NO. 09

F I J I

BASIC DESIGN STUDY REPORT

ON

FISHERIES DEVELOPMENT PROJECT

October 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to a request of the Government of Fiji, the Japanese Government decided to conduct a survey on the Basic Design for Fisheries Promotion Project and entrusted the survey to the Japan International Cooperation Agency (J.I.C.A.). The J.I.C.A. sent to Fiji a survey team headed by Mr. Tatsuhiko Iwasawa from August 8 to August 26, 1981.

The team had discussions with the officials concerned of the Government of Fiji and conducted a field survey in Suva, Lautoka, Savu savu and Taveuni area. After the team returned to Japan, further studies were made and the present report has been prepared.

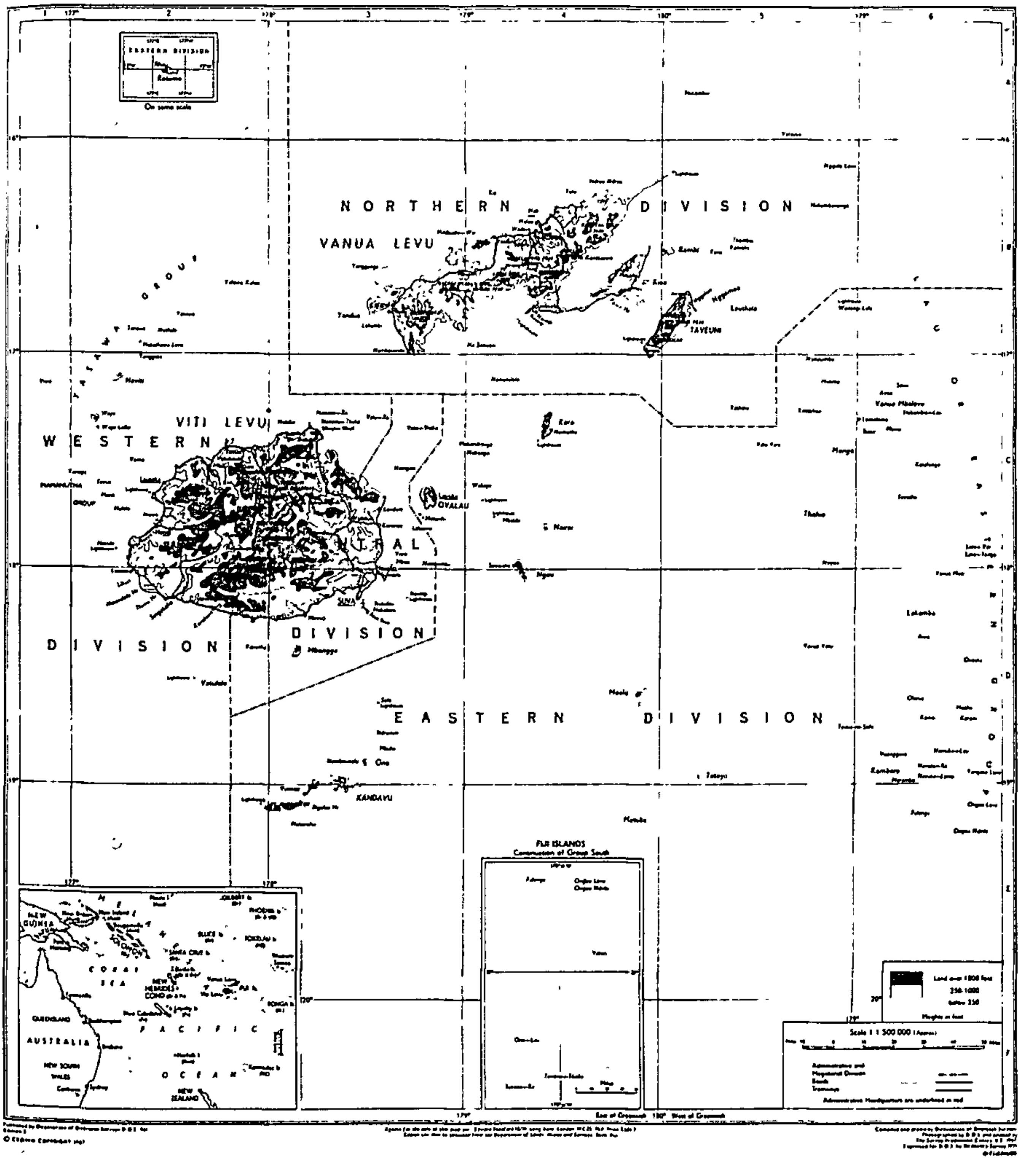
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

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

October 1981

Keisuke Arita
President
Japan International Cooperation Agency

MAP OF FIJI


NORTHERN DIVISION
VANUA LEVU
VITI LEVU
WESTERN DIVISION
CENTRAL DIVISION
EASTERN DIVISION
OVALAU
TAVEUNI
KANDAVU
SUVA
FIJI ISLANDS
PACIFIC OCEAN
CORAL SEA
AUSTRALIA
NEW GUINEA
NEW ZEALAND
QUEENSLAND

ABBREVIATION

G.T	:	Gross Tons
t	:	Tons
m	:	Meter
cm	:	Centi-meter
mm	:	Mili-meter
m^3	:	Cubic meter
m^2	:	Square meter
L	:	Length
W	:	Width
H	:	Height
T	:	Thickness
A	:	Ampere
V	:	Volt
KV	:	Kilo-Volt
KVA	:	Kilo-Volt-Ampere
W	:	Watt
KW	:	Kilo-Watt
cal	:	Calorie
Kcal	:	Kilo-Calorie
AH	:	Ampere-Hour
ø	:	Phase
Hz	:	Hertz
MHz	:	Mega-Hertz
CT	:	Condensing Temperature
ET	:	Evaporative Temperature
C	:	Centigrade
ℓ	:	Liter
AC	:	Alternating Current
DC	:	Direct Current
hr	:	Hour
min	:	Minute
Sec	:	Second
dia	:	Diameter
d	:	Denil
inc	:	Inches
PS or HP	:	Horse Power
rpm	:	Revolution Per Minute
N/mile	:	Nautical mile
KTs	:	Knots
$ or F$	:	Fiji Dollar
M.A.F.	:	Ministry of Agriculture and Fisheries

CONTENTS

ABBREVIATION

SUMMARY

Fiji gained its Independence in October 1970 as a member of the British Commonwealth of Nations after many years of British colonial rule that goes back to 1874. The country has since pursued a steady course of economic growth and now holds an important position in the South Pacific area.

To outline Fiji's economic standing as reflected in major indicators, 1978 recorded a gross national product of F$729.9 million and a per capita income of F$1,202. The economy of Fuji is primarily agrarian and sugar is its backbone, grown mainly on small-holdings, the sugarcane is crushed and partly-refined by the government-owned Fiji sugar Corporation. Sugar is Fiji's major export item. Tourism is the other major industry in Fiji's economy.

The Government of Fiji has implemented a number of long-term national development plans in an effort to establish a viable and self-reliant national economy.

Under these plans, the Government has made strenuous endeavors for the development of domestic natural resources. Particularly under the 8th (1981 - 1985) Development Plan, it has given special weight to the development of its marine resources and fishing industry, with efforts to promote a fisheries development plan formulated for this purpose.

The fisheries development plan consists of three projects formulated for the development of rural coastal fishery, offshore fishery, and fish culture. The rural coastal fisheries development project is intended to ease the transportation of fish to urban areas by consolidating the marketing facilities and by providing icemaking and supply facilities. The project is intended to improve the income level of rural fishermen and cut down the imports of canned fish by augmenting the fishery production. Thus, the Government hopes that the project will boost the country's rural fisheries industry, thereby strength-

ening Fiji's rural development efforts, and will improve protein supply to the urban areas utilising Fiji's marine resources rather than imported canned products.

To attain the objective of this project, the Government of Fiji requested Japan's grant aid for the supply of necessary facilities and equipment in investigation of this request, the Japan lnternational Cooperation Agency sent a survey team to Fiji to collect the data for the basic design of such facilities and equipment.

Durıng its stay in Fiji, the survey team conducted a field survey in the project areas, and had a series of dicussions with the competent Fiji authorities concerning the details of the request. As a result of this field survey and discussions with the Fiji officials concerned, the team learned that the rural coastal fishery in Fiji, though producing a total of about 17,400 tons of annual catch, is still at the traditional subsistence level, and the greater part of catch is used for fishermen's own consumption owing to the shortage of ice and cold storages and the delayed consolidation of marketing facilities. The team reached the conclusion that the supply of icemaking and cold storage facilities and fishing gear is indispensable and urgently needed for the project.

On the strength of this finding, the team signed the Minutes of Discussions in which it pledged to convey to the Japanese Government the intentions and desires of the Government of Fiji regarding its request for grant aid for the supply/construction of icemaking facilities, a fish collection and marketing center, fish collection vessels and vehicles, and fishing gear.

The following are the main facilities and equipment needed for the project implementation.

(1) Marketing facilities

Ice plants, ice storages, a fish collection and marketing center provided with cold storages and freezers, ice boxes, etc.

(2) Collection and transportation equipment

Fish collection vessels and refrigeration vehicles.

(3) Fishing gear and equipment.

The executing agency of the rural fisheries development project is the Fisheries Division of the Government of Fiji. The project operating fund has been already appropriated in the Government's working budget, and it is expected that suitable measures will be enforced for its smooth and efficient disbursement so that the new facilities and equipment will be utilized for the maximum benefit of the project.

The Government of Fiji has just started its 8th Development Plan (1981 - 1985). Considering the socio-economic expectations for this Plan, it can be said that the request for Japan's grant aid is very justifiable, because it will be made for the supply of facilities and equipment which will do much to assist the Plan achieve its developmental goals for Fiji's fisheries industry. The team believes that Japan's cooperation in the Plan in the form of grant aid has an undisputable significance and will also produce an important development effect.

CHAPTER 1. PROJECT BACKGROUND AND DETAILS OF REQUEST

1.1 Project Background

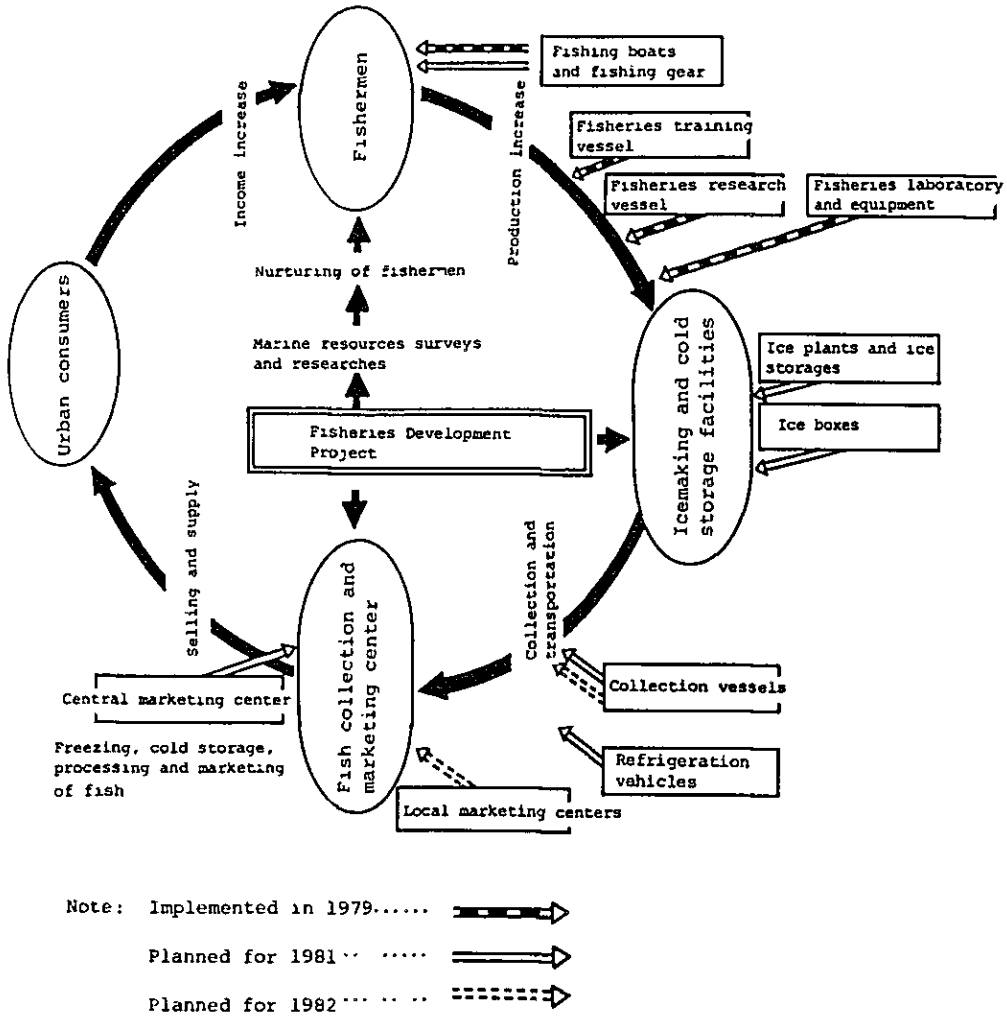
Since it was liberated from the British colonial rule and gained its independence in October 1970, Fiji has positively implemented a number of national development plans formulated to put an end to the heavy dependence on Britain for the independence and localization of its economy.

However, the Fiji economy having long been based on agriculture, farm produce such as sugar and coconuts holds the dominant position in the gross national product and in the export trade. The country is therefore confronted with a diversity of difficulties resulting from the global inflationary tendencies, such as the cost escalation of consumer goods and the shortage of foreign currency reserves.

The situation has forced the Government of Fiji to direct special efforts to the development of domestic resources. For the development of marine resources, in particular, the Government incorporated a fisheries development plan in its 5th National Development Plan (1965 - 1970), extablished Fisheries Division, and actively concluded loans with international financing institutions, thus enforcing positive administrative and financial measures to promote the development of its fishing industry. Augmented production and smoother marketing of marine products for supplying sufficient protein foods to the people is one of the major food policies of the Government because the country's population is increasing at an annual rate of about 1.8% (average of the last five years).

Against the background mentioned above, the Government planned to promote the development of offshore fishery and rural coastal fishery for augmented fishery production, and to enlarge and consolidate the marine products distribution system. This report presents the findings of a survey conducted with specific emphasis on the development of rural fisheries.

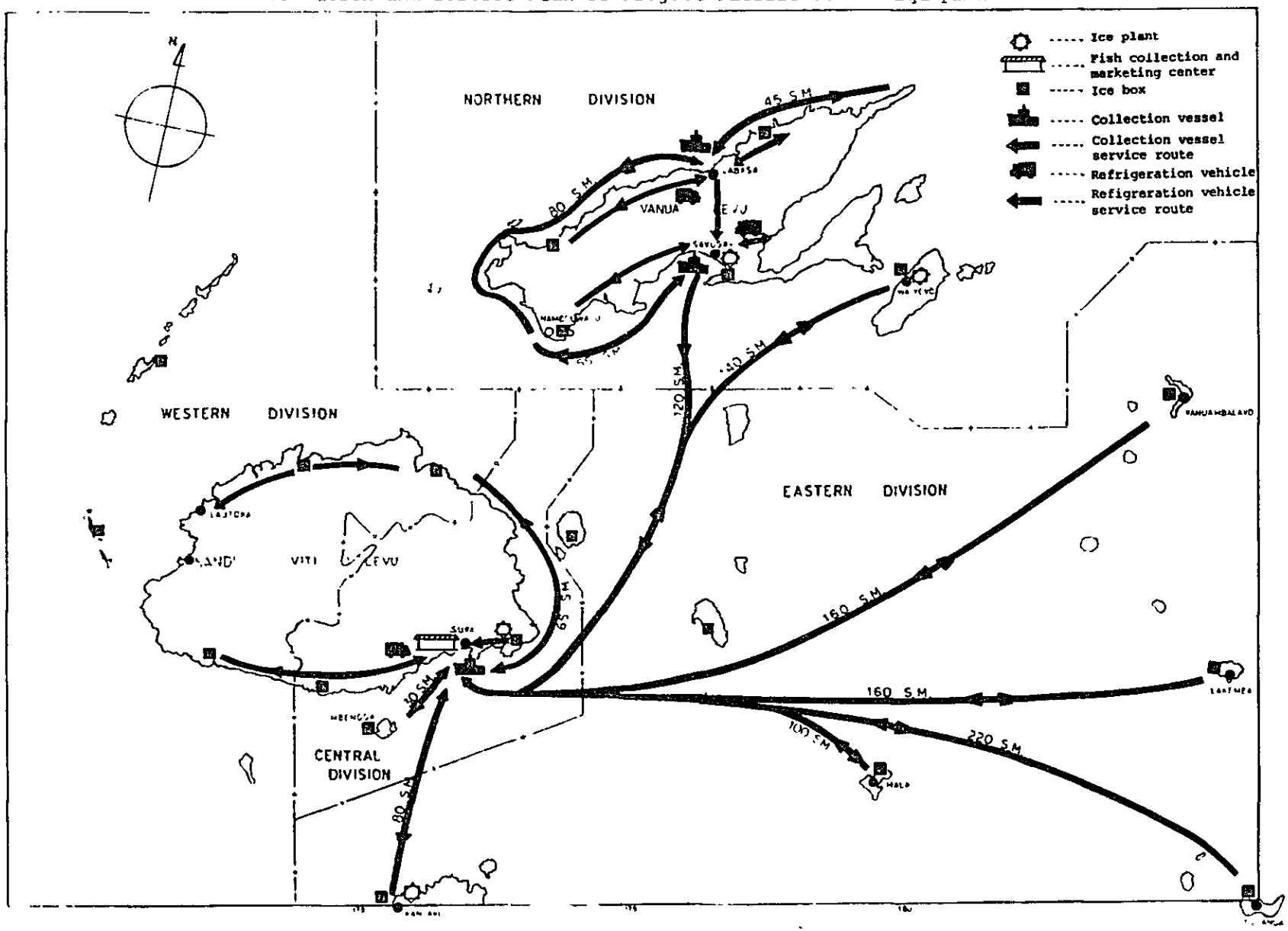
The following figure illustrates the rural fisheries development project as envisaged by the Fisheries Division of the Government of Fiji.



The facilities and equipment required for the project cannot be procured within Fiji, nor can they be imported from abroad owing to the shortage of foreign currency reserves.

The following figure shows the distribution and service routes of the facilities and equipment to be supplied for the project.

Distribution and Service Plan of Project Facilities and Equipment



1.2 Details of Request

The details of facilities and equipment requested to be supplied under the Japanese grant aid are as shown below (Refer to the distribution and service plan shown on the preceding page).

Item	Facilities and equipment/ Installation site	Purpose
Marketing facilities		
Icemaking plant	Ice plants with ice storages to be installed in the following 4 areas. ° Wainibokasi ° Savu savu ° Taveuni ° Vunisea	Manufacture and store ice and supply it to local fishermen.
Ice boxes	30 sets to be installed in local fishing villages.	Store the ice and catch temporarily to preserve the freshness of fish landed in local fishing villages.
Fish collection and marketing center	A center equipped with cold storages, freezers, workshop, office building, and marketing and processing equipment, to be constructed at Lami.	Perform the fish handling, processing, freezing and storage functions as a collection and marketing center serving as a base for fish distribution to urban consuming areas.
Collection and transport equipment		
Collection vessels	1 large collection vessel (30 G.T) to be put in service at Suva. 2 small collection vessels (5 - 6 G.T) to be put in service at the following bases. ° Savu savu ° Lambasa	Supply ice to local fishing villages and collect fishes therefrom to transport them to urban fish markets or the collection center.
Refrigertion vehicles	3 units to be put in service at the following bases. ° Suva ° Savu savu ° Lambasa	- do -

Item	Facilities and equipment/ Installation site		Purpose
Fishing gear and equipment	Gill net with accessories	36 sets	Increase the fishery production by distributing them to local fishermen.
	Handline with accessories	36 sets	- do -
	Fishing equipment		
	Fish finder	36 sets	Increase the local fishery production and disseminate advanced fishing technique by installed them on the small fishing boats now being constructed by the Fisheries Division for distribution to local fishermen.
	Fishing winch	36 sets	
	Marine diesel engine with accessories	36 units	
	Propeller and propeller shaft	36 sets	
	Anchor and anchor rope	36 sets	
	Steering wheel, compass and life jacket	36 sets	
	Seine net	1 unit	Conduct seine net fishing operation of an experimental basis for its planned introduction aimed at catching surface fish in local coastal waters.
	Lift net	1 unit	Catch the bait for the coastal pole and line fishing operation.

It is planned that the management and operation of the facilities and equipment listed above will be undertaken by the Fisheries Division and the National Marketing Authority.

CHAPTER 2. OUTLINE OF SURVEY

2.1 Objective and Scope of Survey

The objective of the survey was to study the necessity and adequacy of the facilities and equipment for which the Government of Fiji requested Japan's grant aid, and to work out the basic design such facilities and equipment according to the situation of Fiji.

The scope of the survey was determined to attain this objective. The following were the main items covered by the survey.

(1) Background of the request.

(2) General situation in Fiji, and the future prospects of Fiji's fishing industry.

(3) Existing state of rural fisheries in the neighborhood of Suva, Savu savu and Lambasa.

(4) Existing state of fishing facilities, and their utilization of fishermen.

2.2 Survey Policy

Fiji's request was made for the supply of a series of facilities and equipment necessary for the production, cold storage, transportation and distribution. Specifically, they included the fishing gear and equipment for fishery production, the collection vessels and refrigeration vehicles for fish collection and transportation, the icemaking facilities for maintaining the freshness of fish, and the cold storage and marketing facilities.

The basic policy along which the team conducted its survey was to study whether such facilities and equipment are necessary and adequate and can be used efficiently for the development of rural fisheries in the future. In each project area, therefore, the survey was focused on the administrative setup,

availability and future prospects of technical support systems for rural fisheries development, inspections and interviews for clarifying the situation in rural fishing villages, operation and utilization of various facilities related to fisheries.

2.3 Formation of Survey Team

The team was organized with the following members led by Mr. Tatsuhiko Iwasawa.

Mr. Tatsuhiko IWASAWA (Leader of the Team)
International Affairs Div.
Oceanic Fisheries Dept., Fisheries Agency
Ministry of Agriculture, Forestry and Fisheries

Mr. Kunihiko OOHATA (Planner)
Long Distance Fisheries Div.
Oceanic Fisheries Dept., Fisheries Agency
Ministry of Agriculture, Forestry and Fisheries

Mr. Naoyoshi SASAKI (Coordinator)
First Procurement Division
Procurement Department
Japan International Cooperation Agency

Mr. Kiyoyasu MIYAHARA (Fisheries Expert)
Universal Marine Consultant Co., Ltd.

Mr. Yutaka MATSUI (Marketing & Refrigeration Expert)
Universal Marine Consultant Co., Ltd.

Mr. Hiroshi FUTAMI (Naval Architect)
Universal Marine Consultant Co., Ltd.

2.4 Itinerary of Survey Team

The survey was conducted for a period of 19 days from August 8 to 26, 1981. The itinerary of the survey team is shown in Annex II.

2.5 Officials Concerned of the Government of Fiji

The names of the officials concerned of the Government of Fiji with the project, including those with whom the team had discussions, are shown in Annex III.

2.6 Minutes of Discussions

The Minutes of Discussions between the team and the Fiji officials was signed and exchanged on August 21, 1981 by Mr. Tatsuhiko Iwasawa, the team leader, and Mr. R. Yarrow, the Permanent Secretary for Agriculture and Fisheries of the Government of Fiji. The text of the Minutes is shown in Annex I.

CHAPTER 3. BASIC DESIGN

If the facilities and equipment required for the project are supplied as requested, it is certainly to be desired that the project will function effectively and be positioned as an essential basis for the future development of rural fisheries.

For this reason, the kinds, specifications and quantity of all facilities and equipment should be determined after ascertaining that they are indispensable and can be fully utilized for the rural fisheries development.

The basic design of the facilities and equipment to be supplied along such fundamental approaches, was worked out not to attain a phenomenal increase in fishery production or promote the rural fisheries in a short time, but in due recognition of the need for providing the basis for developing stages from a long-term point of view.

Quantities of Facilities Originally Requested/Modified in Basic Design

Requested Quantity	Modified Quantity	Remarks
(Marketing facilities)		
Ice plant 4 places ° Wainibokasi ° Savu savu ° Taveuni ° Vunisea	3 places ° Wainibokasi ° Savu savu ° Taveuni	Vunisea was excluded because it is located at a distance of only about 80 miles from Suva and can therefore be supplied with ice by collection vessels, and also because its fishery production is small.
Ice box 30 sets	20 sets	The quantity was reduced to 20 sets according to the local distribution plan.
Collection and marketing center 1 unit	1 unit	

Requested Quantity	Modified Quantity	Remarks
(Collection and transport equipment) Collection vessel 3 Refrigeration vehicle 3	2 3	The number of small collection vessels was reduced to 2 because fishery production of islands far from the main islands is still small.
(Fishing gear and equipment) 36 sets	16 sets	The originally requested quantity was reduced to 16 sets because the stock data indicates that the gear and equipment supplied in 1980 have just begun to be utilized.
(Seine net and lift net) 1 unit each	1 unit each	The originally requested quantity of 1 unit was not changed because both nets are useful in introducing new fishing methods for rural fisheries development.

3.1 Icemaking Facilities

3.1.1 Basic Plan

At present, the icemaking facilities belonging to the Fisheries Division are located in Lami, Wainibokasi, Lautoka, Lambasa and Savu savu, and they produced a total of about 1,800 tons of ice in 1980 (Annual Report of M.A.F., 1980).

The ice plant at Wainibokasi breaks down often because it is already superannuated, but there is no prospect for its repair because no replacement parts can be obtained. The fishermen in the neighboring areas are confronted with an acute shortage of ice. The construction of a new ice plant was planned to take the place of this outworn plant. The supply of electric power and high-quality fresh water is large enough for the operation of the new plant. The selected plant site adjoins to the existing plant.

At Savu savu, there is an icemaking unit with a daily production capacity of 300 Kg of block ice, which was installed in 1977 with the financial aid of the Bank of New Zealand. Owing to the deficient maintenance service, however, it often gets out of order and does not exhibit its capacity to the full. In addition, lacking an ice storage, this unit is operated on an order production basis, so that its ice production falls far short of the demand of local fishermen. The new ice plant with an ice storage is planned to be installed at the site already secured, which is adjacent to the workshop supplied by the Japanese Government in 1980. In the hinterland of the site, there is a diesel engine power plant. The supply of electric power and high-quality fresh water can be secured for the operation of the plant.

At Taveuni, there are no icemaking or cold storage facilities. The island has an estimated population of about 11,000 (1980), about 100 fishermen, and about 60 fishing boats with fishing permits. According to the staff members of Savu savu Station of the Fisheries Division and the Ministry of Agriculture and Fisheries interviewed by the team, "there are many farmers

who are currently engaged mainly in coconut cultivation and want to shift to fishing operation." The installation of the new ice plant will increase the number of fishermen and provide the basis for fisheries development in this area.

The new ice plant with an ice storage is planned to be installed in an area of about 120 m^2 which has already been secured within the compound of the existing farm produce market. There is no difficulty in securing high-quality fresh water at this site. However, since no power supply is available for the plant operation, it is planned that the plant will be equipped with diesel engine generators.

Note: Electric power required for the people's daily lives and for hotels, restaurants and public facilities in this area is supplied by private power plants.

3.1.2 Studies for Determination of Specifications

° Determination of size/capacity

Although it is most desirable to determine the size and capacity of the ice plant and ice storage on the basis of fish catch, no accurate forecast can be made for the increase of fish catch resulting from the project implementation.

The following table shows the estimated fishery production and the actual ice production appearing in the statistics of the Fisheries Division for 1979 and 1980.

Unit: ton

Administrative Division	Consumption by Households (EST.)	Marketed Fish	Total Production (A) (EST.)	Ice Production (B)	B/A (%)
Central Div.	2,836	1,726	4,562	647	14
Western Div.	6,113	1,272	7,389	680	9
Northern Div.	1,324	512	1,836	497	27
Eastern Div.	3,553	69	3,622	0	0
Total	13,826	3,579	17,405	1,824	—

Note: To breakdown the ice production of each division by area, 647 tons of the Central Division are made up of the productions at Lami (536 t) and Wainibokasi (111 t), 680 tons of the Western Division come from Lautoka, and 497 tons of the Northern Division represent the productions at Lambasa and Savu savu.
The ratio of the estimated fish consumption by fishery households to the estimated total fish catch is as high as about 79%, whereas only about 21% of the total fish catch is supplied to consumers through the existing marketing channels including the municipal markets, roadside stalls, and the National Marketing Authority.

Considering the data given in the above table and note, the ice demand in each division was calculated by assuming the following two conditions.

1) About 2/3 of the fish catch used for fishermen's consumption are actually required for the daily lives of fishery households, and the remaining 1/3 can be sold on fish markets.

2) When supplying fresh fish to the market, the ratio of fish to ice is generally maintained at 1:1. However, the ratio can be set at 1:0.8 because a relacively short period of icing is considered.

$$\text{Ice demand} = \left\{\begin{matrix}\text{Marketed} \\ \text{fish catch}\end{matrix} + \left(\begin{matrix}\text{Fish catch consumed} \\ \text{by fishermen (EST.)}\end{matrix} \times 1/3\right)\right\} \times 0.8 - \text{Ice production (1980)}$$

Unit: ton

Central Div.	{1,726 + (2,836 x 1/3)} x 0.8 - 647 = 1,490
Western Div.	{1,272 + (6,113 x 1/3)} x 0.8 - 680 = 1,968
Northern Div.	{ 512 + (1,324 x 1/3)} x 0.8 - 497 = 265
Eastern Div.	{ 69 + (3,553 x 1/3)} x 0.8 - 0 = 1,003
	Total 4,726 tons

Thus, the calculation worked out on the basis of the 1980 data of coastal fishery production and ice production indicates that the ice shortage in the whole of Fiji amounts to a total of about 4,700 tons.

If the ice plant with a daily production capacity of 5 tons is installed in the three areas and put in operation according to the demand, about 4,800 tons of ice can be supplied by running the three plants 320 days a year. Hence, it is possible to fill the above mentioned ice demand.

The ice plant to be introduced was determined to be an automatic plate icemaking plant, in consideration of the kinds and sizes of fish, easy handling of ice, and simplicity of plant operation.

The ice storage was determined to have a storage capacity of 20 tons equivalent to four times the daily icemaking capacity of the ice plant (5 tons), and was also designed to be used as a fresh fish cold storage.

° Ice box

It is planned that ice boxes to be used as temporary cold storages of fish as well as ice storages will be distributed to local fishing villages.

For the ease of transportation within Fiji based on the local distribution plan, the ice box was designed to have prefabricated heat-insulating panels to be assembled at site, and an ice storage capacity of about 2.6 m^3.

Furthermore, to assure that it will exhibit sufficient durability and excellent ice/fish storage capabilities in the hot and humid climate in Fiji, the ice box was designed to have a sufficient heat-insulating structure, with urethane foam laminated between outer panels made of aluminum.

3.1.3 Specification of Basic Design

(1) Icemaking Facilities

Equipment	Specifications/Standards
Ice plant	——— 3 sets
	Type : Plate icemaking unit.
	Icemaking capacity : 5 tons/day.
	Plant building : Steel frame, prefabrication type.
	Icemaking unit : R22 condensing unit (CT 38°C, ET -18°C, 34,000 Kcal/hr x 18 KW, 400 V x 3ø, 50 Hz) air condenser, receiver, dryer, etc.
	Water supply pump : 50 ℓ/min x 9 mH x 0.2 KW, with valves and pipes.
	Others : Switchboard and accessories; Wiring materials, switches, sockets, etc.; Illuminating equipment and materials; Piping materials for water supply and drainage; Construction materials.
	Chemicals, etc. : Freon gas - R22, freon detector, refrigerator oil, silica gel, etc.
	Tools, spare parts, etc. : Standard tools and spare parts necessary for the operation and maintenance of the plant.
Generating plant	To be installed in the Taveuni area. 1 set
	Diesel generator : 60 HP x 2.
	Capacity : 50 KVA x {AC 400 V, 3ø, 50 Hz / AC 200 V, 1ø, 50 Hz}
	Tools, etc. : Standard tools and spare parts.

Equipment	Specifications/Standards		
Ice storage	Type	: Prefabrication type.	3 sets
	Capacity	: Approx. 20 tons.	
	Storage temperature	: -5°C.	
	Dimensions	: Approx. 4.5 m(L) x 4.5 m(W) x 2.4 m(H); Thickness of heat insulating panel - 100 mm.	
	Outer panel material	: Aluminum panel, with urethane foam laminate on for heat insulation.	
	Heat insulating door	: 0.9 m x 1.8 m x 100 mm (thickness).	
	Air curtain	: 1.0 m x 43 m^3/min x 0.23 KW.	
	R22 condensing unit	: CT 32°C, ET -15°C, 3,500 Kcal/hr x 2.2 KW, 400 V, 3ø, 50 Hz, complete with air condenser, receiver and standard accessories.	
	Cooler	: 22.5 m^2 x 32.0 m^3/min x 0.2 KW, with heater defrost system.	
	Other components and materials	: Switchboard and accessories; Wiring and piping materials; Illuminating equipment and materials;	
	Tools, etc.	: Standard tools and spare parts necessary for the operation and maintenance of the storage.	

(2) Ice Box

Equipment	Specifications/Standards		
Ice box	------------------------------------ 20 sets		
	Type	:	Prefabricated type.
	Material	:	Aluminum panel, with urethane foam laminate on for heat insulation.
	Dimensions (approx.)	:	1.8 m(L) x 1.2 m(W) x 1.2 m(H) x 100 mm(T).
	Capacity	:	Approx. 2.6 m^3 (approx. 1.5 tons).
	Door	:	Approx. 0.6 m x 0.6 m, insulated by urethane foam with a thickness of about 100 mm.

3.2 Fish Collection and Marketing Center

3.2.1 Basic Plan

The following table shows the coastal fishery production and population distribution in Fiji by area.

Administrative Division	Population	Fish production by Rural Fisheries		
		Consumed by Households (EST.)	Supplied Markets	Total (EST.)
		tons	tons	tons
Central Div.	218,000	2,826	1,726	4,562
Western Div.	253,000	6,113	1,272	7,385
Northern Div.	105,000	1,324	512	1,836
Eastern Div.	44,000	3,553	69	3,622
Total	620,000	13,826	3,579	17,405

Source: Statistics of the M.A.F. 1979, 1980.

The annual per capita fish consumption in Fiji, calculated as a simple arithmetic average on the basis of the above table, is 28.07 Kg as shown below.

17,405,000 Kg ÷ 620,000 (persons) = 28.07 Kg/person

Compared with the per capita annual consumption of 65.3 Kg in Japan, about 7 Kg in Australia, 10 Kg in Indonesia, and 15 Kg in the United States, and adding the urban consumption of frozen marine products imported from Australia and New Zealand, this figure indicates that the Fijians have a considerably strong appetite for fish.

As for the present status of distribution of the catch by coastal fishery, it is known that about 79% of the total catch, or about 13,800 tons, is landed for fishermen's consumption, and the remainder of about 21%, or about 3,580 tons, is supplied to consumers through municipal markets, roadside stalls, and the National Marketing Authority. It is probable that the small share of marketed catch is ascribable to the fact that

fish marketing is made difficult owing to the shortage of ice and cold storage facilities indispensable for freshness preservation in local areas and the deficient availability of transport means.

As shown in the figures on pages 6 and 7 , the Fisheries Division plans to consolidate fish marketing facilities as one of the concrete measures for implementing the rural fisheries development project.

The team studied the necessity and justifiability of this plan, including its correlations with the overall project plan, and designed the fish collection and marketing center to be provided with icemaking facilities, cold storage and freezing facilities, and fish handling and processing equipment.

As for the construction site of the center, the seashore area adjacent to the Fisheries Division which is now under reclamation (August 1981) was selected (see the "Reclamation Plan for Fish Collection and Marketing Center," page 28). The reclamation work is expected to be completed at the end of 1981.

The construction of the center in this reclaimed land area must be preceded by the foundation work to be undertaken by the Government of Fiji to provide the ground with a sufficient bearing power (nore than 5 t/m^2)

3.2.2 Studies for Determination of Specifications

° Determination of scale

Calculation for the required building area of the center was worked out by assuming a number of conditions, as shown below.

Conditions assumed for calculation:

Annual number of operating days	300 days
Daily fish handling volume	6,000 Kg

Formula for building area calculation:

$$S = \Sigma \frac{N}{R \times \alpha \times P}$$

where, N: Daily fish handling volume (Kg/day).

R: Rotation (Time/day)

P: Fish handling volume per unit area (Kg/m^2).

α: Occupancy (%).

S: Required building area (m^2).

$$S = \frac{6{,}000 \text{ Kg}}{1(\text{time/day}) \times 0.33 \times 50 kg/m^2} = 360 \text{ } m^2$$

Besides the building area of 360 m^2 calculated above, there should be an area of about 58 m^2 provided for cold storage (storage capacity - approx. 60t) and about 16 m^2 for the freezer (daily production capacity - approx. 2t). Hence, the center must have a total building area of about 440 m^2.

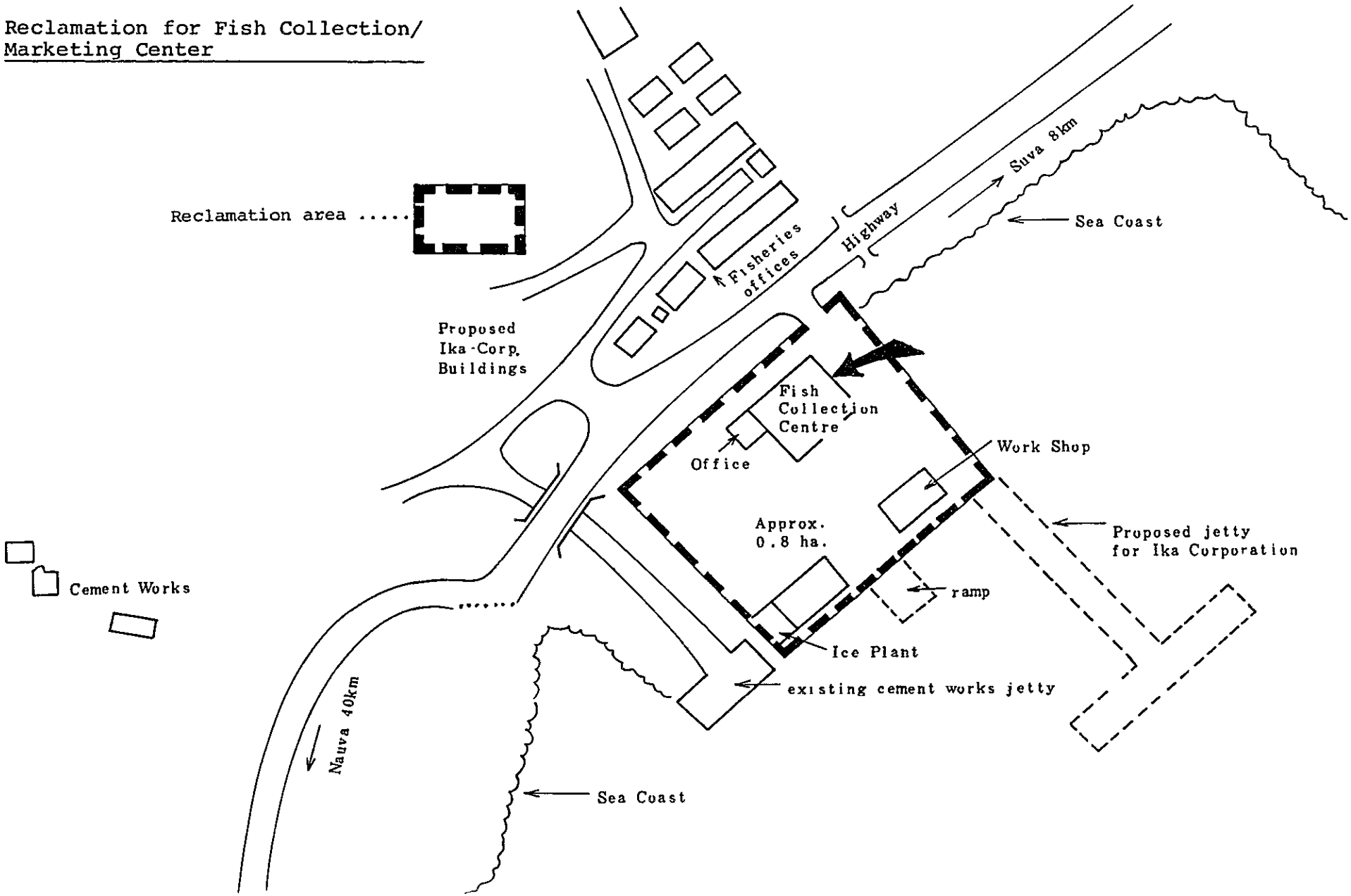
(1) In the design of the Marketing Center building, consideration was given to the possible damage due to hurricanes. Hence, it was designed as a prefabricated building having a light steel frame structure capable of withstanding a wind pressure of 60 m/sec. Its roof will be tiles with color roofdeck with an antisweat covering to shut out the heat and humidity of the tropical climate, and will also be given a sufficient pitch for quick drainage of rainwater.

Its outer walls will be covered with color steel sheets, and have louver glass windows large enough for lighting and ventilation and framed with durable aluminum sashes.

It will have a concrete floor spacious enough for fish handling and processing and inclined suitably for satisfactory drainage of waste water.

(2) The Marketing Center was designed to have an office building annexed to it for its management and operation. The annex will have offices, a dining room, kitchen, lavatories to be used by clerical and fish handling workers. Water closets, showers and wash basins will be provided separately for males and females. The required office building area is about 51 m^2.

Reclamation for Fish Collection/
Marketing Center



3.2.3 Specification of Basic Design

Item	Specifications/Standards			
Fish collection and marketing center				1 unit
Building	Building area	:	Approx. 440 m^2	
	Structure	:	Prefabricated building with a light steel frame structure.	
	Materials	:	Roof - color roofdeck, insulated.	
			Outer walls - color steel sheets, with aluminum sashes for louver glass windows.	
	Complete with interior water supply and drainage facilities and lighting facilities.			
Cold storage (A)	Storage temperature	:	-25°C	
	Storage capacity	:	Approx. 40 tons.	
	Floor area	:	Approx. 38.8 m^2. (7.2 m(L) x 5.4 m(W) x 2.7 m(H))	
	Heat insulation	:	Approx. 120 mm thick urethane foam panels, with dial thermometer.	
	Outer walls	:	Aluminum panel	
	Door dimensions (Heat insulated)	:	Approx. 0.9 m(W) x 1.8 m(H) x 100 mm(T).	
	Air curtain	:	1.0 m x 0.23 KW.	
	Condensing unit	:	CT 32°C, ET -32°C, 12,000 Kcal/hr x 15 KW, 400 V x 3ø, 50 Hz, with an air condenser, receiver, refrigerant (R-502).	1 set
	Cooler	:	118 m^2 x 144 m^3/ min x 0.4 KW x 2, with heater defrost system.	1 set

Item	Specifications/Standards		
	Switchboard and wiring materials		1 set
	Piping materials		1 set
	Standard tools and spare parts necessary for operation and maintenance.		1 set
Cold storage (B)	Storage temperature	: -5°C	
	Storage capacity	: Approx. 20 tons.	
	Floor area	: Approx. 19.4 m^2. (3.6m(L) x 5.4 m(W) x 2.7 m(H))	
	Heat insulation	: Approx. 100 mm thick urethane foam panels, with dial thermometer.	
	Outer walls	: Aluminum-coated steel sheets.	
	Door dimensions (Heat insulated)	: Approx. 0.9 m(W) x 1.8 m(H) x 100 mm(T).	
	Ceiling structure	: Light steel frame structure.	
	Condensing unit	: CT 32°C, ET -15°C, 3,400 Kcal/hr x 2.2 KW, 400 V x 3ø, 50 Hz, with an air condenser, receiver, refrigerant (R-22), and standard accessories.	1 set
	Air curtain	: 1.0 m x 0.23 KW.	
	Cooler	: 22.5 m^2 x 32 m^3/min x 0.2 KW, with heater defrost system.	1 set
	Switchboard and wiring materials		1 set
	Piping materials		1 set
	Standard tools and spare parts necessary for operation and maintenance.		1 set
Blast freezer	Freezing capacity	: 2 tons/24 hrs.	
	Floor area	: Approx. 14.5 m^2. (2.7 m(L) x 5.4 m(W) x 2.7 m(H))	
	Heat insulation	: Approx. 120 mm thick urethane foam panels, with dial thermometer.	

Item	Specifications/Standards
Equipment	Outer walls : Aluminum Panel Door dimensions (Heat insulated) : Approx. 0.9 m(W) x 1.8 m(H) x 100 mm(T). Ceiling structure : Prefabricated light steel frame structure. Freezing shelves : 3.2 m(L) x 0.8 m(W) x 2.4 m(H). Condensing unit : CT 32°C, ET -35°C, 10,500 Kcal/hr x 15 KW, 400 V x 3ø, 50 Hz, with an air condenser, receiver, refrigerant (R-502), and standard accessories. — 1 set Cooler : 124.5 m^2 x 180 m^3/min x 0.75 KW x 2, with heater defrost system. — 1 set Switchboard and wiring materials — 1 set Piping materials — 1 set Standard tools and spare parts necessary for operation and maintenance. — 1 set Forklift truck Pay load : 1,000 Kg. Battery : DC 48 V. Lift height : 3 m. Battery charger : 400 V x 3ø, 50 Hz. Standard tools and spare parts ..... 1 set Bandsaw (for cutting fish) — 2 units Dimensions : 550 mm x 865 mm x 1,375 mm. Capacity : 1.5 KW, 220 V. Fish washing tank — 2 sets 2 m x 1.2 m x 0.5 m, stainless steel, with mount. Fish processing table — 2 sets 1.8 m x 0.9 m x 0.8 m, stainless steel.

Item	Specifications/Standards	
	Aluminum fish container 600 mm x 400 mm	200
	Plastic fish basket 600 mm x 400 mm	200
	Assorted fish knives	30
	Scale 250 kg : 1 set 100 kg : 6 sets 20 kg : 2 sets	
	Freezer Chest type : Capacity approx. 515 lit., -20°C, 220 V. Display type : Capacity approx. 515 lit., -20°C, 220 V.	5 sets each
	Cash register 220 V.	5 sets
Office building and equipment		1 set
Office building	Floor area : Approx. 51 m^2. Structure : Prefabricated light steel frame structure. Materials : Roof - Color roofdeck. Outer walls - Color steel sheets, with aluminum sashes for louver glass windows. Complete with interior water supply and drainage facilities and lighting facilities.	

Item	Specifications/Standards	
Office equipment	Desk and chair	2 sets
	Electric typewriter, 220 V	2 sets
	Ceiling fan, 220 V	2 sets
	Bookshelves	2 sets
	Filing cabinet	2 sets
Kitchen equipment	Sink, stainless	1 set
	Gas range, with ventilation fan	1 set
	Electric water heater, 220 V	1 set
	Ceiling fan, 220 V	1 set
	Overhead shelves	1 set
Toilet and shower	Wash basin	1 set each for males and females
	Water closet	"
	Mirror	"
	Shower set	"

3.3 Refrigeration Vehicle

3.3.1 Basic Plan

The refrigeration vahicle was designed to serve the dual purpose of collecting freash fish from local fishermen and transporting them to urban consuming areas without impairing the freshness, and supplying ice from ice plants to local fishermen to make it possible for them to preserve the freshness of fish.

For this purpose, it is planned that one refrigeration vehicle each will be distributed to Suva, Savu savu and Lambasa, which are the main fishing bases and provided with an ice plant.

3.3.2 Studies for Determination of Specifications

Since it is probable that the roads leading to local fishing villages are still in a poor condition, the refrigeration vehicle, which will be a 2-ton diesel engine truck, must have a structure rigid enough to run on any rugged roads.

The refrigerator to be mounted on the vehicle will have a storage capacity of about 2,000 Kg with the heat-insulating urethane foam laminated between the aluminum outer panel sheets. The vehicle will also have a freezer for maintaining the freshness of fish at a storage temperature of about -5°C.

3.3.3 Specification of Basic Design

Item	Specifications/Standards
Refrigeration vehicle	3 units
	Type : Van type refrigerating vehicle.
	Pay load : 2,000 Kg.
	Dimensions : 4.8 m(L) x 2.0 m(W) x 2.7 m(H).
	Freezing facilities : Freezer for maintaining a storage temperature of -5°C, and accessories.

3.4 Collection Vessel

3.4.1 Basic Plan

The collection vessel was designed to serve the dual purpose Of collecting fish from fishermen and supplying them with ice. It will collect fish from the coastal fishing villages and the islands scattered in the Northern and Southern Divisions and transport them in a fresh, refrigerated state to urban consumer markets such as Suva and Savu savu, and at the same time will supply ice for freshness preservation to rural fishermen from the fishing bases equipped with an ice plant.

At present, fish caught in coastal waters near urban areas are shipped to consumer markets by the fishermen themselves. However, about 79% of fish caught by fishermen in remote fishing villages and islands is landed for fishery households' consumption because of the absence of transport means to urban consuming areas and also because of the shortage of ice for freshness preservation.

Unit: ton

Administrative Division	Consumed by Household (B) (EST.)	Marketed Fish	Production by Rural Fisheries (A) (EST.)	B/A (%)
Central Div.	2,836	1,726	4,562	62
Western Div.	6,113	1,272	7,385	83
Northerm Div.	1,324	512	1,836	72
Eastern Div.	3,553	69	3,622	98
Total	13,826	3,579	17,405	79

Source: Statistics of the M.A.F. 1980.

It can be noted in the above table that fish consumption by fishery households is large, particularly in the Eastern Division, which consists of small islands, accounting for 98% of the total catch.

The Fisheries Division requested the supply of total of three collection vessels, one large vessel to be based at Suva for fish collection from the islands in the Eastern Division and two small vessels to be based at Savu savu and Lambasa for short-distance collection service. However, owing to the anticipated shortage of operational costs resulting from the budgetary reasons on the part of the Government of Fiji and because of the estimated production increase in the Eastern Division, the supply of the large vessel was suspended and it was determined to put two small vessels in service, one to be based at Suva in the Central Division and another at Savu savu in the Northern Division.

3.4.2 Studies for Determination of Specifications

In determining the specifications of the two small collection vessels, consideration was given to the past data and prospective increase of coastal fishery production. One of them was designed to have a gross tonnage of 11 tons and a fish hold capacity of about 10 m^3, and the other to have a gross tonnage of 7 tons and a fish hold capacity of about 6 m^3.

The sea area embracing the service routes of the collection vessels is generally calm during the April - October period when the wind force ranges from 0 to 2 (Beaufort wind scale) and the wind speed from 0 to 3.3 m/sec. In the monsoon season lasting from November to March, however, it is known that the area becomes rough with southwesterly wind blowing at a speed of 3.4 - 10.7 m/sec (wind force 3 - 5), causing a wave height of 4 - 6 m. In the design of the vessels, therefore, prime consideration was given to the safety, sea worthiness, and economic efficiency. Hence, each vessel was designed to be a lightweight, light draft FRP vessel.

To assure that they will perform the functions of refrigerating carriers to the full in the hot and humid tropical climate in Fiji, the fish hold was designed to have a heat-insulating structure, with a freezer installed to maintain the required storage temperature.

Since the service routes pass through coral reefs, each vessel will be equipped with safety devices such as a fish finder (serving also as an echo sounder), radar, and other nautical instruments. It will also have a tender boat to be used for loading and unloading of fish and ice as well as for communication between the shore and the vessel because most of local fishing villages are not considered to have well-consolidated berthing and cargo handling facilities.

(1) 11-ton Collection Vessel

This vessel was designed to remain at sea for about one week and have a cruising range of about 600 N/miles.

1). Shape

In order to endure expected oceanic conditions and waves in the operation area and to maintain sufficient buoyancy, the vessel is designed to have a forecastle slightly higher than on normal vessels. The bow is especially shaped to offer satisfactory stability and sea worthiness.

2). Principal particulars

Overall length	:	Approx. 14.50 m
Extreme breadth	:	Approx. 3.50 m
Overall depth	:	Approx. 1.65 m
Length (Register)	:	12.00 m
Breadth (Moulded)	:	3.20 m
Height (Moulded)	:	1.05 m
Gross tonnage	:	Approx. 11.00 tons
Main engine	:	One 150 HP diesel engine, 1,600 rpm Four cycle high-speed vertical type
Propeller:	:	High tension cast brass

Speed	:	Maximum at trial	Approx. 9.0 Knots
		Service speed	Approx. 7.5 Knots
Capacity	:	Fuel tanks	Approx. 2.8 m^3
		Fresh water tanks	Approx. 0.6 m^3
		Fish hold	Approx. 10.0 m^3
Complement	:		3 persons

3). Hull construction

Efforts should be made to minimize the weight of the vessel by using light-weight and strong FRP panels or by means of the layered structure.

The structural specifications are as follows:

Outside planking	:	FRP panels, or layered structure
Deck	:	Plywood covered with FRP or layered balsa
Bulkhead	:	Plywood covered with FRP
Engine bed	:	FRP with rigid polyurethane foam as core material
Rudder	:	Galvanized steel plates
Rudder head	:	Stainless steel
Propeller shaft	:	High tension brass
Stern tube	:	High tension cast brass of FRP

4). General arrangement

The bow is provided with a sunken forecastle to offer good sea worthiness. As shown in the drawing of the general arrangement, the vessel contains the sunken forecastle (divided into upper and lower parts with deck and storage on the upper part and void space on the lower part), the fish holds (three sections), the engine room (fuel tanks are located on both sides in the rear), the steering room above the engine room, toilet (on the port side) and galley (on the starboard

side) behind the engine room bulkhead, and accommodation space large enough for two crew members. Fresh water tanks are installed on both sides below the accommodation area. The quarter-deck will be used as a working deck-cum-tender boat accommodation space. Fuel tanks are installed and the steering room is located below the quarter-deck.

5). Facilities

- Accommodation

In order to keep the accommodation space as comfortable as possible in the tropical sea, it is kept away from the engine room which generates heat and, further, is provided with forced ventilation. In consideration of the physical constitution of the Fijians, bunk beds of 600 mm x 1,900 mm are provided. The captain's bed is located behind the wheel house.

- Loading and unloading facilities

Wires are stretched between the front and rear masts to position a pulley above each fish hold and hatch so that catch is unloaded and ice is loaded by means of the hoisting drums and side rollers of two winches installed against the engine room wall. Heaving up the anchor is also made possible by means of the winches.

- Fish holds

The fish holds are so designed that they can also be used as ice holds. They are insulated and the plywood used as inside panels is covered with FRP to protect the insulation material from water seepage. The joist to support the cooling pipe is nailed to the joists in the ceiling and walls of insulated areas.

· Engines

An electrically starting high speed main engine was chosen to offer as wide a working area as possible. One refrigerating unit is installed in front of the main engine. Two generators, one DC 24 V and the other AC 225 V (3ø, 50 Hz) are driven from the front of the main engine.

· Electrical equipment

24V batteries are provided to start the main engine and for lighting and radio equipment. The refrigerating machine, its cooling water pump and the warping winches operate on one AC generator of 225 V, 3ϕ, 50 Hz, which is provided with a constant-voltage and frequency controller. The DC generator of 24 V is used to recharge the battery used for starting the main engine. A batteries for relieving the lighting and the radio equipment are recharged by the AC generator. The electrical blower in the engine room operates on AC 220V and others on DC 24 V while general lighting works on AC 100 V.

6). Equipment specifications

· Deck department

Steering gear	:	Manual, Hydraulic type (with built-in magnetic compass)	One set
Vessel attachments	:	As required by law.	One set
Anchor and anchor cable (Danforth)	:	As required by law.	One set
Lifesaving and fire fighting equipment	:	As required by law.	One set
Navigation equipment	:	As required by law.	One set
Deck articles	:	As required by law.	One set

Tender boat (made of FRP, with 5 PS outboard motor):		One set
Warping winch (Electrical, 0.1 t x 15 m/min x 0.4 KW):		Two sets
Rollers and side rollers for anchoring:		Two sets each

· Ventilation

Accommodation and galley	:	Electric blower (inlet and exhaust) DC 24 V, Approx. 90 W	One each
Toilet	:	Natural ventilator (mushroom type)	One unit
Engine room	:	Electric blower (inlet) AC 220 V, 3ø, 0.2 KW	One unit

· Fish hold refrigeration equipment

Refrigerating unit	:	R-12 direct expansion type	One set
Capacity	:	4,000 Kcal/hr x 2.2 KW x 700 rpm	
Temperature maintained	:	-2°C	

The set includes :

Dryer, expansion valve panel, inlet header, cooling tubes for fish hold, starter, control panel, electronic thermostat, electric thermometer.

Cooling water pump for the refrigerating unit: One set

3 m^3/hr x 20 m x 0.75 KW

· Engine department

Main engine	:	4 cycle diesel engine 150 HP x 1,600 rpm	One set
Main engine remote controller	:	Wire system	One set

Reduction gear	:	With wet type oil pressure multiple disk clutch	One set
Propeller	:	Solid propeller with three blades, fixed pitch	One set
Stern tube	:		One set
Pump for fire fighting and miscellaneous water:			One unit
With main engine driving clutch Approx. 6 m^3/hr x 8 m			
Cooling water pump for main engine:			One unit
Lubricating oil pump for main engine:			One unit
Lubricating oil pump for reduction gear:			One unit
Bilge pump:			One unit
Fuel pump:			One unit

· Electrical equipment

Generator: AC 225 V x 3ø x 50 Hz, 10 KVA (with constant voltage and frequency controller and manual clutch)		One unit
Battery for starting main engine:	12 V, 150 AH	Two units
Generator for charging the above battery:	DC 24 V	One unit
Motor for starting the main engine:	DC 24 V	One unit
Battery for lighting and radio:	12 V, 150 AH	Two units
Charging equipment with selenium rectifier and transformer: 30 A, AC 225 V → AC 24 V → DC 24 V		One set
Dry transformer:	AC 225 V → AC 100 V, 2 KVA	One unit
Switchboard with built-in charging		One unit

• Lighting equipment

Navigation lights: mast light, side light(2), stern light, anchor light (DC 24 V) — One set

Portable lamp: DC 24 V (10 - 20 W)/ AC 100 V (40 W) with cord and plug — Four sets

	DC 24 V	AC 100 V
Steering room:	20 W - 1	30 W, 10 W (fluorescent lamp) - 1 each
Engine room:	20 W - 2	40 W (fluorescent lamp) - 5
Accommodation space:	20 W - 1	20 W (fluorescent lamp) - 1 10 W (fluorescent lamp) - 2
Galley:	20 W - 1	20 W (fluorescent lamp) - 1
Toilet:	10 W - 1	10 W (fluorescent lamp) - 1
Deck store:	20 W - 1	40 W - 1
Projector:		300 W - 1
Corridor light:	AC 100 V	Both sides 40 W - 1 each Stern 40 W - 1

• Nautical instrument and wireless installation

Magnetic compass; Card diameter: 100 mm — One set

SSB wireless telephone transmitter and receiver (with built-in radio): — One set

Frequency: 1.6 - 3.9 MHz, 4, 6, and 8 MHz

Output: A3J 10 W, A3H 2.5 W

Power supply: DC 24 V, Approx. 3 A

Radar: (DC 24 V, 120 W) — One set

Peak transmission power: 5 KW

Frequency: 9,410 ± 30 MHz x band (3 cm)

Range: 0.25, 0.75, 1.5, 3, 6, 12, 24, 40 N/mile

Antenna width: Diameter 900 mm (3 feet, Radome)

Braun tube: 7 inch (with 12-inch magnifying lens)

Fish finder: One set

Frequency:	50 KHz
Output:	300 W
Recording:	Dry type, width of 100 mm
Finding range:	0 - 360 m
Power supply:	DC 12 - 35 V, Approx. 15 KVA

(2) 7-ton Collection Vessel

This vessel was designed to remain at sea for about 5 days and have a cruising range of about 400 N/miles.

1) Shape

The vessel is designed to be of the same type as the 11-ton collection vessel.

2) Principal particulars

Overall length	:	Approx. 13.25 m
Extreme breadth	:	Approx. 3.00 m
Overall depth	:	Approx. 1.44 m
Length (Register)	:	10.50 m
Breadth (Moulded)	:	2.48 m
Height (Moulded)	:	0.84 m
Gross tonnage	:	Approx. 7.00 tons
Main engine	:	One 74 HP diesel engine, 1,800 rpm Four cycle high-speed vertical type
Propeller	:	One made of high tension cast brass

Speed	:	Maximum at trial	Approx. 9.0 Knots
		Service speed	Approx. 7.5 Knots
Capacity	:	Fuel tanks	Approx. 1.5 m^3
		Fresh water tanks	Approx. 0.5 m^3
		Fish hold tanks	Approx. 6.0 m^3
Complement	:		3 persons

3) Hull structure

Same as the 11-ton vessel.

4) General arrangement

As shown in the drawing of the general arrangement, the vessel will have an air chamber, fish hold (3 compartments), engine room (with a fuel tank on both sides) arranged from stem to stern. The steering house will be provided above the engine room. Behind the engine room enclosure bulkhead, the toilet (left side) and the gallery (right side) will be provided. The accommodation space for the two-man crew will be in the back of the galley. The quarter-deck will be used as a working deck-cum tender boat accommodation space, below which will be provided the steering gear room, fresh water tank, and fuel tank.

5) Facilities

° Accommodation space
° Loading and unlading
° Fish holds
° Engine and accessories
° Electrical facilities
° Deck machinery and equipment
° Ventilation system
° Lighting equipment

The above facilities will be identical to those of the 11-ton vessel.

- Fish hold refrigeration equipment

Refrigerating unit	:	R-12 direct expansion type	One set
Capacity	:	2,700 Kcal/hr x 1.5 KW x 500 rpm	
Temperature maintained	:	-2°C	

The set includes :

Dryer, expansion valve panel, inlet header, cooling tube, starter, control panel, electronic thermostat, and electrical thermometer.

Cooling water pump for the refrigerating unit: One set

3.0 m^3/hr x 20 m x 0.75 KW

· Engine department

Main engine	:	4 cycle diesel engine 74 HP x 1,800 rpm	One set
Main engine remoto controller	:	Wire system	One set
Reduction gear	:	With wet type oil pressure multiple disk clutch	One set
Propeller	:	Solid propeller with three blades, fixed pitch	One set
Stern tube	:		One set

Pump for fire fighting and miscellaneous water: One unit

With main engine clutch
6 m^3/hr x 8 m

Cooling water pump for main engine: One unit

Lubricating oil pump for main engine: One unit

Lubricating oil pump for reduction gear: One unit

Bilge pump: One unit

Fuel feed pump: One unit

· Electrical equipment

Generator: AC 225 V x 3ø x 50 Hz, 10 KVA One unit

(with constant-voltage and frequency controller and manual clutch)

Battery for starting the main engine: 12 V, 120 AH Two units

Generator for charging the above battery:	DC 24 V	One unit
Motor for starting the main engine:	DC 24 V	One unit
Battery for lighting and radio:	12 V, 150 AH	Two units
Charging equipment with selenium rectifier and transformer:		One set
30 A, AC 225 V → AC 24 V → DC 24 V		
Dry transformer:	AC 225 V → AC 100 V, 2 KVA	One unit
Switchboard with built-in charging switchboard:		One unit

- Lighting equipment

The above facilities will be identical to those of the 11-ton vessel.

- Nautical equipment and wireless installation

Magnetic compass;	Card diameter: 100 mm	One set
SSB wireless telephone transmitter and receiver (with built-in radio):		One set
Frequency:	1.6 - 3.9 MHz, 4, 6, and 8 MHz	
Output:	A3J 10 W, A3H 2.5 W	
Power supply:	DC 24 V, Approx. 3 A	
Radar: (DC 24 V, Approx. 80 W)		One set
Peak transmission power: 4 KW		
Frequency:	9,445 ± 30 MHz x band (3 cm)	
Range:	0.5, 1.5, 3, 6, 24 N/mile	
Antenna width:	Diameter 760 mm (2.5 feet, Radome)	
Braun tube:	6 inch (with magnifying lens of 11 inch)	

Fish finder: One set

Frequency:	50 KHz
Output:	300 W
Recording:	Dry type, width of 100 mm
Finding range:	0 - 360 m
Power supply:	DC 12 - 35 V, Approx. 15 KVA

3.5 Fishing Gear and Equipment

3.5.1 Basic Plan

As part of the rural fisheries development project, the Fisheries Division is conducting training for rural fishery leaders which includes the construction of a small fishing boat. Designed by FAO specifically for coastal fishing operation in Fiji, this fishing boat is a resin-coated wooden boat measuring 8.7 m (length) x 2.7 m (breadth) x 0.6 m (draft).

It is planned that all boats built during the Division's training course will be supplied to main fishing bases after fitting out with necessary nautical instruments, fishing gear and equipment for dissemination of advanced fishing techniques. The Fisheries Division has just launched this plan utilizing the 56 sets of engines, nautical instruments, fishing gear and equipment supplied by the Japanese Government in 1980.

For further promotion of this plan, the Government of Fiji made a request for an additional supply of fishing gear and equipment, which the team considers necessary and adequate for augmenting the fishery production in Fiji.

3.5.2 Studies for Determination of Specifications

In determining the kinds, quantity and specifications of the fishing gear and equipment, consideration was given to the gear and equipment supplied by Japan in 1980 and to the progress of the said plan. The quantity was established 8 sets a year for two years, and the specifications were determined according to the principal particulars and specifications of the boats to be built.

(1) Engine and Accessories, and Nautical Instruments

The design was worked out for the 20 HP inboard diesel engine, pumps, propeller and propeller shaft, magnetic

compass, steering wheel, life jackets, anchor and anchor rope, etc.

(2) Fishing Gear and Equipment

The designed fishing gear included two kinds of gill nets (monofilament and multifilament) for catching surface fishes such as Spanish mackerel, barracuda and spine venomous fish, as well as floats, sinkers, ropes and other tools necessary for mounting the net. The net hanging will be performed by Fijian fishermen during the training course.

The fishing handline including the line and hook was designed to catch midwater fish and bottom fish such as yellow jack, red sea bream and deep sea bass in the coastal reef areas.

The design of fishing equipment was worked out for the multipurpose fishing winch that can be used for long line and pot fishing besides gill net and handline fishing, as well as for the fish finder that can be used for both fishing and nautical purposes. This equipment designed with careful consideration given to the water depth, fishing methods and catchable fish species in the operational areas.

3.5.3 Specification of Basic Design

Item	Specification	Quantity	Remarks
Marine diesel engine	20 HP, inboard with electric starter and standard spares	16 units	
Fuel oil pump		16 units	
Bilge pump	With hose and strainer	16 units	
Kingston cock	With cooling hose and strainer	16 units	
Water mixing elbow	With hose	16 units	
Extension wire	For engine operation, 3 m	16 units	
Battery	With switch and charging equipment	16 units	Battery fluid not included.
Propeller	430 mm x 300 mm (dia)	16 units	
Propeller shaft	28 mm (dia) x 3,120 mm (length) with flexible coupling	16 units	
Stern tube	28 mm (dia) x 2,150 mm (length)	16 units	
Half coupling	For propeller shaft solid type	16 units	
Remote controller		16 units	
Tachometer and sender		16 units	
Anchor	12 Kg, 7.5 Kg each	16 units	
Anchor rope	Polyethylene, 12 mm x 220 mm	16 units	
Fishing winch	Hydraulic, 300 Kg Sheave size 4 - 12 mm, 60 m/min	16 units	
Rope	Polyethylene 4 mm x 600 m dark color	16 units	Grey or green color.
Fish finder	12 V, 50 Hz, 160 fathoms With transducer, Dry recording paper 12 rolls	16 units	
Gill net	Monofilament, (50 m x 4 pcs) x 5 m mesh size 3" stretched	16 units	With ancillar materials for complete not.

Item	Specification	Quantity	Remarks
Gill net	Multifilament (50 m x 4 pcs) x 5 m Mesh size 3" stretched 210 d x 9 ply	16 units	With ancillar materials for complete net.
Fishing handline	Tetlon/nylon mixed No.60, 600 m	16 units	
Mending twine	Monofilament No.6	16 sets	
Mending twine	Multifilament, 210 d x 9 ply 0.5 Kg	16 sets	
Steering wheel	Cable operation	16	
Fishing hooks	Assorted. 300 pcs each	16	
Trace wire	Assorted.	16	
Life jackets		16	
Compass	Magnetic	16	

3.6 Fishing Gear for Fishing Development

3.6.1 Basic Plan

The fishing gear for the development of the fisheries is scheduled to be provided to the fisheries research vessel and the small fishing vessels under construction by the Fisheries Division. It will be operated on trial basis under the supervision of the Fisheries Division expected that the use of such gear will spread among the rural fishermen of the country in the near future.

The introduction of seine net fishing method more efficient than others such as gill nets, has been planned for catching horse mackerel found in coastal waters.

The lift nets are to be introduced to test their effectiveness in catching anchovies, found in local estuaries and waters in the vicinity of coastal mangrove forests, which are used as live bait for bonito and tuna for pole and line fishing. It is hoped that the use of lift nets will spread among the fishermen in the near future.

3.6.2 Studies for Determination of Specifications

A fishing method of a small scale with a simple net configuration without power has been designed in consideration of a testing operation and according to the technical level of the Fijian fishermen.

3.6.3 Specification of Basic Design

Item	Specification	Quantity	Remarks
Seine net	Nylon, 130 m(L) x 28 m(D)	One set	Complete set with spares.
Lift net	Nylon, 8 m(L) x 8 m(B) 3/8 inc meshes size	One set	Complete set with spares.

3.7 Drawings and Construction Schedule

(1) Icemaking Facilities

① • Floor plan for Wainibokasi and Savu savu
• Front elevation for Wainibokasi and Savu savu

② • Floor plan for Taveuni
• Front elevation

③ Construction schedule

(2) Fish Collection and Marketing Center

① • Floor plan
• Elevation

② Office building
• Elevation
• Floor plan

③ Construction schedule

(3) Collection Vessel

① General arrangement of the 11-G.T type

② General arrangement of the 7-G.T type

③ Construction schedule

(4) Construction of Fishing Nets

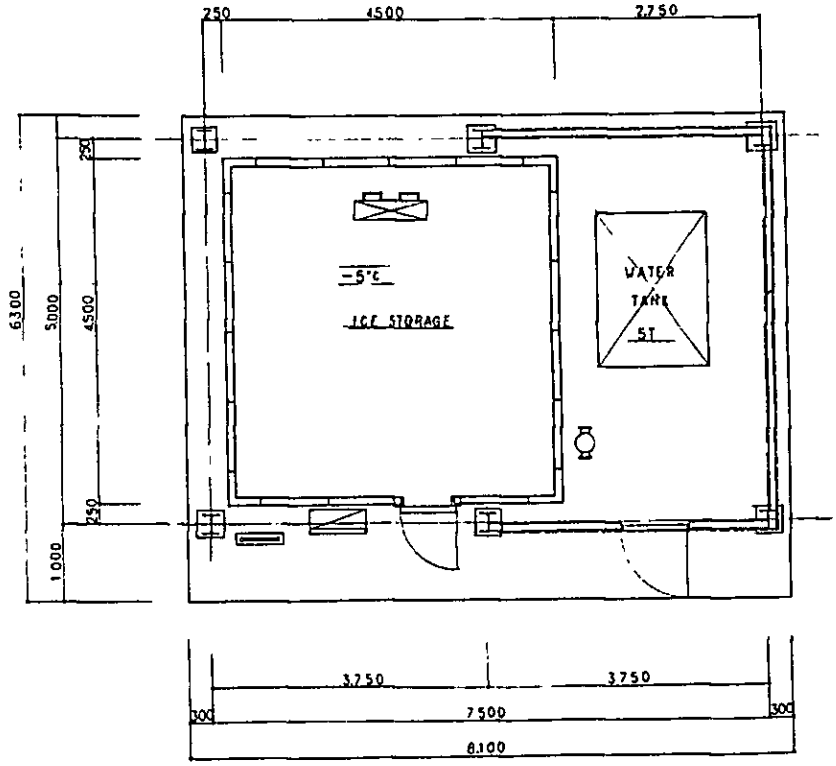
① Gill net

② Seine net

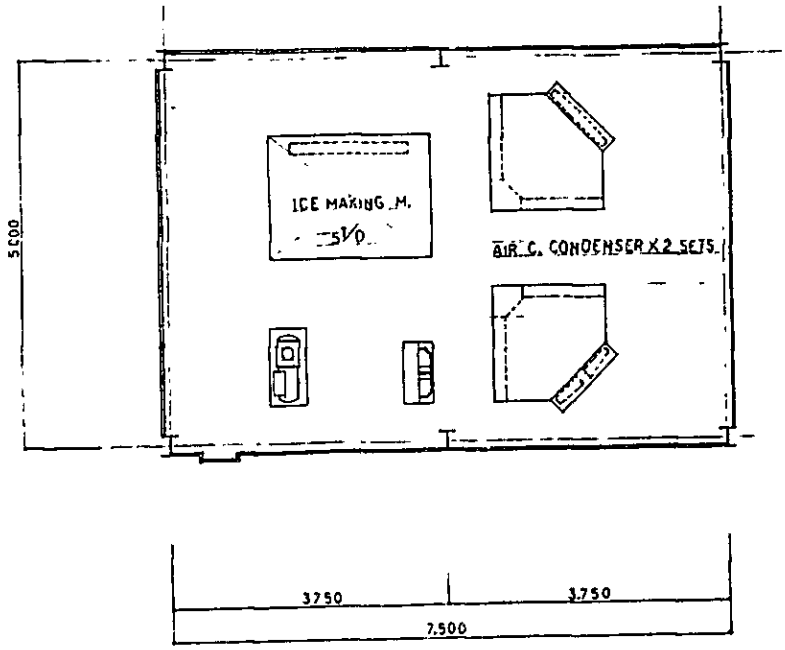
③ Fishing method by lift net

(1) Icemaking Facilities for Wainibokasi and Savu savu

① · Floor plan

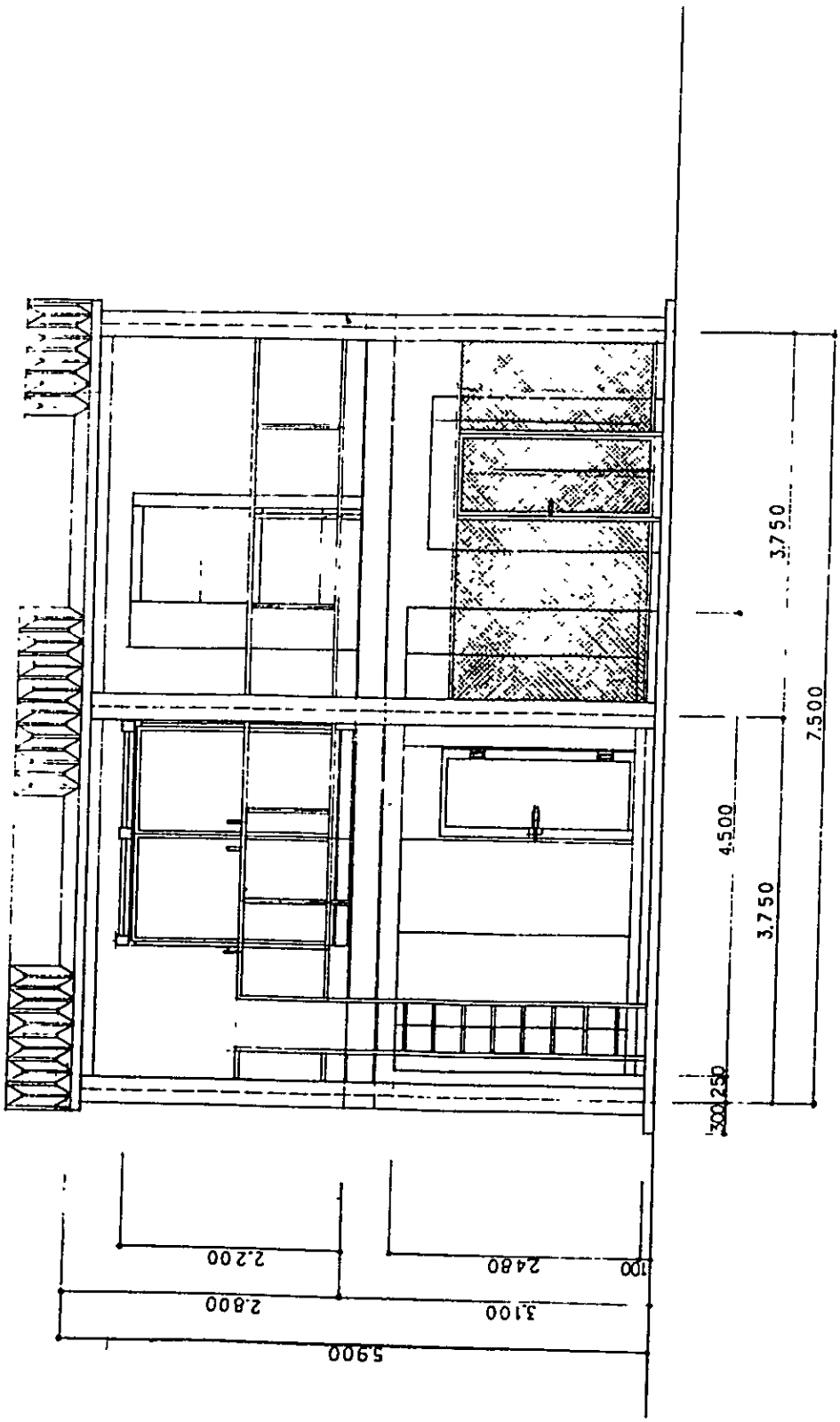


1ST FLOOR PLAN



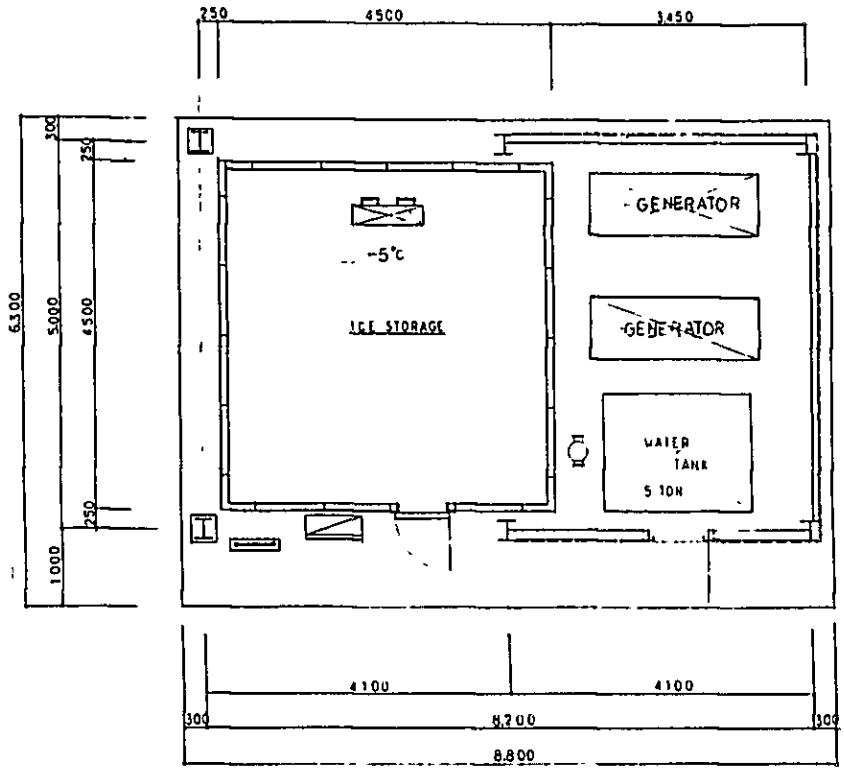
2ND FLOOR PLAN

· Front elevation

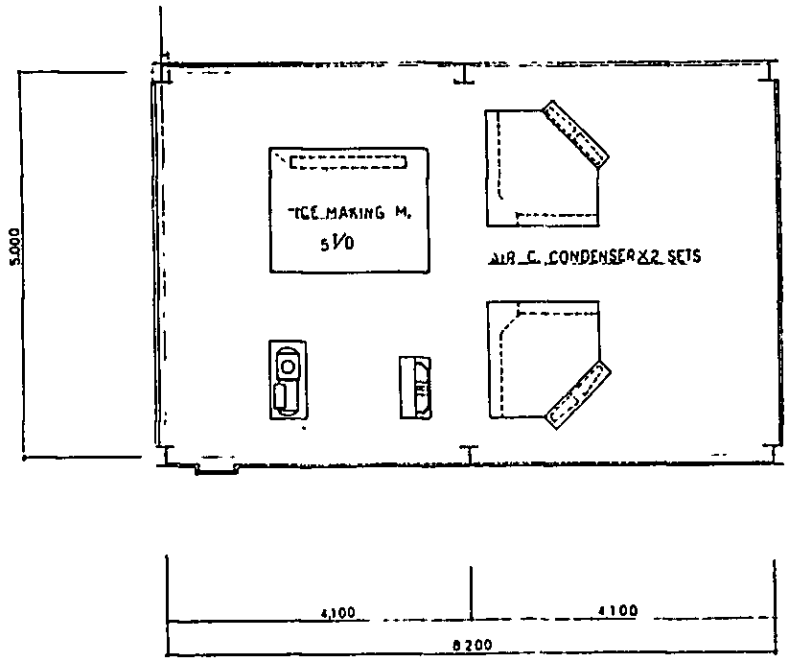


FRONT ELEVATION

② · Floor plan for Taveuni

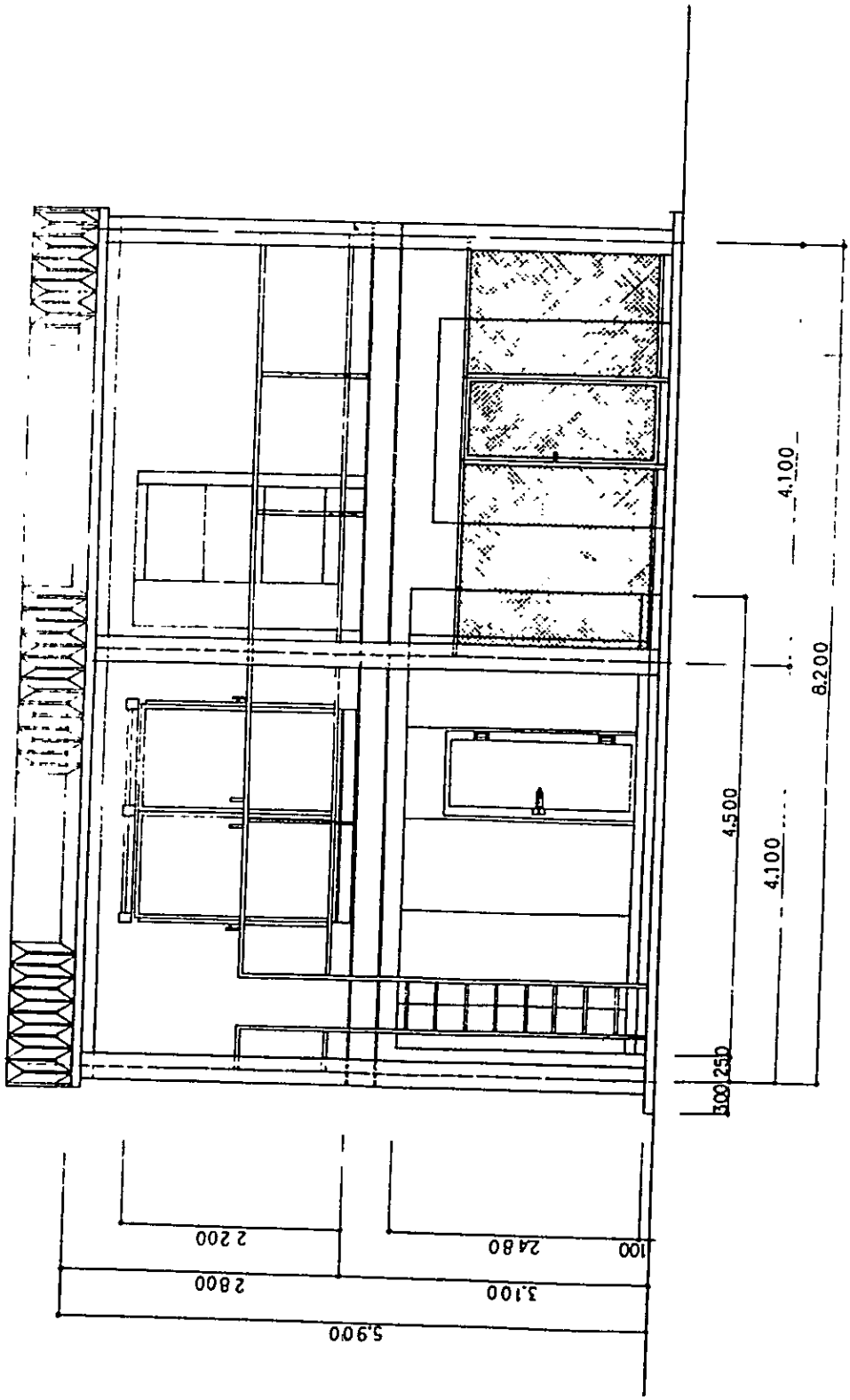


1st FLOOR PLAN



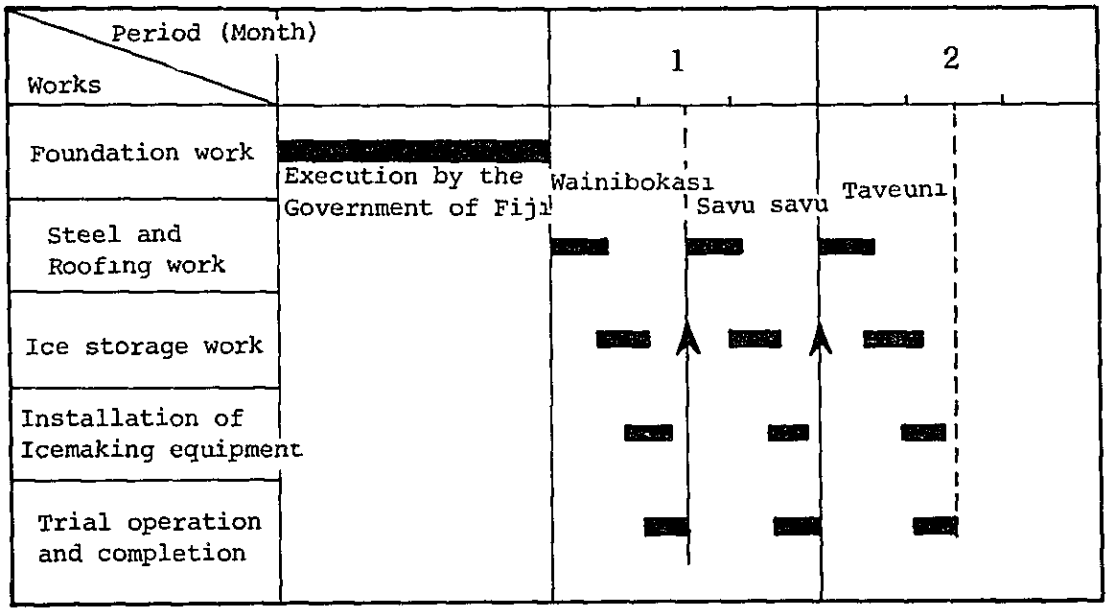
2ND FLOOR PLAN

· Front elevation



FRONT ELEVATION

③ Construction schedule

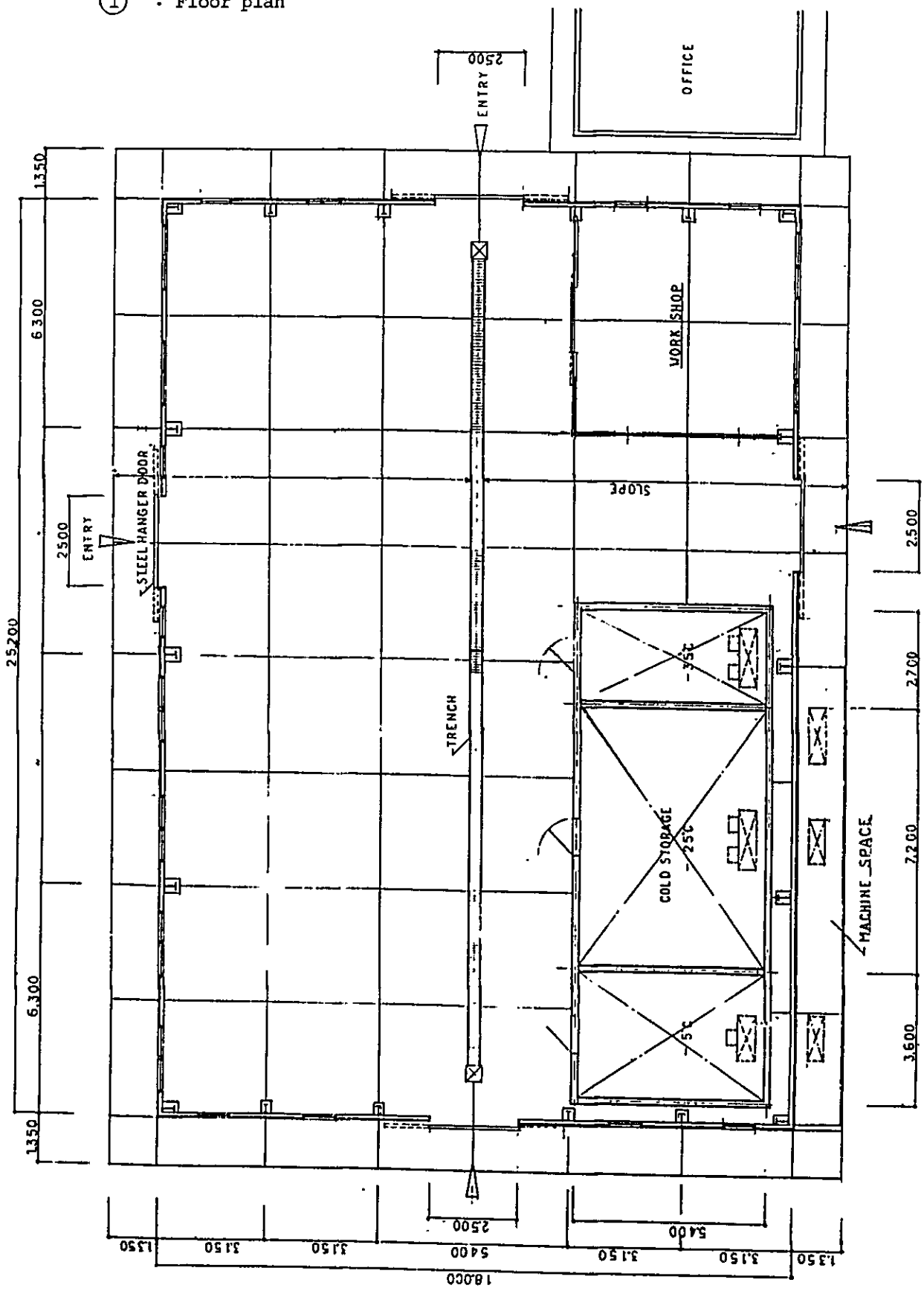


Foundation work: The foundation work for three construction sites (Wainibokasi, Savu savu, and Taveuni) is to be executed by the Government of Fiji.

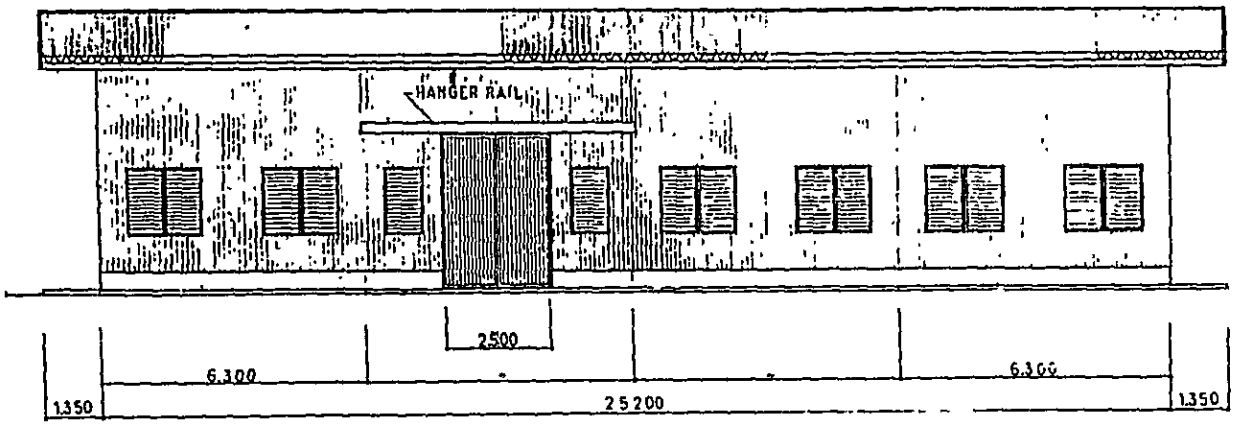
Execution of works: The execution of a series of works from steel work through trial operation is to start with Wainibokasi. A duration of approximately 15 days is scheduled per location. As a result, a total of approximately 45 days is proposed to complete at three locations.

(2) Fish Collection and Marketing Center

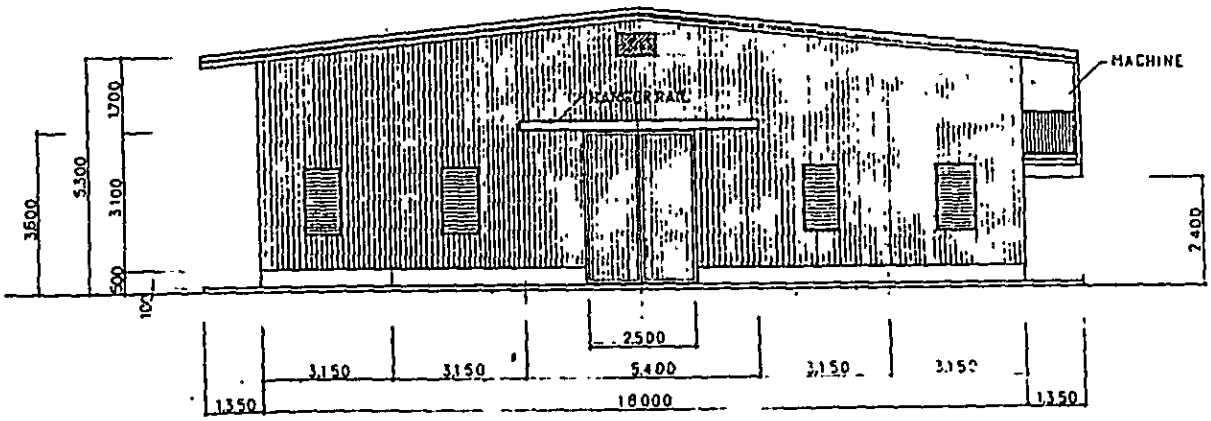
① · Floor plan



· Elevation



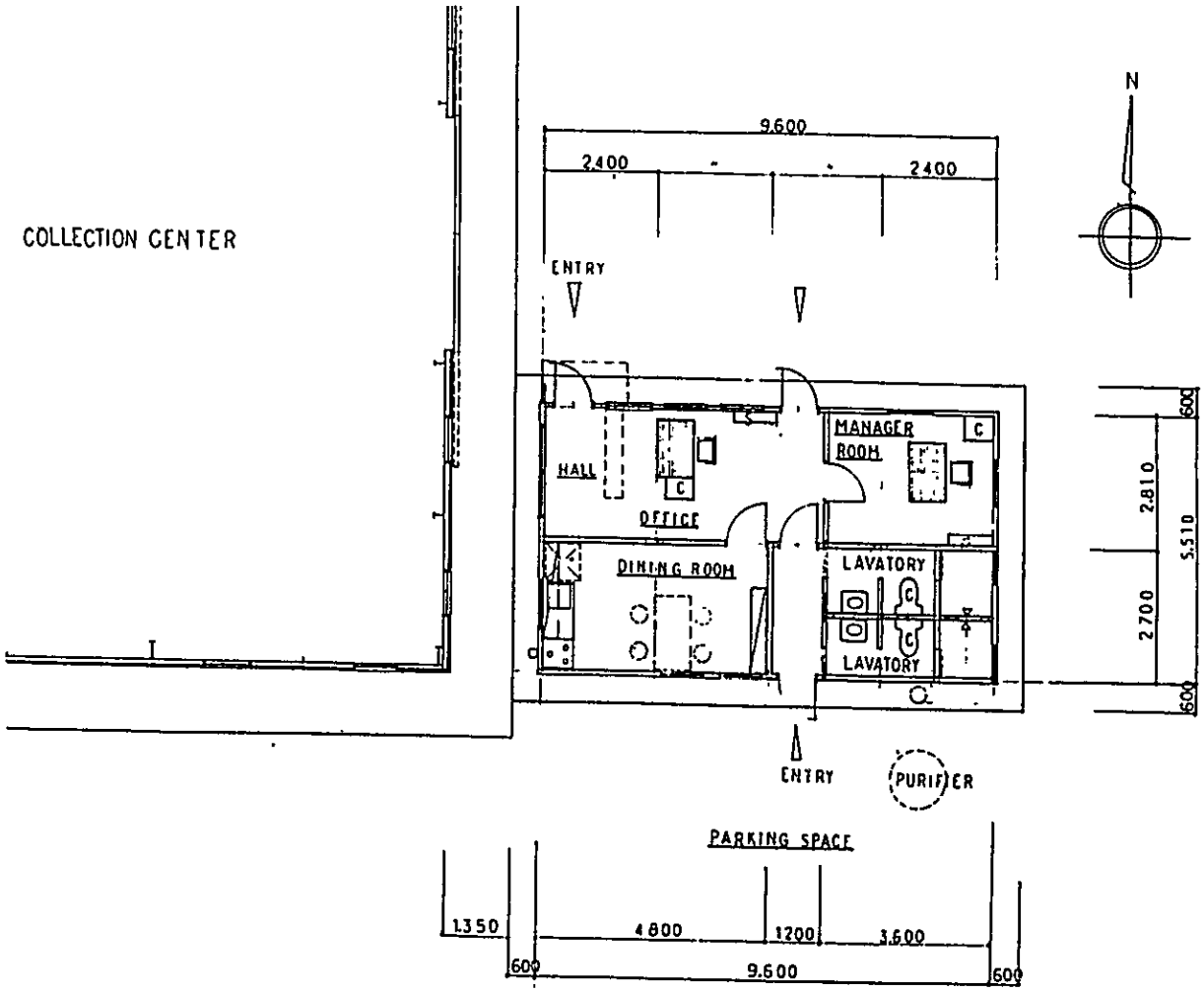
N.ELEVATION



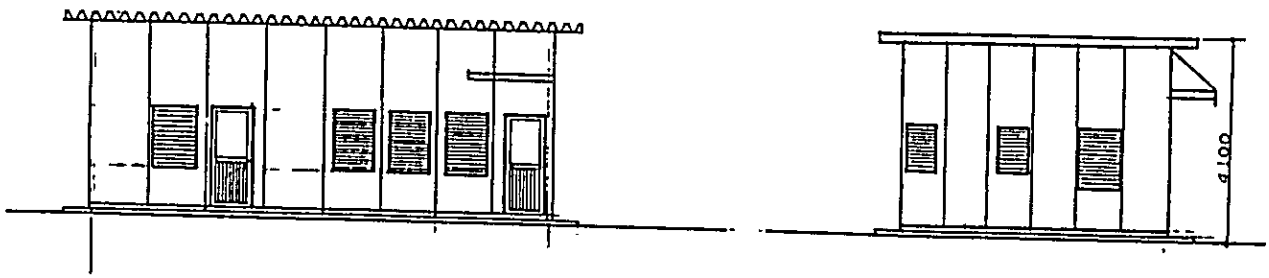
W-ELEVATION

② Office building

· Floor plan



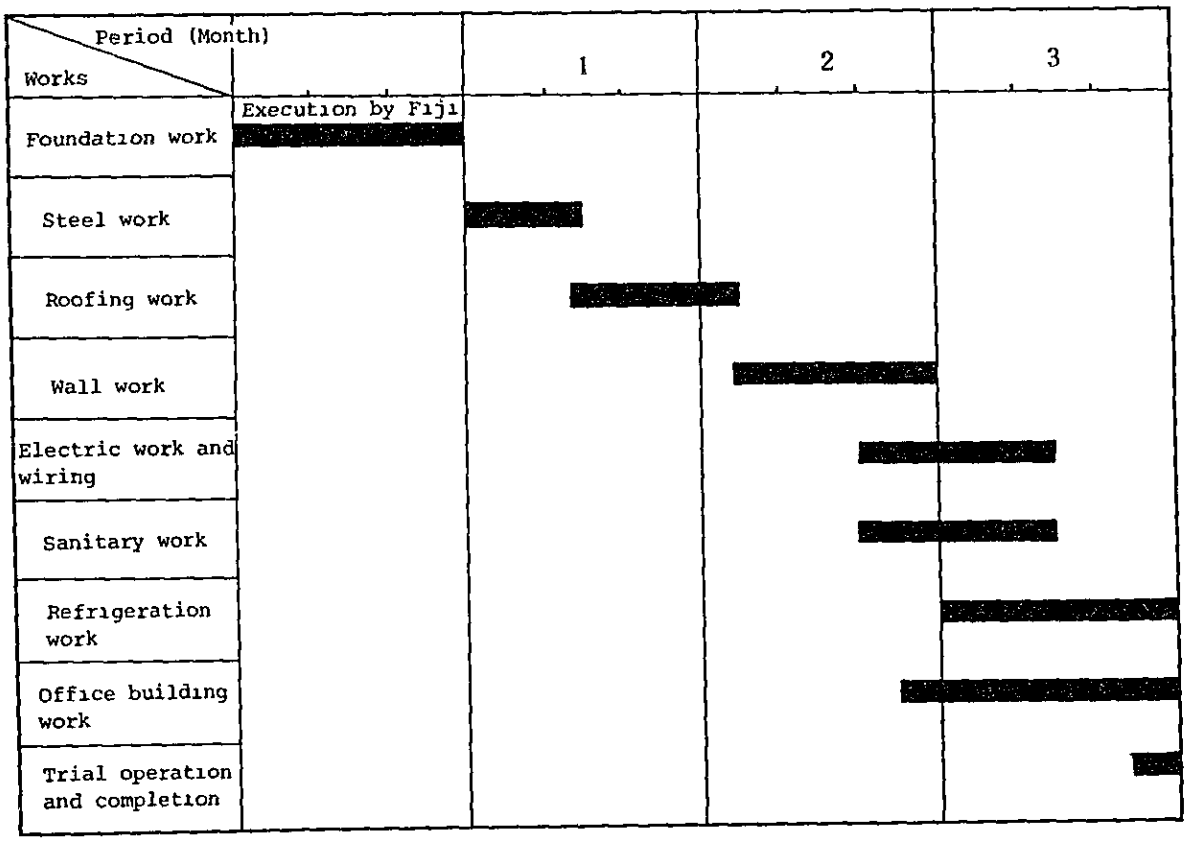
· Elevation



N—ELEVATION

E—ELEVATION

③ Construction schedule



Foundation work:	The foundation work is to be executed by the Government of Fiji.
Steel work:	A duration of approximately two weeks is allocated between the delivery of materials into the construction site and the completion of construction.
Roofing work:	Roofing work is scheduled to be completed within three weeks approximately.
Interior and external wall work:	Interior and external wall work is scheduled to be completed within 25 days approximately.
Wiring and sanitary work:	Approximately about three weeks each.

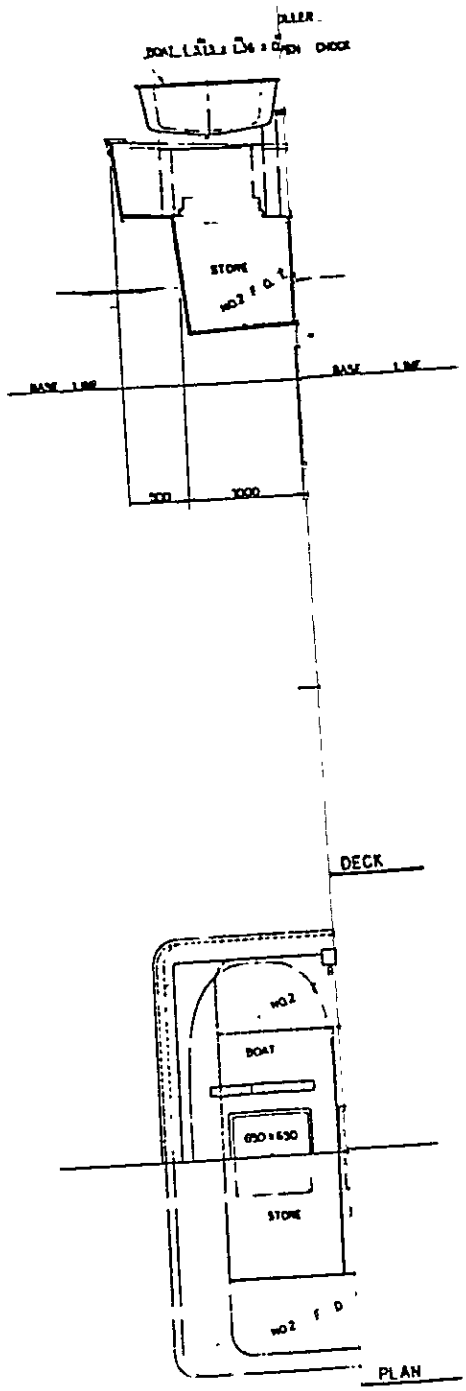
Refrigeration work:	Approximately one month is scheduled.
Construction of the office building:	A period of approximately 35 days is allocated to complete the building.

A total period of approximately three months is expected between the transport of construction materials into the site, and the trial operation of equipment and the completion of construction.

(3) Collection Vess

① General arr

PRINCIPAL DIMENSION		
H OVER ALL	ABT	14.50 m
TH OVER ALL	ABT	3.50 m
OVER ALL	ABT	1.65 m
H REGISTER		12.00 m
TH (MLD)		3.20 m
(MLD)		1.05 m
TONNAGE	ABT	11.0 T
HOLD CAPACITY	ABT	100 m³
ENGINE		130 PS x 1
MED SPEED (MAX)	ABT	9.0 KTS



GENERAL ARRANGEMENT

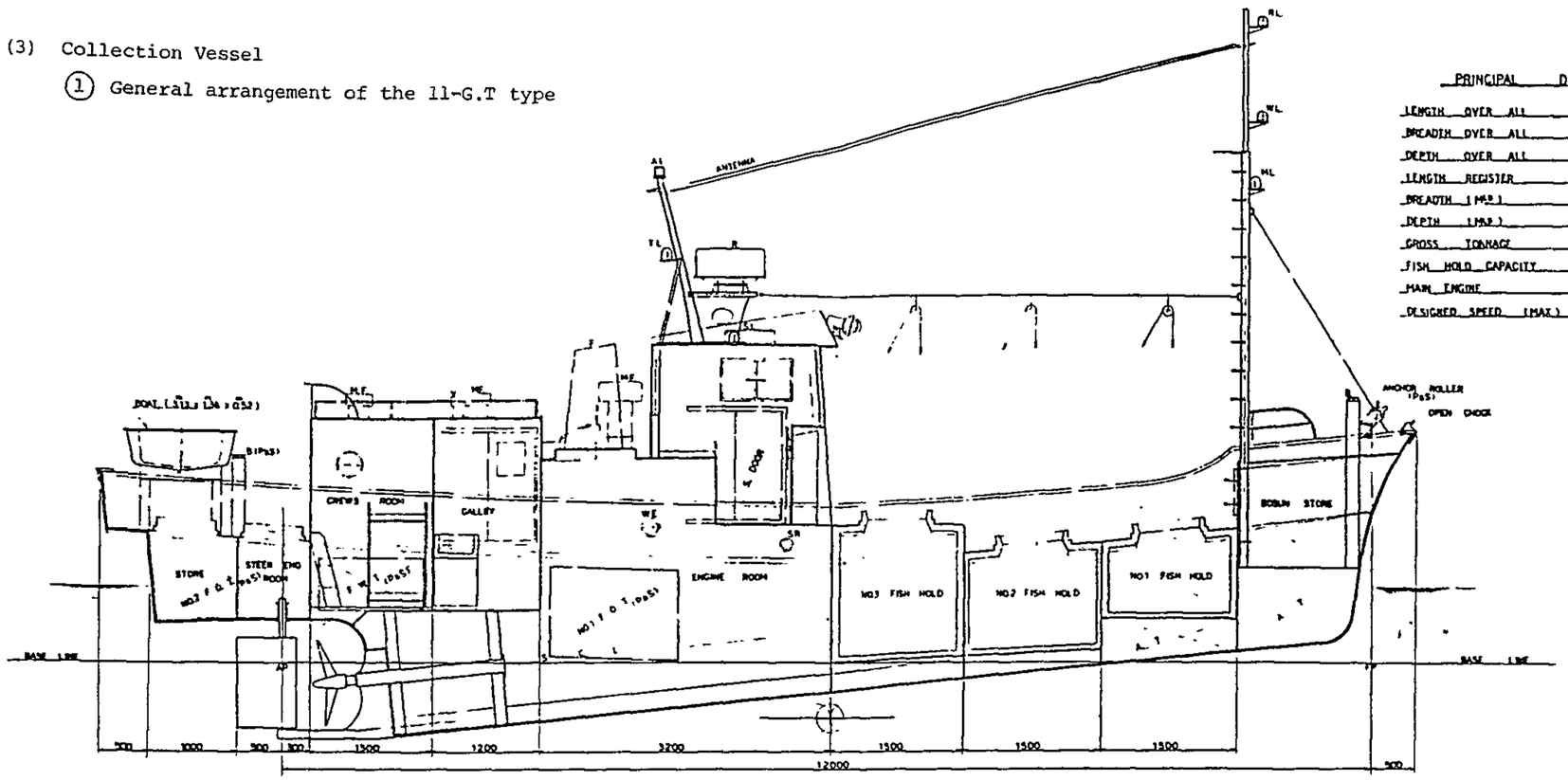
11 G.T. TYPE F.R.P

COLLECTION VESSEL

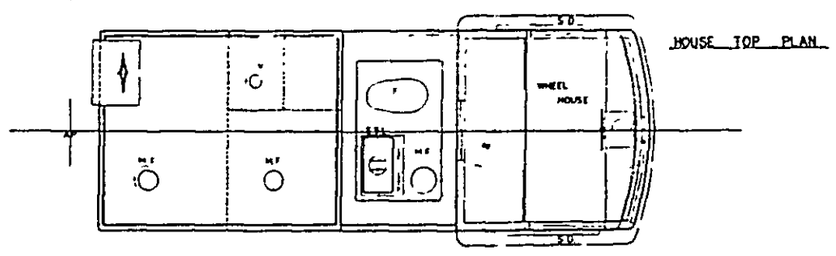
SCALE 1 : 30

(3) Collection Vessel

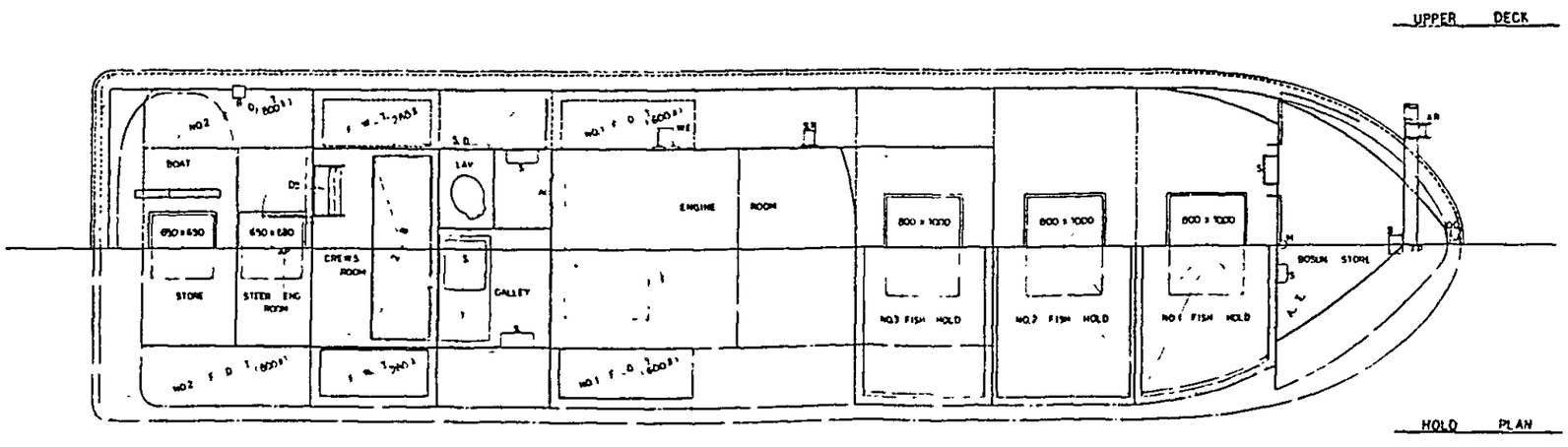
① General arrangement of the 11-G.T type



PRINCIPAL DIMENSION		
LENGTH OVER ALL	ABT	14.50 M
BREADTH OVER ALL	ABT	3.30 M
DEPTH OVER ALL	ABT	1.65 M
LENGTH REGISTER		12.00 M
BREADTH (MLD)		3.20 M
DEPTH (MLD)		1.05 M
GROSS TONNAGE	ABT	11.0 T
FISH HOLD CAPACITY	ABT	100 M³
MAIN ENGINE		150PS x 1
DESIGNED SPEED (MAX)	ABT	9.0 KTS



HOUSE TOP PLAN



UPPER DECK

HOLD PLAN

GENERAL ARRANGEMENT

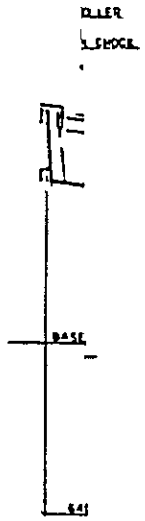
11 G.T. TYPE F.R.P.

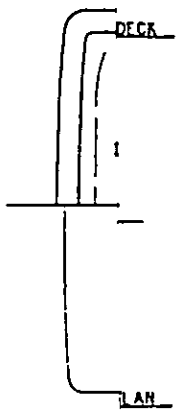
COLLECTION VESSEL

SCALE 1 : 30

② General ar

PRINCIPAL DIMENSION	
LENGTH OVER ALL	11.25 m
BREADTH OVER ALL	5.00 m
DEPTH OVER ALL	1.44 m
LENGTH REGISTER	10.50 m
BREADTH (MLD)	2.45 m
DEPTH (MLD)	0.94 m
GROSS TONNAGE	7.00 T
FISH HOLD CAPACITY	6.00 m³
MAIN ENGINE	74 PS × 1
DESIGNED SPEED (MAX)	9.0 KTS





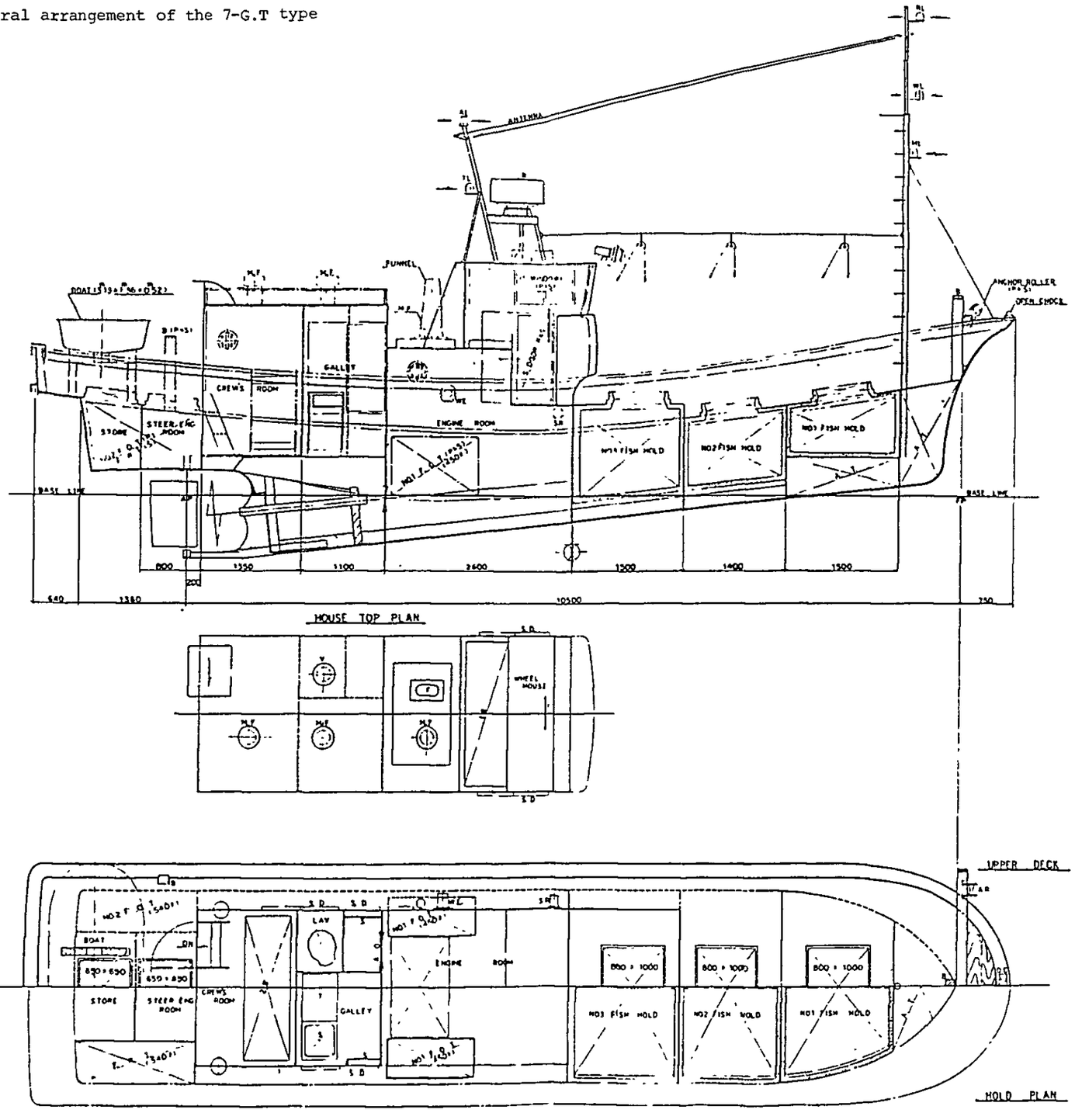
GENERAL ARRANGEMENT

7 GT TYPE FRP

COLLECTION VESSEL

SCALE 1 30

② General arrangement of the 7-G.T type



PRINCIPAL DIMENSION

LENGTH OVER ALL	ABT	12.25 m
BREADTH OVER ALL	ABT	5.00 m
DEPTH OVER ALL	ABT	1.44 m
LENGTH REGISTER		10.50 m
BREADTH (MLD)		2.45 m
DEPTH (MLD)		0.84 m
GROSS TONNAGE	ABT	7.00 T
FISH HOLD CAPACITY	ABT	6.00 m³
MAIN ENGINE		74PS × 1
DESIGNED SPEED (MAX)	ABT	9.0KTS

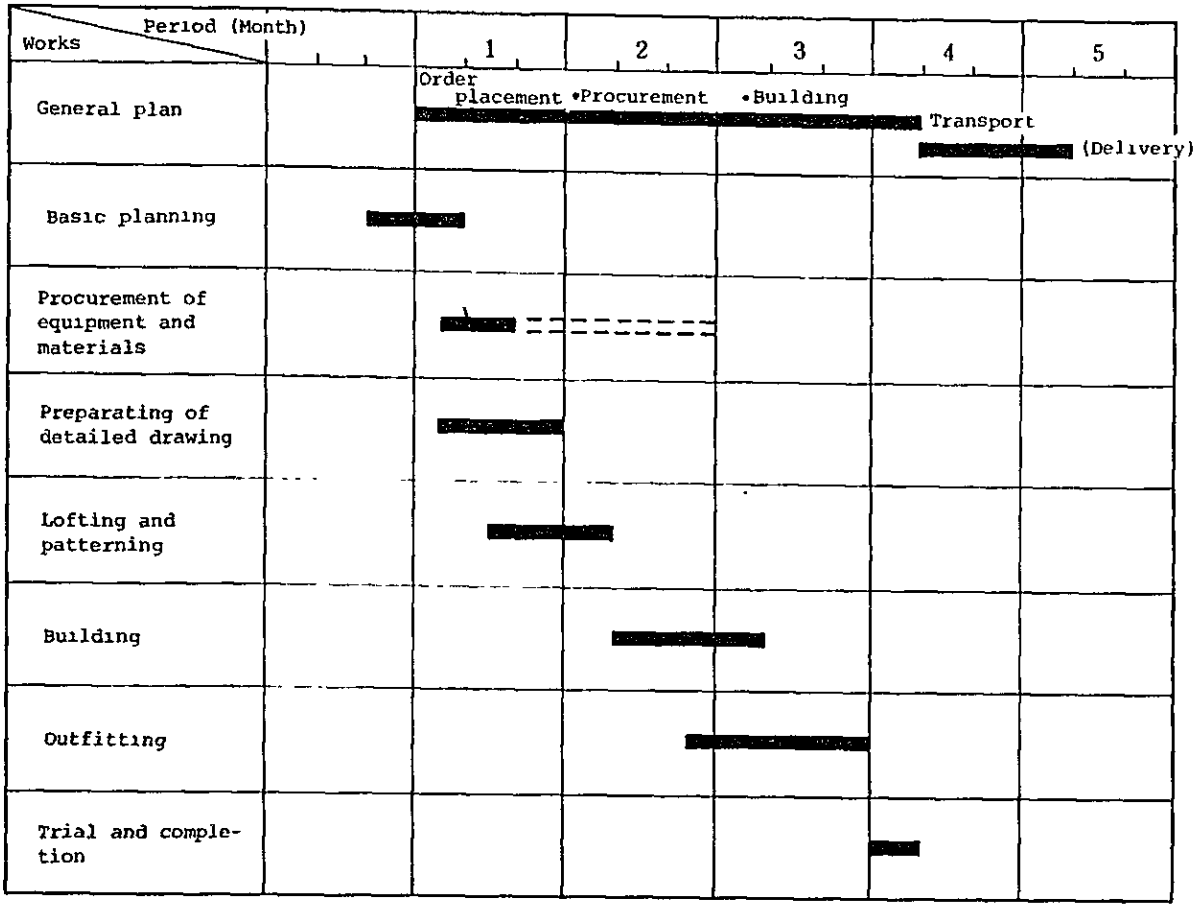
GENERAL ARRANGEMENT

7GT TYPE FRP

COLLECTION VESSEL

SCALE 1 30

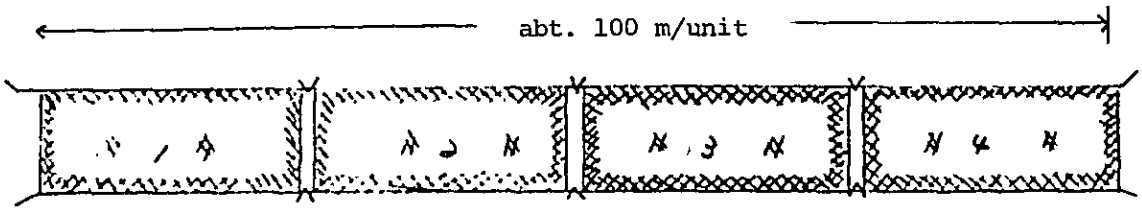
③ Construction schedule

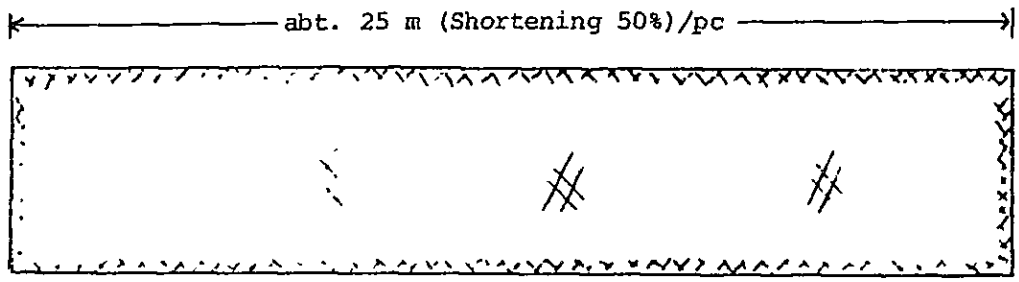


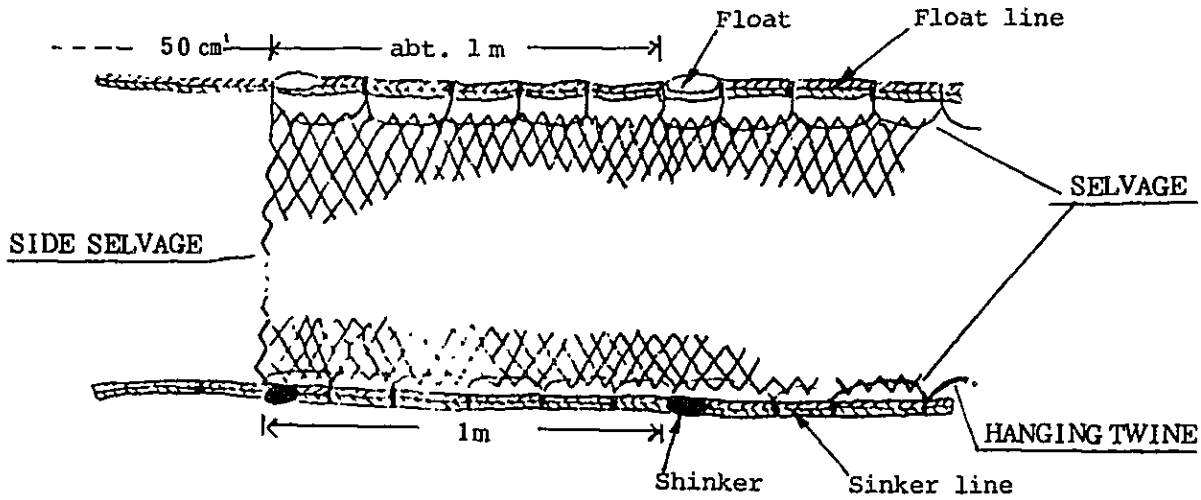
Basic planning:	Determination of specifications and capacities.
Procurement of equipment and materials:	Procurement of hull, engines and electrical equipment and various materials.
Preparation of detailed drawings:	Detailed drawings of hull, engines and electrical equipment.
Lofting and patterning:	Laying out of a full sized working drawing and making of wood patterns.
Building:	Paneling of FRP by means of wood patterns and fitting of structures.
Outfitting:	Installation of engine and other equipment and fittings, piping, wiring, and interior finish work.
Trial:	Trial operation of engine and other equipment, and speed, performance, and other tests.

(4) Construction of Fishing Nets

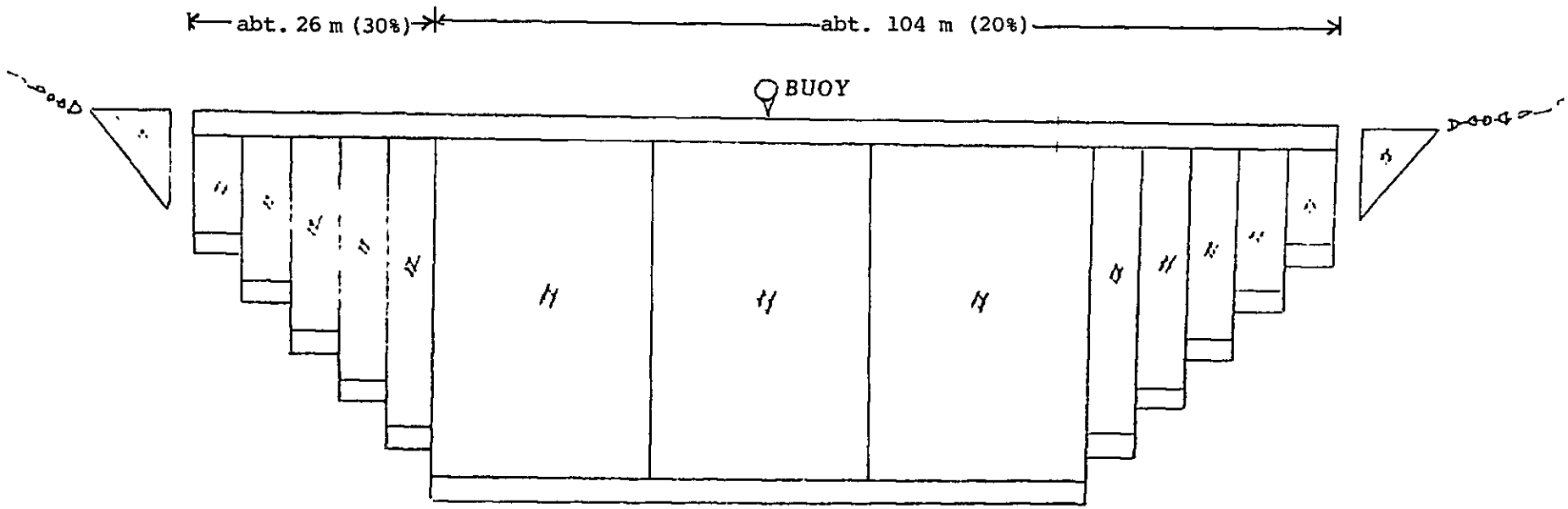
① Gill net



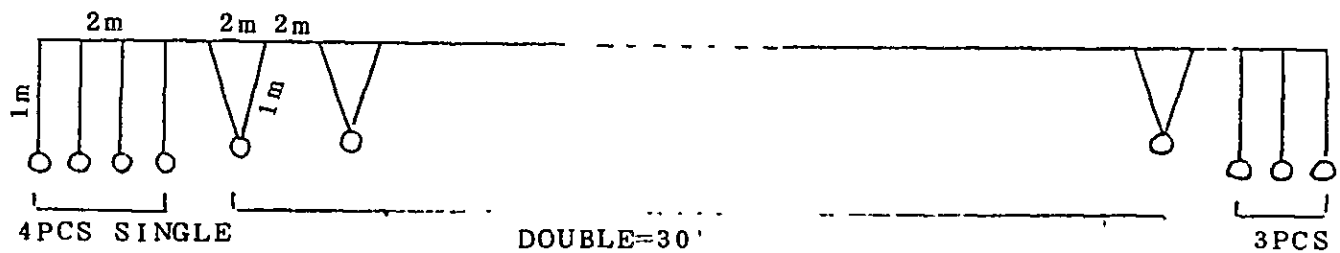




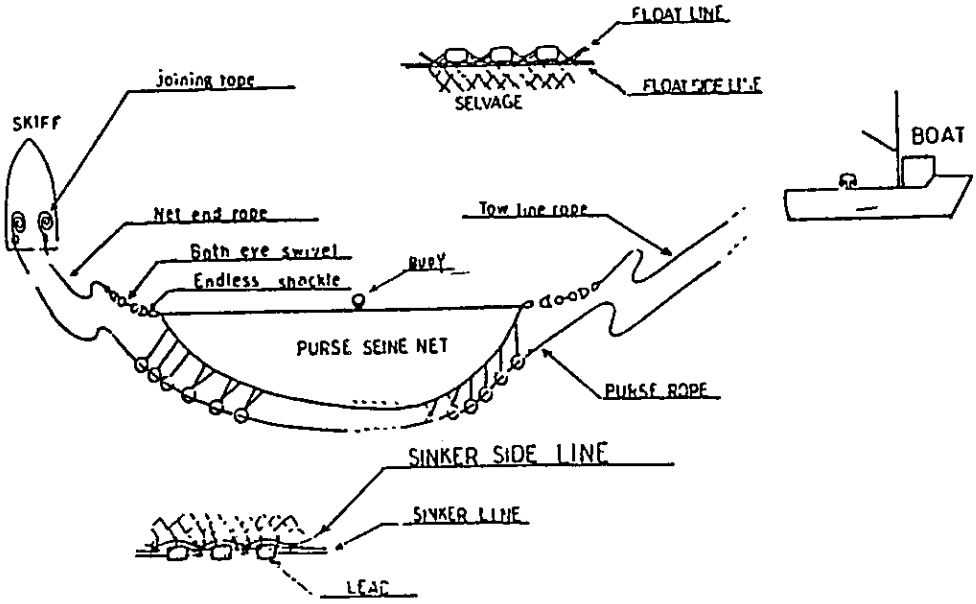
② Seine net (A)



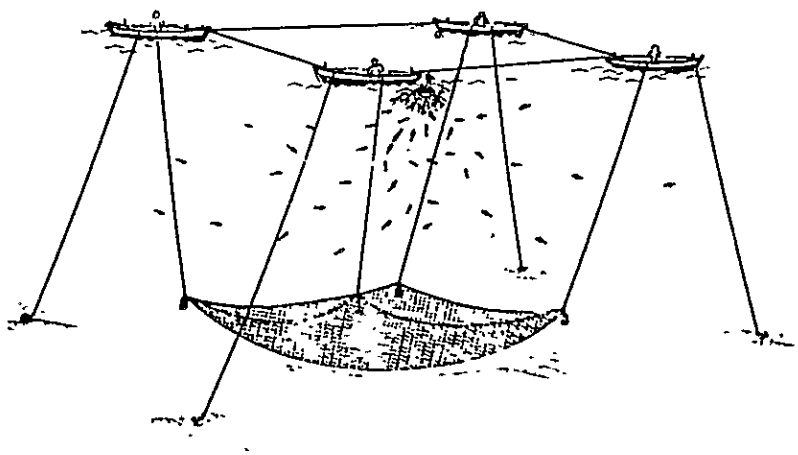
Part of Sinkers



Fishing method by seine net (B)



③ Fishing method by lift net



3.8 Management and Operation Plan

3.8.1 Measures to be taken for Execution of Plan

Facilities and equipment to be provided for the project implementation must be maintained in perfect storage condition until they are taken over by the ultimate beneficiaries in Fiji so that they will function properly as soon as required. For that purpose, the following measures must be taken at the expense and responsibility of the Government of Fiji, without any delay, when they are unloaded in the Fiji port.

(1) The customs formalities must be promptly completed to clear the equipment and materials as soon as the vessel arrives into the Fiji port.

(2) Unloaded equipment and materials must not be exposed to the weather but properly stored. Further, proper measures should be taken to protect them from damage and theft.

(3) All of machines and equipment should be transported to each destination safely and promptly so that they can be utilized as soon as required.

(4) Land necessary for the construction of the ice plants and the fish collection and marketing center must be secured, and the leveling of ground, foundation work and supply of water and electricity must be completed in advance so that the construction can commence as soon as materials arrive at the site.

(5) Equipment and materials must be placed under the direct management of the Fijian Government and instructions should be given in order to provide adequate maintenance and proper management.

(6) Instructions for equipment utilization should be given as required from both the technical and operational standpoint.

3.8.2 Operational Expense

The operation of the icemaking and refrigeration facilities and vessels involves expenses. For smooth continuous operations, it is necessary to work out a suitable budgetary and personnel plan on the basis of an accurate estimation. Furthermore, finding a method of recovering such expenses, as outlined in the study of economic effects mentioned later, is the key to the success of the project.

Annual operational expenses are estimated below on the basis of hypothetical conditions.

(1) Ice plants

The estimation for each location, one in Wainibokasi and the other in Savu savu, including the ice storages is as follows:

Hypothetical conditions:

Number of work days per year:	300 days (Annual operation rate of approximately 80%)
Number of daily operational hours:	12 hours
Annual production projected:	Approx. 750 tons

Basis of calculation:

Personnel expenses:	Manager 1 x $960/month x 12 (months) = $11,520 (Annual)
	Employee 2 x $360/month x 10 (months) = $7,200 (Operation months only)
Electric charges:	$0.11/KWH x 220 KWH/t x 750 tons = $18,150
Water charges:	$0.50/$m^3$ x (750 m^3 x 1.2) = $450
Maintenance expenses:	$0.50/t x 750 t = $375
Cost of equipment and depreciation:	Nil (due to grant aid)

Unit: F$

Item	Personnel expenses	Electric charges	Water charges	Maintenance expenses	Total
Total amount	18,720	18,150	450	375	37,695

Icemaking costs are $37,695 x 1/750 tons = $ 50.26/ton

Thus, a total amount of approximately $37,700 is required per plant and, as a result, an annual total of $75,400 should be allocated for two ice plants.

The estimation for the ice plant in the Taveuni area is as shown below. Since no power supply is available for the plant operation in the area, the estimated annual operational expenses include the working expenses of a privatly owned generator.

Among the hypothetical conditions listed above, the manager's expenses are excluded because Taveuni is a detached island and the plant will be placed under the supervision of a travelling manager.

The plant is to be operated by two employees during an operational period of ten months. Electric charges are also excluded because power will be supplied by the privately owned generator.

Basis of calculation:

Personnel expenses: Employees 2 x $360/month x 10 months = $7,200

Water charges: $0.5/$m^3$ x (750 m^3 x 1.2) = $450

Power cost:

Heavy oil: {0.22 ℓ/HP/hr x 60 HP x 12 hrs/day x 300 days} x 0.40/ℓ = $19,000

Lubricant {0.0022 ℓ/HP/hr x 60 HP x 12 hrs/day x 300 days x $0.8/ℓ = $380

Maintenance expenses: $1,200

Cost of equipment and depreciation: Nil (due to grant aid)

Unit: F$

Item	Personnel expenses	Water charges	Power cost	Maintenance expenses	Total
Total amount	7,200	450	19,380	1,200	28,230

Thus, an annual running cost of approximately $28,230 will be required and the icemaking will cost $37.64 ($28,230 x 1/750 t) per ton.

The operation of three ice plants will cost approximately $103,630.

A total of 2,250 tons of ice (750 t x 3 facilities) will be produced annualy at an average icemaking cost of $46.06/t which is below the current market price of $50/t.

(2) Fish Collection and Marketing Center

The annual operational expenses of the Marketing Center are estimated as follows.

Hypothetical conditions:

Number of work days per year: 300 days
Annual total tonnage of products refrigerated: 1,080 t
Annual total tonnage of products frozen: 240 t

Bases of calculation:

Personnel expenses:
- Manager: 1 x $960/month x 12 months = $11,520
- Clarical worker: 1 x $600/month x 12 months = $7,200
- Field workers: 4 x $360/month x 10 months = $14,400

Electric charges: $0.11/KWH x 0.02 KW/$m^2$ x 440 m^2 x 4 hrs/day x 300 days = $1,162

Power cost:

Refrigeration:	$0.11/KWH x 350 KWH/t x 60 t = $2,310	$7,062
Freezing:	$0.11/KWH x 180 KWH/t x 240 t = $4,752	

Water charges: $0.50/$m^3$ x 20 m^3 x 300 days = $3,000

Facilities maintenance cost: $100/month x 12 months = $1,200

Cost of equipment and depreciation: Nil (due to grant aid)

Unit: F$

Item	Personnel expenses	Electric charges	Power cost	Water charges	Factory expenses	Total
	33,120	1,162	7,062	3,000	1,200	45,544

Thus, an annual total operation cost are approximately $45,500 will be required.

(3) Refrigeration vehicles

Annual operational expenses of each vehicle are estimated as follows:

Hypothetical conditions:

Number of work days per year: 250 days

Annual mileage: 50,000 Km

Basis of calculation:

Personnel expenses:	2 x $360/month x 12 months = $8,640
Fuel expenses:	$0.40/ℓ x 50,000 Km x 1/8 ℓ/Km = $2,500
Maintenance expenses:	$1,200/year
Depreciation:	Nil (due to grant aid)

Unit: F$

Item	Personnel expenses	Fuel expenses	Maintenance expenses	Total
	8,640	2,500	1,200	12,340

An annual total operation cost of approximately $37,000 will be required for the three vehicels.

Annual possible transport capacity per vehicle is estimated for fish and ice as follows:

Carrying capacity: 2,000 Kg (according to basic design)

Capacity per load:

Fish: 2,000 Kg x 0.8 x (1 - 0.3) = 1,120 Kg

where; 0.8: Effective volume

0.3: Fish volume

1,120 Kg/load x 10 loads/month x 10 months = 110 t/year

Ice: 2,000 Kg x 0.8 (effective volume) = 1,600 Kg

1,600 Kg/load x 10 loads/month x 10 months = 160 t/year

Hence, one refrigeration vehicle will be able to transport 110 tons of fish and 160 tons of ice annually. This mean that 330 tons of fish and 480 tons of ice can be transported annually.

(4) Collection vessels

Hypothetical conditions:

Annual operational plan

Item	11-ton type	7-ton type	Remarks
Number of days/voyage	7 days	5 days	From departure to re-entry to the base port
Hours under way/day	8 hr	8 hr	
Number of days/month	7 days x 3 = 21 days	5 days x 4 = 20 days	
Number of days/year	21 days x 10 = 210 days	20 days x 10 = 200 days	The remaining two months are allocated for maintenance of the vessel.

Basis of calculation:

	11-ton type	7-ton type	Remarks
Wage:			
Captain:	$5,000/year	$5,000/year	
Chief engineer:	$5,000/year	$5,000/year	Annual contract
Other crew:	$2,500/year	$2,500/year	
Sea allowance:	$3/day x 210 days	$3/day x 200 days	Only for the number of days at sea
Provisions allowance:	$3/day x 360 days	$3/day x 360 days	
Fresh water:	$0.50/$m^3$	$0.50/$m^3$	
Fuel oil:	$0.40/ℓ	$0.40/ℓ	
Hull insurance premium:	$2,000/year	$1,500/year	
Maintenance expenses:	Construction cost x 2%	Construction cost x 2%	
Cost of construction and depreciation:	Nil	Nil	(due to grant aid)

Note: Basic unit price is in accordance with the information supplied by the Fijian Fisheries Division and an unknown unit price is based on estimation.

Item	11-ton type	7-ton type
Personnel expenses:		
Wages:	$5,000 x 2 = $10,000/year	$5,000 x 2 = $10,000/year
	$2,500 x 1 = $2,500/year	$2,500 x 1 = $2,500/year
Sea allowance:	$3/day x 3 x 210 days = 1,890	$3/day x 3 x 200 days = $1,800
Provisions allowance:	$3/day x 3 x 360 days = $3,240	$3/day x 3 x 360 days = $3,240
Fresh water:	$0.50/$m^3$ x 40 m^3 = $20	$0.50/$m^3$ x 40 m^3 = $20
Fuel cost:	$0.40/ℓ x 0.22 ℓ/HP/hr x 12 hrs x 150 HP x 210 days = $33,264	$0.40/ℓ x 0.22 ℓ/HP/hr x 12 hrs x 74 HP x 200 days = $15,629
	$0.4 x 0.22 x 6 hrs x 150 HP x 155 days = $12,276	$0.4 x 0.22 x 6 hrs x 74 HP x 155 days = $6,056
Fixtures and consumable supplies:	$1,300	$800
Hull insurance premium:	$2,000	$1,500
Maintenance expenses:	$2,600	$1,600

Unit: F$

Item	Personnel expenses	Fresh water	Fuel oil	Fixtures consumable supplies	Insurance premium	Main-tenance expenses	Total
11-ton type	17,630	20	45,540	1,300	2,000	2,600	69,090
7-ton type	17,540	20	21,685	800	1,500	1,600	43,145
Total	35,170	40	67,225	2,100	3,500	4,200	112,235

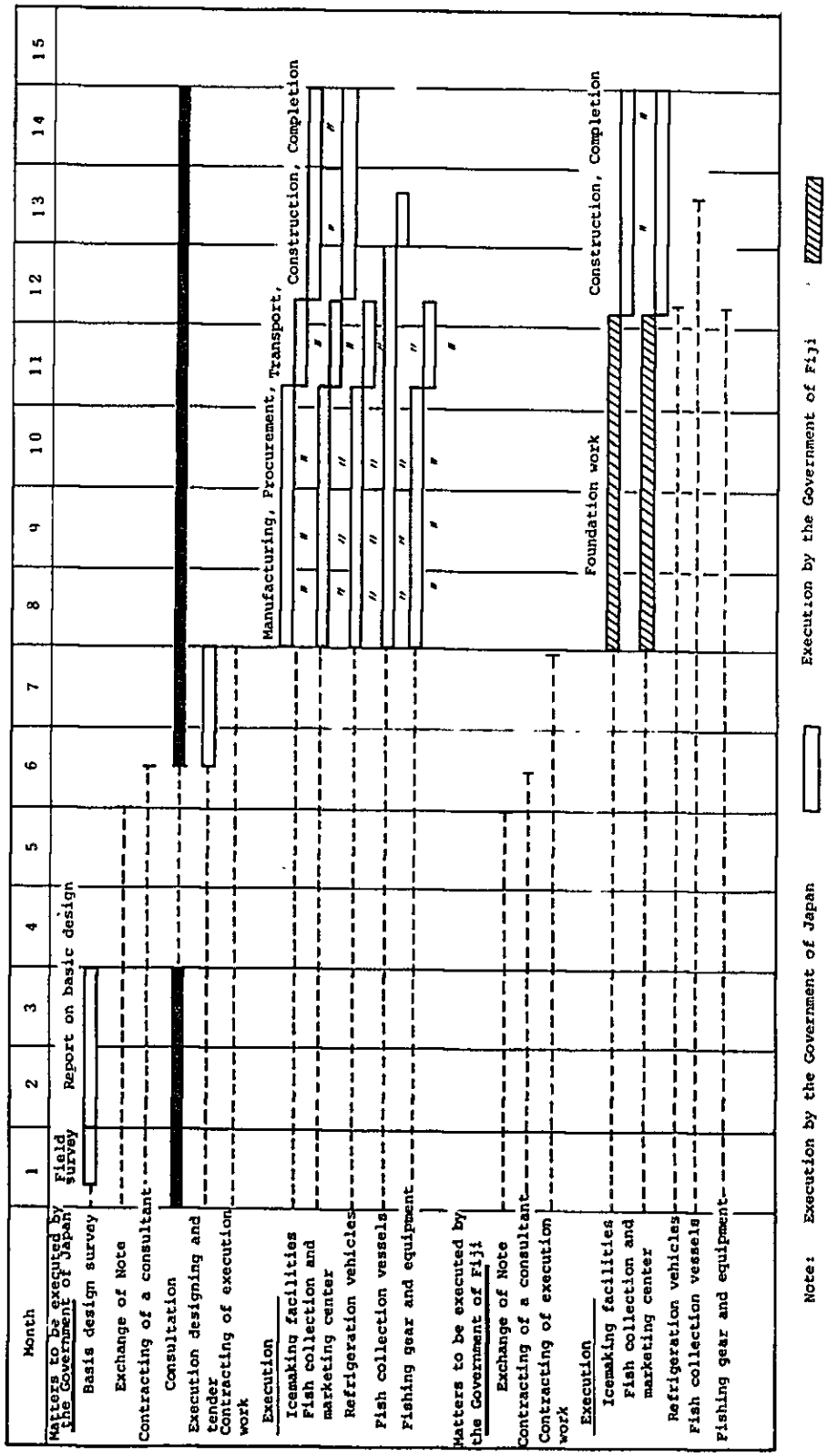
An annual total of approximately $112,200 will be required to operate the two collection vessels. The annual transport capacity of fish and ice is calculated as follows:

Item	11-ton type	7-ton type
Fish hold capacity	10 m^3	6 m^3
Fish	10 m^3 x 0.8 x (1 - 0.3) = 6 tons	6 m^3 x 0.8 x (1 - 0.3) = 4 tons
	Where; 0.8: Effective volume (1 - 0.3): Fish volume	
	6 tons/voyage x 30 voyage/year = 180 tons/year	4 tons/voyage x 40 voyage/year = 160 tons/year
Ice	10 m^3 x 0.8 = 8 tons	6 m^3 x 0.8 = 5 tons
	8 t/voyage x 30 voyage/year = 240 tons/year	5 t/ oyage x 40 voyage/year = 200 tons/year

Thus, the two vessels will be able to transport 340 tons of fish and 440 tons of ice annually.

3.9 Execution Schedule

The execution schedule is as shown in the table below.



CHAPTER 4. EFFECT OF PROJECT IMPLEMENTATION AND ITS EVELUATION

The purpose of the project is to improve the existing traditional small scale fishing industry in Fiji through modernization of fishing gear and establishment of fish products distribution facilities.

Hence, the implementation of the project is expected to produce both technical and economic effects on the fisheries industry.

4.1 Technical Effect

Technical effects of various facilities, equipment and materials which are to be provided in accordance with the Japan's grant aid are as summarized below:

(1) Recognition of the importance of fish catch handling techniques and the maintenance of product freshness.

Refrigeration and distribution facilities and transport equipment such as refrigeration vehicles and collection vessels will enable not only those who are directly involved in their operations but, also, rural fishermen, to recognize how important proper fish handling and maintenance of product freshness are for added values.

Hence, an improvement in fish handling techniques which help preserve freshness is expected to be made.

(2) Fishing gear and technologies

Fishing equipment to be provided in accordance with the Japan's grant aid will give the rural fishermen an opportunity to learn more about the manufacture and technology of fishing gear. Their newly acquired technical knowledge can be expected to be applied to benefit the rural fisheries.

4.2 Economic Effect

(1) Effect of Icemaking Facilities

An icemaking cost of 4.6 cent/kg (F$46.06/t) has been obtained on the basis of 300 working days per year as estimated on page 76 although the cost depends on the capacity of the ice plants and the rate of operation.

Since each ice plant will be operated by a branch of the Fisheries Division in each fishing district, profit may not be essential as long as the icemaking cost is compensated for. However, if profitability is to be considered as a public enterprise, it will be necessary to increase production while attempts should be made to reduce expenses.

Greater profitability can also be attained by using available ice storage space for fish cold storage. It is certain that the plants will be able to supply ice at equivalent to or lower than the current market price of 5¢ to 7¢ per kilogram even after the cost of transportation is borne.

Fish and ice supplies are interrelated. An increased ice supply increases the capability to provide a greater supply of fresh fish wherever there is an existing demand. Thus, the Fisheries Development Project is expected to produce a positive effect on the economy. The further development of the country's fishing industry will lead to higher incomes and higher standards of living for its fishing communities.

(2) Effect of Fish Collection and Marketing Center and Transport Vehicles and Collection Vessels

The establishment of the Marketing Center has significance. It seems that in the past, fishery in the country remained only at such a level that was only enough to meet home consumption due to the lack of a proper distribution system and facilities despite the fact that there was a potential for the development of local fishery.

A significant economic effect is expected if the Cen plays a central role in a well organized distributio system. Collection vessels and refrigeration vehicl used for the transportation of both fish and ice, wh are planned along with the Fish Marketing Center, wi an effective means to transport local catches to urb sumer areas.

Hence, economic and social effects are expected sinc caught in remote areas and islands will be collected land and sea and then supplied fresh fish to urban c through the Marketing Center.

(3) Effect of Fishing Gear, Equipment and Materials

Although it would be difficult to estimate probable increases in fish production, it is certain that the ing equipment to be provided under Japan's grant aid will be extremely useful in the promotion of rural f it will have a far-reaching effect on the Fiji's soc

4.3 Comprehensive Evaluation

As mentioned earlier, the request for Japan's grant part of the comprehensive program which includes the lishment of a system which will assist in providing smooth systematic supply of fresh fish products to c

The facilities, equipment and materials will be of a significant value in obtaining greater fish catches supplying increased quantities of fresh quality prod Also, when operated systematically, they will provid foundation for the further development of the countr fishing industry.

From the aforementioned, it is deemed that the Japan aid will have a significant impact on Fiji by satisf social and economic needs for more protein and highe ment.

ANNEX:

I. Minutes of Dischssions

II. Itinerary of Survey Team

III. Officials concerned of the Government of Fiji

IV. A list of Collected Data

I. THE BASIC DESIGN SURVEY TEAM FOR THE FISHERIES DEVELOPMENT PROJECT IN FIJI

Minutes of Discussions

In response to a request by the Government of Fiji to study its Fisheries Rural Development Programme of Fiji, the Government of Japan has sent, through the Japan International Cooperation Agency (hereinafter referred to as "JICA") which is an official Agency implementing the economic and technical cooperation of the Government of Japan, a team headed by Mr. Tatsuhiko Iwasawa of the Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries to conduct a basic design survey on the rural development project in Fiji (hereinafter referred to as the "Project") for nineteen days from August 8th, 1981.

The team had a series of discussions and exchanged views with the officials of the Fisheries Division, representing the Government of Fiji. Both parties have agreed to recommend that their respective Governments and the authorities concerned examine the result of the survey attached herewith and cooperate towards the realization of the Project.

Tatsuhiko Iwasawa
Leader of the Team,
Japanese Survey Team

Robin Yarrow
Permanent Secretary for
Agriculture and Fisheries

Peter Hunt
Chief Fisheries Officer,

Ministry of Agriculture and
Fisheries

August 21st, 1981

Attachments

1. The objectives of the Project are to provide the necessary facilities and equipment for upgrading fisheries rural development programmes and activities.

2. The proposed sites of the Project involving infrastructure are Lami, Wainibokasi, Savu Savu and Taveuni.

3. The Japanese Survey Team will convey the desire of the Government of Fiji to the Government of Japan that the latter will take necessary measures to cooperate in implementing the project and will provide the items as listed in order of priority in Annex I, within the budgetary limits of Japanese economic co-operation in grant aid form.
   The plans for ice plants, collection centre, collection boats and others are shown in Annex II.

4. The Government of Fiji will take the following necessary measures on condition that the grant aid assistance by the Government of Japan is extended to the project:-

   1) provide data and information necessary for the design and the construction

   2) secure land necessary for the construction

   3) clear, fill and level the project sites as needed before the start of construction

   4) construct and prepare the access road to the project sites, as needed

   5) provide other items listed in Annex III

   6) ensure prompt unloading and customs clearance in Fiji of imported materials and equipment for the construction and also to facilitate the internal transportation for them

7) exempt Japanese nationals concerned from customs duties, internal taxes and other fiscal levies which may be imposed in Fiji on the occasion of the supply of materials and services for construction

8) to provide and accord the necessary permissions, licences and other authorization required for carrying out the project

9) to provide necessary local labour for installation of the Project plants and facilities.

ANNEX 1.

Priority 1. Ice plants 5 tons/24 hours, ice storage of 20 tons, x 3 units for Wainibokasi, Savu Savu and Taveuni
Generating plant for Taveuni
Village ice storage units 1.5 tons x 20 units

2. Collection centre

   a. prefabricated building
   b. cold storage (1 x 40t at -25°C, 1 x 20t at -5°C)
   c. blast freezer (2t/24 hours)
   d. office building and equipment
   e. fish marketing and processing equipment

3. Refrigerated vehicles 2 tons x 3 units

4. Small collection vessels x 2 units (Fish holds 6 and 10m^3 respectively)

5. Fishing gear and equipment for rural training programme (16 units)

6. Fisheries development gears

7. Large collection vessel including containers and equipment.

ANNEX II.

1. ICE PLANT; Wainibokasi, Savu savu, Taveuni. 3 sets

(1) Icemaking Capacity 5 Tons/day, Plate Ice.

1) Ice Making Unit : R22 Compressor with 18KW Motor, Air Condenser, Receiver, Oil Separator, Dryer, Accumulator, Standard Accessories 3 sets

2) Raw Water Supply Pump with Motor and Valves, Pipes, Joints etc. 3 sets

3) Electric switch board and wiring materials 3 sets

4) Construction materials for ice plant Steel Frame, Roof materials, Checker Steel plate, Bolts and nuts etc. 3 sets

5) Chemicals Freon - R22 Refrigeration machine oil, Freon Detector, Silicagel etc. 3 sets

6) Generating Plant (Taveuni) 1 set

7) Tools, Spare parts and Accessories 3 sets (manufacturer's standard)

(2) Ice Storage (Temp. - 5°C) 20 Tons

1) Insulation Panel
Dimensions: (approx. $4.5^{mL} \times 4.5^{mW} \times 2.4^{mH} \times 100^{T}$)
Made of rigid urethane foam Laminated between Aluminium coated steel sheets with insulation, (or galvanized steel sheets), Dial thermometer and standard accessories 3 sets

2) Evaporator and Condensing Unit 3 sets

3) Tools spare parts and Accessories (manufacturer's standard) 3 sets

(3) Ice Boxes in Village

Dimension: (Approx. $1.5^{mW} \times 1.5^{mL} \times 1.2^{mH} \times 100^{m/mT}$)

20 sets

Made of Rigid Urethane Foam Panels Laminated Galvanized (or Aluminium) Steel with Insulation Door (Approx. $0.6^{m} \times 0.6^{m} \times 100^{mm/T}$)

Prefabricated, to be assembled in Fiji.

2. Collection Center

(1) Prefabricated Building: 440^{m^2}

Construction Materials: Steel Frame,
Roof Material with insulation,
Wall material: colored iron sheet and Iron nets, etc.

(2) Cold Storage (-25°C) 40 Tons

Dimension: (Approx. $5.4^{mW} \times 7.2^{mL} \times 2.7^{mH} \times 120^{m/mT}$)

1) Made of rigid urethane foam panels laminated Galvanized (or Aluminium) Steel with insulation Door ($0.9^{m} \times 1.8^{m} \times 100^{m/mT}$), Dial Thermometer and standard accessories.

2) Condensing Unit: R22 Compressor
Air Condenser, Receiver,
Oil Separator, Dryer, Accumulator,
Standard Accessories 1 set

3) Evaporator: Standard Accessories 1 set
(Cooler, Thermo Exp. Valve,
Piping, etc.)

4) Tools spare parts and Accessories 1 set
(manufacturer's standard)

(3) Cold Storage (-5°C) 20 Tons

Dimension: (Approx. $5.4^{mL} \times 3.6^{mW} \times 2.7^{mH} \times 100^{m/mT}$)

1) Made of rigid urethane foam panels laminated Galvanized (or Aluminium) steel with insulation door ($0.9^{m} \times 1.8^{m} \times 100^{mmT}$), Dial Thermometer and standard accessories.

2) Condensing Unit: R22 Compressor 1 set
Air Condenser, Receiver,
Oil Separator, Dryer,
Accumulator, Standard Accessories

3) Evaporator: Standard Accessories 1 set
(Cooler Thermo. Exp. Valve,
Pipings, etc.)

4) Tools Spare Parts and Accessories 1 set
(manufacturer's standard)

(4) Blast Freezer (-35°C) 2 Tons/day

Dimension: ($5.4^{mW} \times 2.7^{mH} \times 2.7^{mH} \times 125^{mm/T}$)

1) Made of rigid urethane foam panels laminated Galvanized (or aluminium) steel with insulation, door ($0.9^{m} \times 1.8^{m} \times 125^{mm/T}$) Dial Thermometer and Standard Accessories (including shelves)

2) Condensing Unit: R22 Compressor 1 set
Air Condenser, Receiver,
Oil Separator, Dryer, Accumulator,
Standard Accessories, etc.)

3) Evaporator: Standard Accessories 1 set
(Cooler, Thermo. Exp. Valve,
Piping etc.)

4) Tools spare parts and Accessories 1 set
(manufacturer's standard)

(5) Office Building and Equipment

1) Prefabricated structure: 50^{m^2} (Approx.)
Accomodation, 2 office rooms
Toilet, Shower, Utility Room.

2) Equipment for office

Item	Specification	Quantity	Remarks
Office room			
Desk and Chair		2 sets	
Typewriter		2 sets	
Ceiling fan		2 sets	
Shelves		2 sets	
Filing cabinet		2 sets	
Recreation and eating area			
Sink	stainless	1 set	
Gas stove	3 - 4 rings	1 set	
Water heater	electric	1 set	
Ceiling fan		1 set	
Overhead shelves		1 set	
Toilet			
Water closet	1 male, 1 female	2 sets	
Wash basin	" "	2 sets	
Mirror	" "	2 sets	
Shower room			
Shower set	1 male, 1 female	2 sets	

(6) Fish marketing and Processing equipment

1) Battery Fork Lift Vehicle 1 set
Capacity 1,000 KG
Lift Height 3^{m}
Battery 48^{V}
Battery Charger

2) Fish marketing and Processing equipment

Bandsaw	2 sets
Tables Stainless Steel	2 sets
Fish Washing Sink	2 sets
Aluminium Fish Containers	
600 x 400	200
Plastic Fish Basket	
600 x 400 mm	200
Assorted Knives	30
Scales 250 kg	1
Scales 20 kg	2
Scales 100 kg	6
Freezers - Chest 515 litre	5
Freezers - Display 515 litre	5
Cash Registers	5

3. Refrigerated Vehicles (-5°C) 3 Units

Pay Load 2000 kg

Tools, Spare Parts and Accessories (maker's standard)

Notice - Additional Tools, Spare Parts, Accessories to be included for all items

Items to be provided by Fiji Government

1. Foundation materials
2. Electric wiring materials and power supply to site
3. Raw water piping materials and water supply to site
4. Cost of labourers at site
5. Domestic transportation of materials to site

4. Small Collection Vessel

(1) 6 Gross Tons

Item	Specification	Quantity	Remarks
1. Principal particular			
Length overall	about	13.65 m	
Length (Register)	"	10.50 m	
Breadth overall	"	3.00 m	
Breadth (Moulded)	"	2.48 m	
Depth (Moulded)	"	0.84 m	
Designed gross tonnage	"	6 tons	
Capacity			
Fish hold	about	6 m^3	
Fuel oil tank	"	1.5 m^3	
Fresh water tanks	"	0.5 m^3	
Complement		3 persons	
Main engine	74 HP,	1,800 r.p.m.	
Trial speed (max)	about	9 knots	
Service speed	"	7.5 knots	
Cruising range	about	400 N/miles	
Rule and regulation	JG or NK		
2. Construction			
Hull, deck and superstructure to be of FRP (fibreglass reinforced plastic).			
3. Deck part			
Deck machinery & equipment			
4. Fire fighting equipment			J/G
5. Life saving equipment			J/G
6. Ventilation system			J/G

Item	Specification	Quantity	Remarks
7. Engine part			
Main engine	74HP, 4-cycle diesel engine 1,800 r.p.m.	1 set	
Remote control device		1 set	
Other machinery and pump			
8. Refrigeration	(Fish hold temperature -2°C)	1 unit	
9. Electric part			
Power generator	AC 225V, 50Hz	1 set	
Alternator	DC 24V	1 set	
Battery	DC 24V	2 sets	
Navigation lights			
Room lights			
Deck lights			
Deck flood lights			
10. Radio telephone and nautical instruments			
Radiotelephone	SSB 10W	1 set	
Radar	about 24 miles	1 set	
Echo sounder	with recording paper dry type	1 set	
11. Tender boat	2.5 - 3m. with 5 h.p. outboard engine	1 set	
12. Tools and spare parts			
Additional tools and spare parts to be supplied.			

(2) 10 Gross Tons

Item	Specification	Quantity	Remarks
1. Principal particular			
Length overall	about 14.50 m		
Length (Register)	" 12.00 m		
Breadth overall	" 3.52 m		
Breadth (Moulded)	" 3.00 m		
Depth (Moulded)	" 1.00 m		
Designed gross tonnage	" 10 tons		
Capacity			
Fish hold	about 10 m^3		
Fuel oil tank	" 2.5 m^3		
Fresh water tank	" 1.0 m^3		
Complement	3 persons		
Main engine	115 HP, 1,600 r.p.m.		
Trial speed (max)	about 9 knots		
Service speed	" 7.5 knots		
Cruising range	about 600 N/miles		
Rule and regulation	JG or NK		
2. Construction			
Hull, deck and superstructure to be of FRP (fibreglass reinforced plastic)			
3. Deck part			
Deck machinery and equipment			
4. Fire fighting equipment			
5. Life saving equipment			
6. Ventilation system			

Item	Specification	Quantity	Remarks
7. Engine part			
Main engine	115 HP, 4-cycle diesel engine 1,600 r.p.m.	1 set	
Remote control device		1 set	
Other machinery and pump			
8. Refrigeration	(Fish hold temperature -2°C)	1 unit	
9. Electric part			
Power generator	AC 225V, 50Hz	1 set	
Alternator	DC 24V	1 set	
Battery	DC 24V	2 sets	
Navigation lights			
Room lights			
Deck flood lights			
10. Radio telephone and nautical instruments			
Radio telephone	SSB 10W	1 set	
Radar	abt. 48 miles, 5 kW	1 set	
Echo sounder	With recording paper dry type	1 set	
11. Tender boat	2.5 - 3.0m with 5 h.p. outboard motor	1 set	
12. Tools and spare parts			
Additional tools and spare parts to be supplied.			

5. Fishing Gears Equipment

Item	Specification	Quantity	Remarks
Marine diesel engine	20HP, inboard with electric starter and standard spares	16 units	
Fuel oil pump		"	
Bilge pump	With hose and strainer	"	
Kingston cock	With cooling hose and strainer	"	
Water mixing elbow	With hose	"	
Extension wire	For engine operation	"	
Battery	With switch	"	
Propeller	430^{mm} x 300^{mm}	"	
Propeller shaft	28^{mm} dia x 3120^{mm} with flexible coupling	"	
Stern tube	28^{mm} dia x 2150^{mm}	"	
Half coupling	For propeller shaft slid type	"	
Remote control cable tachometer and sounder		"	
Anchor	12Kg, 7.5Kg each	"	
Anchor rope	Polyethylene, 12^{mm} x 220^{m}	"	
Fishing winch	Hydraulic, 300 Kg Sheave size 4-12^{mm}, $60^{m/mm}$	"	
Rope	Polyethylene 4^{mm} x 600^{m} dark colour	"	
Fish finder	12V, 50Hz, 160 fathoms With transducer, Dry recording paper 12 rolls	"	
Gill net	Monofilament, (50m x 4) x 5m mesh size 3" stretched	"	With ancillary materials
Gill net	Multifilament, (50m x 4) x 5m mesh size 3" stretched 210d x 9 ply.	"	"
Fishing handline	Tetlon/nylon mixed No. 60, 100m x 6 coil	"	
Mending twine	Monofilament No. 6	16 sets	
Mending twine	Multifilament, 210d x 9 ply. 0.5 Kg	"	

Item	Specification	Quantity	Remarks
Steering wheel	Cable operation	16 sets	
Fishing hooks	Assorted	16	
Trace wire	Assorted	16	
Life jackets		16	
Compass	Magnetic	16	

6. Fisheries Development Gear

Seine net	For mackerel fishing Small type 100^{m} - 150^{m} x 10^{m} - 15^{m}	1 unit
Lift net	For bait fishing 8^{m} - 10^{m} x 8^{m} - 10^{m} Mesh size 3/8"	1 "

7. 30 Gross tons Collection Vessel 1

Length	about 17.5 m	Remark:
Breadth	" 4.0 m	With sea water ice making machines
Depth	" 1.7 m	Machine, 2 1/2 tons/day
Gross tonnage	" 30 tons	Quick freezer 5 tons/day
Complement	4 persons	
Hull material	FRP	
Main engine	240 HP/1,600 r.p.m. Cycle single acting	
Fish hold	- 30°C, 9 m^3	
Freezing room	8 m^3	

ANNEX III.

Items whose costs and related work will be borne by the Fisheries Division for the Government of Fiji:

1. Water supply mains to the collection centre

2. External drainage from the centre and sewage treatment facilities

3. Electrical power main line to the centre

4. Telephone lines and equipment

5. Exterior facilities and landscaping

6. Provision of space necessary for such construction as temporary office, working area, stock yards, and others

7. Carpet, curtains and other furnishings

8. Maintenance and operation costs and expenses

II. Itinerary of Survey Team

Number of Days	Date	Day		Description	Place of Overnight Stay
1	Aug. 8	Sat.	20:55	Departure from Tokyo by TE 024.	In flight
2	Aug. 9	Sun.	08:25	Arrival at Nandi.	
			10:00	Departure from Nandi by PC 012.	
			11:10	Arrival at Suva.	
				Consolidation of survey data, and intra-team arrangements.	Suva
3	Aug.10	Mon.	Morning	Courtesy call on the Japanese Embassy in Fiji.	
			Afternoon	Courtesy call on the Fisheries Division of Fiji Government; Arrangements for survey schedule and explanation of T/R.	Suva
4	Aug.11	Tue.	Morning	Courtesy call on the Fiji Foreign Ministry; Consultation with the officials of the Fisheries Division.	
			Afternoon	Consultation with the officials of the Fisheries Division.	Suva
5	Aug.12	Wed.	Morning	Survey of the Suva area (Municipal market, commercial port berthing facilities, Government shipyard, and Bish shipyard); Visit to Naduruloulou Research Station of the Fisheries Division.	
			Afternoon	Survey of the Wainibokasi area (Proposed ice plant site, Nakelo landing base, and wharf facilities); Survey of Kiuva Village (Interviews with fishermen to collect data on the activities of the fisheries cooperative society and actualities of fishing operation).	Suva

Number of Days	Date	Day		Description	Place of Overnight Stay
6	Aug.13	Thu.	Morning	Survey of the Suva area (Visits to Fiji Institute of Technology, UNDP Suva Office, University of South Pacific, School of Maritime Studies).	
			Afternoon	Consultation with the officials concerned of the Fisheries Division.	Suva
7	Aug.14	Fri.	07:30 07:55	Departure from Suva by FJ 007. Arrival at Nandi.	
				Visits to Lautoka Station of the Ministry of Agriculture and Fisheries and Lautoka Station of the Fisheries Division, and consultation with the officials concerned of the two stations.	
				Survey of the Lautoka area (Inspection of the ice plant, wholesale market, municipal market, commercial port berthing facilities, and fishing boats, and interviews with fishermen).	Lautoka
8	Aug.15	Sat.		Survey of the Lautoka area (Inspection of the municipal market and fishing boats, and interviews with fishermen).	
				Intra-team discussion and arrangements, and data consolidation.	Lautoka
9	Aug.16	Sun.	07:10 07:45	Departure from Nandi by FJ 004. Arrival at Suva.	
				Survey of roadside stall fish selling in the Suva area.	
				Intra-team discussion and arrangements, and data consolidation.	Suva

Number of Days	Date	Day		Description	Place of Overnight Stay
10	Aug.17	Mon.	Morning	Discussion with the officials concerned of the Fisheries Division.	
			14:45 15:30	Departure from Suva by PC 077. Arrival at Savu savu.	
				Discussion with the officials concerned of Savu savu Station of the Fisheries Division, and interviews with fishermen.	Savu savu
11	Aug.18	Tue.		Visit to Savu savu Station of the Ministry of Agriculture and Fisheries, and discussions with the officials concerned.	
				Survey of the Savu savu area (Proposed ice plant site, power plant, workshop, berthing facilities, icemaking facilities, refrigerating facilities; and interviews with fishermen).	
				Savu savu → Buca Pt.	
				Buca Pt. → (ferry boat) → Taveuni Is.	
				Survey of the Taveuni area (Survey of the west coast and northern area of Taveuni Is., i.e., southern Vuna Waimaqera, central Waiyevo, and northern Navokacoa; inspection of the proposed sites of ice plant and ice storage, municipal market, and berthing facilities; and interviews with fishermen).	Taveuni
12	Aug.19	Wed.		Tavenuni → (ferry boat) → Buca pt.	
				Buca Pt. → Savu savu → Lambasa.	Lambasa

Number of Days	Date	Day		Description	Place of Overnight Stay
13	Aug.20	Thu.		Discussion and arrangements with the officials concerned of Lambasa Station of the Fisheries Division.	
				Survey of the Lambasa area (Inspection of the Fisheries Division's facilities, ice plant, cold storage, commercial port berthing facilities, fishing boat berthing facilities; and interviews with fishermen).	
			12:15 13:00	Departure from Lambasa by FJ 071. Arrival at Suva.	
				Consultation with the officials converned of the Fisheries Division; Preparation of draft minutes.	Suva
14	Aug.21	Fri.		Consultation with the officials concerned of the Fisheries Division, and reviewal of the draft minutes.	
			16:00	Signing and exchange of the Minutes of Discussion.	Suva
15	Aug.22	Sat.	07:45 08:00	Departure from Suva by PC 41. Arrival at Levuka.	
				Visit to Pacific Fishing Co. and inspection of the company.	Levuka
16	Aug.23	Sun.	11:30 11:45	Departure from Levuka by PC 46. Arrival at Suva.	
			Afternoon	Intra-team discussion and arrangements, and data consolidation.	Suva

Number of Days	Date	Day		Description	Place of Overnight Stay
17	Aug.24	Mon.		Arrangements with the Fisheries Division. Survey of the Fisheries Division's facilities and the Lami area (Hostel for fisheries trainees, Fisheries Laboratory, shipbuilding facilities, cold storage facilities, materials warehouses, proposed site of the fish collection marketing center now under reclamation work, ice plant, fisheries research vessel (Tui-Ni-Wasabula), and skipjack fishery training vessel (IKA No.5), and wharf facilities).	Suva
18	Aug.25	Tue.		Arrangements with the Fisheries Division. Presentation of the survey report and a copy of the Minutes of Discussion to Ambassador Ikebe at the Japanese Embassy in Fiji.	
			16:00	Departure from Suva by car for a survey of fishing villages along the southern coast of Viti Levu Is.	
			20:00	Arrival at Nandi.	Nandi
19	Aug.26	Wed.	01:10 06:55	Departure from Nandi by JL 776. Arrival at Tokyo.	

III. Officials Concerned of the Government of Fiji

MR. ROBIN YARROW	Parmanent Secretary	Ministry of Agriculture and Fisheries
DR. P.C. HUNT	Chief Fisheries Officer	Ministry of Agriculture and Fisheries Division
DR. A.D. LEWIS	Principal Research Officer	" " (Lami office)
MR. Mc. GREGOR	Principal Officer	" " (")
MR. S. TUICAVUILATI	Acting Principal Officer	" " (")
MR. S. TUILAULALA	Senior Fisheries Officer	" " (")
MR. JERRY WONG	Technical Officer	(Savu savu Office) "
MR. C. SINGH	Officer in charge	(") "
MR. SATYA NAND LAL	Senior Fisheries Assistant	(") "
MR. UTAM	Officer in charge	(") "
MR. CHARLES S. EVENING	Technical Fisheries Officer	(Lautoka Office) "
MR. KARAN SINGH	Senior Fisheries Officer	(") "
MR. S. SEWAK	Senior Fisheries Officer	(Lambasa Office) "
MR. REKI TADULALA		(Wainibokasi Ice Plant) "
MR. MACIU LAGIBALAU		(Naduruloulou Station) "
MR. PHIL HOTCHIN	Principal Agricultural Officer	(Savu savu Station) "
MR. RAM GOPAL	Agricultural Officer	(Taveuni Station) "
MR. ILAITIA VDAMU	Principal Assistant Secretary	Ministry of Foreign Affairs
MR. IAN PERKS	Assistant Secretary	"

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7. Fiji Institute of Technology ..... F.I.T