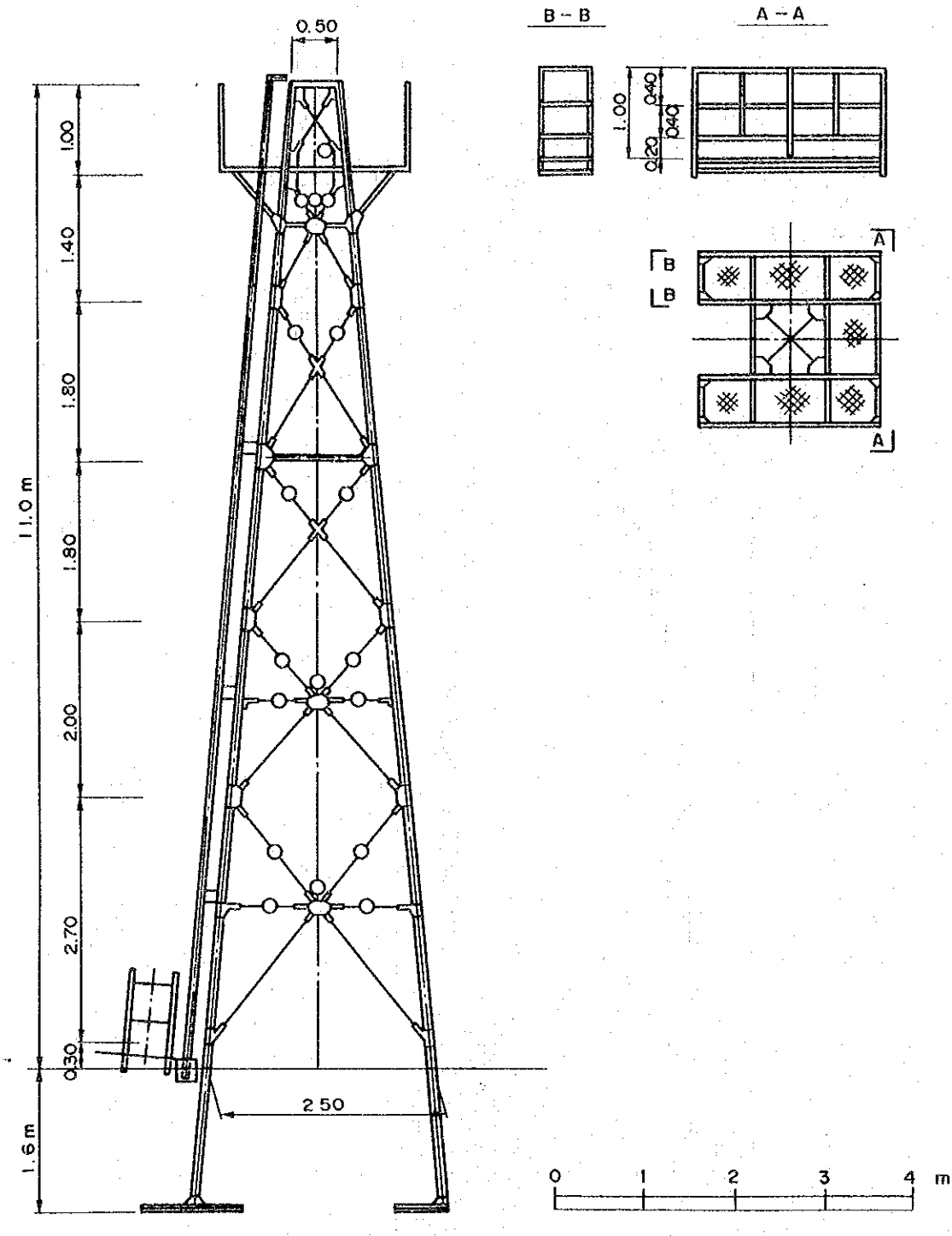


Fig. 5-21 CROSS SECTION OF TOWER OF BEACON

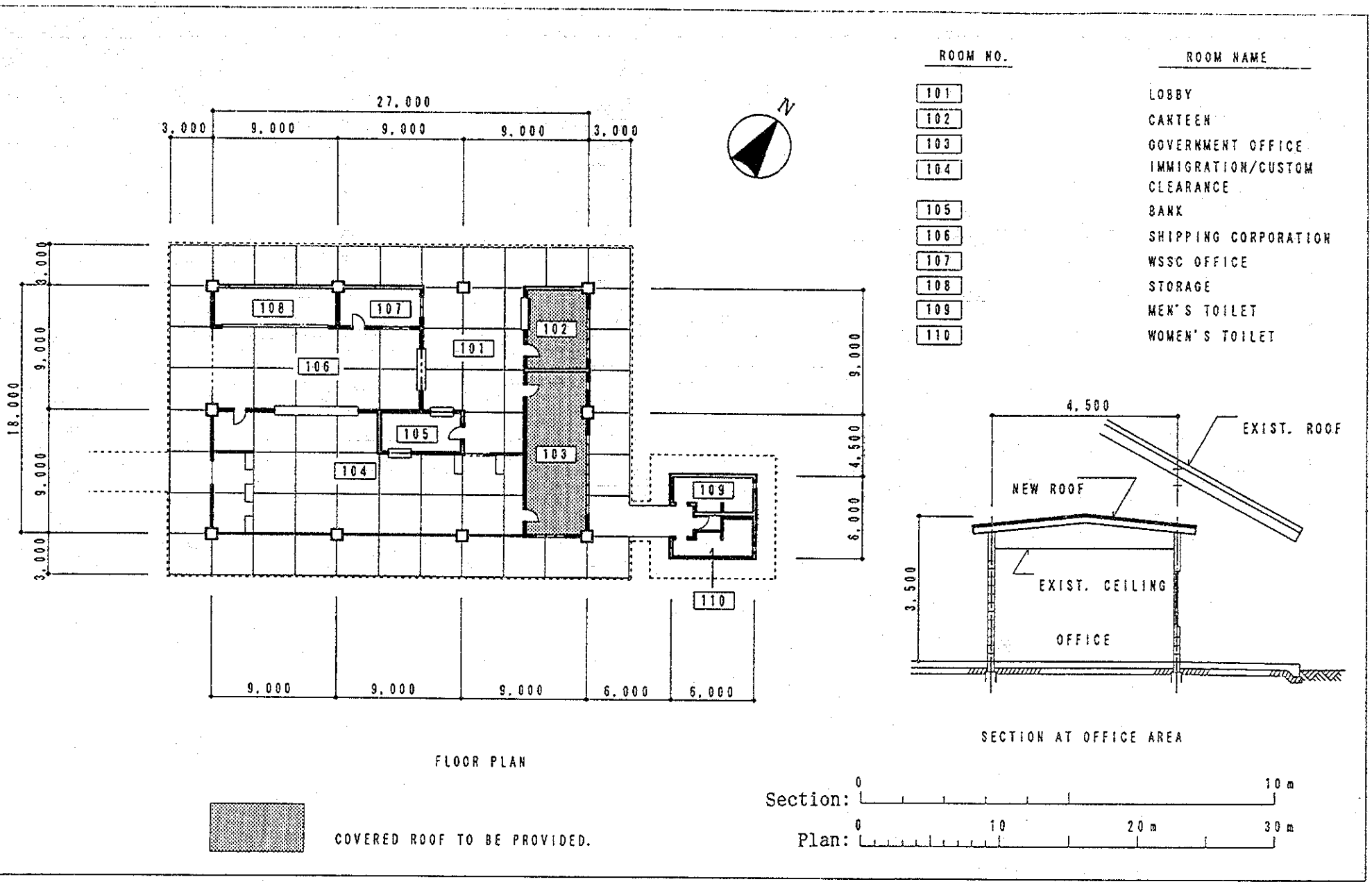


Fig. 5-22 LAYOUT PLAN OF FERRY TERMINAL BUILDING AT APIA PORT

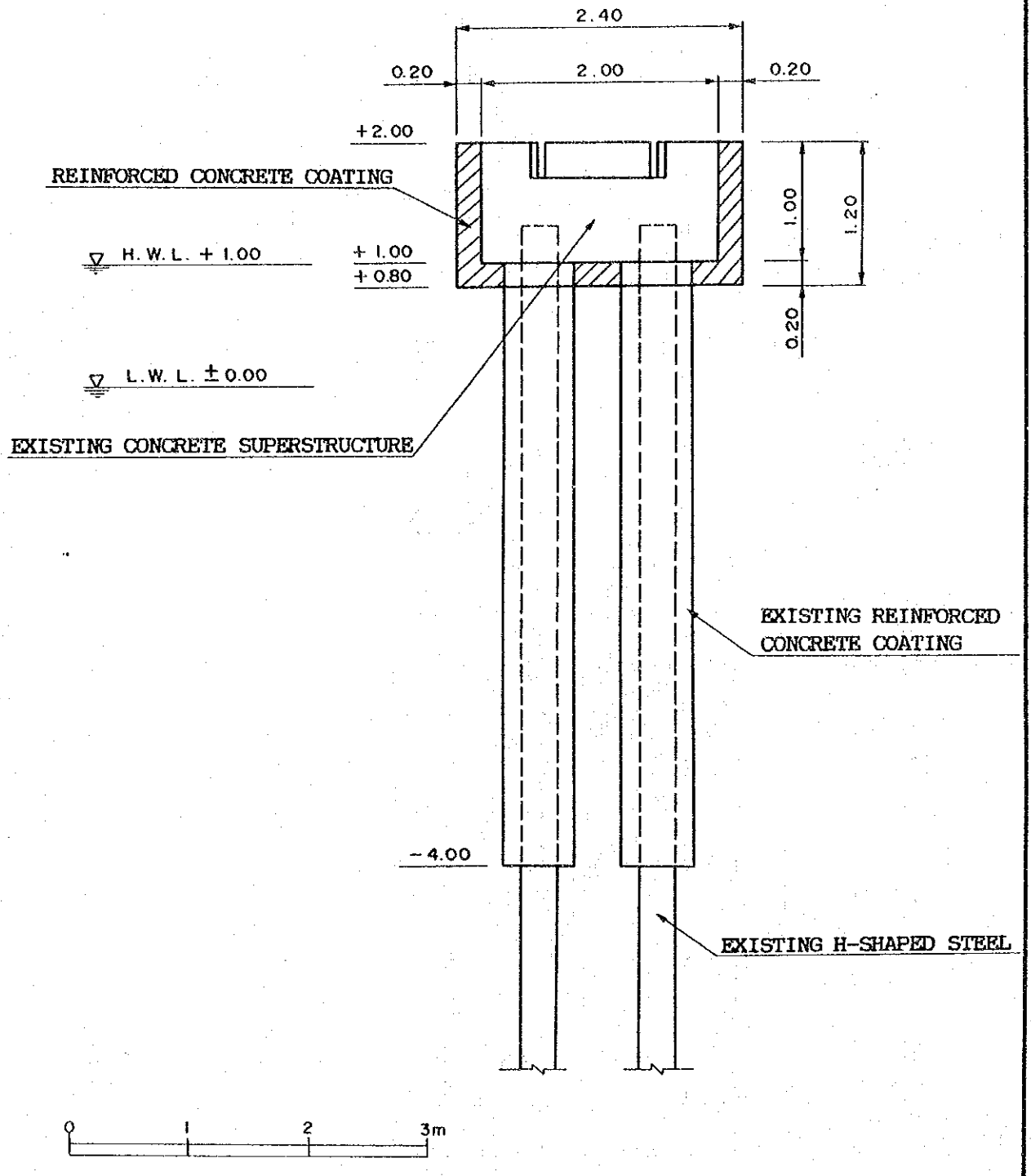


Fig. 5-23 TYPICAL CROSS SECTION OF MOORING DOLPHIN

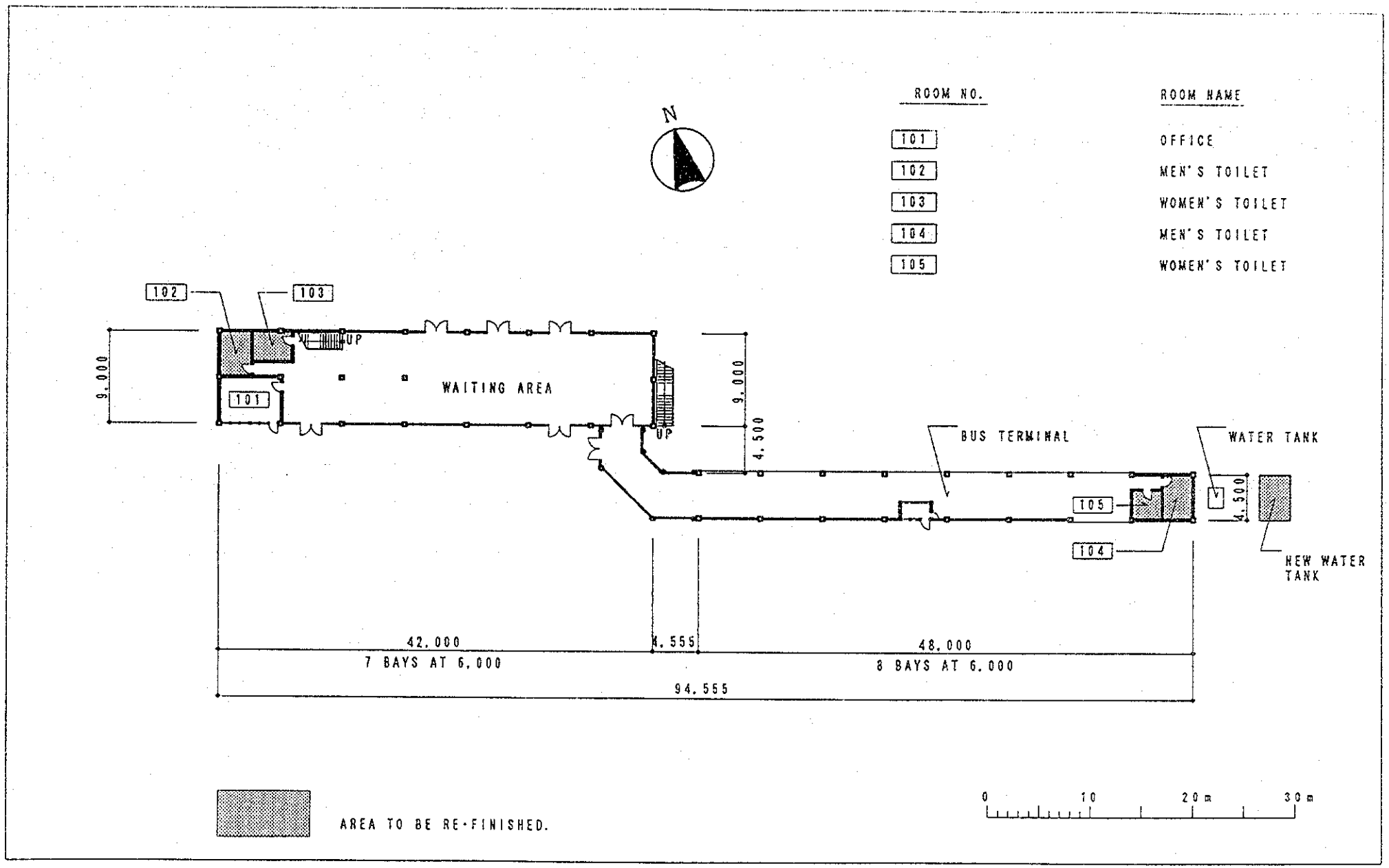


Fig. 5-24 GROUND FLOOR PLAN OF FERRY TERMINAL BUILDING AT MULIFANUA PORT

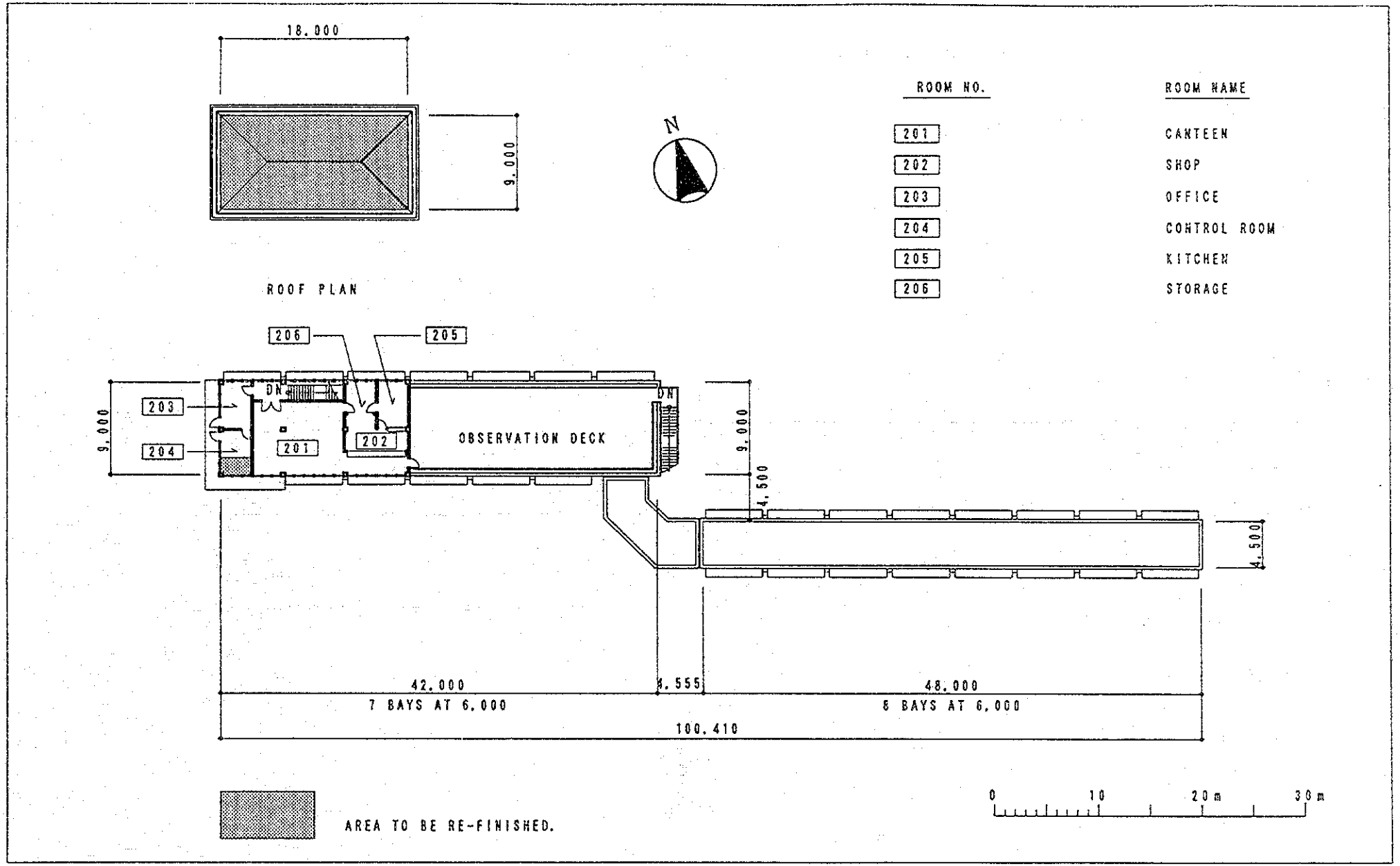


Fig. 5-25 1ST FLOOR PLAN OF FERRY TERMINAL BUILDING AT MULIFANUA PORT

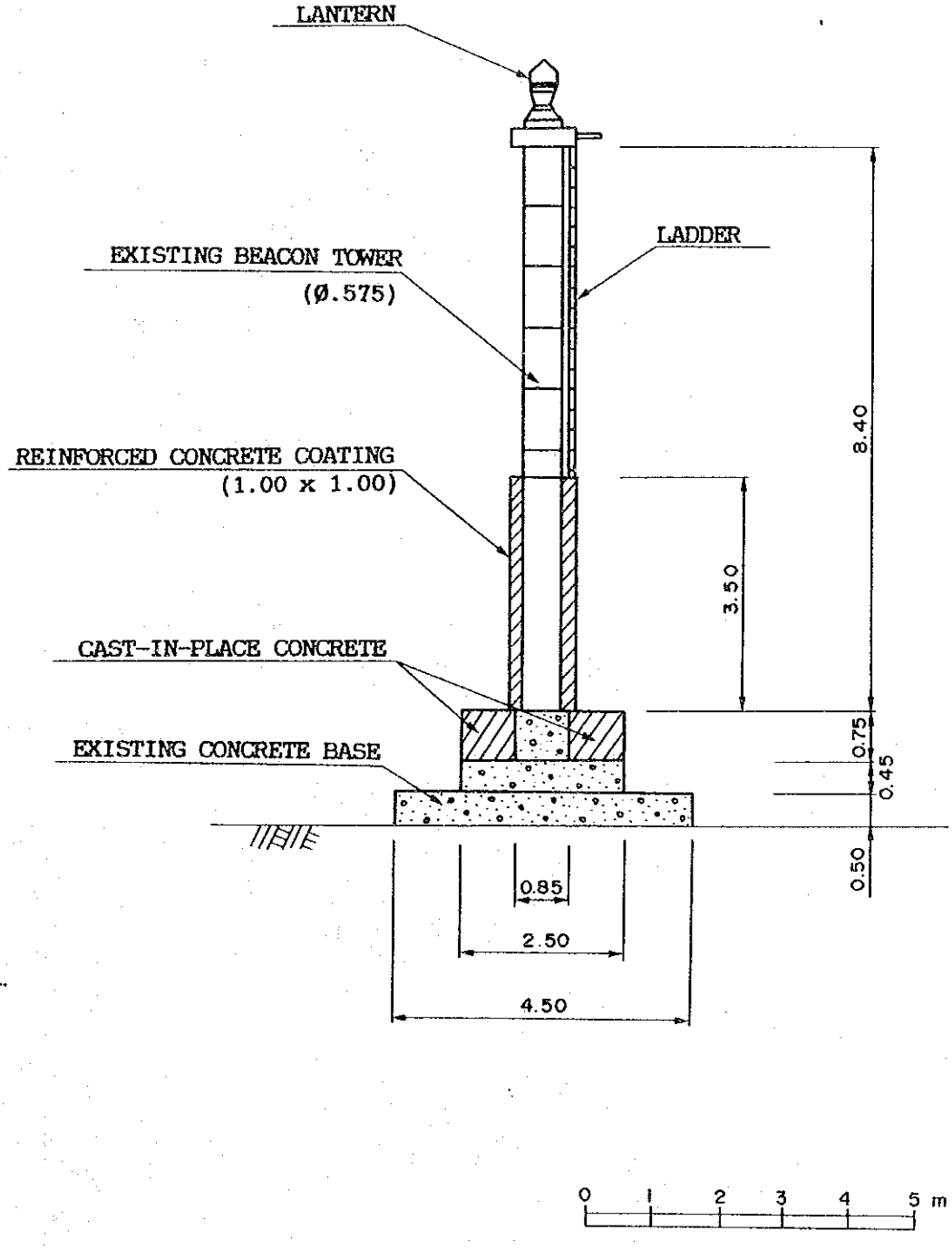
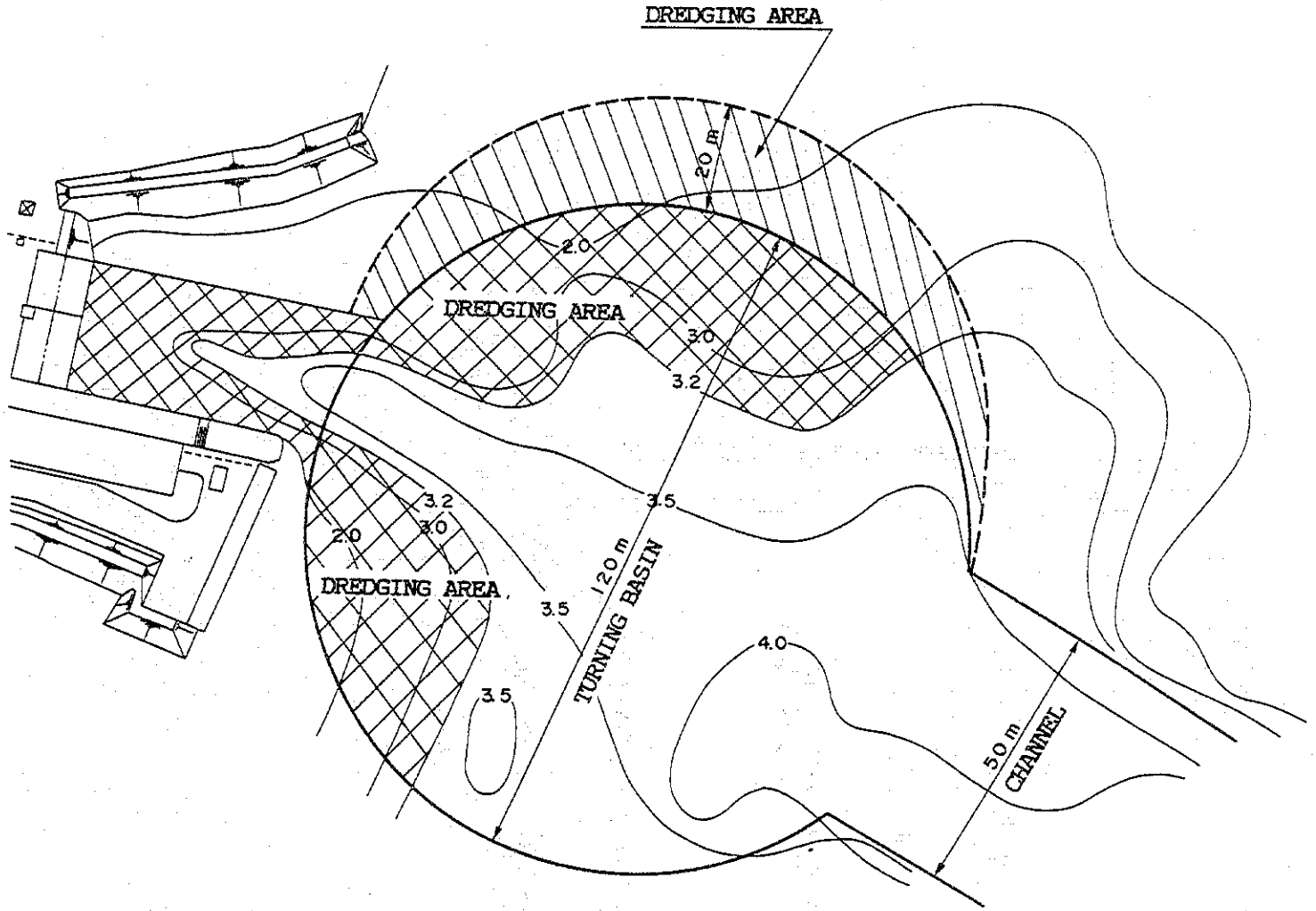


Fig. 5-26 CROSS SECTION OF INNER BEACON AT MULIFANUA PORT



NOTE: Depth in meter below Chart Datum Line (0.00 m)

Mean Sea Level = + 0.7 m above C.D.L.

0 10 20 30 40 50 m

Fig. 5-27 LAYOUT PLAN OF DREDGING AREA AT MULIFANUA PORT

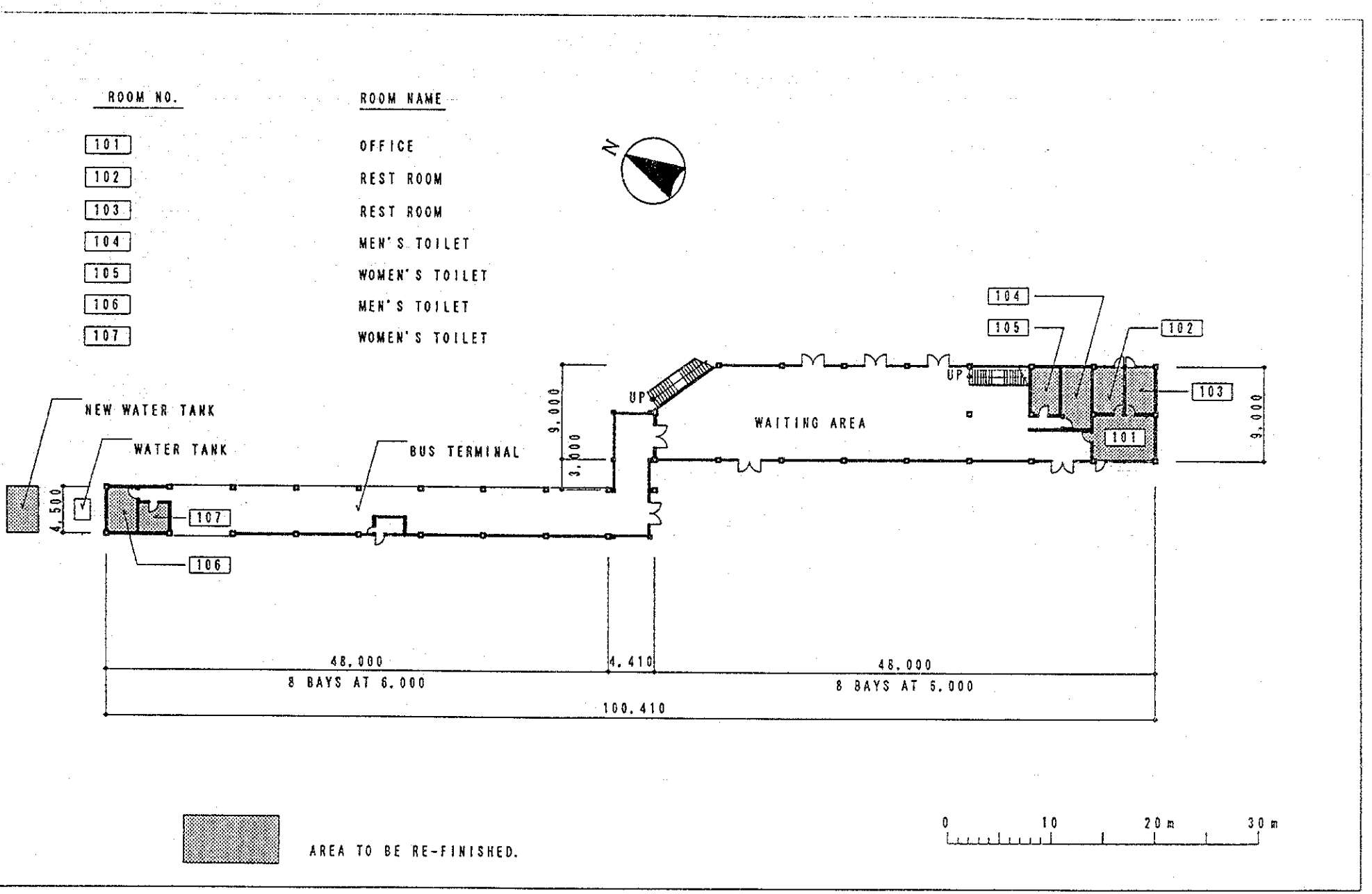


Fig. 5-28 GROUND FLOOR PLAN OF FERRY TERMINAL BUILDING AT SALELOLOGA PORT

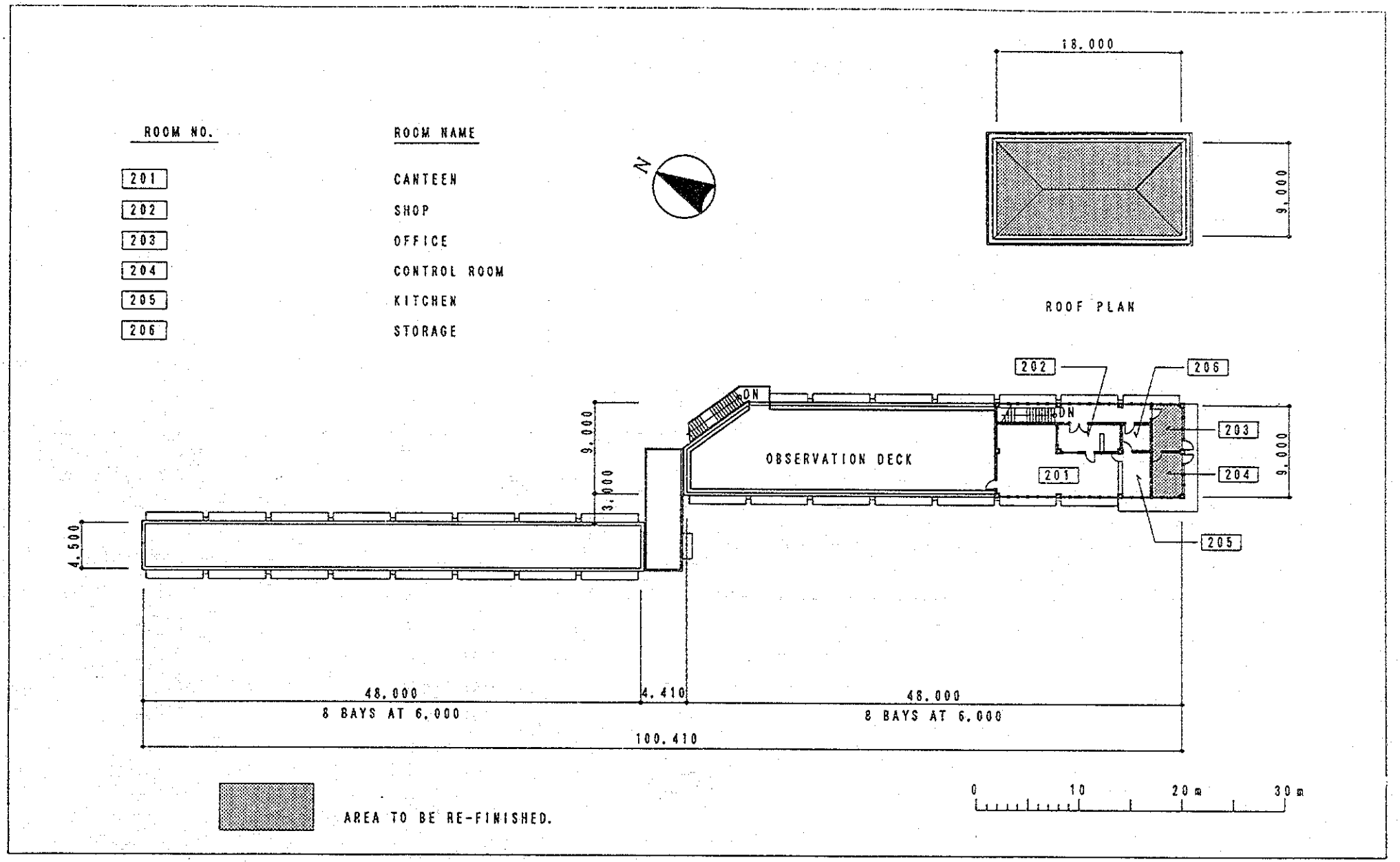


Fig. 5-29 1ST FLOOR PLAN OF FERRY TERMINAL BUILDING AT SALELOLOGA PORT

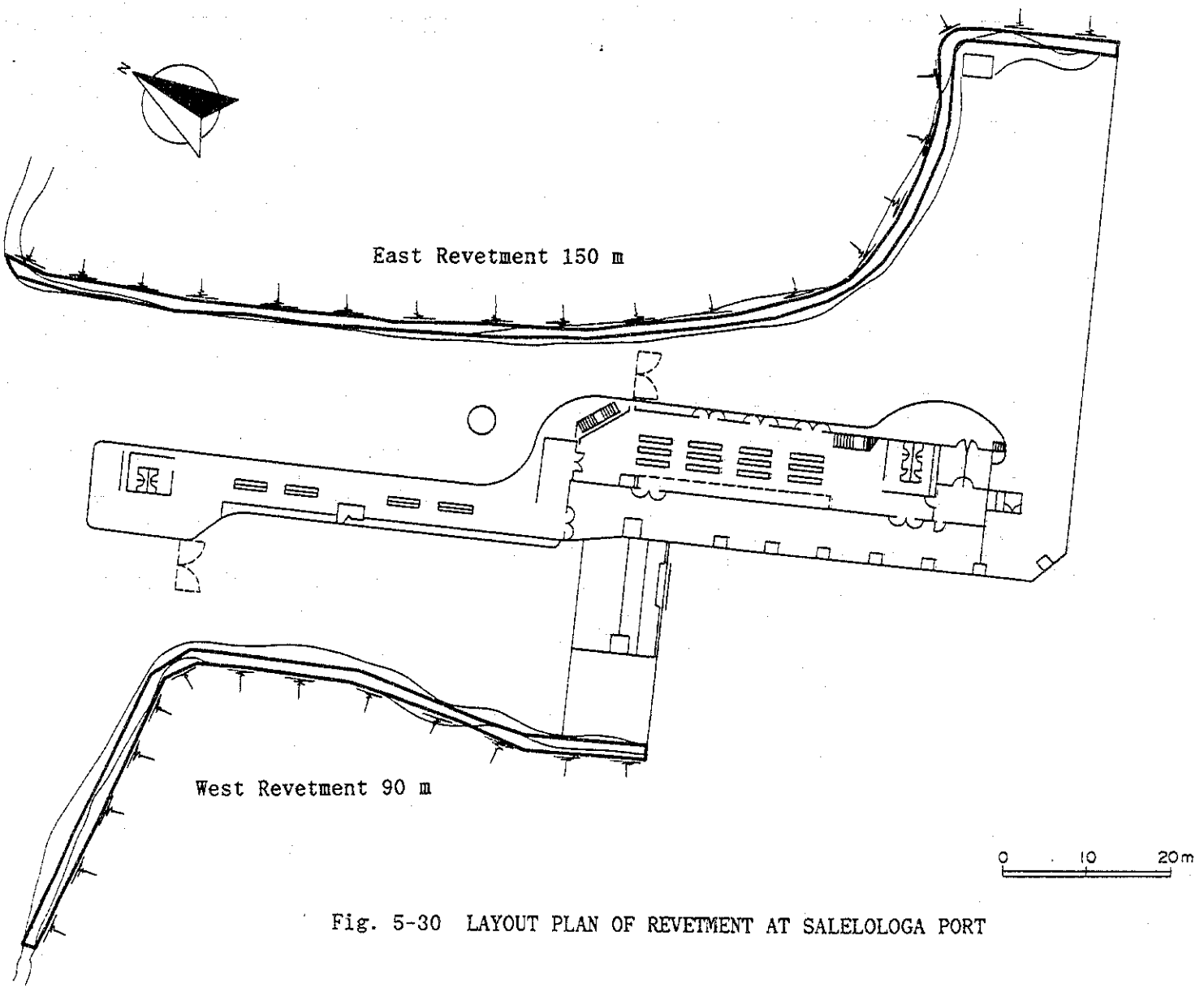


Fig. 5-30 LAYOUT PLAN OF REVETMENT AT SALELOLOGA PORT

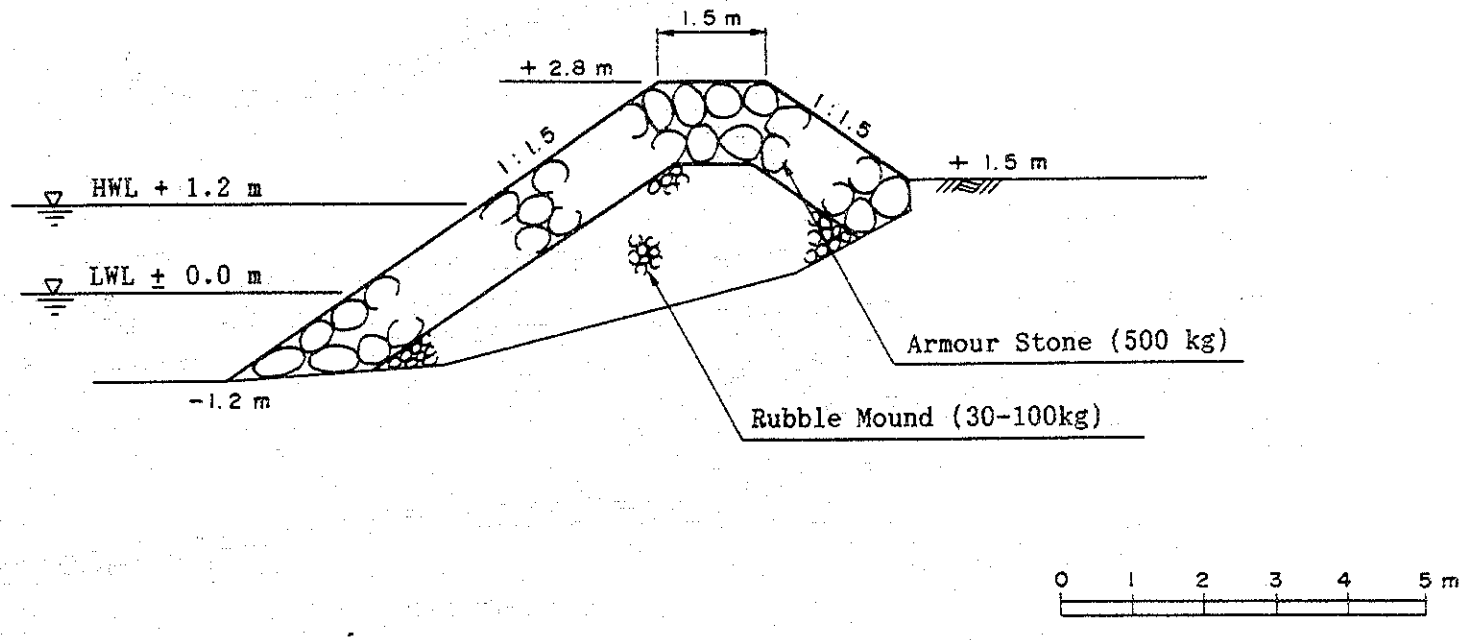


Fig. 5-31 TYPICAL CROSS SECTION OF REVETMENT AT SALELOLOGA PORT

5.3.3 Design of Foreshore Protection Facilities

(1) Restoration

The damaged foreshore protection facilities shall be rehabilitated. In designing, the crown height and weight of rubble stones before the disaster will be reviewed and the revetments will be reinforced if necessary. The sections to be restored are Sections A-B: 300m, B-C: 700m, C-D: 700m, D-E: 150m, E'-F: 1,115m, F-G: 350m and total length is 3,315m.

(2) Design Conditions

1) Tide		HHWL	+2.0 m
		HWL	+1.0 m
		LWL	±0.0 m
2) Wave	Section	A-B	$H_{1/3}$ = 1.4 m, $T_{1/3}$ = 12.5 sec
	Section	B-C	(1)$H_{1/3}$ = 2.0 m, $T_{1/3}$ = 12.5 sec
			(2)$H_{1/3}$ = 2.1 m, $T_{1/3}$ = 12.5 sec
			(3)$H_{1/3}$ = 1.1 m, $T_{1/3}$ = 12.5 sec
	Section	C-D	(1)$H_{1/3}$ = 1.9 m, $T_{1/3}$ = 12.5 sec
			(2)$H_{1/3}$ = 1.7 m, $T_{1/3}$ = 12.5 sec
	Section	D-E	$H_{1/3}$ = 1.7 m, $T_{1/3}$ = 12.5 sec
	Section	E'-F	$H_{1/3}$ = 1.0 m, $T_{1/3}$ = 12.5 sec
	Section	F-G	$H_{1/3}$ = 1.2 m, $T_{1/3}$ = 12.5 sec

(3) Structural Design

For the revetment throughout the entire section, a rubble slope type, similar to the design before the disaster, shall be adopted.

The slope of rubble stones is 1:1.5 and the crown width is 1.5m. The stepped slope filled with concrete shall be provided to the slope behind the armour stones, and concrete pipes to drain over-topped sea water shall be provided along the back of the revetment with the exception of Section F-G.

- **Crown Height**

In determining the crown height, the allowable rate of wave overtopping are set for every section as shown in Table 5-4 according to its importance and utilization of the land behind the revetment. Table 5-5 summarizes the results of the required crown height calculated from the above mentioned design wave and tidal level.

Table 5-4 ALLOWABLE LIMIT OF WAVE OVER-TOPPING

Section	A-B	B-C	C-D	D-E	E'-F
Allowable limit (m^3/m.sec)	0.02	0.01	0.02	0.02	0.02

Table 5-5 DESIGN CROWN HEIGHT

Section	Ground Level	Design Wave	Allowable Limit	Required Crown Height
A - B	+2.3 m	1.4 m	0.02	+3.0 m
B - C	+4.0 m	2.0 m	0.01	+4.4 m
	+4.1 m	2.1 m	0.01	+4.6 m
	+2.8 m	1.1 m	0.01	+3.1 m
C - D	+2.5 m	1.9 m	0.02	+4.2 m
	+2.5 m	1.7 m	0.02	+4.0 m
D - E	+2.5 m	1.7 m	0.02	+3.5 m
E - F	+2.0 m	1.0 m	0.02	+3.1 m
F - G	+1.4 m	1.2 m	-	(+3.0 m)

a) Section A-B

Beach Road runs behind the revetment and many commercial buildings such as restaurants, hotels, printing office, markets, etc., are located behind the road.

The allowable rate of wave overtopping is set at 0.02 m^3/m.sec and the required crown height is calculated as +3.0m.

The required weight of armour stones of the revetment is calculated at 1.0t.

b) Section B-C

This section is the most important section with many important governmental and commercial buildings lining behind Beach Road. The allowable rate of wave overtopping is set at 0.01 m^3/m.sec. The ground heights of those area are high as +4.0 - +2.8 m and the revetment in front of Aggie Grey's Hotel has already temporarily repaired with crown height of +4.6 m. The required crown height for the area without front reef from Aggie Grey's Hotel to High Commission is +4.6 m, and that for the area with front reef from High Commission to JICA office is +3.1 m. Further, considering importance of buildings behind the Beach Road and damage caused by cyclones "Val" and "Ofa", a revetment of gentle slope shall be adopted for a part of the section in front of Aggie Grey's Hotel.

The required weight of armour stones of the revetment is calculated at 1.0t.

c) Section C-D

In this section, two Government buildings are now under construction about 150 m away from the outer edge of the reclamation area and the land area behind the revetment is planned to be developed for public purposes. The allowable rate of wave overtopping is set at 0.02 m^3/m.sec accordingly. The required crown height is calculated at +3.5 m - 4.2 m.

Though the existing ground level is low about +2.5m, the design crown height is determined as above which might aggravate sight from the reclamation area. This high crown height can be justified since the design wave height is high and further reclamation could be planned in future by the Government of Western Samoa to raise the present ground level of +2.5m .

The required weight of armour stone is calculated at 1.5 t - 2.0 t.

d) Section D-E

This section is a natural sandy beach adjoining the section C-D. The allowable rate of wave overtopping is set at 0.02 m^3/m.sec as the same as that for the section C-D. The existing ground level is +2.5m, and the crown height of +3.5m is calculated and adopted similarly to the section C-D. The required weight of rubble stones is calculated at 1.5t. The rubble stone revetment shall be constructed along the top of the beach to maintain the natural beach as it is.

e) Section E'-F

In this section, there are important facilities such as Kitano Tusitala Hotel, Godinet Hotel, etc. The Government of Western Samoa plan to implement a reclamation work in the front water area to widen the coastal road and construct public facilities.

The required crown height is calculated at +3.1m to satisfy the allowable rate of wave overtopping of 0.02 m^3/m.sec. The required weight of rubble stones is calculated at 600kg.

f) Section F-G

In this section, to protect the Radio Station and Apia Observatory from the cyclone waves, the revetment shall be partially rehabilitated.

The ground level around Apia Observatory is very low at + 1.4 m flooded at high tide of +2.0m even without wave over-topping. Therefore, the design to prevent wave over-topping like for the other sections is not adoptable. To prevent over flow of waves affecting the facilities behind, the crown height of the revetment is set at 0.8 times $H_{1/3}$ above HHWL, +3.0m.

(4) Design Drawings

Layout plan and typical cross sections for each section for foreshore protection facilities at Apia are as follows.

Fig. 5-32 Layout Plan of Foreshore Protection Facilities at Apia
Fig. 5-33 Typical Cross Section for Section A-B
Fig. 5-34 Typical Cross Section for Section B-C
Fig. 5-35 Typical Cross Section for Section C-D
Fig. 5-36 Typical Cross Section for Section D-E
Fig. 5-37 Typical Cross Section for Section E'-F
Fig. 5-38 Typical Cross Section for Section F-G
Fig. 5-39 Typical Cross Section of Drainage

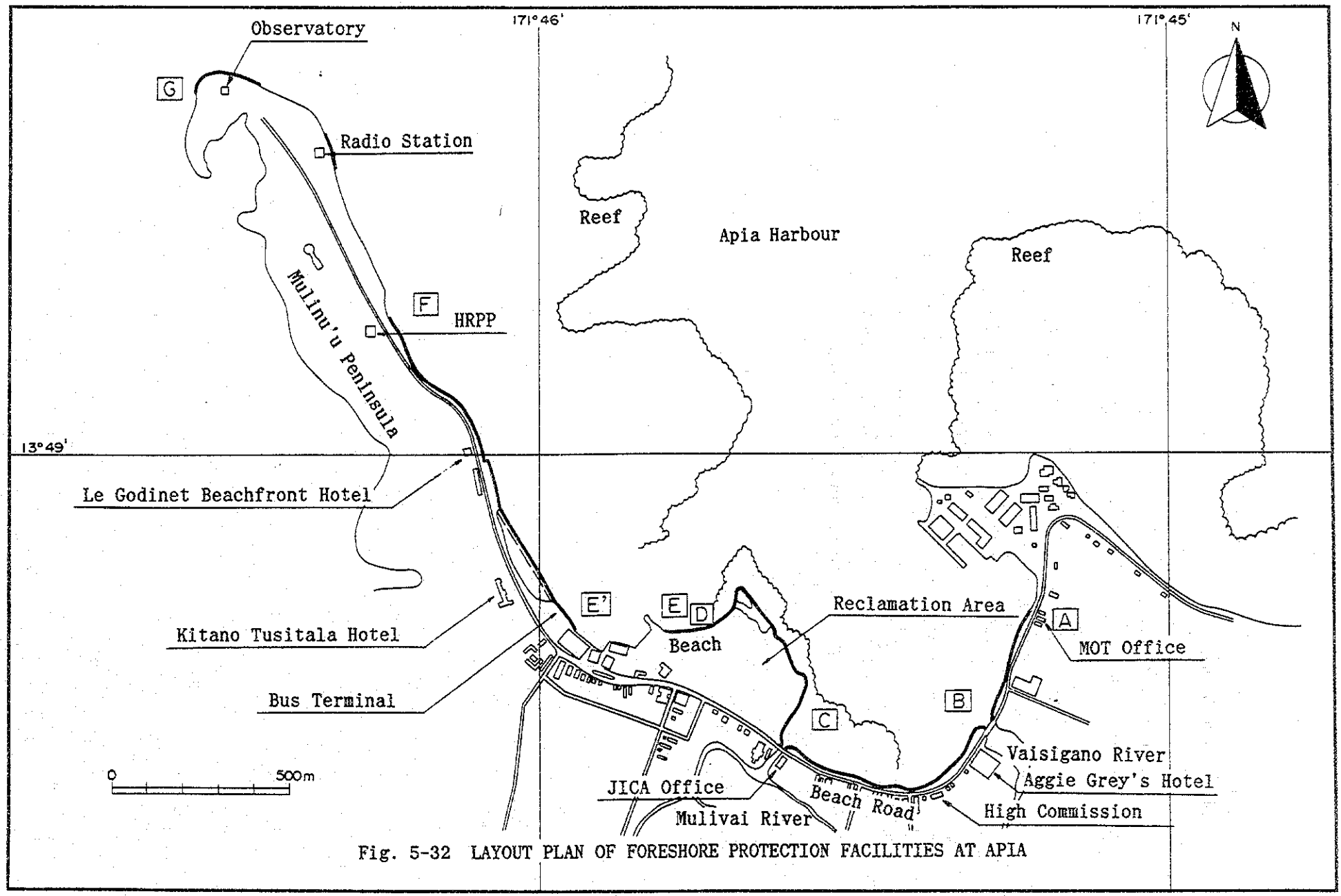


Fig. 5-32 LAYOUT PLAN OF FORESHORE PROTECTION FACILITIES AT APIA

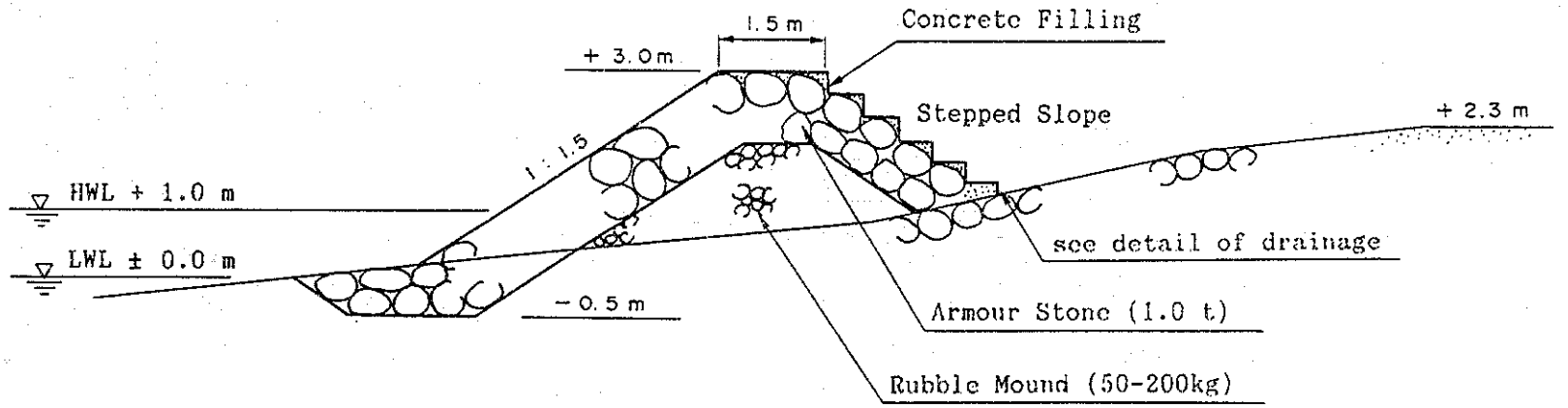


Fig. 5-33 TYPICAL CROSS SECTION FOR SECTION A-B

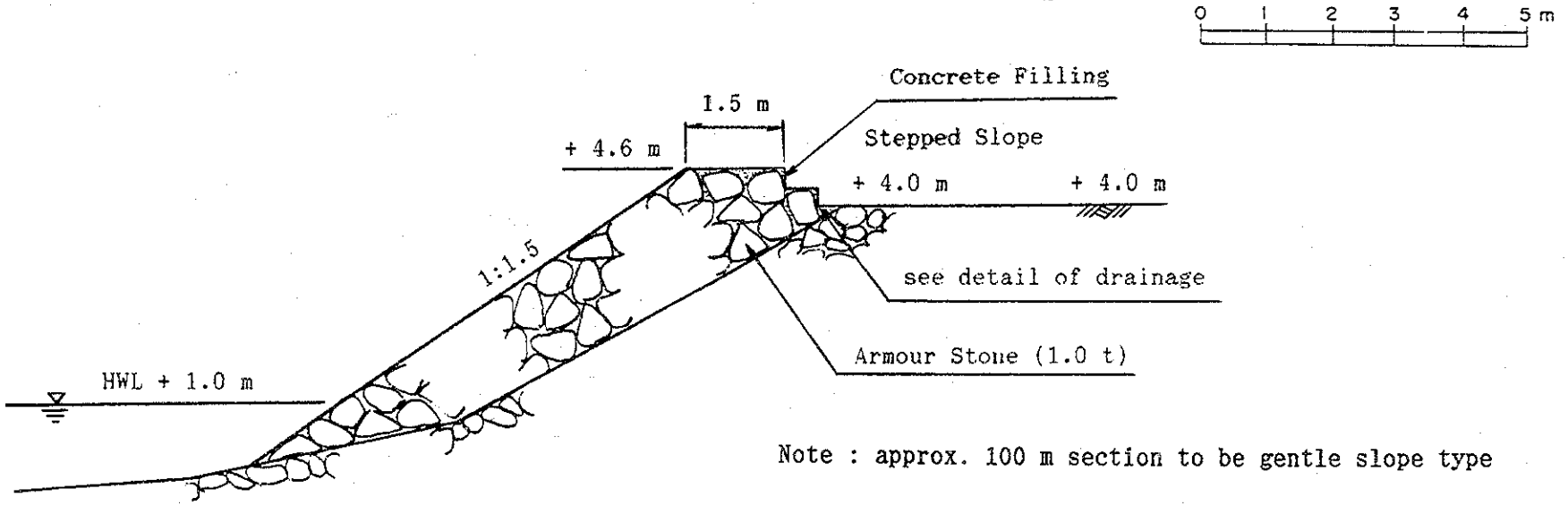


Fig. 5-34 TYPICAL CROSS SECTION FOR SECTION B-C

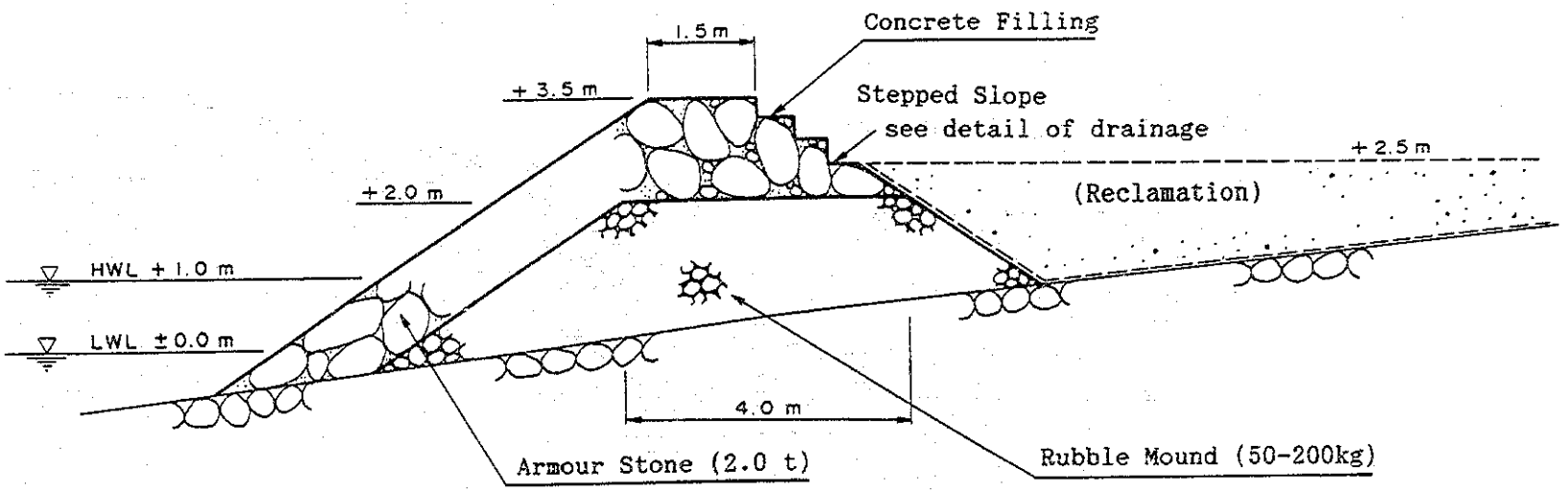
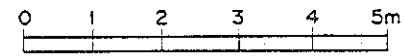


Fig. 5-35 TYPICAL CROSS SECTION FOR SECTION C-D



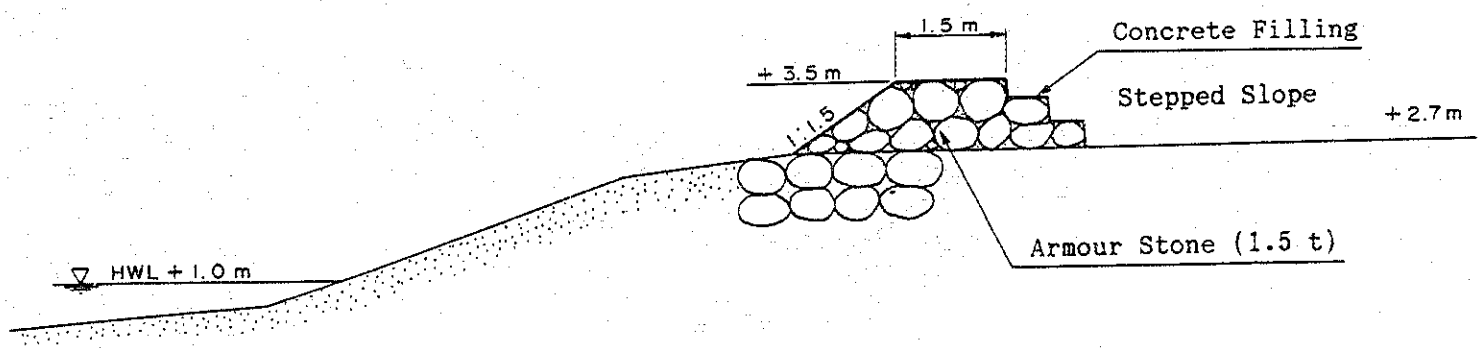
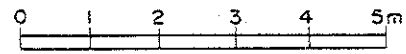


Fig. 5-36 TYPICAL CROSS SECTION FOR SECTION D-E



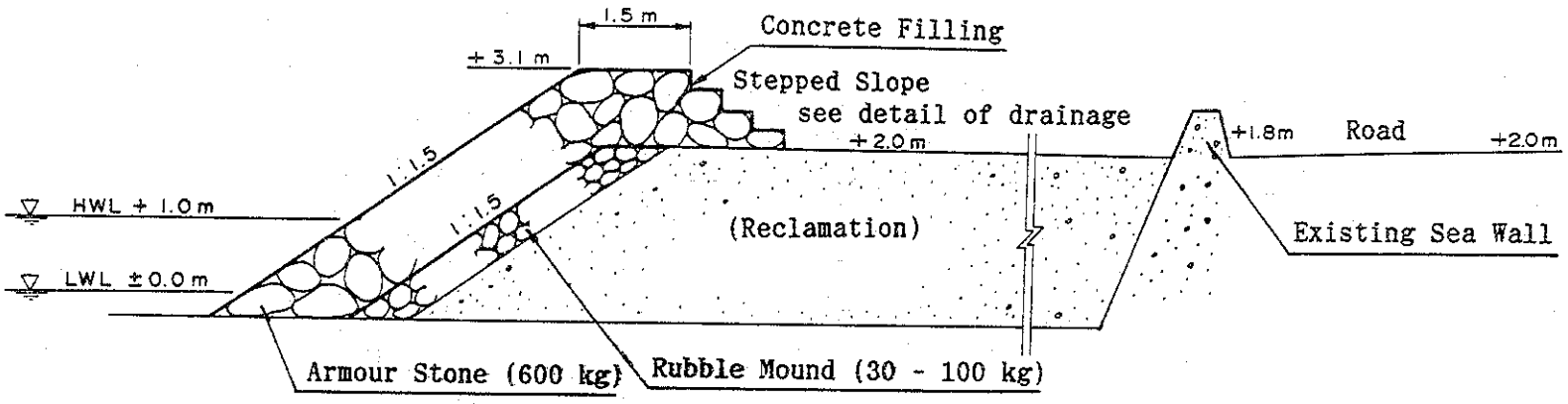
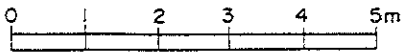


Fig. 5-37 TYPICAL CROSS SECTION FOR SECTION E'-F



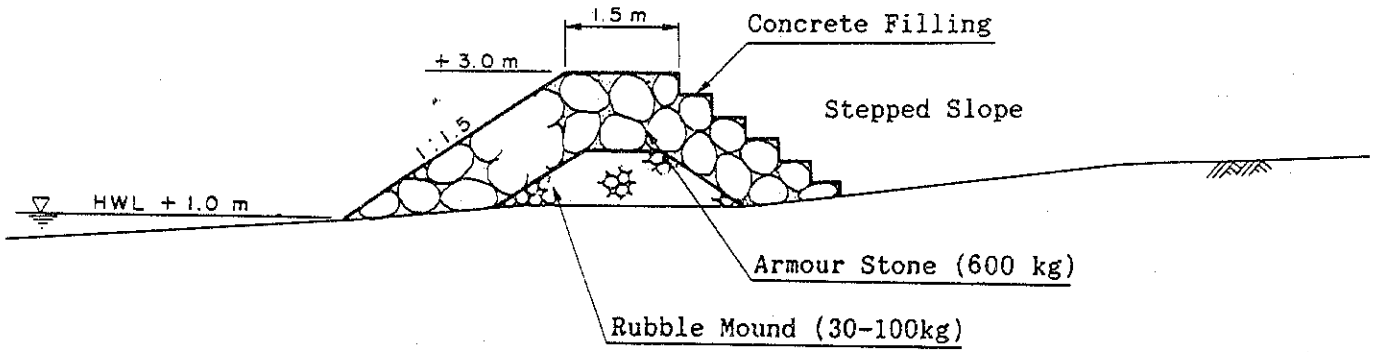
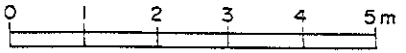


Fig. 5-38 TYPICAL CROSS SECTION FOR SECTION F-G



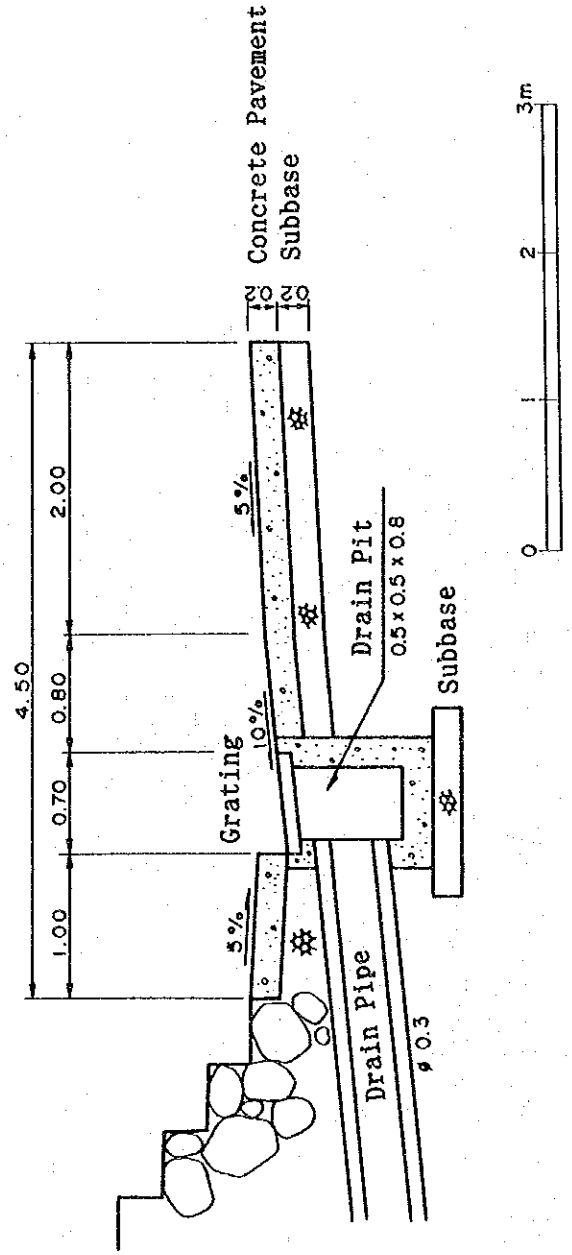


Fig. 5-39 TYPICAL CROSS SECTION OF DRAINAGE

5.4 Implementation Plan

5.4.1 Implementation Policies

(1) Implementation Policies

This project will be carried out under the scope of the Japanese Grant Aid System. After approval of the project by the Government of Japan and the Government of Western Samoa, an Exchange of Notes (E/N) will be concluded between both governments and the project plan will be officially put into effect. Then, a Japanese consultant, which shall be appointed by the Government of Western Samoa will start the detailed design work of facilities and equipment. After preparation of tender documents by the consultant, Japanese contractors shall be selected by tender and then the construction work will commence.

The construction period is expected to be 21 months taking into consideration the scope of the project and site conditions. The length of the construction period will be governed by the restoration works of foreshore protection facilities and breakwater in Apia Port.

MOT and PWD are the executing organizations of the Project in Western Samoa for the port facilities and the foreshore protection facilities respectively. For the execution of this project, close cooperation and arrangement between Japanese project group and MOT as well as PWD are required. Fig. 5-40 shows organization of construction management.

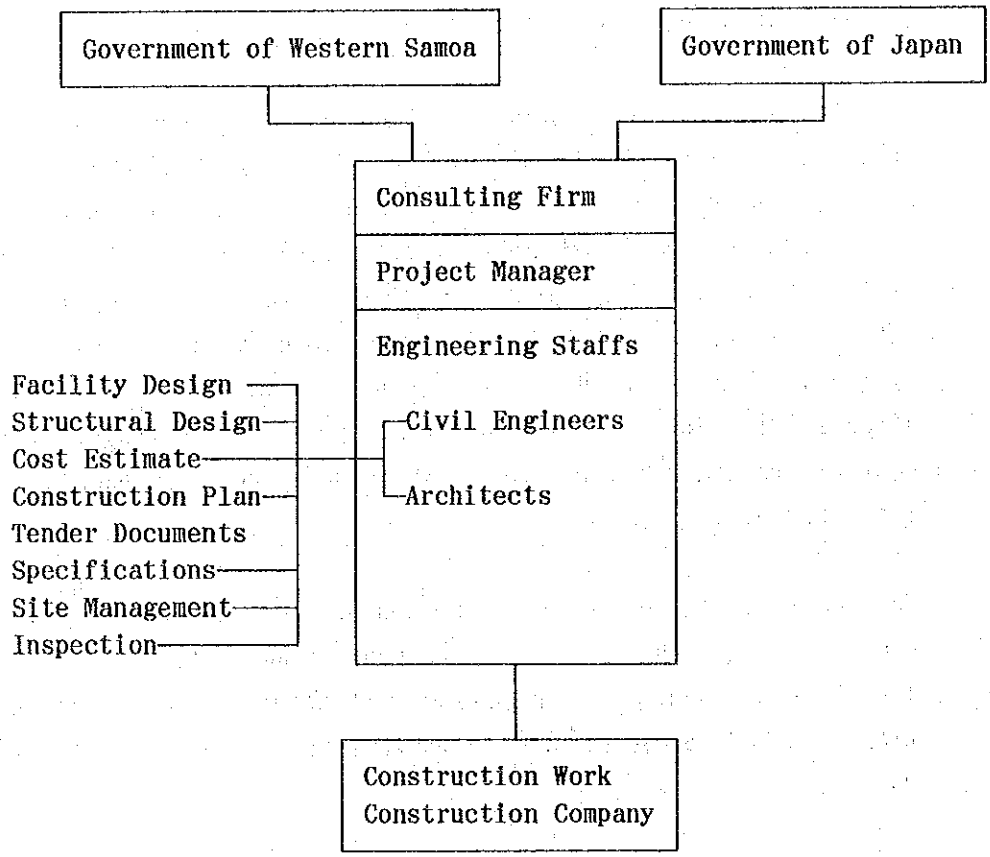


Fig. 5-40 ORGANIZATION CHART OF PROJECT IMPLEMENTATION

(2) Scope of the Grant Aid Project

1) Scope of the grant aid project

The scope of work of the project by the grant aid covers the following items:

(1) Port Facilities	
Phase I	Phase II
1. Apia Port - MOT Office - Main Wharf Area Shed No. 1/Shed No.4 Main Wharf: Rubber/Wooden Fenders Wharf Light, Curbing Leading Beacon - Ferry Terminal Area Terminal Building Ferry Ramp: Curbing, Dolphin 2. Mulifanua Port Terminal Building Leading Beacons Channel Dredging 3. Salelologa Port Terminal Building Revetment	1. Apia Port - Breakwater

(2) Foreshore Protection Facilities	
Phase I	Phase II
Section A-B : MOT office to Vaisigano River (Distance : 300m) Section B-C : Vaisigano River to Mulivai Stream (Distance : 700m) Section C-D : Mulivai River to Sandy Beach on Reclamation Area (Distance : 700m) Section D-E : Beach Sandy on Reclamation Area (Distance : 150m)	Section E'-F: Bus Terminal to HRPP Office (Distance : 1,115m) Section F-G : HRPP Office to Apia Observatory (Distance : 350m)

2) Undertakings by the Government of Western Samoa

The followings are the items to be undertaken by the Government of Western Samoa under its responsibility.

a) Distribution of power line to front and rear beacons in Apia
b) Reclamation work at the outermost area of the Section C-D

5.4.2 Construction Conditions and Implementation Plan

(1) Construction conditions in Western Samoa

1) Working hour

Normal working hour : 7:30-12:00, 13:00-16:30
Total 8 hrs/day

Working day : Monday to Friday

Overtime payment : 50% increase (100% for public holidays)

2) Construction Standard

Both civil and building works are based on the Japanese Standard, while the New Zealand Standard are followed for electrical works.

3) Annual working days

Annual working days except holidays and bad weather days can be assumed as 200 days.

Working days at sea, except for rehabilitation work of the breakwater in Apia Port, can be assumed as almost the same as those on land, because both Apia and Mulifanua Ports are well sheltered from offshore waves by surrounding reef.

4) Construction equipment

Special work vessels and construction equipment are not locally available, while small size construction equipment are locally available.

5) Construction Materials and Construction cost

Most of construction materials, such as cement, steel, asphalt, etc. have to be imported, while armour stone, crushed stone and sand are locally available.

(2) Implementation Plan

In planning the implementation schedule, the followings shall be given a special attention.

1) Construction schedule shall be planned by taking into consideration such natural conditions as rainfall, wind, wave, etc.

2) Work schedule of the other projects should be coordinated with this project.

3) Number, time and period of Japanese experts should be minimized.

4) Use of local material should be maximized.

5) Utmost attention should be paid in the construction work of the breakwater in Apia Port and dredging work of the turning basin in Salelologa Port in a monsoon season of November through March.

6) The construction work of the first phase will be carried out in several sites for many items requiring efficient and appropriate control program.

7) Procurement of materials such as stones, ready-mixed concrete, etc. should be carefully planed and controlled because the supply rates are limited.

5.4.3 Supervision by the Consultant

The policy of the Japanese Government for the grant aid project requires that the project proceeds consistently throughout the period from the detailed design stage to the construction stage under the assistance of the Japanese consultant which shall be employed by the local government at the time of initiation of detailed design works of the Project.

The consultant is requested to supervise the construction work by stationing resident engineers at the site for guidance and instruction in work and testing, inspecting and reporting, as well as a short term dispatching of specialized engineers for each specific technique.

(1) Object of supervisory control

1) Control of the work progress in accordance with the construction schedule, maintaining close contact and reporting to the personnel in both countries responsible.

2) Provision of adequate guidance and advice to the construction staff so that they can complete construction of the facilities to conform with the detailed design.

3) Provision of guidance for adoption of local materials and subcontractors as much as possible.

4) Promotion of technology transfer in construction and engineering to make the most of the grant project.

5) Provision of adequate advice and guidance on maintenance of the delivered facilities to help smooth operations thereof.

(2) Main supervisory work on construction

1) Assistance on contracting

Providing assistance on selection of contractors, determining type of contract, preparing draft of contract agreements, reviewing details in work plans and witnessing contract awarding.

2) Checking and approval of work drawings, etc.

Checking and approving work drawings, as well as materials, finishings and equipment proposed or submitted by the contractors.

3) Guidance in construction work

Reviewing work plans, processes, etc., providing guidance for contractors, and reporting progress of the work to the owner.

4) Assistance in payment to the Contractor

Collaborating in checking and processing bills on payments to the contractor for the work in progress and for the completed work.

5) Witnessing inspections

Inspecting periodically each of the works in progress and completed and guiding the contractor.

The consultant shall, upon confirmation of completion of the works and fulfillment of requirements of the contract, witness the delivery of the objects of the contract and confirm the owners' acceptance thereof to complete obligations.

The consultant shall also provide reports to the Government of Japan in relation with work progress, payment procedures and delivery of completed facilities.

5.4.4 Procurement and Logistic Policy

Special attention should be paid to the items below in procuring necessary material/equipment for this project.

(1) Policy on procuring material/equipment

For procurement of material and equipment, local availability will have to be thoroughly examined. The procurement policy is to minimize supply from Japan.

1) Supply from Japan

For certain material/equipment to be procured from Japan, a procurement schedule will have to be studied carefully since such material require a long period from production to delivery. In ordering fabricated materials, production, processing, packing and shipping will require a much longer time.

Though some small-sized construction machinery is locally available, an equipment procurement plan from Japan should be established considering the local services condition and possibility of long term lease.

Close communication with related authorities have to be kept for unloading and customs clearance at the local port to effect mobilization without delay.

2) Local supply

Stones are major material to be supplied locally. For procurement of stones, careful studies on sources, capacity, quality, and transportation have to be made. On the quality of imported materials such as cement and asphalt, etc., a thorough check on price, quality and quantity are necessary.

3) Cost

Low price has priority in selecting a supply source either locally or from Japan. It should be noted that the supply price from Japan must include fees for packing, transport and insurance but is exempted from tax.

(2) Material and equipment supply

On supply and logistics of material and equipment, some details on this particular project are given as below.

1) Material

Local : Rubble (50 - 1,000 kg), Crusher-run, Timber, Cement, Asphalt, Steel Bars and Materials for Building, etc.

Japan : Steel form, Fenders, Bollards, Marker lights, Scaf-folding, etc.

2) Equipment

Local : Dump truck (4 - 10 t), Bulldozer (11 t), Loader (1.0 - 1.4 m^3), Backhoe (0.3 - 1.0 m^3), Truck crane (10- 30 t), Work boat (20 ps), Roller (10 t), Vibrator (o 60 mm)

Japan : Crawler crane (100t), Barge (1,000t), Tug boat (600ps), etc.

5.4.5 Construction Schedule

Implementation of the project by the grant aid of the Japanese Government will proceed in the following manner.

After an exchange of official notes between the Government of Japan and Western Samoa, the latter is requested to conclude a consulting contract with a pertinent Japanese consulting company, as soon as possible.

The consulting contract will cover detailed design, tender management and supervision of the construction. Before awarding the construction contract, the consultant shall have finished detailed design work and cost estimation and tender management. As shown in Table 5-5, 3 months are required for detailed design and 10 months for construction works in the first phase and 3 months for detailed design and 11 months for construction works in the second phase.

Since the overall project term exceeds 12 months, the project will have to be divided into two phases in accordance with the Japanese governmental budget system. Therefore, before the start of the second phase project, all procedures such as an exchange of notes, the consulting contract and the construction contract will have to be repeated between the related parties.

In the first phase of the Project, the most urgently required items such as the restoration of the all port facilities except the breakwater in Apia Port and foreshore protection facilities (sections A to E) in Apia are included.

In the second phase of the Project, restoration of the breakwater in Apia Port and foreshore protection facilities (section E' to F and part of section F to G) in Apia. The breakwater is preferable to be constructed in the first phase to keep the calmness of port area, but it is scheduled to be constructed in the second phase due to limited supply rate of ready-mixed concrete and sea conditions.

Table 5-5 PROJECT IMPLEMENTATION SCHEDULE

		1	2	3	4	5	6	7	8	9	10	11	12	Remarks
PHASE (I)	D/D	*****	(Field)											Site Survey
		**********		****	(Home)									Design, Tender Documents
				**	(Field)									Approval of Tender Documents
	Const'n	1	2	3	4	5	6	7	8	9	10	11	12	
		**********			(Mobilization)									
		*****	(Preparation)											
			**********											Apia Port Facilities
					**********									Mulifanua Port Facilities
								**********						Salelologa Port Facilities
				**********										Foreshore Protection Facilities
		1	2	3	4	5	6	7	8	9	10	11	12	
PHASE (II)	D/D	*****	(Field)											Site Survey
		**********		****	(Home)									Design, Tender Documents
				**	(Field)									Approval of Tender Documents
	Const'n	1	2	3	4	5	6	7	8	9	10	11	12	
		**********		(Mobilization)										
		*****	(Preparation)											
		**********												Apia Port Breakwater
		**********												Foreshore Protection Facilities

CHAPTER 6

PROJECT EVALUATION AND CONCLUSION

CHAPTER 6 PROJECT EVALUATION AND CONCLUSION

Western Samoa was struck by two large cyclones "Ofa" and "Val" in February, 1990 and December, 1992. The cyclone ""Val" caused extensive damages estimated as high as 300 million US$, including damages to such basic social infrastructure as port and foreshore protection facilities. The economic activities of Western Samoa have virtually been brought to a serious situation due to the cyclone damages and the restoration works are currently being implemented in various sectors supported by emergency foreign assistances. The project includes the restoration and improvement of the port and foreshore protection facilities and its effects are evaluated as follows.

6.1 Project Evaluation

(1) Port Facilities

All the port facilities damaged by the cyclone "Val" are essential for safe and efficient operation of ports. At present, the port functions have been either severely curtailed or completely lost. The recovery of these functions by the restoration work will have the major effects as follow.

- Apia Port

1) Recovery of safe and efficient port management by the rehabilitation of MOT office

2) Reduction of damage to cargoes and improvement in security of cargoes, and improvement of efficiency of container cargo handling operation by the repair and demolition of the port sheds

3) Improvement in safety and efficiency of berthing and cargo handling operations through the rehabilitation of the main wharf

4) Improvement in safety of inner port facilities and in efficiency and safety of berthing and cargo handling operations by the reconstruction of the breakwater.

- Ferry Terminals, Apia, Mulifanua & Salelologa

1) Relief of ferry passengers from inconvenience of the damaged terminal facilities by restoration of the terminal buildings.

2) Improvement in safety of the onshore facilities by the restoration of the seawall.

3) Improvement in safety of navigation in the turning basin by dredging work.

- Navigation Aids

Improvement in navigational safety through the restoration of the navigation aids.

(2) Foreshore Protection

The foreshore protection facilities along Apia Bay are insufficient both in stability and basic required function to prevent wave over-topping. The various facilities along the bay were seriously damaged by two large cyclones "Ofa" and "Val". The rehabilitation and improvement of the foreshore protection will have the major effects as follows.

1) Protection of the public and private facilities along the bay from cyclone damages.

2) Improvement of stability of the foreshore protection and thereby reduction of maintenance cost.

3) Protection of the reclamation area from erosion and wave over-topping.

Apia Port is only one gateway port open to foreign trade in the country handling about 180,000 t of cargoes a year while Mulifanua and Salelologa Ports provide ferry transport between two major islands of Upolu and Savaii for about 270,000 passengers a year. While, the foreshore protection along Apia Bay provides sea defense to the capital of the country. Rehabilitation and improvement of both port and foreshore protection facilities is expected to contribute to early recovery of economy through direct effects mentioned above.

6.2 Conclusion

Apia Port is nucleus for maritime transportation providing an important support to the economy of Western Samoa while Mulifanua and Salelologa Ports have been taking an important role of ferry service connecting Upolu and Savaii Islands. The serious damages caused by the cyclone "Val" to the facilities of these ports adversely affect the economic activities of Western Samoa necessitating the urgent implementation of restoration works.

The area along Apia Bay accommodates the politically and economically most important facilities. However, the foreshore protection along the bay is insufficient in stability and function causing frequent cyclone damages. Improvement of the foreshore protection is urgent need to relieve this situation and to allow adequate city development plan.

The urgent restoration and improvement of the port and foreshore protection facilities 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.

APPENDICES

APPENDICES

1. Basic Design Study Team Members and Field Study Schedule
2. Minutes of Discussion
3. List of Interviewees
4. Statistical and Technical Data

Appendix 1 Basic Design Study Team Members and Field Study Schedule

(1) Basic Design Field Study

o Study Team Members

Name	Assignment	Position
Mr. Shoji Shimbo	Team Leader	Managing Director, Grant Aid Study & Design Department, JICA
Mr. Hisao Ouchi	Port Planner	Sr. Supervisor for Port Engineering, Engineering Division, Ports & Harbours Bureau, MOT
Mr. Yoshimi Murai	Foreshore Protection Planner	Director, 1st Survey Division, Tokushima Construction Office, Shikoku Regional Construction Bureau, Ministry of Construction
Mr. Nobuhiro Fukuda	Project Coordinator	Deputy Director, Second Basic Design Study Division, Grant Aid Study & Design Department, JICA
Mr. Hisanori Kato	Restoration Planner	Nippon Tetrapod Co., Ltd.
Mr. Shigenori Fujito	Architectural Designer	-ditto-
Mr. Hiroaki Gahara	Port Facilities Designer	-ditto-
Mr. Kiyotaka Sasao	Natural Condition Survey (1)	-ditto-
Mr. Genichiro Shimoji	Natural Condition Survey (2)	-ditto-

o Basic Design Field Study Schedule

THE PROJECT FOR REHABILITATION AND IMPROVEMENT OF CYCLONE-DAMAGED PORTS AND FORESHORE PROTECTION

Day	Date		Itinerary				
	Japan	Samoa	Team Leader	Port Planner and Foreshore Protection Planner	Project Coordinator	Restoration Planner, Port Facilities Designer, Architectural Designer, Natural Condition Surveyors 1 & 2	
1	June 25			NRT (FJ303) (FJ252)	NRT (FJ303) (FJ252)	NRT (FJ303) (FJ252)	
2	26	June 25		NADI -> APIA same as right ->	NADI -> APIA same as right ->	NADI -> APIA Courtesy call to JICA & meeting Investigation of Apia & Mulifanua Ports	
3	27	26		Investigation of Apia Port and revetment; Courtesy call to PWD & presentation of ICR	<- same as left	<- same as left	
4	28	27	NRT (NZ034)	Investigation of Asau & Salelologa Ports	<- same as left	<- same as left	
5	29	28	(NZ419) AKL -> WLN Courtesy call to Embassy	Team meeting	<- same as left	Restoration Planner Port Facilities Designer Architectural Designer <- same as left	Natural Condition Surveyors Preparation for survey
6	30	29	(NZ410)(NZ058) WLN->AKL->APIA	Explanation & discussion on ICR & QTNR	<- same as left	<- same as left	Natural Conditions Survey ↑

7	July 1	30	Courtesy call to PWD	Discussion on ICR & QTNR	<- same as left	<- same as left		S o
8	2	July 1	Courtesy call to MOT,MOFA,TD	Discussion on ICR & QTNR	<- same as left	<- same as left		u n
9	3	2	Discussion on Minutes of Discussion, Apia Port investigation	<-same as left	<- same as left	<- same as left		d i n g
10	4	3	Signing of Minutes of Discussion	<- same as left Courttesy call	<- same as left	<- same as left		S
11	5	4	-	(NZ075)(AN725) APIA->AKL->WLN	-	<- same as left		u r
12	6	5	-	(NZ466) WLN -> AKL	-	Team meeting Data analysis		v e
13	7	6	-	Courtesy call to Embassy (NZ033) AKL -> NRT	-	Restoration Planner PWD Data collection	Civil & Arch Designers Site investigations on damages	y
14	8	7	(NZ059)(NZ437) APIA->AKL->WLN		(NZ059)(NZ437) APIA->AKL->WLN	-ditto-	-ditto-	T o p S
15	9	8	Courtesy call to Embassy		Courtesy call to Embassy	-ditto-	-ditto-	o g u r
16	10	9	(NZ456) WLN->AKL		(NZ456) WLN -> AKL	-ditto-	-ditto-	r a v e
17	11	10	(JL774) AKL->NRT		(JL774) AKL -> NRT	Meeting with MOT	Meeting, Investigation of damages	p h y i c
18	12	11				Data Collection	Investigation of damages	

19	13	12				Team meeting Data collection		
20	14	13				Meeting	Meeting, Investigation of damages	I n v e
21	15	14				Data Collection	Data Colle- ction and Investigation of damages	s t i g a
22	16	15				-ditto-	-ditto-	t i o
23	17	16				-ditto-	-ditto-	n
24	18	17				-ditto-	-ditto-	o f
25	19	18				-ditto-	-ditto-	D a
26	20	19				Team meeting Data Collection		m a g
27	21	20				PWD; Data Collection	PWD; Data Collection	e s
28	22	21				Meeting	Meeting Data Collection	
29	23	22				Courtesy call to MOT & PWD		
30	24	23				(PH743) APIA -> AKL		
31	25					(JL743) AKL -> NRT		

(2) Draft Report Explanation

o Team Members

Name	Assignment	Position
Mr. Hisao Ouchi	Team Leader	Sr. Supervisor for Port Engineering, Engineering Division, Ports & Harbours Bureau, MOT
Mr. Yoshimi Murai	Foreshore Protection Planner	Director, 1st Survey Division, Tokushima Construction Office, Shikoku Regional Construction Bureau, Ministry of Construction
Mr. Nobuhiro Fukuda	Project Coordinator	Deputy Director, Second Basic Design Study Division, Grant Aid Study & Design Department, JICA
Mr. Hisanori Kato	Restoration Planner	Nippon Tetrapod Co., Ltd.
Mr. Hiroaki Gahara	Port Facilities Designer	-ditto-

o Draft Report Explanation Schedule

THE PROJECT FOR REHABILITATION AND IMPROVEMENT OF CYCLONE-DAMAGED PORTS AND FORESHORE PROTECTION

Day	Date		Itinerary		
	Japan	Samoa			
1	Oct. 7		NRT (NZ204) ->		
2	8	Oct. 7	AKL (NZ445) -> WLN		
3	9	8	WLN (AN726) -> AKL (PH744) -> APIA		
4	10	9			Courtesy call to Embassy
					Courtesy call and Draft Report Explanation to JICA, MOT & PWD
5	11	10			Investigation of Port and Foreshore Protection
6	12	11	Foreshore Protection Planner NRT (JL076) -> HNL		Team meeting
7	13	12	HNL (NZ059) -> APIA		Investigation of Port and Foreshore Protection
8	14	13			Draft Report Explanation and Discussion to/with MOT and PWD
9	15	14			Inspection of Foreshore Protection with PWD
10	16	15			Draft Report Explanation and Discussion to/with MOT and PWD Preparation of Minutes of Discussion
11	17	16	Four Members	Team Leader	Discussion on and Signing of Minutes of Discussion
12	18	17	APIA(NZ075) -> AKL (NZ433) -> WLN	-> APIA(NZ075) -> -> AKL (NZ033) ->NRT	
13	19	18	WLN (NZ458) -> AKL		Courtesy call to Embassy
14	20	19	AKL (NZ033) -> -> NRT		

Appendix 2

(1) Basic Design Field Study

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY
ON
THE PROJECT FOR REHABILITATION
OF
CYCLONE-DAMAGED PORTS AND APIA HARBOUR REVETMENT
IN
WESTERN SAMOA

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 of Cyclone-damaged Ports and Apia Harbour Revetment (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Western Samoa a study team, which is headed by Mr. Shoji Shimbo, Managing Director, Grant Aid Study & Design Department, JICA, and is scheduled to stay in the country from June 25th to July 23rd, 1992.

The team held discussions with the officials concerned of the Government of Western Samoa and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further works and prepare the Basic Design Study report.

Apia, July 3 1992

Mr. Shoji Shimbo
Team Leader
Basic Design Study Team
JICA

Hon. Jack Netzler
Minister of Transport
Western Samoa

Hon. Leafa Vitale
Minister of Works
Western Samoa

ATTACHMENT

1. OBJECTIVE

The objective of the Project is to expedite recovery from the devastation caused by the cyclone "Val" through rehabilitation of port facilities and Apia Harbour foreshore protection.

2. PROJECT SITES

The Project sites are as follows ;

Apia Port
Apia Harbour Foreshore Protection
Mulifanua Port
Salelologa Port

3. EXECUTING AGENCY

Ministry of Transport (MOT) and Public Works Department (PWD) are responsible for the administration and execution of the Project.

4. ITEMS REQUESTED BY THE GOVERNMENT OF WESTERN SAMOA

After discussions with the Basic Design Study Team, the following items were finally requested by the Government of Western Samoa.

1) Rehabilitation plan for port facilities at Apia, Mulifanua and Salelologa Ports.

2) Rehabilitation plan for Apia Harbour Foreshore Protection.

3) Project description is shown in Annex 2.

However, the final components of the Project will be decided after further studies.

5. JAPAN'S GRANT AID SYSTEM

(1) The Government of Western Samoa has understood the system of Japanese Grant Aid explained by the team.

(2) The Government of Western Samoa will take necessary measures, described in Annex 1 for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. SCHEDULE OF THE STUDY

(1) The Consultants will proceed to further studies in Western Samoa until July 23rd.

(2) Based on the Minutes of Discussions and technical examination of the study results, JICA will complete the final report and send it to the Government of Western Samoa by December, 1992.

Annex 1. NECESSARY MEASURES TO BE TAKEN BY WESTERN SAMOA

1. To provide data and information necessary for the Project.

2. To secure land area necessary for the execution of the Project and provide land space for construction works.

3. To provide access roads to the sites of construction works.

4. To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities to the Project area before the commencement of the works.

5. To arrange priority supply of stone materials from the Alafua Quarry.

6. To implement reclamation work on the outermost reclaimed area where the backfill material has been eroded.

7. To ensure prompt unloading and customs clearance at the port of disembarkation in Western Samoa and internal transportation of imported materials and equipment to the construction yard/site.

8. To exempt any equipments, materials and supplies brought into and/or purchased in Western Samoa in connection with the performance of the works from any tax, duties and levies which are imposed in Western Samoa.

9. To exempt Japanese nationals engaged in the Project from custom duties, internal taxes and other fiscal levies which may be imposed in Western Samoa with respect to the supply of the products and services under the verified contracts.

10. To accord Japanese nationals whose services may be required in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry and stay therein for the performance of their work.

11. To bear commissions to the Japanese foreign exchange bank for the banking services based on the Banking Arrangement, in accordance with Japan's Grant Aid procedure.

12. To bear all expenses, other than those to be borne by the Grant Aid, necessary in connection with the implementation of the Project.

13. To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid.

Annex 2. PROJECT DESCRIPTION

Major items of the Project are as follows in priority order:

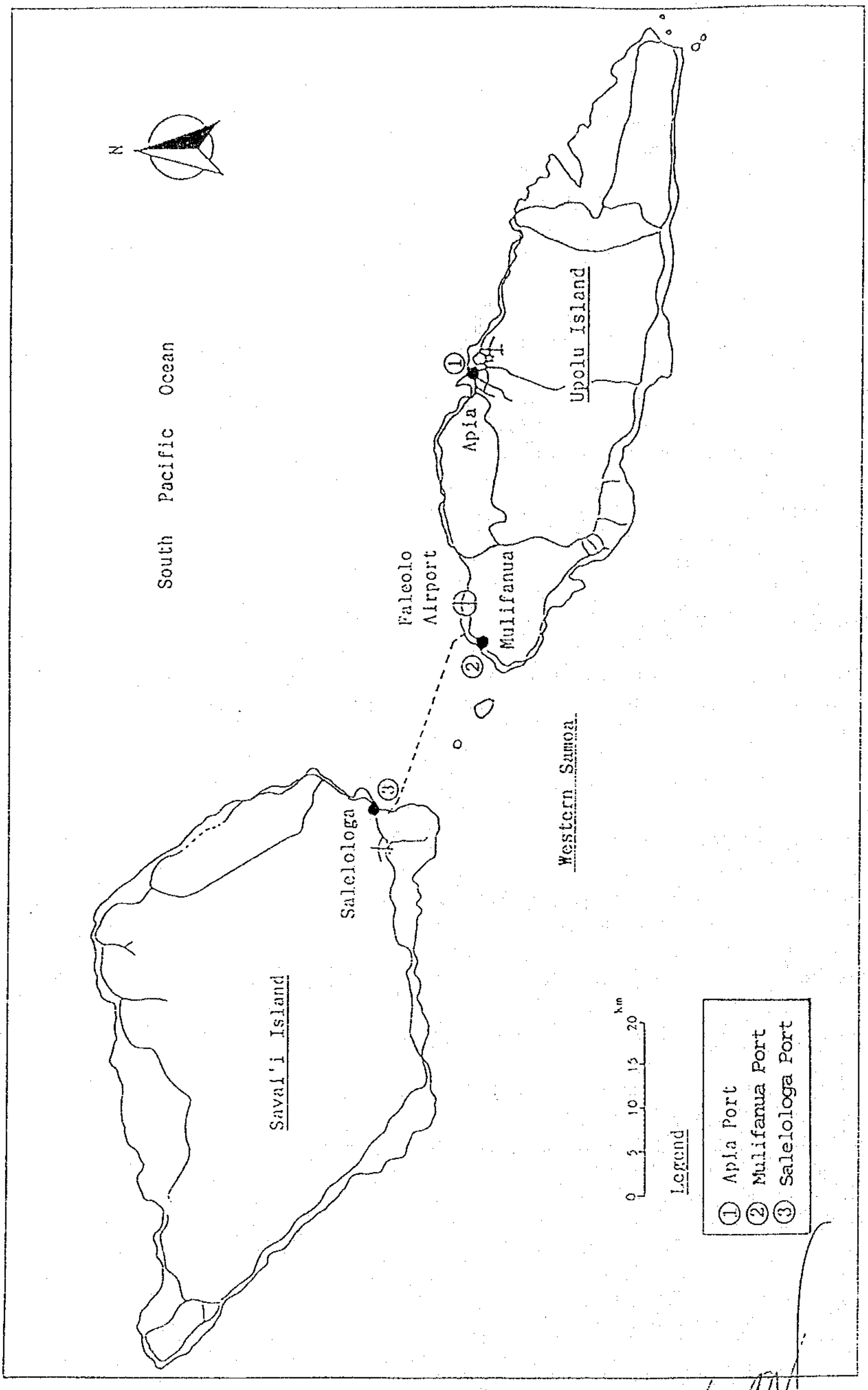
Port Facilities

Apia Port	Mulifanua Port	Salelologa Port
1. Shed No.4 (demolish Shed No.1)	3(2) Ferry Terminal Building	3(1) Ferry Terminal Building
2. Main Wharf	8. Channel	6. Revetment
4. Breakwater	9. Beacon	
5. Beacon	12. Revetment	
7. Container Yard		
10. Ferry Terminal Building		
11. Mooring Dolphin		

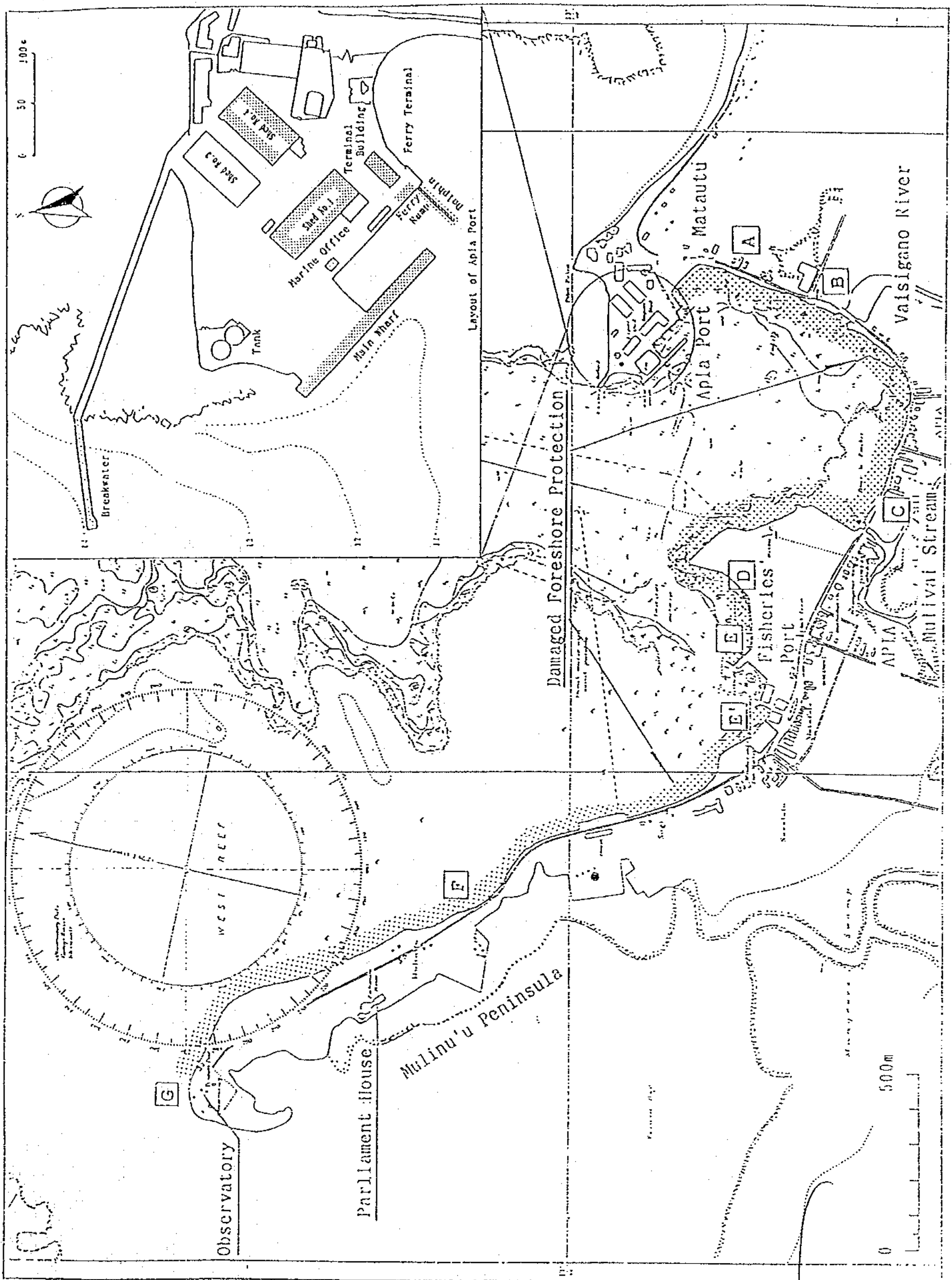
The Government of Western Samoa has expressed strong desire to rehabilitate the office building of Ministry of Transport serviceable.

Apia Harbour Foreshore Protection

Section A - B :	Waterfront - Vaisigano River Restaurant	2
Section B - C :	Vaisigano River - Mulivai Stream	1
Section C - D :	Mulivai Stream - Sand Beach	3
Section D - E :	Sand Beach	5
Section E' - F :	Bus Terminal - HRPP Headquarters	4
Section F - G :	HRPP Headquarters - Observatory	6



Location of Ports


Layout of Apia Port
Shed No.1
Shed No.2
Shed No.4
Terminal Building
Ferry Terminal
Ferry Ramp
Dolphin
Marine Office
Main Wharf
Tank
Breakwater
Matautu
Apia Port
Vaisigano River
APIA
Mulivai Stream
Fisheries Port
Damaged Foreshore Protection
Mulinu'u Peninsula
Parliament House
Observatory
A
B
C
D
E
E'
F
G
500m

(2) Draft Report Explanation

MINUTES OF DISCUSSIONS

OF

THE DRAFT REPORT OF THE BASIC DESIGN STUDY

OF

THE PROJECT FOR REHABILITATION AND IMPROVEMENT OF

CYCLONE-DAMAGED PORTS AND FORESHORE PROTECTION

IN WESTERN SAMOA

(CONSULTATION ON DRAFT REPORT)

In June, 1992, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study team on the Project for Rehabilitation and Improvement of Cyclone-damaged Ports and Foreshore Protection (hereinafter referred to as "the Project") to Western Samoa and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult the Western Samoan side on the components of the draft report, JICA sent to Western Samoa a study team, which is headed by Mr. Hisao Ouchi, Senior Supervisor for Port Engineering, Engineering Division, Ports & Harbours Bureau, Ministry of Transport, and is scheduled to stay in the country from October 8th to 17th, 1992.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Apia, October 16, 1992

Hisao Ouchi
Leader
Draft Report Explanation Team
JICA

Hon. Jack Netzler
Minister of Transport
Western Samoa

Hon. Leafa Vitale
Minister of Works
Western Samoa

ATTACHMENT

(1) Components of draft report

The Government of Western Samoa has agreed and accepted in principle the components of the draft report proposed by the Team.

(2) Japan's Grant Aid System

1) The Government of Western Samoa has understood the system of Japanese Grant Aid explained by the team.

2) The Government of Western Samoa will take necessary measures described in Annex, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

(3) Further schedule

The team will make the final report in accordance with the confirmed items, and sent it to the Government of Western Samoa by the end of December 1992.

ANNEX

Necessary measures to be taken by the Government of Western Samoa in case Japan's Grant Aid is executed.

1. To secure the site for the Project.

2. To clear, level and reclaim the site prior to commencement of the construction.

3. To undertake incidental outdoor works such as gardening, fencing, gates and exterior lighting in and around the site.

4. To construct the access road to the site prior to commencement of the construction.

5. To provide facilities for distribution of electricity, water supply, telephone, drainage, sewage and other incidental facilities to the Project site.

   1) Electricity distribution line to the site
   2) City water distribution main to the site
   3) Drainage city main to the site
   4) Telephone trunk line to the main distribution panel of building
   5) General furnitures such as carpets, curtains, tables, chairs and others

6. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

7. To exempt taxes and to take necessary measures to customs clearance of the materials and equipment brought for the Project at the port of disembarkation.

8. To accord Japanese Nationals whose services may be required in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry into Western Samoa and stay therein for the performance of their work.

9. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant.

10. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.

11. To relocate the small shops located on the revetment in front of Bus Terminal prior to commencement of the construction.

12. To arrange supply of stone materials from the Alafua Quarry prior to commencement of the construction.

13. To approve traffic restriction on a coastal road during the construction as required.

14. To implement a reclamation work on the outermost part of the reclamation area in a timely manner.

15. To implement a reclamation work in front of Kitano Tusitala Hotel by the end of June 1993.

16. To acquire agreement for use of the reclaimed area from such business enterprises and residents as Kitano Tusitala Hotel, etc. along the proposed reclamation area piror to the commencement of the reclamation work.

17. To distribute power line to front and rear beacons in Apia prior to commencement of the construction.

18. To acquire agreement from Aggie Grey's Hotel to improve the revetment repaired by them prior to commencement of the construction.

19. To assist for smooth implementation of the work in arranging supply of stone materials, ready mixed concrete, etc. and coordination with the other projects.

Appendix 3 List of Interviewees

Western Samoa Government

Name	Organization	Position
Hon. Tofilau Eti Alesana		Prime Minister
Hon. Jack Netzler	Ministry of Transport	Minister
Mr. Nofo Vaaelua	Ministry of Transport	Secretary
Mr. Amituanai Malu Faalogo	Ministry of Transport	Assistant Secretary Marine & Shipping
Mr. Peniamina Talouli Afutiti	Ministry of Transport	Senior Marine Electrician
Hon. Le'afa Vitale	Public Works Department	Minister of Works
Mr. Isikuki Punival	Public Works Department	Director of Works
Mr. Tim Waters	Public Works Department	Acting Chief Civil Engineer
Mr. David Salomon	Public Works Department	Acting Chief Water Engineer
Mr. Ieti Taulealo	Public Works Department	Executive Planner
Mr. Teresa Ngau-Chun	Public Works Department	Town Planner
Mr. Epa Tuioti	Treasury Department	Financial Secretary
Ms. Hinauri Petana	Treasury Department	Assistant Secretary of Finance
Mr. M. Sua	Ministry of Foreign Affairs	Secretary
Mr. Sisi Suisala	Western Samoa Government Office Building	Project Manager
Mr. Chris M. Phillip	Special Project Development Corporation	General Manager

Private Sector

Name	Company Name	Position
Mr. Henry Westerlund	Blue Bird Transport Co., Ltd.	Managing Director
Mr. Rudolf Henry Ott	Ott Transport Co., Ltd.	Managing Director
Mr. Frederick Wetzell	Apia Concrete Products Ltd.	President
Mr. R.A. Peacocke	Central Bank of Samoa	Project Director
Mr. Papalii John Ryan	Pacific Forum Line	Manager S. E. Pacific (Agencies)