BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
THE CONSTRUCTION OF
FISHERY FACILITIES AND
SUPPLY OF EQUIPMENT
IN
THE REPUBLIC OF SEYCHELLES

October 2006

JAPAN INTERNATIONAL COOPERATION AGENCY

ECOH CORPORATION

PREFACE

In response to a request from the Government of the Republic of Seychelles, the Government of Japan decided to conduct a basic design study on the Project for the Construction of Fishery Facilities and Supply of Equipment and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Seychelles a study team from January 8 to February 5, 2006.

The team held discussions with the officials concerned of the Government of Seychelles, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Seychelles in order to discuss a draft basic design, and as this result, the present report was finalized.

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

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

October, 2006

Masahumi Kuroki
Vice-President
Japan International Cooperation Agency

October, 2006

LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on the Project for the Construction of Fishery Facilities and Supply of Equipment in the Republic of Seychelles.

This study was conducted by ECOH CORPORATION, under a contract to JICA, during the period from December, 2005 to October, 2006. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Seychelles and formulated the most appropriate basic design for the project under Japan's Grant Aid scheme.

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

Very truly yours,

Hitoshi Takemoto
Project manager,
Basic design study team on
The Project for the Construction of
Fishery Facilities and Supply of Equipment
ECOH CORPORATION

SUMMURY

1. Outline of the Country

The Republic of Seychelles (hereinafter referred as Seychelles) is the island country located at south west of Indian Ocean consisting 115 islands with total gross land area of 445km^2 and the population of 83,723 (National Census in 2002). EEZ area of the country is 1.37million km^2 having rich fishery resources. Seychelles belongs to maritime tropical climate, the average temperature is high with 26 to 28C° through a year and the average humidity is also high with approximately 80%. The season is separated by almost two seasons that are the dry season in May to September with predominant wind from south east and the monthly precipitation is 80 to 150mm, and the rainy season in October to April with predominant wind from north west and especially, monthly precipitation of January reaches to 400mm. The annual precipitation is 2,200mm as recorded however the influence by cyclone is small since this country belongs to the equatorial calm zone.

GDP of Seychelles in 2004 is 703.5million US Dollars, GDP per capita is about 8,400 US Dollars, GNI per capita is 8,090 US Dollars and they are remarkably high amongst other African countries. Main industries wise breakdown of GDP are 3 % for Primary industry, 27% for Secondary industry and 70% for Tertiary industry. Main industry is tourism and fisheries centering tuna and especially the tourism hires about 30% of labor population and earns about 70% of foreign currency revenue. However, too much dependent tendency on the tourism is easy to be influenced by international situation, the Government is now challenging to develop fisheries, agriculture and artisanal industries. The actual growing rate of GDP was stagnant with the figure of -6.3% in 2003 and -2.0% in 2004. The export amount in 2004 was 200million US Dollars and the import amount was 504million US Dollars and the trade balance becomes heavy deficit therefore, the Government is aiming to increase self-supply ratio of daily commodities and foods in order to decrease import amount.

2. Background of the Project

The Government of Seychelles deems fisheries industry as most important industry for national economic development and made a fishery policy in 2005 (The Fisheries Policy of Seychelles 2005) and the following 7 development strategies were extracted.

1)Conservation and Management of marine resources, 2)Creation of employment, 3)Maximum revenue from fisheries, 4)Promotion of integrated economy, 5)Enhancement of food supply and food security, 6)Safety at sea, 7)Maintaining Port Victoria as tuna fishery base in west Indian ocean.

Concerning the artisanal fisheries, especially from the view points of securing supply of fishery products to domestic market, creation of employment, acquisition of foreign currency and etc. including tourism, the facilities in Victoria Fishing Port has been improved as core facility. However, as this fishing port has the limitation to expand, the Government of Seychelles has made the development plan to have a new fishing port in Providence where is new industrial estate now under developing together with the improvement of Bel Ombre Fishing Port which is the 2nd largest fish landing place in Seychelles.

This project, based on the above described Fishing Port Development Plan, is to promote reducing the congestion of Victoria Fishing Port and improving surrounding fishing ports in an integrated manner and this is deemed as necessary improvement of infrastructure for the promotion of artisanal fisheries in Seychelles.

The fishery sector contributes to improvement of the economic structure with its bias toward tourism by acquisition of foreign currency, through the export of canned tuna and fishery products which account for about 90% of total exports, fish license fees for tuna fishing, transshipment fees, usage fees of fishing port, etc.. The Government of Seychelles has promoted fishery industry improving main fishing ports through the Grant Aid by the Government of Japan during 1980s to 1990s. Consequently, the volume of fish catch has been increased by the increase of number of fishing boats and their growing in size and export amount related fisheries has been remarkably increased from 13million US Dollars in 1990 to 180million US Dollars in 2004.

The fishery industry in Seychelles can be broadly classified into industrial fishery targeted at tuna, semi-industrial fishery for long-line fishing and shark fishing, and artisanal fishery targeted at demersal fish and small pelagic fish. Semi-industrial and artisanal fisheries are centered mainly on artisanal fishery facilities in Victoria Fishing Port (hereinafter referred as Victoria Fishing Port) and also landed in about 20 beaches scattered in the island. The fish catch volume was 4,288ton in 2004. Most of the artisanal catch is consumed locally and playing an important role in providing animal protein, in supplying fresh fishery products to the tourism industry.

Victoria Fishing Port had quay, fish handling shed and etc. through the Grant Aid in 1997 by the Government of Japan. The fish catch volume in 2004 was 1,368ton being equivalent to 32 % of the catch volume of semi-industrial and artisanal fisheries. It has passed 10 years since this fishing port has constructed and the number of fishing boats to utilize this port increased to 113 from 83 in 1997 and the following issues have become problematic.

1) The quay is very congested and results in deterioration of fish freshness due to reduced fish landing efficiency since fishing boats are moored trebly or quadruply.
2) The risk of dangerous mooring has been increased by hitting each hull in mooring quay.
3) The total production volume of two ice making plants in fish processing companies is 50 ton/day and the volume to be used for processing and export use that is 24 ton/day has to be deducted then, only 26 ton/day is available against the inevitable ice volume for sailing out of fishing boats which is about 43 ton/day therefore, the waiting time for ice supply is occurred as maximum of one week.

In spite of the situation, the quay for artisanal fishery in Victoria Fishing Port has no room for expansion since two fish processing companies are located at the both sides. In order to solve the problems the Government of Seychelles has planned to construct a new fishing port in Providence where is locating about 5 km from Victoria Fishing Port and has developed as industrial estate from 1985. The plan is the fishing port for artisanal fishery combined with fish processing factories and the reclamation, breakwater and dredging for basin have been already executed. However, the quay or other fishing port facilities like ice making plant are not constructed due to the shortage of budget.

While, Bel Omble is the 2nd largest fishing port next to Victoria Fishing Port and it has been utilized by 20 artisanal fishing boats in 2004. The volume of fish landing is 302ton which is equivalent to 7% of fish landing volume of semi-industrial and artisanal fisheries. The Government of Seychelles has made this fishing port development plan and has executed the construction works (breakwater, dredging of basin, landing facility and etc.) step by step from 1988. However, the ice making plant is unavailable in Bel Omble and have to bring the ice from Victoria Fishing Port by car. 12 boats out of fishing boats registered in this port therefore, land fishes and berth at Victoria Fishing Port by necessity that leads the congestion of Victoria Fishing Port.

The Government of Seychelles has requested the Grant Aid to the Government of Japan in order to solve the congestion of Victoria Fishing Port together with promoting artisanal fisheries of both areas where are Providence in new industrial estate to have fishing port facilities and Bel Omble Fishing Port being the 2nd largest landing place to install the ice making plant.

3. The Outline of Study Result and Contents of the Project

The Government of Japan has decided to conduct Basic Design Study for the Seychelles request and JICA has dispatched the study team with the following schedule.

Basic Design Study : January 8, 2006 to February 4, 2006

Explanation of Draft Final Report : September 10, 2006 to September 17, 2006

The team as well as having the meetings with concerned persons in the Government of Seychelles conducted field survey in the project sites and analyzed after getting back to Japan. As the result, in order to solve the port congestion in Victoria Fishing Port the following facilities based on the request to be constructed and relocate fishing boats from Victoria Fishing Port to Providence and Bel Omble. It has been concluded that the number of fishing boats is necessary to reduce to the number at the time of quay construction of Victoria Fishing Port in 1997.

1) Construction of fishing port facilities in Providence
2) Construction of ice making plant in Bel Omble

The facilities to be constructed and the equipments to be procured by this project are planned like as follows judging from the project back ground, contents, natural conditions, maintenance organizations, constructional situations and others with the appropriate scale and components as the Grant Aid scheme.

Contents of the Project

[Facilities]

Name of Facility	Size	Content of Plan
Providence (Civil Facilities)		
Quay	Length: Landing quay: 20m Mooring quay: 59m Bunkering quay: 20m Structure: Steel sheet pile type (Vertical pile anchorage)	Crown height: D.L+2.5m Depth: D.L-2.5m
Pavement	Landing quay: length 20m width 10m	Concrete pavement Thickness: 20cm
Mooring buoy	5 units	Polyethylene type Diameter: approx. 1,400mm Height: approx. 990mm
Navigation aid	Buoy type: 3 units Land type: 1 unit	Power source: Solar cell module type Light source: Light emitting diode (LED) type Effective luminous intensity: Approx. 8 cd Luminous range: Approximately 4.5 km
Providence (Building Facilities)		
Ice plant	Total floor area: ground floor 276m^2 first floor 48m^2 Ice making machine: 5 ton/day x 2 units Ice storage capacity: 15 ton Water tank: 30 ton Blast freezer: 1 ton/8 hours Cold storage: -25 degrees, capacity 30 ton	Steel-flame two-story, continuous footing Column: steel structure Wall: heat insulating siding Roof: V-shaped steel roofing
Administration building	Total floor area: 204m^2	Steel-frame one-story, continuous footing Column: reinforced concrete Wall: Concrete block Roof: V-shaped steel roofing
Fish handling shed	Total floor area: 96m^2	Steel-frame one-story, continuous footing Floor: floor hardner Column: reinforced concrete Roof: V-shaped steel roofing
Fishermen's gear storage	Total floor area: 177m^2 (with toilet and shower) 2.5m×2m 24 stores	Steel-frame one-story, continuous footing Column: reinforced concrete Wall: concrete block Roof: V-shaped steel roofing

Name of Facility	Size	Content of Plan
External facilities	Pavement: 3,200m^2 Outdoor Light: 11 nos Reefer container power source: 4 units Fire hydrant: 2 units Water tap: 3 nos Power supply: 5 nos	Interlocking block Height 4.5m, 250 watts
Bel Ombre (Building Facilities)		
Ice plant	Total floor area: ground floor 68m^2 first floor 39m^2 Ice making machine: 3 ton/day 2 units Water tank: 15 ton Ice storage capacity: 9 ton	Steel frame one story, continuous footing Column: steel structure Wall: heat insulating siding Roof: V-shaped steel roofing

[Equipment]

Name of Equipment	Quantity	Content of Plan
Providence		
Forklift	1 unit	Load capacity: 1 ton Fuel: LPG system
Fish box	20 boxes	Plastic Capacity: 500 liter
Pallet box	1 box	Plastic, one side door Capacity: 850 liter
Bel Ombre		
Forklift	1 unit	Load capacity: 1 ton Fuel: LPG system
Pallet box	1 box	Plastic Capacity: 500 liter

4. Project Period and Estimated Project Costs

It is necessary 5.5 months for detailed design and 19 months for construction period totaling 24.5 months when this project is implemented by the Grant Aid. The estimated project costs will be 1,203 million Japanese yen (Japan side 1,141 million yen, Seychelles side 62.21 million yen)

5. Verification of the Project Appropriateness

With the implementation of this project, the congestion of Victoria Fishing Port is resolved and the artisanal fisheries in Providence Fishing Port and Bel Omble Fishing Port are encouraged. This project will bring the direct benefit to approximately 500 fishermen in Victoria and Bel Omble Fishing Ports and to improve fishery activities of several hundreds industry workers related with semi-industrial and artisanal fisheries including Providence. And also, this contributes to the promotion of food self-sufficiency rate and acquisition of foreign currency and it leads to the indirect benefit for all the 84,000 people in Seychelles. After the completion of this project, any problems are seen as no problem on the operation and management since Seychelles Fishing

Authority (SFA) is going to operate and manage the facilities and the equipments.

The following effects are expected in particular and this project is considered appropriate as the project under Grant Aid scheme.

<Direct Effects>

1) Dissolution of port congestion in Victoria Fishing Port

Fishing boats using Victoria Fishing Port will be reduced in number from present 113 boats to 77 boats by the relocation of fishing boats to Providence and Bel Omble. (Mooring boats per day will be reduced from 58 boats to 40 boats) Because the 100% of fishing boats can be moored automatically.

The port congestion will be resolved, as the result, the facilitation of landing and preparation work for sailing out and the safety mooring are going to be possible. These lead to higher operation ratio, reduction of boat repair, lowering post-harvest losses and the income of fishermen can be improved.

2) Promotion of artisanal fisheries in Providence

24 fishing boats will use this fishing port relocated from Victoria Fishing Port. Estimated landing volume is 273 ton per year and this is going to be the 3rd largest fishing port next to Victoria and Bel Omble.

3) Promotion of artisanal fisheries in Bel Omble

21 fishing boats combined with 12 boats relocated from Victoria Fishing Port will use this fishing port. Estimated landing volume is 447 ton per year which increased 48% comparing with the year of 2004.

4) Facilitation of preparation work for sailing out in Victoria and Bel Omble Fishing Ports

Maximum about one week waiting time for getting ice that fishermen in Victoria and Bel Omble Fishing Ports has suffered will be pretty much resolved.

5) Stable supply and lowering of post-harvest losses of bait in Providence

The stable supply and lowering post-harvest losses from a large catch of bait for 24 fishing boats relocated from Victoria Fishing Port can be ensured.

<Indirect Effects>

1) 6 medium and small fish processing companies wish to move in fish processing facilities that The Government of Seychelles is to construct in parallel with the construction of fishing port in Providence and 2 processing companies already operated in the area will make fish processing complex. With this complex a new market is born and the economic effect such as on the export promotion of fishery products, labor employment, multiplied effects to related industries like distributions and sales are expected.

2) The economic effects is promised such as on multiplied effects to related industries like distributions and sales promotion and labor employment in Bel Omble Fishing Port. The vitalization of the area economy can be expected by the fishery promotion together with tourism promotion through construction of recreational facilities (Park, Restaurant and etc.) which the Government of Seychelles is now in progress in parallel with the construction of fishing port.

It is recommended that the implementing agency, the SFA shall make use of the facilities after the completion and operate them paying much attention to the following points.

(1) Proper operation and management

The balance of payment for the operation cost in Providence Fishing Port will show about SR 200 thousand deficit while Bel Omble is expected to the same amount surplus which the balance will even out each other. However, it is necessary to operate efficiently and pay attention to cutting the costs.

(2) Safe and effective quay management

Quay for landing, mooring and bunkering have been minimized against number of fishing boats to use in Providence. The SFA is required to instruct proper landing order or mooring spot and operate and manage the quay with safe and effective utilization when boats will be gathered one time at the time of sailing out and landing. The mooring of non operated boats could be the cause of port congestion therefore, it is necessary to make fishermen respect fishing port utilization rules including to move non operated boats from fishing port facility to other spot like rubble mound seawall located at inner part of basin.

(3) Periodical facility inspection

In order to extend life span without loosing facility function, it is important to inspect the facilities periodically and usual maintenance work. It is said that a constructed facility after 10 years from its completion requires checking and repair. Concerning the corrosion of steel structure, if the re-painting is done when the rust is found the cost of repair will be small and prevent the deterioration and the expected lifetime can be extended. Therefore, after the completion of these facilities, the SFA which manages the facilities is expected to set up the items to be checked (For example rust on structures and etc.) and if some defects are found by execution of regular checking the immediate repair is required.

(4) Bait sales for semi-industrial and artisanal fishing boats

After this goes to the operation, the SFA is to sell bait other than sales of ice and it could be competed with the prices of two fish processing companies in Victoria Fishing Port. The fish processing companies are supplying bait(imported) and ice cheaper than general retail price to contracted boats subject to getting their fish catch on a priority base. Therefore, the SFA can not expect the profit by the sales of bait but should aim to have good balance in buying and selling of

bait that is the price adding necessary expenditure on bait purchasing cost price.

(5) Garbage control in Providence Fishing Port

The project site of Providence is located on extension line of runway of Seychelles International Airport. So, Seychelles Civil Aviation Authority is anxious about some troubles for takeoff and landing of aircraft by means of sea birds which are gathered after raw garbage and fish snuffs. This project does not include such facilities to process fishes however, the SFA should entirely control raw garbage like from food stuff.

(6) Repair of armor stone of existing breakwater

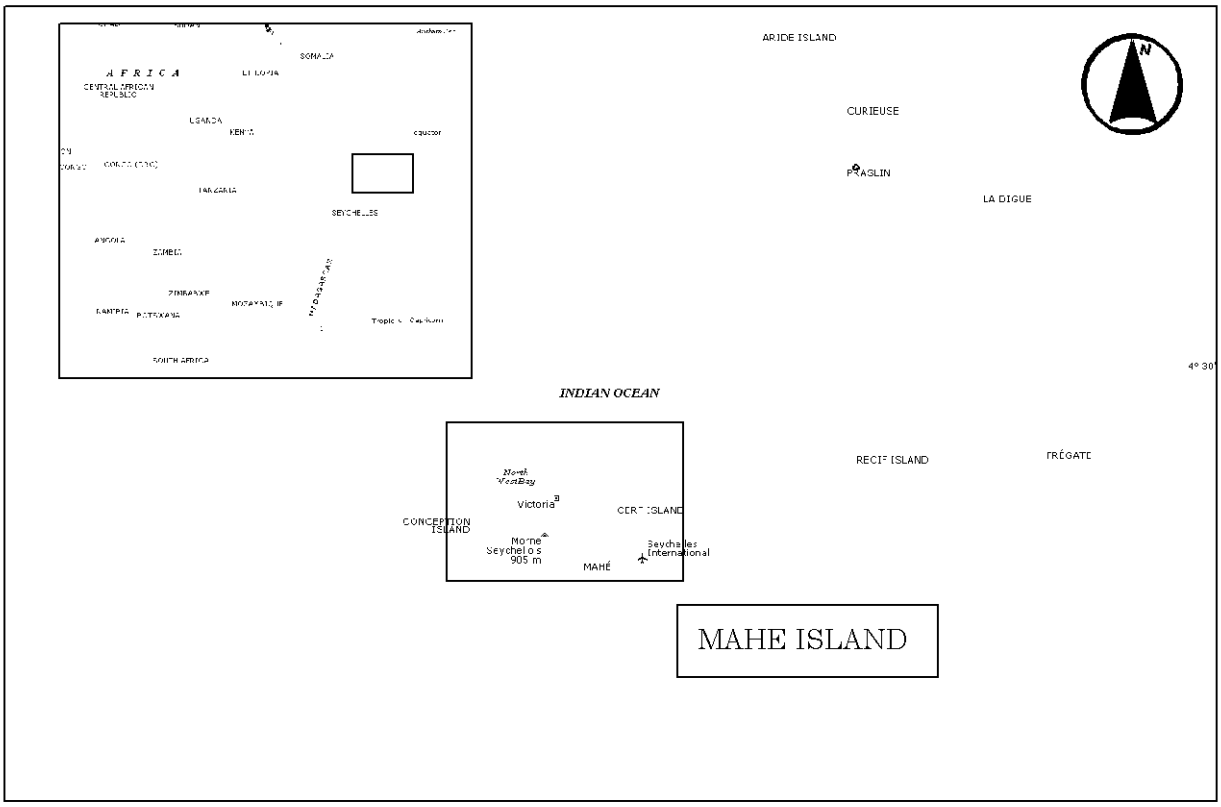
The breakwater has been constructed by the Government of Seychelles in Providence. As the weight of present armor stones is 500～1,000kg/piece it is considered poor against extreme storm waves. The Government of Seychelles should execute the remedial work in case that the breakwater is damaged by such wave.

(7) Maintenance dredging of basin

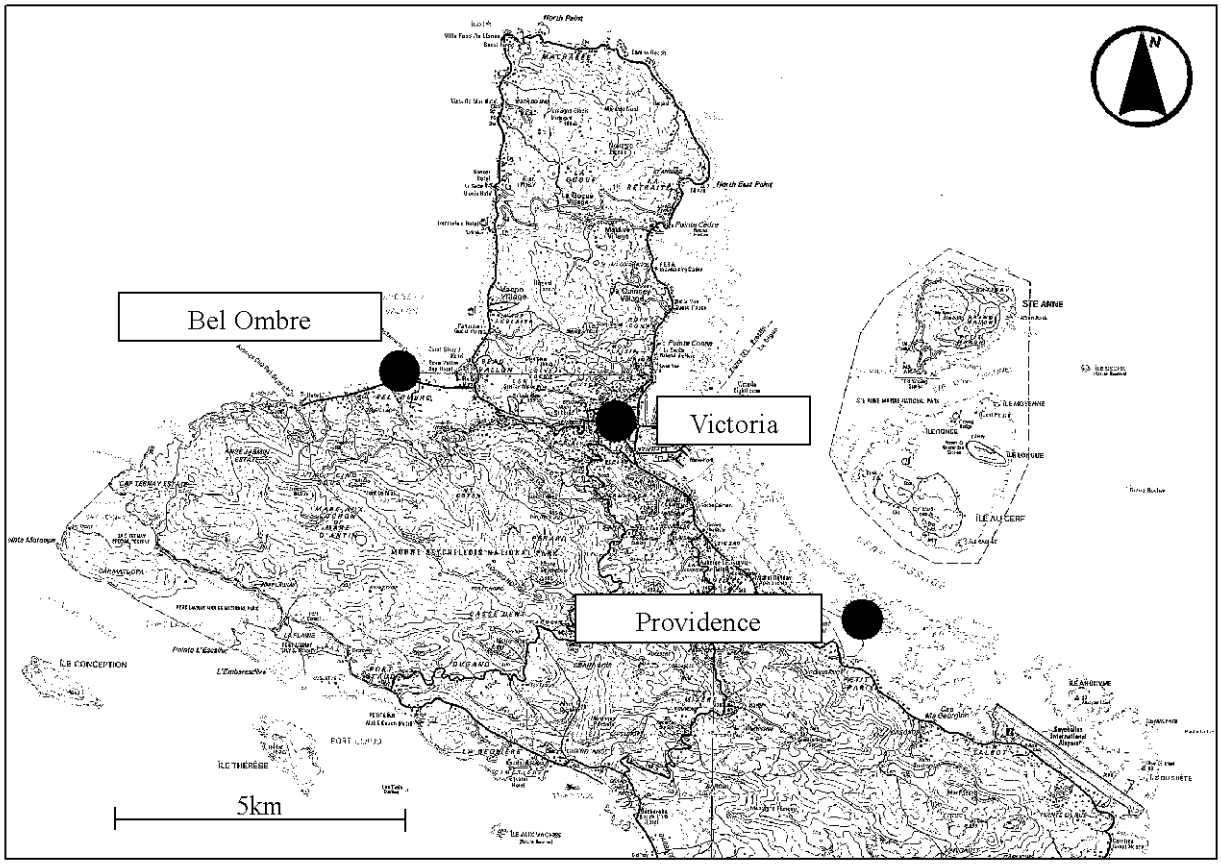
The mooring basin of this project site in Providence has been dredged keeping water depth of 9～10m by the Government of Seychelles. It will not be considered that the beach littoral drift or immediate erosion by sediment transport from rivers however, some changes like sedimentation in long time viewpoint will be imperative. Therefore, periodical sounding survey should be conducted and the maintenance dredging should be executed by the Government of Seychelles when necessary.

CONTENTS

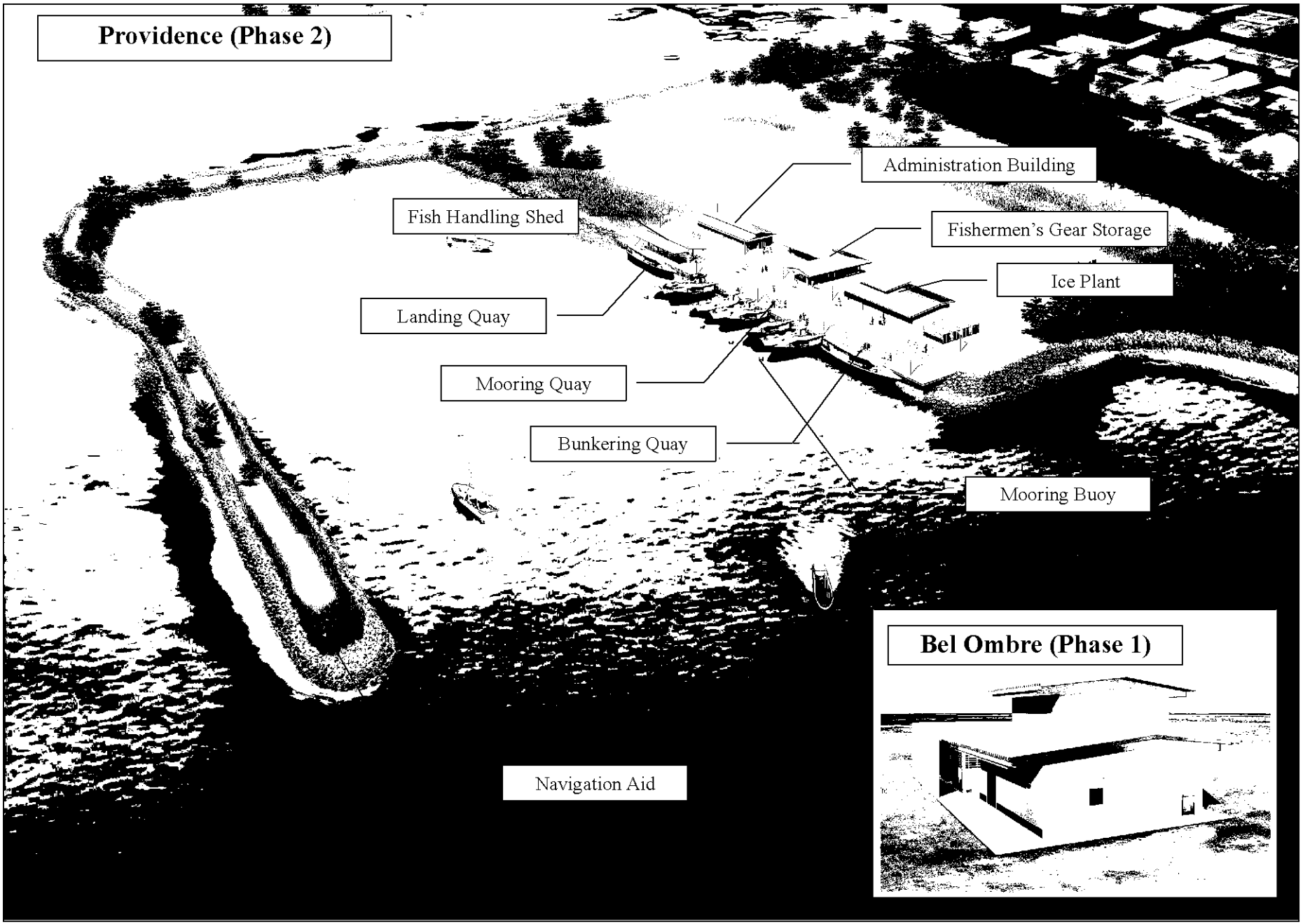
[**Appendices**]



Location of Seychelles



Location of Project Site



Perspective

List of Figures

List of Tables

page

Ablibiations

BOD	Biochemical Oxygen Demand
BD	Basic Design
BS	British Standard
CD	Candela
CDL	Chart Datum Line
COD	Chemical Oxygen Demand
DL	Datum Level
DO	Dissolved Oxygen
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
E/N	Exchange of Notes
EU	European Union
FL	Floor Level
FRP	Fiver Reinforced Plastic
GDP	Gross Domestic Product
GNI	Gross National Income
GL	Grand Level
GT	Gross Tonnage
HWONT	Mean High Water Neap
HWOST	Mean High Water Springs
HWL	High Water Level
JASS	Japan Architectural Standard Specification
JICA	Japan International Cooperation Agency
JIS	Japan Industry Standard
LED	Light Emitting Diode
LPG	Liquefied Petroleum Gas
LWL	Low Water Level
LWONT	Mean Low Water Neap
LWOST	Mean Low Water Springs
Lx	Lux
MNER	Ministry of Environment and Natural Resources
MSL	Mean Sea Level
OFCF	Overseas Fishery Cooperation Foundation
NGO	Non Governmental Organizations
NHHWL	Nearly Highest High Water Level
NLLWL	Nearly Lowest Low Water Level
PUC	Public Utilities Corporation

SBS	Seychelles Bureau of Standard
SCAA	Seychelles Civil Aviation Authority
SFA	Seychelles Fishing Authority
SPA	Seychelles Port Authority
SR	Seychelles Rupee
SS	Suspended Solid
TOR	Terms of Reference

Chapter 1

Background of the Project

Chapter 1 Background of the Project

1-1 Background of the Project

The Government of Seychelles has placed the most important industry for their economic development making the Fisheries Policy in 2005 and promoted sustainable and responsible Fisheries Development.

Victoria Fishing Port is the center for semi-industrial and artisanal fisheries. The quay, fish handling shed and etc. have been constructed by the grant aid of the Government of Japan in 1997. Since then, the quay became congested with the increase of fishing boats and losing freshness of fish by poor landing efficiency and unsafe mooring of fishing boats has been occurred. While Bel Omble is the 2nd largest fishing port next to Victoria Fishing Port and the Government of Seychelles is now under the expansion of fishing port. However, there is no ice plant here main fishing boats land and moor in Victoria Fishing Port and it leads to the congestion of Victoria Fishing Port.

The Government of Seychelles has requested the Grant Aid to the Government of Japan for the promotion of artisanal fisheries and solving the congestion of Victoria Fishing Port through the construction of fishing facilities in Providence where is a new industrial estate and the construction of ice plant in Bel Omble Fishing Port

1-2 Natural Conditions of the Project Sites

1-2-1 Meteorological Conditions

Past meteorological data were collected at the Natural Meteorological Services in the Seychelles International Airport.

(1) Wind Direction and Speed

Wind speed data collected were for the period from 1972 to 2005 and wind directions were from 1996 to 2005. Table 1-2-1(1) shows mean speed and predominant wind directions for each month. Maximum mean wind speed is 6.2m/sec in August, and it is calm year-round. It is approximately 30m/sec as maximum gust. Winds from west are predominantly northwest monsoon season in November to March and from southeast for southeast monsoon season in April to October.

Table 1-2-1(1) Mean Wind Speed, Maximum Instantaneous Gust and Direction

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Wind(m/sec)	3.2	3.2	2.7	2.5	4.0	5.4	5.8	6.2	5.8	4.1	2.8	2.8
Max. Gust(m/sec)	29.3	28.3	31.4	26.2	27.3	24.7	31.4	25.7	24.7	23.7	30.4	28.8
Direction	W	W	W	SE	SE	SE	SE	SE	SE	SE	S	W

Source: Seychelles National Meteorological Services (1972-2005)

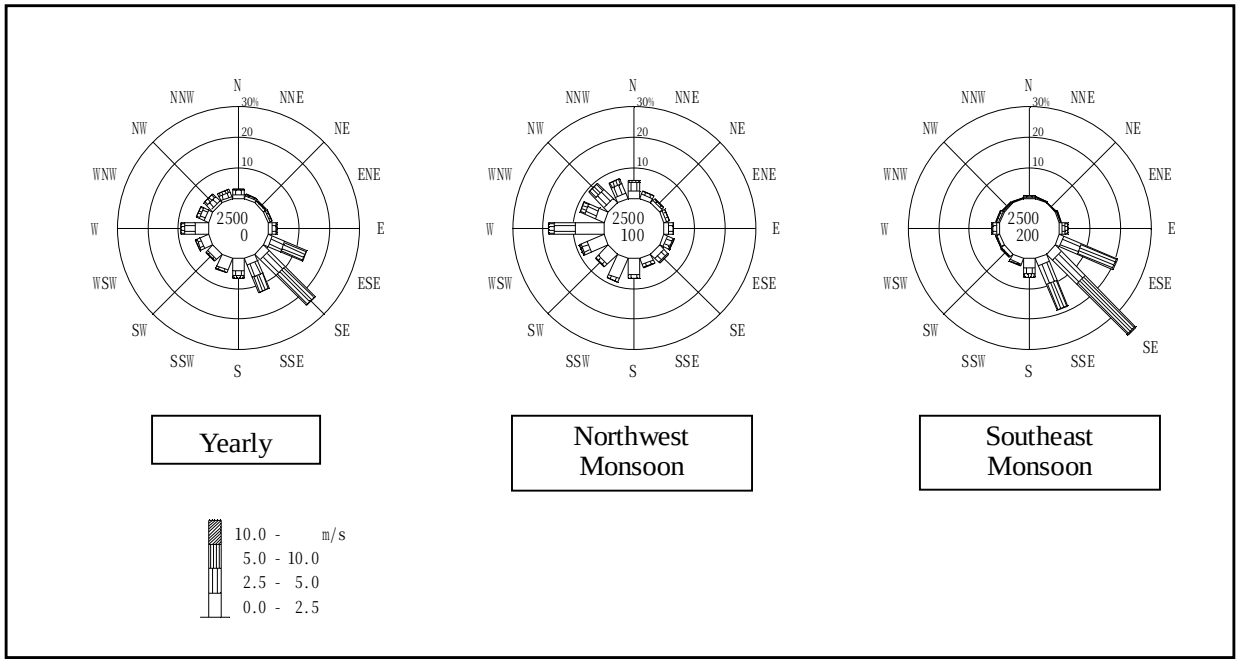


Figure 1-2-1(1) Wind Rose

Table 1-2-1(2) Wind Direction and Frequency

YEAR 2500 MONTH 0 KESOK 144

WAVE DIRECTION / WIND SPEED (M/S)	U.K.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM	0 .0	11 .0	0 .0	0 .0	1 .0	4 .0	3 .0	0 .0	5 .0	1 .0	0 .0	0 .0	0 .0	1 .0	3 .0	0 .0	0 .0	29 .0
0.0 - 2.5	134 .2	1090 1.2	724 .8	498 .6	534 .6	931 1.1	1233 1.4	2191 2.5	2102 2.4	3480 4.0	3689 4.2	2225 2.5	2626 3.0	3910 4.5	1327 1.5	760 .9	718 .8	28172 32.2
2.5 - 5.0	51 .1	1230 1.4	502 .6	301 .3	488 .6	1113 1.3	3943 4.5	6422 7.3	3787 4.3	1498 1.7	651 .7	524 .6	1018 1.2	3054 3.5	1634 1.9	1711 2.0	1353 1.5	29280 33.5
5.0 - 7.5	12 .0	274 .3	86 .1	79 .1	98 .1	504 .6	5058 5.8	9211 10.5	3826 4.4	611 .7	126 .1	126 .1	298 .3	814 .9	682 .8	1090 1.2	671 .8	23566 26.9
7.5 - 10.0	1 .0	8 .0	2 .0	2 .0	4 .0	64 .1	1655 1.9	2841 3.2	933 1.1	82 .1	12 .0	19 .0	34 .0	107 .1	80 .1	145 .2	64 .1	6053 6.9
10.0 - 15.0	0 .0	1 .0	0 .0	0 .0	0 .0	5 .0	130 .1	213 .2	36 .0	11 .0	2 .0	1 .0	9 .0	8 .0	4 .0	1 .0	5 .0	426 .5
15.0 - 20.0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	1 .0	0 .0	0 .0	0 .0	0 .0	1 .0
20.0 - 25.0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
25.0 - 30.0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
30.0 -	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	1 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	1 .0
TOTAL	198 .2	2614 3.0	1314 1.5	880 1.0	1125 1.3	2621 3.0	12022 13.7	20879 23.9	10689 12.2	5683 6.5	4480 5.1	2895 3.3	3986 4.6	7894 9.0	3730 4.3	3707 4.2	2811 3.2	87528 100.0

Upper Case Figure: Number of Appearance, Lower Case Figure: Frequency (%)

Source: Seychelles National Meteorological Services (1996 to 2005)

(2) Temperature

The average temperature is high with 26 to 28℃ through a year as shown in Table 1-2-1(3). The mean high is above 30 degrees from November to May. The mean low is not less than 24℃.

Table 1-2-1(3) Monthly Mean Temperature **(unit:Centigrade)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max. Temp.	30.0	30.5	31.1	31.4	30.6	29.1	28.4	28.5	29.1	29.8	30.2	30.2
Min. Temp.	24.3	24.9	25.1	25.2	25.5	24.7	24.1	24.0	24.4	24.5	24.2	24.2
Mean Temp.	27.1	27.7	28.1	28.3	28.1	26.9	26.2	26.3	26.8	27.2	27.2	27.2

Source: Seychelles National Meteorological Services (1972 to 2005)

(3) Humidity

The mean humidity through the year is very high from 79% to 82% as shown in Table 1-2-1(4).

Table 1-2-1(4) Monthly Mean Humidity **(unit: %)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Hum.	82	80	80	80	79	79	80	80	79	79	80	82

Source: Seychelles National Meteorological Services (1972 to 2005)

(4) Precipitation

The season is separated by almost two seasons that are the dry season in May to September with predominant wind from south east and the monthly precipitation is 80 to 150mm, and the rainy season in October to April with predominant wind from north west and especially, monthly precipitation of January reaches to 400mm as shown in Table 1-2-1(5). The annual precipitation is 2,200mm as recorded.

Table 1-2-1(5) Monthly Mean Precipitation and Daily Maximum Precipitation

(unit:mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Monthly	402.5	283.2	194.9	186.7	151.6	105.1	76.6	119.3	154.0	189.7	206.3	302.8
Max. Daily	99.3	93.6	55.8	53.4	50.5	33.8	24.9	37.9	56.5	68.7	59.5	67.1

Source: Seychelles National Meteorological Services (1972-2005)

Daily mean hours of sunshine at 7 AM to 7 PM during northwest monsoon which is from December to March is short with the figure of 5.9 hours as shown in Table 1-2-1(6).

Table 1-2-1(6) Daily Mean Hours of Sunshine **(unit: hours)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily Sunshine	5.0	6.2	6.9	7.8	10.2	9.4	7.5	7.5	7.3	7.3	6.8	5.5

Source: Seychelles National Meteorological Services (1972-2005)

Table 1-2-1(7) shows monthly maximum and mean rainfall intensity over the last 34 years. The amount above 91 mm/hour was recorded in May.

Table 1-2-1(7) Monthly Rainfall Intensity **(unit:mm/hour)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max. Hourly	76.0	65.4	60.8	49.2	91.4	47.1	51.3	59.4	77.2	62.2	67.8	53.0
Mean Hourly	39.7	34.3	27.1	26.9	24.3	13.6	11.8	14.7	22.1	25.9	26.4	27.9

Source: Seychelles National Meteorological Services (1972-2005)

(5) Cyclone

The low-pressure trough named as Southern Equatorial Trough is borne and make rain during June to September near 60 degrees E to 90 degrees E longitude, however, Seychelles is rarely affected.

In late years, the tropical cyclone, Ikonjo approached the outer island in 1990. In September 2002, storm hit Mahe and Praslin, and the residential houses have been damaged in Praslin. However, it is still rare case that Seychelles is hit with cyclone.

1-2-2 Sea Conditions

(1) Wave

Ultrasonic hydrographic meter was installed at about 300m offshore from project site and wave height, period and the direction were observed during 23 days commenced from 11th January to 2nd February.

Maximum height of significant wave（$H_{1/3}$） was 0.56m and period ($T_{1/3}$) was 5 to 6 second. East-northwest wave direction was predominant.

(2) Tide

Ultrasonic hydrographic meter was installed at the same point as in the above-mentioned wave observation and tide level was observed during 23 days. The harmonic analysis results of the tide level recorded at Providence are shown in Figure 1-2-2(1). It almost matched with the figure of tide table which the Seychelles Fishing Authority (SPA) used in Seychelles.

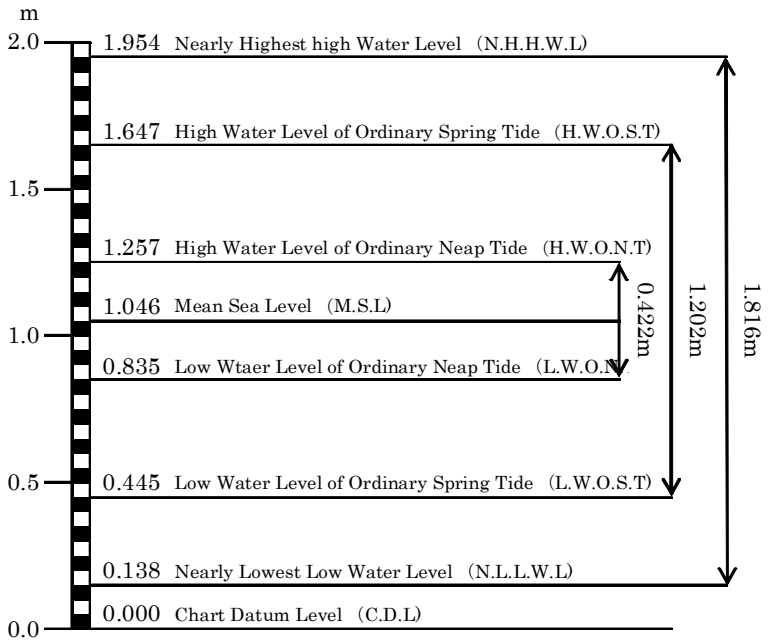


Figure 1-2-2(1) Tide Condition at Providence

(3) Tidal Current

The current conditions were observed at the depth 0.5m below water level in the vicinity of project site with floats thrown into the water at four places. On the day of observation there it was influenced by northwest winds, and the indicated current direction was about the same as the wind direction regardless of flood and ebb tide. The mean current speed was 6 m/min.

There is northwest current in northwest monsoon season and southeast current in southeast monsoon season according to the interviews from SPA and fishermen.

(4) Littoral Drift

A field survey and an interview survey on littoral drift were carried out in Providence site. The project site is reclaimed area where is spreading from Victoria to international airport. Cerf island located at offshore side of coral reef prevents project site from direct wave affection. There was no supply source of littoral drift nor places of erosion and accretion near project site. There are some rivers flowing into the lagoon behind the project site, however length of river is short and also Mahe island formation is granite, therefore the influx of sand into lagoon from these rivers seems to be small.

However, since some changes like sedimentation in long time view point will be imperative, it has been confirmed at the time of Explanation of Draft Final Report that the Government of Seychelles shall conduct the maintenance dredging and also been mentioned in the Minutes of Discussions.

1-2-3 Topography and Bathymetry

The topographic survey on land at the both sites of Providence and Bel Ombre and sea area at the Providence site was carried out, the results thereof are shown in Appendix 5-1 and 5-2. Heights

of ground levels are +3m at Providence and +2m at Bel Ombre and are almost same due to the reclamation area.

The water depth is 9 to 10m in mooring basin and 6 to 14m at outer basin in Providence. It means that this area is reclaimed land by dredged soil according to the bathymetric map.

1-2-4 Soil Conditions

The soil investigation was conducted by on-land borings at Providence site. Reclaimed coral sand exist at about 8 to 12m from ground level. Compositions of this layer are mainly consisted of fine to coarse sand and N values are ranged from 0 to 28. Generally, N value is high at around 2m depth. There are marine sediments that silt and low cohesive are observed below coral sand layer. N values are ranged from 0 to 10 between below coral sand and 20 meters depth, and that goes up to 20 to 50 at the depth deeper than 20m. The results of soil investigation are shown in Figure 1-2-4(1) and 1-2-4(2).

Ground water level survey was carried out at BH (borehole)-1 during 8 days from 18th to 25th of January. BH-1 is located 40m from shore line. Ground water level is 7~30cm lower than tide level. There is little time difference between ground water level and tide level.

Three plate load bearing tests were carried out at two points of Providence, where are located near BH-1 and BH-2 and one point at Bel Ombre. Plate load bearing tests carried out at one meter below ground level that was excavated by backhoe. Bearing capacity of soil is approximately 13 tf/m^2 in each point as the results of plate load tests.

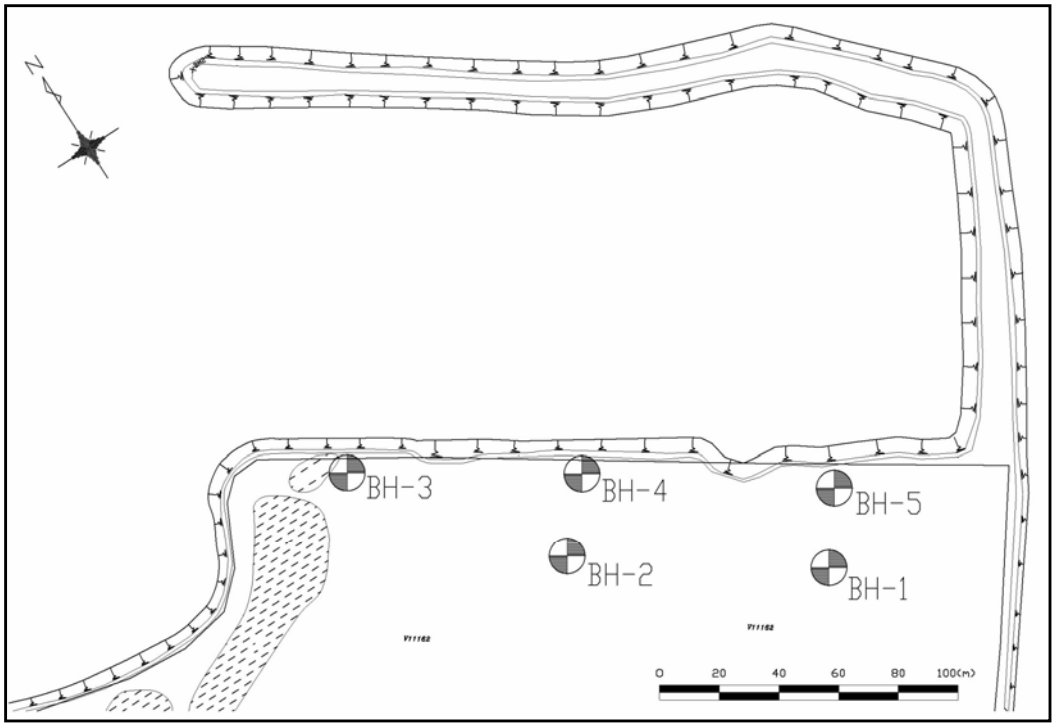


Figure 1-2-4(1) Location of Boreholes at Providence

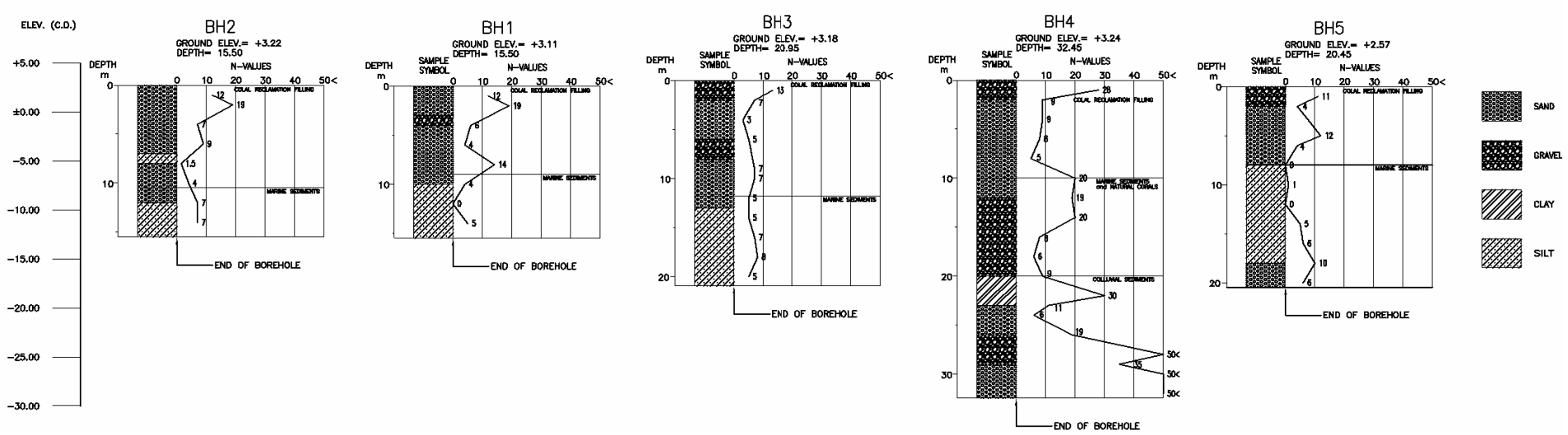


Figure 1-2-4(2) Results of Soil Investigation

1-2-5 Seabed Material and Construction Material Survey

(1) Seabed Material Survey

Four samples of seabed materials were taken from seabed in the vicinity of Providence site. Sampling point S1 is located at offshore of the river Cascade which is southeast ward from the project site, S2 is located at offshore of breakwater in the project site, S3 is located in the mooring basin and S4 is located at offshore of the river Brillant which is northwest ward from the project site. S1 is consisted of sand (40%) mixed with silt, small amount of coral and shell fragments. S2 is consisted of sand mixed with silt and shell fragments. S3 is consisted of sandy silt (sand 9%) and clay with minor shell fragments. S4 is consisted of sand mixed with coral, shell fragments and minor silt.

Grain-size distribution carves and sampling points are shown in Figure 1-2-5(1) to 1-2-5(5).

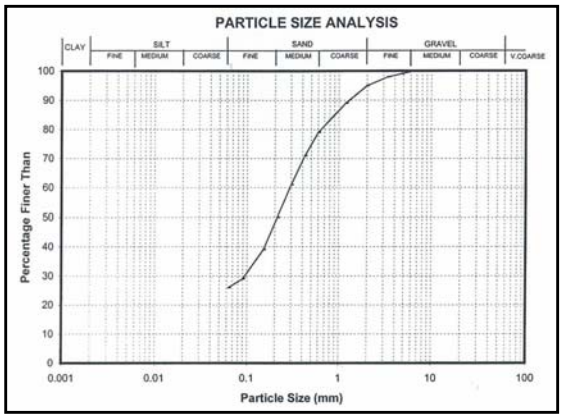


Figure 1-2-5(1) S1 Point

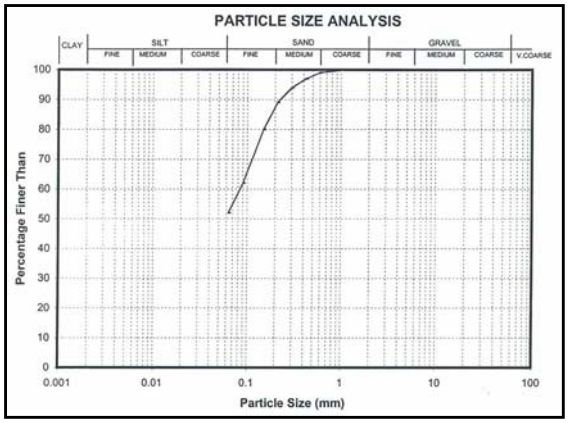


Figure 1-2-5(2) S2 Point

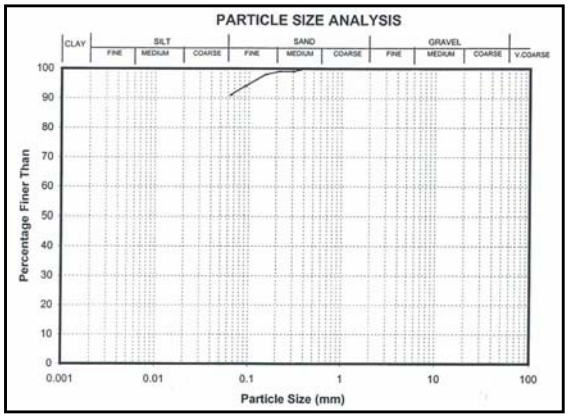


Figure 1-2-5(3) S3 Point

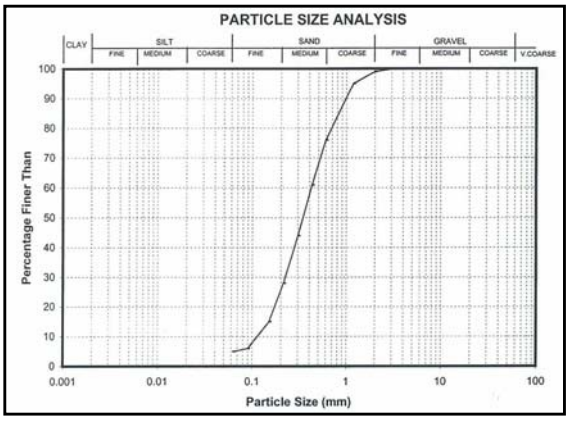


Figure 1-2-5(4) S4 Point

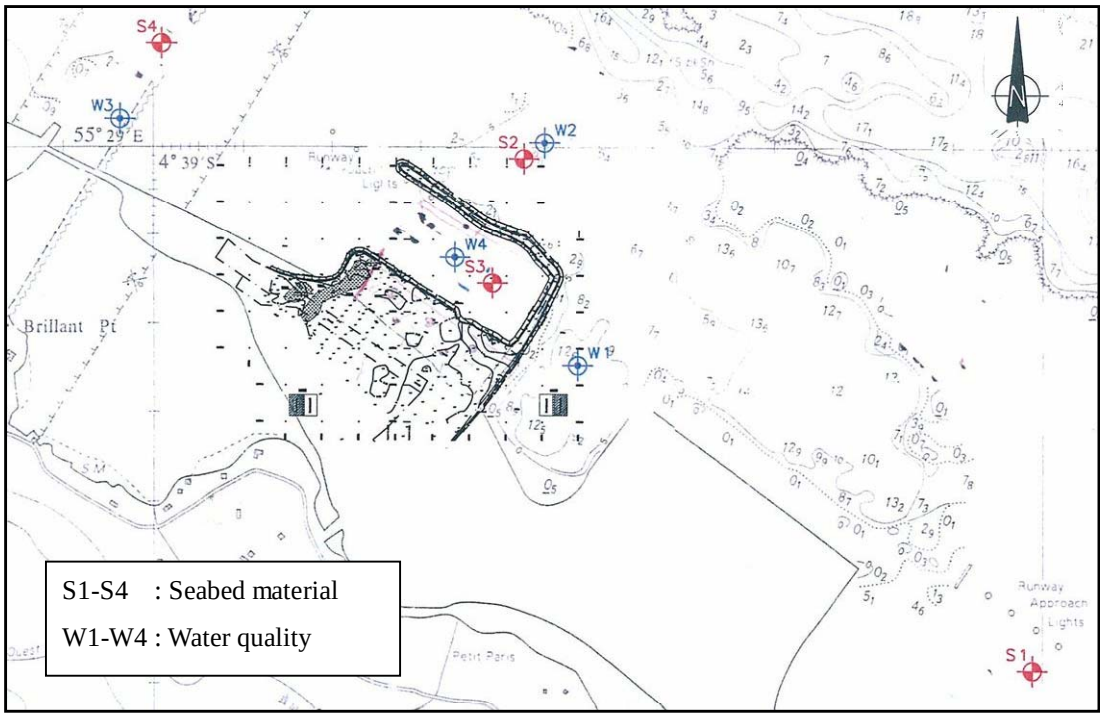


Figure 1-2-5(5) Sampling Points of Seabed Material and Water Quality Survey

(2) Construction Material Survey

Cobbles and material of concrete such as aggregate were analyzed characteristic of specific gravity and strength etc. Results of construction material survey are shown in Table 1-2-5(1).

Table 1-2-5(1) Results of Construction Material Survey

	Test	Result
FINES	Moisture Content	2.7%
	Specific Gravity	2.74 t/m³
GRAVEL (20/10)	Density Test	Bulk density = 2.19 t/m³ Dry density = 2.13 t/m³
	Density Test	2160 kg/ m³ (Compacted Unit Mass)
GRANITE - Grey	Strength Test	16.6 MPa
	Specific Gravity	2.75 t/m³
GRANITE – Black	Strength Test	18.3 MPa
	Specific Gravity	2.96 t/m³
GRANITE - White	Strength Test	7.7 MPa
	Specific Gravity	2.65 t/m³

1-2-6 Earthquake

According to National Meteorological Services, Seychelles Ports Authority and Ministry of Land Use and Habitat, Seychelles have not experienced any seismic damages and have no seismic instrument equipped. And also, seismic factor is not taken into consideration for design of buildings and civil structure in Seychelles.

1-2-7 Water Quality Survey

Samples were collected from four sampling points (see Figure 1-2-5(5)) in the vicinity of the project site area at ebb tide and flood tide. Water quality tests analyzed dissolved oxygen (DO), chemical oxygen demand (COD), suspended solid (SS), N-hexane extraction substance and coliform bacilli. The quality of coastal waters is within the allowable range of class A (Fishery class 1, bathing) in accordance with Standards Related to the Conservation of the Living Environment in Japan. Costal water of N-hexane extraction substance is within the allowable range of class C (Conservation of the environment) in accordance with Standards Related to the Conservation of the Living Environment in Japan.

Sampling point W1 is located in front of dock yards area, where is south ward of project site, and N-hexane extraction substance value is the highest in all points. Suspended solid (SS) value of sampling point W2, where is located offshore of breakwater is the highest value in all samples. This is indicated that silt is stirred up from sea bed caused by current. Sampling point W3 is located offshore of the river Brillant and show the most value of Total Coliforms which is seemed to be affected by domestic wasted water. Sampling point W4 is in the mooring basin and all values are relatively good. It is recommended to keep water quality environment based on the level of W4 as the quality before construction carried out water quality test by the SFA to manage fishery facilities in future.

Table 1-2-7(1) Results of Water Quality Tests

Tests	Standard Value	W1		W2		W3		W4	
		ebb	flood	ebb	flood	ebb	flood	ebb	flood
Dissolve Oxygen (DO)	7.5mg/l or more	-	7.69	-	8.68	-	8.92	-	8.56
Chemical Oxygen Demand (COD)	2mg/l or less	2	1.4	1.4	1.2	1.2	1.3	1.8	1.6
Suspend Solid (SS)mg/l		15	22	22	17	12	10	<3	5
n-hexane Extracts	Not detectable	8	4	5	6	<4	<4	<4	-
Total Coliform (CFU/100ml)	1,000 or less	50	80	150	250	98	300	65	72

1-2-8 Consideration of Stability of Armor Stone for Existing Breakwater

Regarding design wave height for the existing breakwater H=2.85m, required weight of armor stone is calculated using Hudson formula is as follows.

$$W = \frac{r_r \times H^3}{K_D \times (Sr-1)^3 \times \cot A} = \frac{2.65/1.03 \times (2.85)^3}{4.0 \times (2.65/1.03-1)^3 \times 1.5}$$

= 2.56 ton/piece

Where, W: Minimun weight of stones (ton)

r_r: Unit weight of stone in air (ton/m^3)

Sr: Specific gravity of stone to sea water

A: Angle of the slope to horizontal plane (degrees)

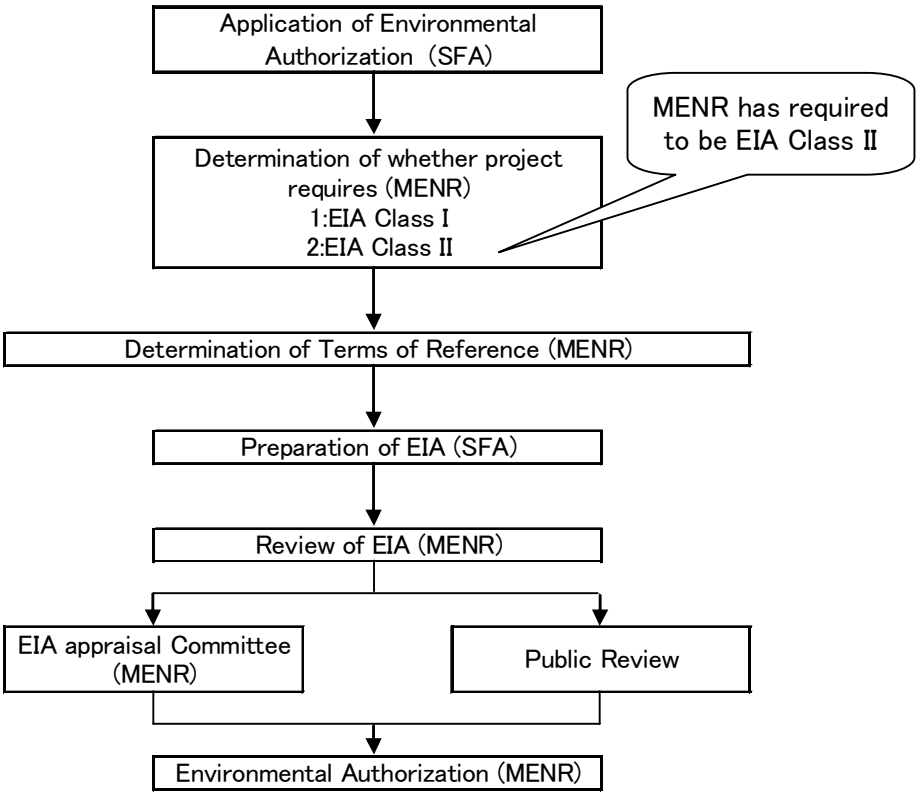
H: Wave height (m)

K_D: Constant determined by the armoring stones and damage rate = 4.0

Since weight of armor stones for the existing breakwater are ranged from 500kg to 1,000kg, weight of armor stones are considered relatively small against design wave. In case that the existing breakwater is damaged by storm waves, it has been confirmed in the Minutes of Discussions that the Government of Seychelles shall rehabilitate the existing breakwater.

1-3 Environmental Impact Regarding Construction Works

EIA approval process, scope and procedures in Seychelles are defined in the Environment Protection Act (Act 9 of 1994) and Environment Protection (Impact Assessment) Regulations, 1996. EIA approval process in Seychelles shows Figure 1-3(1). Regarding Providence Fishing Port Project, the SFA, the Implementation agency submits a application of environmental authorization for a development project to Ministry of Environment and Natural Resources (MENR) and MENR appraises the EIA report and issues the environment authorization.



MENR: Ministry of Environment and Natural Resources
SFA: Seychelles Fishing Authority

Figure 1-3(1) EIA Approval Process in Seychelles

Department of Environment, MENR issued the letter concerning environment impact to the SFA on September 7, 2005. In this letter, Department of Environment has conformed that Department of Environment has no objection in principal to this project due to the following reasons.

a) Zone 6 is not in a protected or sensitive area, and is located on a reclaimed piece of land. This site has been already been earmarked for industrial development and necessary survey was done prior to the reclamation to confirm that site can be used for this particular purpose.

b) Department of Environment would therefore have no objection to approving this project which is expected to have negligible impact on the environment of the area.

Department of Environment has confirmed that the submission of a class II Environmental Impact Assessment will be required for the project. The environmental impacts associated with such a development in zone 6 of Providence Industrial Estate had already been extensively covered and detailed upon the submission of the approved Environmental Impact Assessment Report submitted in October 1998 for the East Coast Reclamation Phase III by the Ministry of Land Use and Habitat. Having perused the document, Department of Environment have noted that all the baseline studies had already been conducted for the affected area and prediction of impacts and mitigating measures elaborated, thus enabling the Authority to conclude that the project can be implemented with minimal foreseen adverse impacts.

The SFA received the terms of reference (TOR) for EIA class II report from Pollution Control and Environment Impacts Division, Department of Environment on March 17, 2006. The SFA submitted the EIA class II report to Department of Environment in mid-September 2006 and obtained the environmental authorization on September 29, 2006.

Concerning the construction of ice plant in Bel Ombre, the SFA has not required to submit EIA report to Department of Environment and obtained the environmental authorization on September 29, 2006.

Though there is no significant impact affected by environment, turbidity will occur due to excavating work for demolishing of existing revetment and rip-rap work for the quay structure. Turbidity which is occurred by excavating and riprap work will be protected by silt protector. Turbidity will be measured by a turbidity meter during excavating and riprap works at three locations in Providence. Frequency of measurement is once a week in one month before these works, every day during these works and once a week in one month after these works.

Chapter 2

Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Relation in the Project with Fisheries Development Plan

[Overall Goal]

Promotion of artisanal fisheries in Seychelles

[Project Purpose]

(a) Solution of congestion of Victoria Fishing Port

(b) Promotion of artisanal fisheries at Providence and Bel Ombre Fishing Port

The Government of Seychelles has made the plan to improve fishing port facilities around Victoria Fishing Port in order to promote artisanal fisheries. This project in the scheme aim for promoting artisanal fisheries and related industries together with solving the congestion of Victoria Fishing Port through the construction of new fishing port in Providence and installing ice making plant in Bel Omble Fishing Port.

2-1-2 Outline of the Project

This project for attaining the above aim, includes the construction of fishing port facilities in Providence, installing ice making plant in Bel Omble. This gives the decease of daily mooring fishing boats in Victoria Fishing Port, the increase of the fish landing volume, number of fishing boats, ice making volume and number of fish processing companies in Providence and the increase of the fish landing volume, number of fishing boats and ice making volume in Bel Omble. The objective for the Grant Aid in this scheme is to construct fishing port facilities and supply plastic container for ice transfer in Providence and install ice making plant and plastic container for ice transfer in Bel Omble.

Figure 2-1-2(1) shows the relationship in the project with fisheries development plan.

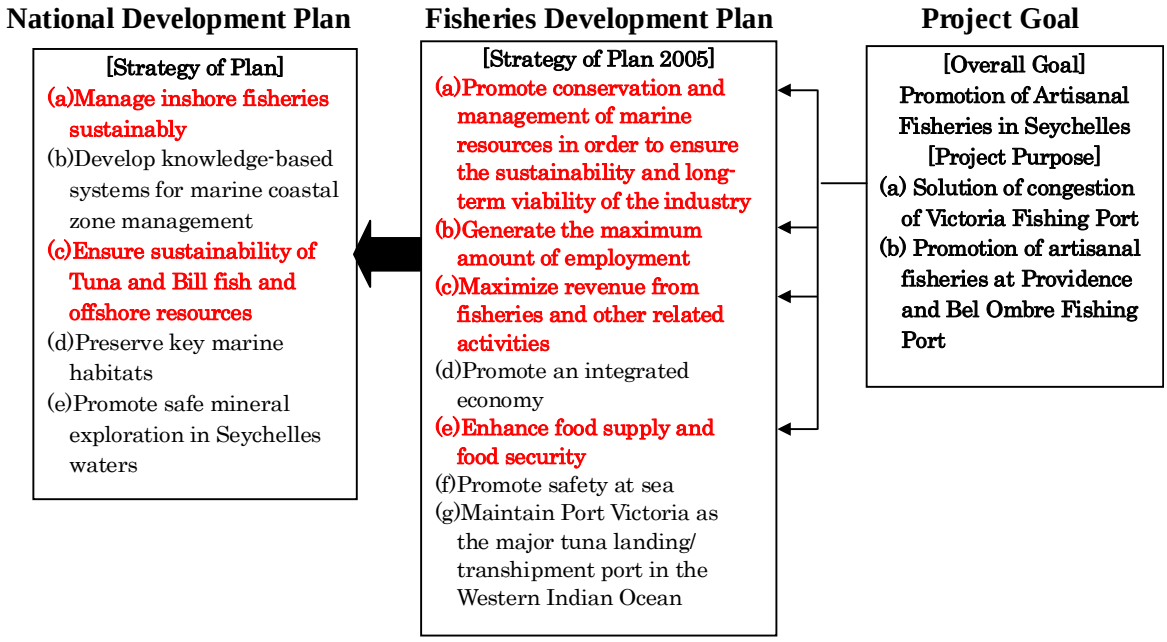


Figure 2-1-2(1) Relationship in the Project with Fisheries Development Plan

(1) Inputs of the Project

1) Japan side

(a) Construction of fishing port facilities and procurement of equipments at Providence

(b) Construction of ice making plant and procurement of equipments at Bel Ombre Fishing Port

2) Seychelles side

(a) Secure of temporary construction yard

(b) Supply of electricity, water and telephone to the project site, sewage connection, construction of access road, erection of fence and installation of a fuel station including fuel tanks

(c) Operation and maintenance of facilities and equipments

(2) Activities of the Project

(a) Assignment of staffs for implementation of the Project

(Staffs for operation and maintenance of Providence and Bel Ombre Fishing Port

(b) Construction of quay, administration building, fish handling shed, ice plant and fishermen's gear storage at Providence Fishing Port

(c) Construction of ice making plant at Bel Ombre Fishing Port

(d) Procurement of equipment for ice transfer at Providence Fishing Port

(e) Procurement of equipment for ice transfer at Bel Ombre Fishing Port

(3) Outputs of the Project

(a) Reduction of number of fishing boats moored per day in Victoria Fishing Port

(b) Increase of fish landing volume at Providence and Bel Ombre Fishing Port

(c) Increase of number of fishing boats in Providence and Bel Ombre Fishing Port

(d) Increase of ice making volume in Providence and Bel Ombre Fishing Port

(e) Increase of number of fish processing companies in Providence

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Examination of Contents of the Request

(1) Confirmation of Contents of the Request

Table 2-2-1(1) shows contents of the request following discussions in the basic design study (field study).

Table 2-2-1(1) Contents of Request Following Discussions

Requested items	Priority
Providence	
1. Quay 100~125m,-2.5m depth with fish landing shed 20m (including anchoring buoys for mooring and navigation lights for access channel)	1
2. Bunkering lay-by 20m (with fuel and water supply)	2
3. Administration office (15~20 persons)	5
4. Fishermen's store and toilet, shower	7
5. Cold room for bait and fish storage (comprising blast freezer and cold storage with receiving area and fish bins, a back-up generator)	4
6. Boat repair yard (including slipway or a 15 ton truck crane)	6
7. Ice plant 5ton/day 2 units (including ice shooter and a back-up generator)	3
8. Forklift 1 unit	8
Bel Ombre	
1. Ice plant 2.5ton/day 2 units (including a back-up generator)	1
2. Forklift 1 unit	2

After the requested contents were confirmed by and discussed with the Seychelles Fishing Authority (SFA), which is the implementing Agency in the recipient country, the following items were changed.

1) Providence

a) The fish landing shed will be constructed on a 20m section of the 100~125m quay to form the landing quay. Installation of anchoring buoys in front of the mooring quay and navigation aids for the access channel to Providence Fishing Port were added to the request.

b) Installation of water supply facilities at bunkering quay for fueling was added to the request.

c) An administration building with an area of 432 m^2 was included in the original request, but the area was changed to space for 15~20 persons.

d) Regarding the fishermen's gear storage, installation of toilets and showers were added to the request.

e) Regarding the cold room for bait and fish storage, the composition was changed to include a blast freezer and cold storage with receiving area and fish bins, and a back-up generator.

f) Since the Seychelles side agreed to construct a fuel station with 15,000 liter diesel and 5,000 liter benzene storage tanks, the fuel station has been excluded from the request.

g) Regarding the boat repair yard, construction of a slipway for landing the fishing boats or

procurement of a 15-ton truck crane was added to the request.

h) Regarding the two ice making machines with a capacity of 5 ton/day, installation of an ice shooter and back-up generator was added to the request.

i) Two forklifts were originally requested at Bel Ombre, but the request has been changed to one forklift each at Providence and Bel Ombre.

2) Bel Ombre

a) Ice making machine with a capacity of 2.5 ton/day was included in the original request, but the request was changed to ice making machine of 5.0 ton/day on the strong request of the fishermen at the stakeholders meeting. Installation of a back-up generator was added to the request.

b) Regarding the 5 ton truck with crane, since this equipment was provided the SFA by the Overseas Fishery Cooperation Foundation (OFCF) in May 2004, it has been excluded from the request.

c) One 15 ton truck crane was requested in the original request. However, since the 15 ton truck crane requested for the boat repair yard at Providence can also be used at Bel Ombre, the truck crane has been excluded from the request.

(2) Examination of Contents of the Request

1) Civil Facilities

(a) Quay

The quay is a basic fishing port facility for landing fish and supplying fuel, water and ice to fishing boats. This facility is considered important and necessary for fishing boats to relocate from Victoria Fishing Port to Providence.

(b) Boat Repair Yard with Slipway

A boat repair yard with slipway is considered necessary. However, 2 boat repair shops (Gondwana Granite Co., Ltd. and Marine and Engineering Works) are located on the eastern side of the project site in Providence. These shops are equipped with cranes and rail-type slipways and repair not only pleasure boat and yachts, but also fishing boats. The usage fees of these shops are high (slipway usage US$60 per day, boat landing US$600, crane US$160 per hour) and there are often many boats waiting their turn for repairs. Construction of a boat repair yard with slipway is therefore recognized as necessary for Providence Fishing Port. From the viewpoint of relieving fishing port congestion in Victoria, however, which is the purpose of this project, it is not judged to be a minimum requirement as fishing boats will relocate from Victoria Fishing Port to Providence. Consequently, priority is given to construction of the quay, ice making facilities, administration building and fishermen's gear storage in this project, and the boat repair yard with slipway is excluded from the project.

(c) Navigation Aids

Since coral reefs exist widely in the vicinity of Providence Fishing Port, navigation aids for

the access channel are considered necessary for safe navigation of fishing boats. In particular, navigation aids are considered necessary for entry and departure by night.

(d) Anchoring Buoys

Fishing boats moor perpendicularly to the mooring quay to save the space. Anchoring buoys are considered necessary to anchor the fishing boats at the quay and prevent collisions among boats.

2) Building Facilities

(a) Ice Plant

There must be a building to hold equipment such as an ice making machine, blast freezer and cold storage, and office for a engineer, operators and other staffs.

(b) Fish Handling Shed

It is necessary to construct a shelter to protect catches of fish from rain and direct sunlight when they are landed on the landing quay.

(c) Administration Building

There must be offices for the personnel operating and managing Providence Fishing Port in accordance with the staff assignment drawn up by the SFA.

(d) Fishermen's Gear Storage

There must be storage in which each of the fishermen can keep their spare parts of inboard engine, fishing nets and other fishing gears, to prevent theft. At Victoria Fishing Port where there are no fishermen's gear storage, fishermen point out security problems. There must also be public toilets and shower facilities for fishermen to ensure hygiene at the fishing port.

(e) Ice Making Machine

To solve the congestion at Victoria Fishing Port, fishing boats must be relocated to Providence and Bel Ombre. The installation of ice making machines at Providence and Bel Ombre is highly necessary as a precondition for the relocation of fishing boats. Currently, the supply of ice in and around Victoria depends on the ice making machines owned by two fish processing companies located in Victoria Fishing Port. In addition to the Victoria fishermen, fishermen also come by truck to Victoria Fishing Port from the northern part of Mahe Island, such as Bel Ombre, in order to purchase ice. However, the two companies have only low ice supply capacities so that ice is chronically in short supply. The shortage of ice means that some fishing boats are unable to go out fishing because they have no ice to load, leading to a reduction in fishing operations, which has an adverse economic influence on the fishermen.

(f) Ice Shooter

The ice making machine should produce plate ice, which is harder to melt and easier to

convey than flake ice. Since a shooter is difficult for maintenance, belt conveyors and screw-type conveyors tend to malfunction mainly due to freezing of the unit and its parts. Pressure transfer is also an option but may not be free from problems in the installation of the equipment, putting the ice into the compressor, and the carrying out of maintenance. It is true that these methods are more convenient after installation, but the various problems attendant on installation should not be ignored. Therefore, ice shooter shall be excluded from this project. As an alternative plan, forklifts shall be considered so that ice can be loaded using forklifts in the same way as at present.

(g) Blast Freezer and Cold Storage

Another important condition for the relocation of fishing boats from Victoria Fishing Port to Providence, in addition to the above-mentioned improvements to the quay and ice making facilities, is the guaranteed supply of bait. The only storage facilities for the bait used in long line fishing are the blast freezer owned by 2 processing companies at Victoria Fishing Port, but these freezers are not used for ordinary fishermen on a commercial basis. In particular, mackerel is mainly used as bait for bottom long-line fishing but the lack of blast freezer results in the use of fresh bait and make it necessary for the catch of fish to be limited when supply exceeds demand. Additionally, the surplus fish from a large catch and the unsold stocks from the fish markets end up being discarded due to the lack of storage facilities for them. There is a strong need for blast freezer and cold storage in order to prevent these post-harvest losses and to ensure a stable supply of bait and fish products.

(h) Back-up Generators

Back-up generators are needed when there are frequent power failures and long outages. In 2000, the Seychelles government improved and enhanced the power facilities and significantly increased the generating capacity by constructing facilities with a reserve capacity designed to meet any future increase in power demand. Consequently, a sharp reduction in the number of power failures and shorter outage times were confirmed in this study. An ice making plant provided in Anse a la Mouche is not equipped with a back-up generator, because power failures rarely occur.

In conclusion, there is little necessity to install back-up generators and these are excluded from this project.

3) Equipment

(a) 15 ton Truck Crane

15 ton truck crane is used at the new Providence Fishing Port and Bel Ombre mainly to hoist fishing boats in order to repair the hulls. Considering the frequency of use estimated from the number of registered fishing boats and the ownership of a 5 ton truck with crane by the SFA, there is little need for a 15 ton truck crane and it is excluded from this project.

(b) Forklift

The quay of Victoria Fishing Port is chronically congested with landing of fish catches and

loading of ice, materials and equipment before sailing out fishing. The purpose of this project is to build a new port in Providence, install ice making machines there and in Bel Ombre, and relocate some of the fishing boats based at Victoria Fishing Port, thus alleviating the congestion at this port.

While an ice shooter has been requested, it is to be excluded from equipment to be provided, because as mentioned above, there are problems regarding the maintenance and management of the actual machinery. As an alternative plan, forklifts shall be considered.

Currently at Victoria Fishing Port, ice is loaded by packing the ice into plastic bags, 30 or 50 kg per bag, putting the bags into box, and then conveying the box by forklift to the quay. The amount of ice to be loaded onto each fishing boat for each trip is as much as 1.5 ton even for a small, leconomie class boat. Loading the ice without the use of motive power is hard physical work for the fishermen and extends the length of time each fishing boat is moored at the quay before sailing out, thus lowering the efficiency of fishing operations. In addition to the loading of ice and bait, forklifts are frequently used to load and unload fishing gear, to transport frozen bait, and to stack and unstack frozen fish in the cold storage.

Therefore, it is difficult for the loading of ice and bait to be manually done. Using a hydraulic lifter, for example, makes it relatively easy to load ice and bait if there is a flat surface from the ice plant to the quay. Since Bel Ombre is reclaimed land, however, the use of lifters to load ice and bait requires a concrete or asphalt pavement from the ice plant to the quay. Additionally, cargo handling by manual about 12 ton (10 ton of ice and 2 ton of bait) per day in the case of the Providence is a heavy burden on the fishermen, and is not in keeping with the times.

One way would be for the SFA to employ a large number of workers to carry the ice and to provide a large number of hydraulic lifters in order to tackle the problem through the power of sheer numbers; but restrictions such as labor costs make this method inadvisable.

The provision of forklifts will maintain the way the ice is loaded at Victoria Fishing Port at present, and will not force heavy manual work on the fishermen. Therefore, it is concluded that there is a strong need for forklifts.

(c) Fish Box

Fish boxes, used as storage boxes for fish catches and frozen bait, shall also be used as shipping boxes to transport the fish. The advantages of using fish boxes are that direct contact of the fish with other objects can be avoided; the fish can be protected from sunlight; and ice can be scattered over the fish to keep them fresh and clean. Simply piling up frozen fish for storage in a cold storage increases dead space. Using fish boxes will enable the effective use of storage space.

(d) Pallet Box

The pallet box for forklift is indispensable to transport ice from ice plant to fishing boats efficiently. Therefore, pallet box is included in this project.

2-2-1-2 Design Policy

(1) Basic Policy for Civil Facilities

1) Concept of Design Boat

With the purpose of solving the congestion in Victoria Fishing Port, the minimum fisheries facilities are to be constructed so as to relocate the increased number of fishing boats from the designed number of fishing boats in the Basic Design Study for Improvement of Victoria Artisanal Fishing Port done in 1997 (hereinafter called as BD1997) to Providence and Bel Omble.

The definition of solving the congestion of Victoria Fishing Port is to reduce number of fishing boats to 40 boats per day at the time of BD1997 from 58 boats which is the current number of boats mooring per a day. As 6 boats per day relocate from Victoria Fishing Port by installing ice making plant in Bel Omble, the mooring number of boats per a day in Providence will be 12 boats per day (58-40-6) and this number will be the base of number of design boat. The breakdown and the element are shown in Table 2-2-1(2). The detail is described at "2-2-2-1 Basic Plan for Civil Facilities".

Table 2-2-1(2) Breakdown and Dimensions of Design Boat

Design boat	Breakdown of number of mooring boat per day in Providence	Length L(m)	Width B(m)	Ice on board (ton)	Bait on board (ton)
Leconomie class	5	7.5	2.0	1.5	0.1
Whaler class	4	11.0	3.5	3.0	0.5
Semi-industrial class	3	17.0	5.0	12.0	2.0

2) Concept of Setting the Scale of Quay

The quay extension planned in Providence is to adopt the same standard judging from the analysis of service status in Victoria Fishing Port and the landing quay.

a) The landing quay and bunkering quay shall be the magnitude so as to be moored by longest semi-industrial fishing boat out of design boats.

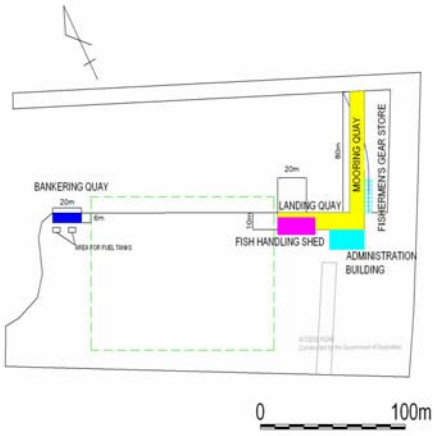
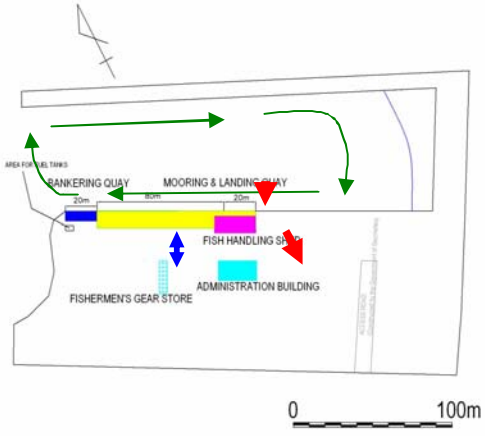
b) The mooring quay shall be the magnitude to be able to moor longitudinally by all 12 boats.

3) Concept of Facility Arrangement

The project site in Providence is a reclaimed land and prevented from offshore waves by the breakwater and rubble revetment constructed by the Government of Seychelles. The quay is planned on the face line of the revetment for efficient fish landing, safe mooring and safe fueling.

The results of the study regarding alternative facility arrangements are shown in Table 2-2-1(3). According to this study, the alternative plan B is adopted. The bunkering quay, mooring quay and landing quay shall be arranged in order from the western side (entrance of the mooring basin) of the project site to prevent confusion in the flow of fishing boats.

Table 2-2-1(3) Alternative Plans for Facility Arrangement

Plan	Plan A	Plan B
Flow Fishing boats Fish Fishermen		
Outline of plan	a) The gentle sloping beach located in the inner part of the mooring basin is reclaimed and the mooring quay is constructed. b) The landing quay is also constructed in the inner part of the mooring basin. c) The facilities on land, such as the fish handling shed, administration building and fishermen's gear storage, are arranged behind the quay. d) It is necessary to dredge up to -2.5m in front of the quay. e) The bunkering quay is constructed as far as possible from the flow of fish and fishermen. f) A corner is formed in the quay making a 30m dead space.	a) The landing quay, mooring quay and bunkering quay are arranged in a direct line from the inner part of the mooring basin so that the gentle sloping beach is left as it is. b) Facilities on land are arranged behind the quay. c) It is necessary to dredge up to -2.5m in front of the quay.
Flow of fishing boats, fish and fishermen	a) It is dangerous as the paths of the boats coming to land fish and the boats departing after fueling cross. b) Fish can be easily shipped from the fish handling shed. c) It is convenient when all the facilities are arranged close by the quay, but there is a possibility that the administration building planned in the center of the quay may be an obstacle to traffic movement. d) In this case, if the apron of quay is the road for traffic, the flow of fish and fishermen may become congested.	a) Safe navigation of fishing boats is ensured as the paths of boats do not cross. b) Fish can be easily shipped from the fish handling shed. c) Safety and operating efficiency are high as the flow of fishing boats, fish and fishermen does not get congested.
Calmness of mooring basin	a) The calmness of the mooring basin will deteriorate due to reclamation of the gentle sloping beach located in the inner part of the mooring basin.	a) The calmness of the mooring basin is maintained as the gentle sloping beach is left as it is.
Environmental impact	a) It is necessary to reclaim the beach located in the inner part of the mooring basin in order to construct the mooring quay. b) It is necessary to dredge up to -2.5m in front of the landing quay.	a) It is necessary to dredge up to -2.5m in front of the landing quay. b) Large-scale dredging and reclamation works are not necessary.
Future expansion	a) Land for future expansion is widely secured as the main facilities are concentrated in the inner part of the port.	a) Compared to Plan A, there is a little land for future expansion.
Evaluation		Selected

4) Concept of Quay Structure

Concerning the quay structure, as the under water ground consist of coral sand and silt which are relatively soft with N value under 10, the gravity type structure with concrete blocks which worries about uneven subsidence or pile type structure which needs huge construction cost are not taken but steel sheet pile type structure which is superior in simple construction and economical efficiency. The design boat is semi-industrial fishing boat (average length 17m, average width 5m, maximum draft 2m). Comparison result of quay structures is described at "2-2-2-1 Basic Plan for Civil Facilities".

5) Concept of Design Standards

Since there are no standards governing the planned facilities in Seychelles, the following Japanese standards will be applied.

a) Design standards for fishing port and fishing ground facilities (Japan Fishing Port Association)
b) Technical standards and explanation for port and harbor facilities (Japan Port and Harbor Association)

6) Concept of Natural Conditions

(a) Wave Conditions

The mooring basin at Providence is calm as it is protected from offshore waves by the existing breakwater. Therefore, waves are not taken into consideration in the design of the steel sheet pile type wall as the wave height caused by fishing vessels is approximately 30cm.

(b) Tidal Current

The tidal current is not taken into consideration in the quay design as the velocity of 6 m/min is small.

(c) Soil Conditions

The soil conditions used for the quay design are shown as follows.

N value	: 3 (sand)
Cohesion	: 0
Angle of internal friction	: 25 degrees

(d) Seismic Force

Seismic force is not considered for quay design as Seychelles have not experienced any seismic damages.

7) Concept of Conditions of Construction and Procurement

The construction material is to purchase locally as much as possible. Especially, ready mix concrete and stones are purchasable locally. All steel materials like steel sheet piles, reinforced bars and others are depending on the import therefore, judging from the quality these are to procure

from Japan. Concerning rubber fenders, bollards and materials for electrolytic protection which are difficult to purchase locally judging from the all the aspects of specification, quality, price, delivery and easy construction these are also procure from Japan.

A driving machine of steel sheet pile for quay construction (Crawler crane and Vibro Hammer) will be needed as civil construction machine. However, as the leasing of these machines is impossible in Seychelles, they are to procure from Japan judging from economical efficiency including transportation fee and etc. The crane barge (6ton capacity) which can be obtained locally is used for placing armor stones in front of quay construction.

8) Concept of Using Local Construction Company

There are several local construction companies which have some experiences in Seychelles. However, large projects, such as wastewater treatment plants etc., were constructed by foreign construction companies. One local construction company in Seychelles has experience in marine construction, but the main part of the quay wall works and large-scale reclamation works were carried out by foreign companies.

Guidance from skilled Japanese experts will be needed for the steel sheet piling works of marine construction works.

9) Concept of Execution Plan

The project site was land reclaimed by dredging the coral sand and the reclaimed land has been protected by the existing breakwater and revetment of granite. Consideration is given to execution so that construction work is executed on land as far as possible with due regard to the reduction of construction costs, as the ground level of the reclaimed area is comparatively flat.

(2) Basic Policy for Building Facilities

1) Concept of the Arrangement of Facilities

In Providence, the administration building is planned for operation and maintenance of the facilities, the fish handling shed for keeping freshness of landed fish, the ice plant (ice making machine, blast freezer and cold storage) for keeping fish freshness after catch and supply of bait, the fishermen's gear storage for storage of fishing gears. Building facilities shall be arranged in order to prevent confusion in the flow of ice, fishermen and fish as follows.

(a) The ice plant shall be located near a bunkering quay, because more ice is needed upon departure from the port than after the landing of a fish catch, and bait is needed also upon departure.

(b) The administration building shall be located behind the landing quay, because of the need to manage the whole of the new fishing port.

(c) The fish handling shed shall be located on the landing quay. This area is provided mainly to shade out sunlight and ensure workability on rainy days.

(d) The fishermen's gear storage shall be located behind the mooring quay, because this building needs ample space for repair of fishing net.

2) Concept of the Structure of Facilities

Concerning building structures, as soil condition under water is comparatively soft, steel structure is to be taken and trim the weight of building using light roof material. Administration building and fishermen's gear storage are to be constructed by steel reinforced concrete pillars and block walls which are commonly used in Seychelles.

3) Concept of Design Standards

Design of building facilities shall comply with building standards in Seychelles which are made based on the British Standards.

4) Concept of Natural Conditions

(a) Wind Load

The average wind speed shall be 38 knots (20 m/sec) and wind pressure shall be 245 N/m^2 according to wind data.

(b) Bearing Capacity

The bearing capacity of soil shall be 10 t/m^2 according to the results of plate load bearing tests.

(c) Seismic Force

Seismic force is not considered for design of building same as civil facilities.

5) Concept of Conditions of Construction and Procurement

The construction material is to purchase locally as much as possible. Especially, ready mix concrete and building blocks are purchasable locally. All steel materials like steel frame, reinforced bars and others are depending on the import therefore, judging from the quality these are to procure from Japan. For the construction planned in this project, those materials in insufficient stock for which it is difficult to assure the necessary quality or the necessary volume through local procurement will be procured from Japan.

The machines for building construction will be used at the first phase construction stage in Bel Omble and locally leased machines are to be used due to small working volume with building construction only. And , such machines in Providence belong to second phase construction stage and they are necessary to procure from Japan for civil construction.

8) Concept of Using Local Construction Company

There is a company which has an experience to construct hotel in Seychelles for general building construction and equipment work. Therefore, it will be possible to work for construction under the instruction and guidance as local subcontractor. However, the roofing material is to import from Japan and the roofing work is necessary to be done by a skilled expert from Japan in order to prevent from rain leaking.

9) Concept of Execution Plan

The most important point in studying the period for the construction of building structures shall be to take into consideration the construction periods for the civil facilities and ice plant. In drawing up a plan for the ice plant it will be necessary to calculate backwards from the installation period needed for the ice plant and accordingly decide on the date at which the building construction must start. Since the Fish handling shed is a facility built directly on top of the quay, the construction plan for it shall adjust with the construction period of the quay.

(3) Basic Policy for Ice Making Machine and Freezing Equipment

1) Consideration of Equipment Capacity

The magnitude of Providence Fishing Port is planned based on the 12 boats/day which is number of mooring fishing boats per a day relocating from Victoria Fishing Port to Providence.

(a) The ice making capacity is calculated taking the ice volume on board (1.5～12 ton) according to refilling ratio 0.19 for 12 boats and the size of fishing boat into consideration.

(b) The capacity of blast freezer is planned assuming the post-harvest losses at a large catch of mackerel to be utilized for bait to artisanal fishing boats except semi-industrial fishing boats will be about 1 ton/day.

(c) The cold storage is planned as storing frozen bait (squid and mackerel pike) for semi-industrial fishing boats and bait (mackerel) catch locally for artisanal fishing boats. The freezing equipment could be a single room that serves as both a blast freezer and cold storage. However, introducing into the freezer normal-temperature fish to be deep-frozen will make the internal temperature unstable and consequently the fish will freeze more slowly. There will also be a greater load on the freezing equipment. Therefore, the blast freezer and cold storage will be designed as separate facilities.

(d) The magnitude of Bel Omble Fishing Port is calculated based on the number of mooring fishing boats per a day 11 boats (current mooring number 5 boats + relocated boats from Victoria Fishing Port 6 boats)

2) Consideration of Specifications of Equipment

The equipment shall be salt-resistant because both Providence and Bel Ombre are on the seafront. Since Seychelles has a hot and humid climate, detailed data on temperatures and humidity in particular shall be reflected in the design of the freezing equipment, through the calculation of the freezing capacity and selection of cooling systems.

(4) Basic Policy for Equipment

1) Forklift

As the ice shooter is not installed in ice making plant, a folk lift is planned as loading method of ice. A forklift is planned its maximum handling load judging from the usage as ice transportation, fish transportation after catch, handling fishing gears and based on the one time ice volume on board and the capacity of ice making and freezing. LPG is to be used as driving fuel considering usage inside of cold storage and blast freezer.

2) Fish Box

The fish box which was not requested is planned since it is inevitable to handle bait and fish after catch effectively in cold storage. The quantity of fish box is to be possible quantity of bait for artisanal fishing boats.

3) Pallet Box

The plastic container as pallet box is to be transferable by forklift since the ice is loaded onto fishing boats packed by 30~50kg bags.

2-2-2 Basic Plan

2-2-2-1 Basic Plan for Civil Facilities

(1) Setting the Scale of Civil Facilities

1) Setting the Scale in BD1997 and Required Length of Quay

In BD1997, the actual number of boats utilizing the facilities in Victoria Fishing Port was confirmed as 83, as shown in Table 2-2-2(1).

Table 2-2-2(1) Number of Boats Utilizing Victoria Fishing Port (BD1997)

Type	Leconomie	Whaler	Lavenir	Schooner	Semi-industrial	Total fishing boats	Other boats	Grand Total
No. of boats	9	39	10	18	7	83	6	89

(Source: Basic design report in BD1997)

The number of design boats adopted is 40, representing the average over the full survey period according to the results of the survey of the number of boats moored in Victoria Fishing Port. The breakdown of boats is as shown below.

[Number of design boats in BD1997]

Leconomie class	4
Whaler, lavenir, schooner class	33
Semi-industrial class	3
Total	40

The number of landing boats and mooring boats, as computed on the above basis, is shown in Table 2-2-2(2).

Table 2-2-2(2) Number of Landing Boats and Mooring Boats （BD1997）

Type of boat	No. of boats (a)	No. of landing/ice supplying boats (b)	No. of fueling boats (b')	Potential landing hours (c)	Landing hours per boat (d)	No. of simultaneously landing boats (e)=(b)/(c)x(d)	No. of mooring boats (a)-(e)
Leconomie class	4	1	2	4 hrs	0.5 hrs	0.125→0	4
Whaler class Lavenir class Schooner class	33	6	8	4 hrs	1.0 hrs	1.5→1	32
Semi-industrial class	3	1	1	4 hrs	1.5 hrs	0.375→1	2
Total	40	8	11			2	38

(Source: Basic design report in BD1997)

Based on the above results, the required length of quay is calculated as shown in Table 2-2-2(3).

Table 2-2-2(3) Required Length of Quay

Quay	Type of boat	Dimensions	
Landing	Leconomie	No. of boats	0
		Landing time (min)	30
		Length of boat (m)	5.0
		Length of berth (m)	5.75
		Length of quay (m)	0
	Lavenir Whaler Schooner	No. of boats	1
		Landing time (min)	60
		Length of boat (m)	9.0
		Length of berth (m)	10.35
		Length of quay (m)	10.35
	Semi-industrial	No. of boats	1
		Landing time (min)	90
		Length of boat (m)	15.0
		Length of berth (m)	17.25
		Length of quay (m)	17.25
	Sub total	(m)	27.6
Mooring	Leconomie	No. of boats	4
		Width of boat (m)	2.0
		Length of berth (m)	3.0
		Length of quay (m)	12.0
	Lavenir Whaler Schooner	No. of boats	32
		Width of boat (m)	3.5
		Length of berth (m)	5.25
		Length of quay (m)	168.0
	Semi-industrial	No. of boats	2
		Width of boat (m)	5.0
		Length of berth (m)	7.5
		Length of quay (m)	15.0
	Sub total	(m)	195.0
Fueling	Semi-industrial	1 boat x 17.25 (m)	18.0
Total length		(m)	240.6

(Source: Basic design report in BD1997)

[Length of quay]

Landing and ice supplying quay	28m
Mooring quay	195m
Bunkering quay	18m
Total	241m

Note: The length of the quay actually constructed (224m =planned 164m + existing 60m) is 17m shorter than the required length.

2) Shortage of Quay Length in Victoria Fishing Port

(a) Number of Design Boats

The number of fishing boats that actually utilize the facilities in Victoria Fishing Port has been confirmed to be 113 in BD2006, as shown in Table 2-2-2(4).

Table 2-2-2(4) Number of Boats Utilizing Victoria Fishing Port (BD2006)

Type	Leconomie	Whaler	Lavenir	Schooner	Semi-industrial	Total fishing boats	Other boats	Grand Total
No. of boats	14	41	17	29	12	113	7	120

The results of the survey of the number of boats moored in Victoria Fishing Port in January 2006 are shown in Table 2-2-2(5).

Table 2-2-2(5) Results of Fishing Boat Survey in January 2006

Date	Leconomie	Whaler	Lavenir	Schooner	Semi-industrial	Others	Total
16/1/2006 Mon	11	19	12	11	8	2	63
17/1/2006 Tue	8	20	11	12	7	2	60
18/1/2006 Wed	6	18	9	14	7	2	56
19/1/2006 Thu	11	16	10	11	7	2	57
20/1/2006 Fri	12	19	9	10	5	1	56
21/1/2006 Sat	12	19	8	9	5	1	54
22/1/2006 Sun	10	13	10	9	5	1	48
23/1/2006 Mon	10	16	10	9	6	1	52
24/1/2006 Tue	11	21	9	13	5	0	59
25/1/2006 Wed	8	19	12	13	3	0	55
26/1/2006 Thu	10	19	12	13	3	0	57
27/1/2006 Fri	9	20	11	14	5	0	59
28/1/2006 Sat	10	21	12	14	5	0	62
29/1/2006 Sun	9	19	12	16	5	0	61
Total	137	259	147	168	76	12	799
Average	9.8	18.5	10.5	12	5.4	0.9	57.1

Note: In BD1997, the average number of fishing boats moored in port over the weekdays (Friday to Monday), the peak period, was adopted as the number of design boats. As a result of the survey in BD2006, the average number of boats over the full survey period is adopted, as there was hardly any difference between weekdays and weekends.

[Number of design boats in BD2006]

Leconomie class	10
Whaler, lavenir, schooner class	42
Semi-industrial class	6
Total	58

Note: Ratio of mooring boats in port = number of boats moored per day/number of boats utilizing the quay.
Ratio in BD1997: 40/83=0.48, Ratio in BD2006: 58/113=0.51
This means that the number of fishing boats which in moored in Victoria Fishing Port is almost the same as number of fishing boats in sailing out fishing in a day.

(b) Required Length of Quay at Present

Following the growth in the size of the boats designed by the project, the dimensions of the boats have been changed as shown in Table 2-2-2(6). The width of design boats has been not changed, but the length in BD2006 has been 2m longer than that in BD1997.

Table 2-2-2(6) Dimensions of Design Boats by the Project

Type of boat	BD1997		BD2006		
	Length (m)	Width (m)	Length (m)	Width (m)	Ice on board (ton)
Leconomie class	5.0	2.0	7.5	2.0	1.5
Whaler class	9.0	3.5	11.0	3.5	3.0
Semi-industrial class	15.0	5.0	17.0	5.0	12.0

(c) Calculation of Number of Landing Boats and Mooring Boats

In BD1997 it was assumed that the number of landings and the number of fuelings were the same, but in BD2006 the number of landings was confirmed by the field survey. The results of the survey are as shown in Table 2-2-2(7).

Number of boats landing fish per day = 126 boats / 12 days = 10.5= 11 boats/day

Note: The number of boats landing fish per day is calculated for 12 days excluding Sunday, because fish is not landed on Sunday.

Regarding fueling, the fuel sales records for 2005 were obtained and the number of fueling boats was derived by the same method as that used in BD1997, by totaling the number of fuel sales from January to March, converting this data to weekly totals, and calculating the average number of sales per day for the top three weeks. The results of the calculation are as shown in Table 2-2-2(8).

Number of fueling boats per day = (57 + 51 +50) times / 3 weeks / 5 days = 10.53
= 11 boats/day

Note: The number of fueling boats per day is calculated for 5 days/week, because fuel is not sold on Saturday and Sunday.

Table 2-2-2(7) Time of Landing and Number of Boats

(unit: number of boats)

Time of landing (hours)		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
16/1/2006	Mon	0	0	0	0	0	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
17/1/2006	Tue	0	0	0	0	1	1	2	2	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	9
18/1/2006	Wed	0	0	0	0	2	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
19/1/2006	Thu	0	0	0	0	1	2	1	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	9
20/1/2006	Fri	0	0	0	0	1	5	1	1	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	13
21/1/2006	Sat	2	1	1	1	1	1	2	2	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	15
22/1/2006	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23/1/2006	Mon	0	0	0	0	0	2	2	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	9
24/1/2006	Tue	0	0	0	1	0	2	2	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10
25/1/2006	Wed	0	0	0	0	0	4	2	2	2	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	14
26/1/2006	Thu	0	0	0	1	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
27/1/2006	Fri	0	0	0	0	0	4	1	3	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
28/1/2006	Sat	0	2	1	1	0	0	2	0	3	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	14
29/1/2006	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		2	3	2	4	7	25	20	19	21	9	7	3	3	0	0	0	0	0	0	0	1	0	0	0	126

Table 2-2-2(8) Utilization of Fuel Station (January to March 2005)

Date	Day	No. of boats	Date	Day	No. of boats	Date	Day	No. of boats
1st week			5th week			9th week		
4/1/2005	Tue	4	1/2/2005	Tue	12	1/3/2005	Tue	8
5/1/2005	Wed	10	2/2/2005	Wed	12	2/3/2005	Wed	9
6/1/2005	Thu	4	3/2/2005	Thu	4	3/3/2005	Thu	7
7/1/2005	Fri	10	4/2/2005	Fri	8	4/3/2005	Fri	11
8/1/2005	Sat		5/2/2005	Sat		5/3/2005	Sat	
9/1/2005	Sun		6/2/2005	Sun		6/3/2005	Sun	
10/1/2005	Mon	16	7/2/2005	Mon	21	7/3/2005	Mon	15
Sub total		44	Sub total		57	Sub total		50
2nd week			6th week			10th week		
11/1/2005	Tue	4	8/2/2005	Tue	8	8/3/2005	Tue	8
12/1/2005	Wed	7	9/2/2005	Wed	7	9/3/2005	Wed	9
13/1/2005	Thu	6	10/2/2005	Thu	4	10/3/2005	Thu	8
14/1/2005	Fri	5	11/2/2005	Fri	8	11/3/2005	Fri	7
15/1/2005	Sat		12/2/2005	Sat		12/3/2005	Sat	
16/1/2005	Sun		13/2/2005	Sun		13/3/2005	Sun	
17/1/2005	Mon	16	14/22005	Mon	21	14/3/2005	Mon	14
Sub total		38	Sub total		48	Sub total		46
3rd week			7th week			11th week		
18/1/2005	Tue	10	15/2/2005	Tue	8	15/3/2005	Tue	8
19/1/2005	Wed	8	16/2/2005	Wed	8	16/3/2005	Wed	7
20/1/2005	Thu	6	17/2/2005	Thu	5	17/3/2005	Thu	7
21/1/2005	Fri	5	18/2/2005	Fri	5	18/3/2005	Fri	16
22/1/2005	Sat		19/2/2005	Sat		19/3/2005	Sat	
23/1/2005	Sun		20/2/2005	Sun		20/3/2005	Sun	
24/1/2005	Mon	16	21/2/2005	Mon	21	21/3/2005	Mon	13
Sub total		45	Sub total		47	Sub total		51
4th week			8th week			12th week		
25/1/2005	Tue	9	22/2/2005	Tue	8	22/3/2005	Tue	10
26/1/2005	Wed	7	23/2/2005	Wed	8	23/3/2005	Wed	8
27/1/2005	Thu	8	24/2/2005	Thu	4	24/3/2005	Thu	9
28/1/2005	Fri	11	25/2/2005	Fri	10	25/3/2005	Fri	
29/1/2005	Sat		26/2/2005	Sat		26/3/2005	Sat	
30/1/2005	Sun		27/2/2005	Sun		27/3/2005	Sun	
31/1/2005	Mon	10	28/2/2005	Mon	18	28/3/2005	Mon	19
Sub total		45	Sub total		48	Sub total		46

(Source: SFA)

The number of landing boats and mooring boats per day in BD2006 are shown in Table 2-2-2(9). The required length of quay at present in Victoria Fishing Port is calculated as shown in Table 2-2-2(10). The shortage of quay length is expected to be 119m as actual length of quay constructed.

Table 2-2-2(9) Number of Landing Boats and Mooring Boats （BD2006）

Type of boat	No. of boats (a)	No. of landing/ice supplying boats (b)	No. of fueling boats (b')	Potential landing hours (c)	Landing hours per boat (d)	No. of simultaneously landing boats (e)=(b)/(c)x(d)	No. of mooring boats (a)-(e)	No. of boats (BD 1997)	Short-age
Leconomie class	10	2	2	4 hrs	0.5 hrs	0.250→0	10	4	6
Whaler class Lavenir class Schooner class	42	8	8	4 hrs	1.0 hrs	2.000→2	40	33	9
Semi-industrial class	6	1	1	4 hrs	1.5 hrs	0.375→1	5	3	3
Total	58	11	11			3	55	40	18

Note: The distribution of boats by type has been set with reference to the distribution of the fishing boats.
Leconomie: Whaler: Semi-industrial fishing boats = 2:8:1

Table 2-2-2(10) Required Length of Quay at Present

Quay	Type of boat	Dimensions	
Landing	Leconomie	No. of boats	0
		Landing time (min)	30
		Length of boat (m)	7.5
		Length of berth (m)	8.625
		Length of quay (m)	0
	Lavenir Whaler Schooner	No. of boats	2
		Landing time (min)	60
		Length of boat (m)	11.0
		Length of berth (m)	12.65
		Length of quay (m)	25.3
	Semi-industrial	No. of boats	1
		Landing time (min)	90
		Length of boat (m)	17.0
		Length of berth (m)	19.55
		Length of quay (m)	19.55
	Sub total	(m)	44.85
Mooring	Leconomie	No. of boats	10
		Width of boat (m)	2.0
		Length of berth (m)	3.0
		Length of quay (m)	30
	Lavenir Whaler Schooner	No. of boats	40
		Width of boat (m)	3.5
		Length of berth (m)	5.25
		Length of quay (m)	210
	Semi-industrial	No. of boats	5
		Width of boat (m)	5.0
		Length of berth (m)	7.5
		Length of quay (m)	37.5
		(m)	277.5
Fueling	Semi-industrial	1 boat x 19.55 (m)	19.55
Total		(m)	341.9

[Length of quay]

	BD2006	BD1997	Shortage
Landing and ice supplying quay	45m	28m	17m
Mooring quay	278m	195m	83m
Bunkering quay	20m	18m	2m
Total	343m	241m	102m
		(224m)	(119m)

Note: ( ) is actual quay length constructed.

(d) Appropriateness of Length of Quay Planned in BD1997

The reason for the 119m shortage of quay length in BD2006 is the number of boats moored in the port (average number of boats over the full survey period) has increased from 40 boats in BD1997 to 58 boats in BD2006.

The planned length of the quay in BD1997 was calculated by the average number of boats moored in Victoria Fishing Port in 1997 (40 boats) and the plan does not reflect the maximum number of boats moored in the port (53 boats) or the future increase in the number of boats. Consequently, it is considered that the scale of the plan in the grant aid scheme was suitably set in view of getting maximum effects with minimum scale.

3) Setting the Scale of Quay at Providence Fishing Port

The required length of the quay in Providence is set by subtracting the number of boats to be transferred to Bel Ombre from the number of boats that exceed the present capacity of Victoria Fishing Port. The number of design boats at Providence is calculated as shown in Table 2-2-2(11). The number of landing boats and mooring boats at Providence Fishing Port are calculated as shown in Table 2-2-2(12).

Table 2-2-2(11) Number of Design Boats at Providence

Type of boat	No. of boats at present in Victoria (a)	No. of boats in BD1997 in Victoria (b)	No. of boats transferring to Bel Ombre (c)	No. of boats transferring to Providence (a')=(a)-(b)-(c)
Leconomie class	10	4	1	5
Whaler class Lavenir class Schooner class	42	33	5	4
Semi-industrial class	6	3		3
Total	58	40	6	12

Table 2-2-2(12) Number of Landing Boats and Mooring Boats at Providence

Type of boat	No. of boats at Providence (a')=(a)-(b)-(c)	No. of landing boats (b)	No. of fueling boats (b')	Potential landing hours (c)	Landing hours per boat (d)	No. of simultaneously landing boats (e)=(b)/(c)x(d)	No. of mooring boats (a)-(e)
Leconomie class	5	1	1	4 hrs	0.5 hrs	0.125→0	5
Whaler class Lavenir class Schooner class	4	1	1	4 hrs	1.0 hrs	0.250→0	4
Semi-industrial class	3	1	1	4 hrs	1.5 hrs	0.375→1	2
Total	12	3	3			1	11

Based on the above results, the required length of the quay is as shown in Table 2-2-2(13).

Table 2-2-2(13) Required Length of Quay at Providence

Quay	Type of boat	Dimensions		
Landing	Leconomie	No. of boats		0
		Landing time	(min)	30
		Length of boat	(m)	7.5
		Length of berth	(m)	8.625
		Length of quay	(m)	0
	Lavenir Whaler Schooner	No. of boats		0
		Landing time	(min)	60
		Length of boat	(m)	11.0
		Length of berth	(m)	12.65
		Length of quay	(m)	0
	Semi-industrial	No. of boats		1
		Landing time	(min)	90
		Length of boat	(m)	17.0
		Length of berth	(m)	19.55
		Length of quay	(m)	19.55
	Sub total		(m)	19.55
Mooring	Leconomie	No. of boats		5
		Width of boat	(m)	2.0
		Length of berth	(m)	3.0
		Length of quay	(m)	15
	Lavenir Whaler Schooner	No. of boats		4
		Width of boat	(m)	3.5
		Length of berth	(m)	5.25
		Length of quay	(m)	21
	Semi-industrial	No. of boats		3
		Width of boat	(m)	5.0
		Length of berth	(m)	7.5
		Length of quay	(m)	22.5
	Sub total		(m)	58.5
Fueling	Semi-industrial	1 boat x 19.55	(m)	19.55
Total length			(m)	97.6

[Required length of quay at Providence]

Landing quay	20m
Mooring quay	59m
Bunkering quay	20m
Total	99m

Note: In BD1997, it was considered that boats for landing fish and boats for fueling utilized the same quay. Boats cannot be moored at the same quay when other boats are unloading fish. Consequently, fishing boats shall not be moored at the landing quay except the purpose of fish landing in Providence Fishing Port and the mooring quay will be secured of a length sufficient for the number of boats moored in port.

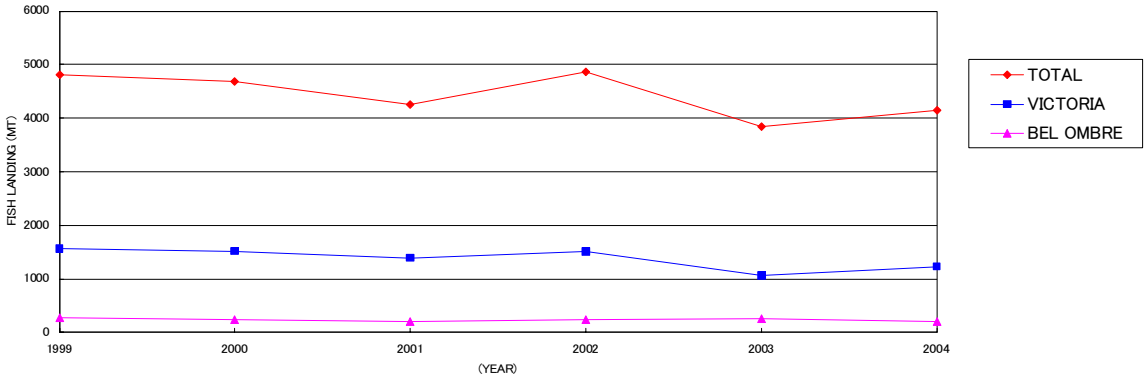
4) Effect of Resolution of Congestion in Victoria Fishing Port by This Project

As for the number of boats moored in port per day, 12 boats/day are expected to transfer from Victoria Fishing Port to Providence and 6 boats/day to Bel Ombre, following the construction of fisheries facilities in Providence and ice making facility in Bel Ombre in this project. As a result, the number of boats moored in Victoria Fishing Port will decrease from 58 boats/day at present to 40 boats/day. All 40 fishing boats can be accommodated in Victoria Fishing Port (quay length 224m in BD1997). Consequently, the number of fishing boats utilizing Victoria Fishing Port will be decreased from 113 to 77 boats.

5) Estimated Fish Landing Volume in Providence and Bel Ombre Fishing Port (after completion of the Project)

(a) Change of Annual Fish Catch

Yearly volume of fish catch by artisanal fisheries in Seychelles has been 4,000~5,000 ton. The fish catch volume in 2004 was 4,143 ton. The yearly landing volume in Victoria Fishing Port and Bel Omble have been 1,000~1,500 ton and 200~250 ton respectively by the artisanal fisheries except outboard engine and in 2004 it was 1,225.4 ton and 208.0 ton respectively. Figure 2-2-2(1) shows the record from 1999 to 2004.



（Source：Seychelles Artisanal Fisheries Statistics for 2004）

Figure 2-2-2(1) Fish Catch of Artisanal Fisheries and Fish Landing Volume of Two Fishing Port

And, the landing volume by semi-industrial fisheries in 2004 was 100.6 ton. The semi-industrial fishing boats are landing only at Victoria Fishing Port. Table 2-2-2(14) shows the landing volume of semi-industrial fisheries.

Table 2-2-2(14) Fish Landing Volume of Semi-industrial Fisheries

(unit: ton)

Type of fisheries	2002	2003	2004
Semi-industrial fisheries	190.0	76.4	110.6

Increase number of fishing boats has been confirmed in field survey in BD2006. However, increase of number of boats does not always lead to increase of fish catch and it is considered that there are some restrictions from fish resources.

(b) Fish Landing Volume per Fishing Boat

The fish landing volume per a fishing boat by type is estimated from fish landing records in 2004 as shown in Table 2-2-2(15) and 2-2-2(16).

a) Victoria Fishing Port

Table 2-2-2(15) Fish Landing Volume per Boat by Type (Victoria Fishing Port)

Type of boat	Number of boat	Total fish landing (ton)	Fish landing per boat (ton)
Outboard engine*[1]		32.6	
Artisanal boat except outboard engine*[2]	101	1,225.4	12.1
Semi-industrial boat	12	110.6	9.2
Total	113	1,368.6	

*1：Outboard engine are not included in design boats for the project.
*2：Leconomie, whaler, lavenir and schooner boats are included.

b) Bel Ombre Fishing Port

Table 2-2-2(16) Fish Landing Volume per Boat by Type (Bel Ombre Fishing Port)

Type of boat	Number of boat	Total fish landing (ton)	Fish landing per boat (ton)
Outboard engine*[1]		93.6	
Artisanal boat except outboard engine*[3]	9	208.0	23.1
Total	9	301.6	

*1：Outboard engine are not included in design boats for the project.
*3：Whaler boats are only included.

The difference of estimated landing volume per boat in Victoria Fishing Port (12.1 ton) and Bel Omble Fishing Port (23.1 ton) is caused that the high value added fishes (Snapper, Grouper, Sea Cucumber, Shark Fin) are landed in Victoria Fishing Port against horse mackerel are mainly landed in Bel Omble Fishing Port. Fishing ports improvement by this project, as these high value

added fishes are estimated to be landed in Providence and Bel Omble Fishing Ports as well, 12.1 tons of the landing volume per boat of artisanal fishing boats except outboard engine is adopted.

(c) Estimated Fish Landing Volume at Providence and Bel Ombre Fishing Port

Fish landing volume per year at Providence and Bel Ombre Fishing Port after completion of the Project are estimated as shown in Table 2-2-2(17) and 2-2-2(18).

a) Providence Fishing Port

Table 2-2-2(17) Estimated Fish Landing Volume at Providence Fishing Boat (after Completion of the Project)

Type of boat	Number of boat	Fish landing per boat (ton)	Total fish landing (ton)
Artisanal boat except outboard engine*[2]	18	12.1	217.8
Semi-industrial boat	6	9.2	55.2
Total	24		273.0

b) Providence Fishing Port

Table 2-2-2(18) Estimated Fish Landing Volume at Bel Ombre Fishing Boat (after Completion of the Project)

Type of boat	Number of boat	Fish landing per boat (ton)	Total fish landing (ton)
Outboard engine			93.6
Artisanal boat except outboard engine*[3]	9	23.1	208.0
Artisanal boat relocated after the Project	12	12.1	145.2
Total	21		446.8

6) Increase Number of Boats at Providence and Bel Ombre Fishing Port (after completion of the Project)

(a) Providence Fishing Port

The number of mooring fishing boat per a day is designed as 24 boats considering 12 boats which are relocated from Victoria Fishing Port with 0.51 “Number of Boats in Port Ratio” (12÷0.51).

Note: Number of Boats in Port Ratio = 58 number of boats moored in port per day / 113 number of boats utilizing Victoria Fishing Port.

(b) Bel Ombre Fishing Port

The fishing boats (except outboard engine) operated in Bel Omble Fishing port as the base is now 9 boats. The number of fishing boats registered in Bel Omble Fishing Port but using Victoria Fishing Port due to non availability of ice making plant are 12 boats. After the completion of this project it will be 21 boats (9 + 12 boats) since registered boats in Bel Omble Fishing Port using Victoria Fishing Port will be relocated to Bel Omble.

Table 2-2-2(19) Increase of Number of Boats after Completion of the Project

Fishing port	Before the Project	After the Project
Providence Fishing Port	0	24
Bel Ombre Fishing Port	9	21

(2) Basic Plan for Civil Facilities

1) Quay

(a) Crown Height

The crown height of the quay is set in relation to the tidal level differential and the size of the fishing boats. Since the tidal level differential at Providence is 1.2m and the maximum boat size is 20 GT (gross tonnage), the crown height is set as follows.

Crown height = H.W.L. + 0.7m

= 1.65m + 0.7m = D.L.+2.35m

Since the crown height of the existing quay in Victoria Fishing Port is D.L.+2.5m, the crown height of the quay in Providence Fishing Port shall be D.L.+2.5m.

Table 2-2-2(20) Setting of Crown Height（above H.W.L.）

Fishing boat(GT) / Tidal differential	0～20	20～150	150～500	Over 500
0.0～1.0m	0.7m	1.0m	1.3m	1.5m
1.0～1.5m	0.7m	1.0m	1.2m	1.4m
1.5～2.0m	0.6m	0.9m	1.1m	1.3m

（Source: Design standard of fishing port and fishing ground facilities）

(b) Depth of Quay

Regarding the water basin in front of the quay and the mooring basin, the depth shall be sufficient to allow fishing boats with a full load to berth at the quay. The depth of the quay is planned as follows. The depth of the existing quay in Victoria Fishing Port is D.L.-2.5m.

Planned depth of mooring basin = maximum draft of boats + clearance

Clearance: If the sea bottom is hard more than 0.5m

If the sea bottom is soft 0.5m

（Source: Design standard of fishing port and fishing ground facilities）

Planned depth of quay = 2.0m + 0.5m = D.L.-2.5m

(c) Length of Quay

According to the afore-mentioned required length of the quay, the planned length of the quay

in Providence Fishing Port is 99m. The location of the quay will be on the face line of the existing revetment. The junction is planned 10m between the quay and the existing revetment in order that rip rap (slope 1:1.5) from the existing revetment does not get into the quay area. Consequently, the length of the quay structure is 119m.

Planned length of quay = 99m

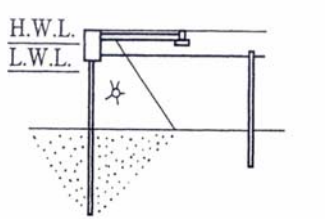
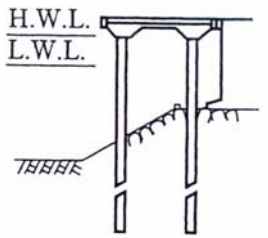
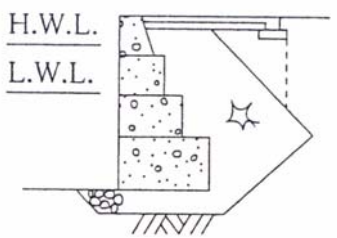
Length of junction area = 10m x 2 = 20m

Length of quay structure = 99m + 20m = 119m

(d) Quay Structure

Regarding the quay structure, as a result of comparison of three types (steel sheet pile type, pier type and concrete block type) as shown in Table 2-2-2(21), the steel sheet pile type is adopted. Considering the differential settlement of the structure, tie wires are adopted for the material.

Table 2-2-2(21) Comparison of Quay Structure Types

Type of structure	Steel sheet pile type	Pier type	Concrete block type
Cross section			
Natural conditions	a) This structure is relatively suitable for soft soil. b) If the soil condition is hard or contains boulders, pile driving is difficult. c) This structure is relatively resistant to waves.	a) This structure is suitable for soft soil. b) If the soil condition is hard or contains boulders, pile driving is difficult. c) The concrete slabs may be damaged by waves.	a) Differential settlement of this structure is anticipated due to consolidation of the soft soil layer. b) This structure is suitable for sand and gravel layer. c) In the case of deep water, the weight of the block increases and construction costs are high. d) This structure is relatively resistant to waves.
Efficiency and convenience	a) Installation of steps is difficult.	a) This structure is relatively vulnerable to horizontal loads. b) Installation of steps is difficult.	a) This structure can endure berthing force. b) Installation of steps is easy.
Difficulty of execution and construction cost	a) Construction work can be conducted on land and a large crane is not necessary. b) Construction machinery is relatively simple and work can be done promptly. c) Construction period is short. d) Steel products are not available in Seychelles, so a procurement source and duration must be taken into consideration.	a) A barge for pile driving is necessary. b) The construction period is long, as with the block type. c) Steel products are not available in Seychelles, so a procurement source and duration must be taken into consideration.	a) A large crane for placing the concrete blocks is necessary, and a long period and fabrication yard are necessary for manufacturing the blocks. b) Execution work is easy. c) The main materials can be manufactured in Seychelles.
Maintenance	a) Corrosion of steel products must be taken into consideration.	a) Corrosion of steel products must be taken into consideration.	a) Maintenance work is easy.
Cost	1	3	2
Evaluation	Selected		

The design conditions are shown as follows.

a) Tidal Level

H.W.L. +1.65m

L.W.L. +0.45m

b) Dimensions of Quay

Planned depth D.L.-2.5m

Crown height D.L.+2.5m

c) Wave Conditions

Waves are not taken into consideration in the design for quay of the steel sheet pipe type.

d) Tidal Current

The tidal current is not taken into consideration in the quay design.

e) Soil Conditions

According to the results of investigation of the soil conditions at the planned location of the quay, coral sand used for reclamation works exists up to approximately -10m from the ground surface (+3.0m) and the N value under water is close to under 10. Silt exists up to -20m. The soil conditions used for the quay design are shown as follows.

N value	: 3 (sand)
Cohesion	: 0
Angle of internal friction	: 25 degrees

f) Design Fishing Boats

Weight	: 20 GT (gross tonnage)
Maximum length	: 23m
Maximum draft	: 2m

g) Berthing Velocity of Boats : 0.5 m/sec

h) Surcharge : 1.0 kN/m^2

i) Seismic Force : not considered

j) Corrosion Rate of Steel Sheet Piles

Under water	: 0.02 mm/year
Under sea bottom	: 0.03 mm/year

Regarding measures to anti-corrosion of the steel sheet piles, the bottom height of the coping

concrete shall be D.L.0.0m and cathodic protection (estimated life: 30 years) will be adopted underwater.

k) Bulk Density

Reinforced concrete	: (air) 24.5 kN/m^3 (underwater) 14.2 kN/m^3
Plain concrete	: (air) 23.0 kN/m^3 (underwater) 12.7 kN/m^3
Steel products	: (air) 78.5 kN/m^3 (underwater) 68.2 kN/m^3
Armor stone	: (air) 18.0 kN/m^3 (underwater) 10.0 kN/m^3
Back filling	: (air) 18.0 kN/m^3 (underwater) 10.0 kN/m^3
Sea water	: 10.3 kN/m^3

l) Allowable Stress

Steel for structure	: 140 N/mm^2
Deformed bar	: 180 N/mm^2
Steel sheet pile	: 180 N/mm^2

(e) Width of Apron

The width of the quay apron is set by utilization as follows.

a) Landing quay	when carrying fish into warehouse	: 3.0m
	when sending fish from apron to outside by vehicle	: 10.0m
b) Preparation quay		: 10.0m
c) Mooring quay		: 6.0m

（Source: Design standard of fishing port and fishing ground facilities）

A landing quay, mooring quay and bunkering quay will be constructed in this project. As the fish landed are immediately sent to Victoria fish market by truck for reasons of hygiene, the width of the apron shall be 10m. Regarding the structure of the apron at the landing quay, concrete paving will be adopted as the fish handling shed will be constructed. Regarding the mooring and bunkering quays, interlocking concrete block paving will be adopted in consideration of easy maintenance after completion by the Government of Seychelles.

(f) Foot Protection in front of Quay

The existing revetment will be excavated up to -3.0m to construct the quay. After the steel sheet piles are driven in, the sea bottom in front of the quay will be covered up to -2.5m by rip rap (20 to 50 kg/piece). At the entrance to the mooring basin, the sea bottom will be covered up to -2.5m by armor stone (1 ton/piece) as it is affected by waves.

(g) Incidental Facilities

Rubber fenders, 150H x 2,000L, shall be placed at 5m intervals. Bollards (5 ton type) shall be placed at 10m intervals. Considering fishing boats berthing perpendicularly, mooring rings will be

installed between the bollards. Curbing will be installed on the coping concrete to prevent vehicles falling off the quay. Rubber ladders will be installed in two places.

2) Anchoring Buoys

Five anchoring buoys will be installed at 15m intervals in front of the 59m mooring quay, as same Victoria Fishing Port. The buoys shall be 1,400mm in diameter and made of polyethylene.

3) Navigation Aids

Three navigation buoys with lanterns and one navigation aid with lantern will be installed as shown in Figure 2-2-2(2). The specifications of the lantern are as follows.

Power source	: Solar cell module type
Light source	: Light emitting diode (LED) type
Light character	: Flash 4 sec
Effective luminous intensity	: Approximately 8 cd (candela)
Light color	: No.1 and No.4 red
	: No.2 and No.3 green
Luminous range	: Approximately 4.5 km

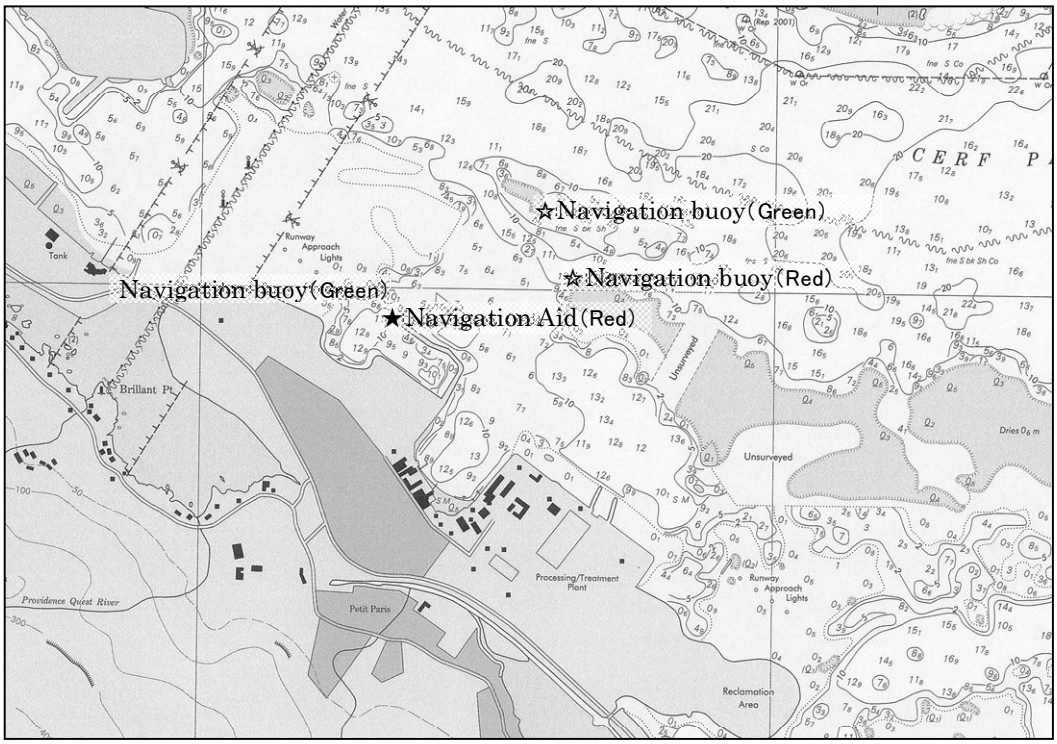


Figure 2-2-2(2) Location of Navigation Aids

2-2-2-2 Basic Plan for Building Facilities

(1) Building Facilities

1) Consideration of Plan of Facilities

Buildings in Seychelles often have a basic concrete block structure. There are not a few precedents of buildings with columns and beams of reinforced concrete and walls built from blocks, as well as building frame with external block corners, making the most of the advantages of an earthquake-free country to alleviate horizontal stresses. In these cases, however, concrete-block beams are contained in concrete and a wooden floor joist and roof truss is placed on them to form the second floor. Walls are most frequently finished with mortar. In most cases roofs are finished with corrugated iron sheets. The overhang of the eaves is relatively long to block sunlight and keep the rain off.

The shape of the roof is very similar to the hipped roof or half-hipped roof found in Japan. Hipped roofs are often topped with small roofs for ventilation, which seems to indicate an emphasis on under-roof ventilation. On the other hand, it is true that using louvers for ventilation degrades rain protection.

Consideration must be given to plan for the arrangement of buildings in terms of overall flow and influence on the period of construction and civil structures.

Consideration for the arrangement of facilities is as follows:

a) An ice making machine and an ice storage shall be installed on the first and ground floors, respectively. The vertical distance between the work space at the front and the outside shall be minimized to facilitate the transporting of ice. At one end of the work space there shall be an anteroom for workers and a money-collecting office.

b) The administration building shall be a one-story building divided into various departments. The floor plan shall be of offices located on both sides of a central corridor running the length of the building.

c) The fish handling shed is provided mainly to shade out sunlight and ensure workability on rainy days. The end of the fish handling shed must extend almost to the edge of the landing quay. The lower end of the beams must be high enough to allow the passage of trucks carrying catches of fish.

d) Concerning the fishermen's gear storage, each of the storage shall have a floor area of 2m by 2.5m. Each of storage shall be equipped with 1 lighting fixture and 1 socket outlet.

2) Consideration of the Structure of Facilities

a) The dead load of the ice plant itself shall be as light as possible because the live load can be heavy. An appropriate superstructure will have a steel frame. The sub-surface water level shall be taken into consideration in planning the foundations. At present, the plan should

incorporate a strip footing comparable to a mat foundation. The foundations and the ground floor shall be constructed of reinforced concrete, and the walls of lightweight members lined with insulating materials. The roof shall be appropriately finished with a lightweight material, such as a folded-plate roof. On the first floor, the ice making machine shall be supported by a steel frame and the floor on which people walk shall be made of steel plates.

b) The administration building shall be one-story, and the live load will not be particularly heavy. The foundation shall be a spread foundation (strip foundation or independent footing) and the superstructure shall be of a reinforced-concrete framework with concrete-block walls. The roof truss shall be of a steel frame construction, not wooden, taking into consideration the amount of rainfall and the effect of the wind in the rainy season.

c) The fish handling shed to be located on the top surface of the quay shall take the form of a canopy, with two columns in the front and back facing the quay to provide structural support against wind pressure. Columns parallel to the quay shall be placed at intervals of multiples of 1,600 mm, taking into consideration the physical relationship with the structure of the civil facilities (assumed to be a steel sheet pile type structure). This numerical value was derived from the interval of 1,600 mm between the tie-wires supporting the steel sheet piles of the quay. The underground beams and the footing shall be accommodated between two neighboring tie-wires so that the weight of the building shall not affect the tie-wires.

d) The fishermen's gear storage and public toilets shall have a framework made partially of reinforced concrete with concrete-block walls, topped with a lightweight roof material such as a folded-plate roof. The doors shall be independently lockable.

3) Floor Plan

(a) Ice plant (Providence and Bel Ombre)

Space for the delivery of ice shall be secured at the front of the ice storage to be installed on the ground floor. There shall be as little difference in levels as possible at the base of the entrance/exit door through which the ice is to be carried out. There shall also be a space at the front of the blast freezer and cold storage for carrying in and out the fish products stored therein. Cooling equipment that can be installed outdoors may be placed outdoors to save on floor space in the building, but sufficient consideration must be given to the salt resistance of the equipment. Additionally, there must be a water tank, as water cannot be directly supplied from the main city water pipes to the equipment, although Seychelles water supply does have sufficient water pressure. There shall be a workspace around the blast freezer and cold storage inside the outer wall, for the purpose of piping and maintenance.

At Providence Fishing Port, 1 engineer shall be permanently stationed for maintenance and repair of the equipment to be installed in the ice plant, and next to the engineer's office shall be stored the tools required for maintenance. There shall also be offices for other

permanently-stationed personnel, including 1 person to carry out ice, 1 person to manage bait and other products to be stored in cold storage and blast freezer, and 1 person to collect bills.

In Bel Ombre, there shall be a storage space for tools and an office for a bill collector.

(b) Administration Building

Table 2-2-2(22) lists the personnel and planned room areas based on the Japanese standard of a per-person room area of $5m^2$ to $15m^2$ (Compiled Reference for Architectural Design published by the Architectural Institute of Japan).

Table 2-2-2(22) Administration Building Personnel and Planned Room Areas

Personnel	Capacity	Room area	Remarks
Port Manager	1	13.26 m^2	General manager of the port
Administrator	1	10.92 m^2	Manager of general affairs and accounting
Enforcement Officer	2	13.65 m^2	Surveillance against illegal fishing
Research Technician	2	13.65 m^2	Inspection of fish configuration and biological analysis
Fisheries Technician	2	13.65 m^2	Survey of catch size and number of fishing boats
Pier Master	1	8.75 m^2	Berthing instructions to fishing boats
Security	1	7.50 m^2	Double shift system
Maintenance Engineer	1	10.50 m^2	Installation of electricity control panels
Cleaner/Tea lady	2	11.70 m^2	One person indoors, one outdoors
Storage & Stack Room		10.53 m^2	
Conference Room		36.00 m^2	

Personnel responsibilities are as follows:

Port Manager:	The general manager for all the operations at Providence Fishing Port, also providing coordination with the SFA head office and its higher organization (the Ministry of Environment and Natural Resources) and Boat Owner's Association, etc.
Administrator:	In charge of general affairs such as accounting and clerical work.
Enforcement Officer:	Ensures that the laws are observed by the owners, captains and crew of all the fishing boats based at Providence Fishing Port, and investigates illegal acts in cooperation with the police. Uncovers fishing activities of unregistered fishing boats, seizes logs, and checks illegal fishing gear. This surveillance against illegal fishing is an important job in achieving the sustainable use of marine resources, a national fishery development goal of Seychelles. Responsible for carrying out 24 hours duty a day, two persons must be permanently stationed at Providence Fishing Port.
Research Technician:	On the arrival of a fishing boat at the port, collects data such as fish length and weight of landed fish. Also dissects fish to conduct detailed biological analysis. Dives in the sea to investigate fish resources. Since fishing boats may come into the port at any time, two persons are on 24 hours duty a day and must be permanently stationed at Providence Fishing Port.
Fisheries Technician:	On the arrival of a fishing boat at the port, identifies fish and conducts a hearing of the crew regarding the amount landed in order to write a survey record. Also checks the arrival and departure of fishing boats in order to collect such data as operating hours for a statistical survey on fisheries. Since fishing boats may come into the port at any time, two persons are on 24 hours duty a day and must be permanently stationed at Providence Fishing Port.
Pier Master:	Gives instructions to fishing boats about berthing and otherwise is responsible for the use of the quay.
Security:	Is responsible for maintaining the security of Providence Fishing Port. On 24 hours duty a day.
Maintenance Engineer:	Responsible for the maintenance and management of electrical power, water supply and drainage, and telephone system for the entire Providence Fishing Port. The electricity control panel is installed in offices.

The area of the conference room shall be planned on the assumption that Providence Fishing Port Management Committee will hold meetings in the administration building to be attended by 20 persons as listed in Table 2-2-2(23). Although the minimum required space will exceed 40m^2 if

meeting attendees sit in the usual U-shape or square, it is assumed that an area of 4m x 9m=36m^2 will be adequate with a better arrangement of desks and chairs.

Table 2-2-2(23) Number of Persons Using the Conference Room

Meeting attendees		Number
Persons permanently stationed in the administration building	Port Manager	1
	Administrator	1
	Enforcement Officer	1
	Research Technician	1
	Fisheries Technician	1
	Pier Master	1
	Security	1
	Maintenance Engineer	1
Persons permanently stationed in the ice plant	Ice Plant with Blast Freezer and Cold Storage Engineer	1
Ministry of Environment and Natural Resources		1
Seychelles Fishing Authority (SFA)	Managing Director and others	3
Seychelles Port Authority (SPA)		1
Public Utilities Corporation (PUC)		1
Boat Owner's Association	Providence and Victoria	2
Fishery Cooperative	NGO	1
Fish processing companies		2
Total		20

The illumination over desks in the offices shall be around 500 lux, and each office shall be equipped with an air conditioner because of the hot and humid climate of the site.

(c) Fishermen's Gear Storage

Fishing boats to be relocated from Victoria Fishing Port to Providence shall use Providence Fishing Port to conduct all their activities including the landing of fish catches, fueling and mooring, which means that their base port will be changed. The number of fishing boats to be used is calculated as 24 boats taking a ratio of mooring boats in port (0.51) for 12 boats into account. There shall be fishermen's gear storages for each of the 24 fishing boats included in the number of fishing boats that use Providence Fishing Port, i.e., 24 storage in total.

For ease of use, storage will be constructed as 12 back-to-back pairs. These storage shall be of the same size as the fishing gear storage in Bel Ombre, which are 2.0 m wide and 2.5 m deep. Each of the storage shall be equipped with shelves 70 cm long, wall outlets and lighting fixtures as incidental equipment and, for the entire group of storage, there shall be a water tap for washing outside of the storage. The number of fishing boats mooring at Providence Fishing Port has been calculated to be 12 per day and the total number of fishing boat crew and support persons on land to be 60 per day. The corresponding numbers of necessary toilet equipment, therefore, are 2 toilet bowls and 2 urinals for men, 2 wash basins for men, 1 toilet bowl for women, 1 wash basin for women, and 1 shower.

(d) Fish Handling Shed

Shelters for fish landing shall be constructed along the landing quay. The column centers shall be established at 5.0 m from the quay to allow for passage by the trucks that pick up the fish catches. There shall be an equal distance from this to a column to be set up at the back to support the cantilever. The roof shall be salt resistant material concerning about the influence of sea water. Additionally, there shall be water tap and waterproof outlets for cleaning the floor and lighting fixtures shall be installed for landing fish at night.

(e) Fire-extinguishing Equipment

As fire-extinguishing equipment for Providence Fishing Port, 1 fire hydrant shall be provided near the administration building and 1 near the ice plant, both of the same buried type as that has used in Victoria Fishing Port.

(f) External Facilities

Taking nighttime operations into consideration, total 11 lighting fixtures shall be provided in the passages of the buildings and along the quay of Providence Fishing Port. Additionally, a drainage plan, including side ditches to passages and other drainage, shall be implemented to drain rainwater from the project site. Along the quay, there shall be 3 water taps for use by fishing boats and 5 power supplies for minor repairs to fishing boats.

4) Cross-sectional Plan

Regarding the cross-sectional plan of facilities, consideration must be given to the control of rainfall and the problem of ventilation, considering that the annual average temperature is over 30 Celsius degrees.

(a) Ice Plant (Providence and Bel Ombre)

Basically, the ice plant shall be a two-story building. On the ground floor there shall be space for ice storage, the delivery of ice, the ice plant engineer's office and a tool shed. On the first floor there shall be ice making machine. Stairs to the first floor shall be provided for maintenance and management of the ice making machine. The floor height shall be 100 mm higher than the ground level, with a gradient of about 1/100 towards the outside in order to drain water from melted ice. A slope shall be provided also on the outside to facilitate the transportation of ice by a forklift. Surface protection using synthetic resin shall be provided to protect the floor concrete.

(b) Administration Building

The floor height shall be 100 mm higher than the ground level and the ceiling height of each room shall be FL+2,600 mm. The folded plate of the roof shall be lined with insulation materials in order to minimize the effects of direct sunlight. To provide under-roof ventilation, a gabled roof shall be used with ventilation holes on the side of the building as well as behind the eaves for weight ventilation. All of these arrangements will enable under-roof ventilation.

(c) Fishermen's Gear Storage

The lowest part of the floor shall be 100 mm higher than the ground level to prevent rain, and there shall be a gradient of about 1/100 from the innermost part of the storage in order to drain the incoming rainwater. The height of partition shall be FL+2,700mm and install shelves at the height of FL+1,500mm. 1 lighting fixture shall be installed per storage. For the sake of ventilation, hollow concrete blocks shall be used in the lower part of the external walls and wire mesh in the ceiling. The public toilet and the shower room shall have a floor with a gradient to drain washing water from the floor and breast wall, and the drainage shall be processed inside the toilet. For the sake of ventilation, there shall be a space between the upper end of the external wall and the steel roof truss.

(d) Fish Handling Shed

The roof shall be higher on the sea side than on the land side to prevent rain from falling into boats when fish catches are landed on a rainy day. At Victoria Fishing Port, the common method of handling fish is for trucks to come to the quayside, pick up the landed fish, and carry them to the market. According to the data available from Japanese manufacturers, the maximum height of 2 ton trucks is 1,970 to 2,205 mm (Isuzu) and 2,100 to 2,160 mm (Mitsubishi) and the maximum height of 4 ton trucks is 2,480 mm (Hino). The lower end of the beam of the steel structure supporting the folded-plate roof shall be higher than the maximum height of trucks. Taking stability into consideration, 2 columns shall be set up at right angles to the face line of the quay. The lower end of the beam between these columns shall also be higher than the maximum height of trucks. A valley gutter shall be installed on the upper end of the column on the quay side to collect rainwater. Surface protection using synthetic resin shall be provided to protect the floor concrete.

5) Building Finish Schedule

Building finish schedule of each facility is shown in Table 2-2-2(24) to 2-2-2(32).

(a) Administration Building

Table 2-2-2(24) Exterior Finish Schedule of Administration Building

Portion	Finishes
Roof	V-shaped Galvanized steel roof, pre-coated with fluoric resin paint and insulation material on back side
Plancer	Asbestos free Calcium Silicate board with vinyl chloride paint finish
Exterior Wall	Hollow concrete block, mortar trowel finish with vinyl chloride paint
Opening	Aluminum window ,aluminum door, steel door
Berm	Reinforced Concrete steel trowel finish

Table 2-2-2(25) Interior Finish Schedule of Administration Building

Room Name	Floor	Base	Wall	Ceiling	Molding at corner of ceiling and wall
Office, Corridor	Vinyl tile	Wooden with Emulsion paint	Hollow concrete block, mortar trowel finish with Emulsion paint	Gypsum board with emulsion paint	Wooden with Emulsion paint
Toilet, Shower room	Ceramic tile	Ceramic tile	Under wall : Ceramic tile Wall: Hollow concrete block, mortar trowel finish with Emulsion paint	Asbestos free Calcium Silicate board with vinyl chloride paint finish	

(b) Fishermen's Gear Storage

Table 2-2-2(26) Exterior Finish Schedule of Fishermen's Gear Storage

Portion	Finishes
Roof	V-shaped Galvanized steel roof, pre-coated with fluoric resin paint and insulation material on back side
Plancer	Asbestos free Calcium Silicate board with vinyl chloride paint finish
Exterior Wall	Hollow concrete block, mortar trowel finish with vinyl chloride paint
Opening	Wood door with oil paint
Floor	Reinforced Concrete steel trowel finish with Polyurethane resin paint

Table 2-2-2(27) Interior Finish Schedule of Fishermen's Gear Storage

Room Name	Floor	Base	Wall	Ceiling
Gear storage	Reinforced Concrete steel trowel finish Polyurethane resin paint finish	Mortar trowel finish with Emulsion paint	Hollow concrete block, mortar trowel finish with Emulsion paint	Wiremesh ϕ6-150x150 with oil paint
Toilet, Shower room	Ceramic tile	Ceramic tile	Hollow concrete block, mortar trowel finish with Emulsion paint	Asbestos free Calcium Silicate board with vinyl chloride paint finish

(c) Fish Handling Shed

Table 2-2-2(28) Exterior Finish Schedule of Fish Handling Shed

Portion	Finishes
Roof	V-shaped Galvanized steel roof, pre-coated with salt-resistant paint
Beam	Steel Structure, rust protection paint with polyurethane resin paint
Column	Mortar steel trowel finish with vinyl chloride paint
Floor	Reinforced Concrete steel trowel finish with epoxy resin paint

(d) Ice Plant (Providence)

Table 2-2-2(29) Exterior Finish Schedule of Ice Plant (Providence)

Portion	Finishes
Roof	V-shaped Galvanized steel roof, pre-coated with fluoric resin paint and insulation material on back side
Plancer	Asbestos free Calcium Silicate board with vinyl chloride paint finish
Exterior Wall	Insulated steel panel wall, pre-coated with fluoric resin paint
Opening	Aluminum window ,aluminum door, steel door
Berm	Reinforced Concrete steel trowel finish

Table 2-2-2(30) Interior Finish Schedule of Ice Plant (Providence)

Steel structure		Rust protection paint with polyurethane paint			
Room Name	Floor	Base	Wall	Ceiling	Molding at corner of ceiling and wall
office	Reinforced Concrete steel trowel finish with Polyurethane resin paint	Wooden with emulsion paint	Asbestos free ACB on LGS frame with vinyl chloride paint	Asbestos free Calcium Silicate board on LGS frame with vinyl chloride paint	Wooden with emulsion paint
Other than office	Reinforced Concrete steel trowel finish with Polyurethane resin paint	Polyurethane resin paint	Backside of exterior wall	Backside of V-shaped roof	

(e) Ice Plant (Bel Ombre)

Table 2-2-2(31) Exterior Finish Schedule of Ice Plant (Bel Ombre)

Portion	Finishes
Roof	V-shaped Galvanized steel roof, pre-coated with salt-resistant paint and insulation material on back side
Plancer	Asbestos free Calcium Silicate board with vinyl chloride paint finish
Exterior Wall	Insulated steel panel wall, pre-coated with fluoric resin paint
Opening	Aluminum window ,aluminum door, steel door
Berm	Reinforced Concrete steel trowel finish
Wall around Machine	Hollow concrete block, mortar trowel finish with vinyl chloride paint

Table 2-2-2(32) Interior Finish Schedule of Ice Plant (Bel Ombre)

Steel structure		Rust protection paint with polyurethane paint			
Room Name	Floor	Base	Wall	Ceiling	Molding at corner of ceiling and wall
Office	Reinforced Concrete steel trowel finish with Polyurethane resin paint	Wooden with emulsion paint	Asbestos free ACB on LGS frame with vinyl chloride paint	Asbestos free Calcium Silicate board on LGS frame with vinyl chloride paint	Wooden with emulsion paint
Other than office	Reinforced Concrete steel trowel finish with Polyurethane resin paint	Polyurethane resin paint	Backside of exterior wall	Backside of V-shaped roof	

6) Utilities Plan

(a) Electrical Facilities

a) Providence Fishing Port

The electrical power needed for the utilities in this project will be drawn from the public electricity grid and supplied via the local substation. The capacity of the power station in Mahe Island is greater than the demand, and the main power lines near to the project site are designed to form a loop, which means that even if some lines go down the design allows power to be supplied from elsewhere, so that the possibility of a power failure is low.

The strength of indoor lighting is set at 500 lux for the offices in the administration building and in the ice plant, and at 180 lux for the fishermen's gear storage and at 300 lux for fish handling shed. As incidental facilities telephone wires and electrical outlets shall be provided in the offices and one electrical outlet shall be provided in each of the fishermen's gear storage.

Table 2-2-2(33) shows the amount of electric consumption per day in each of the facilities.

Table 2-2-2(33) Amount of Electric Consumption at Providence

Facility	Amount of electric consumption per hour (kwh)	Average number of hours used (h)	Electric consumption (kwh/day)
Administration building	17.67	8.0	141.36
Fishermen's gear Storage	2.83	2.0	5.66
Fish handling shed	2.26	10.0	22.60
Ice plant	73.75	24.0	1,770.00
Ice plant (lighting, electrical outlets)	6.51	8.0	52.08
Outdoor lighting	3.30	10.0	33.00
Total			2,024.70

b) Bel Ombre Fishing Port

The amount of electric consumption in connection with the Bel Ombre ice plant is 27.58 kwh x 24h = 661.92 kwh for the ice plant plus 3.44 kwh x 8h = 27.52 kwh for lighting and electrical outlets, making a total of 689.44 kwh per day.

Electrical outlets and telephone lines shall be provided in the offices.

Table 2-2-2(34) Amount of Electric Consumption at Bel Ombre

Facility	Amount of electric consumption per hour (kwh)	Average number of hours used (h)	Electric consumption (kwh/day)
Ice plant (for ice making machine)	27.58	24.0	661.92
Ice plant (lighting, electrical outlets)	3.44	8.0	27.52
Total			689.44

(b) Water Supply Facilities

a) Providence Fishing Port

Seychelles is fully equipped with plumbing facilities. Underground pipes of 100mm in diameter carry water from the two filtration plants on Mahe Island to close to the project site of Providence Fishing Port, and the water pressure, at 8 to 10 bar (8.16 to 10.2 kg/cm^2) is quite sufficient.

The amount of water to be used per day in this project will be: for the ice plant, 25 ton/day; for the staff permanently stationed in the administration building, 100 l/day x 20 persons = 2,000 l/day = 2 ton/day; reckoning the number of fishermen using the fishermen's gear storage, 40 l/day x 60 persons = 2,400 l/day = 2.4 ton/day; for drinking water to be loaded onto the fishing boats, 2.0 ton/day, making the total amount of water used daily by the port as a whole 31.4 ton/day.

In order to cope with fluctuations in water pressure it is planned that the water supply for the ice plant will be stored in a water tank and water from the tank used as necessary. The water tank will have the capacity to hold the amount of water used daily by the ice plant, which is 30 ton (3.0m x 4.0m x 2.5m).

Table 2-2-2(35) Amount of Water Used at Providence

Facility	Amount of water used (ton/day)	Remarks
Ice plant	25.0	Ice making machine approx. 13 ton Condenser approx. 7 ton Blast freezer approx. 4 ton Ice storage approx. 1 ton
Administration building	2.0	20 persons x 100 l/day
Fishermen's gear storage (Toilet and shower)	2.4	60 persons x 40 l/day
Drinking water for fishing boats	2.0	
Total	31.4	

b) Bel Ombre

The ice plant is the only facility planned for Bel Ombre, and this will use 13.4 ton of water per day. A water tank will be provided, and the water supplied from there. The capacity of the water tank will be 15 ton (3.0m x 2.0m x 2.5m), the amount of water to be used daily by the ice plant.

Table 2-2-2(36) Amount of Water Used at Bel Ombre

Facility	Amount of water used (ton/day)	Remarks
Ice plant (for ice making machine)	13.4	Ice making machine approx. 8 ton Condenser approx. 4 ton Ice storage approx. 1 ton
Total	13.4	

(c) Drainage Facilities

a) Providence

It is planned for drainage from the fishing port to be separated into wastewater and rainwater. Rainwater will be treated in two ways; one way is for it to be allowed to flow over the slope of the land into the sea, and the other is for it to be channelled via a ditch from the central part of the site to the quayside. As for the treatment of wastewater, wastewater pipes from the site are to be connected to sewage pipes installed behind the site by the Government of Seychelles. The amount of wastewater discharged from the site will be 2.0 ton/day from the administration building and 2.4 ton/day from the fishermen's gear storage, a total of 4.4 ton/day (Refer to Table 2-2-3(35).

b) Bel Ombre

In Bel Ombre no facilities are to be provided in this Project except the ice plant, from which there will be no discharge of wastewater. As the 3rd Development Plan of Bel Ombre Fishing Port by the Government of Seychelles has included the toilet for fishermen, no toilet is planned in the ice plant of this project.

(2) Ice Making Plant

1) Providence

The capacity of the ice making machine shall be estimated on the assumption that the number of fishing boats moored at Providence Fishing Port is 12 boats per day. The amount of ice on board per boat is assumed from the current status of Victoria Fishing Port. The necessary amount of ice to be supplied per day is "Number of fishing boats moored at the port" multiplied by "Supply ratio" multiplied by "Amount of ice on board per boat".

Leconomie class	5 boats x (11/58) x 1.5 ton	=1.4
Whaler class	4 boats x (11/58) x 3.0 ton	=2.3
Semi-industrial class	3 boats x (11/58) x 12.0 ton	=6.8
Total		10.5→10 ton

Therefore, the capacity of the ice making machine shall be 10 ton per day and the capacity of the ice storage shall be 15 ton which is 1.5 times as large as that of the ice making machine. The specifications of ice making machine is shown in Table 2-2-2(37).

2) Bel Ombre

1 Leconomie class and 11 whaler class fishing boats are using Victoria Fishing Port because, although they want to be based in Bel Ombre, the ice cannot be obtained there. The Government of Seychelles is now expanding the fishing port in Bel Ombre. If ice can be supplied, 12 fishing boats will be relocated from Victoria to Bel Ombre. Bel Ombre is already used by 9 whaler class fishing boats, for which ice is transported over land from Victoria Fishing Port. Therefore, the capacity of the ice making machine shall be estimated on the assumption that these 21 fishing boats will use this port.

Of these 21 fishing boats, the number of fishing boats moored at the port per day is calculated as follows:

21 boats x Ratio of boats moored at the port (58/113) =10.78→11 boats

Assuming that the ratio of Leconomie class to whaler class is 1 to 20.

Leconomie class	0.52 → 1 boat
Whaler class	10.47→10 boats (5 from Victoria Fishing Port and 5 at Bel Ombre)

The necessary amount of ice to be supplied per day is "Number of fishing boats moored at the port" multiplied by "Supply ratio" multiplied by "Amount of ice on board per boat."

Leconomie class	1 boat x (11/58) x 1.5 ton	=0.3
Whaler class	10 boats x (11/58) x 3.0 ton	=5.7
Total		6.0→6.0 ton

Therefore, the capacity of the ice making machine shall be 6 ton per day and the capacity of the ice storage shall be 9 ton which is 1.5 times as large as that of the ice making machine. The specifications of ice making machine is as shown in Table 2-2-2(37).

Table 2-2-2(37) Specifications for Ice Making Machine

Facility	Providence	Bel Ombre
Capacity	10 ton/day	6 ton/day
Type	Plate ice making	Plate ice making
Refrigeration unit	Open-type refrigerator using ammonium Motor approx. 22 kw	Open-type refrigerator using ammonium Motor approx. 15 kw
Condenser	Vaporizing type Capacity of approx. 50ton	Vaporizing type Capacity of approx. 25 ton
Re-evaporator	Water-cooled heat exchanger type	Water-cooled heat exchanger type
Ice storage capacity	15 ton	9 ton

Ammonia (NH_3) as refrigerant for the refrigeration system at Providence and Bel Ombre Fishing Port is adopted according the following reasons;

a) Seychelles economy is very much depending on tourism and attach importance to the environmental issue.
b) Local biggest fish processing company "Indian Tuna Company Ltd." use Ammonia refrigeration system. They have a good reputation with ammonia refrigerant, and they have no difficulty to maintain the ammonia system.
c) An ammonia refrigeration engineer is available in Seychelles and the SFA will employ him for maintenance of the equipments in this project.
d) As CFC and HCFC refrigerant (example R-22) refrigerant will be abolished at 2020, ammonia (NH_3) is recommended considering the future after the project.
e) Recently, major international industrial refrigeration companies produce mostly ammonia refrigeration equipments.

2) Solution of Shortage of Ice Supply in Victoria Fishing Port

(a) Supply of Ice to Fishing Boats in Victoria Fishing Port

Table 2-2-2(38) shows the ice production capacity and the possible supply volume to fishing boats by two fish processing companies in Victoria Fishing Port. The total production capacity of ice is 50 ton/day however 50% of the ice is used for their processing factory and the export. The ice making machine which has been granted from the Government of Japan has lost the production capacity from 6 ton/day to 4 ton/day due to the aging. Therefore, the ice volume to be able to supply to fishing boats is 26 ton/day.

Table 2-2-2(38) Ice Production and Supply Capacity

Type of ice	Company	Ice production (ton/day)	Ice supply (ton/day)
Flake*1	Oceana Fisheries	24	12
	Sea Harvest	20	10
Plate*2	Oceana Fisheries	6	4
Total		50	26

*1：Each company uses 50% of ice production in own factory.
*2：Capability of ice production has declined due to deterioration of ice making machine.

(b) Demand of Ice at Present in Victoria Fishing Port

As Table 2-2-2(39) shows, the demand volume of ice from fishing boats in Victoria Fishing Port at present is about 43 ton/day. The ice volume getting in Victoria Fishing Port by the fishing boats belong to Bel Omble was included in the figure. The ice volume is inadequate for the need since the ice supplying volume in Victoria Fishing Port is only 26 ton/day.

Table 2-2-2(39) Demand of Ice at Present in Victoria Fishing Port (including Bel Ombre Foishing Port)

Type of boat	Number of boat (a)	Ice on board (ton) (b)	Supply ratio*4 (c)	Demand of ice(ton) (a)x(b)x(c)
Leconomie	10	1.5	11/58	2.8
Whaler	42	3.0	11/58	23.9
Whaler*3	5	3.0	11/58	2.8
Semi-industrial	6	12.0	11/58	13.7
Total				43.2

*3: Whaler boat in Bel Ombre Fishing Port.
*4: Supply ratio is calculated by number of boats refueling per day (11 boats) / number of boats mooring in port per day (58 boats).

(c) Demand of Ice after the Project in Victoria Fishing Port

After the completion of this project, the ice demand will be about 27 ton/day from about 43 ton/day in Victoria Fishing Port as shown in Table 2-2-2(40). It is considered that the ice shortage is going to be nearly solved.

Table 2-2-2(40) Demand of Ice after Completion of the Project in Victoria Fishing Port

Type of boat	Number of boat (a)	Ice on board (ton) (b)	Supply ratio*4 (c)	Demand of ice (ton) (a)x(b)x(c)
Leconomie	4	1.5	11/58	1.1
Whaler	33	3.0	11/58	18.8
Semi-industrial	3	12.0	11/58	6.8
Total				26.7

(3) Blast freezer and cold storage

1) Blast freezer

A blast freezer shall be used to make frozen products for bait for long line fishing and bottom long line fishing and to freeze surplus catch. The blast freezer shall conduct air-blast freezing on such main bait fish as mackerel, using a combination of freezing pans and freezing shelves. The freezing shelves shall be equipped with casters for easy wheeling into and out of the blast freezer, with a per-unit frozen weight of about 200 kg to allow for manual wheeling.

The capacity of blast freezer is designed considering the post-harvest losses of mackerel at large catch which is used as bait for artisanal fishing boats except semi-industrial fishing boats. The bait volume needed in a day is 0.3 ton (see Table 2-2-2(41)) excepting for semi-industrial fishing boats and the mackerel mainly catch by gillnet of out board engines are used. The mackerel catch is very much depended on the year and the season as shown in Table 2-2-2(42). 3 ton/day can be caught at a large catch and sell them as fresh bait and or at fish market however remaining about 1 ton/day is discarded. While at an extremely small catch, it is inevitable to buy other bait. Therefore, the capacity of blast freezer is designed as 1 ton/8hours and the effective utilization of post-harvest losses and the stable supply will be attained through supplying it even in an off catch season by storing the remaining volume in blast freezer.

Table 2-2-2(41) Required Bait per Day in Providence Fishing Port

Type of boat	Number of boat (a)	Bait on board (ton) (b)	Supply ratio*4 (c)	Demand of bait (ton) (a)x(b)x(c)
Leconomie	5	0.1	11/58	0.1
Whaler	4	0.5	11/58	0.2
Semi-industrial	3	2.0	11/58	1.1
Total				1.4

Table 2-2-2(42) Monthly Fish Catch of Mackerel by Gill Net in Mahe

(unit: ton)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1999	33.5	79.0	63.3	49.3	26.7	5.1	6.3	5.7	2.4	10.6	26.3	6.7	314.9
2000	76.3	34.8	18.9	11.0	14.0	8.0	33.3	3.4	20.5	0.0	6.8	9.3	236.3
2001	5.5	10.6	4.7	4.5	9.5	0.0	2.7	17.7	0.8	22.0	22.2	54.8	155.0
2002	2.9	45.2	62.2	14.3	12.6	1.8	22.0	8.0	4.3	20.6	6.5	52.6	253.0
2003	22.1	17.8	18.4	32.6	20.2	1.1	1.3	4.2	5.5	14.9	7.0	8.3	153.4
2004	43.0	41.4	20.8	24.1	20.1	12.2	45.9	39.3	52.6	15.0	49.0	25.4	388.8

（Source：Seychelles Artisanal Fisheries Statistics for 2004）

Note: Yellow markers are large catch month and non catch month.

(a) Bait Types

The following 3 major types of bait are used:

a) Frozen Bonito

Bonito caught by purse seiners and with no commercial value. Frozen bonito keeps for a long time but, because of variations in fish size, is considered inappropriate bait for the

tuna and swordfish caught by semi-industrial fishing boats. The Indian Tuna Company Ltd. (ITC) does not sell bonito for bait but fishermen are purchasing bonito directly from purse seiners. The unit price is approximately SR 1,000 per ton.

b) Frozen Squid and Saury

Bait imported by the fish processing companies, consisting of imported squid and saury mainly from Taiwan which can be imported only by a company owning freezing equipment. This type of bait, preferentially sold at a high price to the fishing boats under contract with the fish processing company concerned, is used only by the semi-industrial fishing boats. The import unit price is approximately US$ 2,000 per ton.

c) Mackerel caught locally

Surplus of fish catches landed by local fishermen (mainly pelagic fish such as mackerel) and surplus of pelagic fish used as live bait at the time of a large catch of fish that will not keep for a long time. These types of bait are used by small fishing boats operating for a fewer number of days. The unit price is SR 6,000 per ton, more expensive than bonito.

(b) Purchase of Bait

With the exception of the bonito that fishermen purchase directly from purse seiners, the SFA is planning to purchase the remaining two types of bait in bulk on behalf of the fishermen. The bait will be necessary to purchase systematically through negotiations with the Boat Owner's Association and the fishermen's Corporative (NGO).

(c) Sale of Bait

The SFA is currently selling fuel to fishermen under favorable conditions. After this project is implemented, the SFA will also sell bait, and it is expected that this will cause competition in terms of selling price with two fish processing companies at Victoria Fishing Port. The companies are supplying ice and bait (imported bait) to the fishing boats under contract with them at lower prices than general retail prices, on condition that they sell their catches preferentially to the companies. Since this project is for public facilities, therefore, the SFA should set the price at purchase cost plus necessary expenses, so that purchases and sales will balance instead of a profit being earned from this project.

2) Cold Storage

The cold storage shall be used to store the bait frozen as described above and to store bait for long-line fishing (mainly squid and saury) to be imported from other countries. The SFA does not currently own cold storage and cannot store either the bait to be sold to fishermen or the surplus from catches. After this project is implemented, the SFA will have refrigerated space and space in which to handle bait and decrease post harvest losses of surplus catch.

The blast freezer is designed to store the frozen bait (squid and mackerel) for semi-industrial fishing boats and the bait (mackerel) catch locally by artisanal fishing boats. The storage of frozen bait is assumed as 20ton since it is imported from overseas by 20ton reefer container. And, the

storage of mackerel is assumed as 10 ton (the bait volume needed in one month by artisanal fishing boats) since it depends on big fluctuation of catch volume. The total storage is assumed as 30 ton. The temperature inside is designed as -25℃.

There should be no problem in the maintenance and management of the facilities because there is a plan to employ a engineer for the refrigerators including ice making machines.

Specifications of the blast freezer and the cold storage are shown in Table 2-2-2(43).

Table 2-2-2(43) Specifications of Blast Freezer and Cold Storage

Facility	Blast freezer	Cold storage
Capacity	1 ton/8hours	30 ton
Refrigeration unit	Open type 2-stage reciprocated compressor using ammonium Motor approx. 19 kw	Open type 2-stage reciprocated compressor using ammonium Motor approx. 15 kw
Condenser	Vaporizing type Capacity of 15 ton	Shared with blast freezer
Defrost tank	FRP knockdown model Capacity of 2 ton Heater with a pump	Shared with blast freezer
Cooling unit	Floor mounted evaporator Air-blast type	Cooling unit in the freezer One fan of 0.2 kw 2 sets

2-2-2-3 Basic Plan for Equipment

(1) Forklift

Forklifts are frequently used to convey ice, transport fish catches and load and unload fishing gear. Since no ice shooter is installed at the ice making equipment, forklifts are particularly indispensable for loading boats with ice. Taking into account the per-boat amount of ice on board and the size of the ice making machines and refrigerating facilities, the maximum load shall be one ton. Forklifts shall operate on LPG because of their use indoors and in cold storage. There shall be two forklifts in total, one for Providence and another for Bel Ombre.

Following is a consideration of the per-day operating time of a forklift should one be provided.

1) Preconditions

[Ice on board]

a) One ice bag shall contain 30kg of ice.

b) Considering the box capacity and the forklift capability, the amount to be conveyed per trip shall be 30 kg x 24 bags = 720 kg, which is rounded down to 700 kg per trip.

c) One box shall be used for conveyance.

d) The time required for the loading of ice per trip shall be 0.4 hours (24 minutes), the present situation at Victoria Fishing Port.

[Bait on board]

a) For Victoria Fishing Port, the time required for bait on board per trip shall be 0.2 hours (12 minutes) because of the large quantity of fish boxes for bait storage (400 kg per trip).

b) For Bel Ombre, the time required for the bait on board per trip shall be 0.4 hours (24 minutes), the same as that required at Victoria Fishing Port, as a box shall be used for conveyance.

2) Providence Fishing Port

The amount of ice needing to be supplied per day (with the supply ratio already considered), based on the size of the ice making machine, shall be as follows:

Leconomie class:	1.4 ton
Whaler class:	2.3 ton
Semi-industrial class:	6.8 ton

The operating time of the forklift for ice on board is calculated as follows:

Leconomie-class:	1.4 ton/0.7 ton =2.00	2 trips x 0.4 hours	=0.8
Whaler class:	2.3 ton/0.7 ton =3.29	4 trips x 0.4 hours	=1.6
Semi-industrial class:	6.8 ton/0.7 ton =9.71	10 trips x 0.4 hours	=4.0
		Total	6.4 hours

The amount of bait on board per day shall be as follows:

Leconomie class:	0.1 ton
Whaler class:	0.5 ton
Semi-industrial class:	2.0 ton

The operating time of the forklift for bait on board is calculated as follows:

Leconomie-class:	0.1 ton x 5 boats x (11/58)/0.4 ton = 0.24	1 trip x 0.2 hours	=0.2
Whaler class:	0.5 ton x 4 boats x (11/58)/0.4 ton = 0.95	1 trip x 0.2 hours	=0.2
Semi-industrial class:	2.0 ton x 3 boats x (11/58)/0.4 ton = 2.85	3 trips x 0.2 hours	=0.6
		Total	1.0 hour

The loading of ice and bait alone will take about 7.5 hours of operation per day. Additionally, forklifts shall be used at any time to convey bait purchased from other countries into the cold storage, to load and unload fishing gear in accordance with the fishing season, to transport frozen fish to the blast freezer when the catch is large, and to stack and unstack goods inside the cold storage.

3) Bel Ombre Fishing Port

The amount of ice needing to be supplied per day (with the supply ratio already considered), based on the size of the ice making machine, shall be as follows:

Leconomie class: 0.3 ton
Whaler class: 5.7 ton

The operating time of the forklift for ice on board is calculated as follows:

Leconomie class:	0.3 ton/0.7 ton = 0.43	1 trip x 0.4 hours	=0.4
Whaler class:	5.7 ton/0.7 ton = 8.14	9 trips x 0.4 hours	=3.6
		Total	4.0 hours

The amount of bait to be loaded per day shall be as follows:

Leconomie class: 0.1 ton
Whaler class: 0.5 ton

The operating time of the forklift for bait on board is calculated as follows:

Leconomie class:	0.1 ton x 1 boat x (11/58)/0.7 ton	= 0.03	1 trip x 0.4 hours	=0.4
Whaler class:	0.5 ton x 10 boats x (11/58)/0.7 ton	= 1.36	2 trips x 0.4 hours	=0.8
			Total	1.2 hours

The loading of ice and bait alone will be assumed to take about 5 hours of operation per day. Additionally, forklifts shall be used to load ice and bait and to load and unload fuel tanks and fishing gear to outboard engine boats.

(2) Fish Box

The floor plan of the cold storage (10 m wide by 5 m long) shall be divided into three areas as shown in Figure 2-2-2(3).

a) Space for stacking fish boxes: 1m x 10m
b) Space for stacking without box: 2m x 10m
c) Work space for forklift: 2m x 10m

Bait purchased at the project site consists of bonito from purse seiners and pelagic fish that are the surplus from the catch (such as mackerel), which come in varying sizes. Bait purchased from purse seiners, in particular, is frozen unsorted and not packed in carton. For efficient storage of bait in the cold storage, fish boxes shall be provided. Fish boxes shall be about 1.4m long, 0.9m wide, and 0.7m high approximately. Seven boxes are lined lengthwise in the cold storage (so that the forks of a forklift can be inserted) and stacked three boxes high. The shape and number of fish box shall be 20 boxes with 500 liter plastic container which is possible quantity to store 10 ton of bait for artisanal fishing boats.

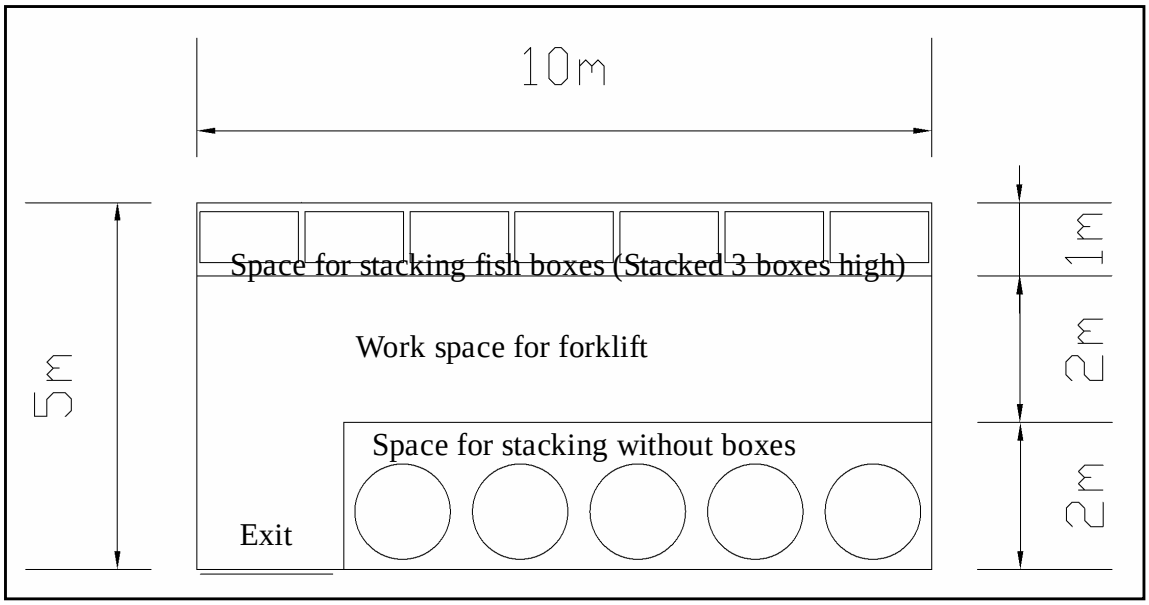


Figure 2-2-2(3) Schematic View of Stacking in Cold Storage

The specifications of fish box are as follows.

Plastic box:	20 boxes
Capacity:	500 L
External dimensions:	Approx. 1,340mm x 865mm x H688 mm

(3) Pallet Box for Forklift

Pallet box to be used for the conveyance of ice bags and other materials and equipment by forklift shall be big enough to contain 24 ice bags with a capacity of 30 kg per bag. There shall be two 850 liter plastic boxes (one for Providence and another for Bel Ombre). The specifications of pallet box are as follows.

Plastic container:	2 boxes
Capacity:	850 L
External dimensions:	Approx. 1,000mm x 1,200mm x H1,000 mm

2-2-3 Basic Design Drawing

2-2-3-1 Outline of the Project

The planned facilities and equipment in the Project are shown in Table 2-2-3(1) to 2-2-3(3).

(1) Civil Facilities

Table 2-2-3(1) Outline of Civil Facilities

Name of Facility	Size	Content of Plan
Providence (Phase 2)		
Quay	Length: Landing quay: 20m Mooring quay: 59m Bunkering quay: 20m Structure: Steel sheet pile type (Vertical pile anchorage)	Crown height: D.L+2.5m Depth: D.L-2.5m
Pavement	Landing quay: length 20m width 10m	Concrete pavement Thickness: 20cm
Mooring buoy	5 units	Polyethylene type Diameter: approx. 1,400mm Height: approx. 990mm
Navigation aid	Buoy type: 3 units Land type: 1 unit	Power source: Solar cell module type Light source: Light emitting diode (LED) type Effective luminous intensity: Approx. 8 cd Luminous range: Approximately 4.5 km

(2) Building Facilities

Table 2-2-3(2) Outline of Building Facilities

Name of Facility	Size	Content of Plan
Bel Ombre (Phase 1)		
Ice plant	Total floor space: ground floor 68m^2 first floor 39m^2 Ice making machine: 3 ton/day 2 units Water tank: 15 ton Ice storage capacity: 9 ton	Steel frame one story, continuous footing Column: steel structure Wall: heat insulating siding Roof: V-shaped steel roofing
Providence (Phase 2)		
Ice plant	Total floor space: ground floor 276m^2 first floor 48m^2 Ice making machine: 5 ton/day x 2 units Ice storage capacity: 15 ton Water tank: 30 ton Blast freezer: 1 ton/8 hours Cold storage: -25 degrees, capacity 30 ton	Steel-flame two-story, continuous footing Column: steel structure Wall: heat insulating siding Roof: V-shaped steel roofing
Administration Building	Total floor space: 204m^2	Steel-frame one-story, continuous footing Column: reinforced concrete Wall: Concrete block Roof: V-shaped steel roofing
Fish handling shed	Total floor space: 96m^2	Steel-frame one-story, continuous footing Floor: floor hardner Column: reinforced concrete Roof: V-shaped steel roofing
Fishermen's gear store	Total floor space: 177m^2 (with toilet and shower room) 2.5m×2m 24 stores	Steel-frame one-story, continuous footing Column: reinforced concrete Wall: concrete block Roof: V-shaped steel roofing
External facilities	Pavement: 3,200m^2 Outdoor Light: 11 nos Reefer container power source: 4 units Fire hydrant: 2 units Water tap: 3 nos Power supply: 5 nos	Interlocking block Height 4.5m, 250 watts

(2)Equipment

Table 2-2-3(3) Outline of Equipment

Name of Equipment	Quantity	Content of Plan
Bel Ombre (Phase 1)		
Forklift	1 unit	Load capacity: 1 ton Fuel: LPG system
Pallet box	1 box	Plastic Capacity: 500 liter
Providence (Phase 2)		
Forklift	1 unit	Load capacity: 1 ton Fuel: LPG system
Fish box	20 boxes	Plastic Capacity: 500 liter
Pallet box	1 box	Plastic, one side door Capacity: 850 liter

2-2-3-2 Basic Design Drawings

(1) Providence Fishing Port

Figure 2-2-3(1) General Layout Plan (Providence)
Figure 2-2-3(2) Plan of Quay
Figure 2-2-3(3) Cross Section of Quay
Figure 2-2-3(4) Layout Plan of Administration Building
Figure 2-2-3(5) Elevation View of Administration Building
Figure 2-2-3(6) Layout Plan of Ice Plant
Figure 2-2-3(7) Elevation View of Ice Plant
Figure 2-2-3(8) Layout Plan of Fish Handling Shed
Figure 2-2-3(9) Elevation View of Fish Handling Shed
Figure 2-2-3(10) Layout Plan of Fishermen's Gear Storage
Figure 2-2-3(11) Elevation View of Fishermen's Gear Storage

(2) Bel Ombre Fishing Port

Figure 2-2-3(12) General Layout Plan (Bel Omble)
Figure 2-2-3(13) Layout Plan of Ice Plant
Figure 2-2-3(14) Elevation View of Ice Plant

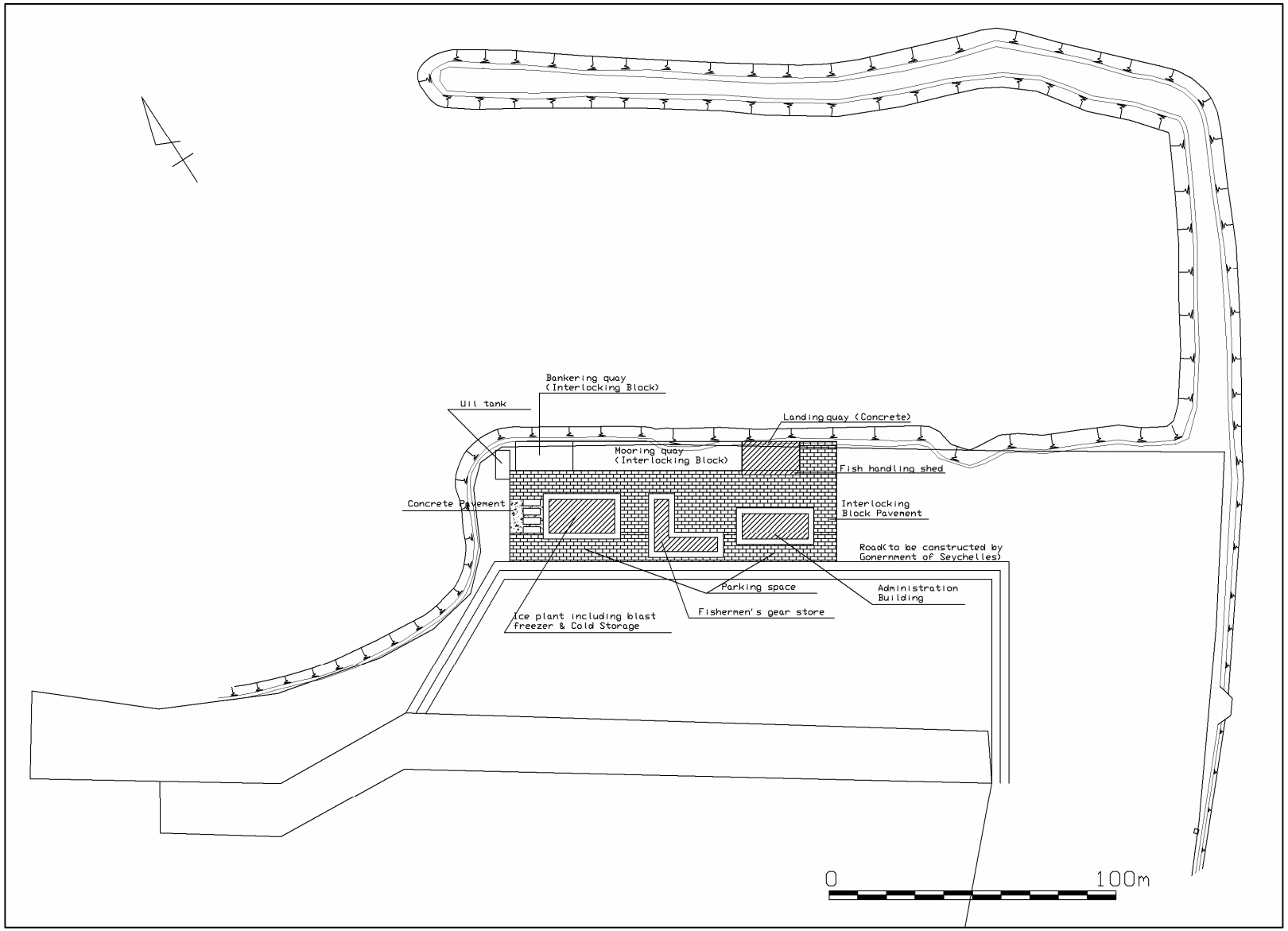


Figure 2-2-3(1) General Layout Plan (Providence)

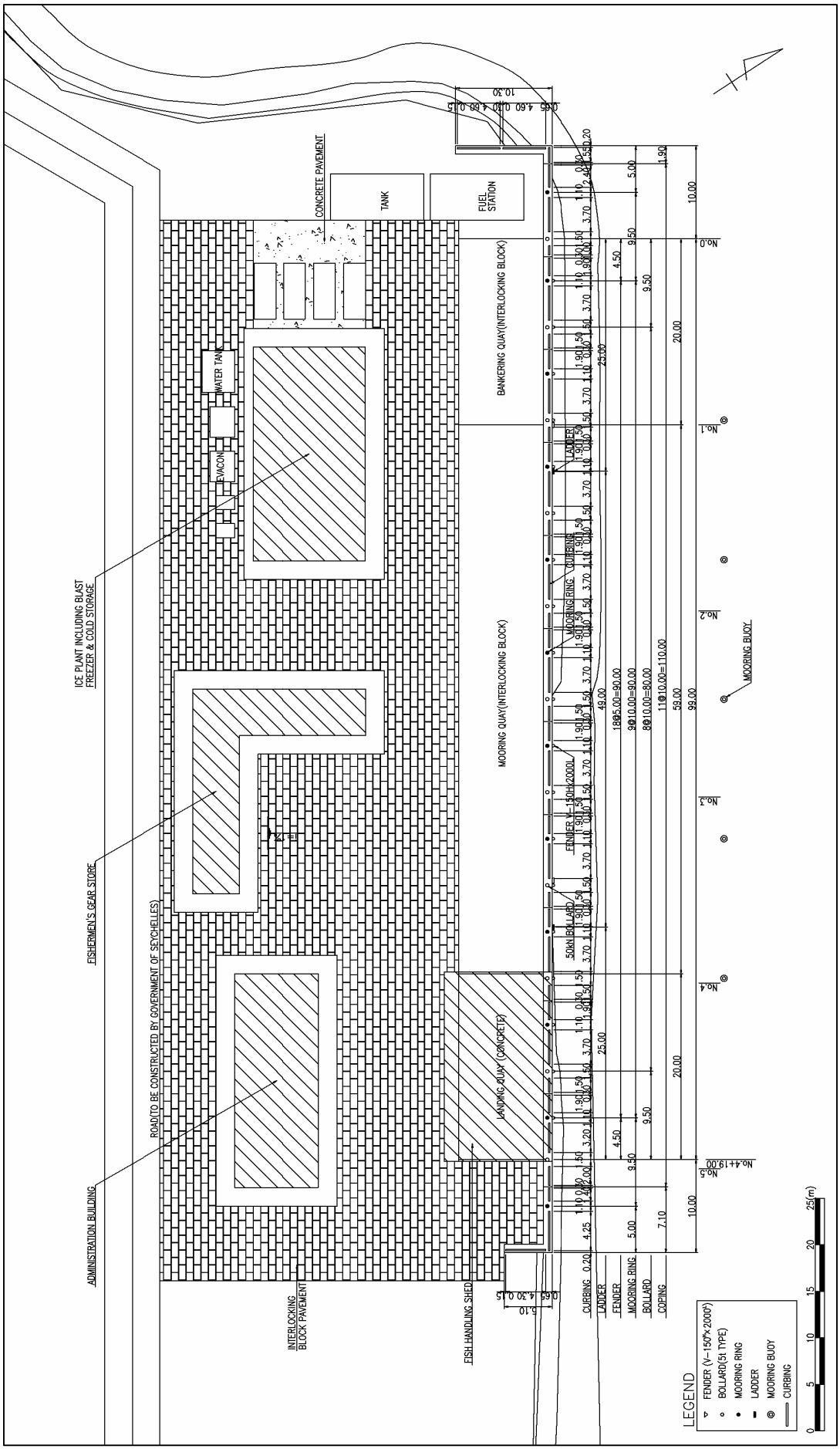


Figure 2-2-3(2) Plan of Quay

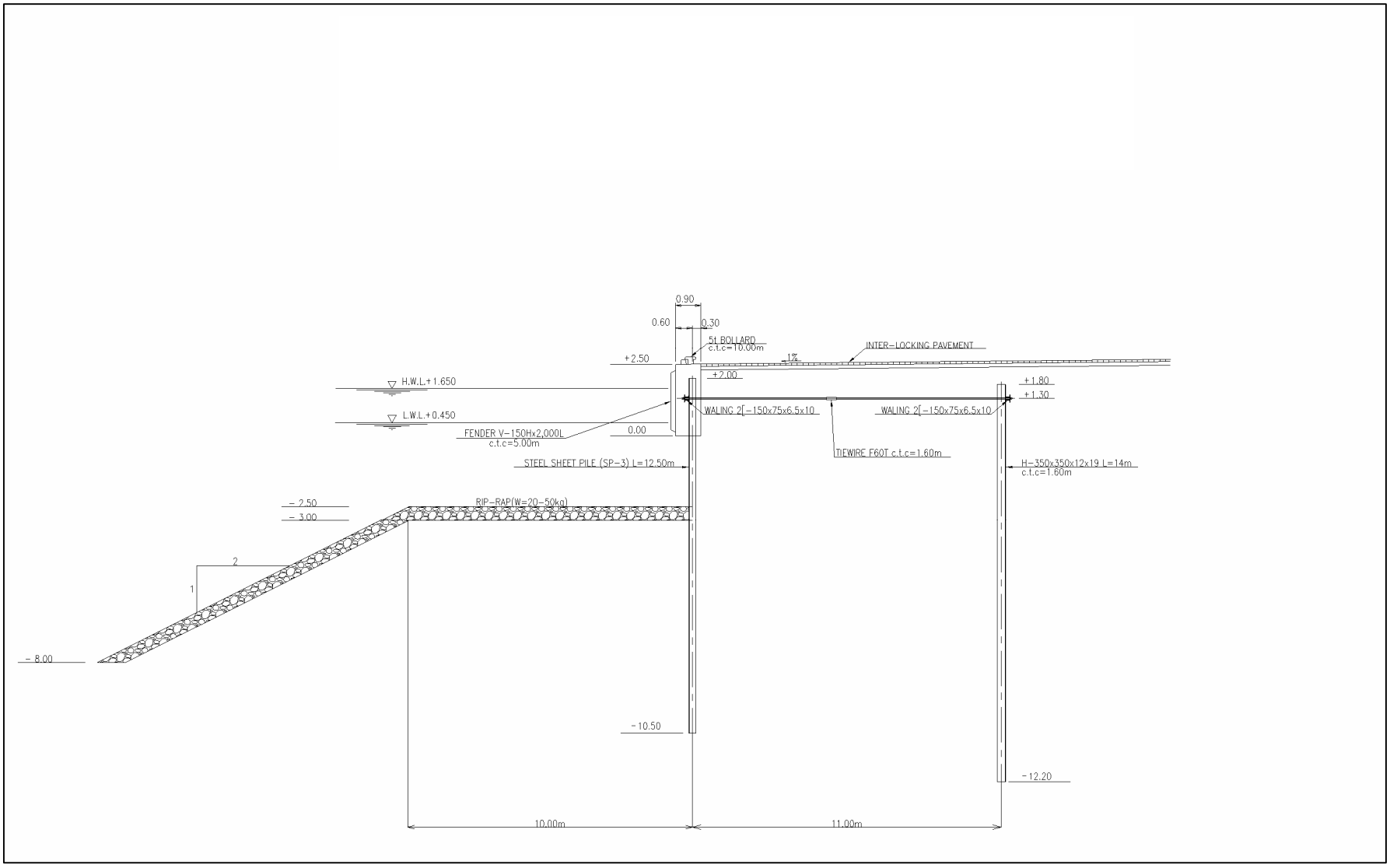


Figure 2-3-3(3) Cross Section of Quay

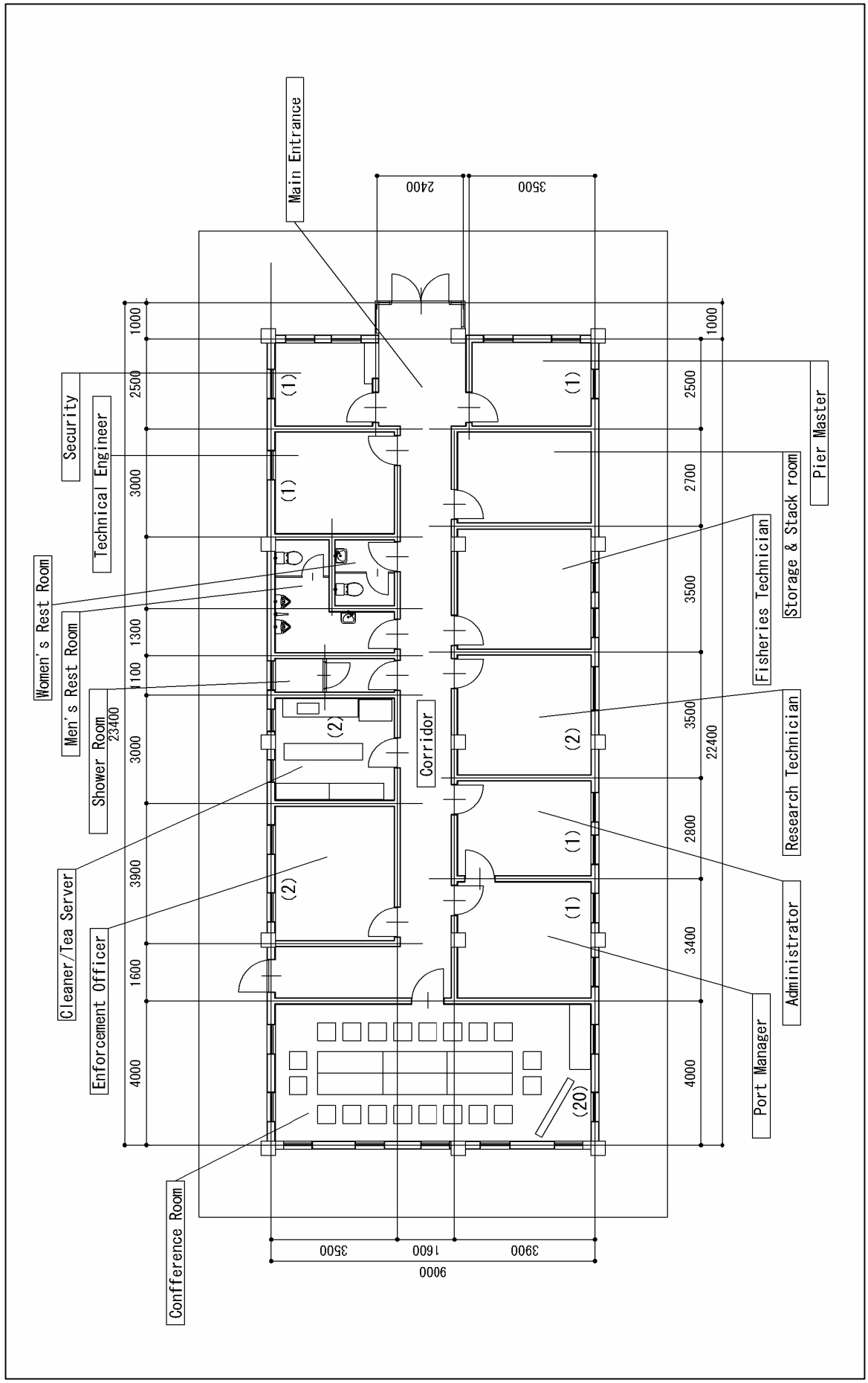


Figure 2-3-3(4) Layout Plan of Administration Building

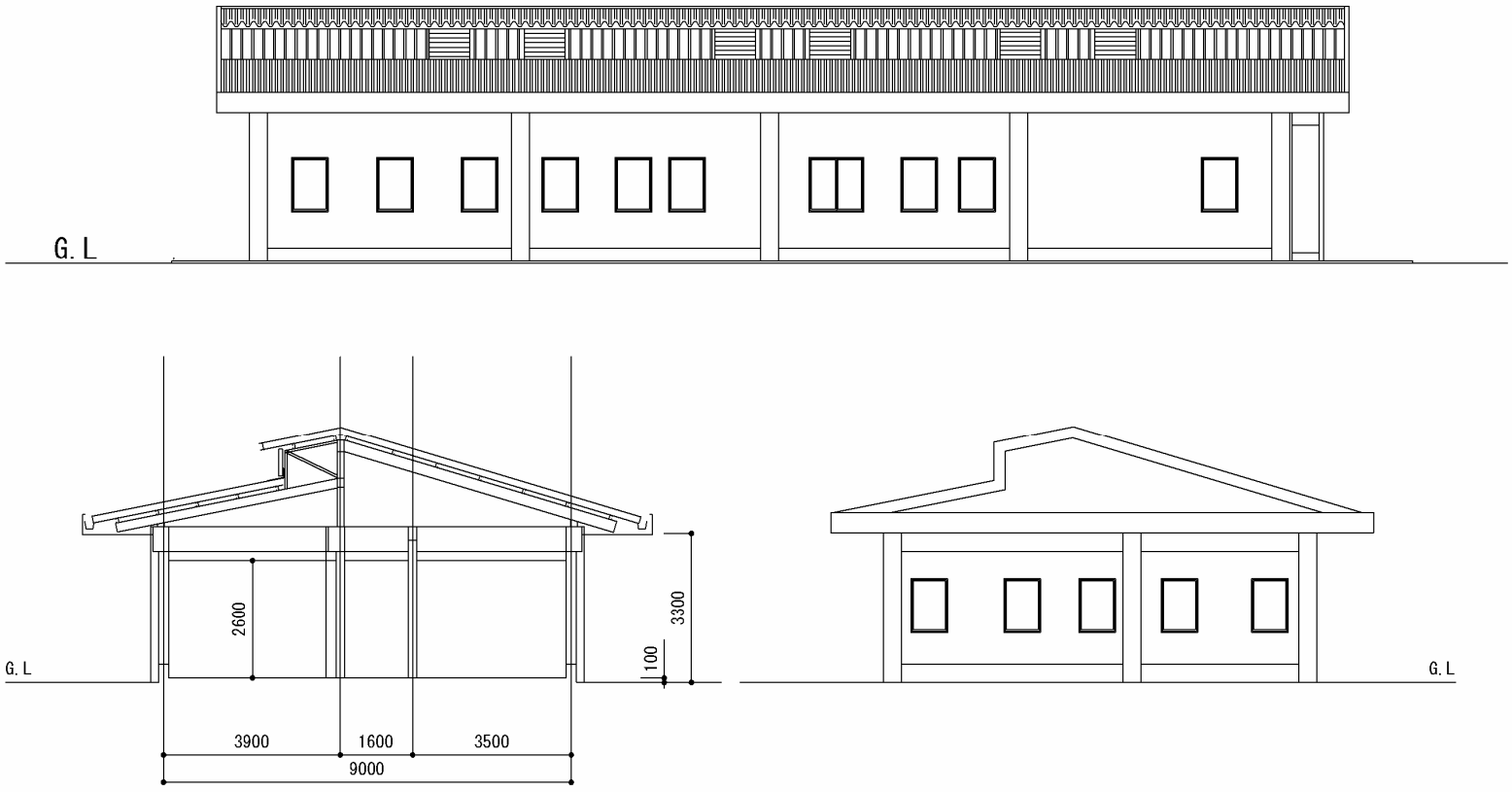


Figure 2-2-3(5) Elevation View of Administration Building

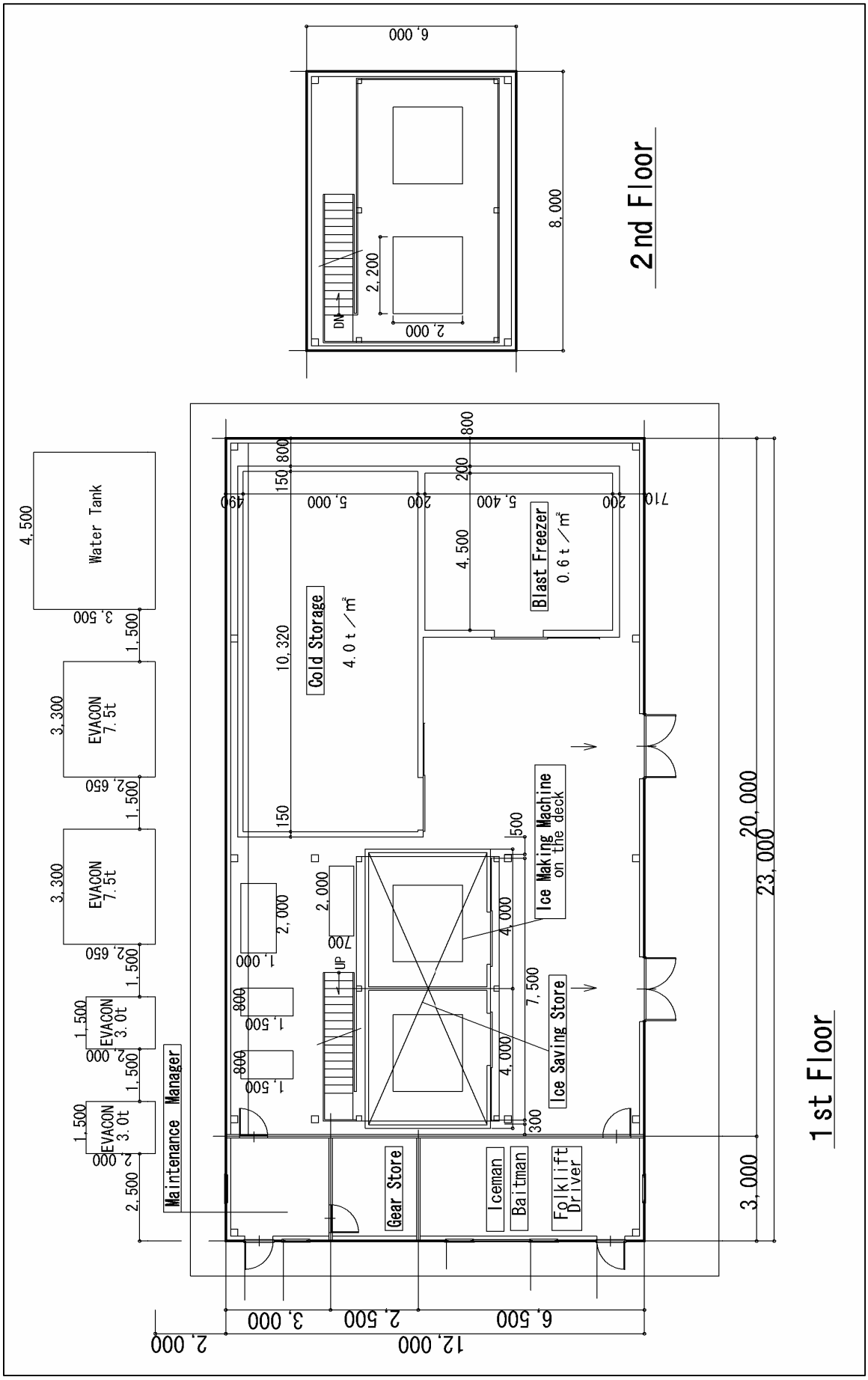


Figure 2-2-3(6) Layout Plan of Ice Plant

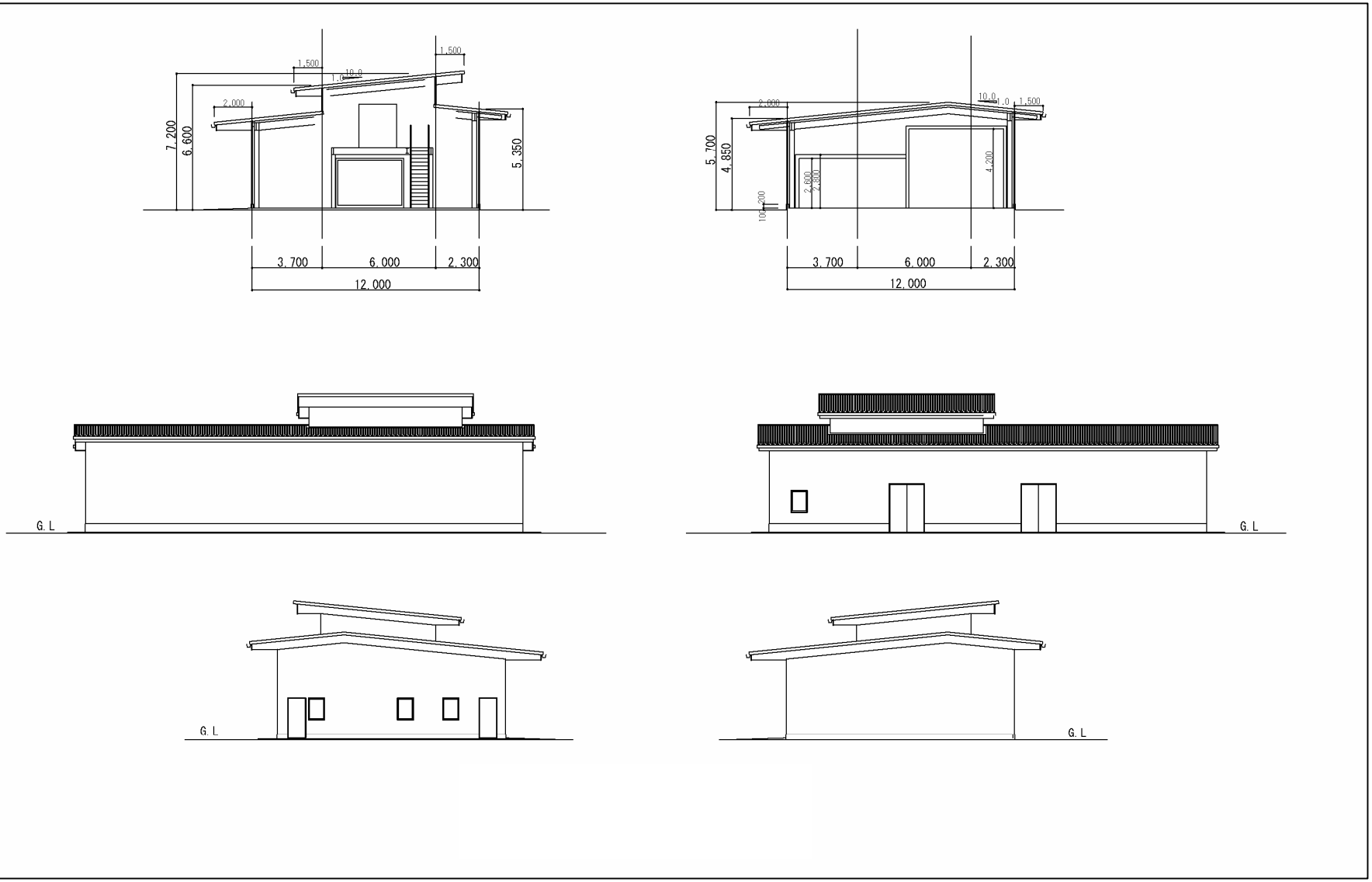


Figure 2-2-3(7) Elevation View of Ice Plant

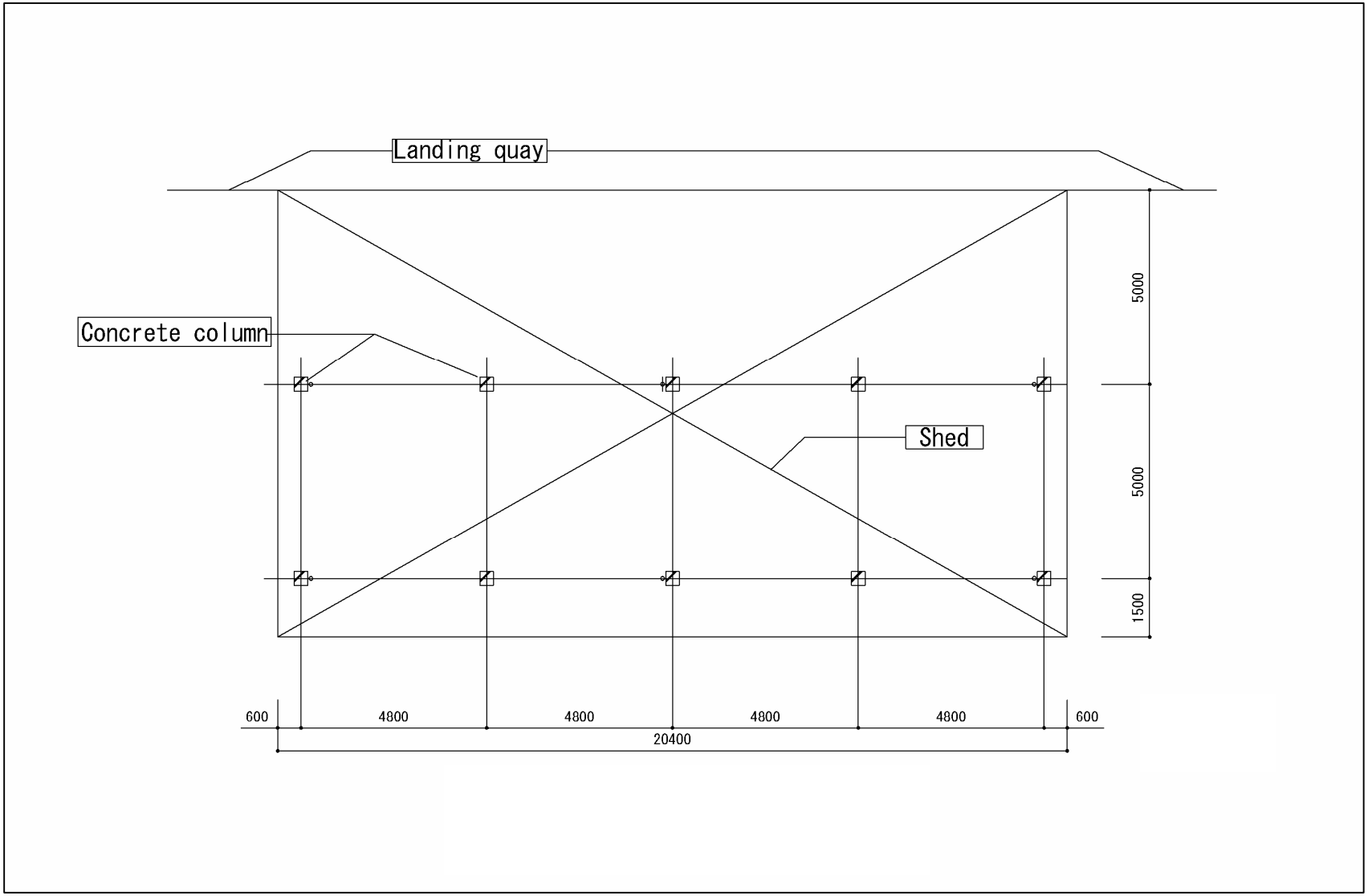


Figure 2-2-3(8) Layout Plan of Fish Handling Shed

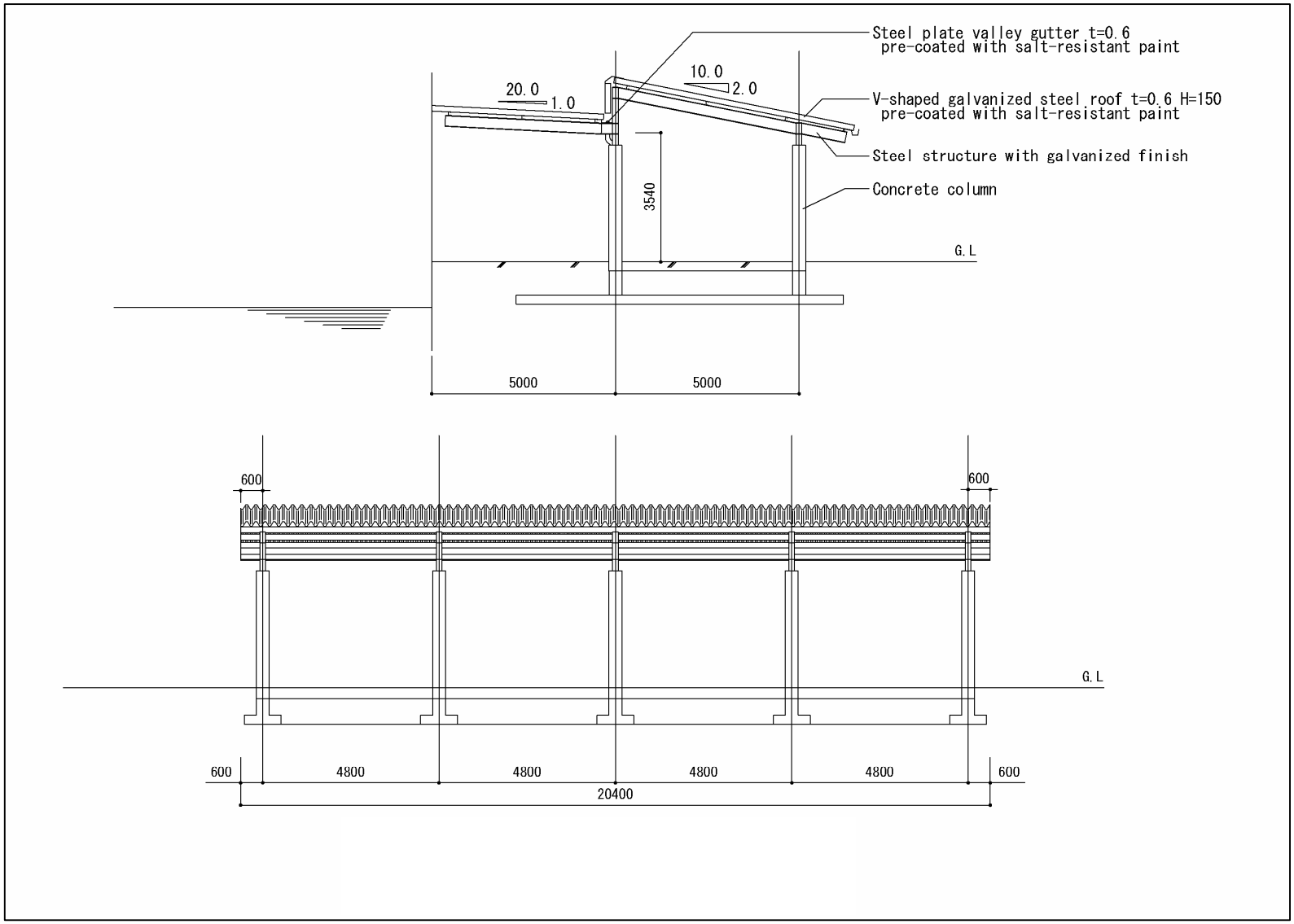


Figure 2-2-3(9) Elevation View of Fish Handling Shed

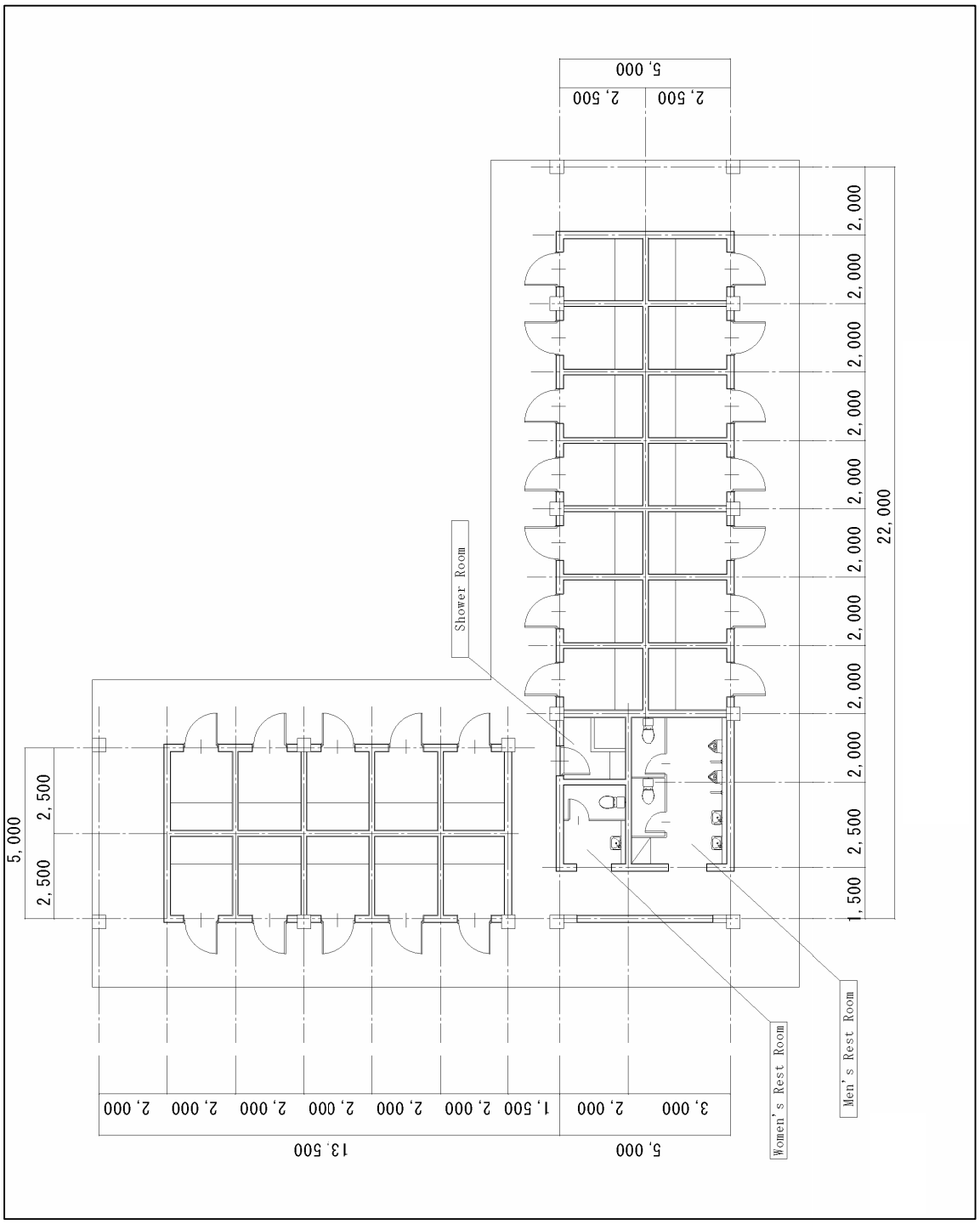


Figure 2-2-3(10) Layout Plan of Fishermen's Gear Storage

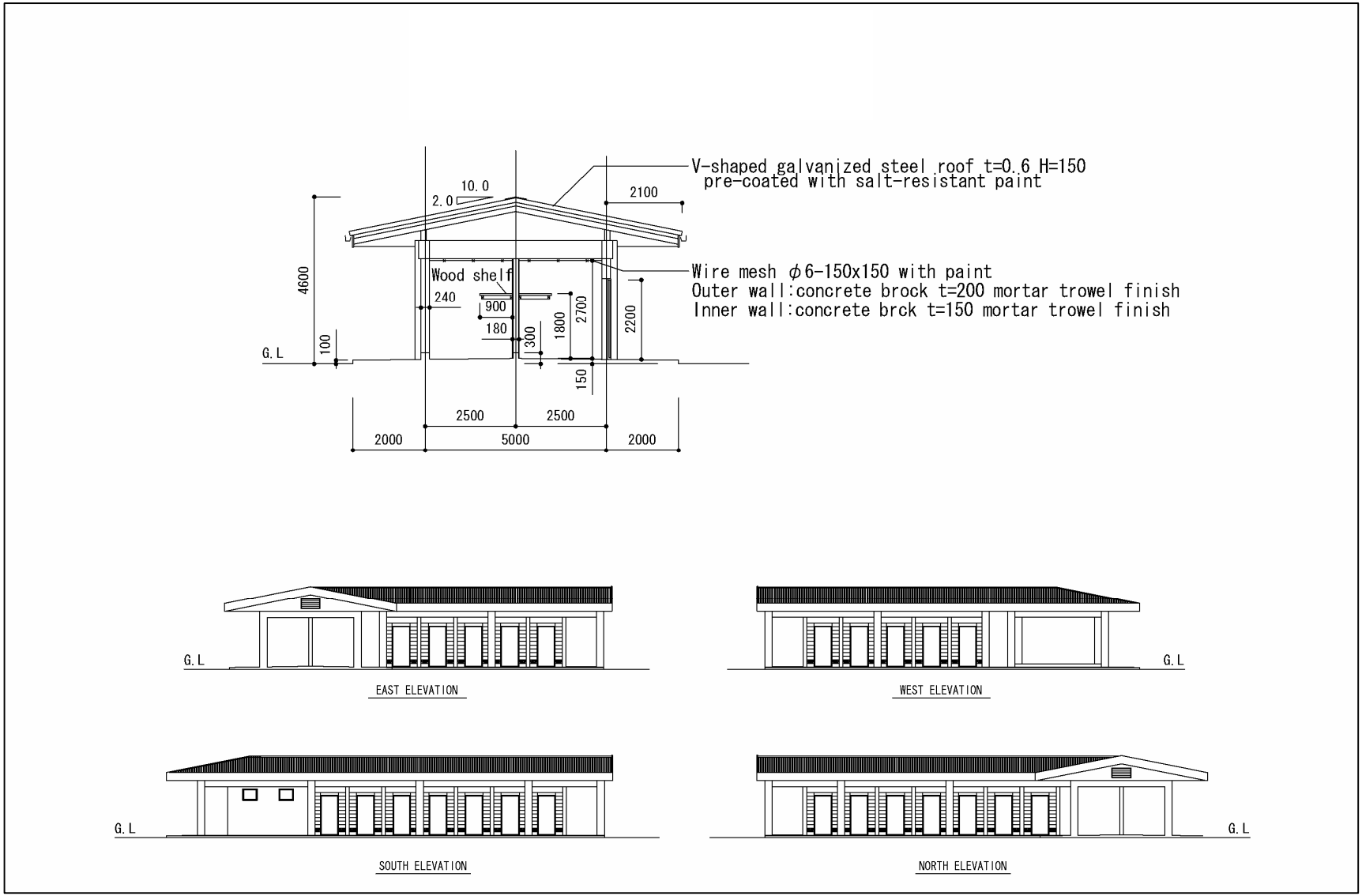


Figure 2-2-3(11) Elevation View of Fishermen's Gear Storage

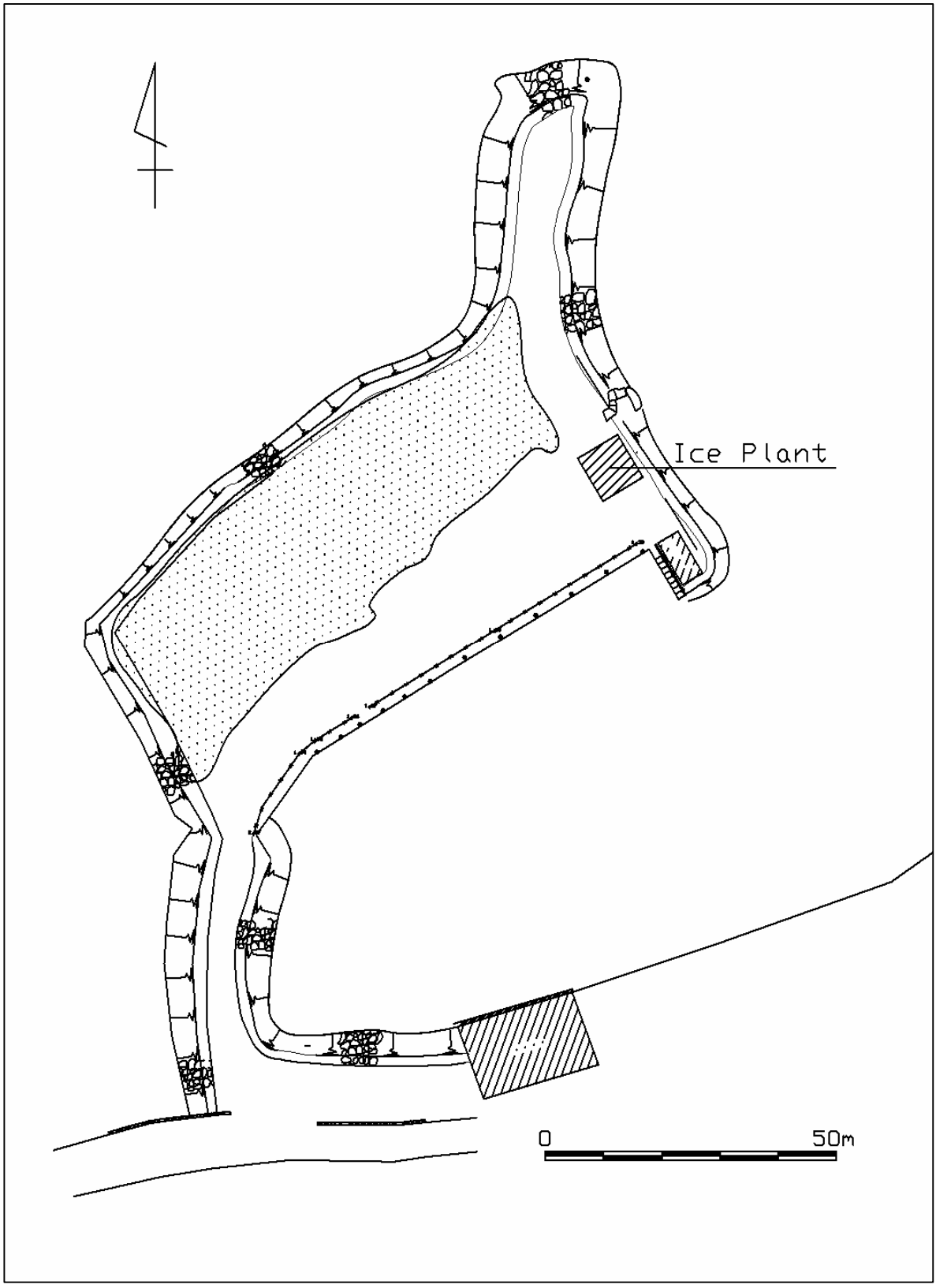


Figure 2-2-3(12) General Layout Plan (Bel Ombre)

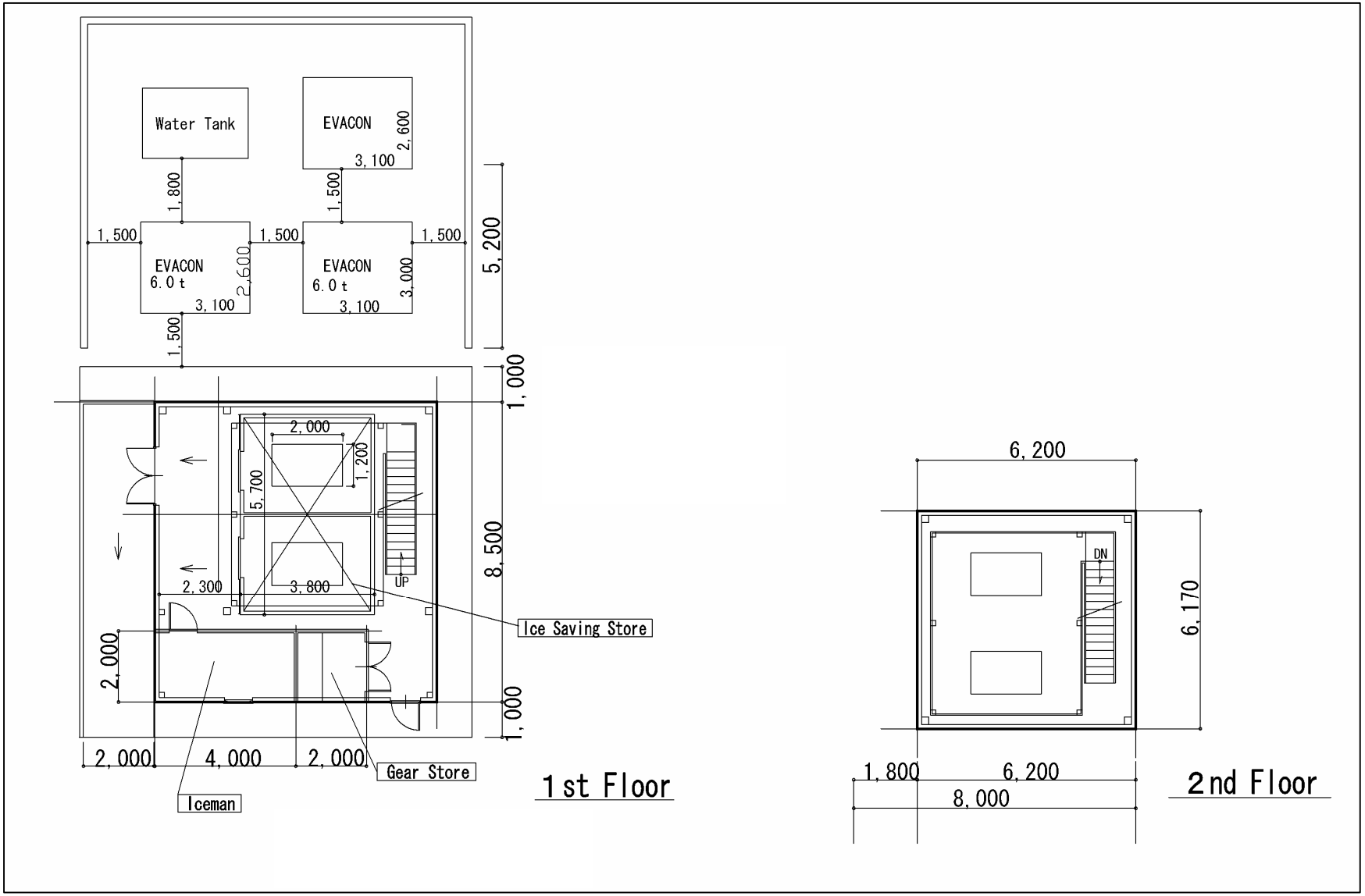


Figure 2-2-3(13) Layout Plan of Ice Plant

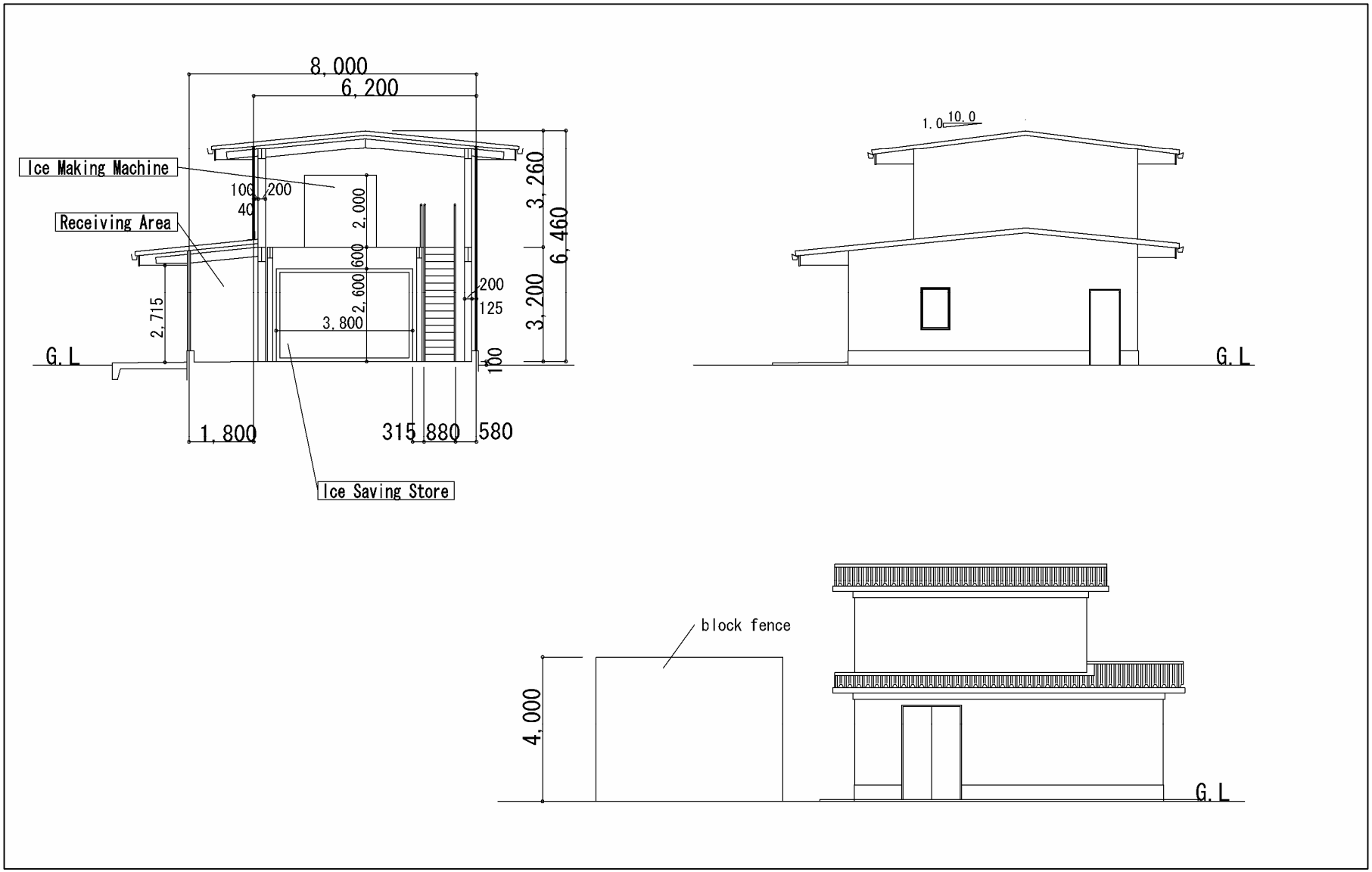


Figure 2-2-3(14) Elevation View of Ice Plant

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Basic Concept

a) Regarding implementation of the Project for the Construction of Fishery Facilities and Supply of Equipment, after the Exchange of Notes (E/N) between the Government of Japan and the Government of Seychelles, an agreement for undertaking consulting services will be concluded between the Government of Seychelles and the Japanese Consulting Firm.

b) The Consulting Firm will prepare all the documents required for the tender and conclusion of the contract, such as the drawings of the facilities, technical specifications, cost estimations and so forth. After the approval of these documents by the Government of Seychelles, the contractor for this project will be selected from and among Japanese construction companies by examination of their pre-qualifications and tender procedures.

c) The construction work will be performed by the selected construction company in accordance with the construction contract concluded between the Government of Seychelles and the construction company.

d) The overall work period is expected to be 5.5 months for detailed design, and phase-1(Bel Ombre) of 8 (eight) months and phase-2(Providence), 12 (twelve) months, i.e. totally 19 (nineteen) months for construction, allowing for the scale and contents of the Project as well as the site conditions.

(2) Implementation Concept

a) The fishery facilities to be built in the Project are civil works, such as landing quay, mooring quay and bunkering quay, and building works, such as an administration building, fish handling shed, ice plant and fishermen's gear storage. The civil works will be carried out on land, except for the rip-rap work for the quay construction, which will be carried out offshore, in order to cut costs and reduce the construction schedule. Construction of the superstructure of the quay wall will be commenced after driving in steel sheet piles, observing their alignment and checking that they are stable, on account of the soft sand layer 5m to 10m under the ground. Although the buildings are planned on reclaimed land where the ground condition is good, the soil bearing capacity will be confirmed before construction commences.

b) Several local construction companies in Seychelles have experience in civil and building works. However, large projects, such as wastewater treatment plants, etc., were constructed by foreign construction companies. One local construction company in Seychelles has experience in marine construction, but the main part of the quay wall works and large-scale reclamation works were carried out by foreign companies. Construction companies have general building work and equipment work experience, such as construction of hotels. With regard to marine works, small type 50 ton class flat barges are available.

c) The ice making machine with blast freezer and cold storage will be procured from Japan, taking into consideration quality and durability, and assembled in Seychelles under the instruction and supervision of Japanese experts.

d) With respect to materials that can be procured locally, the quality and supply capability are to be carefully studied, with priority given to local procurement whenever possible, and procurement from Japan will be minimized in order to suppress costs.

2-2-4-2 Implementation Conditions

(1) Considerations for Construction

1) Construction Company

There are several construction companies which have experience of a small project in Seychelles, and they will be assigned as subcontractors under the supervision of the Japanese construction company.

2) Construction Machinery

There is one leasing company for small size construction machinery in Seychelles, and local construction companies also have construction machinery but of limited type and quantity. Machinery for lease is limited to backhoes, wheel-loaders and dump trucks etc. In formulating the execution plan, planning focused mainly on on-land execution, therefore crawler and truck cranes will be required for long periods. The use of working barges and a diver's boat will be minimized. Basically, as construction machinery are not able to procure locally or from neighboring countries, the machinery will be brought from Japan.

3) Labor

Supervision by skilled Japanese experts will be needed for installation of the ice plant with blast freezer and cold storage. Supervision by skilled Japanese experts will also be needed for the steel sheet piling works and roofing works of the buildings.

4) Construction Materials

Construction materials, including ready-mixed concrete, armor stone, paving blocks and building blocks, are produced in Seychelles. Cement and steel products including reinforced bars are imported mainly from Japan, Europe and India, and other building materials are imported according to need. Therefore, stocked materials are not enough. For the construction planned in this project, those materials in insufficient stock for which it is difficult to assure the necessary quality or the necessary volume through local procurement will be procured from Japan.

5) Safety Control

This project site was constructed a reclamation area which was part of a developed industrial area; it is not a closed resident area. During the construction period, fencing and safety signs will be installed to indicate hazardous areas around the project site clearly in order to prevent entry by or injury to third persons. The contractor should inform the Seychelles Civil Aviation Authority of

the work period and working time etc. before commencing crane work, because the project site is directly under the approach course of aircraft to the international airport.

(2) Implementation Conditions

a) An appropriate construction plan (temporary facility, construction method and schedule) will be prepared, taking into account the natural conditions at the site.

b) The dispatch of Japanese experts will be planned carefully in respect of the number of persons, timing and duration, in accordance with the progress of work.

c) Local equipment and materials will be used whenever possible to minimize the cost of procurement of such equipment and materials from foreign counties.

d) Construction work at the site will require a temporary yard that can be used to accommodate temporary facilities, such as the area where materials and machinery can be kept, a fabricating yard for formwork and reinforcing bars, and other facilities. As noted in the Minutes of Discussions, this land is to be provided by the Government of Seychelles at a location close to the project site.

2-2-4-3 Scope of Works

The scope of works to be undertaken by the Government of Japan and the Government of Seychelles is as follows.

(1) Scope of works to be undertaken by the Government of Japan

[Construction works]

1) Providence Fishing Port

- Construction of quays (landing, mooring and bunkering)
- Construction of an administration building
- Construction of fishermen's gear storage
- Construction of an ice plant including ice making machine, blast freezer and cold storage
- Construction of a fish handling shed

2) Bel Ombre Fishing Port

- Construction of an ice plant (ice making machine)

[Procurement of Equipment]

1) Providence Fishing Port

- Forklift: 1 unit
- Fish box: 20 boxes
- Pallet box: 1 box

2) Bel Ombre Fishing Port

- Forklift: 1 unit
- Pallet box: 1 box

(2) Scope of Works to be Undertaken by the Government of Seychelles

1) Providence Fishing Port

(a) Services and utilities, e.g. electricity, water, sewage and telephone lines connected to the project site, will be provided.

(b) A 420m-long access road with rain water drainage will be constructed from the existing road to the project site.

(c) A 370m-long fence and gate will be erected around the project site.

(d) A fuel station including fuel tanks

2) Bel Ombre Fishing Port

(a) Services and utilities, e.g. electricity, water and telephone lines connected to the ice plant, will be provided.

2-2-4-4 Consultant Supervision

Based on the Government of Japan's policy for grant aid scheme, integrated and smooth detailed design and supervisory work of the execution of the project will be implemented by a consultant who fully understands the main purport of the basic design. At the stage of supervising execution of the project, the consultant will send a resident engineer to the project site, and will make sure that engineers are sent for the necessary duration, based on the progress of the construction works, and will carry out inspections and provide guidance.

(1) Supervisory policy

a) The timeframe of the work will be strictly observed through close communication and reporting between the persons and organizations concerned in both countries to prevent any delay in completion of the facilities, based on the construction schedule.

b) Prompt and appropriate guidance and instructions will be provided to contractors to ensure construction of the facilities in compliance with the drawings and specifications agreed upon.

c) As far as possible, priority will be given to the utilization of local construction methods using local materials.

d) The efficacy of the project as a grant aid project will be fully realized, with the aim of promoting technology transfers relating to construction techniques and technologies.

e) Appropriate guidance and instructions will be provided regarding maintenance of the completed facilities after delivery to the recipient side to encourage smooth operation of the facilities.

(2) Supervisory Work

1) Preparation of Contract

The Consultant will supervise the selection of a contractor to carry out the construction work, determine the type of contract, draft the contract documents, evaluate the detailed work contents and be present at the signing of the contract.

2) Evaluation and Approval of Shop Drawings, etc.

The Consultant will evaluate the shop drawings, materials, finishing samples and equipment

submitted by the contractor.

3) Direction of Construction Work

The Consultant will review the construction plans and schedules, provide instructions to the contractor, and report on the work to the Government of Seychelles.

4) Process of Payment

The Consultant will evaluate and approve the contents of the bills and other documents pertaining to the payments to be made to the contractor during and after the construction, and will provide supports on the necessary procedures.

5) Inspection and witness

The Consultant will conduct inspections, when necessary, of the work in progress and provide appropriate instructions to the contractor. Having confirmed that the work has been completed and the contract fulfilled, the Consultant will witness the delivery of the Project and confirm the Government's acceptance. The Consultant will also report to the Government of Japan any necessary items that arise during the construction concerning the progress of work, payment procedures and status, and delivery of the completed facilities.

2-2-4-5 Procurement Plan

In the process of procuring the materials and equipment that are necessary for the Project, special attention will be paid to the following.

(1) Procurement policy

With respect to materials that can be procured locally, the quality (and inspection conditions) and the supply capability (deadlines and quantities) will be thoroughly investigated and local procurement given priority whenever possible. Procurement from Japan will be kept to a minimum from the standpoint of cost and deadlines.

1) Procurement from Japan

A detailed procurement and transport schedule must be prepared well in advance for those materials and equipment to be procured from Japan that normally require a long period of time from ordering to manufacturing, packing and shipment.

Cost comparisons will be made and cheaper machinery will be selected between construction machineries being procured locally or Japan.

2) Local Procurement

Of the materials to be procured locally, stone, aggregates and other materials that are primary materials will be decided with ample consideration given to the place of origin, quality, transport capability and other factors.

3) Cost

Cost comparisons will be made and lower-cost materials used when materials are procured locally or from Japan. If materials are procured from Japan, additional costs for packing, transport, insurance and port charges will be taken into consideration, as well as tax exemptions.

Based on the above, the procurement plan of the main materials and equipment to be used in the Project will be established as indicated below.

(2) Procurement Items

1) Construction Materials

The following shows the results of investigation of procurement sources based on the avove.

Table 2-2-4(1) Procurement Plan of Construction Materials

Construction Material		Procurement Country			Remarks
		Local	Japan	Third	
Civil work	Fender, bollard for quay wall		x		
	Stone and aggregate	x			
	Reinforced steel bar		x		
	Steel sheet pile		x		
	Tie-wire		x		
	Cement	x			
	Concrete	x			
	Formwork material	x			
	Timber	x			
Building work	Sand and aggregate	x			
	Reinforced steel bar		x		
	Cement	x			
	Concrete	x			
	Formwork material	x			
	Concrete block	x			
	Timber	x			
	Steel fittings		x		
	Wood fittings		x		
	Roofing material		x		
	Glass	x			
	Paint and varnish		x		
	Tile		x		
Electric	Cable		x		
	Conduit tube		x		
	Distribution board, cabinet panel		x		
	Switch, outlet		x		
	Lighting fixture		x		
	Bulb		x		
Plumbing	Piping material		x		
	Bulb		x		
	Plumbing fittings		x		
Air-conditioning	Air-conditioning equipment		x		
	Exhaust fan		x		
Equipment	Ice plant		x		
	Other equipment		x		

2) Construction Machinery

Small construction machinery will be obtained through local sub-contractors, but large cranes are not available. Construction machinery to be used in the Project is shown in the table 2-2-4(2).

Table 2-2-4(2) Procurement Plan of Main Construction Machinery

Machinery			Country			Remarks
			Local	Japan	Third	
	Crawler crane	80t		x		
	Barge with crane	6t	x			
	Tugboat		x			
	Backhoe	$0.8m^3$		x		
	Backhoe	$1.4m^3$		x		
	Dump truck	10t	x			
	Bulldozer	15t		x		
	Truck crane	25t		x		
	Trailer	20t	x			
	Vibrating roller	10t	x			

2-2-4-6 Quality Control Plan

(1) Quality Control of Materials

With respect to the materials used in the construction, supervision is to be carried out in conformance with the following: the common specifications for fishing port construction issued by the Japan Fishing Ports Association, the common specifications for port construction issued by the Ministry of Land, Infrastructure and Transport of Japan, the building construction standard specifications and descriptions in JASS 5, issued by the Architectural Institute of Japan, the common specifications for building construction issued by the Ministry of Land, Infrastructure and Transport of Japan, the building construction supervision manual issued by the Ministry of Land, Infrastructure and Transport, and Japanese Industrial Standards (JIS), and approval is to be obtained in advance before the materials are procured.

(2) Design of Concrete Mix

The composition of the concrete and mortar to be used in the construction works will be studied and tested in advance to confirm the strength, time required for mixing, and other factors, and the methods by which it is to be applied will be investigated. Moreover, a table showing the test results for each mixture, a table showing the concrete strength status, and control charts (X-R control charts, etc.) will be drawn up and the quality maintained and controlled.

2-2-4-7 Implementation Schedule

If this project is implemented through grant aid scheme by the Government of Japan, a Japanese consultant will be selected by the Government of Seychelles following an Exchange of Notes (E/N) between the two countries, and a detailed design and supervision contract will be concluded between the Government of Seychelles and the consultant. After that, the detailed design and tendering documents will be prepared, and the undertaking completed by means of tendering, construction contracts and construction works.

(1) Preparation of Detailed Design Document

After the consultant agreement is concluded between the Government of Seychelles and the Japanese Consultant, the agreement will be submitted to the Japanese Government for verification. Once it is verified, the Consultant will begin drawing up the detailed design. In the detailed design, the following tender documents will be prepared based on this Basic Design Study report: design drawings, technical specifications, instructions for tendering and so forth. During this time, consultations will be held with the Government of Seychelles concerning details of the facilities and equipment, and ultimately, the tender documents will be approved by the Government of Seychelles.

The duration required for the detailed design will be approximately 3.0 months.

(2) Tendering

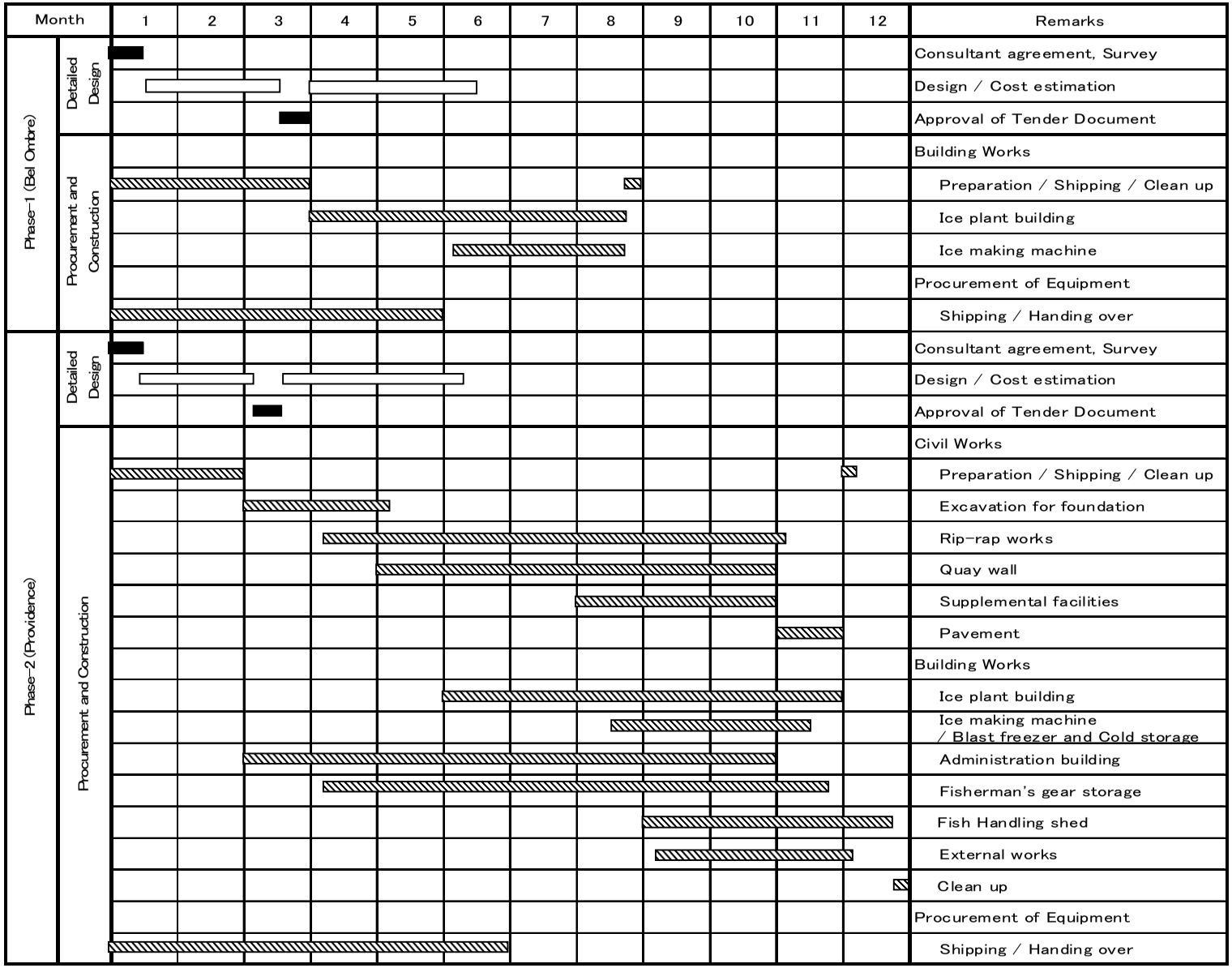
The contractor (a Japanese construction company) who will be involved in the construction of the project facilities will be selected by tender. The tender will be conducted in the following order: public announcement of tendering, receipt of requests to participate in the tender, examination of pre-qualifications, distribution of tender documents, submission of tenders, evaluation of the tenders, designation of the contractor and conclusion of the construction contract. The whole procedure will require 2.5 months.

(3) Execution of Construction Works

The work will start after the construction contract is concluded and the contract is verified by the Government of Japan. As a result of estimation of the construction period, taking into account the scale and contents of the project facilities including problems relating to the local construction conditions, and on the assumption that no force majeure will occur, a period of approximately 19 months that phase-1(Bel Ombre) of 8 (eight) months and phase-2(Providence), 12 (twelve) months will be required.

The process of carrying out the Project from the Exchange of Notes (E/N) to its completion is as shown in Table 2-2-4(3).

Table 2-2-4(3) Implementation Schedule



2-3 Obligations of Recipient Country

The following is a summary of the obligations of the Government of Seychelles as confirmed in the Minutes of Discussions and other documents during the Basic Design Study.

a) Conducting the environmental impact assessment (EIA Class II)
b) Obtaining environmental authorizations.
c) Securing land (temporary construction yard) necessary for the Project
d) Cutting down trees and removing obstacles (scrap, garbage, etc.) from the construction site
e) Securing a disposal site (nearby) for construction waste soil
f) Providing electricity, water supply and sewerage, and telephone lines
g) Constructing the access road with rain water drainage to the site
h) Constructing a fence and gate around the site
i) Constructing a fuel station with fuel tanks at Providence Fishing Port
j) Conducting maintenance dredging in the mooring basin at Providence Fishing Port
k) Conducting maintenance works of the existing breakwater at Providence Fishing Port
l) Establishing the Providence Fishing Port Management Committee in order to start utilizing fishing port facilities
m) Exempting and clearing through customs equipment and materials imported into Seychelles
n) Exempting taxes and other physical levied by Seychelles on Japanese personnel coming into Seychelles in order to carry out the verified contracts by the Government of Japan and work relating to the contracts
o) Providing the necessary arrangements in terms of entering and residing in the country to Japanese personnel coming into Seychelles in order to carry out the verified contracts and work relating to the contracts
p) Paying the fees for banking arrangements and payment authorizations
q) Obtaining any approvals and permissions necessary in Seychelles in order to carry out the construction works
r) Appropriate and effective use of the facilities constructed through grant aid by the Government of Japan
s) Paying all expenses that are necessary to the project and not covered by the grant aid by the Government of Japan

2-4 Project Operation Plan

2-4-1 Operation and Maintenance Organization for the Facilities

Providence Fishing Port will be operated and managed by 18 SFA staffs. A port manager will be appointed from present staffs of SFA head office and the rest of 17 staffs will be newly recruited by the SFA. At present, Victoria Fishing Port is properly operated and managed by staffs of SFA head office. Fishery facilities in Providence Fishing Port constructed by this project are able to be technically maintained and managed due to the technical supports and instructions conducted by staffs of SFA head office.

Ice plant at Bel Ombre Fishing Port will be operated by an ice plant operator and a forklift driver who will be recruited by the SFA. Ice making machine will be concurrently maintained by an ice plant/cold storage engineer recruited for Providence Fishing Port.

The SFA will establish the Providence Fishing Port Management Committee as an adjust committee between port users and related government agencies in order to discuss and resolve management and usage problems at the fishing port and ensure effective use of the facilities. The committee will be composed of the following part-time members, being Managing Director of SFA as the chairman, Ministry of the Environment and Natural Resources, SFA, SPA, PUC, Boat Owner's Association, an NGO and fish processing companies.

2-4-2 Operation and Maintenance Organization

The operation and maintenance organization and work content of Providence Fishing Port are shown in the following Table 2-4-2(1) and Figure 2-4-2(1).

Table 2-4-2(1) Work Content for Operation and Maintenance of Providence Fishing Port

Personnel	Work Contents	Number
Port manager	General management representative, Coordination with the SFA, Ministry of Environment and Natural Resources and Fishing Boat Owner's Association etc.	1
Administrator	In charge of general affairs, such as accounting, clerical tasks etc.	1
Pier master	Responsible for quay use, such as indication of mooring spot etc.	1
Enforcement officer	To monitor illegal operation of fishing boats based in Providence Fishing Port	2
Research technician	To collect fish configuration data and conduct biological analysis immediately after landing	2
Fisheries technician	To collect fisheries statistics such as amount of catch and number of fishing boats to sail in/out	2
Security	Responsible for security at port	1
Ice plant/blast freezer/cold storage engineer	Engineer responsible for operation and management of refrigeration equipment	1
Maintenance engineer	Engineer responsible for maintenance of electricity and water supply and drainage	1
Cleaner/tea lady	Janitor who cleans port area	2
Ice plant operator	To sell ice and collect payment	1
Blast freezer/cold storage operator	To transport bait and fish	1
Forklift driver	Forklift driver	1
Fuel pump/water operator	To supply water/fuel and collect payment	1
Total		18

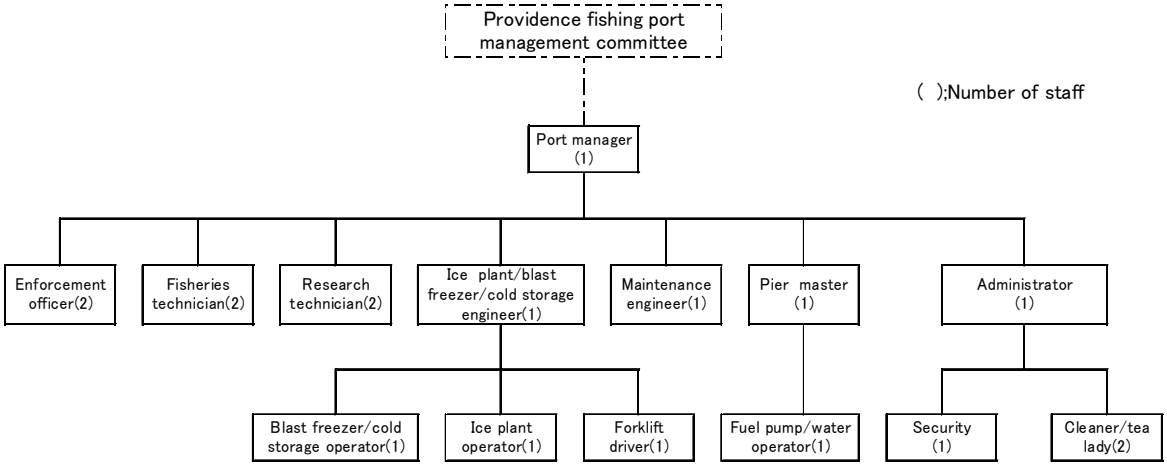


Figure 2-4-2(1) Organization of Providence Fishing Port

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

Project cost estimation is approximate 1,203,000,000 Japanese Yen. This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

Project Cost Estimate **Approximate ¥1,141,000,000**

Table 2-5-1(1) Project Cost Estimation

Item			Project Cost Estimation (¥)	
Facilities	Civil Works	Providence Fishing Port Landing Quay, Mooring Quay, Bunkering Quay	372,000,000	1,023,000,000
	Building Works	1) Providence Fishing Port Administration building, Fishermen's Gear storage, Ice Plant with Blast Freezer and Cold Storage, Fish handling shed, External Works 2) Bel Ombre Fishing Port Ice Plant	642,000,000	
Equipment		Forklift, Fish Boxes, Pallet Boxes	9,000,000	
Detail Design and Consultant Supervision				118,000,000

(Note: US$=115.83 Japanese Yen: Average rate of six month which is August 2005 to January 2006)

The cost borne by the Government of Seychelles is estimated tentatively. Total cost will be 2,787,000 Seychelles Rupees (SR). Details are as shown in Table 2-5-1(2).

This will be budgeted as the cost for the implementation of this project out of National Budget for the SFA. This amount is equivalent to 5% of the budget of Ministry of Environment and

Natural Resources and 26% of the SFA budget in 2005 however, it has been confirmed at the time of Explanation of Draft Final Report that the SFA shall be secured it by applying the special budget to the Ministry of Finance.

Table 2-5-1(2) Cost Borne by the Government of Seychelles

Items	Cost (SR)
Providence Fishing Port	
Electric power supply to site (250m)	453,000
Water supply to site (250m)	210,000
Waste water pipe connected to site (250m)	210,000
Telephone line to site (250m)	47,000
Access road construction to site with rain water drainage (420m)	1,252,000
Fence and gate installation around site (370m)	66,000
A fuel station including fuel tanks	382,000
Sub total	2,620,000
Bel Ombre Fishing Port	
Electric power supply to site (125m)	92,000
Water supply pipe to site (125m)	75,000
Sub total	167,000
Total	2,787,000

2-5-2 Operation and Maintenance Cost

(1) Operation and Maintenance Cost

Operation and Maintenance costs of fisheries facilities of Providence and Bel Ombre Fishing Ports can be estimated as shown in Table 2-5-2(1) and 2-5-2(2). The SFA has properly been managing Victoria Fishing Port. The SFA will also directly manage Providence and Bel Ombre Fishing Ports. Operation cost is calculated based on the cost of existing facilities (water, electricity and ice) and salary scale mentioned in the Utilization Plan for fisheries facilities in new Providence and Bel Ombre Fishing Ports.

Table 2-5-2(1) Operation and Maintenance Cost at Providence Fishing Port

Unit : Seychelles Rupees (SR)

Expenditure		
(1) Personnel cost		
Port Manager	5,150 SR x 12 months	61,800
Administrator	4,150 SR x 12 months	49,800
Pier Master	2,250 SR x 12 months	27,000
Enforcement Officer (2)	3,150 SR x 2 persons x 12 months	75,600
Research Technician (2)	3,150 SR x 2 persons x 12 months	75,600
Fisheries Technician (2)	2,250 SR x 2 persons x 12 months	54,000
Security	2,250 SR x 12 months	27,000
Ice plant/Cold Storage Engineer	5,150 SR x 12 months	61,800
Maintenance Engineer	3,150 SR x 12 months	37,800
Cleaner/Tea Server (2)	2,250 SR x 2 persons x 12 months	54,000
Ice plant Operator	2,250 SR x 12 months	27,000
Blast Freezer/Cold Store Operator	2,250 SR x 12 months	27,000
Forklift Driver	2,250 SR x 12 months	27,000
Fuel Pump Operator	2,700 SR x 12 months	32,400
	Sub total	637,800
(2) Operation cost		
1) Electricity		539,734
Basic Charge	125KVA x 12months x 27.49SR	41,235
Administration building	17.67kw/hr x 8hr x 25days x 12months x 0.69SR	29,262
Fishermen's gear storage	2.83kw/hr x 2hr x 25days x 12months x 0.69SR	1,172
Ice plant/blast freezer & cold storage	73.75kw/hr x 24 hr x 365days x 0.69SR 6.51kw/hr x 8hr x 25days x 12months x 0.69SR	445,775 10,781
Fish handling shed	2.26kw/hr x 10hr x 25days x 12months x 0.69SR	4,678
Outdoor lights	3.3kw/hr x 10hr x 25days x 12months x 0.69SR	6,831
2) Water		135,582
Administration building	$2m^3$ x 25days x 12months x (8.42+3.32)SR	7,044
Fishermen's gear storage	$2.4m^3$ x 25days x 12months x (8.42+3.32)SR	8,453
Ice plant/blast freezer & cold storage	$25m^3$ x 365days x 13.16SR	120,085
3) Bait expense	(35ton x 12months) x 1000kg x 2.7SR x 0.8	907,200
4) Maintenance cost for facilities	0.1% of Construction cost	28,000
Cost 1)+2)+3)+4)	Sub total	1,610,516
Operation and Maintenance Cost	Total	2,248,316

Income		
(1) Sales of ice and bait		
1) Sales of ice	((10ton/day x 25days x 12months)/0.05ton) x 14SR	840,000
2) Sales of bait	(35ton x 12months) x 1000kg x 2.7SR	1,134,000
(2) Rental fee of fishermen's gear storage	24 units x 12 months x 255 SR	73,440
Income	Total	2,047,440

Table 2-5-2(2) Operation and Maintenance Cost of Ice Plant at Bel Ombre Fishing Port

Unit : Seychelles Rupees (SR)

Expenditure		
(1) Personnel		
Ice plant Operator	2,250Rs x 12months	27,000
Forklift Driver	2,250Rs x 12months	27,000
	Sub total	54,000
(2) Operation Cost		
1) Electricity		188,896
Basic charge	50KVA x 12months x 27.49SR	16,494
Ice plant	27.58kw/hr x 24hr x 365days x 0.69SR 3.44kw/hr x 8hr x 25days x 12months x 0.69SR	166,705 5,697
2) Water		48,034
Ice plant	$10m^3$ x 365days x 13.16SR	48,034
3) Maintenance cost of facility	0.1% of Construction cost	7,131
Cost 1)+2)+3)	Subtotal	244,061
Operation and Maintenance Cost	Total	298,061

Income		
(1) Sales of Ice		
1) Sales of ice	((6ton/day x 25days x 12months)/0.05ton) x 14SR	504,000
Income	Total	504,000

(2) Balance

Providence: 2,047,440-2,248,316= -200,876 SR

Operation and maintenance costs run in deficit.

Bel Ombre: 504,000-298,061= +205,939 SR

Operation and maintenance costs run in surplus.

As the deficit of Providence Fishing Port is covered by the profit of an ice plant at Bel Omble Fishing Port with the break even and therefore, the operation and maintenance is seems possible. Both ports are managed by the SFA directly, so in case that the balance of payment is not kept, the SFA is to compensate it from the total budget (about 11 million SR in 2006).

2-6 Other Relevant Issues

The following are items that should be dealt with promptly following the signing of E/N in order to ensure that the project is carried out smoothly.

a) The SFA shall apply for a planning permit to the Government of Seychelles and carry out procedures for obtaining permits.
b) The SFA shall secure the disposal site near the project site for surplus soil from excavation for foundation work.
c) There are some abandoned discharge pipes and some trees growing in the project site where construction is planned that need to be removed. Since any delays in clearing the site for construction will have a major impact on the implementation of the project, it is essential that the removal, clearing and grubbing work shall be carried out quickly.
d) SFA shall conduct to residents to keep off the project site from land and sea under instructions of the SFA duration of construction works, where is a reclamation area although there is no residence near the project site.
e) Aircraft runway approach is lining above the project site. The contractor should inform crane works before commenced to Seychelles Civil Aviation Authority. The SFA shall provide for the smooth handling of above procedure.
f) The SFA shall conduct to residents to keep off the project site duration of construction works at the Bel Ombre site.
g) The SFA shall establish the Providence Fishing Port Management Committee and prepare for fishing boats to transfer from Victoria Fishing Port to Providence in order to commence to use the facilities in Providence Fishing Port after completion of the project.

Chapter 3

Project Evaluation and Recommendations

Chapter 3 Project Evaluation and Recommendation

3-1 Project Effect

The following effects are expected in particular and this project is considered appropriate as the project under Grant Aid.

<Direct Effects>

1) Dissolution of port congestion in Victoria Fishing Port

Fishing boats using Victoria Fishing Port will be reduced in number from present 113 boats to 77 boats by the relocation of fishing boats to Providence and Bel Omble. (Mooring boats per day will be reduced from 58 boats to 40 boats) Because the 100% of fishing boats can be moored automatically.

The port congestion will be resolved, as the result, the facilitation of landing and preparation work for sailing out and the safety mooring are going to be possible. These lead to higher operation ratio, reduction of boat repair, lowering post-harvest losses and the income of fishermen can be improved.

2) Promotion of artisanal fisheries in Providence

24 fishing boats will use this fishing port relocated from Victoria Fishing Port. Estimated landing volume is 273 ton per year and this is going to be the 3rd largest fishing port next to Victoria and Bel Omble.

3) Promotion of artisanal fisheries in Bel Omble

21 fishing boats combined with 12 boats relocated from Victoria Fishing Port will use this fishing port. Estimated landing volume is 447 ton per year which increased 48% comparing with the year of 2004.

4) Facilitation of preparation work for sailing out in Victoria and Bel Omble Fishing Ports

Maximum about one week waiting time for getting ice that fishermen in Victoria and Bel Omble Fishing Ports has suffered will be pretty much resolved.

5) Stable supply and lowering of post-harvest losses of bait in Providence

The stable supply and lowering post-harvest losses from a large catch of bait for 24 fishing boats relocated from Victoria Fishing Port can be ensured.

<Indirect Effects>

1) 6 medium and small fish processing companies wish to move in fish processing facilities that The Government of Seychelles is to construct in parallel with the construction of fishing port in Providence and 2 processing companies already operated in the area will make fish processing complex. With this complex a new market is born and the economic effect such as on the export promotion of fishery products, labor employment, multiplied effects to related industries like

distributions and sales are expected.

2) The economic effects is promised such as on multiplied effects to related industries like distributions and sales promotion and labor employment in Bel Omble Fishing Port. The vitalization of the area economy can be expected by the fishery promotion together with tourism promotion through construction of recreational facilities (Park, Restaurant and etc.) which the Government of Seychelles is now in progress in parallel with the construction of fishing port.

The effect and the improvement degree from the present is shown in Table 3-1(1).

Table 3-1(1) The Effect and the Improvement Degree from the Present

Current status and issues	Countermeasures (Project)	Effect & Improvement degree
1. The quay in Victoria Fishing Port is extremely congested by the increase of fishing boats and it leads to lowering freshness of fish due to the bad landing efficiency in landing quay.	・Construction of fishing port facilities in Providence ・Construction of ice plant in Bel Omble Fishing Port	24 boats relocate from Victoria Fishing Port to Providence Fishing Port and 12 boats from Victoria to Bel Omble so, the number of fishing boats in Victoria will be reduced to 77 boats from 113 boats and 100% mooring become possible.
2. With the same reason above, the mooring quay in Victoria Fishing Port has faced to increasing danger for mooring.	-Ditto-	-Ditto-
3. In Victoria Fishing Port the waiting time for about one week in maximum has born due to the insufficient ice supply to fishing boats.	・Construction of ice plant in Providence Fishing Port ・Construction of ice plant in Bel Omble Fishing Port	The waiting time for ice supply will be almost solved in Victoria and Bel Omble Fishing Ports.
4. Major fishing boats in Bel Omble are now landing and mooring in Victoria Fishing Port due to no ice supply there and this leads to the congestion of Victoria Fishing Port.	・The installation of ice plant in Bel Omble Fishing Port	12 fishing boats used Victoria Fishing Port but registered in Bel Omble relocate to Bel Omble Fishing Port and this contribute to solve the congestion of Victoria Fishing Port
5. The fish catch of mackerel as the bait for artisanal fishing boats is very much depended on season and post-harvest losses in a large catch and shortage in a small catch are born.	・Installation of blast freezer and cold storage in Providence Fishing Port	Stable supply of bait and lowering post-harvest losses can be attained in Providence Fishing Port.

3-2 Recommendations

It is recommended that the implementing agency, SFA shall make use of the facilities after the completion and operate them paying much attention to the following points.

(1) Proper Operation and management

The balance of payment for the operation cost in Providence Fishing Port will show about SR 200 thousand deficit while Bel Omble is expected to the same amount surplus which the balance will even out each other. However, it is necessary to operate efficiently and pay attention to cutting the costs.

(2) Safe and effective quay management

Quay for landing, mooring and bunkering have been minimized against number of fishing boats to use in Providence. The SFA is required to instruct proper landing order or mooring spot and operate and manage the quay with safe and effective utilization when boats will be gathered one time at the time of sailing out and landing. The mooring of non operated boats could be the cause of port congestion therefore, it is necessary to make fishermen respect fishing port utilization rules including to move non operated boats from fishing port facility to other spot like rubble mound seawall located at inner part of basin.

(3) Periodical facility inspection

In order to extend life span without loosing facility function, it is important to inspect the facilities periodically and usual maintenance work. It is said that a constructed facility after 10 years from its completion requires checking and repair. Concerning the corrosion of steel structure, if the re-painting is done when the rust is found the cost of repair will be small and prevent the deterioration and the expected lifetime can be extended. Therefore, after the completion of these facilities, the SFA which manages the facilities is expected to set up the items to be checked (For example rust on structures and etc.) and if some defects are found by execution of regular checking the immediate repair is required.

(4) Bait sales for semi-industrial and artisanal fishing boats

After this goes to the operation, the SFA is to sell bait other than sales of ice and it could be competed with the prices of two fish processing companies in Victoria Fishing Port. The fish processing companies are supplying bait (imported) and ice cheaper than general retail price to contracted boats subject to getting their fish catch on a priority base. Therefore, the SFA can not expect the profit by the sales of bait but should aim to have good balance in buying and selling of bait that is the price adding necessary expenditure on bait purchasing cost price.

(5) Garbage control in Providence Fishing Port

The project site of Providence is located on extension line of runway of Seychelles International Airport. So, Seychelles Civil Aviation Authority is anxious about some troubles for

takeoff and landing of aircraft by means of sea birds which are gathered after raw garbage and fish snuffs. This project does not include such facilities to process fishes however, the SFA should entirely control raw garbage like from food stuff.

(6) Repair of armor stone of existing breakwater

The breakwater has been constructed by the Government of Seychelles in Providence. As the weight of present armor stones is 500～1,000kg/piece it is considered poor against extreme storm waves. The Government of Seychelles should execute the remedial work in case that the breakwater is damaged by such wave.

(7) Maintenance dredging of basin

The mooring basin of this project site in Providence has been dredged keeping water depth of 9～10m by the Government of Seychelles. It will not be considered that the beach littoral drift or immediate erosion by sediment transport from rivers however, some changes like sedimentation in long time viewpoint will be imperative. Therefore, periodical sounding survey should be conducted and the maintenance dredging should be executed by the Government of Seychelles when necessary.