No.

Fisheries Division,
Ministry of Agriculture, Forestry & Fisheries
Saint Vincent and the Grenadines

BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
OWIA FISH LANDING COMPLEX CONSTRUCTION
IN
SAINT VINCENT AND THE GRENADINES

October, 2006

JAPAN INTERNATIONAL COOPERATION AGENCY

ECOH CORPORATION

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PREFACE

In response to a request from the Government of Saint Vincent and the Grenadines, the Government of the Japan decided to conduct a basic design study on the Project for Owia Fish Landing Complex Construction and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to St. Vincent a study team from February 22 to March 19, 2006.

The team held discussions with the officials concerned of the Government of Saint Vincent and the Grenadines, 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 St. Vincent 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 Saint Vincent and the Grenadines 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 Owia Fish Landing Complex Construction in Saint Vincent and the Grenadines.

This study was conducted by ECOH CORPORATION, under a contract to JICA, during the period from February, 2006 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 St. Vincent 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,

Eiichi Matsuura
Project manager,
Basic design study team on the Project
for Owia Fish Landing Complex Construction
ECOH CORPORATION

Summary

Summary

Saint Vincent and the Grenadines is the island country located at south of Lesser Antilles in Eastern Caribbean Sea consisting of St. Vincent Island and Grenadines with other various 600 islands. 344sq.km is for St. Vincent out of 389sq.km of total land area.

The population is 117,534(assumption in 2005) and GDP/C is US$2,520 (in 2000).

Saint Vincent is the volcanic island having north-south mountain ranges with the forest and there are few flat lands in the coasts. The climate is tropical with 26 ° as annual average temperature, 1,500mm annual precipitation in seashore and approximately 3,800mm in inland mountains.

The main industry of the country is agriculture however the cultivated acreage is very limited to 10% of total land area and the preferential treatment with England that has been the major exporting country is going to be abolished within a few years.

Therefore, tourism and fishery as alternative industries of agriculture become national main issue. In the goal of Three Year Plan for National Development (2004-2006) “Poverty reduction through an export promotion and private sectors within the framework for the correction of income imbalance and ensuring the food security” has been set out. As the relevant policy “Slough off from traditional banana industry and is taking fishery industry as an important developing sector which inhabits bountiful unused resources in view of valuing diversity of products” has been also recognized. In the Fisheries Policy and Plan, “The ocean has supplying most important natural resources however it is necessary to continue to develop getting the supports from advanced countries since the resources in deep water and offshore area are unused except some coastal resources. 4 Basic Policies are as follows.

① Promotion of total output and improvement of productivity through the improvement of processing operation and quality control after catch.
② Promotion of development in artisanal fisheries through improving the quality of marine products.
③ Export promotion by adopting the advanced export standard for marine product and the production increase of import-alternative products.
④ Enhancing administrative capabilities including the Fishery Division

There exists only the artisanal fishery in St. Vincent now and 2000tons catch per year is sufficient to supply the domestic demand therefore, it will have a limit to make fishery industry as key industries even by the expansion of domestic market.

Under the circumstance, the exploitation of overseas market is inevitable. Fortunately enough, St. Vincent has fishing ground of large size migrant like tuna in offshore where will be a key to exploit overseas market and also had achievement of 168tons of average export volume. Actually however, St. Vincent has received the notice on 22 December 2000 to eliminate her from the third country list concerning fin import with 7

improvements order as human food from EU which is an important major overseas market. As the countermeasure, the Government of St. Vincent has requested the support to Japan and Cuba. The upgrading of Kingstown Fish Market to correspond with HACCP and the improvement of inspection facility and equipments were conducted by the support of the Government of Japan and they will go into full-scale operation from October 2006.

The Government of St. Vincent has developed 25 fish landings places and set up 7 fisheries zonings to connect each fish landing place with cold chain by government operated Kingstown Fish Market Company which will be founded in the fiscal year of 2006 and is going to cope with the increase of domestic and export demand. The infrastructure development of each fish landing facility has been completed except Zone-2, Layou Zone-5, Biabou and Owia and the function enhancement is now the issue. The Fishery Division, Ministry of Agriculture, Forestry and Fisheries of St. Vincent is now preparing to issue a process manual (Hand Book) to handle fresh fish processing for each fish landing place as well as developing legal system.

The issues of fishery industry of St. Vincent are as follows.

① It will have a limit to make fishery industry to be a key industry even by the expansion of domestic market due to the small domestic demand.

② Therefore, the exploitation of overseas market is inevitable.

③ HACCP corresponding is required on the exporting goods and the equipments and the facilities (Processing facility, Ice-making facility, Child facility, Freezing facility and etc.) have to be corresponded to HACCP as well as enhancing staff training when overseas market is targeted.

④ At the same time, as the quality and the stable supply are required consequently, it is necessary to keep constant fish catches.

⑤ It is necessary to confirm the resources, enhance fish catch devices and develop the base for safety operation so as to solve these issues.

⑥ For that reason, it is necessary to give proper attention to both domestic and overseas demands by a rink among 25 domestic fish landing places in St. Vincent with cold chain. Fishery Division is now proceeding to develop fish landing bases including National Kingstown Fish Market Company realizing the cold chain rink as their policy under the support of advanced countries.

Under the circumstances, the fishery sector in St. Vincent has planned to develop 11 fishery centers to support artisanal fishery and 8 centers have been constructed (7 fishery centers were constructed by Japanese Grant Aid Cooperation) Owia out of remaining 3 places being located at north east of St. Vincent Island is not developed yet and there is the situation that no proper fishing port and related facilities exist in the coast of Atlantic Ocean. Owia has 2nd fish landing volume in St. Vincent Island next to Kingstown. However, Owia has many problems such as the difficulty to berth and moor by fishing boats, unsafe work of fishermen and big loss after catch due to the several restrictions resulting from topographic and oceanographic condition and unsettled situation as fishing

port and related facilities. With that background, the Government of St. Vincent has requested the construction of Owia Fish Landing Complex, Breakwater and etc. by Grant Aid Cooperation to the Government of Japan in June 2004 in order to realize the promotion of safety and the proper treatment after catch. The Government of Japan has accepted the request and the preliminary study has been conducted in July and August 2005 in order to judge the appropriateness as the Grant Aid Cooperation. As the result of the study, the project appropriateness and the necessity have been confirmed and the priority has established and the slipway was ranked as top priority together with other civil facilities, building facilities and equipments. The Government of Japan has decided to send the team for Basic Design Study and their schedule was as follows.

The Basic Design Study: February 21, 2006 ～March 22, 2006

The Explanation of Draft Final Report: August 20, 2006～August 31, 2006

The following situations have been confirmed through the study.

① Difficulty to berth and moor for fishing boats.

The fishing boats here are small boats with the LOA of about 8m and 32 boats are actually working. As quay, mooring facility, slipway and so forth are not equipped, the fish landing place is mere the flat place with the width of 2 m in the coast made of gravel and fishing boats are enforced to land facing waves breaking at the time of berthing.

② Unsafe fishermen's work

Owia Bay is faced to open sea and the breaker zone with wave height more than 1m is spread at the existing landing place and in front of the project site. Since, there are no breakwater or revetment to protect fishing boat activities nor safe tranquil water area, 6 men are now required for fish landing and in and out of the boats.

2 crews and 4 supporters totaling 6 men are now required for fish landing

③ Big harvest loss after catch

Good fishing ground is scattered about adjacent water area of Owia bay and it is an operation water area for fishing boats of other countries which belong to Caribbean Sea, and also utilized as trading spot of fresh fish from St. Lucia, Martinique and etc. However, in the area of North Windward (Owia, Fancy, Sandy Bay) including the project site, there are no cold storage facility and it is difficult to get ice there therefore, unfortunately, there are many chances to throw out fish since fish freshness can not be kept by cold storage facility.

④ Many chances to damage to fishing boats

Fishing boats are often damaged by hitting the gravel and are necessary to repair repeatedly at the time of landing and lost the chances to sail out fishing

With above reasons, this project has been decided to construct the fish landing complex in Owia area covering 3 fishing villages Fancy, Owia and Sandy Bay from the

north within the zone-5 in the zoning of St. Vincent. The project is to construct and supply ①civil structures ②building facilities ③fresh fish storage facility ④ material for fresh fish distribution.

The facilities and equipments which will be constructed and supplied in Owia Fish Landing Complex by this project are shown in the following list and they will be separated by two stage constructions. This project is to require 5.5 months for detailed design, 10.5 months for 1st stage construction (civil engineering works) and 7 months for 2nd stage construction (civil engineering, buildings and equipments).

Project cost is estimated with One billion four hundred thirty million yen for Japan side and Six million yen for recipient country.

The content of planned facilities and equipments

(1) First Phase Construction

Classification	Facilities	Specification	Quantity
Civil Engineering Facilities	1) Land Reclamation	Designed Foundation Height：＋7.5 （Cutting；9,448m³、Filling；5,860m³）	3,023 ㎡
	2) Revetment	Structure: Composite type with wave absorbing work and Rubble Rock Mound Seawall Quay：20m（Crown Height+1.1） （Ancillary Facilities；Fenders、Bollard、Car Stopper、Lighting）	90m
	3) Slipway	Structure：Trihedral (16m×57m) Slope：1:6、Designed water depth：-2m （Ancillary Facilities：2 winches、Sayrah）	912 ㎡

(2) Second Phase Construction

Classification	Facilities	Specification	Quantity
Civil Engineering Facilities	1) Breakwater	Structure ： Composite type with wave absorbing work Quay：15m（Crown Height+1.1） （Ancillary Facilities：Fenders, Bollard, Car Stopper、Light Bean、Lighting）	35m
	2) Rubble Rock Mound Seawall	Structure: Rubble Mound Type	44m
	3) Road・Pavement	Road：6m×122m、1:10 Slope Pavement：Slipway（322.5 ㎡）、 Revetment（75.6 ㎡）	732 ㎡ 398 ㎡
Building Facilities	1) Fishery Center Building	Structure：RC（27.5m×14.5m×4.2m） Cooperative Office、Manager Room、Fishery Division Office、Assembly Room、Processing Factory、Fishing Gear Sales Booth、Toilet	397.75 ㎡
	2) Fishermen's Locker Building	Structure：RC（4.0m×29.0m×3.6m） ①Locker：20 No. ②Toilet：Men(2)、Women(1) ③Shower：Men(2)	116.0 ㎡

	3) External Facilities・Others	①Pavement（Concrete Pavement） ②Fishnet Drying Space（Concrete Pavement） ③Septic Tank（Compound Treatment Tank、below 60ppm） ④Water Tank（8ton）	1,280 ㎡ 450 ㎡ 1unit 1unit
	4)Special Facilities	① Ice Making Facility（1ton/day、Flake Ice）、 ② Ice Storage Facility（2ton）、 ③ Refrigerator（2ton +/-5℃）、 ④ Freezer（2ton、-25℃） ⑤ Fuel Supply Facility（Fuel Tank：2,000ｌ、Gasoline ・Diesel、Fuel Pump：2Pumps、2Counters , 2Nozzules ） ⑥ Emergency Generator（65KVA）	1Unit 1Unit 1Unit 1Unit 1Set 1Unit

Classification	Facilities	Specification	Quantity
Equipments	1) Stainless Washing Basin	1,800×760×900	2 no.
	2) Stainless Working Table	1,800 ×760×900	2 no.
	3) Heat Insulated Fish Boxes	From Fishing Boat：1,100×570×670 Transport from Fisheries Center：1,180×1,040×117	28no. 2no.
	4) Fish Trey	Freeze Fish：1,150×750×70 Chilled Fish：652×365×218	70no. 70no.
	5) Fish Box for Freezer	1,500×1,200×1,600×10tiers	4sets
	6) Pressure Washer & Horse	Discharge Rate：30～32ｌ、Horse Diameter：1/2inch×10m	1set
	7) Diving Compressor	Discharge Pressure 29MP Rotating Speed1,200	1no.
	8) Plastic Fish Box	1,105×542×257	28no.
	9) Platform Scale	0～150kg	2no.
	10)Spring Scale	0～10kg	4no.
	11)Handcart	0～200kg	2no.
	12)FRP Tank	1,700×1,000×540	1 no.
	13)Plastic Perforated Basket	572×404×260（with handle）	4no.

By the completion of this project the following effects are expected and therefore, it is judged to be appropriate and significant as grant aid cooperation.

【Direct Effects】

① Fish landing place is equipped in Owia area

Fish landing time will be drastically improved from present average two hours to average 1 hour by constructing the quay. The preparation time for sailing out will be considerably shortened from present average two hours to average one hour.

② Landing work becomes efficient

As safe water area will be secured by the construction protective facilities for fishing port, safe workability will be secured and consequently, labor force for preparation and landing per one boat will be lightened from present 6 men to about 2 men.

③ Safety work is secured

As the chance to sailing out will be increased by facilities construction, 85 tons/year of landing volume will be increased.

④ Unloading volume is increased

By installing cold storage facilities such as Ice making, Child and Freeze Storages, preserving freshness of fish catch become possible and decrease fish thrown.

⑤ Preservation of freshness

Installation of cold storage such as ice making facility, child facility and freezing facility keep fish catch preserve freshness and can decrease post-harvest losses.

⑥ Area for refugee (escape) is created

The project site where oceanographic conditions are very sever has good fishing grounds and not only fishing boats belong to Owia, Fancy and Sandy Bay but also fishing boats belong to other ports can utilize this as a refuge port.

⑦ Damage of fishing boat is decreased

The working time for repairing wooden boats which were damaged by strong breaking waves and rocks will be decreased to a few times in a year due to the development of tranquil water area by the construction of surrounding facilities and the slipway construction.

⑧ Distribution volume of fish catch is increased

With the construction of Fisheries Center in this area, not only the volume of thrown out fishes is decreased or the number of sailing out is increased, but also fish catch will be collected here and distribution volume to surrounding area will be increased.

【Indirect Effects】

① Fresh fishes unloaded at the Owia Fisheries Center will make the supply volume, the quality fishery products and the cash income increased not only in three villages (Fancy, Owia and Sandy Bay) but also in other towns and villages near George Town and total St. Vincent Island through Kingstown Fisheries Market.

② With the development of this facilities, labor environment of fishermen will be improved and the increase of days operated and fisheries income can be expected. It is expected that the motivation of fishermen will be improved and the employment opportunities will be born.

③ It can be contributed to regional development expecting this will be the repository of fish catch with the construction of fisheries facilities in St. Vincent as first one in north east of the island.

It is recommended that North Windward Fisheries Cooperative which is the operation organization of Owia Fish Landing Complex after the completion of the project shall operate and manage it paying the attention to the following points.

① Proper operational management

The operation and management of facilities will be consigned to North Windward Fisheries Cooperative after conducting training and supporting by Fisheries Division of St. Vincent, National Fish Market Company and Cooperative Department. This Fisheries cooperative would commence their work after well trained however this is supposed to be independent enterprise which is required efficient operation and cutting unnecessary cost.

② Management of safe and efficient water facilities

Quay for landing and preparation is planned as minimum necessary construction against present number of fishing boats. There is a possibility to be congested by fishing boats at the time of sailing out and fish unloading. However, the working time in comparison with the present situation is possible to be reduced dramatically. It is necessary to operate safe and efficient utilization of the water facilities having with operation rules.

③ Trade Embargo other than the Owia Fish Landing Complex

Storage time of fresh fish will be improved a lot with the installation of chilled storage facility by this project. With this, it is not necessarily to clean fish within a day after catch. Fish trade with the exception of own consumption should be prohibited at any place than Owia Fish Landing Complex as the rule of Fishery Center. Especially, direct trade with brokers or fresh fish buyer boats from overseas countries should be prohibited in view of accurate counting of fish catch volume.

It is necessary to send customs officers from Kingstown to check the fish export when foreign boats arrives Owia Fishery Center to buy fish.

④ Establishment of fish trade rule

This project is going to improve retail booth however, the establishment of trade rule to sell fish through fishery cooperative with fresh fish brokers from capital region is necessary. In order to realize it, the fish trade rule that fishery cooperative takes all landed fish and the fishery cooperative will pay back to fishermen according to the result of the sale. As a matter of fact, the trade rules to restrict to take fresh fish from fishing boats without ice in view of promoting the quality control for keeping freshness are necessary.

⑤ Usage of Ice

Fishermen are inadequate to consider of ice necessity due to the one day fishery. Fishery

Cooperative should educate fishermen that the quality preservation of fresh fish is influenced on fish price and it is definitely necessary to make fishermen always use ice. It is necessary to educate that fish thrown out will be decreased by using ice and consequently the income of fishermen will be increased.

⑥ Equipment application

The accuracy of fishery data will be improved by the management of fishery cooperative for the fish catch since the equipments such as ice boxes, heat-insulated fish boxes, scales will be supplied. The fishery cooperative will educate and make fishermen fully understood how to use fish boxes or scales according to the supply purpose.

⑦ Lecture and Training for fishermen

Fishery Cooperative will take a tax preference depending on the activities. Therefore, they are necessary to contribute to fishermen's better life by conducting lectures for the dissemination of fish catching skills or enhancement of living standard and for their recreation.

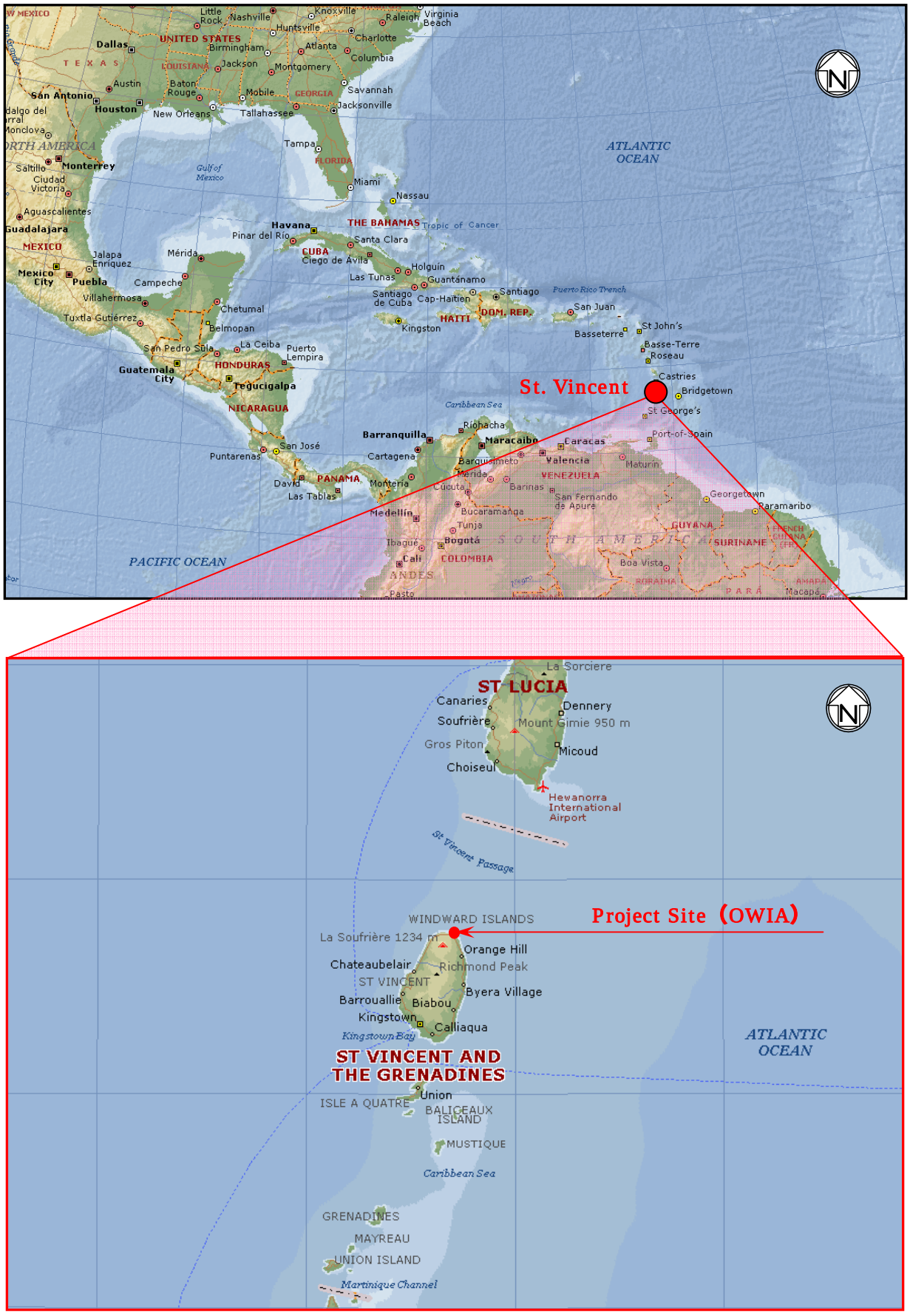
⑧ Fishery Statistic

St. Vincent points to enhance administrative capabilities including the Fishery Division as one of related policy of Fisheries Policy and Plan. Presently, it is necessary to improve the statistic concerning fishery productivities although filing fish catch volume by estimated statistic. This is important to get the data to know resource condition of target fish and the relation between market price and landed price consequently, to study fishermen's better life. And it will be precious and important information for fisheries promotion policy by always getting accurate data of the relation between total fish catch and resources stock in St. Vincent.

CONTENTS

［Appendices］

■ Location Map



■ Perspective Plan

LIST OF FIGUREURE

Chapter 1 Background of the Project

Chapter 2 Contents of the Project

LIST OF TABLE

Chapter 1 Background of the Project

Chapter 2 Contents of the Project

Chapter 3 Project Evaluation and Recommendation

Appendices

ABBREVIATIONS

ASTM	American Society for Testing and Materials
B/A	Bank Arrangement
CARICOM	Caribbean Community
CIDA	Canadian International Development Agency
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CRFM	CARICOM Regional Fisheries Mechanisms
CSME	Caribbean Single Market and Economy
CUBIC	Caribbean Uniform Building Code
CWSA	Central Water and Sewerage Authority
EC$	East Crib Dollar
EIA	Environmental Impact Assessment
E/N	Exchange of Note
EEZ	Exclusive Economic Zone
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FRP	Fiver Reinforced Plastic
GDP	Gross Domestic Product
HACCP	Hazard Analysis and Critical Control Point
IES	Initial Environmental Evaluation
IWC	International Whaling Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
JIS	Japan Industry Standard
KFC	Kingstown Fish-Market Center
NKFM	New Kingstown Fish-Market
OECS	Organization of Eastern Caribbean States
OFCF	Overseas Fishery Cooperation Foundation
OFCA	Overseas Fisheries Consultants Association
VINLEC	Saint Vincent Electricity Services Ltd.

Chapter 1 Background of the Project

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1-1 Background of the Request

The main industry of the country is agriculture however the cultivated acreage is very limited to 10% of total land area and the preferential treatment with England that has been the major exporting country is going to be abolished within a few years.

Therefore, tourism and fishery as alternative industries of agriculture become national main issue. The fishery sector in St. Vincent has planned to develop 11 fishery centers to support artisanal fishery and 8 centers have been constructed (7 fishery centers were constructed by Japanese Grant Aid Cooperation) Owia out of remaining 3 places being located at north east of St. Vincent Island is not developed yet and there is the situation that no proper fishing port and related facilities exist in the coast of Atlantic Ocean. Owia has 2nd fish landing volume in St. Vincent Island next to Kingstown. However, Owia has many problems such as the difficulty to berth and moor by fishing boats, unsafe work of fishermen and big harvest loss after catch due to the several restrictions resulting from topographic and oceanographic condition and unsettled situation as fishing port and related facilities. With that background, the Government of St. Lucia has requested the construction of Owia Fish Landing Complex, Breakwater and etc. by Grant Aid Cooperation to the Government of Japan in order to realize the promotion of safety and the proper treatment after catch.

1-2 Requested Component

The Government of St. Vincent has requested the Grant Aid Cooperation for the construction of Owia Fish Landing Complex in North East of St. Vincent Island (North Windward Area) to the Government of Japan in June 2004. The requested components are as per Table 1-2.(3) and the draft of the plan is shown at Figure1-2.(1).

The operation plan of the project is considered as follows.

(1) Project operational plan

1) Operation and Management Organization of Fish Landing Complex

The project facilities are to be consigned to the new fishery cooperative (tentative name, North Windward Fisheries Cooperative) under the operation supervision and the support by Fishery Division although the facilities belong to the Fishery Division, Ministry of Agriculture, Forestry and Fisheries when constructed. This cooperative is going to hold inaugurate meeting in coming December, 2006 under the support of Fishery Division and Ministry of Social Development and it will be formally registered to the Cooperative Association Bureau by the facilities expected completion day that is July,

2008. In case that the Fishery Cooperative cannot be set up in time, Fishery Division by itself would manage, maintain and take the responsibility of the facilities until transferring it to the Fishery Cooperative. Once the Fishery Division has set up fishery cooperative in Calliaqua and Barrouallie and entrusted them with the management and operation for the facilities and equipment of the fishery centers thus the Fishery Division is able to do that again. Actually, the Calliaqua Fishery Center has been operated and managed self-reliantly and completely by Fishery Cooperative at the time of March, 2006 and the autonomous operation of the Barrouallie Fisher Center has been almost attained. Judging from the experience of the direct management by Fishery Division and the transfer experience to Fishery Cooperative after that, the Fishery Division or together with the National Fisheries Marketing Ltd. can be possibly managed and operated and transferred to Fishery Cooperative at later days. The transferred schedule of Fishery Complex to Fishery Cooperative made by the Fishery Division is as follows.

Table 1-2.(1) Transferred schedule to Cooperative

Schedule	Cooperative Establishment	Construction Schedule
Dec.2006～Apr. 2007	Inaugurate Meeting, Management Committee	Conclusion of EN
May 2007～Dec. 2007	Master Plan	May 2007:Commencement of 1st phase construction
Jan. 2008～Jul. 2008	Project Feasibility Study, Training	Jan. 2008: Commencement of 2nd phase construction Mar. 2008: Completion of 1st phase construction Jul. 2008: Completion of 2nd phase Construction
Jul. 2008～Dec. 2008	Training, Registration Approval by Cooperative Association Bureau, Commencement of operation by the Cooperative	The operation of facilities will be consigned to the Cooperative

2) Management and Operation Organization by the Cooperative

The Fishery Cooperative will operate and manage the facilities under the supervision and guidance of Fishery Division. The Fishery Cooperative is scheduled to have 50～60 members. This will be operated by 8 directors including Director's General. The Fishery Cooperative will hire the manager, the assistance for Ice making, Child machines and etc. to manage and operate the facilities. However, concerning a chief engineer for ice making and child machines, an engineer from the Fishery Division will be the person in charge for the time being and train and bring up the assistant engineer hired by the Cooperative.

Necessary personnel and the organization to operate and manage the facilities are shown with the below table.

Table 1-2.(2) Necessary personnel of the facilities

Personnel/Engineer	Number of Personnel	Organization
Manager -cum- Accountant	One	Fishery Cooperative
Chief Engineer for Ice making, Child and Freezing machines	One	Fisher Division
Assistant Engineer for Ice making, Child and Freezing machines	One	Fishery Cooperative
Clerk	One	Fishery Cooperative
Security	Two	Fishery Cooperative
Cleanser	Two	Fishery Cooperative
Total	Eight	

(Note-1) Calliaqua Fishery Center is operated by one manager, two Cleansers and two securities. The maintenance work for ice making machine and the refrigerator is carried out by the staff of Fishery Division. Other than this like in-out control of refrigerator and ice sales are done by cooperative directors with their volunteer depending on the day of the week.

(Note-2) Barrouallie Fishery Center is operated by one clerk for sales and accounting and one volunteer from JOCV. The maintenance of the ice making machine is carried out by the staff of Fishery Division.

Table 1-2.(3) Requested Components from the Government of St. Vincent

Component	Specifications	Quantity
1. Civil Engineering Facilities		
1) Land reclamation (Creation of building site)	Expansion of on-shore site premise	Approx. 560 m^2
2) Revetment		Approx. 400 m^2
3) Slipway	Including boat hauling yard and sea defense	Approx. 400 m^2
4) Breakwater	Concrete	Approx. 300 m^2
2. Building facilities		
1) Gear lockers	RC structure, 2.0 m x 3.0 m x 26 units	26 units
2) Fishery center	RC block structure, 12 m x 20 m x 3.5 m, 2 floors	480 m^2
①Office quarters and meeting room	Office quarters60 m^2, meeting room 80 m^2, toilets	
②Storageice-making machine/ice-storage/cold storage	1-ton cold storage (+/-5℃), 1 unit of 1-ton/day ice-making machine (flake ice), 2-ton ice-storage	
③Blast cold storage facility cold storages	1 unit of 2 tons (+/-5℃)	
④Fish handling, processing and forwarding area	40.0 m^2	
⑤Operation booth and general storage	40.0 m^2	
⑥Fishing tackle shop		1 unit
⑦Toilets and showers (1 F)	Toilets, 2 units; showers, 2 units	
⑧Retailing stalls	1.7 m x 2.0 m/stall	8 units
3) Toilets and showers	RC structure, 2 units for gentlemen and 2 units for ladies, 2 showers	6 m^2/building, 2 each
4) Septic tank	Bricks or RC blocks, 12 m^3 septic tank x 1 unit, about 30 m overall length of drainage	1 unit
5) Fuel station	Facilitates diesel and gasoline	1 unit
6) Fishnet drying space	RC structure, 5.0 m x 8.0 m x 2.4 m	1 unit
7) Pavement		
8) City water reservoir tank	5 m^3	1 unit
9) Stand-by generator	50 kVA	1 unit
3. Equipment		
1) VHF radio equipment		
2) Heat sealer		
3) Vacuum filling machine		
4) Stainless-steel washing basin		
5) Stainless-steel working table		
6) Commercial-use cold storage facility		
7) Ice box		
8) Heat-insulated fish box		
9) Fish tray		
10) Tray for blast cold storage facility cold storage		
11) Shelf for cold storage facility		
12) Pressure washer		
13) Hose for pressure washer		
14) Personal computer, desk, chair		
15) Diving compressor		
16) Plastic fish box		
17) Platform scale		
18) Spring scale		
19) Handcart		
20) Diving equipment		

(Note) The specifications and quantities of equipment are not stated in the request document.

Quote: Compiled from the Request Letter submitted by the Government of St. Vincent.

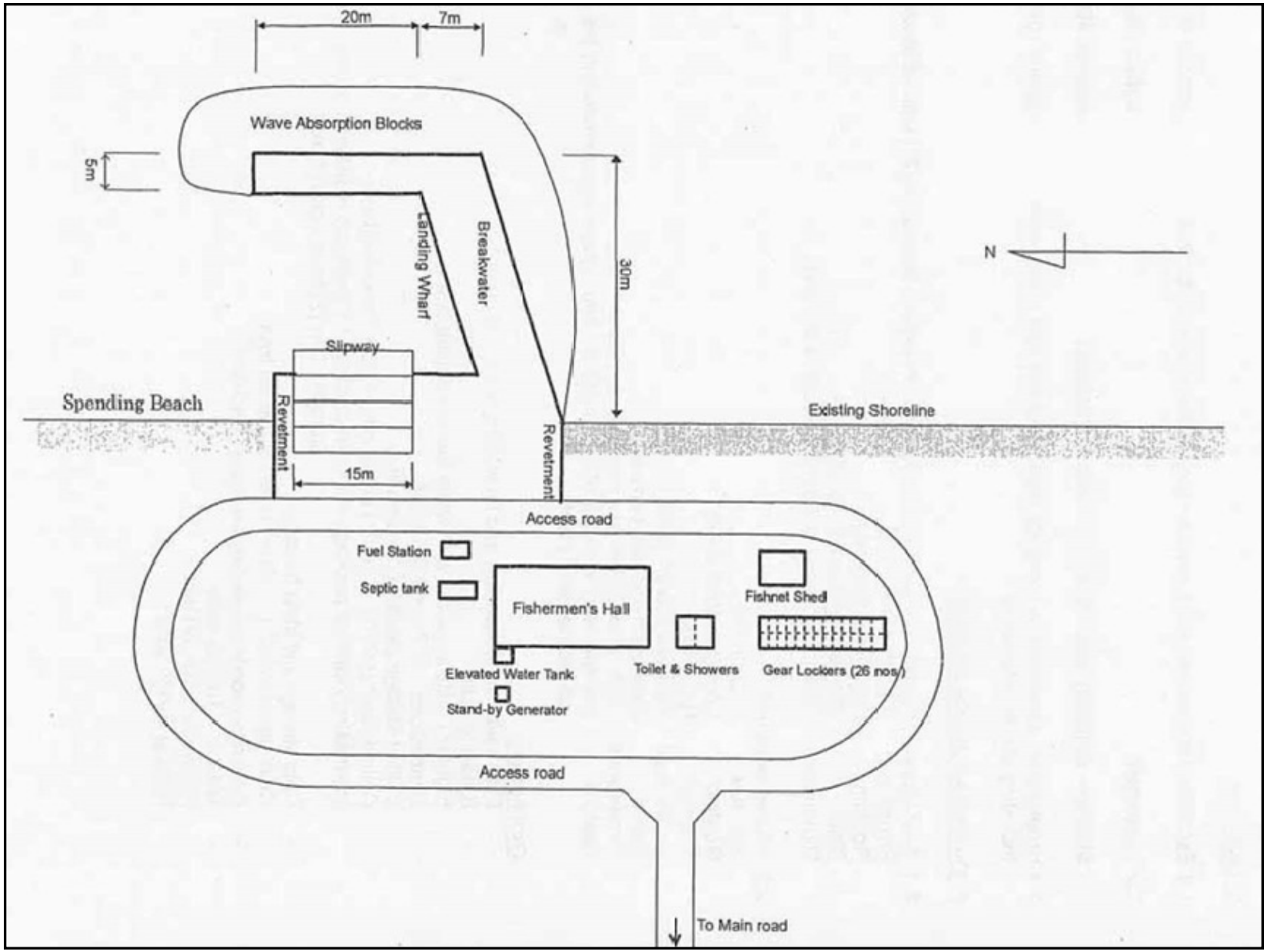


Fig 1-2.(1) The Project Plan of Owia Fishery Complex made by the Government of St. Vincent (attached with the request letter)

Chapter 2　Contents of the Project

Chapter 2　Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Relationship between the Project and the Sector and National Development Plans

(1) Goals of the Sector and National Development Plans

"To promote the small-scale fishing industry in the northern part of St. Vincent Island and to create new employment opportunities."

(2) Project Goals

"Increase of the fish catch in the target area through improvement of the safety of fishing operation to increase of fishing efforts."

(3) Outline of the Project

To achieve the above goals, this project is to provide a fisheries center in North Windward area (Owia) in the northern part of St. Vincent Island, and the center is intended for fishers in the 3 fishing villages of Fancy, Owia, and Sandy Bay (from north to south) in the Zone 7 of fisheries zoning of St. Vincent. The coverage of the grant aid project will include (1) civil work, (2) building facilities, (3) fish storage facilities, and (4) materials for fish distribution. Fig 2-1-1.(1) shows the relationship among this project, Fisheries Development Plan and Three-year Plan for National Development. Table 2-1-1(1) summarizes the coverage of the grant aid project.

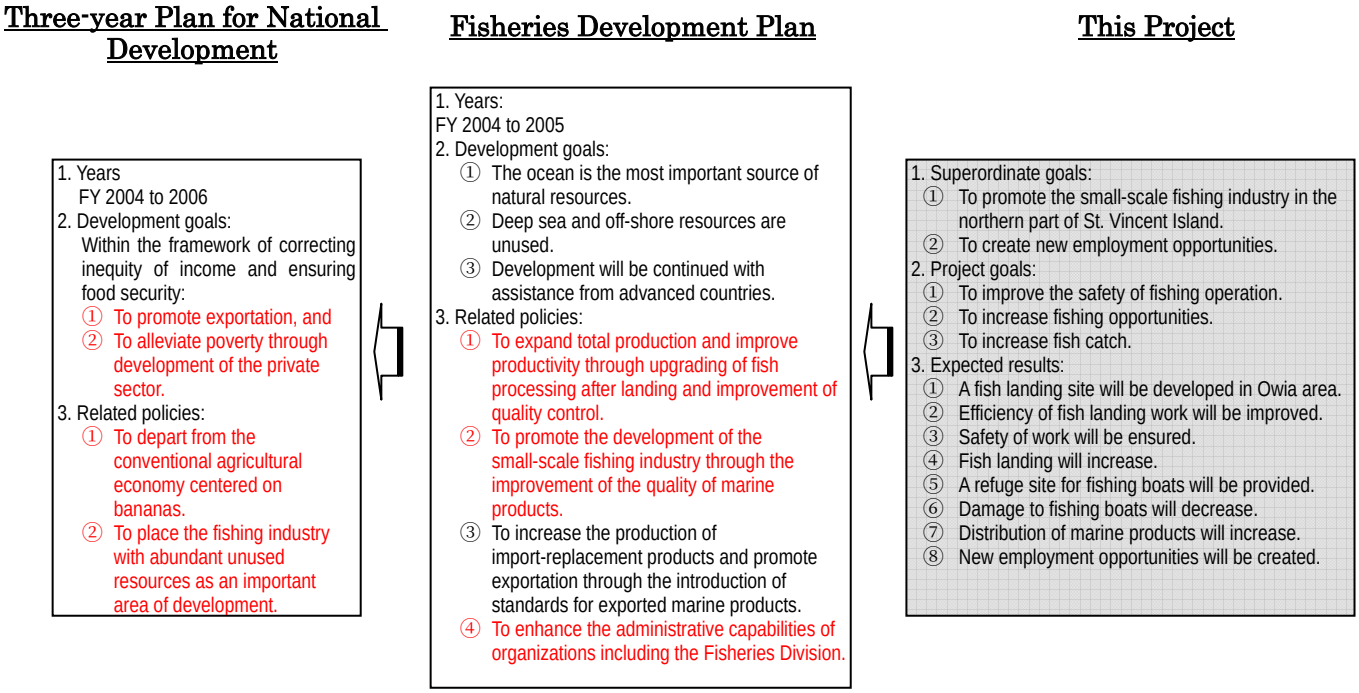


Fig 2-1-1. (1) Relationship between This Project and Super ordinate Programs (Fisheries Development Plan and Three-year Plan for National Development)

Table 2-1-1.(1) Summary of the Coverage of the Grant Aid Project

Summary of Requests from St. Vincent			Summary of Coverage of the Grant Aid Project	
	Specifications	Quantity	Specifications	Quantity
1. Civil Engineering Facilities				
1) Land reclamation (Creation of building site)	Expansion of on-shore site premise	Approx. 560 m²	- Site preparation (excavated material: 9,448 m³, banking: 5860 m³) - Site passway [6 m x approximately 122 m]	3,023m² 732 m²
2) Revetment		Approx. 400 m²	- Revetment (including quay) - Rubble rock mound seawall	90 m 44 m
3) Slipway	Including boat hauling yard and sea defense	Approx. 400 m²	3-faced structure 16 m x 57 m, slope 1/6, 2 units of winches	912 m²
4) Breakwater	Concrete	Approx. 300 m²	Composite breakwater with wave suppressor (with quay, including incidental facilities)	35 m
2. Building facilities				
1) Gear lockers	RC structure, 2.0 m x 3.0 m x 26 units	26 units	RC structure, 2.0 m x 2.0 m x 3.0 m	20 units
2) Fishery center	RC block structure, 12 m x 20 m x 3.5 m, 2 floors	480 m²	RC structure, 27.5 m x14.5m x 4.2 m	397.75 m²
(1) Office quarters and meeting room	Office quarters60 m², meeting room 80 m², toilets		Office 34 m², manager room 14 m², Fishery department office 12 m², meeting room 49 m²	114 m²
(2) storageice-making machine/ice-storage /cold storage	1-ton cold storage (+/-5℃), 1 unit of 1-ton/day ice-making machine (flake ice), 2-ton ice-storage		- 2-ton cold storage (-25℃), - 1-ton/day ice-making machine (flake ice), - 2-ton chilled storage facility (+/-5℃), - 2-ton ice-storage	1 unit 1 unit 1 unit 1 unit
(3) Blast cold storage facility　cold storages	1 unit of 2 tons (+/-5℃)		Not supported-	
(4) Fish handling, processing and forwarding area	40.0 m²		For primary processing, including cooking table for retail sale	66 m²
(5) Operation booth and general storage	40.0 m²		To be included in the Fishery center	
(6) Fishing tackle shop		1 unit	20 m² (fishing tackle shop, pantry)	1 unit
(7) Toilets and showers (1 F)	Toilets, 2 units; showers, 2 units		2 toilets each for men and women,	
(8) Retailing stalls	1.7 m x 2.0 m/stall	8 units	Not supported	
3) Toilets and showers	RC structure, 2 units for gentlemen and 2 units for ladies, 2 showers	6 m²/building, 2 each	To accompany to the Gear lockers Toilets: 2 for men and 1 for women, showers: 2 for men	36 m²
4) Septic tank	Bricks or RC blocks, 12 m³ septic tank x 1 unit, about 30 m overall length of drainage	1 unit	Combined-treatment septic tank (≤ 60 ppm discharge standard)	1 unit
5) Fuel station	Facilitates diesel and gasoline	1 unit	Oil storage tank 2000 liters x 2 (gasoline and diesel) Fueling pumps: 2 pumps, 2 counters, and 2 nozzles	1 units
6) Fishnet drying space	RC structure, 5.0 m x 8.0 m x 2.4 m	1 unit	30 m x 15 m, concrete pavement	450 m²
7) Pavement			Outdoor facilities, road in premises, , parking lot, etc.	1,280 m²
8) City water reservoir	5 m³	1 unit	8 tons	1 unit

tank				
9) Stand-by generator	50 kVA	1 unit	65 kVA	1 unit
3. Equipment				
1) VHF radio equipment			Not supported	
2) Heat sealer			Not supported	
3) Vacuum filling machine			Not supported	
4) Stainless-steel washing basin			1800 (L) x 760 (B) x 900 (H)	2 units
5) Stainless-steel working table			1800 (L) x 760 (b) x 900 (H)	3 units
6) Commercial-use cold storage facility			Not supported	
7) Ice box			To be included in Heat-insulated Fish Box	
8) Heat-insulated fish box			Outside dimensions: 1100 x 570 x 670 (265 liters) Outside dimensions: 1180 x 1040 x 117	28 pcs 2 pcs
9) Fish tray			For frozen products: 1,150 x 750 x 70 For chilled products: 642 x 365 x 218	70 pcs 70 pcs
10) Tray for blast cold storage facilitycold storage			Not supported	
11) Shelf for cold storage facility			Included in building special facility	
12) Pressure washer			Output 30-32 litres	1 set
13) Hose for pressure washer			Hose: diameter 1/2 inch x 10 m	To be included in 12)
14) Personal computer, desk, chair			Not supported	
15) Diving compressor			Discharge pressure 29 MP, revolution 1200	1 unit
16) Plastic fish box			1105 x 542 x 257, 112 liters	28 pcs
17) Platform scale			Weighing capacity: 0-150 kg (or 0-300lbs)	2 units
18) Spring scale			Weighing capacity: 0-10 kg (or 0-40lbs)	2 units
19) Handcart			Carrying capacity: 0-200 kg (or 0-400lbs)	2 units
20) Diving equipment			Not supported	
21) FRP tank			1700 (L) x 1000 (B) x 540 (H), 550 liters	1 pcs
22) Plastic perforated basket			572 x 404 (B) x 260 (H), 39 liters, with handle	4 pcs

(Note) The specifications and quantities of equipment are not stated in the request document.

Quote: Compiled from the Request Letter submitted by the Government of St. Vincent.

2-1-2 Expected Results of the Project

The expected results of the project are as follows:

① Fish landing place is equipped in Owia area.

② Landing work becomes efficient.

③ Safety work is secured.

④ Landing volume is increased.

⑤ Fish catch is kept to preserve freshness.

⑥ Area for refugee (escape) is created.

⑦ Damage to fishing boats is decreased.

⑧ Distribution volume of fish catch is increased.

Fig 2-1-2.(2) represents the logic model illustrating the relationship among the project, result, project goals and National goals.

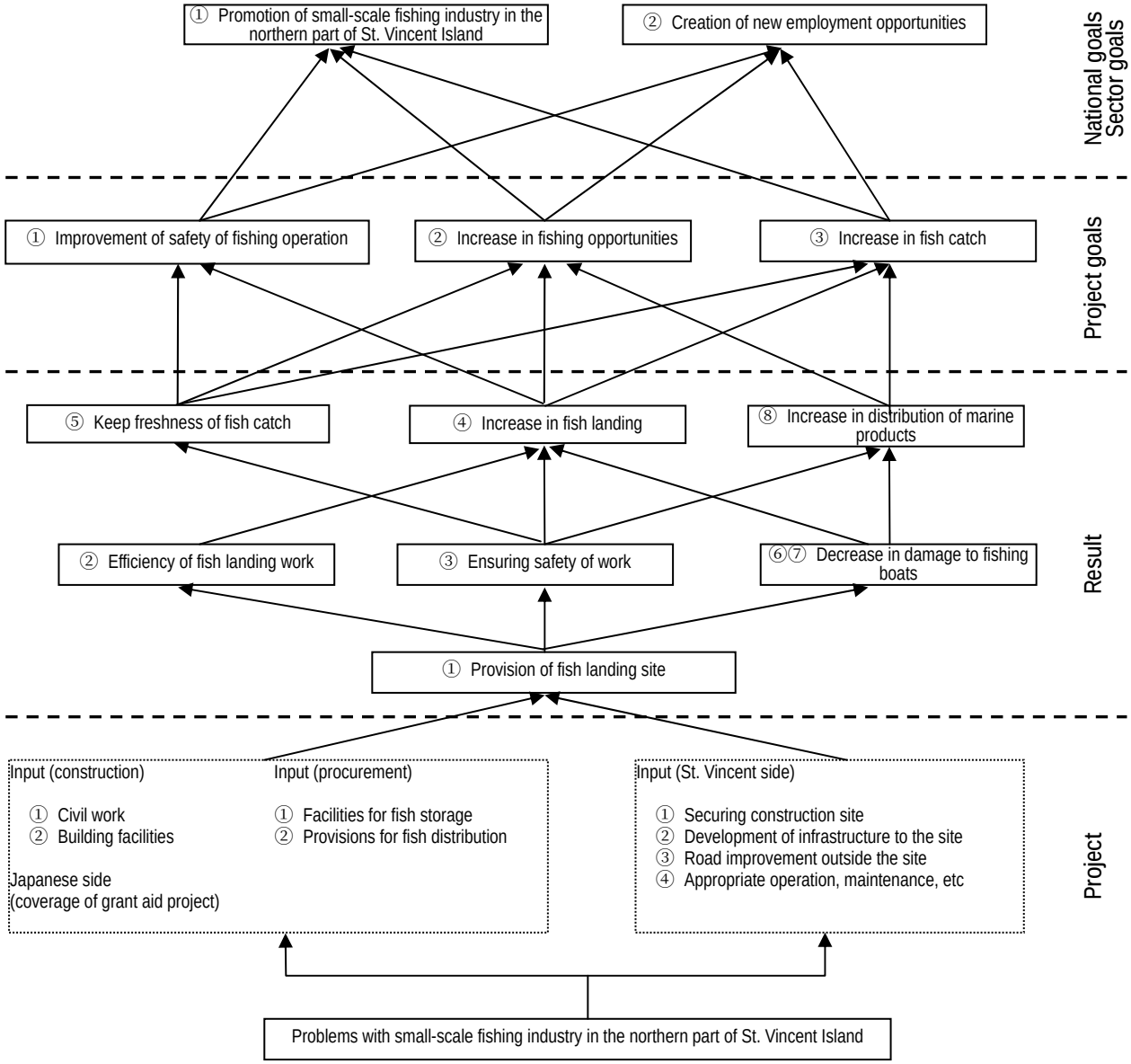


Fig 2-1-2.(1) Relationship among the project, results, project goals, and super ordinate goals (logic model)

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Examination of the Content of Request

(1) Fishing Port Facilities

a) Land Reclamation (Site Preparation)

The project site is a long, narrow piece of land with the width of 75 m located between a load and a boulder beach on the coastline. The slope of the area from the road behind the site to the seashore is as steep as about 1/6, and the height difference in the premises is about 12 m. In addition, because the premise is also sloped gently in the north-south direction along the length of the premises, the southern part of the premises has a height difference of about 2.5 m between the ground level and the top edge of the road.

Onshore facilities should be constructed at a sufficient ground height without influences of waves caused by hurricanes. On the other hand, the slipway on the shore must be designed to have a slope of 1/8 to 1/10, as typically needed for such a structure, and the water depth at the tip of the slipway must be sufficient for the vessels that are intended to use the facility.

Because of the scarceness of flat areas and the small distance from the road behind the project site to the seashore, it is important that the design of elevation and slopes in the site is designed for convenient use of fishermen, considering the movement of fish, persons, and vehicles. Due to the topographical features and limitations in the project site, there will be a need for site preparation work and some land reclamation along the beach. In particular, site preparation and land reclamation work involve the limitation concerning the movement of large construction plants and the passage of vehicles depending on road conditions. Because the amount of this type of work dramatically affects the project cost, the premises should be designed to require as little earth moving, earth cutting, and reclamation as possible.

b) Revetment

Revetment will be needed as the basic structure that protects the slipway, constructed toward the off-shore direction largely in perpendicular to the shoreline, from the effect of waves. The revetment requires the length to reach the water depth for protecting tips of the slipway.

c) Slipway

The existing boat yard in the project site is a simple facility of logs on the sandy beach which is prepared with removing boulders. The width of the slope is also very insufficient. In addition, the sea area in front of the facility is a breaker zone, and waves of about 1 m are directly entering the facility in normal conditions. The area just behind the existing boat-hauling site is a steep slope. Because there is no space to be used as a boat yard with sufficient land area and safe height, fishing boats must be routinely moved up the steep slope to the area at a safe height. In this situation, the process of boat hauling is causing

considerable damage to boats, and the work involves too much danger and labor for aged fishers. According to the hearing survey to fishers, they are using wooden boats that can be repaired relatively easily to cope with the frequent damage to the bottom and other parts of boats.

In view of these facts, the need for the construction of a slipway with winch to realize convenient and safe working environment is considered very high and urgent.

d) Breakwater

Unlike the Caribbean coast, Owia Bay containing the project site facing the Atlantic Ocean is characterized by severe wave conditions. The breakwater is a facility not only to protect the slipway, revetment, and other structures behind it but also to keep the calmness in the harbor, facilitate the arrival, departure, manipulation, and mooring of fishing boats, and ensure the safety of fishing boats.

Because it is necessary to ensure calmness in front of the slipway and secure sufficient maximal working wave height at the wharf, a breakwater with minimal specifications must be constructed.

(2) Building Facilities

a) Gear Lockers

Three gear lockers currently existing in Owia are all personally owned by beach seine and purse seine fishermen, and are utilized for storing fishing maintenance gears (net cords, ring buoys, and sinkers, etc.), air tanks, oil, fishing crates, fishing boat maintenance equipment, and tools for commercial fishing whereas no gear lockers exist in Fancy nor Sandy Bay. The fishing gears stored at home by trolling line and hand line fishermen are placed in circular cans 30cm in diameter and 50cm in depth for transportation to the fishing boats and back home after catching fish. Transporting 20-L fuel tanks and fishing gear cans home is a considerable burden on trolling line fishermen who live on the high plains of Owia, and the use of facilities for trolling line fishing boats in Fancy and Sandy Bay, which are distant from the facilities, reduces the inconvenience and labor required for transporting fishing gear, and the installation of gear lockers is also necessary to improve fishing effort. Consequently, nine gear lockers for trolling line fishing boats in Fancy and Sandy Bay are required, and three lockers for beach seine and purse seine fishing boats that currently have lockers.

The need for gear lockers are seemed to be less in Owia than in Fancy and Sandy Bay. However, setting aside the fishermen who live within 100m of the Project site, those who live in the heights overlooking Owia Bay must carry the fishing gear can and 20-L fuel tank which inflict a considerable burden on them. Nevertheless, Owia do not currently have gear lockers.

Accordingly, there is a substantial need for gear lockers in Owia, mainly for those who

live in the heights overlooking Owia Bay and also for those in Fancy and Sandy Bay, .

b) Fishery Center

① Office

This Fishery Center will be operated by the Fisheries Cooperative that will be organized by the fishermen. According to the agency of the Government of St. Vincent regulating the establishment and management of Fisheries Cooperatives, its own space for operation and office work is legally required. Therefore, there must be the space for the director, general office work, ice vending, and other services of the Fisheries Cooperative.

North Windward area is located far from the national capital Kingstown, where the Fisheries Division of St. Vincent is located. Therefore, in addition to the offices of the Fisheries Cooperative, there also must be the space for office quarters of instructors sent from the Fisheries Division of St. Vincent, who will supervise this facility and guide fishermen in North Windward area regarding the Government's policies on fisheries.

② Ice-making machine

Ice-making is indispensable for preserving the freshness of fish. Fish should be cooled with ice promptly after catching. This will be all the more important if the fish is directed to export. Fish for export kept fresh with ice should be sent to the HACCP certified factory in Kingstown and be processed, frozen, and packaged for export, or the fish should be stored in a chilled storage facility with ice for fresh sale on the next day.

In view of the above facts, ice-making machine is extremely important and indispensable.

③ Ice -storage

In order to store ice cubes produced by the ice-making machine, the ice storage equipped with a refrigerating unit is essentially required.

④ Chilled storage facility

Currently, the catches are unloaded at Owia generally around 3:00PM, making same-day sales difficult, so the catches have to be sold the next day. Further, as there are no land-based facilities for storing the catches, nearly all the fish caught is not unloaded until the next day, and are left in the water overnight in the nets used for fishing. The purse seine is tied to prevent the caught fish from escaping, and thus the area in which the fish can move is limited. As a result, the fish bump into and injure each other, and the next morning fish with remarkably deteriorated freshness are left behind, and as a result even those brought ashore are not suitable as produce, as they are taken a considerable distance by truck to be sold. Thus, it is necessary to adjust the

shipping volume in accordance with the market demand by storing catches brought ashore temporarily in a chilled storage facility for the purposes of ensuring freshness of the catches, and of making effective use of the frozen storage, to which the chilled catches are transferred and stored for the sale in the following day.

Chilled storage facilitiess are used to store fish left after sale on the same day and excess catches that have been packed in ice-filled containers, and to maintain their freshness for sale the following day. The necessity for chilled storage facilities is great for effectively use these resources without discarding. In particular, purse seine fishing operated by the local fishermen of Owia produces a very large fish catch per operation that cannot be consumed locally and surplus fish is generated frequently. Therefore, it is important to have flexible marketing abilities for reduction of harvest loss and shipping management by use of this kind of primary storage facility.

⑤ Cold storage facility

Commonly, cold storage facilities are used for the purpose of adjusting the shipping volume in accordance with the market demand: these are used to store catches that have been flash-frozen using a blast cold storage facility or other flash-freezing equipment – thus the burden on the frozen storage is reduced – and serve as part of the cold-chain system.

However, since the facility in question is not designed to flash freeze catches, the heat burden on the storage is fairly large. What is more, it is incapable of and inappropriate for freezing a large volume of fresh fish. Even so, it can be used to slowly freeze a smaller volume of fish over a prolonged period of time. Thus, if the capability of the cold storage facility is improved (more specifically, by improving the capability of the unit cooler which is the actual coolant device to be installed within the frozen storage, improving the capability of the cooling fan, or adopting a double-deck compressor), it is still possible to reduce the time required for freezing and to increase the volume of catches to be frozen with the slowly-freezing method provided catches are first chilled in a refrigerator and its temperature remains sufficiently low. In this manner, it is possible to make use of the frozen storage facility for the purposes of freezing and storing catches by improving its capacity and appropriately combining various usage methods.

Currently, Owia fishermen rent trucks for shipping their catch when large hauls are brought ashore at high process (approx. EC$200), and have no option but to travel from the North Windward area to the main area of Georgetown. Consequently, the freshness of the fish cannot be maintained, and not only is it necessary to sell the fish immediately after catching them, but as a result, 10% to 30% of the harvest is lost and, further, the time spent in fishing activities at sea is restricted.

From the above facts, and also to improve the sales efficiency from the planning area to the area of consumption, it is effective to strive to ship the catches all in one go according to market conditions when a certain amount of frozen products have been

frozen and stored in a relatively good condition, and thus the need for freezers that can fulfill this function is great.

Blast cold storage facilities are, on the other hand, normally used to freeze a large volume of catches at one time in a short period of time, but in consideration of the current amount of catches, it can be concluded that it is too early to procure a blast cold storage facility on the grounds that the refrigerator and cold storage facility described above are sufficiently capable of storing catches and adjusting the shipping volume at the moment.

⑥ Processing Facility

This facility will be used as the working space for sorting, washing, and other processing of landed fish, as well as primary processing before storage in the chilled storage facility and cold storage facility, thawing after storage, and various treatments before shipping. The facility is used also as a venue to sell fish by piece and sell fish by weight in accordance with the consumer needs. This processing facility is placed as a component that is complementary to the above-mentioned components of blast cold storage facility, chilled storage facility, and cold storage facility.

Because of this reason, this facility is indispensable not only as the working space for fish processing but also as a gateway to the cold storage facility and the space to sell cut fish by weight after scraping off scales and removing internal organs as local people do as a sales custom.

⑦ Retailing Stalls (Fisheries Retailing Shop)

At the present, the fish landed at Owia Fishing Port is sold by the fishermen themselves without any middlemen. Because of this sales custom and the absence of a cooling facility, the limitation on the time for off-shore fishing activities is currently imposed. The completion of this Project will make it possible to store catches in a cooling facility regardless of the time of fish landing, and to resolve the restriction on fishing activities.

In the meantime, the retailing stalls to be constructed under the Project will enable consumers to purchase fresh fish whenever they visit Owia. Because of the small market of fresh fish around Owia, it is likely that the sales activity using part of the processing space will sufficiently cope with the demand from local consumers Fishermen Project.

⑧ Meeting Room

As of 2006, the total number of workers in the fisheres industry including ship owners and captain fishermen in North Windward area covering Owia, Fancy, and Sandy Bay villages is about 115. About 60 of them – ship owners, captains and other major fishermen's corporative members – attend briefings and other meetings at the

Fishery Center held by the Fisheries Division of St. Vincent, indicating their strong interest in the Government's administrative measures regarding fisheries. While the Fishery Center is planned to be operated by the Fisheries Cooperative, this organization is expected to comprise about 50 to 60 members.

At the present, opportunities for meeting of fishermen include various training seminars conducted by the Fisheries Division for the purpose of promoting the fishing industry and education of fishermen. However, there is no appropriate building, and they are obliged to hold such meetings in smaller scales than needed. After the establishment of the Fisheries Cooperative, they also need the space for holding regular meetings for the operation of the organization, such as the general conference of cooperative members.

On the other hand, there is a community center diagonally across the road in front of the Project site. However, this space is used for community relations programs and serving more like a dance hall used by local inhabitants, and is not appropriate for the meeting of the Fisheries Cooperative organization.

Therefore, the construction of the meeting room for the Fisheries Cooperative is also indispensable for the operation of the Cooperative organization.

⑨ **Fishing Tackle Shop/ Pantry**

In the Project site area, there is a general store which sells the local fishermen fishing gears, drinks and snacks, as well as goods for daily living, and which also functions as a convenient facility for fishermen for a rest. Acquisition of land for the project by the Government of St. Vincent will result in the removal of this general store. The fishing tackle shop with pantry should be newly provided because of an indispensable facility for the fishermen in North Windward area.

c) Toilets and Showers

There are no public toilets and showers in the vicinity of the Project site in Owia. Toilets are needed not only for the convenience as the facility used by fishermen before and after fishing operation but also from the viewpoint of public hygiene.

As mentioned in "Gear Lockers," many fishermen will walk or ride a mini bus from the Fishery Center to their residents, and this means that they need to change clothes after returning from fishing operation. Therefore, there is a high demand for shower facilities to be used for changing clothes after fishing operation and the need for such facilities is considered high. For the sake of convenience, however, these facilities should be planned as a part of the gear locker facilities.

d) Septic Tank

After the establishment of the Fishery Center, there will be generation of high-BOD wastewater, including wastewater from toilets and fish processing and drains from showers,

pantry, and general hand washing. In particular, wastewater from toilets and fish processing will have high BOD levels. On the other hand, St. Vincent does not have institutional discharge standards regarding wastewater and sewerage water. The wastewater from toilets is usually disposed of by the soil infiltration of supernatant after storage in pits. Sewerage water is generally discharged untreated to rivers and the sea. Although the Ministry of Health and Environment of St. Vincent will not require further treatment beyond institutional regulation, the effectiveness of a septic tank at the Fishery Center is highly expected. Because round haul net fishing is also operated in Owia Bay, coastal sea pollution should be considered not only in terms of marine resources conservation but also from environmental aspects.

e) Fuel Station

No fuel station is in Owia. The nearest fuel station in the neighboring area is located in Georgetown, midway to the capital. While there are private venders who regularly go to the fuel station in Georgetown to buy fuels and store them in Owia, their prices are unreasonably high, reflecting a seller's market. For eliminating this unreasonable situation for local inhabitants and stimulation of local economy, it is desirable that the Center has fuel tanks for the convenience of local inhabitants and the fishermen based in Owia. The fuel tanks need to be planned both for diesel fuel for vehicles used by local inhabitants and gasoline for outboard motors used by fishermen. The size of each tank should be sufficient to support the activities during a week.

f) Fishnet Drying Space

The fishing tackles used by the fishermen in North Windward area are purse seine, trolling line, long lines, etc. and these must be repaired after the boat's return to the port before the next fishing operation. This component is the facility for such maintenance of fishing tackles, and is indispensable as a facility for fishermen at the fishing port.

g) Pavement

The areas requiring pavement the project site are "site pass ways," "parking lots," and "fishnet drying space." Fish will be moved from fish landing to the Fishery Center using handcarts, and this will require flat smoothly paved surface along the route. Pavement of "roads on premises" and "parking lots" are required for the efficient and smooth shipping of fish from the Fishery Center, movement of ice and fishing tackles within the Center, and movement of fishing boats to avoid disasters. A flat smoothly paved surface is also needed as the space for drying fishnets to avoid damage to nets.

h) City Water Reservoir Tank

According to the Central Water and Sewerage Authority (CWSA) of St. Vincent, the pressure of water supplied along the road in front of the planned Fishery Center is 221 psi, and the supply rate is 20 gallons (75.8 liters) /minute. On the other hand, the total number of

faucets planned for the facilities is approximately 45, and according to the "Design Standards for Building and Facilities, edited by Ministry of Land, Infrastructure and Transport", the "rate of water supplying instrument used at the same time" should be 39% of the total number of faucets. Further, according to the same reference, if the amount of faucet flow is 13A, as this is 15L per minute, the amount of water used in any moment per minute should be 45 x 0.39 x 15= 263L per minute. In other words, if the facilities are connected directly to the tap water pipes, which are supplying 75.8L per minute, the amount supplied that instant will overwhelmingly fail to meet demand. Consequently, a water reservoir tank method of "water receiving tank + pressurized pump feed" is planned using water received from the existing public tap water pathways.

This flow rate is not sufficient, assuming the maximal demand from the simultaneous use of planned facilities.

Moreover, when it comes to the installation condition of the water supply pipes, not all of the pipes along the road are buried underground, and pipes are exposed at several locations. This means that water supply pipes are liable to break due to traffic accidents and natural disasters, and it is reasonable to expect occasional breakdown of water supply and receive contaminated water. Because this Fisheries Center requires uninterrupted ample water supply with ensured quality, a city water reservoir tank capable of supplying necessary amount of water must be installed.

i) Stand-by Generator

According to St. Vincent Electricity Services Limited (VINLEC), the frequency of power outage in the power lines in Owia area is normally 2 to 3 times a month, and the time to recovery is as long as 6 to 8 hours.

The power supply to Owia is supported only by the one-way feeder line from South River Water Power Plant without the backup from other power stations. Therefore, power outages expected during hurricanes and other disasters would require considerable time to recovery. Power outage due to the exchange of transformers and other works in the power supply system may also be prolonged, depending on the nature of the work. Therefore, to be prepared for the power breakdown due to disasters and power supply works, the stand-by generator is considered a necessary component of this Project.

(3) Equipment

a) VHF Radio Equipment

This equipment may become necessary when the facilities in Owia are used effectively and the number of fishing boats based in Owia is increased. However, it is not needed, considering the current small fishing boats, which do not have space for installation. Radio equipment would be required, if a large convoy is organized and information concerning safety, oceanic conditions, location and movement of fisheries, and directions regarding fishing operation are transmitted from a land-based station or the flagship in

an organized way, for example. Considering the small scale fishing operation at the present, we have to say that the necessity of this equipment is low.

b) Heat Sealer

Owia lacks the capability for product processing for export or shipping to the supermarkets in the metropolitan area (there are no inhabitants with the expertise of fish processing). This equipment will be effective only some time after the completion of the Fishery Center, when the access to the capital will have been improved by road improvement and sufficient training will have been conducted. The provision of this equipment is untimely.

c) Vacuum Filling Machine

The need for this equipment is low, because of the same reason as in b).

d) Stainless-steel Washing Basin and Stainless-steel Working Table

Primary processing of fish, such as washing of fish and removal of offal, need to be performed in Owia. Therefore, these items are necessary. However, while the request document listed washing basins and working tables separately, these should be integrated together to improve work efficiency. These should be planned to have unified dimensions, prioritizing the efficiency of work and cleanness.

In particular, washing basins should be equipped with a water supply and a filter. The quantity of stainless-steel washing basins should be 2 units each of stainless-steel washing basins for fishermen using the Owia Fishery Center in Owia, Sandy Bay, Fancy, and the area of the Caribbean side, and that of stainless-steel working tables 3 units each upon the premises that the tables will be used also by workers engaging in sales of fishery products.

e) Commercial-use Cold storage facility

Although the St. Vincent side considers this necessary as a part of the retailing stalls, the need for it in selling frozen fish can be met by the use of heat-insulated fish boxes, and there is no need for providing special commercial-use cold storage facilities.

f) Ice Box and Heat-insulated Fish Box

These boxes are needed for the purpose of storing ice on board- the currently used fishing boats having no special fish holds-and transporting fish packed with ice and frozen fish. While the request makes distinction between ice boxes and heat-insulated fish boxes, these should be considered more reasonably as 2 types of heat-insulated fish boxes, one for on board use and the other for transportation of fish to the metropolitan area. Considering the holding capacity of fishing boats in St. Vincent, the fish boxes for on board use should have a capacity of 265 liters, and the quantity should match the number

of fishing boats currently exist in Owia. The boxes for fish transportation to the metropolitan area should have a capacity of 1015 liters, considering the capacity of pickup trucks used in the area, and the quantity should be twice the number of pickup trucks, allowing for the retention in the metropolitan area.

g) Fish Tray

Fish trays are highly needed, as they are used for the movement of cleanly processed fish and frozen fish within the Fishery Center, as well as for chilled storage. The need is also high, because untreated fish arriving from outside must be distinguished from processed fish. However, fish trays must be divided into those for storing frozen fish and those for chilled storage.

The size of the tray should match the weight (about 30 kg) that can be carried by 2 men. Considering the storage capacity of the chilled storage facility (2,000 kg) and the capacity of each tray (30 kg), the needed quantity is as follows:

2,000 kg (capacity of chilled storage) / 30 kg (capacity of tray) = 70 trays.

In the chilled storage facility, fish is stored with ice. The needed quantity is:

2,000 kg (capacity of chilled storage) / 30 kg (capacity of tray) = about 70 trays.

h) Tray for Blast Cold storage facility

It is concluded that it is too soon to adopt a blast cold storage facility at the moment, and thus trays for the blast cold storage facility will be excluded from components to be procured in this Plan.

i) Shelf for Cold storage facility

The need for this item is very high, as it is used for orderly storage of fish and helps efficient utilization of the limited capacity of the storage. Assuming that the vertical intervals between shelves in the frozen storage are 160 mm and the storage has up to 10 tiers (within the height of moving heavy items by human power), the overall height of the shelves would be 1650 mm. Next, shelves can be installed only on the sides of the storage (about 4,000 mm long on each side) and clearances of at least 1000mm must be left to allow installation and cleaning of the shelves.

Therefore, the actual available space would be 4000 mm (L) x 1300 mm (D) x 2200 mm (H) x 2 positions. The products weighing 2000 kg would be stored in this space. Because these shelves for fish storage must be moved during cleaning, each unit must be of the size and weight that can be moved by human power.

Therefore, we plan to install 2 units in the space of 3000 mm (L) and its standard to be about 1500(L) x 1200(B) x 1600(H) x 10 tiers, and the needed quantity is 2 (for each side) x 2 = 4 sets (for both sides). Thus, the number of fish trays that can be held in a set of storage shelves is: 2 trays x 10 tiers = 20 trays.

j) Pressure Washer and Hose for Pressure Washer

Cleaning after daily work is important for maintaining the sanitary condition in the fish processing area. In particular, these items are very effective in the removal of residues that tend to accumulate in the corners of the working area. While the request document lists these items separately, the hose should be included as a part of the main equipment.

k) Personal Computer, Desk, and Chair

The need for providing these items is low, because they are items that should be procured on the local side.

l) Diving Compressor

In St. Vincent, diving gears are used for closing the bottom of the net in purse seine fishing. Diving compressors are needed because this purse seine fishing produces large fish catch. Purse seine fishing is a method of fishing in which a long net that encircles the fish is lowered into the water, and it is necessary to tie the bottom of the net to prevent the fish from escaping. In St. Vincent, there is no fishing gear designed essentially as purse seine -fishing nets; rather, the traditional local fishing method is for the fisherman to dive himself and tie the bottom of the net to trap the catch. To improve fishing methods under the guidance of the Fisheries Division and local experts dispatched to be on-site, there is no need for compressors, but in reality, it is difficult (economically) to change the mindset of the locals, who are fond of this method of fishing and have used it for many years. Unless these fishing methods are improved, the need for diving gear is great, and it is currently not possible to make a living through fishing. Further, there are no compressors in the vicinity of the Owia project area, and it is necessary to make the slightly far journey to Kingstown for oxygen refills, making it necessary in effect to pay high transport costs and refill costs (EC$100 per bottle), so the inconvenience is pressing.

From the above facts, the need for shared resources among local fishermen is great.

m) Plastic Fish Box

As a feature of the fishing methods typically operated in the Caribbean Sea, the fish catch mainly consists of large fish such as dolphinfish and Spanish mackerel. However, the catch in Owia mainly consists of small and medium-sized fish, reflecting the difference in fishing methods. The fish boxes for fish transportation, therefore, should logically be intended for small and medium-sized fish, but the occasional catch of large fish actually occurs. While large boxes can serve the purpose of small boxed, the reverse is not true, and we plan to provide fish boxes that can hold large fish. The capacity of fish boxesshould match the weight of 35 kg, which can be carried by 2 men (while the capacity is 112 liters, actual weight capacity is limited to 35 kg). The needed quantity is: 1,000 kg

(a day's fish landing) / 35 kg (capacity of fish box) = about 28. The boxes must have handles and draining holes.

n) Platform Scale

This is needed for weighing during the receiving of catch and ice vending. Two platforms are needed: "one for weighing ice laden on the fishing ship and fish carried in from the landing docks", and "the other for weighting frozen products and clean fish that have been processed in the facilities". Weighing performance needs to be able to load and weigh four boxes that can hold approximately 35kg of fish each at the same time (35kg x 4 fish boxes = 150kg), and two are required, "one for weighing catch", and the other for "weighing ice".

o) Spring Scale

This is needed for weighing during the retailing of fish. Considering the items sold (cut fish), the weighing capacity should be 0 to 10 kg at the most, and two units will be produced in this Plan.

p) Handcart

Handcarts are needed as the means for transporting fish in plastic fish to the processing area. They are also needed as the means for moving processed fish and frozen fish within the facilities. It is necessary to make distinction between the handcarts used for untreated fish arriving from outside and those for clean treated fish within the facilities.

The size of each handcart should be sufficient to carry the fish catch (5 fish boxes containing 35 kg of fish each) at once. Considering the use in wet places, the material should be stainless steel. The needed quantity is 2 for fish transportation from the landing pier to the facility.

q) Diving Equipment

Because not all fishermen are engaged in dive fishing and use of this equipment would be limited to the fishermen performing purse seine fishing, this should be procured by individual fishermen.

(4) Additional Materials (FRP Tanks and Plastic baskets)

Primary cleaning is required at the instant that the fish are landed. Nevertheless, fishing methods in Owia are purse seinet fishing, so the amount of a single landing is great and, further, the main types of catch are small and medium-sized. Consequently, to clean each small and medium-sized fish caught individually would not only take many hours, but also potentially result in loss of freshness.

From the above facts, to clean a large amount of fish all in one go, an effective method is to fill a large FRP tank with water, and then dip the fish, which have been placed in nets orin plastic baskets with numerous holes, into the tank to clean them all at once. Consequently, FRP tanks and plastic baskets are required.

a) FRP Tank

The material used is FRP, which is lightweight and has excellent durability. Its construction enables free movement depending on the catch on that day, the work plan, and workability, and is also equipped with simple waste water valves for easy water changeover. One tank with the capacity of around 550 liter will be procured.

b) Plastic Baskets

The material is lightweight and durable, and the plastic enables smooth and clean water flow. Its construction is equipped with handles at both ends for ease of carrying. Further, the volume enables easy carrying by two adults when laden with fish that has basically been cleaned. Four baskets are required. (Divide four adults into two teams of two, and alternately carrying and cleaning two baskets.)

2-2-2 Design Policy

(1) Identification of Planning Conditions of Fishing Boats

1) Number of Fishing Boats

The survey has shown that the actual number of vessels in operation in the three landing sites of Owia, Fancy, and Sandy Bay totals 32, whereas statistics (of the Fisheries Division) show 40 vessels registered in the three ports. For planning the facilities, the number of vessels in operation (i.e. 32 vessels) shall be employed.

Purse seiners operate in a group of three, including a large double-ender, a small double-ender, and a net-transportation boat (FRP). All three vessels shall be parked at the respective parking area of top of slipways.

Table 2-2-2.(1) Fishing boats for planning

Purpose	Fishing Method	Type of Vessel	Number of Vessels	Total
Mooring in basin	Purse seine net	Double-ender (Large)	3 (2)	5
		Double-ender (Small)	3 (2)	5
		Subtotal	6 (4)	10
On-shore storage	trawl, bottom trawl, hand lining; purse seiner (for transportation)	Dolly	21	21
		FRP	5(2)	7
		Subtotal	26(2)	28
Total			32(6)	38

Note : Numbers in brackets indicate ships normally hauled in Chateaubelair and Barrouallie ports.

2) Type and Size of Planned Vessels

① Artisanal boats
② Training vessels (donated by the Japanese Government)
③ Fish buying vessels

3) Type of Planned Vessels

① Small Vessels: Length=28 FT (8.4m), Width=6 FT (2.0m), Draft=3 FT (0.9m)
② Training Vessels: Length=10.60m, Width=2.96m, Draft=2.43m (Loaded)
③ Fish buying Vessels: Length-17m, Width-5m, Draft=3m

(2) Number of Planned Vessels and Quay Length

Although the Plan's primary focus is on 32 small vessels, water facilities shall have enough depth to accommodate training vessels, fish buying vessels and hauling vessels from Chateaubelair and Barrouallie.

1) Landing Berth

Based on the assumption that 20 minutes per small boat is required for in-port preparation and a maximum capacity of 6 vessels/hour is required, the following figure can be obtained:

60 minutes ÷ 20 minutes/vessel = 3 vessels/hour

Therefore, berths for unloading and preparation shall accommodate 3 vessels per hour, with up to 2 berths occupied at a same time of departure and landing. Total length of berth shall be as follows:

(8.4m + 0.15 x 8.4m) x 2 berths = 19.32 m 20 m

This berth shall also be used for filling gas and preparation.

2) Lay-by Berth (Optimal Use of Breakwater Construction)

Double-enders (3 large vessels) at Owia plus Chateaubelair and Barrouallie (2 large vessels) are relatively large vessels; and taking into account the local customs, it is likely that these 5 vessels will be normally moored (except in emergency conditions). Therefore, they shall be moored lengthwise, in line with the quay behind the breakwater.

{2m＋（0.5×2m）}×5 vessels =15m

3) Slipway

The slipway will accommodate fishing boats on land in the several lanes to reserve the space for efficiently shifting boats. Since fishing boats with different fishing gears are operated in different fishing operation modes, the five lanes with powered winches at a rate of 7 boats per lane will be arranged as follows:

- One lane for longer FRP purse seine boats,
- Two lanes for trawlers from Chateaubelair and Barrouallie,
- Two lanes for 14 trawlers at Owia

Slipway width shall be designed so as to accommodate 5 vessels in parallel position, therefore amounting to 2.0m x 5 vessels +1.0 m x (5+1) = 16 meters. Boat parking yard shall accommodate all 28 vessels; Fishing boats for refuging from an anomalous sea condition shall be hauled onto the roads and other open spaces in the Center.

4) Turning Basin

Turning basin for a vessel usually requires a circle area of 3 times of the vessel length. In case of small double-enders, activities of which will be the most frequent in the port, the diameter of the area will be 26 meters, whereas the largest vessel, i.e. fish buying vessels, would require much longer 51 meters. As the latter size is too large, a turning basin will be set at 32 meters which is equivalent of the double length of the largest vessel.

(3) Volume of Fish Landed

Based on the field hearings and questionnaires, the daily volume of landed fish is estimated to be approximately 1 ton.

Table 2-2-2.(2) Estimated Volume of Fish landed

	Number of Vessels	Operation Days per Month	Estimated Volume per Day
Local round haul vessels	3	20	383kg
Other round haul vessels	2	20	261kg
Trawls	23	20	300kg
bottom trawls	23	20	83kg
Total			1,027kg

(4) Planned Facilities and its Allocation (Plan)

1) Measures in Emergency

① In anomalous weather conditions (such as hurricanes), all vessels shall be parked on land.

② In such occasions, five vessels shall be parked on the boat yard of slipway; the rest shall be parked on the roads and drying- net spaces in the Center.

③ Moreover, in such occasions, the port shall serve a shelter for boats from other ports. Such boats shall be accommodated in the facility as well as on main roads of the vicinity.

④ For the above purposes, roads which lead from the fishery facility to the main road shall be set in a straight line wherever possible, so as to enable easy parking of the boats.

2) Planned Facilities

Based on a review of the request, the planned fisheries facilities and its equipment covered in the study, as well as the connection of each facility to the fishing port, is specified in Table 2-2-2. (3).

Table 2-2-2.(3) Planned Facilities: Function and Connection to Fishing Port

Class	Planned Facilities \ Function in Port	Parking /Storage	Fish Landing	Preparation / Lay-by	Hauling/ Launching	Refuge	Distribution	Hygiene	Management	Access	Connection
Fishing Port Infrastructures	1) Expansion (by Reclamation and Backfill)	○	○	○	○	○	○	○	○	○	
	2) Revetment (incl. Quay)	○	●	●	●		●		●	○	Revetment/Slipway/Breakwater Construction functions share common waters so are highly correlated; therefore, aligned development of the three areas is preferable. Also preferable is the effective use of calm waters for loading/preparation/interval facilities.
	3) Slipway				●	●			●	●	
	4) Breakwater Construction(incl. Quay)	○	●	●	●	○	●		●	○	
On Shore Fisheries Facilities	1) Gear Lockers	○	○	●					●	●	Strong connection with preparation/interval/control functions, therefore it is preferable and convenient to place gear lockers adjacent to off-shore facilities.
	2) Fishers's hall										The Fishers's Hall integrates distribution/hygiene/control functions. Location of the control function should be defined where it could oversee the whole facility. Distribution function should take into consideration the fish handling procedures, therefore positioned in line with fish landing/access functions.
	①Office quarters	○	○	○	○	○	●	●	●	●	
	② Ice-making and cold storage		○				●	●	●	●	
	③Blast Freezer		○				●	●	●	●	
	④Fish Processing / Retail Stalls		○				●	●	●	●	
	⑤Conference / Community Hall			○					●	●	
	⑥Fishing Gearshop			○			●		●	●	
	⑦Kitchen (Water Boiler)							●	●	○	
	3) Toilets / Showers	○	○	○				●	●	●	Toilets / Showers should have a strong connection with Gear Lockers for convenience.
	4) Septic Tank and drainage							●	●	○	
	5) Fuel and Water Station	○		●				●	●	●	Strong connection with preparation/interval functions.
	6) Fishnet Shed	○		●					○	○	Strong connection with Gear Lockersand and Boad Hauling Facilities for convenience.
	7) Pavement (Roads / Parking Lot)	●	●	●	●	●	●	●	●	●	
	8) Water Tank							●	●	○	Strong connection with distribution/control/hygiene functions; therefore, alignment with conference/community hall is preferable. Easy access to fish landing function for streamlined distribution is preferable.
	9) Stand-by Generator				●		○	○	●	○	
Fishing Equipments	1) Shelf for Freezer		○				●		○	○	
	2) Stainless Steel Tank		○				●		○	○	
	3) Stainless Steel Cutting Board		○				●		○	○	
	4) Thermal Box for Fish Storage		○				●		○	○	
	5) Fish Tray		○				●		○	○	
	6) Pressurized Washer							●	●		
	7) Hose for Pressurized Washer							●	●		
	8) Underwater Compressor		○						●	○	
	9) Plastic Case for Fish		○				●		○	○	
	10) Platform Scale		○				●		●	○	
	11) Spring Scale		○				●		●	○	
	12) Wheelbarrow		●				●		○	●	

Note 1) ● : Strong Connection ○ : Moderate Connection

Note 2) In the table above, colored parts indicate those areas which have a strong connection to fishing port.

3) Allocation Plan

Table 2-2-2.(3) shows the planned facilities/equipment grouped by function. Taking consideration of the local natural/geographical conditions, fishers' convenience and safe activities in the port, the facilities should be allocated in the project site efficiently and economically. Special attention required in this plan is to allocate the facilities in the limited area and its difference in height (maximum 15m). Under the site conditions, proper consideration of systematic earthwork and the layout of the facilities should be required for minimization of the construction cost.

Based on the geographical/natural characteristics in the planned area, a proper layout plan is discussed in terms of convenience, safety and economy for:

1) Earthwork,
2) Layout of roads and ditches,
3) Layout of fishing port facilities as a breakwater, slipway, and
4) Buildings in the Center

The policy for allocation is tabulated in Table 2-2-2 (4).

Judging from the above, the preferable allocation of each function of the planned facilities are defined as shown in Fig 2-2-2 (2).

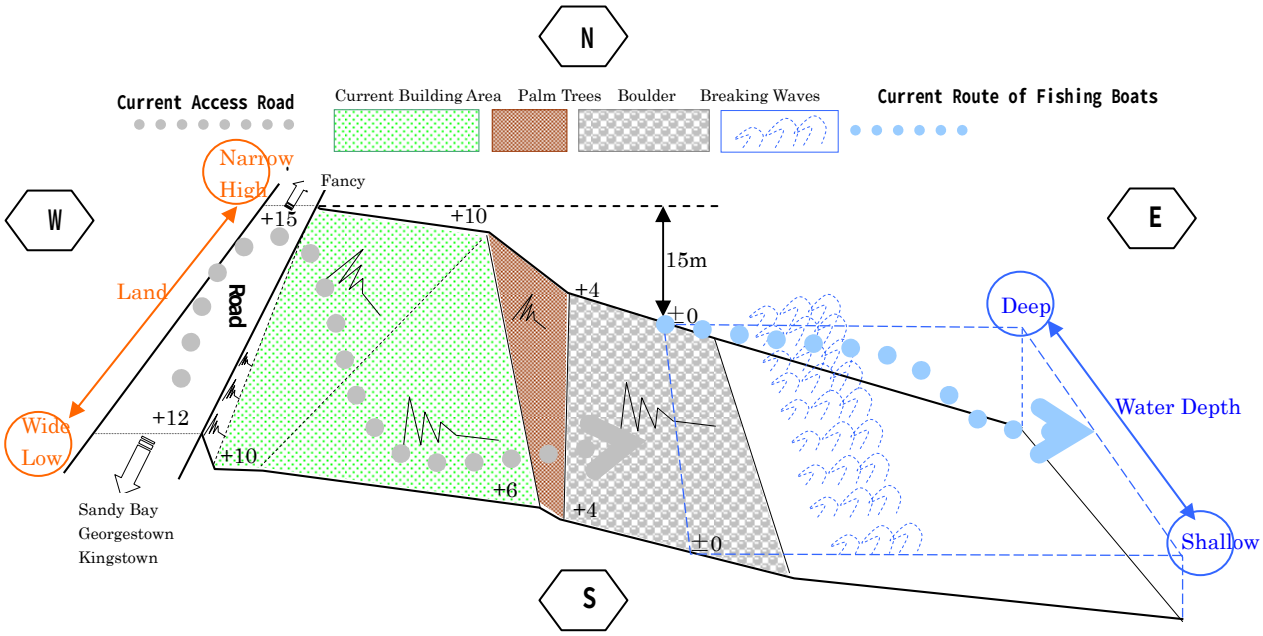
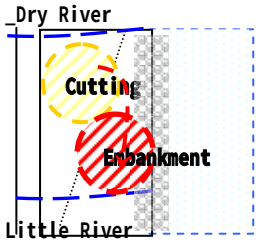
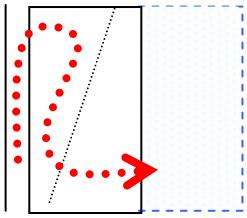
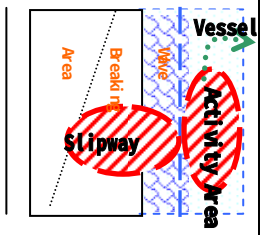
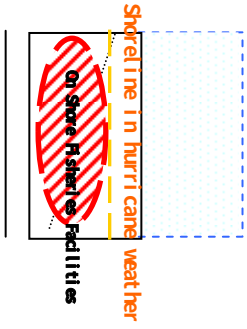


Fig 2-2-2.(1) Natural/Geographical Mechanism of Site (Cross-Section of Premise)

Table 2-2-2.(4) Allocation Plan: Basic Assumptions

	Convenience	Safety	Economics	Allocation Plan
① Civil Work	②③④ should be located close to each other; gradient should be kept to a minimum	Level land within the premise should be kept to a minimum, so that there should be no steps between facilities. Development Works in the existing river areas and boulder shore should be avoided wherever possible.	Surplus soil from cutting and embankment should be minimized. Reclamation should be avoided wherever possible; current shoreline should be protected.	
② Road /Embankment Access Structure	Correlated Functions/Facilities should be located close to each other.	Gradient of roads should be kept to a minimum.	Allocation should be in line with the area's geography to minimize cutting and embankment of soil.	
③ Fishing Port Infrastructures • Fish Landing • Parking • Preparation • Hauling/ Launching • Refuge	In areas within the breakwater construction and revetment, fishing boats could have ease of access closer to offshore, rather than in the wave breaking area.	To minimize the effect of high tides, vessel route should run closer to offshore rather than across the wave-breaking area. Care should be given not to disturb existing fishing activities.	Economically, slipway should be located where gradient is small and height of on-ground rooftop is small; breakwater construction should be located in shallow waters.	
④ On shore Fisheries Facilities • Distribution • Management • Preparation • Lay-by	Should be aligned with access functions: i.e. located between facility entrance and fish landing facility.	Should be located high enough so that waves will not reach in times of hurricanes. Preferable to locate on cut soil.	On-shore fishing activity areas/facilities should be allotted as small a land area as possible.	

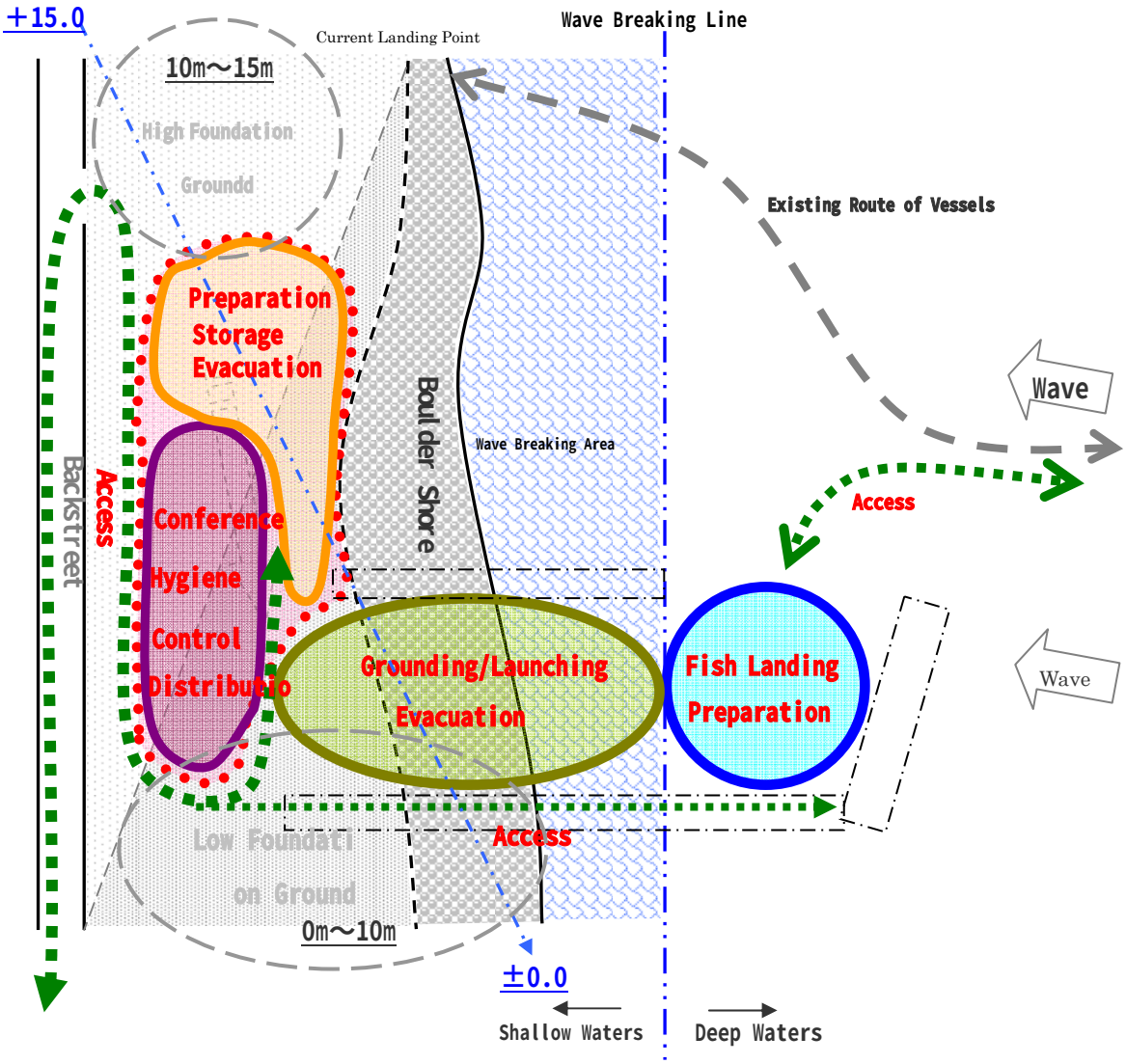


Fig 2-2-2.(2) Function Zoning of Planned Facilities

(5) Basic Policies for Civil Engineering Facilities

1) Basic Policies

a) Basic Policies for Plan

The Atlantic Ocean around Owia Bay is characterized by constant severe wave conditions, most typically oceanic swells. Moreover, Caribbean countries (including St. Vincent and the Grenadines) are classified into a hurricane-prone area, which often results in a large number of relevant damages. Because of such natural conditions and geographical features around the planned area, no basic facility for fishing operation has been yet constructed (i.e. fish landing facilities, primary processing, and fish stores). Accordingly, elderly fishers, a majority in the sector, have to overcome many obstacles in order to perform their jobs.

The fishing grounds with rich resources around the project site let fishers expect additional fish catch, however, they have no measures of increase of fish catch because of

a lack of fisheries facilities and a poor road to the capital city. Fishers in the North Windward region (including Owia) have high expectations toward the project, especially for fishing port facilities such as a landing berth, a slipway and breakwater structures. With consideration of the precipitous terrain of the project site and the severe wave conditions peculiar to the Owia Bay, the fishing port facilities are bound to be costly; thus it is necessary to consider not only safety but also workability and economy in planning the layout of the facilities.

The local conditions and workability should be taken into consideration in planning offshore structures (fishing port infrastructures) in the first place. In accordance with the fundamental principle of the development being "for a better life for artisanal fishers, by improving the safety and convenience of fishing activities (fish landing, boat hauling)", the optimized facilities are designed, based on the following basic policies:

[Basic policies for planning]

① Facility planning is executed on the basis of the practical fisheries activities in Owia, Fancy, and Sandy Bay, which were found by the study team. A layout of water area is designed, considering a training vessel and fish buying vessels.

② Development with removal of boulders along the coastline in the site is minimized because boulders stabilize the shoreline. For the same reason, the estuaries of the Little River and Dry River are not developed.

③ Facilities shall be allocated so that the construction will not affect present fisheries activities in Owia.

④ Considering local hydrographic conditions and minimization of environmental and social impacts, facilities with a proper water depth and structures are design so as not to change seabed topography.

⑤ For minimizing construction costs, necessary and minimum length of a breakwater is designed and a berthing facility is applied. Port facilities shall be allocated with careful regard to existing routes of vessels and wave breaking conditions.

b) Applied Planning Standards

Since there is no standard concerning port development plans in the country, planning shall be laid in conformity with the following Japanese standards:

- "Guidelines for Fishing Port Planning (National Fishing Port Association)"
- "Guidelines for Fishing Port and Ground Facility Planning (National Fishing Port and Ground Association)"
- "Standard Design Manual for Fishing Port Structures (National Fishing Port and Ground Association)"

c) Basic Guidelines for Fishing Port Facilities

① Land Reclamation

In allocating the planned facilities, it is necessary to ensure a convenient layout of the facilities for efficient fisheries activities in the Center as well as minimize reclamation, since the plan has to be made to accommodate all the necessary facilities within a limited and uneven area. Moreover, the ground height of building as Fisheries Center, gear lockers, etc. should be identified with sufficient attention to waves caused by hurricanes, data of which is calculated with wave hindcasting and is obtained in field hearings.

The main roads leading to the sites have traffic restrictions: there are limitations on the transportation of construction equipments and passable vehicles. To comply with such restrictions, earthwork should be minimized in volume; it is also necessary to devise ways of making use of surplus soil gained by cutting land.

② Breakwater and Revetment

Since severe waves were observed in the Owia Bay area facing the Atlantic, a breakwater and a revetment are required for the following reasons: first, to protect the slipway/sites behind the revetment from high waves coming in from the open sea; second, to ensure enough berth height so that fish un-loading and preparation activities be protected from surging waves; and third, to ensure tranquility and facilitate the entrance/clearance of fishing boats and boats hauling onto the slipway.

Allocation of the facilities is kept to the minimum extent required for securing tranquility in front of the slipway and for safe enough height of the berths for fisheries activities not to suffer damage from waves, confirming waves in the port area through wave agitation analysis. As for the breakwater structure, end-on operation shall be employed, because of no base port for floating fleet near the site and the local severe wave conditions. In this connection, a high mound composite breakwater structure shall be adopted, with reference to local hydrographic conditions and equipment necessary for the operation. Furthermore, a part of the port side of the breakwater is also used for a berthing facility to minimize construction costs.

③ Slipway

To avoid seabed topographic change as stated previously, the front end of the slipway is set at a depth of −2m, from which the slipway extends to the ground height of the Fishery Center at + 7.5m. Consequently, the gradient of slipway is to be around 1/6, while it is generally expected to be about 1/6 to 1/10. Moreover, for fishing boats seeking evacuation in anomalous weather conditions, a boat yard is required at the top end of the slipway; therefore the total slipway length amounts to 60m. Based on this calculation, the slipway shall be equipped with winches to reduce fishers's workload.

In the plan, the slipway accommodates 32 boats; in emergency, however, all fishing boats operating in the area, including those from other ports, are parked via slipway, and refused to net drying space and inner roads of port.

④ Revetment

Revetment construction shall be carried out so that it runs offshore, perpendicular to the strandline, in order to protect the slipway and access roads between berths in the port. Rubble-mound revetment, adjacently located to the north of the slipway, is extended to the water depth necessary for protecting the front end of the slipway; it has a sloping breakwater structure with rubble stones. On the other hand, as for those revetment intended as a protective barrier for internal access roads between berths, they have the same structure as the breakwater at the part connecting the revetment and the breakwater, whereas a part for dissipating waves is of a rubble stones structure to secure their stability. Moreover, to ensure stability and workability, the structure shall be integrated with berth construction.

⑤ Other Fishing Port Facilities

The other facilities include in-port roads, pavement, beacon lights, fenders, bollards, curbing, water faucets, fuelling cocks, and lighting equipment.

d) Condition Setting for Planned Vessels

Table 2-2-2.(5) Condition Setting for Vessels

Category	Condition	
Target Vessels	Small Vessels	Large Vessels
Type	Double ender (Large)	Fish buying vessels
Length	8.4m	17.0m
Width	2.0m	5.0m
Draft	0.9m	3.0m
Landing Speed	0.5m/s	0.4m/s
Pulling Power	10kN	30kN

e) Surcharge to Berth

Table 2-2-2.(6) Surcharge

Category	Load（kN/m^2）
Unloading Berth	10
Lay-by Berth	10
Preparation Berth	5
Revetment/Embankment	5

2) Guidelines for Natural Conditions

a) Air Temperature/Rainfall

The air temperatures in this area are from twenty-five to twenty-seven degrees Centigrade throughout the year, which doesn't comprise any major obstacle to the construction.

There are seventy-seven days with more than 10 mm/day of rainfall; therefore, it is necessary to consider the effect on the construction caused by rainfall, such as the rate of work stoppage. The months from July to December in particular have high precipitation among rainy seasons.

b) Tide

As the findings from the survey of natural conditions show that the M.W.L indicated by the survey almost equals to the figure "St. Vincent Trig. Datum = ±0.0," relevant height of tide values are set as follows:

Table 2-2-2.(7) Height of Tide in Planned Areas (m)

H.H.W.L	＋0.329
H.W.L	＋0.171
M.W.L（Vincent Trig. Datum）	±0.000
L.W.L	－0.171
L.L.W.L	－0.329

c) Design Wave

Based on the findings from natural conditions, the following design wave in the project areas is identified, according to water depth:

Table 2-2-2.(8) Design Wave Height

Water Depth	Wave Direction	Wave Height	Period
－6m	E	5.36 m	13 s
－5m	E	4.70 m	
－4m	E	3.96 m	
－3m	E	2-21 m	
－2m	E	2.47 m	
－1m	E	1.73 m	

d) Littoral Drift

Results of submarine sediment profiling indicate that the median particle size at water depths construction level is about 0.4mm to 0.6mm; silt component of fine particle size was virtually undetected because the sediment was composed of sandy soil. Moreover, no field hearings have reported a large amount of sediment discharge from the neighboring rivers, Dry River and Little River. Therefore, there should be little possibility of large drift sand movement. Furthermore, judging from the adhesion of algae to sub-bottom boulders and the discharge-duration survey, it would appear that no obvious flow is arising. Field hearings on this topic presents that boulders around the strandline are in a stable condition.

The cliffs located at both sides of Owia Bay, Dry River and Little River are supposed to be sources of supplying sand to the shores at the site. Dry River supplies literally no

water flows, except one flood in a year, and the same situation occurs in Little River. No traces of collapse and erosion are found at the both cliffs. Considering the above, the only source of littoral drift is identified as the sand of the seabed.

The topographic change of the seabed is calculated following the steps as below:

- Calculation of wave deformation with the fishing port facilities
- Calculation of shear stress on the seabed, which is external forces to move sand
- Calculation of volumes of transported sand
- Calculation of balance of sand volume

The calculation results shows that about 10 cm sand is accumulated in the north and south areas of the fishing port facilities and that significant change of the seabed is not found in the north area close to the facilities.

From the above, the effect of littoral drift may be considered as negligible.

e) Soil Condition

The breakwater is a gravity composite breakwater structure and it conforms well to a firm seabed or shallow bedrock layers; however, in the case of a soft seabed, measures against differential settlement are required. At the basic design stage, however, the result of soil profiling has not been obtained through its on-site boring. The profiling result and the observation through the survey in the field present that the seabed is covered with sand mixed with gravels; this means that the soil under the seabed is in comparatively good condition. Hence the introduction of settlement prevention mats is taken into consideration for the present. These mats will be removed when on-site findings assure safe ground condition with no possibility of settlement.

3) Guidelines for Construction Procurement

Construction equipment and materials shall be locally procured as much as possible: especially, local cement and aggregate are sufficiently available. Materials shall conform to JIS-standards, or shall be of equal quality.

Floating fleet is necessary for transportation/ installation of concrete blocks for the breakwater construction. However, no construction companies in the country have floating crafts and experience of marine work on the Atlantic side. For this reason, floating crafts and large cranes shall be procured from the Republic of Trinidad and Tobago and Barbados.

4) Guidelines for the Use of Local Construction

Marine work in the country has been conducted by the construction firms in Trinidad and Tobago and Barbados, since local construction firms specialize in road works and small building works. Several firms have some experience of harbor works in contracting with foreign firms, but do not have the equipment or laborers necessary for marine work. Even allowing these circumstances, local firms may be possibly involved under

subcontracts. However, it is noted that installation of blocks at the Atlantic side will be conducted by Japanese technicians because it is dangerous work and requires special techniques.

5) Guidelines for Construction Methods

In constructing the breakwater with wave absorbing blocks, marine work shall be kept to a minimum; instead, end-on operation shall be employed, considering site conditions and local construction circumstances.

(6) Basic Policies for Architectural Facilities

1) Basic Policies

a) Applied Planning Standards

Planning shall apply the relevant Japanese Building Standards Law and Japanese Industrial Standards (JIS), referring to CUBiC and "Organization of Eastern Caribbean States Building Cord adapted of St. Vincent and the Grenadines" used in St. Vincent and the Grenadines.

b) Structural Planning Conditions

① Seismic Force

Based on CUBiC, the "Organization of Eastern Caribbean States Building Cord adapted of St. Vincent and the Grenadines" sets the general horizontal force, V, in accordance with the following formula, and the coefficient of the horizontal shearing force, ZCIKS, to be multiplied by the vertical load, W, is 0.072 at minimum.

V = (General Horizontal Force)Z CIKSW

Z: Regional Coefficient (0.5 for St. Vincent and the Grenadines)

C: Basic Elasticity and Time Modulus of Structures (not exceeding 0.12)

I: Building Modulus by Use (I = 1.5 for major public buildings)

K: Structural System Modulus (K = 0.8 for RC rigid-framed structure)

S: Building Natural Oscillation Modulus in a Building Site (1.0 or more)

W: Building Fixed Load + Building Live Load

On the other hand, under the Japanese Building Standards Law, the seismic force is calculated by multiplying the vertical load (W: fixed load of building itself + live load) with the seismic layer shearing force, Ci=Z Rt Ai Co. Since the definitions of "W"s in the two formulae are identical, it is the seismic layer shearing force, Ci, in the Japanese Building Standards Law that is equivalent to the coefficient of the horizontal shearing force, ZCIKS, referred to in CUBiC. Following the formula shown below, Ci equals 0.14, exceeding 0.072 in CUBiC.

Ci=Z Rt Ai Co=0.7x1.0x1.0x0.2=0.14

Z: the value which is defined by the Ministry of Land, Infrastructure and

Transport in accordance with records on earthquakes in the past and indicates the degree of damages (0.7)

Rt: oscillation property of building (1.0)

Ai: the value which is defined by the Ministry of Land, Infrastructure and Transport and indicates the distribution of directions of heights of buildings for the seismic layer shearing force (1.0)

Co: Coefficient of standard shearing force (0.2 or more)

This difference regarding the coefficient of the horizontal shearing force between in Cubic and in Japanese Building Standard Law seems to stem from the differences concerning legal structures and technical standards of two countries. St. Vincent is located in the seismic area on the volcano belt zone same as Japan. And, St. Vincent area had the 6~6.9 Richter scaled earthquake in 1976~1989 historically. Therefore, regarding seismic design criteria, Japanese Building Standard will be adopted for this Project.

② Wind Load

To correspond to a wind velocity of 35 meters per second worked out by assuming the average in 10 minutes from 50 years of expected values, the "Organization of Eastern Caribbean States Building Cord adapted of St. Vincent and the Grenadines" provides for the following figure and definitions on the basis of CUBiC:

W (Wind Load) = (qref) (Cexp) (Cshp) (Cdyn)

qref: Wind Speed by Region (qref = 0.73kPa in St. Vincent and the Grenadines)

Cexp: Building Height (Cexp = 0.9 under the condition of H = 5 or less)

Cshp: Building Shape (Cshp = ±0.7)

Cdyn: Principal Structural Part (Cdyn = 2.0)

Comparing CUBiC with the current Japanese Building Standards Law regarding "the roof level structural frame of a building 4 meters high with a flat roof," the wind load (principal structural part) obtained on the basis of CUBiC is W = 0.73Kpa*0.9*0.7*2.0 = 919Pa (N/㎡), which is, if calculated in accordance with the Building Standards Law of Japan, W＝qCf, (q=0.6E Vo^2 C), W=0.6 E Vo^2 Cf＝1162N/㎡.

Although the wind load, W, calculated according to CUBic and the wind load, W, calculated according to the Building Standards Law of Japan should be identical to each other because these two countries have shared experiences of harricanes or strong typhoons, the difference shown here seems to stem from differences concerning legal structures and technical standards between the countries. In consideration of the two types of wind load – one in CUBiC and the other in the Building Standards Law in Japan – under the similar circumstances subject to stormy winds, it seems technically reasonable to prioritize the latter as the standards for this Project on the grounds that it is in conformity to the international standard and hence more appropriate.

③ Bearing Capacity of Soil

From an economic standpoint, the direct infrastructure system with independent footings incorporated, instead of pile foundations, shall be adopted for the one-story buildings being planned; according to a plate loading test, the appropriate bearing capacity of soil in the field is assumed to be 103 kPa.

④ Wastewater Discharge Standard

Although the St. Vincent and the Grenadines has no BOD wastewater discharge standard, from an environmental standpoint, wastewater discharge standard shall be set at 60 ppm, which is the standard value used in Japanese fishing ports.

⑤ Measures for Salt Proof

The planned areas are located inshore and exposed to the danger of salt damage. Therefore, electric equipment parts which are exposed shall have salt resistance measures.

2) Guidelines for Natural Conditions

Since the project sites are slope areas, construction will be undertaken after site preparation. The Fishery Center is regarded as a heavy structure because it is equipped with machineries. This kind of heavy structure shall be placed on cut lands in site preparation; as for Gear Lockers, necessary bearing capacity of soil shall be ensured.

3) Guidelines for Construction Circumstances

Road transport conditions, especially from its capital, Kingstown, in Owia in the country are not well. Therefore, in the construction phase, maritime transport shall be employed to carry the large amount of construction materials; in the operation phase, however, long materials (most typically, roofing steel sheets) should be transported by land.

Therefore, in consideration of ease of maintenance in the operation phase, it would be essential to choose construction materials which could be transported in small lots.

4) Guidelines for the Use of Local Construction Contractors

It can be safely said that local construction companies in St. Vincent and the Grenadines including the ones in the Caribbean Economic Community as a special economic zone have enough technical skills and labor supply capability.

5) Guidelines for Construction Methods

Basically it might be appropriate to adopt masonry construction, which is a local traditional method used widely. This method may be suitable for housing; however, it is

not suitable for large buildings used as a fisheries center, because of its limit as a structural system in creating large intercolumnar space (span). Therefore, for the framework a RC rigid-framed structure shall be employed so as to secure large spans between columns, and masonry construction using concrete blocks shall be employed for exterior and interior walls to fill in the intercolumnar space.

(7) Basic Policies for Construction Equipment and Materials

Construction equipment and materials to be provided in this plan are crucial for the project to be achieved and to attain the greatest possible effects. They pertain to the transportation, measurement, processing, and storage of fish, facility cleaning, and accessory fishing gear, and include the following.

- Fish Preservation : ice making machinery, icehouses, chilled storage facilities, cold storage facilities
- Fish Transportation : insulated fish crates/plastic fish crates/carts
- Fish Measurement : platform scales/spring scales
- Fish Processing : stainless steel workbenches/stainless steel washing tubs
- Fish Storage : fish trays/racks for freezers
- Facility Cleaning Equipment : pressure washers/hose for pressure washer
- Accessory Fishing Gear : diving compressors

2-2-3 Basic Plan

2-2-3-1 Basic Plan for Fishing Port Facilities

(1) Fishing Port Facilities

1) Breakwater and Revetment

① Structure Type

The breakwater of a composite type with wave absorbing concrete blocks is designed considering the end-on operation method.

In general, a composite breakwater is composed of an upright wall based on rubble mounds and demonstrates the function similar to a sloping breakwater if the mound elevation is high, and the function similar to an upright breakwater if the elevation is low. A composite breakwater has some advantages: they can be applied to relatively soft grounds because the higher mound enables to de-concentrate the overall load; and optimal design can be conducted with selecting mound elevations for economic and easy performance of the work in accordance with the water depth.

② Required Weights of Wave-Absorbing Blocks and Armor Units

The Hudson Formula shown below is used for the calculation of the required weights of armor units for slopes

$$W = \frac{r_r \times H}{K_D(S_r-1)^3 \cot \alpha}$$

W: Required weight of Tetrapod (t)

r_r: Unit accumulated weight of concrete (2.3t/m^3)

S_r: Relative density of concrete to seawater ($S_r=r_r/r_w$)

r_w: Unit accumulated weight of seawater (1.03t/m^3)

H: Designed wave height (m)

K_D:Constant to be determined in accordance with armor units and a damage rate (8.3)

α : Angle between the slope and the horizontal plane ($\cot \alpha = 4/3$)

The required weights of Tetrapod at various depths of water calculated on the basis of the above formula are summarized below. In particular, where the weight of Tetrapod around a breakwater head is concerned, 50 percent of the required weight of the breakwater head must be taken into account.

Table 2-2-3.(1) Weights of Wave-Absorbing Blocks and Armor Stones

Depth of water	-6m	-5m	-4m	-3m	-2m
Design wave height	5.45m	4.70m	3.96m	2-21m	2.47m
Required weights of wave-absorbing blocks	17.8t	11.4t	6.8t	3.6t	1.7t
Tetrapods (actual weights)	20t-type (18.4t)	12.5t-type (11.5t)	8t-type (7.36t)	4t-type (3.68t)	2t-type (1.84t)
Tetrapods around breakwater head (1.5 times)	32t-type	20t-type	12.5t-type	6.3t-type	2-2t-type
Required weights of armor stones	1t～2t	1t	500kg	200kg	100kg
Required weights of basic rubble mounds	100kg	50kg	30kg	15kg	5kg

③ Crown Height of Breakwater

Normally, the crown height of a breakwater is obtained with using "F.H. (crown height) = R_L + H.W.L". Since vessels in the project will be evacuated in rough seas, a certain rate of wave overtopping is allowed in the basin behind the breakwater, which will be located at the seabed elevation of –5m.

"Guidelines for Design of Facilities for Fishing Ports and Fishing Grounds (National Fishing Port and Ground Association)" requires the crown height of a breakwater as RL ≧0.6H above H.W.L. Wave setup, an increase in an average water level caused by waves, should be considered in the wave-breaking zone for determine the crown height of the breakwater.

The crown height of breakwater in the project requires higher than 3.5 m above H.W.L. as shown below:

$$F.H \geqq RL + H.W.L. + \text{Rate of wave setup}$$
$$= 0.6 \times 4.70m + 0.329\ m + 0.21m$$
$$= 3.5\ m$$

Table 2-2-3.(2) Wave Setup

Water Depth	-5m
h/H'_0	1.138
H'_0/L_0=	0.02
η / H'_0	0.040
η (Increase in water level)	0.21m

Using the above Guideline to estimate a rate of waves overtopping the breakwater, the rate is 0.1 cubic meters/m/sec. It is greater than the tolerable limit of overtopping rate in the range of 0.01 and 0.06 m^3, which is the rate that damages by wave overtopping may occur.

To seek the rate in the allowable range, examination of the rate in case of a crest height of 4.0m was conducted to obtain the wave-overtopping rate of 0.05 cubic meters/m/sec.

The above consideration determines to be +4.0m as the crown height of the breakwater with conditions of a certain rate of wave overtopping.

④ Width of Rubble Mounds

The width of basic mounds will be set in conformity to the Guideline on Designs of Facilities for Fishing Ports and Fishing Grounds, as shown below.

Table 2-2-3.(3) Width of the Crown of Basic Mounds

Designed wave height H	Width of Basic Mounds	
	Outside harbor	Within harbor
H<3.5m	3m or more	2m or more
H≧3.5m	5m or more	3m or more

2) Quays

① Setting of Crest Height

The crest elevation of quays must be determined with cares to prevent seawater from overflowing on the quays on high tides. In general, a necessary height of a quay at fishing ports in Japan is calculated, following Table 2-2-3.(4) that shows heights to be added to High Water Level. with different tidal levels and different sizes of fishing vessels. In this case, the required crest height of quay will be: 0.171＋0.7＝＋0.871.

Table 2-2-3.(4) General Formula to Calculate height of Quay Sides

Tidal range	Fishing vessel up to 20 Gross Tons	Fishing vessel between 20 & 150 Gross Tons
0.0m ～ 1.0m	0.7m	1.0m
1.0m ～ 1.5m	0.7m	1.0m
1.5m ～ 2.0m	0.6m	0.9m

If the intrusion of seawater on high tides is taken into account, the figure will be 66.5cm, which is calculated based on an experimental formula for high water forecast by the Meteorological Agency. In this case, the necessary height of quay sides is +0.836, which is more or less the same as the figure obtained in accordance with Table 2-2.(3).

$$H = a \times (1010-p) + bw^2\cos\theta + c$$

a =0.9

p =959(Average central pressure: 979、981、929、950、956)

b =0.02(There is a channel between Saint Vincent Island, where Owia Bay is located, and Saint Lucia, so that it can be assumed that there is little effect of winds on high water. Accordingly, values of various places with the similar geography in Japan are referred to to obtain the average figure: these places are Kushiro, Hachinohe, Miyako, Choshi, Ito, Omaezaki, Toba, Tsumoto, Wakayama, Kochi, Tosa-Shimizu, and Aburatsu in Japan.)

w ＝32.1km/s（The maximum wind speed of "Emily" in the data available）

c = none, and

θ =0°(i.e., cos θ =1).

Thus,

$H = 0.9(1010\text{-}059)+0.02\times32.1^2 = 66.5\text{cm}$

Moreover, when quays are actually used, the results of surveys on harbor tranquility, as shown below, should be taken into account, so that approximately 30cm will be allowed. The height of quays in the project is set at 1.1 meters. The relation between the crest height of the quay and sea levels of H.H.W.L. an L.L.W.L. are shown in Figure 2-2-3.(1). In this case, the difference between fishing vessels and the crown of the quays is somewhat large, 1.4m, but this seems to be acceptable. At the same time, the height determined seems reasonable if it is taken into account that large vessels buying fish on the sea also use the quays.

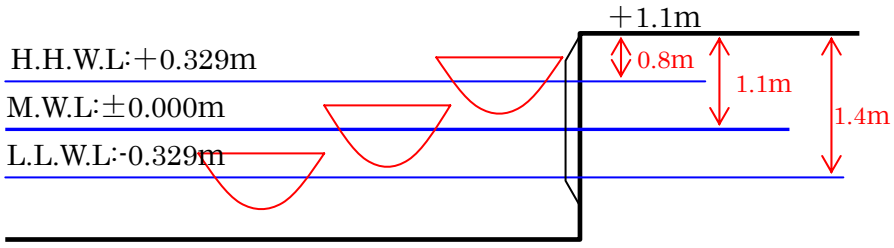


Fig 2-2-3.(1) Relationship between Tidal Levels and Height of Quays

② Aprons

- Width of Aprons:

"The Guideline for Designs of Facilities for Fishing Ports and Fishing Grounds" stipulates that the width of aprons should be set at 10 meters as shown below, considering free approach to the berths for vehicles. In this Plan, however, berths are located at the backside of the breakwater and the width of the apron is limited at 8 meters because of an economical reason. The proposed width may restrict free activities on the apron; however, safe handling and vehicles' traffic will be secured under the control of the authority. The width of the apron is proposed as 8 meters.

Table 2-2-3.(5) Width of Aprons

Category		Width of aprons
Quays for landing of fish	All fish to be carried to storage shed	3.0m
	All fish to be carried directly from aprons by vehicles	10.0m
Quays for fishing and preparation		10.0m
Quays for lay-by		6.0m

- Slope of Aprons:

The gradient of the apron is 2% considering activities and drainage on the apron.

3) Slipway

① Width of Slipway

The width of slipway(landing place) is set to accommodate five lanes of fishing vessels and it is 16 meters: 2.0m x 5 vessels +1.0m x (5+1). The boat yard on the slipway is used for all the 28 vessels, whereas inner-port roads and open spaces in the premises of the Fisheries Center will be used in an emergency. In the meantime, double-enders are moored, in principle, at the end-point of the slipway, or anchored in the basin.

② Slope of Slipway and Planned Water Depth

- Slope:

Since a slope is set at between 1/6 and 1/10 in standard design, the slipway at a slope of 1/6 is designed so as to minimize necessary space for the slipway comprised of three sections: front slope, rear slope and landing space.

- Planned Water Depth:

The depth is set at –2.0m so as to secure "draught for small fishing boards + allowance (0.5m) under L.L.W.L."

③ Height of Slipway

Normally, the height of slipway is set as "H.W.L. + 2H (H is the wave height at the front of the slipway)" on the basis of the Guideline. Fig 2-2-3.(2) shows a result of the calculation of waves in the basin. In the Figure, the ratio of wave height at the front of the slipway to incident wave height indicates approximately 0.30,which means that the wave height ($H_{1/3}$) in front of the slipway is: 5.36m×0.30＝1.6m.

Thus, the necessary height of slipway is: +0.329＋2×1.6m＝3.6m.

Meanwhile, the zone between the point at ＋3.6m and the road at the harbor behind will be used for a landing place.

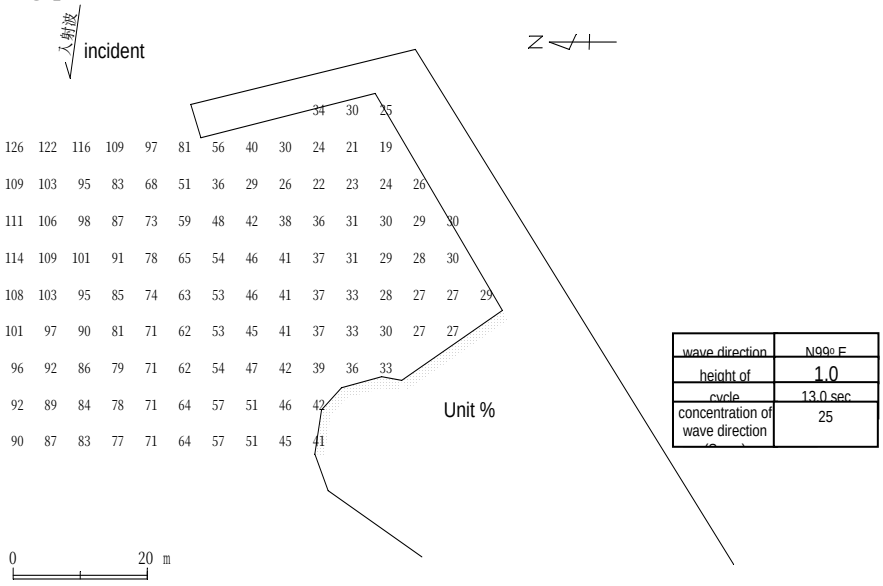


Fig 2-2-3.(2) Result of Calculation of Harbor Tranquility

④ Pavement of Slipway

The slipway above the design water level is of concrete pavement, while the facility under the water below H.H.W.L.(front of slope) is of pre-cast concrete blocks. As shown in Fig 2-2-3.(3), the thickness of concrete paving is set at 50cm, and the thickness of rubble stones is 30cm.

Concrete pavement is adopted for the Boat Yard, the thickness being set at 30cm, and that of the rubble stones at 30cm.

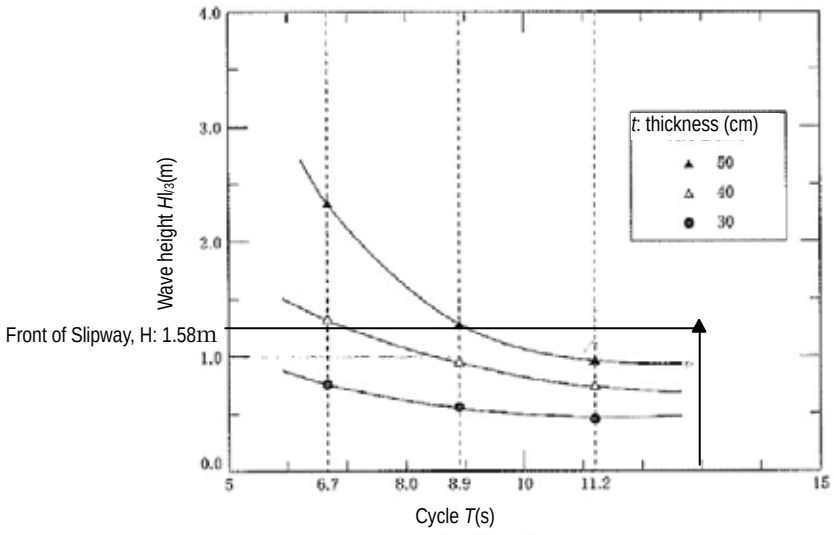
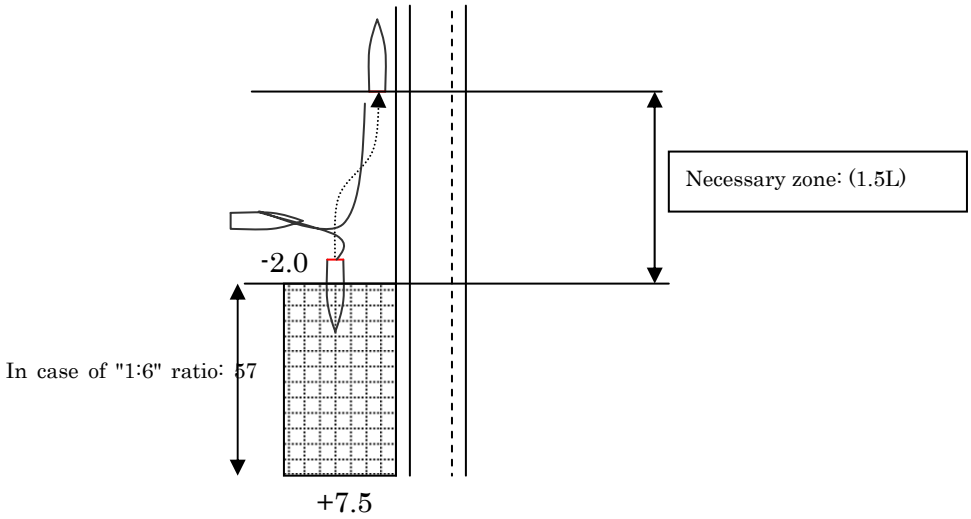


Fig 2-2-3.(3)　Necessary Thickness of Laying Blocks

⑤ Water Area in front of Slipway

For turning boats in front of the slipway, zone of 13 meters will be secured, which is longer than 1.5 times of Length of designed vessel of the design as suggested by the "Guideline on Plans of Fishery Harbors."



※　Necessary zone　=1.5 x 8.4m

=12.6m　13.0m

Fig 2-2-3.(4)　Necessary Zone in Front

⑥ Cross-Section of Slipway

As a result of considerations, the structure of cross-section surface of the slipway will be set as shown below.

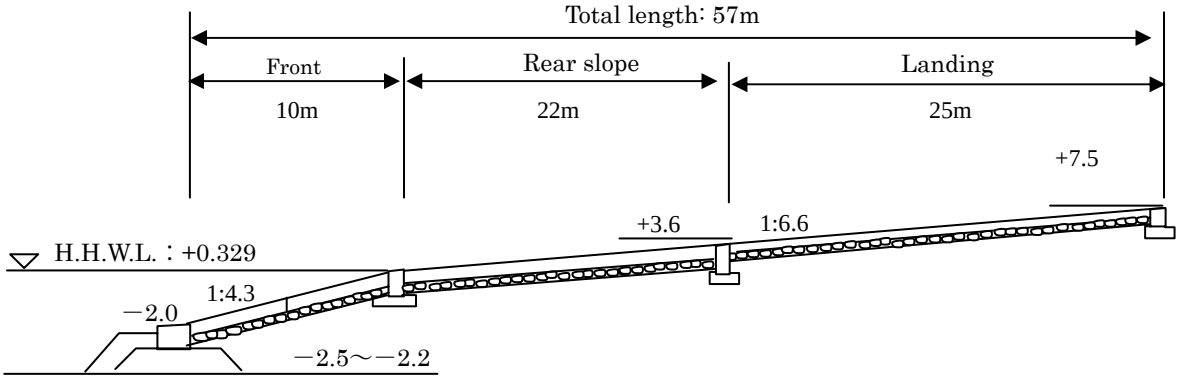


Fig 2-2-3. (5) Cross-Sectional Structure of Slipway

4) Other Facilities

① Fenders

For mooring boats alongside the berth for landing or preparation, rubber fenders are installed so that two fenders are allocated per boat. Since the length of the vessels subject to the Plan is 8.4 metes, the interval between fender beams is set at 3 meters, assuming that the length of parallel board is a half of that of the vessels.

Rubber fenders are prepared for fish-buying boats, the largest boats (length: 17m, width: 5m, draft: 3m), and v-shaped rubber fenders (200H) are applied to the berth. In spite of the normal position of fenders at M.L.W.L., but because the side of the vessels subject to the Plan is low in this case, fenders cover the range between L.W.L and a crest of the berth for safe mooring of fishing boats.

② Beacon Lights

Installation of light beacons is planned so as to secure safe navigation of the fishing boats early in the morning, early dark and during the night. The range of light will be 3 nautical miles so that vessels can detect the light when approaching to the Owia Bay.

Table 2-2-3. (6) Data concerning Beacon Lights

Location of installment	Quantity	Model	Source of light	Color	Quality of light	Range of light
Head of Breakwater	1	Upright	LED-lantern Solar buttery	Yellow	Fl. 4 s (0.5+3.5)	3.0 nautical miles

③ Bollards

Bollards are installed to accommodate upward tractive forces driven by larger ships. This will be inevitable in that the sizes of the vessels subject to this Plan are various. The largest vessel as a design boat is a fish-buying boat of 17m long. The Guideline on Designs

of Facilities in Fishing Ports and Fishing Grounds shows that the vessel is equivalent to a vessel of 20G.T. , its tractive force being 3tf (30kN) according to Table 2-2-3.(7).

And they are installed at 5-meter intervals in accordance with Table 2-2-3.(8).

Table 2-2-3. (7) Tractive Forces and Speeds of Fishery Vessels

Type of vessel (G.T.)	Length of vessel (m)	Width of vessel (m)	Speed of vessels when berthing (m/s)	Tractive force
3G.T.	9.0m	2.4m	0.5m/s	1.0tf（10kN）
5G.T.	11.0m	2.3m	0.5m/s	
10G.T.	13.0m	3.5m	0.5m/s	
20G.T.	17.0m	4.3m	0.5m/s	3.0tf（30kN）
30G.T.	20.0m	4.7m	0.4m/s	

Table 2-2-3. (8) Intervals in between Mooring Posts

Water depth of mooring wharf	Intervals in between mooring posts
-3m or less	5.0m
More than -3m ～ less than -5m	7.5m
－5m or more	10.0m

④ Curbing

Curbing is installed at 0.3-meter intervals, or at intervals of 1.5 – 2.5 meter for safety purposes when bollards are placed in between. They will be placed 0.7 meter away from the face line of the quay in consideration for room required for fish landing.

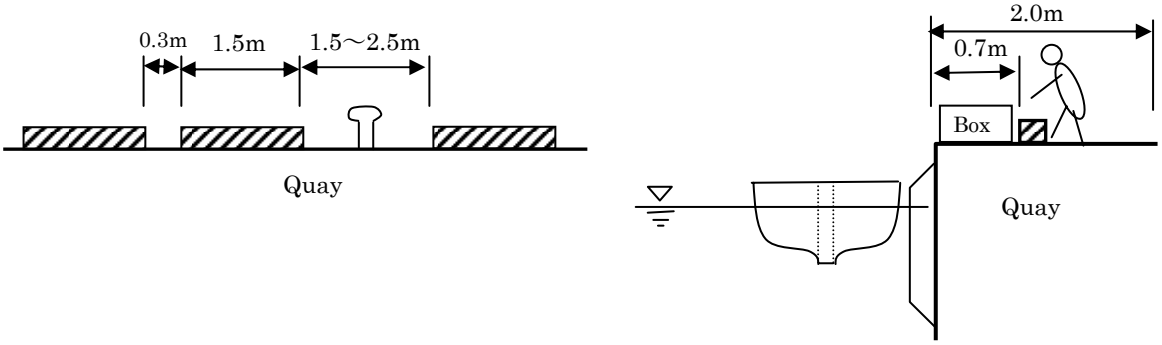


Fig 2-2-3. (6)　Intervals between Car Stops

⑤ Roads in Port

Roads in the port is paved with concrete pavement and the width of the roads be 6.0m as stated below:

Overall width ＝ vehicular road (4.0m) + shoulder (0.5m) ×2 ＋ pavement (1m)

＝ 6.0m

⑥ Pavement

Concrete pavement is applied to roads in port, the parking area behind the Fishermen's Center, and the drying space for fishing gear.

- Thickness of concrete pavement:

  The thickness of the pavement for the roads in harbor, the drying space and the parking area will be set at the minimum given by the "Manual for Cement Concrete Pavement," 15cm (L-shaped traffic, Design CBR: 8 or more). Also, iron fences will be installed within the premises.

- Base course:

  The base course will be at least 15cm thick.

- Pavement joints:

  Concrete pavement consists of concrete blocks of 5m x 5m and the every joins are executed with proper materials as elastic joint fillings or wooden plates.

⑦ Lighting Fixture

For activities early in the morning and after sunset, 2 lighting fixtures are installed so as to keep the lighting intensity in the apron of the quay at 25 Lux or so. Besides, one each will be installed at the slipway and near the store for fishing gear; and one on the roads in the port at interval of 25meters (a total of 5 fixtures). In sum, 9 lighting fixtures are installed.

(2) Layout Plan of Civil Engineering Facilities

1) The Results of Considerations concerning Layout Plan

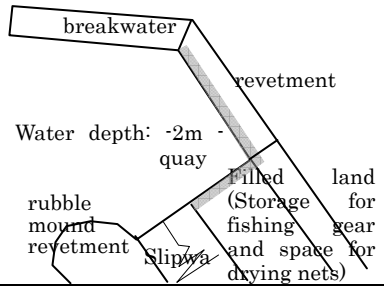
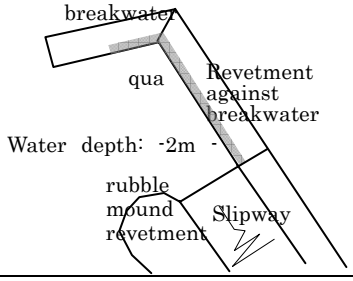
Where layouts of port facilities – that is, a layout of breakwater, revetments, slipway, quay, and reclaimed land – are concerned, two possible cases have been examined in consideration of the functions of each facilities as mentioned below and policies of the layout plan as discussed in section (4) of 2-2-3.

- The breakwater must be built in such a direction that can secure tranquility in the basin for to secure operation efficiency of 90% or higher (that is, 40cm or under) for the boats at the quay and slipway under ordinary waves.
- The port entrance will be constructed so as to face the north since it is reasonable to make use of the existing waterway used by fishing boats.
- Marine construction work must be avoided as much as possible, as the wave conditions around the site are severe. Appropriate locations of the slipways and quay should be determined, considering water depth obtained from the bathymetry survey.

The above examination shows that Case-B is superior as a whole because the cost-benefit performance should be taken into account, referring to the water depth at the

location of the breakwater and length of the facility

Table 2-2-3. (9) Comparative Study of Layouts of Civil Engineering Facilities

(Proposed) layout	Case-A	Case-B
Basic layout		
Concept of layout	Convenience of facilities within the port will be improved because not only the slipway and quay but also the storage for fishing gear and drying space for fishnets can be placed within the area with tranquil waves, which is realized by construction of breakwater, though some filled-in lands are required.	The area with tranquil waves will be used for the slipway and quay only, while the length of breakwater will be minimized as much as possible.
Overall length of breakwater (m)	50m	35m
Water depth of breakwater	－6m～－5m	－5m～－4m
Length of revetment (m)	33m	33m
Need or otherwise of land-filling	Required	None
Height of incident wave	1.35m	1.35m
harbor tranquility (ratio of wave height)	0.2 (30cm)	0.3 (40cm)
Convenience	High efficiency: it will secure a high degree of tranquility, and enable the comprehensive use of slipway, quay and storage. Also, quay can be constructed at the forefront of filled-in land.	It is less convenient than Case-A because of a longer distance between quay and storage than that in case-A. But the landing efficiency of fish is more or less the same.
Economic efficiency	Coastal reclamation and a longer breakwater are needed, resulting in higher costs than Case-B.	It will cost less than Case-A because of the absence of the necessity for coastal reclamation and a shorter breakwater.
Overall rating	Good	Excellent

2) Results of Analysis on Calmness

① Incident Waves for Calculation of Harbor Calmness

A representative offshore wave for calculation of harbor Calmness is selected in the data of winds and waves obtained in Owia, St. Vincent.

The wave is determined, generally referring to a wave denoting the operation ratio between 90% and 97.5%, subject to change according to the usage of the port facilities. Considering the scale of the facilities in the project, a representative wave for the

calculation is set at 95% of the ratio, which is equivalent to the probability of nonexceedance of the offshore waves.

According to the results of hindcasting waves, the representative wave of 95% showing nonexceedance is 2.5 meters whose frequency corresponds to 6 – 8 seconds. As for the Calmness of the basin behind the breakwater, the frequency of the ocean waves in question is set at 8. Concerning wave directions, wave direction E is adopted for the calculation, which is the most frequent. Since these values concerning waves are based on the offshore conditions, numerical calculation of wave transformation (refraction calculation) has been also conducted for waves at shallow water area to obtain values of incident waves at the breakwater. The calculation shows that the ratio of wave height at the port mouth is 0.54, and that the direction of incident waves is N97°E. The conditions of waves to be used for the calculation of harbor Calmness are shown below. The angular spreading parameter of waves, Smax, has been set at 10 which correspond to the offshore waves, and 25 for the target point in accordance with the depth/wavelength ratio (h/Lo) of incident waves.

Table 2-2-3.(10) Conditions concerning Waves for Calculation of Harbor Calmness (Data concerning Incident Waves)

Data on offshore waves		Refraction coefficient	Data on incident waves	
Height (Ho)	2.5m	0.54	Height (H)	1.35m
Cycle (T)	8s		Cycle (T)	8s
Direction	E		Direction	N97°E
Angular spreading parameter (Smax)	10		Angular spreading parameter (Smax)	25

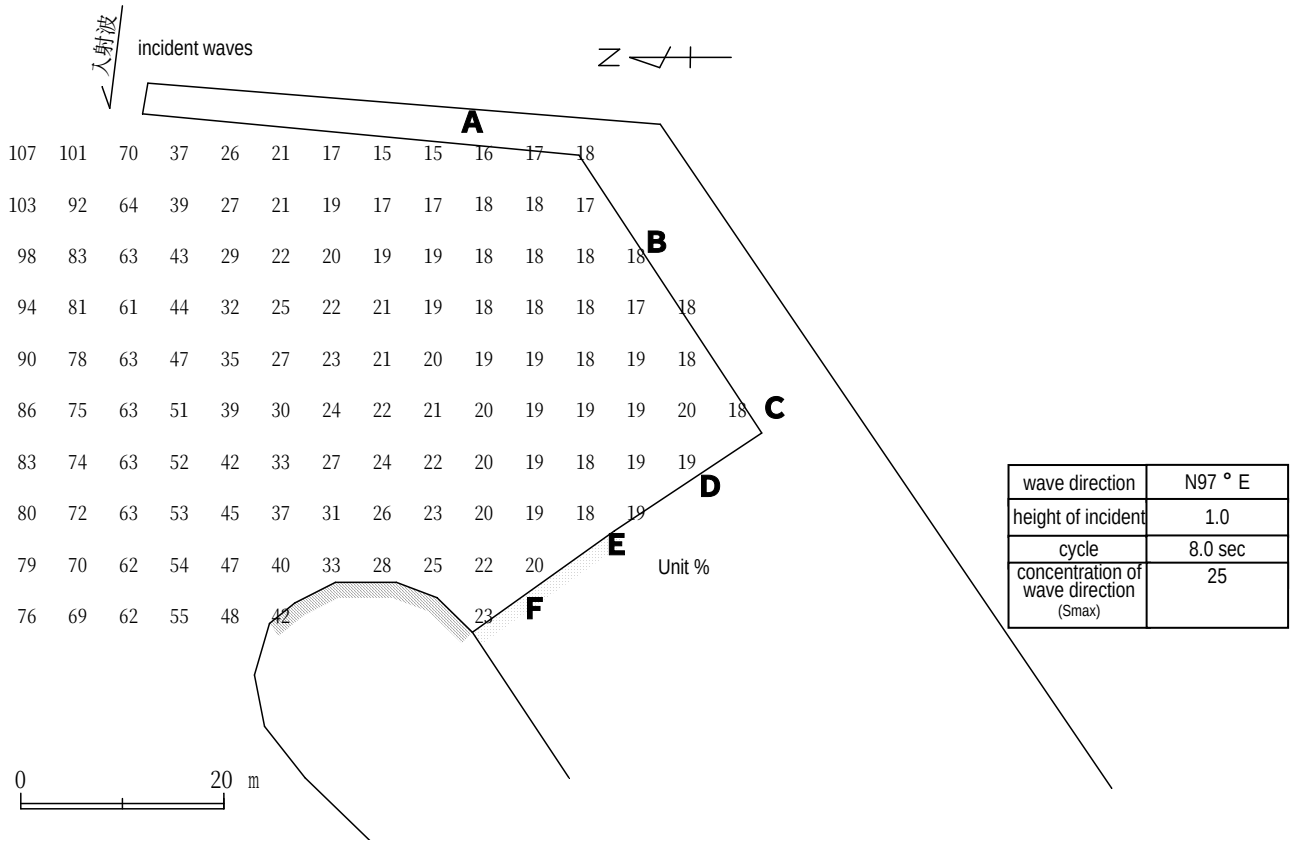
② The Results of Analysis on Harbor Calmness

The results of the analysis on harbor Calmness in Cases A and B are shown in Fig 2-2-3.(7) and 2-2-3.(8). Concerning the extension of the length of breakwater, an idea of setting the breakwater at 30 – 40cm or shorter in front of the quay and ramp has been examined.

The analysis has found that there is a necessity for the extension of breakwater by 50 meters or so in Case A, and by 30 meters in Case B.

Table 2-2-3.(11) Comparison of Harbor Calmness

		Wave height ratio (%)		Height (m)	
		Case-A	Case-B	Case-A	Case-B
Side of Quay	A	17%	26%	0.23m	0.35m
	B	18%	24%	0.24m	0.32m
	C	18%	24%	0.24m	0.32m
Side of Slipway	D	19%	24%	0.26m	0.32m
	E	19%	24%	0.26m	0.32m
	F	21%	29%	0.28m	0.39m



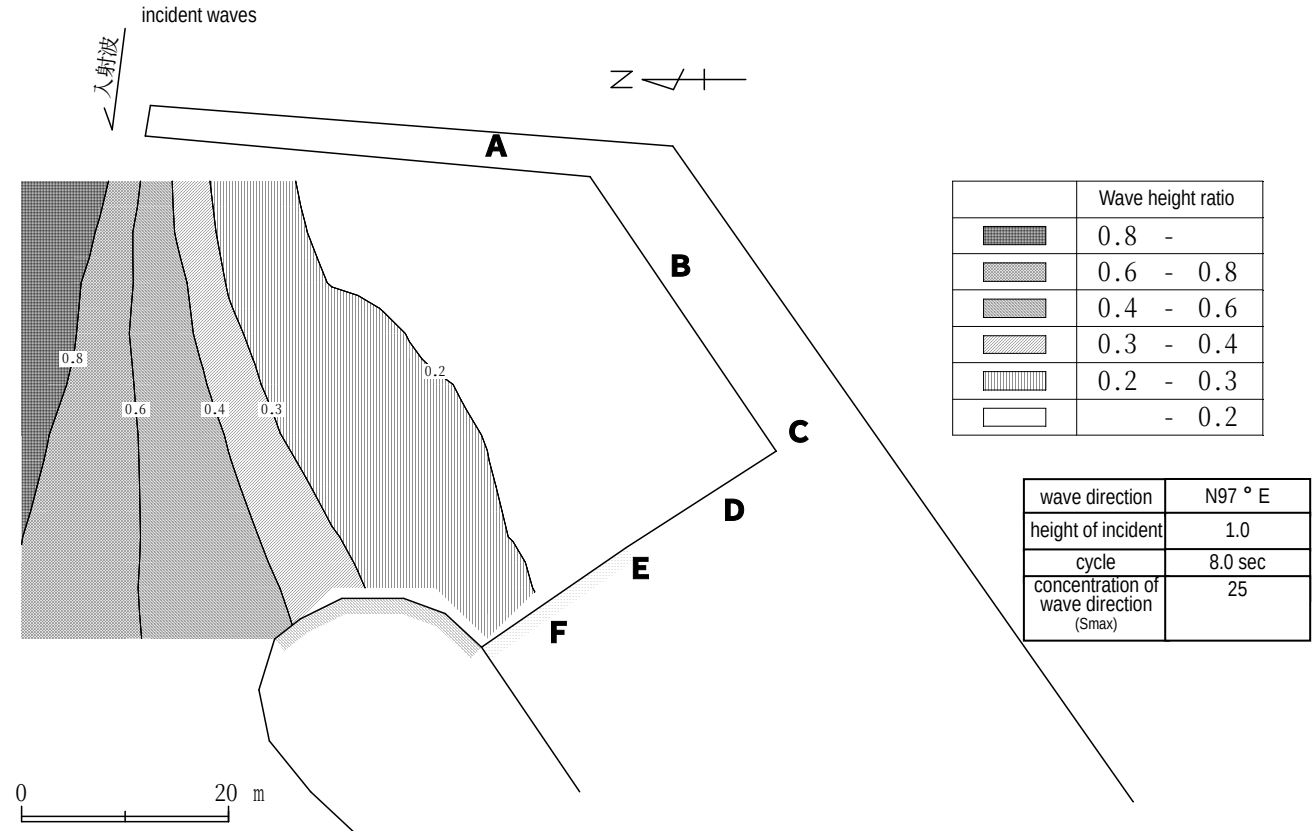
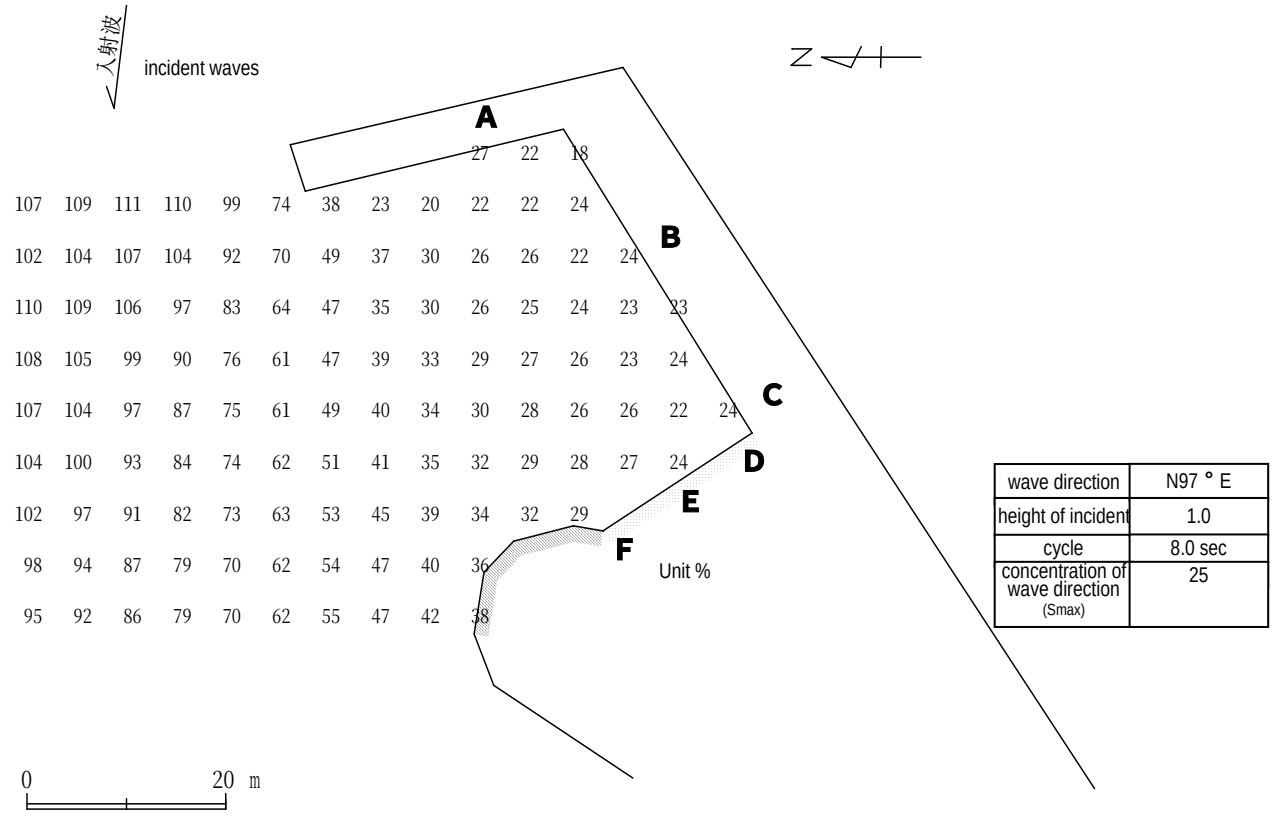
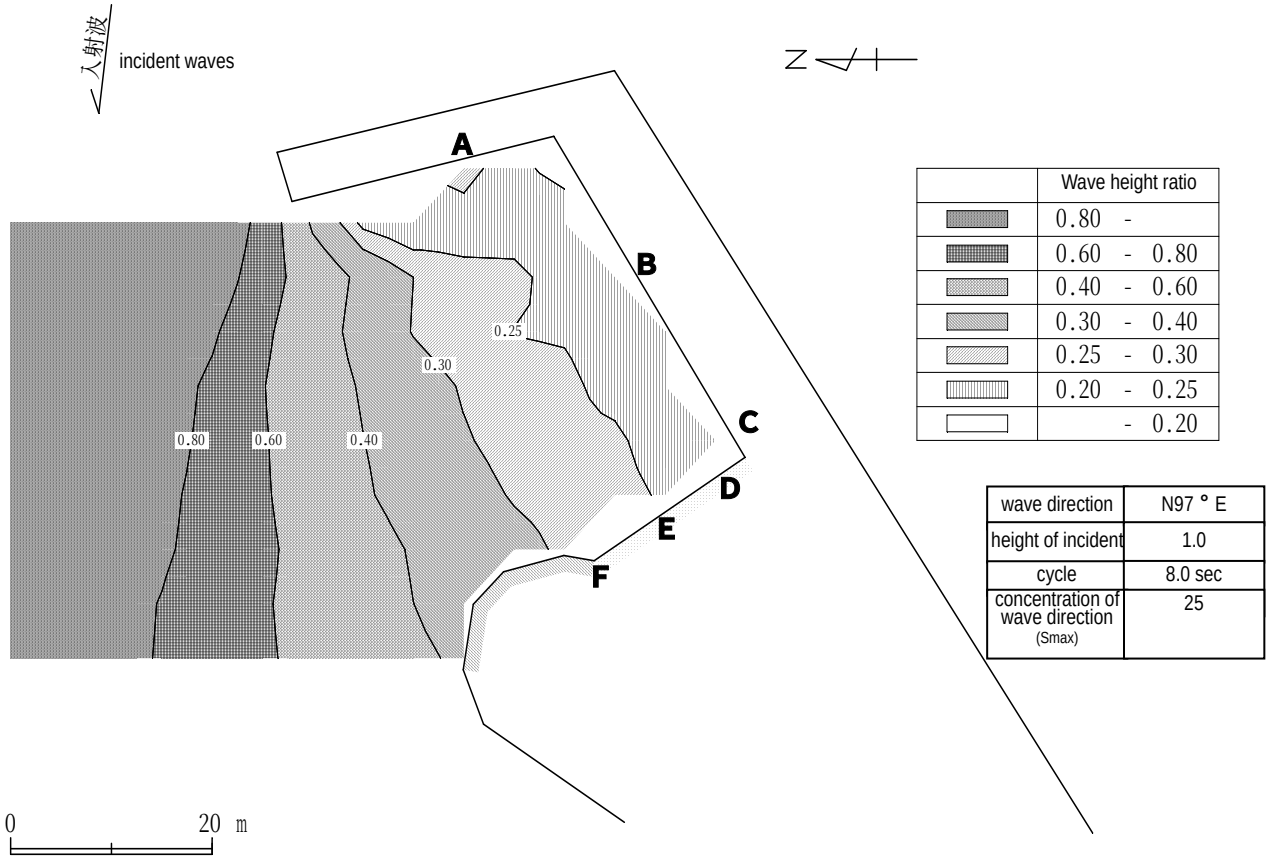


Fig 2-2-3.(7) The Results of Analysis on Harbor Calmness in Case A



wave direction	N97 ° E
height of incident	1.0
cycle	8.0 sec
concentration of wave direction (Smax)	25



	Wave height ratio
	0.80 -
	0.60 - 0.80
	0.40 - 0.60
	0.30 - 0.40
	0.25 - 0.30
	0.20 - 0.25
	- 0.20

wave direction	N97 ° E
height of incident	1.0
cycle	8.0 sec
concentration of wave direction (Smax)	25

Fig 2-2-3.(8) The Results of Analysis on Harbor Calmness in Case B

2-2-3-2 Basic Plan for Construction Facilities

(1) Size of Construction Facilities

1) Gear Lockers

① Design Policy

The facility will be used largely to store fishing gear, so that it has to be constructed in the ways that each unit of the storage can be visible from outside, and all the units of the storage will be placed in line for antitheft purposes, that is, so as to eliminate any blind spots.

② Planned Size:

Three gear lockers currently existing in Owia are all personally owned by beach seine and purse seine fishermen, and are utilized for storing fishing maintenance gears (net cords, ring buoys, and sinkers, etc.), air tanks, oil, fishing crates, fishing boat maintenance equipment, and tools for commercial fishing whereas no gear lockers are existing in Fancy nor Sandy Bay. The fishing gears stored at home by trolling line and hand line fishermen are placed in circular cans 30cm in diameter and 50cm in depth for transportation to the fishing boats and back home after catching fish. Transporting 20-L fuel tanks and fishing gear cans home is a considerable burden on trolling line fishermen who live on the high plains of Owia, and the use of facilities for trolling line fishing boats in Fancy and Sandy Bay, which are distant from the facilities, reduces the inconvenience and labor required for transporting fishing gear, and the installation of gear lockers is also necessary to improve fishing effort.

Consequently, nine gear lockers for trolling fishermen are required as well as three for beach seine and purse seine fishermen in Fancy and Sandy Bay that currently have lockers . The need for gear lockers are seemed to be less in Owia than in Fancy and Sandy Bay however, setting aside the fishermen who live within 100m of the project site, those who live in the heights overlooking Owia Bay must carry the fishing gear can and 20-L fuel tank which inflict a considerable burden on them. Nevertheless, Owia do not currently have gear lockers.

Accordingly, eight gear lockers are planned to be constructed mainly for those in the heights in Owia amongst the total of 14 trolling fishing boats It brings the total of 20 lockers (9 + 3 + 8), including those for Fancy and Sandy Bay.

Each unit is planned to be 2m x 2m, after taking into account the existing shed floor area,which is 2 to 2.5 ㎡, and the scale of the fisheries centers in the past. Outdoor motors, tools, fishing gears, fishing net, spare fuel

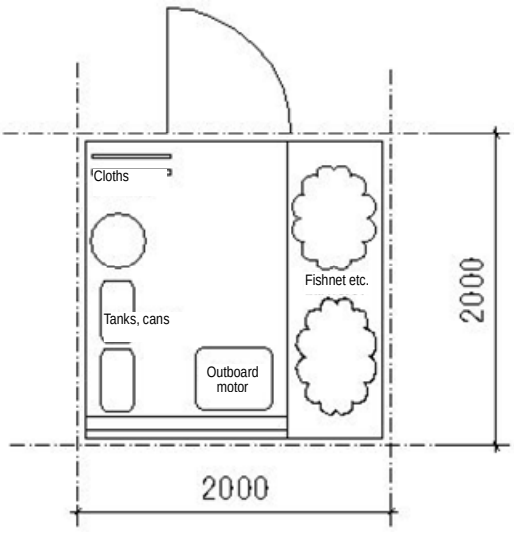


Fig 2-2-3.(9) Gear Locker

tanks, extra clothes, oxygen tanks for diving, and etc. shall be stored in the unit.

2) Fishery Center

a) Office Quarter

① Design Policy

This Fishery Center will be, though managed by a fishermen's corporative organized by fishermen, an outpost organization of the central Fishery Division, regarded as the center of "zone 5" under the fishery administration of St. Vincent. In line with this, its office must have two essential functions as facility management to control the entire fishery facilities at the harbor and operation management to be in close relation to actual facility operation. Upon planning the office quarters, an administrative office for the fishermen's corporative and the one for the fishery division are considered due to the nature of management required for the fishermen's corporative and the fishery administration.

② Planned Size:

Staff members of the fishermen's corporative stationed in the office on a full-time basis will be: one manager; one maintenance officer; one maintenance assistant; one clerk; one cleaner; two security guards; and one (1) ice seller, all of whom with the exception of the clearer and security guards – five workers – need the office.

On the other hand, apart from rooms for these cooperative union staff members, an additional office will be installed for a supervisor from the Fishery Division of the government of St. Vincent. The space of the offices per person will be determined with reference to the Architectural Institute of Japan's "Handbook for Resources of Architecture" as shown below.

Manager:	Approx. 14 ㎡/person
Maintenance office and Staff from Fishery Division:	Approx. 8~12 ㎡/person
Other general staff members:	Approx. 8 ㎡/person

b) Ice-Making Machine

① Design Policy

Ice will be used for various purposes: for loading on fishing boats; for transportation from the production sites to the consumption sites; and for use at the consumption sites where products are processed and sold at retail shops. In other words, when using ice cubes, it is important to maintain consistently the freshness of fish from the time they are caught to the time they are sold at retail shops. Once products have lost their freshness, they will never regain the freshness even if they are stored with ice cubes or frozen again. Hence, it is desirable to keep fish cool as soon as possible after they are captured.

In this regard, an ice-making machine is one of the most important facilities for the

sake of maintaining the quality of the catches as commercial products. Although the shapes of ice may vary depending on its purpose, many ice-making machines which have been supplied to St. Vincent are machines producing flake ice, and thus local technicians are familiar with the handling and structure of this type of ice-making machines. Thus, the flake ice will be planned in this project.

② Planned Size: one (1) ice-making machine capable of producing one (1) ton of ice cubes per day

In determining the size of ice-making machine, marine products from fishery operators of the west coast along the Caribbean Sea should be taken into account. However, since there are some ice-making machines in the west coast which are not fully made effective use of, the size of the ice-making machine to be supplied in this project will be determined in consideration solely for the current fish catches and the amount of fresh fish catches shipped to the metropolitan area. It is reasonable to choose a 1-ton machine on the grounds that the maximum daily fish catches in the good landing season in Owia is one ton and the amount of ice used is considered to be the same as the weight of fish catches and thus ice-making machine shall be the type capable of producing 1 ton per day. Ice necessary for the onshore processing will be supplied from ice already in stock in the ice-storage.

c) Ice-storage

① Design Policy

This facility will be used to efficiently store the ice produced by the ice-making machine and supply ice at any time. And a equipment for cold storage will be installed within the ice-storage.

② Planned Size: one (1) ice-storage capable of storing two (2) tons of ice

Ice is used for loading on fishing boats; for transportation from the production sites to the consumption sites; and for use at retailing places, so that it is important to supply ice consistently. Thus, the required capacity of the ice-storage is at least twice as large as the daily production volume of ice, that is, two (2) tons of ice storage capacity.

d) Chilled storage facility

① Design Policy

Currently, the catches are unloaded at Owia generally around 3:00PM, making same-day sales difficult, so the catches have to be sold the next day. Further, as there are no temporary storage for the catches, nearly all the fish caught is not unloaded, but is kept in the nets in the sea until the next day. The nets are tied to prevent the caught fish from escaping, and thus the room in which the fish can move is limited. As a result, the fish rub each other and are damaged, and in the morning in the next day, fish with

deteriorated freshness remain: therefore, there are catches which are not suitable, even if they are landed, for transportation by truck to distant places for sale.
Consequently, catches that are brought ashore need to be stored temporarily in a cold storage for slow-freezing after being kept in a chilled storage facility to prevent the value of the product falling for sale the next day, and shipping must be regulated according to the needs of the market. Further, refrigerated storage is also necessary to make effective use of the leftovers from sales on the same day, without throwing them away.

② Planned Size: one (1) chilled storage facility capable of storing two tons of articles

Currently, the amount landed in Owia annually is 85 tons (approx seven tons per monthly average). Despite variations due to the fishing methods and fishing periods, the greatest amount caught per day on average can be viewed as 1.3 ton. At the moment when the fishery center has not yet been constructed, the number of occurrences that a trawler catches 2000lb (approx. one (1) ton) of fish in a day is already 10 times – that is, 3 boats x 10 times = 30 times/year. Of such occurrences, according to hearing surveys, it is likely that the volume of daily catches reaches one (1) ton for two consecutive days on season.

Local consumption is approximately 200Kg per day. Based on these facts, rough calculations were performed to set the scale of the refrigerator.

As shown in Fig 2-2-3.(10) and Table 2-2-3.(12), the results of the simulation and the line of flow for the fish within the facilities suggests that a chilled storage facility of the capacity of approximately 1.2 tons should be needed if the volume of daily catches reached one (1) ton for two consecutive days. Or in order to store a maximum 1.3 ton of catches per day, a chilled storage facility of the capacity of approximately 1.5 tons will be needed. Nevertheless, when the following points are considered, a two-ton chilled storage facility seems more suitable.

If the actual load on the cooling unit used is added to the load due to external air, etc., when the door is opened and closed, the target amount is the same load for using both 1 and 2 tons. Consequently, it is more economical to select a chilled storage facility with the larger two-ton capacity, and this can also accommodate increased fishing yields after installation.

- The equipment for cold storages for chilled storage facility capable both one (1) ton and two tons are deemed have the same amount load due to the actual load by opening and closing the doors. Accordingly, it is more economical to adapt the refrigerator capable two tons of article, enabling to handle the prospective catch increase after this project.
- As it is necessary to build shelves in the storage facilities for the fish, and a workspace for loading and unloading, a certain extra space is necessary for the storage surface area of the fish.
- If the space is narrow, contamination by outside air due to the opening and closing of the workspace door will be accelerated, increasing the temperature within the

room.

- As a result, surplus facilities such as a plastic curtain or air conditioning need to be installed to cut off the hot outside air or to prevent cool air from leaking out of the room, which is not economical.

e) Cold Storage

① Design Policy

At the moment, since the domestic market is small, there are excess catches when the volume of daily catches is large even if the market demand is fully satisfied. In such cases, excess catches have to be disposed because there are no appropriate storage. Thus, it is desirable to flash freeze catches to produce frozen products, temporarily store them, the catches with small heat burden, in the cold storage, and ship them in accordance with the market demand. This process is also important for establishing a cold chain.

However, judging from the volume of catches in Owia and the circulation of the catches, it is too early to adopt a blast cold storage which is to be used to flash freeze a large amount of catches, so that this project will aim to improve the performance of the cold storage so as to slowly freeze catches and make the shipping adjustment.

Accordingly, catches will be stored first in a refiregirator to reduce the heat burden (down to - 5℃), and slowly frozen in a cold storage (down to －25℃～－30℃) for the sake of shipping adjustment according to the market demand.

② Planned Size: one (1) cold storage capable of storing two tons of articles

In setting the size of the cold storage facilities, the simulation results (see Fig 2-2-3.(10) and Table 2-2-3.(12) for details) suggest that it should be reasonable to set the size at a maximum of two tons. At the time when the cold storage demonstrates its full capacity, it is possible to sell the catches effectively to Georgetown, Kingstown or other regions.

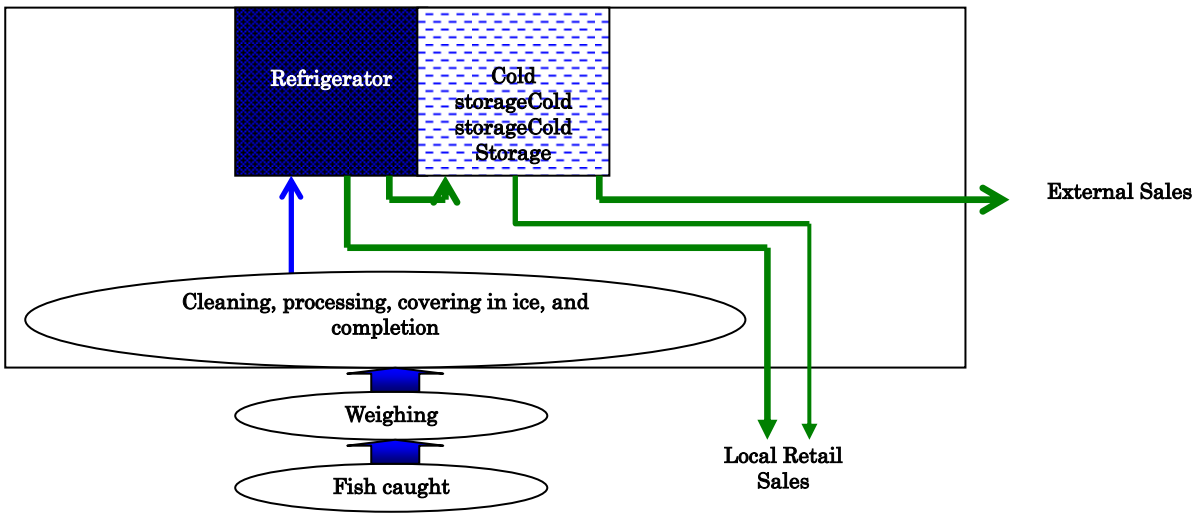


Fig. 2-2-3 (10) Flow Diagram of Catches within the Fishery Center

Table 2-2-3. (12) Simulation of the Shipping Adjustment System of Catches

Date	Volume of catches	Storage Amount		Amount of Retail Sales		Volume of catches to dispose
		Cold Storage	Chilled storage facility	Local Retail Sales	External Sales	
1	1,000	1,000				0
2	1,000	1,000	800	200		0
3	280	280	1600	200		0
4	280	280	1680	200		0
5	280	280	1160	200	600	0
6		0	1240	200		0
7		0	1240			0
8	1,000	1,000	1040	200		0
9	1,000	1,000	1840	200		0
10	280	1080	1840	200		0
11	280	1160	1840	200		0
12	280	480	2000	200	600	0
13		280	2000	200		0
14		280	2000			0
Average	406	580	1560	200	600	0
MAX	1000	1160	2000	200	600	0

Note 1: Local retail sales are 200kg/day.
Note 2: Transport to other regions is 600kg at one time weekly to reduce truck costs.
Note 3: Landed fish is transported to the cold storages a day after temporarily kept in a chilled storage facility.

f) Fish Processing Facility

① Design Policy

As processing facilities, a “workspace for putting ice cubes on fishery products” and “workspace for processing operation” will be all separately planned.

The “workspace for putting ice cubes on fishery products” will be a workplace to supply ice to the fishing boats before leaving and to put ice on the catches. It is normally ventilated due to the nature of work, and serves as a place to supply ice cubes.

The “workspace for processing operation” will be used as a workplace where fish catches are sorted, and rinsed, that is, processed as the primary stage before stored in chilled storage facilitys and de-freezing after the storage, and as the preparation for shipping as well as the retail sales space of the catches. The space will be equipped with a working table necessary for the sale of catches, while using jointly the sink and other equipment installed in the processing facility.

② Planned Size:

The “workspace for putting ice cubes on fishery products” is planned to consist of two different types of workspaces with a total area of 5.5m x 4.0m.

On the other hand, “workspace for processing operation” will be a space of 5.5m in width where the chilled storage facility and cold storage are placed in a row.

Space for supplying ice cubes: 5.5m x 1.5m

Space for putting ice cubes on fishery products: 5.5m x 2.5m

Width of workplaces in front of individual storages and passageways: 11.0m x 1.3m

Width of workspace for processing, including stainless work table: 11.0m x 1.8m

Space for cooking sales products: 11.0m x 1.8m

Space for passageways: 11.0m x 0.9m

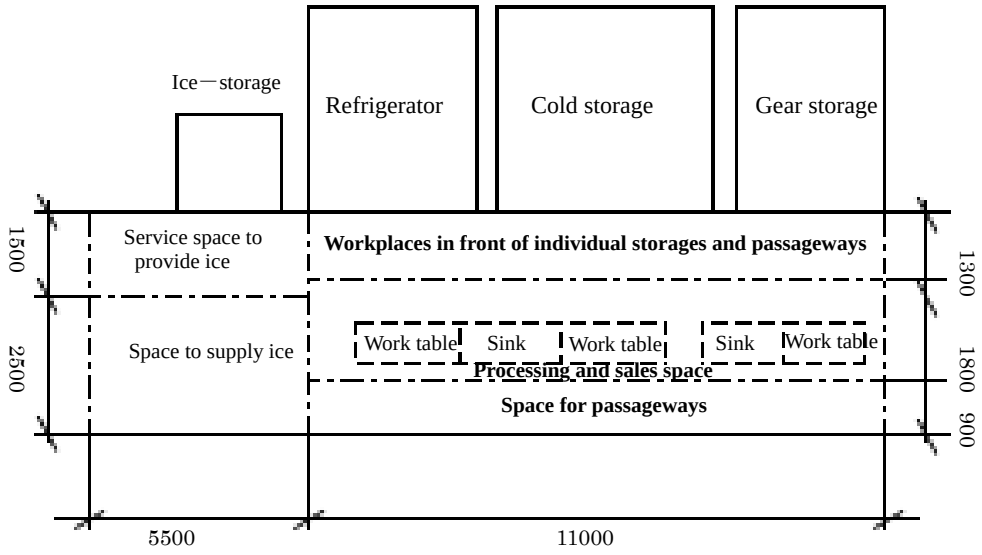


Figure 2-2-3.(11) Processing Facilities

g) Meeting Room

① Design Policy

This Meeting Room will be made use of for general meetings by the union, and for fishery technical training, seminars by individual small divisions of the union, and for voluntary meetings and other purposes by fishermen themselves. It will be also used for the promotion activities for fishery administration, instructions and enlightening educational activities under the sponsorship of the Fishery Division of St. Vincent. It will be designed as a multi-purpose facility so as to flexibly change the arrangements of desks and chairs so as to satisfy various needs in the size of the space according to different themes.

② Planned Size:

The membership of the fishermen's corporative in Northwind ward, equivalent to the number of the crewmembers of the fishing boats subject to this Project, totals 28 boats x two crews = 56 persons. The Fishery Division also assumes in its plan for establishment of the union that the expected membership totals 50 to 60. While the meeting room will be used in various ways, the most determinant factor for its size is the number of participants in union general meetings. Since any resolutions brought to general meetings will take effective, as stipulated in its regulations, only when two thirds of the membership attend the meeting, one can estimate that the number of participants in the meetings will be 40, that is, 60 persons multiplied by 2/3.

In the meantime, it is assumed that the necessary area per head for relatively large meetings, such as general meetings of union members, where chairs are provided but some participants are standing, will be approximately 1.2 – 1.3 ㎡ per person. Thus, the meeting room will be designed to be around 49 ㎡, that is, 40 persons multiplied by 1.23 ㎡.

h) Fishing Tackle Shop (including Pantry)

① Design Policy

The scheme to purchase jointly fishing gear and the permanent facility to sell such gear are considered to be as part of services of the fishermen's corporative in Northwind ward. The existing general goods and fishing equipment store, which has become the target of land expropriation, serves snacks to the fishermen, and functions as a convenient facility for the fishermen before they set sail, when they return to port, and during periods of rest, and this project should also follow suit. Hence, the fishermen's corporative is expected to contribute to union members and local community, so that, in response to the needs of the local community, it will sale not only small fishing-related tools which are currently sold by the fishing gear shop but also various ropes, dobbers, spindles, and other fishing gear, and ships' fitting such as anchors and oil tanks. On the other hand, since it is customary to boil water at the office of the fishermen's corporative, to make light food and drink available at the fishing gear shop, and to providie coffee and other beverages at meetings, it is necessary to build a pantry. These needs can be satisfied by installing a pantry in the fishing gear shop, and thus a shop equipped with a pantry will be planned.

② Planned Size:

Current general/fishing gear store in the area of the Plan sells nylon string, fish line, salcan, lure, underwater gun support, grease, and other daily necessities as well as light meal. However, this shop will be closed down because the government of St. Vincent is to expropriate the land. Since the business of the shop is currently in good shape, the need for products available there will not disappear. Further, fishing equipment sales can be entrusted to the existing general store and fishing equipment store, and this is the final decision of a meeting of the fishermen's corporative, which operates and manages the facility.

The space required for fishing equipment sales is thought to be 21m2, which is the same as the existing sales space.

A case to display fishing gear will be installed in the store, and a kitchen with a cooking table with one sink and one (1) two-hob range in the pantry.

In line with this, the planned size of the fishing gear shop (including the pantry) will be set at 20 ㎡.

3) Toilets / Showers

① Design Policy

Regardless of the business hours of the Fishery Center, early morning, or late night, it is planned to include public toilets and showers that the fishermen can use at any time in the fishing gear lockers.

② Planned Size:

The number of people using the 28 boats is 56 (=28 boats x 2 crew). Consequently, two toilets and two urinals are planned in the gents, and two male shower booths, based on "Handbook for Resources of Architecture". Further, one women's toilet is also planned for the women who work in the fishing port.

4) Septic Tank

① Design Policy

Although the government of St. Vincent stipulates no regulations on BOD emission, the Plan, paying attention to the environmental issues, will incorporate the construction of an individual septic tank which can treat wastewater from the lavatories, fish processing, and other miscellaneous sources with aerobes under the secondary treatment system. The target BOD level of drainage from the septic tank will be set at 60ppm.

② Planned Size

The calculation of the volume of drainage treatment is based on the "Standards and Guidelines on Designs of Building Facilities" supervised by the Building and Repairing Department, Cabinet Office of the Construction minister, and the "Guideline on Plans for Fishery Harbors published by the All-Japan Harbor Association, an incorporated association, as shown below:

Office:	10	L/㎡ per day
Lavatories for fishermen:		
(setting 50% (30 persons) of the union membership as the number of users per day)		
60 L/person per day		
Shower:	500	L/booth per day
Fishery processing (rinse water):	200～1400	L/ton

5) Fuel Station

a) Fuel Tank

① Design Policy

There is no fuel station in the district of Owia: the closest one in the neighboring districts is in Georgetown only. There are some individual businesses in Owia, which go to the petrol station in Georgetown regularly and store the fuel in Owia. However, because it is a seller's market, the businesses, taking advantage of it, supply the fuel to local citizens at tremendously high prices at the moment. Therefore, it is desirable to construct its own fuel tank to make it convenient for local citizens and fishermen engaging in fishery businesses in Owia to obtain fuels, as well as for the purposes of eliminating such an irrational situation from which local people suffers, and vitalizing

local activities. As for the type of fuels, diesel oil is used for vehicles which local people normally use as transportation means, whereas gasoline is used for outdoor engines of fishing boats. Thus, two types of fuel tanks will be supplied. The reason for taking diesel fuel into account is not just to develop and promote fishery industry, but also to develop and vitalize the region as a whole. In the meantime, the handling charges accruing from the sales of fuel will be a solid income resource and can be used as a means to maintain the facilities.

② Planned size: One fuel station with the capacity of 2,000 litters each for gasoline and diesel oil

The size of each tank will be determined on the assumption that the volume is large enough to support the fishing activities for approximately 10 days. In other words, the supply of fuel will be made once every 10 days, but since it is impossible to use tank lorries, oil drums will be sued for the transportation and supply. The capacity of the tanks has been determined in accordance with the following reasons.

- Consumption of gasoline by fishing boats:

Criteria for the setting; the number of boats (23 trawl fishing boats). Fuel consumption per fishing (5 gallons per boat). The frequency of fishing at a good season is set as a standard. The operating rate: 0.3.

Based on the criteria above, the consumption of gasoline is computed in the following way:

Consumption of gasoline by fishing boats = No. of boats (23 boats) x frequency of fishing per month (20 x 0.3) x 5galons
= 690gallons = 2,760litters …….. (1)

- Consumption of gasoline by vehicles in the local communities:

Criteria for the setting: the number of vehicles (96 vehicles, that is, 38 gasoline-fueled and 58 diesel-fueled vehicles). The distance between Owia and Kingstown is 40km. It is assumed that one third of the vehicles as a whole – that is, 10 gasoline-fueled and 20 diesel-fueled vehicles – are used to go to Kingstown; that these cars go to Kingstown five days a week; and that a vehicles moves 10km per 1 litter of the fuel.

○Fuel consumption of vehicles going to Kingstown

*Consumption of gasoline:

4 litters (for 40km) x 2 x 20days/month x 10 vehicles = 1,600litter・・・・・(2)

*Consumption of diesel oil:

4 litters (for 40km) x 2 x 20days/month x 20 vehicles = 3,200litter・・・・・(3)

○Consumption within the region (within the 20km zone)

*Consumption of gasoline:

2 litters (for 20km) x 2 x 20days/month x 28 vehicles = 2,240litter・・・・・(4)

*Consumption of diesel oil:

2 litters (for 20km) x 2 x 20days/month x 38 vehicles = 3,040litter・・・・・(5)

Therefore, the necessary capacities of tanks are:

Total consumption of gasoline: (1) + (2) + (4) = 6,600litters = 1,650gallons

Total consumption of diesel oil: (3) + (5) ＝ 6,240litters = 1,560gallons

Approximately 1,500gallons (or 6,000litters) of gasoline and diesel oil each. Since this is the monthly consumption level, the tanks both for gasoline and diesel oil must be for approximately 2,000litters on the assumption that refilling is needed three times a month.

b) Fuel Facilities

① Intended Use of Individual Components

Fuel supply to fishing boats and vehicles of local people

② Planned size and quantity: One set includes 2 oil tanks, 2 pumps, and 2 nozzles or similar objects

Hosepipe is approximately 4 meter length with a safety guard to prevent leakage while fueling.

6) Fishnet Drying and Repair yard

①Design Policy:

This facility is designed to consist of a space, where fishnets are repaired and mended and another, where they are dried.

② Planned Size:

The fishnet drying yard and the space for repairing fishnets requires 30m x 15m so as to spread and repair a net.

7) Pavement

① Design Policy

Pavement is classifiable into “site passway,” “parking lots,” and “fishnet drying space.” “Site passway” is laid out on traffic lines within the premises of the Fishery Center, and also used as an emergency evaluation area for fishing boats in an emergency such as the

coming of hurricane.

Parking is used to park vehicles owned by staff members, fishermen, visitors and other persons, to park trucks while fishermen are shipping their fish catches, and to unload fish catches.

② Planned Size:

A majority of fishermen in Northwind ward do not possess their own cars. Thus, the capacity of this "parking for own cars" will be set for staff members and visitors. While full-time staff members of the fishery union are seven, those in a higher rank are two. Accordingly, the parking will be designed to be able to have five cars in all, including vehicles of visitors. The parking for logistical trucks will be, on the other hand, designed to be able to accommodate two 4-ton trucks on the assumption that at most two trucks are to use the parking at one time.

8) Water Reservoir Tank

① Design Policy

According to the St. Vincent national water board (CWSA), the water pressure of tap water facilities laid to the planned Fishery Center front path will be 221psi, and the amount of tap water supplied will be 75.8L per minute (20G per minute). On the other hand, the total number of faucets planned for the facilities is approximately 45, and according to the "The National Land and Transport Ministry Architectural facilities Design Standards", the "rate of water supplying instrument used at the same time" should be 39% of the total number of faucets. Further, according to the same reference, if the amount of faucet flow is 13A, as this is 15L per minute, the amount of water used in any moment per minute should be 45 x 0.39 x 15= 263L per minute. In other words, if the facilities are connected directly to the tap water pipes, which are supplying 75.8L per minute, the amount supplied that instant will overwhelmingly fail to meet demand. Consequently, a water reservoir tank method of "water receiving tank + pressurized pump feed" is planned using water received from the existing public tap water pathways.

② Planned Size: One (1) water reservoir tank capable of storing eight tons of water (including accessories)

In accordance with "the knowledge of Facilities for Architectures," edited by Architectural Association of Japan, the capacity of the water receiving tank with the system comprising "water receiving tank + pressurized pump feed" has been designed to store 45% of the daily amount of water usage.

Consequently, the volume of the water receiving tank, which is described later in the daily water consumption table (Table 2-2-3.(13)), is planned to be

17.436tons x 45%= 7.85tons→ Existing FRP tank 8 tons.

9) Stand-by Generator

① Design Policy

It has been made sure that the electric power is transmitted to the Owia region. However, the supply is made from the power station in South River only, and there is no system whereby the electric power is supplied from any other power stations. According to reports of the country's electric power corporation, VINLEC, the power supply line in the Owia region is hit by electricity failure two to three times a month, and that it takes six to eight hours for the recovery. Taking into account possible occurrence of hurricanes and other disasters, one can quite naturally assume that it takes a considerable amount of time to recover the supply of electricity if it is disrupted at the power station responsible for the power supply to the Owia region or somewhere in the electric power transmission lines. Therefore, stand-by generators will be provided for emergency use to the facilities requiring the electricity. Such generators are installed in the existing refrigerating facilities for agriculture in the region.

② Planned Size: One (1) stand-by generator capable of generating the electricity of 65KVA (including accessories)

The power generator's capacity, which is described later, is planned to be 65KVA, 50Hz, 400V/230V, as described later in Table 2-2-3.(14).

(2) Floor Planning of Each Facility

In this Plan, a total of two buildings are to be separately constructed: Fishery Center and gear lockers. The gear lockers and Fishery Center will be connected via site pass ways.

1) Fishery Center

This building consists of three groups: a "group processing and storing products" where fish catches are directly accepted, classified, processed and stored; a "group providing services and selling products" where ice cubes are supplied and fishery products and fishing gear are sold retail; and a "group managing the facilities as a whole".

The "group processing and storing products" is in charge of delivery and storage of catches, and is to be located in the center of the Fishery Center in that it is the central venue of the activities within the premises of the facilities. This group includes a service yard to sorting catches and provide ice, the processing facility, and the chilled storage facility and cold storage.

The "group providing services and selling products" is in charge of sales and provision of fishes and ice cubes, as well as the sale of fishing gear, and is ideally located facing passageway in consideration of the flow to be used so as to make the accessibility easier. In this group, the fishing gear store, fishery product shop and the ice-storage are included. The ice-storage and sales store of ice will be adjacent to the "group processing and storing

products" which is highly related with the former.

The "group managing the facilities" will be located on the sunny, south side of the Fishery Center in consideration of working conditions of full-time workers in the facilities. This group includes the office of the fishermen's corporative, manager room, Fishery Division office, meeting room, toilets, etc. The office of the union will be equipped with the counter to sell ice cubes where ice is sold and managed.

2) Building for Gear Lockers

The buildings for storage of fishing gear will be arranged in a row so as to eliminate blind spots.

(3) Cross-Section Plan of Each Facility

1) Fishery Center

Based on the past experience of damages caused by hurricanes, this building will be constructed on 7.5 meter above the sea level on a developed cutting ground, its ground level being set at GL±0 of the building design. Since there is no risk of inundation at this scheduled ground level, the distance from the top surface of the first floor to the ground below is set at 1FL=GL+0.2m, which is less inconvenient from the functional viewpoint. In the meantime, since the group functioning as a fishery factory and facilities to accommodate a large number of people for meetings will be arranged on the first floor, the story height between the first floor and Roof will be set at 4.0m.

2) Buildings for Gear Lockers

The floor height will be set at GL+0.2m, and the story height at 1FL+3m because users need to access to these building directly from outside.

(4) Planning for Building Construction

For the facilities which do not necessarily require any special long span and are located on a seacoast, reinforced concrete moment frame structure. Concrete blocks will be applied to inside and outside walls between columns, whereas concrete slabs will be used for the floors and roofs. Independent footing without piles and ground floor structure system is composed of underground beams, or structural slab. Concerning this, it is necessary to confirm, prior to the construction work as a prerequisite of structural design, that the soil bearing stress at the foundation is 103kPa. If the stress is found below this level, the ground will be improved and reinforced with crushed stones or by means of surface compaction to satisfy the criteria.

(5) Planning for Finishing of the Building

1) Exterior Finishing

Exterior finishing will be made in the following fashion:

Exterior walls (concrete):	Raised mortar and acrylic stucco
Exterior walls (block):	Raised mortar and acrylic stucco
Roof (Flat roof):	Asphalt roofing
Ceiling under eave (concrete):	Acrylic stucco
Fittings (windows):	Aluminum sash
Fittings (Fishermen's Hall, laboratories):	Aluminum doors
Fittings (shutters):	Baked coating steel shutters
Fittings (gear lockers):	Aluminum doors

2) Interior Finishing

Interior finishing in each building will be made in the following fashion:

① Fishery Center

Room name	Floor	Wall	Ceiling	Height of ceiling
Service yard to sort catches and provide ice	Epoxy flooring Nonslip finishing	Mortar pressed by trowel VP	Upon concrete AEP	Direct ceiling
Union Office and ice cube sales stand	P tiles	Mortar pressed by trowel	LGS T-bar Decorated rock wool board	3.0m
Manager room	P tiles	Mortar pressed by trowel AEP	LGS T-bar Decorated rock wool board	3.0m
Workspace for processing	Epoxy flooring onslip finishing	Mortar pressed by trowel VP	VP on concrete	Direct ceiling
Machine room / Power generating room	Dust-proof flooring	Left as concrete blocks	Left as concrete blocks	Direct ceiling
Space for chilled storage facility and cold storage	Left as concrete blocks	Left as concrete blocks	Left as concrete blocks	Direct ceiling
Gear storage	Epoxy flooring	Left as concrete blocks	Left as concrete blocks	Direct ceiling
Room of fishery product sales	Nonslip finishing	Ceramic tiles	VP on concrete	Direct ceiling
Room of fishing gear sales /pantry	Epoxy flooring Nonslip finishing	Ceramic tiles	Decorative plasterboard	3.0m
Lavatories	Porcelain tiles	Ceramic tiles	Cement board VP	2.5m
General storage	Epoxy flooring	AEP on concrete blocks	Left as concrete	Direct ceiling
Entrance for office quarter	P tiles	Mortar pressed by trowel AEP	Decorative plasterboard	
Office room for fishery division staff	P tiles	Mortar pressed by trowel AEP	LGS T-bar Decorated rock wool board	3.0m
Union meeting room	P tiles	Mortar pressed by trowel AEP	LGS T-bar Decorated rock wool board	3.0m

② Building for Gear Lockers

Room name	Floor	Wall	Ceiling	Height of ceiling
Gear lockers	Epoxy flooring	Mortar pressed by trowel VP	Upon concrete AEP	Direct ceiling
Men's lavatory	Porcelain tiles	Ceramic tiles	Cement board VP	2.7m
Men's shower room	Porcelain tiles	Ceramic tiles	Cement board VP	2.7m
Women's lavatory	Porcelain tiles	Ceramic tiles	Cement board VP	2.7m

(6) Planning for Plumbing and Sanitary System

1) Water Supply Facility

The construction work between the 2-inch PVC pipe for the public water supply laid under the road in front of the Project site and the neighborhood of the border line of the site, including the installment of gauging meters, will be responsible for the Saint Vincentian side. Then, the pipe arrangement up to the FRP-made water receiving tank will be made with PVC pipes with the same diameter, and the subsequent construction work will be carried out so as to supply water to individual buildings with the pumping system.

The daily water consumption is estimated as follows:

Table 2-2-3.(13) Daily Water Consumption

	No. of articles	Consumption per one use (L)	Frequency of use per hour (time/h)	Estimated maximum consumption per hour (L/h)	Working hour(h)	Coefficient	Daily consumption (L/day)
Fishermen's Hall							
Use of clean water							
Toilet bowl (toilet tank)	2	12	9	216	8	0.5	864
Urinal (toilet valve)	1	5	16	80	8	0.5	320
Hand washer	2	3	16	96	8	0.5	384
Mop sink	1	25	3	75	8	0.5	300
Water tap (processing)	4	25	7	700	3	0.5	1050
Water tap (ice-cube sales)	1	25	9	225	8	0.5	900
Pantry	1	15	9	135	8	0.5	540
Outdoor sprinkler (20A)	1	15	9	135	8	0.5	540
Breakwater sprinkler	1	15	9	135	8	0.5	540
Subtotal				1662			5438
Ice-making machine and cold storage							
Ice-making machine	1						1,000
Equipment for cold storage	1	60 x 0.01 x 3.7L/min x 37.5w = 83.3L/h			24	1	2,000
Defrost	1	100L/min x 5min watering every four hours			24	0.3	3,000
Subtotal				250 (6,000/2)			6000
Fishing gear / toilet and shower							
Toilet bowl (toilet tank)	3	12	9	324	8	0.5	1296
Urinal (toilet valve)	2	5	16	160	8	0.5	640
Hand washer	3	3	16	144	8	0.5	576
Mop sink	2	25	3	150	8	0.5	600
Shower	2	42	3	252	8	0.5	1,008
Outdoor Sprinkler (20A)	1	15	9	135	8	0.5	540
Subtotal				1,165			4660

Other							
Outdoor Sprinkler (20A)	1	15	9	135	8	0.5	540
High-pressure jet spray	1	20	10	200	8	0.5	800
Subtotal				335			1340
Total				3412			17432

Quantity to be used is based on the "Standards and Guidelines on Designs of Building Facilities" supervised by the Building and Repairing Department, Cabinet Office of the Construction minister.

2) Drainage Facility

Wastewater discharged from the lavatories and due to fishery processing will be treated by a grease trap to remove solid wastes, and miscellaneous wastewater will be treated in a compound septic tank under the contact aeration method so as to reduce the BOD level down to 60ppm before discharging.

Rainwater will be directly discharged to the sea via U-shaped gutters, pipes, etc.

(7) Planning for Air-Conditioning and Ventilation System

A package system of air-cooled heat pump method will be adopted as an air-conditioning system because of its economic efficiency. Air-conditioners will be installed in the following facilities:

Air-conditioned spaces: manager's office, office room for fishermen's corporative organization (including the counter to sell ice), office room for Fishery Division, and meeting rooms, and fishing tackle shop

(8) Planning for Electricity System

High voltage electric power, 11kv, is transmitted to the road in front of the planned site. This primary power resource will be stepped down to three-phase 400/230V(50Hz) and brought in to the premises on the account of the Saint Vincentian side. Then, the electricity will be distributed, via a leading-in switch and a main switch board, to distribution boards of the individual buildings. In recent years, it seems more common in St. Vincent to attach a low-pressure electrical current source of 100 – 120v to terminal electrical devices, and thus single-phase electrical current source of 200/120v will be supplied as well.

1) Facilities' Capacity of Power Receiving

Table 2-2-3.(14) Facilities' Capacity of Power Receiving

Name of Building	Layer	V	Capacity		Demand ratio (%)	Demand for electricity (KVA)
			KW	KVA		
Fishermen's Hall						
Lighting	1	230		5,250	80	4,200
Plug outlets	1	230		3,500	30	1,050
Plug outlets	1	100			100	400
Ventilation	1	230			70	530

Electric kitchen range	1	230	3.4		80	3,808
Air-Conditioning	1	230	15.6		70	15,288
Cold storage and chilled storage facilities	3	400			80	29,968
Underwater Compressor	3	200	3.7		40	2,072
High-pressure jet spray	3	200	3.7		40	2,072
Shutter	3	400	0.2		50	560
Subtotal				85,447		59,948
Building of storage for fishing gear						
Lighting	1	230		2,300	80	1,840
Plug outlets	1	230		800	30	240
Ventilation	1	230		280	80	224
Subtotal				3,380		2,304
Exterior						
Pole light	1	230		3,375	100	8,5447
Fueling pump	3	400	1.5	2,100	80	1,680
Septic tank	3	400	1.5	2,100	100	2,100
Winch	3	400	22.5	31,500	1/3	10,500
Water Tank	3	400	2.2	3,080	100	3,080
Subtotal				42,155		20,735
Total				130,982		82,987

2) Power Generator's Capacity

Table 2-2-2. (15) Power Generator's Capacity

	No. of Phases	Output Load (kw)	No.	Total Load Pm (kw)	Efficiency	Power Factor (PFL)	Normal Generator Capacity (KVA)	Remark
Ice-sotrage/Cold storage								
Equipment for cold storage (Compressor)	3	5.5	1	5.5	0.83	0.8	8.28	
Unit Cooler (Equipment for cold storage)	3	0.2	2	0.4	0.83	0.8	0.6	
Cold storage								
Equipment for cold storage (Compressor)	3	15	1	15	0.83	0.8	22.59	
Unit Cooler	3	0.2	5	1	0.83	0.8	1.5	
Condenser								
Fan	3	0.75	2	15	0.83	0.8	2.26	
Pumps	3	0.75	1	0.75	0.83	0.8	1.13	
Pumps								
Defroster Pump	3	0.75	1	0.75	0.83	0.8	1.13	
Water receiving tank pump	3	1.1	2	2.2	0.83	0.8	3.31	
Total							40.80	

Note: A equipment for cold storage (compressor) for the ice-making machine has been excluded from the plan because the ice-making machine will not break down even if the power outage of 8 hours or so occurs and ice melts.

In accordance with the guideline on calculation of generator capacity stipulated by the standards of the Japan Engine Generator Association, the total capacity of the power generator at a normal time is set at 40.80KVA. The power generator, on the other hand, is required to have a capacity of 1.25 as much as the burden shown above. Thus, 40.80KVA

x 1.25 = 51KVA, according to which a power generator with 65KVA, 50Hz, 400V/230V will be selected.

(9) Planning for Telephone System

The telephone line has been already available at the road in front of the Project site. From the electrical pole at the road, the line will be wired underground to individual buildings. The wiring work, for which the Saint Vincent side is responsible, will be carried out by a private firm, Cable & Wireless.

2-2-3-3 Basic Plan for Facilities and Equipment

The Fishery Center in Owia serves as a fishery basis and consolidating center of fish catches.

Therefore, fish brought ashore in this area need to be processed and stored in the most efficient manner so as to be kept fresh, and it is necessary for this plan to establish a system whereby the facilities can satisfy the market needs and provide fishery products promptly to final consumers. In the design concerning facilities, equipment, etc., therefore, it is essential to draw up a design of facilities and equipment which will make it possible to achieve the project targets without allowing any obstacles to arise, and help the project demonstrate its effects to the maximum. St. Vincent, on the other hand has been improving the specifications of equipment concerning food sanitation, and related laws and regulations, but there still remain undeveloped sphere, that is, specific criteria necessary for designs of facilities and equipment. Hence, the specifications of various pieces of equipment required for this Plan will be designed with reference to the Japanese Industrial Standards (JIS).

The facilities subject to the design planning here include ice-making machine, ice-storage ,chilled storage facility, blast cold storage facility, and cold storage, whereas the equipment subject to the planning are classifiable into: equipment concerning transportation, processing, measuring, and storing of fish catches; equipment concerning cleaning; equipment to improve the effect of fishing gear; and so on.

(1) Facilities

The primary purposes of the facilities to be constructed are to establish a system to maintain the freshness of fish catch and to prepare shipment satisfying the market needs by appropriately storing fish catches in a cold condition after they are chilled or frozen. The facilities are listed below. It is aimed at, by making effective use of the following equipment, handling fish catches promptly and eventually leading to an increase in the number of fish catches.

- Ice-making machine: An ice-making machine with the daily capability of producing one ton will be provided. The forms of ice cubes may vary depending on intended use, but flake-shaped ice cubes will be made use of in this project in Owia, as strongly requested by the government of St. Vincent on the grounds that a majority of ice-making machines supplied to the country so far fall in the flake-shape type, and thus local engineers are likely to be familiar with the handling and structure of this type.

- Ice-storage: The capacity of an ice-storage has been set at twice as large as that of the ice-making machine, the reason being that extra amount of ice cubes should be kept in stock from the beginning in case of production stoppage due to power outage or other circumstances. At the same time, a small equipment for cold storage will be installed within the storage to maintain a certain room temperature so as to avoid ice cubes stored for a long period from melting, and thus unwanted losses. Accessories include a capacity detector, indoor lights, thermometer, and handle for emergency escape.

- Chilled storage facility: The chilled storage facility will be used to store fish catches in excess of the market demand, so that these can be stored in a cold temperature, rather than being disposed, and sold in the following day. It will be also used to store fish catches temporarily before shipping to large facilities in the metropolitan area.

- Cold storage: The storage slowly freezes catches which have been refrigerated and keep them, so that catches can be shipped in accordance with the market needs.

1) Structure and Arrangement of Facilities

The facilities must be well drained and constructed with strong materials. The focus is to build facilities easy to maintain and handle, and to avoid mechanically complicated structures as much as possible. At the same time, room will be created spacious enough to make it easy to maintain the facilities. From the economic viewpoint, equipment for cold storages will not be installed to individual facilities, but shared by facilities which have similar functions. The compressor to be supplied will be a water-equipment for cold storage system and shared by all machines (three cooling units). The arrangement of facilities between landing and shipping will be made simple and straightforward in consideration with the target activities of the Fishery Center and the functions of the individual facilities.

2) Plan for Equipment for cold storages

Equipment for cold storages are roughly classifiable into three types: sealed, semi-sealed, and open equipment for cold storages. Of these, a sealed equipment for cold storage takes a structure whereby a container thick enough to enable the compressor and drive engine welded to the container from inside to bear the high pressure. This type is widely used as chilled storage facilitys for household use or in showcases at superstores – either way, in small spaces – and is not ideal, in general, for large cooling units. The sealed-type is irrefragable but has to be replaced by a new one once it is broken because it is difficult to repair. Semi-sealed equipment for cold storages, on the other hand, have the identical configuration of a compressor and drive engine. These are the same as sealed equipment for cold storages in terms of structure in that it takes an all-in-one structure, but different from the latter in that, in the former, the compressor and the drive engine are separated and can be disassembled. Thus, theoretically, semi-sealed equipment for cold storages can be maintained and repaired even if they need disassembly for repair, but, in practice, it is fairly difficult to disassemble and reassemble the machines. In an open equipment for cold storage, a compressor and a drive engine are installed independently, but linked with each other via a power transmission device such as a V-belt and a caprin. This structure is adopted for most large-scale cooling unit. Because of the nature of its mechanical structure, a equipment for cold storage in this type requires somewhat large room, but it is advantageous in its easiness of repair.

Taking into account the nature of these different types of equipment for cold storages, an easy-to-repair, open-type will be adopted for the cooling instalation in Owia.

3) Plan for Refrigerant Medium

As a refrigerant medium for the cooling unit, ammonia, a natural refrigerant medium, had been a candidate because of its environmental friendliness. However, it seemed necessary to adopt hydro chlorofluorocarbon due to various reasons: according to hearing surveys to local persons, it has been found that local engineers have no experience in handling ammonia, that it is difficult to obtain ammonia locally, and so on.

Nevertheless, eventually, it is necessary to give up hydro chlorofluorocarbon, too, because of its shortcomings shown below, and instead, it has been determined to adopt R-22.

< Hydro chlorofluorocarbon >

Currently, it is impossible to find any single refrigerant medium whose characteristics are highly closed to those of R-22. Thus, based on the criteria that the characteristics are similar to those of R-22; and that refrigerant mediums must not do any harm to the ozone layer or the global warming (safety and scientific stability), the following types have been selected as alternatives to R-22.

① R-404A:

R-404A is a compound gas consisting of three refrigerant mediums – R-125 (44%), R-143A (52%), and R-134A (4%). While it is incombustible and low toxic, it has a high global warming potential (GWP) some thousands as much as carbon dioxide (CO2), having potential risks to have serious impacts on the issue of global heating if it is carelessly discharged or leaked. What is more, if the leakage of the medium occurs, the balance of the three component mediums is upset within the cooling units, resulting in a possible necessity to refill the medium fully, rather than additional refilling, if the great amount has been leaked. Moreover, the compressed pressure is higher compared to the case of ammonia or R-22, so that it is inappropriate to be used for air-cooling equipment for cold storage in a warm region.

② R-407C：

R-407C is a compound gas consisting of three refrigerant mediums – R-32(23%), R-125 (25%), and R-134 (52%) – and mainly used for package air-conditioners.

③ R-410a：

R-410a is a compound gas consisting of two refrigerant mediums which are R-32 (50%) and R-125 (50%), and mainly used for room air-conditioners. Despite of the easiness to handle, it is not suitable for package air-conditioners because of the pressure. It also requires thick piping.

As seen above, since hydro chlorofluorocarbon takes the form of compound mediums, it cannot demonstrate the ability as expected if the refrigerant medium is leaked or drained while the equipment is under maintenance, and thus the proportion of individual components has been upset. If such cases happen, the refrigerant medium must be fully refilled, causing a great financial burden. At the same time, it will be costly in that it needs a cold storage especially designed for hydro chlorofluorocarbon.

The schedule concerning regulations, revised in 1997, in accordance with the Montreal Protocol is shown below.

Table 2-2-3.(16) Schedule on Regulations Revised in 1997 according to Montreal Protocol

CFC (R-12)	From 1996 on	Totally banned
HCFC (R-22)	From 1996 on	* on or below the standard value
	Between 2004 and 2010	* on or below 65% of the standard value
	Between 2010 and 2015	* on or below 35% of the standard value
	Between 2015 and 2020	* on or below 10% of the standard value
	In 2020	Totally banned. (as an exceptional measure, refilling to existing equipment is allowed for 10 years)
HFC (hydro chlorofluorocarbon) and natural refrigerant mediums	Not subject to regulations	

4) Plan for Spare Parts Procurement

The methods of emergency procurement of spare parts are to be found by drawing up a list of necessary spare parts for each cooling units and equipment for cold storages with the clear statement of the name of maker, responsible section, address, telephone number, fax number, and e-mail address.

(2) Equipment

Equipment to be supplied in this project is aimed at achieving the project target and drawing the effect of the project to the maximum. The list of equipment is shown below.

- Stand-by Generator: This will be for emergency use in case of power outage, and the electricity will be provided to essential machines in the facilities only. Thus, the size of the generator will be minimum necessary for the most crucial machines to keep running.
- Stainless Sink: The main usage is to rinse fish which have been processed at the first stage. Hence, the material must be strong enough and easy to be washed up after the work, so that a stainless sink is planned.
- Stainless Work Table: The main usage is to primarily process fish. Thus, as in the case of stainless sink, the material must be strong enough and easy to be washed after the work, so a stainless work table is planned.
- Heat Insulated Fish Crates: The intended usage is to temporarily store fish catches which are kept cool or frozen while they are transported (from fishing places to the lands, or from the land to markets in the metropolitan area). Hence, the crates must be able to hold the temperature inside, be sufficiently strong, and easy to carry and clean after the work.
- Fish Trays: These will be used to transfer fish catches which have been processed at the first stage within the facilities, or to store them in the cooling installations. They must be made of a strong, light material. The trays must be also easy to clean after the work and well drained.
- Shelves in a cold storage: Necessary tools to keep fish catches in the cold storage. Shelves are essential so as to store as many fish catches as possible within a limited space. They must be made of a strong, light material, and also easy to clean after the work; that is, stainless shelves will be supplied.
- High pressure washer and hosepipes for the washer: These will be used to clean the processing facility. The cleaning after the work on a every day basis is considered to be an essential task to keep the facility clean. Normally, the cleaning is done with water, but, occasionally, residues of fish

catches are scattered around, etc. and stuck on the walls, etc. On other occasions, some small residues remain unremoved on the corners of the room or stuck in the filter of the drainage. For occasional thorough cleaning, the tools in question are of importance. The model to be selected must be easy to use and resistant to corrosion.

- Compressor for diving: It is mainly used to refill compressed air to diving tools which are used in purse seining, a fishing method applied in the Owia region. There are two equipment for cold storage systems in this device – water equipment for cold storage and air-cooling equipment for cold storage- but the former requires extra accessories, and extra care for the maintenance. Thus, the air-cooling equipment for cold storage compressor will be supplied.
- Plastic crates: These will be used to transfer fish catches from the landing place to the processing facility. Long-shaped crates will be supplied on the assumption that they will be used to carry large wandering fish unique in the Caribbean Sea. The capacity will be approximately 35kg, right enough for two adults to carry, and have handles on the both sides of the crates to easily carry. The crates will have holes on the bottom for drainage, and their material will be plastic in consideration for easy cleaning and toughness.
- Platform and spring scales: Scales are intended to measure the weight of fish catches. Platform scales are for fresh fish, with the capacity of 0 – 150kg, while spring ones are for fish for sale, with the capacity of 0 – 10kg. Since both will be used at water-soaked places, the main material of the tools will be stainless if it is possible.
- Trolleys: These will be also used for the transportation of fish catches. In this plan, two types of trolleys will be prepared: one for the transportation from the landing place to the facility, and the other for the transportation of fish catches which have been rinsed or processed at the first stage within the premises. The maximum loading capacity of trolleys will be approximately 200kg, and they must be large enough to carry at least 4 plastic cases with fish catches in. Taking into account the fact that the trolleys are used in wet places, they must be resistant against corrosion; therefore, stainless trolleys will be supplied.
- FRP Tanks: These will be used to primarily wash a large amount of relatively small fish. Since they are used frequently, they must be made of a light, strong material, so that FRP tanks are planned.
- Plastic Baskets: These will be used, together with the FRP tanks described above, to primarily wash the catches. Baskets light enough to be carried by two people and made of a strong material will be chosen.

2-2-4 Basic Design Drawing

(1) Overall Layout Plan

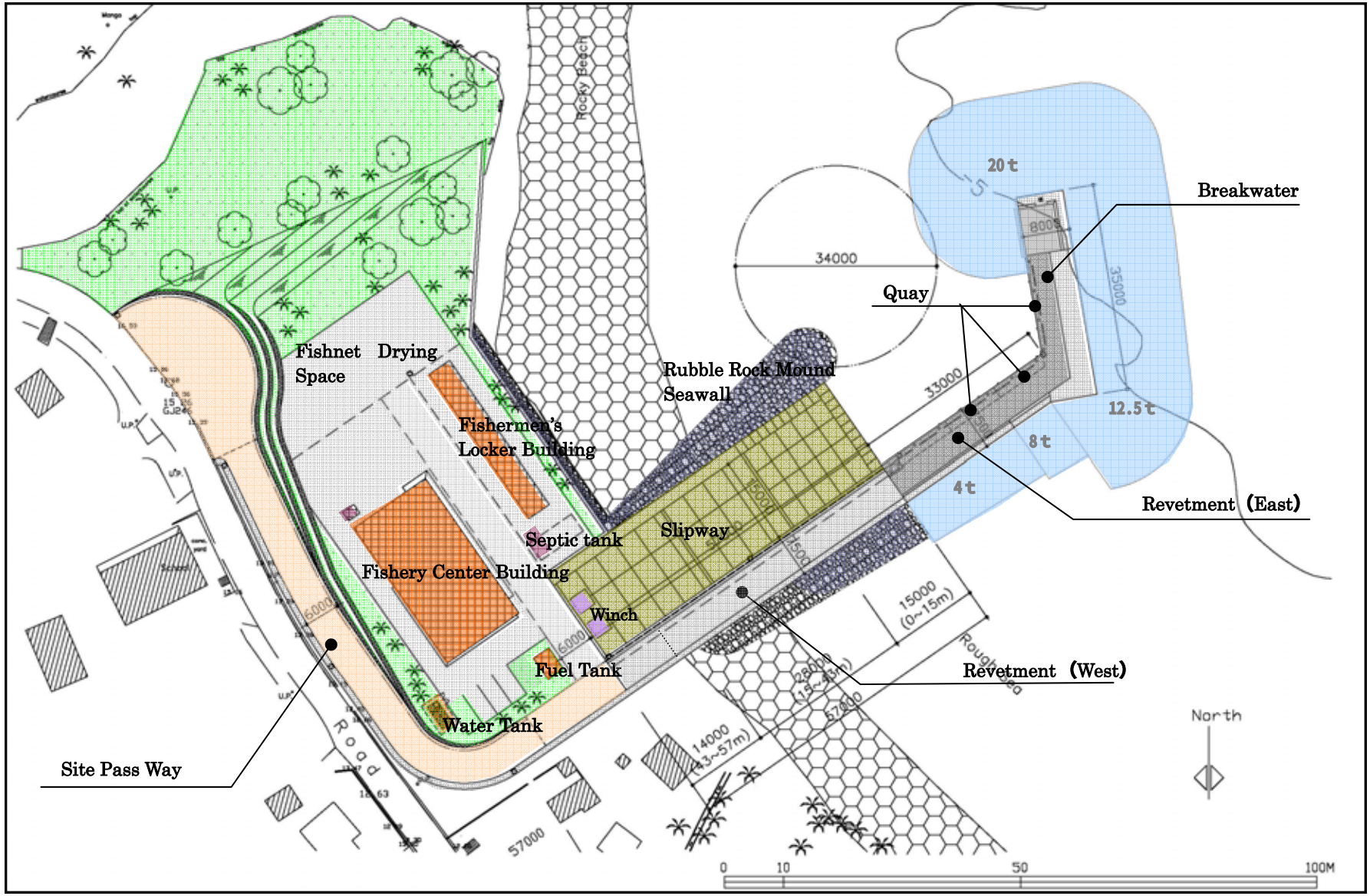


Fig. 2-2-4.(1) Overall Layout Plan

(2) Civil Engineering Facilities

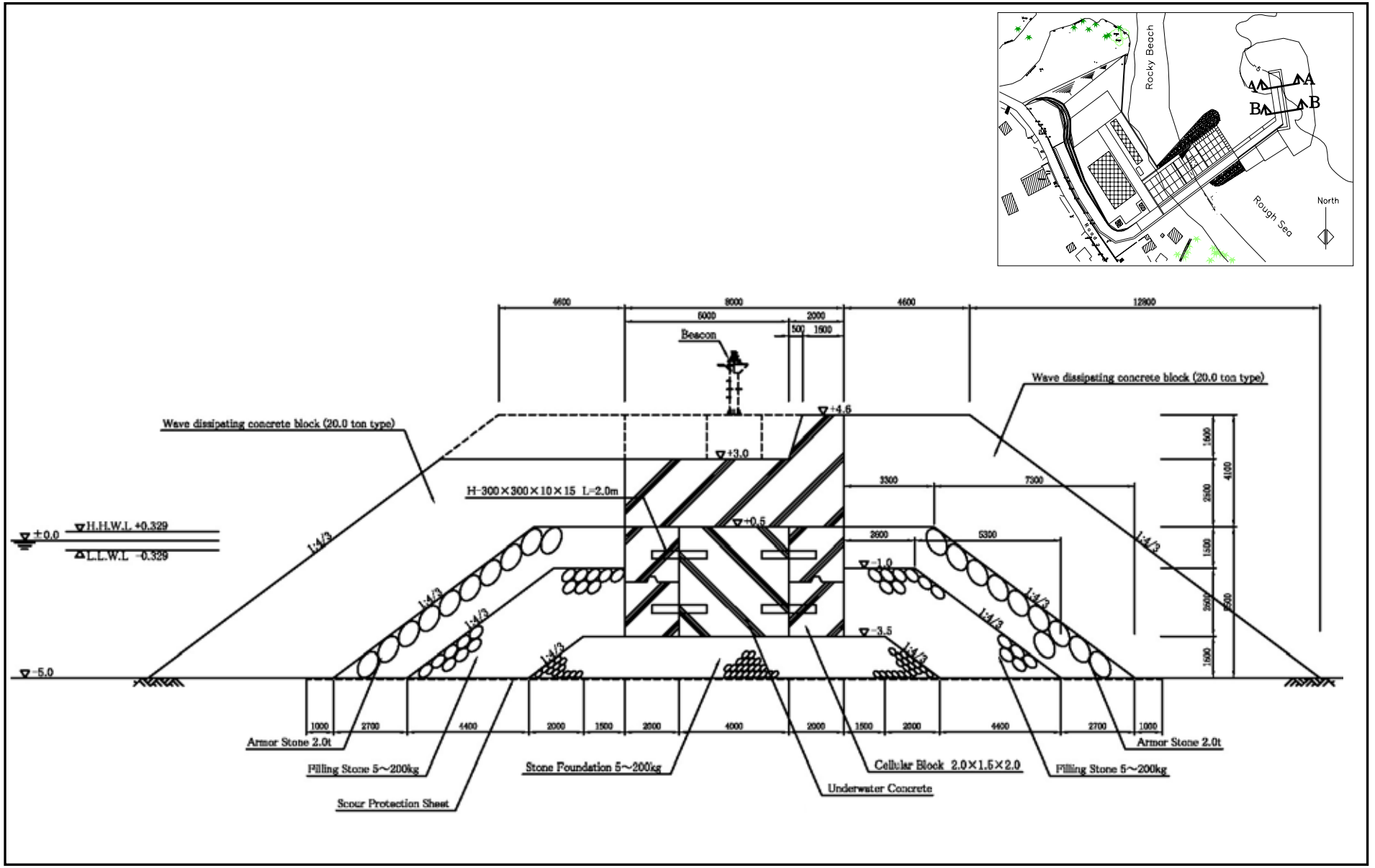


Fig. 2-2-4.(2) Cross Section for Breakwater (Section A-A)

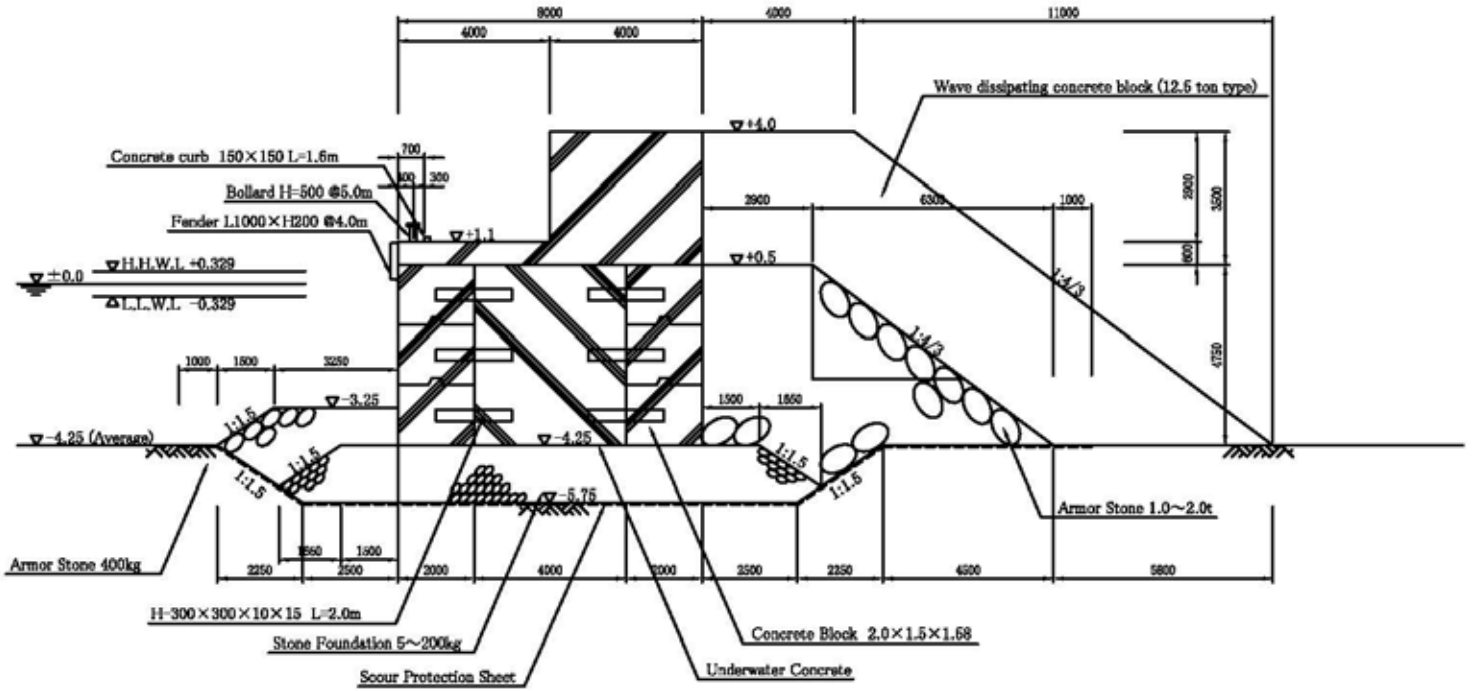


Fig. 2-2-4.(3) Cross Section for Breakwater (Section B-B)

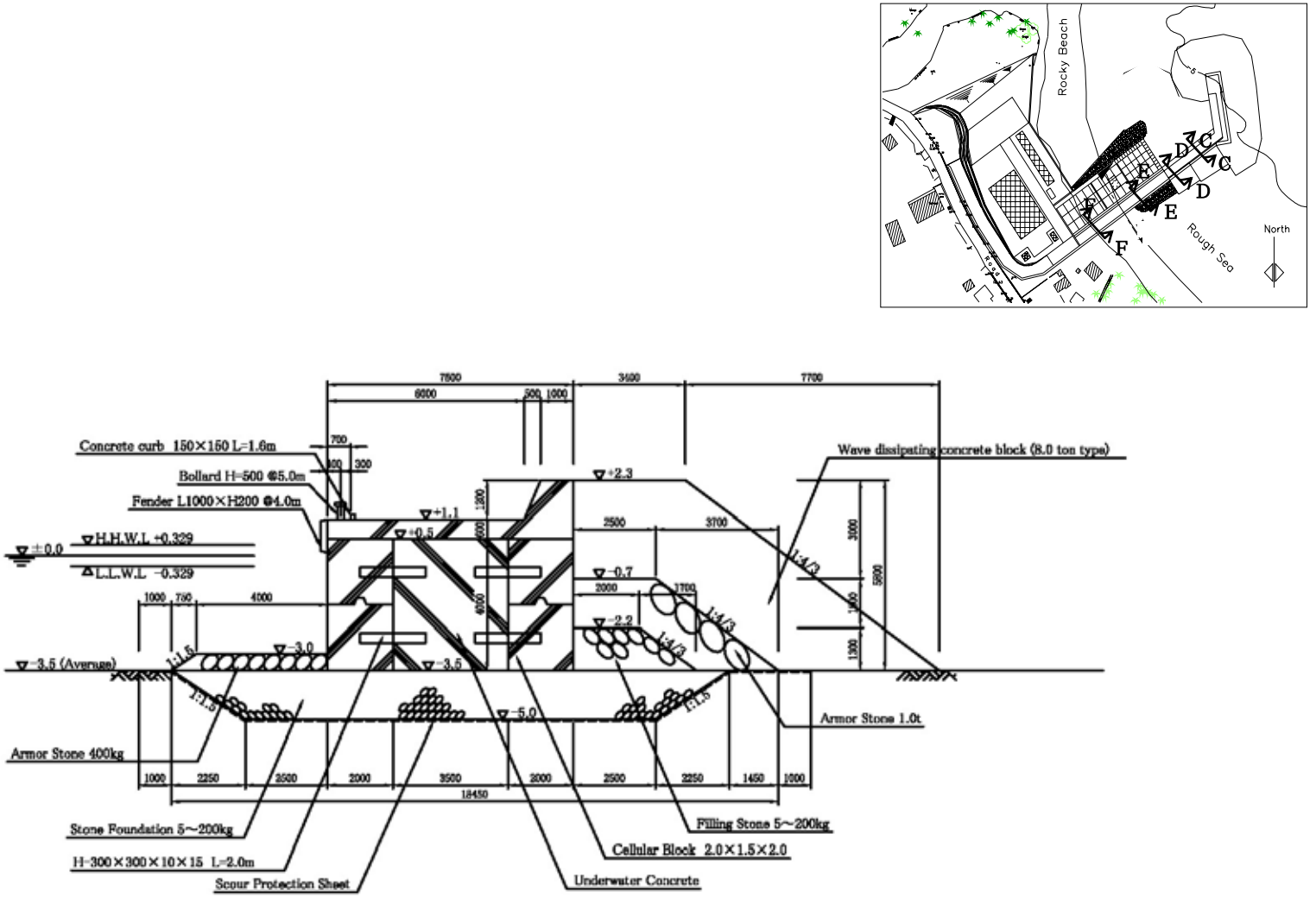


Fig. 2-2-4.(4) Cross Section for Revetment (Section C-C)

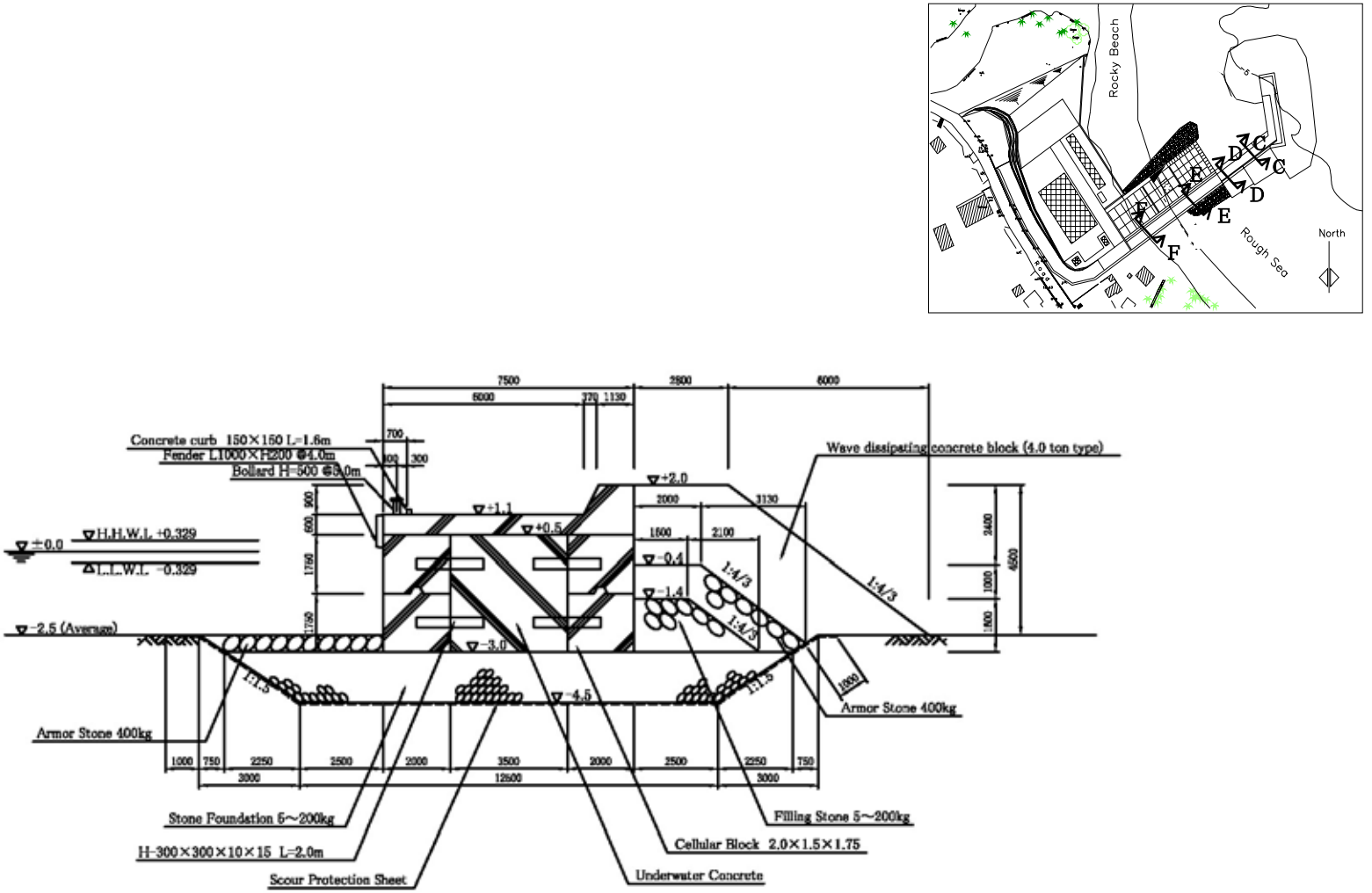
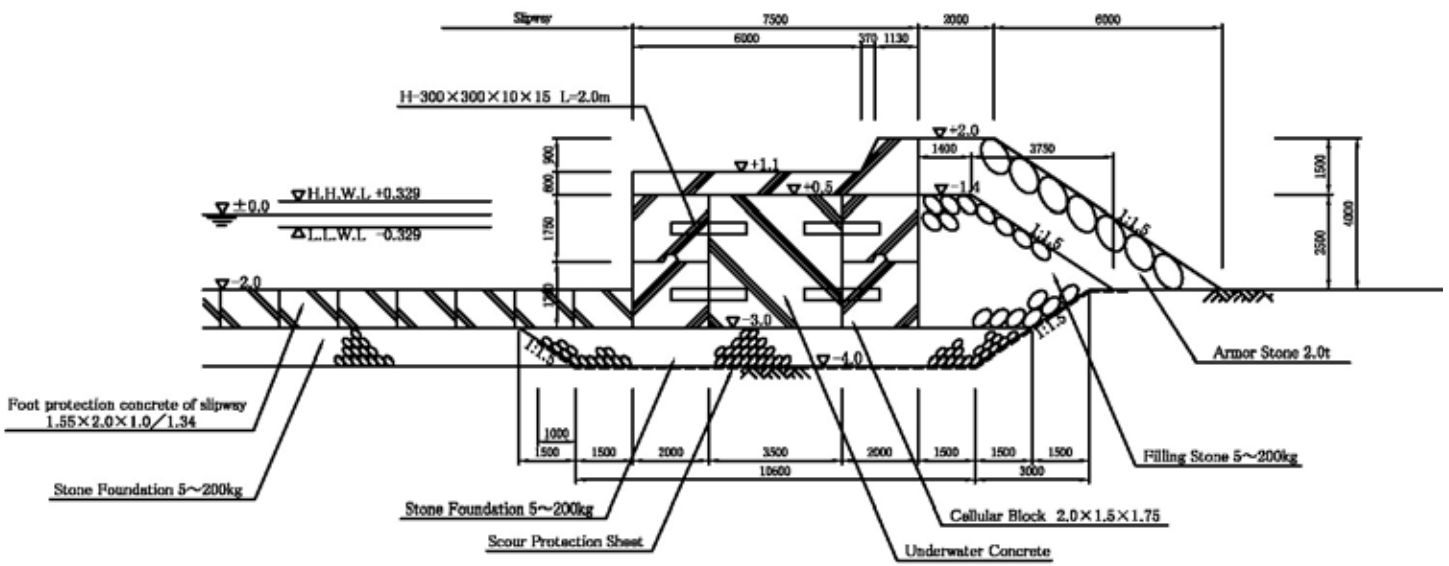


Fig. 2-2-4.(5) Cross Section for Revetment (Section D-D)



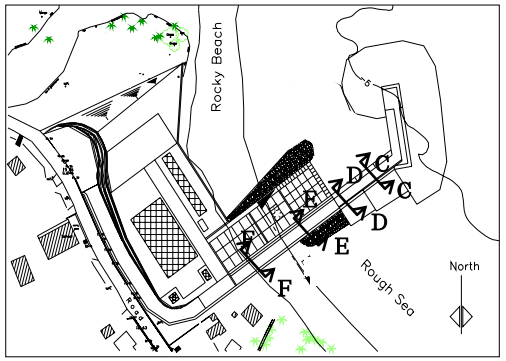
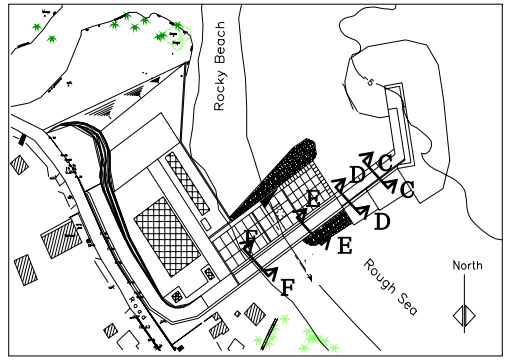


Fig. 2-2-4.(6) Cross Section for Revetment (Section E-E)



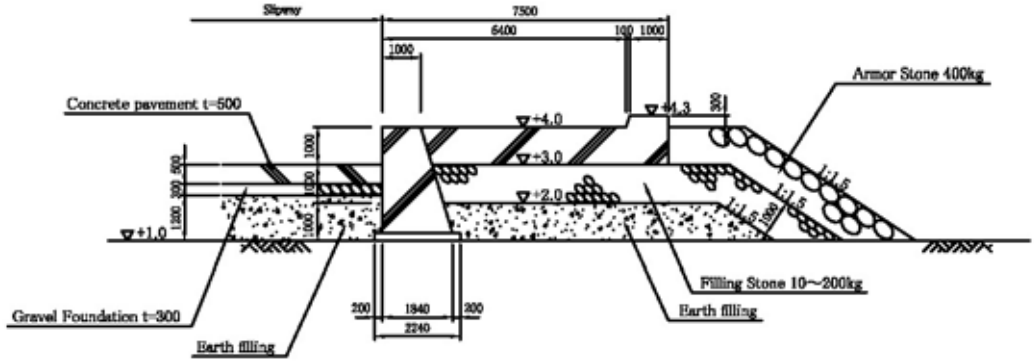
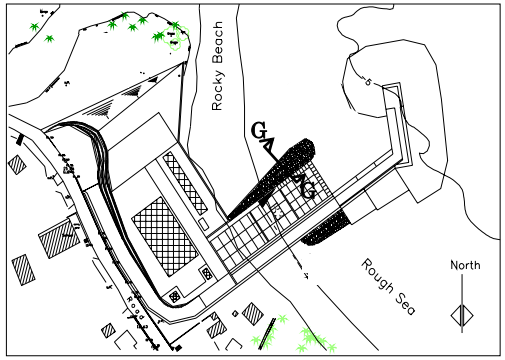


Fig. 2-2-4.(7) Cross Section for Revetment (Section F-F)



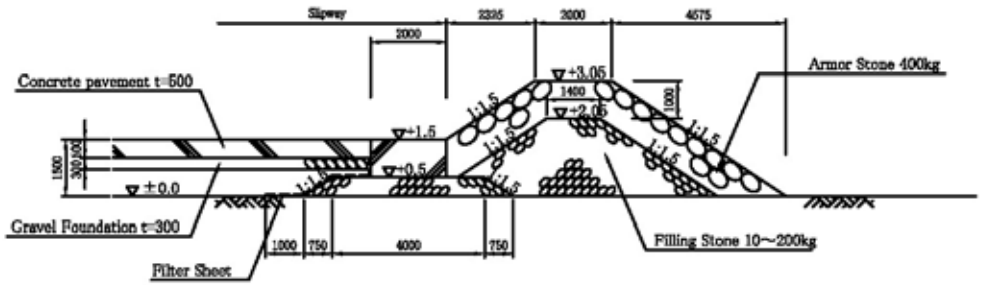


Fig. 2-2-4.(8) Cross Section for Rubble Rock Mound Revetment (Section G-G)

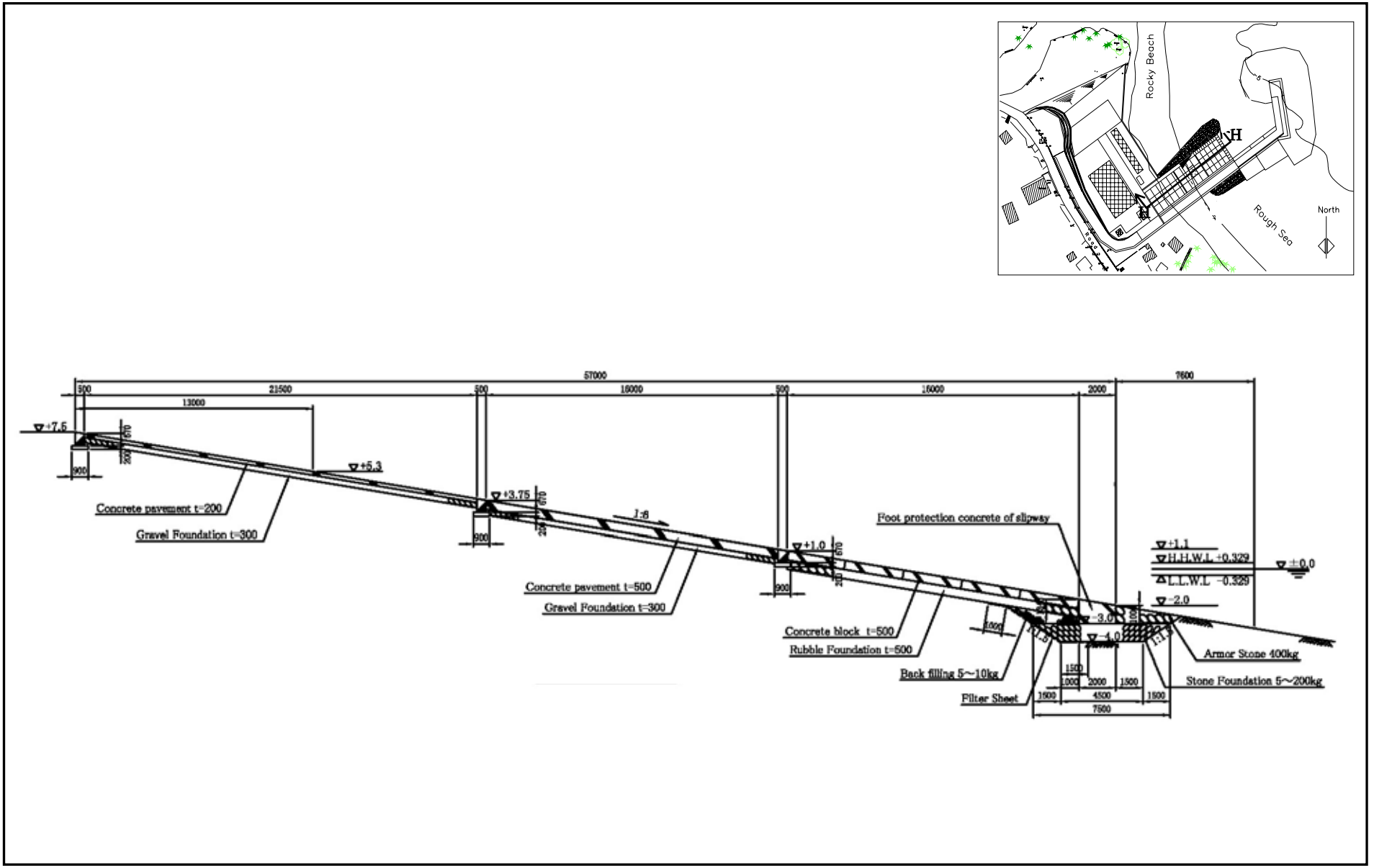


Fig. 2-2-4.(9) Cross Section for Slipway (Section H-H)

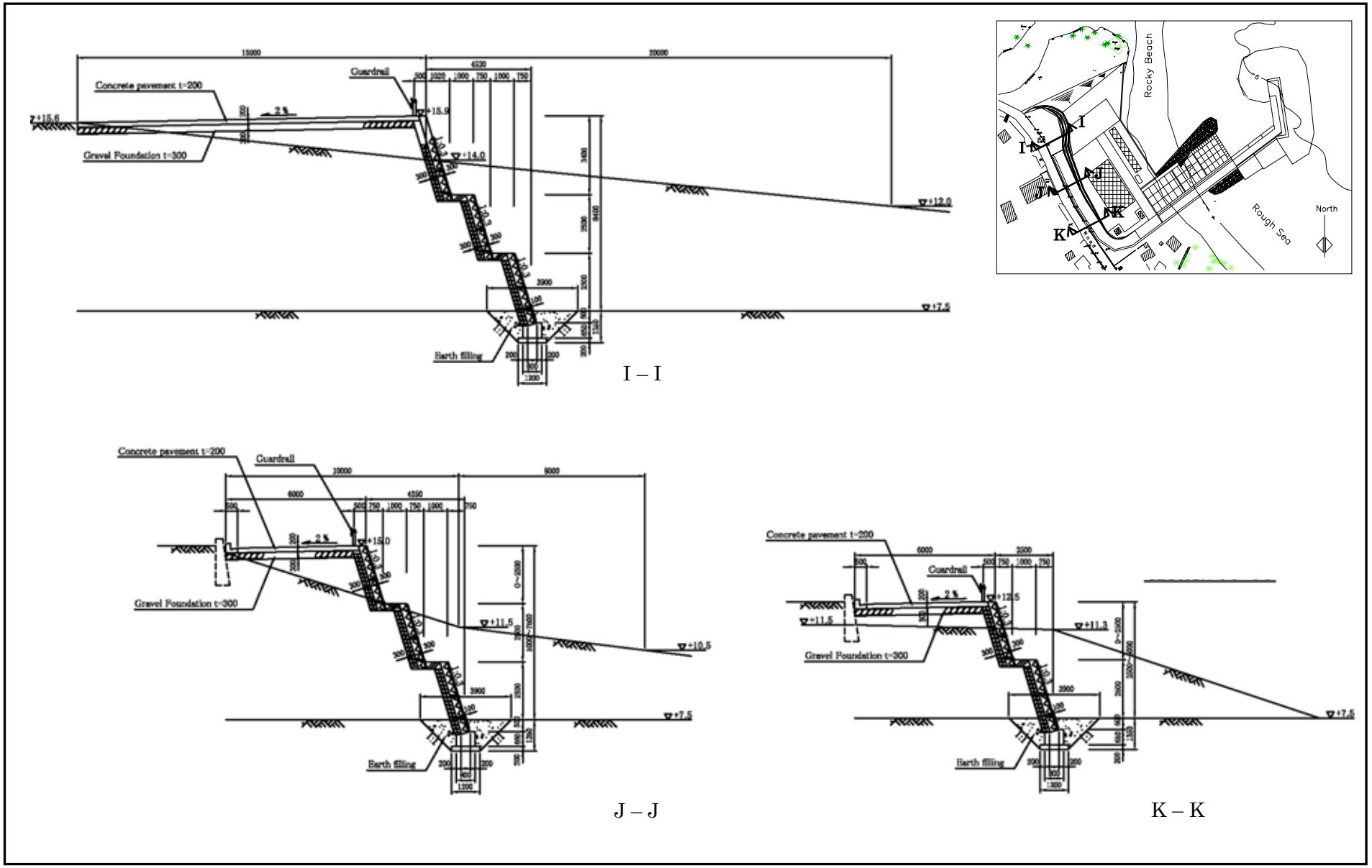


Fig. 2-2-4.(10) Cross Section for Site Passway (Section I-I, J-J, K-K)

(3) Building Facilities

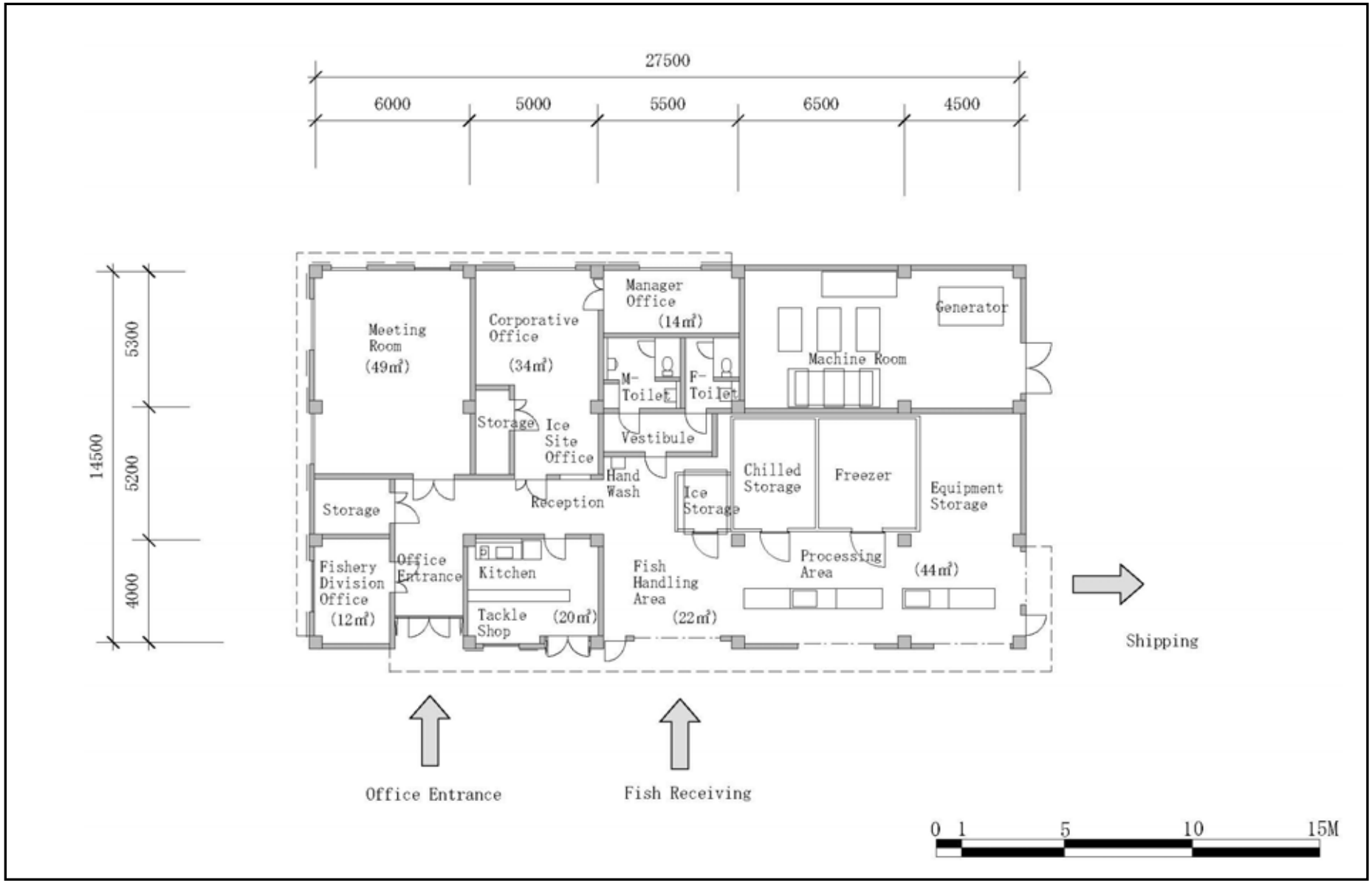


Fig. 2-2-4.(11) Floor Plan for the Fishery Center Building

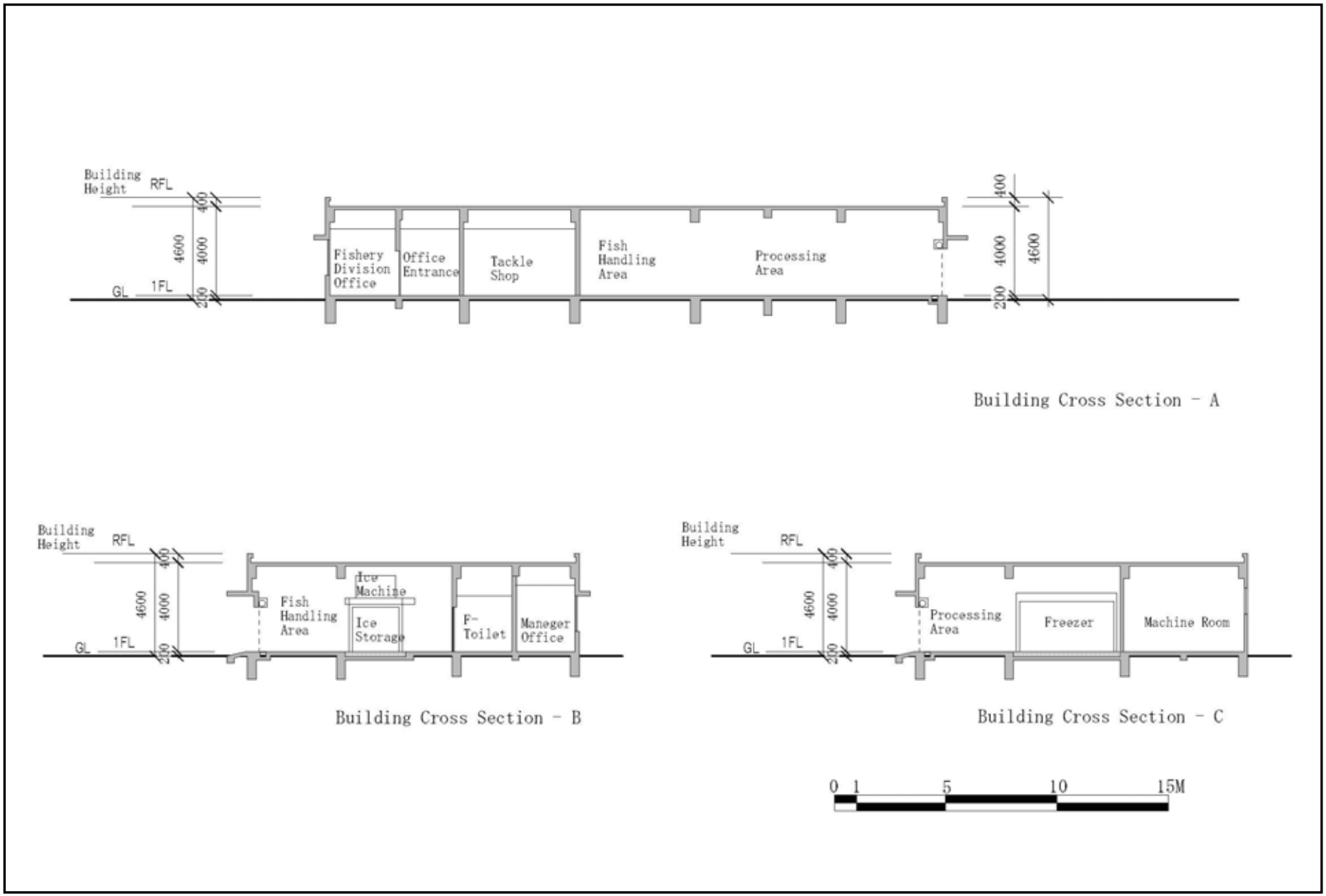
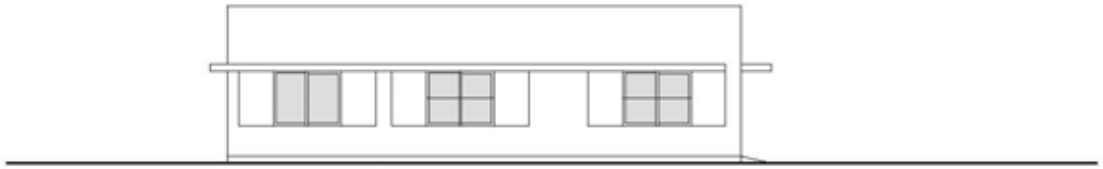


Fig. 2-2-4.(12) Cross Section for the Fishery Center Building

East Building Elevation



South Building Elevation

0 1 5 10 15M

Fig. 2-2-4.(13)　Elevation-1 for the Fishery Center Building

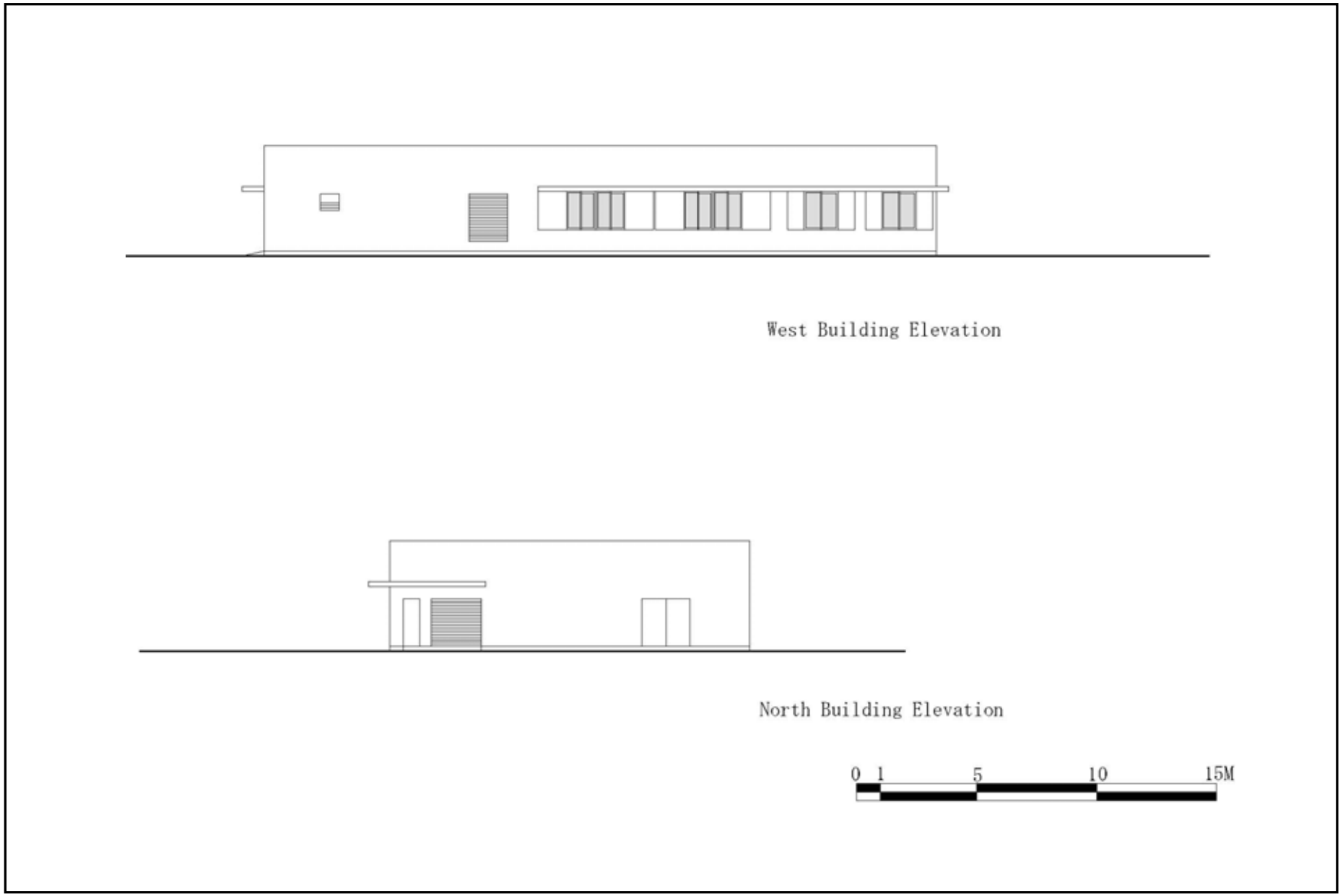


Fig. 2-2-4.(14)　Elevation-2 for the Fishery Center Building

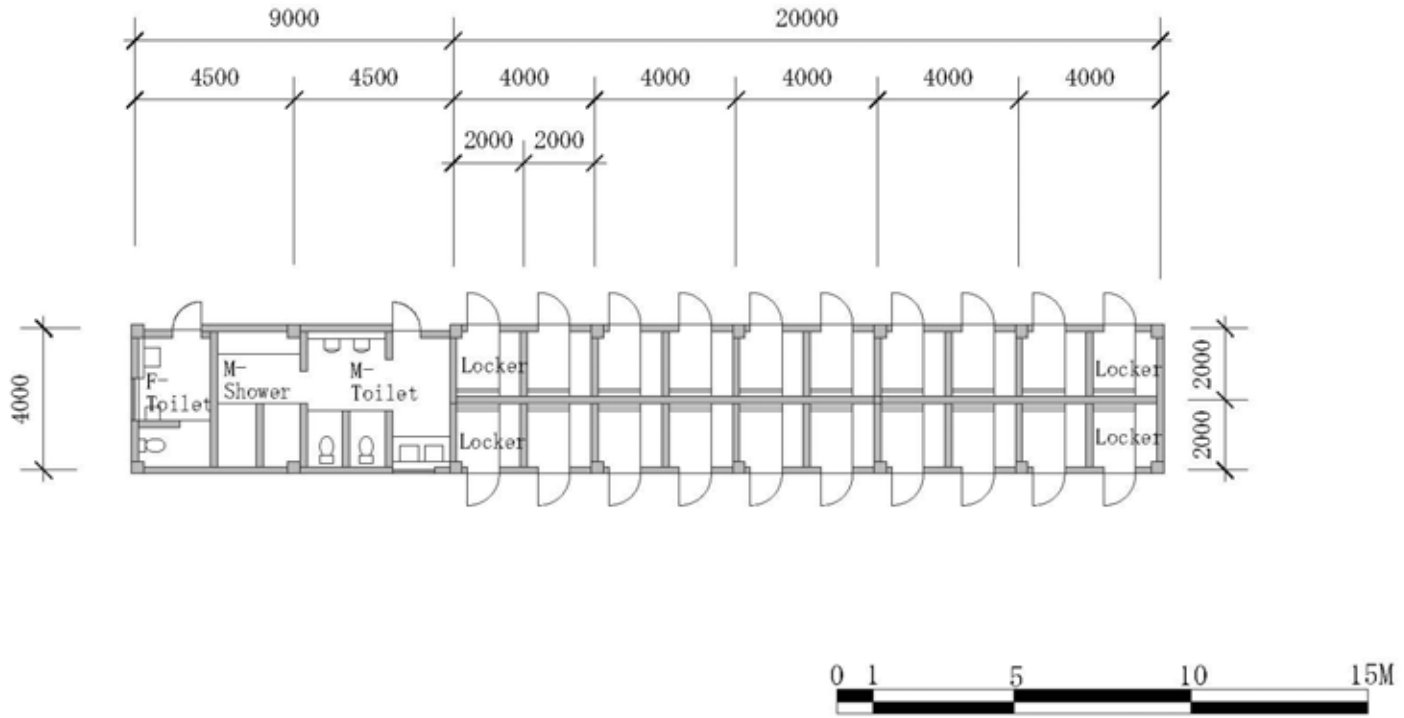


Fig. 2-2-4.(15)　Floor Plan for the Fishermen's Locker Building

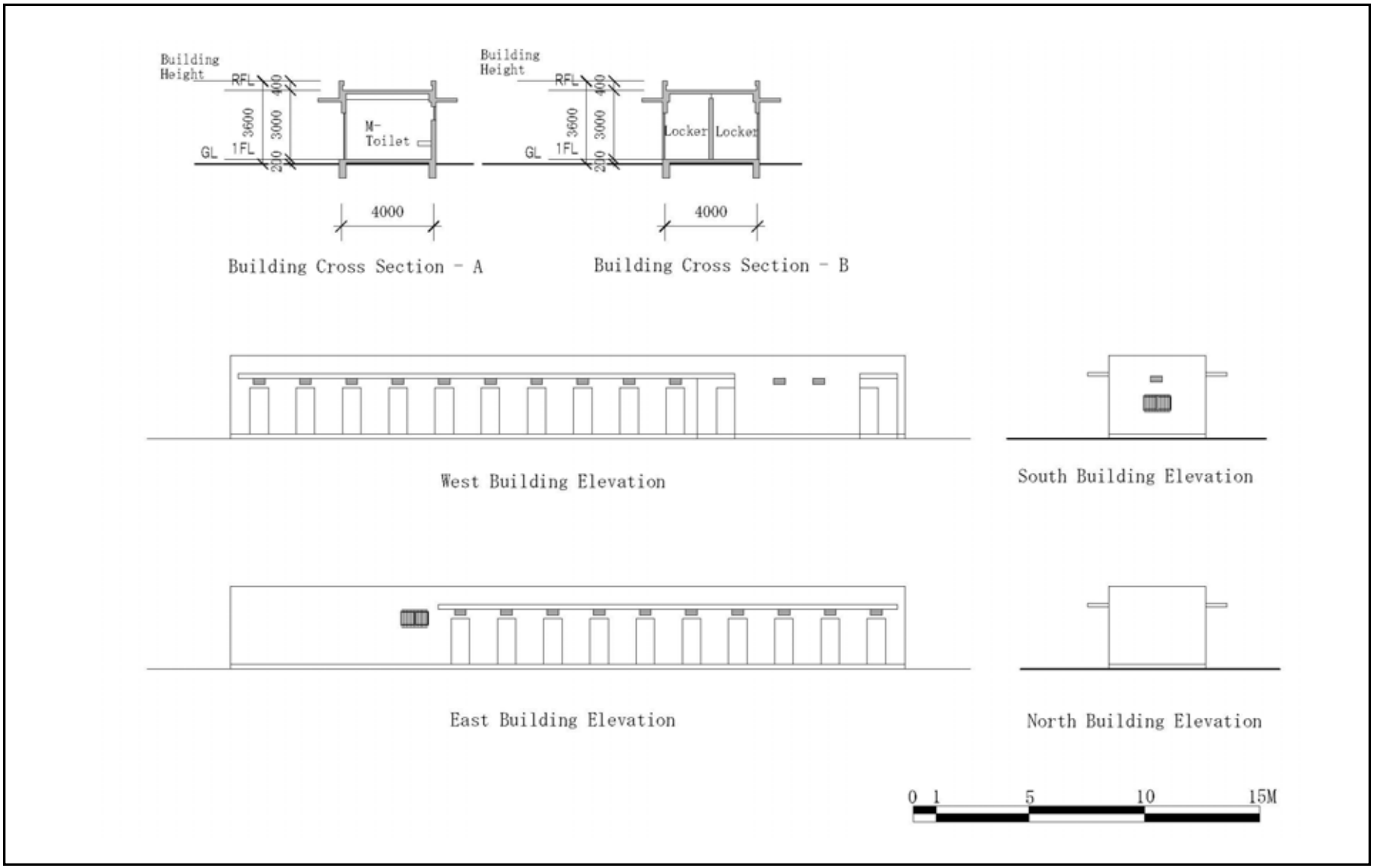


Fig. 2-2-4.(16) Fishery Center Building Cross Section / Elevation

2-2-5 Implementation Plan

2-2-5-1 Implementation Policy

Since the project is implemented under the Japan's grant aid scheme, all the works, without delay, shall be completed within the specified period. The condition requires establishment of a suitable plan for construction methodology, materials procurement, work schedule and quality, and implementation of construction work under to supervision with suitable construction criteria.

(1) Basics Concerning Project Implementation

① For implementation of the Project, after signing of the Exchange of Notes (E/N) between the Government of Japan and the government of St. Vincent and the Grenadines(SVG), a contract for undertaking consulting services will be concluded among the two governments.

② The consulting firm will prepare all documents required for the tender and conclusion of the contract such as the drawings of the project facilities, technical specifications, cost estimates and so forth. After the approval of these documents by St. Vincent and the Grenadines, the contractor will be selected from among Japanese construction firms by examining the pre-qualifications and tender procedures.

③ The construction work will be performed by the selected construction firm, in accordance with the construction contract concluded by the Government of SVG.

④ Regarding the total construction period for this project, 5.5 months will be required for detailed designs and 15 months for construction works. The construction stage is divided into two phases:

- 1st Phase during 10.5 months for the fishing port facilities
- 2nd Phase during 7 months for the other scope

(2) Implementation Policy

① After consideration of the time period and routes to the site, etc., concrete blocks and wave-dissipating blocks will be manufactured as far as possible using the Buccament temporary yard which concrete plant is located nearby and the Rayo quarry site. Manufacture of the blocks in the site aims at reducing sea transportation of the blocks. Considering the topographical characteristics of the site, a necessary concrete plant will be installed in the site.

② For landing heavy machinery and raw materials transported with floating barges, a temporary jetty will be built at the site. A part of the breakwater under construction will be used for the jetty, considering reduction of the cost and minimization of environmental and social impacts.

③ To effectively use the narrow site area and conduct critical work in advance, civil engineering work for the port facilities is partially prioritized, while considering the meteorological and marine conditions. The basic policy will produce a proper

construction management plan to effectively shorten the necessary construction period with minimizing the marine work that affects fluctuation of construction schedule due to uncertain work efficiency on sea. The architectural work will be implemented after the partial marine work.

④ In consideration of safety and the social environment, as well as existing commercial fishing activities, it is intended to install safety nets and fences for fall prevention along the approach road, as well as conducting education on the safe.

⑤ In installing blocks and rubble stones in the sea, all work should be done, based on instructions from Japanese, due to the presumed extreme difficulties in operations arising from the harsh wave conditions in particular. Further, freezers, ice makers, and ice storage facilities will be procured either from Japan or from a third country in consideration of quality and service life, and their assembly and installation should be performed according to instructions from engineers sent from Japan or a third country.

(3) Procurement Policy

The quality and supply performance for materials that can be supplied on site will be examined and local procurement will be prioritized as far as possible, to minimize the cost of procurement from Japan.

2-2-5-2 Implementation Conditions

(1) Construction Conditions

1) Construction Companies

In interviewing local construction companies and public bodies, there are few construction firms and few skilled workers such as carpenters, quarrymen, and steel erectors. A scale of firms is generally small with employees of around 15 to 20 people. Further, they have no experience of main contractors for marine construction work, which is, therefore, carried out by construction companies from neighboring Trinidad and Tobago, and Barbados.

Further, two companies experienced marine civil engineering as subcontractors of firms from neighboring countries in the Caribbean region and they do not have any large floating crafts and any heavy. Consequently, their level is such that they want to accumulate construction experience and expand their scale by procuring construction equipment and engineers when contracting new projects.

From the above, a Japanese construction firm will subcontract local firms and firms from neighboring countries. Work requiring high skills will be conducted by the engineers and technicians from third countries with supervision of Japanese engineers.

2) Construction Machinery

There is one local company leasing construction machinery, but the machinery available locally is only compact back hoes, bulldozers, loaders, dump trucks, agitators, and compact cranes (capable of lifting 35t max.). Local construction companies also own these types of construction machines. Large floating crafts, large cranes and tugboats should be procured from a third country.

3) Construction Materials

Construction materials that can be procured locally are limited to aggregates like sand and gravel, and architectural blocks only. Cement, reinforcing bar, plywood, and electrical and piping materials for general products, and c etc., are imported from third countries; mainly America, Venezuela, Trinidad and Tobago, and Brazil. Further, construction materials (cement, reinforcing bar, and wooden frames, etc.) can be procured locally, but there will not necessarily be sufficient stock. Consequently, to make sure there is a stable supply of these materials, it will be necessary to forge close alliances beforehand with representative agents who can manage stock.

4) Labor Force

Instructions of experienced engineers from Japan or a third country will be necessary to install and calibrate the freezers and ice-making equipment. Further, in installing the concrete blocks, instructions of experienced Japanese engineers will be necessary in installing wave-dissipating blocks and placing armor stones in the Atlantic Ocean, with its harsh billows, due to the lack of experience of marine construction in-country, and even in the neighboring Caribbean countries. In addition, generally experienced engineers shall be procured either locally or from neighboring countries.

(2) Considerations for Implementation Plan

1) Policies for Implementation Planning

a) Natural Conditions

① Owia Bay, the planned construction site, faces onto the Atlantic Ocean, and the billows are normally 1.0 to 2.5m high, which conditions are extremely harsh. Consequently, in implementing marine construction it is necessary to consider work safety and the processes. In particular, marine construction should be avoided from September to November, which is the hurricane season, and December to February, when the marine meteorological conditions are harsh.

② The amount of rainfall at the planned site is 1.5 times greater than the plains in the south of the island of St. Vincent. Rainfall exceeds 10mm per day for 77 days of the year, and this must be factored into the implementation plan. Further, St. Vincent has both a rainy season (May to November) and a dry season (December to April).

③ The planned area is the region with the fewest plains in the country of St. Vincent and

is adjacent to the trunk roads and residential areas of the limited flatlands. In particular, the road from Georgetown to the planned site is full of steep gradients, and narrow, sharp curves. According to a interview of local construction companies, roads with sharp curves and steep gradients hinder the shipping of raw concrete. Further, for overland access, it is necessary to ford the Labacca River, which is dry in the summer, so there is a risk of the road being impassable when it is raining. In addition, from Sandy Bay to the planned site, the height of the power lines across the roads is low.

④ The terrain within the planned area slopes from north to south and from west to east, and there is also a difference in elevation of approximately 12m between the background access rounds and the coastline. The open space that can be used as a prefab yard within the planned area is limited.

b) Social and Environmental Conditions

① In implementing earth work, it is necessary to consider how to prevent mud-contaminated waste water due to rainwater from being washed into the south-facing private land (residential land) adjoining the planning site.

② The trunk roads behind the project site fulfill the role of roads for daily living, and in shipping materials using overland traffic it is necessary to make people aware of the construction information (construction period, traffic of trucks etc.) Further, in shipping materials using marine traffic, it is vital to consider thoroughly the safety of existing commercial fishing activities.

③ Existing raw concrete and asphalt plants are concentrated in the two locations of Kingstown and Rayo in the south of S. Vincent, near the skeletal materials supply point. Further, travel by passenger vehicle from Kingstown to the planning sites takes approximately two hours more, or at least 90 minutes. Consequently, when considering on-site construction, it is necessary to consider the installation sites and shipping methods of the raw concrete.

④ The area around Rayo (Buccament) that adjoins the quarries and raw concrete has government land that can be used as prefab yards.

⑤ The Labacca quarry, which is the closest to the planning site, is more than one hour distant from the planning site, and the stone assures the skeletal material specifications, but it is necessary to consider that the river stone used as covering material is spherical and so has poor bite.

⑥ The labor environment in St. Vincent is Monday to Friday 8:00 hours to 16:00 hours, with Saturday and Sunday as holidays. Sundays in particular require consideration of the local tradition of church attendance.

2) Implementation procedure

The broad flow of the construction is shown in Fig 2-2-5.(1) and 2-2-5.(2). After earthwork be completed, the installation of wave-dissipating blocks due to marine

construction and the installation of base mounds for the perimeter facilities will be prioritized for outbound overland shipments, in consideration of work, safety, and economy. After area stability has been assured due to the installation of perimeter facilities, inclined paths and architectural facilities will be installed. Further, the gravel obtained by the landscaping can be used effectively as base material for the inclined paths and partial landfills, etc. In addition, the base mounds of the coastal protection can be used as temporary jetties required for marine shipments.

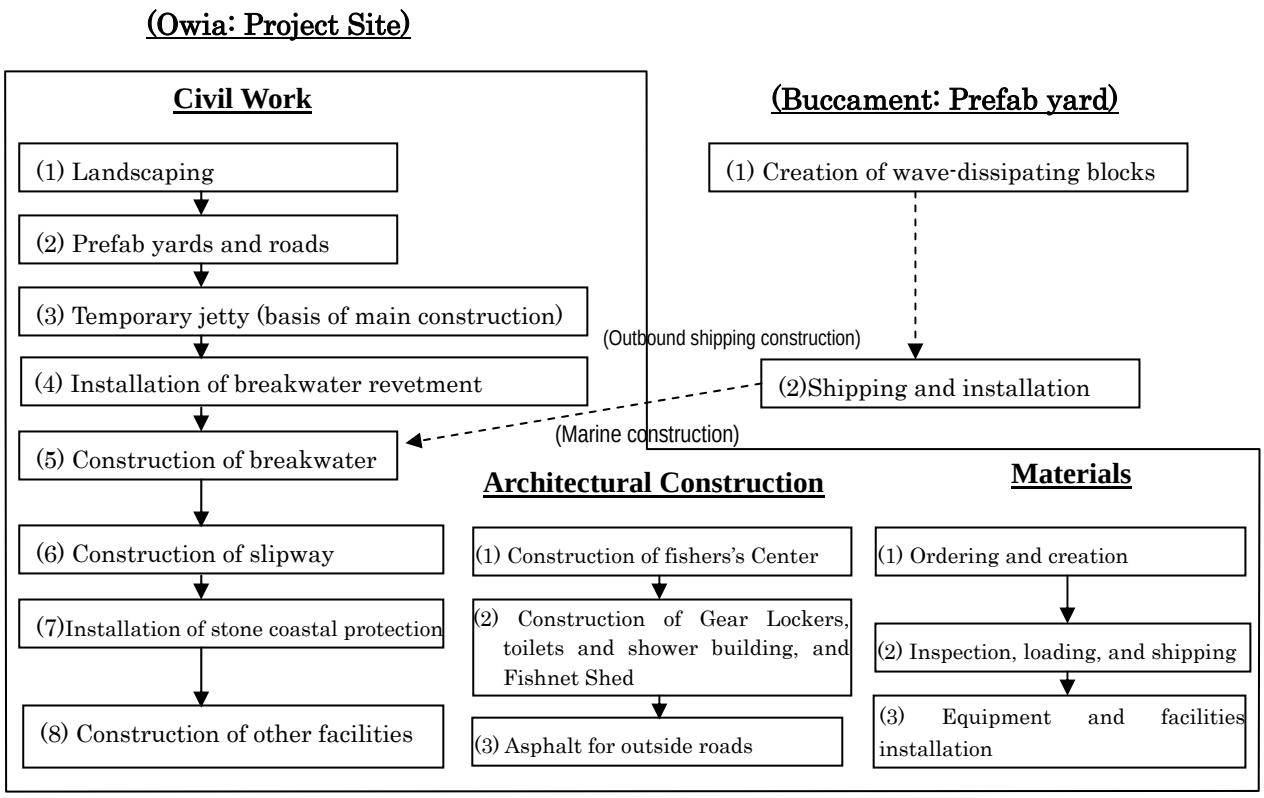


Fig 2-2-5. (1) Building Protocol

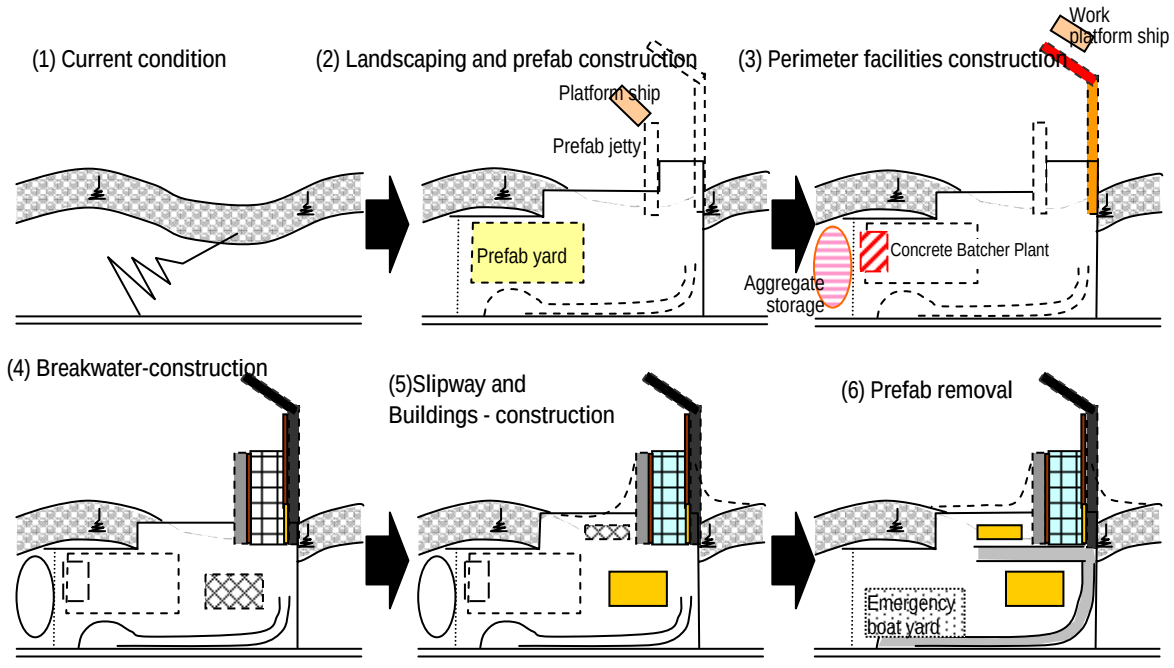


Fig 2-2-5. (2) Draft Procedure for Construction

(3) Construction Conditions

① Create a suitable construction implementation plan after thorough consideration of local natural conditions, and marine climate conditions in particular.

② Plan the dispatch of Japanese staff and technical specialists with suitable numbers, time period, and season, according to construction progress.

③ Use local materials as far as possible, and minimize the procurement of materials from abroad.

④ Thoroughly consider existing commercial fishing activities and local residential areas.

⑤ Movement to the intended construction site will use ordinary roads used by local residents, so pay careful attention to the coming and goings of construction vehicles, and thoroughly inculcate safe driving to avoid accidents.

⑥ Access conditions, marine climate conditions, and meteorological conditions at the intended construction site are all harsh, so thoroughly consider work accidents and traffic disasters, etc.

2-2-5-3 Scope of Works

(1) Scope of Work Undertaken by the Government of Japan

① Consulting on detailed design, bidding assistance, and design management, etc.

② Supply all construction materials and labor required for the construction work on the Japanese side of the present project.

③ Implementation and shipping insurance for shipping both by sea and overland imported materials that are required for materials procurement and construction on the Japanese side of this project.

④ Quality inspections required for materials procurement and construction on the Japanese side of this project.

⑤ With regard to the relevant construction work infrastructure, the basic scope is as follows: all power supplies after the entrainment work on the nearest utility poles to the project site as the boundaries for responsibility, all water supplies after the water pipes have been laid internally from the project site boundary line, all waste water, and telephones up to the overhead cabling within the skeleton.

(2) Scope of Work Undertaken by the Government of St. Vincent and Grenadines

① To secure land necessary for the sites of the project and to clear the debris on the container yard.

② To install water supply pipes from the main supply pipes to the boundary of the project site.

③ To supply electricity to the nearest power utility pole to the boundary of the project site.

④ To procure and install office equipment, phones, and furniture, etc., needed in the offices in the Fisheries Center.

2-2-5-4 Consultant Supervision

Based on the policy of the grant aid scheme, smooth and consistent consultancy work of detailed design work and supervisory work is implemented by a consulting firm which acquires the full knowledge of the project contents prepared in the basic design study.

At the construction management stage, the consulting firm appoints a resident engineer with sufficient experiences of construction management and engineers with expertise are dispatched at the necessary timing for inspection and instructions for proper site management.

(1) Implementation Supervision Policy

① The consulting firm will render appropriate services for immediate completion of the facilities without delay of the schedule through the close contact and communications with the relevant organs of the both countries and the staff concerned.

② The consulting firm will provide personnel concerned of the contractor with immediate and appropriate advices and instruction to complete the facilities in conformity with the contract documents.

③ The priority should be given to the use of locally available material and equipment if the quality and quantities will meet the requirements of the project work.

④ Implementation of the project should help to show effects under a grant aid scheme, offering occasions for technical transfer of construction methods and technologies.

⑤ Appropriate advices and instructions should be given to the recipient sector for smooth management and operation of the facilities after delivery.

(2) Supervisory Duties

1) Assistance on contracting

The consulting firm will provide assistance on selection of contractor, determine the type of contract, draft contract documents, evaluate bill of quantities and witness contract awarding.

2) Evaluation and approval of Shop Drawings

The consulting firm will evaluate and approve proper shop drawings as well as materials and equipment proposed and submitted by the contractor.

3) Management and supervision of construction work

The consulting firm will review the construction plans and schedule, etc., provide

instructions to the contractor and report the progress of works to the client and JICA.

4) Assistance in procedure of payment

The consulting firm will evaluate and approve the proper invoice for the payment to the contractor, confirming the progress of the work upon partial completion and final completion.

5) Inspection and Witness

The consulting firm will inspect the work partially completed when requested by the contractor, give instructions if necessary and certify the partial completion. Upon the confirmation of completion of the works and fulfillment requirements of the contract, the consulting firm will witness the delivery of the all the facilities specified in the contract and complete its duties with the client's acceptance.

The consulting firm will also prepare reports to the Government of Japan in relation to the progress of the works, payment procedures and delivery of completed facilities.

(3) Equipment Procurement

1) Equipment Procurement in Japan

The consulting firm select appropriate equipment meeting the specifications described in the construction drawings/tender documents. Having also considered thoroughly the conditions of the site, its selection is carried out from viewpoints of attachment of devices fro safety and protection, heat transfer processing, and heavy saline resistance. After the consultant's approval of the documents for proposed equipment, a contractor may start manufacturing of the equipment.

Shop drawings should be prepared considering that the machinery can be easily installed and assembled under the local site and labor conditions.

All the materials should conform to JIS standards.

2) Witness for Inspections in Japan

Manufacturer's inspections are required to confirm the conformity to production criteria on domestically specified equipment and al the inspection reports should be submitted to JICA by the consulting firm which witnesses the quantity and approve quality before packing the equipment. The following equipment is inspected by the consulting firm and a relevant organization.

The necessary documents for the inspection should be submitted to the relevant organizations two weeks before implementing the inspection. A representative from the organization witnesses the inspection for proper shipping.

① Ice-maker: operation and performance inspection

② Generator: operation and power generation performance inspection

③ Condenser: operation inspection

④ Auto control panel: operation inspection

⑤ All the equipment: quantity inspection and checking before packing

3) Packing and Land Transportation

When packing, presume that domestic on-site shipping is difficult, and consider thoroughly how to avoid packages being overweight. Make sure that motor types other than fully-sealed outboard fan shapes (i.e., motors with a cooling fan mounted in the outboard specifications) use type F insulation, and are vacuum packed. Further, make sure that pressurized containers contain nitrogen and are fully sealed, and also fully seal electrical control equipment. For marine shipping, use safe routes with minimum trans-shipments and a shipping schedule with no wastage, and also consider thoroughly the number of days required for shipment.

4) On-Site Installation

In considering the local conditions of labor force and logistics, easy and compact components of the machinery should be designed for minimizing local workload of laborers. At the same time, a work plan is prepared in detail and with reasonable schedule. For safe installation engineers with a thorough knowledge of installation on similar cooling and power equipment overseas are dispatched for the instruction and management of the installations.

5) Procedures from Shipping to Site Delivery

① An on-site performance inspection for the machinery is implemented before shipping from the manufacturers' factories.

② Inspection of quantity of the equipment is carried out, based on the packing lists before loading onto the ship.

③ The complete shipping documents are sent to the Government of St.Vincent and the Grenadines and JICA promptly after completing shipping inspection and customs clearance.

④ The whole cargoes are shipped from Yokohama Port to St. Vincent and the Grenadines, from which they are transported to the site.

⑤ After customs clearance, quantity and appearance of the cargoes are checked by an agent appointed the SVG Government and the Japanese Contractor. In case of any nonconformity, it should be reported to the respective organization concerned.

⑥ Mutual understanding among the personnel concerned should be acquired to solve troubles on the matter and the necessary measures should be taken, following the instructions given by the Japanese authority.

6) Expenses for Installation of Equipment

① Personnel Expenses

The cost includes remuneration and travel expenses for engineers specialized for cooling machinery and related electrical work.

② List of Equipment Requiring Expenses

Table 2-2-5.(1) List of Equipment Requiring Expenses

Equipment Name	Installation Work and Type	Installation Equipment
Ice-Maker	Ice-making equipment installation, coolant pipes, water pipes, electrical wiring	Compressors, ice makers, raw water tanks, etc.
Ice Storage	Panel assembly and peripheral equipment installation, coolant pipes, and electrical wiring	Unit coolers
Chilled Storage Facility	Panel assembly and peripheral equipment installation, coolant pipes, and electrical wiring	Compressors and unit coolers
Blast Freezer	Panel assembly and peripheral equipment installation, coolant pipes, water pipes for defrosting, and electrical wiring	Compressors and unit coolers Cooler fans
Frozen Storage Facility	Panel assembly and peripheral equipment installation, coolant pipes, water pipes for defrosting, and electrical wiring	Compressors and unit coolers
Machine Room	Power board installation, control panel installation, generator installation, and electrical wiring	Power boards, control panels, and generators
Defrost Tanks	Tank installation, concrete work, peripheral equipment installation, electrical wiring, and water pipes	Defrost pumps
Evaporative Condenser/Condensers	Concrete tanks and condenser installation Coolant pipes, water pipes, and electrical wiring	Condensers and pumps
Fuel equipment	Concrete work and tank installation Lubricant pipes and electrical wiring	Fuel pump

2-2-5-5 Procurement Plan

Following points should be considered in particular when procuring construction materials, machinery and equipment necessary for implementing the plan.

(1) Procurement Policy

Machinery, Materials and equipment available in the local market should be procured as many as possible and procurement of them from Japan or third countries will be minimized.

Among the materials procured from Japan, materials that need order of manufacturing or domestic processing in Japan require time for their delivery to the Contractor for shipping. A detailed procurement and shipping plan must be established. Further, construction machinery should basically be procured locally or from neighboring countries, and procurement from Japan minimized.

(2) Local Procurement

General construction materials excluding special equipment such as finished materials and equipment devices, etc., are mostly available in St. Vincent. With materials that can be procured domestically, a work plan should be established to use these materials. As easy procurement and quality of materials in local market is prioritized, materials with low availability and quality should be purchased in Japans.

Of the materials procured locally, stone and skeleton materials, which are the main materials, should be selected after thoroughly considering the production site, quality, and shipping performance, etc.

(3) Costs

The least inexpensive materials and machinery are procured comparing local costs and costs in Japan and a third country. If procuring from Japan, the additional costs of exporting costs and exemption of some duties should be considered.

(4) Procurement Items

① Construction Materials

Number	Construction Materials	Local Procurement	Third Country Procurement	Japanese Procurement
01	Sand and aggregate	○		
02	Building stone	○		
03	Reinforcing bar	○		
04	Cement	○		
05	Concrete	○		
06	Mold	○		
07	Concrete blocks	○		
08	Wood	○		
09	Steel fittings			○
10	Wooden fittings	○		
11	Glass	○		
12	Waterproofing materials	○		
13	Paints	○		
14	Tiles	○		
15	Upholstery boards	○		
16	Electrical wiring and conduits	○		
17	Cables	○		
18	Power supply panels			○

19	Switches and power outlets	○		
20	Lighting equipment	○		
21	Generator			○
22	Pipe materials	○		
23	Valves	○		
24	Hygiene equipment	○		
25	Grease traps			○
26	Water tanks			○
27	Pumps			○
28	Septic tank	○		○
29	Air conditioning	○		
30	Ventilator fans and extraction fans	○		○
31	Fender material			○
32	Light beacons			○
33	Slide guidebar			○
34	Winches			○
35	Sludge prevention mats			○
36	Suction prevention mats			○

② Facilities and Equipment

a) Facilities

Number	Equipment Name	Local Procurement	Third Country Procurement	Japanese Procurement
01	Refrigerating equipment for ice makers			○
02	Refrigerating equipment for ice storage equipment and chilled storage equipment			○
03	Panels for ice storage equipment and chilled storage equipment			○
04	Blast freezers and freezing equipment for frozen storage equipment			○
05	Panels for blast freezers and frozen storage equipment			○
06	FPR defrosting tanks			○
07	Defrost pumps			○
08	Water cooled condenser units			○
09	Pumps for water cooled condensers and coolant fan motors			○
10	FRP water tank			○
11	Pumps for water storage equipment			○
12	Full sets of coolant pipe materials			○
13	Full sets of water pipe materials			○
14	Full sets of power boards for power equipment			○
15	Full sets of power panels			○
16	Full sets of operation control panels for freezing equipment			○
17	Full sets of electrical wiring materials			○
18	Tools for freezing equipment installation			○
19	Tools for coolant pipes installation			○
20	Tools for electrical equipment installation			○
21	Tools for water pipes installation			○
22	One set of spare parts for freezing equipment			○
23	One set of spare parts for generators			○
24	One set of spare parts for power control panels			○
25	Fuel pumps			○
26	Stand-by generators			○

b) Equipment

Number	Equipment Name	Local Procurement	Third Country Procurement	Japanese Procurement
01	Stainless steel washing basins			○
02	Stainless steel working table			○
03	Insulated Fish Trays, 2 types		○	
04	Fish trays			○
05	Freezer storage shelves			○
06	Pressurized washing equipment and hoses			○
07	Submersible compressors			○
08	Plastic fish trays			○
09	Platform scales		○	
10	Spring scales		○	
11	Hand carts			○
12	FRP tanks			○
13	Plastic holed baskets			○

③ Construction Machinery

Number	Main Construction Machinery	Local Procurement	Third Country Procurement	Japanese Procurement
01	Deck barge (x1) with 100-t crane		○	
02	50-t crawler crane (x2)		○	
03	Tugboat (550ps) (x1)		○	
04	Concrete batcher plant (15m^3/h)	○		
05	Agitator trucks (4.5m^3) (x2)	○		
06	Trucks (11t) (x1)	○		
07	Truck (Crane equipped) (x1)	○		
08	Damp trucks (10t: x5)	○		
09	Bulldozers (20t) (x1)	○		
10	Backhoes (0.6m^3) (x2)	○		
11	Vibration rollers (0.8t-1.0t) (x1)	○		
12	Trailers (20t) (x1)	○		
13	Truck cranes (35t) (x1)	○		

2-2-5-6 Quality Control Plan

Regarding the quality control of the work, details will be indicated in the specifications of tender documents for the project, which are based on the "Criteria of Quality Control for Port Construction Work" from the "Common Specifications for Port Construction Work in Japan". In addition to the specifications, CUBiC, ASTEM, BS, etc. are applied to the project.

The quality control of materials used for buildings is performed using the architectural construction standards and specifications, the JASS 5 commentary therein (Architectural Institute of Japan), Common Specifications for Building Work (Ministry of Land, Infrastructure and Transport), Guidelines for Management of Building Work (Ministry of Land, Infrastructure and Transport), and the Japan Industrial Standards (JIS).

2-2-5-7 Implementation Schedule

In implementing the project under the Japan's grant aid scheme, after signing the Exchange of Notes (E/N), a Japanese consulting firm will be selected by the Government of St. Vincent with concluding a consultancy contract. Thereafter, the work will be completed with steps of detailed design, documentation for tendering, tendering and contracting, and construction work.

(1) Implementation Design Work

After the consultant contract has been concluded between the Japanese consulting firm and the Government of St. Vincent, the consulting firm will start detailed design with verification of the contract from the Japanese Government. During the detailed design stage, a full set of design documents should be prepared for bidding, based on the basic design study report. Through discussions with the Government of St. Vincent on details of facilities and machinery, approval of all the tender documents should be obtained from the Government of St. Vincent. The detailed design stage will take about 5.5 months.

(2) Tendering

The Contractor, which is a Japanese construction company, is selected determined by tender. The tender is performed in the following order, and require two months: letters of interest, pre-qualifications, distribution of tender documents, tender, evaluation of tenders, determination of a company, and contracting.

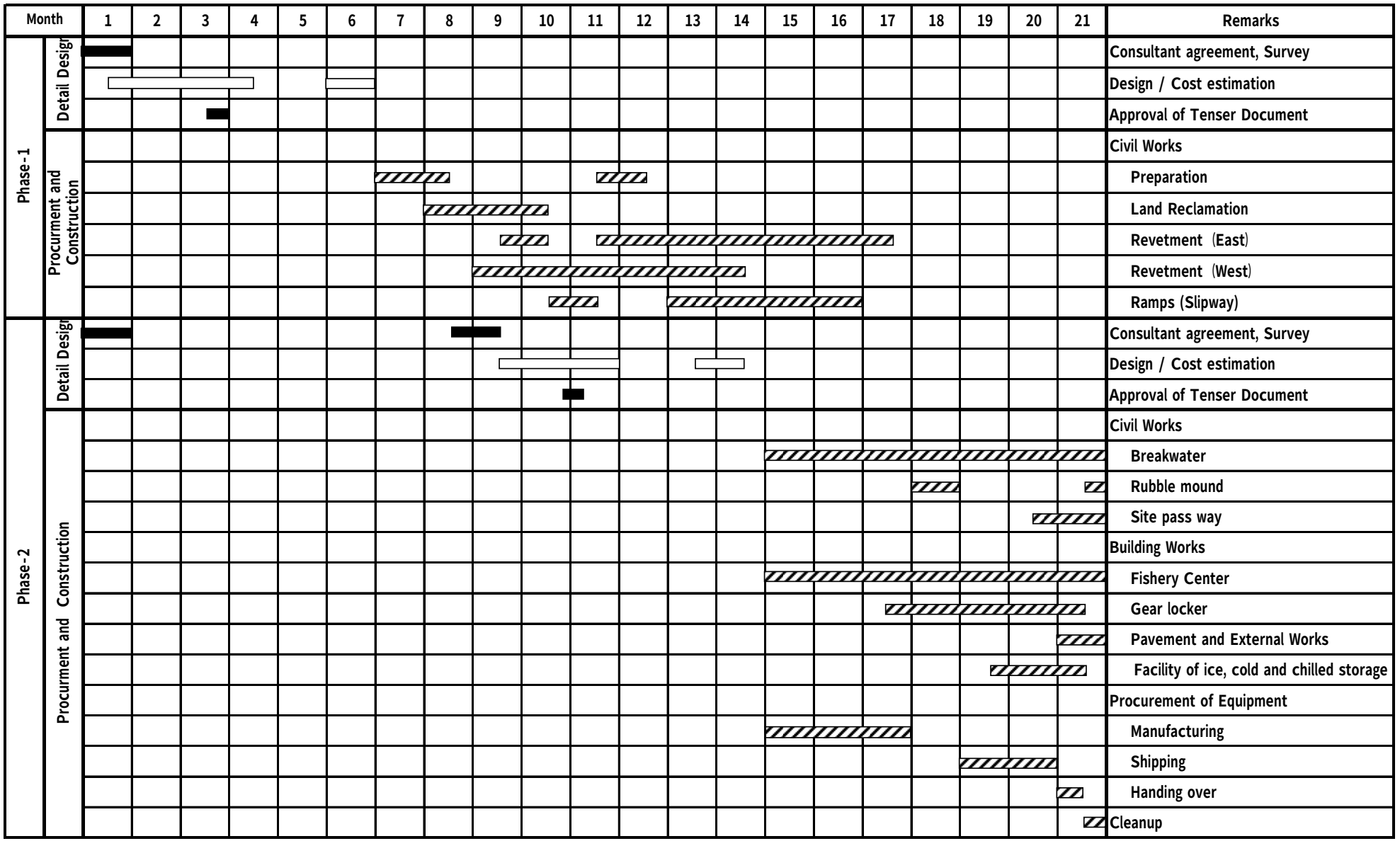
(3) Construction Work

After the construction contract is verified by the Government of Japan, construction work can start. Based on the presumed conditions described above, the major presumption is that the civil engineering construction will be performed first, and the building work thereafter. The former should take twelve months, and the latter approximately eight. In consideration of the period for wrapping up part of the civil engineering and building work, the total construction period is estimated to be approximately 15 months for two phases as:

- First phase: 10.5 months for Civil works
- Second phase: 7 months for (1) Civil work, (2) Building work and Equipment
-

The implementation schedule for the project with two is described in Fig 2-2-5. (3) showing the processes from signing the Exchange of Notes (E/N) to the completion.

Fig. 2-2-5. (3) Implementation Schedule



2-3 Obligations of Recipient Country

Items confirmed in Minutes under the Basic Design Study are as follows.

① The site , clarification of ownership and the temporary construction yard are to be prepared for the project.
② All utilities and telephones are to be fixed.
③ Import duty for the materials imported related with the project to Saint Vincent are to be exempted.
④ Japanese coming to the country to carry on the project under the verified contract, are to be exempted from taxes and other surcharges.
⑤ Japanese above-mentioned are to be accommodated when entering and staying the country.
⑥ Handling commission for B/A and Authorization to Pay are to be born
⑦ The construction permit in the country is to be given.
⑧ The facilities constructed by Japanese Grant Aid are to be made good use of.
⑨ All sums over Japanese funds are to be born.
⑩ The budget and personnel necessary for the project are to be prepared.
⑪ Things are to be fixed without delay when the construction permit is needed to construct the facilities.
⑫ The environmental impact assessment are to be carried out when the assessment is needed for the project.
⑬ It needs to be definite how much responsibility rests with the Fishery Division and North Windward Fisheries Cooperative. for management and operation of the facility equipment.
⑭ The personnel of North Windward Fisheries Cooperative. are to be trained to manage the facilities and maintain the equipments.

2-4 Project Operation Plan

2-4-1 Structure to carry out the project

The project facilities are to be constructed by the Fisheries Division as the operating agency. When constructed, the facilities belong to the Fishery Division. Then new fishermen's association, North Windward Fisheries Cooperative, is going to be entrusted with the management of the facilities under the supervision and guidance of the Fishery Division. In case the new fishermen's association cannot be set up in time, the Bureau by itself or with National Fisheries Marketing Ltd. would manage the facilities a while.
Once the Fishery Division set up fishermen's associations in Calliaqua and Barrouallie and entrusted them with the management and operation for the facilities and equipment

of the Fishery Center by the Fishery Division. They are able to do that again. In the country fishermen's associations contribute to their society supporting one another. They work not only for making a profit but for the public good. They are not taxed for a profit. In Saint Vincent, the Cooperative Association Bureau thinks much of fixing business plan to be independent as an economic organization and hands-on training. When the association is considered to be able to do good business by themselves, the Cooperative Association Bureau let the association registered officially. The Fishery Division, organized and guided 2 fishermen's associations already, will be able to do a good job in this project.

2-4-2 Management and Operation Organization

The fishermen's association, when established, will have 50~60 members. That will be operated by 7 directors as shown in the fig 2-4-2.(1) 8 members are going to manage and operate the facilities.

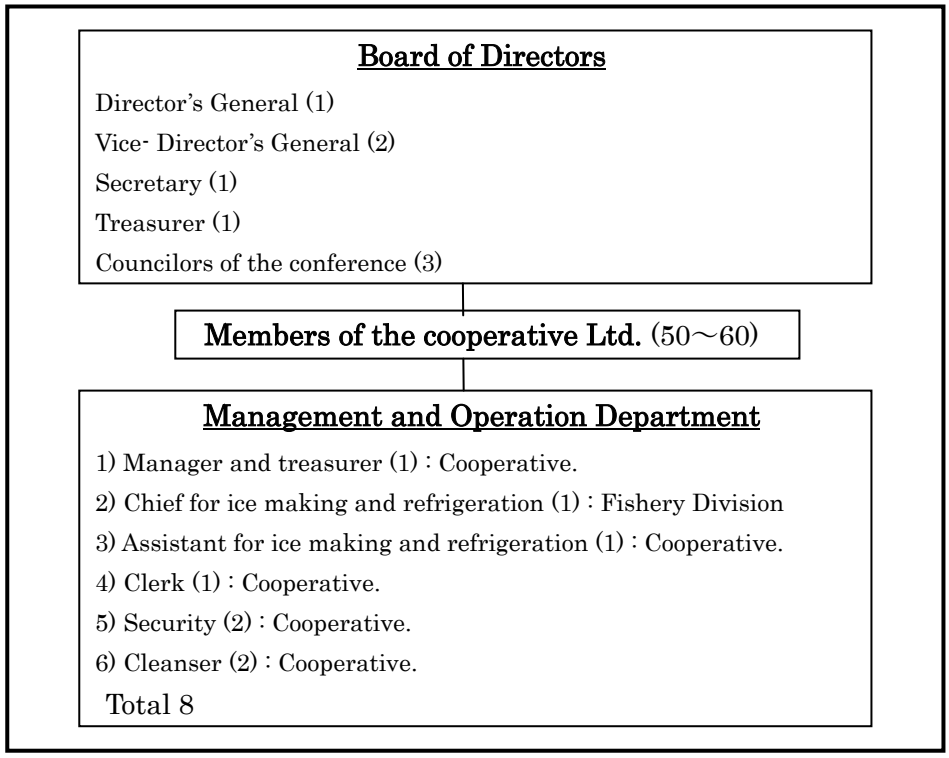


Fig 2-4-2.(1) Organization of North Windward Fisheries Cooperative.

2-4-3 Management and Operation Plan

North Windward Fisheries Cooperative. is going to carry out the project. The activities put into operation by the Cooperative. are as follows. They have carried out

the same work in Calliaqua and Barrouallie, that is in conformity to the cooperative association law and other regulations in the country.

(1) Business Activities

① Fuel supply
② Selling lubricating oil
③ Selling ice
④ Selling fishing gears (Running a gear shop)
⑤ Renting a warehouse and a retail sale booth
⑥ Cold storage management
⑦ Collecting landing charge
⑧ Offering employment
⑨ Filling up a diving tank
⑩ Buying and selling fishes

(2) Insurance Activities

① Selling (fuel and fishing gears) on credit to the members of Cooperative.

(3) Social Activities

① Pension planning
② Compulsory savings
③ Insurance for a ship and life
④ Scholarship
⑤ Selling rebate
⑥ Members' training for fishing etc.

Fig2-4-3 (1) shows the schedule to transfer the management of the facilities to Cooperative. Fishery Division and National Fisheries Marketing Ltd. are going to guide and support the work. Saint Vincent Cooperative Association Bureau will guide the project and plan hands-on training.

Fig 2-4-3. (1) Schedule to transfer of control to Cooperative.

Schedule	Transfer of control	Building Fisheries Center
Dec.2006~Apr. 2007	Meeting to establish and management committee to set up	Conclude E/N
May.2007~Dec. 2007	Planning the project	Commencement of Phase-1 in May,2007
Jan.~July. 2008	Revision and training of the project	Commencement of Phase-2 in Jan,2008 Construction completion of Phase-1 in Mar, 2008 Construction completion of Phase-1 in July, 2008
July.~Dec, 2008	Training・Registration Permission Plan to start the operation of Cooperative Ltd.	Transfer the management and operation of the facilities

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

The total amount of the project covered by Japanese Grant Aid will be approximate 1,430,000,000 Japanese Yen. This cost estimate is provisional and would be further examined by the Government of Japan for approval of the Grant. Mentioned above, Japanese and Saint Vincent governments share the cost as follows.

(1) Japanese expenses

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

Project Cost Estimate Approximate ¥1,430,000,000

Construction of Owia Fish Landing Complex Construction

Expense Item			Project Cost Estimation (¥)	
Facilities	Civil Works	1) Land Reclamation 2)Revetment, Seawall, Quay(including incidental facilities), Revetment for Slipway(rubble mound) 3)Slipway 4)Breakwater 5)Site pass way	944,000,000	1,246,000,000
	Building Works	1) Fishery Center Building - Office quarters and meeting room - Storage ice-making machine / ice-storage / cold strage - Fish handling, processing and forwarding and area - Fishing tackle shop 2) Fishermen's Gear Locker Building 3) Septic Tank 4) Fuel Station 5) Fishnet Drying Space 6) Pavement	302,000,000	
Equipment	Stainless-Steel Washing Table / Stainless-Steel Working Table / Heat-Insulated Fish Box / Fish Tray / Pressure washer / Hose for pressure washer / Diving compressor / Plastic fish box / Platform scale / Spring scale / Handcart / FRP Tank / Plastic perforated basket		13,000,000	
Total of Facilities and Equipment			1,259,000,000	
Detail Design and Consultant Supervision			171,000,000	

(2) St. Vincent's expenses

The cost borne by the Government of St. Vincent is estimated as EC$140,000 excluding eminent domain and resident relocation which is equivalent to approx. 8% of the annual

budget of the Fishery Division (2006). Details are as follow.

Table 2-5-1.(2) St. Vincent's Expenses

Items	Cost (EC$)
Electric power supply cable installation to site	49,000
Water supply pipe installation to site	10,000
Telephone line, Office work machinery, tools and furniture	81,000
Total	140,000

(3) Conditions of cost estimation

① Base date for estimation : May 31, 2006
② Exchange rate : 1US$=¥117.12 1EC$=¥43.38
③ Construction period : Detailed design and construction period are on the progress schedule.
④ Others :The project is carried out by Japanese Grant Aid.

2-5-2 Operation and Maintenance Cost

The balance of payment is as shown in Table 2-5-2.(1) which is based on the average landing volume by this project (85t/year) and North Windward Fisheries Cooperative. which is planned by the Government of St. Vincent can be run on a financially self-sufficiency. The account statement of operation expenses has been made based on collecting a facility rent from members of fishermen's union. The facility rent is paid by fish boat owner according to the landing volume as the fishermen's (Member of Fishermen's Union) portion to be borne. This will not be excessive burden for fishermen and is considered to be a practical prerequisite. Cooling System such as an ice making machine and a refrigerator need to be renewed in about 6 years however the cost will be paid by Fishery Division as the owner of the facilities and the necessary fund is also secured from the facility rent.

Table 2-5-2.(1) Income and Expenditure of Owia Fish Landing Complex

No.	Item	Calculation Bases	Monthly	Yearly
INCOME				
1	Facility Rent for ①～④ $300/Person･Month	① Landing Fee (60 persons) ② Refrigerator Rent (60 Persons) ③ Gear Rocker Rent (60 Persons) ④ Rent for fish sales booth (60 Persons)	18,000	216,000
2	Ice Sales	630lb x 0.25EC$/lb x 30 days	4,725	56,700
3	Fuel Oil Sales	① Gasoline Sales ・ Fishing Boat: 0.60$x613gal./mo. ・ Vehicle: 0.60$x853gal./mo. ② Diesel Sales ・ Vehicle:0.51$x1,560gal./mo. ③ LPG Sales 80 houses x 3$	 368 512 796 240	 4,416 6,144 9,552 2,880
4	Filling Air	100$ x 96 tanks/year	800	9,600
		Total Income	25,441	305,292
EXPENDITURE				
1	Personal Expense	① Manager ($1,500/mo.) 1 person ② Chief Engineer($2,000/mo.) 1 person ③ Engineer ($1,200/mo.) 1 person ④ Clerk ($800/mo.) 1 person ⑤ Cleanser($500/mo.) 2 persons ⑥ Security($600/mo.) 2 persons Sub Total	1,500 2,000 1,200 800 1,000 1,200 7,700	18,000 24,000 14,400 9,600 12,000 14,400 92,400
2	Maintenance Cost such as Electricity	① Ice Storage and Refrigerator ② Chest Freezer and Ice making facility ③ Electric light, Pump and Hall lighting	4,464 9,450 2,214	53,568 113,400 26,568
3	Water Expense	1,300gal./dayx 0.011$x 30days	429	5,148
4	Communication and other office expenses	100$/mo.	100	1,200
5	Facility Rent	Payment to Fishery Division	1,000	12,000
		Total Expenditure	25,357	304,284
		Balance	84	1,008

Remark: $ marks and all the figures are EC Dollars

2-6 Other Relevant Issue

The following points are requested to respond promptly by the Government of St. Vincent after concluded E/N for the smooth execution of the project.

① Smooth filing for the marine construction and the execution of environmental assessment and the permission for excavation or other works of the hinterlands.

② The temporary yard is needed for the construction however it is difficult to find in the project area. That is the land in Buccament on the Caribbean coast of Saint Vincent owned by the Government for the project construction.

③ Four families are living there now. They have to be moved and removal work have to be completed before the construction starts otherwise, it has an serious influence on the project implementation.

④ Let fishermen know when and where fishing boats are to be partly restricted during the construction.

⑤ The necessary formality is needed when ocean dumping of bottom soil and sand by excavation work is required.

2-7 Environmental Impacts by the Construction

Ministry of Health and Environment of Saint Vincent says the project by the government doesn't need IEE and EIA. No inconvenience has been found on the basis of the JICA guideline for Social Environmental Consideration.

The construction has to be carried out carefully in case environmental impacts described below during construction can be foreseen.

(1) Coast Reclamation

The magnitude of reclamation is planned as minimum however, items to be considered for construction are as follows.

① The silt curtain is needed in the excavation work to prevent turbidity.

② The temporary jetty required in marine works is planned to use this both as a part of main works. If not, the temporary jetty will be removed after construction and try recovery to boulder coast as it is.

(2) Facilities on the coast

The site is in next to the private land. The following countermeasures are needed when land facilities will be constructed.

* Drainage works have to be done properly at the time of land reclamation so that dirty water won't run into the southern private land.

(3) Traffic for construction materials and vehicles

The arterial road is planned from King's Town to the site by the end of 2007. It won't be completed by the beginning of the project construction. The main road will have heavy traffic and following things have to be considered to transport materials by construction vehicles.

① As for material and equipments by land transportation, the time and period should be known to all.

② As for material and equipments by marine transportation, the construction plan has to consider the safety of fishery activities.

Chapter 3 Project Evaluation and Recommendations

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effect

Major industry in St. Vincent and Grenadines (SVG) is oriented toward agriculture; however, the agriculture sector confronts the constraints as limitation of its productivity due to only 10 percent of the land for cultivation and as termination of the most–favored-nation provisions for bananas for export to UK in several years. For enhancement of economy in SVG, the Government is eager to develop industries of tourism and fisheries as the other options for the banana industry. In the National 3-year Development Plan, the fisheries industry is highlighted as a high potential for contributing to the economy instead of agriculture concentrated on banana production. The basic policies of the fisheries development plan are as follows:

- Scaling up the total volume of fisheries and productivity by improvement of processing marine products and quality control after catch
- Developing artisan fisheries by quality control of fishery products
- Promoting export with export standards and producing substitutes based on HACCP
- Promoting administrative capability of the Fisheries Division and others

The Government of Saint Vincent planned to set up and arrange 11 Fisheries Centers over the country to support artisan fisheries. 8 centers, 7 of which were completed under the Japanese grant aid scheme, have been under service. Regarding the fisheries center at Owia, one of the left three, the project for developing the facilities has not been implemented so far and no fisheries facilities are available on the coast of the Atlantic. As a result, fishermen are obliged to manage unsafe operation of fishing boats and unsafe landing of fish catch at the landing station; Further, deterioration of fish was caused due to lack of landing and storage facilities for maintaining its quality.

Implementation of the project is expected to improve the present fisheries conditions at Owia as mentioned above and to bring the following effects:

【Direct Effects】

① Fish landing place is equipped in Owia area

Fish landing time will be drastically improved from present average two hours to average 1 hour by constructing the quay. The preparation time for sailing out will be considerably shortened from present average two hours to average one hour.

② Landing work becomes efficient

As safe water area will be secured by the construction protective facilities for fishing port, safe workability will be secured and consequently, labor force for preparation and landing per one boat will be lightened from present 6 men to about 2 men.

③ Safety work is secured

As the chance to sailing out will be increased by facilities construction, 85 tons/year of landing volume will be increased.

④ Unloading volume is increased

By installing cold storage facilities such as Ice making, Child and Freeze Storages, preserving freshness of fish catch become possible and decrease fish thrown.

⑤ Preservation of freshness

Installation of cold storage such as ice making facility, child facility and freezing facility keep fish catch preserve freshness and can decrease post-harvest losses.

⑥ Area for refugee (escape) is created

The project site where oceanographic conditions are very sever has good fishing grounds and not only fishing boats belong to Owia, Fancy and Sandy Bay but also fishing boats belong to other ports can utilize this as a refuge port.

⑦ Damage of fishing boat is decreased

The working time for repairing wooden boats which were damaged by strong breaking waves and rocks will be decreased to a few times in a year due to the development of tranquil water area by the construction of surrounding facilities and the slipway construction.

⑧ Distribution volume of fish catch is increased

With the construction of Fisheries Center in this area, not only the volume of thrown out fishes is decreased or the number of sailing out is increased, but also fish catch will be collected here and distribution volume to surrounding area will be increased.

【Indirect Effects】

① Fresh fishes landed at the Owia Fisheries Center will make the supply volume, the quality fishery products and the cash income increased not only in three villages (Fancy, Owia and Sandy Bay) but also in other towns and villages near George Town and total St. Vincent Island through Kingstown Fisheries Market.

② With the development of this facilities, labor environment of fishermen will be improved and the increase of days operated and fisheries income can be expected. It is expected that the motivation of fishermen will be improved and the employment opportunities will be born.

③ It can be contributed to regional development expecting this will be the repository of fish catch with the construction of fisheries facilities in St. Vincent as first one in north east of the island.

Table 3-1-1.(1) shows effects and improvement with implementation of the project.

Table 3-1-1.(1) Effects and Improvements by the Project

Issues to be settled	Countermeasures in the project	Effects and Improvement
Landing is carrying out on 2-meter wide flat sport made on pebble rocks under breaking waves.	・ Two berths for landing ・ One berth for supplying ice, fuel, water and etc. ・ One ice making facility	・ Landing efficiency will be remarkably improved at about 1 hour. ・Preparation time will be very much improved at about 1 hour.
6 persons (2 boat crews and 4 assistants) are needed when landing.	・ Berth for landing ・ Supply of handcarts to carry fishes	・ Two crews will be enough for landing ・ The assistants can go fishing.
Without a cold store, harvest losses are frequently seen.	・ Ice making machine ・ Refrigerator and freezer	・ Fish becomes possible to keep freshness by the primary process with a refrigerator and freezer. ・ Harvest losses will be very small with ice
Damages of the boats on rocky beaches cause decrease of fishing efforts for their repairs.	・ Slipway ・ Landing and preparation berth	・ Slipway can avoid the damage and safely land their fishing boats ・ Increase of fishing efforts is expected with deceasing repairs of boats.

3-2 Recommendations

North Windward Fisheries Cooperative is going to operate the Owia Fish Landing Complex effectively after the project completion. The Cooperative is recommended to manage and operate the Center with following the views:

(1) Proper Management

North Windward Fisheries Cooperative Ltd. is scheduled to succeed management of the facilities supervised by Fisheries Division, Cooperative Division and National Fisheries Marketing Ltd. The Cooperative will commence operation after being fully trained to carry on the business and require efficient management for self-supporting accounting

(2) Safe and Efficient Management of the Marine Facilities

The planned berth for landing and preparation will accommodate an existing number of boats only. For congestion of boats in the port, management is needed to impose regulated rules for usage of facilities and create allowable time for resolving congestion. The rules will help the safe and efficient management of the berths.

(3) Prohibition of fish sale out of Owia Fish Landing Complex

In the project, refrigeration facilities can be operated to keep fish fresh and prevent losses due to its deterioration. With an exception of personal consumption of fish, management of Owia Fisheries Center should prohibit sale/trade of fish in the outside the Center. For a purpose of obtaining data of accurate fish catch, management should also prohibit direct transaction with brokers or fish buying vessels.

For the customs clearance of fish purchased by foreign fish buying vessels in Owia, the authority should establish a necessary system to dispatch customs officers to the Owia Fisheries Center from Kingstown.

(4) Proper Rules for Transaction

In the project, retail stalls are set up. The management is recommended to regulate rules for the brokers from the capital city to purchase fish through the Cooperative. The rules aims at efficiently selling landed fish without fishermen's efforts and the following procedures are proposed; (1) The Cooperative handles all the fish from fishermen for its sale, (2) The Cooperative share the amount of revenues to each fisherman according to its sales amount.

From a viewpoint of enhancing quality control of fish, proposed is another rule to restrict purchase of fresh fish from boats without ice.

(5) Good Use of Ice

The Cooperative should urge fishermen to use ice on boat for keeping its freshness, which increases their revenues by reduction of fish deterioration.

(6) Use of Materials

Provision of Insulated fish boxes, fish boxes and scales will help accurate acquisition of data on fish catch, which will be conducted by the Cooperative. Fishermen should learn how to use them for meeting their objectives through education and training by the Cooperative.

(7) Training for Fishermen

Taxes for Cooperative Ltd. are lightened because of its social activities. The Cooperative should produce activities for improving fishermen's livelihoods through extension of fishing skills, and for organizing seminars for better living and recreation.

(8) Statistics and Research of Fisheries

Building administrative capacities of Fisheries Division and organizations of the Government are proposed as an important policy among the fisheries development policies. It is understood that statistical data on fish catch is essential for fisheries management. Accurate statistics for fisheries administration will be needed in order to forecast fish catch and its resources, to know the difference of fish prices between at landing site and in the retail market, which will render useful information for promoting fishermen's livelihoods.