DEPARTMENT OF PUBLIC WORKS
MINISTRY OF INFRASTRUCTURE
AND PUBLIC UTILITIES
REPUBLIC OF VANUATU

BASIC DESIGN STUDY REPORT ON THE PROJECT FOR THE WHARF REHABILITATION IN TANNA ISLAND IN THE REPUBLIC OF VANUATU

JULY 1998

JAPAN INTERNATIONAL COOPERATION AGENCY
PACIFIC CONSULTANTS INTERNATIONAL

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PREFACE

In response to a request from the Government of the Republic of Vanuatu (the Government of Vanuatu), the Government of Japan decided to conduct a basic design study on the Project for The Wharf Rehabilitation in Tanna Island and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Vanuatu the Basic Study Team from March 15 to April 8, 1998.

The team held discussions with the officials concerned of the Government of Vanuatu, and conducted field surveys in the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Vanuatu from May 31 to June 9, 1998 in order to discuss the draft basic design, and as this result, the present report was prepared.

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

I wish to express my sincere appreciation to the officials concerned of the Government of Vanuatu for their close cooperation extended to the team.

July 1998

Kimio Fujita
President
Japan International Cooperation Agency

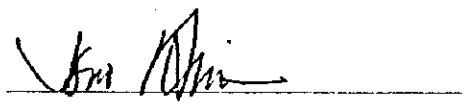
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for The Wharf Rehabilitation in Tanna Island, in the Republic of Vanuatu.

This study was conducted by Pacific Consultants International, under a contract to JICA, during the period from March 6, 1998 to July 31, 1998. In conducting the study, we have taken into full consideration of the present situation in the Republic of Vanuatu, and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

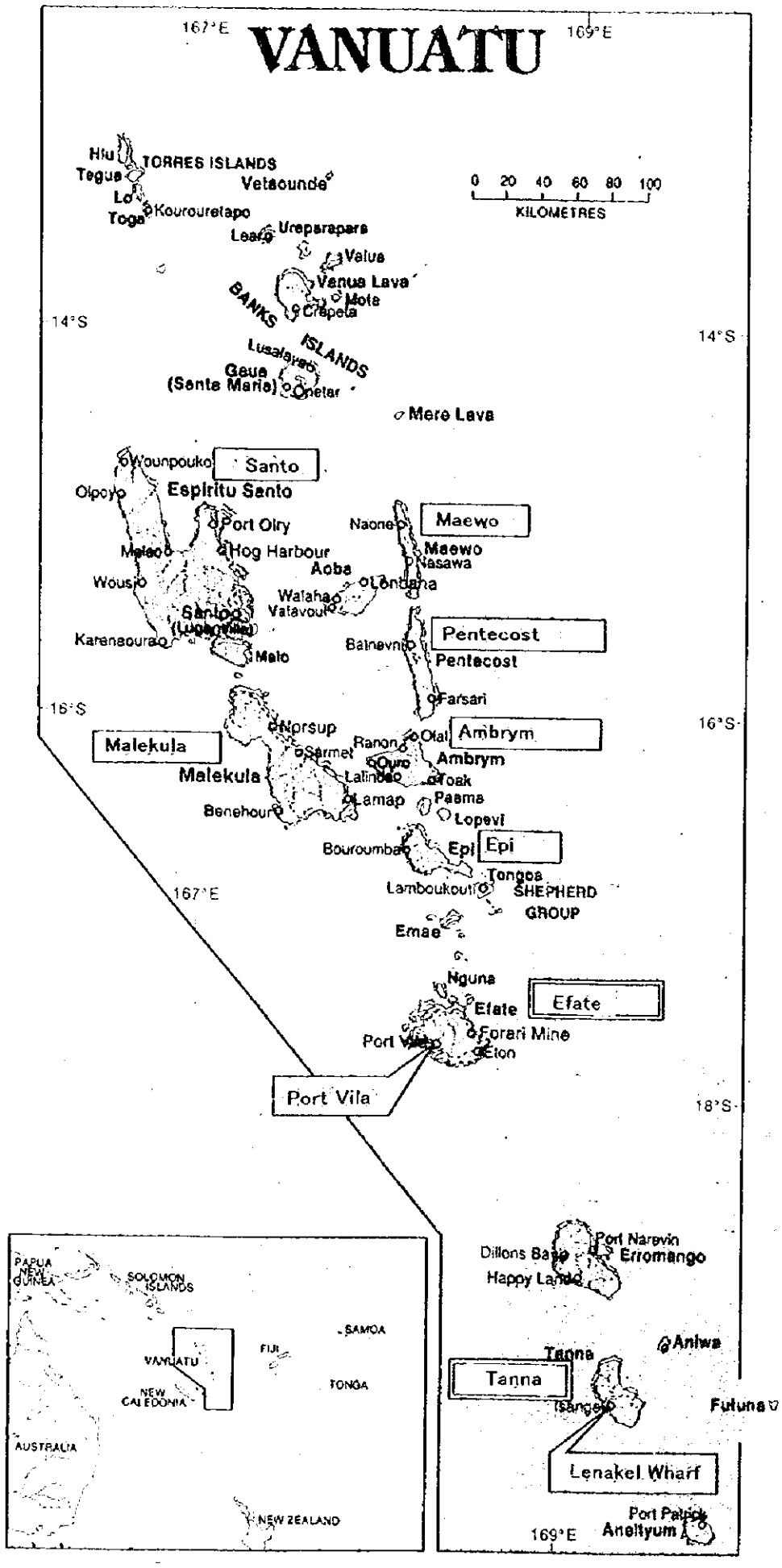
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

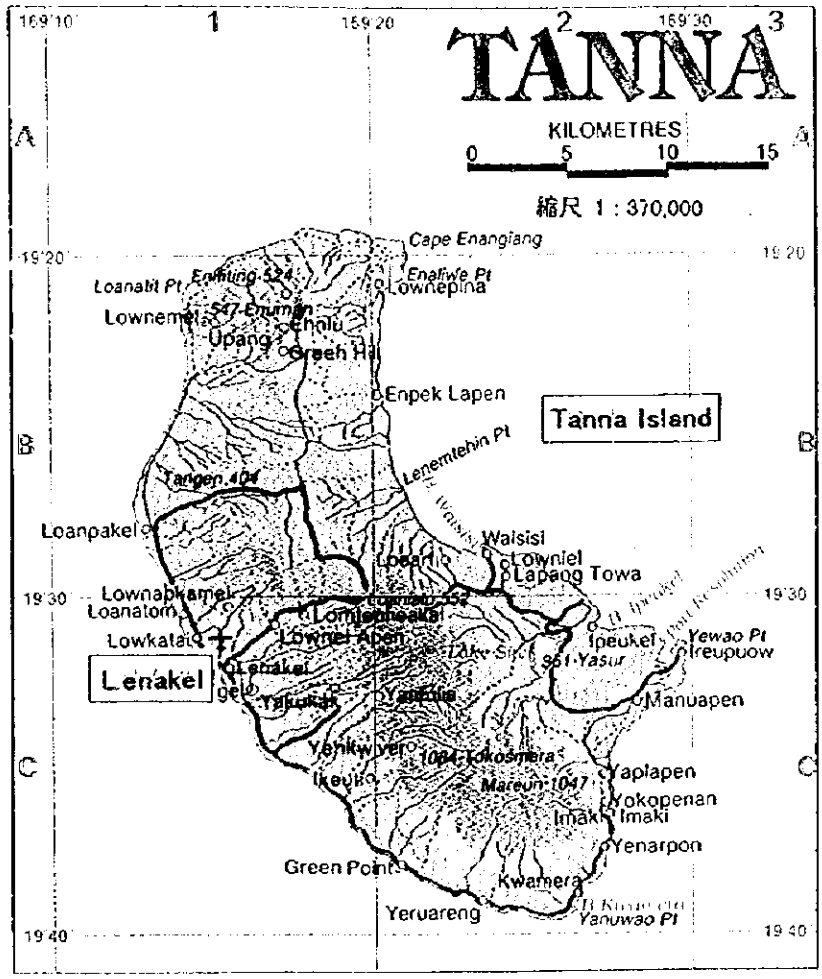


Isao Hino

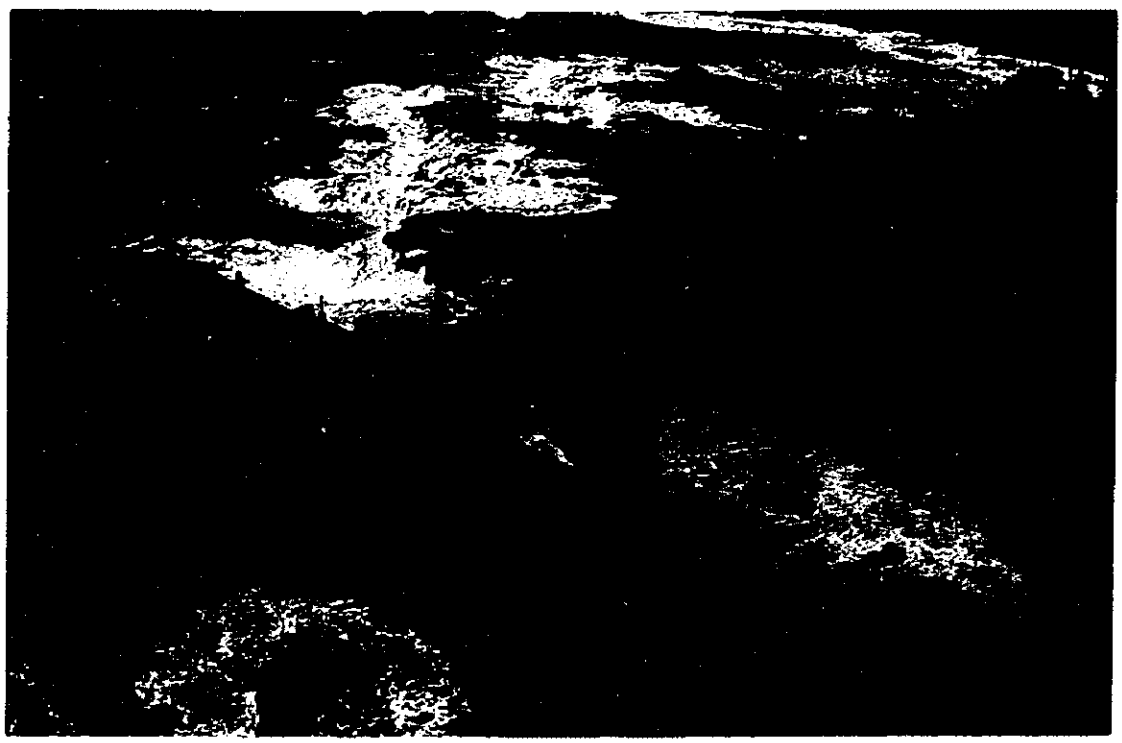
Project Manager
Basic design study team on
The Project for the Wharf Rehabilitation in Tanna Island in the Republic of Vanuatu
Pacific Consultants International



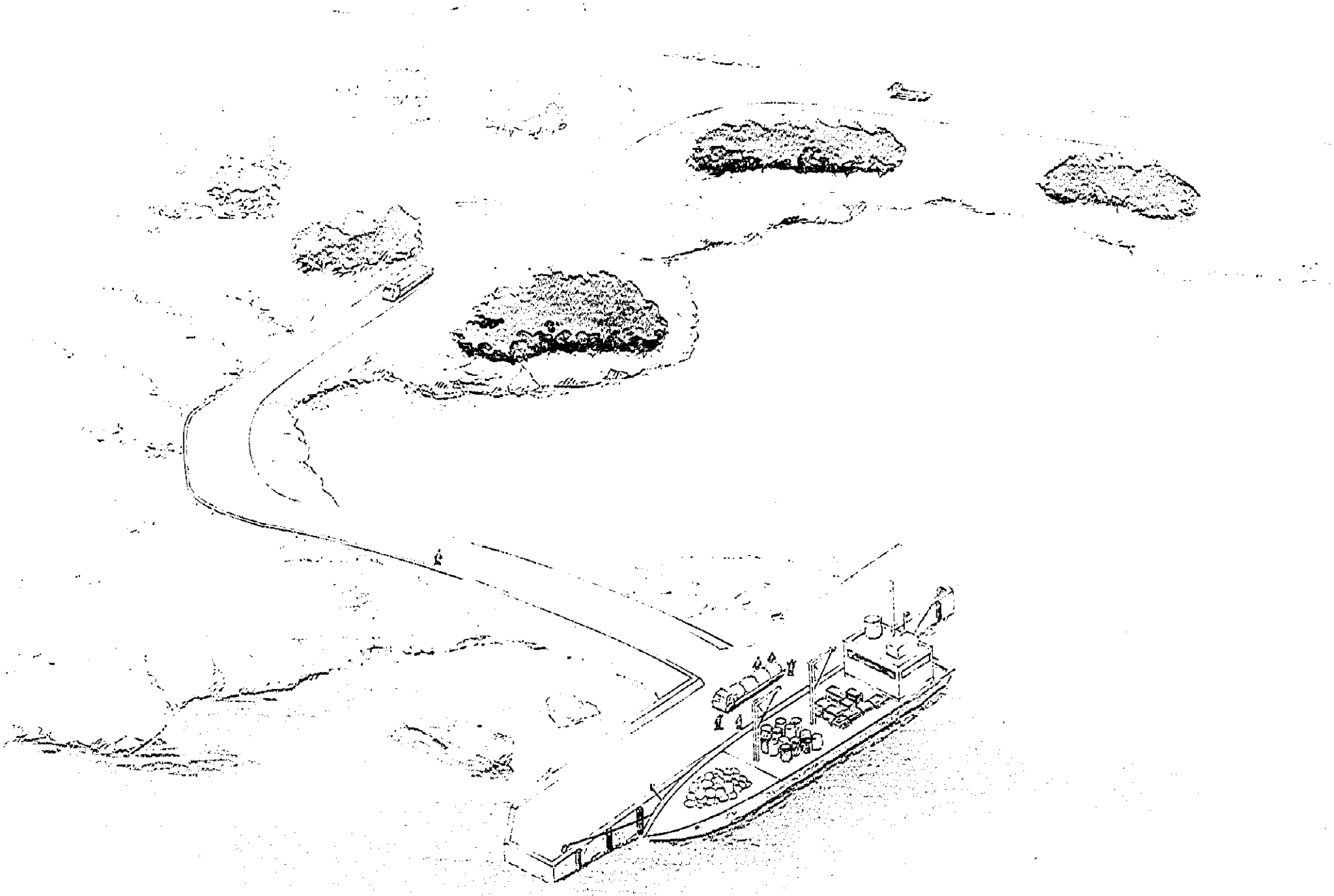
LOCATION MAP (1)

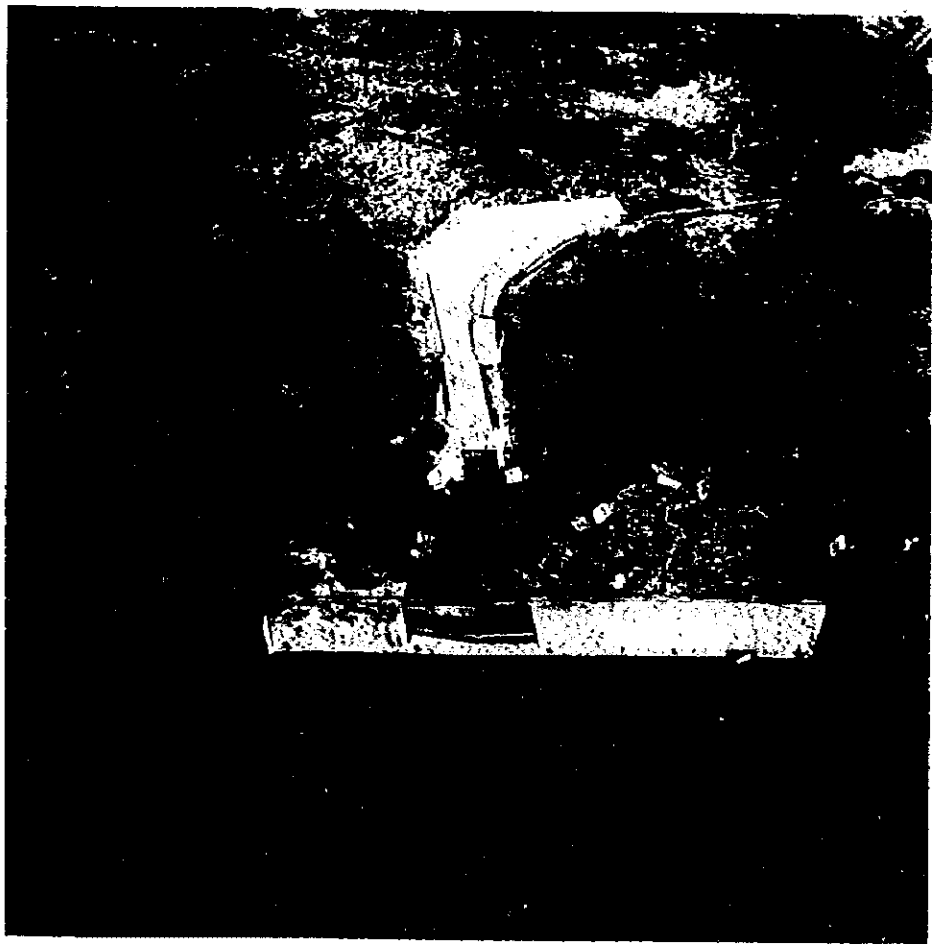


After Disaster of Cyclone " Sarah (Feb. 1994)



LOCATION MAP (2)





Lenakel Wharf (Aero Photograph)

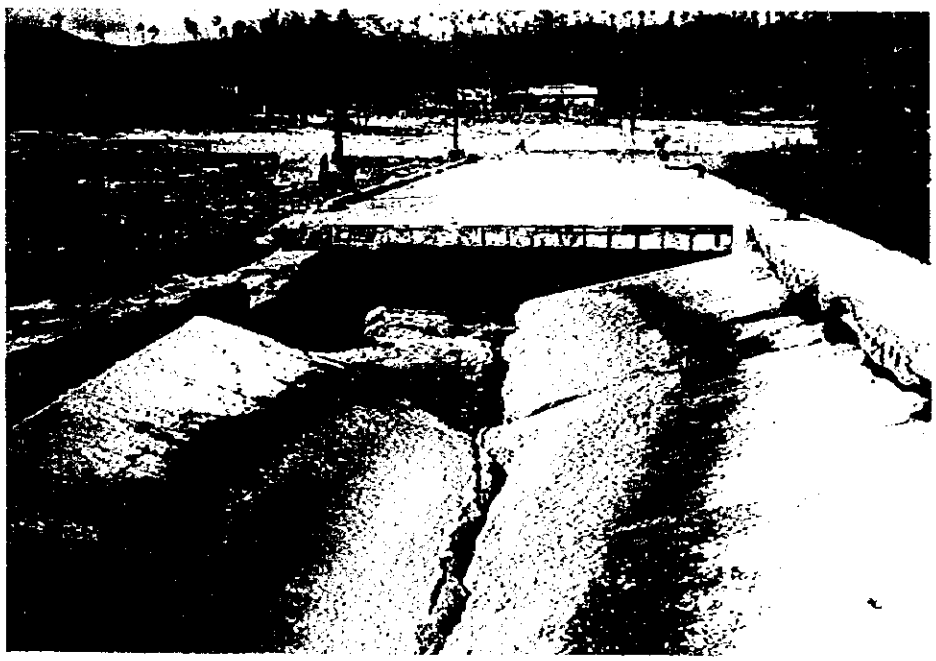
Photograph (1) Cyclone "Yali" (23 Mar. 1998) Attacked

Photograph (2) Damaged Access Road (Gravel Pavement Area)

Photograph (3) Damaged Access Road
(Transition from concrete to gravel pavement)

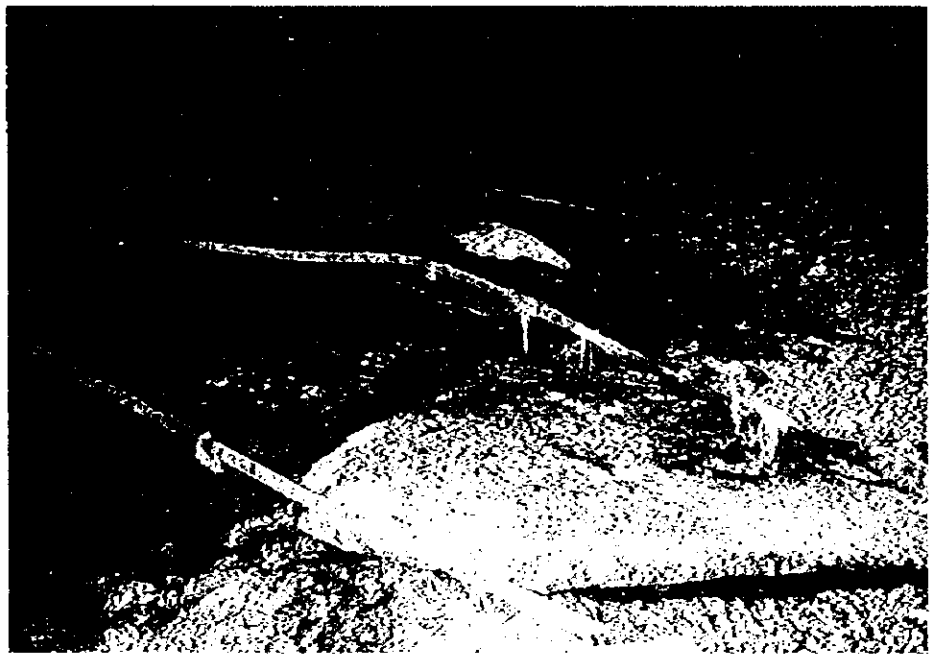
Photograph (4) Damaged Access Road (Concrete moved out)

Photograph (5) Access Road Washed Away
(Area of Connected to the Wharf)

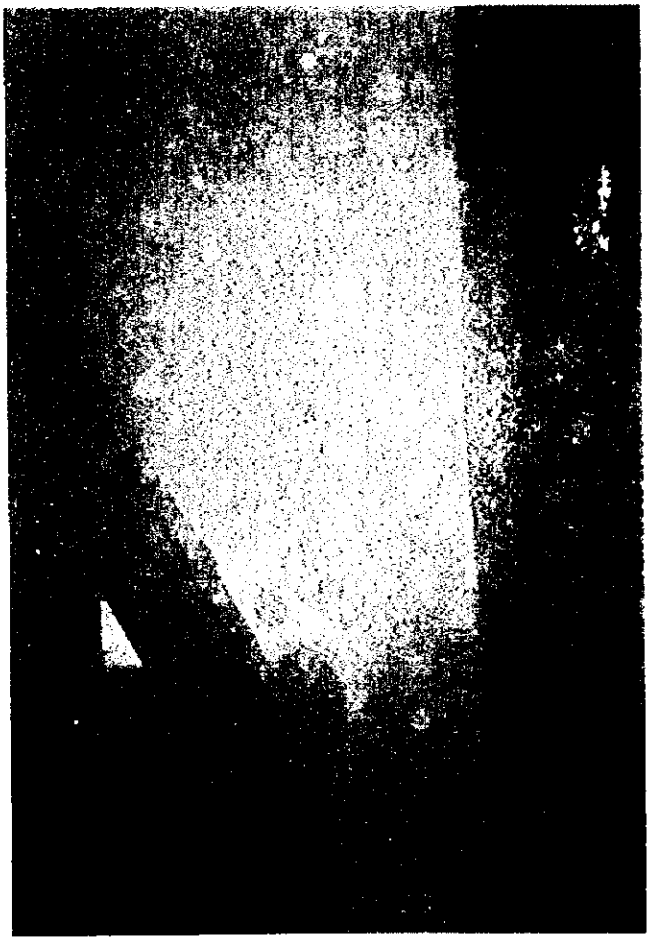


Photograph (6) Damaged Wharf (See from West to East)

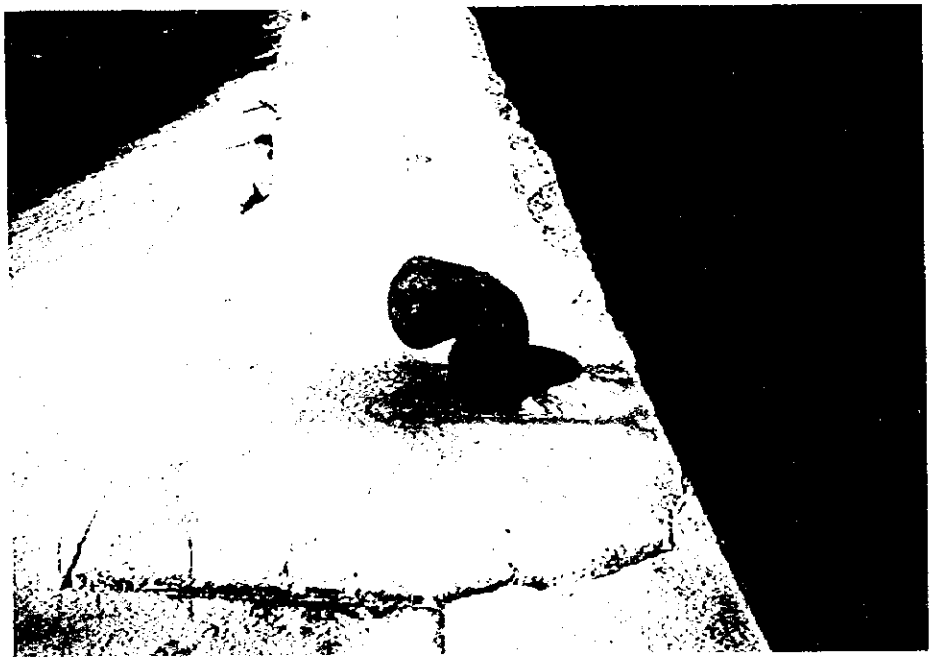
Photograph (7) Damaged Anchor Concrete Block (Wharf)



Photograph (8) Damaged Tie-rod (In side of the Wharf)



Photograph (9) Sheet Pile Damaged by Sunken Barge



Photograph (10) Conditions of Bollard and Concrete Surface of the Wharf

ABBREVIATION

ADB	:	Asian Development Bank
E/N	:	Exchange Note
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
GOJ	:	Government of Japan
GOV	:	The Republic of Vanuatu
GWT	:	Gross Weight Tonnage
MHWL	:	Mean High Water Level
MLWL	:	Mean Low Water Level

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CHAPTER 1

BACKGROUND AND OBJECTIVES OF THE PROJECT

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From 1985 to 1987, a wharf and its access road was constructed in Tanna Island of the Republic of Vanuatu as one of the facilities planned in "the Construction Project of Regional Commercial Centres in Vanuatu" by Japanese Grant Aid Scheme, wherein principal objectives were improvement of cargo handling efficiency for agricultural products and promotion of regional economic activities in the Republic.

In 1994, the facilities were devastated by an enormous cyclone, which was well over the design condition originally developed. Damages incurred during the incident were fairly severe and have made the facilities almost non-functional since then.

In view of the present inconvenience in cargo handling operations due to the above, this study aims at rehabilitation of the facilities to their original functions and capability.

Vanuatu is an archipelago situated in the southeast pacific ocean. The country consists of various small islands, mostly isolated and scattered over a wide area. Port development in the country, therefore, plays an important role in providing essential supporting infra-structure to achieve uniform socio-economic development in the whole country. Port and harbour facilities in such isolated islands have a particular importance, for it is a sole gateway of the essential life lines for the inhabitants, which is considered to be a logistics centre sustaining collection, storing and handling of cargoes, used for outward shipping of agricultural products and transporting inward daily commodities and construction materials.

In the Republic, a distinct difference in regional socio-economy prevails between the central core area and the provincial northern/southern areas, for the former includes comparatively well developed Efate and Santo islands where international ports are located and ocean-going shipping services are operated, while no definite logistics centre has yet been provided in the latter. In order to rectify this imbalance of the regional socio-economy, the government established their Phase III national development policy focusing on the following:

- up-grading of living standards in the provinces;
- improvement of imbalance in regional socio-economy among the islands.

Wherein being promoted as its implementation are, expansion of seaward transport services and promotion of port and harbour development. The present project site of

Lenakel in Tanna Island has functioned as a regional hub of the area in seaborne traffic and is a potential core of the logistics, which is expected to promote socio-economies in the southern area.

At present, privately operated between Port Vila in Efate Island and Tanna Island is a regular service by small cargo vessels of about 200 GT three to four times a month. Inward cargo handled at Lenakel is mostly daily commodities and construction materials, reaching 4,000 tons in their annual volume, whereas 600 tons of agricultural products harvested are shipped outward to the capital in a year.

The incidental damage of Lenakel Wharf has significantly constrained the cargo handling operation. Normal berthing of the vessels to the wharf is almost impossible due to the partial destroy, which enforces offshore unloading by small boats or barges from anchoring vessels. Alternately, manual cargo handling by labours is carried out provided that the damaged wharf is accessible through the adjacent beach during low tide.

Considering such inconveniences in cargo handling operation, this Project aims at recovery of the cargo handling efficiency and its safety operation by rehabilitating the damaged facilities, both the wharf and access road, which will in turn contribute to promotion of the regional socio-economy as well as motivation of the inhabitants towards production activities.

CHAPTER 2

CONTENTS OF THE PROJECT

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2.1 Basic Concept of the Project

The Study Team discussed the scope of the request by the Vanuatu Government and conducted the following surveys and studies:

- structural investigation of the damaged wharf and its access road;
- survey on present status of cargo transport in Vanuatu, at Tanna Island in particular;
- wave hind-cast based on cyclone data collected;
- topographic and hydrographic surveys.

As a result of the surveys, the Study Team confirmed the role of Lenakel Wharf in Tanna Island as an important logistics hub of the isolated islands in the area and concludes that urgent rehabilitation of the facilities is essential in order to facilitate the role principally expected.

In view of the present status and problems of the facilities described in later sections, the intent of the present Project is to rehabilitate the facilities to the same purposes, functions and dimensions as the original. The principal dimensions of the facilities both for this Project and in the original are as follows;

- Berth Length: 55 m
- Berth Water Depth: 5 m
- Width of Access Road: 5 m.(effective width 4m)

The present status and problems of the facilities identified during the site surveys by the Study Team are summarised below.

(1) Seaborne Cargoes at Tanna Island and Its Hinter-Islands

The Study Team collected data on cargo handled at Tanna Island either "before the incident" and "after the incident", which are tabulated below;

Origin/Destination	Commodities	Before the Incident (from 1985 to 1991)	After the Incident (from 1995 to 1997)
from Port Vila to Tanna Island	daily commodities, construction materials, fuels, etc.	3,860 tons/year on average	About 4,000 tons/year on average
from Tanna Island to Port Vila	agricultural products, such as copra, coffee, vegetables, and livestock such as calves	978 tons/year on average	About 600 tons/year on average

According to the forecast conducted and used as a basis for "the Construction Project of Regional Commercial Centres in Vanuatu", outward cargo volume of agricultural products handled at Lenakel was estimated about 950 tons per year on average from 1985 to 2001 under the lower growth scenario, while it was about 1,500 tons in the higher growth. Comparing the estimation with the actual record of 978 tons per annum before the incident from 1985 to 1991, actual cargo volume were very close to the lower growth scenario.

Although the cargo volumes after the incident have dropped to about 600 tons per annum due to inconvenience and inefficiency of the cargo handling operation at the berth and temporary termination of shipping for agricultural products of poor and low quality, the inbound cargo volume from Port Vila handled at Lenakel has remained almost constant since the incident, at about 4,000 tons per annum, reflecting the essential nature of the cargoes, such as daily commodities, construction materials and fuels consumed in the area.

The drop of outbound cargo volume will recover to the original level or the forecast level by the rehabilitation of the facilities, which resolves the present inefficiency in cargo handling operation. In addition, construction of a new airport under the French finance loan will be completed in June 1998 and will also contribute to tourism promotion around the area. The airport project will accelerate the regional socio-economic development, resulting in increasing volume of seaborne cargo.

(2) Dimensions of the Wharf

Water depth of the berth adopted in the original design of "the Construction Project of Regional Commercial Centres in Vanuatu" was -5.0 m, which corresponds to the vessels of 414 GRT in tonnage, the largest in the country. Although the vessels currently utilising the berth are about 200 GRT with their maximum draft of 3.5 m, the present design also adopts the same water depth of -5.0 m, considering wave conditions at the site, possible future operation of larger vessels and the present maximum vessels owned by the operators, i.e., 414 GRT in tonnage and 4.0 m of maximum draft.

Similarly, length of the wharf planned in the present design is 55 m, which is the same as the original, considering average overall length of cargo vessels for 400 GRT and some margins at both front and end of the vessels during mooring.

(3) Wave Height and Seismic Force

In the original design, wave height at the waterfront of the facilities was evaluated through the hind-cast of offshore waves based on wind data before 1981. Unfortunately, attack of larger cyclone than the one resulting in the damage was not recorded at that time. During the survey in Vanuatu, the Study Team collected past cyclone data in the area for a twenty year period, including the above largest one, which was then subjected to further wave hind-cast analysis. Based on results of the analysis, wave height in the present design was determined as a stochastic one for return period of 50 years.

Seismic force in the original design was evaluated by applying the local seismic factor of 0.1 to the body force of the structures. In this study, relevant codes and standards in the country have been investigated and an appropriate factor will be used for the structural design through the examination.

(4) Operation of the Facilities during Storm and Cyclone Passage

In general, port and harbour facilities are planned to be utilised for required net operation days in a year, satisfying calmness in the basin for handling operation of target vessels. Even against storm and cyclone passage, it is

common practice to provide some means of breakwater or others to secure shelter during such extreme conditions. In Tanna Island, unfortunately, no appropriate geography is available for such provisions as natural shelter by deep bay and suitable seabed formation for breakwater construction.

Currently the regular service from Port Villa to Tanna Island is cancelled during such extreme conditions. Frequency of the regular service, three to four trips per month, implies that the current operation can accommodate cargo volumes at present and forecasted in the future. Considering this situation, the scale of the facilities should not be increased, since their operation can be cancelled during the extreme conditions. In extreme conditions, run-up and over-topping of waves over the facilities, both the wharf and its access road, are permitted in the present design, so that the structures are not necessarily bigger and the corresponding construction cost can be minimised.

(5) Construction Materials and Labour

There is little industrial production in Vanuatu other than some wood materials, corals and aggregates for concrete. Other construction materials are all imported, and thus are very expensive. In this rehabilitation, recycling of the materials and any components of the original facilities shall be carefully considered. Materials and labour locally available shall also be considered as possible alternatives.

(6) Maintenance of the Facilities

Neither civil contractor nor civil engineers specialised in port and harbour facilities are available in Tanna Island. Lack of such expertise necessitates the structures and their materials ideally to be free from maintenance in the future servicing period.

It is, however, imperative to regularly monitor and examine the integrity and status of the facilities, especially after the passage of cyclones. To this end, an establishment in the executing agency in charge of the monitoring should be organised.

In the management aspect, an administration in the executing agency should also be provided, which can report any relevant problems of the facilities to

the central government. Cargo statistics in Tanna Island should be officially recorded by the concerned agency.

(7) Environmental Considerations

Tanna Island protects its natural resources, particularly attractive for tourists. The rehabilitation shall incorporate special attention to environmental impacts influencing the surrounding natural resources. Seawater pollution during the construction and waste disposal from the Project shall be minimised with utmost care. For this reason, and as previously discussed, recycling of the original materials should be specifically considered.

2.2 Basic Design of the Facilities

2.2.1 Design Concept

Based on the site surveys and basic concept previously described, basic design of the facilities at Lenakel in Tanna Island was conducted. Summary of the design is shown in Table 2.1 and the details are described hereunder:

Table 2.1 Comparison of Design Concept between the Original and the Rehabilitation

Items	Design Concept		Remarks		
	Original Design	Present Rehabilitation	A	B	C
1. Wharf					
1) Sheet Pile Wall	- 5 m Berth	- 5 m Berth (Repair at damaged portion)	○		
2) Anchor	Concrete anchor block	Anchor steel sheet piles (at damaged portion only)	○		○
3) Tie Rod	25 mm ϕ @ 80 cm	25 mm ϕ @ 80 cm (replacement at damaged portion)	○		
4) Pavement and Back Fill	40 cm thick pavement and crusher-run fill	50 cm thick pavement and filling concrete		○	
5) Coping	R.C.	Replacement of the upper concrete	○		
6) Foot/Toe Protection	7 ton block and stone/rock	30 ton block or more		○	
7) Fender	300 H x 2000 L	250 H x 2000 L and protector (Replacement of 7 units at centre)	○		○
8) Mooring Fixture	15 ton, cast ion, bitt	15 ton, stainless, bollard			○
9) Dredging	maintain -5 m	maintain -5 m	○		
2. Access Road					
1) Embankment	Concrete revetment, crushed stone fill and wave dissipation concrete block	Gravity type monolithic cast-in- place concrete		○	
2) Pavement	20 cm thick concrete and crusher-run	20 cm thick concrete covering the damaged crusher-run pavement	○		○
3. Others					
Lighting	3 units on the apron and 5 units on the access road	No lighting		○	○

Note: A: Structure in the rehabilitation is the same as in the original.
B: Structure is changed for the present design wave height.
C: Additional remedy is incorporated for other reasons.

(1) Wharf

1) Steel Sheet Pile Wall

Existing steel sheet piles can be used for the present design except for two damaged parts, where additional reinforcing steel sheet piles will be driven. Embedment of the existing steel sheet piles is checked whether it is sufficiently stable against the design wave height obtained from the present wave hind-cast.

2) Anchor of the Sheet Pile Wall

Fill materials behind the sheet pile walls were washed out at some portions for about 25 m along the wall line. Concrete anchor blocks installed at such position shall be sealed below the low tide elevation by new steel sheet pile wall of 34 m in total length against possible wash out of the foundation fill. The existing anchor blocks can be used at other portion of 22 m length, for the foundation of the blocks are well set up on the existing coral rock without any wash out.

3) Tie Rod

Portions subjected to wash out are directly exposed to seawater, where tie rods exhibit severe corrosion and deformation. Replacement with new tie rods or reinforcing will be considered in the present design.

4) Concrete Pavement and Back Fill

In the original design of the pavement, crushed stone and reinforced concrete of 40 cm thickness and 240 kgf/cm2 in strength were selected against the design wave height of 2.4 m. The present design wave height of 7 m requires more than 2 m thick concrete pavement in the same constitution as the original pavement. Considering economy of the structure, the original fill material, crushed stone, is replaced with filling concrete above the low tide elevation coupled with upper high strength concrete of 50 cm thickness against abrasion effect. Mesh wire reinforcement will be placed at the surface to prevent possible crack formation.

5) Coping of the Sheet Pile Wall

Abrasive damage is significant in the coping concrete of the sheet pile wall. The upper portion shall be tipped off and replaced with new concrete. Curbs damaged should be replaced monolithically. Upper bolts for fender installation are also damaged, thus be replaced at the time of coping concreting.

6) Foot/Toe Protection

During the incident, existing stone/rock materials for foot/toe protection were washed away and concrete blocks for protection were also moved. In this rehabilitation, an appropriate protection of concrete blocks will be studied against the design wave height determined from the present wave hind-cast.

The stones/rocks lost in the deep seabed can not easily be collected, and will not be obstructive for safe manoeuvring of the vessels approaching the wharf, as well as in environmental aspects. On the other hand, the concrete blocks should be collected and demolished.

7) Fenders

Seven fenders of the fourteen originally installed can be still used for the present rehabilitation, for size of the target vessels in this design is the same as the original. Seven units installed at the centre are, however, severely damaged and should be replaced. The damage of the seven units is diagnosed due to cyclic vertical thrust during vessel contact, quite likely by steel side protector of the vessels rolling during berthing. Some measures, such as guard member for the fenders, will be incorporated in the present rehabilitation.

8) Mooring Bitts

It is observed that corrosion of the bitts originally installed is more severe than normally found in other port and harbour facilities. Reason for such severe corrosion is assumed due to regular splash of seawater in extreme conditions and lack of proper maintenance. In the present

rehabilitation, anti-corrosive materials should be adopted for mooring fixtures.

9) Dredging

The design water depth of -5 m should be maintained in this rehabilitation. Area shallower than the required depth will be checked by sounding and will be dredged to secure safe manoeuvring of the vessels.

(2) Access Road

1) Connection of the Access Road to the Wharf

In the present rehabilitation, position and structure of the connection of the access road to the wharf is re-evaluated against the new design wave height.

2) Pavement on the Access Road

Original crusher-run pavement lost during the incident will be replaced with concrete pavement of the same thickness as the original in the area affected by cyclones.

(3) Other Miscellaneous Facilities and Demolition

1) Lighting on the Apron

As a result of the site surveys and discussion with the Government of Vanuatu, cargo handling at the berth can be conducted avoiding operation at nighttime. In addition, loss of the lighting fixtures is inevitable during cyclone attacks. In view of the fact, provision of lighting is excluded in the present rehabilitation and the existing units will be demolished.

2) Concrete Blocks for Wave Dissipation

Concrete blocks placed for wave dissipation were drifted by the cyclone attack, and will be obstructive for safe manoeuvring of the vessels by possible future attack of cyclones. Collection and demolition is included in the present rehabilitation.

2.2.2 Design Criteria

In this rehabilitation, establishment of servicing period of the facilities is studied taking into account stochastic assessment of possible cyclone attacks. Through the study, the design wave for return period of 50 years is adopted as explained hereunder.

Generally, servicing period implies three different life spans of the facilities. They are functional, economic, social and physical and the shortest life span of the four become the final life span. According to the life span survey of the commercial port in Japan, number of port facilities whose life spans were finished before 30 years are 1,896 out of 1982. This means more than 95% of the port facilities are used more than 30 years. The reasons of the termination of the life spans are functional, physical and social which ratios are almost same. Life span of Tanna wharf could be considered that 99% of the port facilities have more than 30 years service period because only physical life span is important in Tanna island. Based on the above, life span of Tanna wharf shall be decided 50 years except steel sheet pile which will corrode in sea water.

For the return period of design wave height, port and harbour where cyclone or typhoon attack the facilities frequently, life spans of the port facilities are determined 50 years as well as Japan. The occurrence ratio of the higher wave than stipulated design wave for 50 years life span structure is 0.636 and 0.816 for the return period of 50 and 30 years respectively. In order to decide the life span of the structure, following items shall be taking in to account;

1) Life span of Tanna wharf should be 50 years.
2) Rehabilitated Tanna wharf shall be stable for the cyclone same magnitude as Cyclone " Sarah ".
3) The return period of the highest wave recorded of cyclone "Sarah and Tomas" in Vanuatu is 33 years based on the estimation in this study.
4) There is a possibility to damage again if return period is 30 years.
5) If wharf is damaged, construction cost is very expensive because Tanna island is isolated from Efate island.

Based on the above, return period of the design wave height of this project should be decided 50 years.

The design criteria established through the site surveys are summarised in Table 2.2. Details of the design criteria, as well as construction planning and required costs are described below.

Table 2.2 Comparison of Structural Design Criteria

Items	Original Design	Rehabilitation	Remarks
1. Codes and Standards	Japanese Standard for Port and Habour Facilities	JSPFF (DO), National Building Code and New Zealand Standard	Addition of Local Codes
2. Target Vessel	414 GRT Vessels - 5.0 m 55.0 m HWL: + 1.50 m LWL: ±0.0 m		
3. Design Water Depth (m)			
4. Berth Length (m)			
5. Tides			
6. Design Wave			
Offshore Wave Height Ho (m)	5.9	12.0	Change fromWave Hind-cast
Period To (s)	8.8	13.4	
Significant Wave Height H1/3 (m)	2.4	7.2	
7. Seismic Coeficient kh	0.1		
8. Soil Condiions			
DL+0.5 m (GL)~-4.5 m:	Coral Rock		
DL-4.5 m~:	Calcareous Sand and Volcanic Sand		
9. Loading			
1) Live Load	T14 or q=1 tf/m2 (Normal) q=0.5 tf/m2 (Seismic)		
2) Dead Load (Unit weight, tf/m3)			
Plain Concrete	2.3		
Reinforced Concrete	2.45		
Steel	7.85		
Stone/Rock	2.6		
Seawater	1.03		
10. Allowable Over-top: qa (m3/m/s)	1 x 10-4		

(1) Codes and Standards for the Design

The original design was conducted using Japanese Standard for Port and harbour Facilities and corresponding cost estimate guidelines of the Japanese Ministry of Transport. For consistency and due to non-availability of national codes and standards in Vanuatu and adjacent countries, the same Japanese standard and guideline are used in this rehabilitation. However, National

Building Code of Vanuatu and its source of New Zealand standards will also be referred to select appropriate design seismic coefficient and utilisation of local materials, when so required.

(2) Target Vessels

In view of the vessels used for domestic services in Vanuatu, maximum size of the target vessels in this rehabilitation is determined as 414 GRT. The rehabilitation also considers small boats and barges currently utilising Lenakel wharf. (Refer to section 4-4-2 Basic Design of Wharf in "Basic Design Study Report on the Construction Project of Regional Commercial Centres in Vanuatu", March 1985)

(3) Design Water Depth and Length of the Berth

Maximum draft of the target vessels of 414 GRT is 4 m. Taking in to account some margins and wave condition, design water depth of 5 m and crown height of 2.2 m are adopted.

Length of the target vessels is 40 m. With some margins during mooring, berth length of 55 m, as in the original design, is adopted.

- Design water depth: DL-5.00 m;
- Crown height: DL+2.20m;
- Berth Length: 55.0 m

(4) Design Tide Elevation

For the original design conducted in 1985, the following tide elevation was established:

- Mean High Water Level: DL+1.50 m;
- Mean Low Water Level: DL±2.20m. (Chart Datum)

Comparing tide data at Lenakel in Tanna Island for the past several years collected during the site surveys and measurements during the present hydrographic survey, the current tide elevation is about 20 cm lower than the above originally used.

Difference between the actual and original design elevation is small relative to the design crown height and water depth of the existing facilities. Therefore, the original tide is used for the present rehabilitation.

(5) Design Wave Height and Period

In the original design, wave height at the waterfront of the facilities was evaluated through the hind-cast of offshore waves based on the past wind data. In the present rehabilitation, past cyclone data in the area for a twenty year period were collected, which were then subjected to further wave hind-cast analysis based on their track, pressure at the centre, outer pressure and radius. From results of the analysis, design wave height in the present rehabilitation was determined as a stochastic one for a return period of 50 years.

	Original Design (1985)	This Rehabilitation*
Offshore Wave Height (m)	5.9	12.0
Offshore Wave Period (s)	8.8	13.4
Wave Height at Water-Front of the Facilities	2.4	7.2

* Refer to the Report on Wave Hindcast separately prepared.

The original design wave height is equivalent to that for a 30 year return period in the present wave hindcast. (Refer to the Report on Wave-Hindcast separately prepared.)

(6) Design Seismic Condition

Seismic force in the original design was evaluated by applying the local seismic factor of 0.1 to the dead load of the structures. The coefficient from National Building Code (New Zealand Standard NZS 4203) is almost identical to the above originally used. The same value is adopted in the present rehabilitation.

(7) Soil Condition

As the present rehabilitation is scheduled at the same location as the original facilities, no boring exploration was conducted during the site surveys. Soil investigation conducted during the original design is utilised.

According to the results of the soil investigation, from the ground surface (about DL+0.5 m) to the elevation of DL-4.6 m are layers of weathered coral rock, which has a compressive strength of less than 150 kgf/cm2 according to the present laboratory test of samples. Below this elevation, non-uniform formation of calcareous sand, shells and volcanic sandy soil was found, including gravelly corals.

(8) Loading Condition

Cargoes handled at the Wharf are daily living commodities, agricultural products, etc., the same as in the original design. Together with the considerations on the size of the target vessels, the following loading conditions are established in the present rehabilitation referring to the Japanese Standard for Port and Harbour Facilities:

1) Dead Load (unit weight of materials in tf/m3)

- Steel : 7.85;
- Plain Concrete: 2.30;
- Reinforced Concrete: 2.45;
- Stones/Gravels: 2.60.

2) Live Load (surcharge)

- T14 equivalent (1 tf/m2);
- seismic condition (0.5 tf/m2).

(9) Allowable Over-Topping

In the original design, no run-up of waves on the apron was permitted so as not to hamper the cargo handling operation. For the access road, allowable over-topping of the order of 10-4 m3/m/s was adopted to secure safety passage of vehicles. The same criteria are used in the present rehabilitation.

(10) Construction Plan and Cost Estimate

Almost all of the construction materials are imported in Vanuatu basically, but except particular material, construction materials can be procure in Port Vila through trading company. Big equipment shall be imported from near countries or Japan. Aggregate material for concrete can be obtained from

quarry 11 km far from the project site. The traffic road from quarry to project shall be maintained periodically.

1) Materials and Equipment

In Vanuatu, construction materials are almost all imported. Other than special materials, however, most of the common construction materials are available through importers at Port Vila.

Small construction equipment is also available from local contractors. Larger or special equipment required in port and harbour projects has to be mobilised from adjacent countries or Japan.

Concrete aggregates will be provided from a local quarry in Tanna Island about 11 km distant from the project site. Machinery and equipment for collection, crushing/grading and handling also has to be provided. In addition, roadway to the quarry is currently not well maintained for transportation, thus to be renovated and maintained during the construction period.

2) Contractor and Workforce

Several local contractors carrying out building construction are available at Port Vila. There is no such contractor that has experienced pf port and harbour projects.

Skilled workers and operators of construction equipment can be mobilised from Port Vila. Superintendents and engineers have to be mobilised from neighbouring countries or Japan. Available in Tanna Island are only labour for general civil works and drivers of small trucks and vehicles.

3) Utilities and Yards

No public power and drinking water is available in Tanna Island. Contractors have to provide such resources by themselves.

Telecommunications in the island is generally in good condition for both domestic and international lines through microwave network circuit around the archipelago. It is, however, required to install new telephone lines by the national telecommunication company after the approval of

the application. 20 days will be needed for the installation after the application, as well as installation fee.

Temporary yard for the rehabilitation is available adjacent to the project site.

4) Considerations of Climate in Construction

Around the area, stormy weather and rough sea conditions prevail from November to April, when cyclone attack is also frequent. Period of continuous rainy days and rough sea condition in this season should be excluded in the rehabilitation time schedule as much as possible, especially for material/equipment transport and barges/floating equipment mobilisation.

5) Construction Period

The rehabilitation will require 2.5 months for detailed design, including additional surveys, and 10 months for construction considering the above climatic constraints. (Refer to Table 2.2 Project Schedule)

2.2.3 Basic Plan

(1) Rehabilitation of the Facilities (Figure 2.1 and 2.2)

Based on the results from the site surveys and discussion with the Government of Vanuatu, the existing facilities are planned to be rehabilitated in the same position, while there 2 alternatives for the position of the access road. In the first plan, connection of the access road to the wharf is at the same position as the original, while in the second, the connection is shifted about 25 m on-land in order to allow natural wave dissipation on the coral reef, which enables smaller dimension of the access sections. The comparison is tabulated in the following Table 2.3, including the estimated costs for construction.

Table 2.3 Comparison of Alternatives for the Access Road

Items	Original Position	25 m further On-land
1) Top Elevation	DL+3.5 m	DL+2.4 m
2) Embankment Volume (m3/m) Weight (tf/m) Steel Sheet Pile (m/pc)	 18.4 42.3 FSP (Type-V)-7.6	 14.3 32.9 FSP (Type-IV)-4.7
3) Total Length (m)	40 (with Steel Sheet Pile)	40 (with Steel Sheet Pile) 31.5(with Steel Sheet Pile) Total 71.5
4) Others	Wave Protector behind the Wharf (23.4 x 1.3 x 0.9m)	None

As can be seen in the above table, the rehabilitation at the original position becomes shorter, but larger structures are necessary, which accompanies higher run-up inducing over-topping behind the wharf. Accordingly, the wave protector is additionally required.

In order to utilise existing access road and materials and basic concept of the rehabilitation is to construct same as original, original position shall be selected for this project.

Details of the present plan, arrangement of each component and structural considerations are explained hereunder:

1) Dredging

Dredging in front of the wharf to the design depth of -5.0 m is scheduled to cover the area shallower than -5.0 m originally dredged, which is estimated about 700 m2 as shown in Figure 2.1.

2) Reinforcement of the Damaged Sheet Piles

Damaged existing sheet piles of the wharf on both corners are reinforced by additional steel sheet piles to be driven to the same embedment as the existing ones. Required number of the sheet piles are 8 pieces at each corner, which consist of one deformed SSP, three at the front and four at the back. Space formed between the existing and reinforcing sheet piles is filled with concrete as shown in Figure 2.4.

Existing coping is severely damaged at the top. The damaged upper portion is chipped and removed to expose sheet pile head. New coping is formed to cover both the existing and reinforcing sheet piles with new concrete cast in place.

3) Foundation of Anchor Blocks (see Figures 2.2 and 2.3)

The existing concrete anchor blocks are not demolished in order to secure temporary construction space for the rehabilitation, although wash out of the foundation for the concrete blocks is evident. Along the portion where the foundation was washed out, new steel sheet piles are driven from the western corner of the wharf to eastward in order to prevent future washout from the foundation as shown in Figure 2.2. The sheet piles are driven behind the existing concrete blocks, which are fixed with the blocks by new anchor coping to be formed with new concrete cast in place.

Tie rods exposed to sea water in the portion washed out are all reinforced by 29 tie rods newly installed, which connect the steel sheet pile walls to newly formed anchor coping.

4) Foot/Toe Protection in front of the Wharf

30 ton grade concrete block of foot/toe protection in front of the wharf is required to satisfy stability criterion. In the present rehabilitation, concrete protection cast under water is placed, which is equivalent to the concrete block type. About 30 m3, 70 tons in weight, per batch is scheduled to be cast in place, considering the capacity of the equipment. The protection concrete so formed is effective against possible scouring without placement of stone/rock protection, thus making the structure more economical.

5) Section of the Access Road

In the present rehabilitation of the access road at the new position, variation of the sections is studied to determine whether the embankment body is directly subjected to wave action or it is on the coral reef extending on-land, where waves can be naturally dissipated by shoaling effect.

6) Existing Access Road

The existing access road will no longer be used as the principal function. Instead of the original role, the load is planned to be utilised as temporary parking space or temporary stock area for cargoes after minor repair on the damaged portion.

7) Pavement on the Access Road

Portion of the crusher-run pavement damaged and lost during the incident is planned to be replaced with concrete pavement up to the elevation of +3.0 m, where influence of cyclone attack is minimum.

In other area directly in contact with coral reef, rock is replaced with concrete cast in place. Area damaged by rainfall and cyclic attack of reflecting waves is also protected by revetment of steel sheet pile type.

8) Mooring Bitts

Complete replacement of the mooring bitts is scheduled, as severe corrosion of the materials is obvious. Anti-corrosive bitts of stainless steel are to be installed instead of the original cast-ion ones. Cost of the new bitts is estimated to be almost the same as the original.

Key features of the present rehabilitation are summarised in Table 2.4 below:

Table 2.4 General Particulars of Structures in the Rehabilitation

Structural Element	Structural Details	Remarks
1. Wharf		
1) Reinforcement at Corners of the Existing Steel Sheet Pile Wall	New steel sheet piles driven to -10 m behind the existing piles embedded	New coping concrete monolithically cast in place
2) New Anchor Pile	New anchor piles driven to -3.8 m behind the existing concrete anchor blocks with 29 new tie rods	Pile top connected to the existing concrete anchor blocks
3) Concrete Pavement	Replacement of the existing pavement with new concrete pavement monolithically cast in place with filling concrete	RC
4) Back Fill of the Wharf	Replacement of the existing crushed stone fill up to DL±0.0 m with new filling concrete	Monolithically cast in place with concrete pavement
5) Coping Concrete	Tip-off upper o.5 m and newly cast in place	Curb monolithically cast in place
6) Foot/Toe Protection	Demolishing the existing block and monolithically cast under water (30 tons or more per block)	Special mix for underwater casting
7) Dredging	Maintain -5.0 m for shallower area	On-land disposal
2. Access Road		
1) Type A, B	Gravity type concrete block with steel sheet piles (embedded -6.9m)	
2) Type C	Concrete pavement with wire mesh directly on the coral rock	25 cm thick concrete
3) Type D	Concrete pavement with wire mesh and steel sheet pile revetment	coping concrete works
4) Others	RC directly on the coral rock	shoulder repair of the existing access road

(2) Physical Scope of the Rehabilitation

Physical scope of the rehabilitation planned in the previous section is shown in Table 2.5 below:

Table 2.5 Physical Scope of the Rehabilitation

Structural Element	Dimension or Quantity	Remarks
1. Wharf		
1) Reinforcement at 2 corners of the Existing Steel Sheet Pile Wall	7.2 m long	Type IV, 11 l.m.
2) New Anchor Pile	34.4 m long	Type IV, 5.7 l.m.
3) New Tie Rod Installation	29 pieces	25 mm ø
4) Concrete Pavement	395 m2	0.5 m thick
5) Back Fill of the Wharf	395 m2	1.7 m thick
6) Coping Concrete	56 m long	new concrete of 0.5 m height
6) Foot/Toe Protection	180 m2	1.5 m thick on average
7) Dredging	700 m2	0.6 m deep on average
8) Mooring Fixture	Replacement of 5 existing units	anti-corrosive bitt
9) Fender	Replacement of 7 existing units	
2. Access Road		
1) Type A	25 m L x 5 m W	
2) Type B	15 m L x 5 m W	
3) Type C	36 m L x 5 m W	35 cm thick on average
4) Type D	20 m L x 5 m W	20 cm thick pavement and SSP Type III, 3~2 l.m.
5) Others (Shoulder of the existing access road)	23 m L x 1 m W	50 cm on average

It should be noted that collection and disposal of lost concrete blocks, demolition of damaged pavement, removal of apron lighting and corresponding transportation are not listed above, but to be included in the rehabilitation.

(3) Drawings

The following drawings of the rehabilitation are hereto attached:

- Figure 2.1 Rehabilitation Plan of the Access Road;
- Figure 2.2 General Plan of the Wharf Rehabilitation;
- Figure 2.3 Typical Section of Anchor for Wharf Rehabilitation;
- Figure 2.4 Details of Wharf Rehabilitation;
- Figure 2.5 Typical Section of the Access Road Rehabilitation (Type A and B)
- Figure 2.6 Typical Section of the Access Road Rehabilitation (Type C and D)

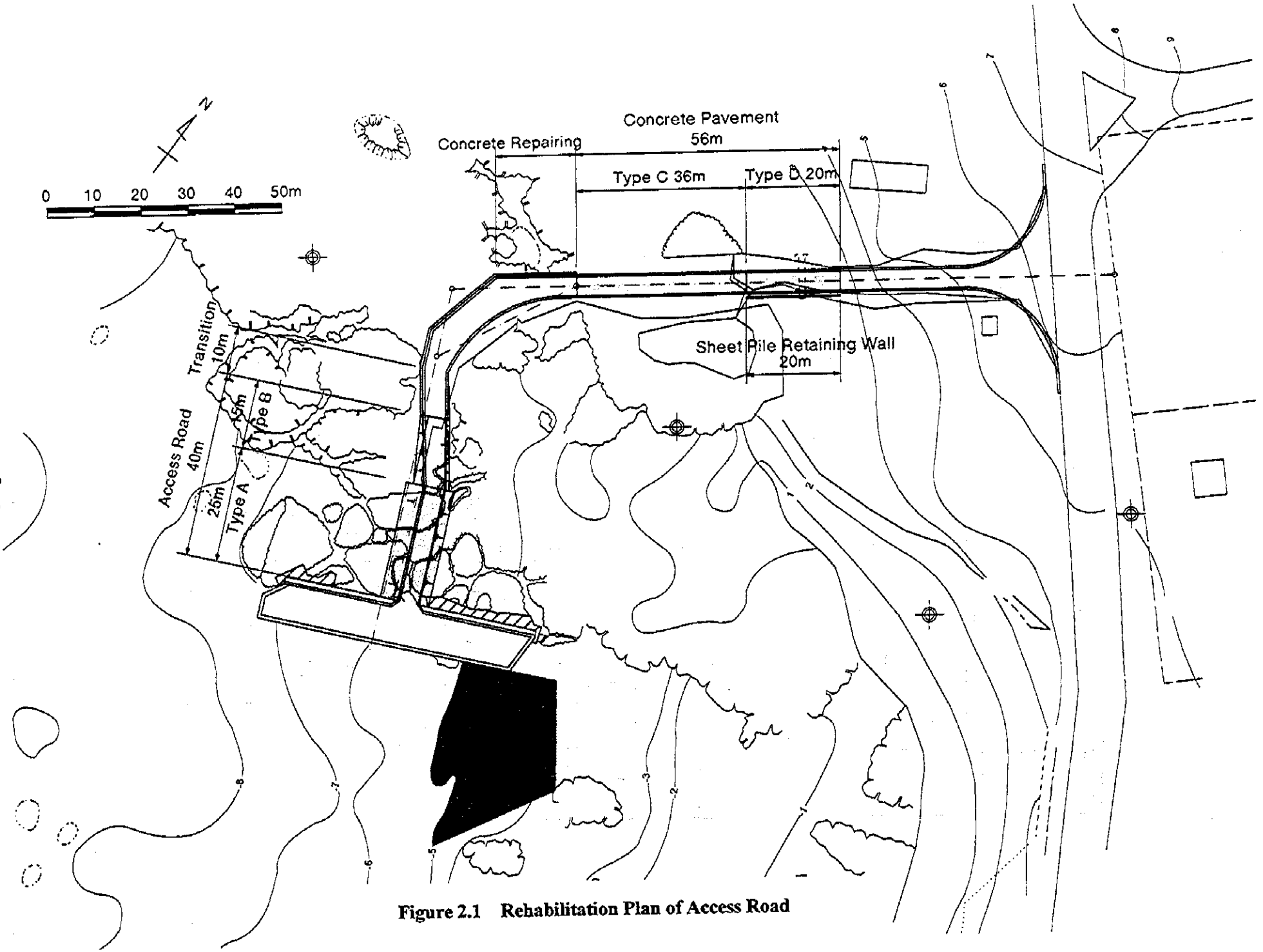


Figure 2.1 Rehabilitation Plan of Access Road

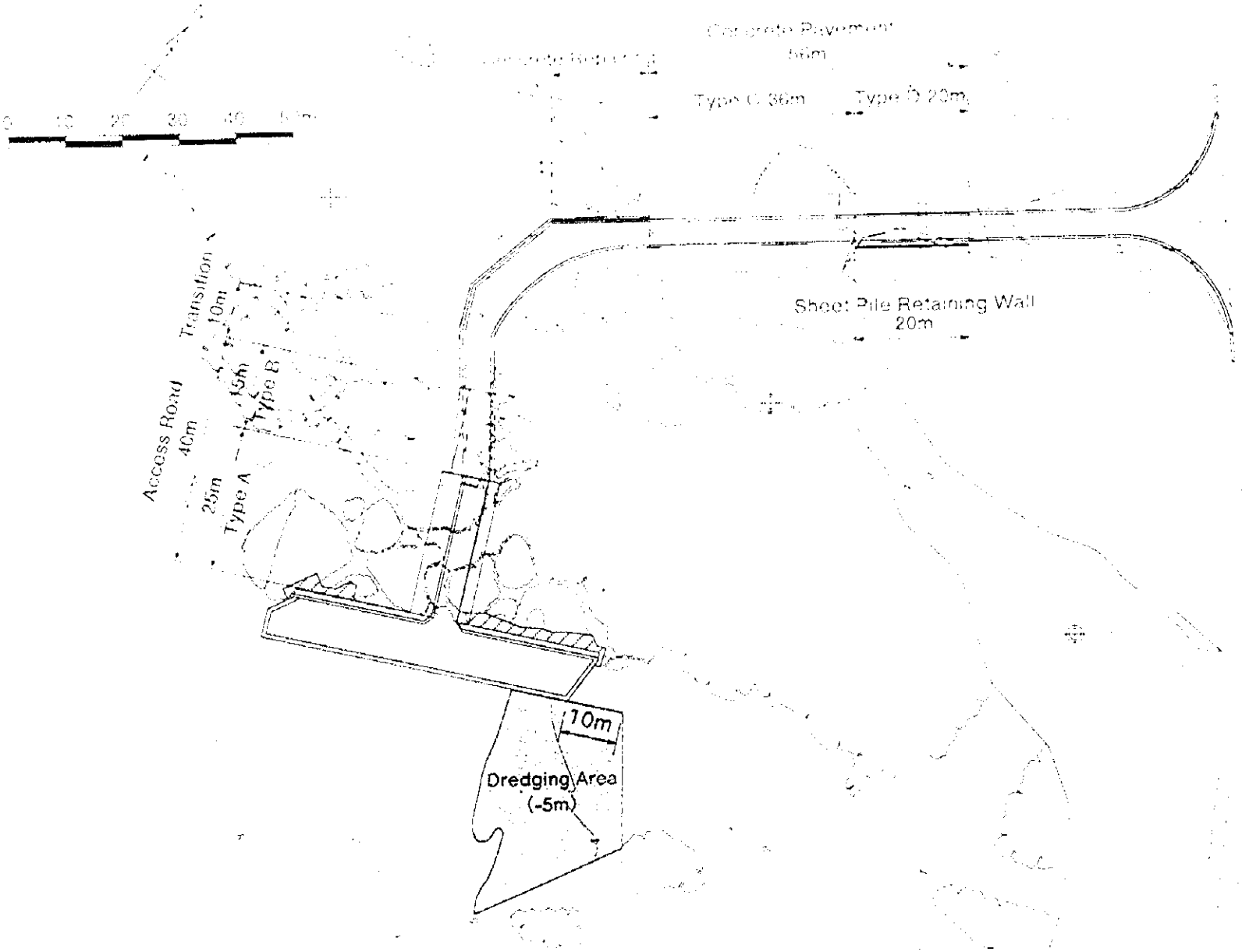


Figure 2.1 Rehabilitation Plan of Access Road

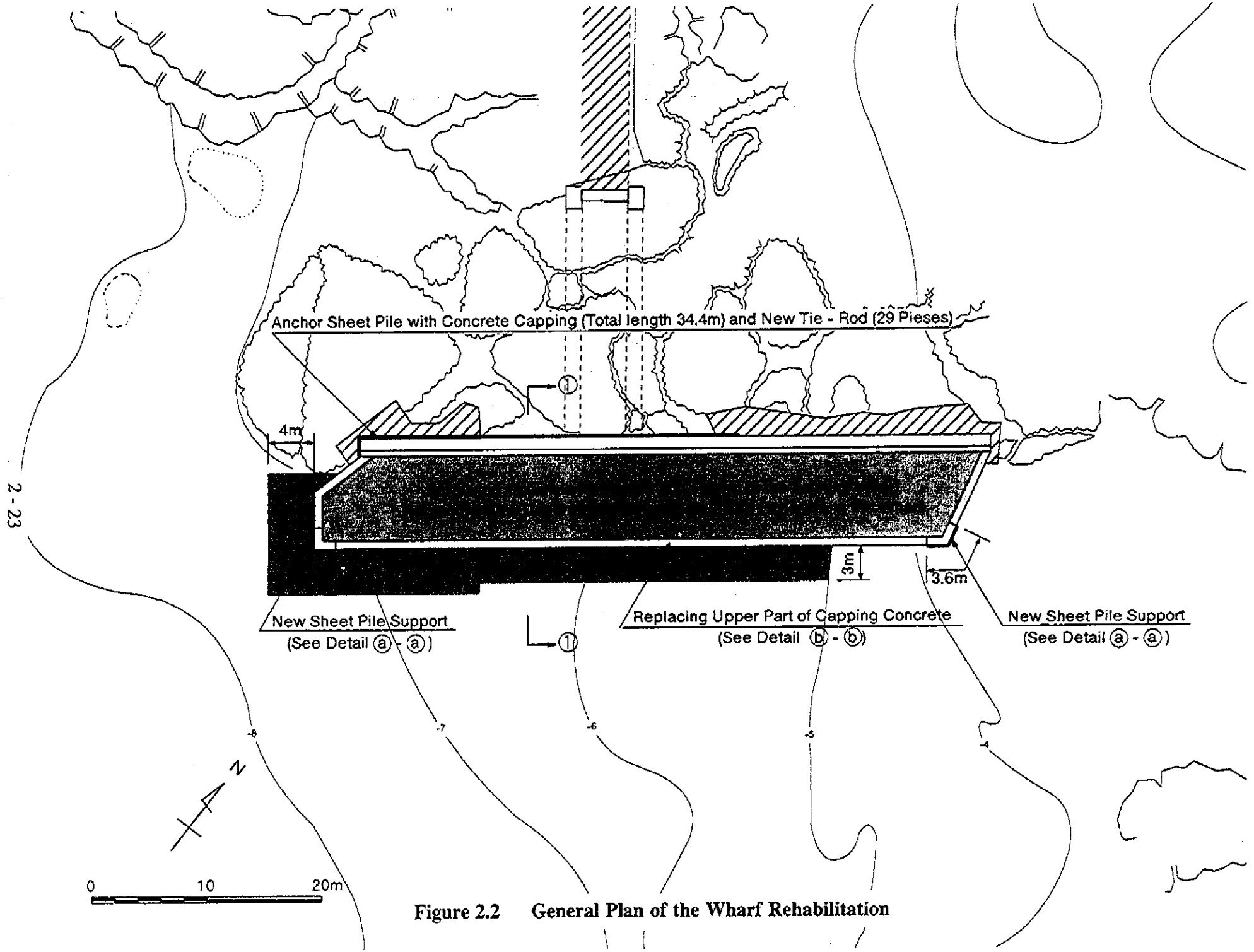


Figure 2.2 General Plan of the Wharf Rehabilitation

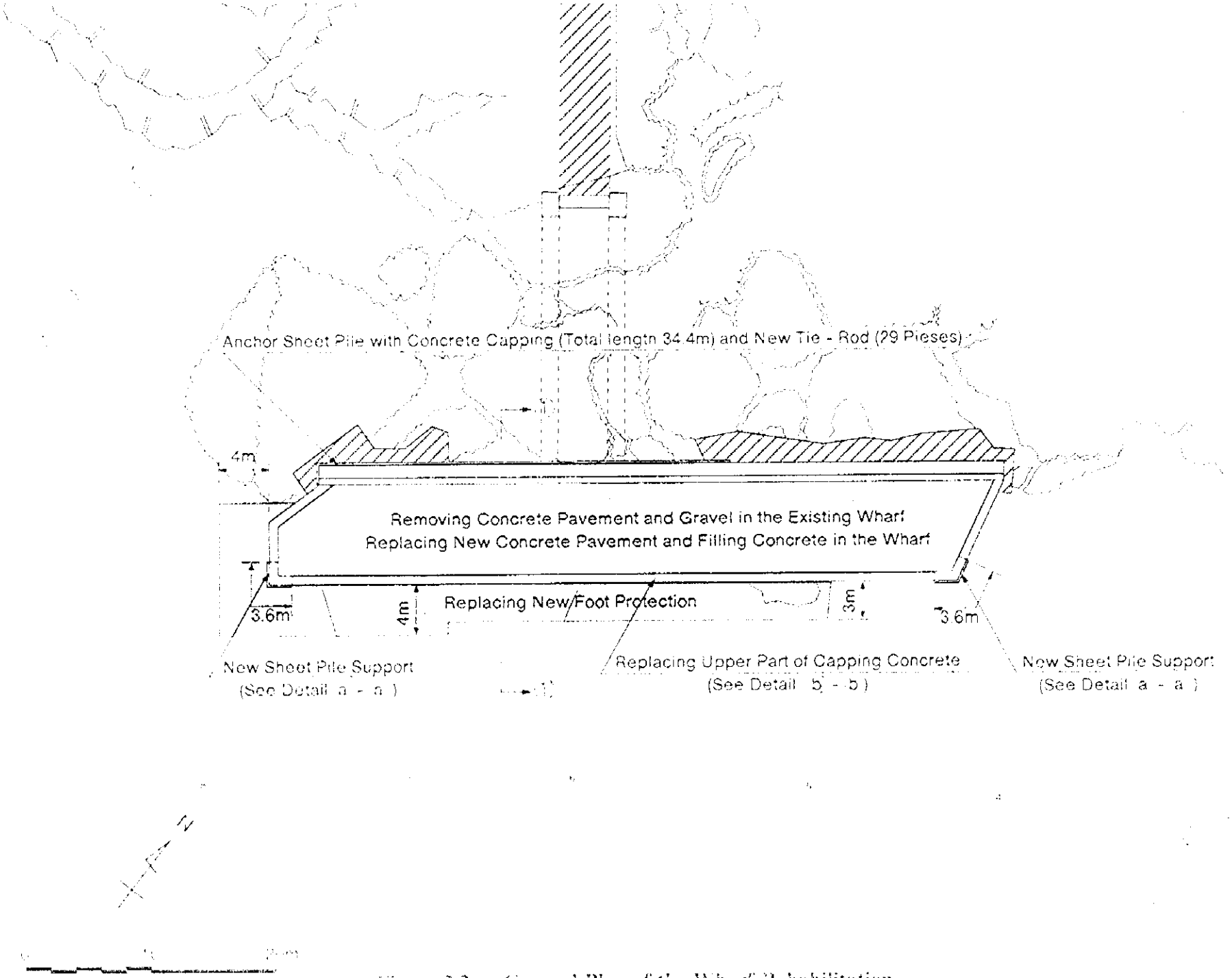


Figure 2.2 General Plan of the Wharf Rehabilitation

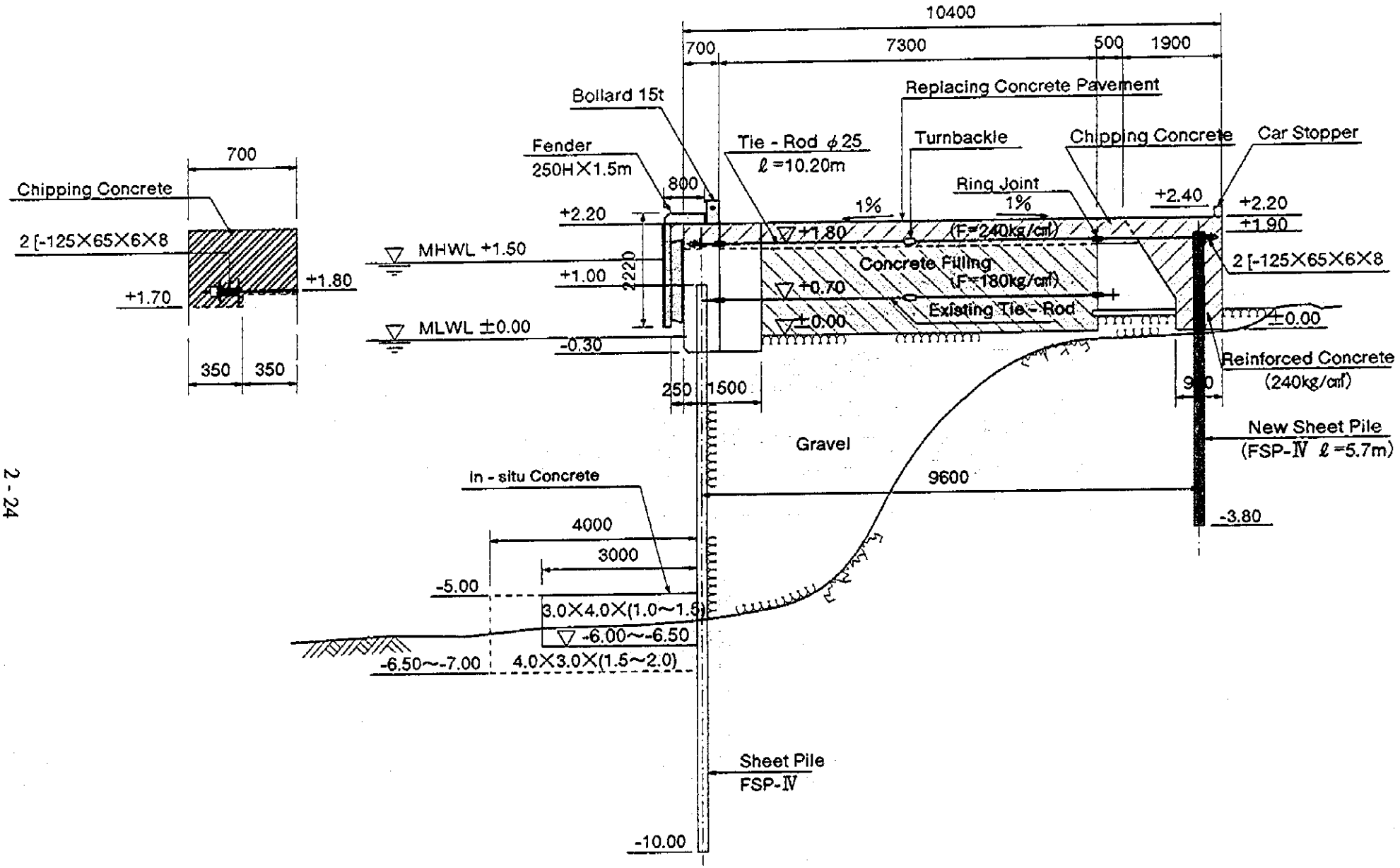


Figure 2.3 Typical Section of Anchor for Wharf Rehabilitation

(Section ①–①)

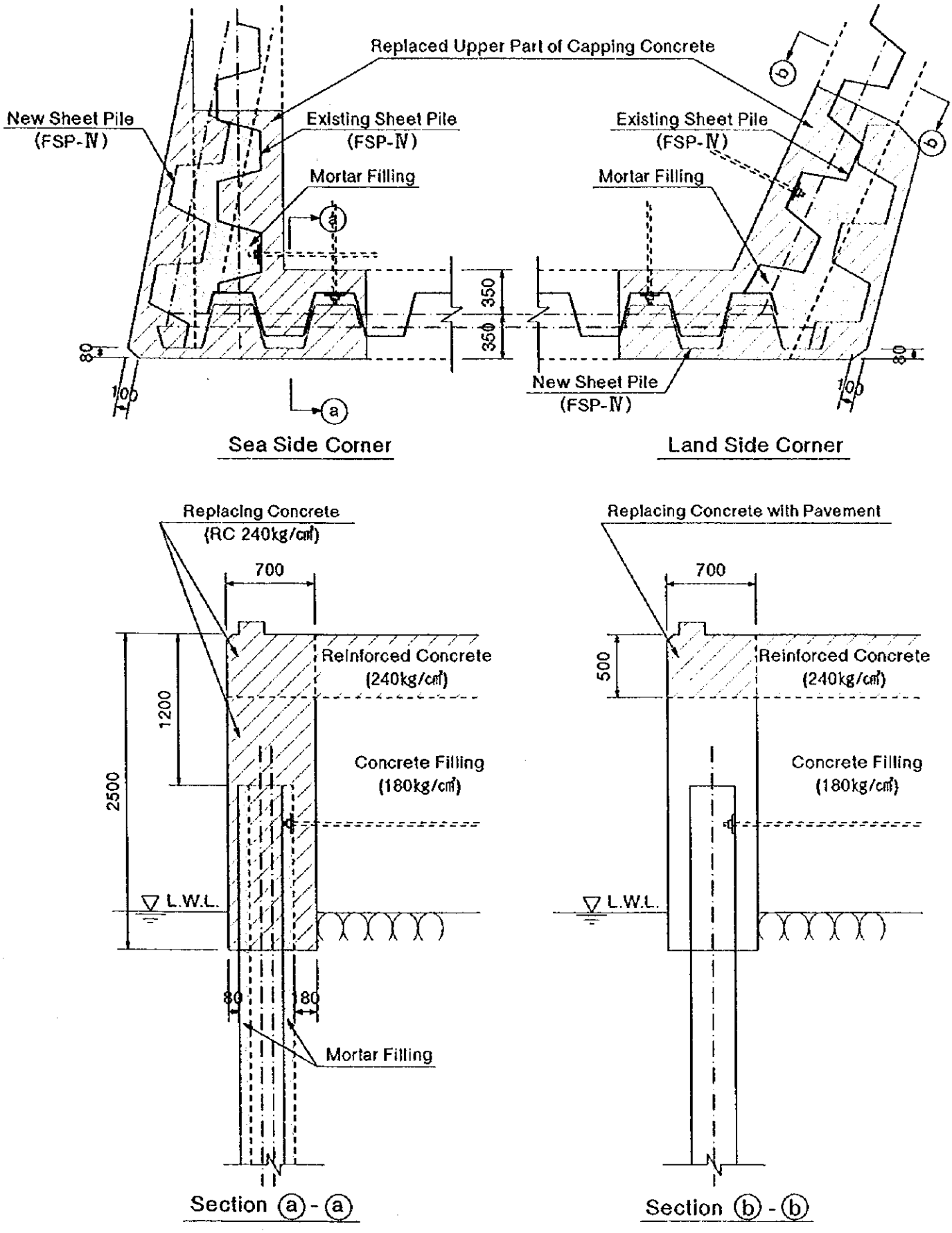
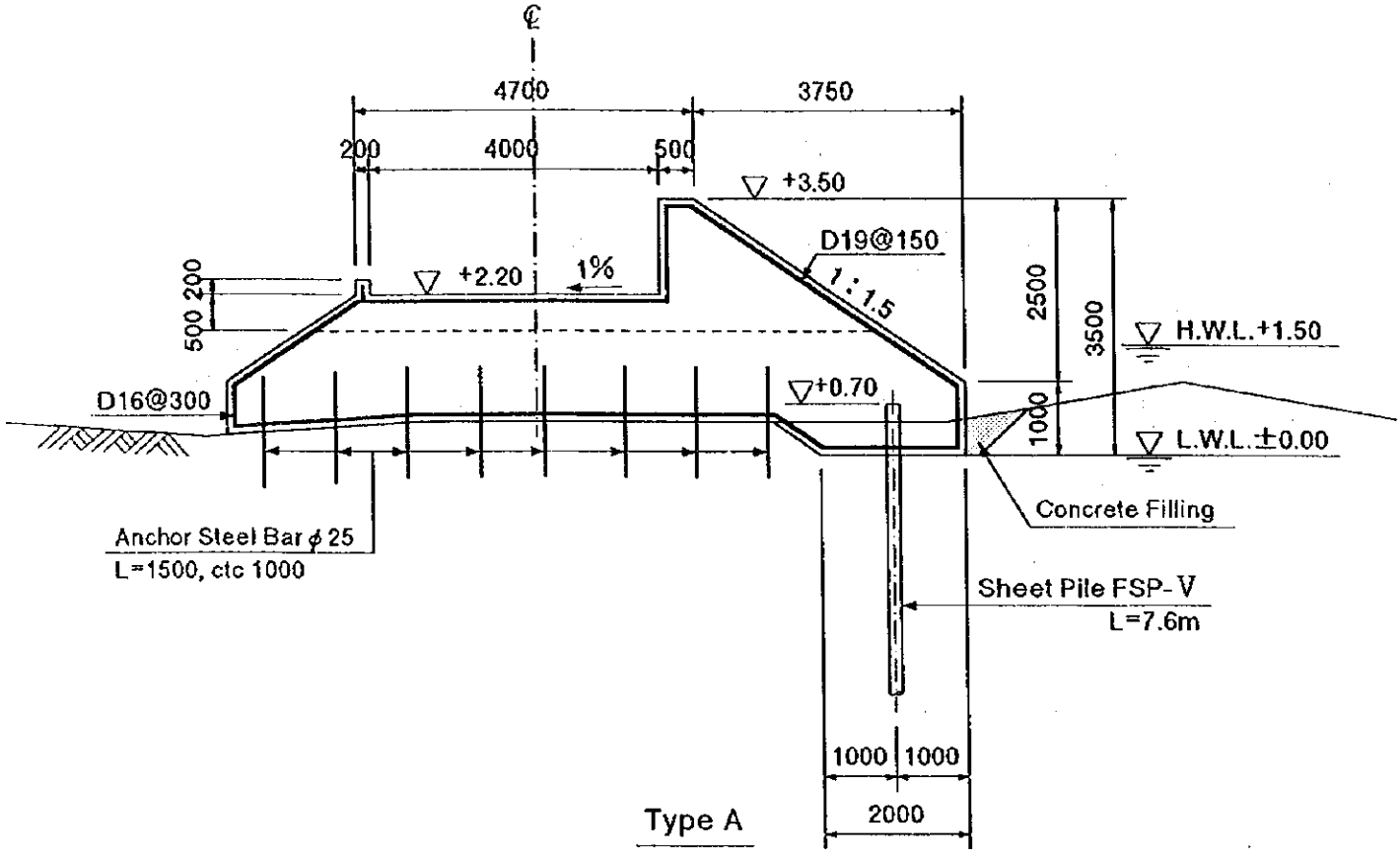


Figure 2.4 Details of Wharf Rehabilitation



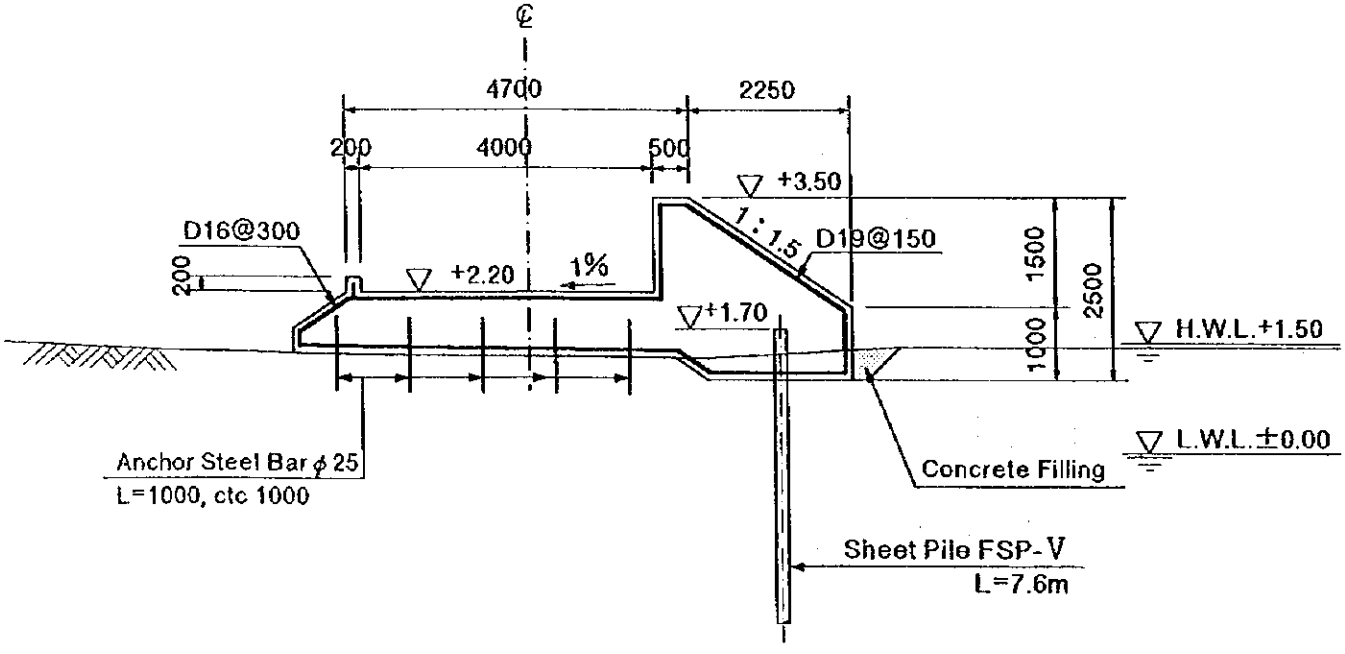
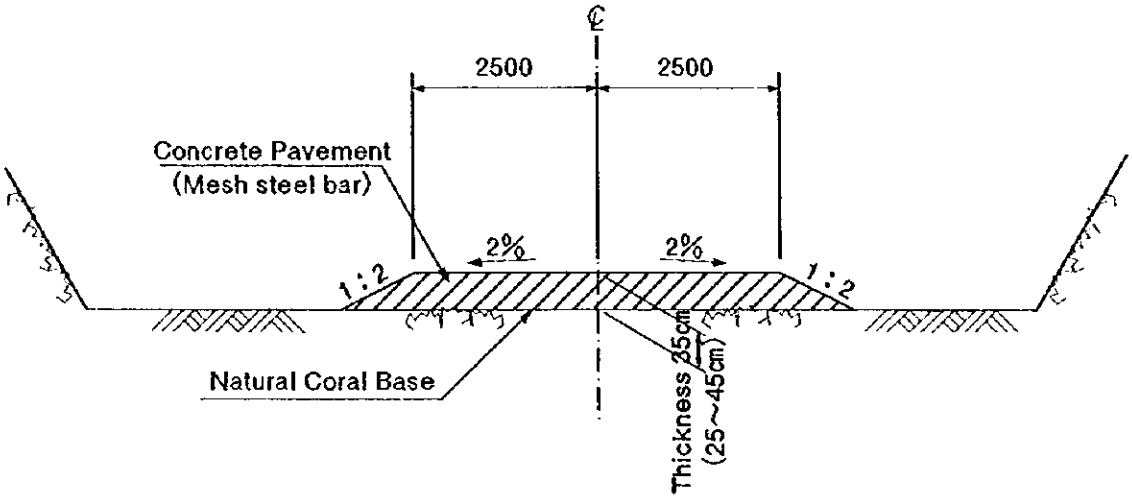
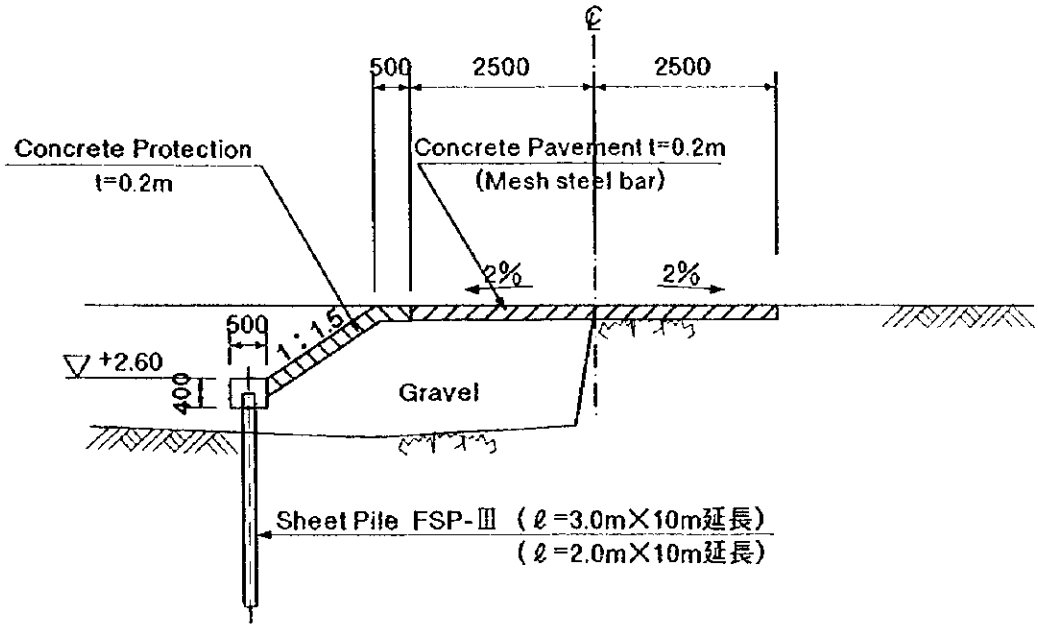


Figure 2.5 Typical Section of the Access Road Rehabilitation (Type A and B)



Type C (Slope : 2.5%)



Type D (Slope : 4.8%)

Figure 2.6 Typical Section of the Access Road Rehabilitation (Type C and D)

CHAPTER 3

IMPLEMENTATION PLAN

CHAPTER 3 IMPLEMENTATION PLAN

3.1 Implementation Plan

3.1.1 Implementation Concept

(1) As Tanna island is an important tourism resources in Vanuatu, with large numbers of tourists every year, during the construction period and after completion of the project, care will be exercised to protect the environment by considering construction method and disposal of the construction waste.

(2) As the construction materials and equipment will mostly be imported, and the cost of the materials, equipment and transportation is a large proportion of the project cost in Vanuatu, the materials available to in Vanuatu and the existing facilities for the project will be used as much as possible for economic and environmental reasons.

(3) The rainy season is from November to April, also the cyclones arrive in this season. In the implementation schedule, the rainy season will be avoided for transportation and construction.

(4) As Tanna island is an isolated island, the material and equipment transportation will take into account the route, method and time for the transportation.

(5) In accordance with the consideration of the wave condition at the site, all construction work except dredging work and the removal of the existing concrete block will be basically constructed from the land site. For the construction from the land site, a temporary road will be made along the planned access road.

(6) As Tanna island has no port facilities without Renakel wharf, the existing Renakel wharf will be utilized for the temporary unloading of the materials and equipment of the project. The temporary road between wharf and land site will be constructed together with the temporary road for construction.

3.1.2 Implementation Conditions

(1) Although there is no construction contractor in Tanna island, local people for the common labour and drivers for the cars will be employed for the project. However, the skilled labour and operators for the construction equipment will be ecruited from Port Vila, the capital of Vanuatu. For the skilled labour for particular work , foreman for the port construction and operator for special equipment, foreigners or Japanese will be employed. The local contractors in Port Vila will only be able to subcontract for supplying the labour force.

(2) The public water ,sewerage system and public electric power is not provided in Tanna island, so the water for construction and drinking water will be taken from the deep well installed by the contractor, also the electric power for construction will be provided by contractor's generator. The telecommunication system including IDD of Telecom company will be available in Tanna island.

(3) As the subsoil condition at the project site is coral rock, the method for driving the steel sheet pipe into coral rock must be taken into account.

(4) In accordance with conditions of the isolated island, the use of the large construction equipment, and using equipment at the same time in the schedule will be avoided, to decrease the amount of equipment needed for the project.

(5) The existing Renakel wharf is still being used for general cargo ship transportation three or four times per month. During the construction period, the wharf will not be able to be used. The ships will be anchored and unloaded to a small ship offshore around the port area. Therefore, the port area will be utilized for the construction together with general cargo handling operation, also a third party will enter the port area during cargo handling.

3.1.3 Scope of Works

In the implementation of this project, the work can be classified into that to be performed by the Japanese side and that by the Vanuatu side as follows:

Type of Works	Japanese Side	Vanuatu Side
Provision of Construction Work Site for the Project (including Temporary Work Yard)		○
Obtaining Permit for Utilizing Road for Construction.		○
Removal work of the Sunken Barge		○
Provision of Anchoring Area Unloading Work of General Cargo Ship		○
Provision of Disposal Area for Construction Waste		○
Rehabilitation of Wharf and Access Road	○	
Removing and Disposal Work of Existing Concrete Blocks	○	
Construction and Demolition of Temporary Road for the Project	○	

3.1.4 Consultant Supervision

The project will commence after all procedures have been completed under the Grant Aid Project Requirements and a Japanese Consulting Firm has signed a Contract Agreement for the Preparation of Tender and Contract Documents and Construction Supervision with the Executing Agency of the Government of Vanuatu, as verified by the Ministry of Foreign Affairs of the Government of Japan for this project. The consultant will perform his work for the Department of Public Works, who is the Executing Agency of the Government of Vanuatu for the project. The work undertaken by the Consultant will generally consist of the following:

(1) Execution of Detail Design

The consultant for the project will prepare the Tender and Contract Documents, Drawings, Technical Specifications, and the detailed construction cost estimate based on the Basic Design Study Report and Exchange of Notes.

(2) Tender Stage

The consultant will be responsible for preparing the Prequalification of Tenderers, and assist the Government of Vanuatu to conduct the Tender Advertising, Prequalification Evaluation of Tenderers, Receipt of Tenders,

Tender Opening, Tender Evaluation, Tender Negotiation, and Contract Award.

(3) Construction Supervision

The consultant will assign one resident engineer on a permanent basis to supervise the work and check the works in accordance with the contract documents. The Project Manager will supervise from time to time at site all works to ensure conformance with the contract documents and provide necessary instructions to the resident engineer.

3.1.5 Procurement Plan

As previously stated, the only construction materials and equipment procured in Tanna island is concrete aggregates, stones and coral aggregates. Also, the materials procured in Vanuatu are cement ,oil, fuel, steel products, and wood which was imported through a supplier in Port Vila. However, the supplier has no stock yard or shed for the steel products and wood, therefore, it has a problem to supply in a timely for the construction schedule. Also, now, the steel products and wood products procured from Japan will be cheaper than these materials procured in Vanuatu, including transportation cost. Therefore, these materials will be procured from Japan. The same conditions apply for construction equipment except barge, tugboat and bulldozer, so that most of the construction equipment will be transported from Japan.

For the route of transportation of the construction materials and equipment, it is planned to transport by a liner ship from Japan or other country to Port Vila. For transportation between Port Vila and Tanna island, it is planned to transport by a tugboat with barge. The following material sources are considered:

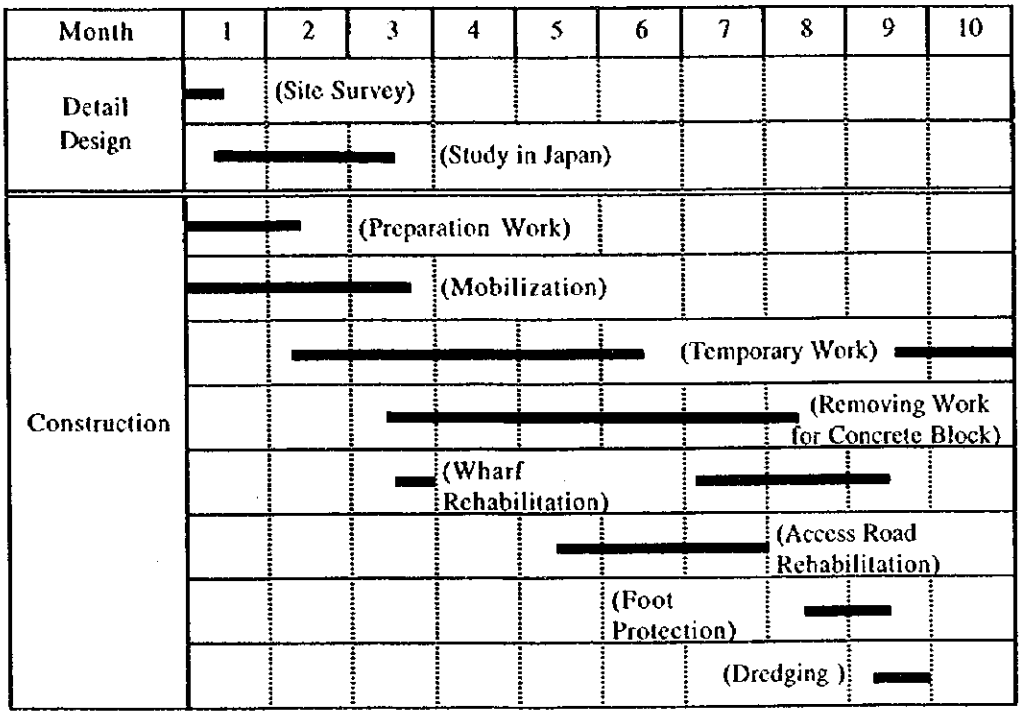
Local Sources : Fuels, Oil, Cement, Concrete Aggregates, Stones, Coral Aggregates

Japan : Steel Products, Steel Sheet Pile, Bollard, Fender, Wood Products

3.1.6 Implementation Schedule

The construction work will be implemented within one fiscal year, the detail design work will be completed followed by construction. The implementation schedule is shown in Figure 3.1.

Figure 3.1 Implementation Schedule



3.1.7 Obligation of the Government of Vanuatu

Necessary measures to be taken by the Government of Vanuatu in case Japanese Grant Aid is extended to the project.

(1) to secure the land necessary for the rehabilitation of the Renakel Wharf and Access Road;

(2) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities outside the site;

(3) to bear commission to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement;

(4) to ensure prompt unloading and customs clearance at ports of disembarkation in Vanuatu and internal transportation therein of the products purchased under the Grant;

(5) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Vanuatu with respect to the supply of the products and services under the verified contracts;

(6) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such facilities as may be necessary for their entry into the Vanuatu and stay therein for the performance of their work;

(7) to ensure that the Wharf and Access Road to be rehabilitated under the Grant be maintained and used properly and effectively for the Project; and

(8) to bear all the expenses, other than those covered by the Grant, necessary for the Project;

(9) to bear commissions, namely advising commissions of the Authorization to Pay (A/P) and payment commissions, to the Japanese foreign exchange bank for its banking services based upon the Banking Arrangement (B/A);

3.2 Project Cost Estimation for Vanuatu Side

The following works should be implemented by the Government of Vanuatu and necessary budget should be allocated timely from 1998 to 1999.

Work Item	Estimate Cost (VT)
Provision of Temporary Yard and Disposal Yard (3,000 m2)	60,000
Removing Sunken Barge	(To be removed by Contractor of New Airport Project in Tanna)
Resident Representative from Executing Agency (Construction Period)	500,000
Total	560,000

3.3 Maintenance and Management

(1) Maintenance system and scheme

The structure of the rehabilitation project is designed based on the maintenance free concept. However it is very important for the rehabilitated structure to be inspected and monitored periodically and after cyclones, earthquakes and incidental accidents. Even for maintenance free structures, it is very important to check the stability and safety of the structure as early as possible to ensure and extend the service period. The Tafea Provincial Government shall conduct the minimum inspection and monitoring as stated below.

1) Wharf

The damage of the steel sheet pile structure is cracks in the apron due to the rough waves and earthquake and corrosion of the steel piles. Faceline of the quay wall has been moved by earthquake due to increasing soil pressure, reaction of tie rod, and movement of anchor wall/pile. Apron concrete and foot protection block has been damaged by the cyclone. Wharf accessories such as mooring bitt, rubber fender and curb stone are damaged due to corrosion and loading/unloading activities.

A. Regular inspection

Inspection items of steel sheet pile structure are tabulated below;

Inspection Item

Location	Inspection Item
Wharf (steel sheet pile)	凹凸 of the faceline of quay wall Corrosion of steel sheet pile
Apron	Settlement, inclination, crack, damage of concrete joint
Foot protection block	Movement, settlement
Sea bed	Erosion of the sea bed in front of sheet pile
Accessory (Bitt and Rubber fender)	Damage, crack, tear, corrosion, bolts and nuts, paint, etc.

B. Irregular inspection

Irregular inspection means that after a cyclone, earthquake or incidental accident.

Inspection Item

Location	Inspection Item	Cyclone	Eq	Acci.
Wharf (steel sheet pile)	⊔⊓ of the faceline of quay wall Inclination of sheet pile	○	○	○
Apron	Settlement, inclination, crack, damage of concrete joint	○	○	○
Foot protection block	Movement, settlement	○	○	○
Sea bed	Erosion of the sea bed in front of sheet pile	○	○	○
Accessory (Bitt and Rubber fender)	Damage, crack, tears, bolts and nuts, etc.	○	○	○

C. Inspection of corrosion

There are two methods for the corrosion inspection of steel material, one is sight inspection and the other is measuring of sheet pile thickness. Sight inspection is to record rough corrosion condition of all steel sheet piles and thickness measuring method is to get the actual thickness of each sheet pile which needs the stability study. After the thickness measurement, corrosion rate per year shall be calculated for the future stability study of the sheet pile.

To decide corrosion rate, there are two methods, one is to measure the thickness of the existing sheet pile, and the other is to measure a specimen of the steel material. For the thickness measuring, corrosion rate is calculated as original thickness minus actual thickness divided by service period. For the specimen method, corrosion rate is calculated as original weight minus actual weight divided by service period. Calculation formula is shown as follows. Steel sheet pile is located in the tidal zone, sea water and sea bed, therefore, the test specimen shall be connected to the sheet pile by electric wire to ensure the same conditions. It is recommended to

install several test specimens at the Tanna wharf area during the rehabilitation project.

Corrosion rate (mm/year) = (T1 – T2)/t

T2 = 10 x W/Ad

T1 : Original thickness (mm)

T2 : Actual thickness (mm)

t : Service period (year)

W : Weight of specimen (g)

A : Surface area of the specimen (cm2)

d : Specific gravity of specimen (7.85g/cm3)

Other Inspection

Location	Item	Method	Pitch
Coping, pavement	Settlement	Level survey of coping concrete and pavement	10 ~ 20 meters
	Inclination	Survey by diver	3 locations/wharf
	Crack, strength, steel bar, etc	Crack, hair crack, segregation, damage, etc (length, width, depth, location, steel bar, condition, etc)	All locations
Foot protection	Movement, settlement	Survey by diver(measure, lead)	10 meters
Sea bed	Erosion	Sounding(20 m wide)	10 meters

D. Particular requirement

Frequency of the regular and irregular inspections is once a year and after the cyclone or earthquake. Inspection of bitt and rubber fender is every six months. It is noted that cracks are likely to be found on the apron or anchor block after earthquake. It is also noted that erosion of the sea bed and movement and/or settlement of the foot protection block are usually found after the cyclone. Corrosion rate of the sheet piles varies due to the sea water condition, temperature, current, location, etc., and it is recommended to inspect every year.

E. Evaluation

Evaluation of the steel sheet pile structure is made based on the stability of the structure. The allowable movement or settlement of the coping concrete and pavement is around 5 cm from the original position or elevation. If corrosion of the sheet pile is more than 4 mm, the stress of the sheet piles will exceed the allowable stress, or if the settlement of the foot protection block is more than 50 cm (EL –5.50 m) after a cyclone. In all the cases above, stability of the sheet pile shall be confirmed based on the appropriate design method to assure the present condition and future service period. The earlier the rubber fender and bitt are inspected the longer service period can be obtained. Steel frame of the rubber fender shall be painted periodically.

F. Countermeasures

Methods of repair of the steel sheet pile due to corrosion are ;
i) reinforced by concrete or reinforced by steel material
ii) cathodic protection, lining, anticorrosion tape, cover protection
The most appropriate method for this project may be cathodic protection, where aluminium alanode is welded on the sheet pile.

2) Access road

The damage to the access road is settlement, cracks, damage of construction joint of the concrete and pavement after the cyclone.

A. Inspection Item

Inspection Item

Location	Inspection item	Inspection method
Concrete	Movement, settlement, inclination	Movement, settlement, inclination
	Crack, hair crack, segregation, steel bar	Crack, hair crack, segregation, damage, etc (length, width, depth, location, steel bar, condition, etc)
Pavement	Crack, hair crack, segregation	Same as above
Steel sheet pile	Corrosion	Corrosion condition

B. Corrosion Inspection

Refer to wharf section above.

C. Particular requirement

Refer to wharf section above. Concrete crack/hair crack and damage of steel sheet piles shall be inspected in detail during low tide.

D. Evaluation and countermeasure

Refer to wharf section above.

(2) Cost of the maintenance and management

The expenditure of the Tafea Provincial Government for the last three years is as stated below;

(unit: VT)

	1995	1996	1997
Actual expenditure	52,900,000	74,600,000	Not yet fixed

According to the provincial government, about 40 % of the above expenditure is the subsidy from the Government of Vanuatu. Estimated cost of the maintenance and management of the project is around 1,000,000VT/year for the remuneration of one additional staff including inspection, collection of the cargo movement and minor repair such as painting. It is also estimated that if additional expenditure is collected by berthing tariff, it will be 25,000 VT/call (250VT/ton). It is reasonable to increase the berthing tariff because of the small additional cost.

「Sight inspection of sheet pile」 Sample of inspection sheet

Name of Port	Tanna wharf	
Name of Facility	Wharf	
Type of Structure	Steel sheet pile	
Planned water depth	-5.00 m	
Length of the Facility	55.0 m	
Date of Construction	Day Month Year	
Tide	M.H.H.W.L +1.5 m、M.S.L +1.75 m、M.L.L.W.L ±0.0 m	
Type of Steel sheet pile	Type IV	
Exposed EL. Of pile	-0.30 m	
Method of corrosion protection	Thickness of steel sheet pile	
Survey date	Above water Day, Month, Year	Above water Day, Month, Year
Whether	Fine	Fine
Tide at the inspection	+0.05 m	+0.5 m
Area of inspection	Above±0.0 m	Above±0.0～-2.0 m
Name of inspector	○○○○	○○○○
Condition of corrosion	Surface corrosion at EL±0.0～+0.7m	
Corrosion hole	±0～+0.5m No. of sheet pile	
Adhesion material	Adhere shell at EL±0.7m No adhesion material at EL. ±0～+0.7m	
Other inspection item		
Picture	Attach picture and sketch	
Remarks		

「Test specimen method」 Sample of inspection sheet

Name of Port	Tanna wharf
Name of Facility	Wharf
Type of Structure	Steel sheet pile
Planned water depth	-5.00 m
Length of the Facility	55.0 m
Tide	M.H.H.W.L +1.5 m、M.S.L +1.75 m、M.L.L.W.L ±0.0 m
Type of steel sheet pile	Type IV
Exposed EL. Of pile	-0.30 m or +0.50 m
Date of piling	Day, Month, Year
Method of corrosion protection	Thickness of steel sheet pile
Survey date	Day, Month, Year
Whether	Fine
Name of inspector	○○○○
Location of inspection	Attached dwg－1 location attached dwg－2
Condition of corrosion	Corrosion rate (mm/y) = $\frac{T_1-T_2}{t}$, $T_2=\frac{10W}{Ad}$ T_1, T_2, W, A, d
Remarks	

「Wharf and access road」 Sample of Inspection Sheet

Name of port	Tanna wharf	Tanna wharf	Tanna wharf
Name of Facility	Tanna wharf	Tanna wharf	Tanna wharf
Structure	Coping concrete	Pavement	Foot protection block
Planned Seabed	-5.0 m		-5.0 m
Length of Facility	55 m		
Tide	M.H.H.W.L +1.5 m、M.S.L +1.75 m、M.L.L.W.L ±0.0 m		M.H.H.W.L +1.5 m、M.S.L +1.75 m、M.L.L.W.L ±0.0 m
Construction Date	Date, Month, Year	Date, Month, Year	Date, Month, Year
Design strength	σ =240 kg/m2	σ =240 kg/m2	σ =180 kg/m2
Inspection date	Date, Month, Year	Date, Month, Year	Date, Month, Year
Whether	Fine	Fine	Fine
Name of Inspector	○○○○	○○○○	○○○○
Settlement	< 5cm	< 5cm	< 5cm
Inclination	< 1%	< 1%	
Movement			
Crack Segregation Damage	Length, depth, pitch, attach sketch and picture	Length, depth, pitch, attach sketch and picture	Length, depth, pitch, attach sketch and picture
Remarks			

3.4 Environmental Impact Assessment

(1) Sources of Environmental Impact

A. During Construction Stage

The sources of environmental impact which could be caused by the proposed plan can be divided into three components as follows:

a. Noise, Vibration and Air quality impact by the operation of heavy construction equipment.
b. Sea water quality impact, Marine biota impact by Dredging and Concrete work.
c. Socio-economic environmental impact by the area in the port occupied for the construction.

B. After Construction

a. Coastal hydrology environmental impact by new constructed facility
b. After construction, re-establishment of the functions of the port operation and safety operation by the project.

(2) Identification of Environmental Impact

A project impact matrix that covers the possible impacts on environmental elements during and after construction is shown in Table 3.3.

(3) Forecast and Evaluation of Environmental Impact of the Proposed Plan

A. Socio-economic Environment During Construction

a. Land Use

As the project purpose is rehabilitation of the existing wharf and access road which was damaged by a cyclone, it is not necessary to allocate new land for the construction facilities yard. The temporary yard for the construction shall be borrowed from the land owner during the construction period. However, the temporary yard would be allocated around the construction yard, which is unoccupied land, therefore any removal would not be neccessory.

Table 3.3 Environmental Impact Matrix for the Proposed Project

Project Component		Socio-economic Environment												Physical and Natural Environment								
Environmental Element		Land Use	Coastal Use	Traffic	Infrastructure	Community	Migrant population	Fishery	Employment	Public Health	Cultural Values	Recreation	Aesthetics	Slope Stability	Coastal hydrology	Sea water quality	Ground water quality	Air quality	Noise	Vibration	Terrestrial biota	Marine biota
During Construction	Operation of equipment			-1									-1					-1	-1	-1		-1
	Transportation		-1					-1				-1	-1					-1	-1	-1		-1
	Removal and demolition		-1					-1	+1				-1					-1	-1	-1		
	Rehabilitation of Wharf		-1						+1				-1			-1						-1
	Rehabilitation of Access road								+1				-1		-1	-1						-1
	Dredging work		-1					-1					-1			-2						-1
After Construction	Disposal of construction waste	-1											-1									
	Wharf		+2	+1	+3		+1						+1	+2								
	Access Road		+1	+3	+3								+1	+2	-1							-1

Environmental Impact Rate

-3 : Significant negative impact
-2 : Moderately negative impact
-1 : Negligible negative impact

+3 : Significant positive impact
+2 : Moderately positive impact
+1 : Negligible positive impact

b. Coastal Use

During construction, the port facilities and port area around the wharf will not be able to be used for general port operations. The general loading/ unloading port operation would be handled by a small ship in another area of the port. It is possible that the port area can be divided into construction area and port operation area, so the impact is not expected to be serious.

c. Traffic

During construction, the maintenance of the public road used for the project would be incorporated into the project, also there are no traffic jams in Tanna island. Therefore, impact on the traffic is predicted to be low.

d. Fishing

The main fishery is outside of the port area, and the number of fishermen working in this area is very small. Therefore, impact on fishing is predicted to be low.

e. Public Health

Assuming that concrete dust will be generated by demolition of existing structure of the wharf, the generated dust may affect the condition of residents health. However, the construction area is about 1km from the residential area, so impact on the public health is not expected to be serious.

f. Employment

For the construction work, local common labour would be employed in the project, and the opportunities for employment in Tanna island are few. Therefore, the construction work will increase the opportunities for employment.

g. Aesthetics

Tanna island has many tourism resources, and attracts many tourists every year. However, the wharf area has no tourism

attractions. Therefore, impact on the aesthetics aspect is predicted to be low.

B. Physical and Natural Environment During Construction

a. Sea water Quality

Assuming that turbid water will be generated by dredging work, the generated turbid water may influence living conditions for the marine biota. However, in the basic study of the site, live coral is not found in this area, also marine biota community is not found. Taking the construction method such as clamshell bucket dredging into consideration, it seems reasonable to suppose that not so much turbid water will be generated by the dredging work. Small fish may be affected by turbid water in the construction site. These fish, however, are expected to return to the area after turbid water is no longer generated. Therefore, impact on the water quality is not expected to be serious.

b. Air Quality, Noise and Vibration

Noise, vibration and air quality will be affected by construction equipment. As previously explained, the construction yard is about 1 km from the residential area, also the construction work would not be executed at night. Therefore, impact on these aspects is not expected to be serious.

c. Terrestrial biota

There are no protected terrestrial biota in the project area.

C. Environment After Construction

a. Coastal hydrology environmental impact by rehabilitated facility

It is expected that no geographical conditions would be changed compared with original plan because there is no additional structure in the new plan.

(4) Conclusion

During construction, it is assumed that impacts will be generated on the socio-economic and natural environment. However, these impacts are predicted to be low and over a small area. Therefore, impact to the environment is not expected to be serious. Also, taking conditions after construction into account, this project would be positive for the socio-economic aspects.

CHAPTER 4

PROJECT EVALUATION AND RECOMMENDATION

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

4.1 Project Effect

In order to rectify up-grading of living standards in the provinces and improvement imbalance of the regional socio-economy among the islands, the government established their Phase III national development policy. Tanna wharf was constructed as one of the facilities planned in "Project of Regional Commercial Centres in Vanuatu" by Japanese Grant Aid Scheme. According to the survey conducted, outward cargo volume of agricultural products handled at Lenakel was about 1,000 tons per year on average until 1994. Although the cargo volumes after the incident have dropped to about 600 tons per annum due to inconvenience and inefficiency of the cargo handling operation at the berth and temporary termination of shipping for agricultural products of poor and low quality, the inbound cargo volume from Port Vila handled at Lenakel has remained almost constant since the incident, at about 4,000 tons per annum, reflecting the essential nature of the cargoes, such as daily commodities, construction materials and fuels consumed in the area. Tourism is one of the most important industry in Vanuatu and foreign revenue of tourism in 1991 is about 38.5 million vatu which equivalent double of total export of commodities. Tanna island is designated for the one of tourism development area in Vanuatu and new Tanna airport is supposed to complete at the end of July 1998. Cargo handling volume of Tanna wharf will not decrease due to the operation of new airport because transportation of the former is agricultural material, daily commodities and construction material and the latter is only passengers.

With the rehabilitation of the project, the following project effect can be expected;

(1) The drop of outbound cargo volume will recover to the original level or more by the rehabilitation of the facilities, which resolves the present inefficiency in cargo handling operation.

(2) Rehabilitation of the facilities will cause cost down of the transportation of daily commodities and recover effective and safe handling of cargoes.

(3) Construction of a new airport will be completed in July 1998 and will also contribute to tourism promotion around the area. The airport project will

accelerate the resulting in increasing volume of seaborne cargo which can not handle by the existing facilities.

4.2 Recommendation

Implementation of the rehabilitation of the Tanna wharf will no doubt provide many good effects, and the project itself will contribute to elevate the Basic Human Needs (BHN) of the people of Vanuatu, and prove its value in the implementation as Grant Aid Project. The operation and maintenance for this project will be performed by Tafea Provincial Government in association with Department of Public Works.

With the rehabilitation of the project, above mentioned project effect can be expected provided that following obligation of the government of Vanuatu can be conducted.

(1) Government of Vanuatu removes the sunken barge in front of wharf before the commencement of the project.

(2) The structure of the rehabilitation project is designed based on the maintenance free concept. However it is very important for the rehabilitated structure to be inspected and monitored periodically and after cyclones, earthquakes and incidental accidents.

(3) In the management aspect, an administration in the executing agency should also be provided, which can collect cargo statistics in Tanna Island officially for the future port planning.

APPENDIX 1

Member List of Survey Team

Appendix - 1 Member List of Survey Team

(1) Survey Stage

Name	Position	Belonging
Mr. Noriaki NISHIMIYA	Team Leader	Planning Division, Grant Aid Project Management Department, Japan International Cooperation Agency (JICA)
Mr. Haruichi TANIGAWA	Technical Adviser	Coast Administration and Disaster Prevention Division Disaster Countermeasure Office
Mr. Isao HINO	Facilities Planner	Pacific Consultants International
Mr. Hiromi NAMIKI	Port Engineer	Pacific Consultants International
Mr. Noboru KOYAMA	Natural Condition Survey	Pacific Consultants International
Mr. Kazunori KASHIMA	Cost Estimate/ Construction Planner	Pacific Consultants International

(2) Draft Report Explanation Stage

Name	Position	Belonging
Mr. Norihiro IKEDA	Leader	First Project Management Division Grant Aid Project Management Department, Japan International Cooperation Agency (JICA)
Mr. Isao HINO	Facilities Planner	Pacific Consultants International
Mr. Hiromi NAMIKI	Port Engineer	Pacific Consultants International

APPENDIX 2

Survey Schedule

Appendix - 2 Survey Schedule

Survey Stage

	Date	Stay	Activities
1	Mar. 15, 1998(Sun)	Tokyo-Vanuatu	Travel
2	Mar. 16, 1998(Mon)	Port Vila	Greeting with Department of Public Works and submission of Inception Report
3	Mar. 17, 1998(Tue)	Port Vila	Greeting with Ministry of foreign Affaire and National Planning Office
4	Mar. 18, 1998(Wen)	Port Vila	Project Site Visit and Greeting with Tafea Provincial Office
5	Mar. 19, 1998(Thu)	Port Vila	Meeting with DPW and Meteorological Data Collection in Fiji
6	Mar. 20, 1998(Fri)	Port Vila	Signing of Minutes of Discussion and Data Collection
7	Mar. 21, 1998(Sat)	Tanna/Nadi	Team Leader travel to Nadi. Other members travel to Tanna Island
8	Mar. 22, 1998(Sun)	Tanna/Suva	Team Leader travel to Suva. Other members Site Survey
9	Mar. 23, 1998(Mon)	Tanna/Suva	Explanation to JICA and Embassy in Fiji. Survey and Data Collection
10	Mar. 24, 1998(Tue)	Tanna/Port Vila	Team Leader travel to Japan. Meeting with Tafea Provincial Government
11	Mar. 25, 1998(Wen)	Tanna/Port Vila	Topographic Survey and Data Collection. Installation of Tidal Gauge
12	Mar. 26, 1998(Thu)	Tanna/Port Vila	Topographic, Quarry Site Survey and Cargo Movement Data Collection
13	Mar. 27, 1998(Fri)	Tanna/Port Vila	Hydrographic Survey, Meteorological, Construction material and Contractor Survey
14	Mar. 28, 1998(Sat)	Tanna	Under Sea Water Survey by diver and Hydrographic Survey
15	Mar. 29, 1998(Sun)	Tanna	Under Sea Water Survey by diver and Additional Topographic Survey
16	Mar. 30, 1998(Mon)	Tanna	Survey and Investigation of Wharf and Access Road. Data Analysis
17	Mar. 31, 1998(Tue)	Tanna	Analysis of Topographic, Hydrographic Survey and Tidal Observation Data
18	Apr. 1, 1998(Wen)	Port Vila	Travel to Port Vila
19	Apr. 2, 1998(Thu)	Port Vila	Meeting with DPW and Cost Estimation Data Collection
20	Apr. 3, 1998(Fri)	Port Vila	Meeting with DPW and Data Collection for Construction Method and Analysis
21	Apr. 4, 1998(Sat)	Nadi	Travel to Nadi
22	Apr. 5, 1998(Sun)	Suva/Auckland	Data Analysis
23	Apr. 6, 1998(Mon)	Suva/Auckland	Explanation to JICA and Embassy in Fiji
24	Apr. 7, 1998(Tue)	Auckland	Travel to Auckland
25	Apr. 8, 1998(Wen)	Auckland-Tokyo	Travel to Japan

APPENDIX 3

List of Parties Concerned in the Vanuatu

Appendix -3 List of Parties concerned in the Vanuatu

(1) Department of Public Works; Ministry of Transport, Communication and Public Works

Mr. Manase TARI	Director
Mr. Jone ROQARA	Deputy Director
Mr. Willie WATSON	Civil Engineer
Mr. Fred GIDEON	Manager, Public Works Office in Tanna
Mr. Fred FESUL	Acting Foreman, Public Works Office in Tanna

Department of Public Works; Ministry of Infrastructure and Public Utilities (at Draft Report Explanation Stage

Mr. Jone ROQARA	Director

(2) Department of Foreign Affairs

Mr. Japheth TAVOA	Principal Assistant Secretary
Mr. Albert Willie KARLO	Multilateral Affairs Officer; Asia Pacific Division

(3) National Planning Office; Office of the Prime Minister

Mr. Jimmy ANDENG	Principal Planning Officer, Acting Director
Mr. James N. TOA	Senior Planning Officer
Ms. Flora KALSARIA	Senior Aid Administration Officer

(4) Department of Provincial Affairs; Ministry of Home Affairs

Mr. Martin TETE

(5) Department of Ports and Marine

Mr. Norris HAMISH	Director

(6) Tafea Provincial Government Council

Mr. Robert YATO	President of TAFEA Province
Mr. Michael KAPALU	Acting Secretary General, TAFEA Province
Mr. Mike Burrel	Planning Advisor, TAFEA Province
Mr. Marshal MANUA	Planner

(7) Department of Customs and Taxes; Ministry of Finance

Mr. John W. Simbolo	Director of Customs and Taxes

(8) Department of Land Survey

(9) Vanuatu Meteorological Station

(10) Environment Unit; Ministry of Health and Welfare

Mr. Trinisson TARI	Information Officer

(11) Department of Geology and Mine

(12) IFIRA Shipping Agencies Ltd.

Mr. Kalpokor KALSAKAU	Manager

(13) JOCV Vanuatu Office

Mr. Noriaki AKABOSHI	Resident Representative

(14) Embassy in Fiji

Yasunori MAKITA	First Secretary

(15) JICA Fiji Office

Yasushi INABA	Resident Representative
Kyoji MIZUTANI	Deputy Resident Representative
Takahiro ISHIZAKI	Assistant Resident Representative

(16) Fiji Meteorological Service

Mr. NAZMIN	Director of Meteorology
Mr. Alipate WAQAICELUA	Principal Scientific Officer

APPENDIX 4

Minutes of Discussion

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY ON THE PROJECT FOR THE WHARF REHABILITATION IN TANNA ISLAND IN THE REPUBLIC OF VANUATU

In response to the request from the Government of Vanuatu, the Government of Japan has decided to conduct a basic design study on the project for the wharf rehabilitation in Tanna island in Vanuatu (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA has sent to Vanuatu a basic design study team (hereinafter referred to as "the Team"), which is headed by Mr. Noriaki NISHIMIYA, JICA. The Team is scheduled to stay in the country from 16 March to 4 April, 1998.

The Team held a series of discussions with the officials concerned of the Government of Vanuatu and conducted a field survey at the study area.

In the course of the discussions and field survey, both parties have confirmed the main items described on the attached sheets.

Port Vila, 20 March, 1998

Noriaki NISHIMIYA
Leader
Basic Design Study Team,
JICA

Manase TARI
Director
Department of Public Works
Ministry of Transport,
Communication and Public Works

Martin TETE
Director
Department of Provincial Affairs
Ministry of Home Affairs

Jimmy ANDENG
Acting Director
National Planning Office
Ministry of Finance and Economic Management

ATTACHMENT

1. Objective

The objective of the Project is to rehabilitate port facilities in the area of Lenakel in Tanna island, thereby to facilitate more effective distribution.

2. Executing Agency

Public Works Department on behalf of The Ministry of Transport, Communication and Public Works is responsible for the administration and execution of the Project. The organization chart is referred in ANNEX I.

3. Project Site

The Project site is located in the area of Lenakel in Tanna island referred in ANNEX II.

4. Items requested by the Government of Vanuatu

The items requested by the Government of Vanuatu are rehabilitation of existing wharf and access road.

5. Japan's Grant Aid System

1) The Government of Vanuatu has understood the system of the Japan's Grant Aid explained by the Team; main feature is described in ANNEX III.
2) The Government of Vanuatu will take the necessary measures, described in ANNEX IV for the smooth implementation of the Project on condition that the Grant Aid by the Government of Japan is extended to the Project.

6. Operation & Maintenance

The facility to be rehabilitated under the Japan's Grant Aid shall be operated and maintained by a Ministry or a Department decided by the Government of Vanuatu.

7. Issues to be Noted

1) Vanuatu side agreed to provide temporary construction yard more than 3,000 m^2 and area for unloading material/equipment near the Project Site.

2) Vanuatu side agreed to remove the sunken barge in front of wharf before end of December 1998.

3) Vanuatu side agreed to provide adequate space for excess and surplus material during the construction near the site.

4) The scale and area of the rehabilitation of the wharf and access road shall be basically same as original dimension. (Wharf length: 55 meters, Width of Wharf: 8.5 meters, Width of access road: 5 meters)

8. Further Schedule of the Study

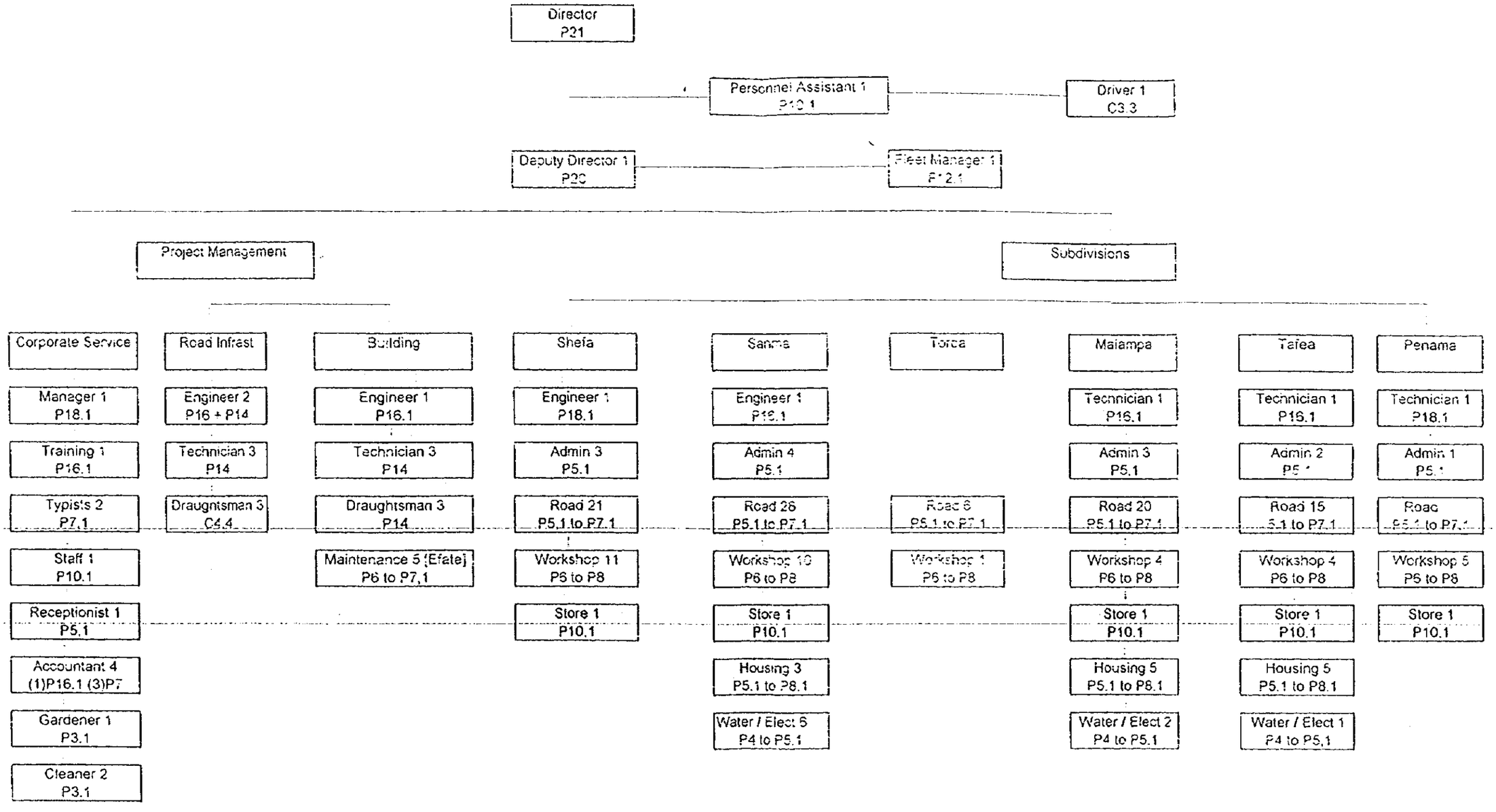
1) The Team will proceed to further studies in Vanuatu until 4 April, 1998.

2) On the basis of the Minutes of Discussions and technical examination of the study results, JICA will prepare the Draft Basic Design and dispatch a team to Vanuatu around May 1998 in order to present the outline of the Draft Basic Design.

3) Upon acceptance of the Draft Basic Design by the Government of Vanuatu, JICA will complete the Basic Design Study Report and forward it in its final form to the Government of Vanuatu by around July 1998.

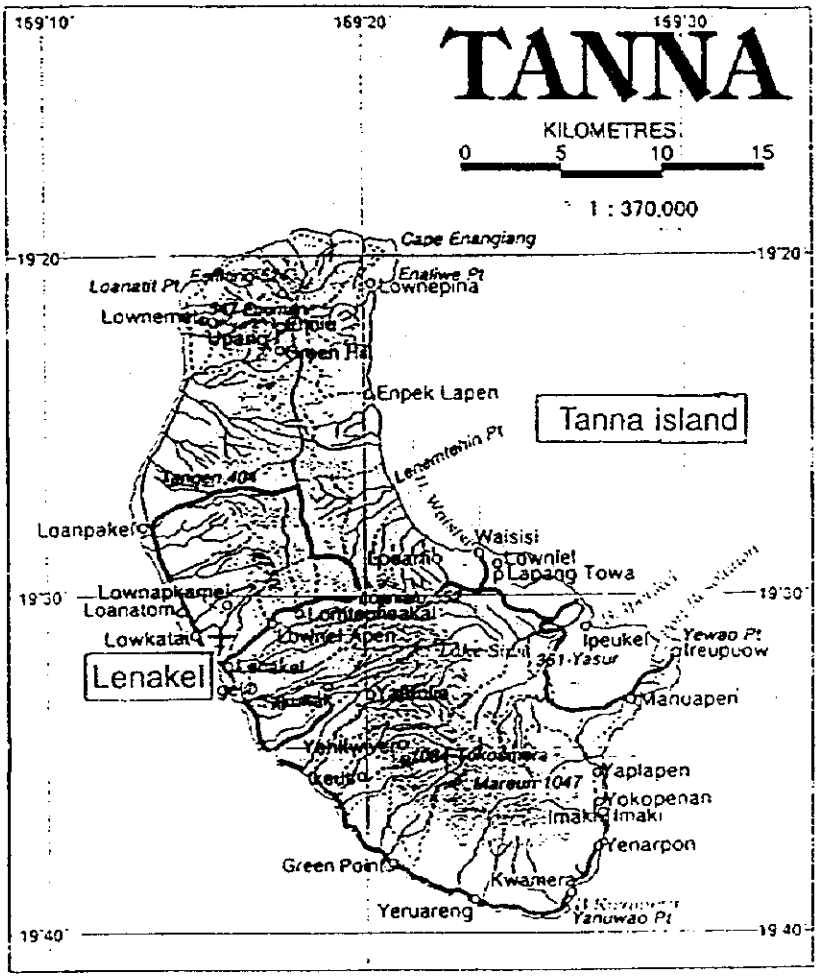
Updated February 1997

PUBLIC WORKS DEPARTMENT



Staff	Unit	Head Office Mang	Corporate Service	PMU Building	PMU Roads	Shefa	Sanma	Malampa	Tafea	Penama	Torba
	Total	5	13	12	15	37	33	40	29	26	7
Total	239										

ANNEX II(1)


TANNA
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Cape Enangiang
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Loanatit Pt
Enpek Lapen
Tanna island
Lenamtenin Pt
Waisisi
Lowniel
Lapang Towa
Loanpakel
Lownapkamei
Loanatom
Lowkatai
Lowniel Apen
Lenakel
Ipeukel
Yewao Pt
Ireupuow
Manuapen
Yaplapen
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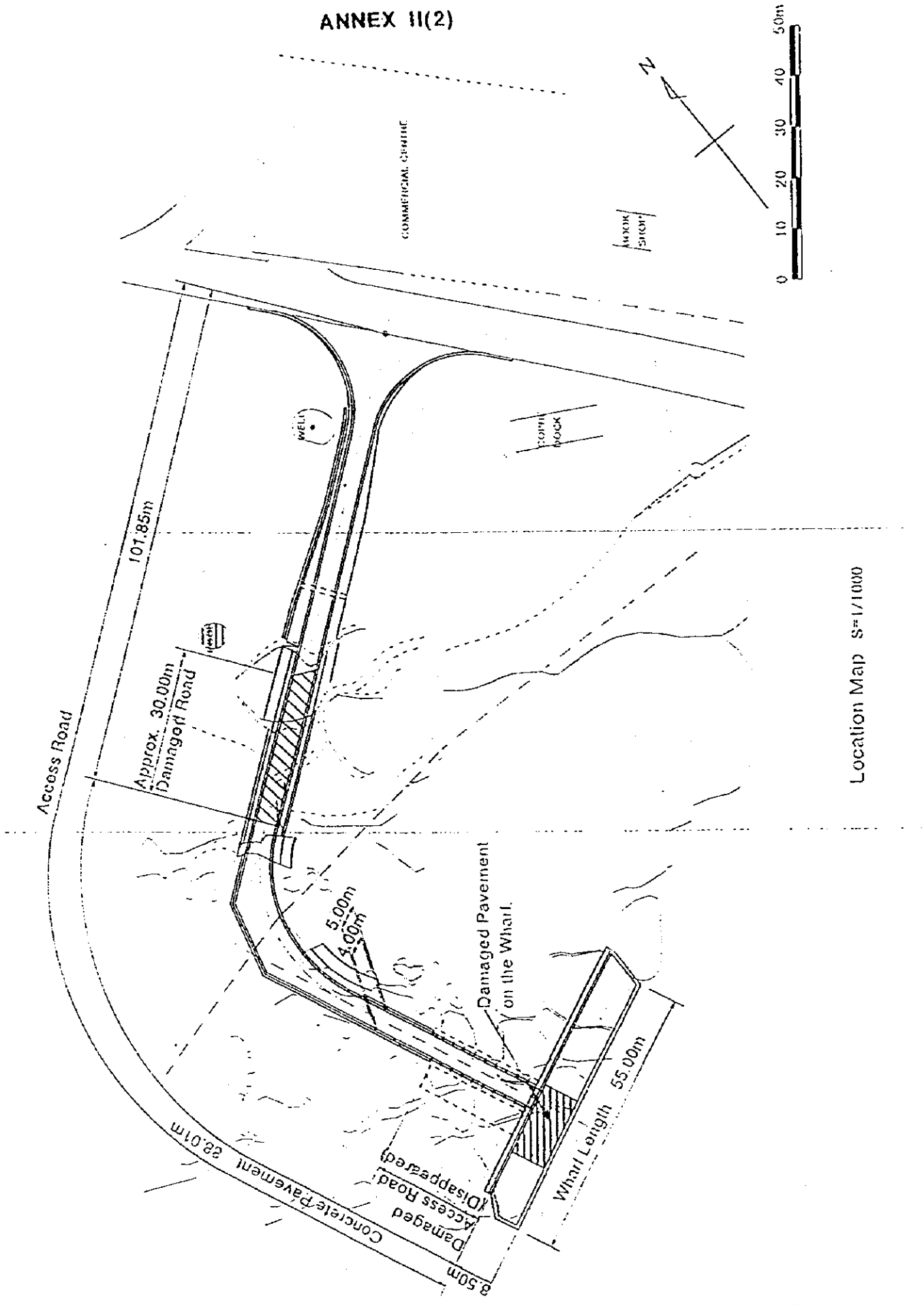
351 Yasur

ANNEX II(2)


COMMERCIAL CENTRE
ANSON SHOP
WELL
COVE ROCK
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0
10
20
30
40
50m
101.85m
Access Road
Approx. 30.00m
Damaged Road
5.00m
4.00m
Damaged Pavement
on the Wharf.
Wharf Length 55.00m
Damaged
Access Road
Disappeared
Concrete Pavement 28.01m
8.50m
Location Map S=1/1000

ANNEX III: JAPAN'S GRANT AID SCHEME

1. Grant Aid Procedure

1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan & Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid Program submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the program to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA and the results are then submitted to the Cabinet for approval.

Fourth, the program, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Government of Japan and the recipient country.

Finally, for the implementation of the program, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on the requested program (hereinafter referred to as "the Program"), is to provide a basic document necessary for the appraisal of the Program by the Government of Japan. The contents of the Study are as follows:

a) confirmation of the background, objectives and benefits of the Program and also institutional capacity of agencies concerned of the recipient country necessary for the Program's implementation;
b) evaluation of the appropriateness of the Program to be implemented under the Grant Aid Scheme from the technical, social and economic points of view;
c) confirmation of items agreed on by both parties concerning the basic concept of

the Program;

d) preparation of a basic design of the Program; and
e) estimation of costs of the Program.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid Program. The Basic Design of the Program is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Program. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Program. Therefore, the implementation of the Program is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For the smooth implementation of the Study, JICA uses a consulting firm selected through its own procedure (competitive proposal). The selected firm participate the Study and prepare a report based upon the terms of reference set by JICA.

At the beginning of implementation after the Exchange of Notes, for the services of the Detailed Design and Construction Supervision of the Program, JICA recommends the same consulting firm which participated in the Study to the recipient country, in order to maintain the technical consistency between the Basic Design.

3. Japan's Grant Aid Scheme

1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Program, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant" means the one fiscal year which the Cabinet approves the Program for. Within the fiscal year, all procedure such as exchanging of the Notes, concluding contracts with consulting firms and contractors and final payment to them must be completed.
However, in case of delays in delivery, installation or construction due to unforeseen

JA

factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability of Japanese taxpayers.

6) Undertakings required to the Government of the recipient country

a) to secure a lot of land necessary for the construction of the Program and to clear the site;
b) to provide facilities for distribution of electricity, water supply, drainage and other incidental facilities outside the site;
c) to ensure prompt unloading, tax exemption and customs clearance at ports of disembarkation in the recipient country and internal transportation therein of the products purchased under the Grant Aid.
d) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.
e) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such as facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.
f) to ensure that the facilities constructed and products purchased under the Grant Aid be maintained and used properly and effectively for the Program; and
g) to bear all the expenses other than those covered by the Grant Aid, necessary for the Program.

7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for operation and maintenance of them as well as to bear all the expenses other than those covered by the Grant Aid.

8) "Re-export"
The products purchased under the Grant Aid shall not re-exported from the recipient country.

9) Banking Arrangement (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the verified contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of recipient country or its designated authority.

ANNEX IV: NECESSARY MEASURES TO BE TAKEN BY THE GOVERNMENT OF VANUATU

The following necessary measures should be taken by the Government of Vanuatu on condition that the Grant Aid by the Government of Japan is extended to the Project.

1. to secure a lot of land necessary for the Project;

2. to clear and level the project site prior to the commencement of the construction;

3. to provide a proper access road to the project site;

4. to provide facilities for distribution of electricity, water supply, telephone trunk line, drainage and other incidental facilities outside of the project site;

5. to undertake incidental outdoor works, such as fencing, exterior lighting, and other incidental facilities in and around the project site, if necessary;

6. to ensure prompt unloading and customs clearance of the products purchased under the Japan's Grant Aid at ports of disembarkation in Vanuatu;

7. to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Vanuatu with respect to the supply of the products and services under the verified contracts;

8. to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such facilities as may be necessary for their entry into Vanuatu and stay therein for the performance of their work;

9. to bear commissions, namely advising commissions of the Authorization to Pay (A/P) and payment commissions, to the Japanese foreign exchange bank for its banking services based upon the Banking Arrangement (B/A);

10. to provide necessary permissions, licenses and other authorization for implementing the Project, if necessary;

11. to ensure that the facilities constructed and equipment purchased under the Japan's Grant Aid be maintained and used properly and effectively for the Project; and

12. to bear all the expenses, other than those covered by the Japan's Grant Aid, necessary for the Project.

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY ON
THE PROJECT FOR
THE WHARF REHABILITATION IN TANNA ISLAND
IN VANUATU

(Consultation on the Draft Basic Design)

The Japan International Cooperation Agency (JICA) has dispatched a basic design study team on the Project for the wharf rehabilitatioin in Tanna island (hereinafter referred to as "the Project") to Vanuatu in March 1998. As a result of the series of discussions in Vanuatu, and technical examination of the results in Japan, JICA prepared the Draft Basic Design of the Project.

To inform the side of Vanuatu with the components of the Draft Basic Design, JICA sent to Vanuatu a study team headed by Mr. Norihiro IKEDA, JICA. The team is scheduled to stay in Vanuatu from June 1 to June 6, 1998.

As a result of discussions, both sides have confirmed main items as described on the attached sheets. The team will proceed to further works and finalize the Basic Design Study Report.

Port Vila, June 4, 1998

Norihiro IKEDA
Leader
Draft Basic Design Team
JICA

Jone ROQARA
Director
Department of Public Works
Ministry of Infrastructure
and Public Utilities

Norris HAMISH
Director
Department of Port and Marine
Ministry of Infrastructure
and Public Utilities

Jimmy ANDENG
Acting Director
National Planning Office
Ministry of Finance and Economic
Management

ATTACHMENT

1. Objective

The objective of the Project is to rehabilitate port facilities in the area of Lenakel in Tanna island, thereby to facilitate more effective distribution.

2. Components of the Draft Basic Design

The Government of Vanuatu has in principle accepted the components of the Draft Basic Design proposed by the team which are shown in ANNEX I.

3. Executing Agency

Public Works Department on behalf of the Ministry of Infrastructure and Public Utilities is responsible for the administration and execution of the Project.

4. Operation & Maintenance

The facility to be rehabilitated under the Japan's Grant Aid shall be operated and maintained by Tafea Provincial Office.

5. Issues to be Noted

1) Vanuatu side agreed to provide temporary construction yard more than 3,000 m^2 and area for unloading material / equipment near the Project site.
2) Vanuatu side agreed to remove the sunken barge in front of wharf before end of December 1998.
3) Vanuatu side agreed to provide adequate space, which is described in ANNEX II, for disposing excess and surplus material during the construction near the site.
4) Vanuatu side agreed to provide anchoring area of general cargo ship for cargo handling as Lenakel Wharf shall be occupied during construction period.
5) It is noted that resident representative of Vanuatu side shall be appointed during construction period.

6. Japan's Grant Aid System

1) The Government of Vanuatu has understood the system of the Japan's Grant Aid explained by the Team ; main feature is described in ANNEX III.
2) The Government of Vanuatu will take the necessary measures described in ANNEX IV for the smooth implementation of the Project on condition that the Grant Aid by the Government of Japan is extended to the Project.

7. Further Schedule of the Study

JICA will complete the Basic Design Study Report and forward it in its final form to the Government of Vanuatu by around July 1998.

ANNEX I: COMPONENTS OF THE DRAFT BASIC DESIGN

This is shown in Basic Design Study Report submitted to Vanuatu side on 2nd June 1998, the basic layout and typical sections are described in drawings attached hereunder.

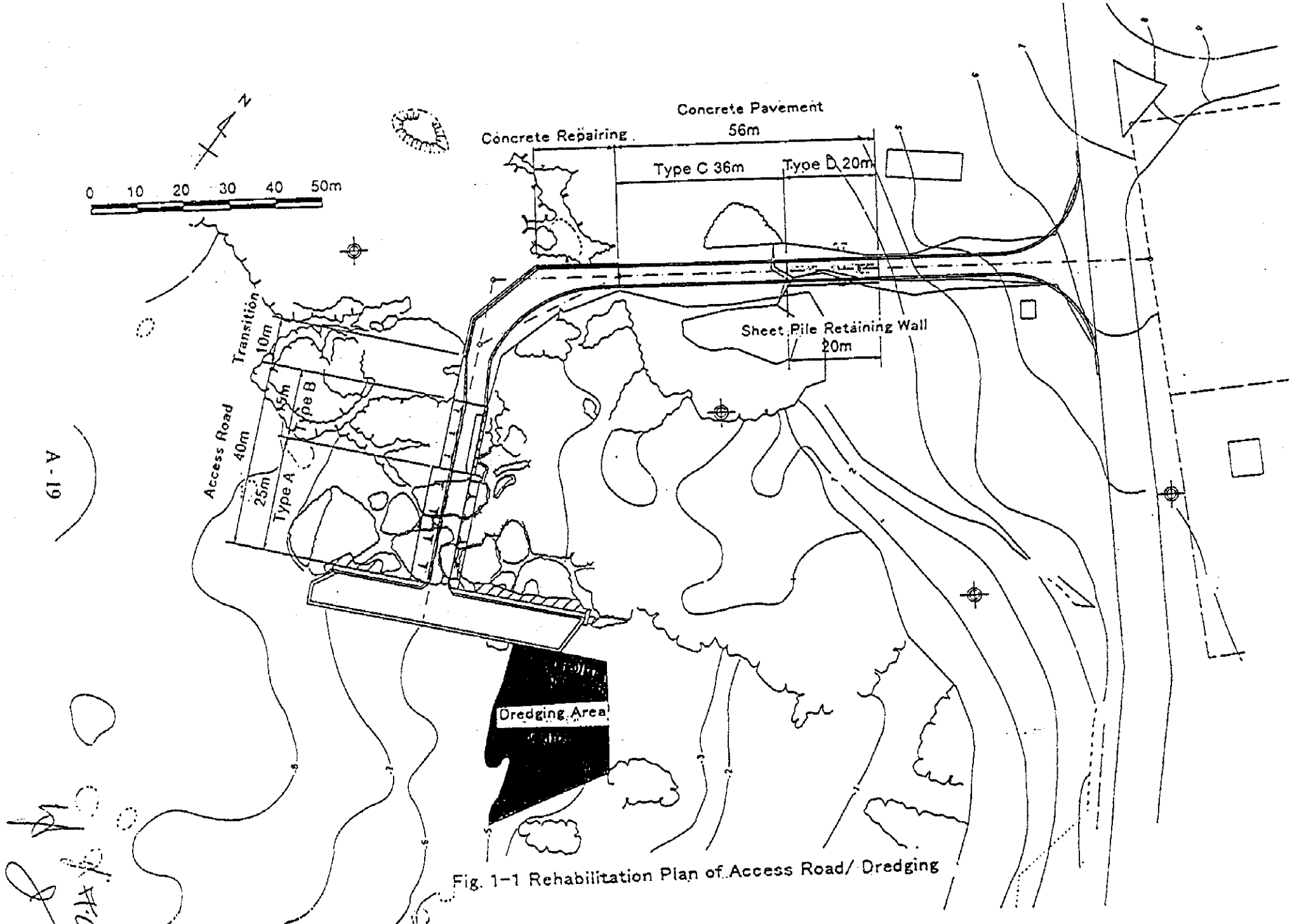


Fig. 1-1 Rehabilitation Plan of Access Road/ Dredging

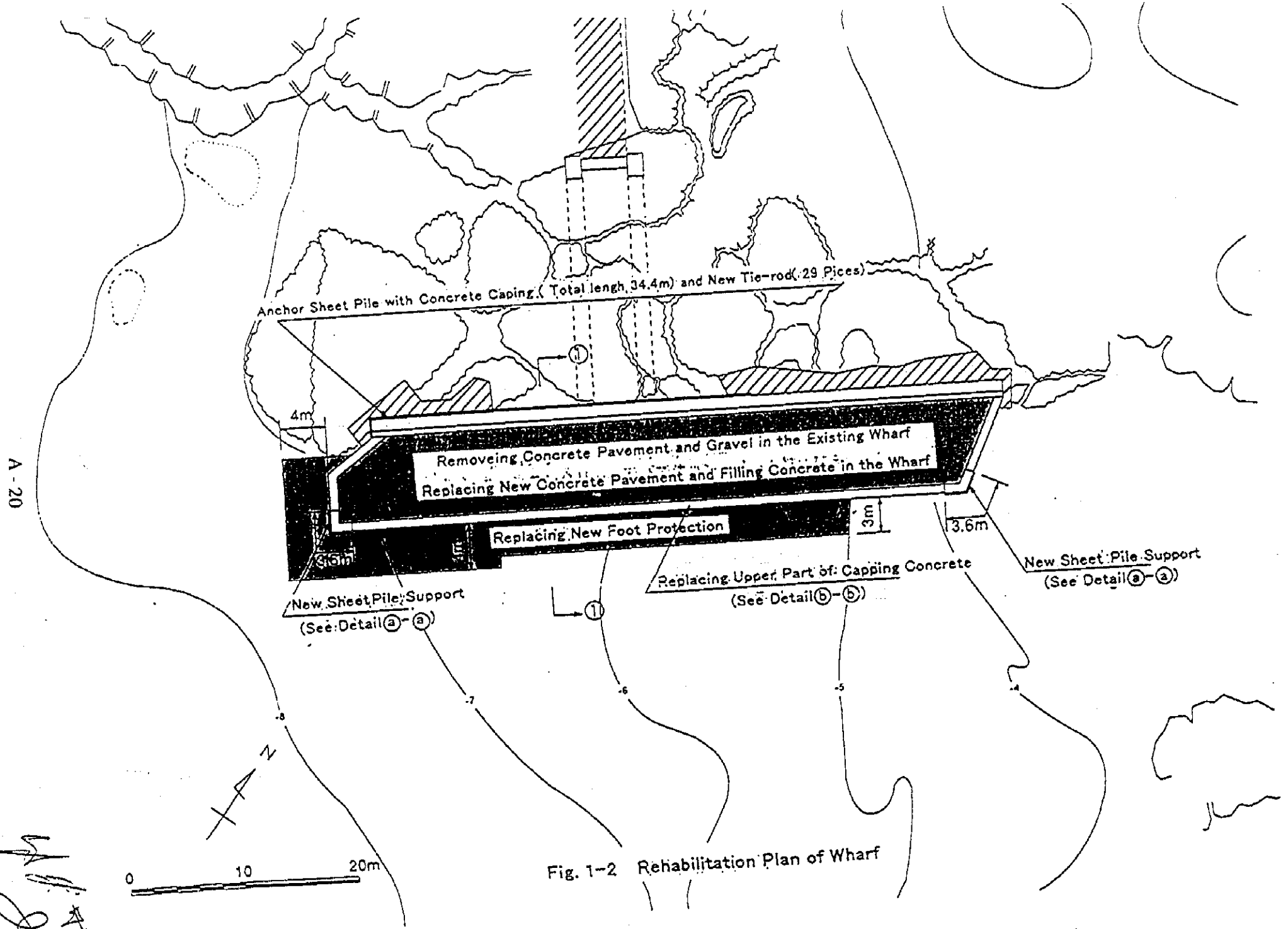


Fig. 1-2 Rehabilitation Plan of Wharf

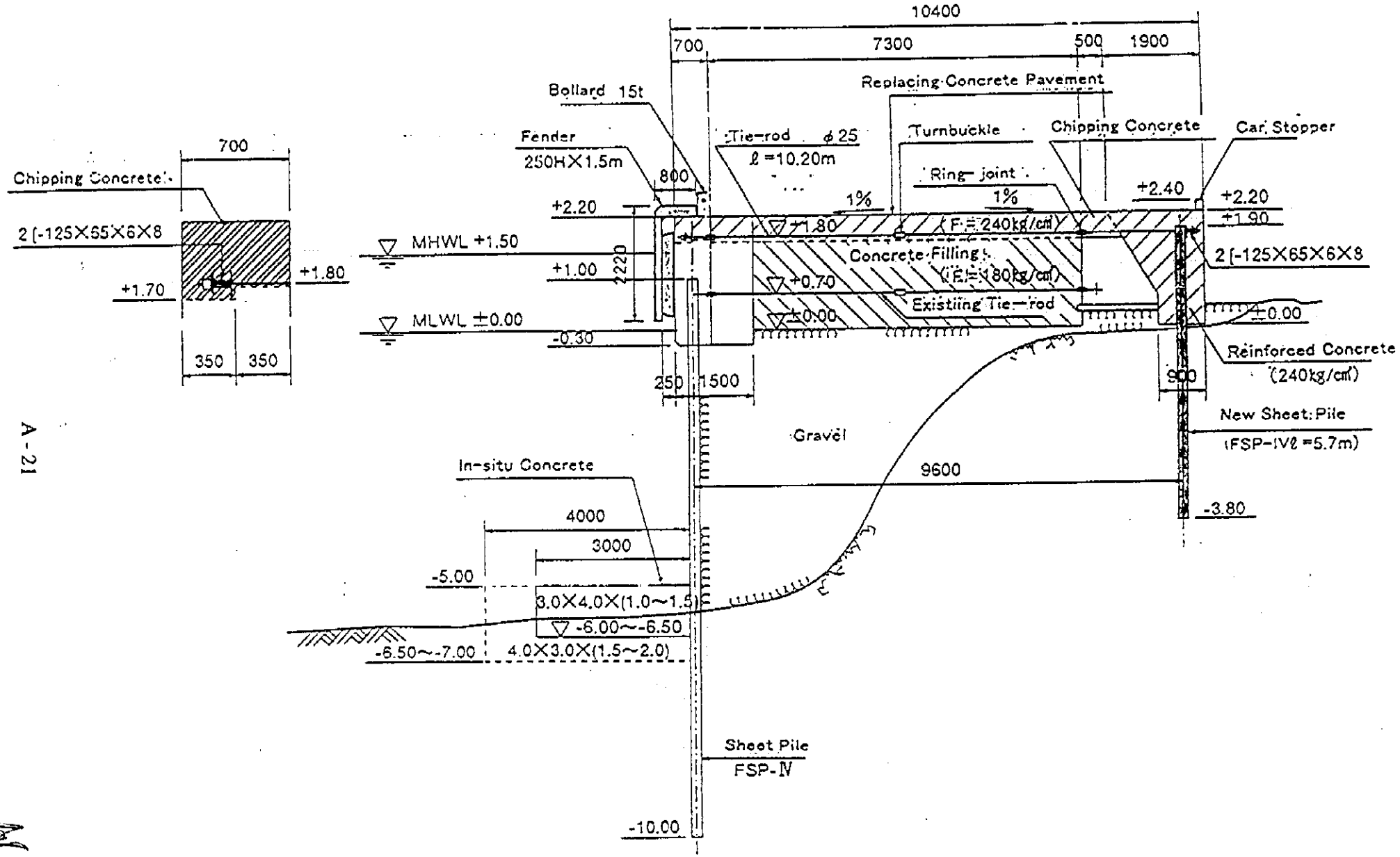
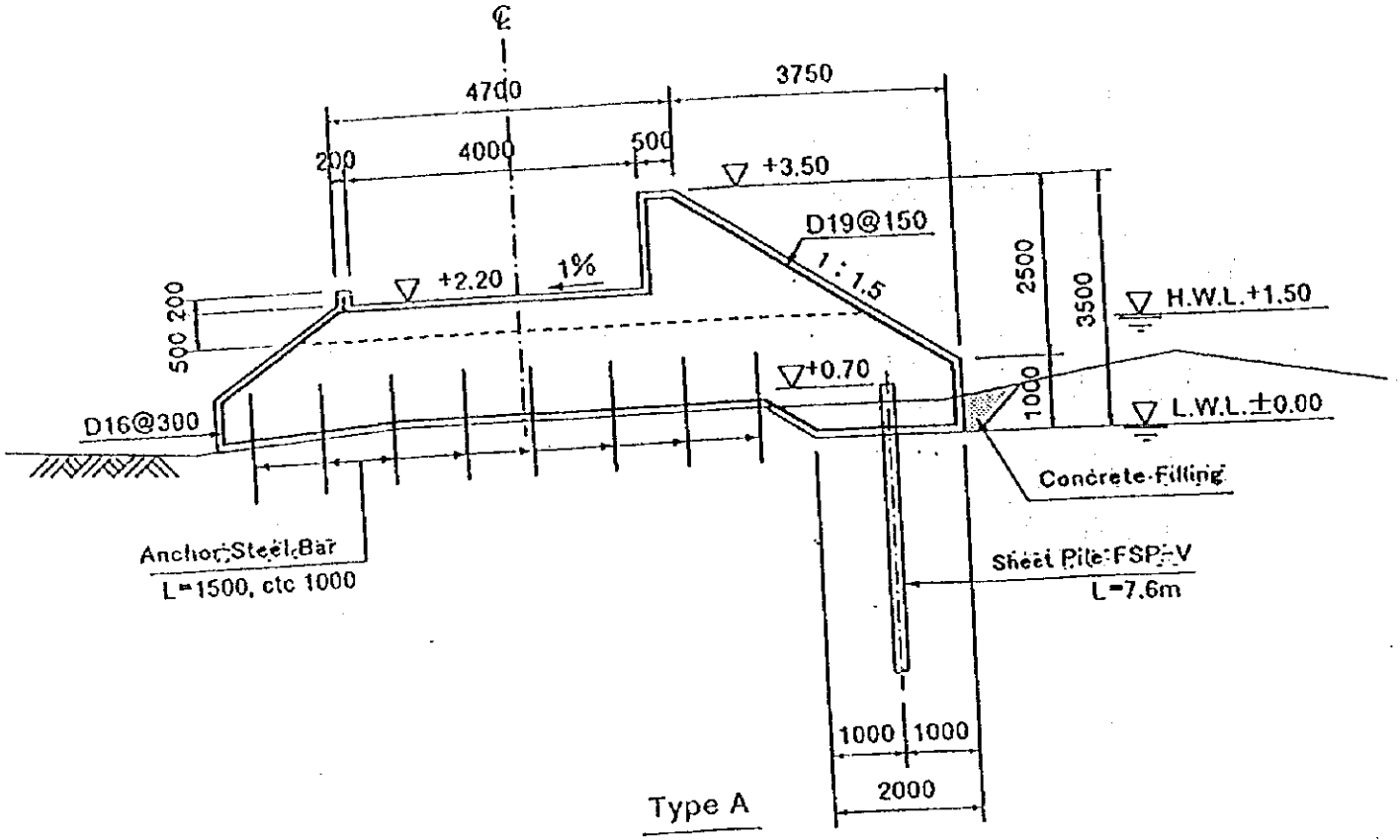
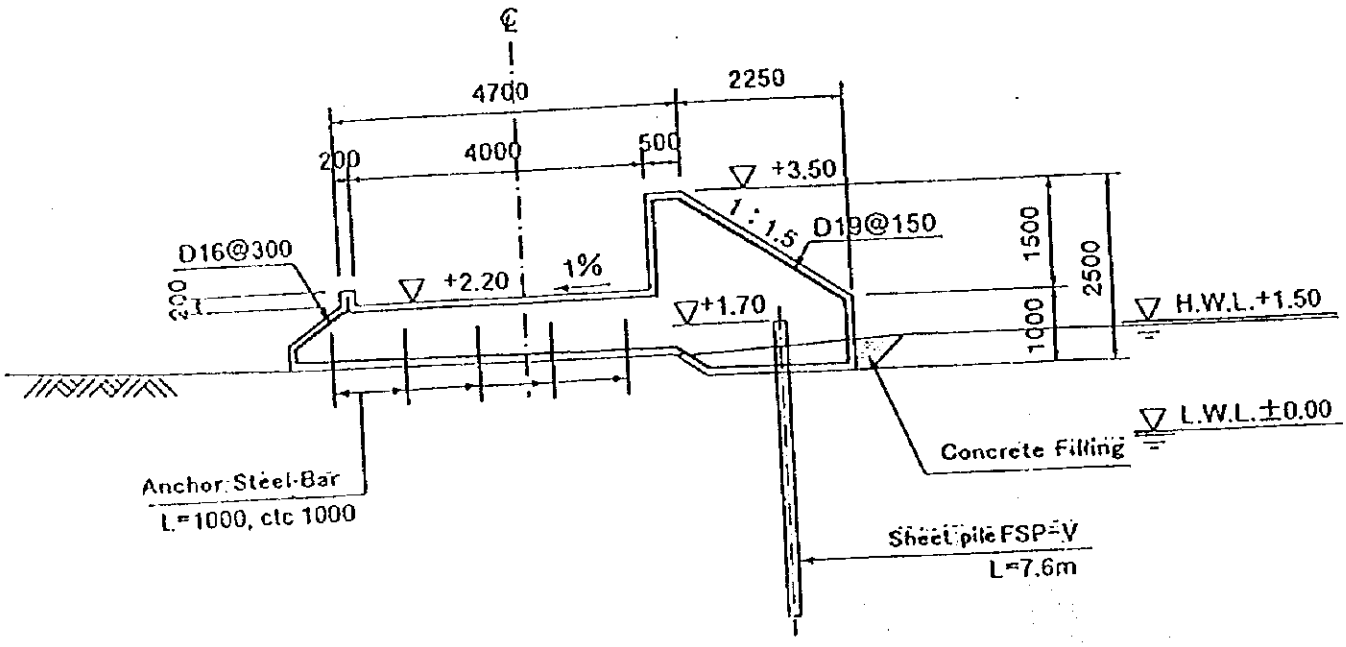


Fig. 1-3 Typical Section of Wharf (Damaged area) S=1/100

(①—① Section)

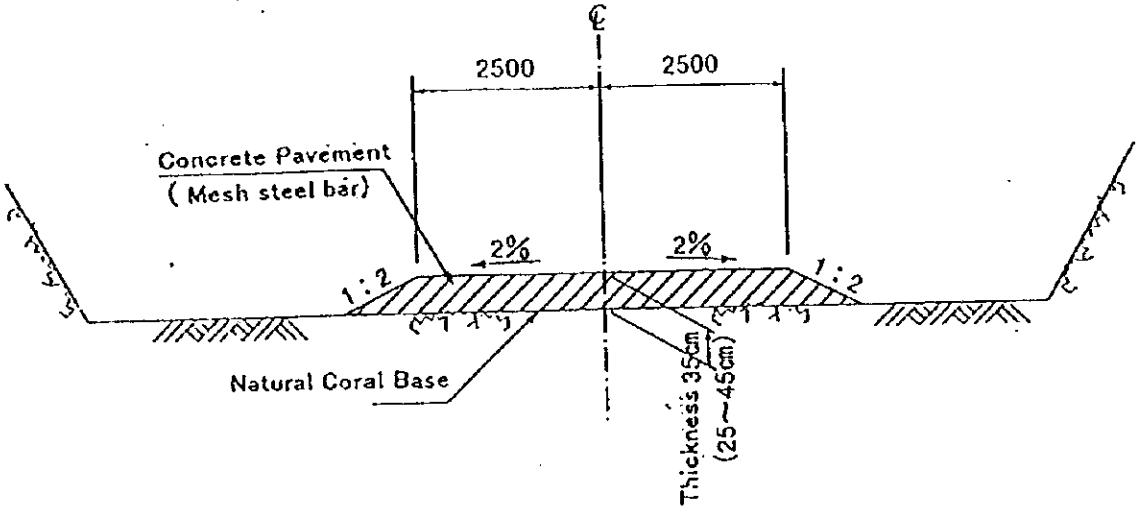


Type A

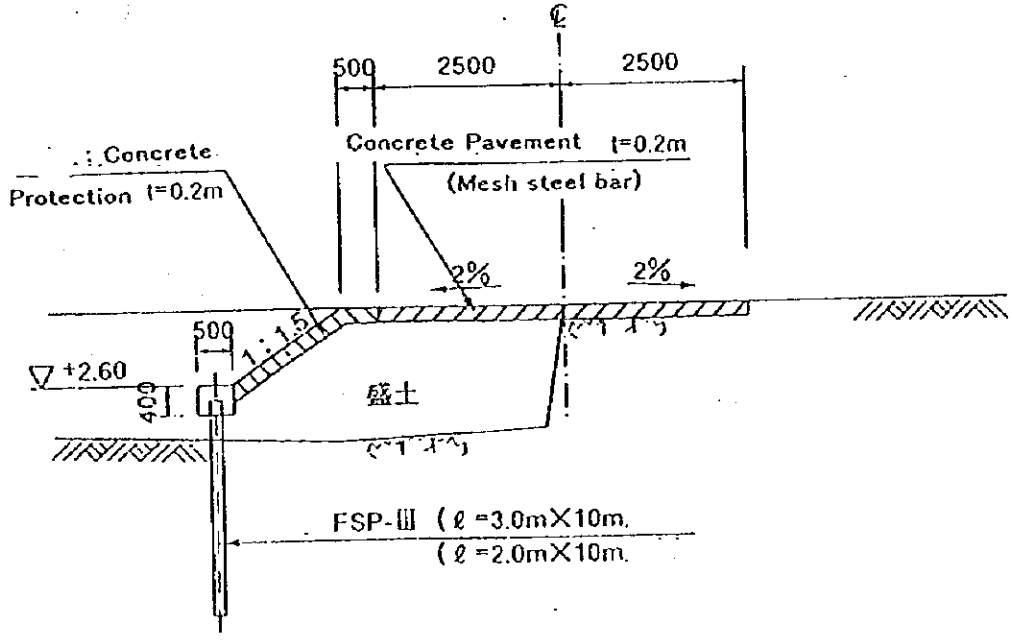


Type B

Fig. 1-41 Typical Section of Access Road (1) S=1 : 100



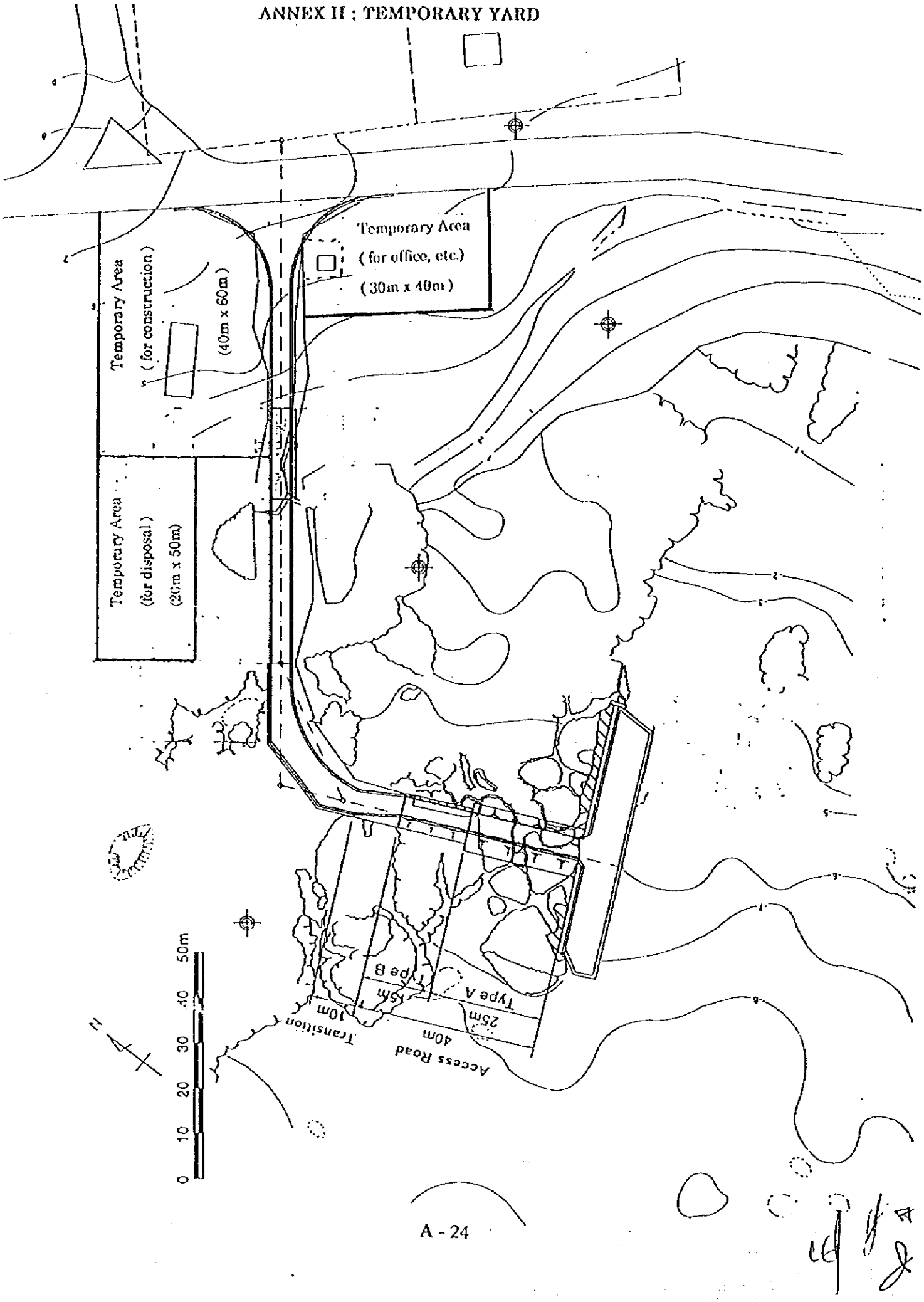
Type C (Slope: 2.5%)



Type D (Slope: 4.8%)

Fig. 1-5: Typical Section of Access Road (2) S=1 : 100

ANNEX II : TEMPORARY YARD



ANNEX III: JAPAN'S GRANT AID SCHEME

1. Grant Aid Procedure

1) Japan's Grant Aid Program is executed through the following procedures.
Application(Request made by a recipient country)
Study(Basic Design Study conducted by JICA)
Appraisal & Approval
(Appraisal by the Government of Japan & Approval by Cabinet)
Determination of(The Notes exchanged between the Governments of
Implementation Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid Program submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the program to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA and the results are then submitted to the Cabinet for approval.

Fourth, the program, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Government of Japan and the recipient country.

Finally, for the implementation of the program, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

1) Contents of the Study
The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on the requested program (hereinafter referred to as "the Program"), is to provide a basic document necessary for the appraisal of the Program by the Government of Japan. The contents of the Study are as follows:

a) confirmation of the background, objectives and benefits of the Program and also institutional capacity of agencies concerned of the recipient country necessary for the Program's implementation;
b) evaluation of the appropriateness of the Program to be implemented under the Grant Aid Scheme from the technical, social and economic points of view;
c) confirmation of items agreed on by both parties concerning the basic concept of the Program;

d) preparation of a basic design of the Program; and
e) estimation of costs of the Program.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid Program. The Basic Design of the Program is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Program. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Program. Therefore, the implementation of the Program is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants
For the smooth implementation of the Study, JICA uses a consulting firm selected through its own procedure (competitive proposal). The selected firm participate the Study and prepare a report based upon the terms of reference set by JICA.

At the beginning of implementation after the Exchange of Notes, for the services of the Detailed Design and Construction Supervision of the Program, JICA recommends the same consulting firm which participated in the Study to the recipient country, in order to maintain the technical consistency between the Basic Design and Detailed Design.

3. Japan's Grant Aid Scheme

1) What is Grant Aid?
The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)
Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Program, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant" means the one fiscal year which the Cabinet approves the Program for. Within the fiscal year, all procedure such as exchanging of the Notes, concluding contracts with consulting firms and contractors and final payment to them must be completed.
However, in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"
The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability of Japanese taxpayers.

6) Undertakings required to the Government of the recipient country

a) to secure a lot of land necessary for the construction of the Program and to clear the site;

b) to provide facilities for distribution of electricity, water supply, drainage and other incidental facilities outside the site;

c) to ensure prompt unloading, tax exemption and customs clearance at ports of disembarkation in the recipient country and internal transportation therein of the products purchased under the Grant Aid.

d) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.

e) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such as facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

f) to ensure that the facilities constructed and products purchased under the Grant Aid be maintained and used properly and effectively for the Program; and

g) to bear all the expenses other than those covered by the Grant Aid, necessary for the Program.

7) "Proper Use"
The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for operation and maintenance of them as well as to bear all the expenses other than those covered by the Grant Aid.

8) "Re-export"
The products purchased under the Grant Aid shall not re-exported from the recipient country.

9) Banking Arrangement (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized bank of Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the verified contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of recipient country or its designated authority.

ANNEX IV: NECESSARY MEASURES TO BE TAKEN BY THE GOVERNMENT OF VANUATU

The following necessary measures should be taken by the Government of Vanuatu on condition that the Grant Aid by the Government of Japan is extended to the Project.

1. to secure a lot of land necessary for the Project;

2. to clear and level the site for the Project prior to the commencement of the construction;

3. to provide a proper access road to the site;

4. to provide facilities for distribution of electricity, water supply, telephone trunk line, drainage and other incidental facilities outside the site;

5. to undertake incidental outdoor works, such as fencing and other incidental facilities in and around the site, if necessary;

6. to ensure prompt unloading and customs clearance of the products purchased under the Japan's Grant Aid at ports of disembarkation in Vanuatu;

7. to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Vanuatu with respect to the supply of the products and services under the verified contracts;

8. to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such facilities as may be necessary for their entry into Vanuatu and stay therein for the performance of their work;

9. to bear commissions, namely advising commissions of the Authorization to Pay (A/P) and payment commissions, to the bank of Japan for its banking services based upon the Banking Arrangement (B/A);

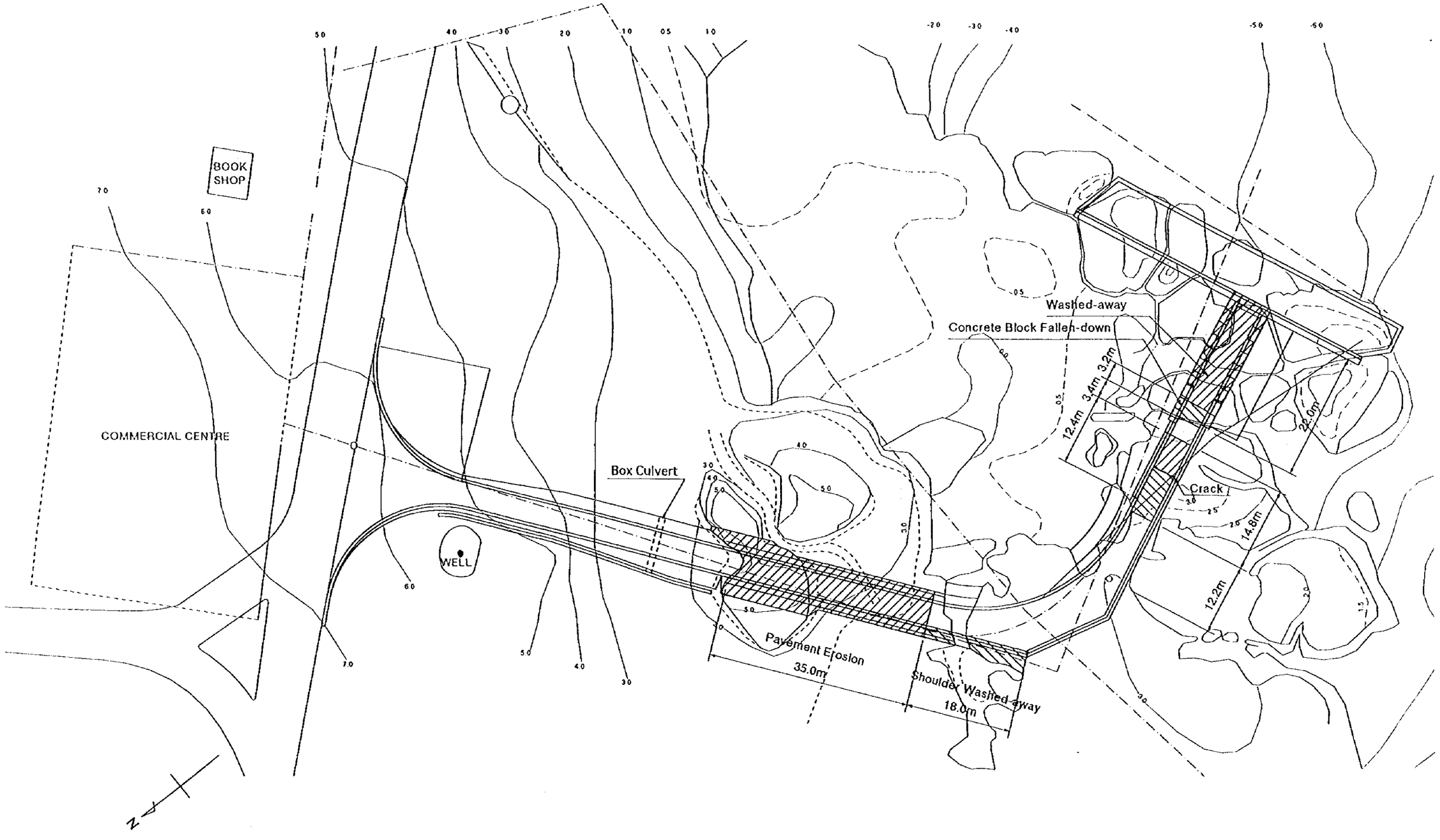
10. to provide necessary permissions, licenses and other authorization for implementing the Project, if necessary;

11. to ensure that the facilities constructed and equipment purchased under the Japan's Grant Aid be maintained and used properly and effectively for the Project; and

12. to bear all the expenses, other than those covered by the Japan's Grant Aid, necessary for the Project.

APPENDIX 5

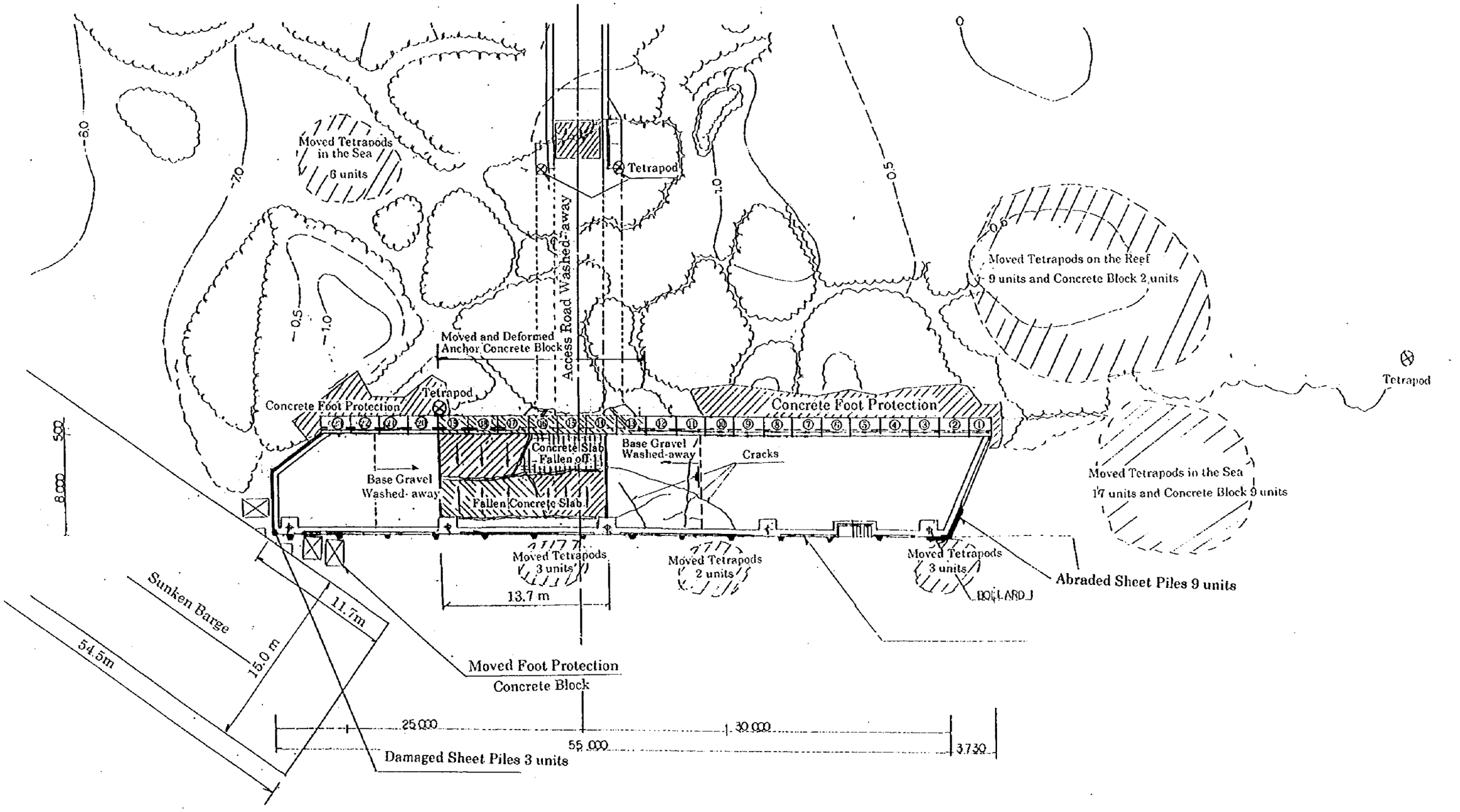
Other Relevant Data (Survey Maps)



PRESENT CONDITION OF THE ACCESS ROAD S=1/600

Fig. 1

/3

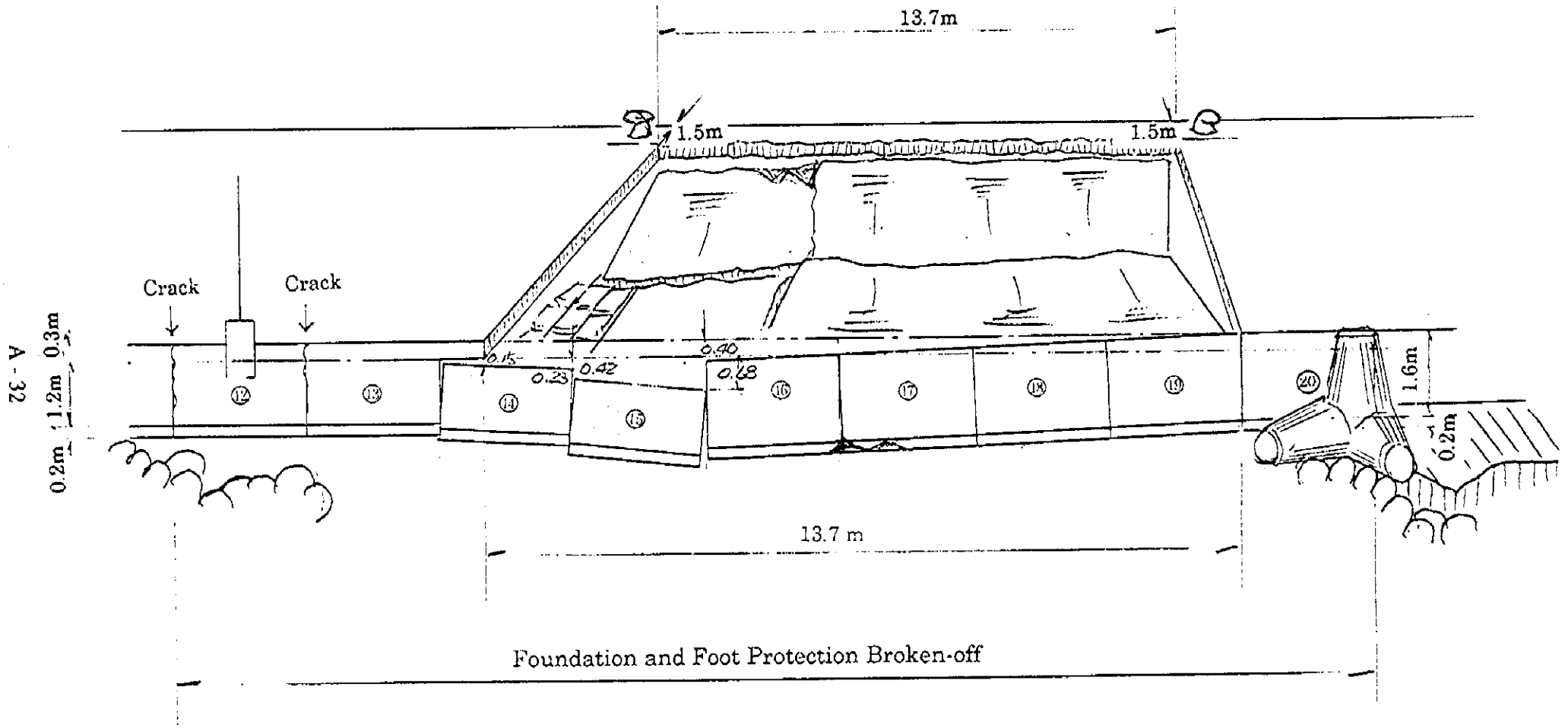


PRESENT CONDITION OF THE WHARF

s = 1:300

Fig. 2

14

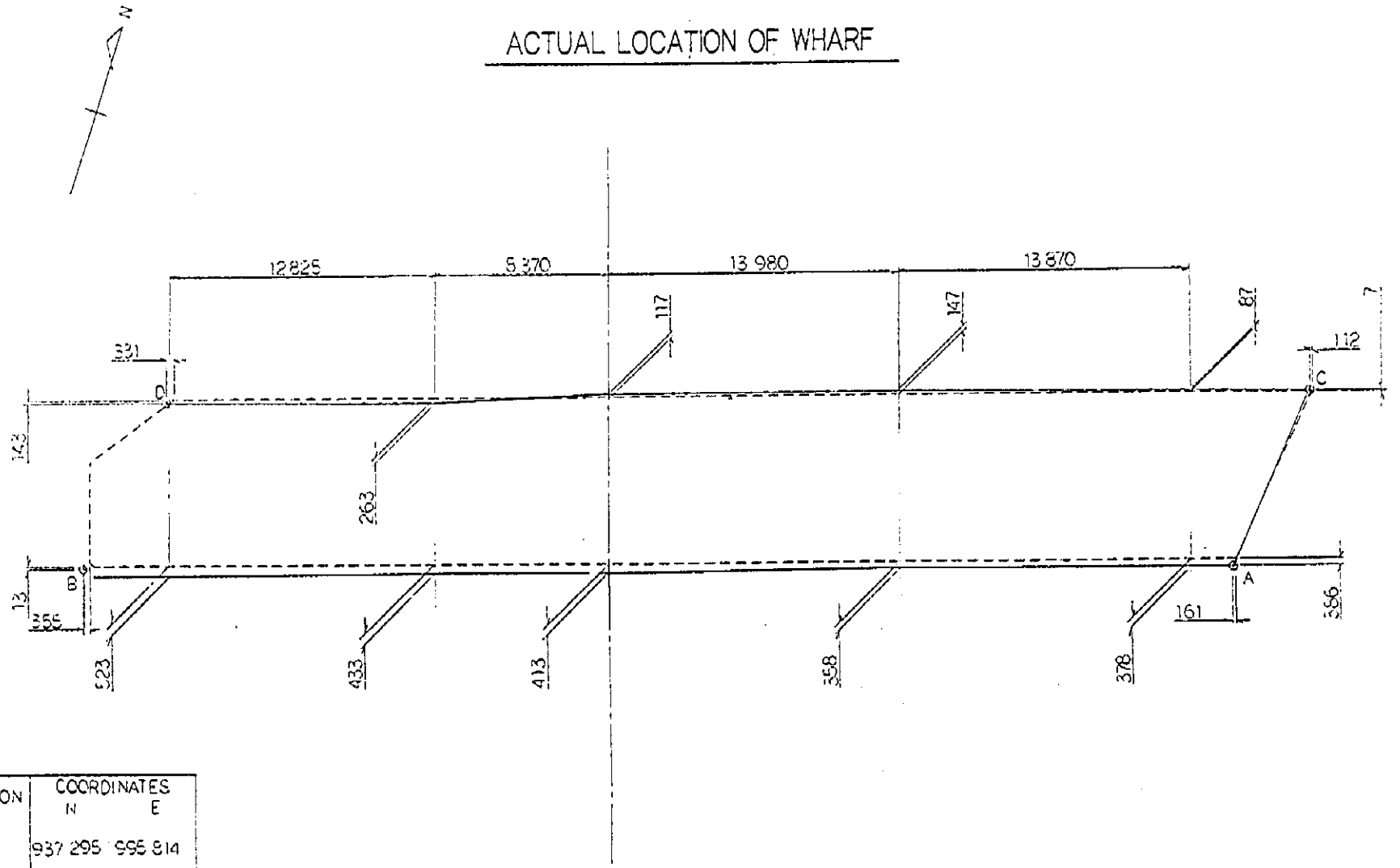


CONDITION OF THE ANCHOR CONCRETE BLOCK

S= None

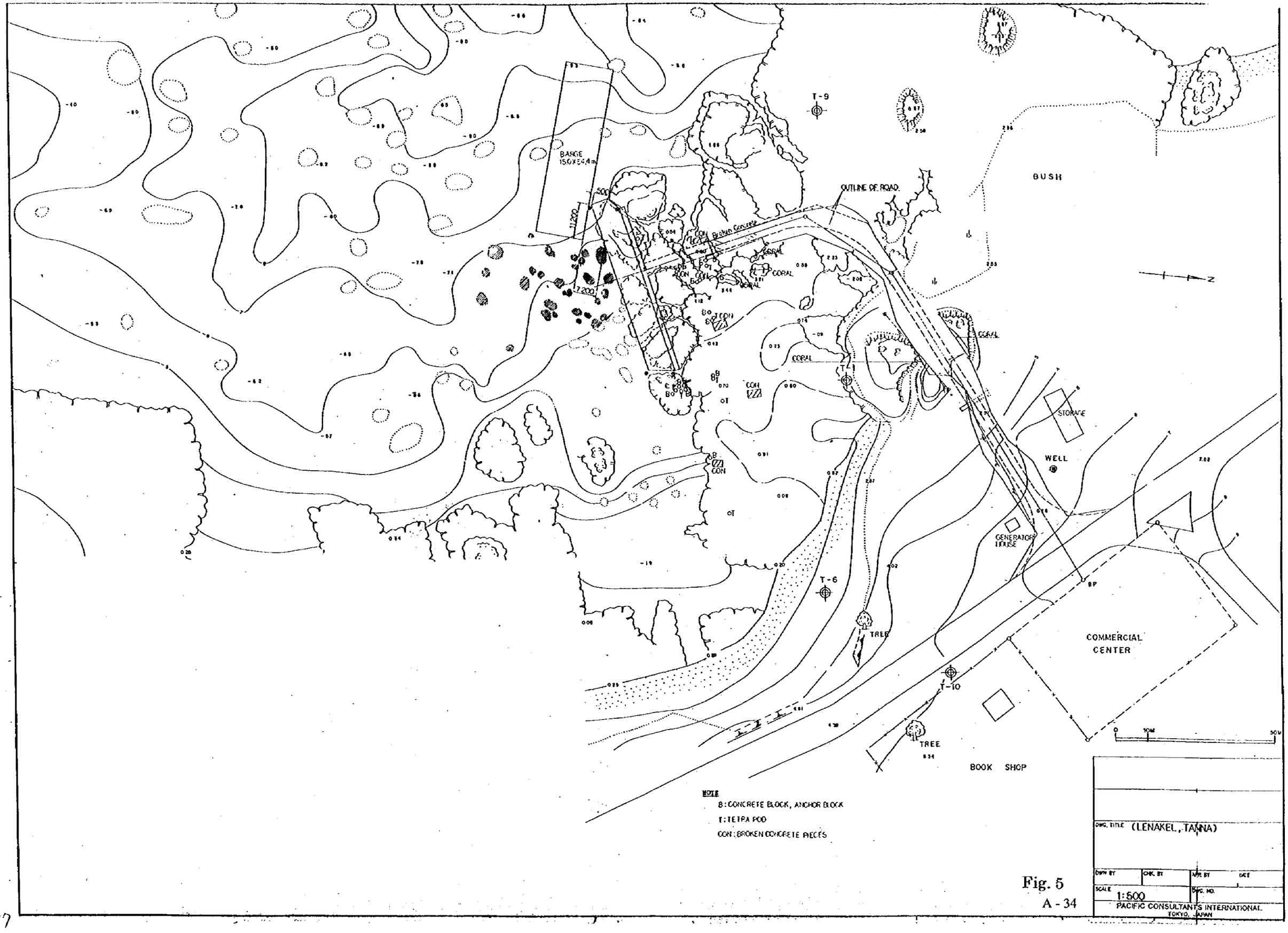
Fig. 3

ACTUAL LOCATION OF WHARF



STATION	COORDINATES N	E
A	937 295	995 814
B	920 275	943 313
C	946 020	996 904
D	929 282	944 567

Fig. 4



NOTE
B : CONCRETE BLOCK, ANCHOR BLOCK
T : TETRA POD
CON : BROKEN CONCRETE PIECES

DWG. TITLE (LENAKEL, TANNA)

DWN BY	CHK. BY	APP. BY	DATE
SCALE 1:500		DWG. NO.	

PACIFIC CONSULTANTS INTERNATIONAL
TOKYO, JAPAN

Fig. 5
A - 34

17


T-9
BUSH
CLEARING AND SWAMPING
WELL
BP
T-6
TREE
T-10
TREE
COMMERCIAL CENTER
BOOK SHOP
0
10M
50M
DWG. TITLE (LENAKEL, TANNA)
DWN. BY
CHK. BY
APP. BY
DATE
SCALE 1:500
DWG. NO.
PACIFIC CONSULTANTS INTERNATIONAL
TOKYO, JAPAN

Fig. 6
A - 35

APPENDIX 6
References

APPENDIX 7 References

Organization

No.	Description	Page	Publisher
1-1	Structure of Public Works Department	10	Department of Public Works
1-2	Port and Marine Department Organization Structure	1	Port and Marine Department
1-3	Organigramme Provincial	1	TAFEA Provincial Office
1-4	TAFEA Provincial Government Structure	1	TAFEA Provincial Office
1-5	Proposed Structure; Public Service of Vanuatu (as of March 1998)	1	Department of Public Works

Economy and Industry

No.	Description	Page	Publisher
2-1	National Accounts of Vanuatu; 1985-1989	52	Statistics Office
2-2	National Population Census; May 1998, VI Tafea	80	Statistics Office
2-3	Report on the Smallholder Agricultural Survey; 1992	25	Statistics Office
2-4	Vanuatu Natioanl Agriculture Census; 1994	190	Statistics Office
2-5	Small Business & Informal Sector Surveys; 1995	142	Statistics Office
2-6	Consumer Price Index; Annual Report 1996	38	Statistics Office
2-7	Statistical Indicators; Fourth Quarter (October - December, 1997)	38	Statistics Office
2-8	3rd National Development Plan (1992 - 1996); (Chapter 17: Transport; Chapter 18:	35	Natioanl Planning Office
2-8	4th National Development Plan (1997 - 2001); (Chapter 9: Urban and Rural Infrastructure)	17	Natioanl Planning Office
2-9	Population Projection 1990 - 2001	1	Natioanl Planning Office
2-10	On-going Projects	9	Natioanl Planning Office

Transportation and Tourism

No.	Description	Page	Publisher
3-1	Vanuatu Domestic Visitor Survey; 1994	52	Statistics Office
3-2	Tourism and Migration; Annual Report 1996	37	Statistics Office
3-3	Summary of Overseas Trade; Annual Report 1994	28	Statistics Office

Natural Condition

No.	Description	Page	Publisher
4-1	Vanuatu National Tide Tables, 1993	32	Department of Land Survey
4-2	Vanuatu National Tide Tables, 1995	32	〃
4-3	Vanuatu National Tide Tables, 1996	32	〃
4-4	Tidal Predictions for Vanuatu - Port Vila	13	〃
4-5	Cyclone datas		Fiji Meteorological Service
4-6	Cyclone Trajectory Map	25	Fiji Meteorological Service
4-7	New Zealand Standard 4203:1992 Code of Practice for GENERAL STRUCTURAL DESIGN and DESIGN LOADINGS for BUILDING	230	Standards New Zealand