

MINISTRY OF AGRICULTURE, LANDS,
FISHERIES, PLANNING AND
COOPERATIVES
ANTIGUA AND BARBUDA

No. 01

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
CONSTRUCTION OF FISH LANDING AND
DISTRIBUTING FACILITIES IN ST. JOHN'S
IN
ANTIGUA AND BARBUDA**

NOVEMBER 1997

JICA LIBRARY



J 1142311 (8)

**JAPAN INTERNATIONAL COOPERATION AGENCY
CRC OVERSEAS COOPERATION Inc.**

G R T
CR (2)
97 - 187

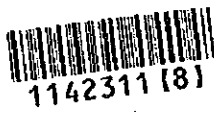
MINISTRY OF AGRICULTURE, LANDS,
FISHERIES, PLANNING AND
COOPERATIVES

ANTIGUA AND BARBUDA

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
CONSTRUCTION OF FISH LANDING AND
DISTRIBUTING FACILITIES IN ST. JOHN'S
IN
ANTIGUA AND BARBUDA**

NOVEMBER 1997

**JAPAN INTERNATIONAL COOPERATION AGENCY
CRC OVERSEAS COOPERATION Inc.**



1142311 (8)

PREFACE

In response to a request from the Government of Antigua and Barbuda the Government of Japan decided to conduct a basic design study on The Project for Construction of Fish Landing and Distributing Facilities in St. John's and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Antigua a study team from July 11, 1997 to August 4, 1997.

The team held discussions with the officials concerned of the Government of Antigua, 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 Antigua 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 Antigua and Barbuda for their close cooperation extended to the teams.

November, 1997



Kimio Fujita
President
Japan International Cooperation Agency

November, 1997

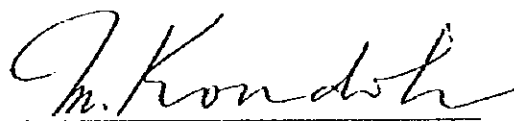
LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on The Project for Construction of Fish Landing and Distributing Facilities in St. John's in Antigua and Barbuda.

This study was conducted by CRC Overseas Cooperation Inc., under a contract to JICA, during the period from July 7, 1997 to November 17, 1997. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Antigua and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

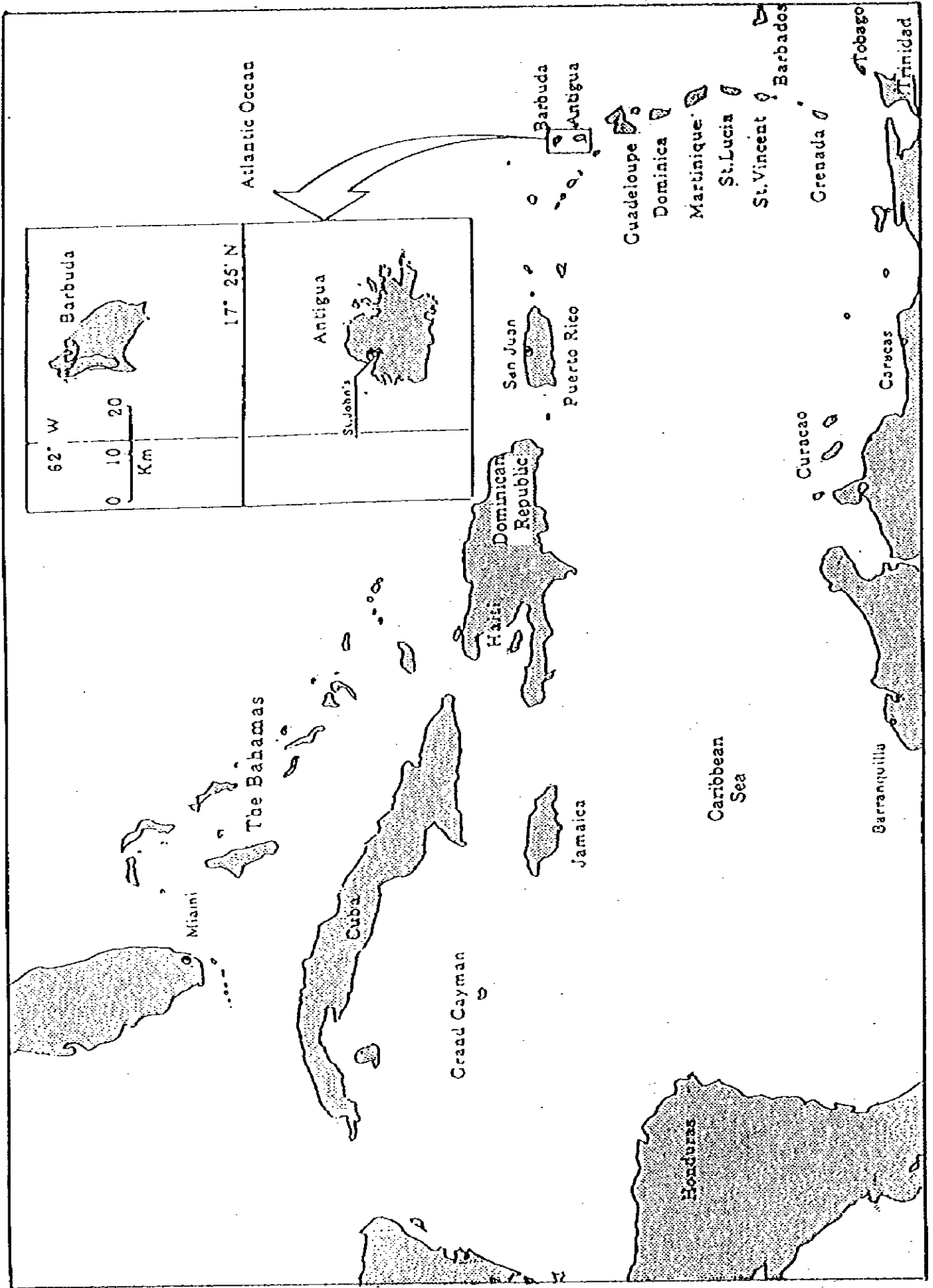
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

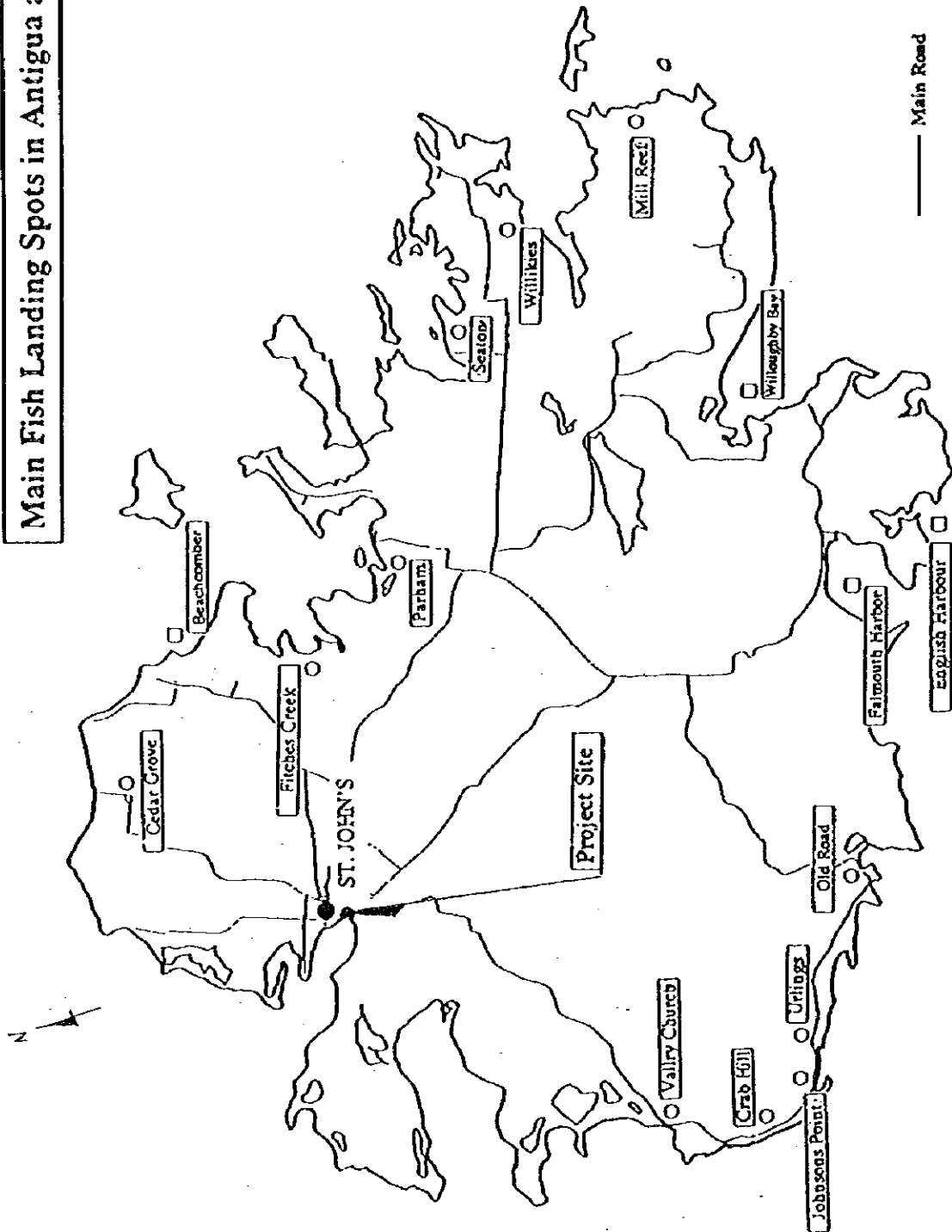


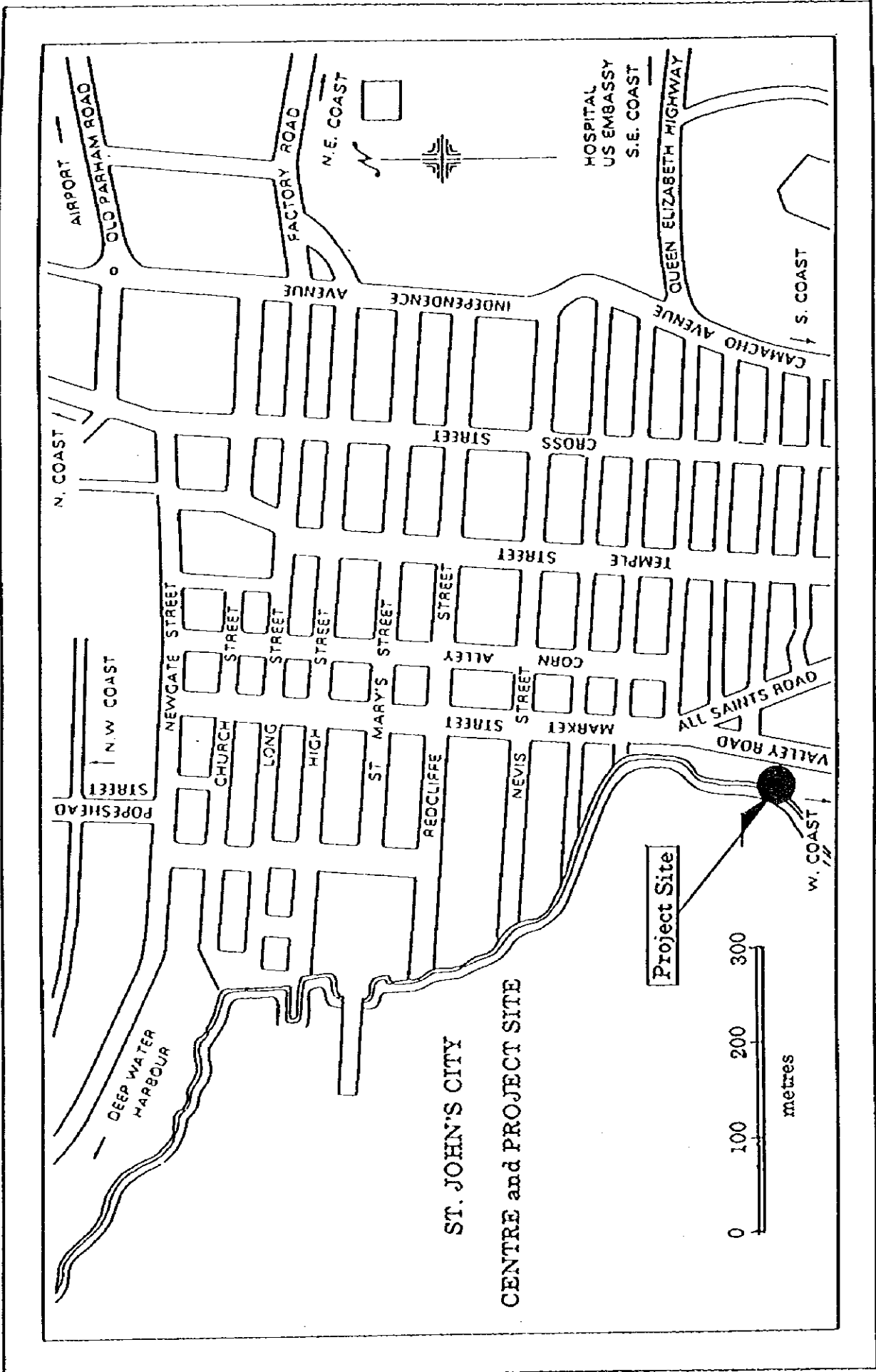
Mamoru KONDO
Project manager,
Basic design study team on
The Project for Construction of Fish Landing
and Distributing Facilities in St. John's
CRC Overseas Cooperation Inc.

ANTIGUA AND BARBUDA



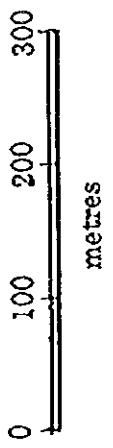
Main Fish Landing Spots in Antigua and Project Site

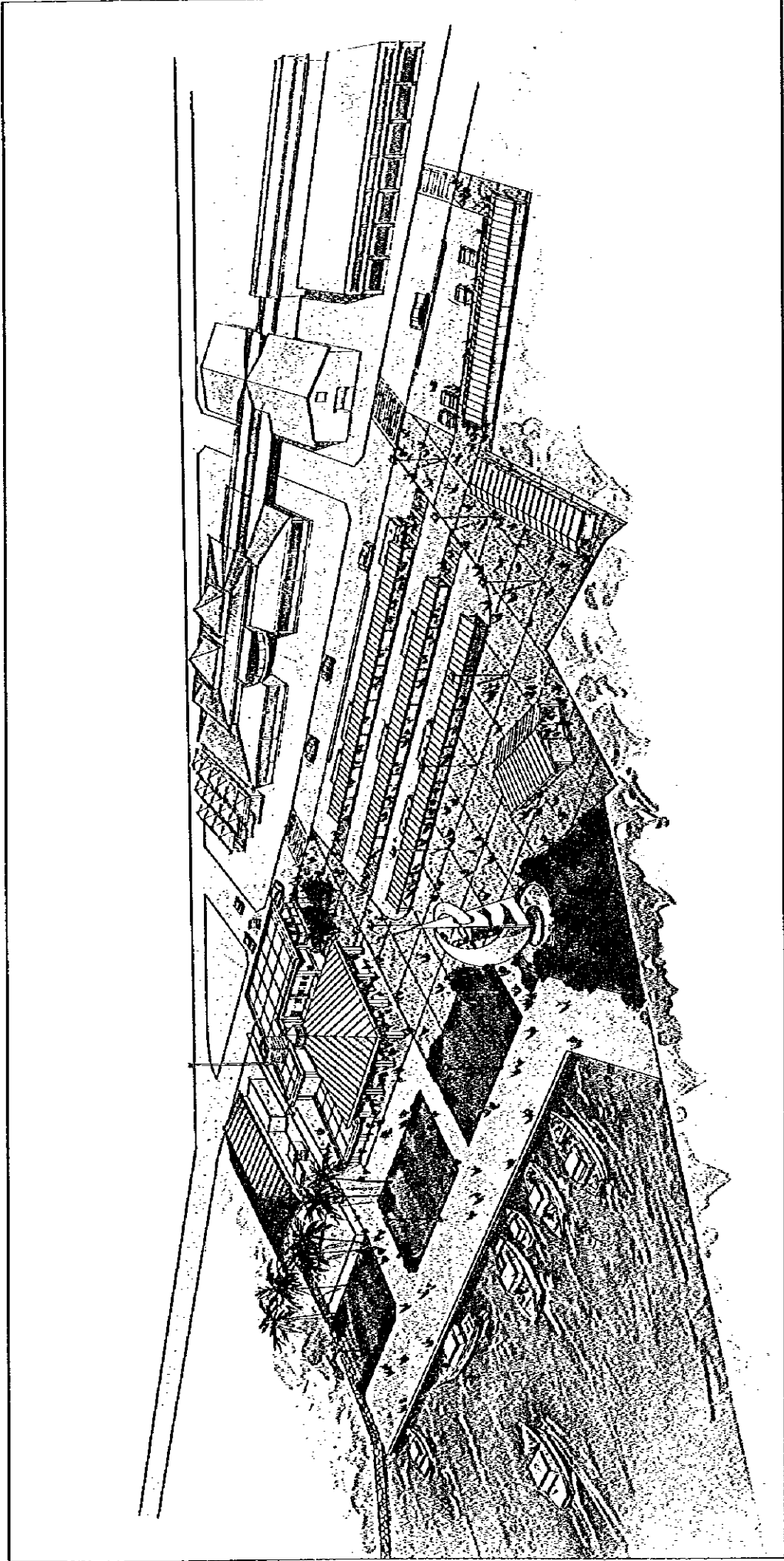




ST. JOHN'S CITY
CENTRE and PROJECT SITE

Project Site



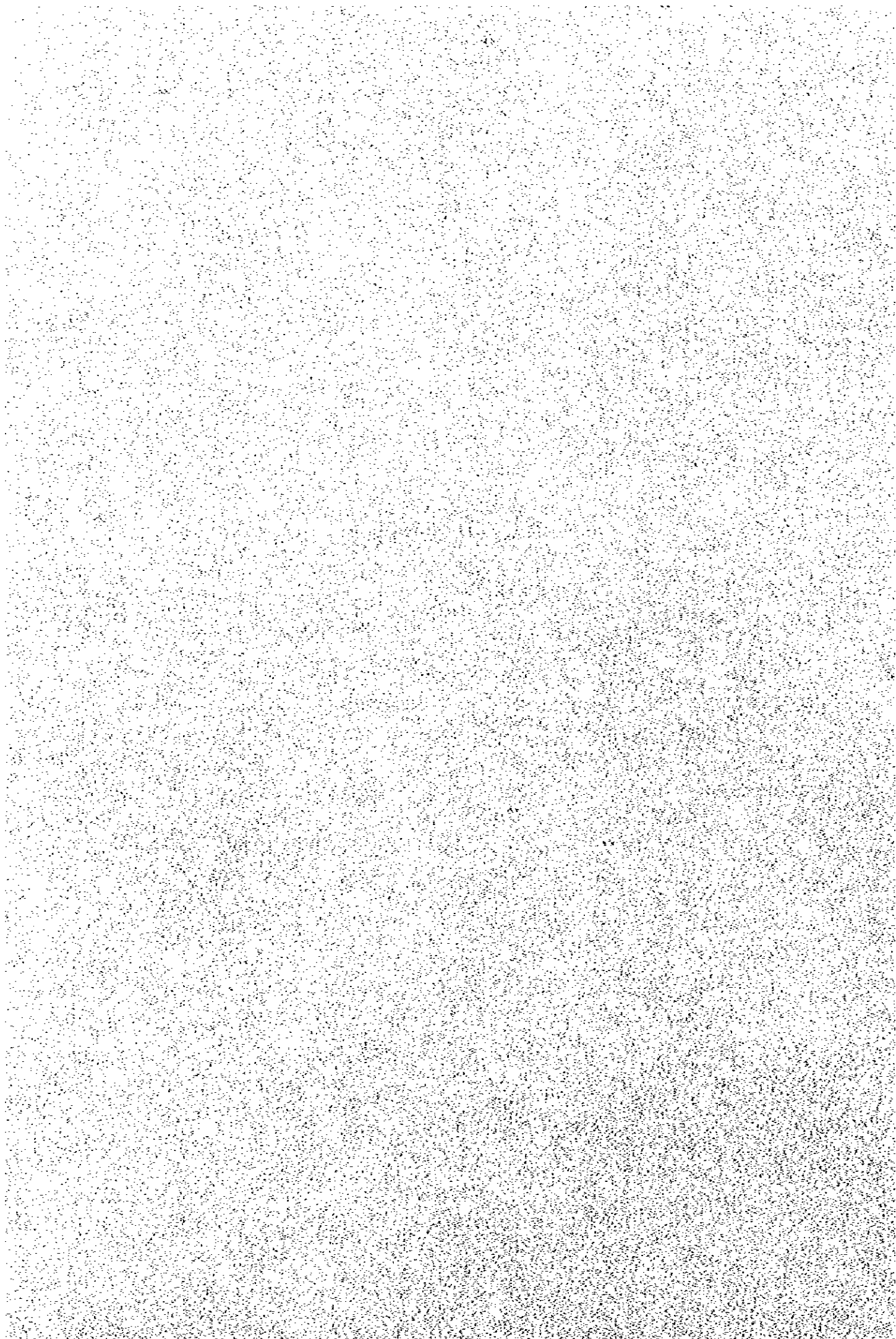


The Project for Construction of Fish Landing and Distributing Facilities in St. Johns

ABBREVIATIONS

- AFL: Antigua Fisheries Limited**
- ATB: Antigua and Barbuda Transport Board**
- CARIB CODE: Caribbean Building Code**
- CARICOM: Caribbean Community**
- CIDA: Canadian International Development Agency**
- CPUE: Catch Per Unit Effort**
- FAO: Food and Agriculture Organization**
- JICA.....: Japan International Cooperation Agency**
- OAS: Organization of American States**
- OECS: Organization of Eastern Caribbean States**
- PMC: Public Market Committee**
- SJDC: St. John's Development Corporation**
- WFM: White's Fish Market (Private fisheries company)**

Contents



CONTENTS

Preface

Letter of Transmittal

Location Map / Perspective

Abbreviations

Chapter 1 Background of the Project

1-1	Background	1-1
1-2	Outline of the requested project	1-4

Chapter 2 Contents of the Project

2-1	Objectives of the Project	2-1
2-2	Basic Concept of the Project	2-3
2-2-1	Contents of the Project and the Results of Discussions	2-3
2-2-2	Basic Design Policy	2-8
2-3	Basic Design	2-12
2-3-1	Design Concept	2-12
2-3-2	Design Conditions	2-16
2-3-3	Basic Design	2-64
2-3-4	Basic Design Plan	2-84

Chapter 3 Implementation Plan

3-1	Implementation Plan	3-1
3-1-1	Implementation Concept	3-1
3-1-2	Implementation Conditions	3-2
3-1-3	Scope of Works	3-3
3-1-4	Consultant Supervision	3-4
3-1-5	Procurement Plan	3-5
3-1-6	Implementation Schedule	3-6
3-1-7	Obligations of the Recipient country	3-9
3-2	Operation and Maintenance Plan	3-9

Chapter 4 Project Evaluation and Recommendations

4-1	Verification of the Appropriateness of the Project	4-1
4-1-1	Project Effect	4-1
4-1-2	Verification of the Appropriateness	4-3
4-2	Recommendations	4-4

4-2-1	Project Implementation.....	4-4
4-2-2	Effective Utilization of the Projected Facilities	4-5
4-2-3	Encouragement of Fisheries.....	4-5

(Appendices)

- 1. Member List of the Survey Team**
- 2. Survey Schedule**
- 3. List of Party Concerned in the Recipient Country**
- 4. Minutes of Discussion**
- 5. Cost Estimation Borne by the Recipient Country**
- 6. Result of Site Survey Works and Wave Analysis**
- 7. References**

Chapter 1

Background of the Project



Chapter 1. Background of the Project

1-1 Background

The economy of Antigua and Barbuda depends largely on tourist industry. About half of the people who have employment persons engage in some kind of work related to tourist industry. The economy has made favorable progress since 1983 in tandem with development of tourist industry but it suffered serious damage caused by the hurricane in 1989 and 1995.

The economic growth rate in 1989, the year hit by the hurricane, nearly halved to 2.8% from 6.4% in 1988, proving that the nation's economic structure is quite unstable. Commodity prices rose 3.7% in 1988 as they had been rising by 3% mark but sharply rose 7.0% after the nation was hit by the hurricane. Thus, the economy which is dependent on tourist industry is currently in a serious situation. In order for development of the economy, its structure should be formed to meet various purposes; to make the most of vitality of private sector, promote industry, generate employment, etc. And it should be an important policy.

Fishery sector contributes 1.8% towards GDP and accounts for 48% of agricultural sector. It is regarded as an important sector which is promising for future development while the nation has no particular resource other than those for tourism. Fisheries in Antigua and Barbuda originated from a small scale coastal fishing for self-sufficiency and gradually developed to small scale commercial fishing with increasing domestic demand for fisheries for use in hotels and restaurants as tourist industry developed. The number of fishermen is about 800. There are 24 fishing villages and 44 fish landing sites in the country. Most of the fishing boats are wooden and three to twenty meters long.

Fishing method is mostly trap fishing in the coastal fishing ground around the islands. Annual gross output is 1700 tons and more than 80% was produced through trap fishing, which shows that fishing skill has not been improved and the nation's fishing is still dependent on artisanal fishing. Per capita fish consumption in the nation is estimated at around 27kg, which shows people's strong tastes for fish.

Expensive groundfish, lobster and conch captured in the coastal fishing ground are allotted for export and tourism-related business. Supply of fresh fish for general public is chronically in short. As a result, fisheries products (cod and other cured fish, canned fish and other processed fish) are imported to cover domestic consumption, which amounts to 700 tons annually.

The nation's fishing is operated with small boats and the fishing method is traditional trap fishing, making its fishing ground limited to sea area along the coast and causing obvious depletion of groundfish. It should be, therefore, a major issue for fisheries development to exploit and manage fish resources. Another issue will be post harvest loss which is caused by insufficient supply of ice, much worsened with poor fish landing and marketing facilities.

To cope with the problems the government of Antigua and Barbuda has planned to introduce fisheries development project in coordination with other Eastern Caribbean nations (OECS nations) based on the policy that sustainable exploitation of fish resources in EEZ shall be promoted with proper development and management plans so that social and economical benefit, which will be most suitable for the people of Antigua, can be expected.

West Bus Station (or Market Wharf) is currently active as the single and largest market in the nation, serving as the base for fishing activities and the key point of urban traffics, which plays an important role for both fishermen/fish vendors and urban residents. The wharf/jetty facilities which have been used for fish landing are as old as 40 years and extremely obsolete despite their importance and the boards are separated from the deck in some places, making works on the jetty involve some kind of danger. The bottom of waters in front of the wharf is piled with sludge from waste water from cities, which has been pouring into St. John's Harbor for many years. Naturally, the environment is not sanitary and the depth of water is not sufficient.

Major services of AFL are supportive work for economic activities of small scale fishermen through purchasing and processing of fish, and provision of ice, in accordance with the fisheries development plan of the government. But the

equipment and facilities for ice-making and ice-storage, which were introduced at the time of establishment of the corporation (AFL) in 1980, are beyond average durable years with inadequate performance. The refrigerant (cooling catalyst) is Fron R-502 whose production is prohibited for environmental preservation as it causes destruction of ozone layer. In these circumstances immediate improvement of the facilities is required. The roof of the fish market which was constructed in 1950 was destroyed by the hurricanes. Besides, water supply and drainage are not in sanitary condition due to inadequate facilities. As a result, fish retailers have to sell the catches in the open air.

The project site at West Bus Station is a market area where fishing people and nation residents including shoppers, passengers of the buses, and etc. visit every day. But the facilities are not fully developed and the traffic lines of people, commodities and vehicles are crossed complicatedly. The shoppers are obliged to do inconvenient shopping.

Under these circumstances, the government of Antigua has drafted the "Project for Construction of Fish Landing and Distributing Facilities in St. John's (wharf, jetty, fish processing plant, ice-making facilities, etc.)" and "Project for Encouragement of Small Scale Fisheries Development (multipurpose survey boat for fishing, multipurpose fish transport boat, ice-making facility, materials for fishing, etc.)" and the government requested Japan for a Grant Aid. In response to the request the government of Japan dispatched a preliminary study team to examine feasibility and rationale of the fisheries development plans (February 1997) and screened the contents of the request.

The government of Japan concluded that the requested "Project for Construction of Fish Landing and Distributing Facilities in St. John's" is adequate and has higher priority for implementation under Japan's Grant Aid Scheme, and decided to conduct a Basic Design Study.

1-2 Outline of the requested Project

The request is mainly aimed at improvement of the existing old fish landing and distributing facilities, etc. at the West Bus Station in St. John's, the capital city of Antigua and Barbuda, to make it serve for the fishermen as a fish landing site adjacent to the market and for the urban residents as a public market with hygienic and civic amenity. It is also aimed at promoting fisheries development, stable supply of fish and fishery products, improvement of post harvest loss, and contributing to development of the capital city .

The main components of the facilities and equipment for the requested project are as follows:

Table 1-2-1 Main Components of the requested Project

Main components	Quantity/ Particulars	Content
1. Facilities		
1-1 Mooring wharf	1 lot (abt. 80m)	
1-2 Landing jetty	1 lot (abt. 30m)	
1-3 Ice making / storage	1 lot (5t x 2)	Flake ice, 10t/day
1-4 Chilled room	1 set (15tons)	
1-5 Blast freezer		
1-6 Cold storage	1 set (abt. 40tons)	-20°C
1-7 Processing area	1 set (abt. 300m ³)	
1-8 Retail counter	1 set (abt. 50m ³)	
1-9 Marketing area	1 set (abt. 150m ³)	6 booths
1-10 Dry storage	1 set (abt. 50m ³)	
1-11 Administrative office	1 set (abt. 300m ³)	
1-12 Meeting room		
1-13 Cooperative office	1 set (abt. 40m ³)	
1-14 Quality control room	1 set (abt. 300m ³)	
1-15 Equipment store	1 set	
1-16 Toilets	1 set	

1-17 Shower room	1 set	
1-18 Water supply system	1 set	
1-19 Fuel supply system	1 set	
1-20 Diesel generator	1 set	20 locker units
Other facilities requested		
(Note: Antigua side requested the preliminary study mission, the mission agreed to investigate its appropriateness in the following basic design study in view of Japan's grant aid scheme.		
1-21 Bus terminal	1 set	
1-22 Small shops (Kiosk)	1 set	
2. Equipment		
2-1 Insulated truck	2 sets	Payload 1 ton
2-2 Pickup truck	1 set	4WD
2-3 Processing table	4 sets	
2-4 Scale	2 sets	
2-5 Trolley	12 sets	
2-6 Icing counter	1 set	(Fish retail showcase)
2-7 Plastic fish container	100 pcs	abt. 70 liters
2-8 (Blank)		
2-9 Insulated fish box	10 pcs	abt. 1000 liters
2-10 Retail scale		
2-11 Band saw	1 set	
2-12 Vacuum sealer	1 set	
2-13 VHF radio	1 set	
2-14 Quality control instruments	1 set	
2-15 Experimental drier and smoke for laboratory use	1 set	
2-16 Office equipment	1 set	
3. Fishing vessels, etc.		
3-1 Fishing boats	1 (multipurpose) 2 (fishing)	abt. 21 m abt. 13 m
3-2 Long-line fishing gear	3 sets	
3-3 Mechanical reel	3 sets	
3-4 Pot-hauling machine (Hydraulic)	3 sets	

Chapter 2

Contents of the Project

Chapter 2. Contents of the Project

2-1 Objectives of the Project

The Government of Antigua and Barbuda has been going on with the redevelopment plan for St. John's since 1986. And the redevelopment plan (improvement and integration of functions of the market), which includes the Project site, is currently one of the most prior issues in the urban development plan of St. John's. The development of fish landing and distributing facilities of the Project is taken as the pivotal plan for the redevelopment of the market area.

West Bus Station landing site (or the market wharf), the target of this Project, is currently active as the only and largest market in the nation, serving as the center of fishing activities and key point of traffics in the capital. It plays quite an important role for both fishing people (including fishermen, fish vendors and etc.), and residents in the capital region.

However, the wharf and jetty which are currently used for landing are about forty (40) years old. They are so aged that some boards are separated from the deck, making activities on the jetty involve some kind of danger. Sludge from waste water of cities, which is pouring into St. John's Harbor, has been piled for many years at the bottom of waters in front of the wharf. The environment is not sanitary and the depth of water is not sufficient.

Major services of AFL are supports for economic activities of small scale fishermen through purchase and process of fish, and provision of ice, in accordance with the fishery development plan of the government (Fishery Division). But the equipment and facilities for ice-making and ice-storage, which were introduced at the time of establishment of the corporation in 1980, are beyond average durable years with inadequate performance. The refrigerant (cooling catalyst) is Fron R-502 whose production is prohibited for

environmental preservation as it causes destruction of ozone layer. In these circumstances improvement of the facilities is keenly required.

The roof of the fish market which was constructed in 1950 was destroyed by hurricanes. Besides, water supply and drainage are not in sanitary condition due to inadequate facilities. As a result fish venders have to sell the catches in the open air.

The project site at West Bus Station is a market area where fishing people and regional residents including shoppers, passengers of the buses, and etc. visit every day. But the facilities are not fully developed and the traffic lines of people, commodities and vehicles are crossed complicatedly. The shoppers are obliged to do inconvenient shopping.

In order to improve such situation, the Project aims to promote implementation of fishery encouragement plan and contribute to redevelopment of urban environment in the capital city of St. John's, in accordance with the market area development plan designed by the government of Antigua. The Project also aims for total rehabilitation and improvement of the existing wharf, jetty, facilities for processing, storage and sales of catches and other auxiliary public facilities at the site. Through adjustment and integration of current functions at the site. The landing area will be improved to be directly connected to the consumers' market, while sanitary environment for the market and urban area will be provided for urban residents so that the following benefits will be expected:

- (1) Activation of fishing (Improvement & development of small scale fishery)
- (2) Reduction of post harvest loss (Improvement of freshness & quality)
- (3) Effective utilization of land in the urban area (Improvement of main terminal for distribution and traffic)
- (4) Relief of traffic congestion at the whole area of the market (Improvement of urban traffics and distribution)
- (5) Development of water front (Improvement of amenity and sanitation, as

well as urban environment)

2-2 Basic Concept of the Project

2-2-1 Contents of the Project and the Results of Discussions

The original contents requested by the Government of Antigua and the contents of the discussions at the preliminary study in January 1997, and the results of the discussions at this Basic Design Study are summarized in Table 2-2-1.

As to fishing port facilities, it was confirmed that the wharf will be moved about 25m forward from the current site so that necessary depth of water may be secured for fishing boats, while existing jetty will be removed. As to the pending items of equipment, it will be examined whether an insulated van (or pickup truck) should be included in the plan after studies on its current and future usage is conducted. (Contents and results of the discussion are described in "2-3 Basic Design".)

Table 2-2-1 Request and result of discussion (1/3)

Original request (Sept. 1996)	After preliminary study (January, 1997)	Result of discussion at Basic Design Study (July, 1997)	Remarks
A. Implementing Agency Ministry of Agriculture, Lands, Fisheries, Planning and Cooperatives (M of A,L,F,P&C)	A. Implementing Agency Ministry of Agriculture, Lands, Fisheries, Planning and Cooperatives (M of A,L,F,P&C)	A. Implementing Agency Ministry of Agriculture, Lands, Fisheries, Planning and Cooperatives (M of A,L,F,P&C)	• No alteration
B. Project site • West bus station	B. Project site • West bus station	B. Project site • West bus station	• No alteration

Original request (Sept. 1996)	After preliminary study (January, 1997)	Result of discussion at Basic Design Study (July, 1997)	Remarks
C. Project management · Fisheries Division (M of A,L,F,P&C)	C. Project management · Planning and Fisheries Division (M of A,L,F,P&C)	C. Project management · Responsible Ministry: Ministry of A,L,F,P&C · Implementing Agency Planning Division (M of A,L,F,P&C)	· Both sides agreed to include an improvement of existing bus terminal facility (*4) because of site condition(*3) which shows important role in the project area.

Note:*1 AFL; Antigua Fisheries Ltd.:governmental cooperation under Fisheries Division

*2 ATB; Antigua Transport Board : under the Ministry of Public Works

*3 ; The site is an important land-traffic terminal (approx. 7,700 passengers a day) and a biggest market area with vegetable, fish, meat markets.

*4 ; Bus terminal improvement : Antigua side requested to the Preliminary study mission in January, 1997, the mission agreed to investigate its appropriateness in the following Basic Design Study in view of Japan's Grant Aid scheme.

Table 2-2-1 Request and result of discussion (2/3)

Original request (Sept. 1996)	After preliminary study (January, 1997)	Result of discussion at Basic Design Study (July, 1997)	Remarks
D. Facility and Equipment			
1. Facilities			
1-1 Mooring wharf	○	1-1 Mooring wharf	· Mooring wharf plan is agreed by both sides among three ideas.
1-2 Landing jetty	○		
1-3 Ice making / storage	◇	1-3 Ice making/storage	· Plate type ice
1-4 Chilled room	○	1-4 Chilled room	· Short time stowage of fresh fish
1-5 Blast freezer	×
1-6 Cold storage	○	1-6 Space to be considered in the layout plan. · The purpose of requested cold storage is for frozen fish imported. · Since this project aims at improving small scale fisheries which promote domestic fish production, stable fish marketing system, import substitution, etc., it is concluded no cold storage is more suitable for the purpose. It is agreed, however, that installation spaces is to be considered in the layout plan as a practicable way of development.	
1-7 Processing area	○	1-7 Processing area (for AFL)	· Existing size
1-8 Retail counter	○	1-8 Retail counter (for AFL)	· Existing size
1-9 Marketing area	○	1-9 Marketing and fish handling area · (for fish retailers and fishermen)	
1-10 Dry storage	○	1-10 Storage spaces (same as item 1-15 below)	· Details up to layout plan.
1-11 Administrative office	○	1-11 Administrative office	· Details up to layout plan.

1-12 Meeting room	○	1-12 Meeting room	· Details up to layout plan.
1-13 Cooperative office	×	-----	
1-14 Quality control room	◇	· · It is agreed that Health and Food Department will continue to have responsibility on the quality inspection because of technical staffs.	
1-15 Equipment store	○	1-15 Storage spaces (same as item 1-10 above)	· Details up to layout plan.
1-16 Toilets	○	1-16 Toilets (for AFL/fishermen, etc.)	· Details up to layout plan (shower in processing area)
1-17 Shower room	×	-----	
1-18 Water supply system to the wharf and jetty	○	----- (Water faucets to be provided in the fish marketing and handling spaces.)	
1-19 Fuel supply system to the wharf and jetty	○	----- (There is a private gas station close to the project site. Less necessity is admitted because of rather small quantity used by the fishermen and no group purchasing activity.)	
1-20 Diesel generator	◇	1-20 Diesel generator · Existing generator worked to run more than 8000 hours for 16 years after installation.	
Other facilities requested (*4)			
1-21 Bus terminal and 1-22 Kiosks (Small shops)		1-21 Bus terminal and 1-22 Kiosks (Small shops) · The most important land traffic facility which is used by approximately 7700 people(passengers) daily. Since there is no protective island nor shelter · Existing 15 small shops under contract with the government (ATB, Ministry of Public Works). These shops are legally operating business: then they are not squatters which illegally occupy the site. · Traffic terminal facilities are under control of ATB. ATB is managing existing facilities including daily cleaning and continue the same as now.	

Table 2-2-1 Request and result of discussion (3/3)

Original request (Sept. 1996)	After preliminary study (January, 1997)	Result of discussion at Basic Design Study (July, 1997)	Remarks
2. Equipment			
2-1 Insulated truck	◇	Pending (**) (2-1 Insulated truck, or 2-2 Pick-up truck)	**Existing operation records, data and future plan are to be carefully examined before conclusion.
2-2 Pick-up truck	◇		
2-3 Processing table	○	2-3 Processing table	
2-4 Scale	○	2-4 Scale	
2-5 Trolley	○	2-5 Trolley	
2-6 Icing counter	◇	2-6 Icing counter	
2-7 Plastic fish containers	○ (Excluded because locally available. Those containers, however, made in Japan are very popular in neighboring countries, information on distributor is given.)	
2-8(blank in P/S's minutes of discussion)	
2-9 Insulated fish box	○	
2-10 Retail scale	○	2-10 Retail scale	
2-11 Band saw	◇ (Installation space and electric source to be provided.)	· AFL's existing band saw is possible to use. Vacuum sealer is out of order and is not used. Installation spaces to be considered in the layout plan.
2-12 Vacuum sealer	◇ (Installation space and electric source to be provided.)	

2-13 VHF radio	◇	2-13 VHF radio · Since marine radio is conveniently used by the fishing boats, and AFL has problem at now without radio communication equipment, it is included in the project. Provision of VHF radio will improve present condition.	
2-14 Quality control instruments	○	-----	· Same as 1-14 above.
2-15 Experimental drier & smoke for laboratory use	×	-----	
2-16 Office equipment	○	----- (Deleted from the project component, because general furniture, office equipment must be borne by the recipient side in accordance with Japan's Grant Aid Scheme.)	
3. Fishing vessels			
3-1 Fishing vessels	×	-----	-----
3-2 Long-line gears	×	-----	-----
3-3 Mechanical reel	×	-----	-----
3-4 Pot hauler (Hydraulic)	×	-----	-----

2-2-2 Basic Design Policy

(1) Appropriateness and necessity of the Project

In relation to the Project for fish landing and distribution facilities in St. John's which was requested by the Government of Antigua, discussions with the Government of Antigua and a site survey were conducted on the background and contents of the request, scale, management system, etc. The results concerning appropriateness and necessity of the Project, as a Japan's Grant

Aid Scheme, are as follows:

1) Necessity of the fishery development plan

Antigua's economy is monocle which depends exclusively on tourist industry. Implementation of the Fishery Development Project, which is expected to improve other industries as well, should be a turning point for fishery development policies and placed importance for national economy. It will enable fisheries products to supplement demands by tourist industry and replace imported products.

2) Current state of fisheries and importance of the Project

The fisheries development policies in Antigua are represented by the AFL project started in 1980. The AFL project initially aimed for introduction of industrial fisheries but it was reformed in 1985 and operated on a reduced scale. Then it assumed duties to support small scale fisheries. Current fisheries in the nation remains artisanal, although some private fishing companies are gradually growing, which requires a systematic promotion of fisheries development.

For further development of fisheries, introduction of appropriate fishing boats for promotion of production, improvement of fishing skill with effective utilization of offshore pelagic fish resources shall be important, and the planned landing and distribution facilities will become the core of development. To realize the above, fishing people are required to be more conscious of fisheries development and the Project shall be a stimulus for their change of attitude. The development of the fish landing and distributing facilities with their auxiliary facilities, making the core of the fisheries development for Antigua, and improvement of market area should give a visual impact to fishing people and local residents. Therefore, the benefits shall be great and implementation of the Project should be significant and worthwhile.

3) Benefits from the Implementation

West Bus Station landing (or the market wharf), which is a site of this project, is currently brisk with complicated flow of people, commodities and serves as the center of fishing activities, a key point of urban traffics, and the largest and single market in the nation. With implementation of the Project, the facilities and the traffic flow will be improved and rearranged taking the condition of the site into account. It will meet the objectives of fisheries development and improve urban environment so that the benefits for the residents are expected to be great. It is recommended, therefore, the development of West Bus Station landing site should be placed priority.

4) Relations to development of artisanal fisheries

The Government of Antigua determined the scope of this project in the fisheries development plan for the landing and distribution facilities. And another plans for development of facilities (including slipway, workshop, fuel stand for fishing boats, etc.) which will form a base for fish production, are being drafted at Point Wharf in St. John's (northern coast in the same harbor) and other sites. Most of the fishing boats in Antigua are wooden with outboard-engine. It is necessary to introduce adequate type of fishing boats for effective utilization of offshore pelagic fish resources, and sustainable utilization of coastal demersal fish resources. Promotion of fish production and replacement of imported fish products with domestically produced ones are important subjects to be tackled and improvement of fish processing technique is required. The plans should be implemented thoroughly at each stage of production, distribution and consumption and continuous support for them is essential.

After a full examination of the Project, taking all the above into account and comprehensively, it was concluded that the Project is appropriate and feasible.

(2) Basic Design Concept

1) Basic Design Policy

It will be the best way to reform and integrate current functions at West Bus Station so that improved landing, which is directly connected to the market, and sanitary market environment will be provided for small scale coastal fishermen and urban residents, respectively.

Basic concept of the Project is that existing fisheries facilities at the market shall be integrated into the fish landing and distributing facilities at the consumers' market in the Project and the site conditions shall be taken into consideration and fully reflected to the basic design.

2) Basic policy of cooperation

Since necessity, urgency of priority, recipient's capacity for implementation have been confirmed, and public benefits are expected great, the Project has been considered appropriate to be implemented with Japan's Grant Aid Scheme. For that reason, contents of the Project will be studied on condition that it will be implemented with Japan's Grant Aid and appropriate basic design will be formulated in line with the basic concept of the Project.

Contents of the Project will be planned on the basis they will contribute to solve the current problems of fishermen and residents. Basic design will be drafted based on the results of the discussions at site survey and integration of current duplicated functions, consultations with private sector, effective management, protection of vested rights, and etc. shall be taken into consideration.

2-3 Basic Design

2-3-1 Design Concept

Basic design of the Project is composed of five(5) items, namely, management plan, layout plan, facility plan, implementation plan and consideration on local conditions, with the following concept.

(1) Management plan

Management plan for the Project will be designed taking the following into account.

1) Facilities of AFL Management

① Effective utilization of existing system

Experience of AFL in fish processing, together with the existing system, should be effectively utilized as AFL will be the managing core for landing and distributing facilities of this project.

② Strengthening of support for small scale fishing activities

Organization of coastal fishermen's groups that provide AFL with materials for fish processing is important, and support for small scale fishermen and fish retailers through development of fish marketing and distributing facilities shall be strengthened under direction of Fishery Division.

③ Development of a system for domestic fish distribution

A fish distribution system for stable supply shall be developed and its effective utilization shall be performed through the above ① full utilization of existing organization, ② strengthening of support for small scale fishing activities.

2) Facilities of ATB Management

As for bus terminals and small shops, existing system will be followed in principle and ATB in the Ministry of Public Works will assume control of operation and management with necessary budget allocation.

As for profitable services of collection of rental fee, leasing contract of facilities, and etc. existing management system will be followed. The management plan of the fish landing wharf and fish market shall feature daily self-management by small scale fishermen and fish vendors so that they may be autonomous as much as possible.

In order to provide pleasant market environment and services the proceeds from the facilities shall be used for limited purposes such as maintenance and repair of the facilities to avoid user's excessive burden.

(2) Layout plan

As the Project site is located in the city of St. John's, expansion of the site cannot be expected. In planning layout, both landing of catches from the sea, and loading of fuel oil and fishing materials from land should be taken into full consideration. An open space will be placed between the bus terminal and fisheries facilities so that traffic line will be adequately arranged. To be concrete, traffic lines for people, commodities and vehicles shall be made clearly purpose-wise and an open space will be introduced for multipurpose use. Therefore, installation of a security fence shall be avoided as far as possible, while measures for security of AFL' building shall be complete.

(3) Facility plan

In accordance with the basic concept of the Project, the functions of AFL and fish market shall be integrated in order to develop fish landing and

distributing facilities in the urban city market.

Fish landing wharf which will be the main facility, and buildings of AFL and fish market which are distribution facility, and other auxiliary public facilities (bus terminals, etc.) will be included. Existing pipes laid underground (pipes for waste water are laid underground of the site extending from the market for vegetables and fruits on the opposite side of the road) will be handled in the Project considering necessary arrangement of drainage systems for surrounding facilities, expected future repair works for separation of pavement or digging. Materials for pavement of the common space which will also serve as a pedestrian path shall be of such kind that make repair works and maintenance easy and shall keep amenity for users as well. Selection for materials shall be made appropriately according to respective purposes of the spaces. Access roads and bus terminals shall be paved for easy maintenance. The reclaimed space between the wharf apron (abt. 10m in width from the front) and existing wharf, except for the access road for vehicles, shall not be covered with pavement so that green planting may be available.

(4) Implementation plan

The drafting of the implementation plan requires full-scale assistance and cooperation of the Antigua government. The preparatory works such as site preparation including removal of existing facilities, securing of substitute land for bus, taxi, boats and shops during the construction, and works for rendering consecutive services will be allotted among people concerned clarifying who is in charge of specific items. In principle, all the implementation plans must be made on one fiscal year basis.

(5) Consideration on the local conditions

1) Natural conditions

- ① Because of high temperature and humidity, lighting and ventilation of

each facility shall be suitably designed. The nation has few rivers and 80% of water for daily life is desalinated. Rain water should be collected and utilized effectively but except for drinking.

- ② The site faces the sea and affected by briny air. Construction materials and equipment should be salt resistant.
- ③ Land level of the site shall be cared for easy drainage of water and flooding or maximum height of waves caused by hurricane.
- ④ The beach in front of the site is calm and the tide is gentle. Preventive measures shall be taken against pollution by waste water from the processing facility.
- ⑤ Material, color and form of buildings shall be cared so that they may match the environment.
- ⑥ In arranging the facilities, traffic situation at the site and neighboring area shall be fully taken into account.

2) Social environment

A fish landing facility for small scale fishermen, buildings for Antigua Fisheries Ltd. (AFL: fish processing, sales of ice, fish and fishing gears), bus terminal, taxi stand, small shops are located at the site. Existing facilities will be readjusted and integrated. Effective arrangement of the facilities shall be planned in line with the redevelopment plan for the market area, drafted by the Government of Antigua, including relocation of taxi stand and arrangement of fish market into this project.

3) Construction conditions

- ① American and British regulations and standard for engineering and construction are mainly adopted. In addition, Carib Code (Caribbean Design Standard) which was agreed between Caribbean nations is adopted. Construction of the facilities shall be conducted in line with Japan's Industrial Standards and above local regulations shall be referred to.

As for the environmental standard for waste water, drainage and etc. local standards shall be adopted for the plan, which was decided after

talks with the Government of Antigua.

- ② Skilled engineers for construction and ocean engineering are not many in Antigua . They were mobilized from neighboring countries for each work in the past depending on the demands. Such situation is common among the West Indies nations.
- ③ Aggregates, sands, gravel and soils for banking are available at the site but materials for construction such as steel (for use of civil engineering / construction), steel sheet pile, steel frame, etc. are not always sufficient in stock because they depend on import. Basically they will be procured locally but when it is difficult they will be brought in from Japan or third countries after cost comparison and examination.
- ④ Utilization of local contractor, materials and equipment
Local contractors are active in public works and their active power shall be efficiently utilized as sub-contractors while local workers should be employed positively.

2-3-2 Design Conditions

(1) Examination of design conditions

Design conditions for fish landing and distributing facilities of this project must be examined based on ;

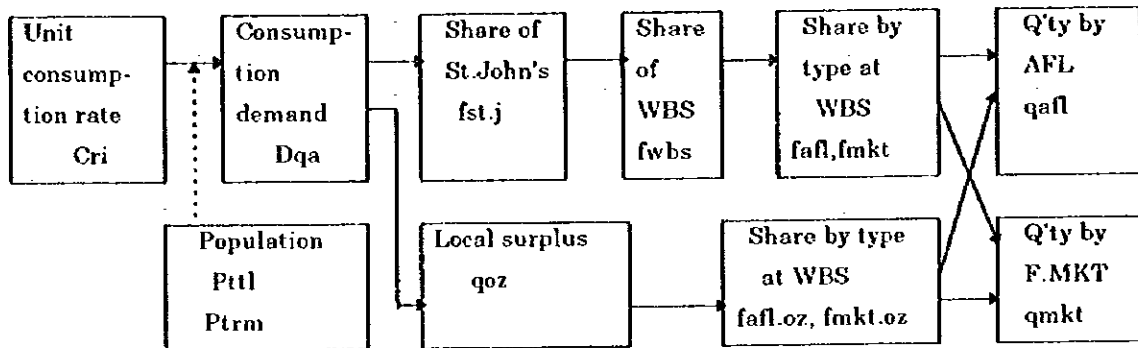
- i) present situation at the site (fish production, number of fishermen, number of fish retailers, etc.)
- ii) population increase of the country
- iii) forecast of facility utilization in a target year of 2005

Design conditions will be examined further, taking a policy of Antigua and Barbuda side, such as fisheries development plan, fisheries facility construction plan into consideration.

Basic flow chart of design conditions are as follows;

Demand flow : $DQa = \Sigma (Cri \times Pai)$, $qwbs = Dqa \times fst.j \times fwbs$,

$qafl = qwbs \times fafl + qoz \times fafl.oz$, $qmkt = qwbs \times fmkt + qoz \times fmkt.oz$



Supply flow : $Qa = \Sigma (CPUEi \times Pfm_i)$, $qwbs = Qa \times fst.j \times fwbs$,

$qafl = qwbs \times fafl + qoz \times fafl.oz$, $qmkt = qwbs \times fmkt + qoz \times fmkt.oz$

$qafl = qwbs \times fafl + qoz \times fafl.oz$, $qmkt = qwbs \times fmkt + qoz \times fmkt.oz$

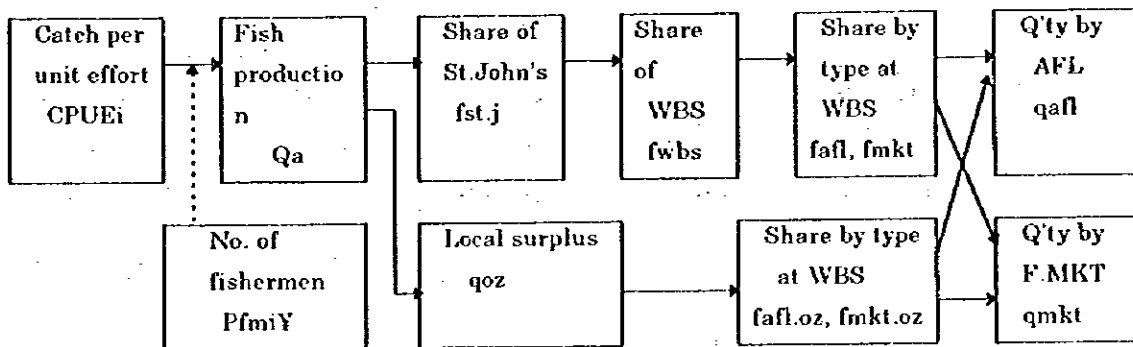


Fig. 2-3-1 Forecast Flow of Demand and Supply

Post harvest loss : $PHL=DQa-SQa$, $Rphl=PHL/Qa$

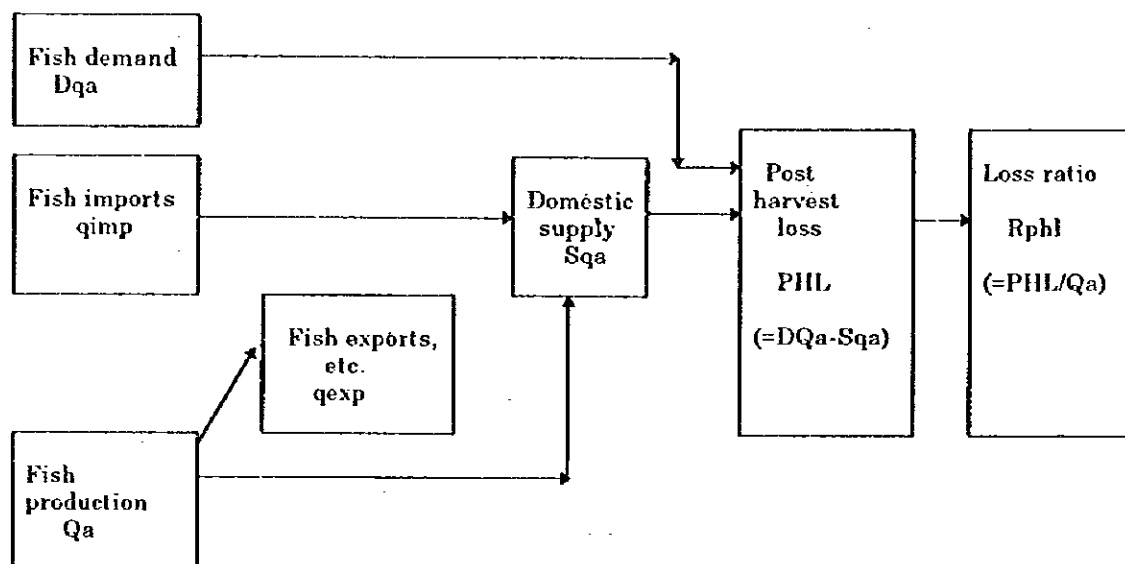


Fig. 2-3-2 Flow of Post Harvest Loss

Since the implementation of the project can improve post harvest loss in a fish distribution after landing, sufficient discussion on a policy of fish marketing development must be held with the Antigua side in order to decide a facility scale.

So far as future plan (fishing boat modernization, fishery base construction and improvement of fishing technology, etc.) is concerned, first priority must be given to a realistic project depending on the development stage, and this project aims at development of fish landing and marketing facility in consuming area in accordance with a concept of this project.

Antigua side is going to promote its fish production program in order to satisfy the domestic fish demand, but at first fish marketing system must be improved because there is so much post harvest loss which reduces actual supply quantity of fish.

Analysis of fish demand/ supply balance also shows that the loss is fairly big. An excessive scale-setting that may invite future problem shall be avoided through careful examination on a current situation.

Design conditions of public service facilities such as bus terminal, kiosks, etc. must be examined based on data/ information from the Antigua and Barbuda Transport Board(ATB); number of buses at west bus station(WBS), number of trips and the service-routes, etc., the results of field survey and Antigua sides market area redevelopment master plan.

Concretely, the following policy will be observed.

- (a) To confirm consistency between catches data and demand-supply forecast
- (b) To examine project scale in order to reduce post harvest loss
- (c) To examine present utilization situation and future trend of project site
- (d) To forecast quantities of fish landing at site, fish from other zones, AFL's fish and fish market retailers' fish

1) Quantity of fish catches and number of fishermen(fishing boats)

Quantity of fish catches landed and each handling quantity of fish by AFL, fish market retailers can be calculated on the following conditions;

*Quantity of fish production based on number of fishermen and catches per unit effort(CPUE)

*Fishing boats are classified into two groups of small(less than 8m) with two fishermen onboard and large(8m and more) with three fishermen onboard

*There are 19 fishing villages and 41 landing sites in Antigua Island. Barbuda has one fishing village and 3 landing sites

Zoning of villages and landing sites are shown below;

Zone 1 to 6 in Antigua, and Zone 7 in Barbuda.

Zone 1 : St. John's Zone 2 : Cederglove Zone 3 : Parham
 Zone 4 : Milleaf Zone 5 : Willowbay Zone 6 : Oldroad

Table 2-3-1 Fish production by zones

Zone	No. of fishing boats (boats)		CPUE kg/p.day		Fishing days a year (days)		Annual fish production			
	Large	Small	Large	Small	Large	Small	Large	Small	Total	(%)
1	40	75	54	36	137	110	296	297	593	(33)
2	7	46					52	182	234	(13)
3	6	32					44	127	171	(10)
4	0	9					0	36	36	(2)
5	16	26					118	103	221	(12)
6	21	51					177	214	391	(22)
7	0	32					0	127	127	(7)
Total	93	274					688	1085	1773	(100)

note : CPUE - Annual average 18kg/p.day. This is obtained from the hearing survey at site, i.e. 27kg/p.year in high season (Nov.-Jan.), and 14kg/p.year in low season (May-Aug.)

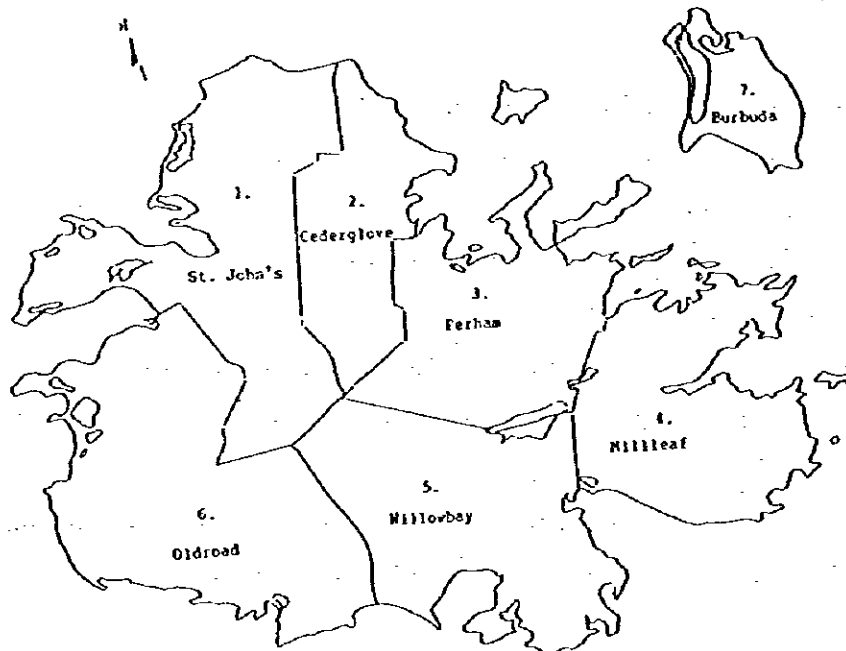


Fig. 2-3-3 Zoning of Antigua Island

① Inflow into St. John's

Total inflow of fresh fish consists of catches by the St. John's fishermen and surplus catches beyond local demand in other 5 zones in Antigua Island. Catches are calculated based on the number of fishermen at each zone. Each zone's share is shown as follows.

Table 2-3-2 Number of fishermen by zone

Zone	Fishing villages	Fish landing sites	No. of fishing boats (boats)			No. of fishermen (person)			
			Large	Small	Total	Large	Small	Total	(%)
1	3	3	40	75	115	120	150	270	(33)
2	4	7	7	46	53	21	92	113	(13)
3	3	10	6	32	38	18	64	82	(10)
4	1	1	0	9	9	0	18	18	(2)
5	3	11	16	26	42	48	52	100	(12)
6	7	9	24	51	78	72	108	180	(22)
7	3	3	0	32	32	0	64	64	(7)
Total	24	44	93	274	367	279	548	827	(100)

Fish production and the demand by zones which are calculated based on number of hotel rooms and population of each zone are estimated as follows.

Zones of 3, 5 and 6 have surpluses of 257 tons in total which are transported into St. John's and supplement part of fish demand in St. John's. Actually, each zone's demand is supplemented by imported fish and fishery products, and part of domestic production excluding exported quantity. Imported fish and fishery products are distributing through St. John's, but part of locally produced fish catches is directly exported although almost of export is made through St. John's.

**Table 2-3-3 Inflow quantity into St. John's from other zones
(Estimates)**

Zone (Parish)	Popula- -tion	Hotel (Tourism)		Fish demand			Fish produc- -tion (D)	Bal'ncc (E) (=D-C)	Inflow into St.J.
		No. of hotel rooms	No. of hotel guests	Local demand (A)	Tour'sm demand (B)	Total (C=A+B)			
1(1)	23,591	1,492	99,425	628	51	678	455	-223	
(2)	15,493	164	10,926	412	6	418	281	-137	
2(3)	4,909	128	8,530	131	4	135	91	-44	
3(4)	4,917	0	0	107	0	107	114	7	7
4(5)	3,252	282	18,792	87	10	96	93	-3	
5(6)	6,695	308	20,525	178	10	189	221	32	32
6(7)	5,802	553	36,851	151	19	173	391	218	218
Sub	63,759	2,927	195,051	1,096	100	1,795	1,646		257
7(8)	1,241	99	6,597	33	3	36	127	91	(Export)
Total	65,000	3,026	201,648	1,729	103	1,832	1,773		

note : *Estimation of number of hotel guests : $Pt=Ni*Rr*Pr*(365/d)$

Pt: Number of hotel guests

Ni: Number of hotel rooms

Rr: Room occupancy ratio

(Rr=0.71 in average;

High 3months 0.95, Mid 3months 0.80, Low 6months 0.55)

Pr: Average number of guests per room Pr=1.8

d : Average days staying d=7days

*Unit consumption rate : Cr

[Ref.] Cr=19.7kg/p.year(in 1986)according to CIDA Mission Report (Jan.1989, p10)

Total supply 1,800tons Tourism demand 300tons

Population demand 1,500tons Population 76,300 (in1986)

(Estimation) Cr=26.6kg/p.year (in 1997) according to result of field survey

Tourism equal population 3,000-4,000 Population abt.64,000

$Cr=(1,800,000)/(65,000+(3,000\sim 4,000))$

=26.726.5

=26.6 (kg/p.year)

② Situation of Market Wharf utilization

Market wharf starts its daily activity around 5:30. At first fishing boats which returned late at night and/or early in the morning from fishing grounds, starts to prepare landing of fish catches, then fish buyers and citizens gather there from around 6:00.

Fish landing from the boats continues for about two hours, because good catches fishing boats take longer time for landing/selling. Usually this morning time activities finish up to the time of 8:00. Fish catches landed are sold to fish retailers and/or directly to people by fishermen. Before direct selling to public consumers fishermen process fish removing scales and gutting, retail price is one dollar expensive compared with the price to retailers.

During daytime, there are some fishing boats returning to the market wharf. Those boats land and sell their catches in a same manner. This daily activity continues till around 5:00 in the evening, then finish. The boats returning after 5:00 o'clock in the evening will land catches next morning.

Some boats land part of their catches at Point wharf where is another landing site in St. John's, and sell to the private fishing company "White Fish Market", so called Micky's, then return to the market wharf.

Fishing pattern of Conch-fishing boats, however, is completely different from the other fishing boats mentioned above, because of dive-fishing; they go fishing everyday except Sundays, starting the wharf early morning at 5:00 or 5:30 and return at around 9:00~10:00. Their daily catches is about 45~60kg in average, almost of which is sold directly to hotels and restaurants, and the remains of catches is sold to public by the conch-fishermen themselves.

In general one boat landing takes one hour in case of smaller catches, and two hours when bigger catches. This seems to be quite long time but it is understandable because of "landing means retailing" which needs weighing and scaling/gutting before selling to people who come to the wharf for fresh fish. First selling place by the fishermen is the wharf, then fishermen move to the fish market with their remains of catches. This is an usual pattern of marketing of fish.

③ The number of fishermen and fishing boats at the market wharf

Total number of fishing boats is 93 (large boats) and 274 (small boats) in Antigua. In the site survey, 38 boats are recognized but 17 boats are not confirmed. Total 55 boats are registered to the market wharf according to the Fisheries Division "Fishing Boats Registration Records".

Table 2-3-4 Fishing boats and fishermen at the market wharf

Kinds of fishing boat	Major fishing method, etc.	No. of fishing boats (boats)		No. of fishermen (p)	
Large (Inboard engine)	Trap fishing (pot fishing) handline, longline, gill-net	15		45	
Small (Outboard engine-A)	Trap fishing, handline	21	40	42	80
Small (Outboard engine-B)	Handline	13		26	
Small (Outboard engine-C)	Dive-fishing (Conch)	6		12	
Total		55		125	

(Source: Fisheries Division)

④ Fish quantity handled at the west bus station (WBS)

Handling quantity of fish at the west bus station site (WBS) consists of the landings by the boats belonging to the market wharf as shown on above paragraph ③, and inflow from other zones into the AFL and the fish market. The quantity is estimated as follows;

$$\begin{aligned}
qoz &= qst.j \times fwbs \\
&= Qa \times fst.j \times fwbs \\
&= (1773 \times 0.33) \times 0.46 \\
&= 585 \times 0.46 \\
&= 269 \text{ (tons)} \\
qoz &= 250 \text{ (tons)}
\end{aligned}$$

⑤ Handling quantity of fish by AFL, Fish market retailers

Each handling quantity is estimated as follows in accordance with the result of site survey.

[AFL]

About 10% of the landings at the market wharf is brought to AFL by the fishermen who are usually supplying fish and are provided with ice, fishing gears under good relationship with AFL.

AFL is collecting fish from other zones twice a day, ten times a week, about 40kg each time; annually 20 tons. Inflow from the other zones is 257 tons a year, then 20 tons is about 8%.

Total annual quantity of fish handled by AFL is 47 tons calculated as follows;

$$\begin{aligned}
qafl &= qwbs \times fafl + qoz \times fafl.oz \\
&= 269 \times 0.10 + 250 \times 0.08 \\
&= 47 \text{ (tons)}
\end{aligned}$$

[Fish market : MKT]

Handling quantity of fish by the fish market is estimated as follows;

Fish market retailers open their temporal shops everyday (7 days a week), and the peak is on Saturday, the other 6 days including Sunday show almost even sales according to the result of site survey.

Saturday $450p \times 1.25\text{kg}/p \times 1\text{day} = 562\text{kg}/\text{week}$

Other days $250p \times 1.25\text{kg}/p \times 6\text{days} = 1,875\text{kg}/\text{week}$

Total $2,437\text{kg}/\text{week}$

$qmkt = 2437\text{kg} \times 52\text{weeks}/\text{year} = 126\text{tons}$

Among the above 126 tons, almost fishes sold at the fish market are landings at the market wharf though, about 40 tons fishes are inflow from the other zones; about 100kg of fish are brought daily except Saturday's 200kg. The ratio of fish from other zones is estimated about 16% (=40tons/126tons).

$fmkt = qmkt/qwbs = 86/269 = 0.32$

$fmkt.oz = qmkt.oz/qoz = 40/257 = 0.16$

Table 2-3-5 Fish handling quantity by AFL and retailers (Forecast)

Items	Basic Design Study (1997)	Target year (2005)	Factor (2005/1997)
Fish production : Qa (ton)	1,773	1,890	1.066
Large boat : qa1 (ton)	688	733	1.066
Small boat : qa2 (ton)	1,085	1,156	1.066
Fishing days(Large boat) : df1	137	137	--
Fishing days(Small boat) : df2	110	110	--
CPUE(Large boat): CPUE-1	18	18	--
CPUE(Small boat): CPUE-2	18	18	--
Fishermen(Large boat) : Pfm1	279	297	1.066
Fishermen(Small boat) : Pfm2	548	584	1.066
Fish production in other zones: qaoz=(1-fst.j)*Qa	1,194	1,273	1.066
Fish production in St.John's: qst.j=Qa*fst.j	579	617	1.066
Share of St.J. : fst.j	0.33	0.33	--
Inflow from other zones : qoz	250	266	1.066
Fish production at WBS qwbs=qst.j*fwbs	268	286	1.066
Share of WBS : fwbs	0.46	0.46	--
Handling quantity by AFL: qaf1=qwbs*fafl+qoz*fafloz	47	50	1.066
Handling quantity by Fish market retailers qmkt=qwbs*fmkt+qoz*fmktoz	126	134	1.066
Share of AFL(at WBS) : fafl	0.10	0.10	--
Share of AFL (other zones) : fafloz	0.08	0.08	--
Share of F.market (at WBS) : fmkt	0.32	0.32	--
Share of F.market (other zones) : fmkt	0.16	0.16	--
No. of fishermen in St.J. (Large boat) : Pfmst.j-1	120	128	1.066
No. of fishermen in St.J. (Small boat) : Pfmst.j-2	150	160	1.066
No. of fishermen at WBS (Large boat) : Pfmwbs-1	45	48	1.066
No. of fishermen at WBS (Small boat) : Pfmwbs-2	80	85	1.066

note : The above forecast is based on the result of site survey by the Basic Design Study team(July, 1997). The factor ratio for this forecast is 1.066 which is obtained from the population increase ratio 0.8% and 8 years from 1997 to the target year 2005.

2) Traffic volume and number of passengers at the west bus station (WBS)

West bus station is also called as market wharf locally, which is the site of this project. One third of the site is being used for a bus terminal.

Outline of the WBS are indicated as follows;

*Number of buses : 77

*Service area :

Areas#1, #2, #6 among the following 6 areas are based at WBS.

Table 2-3-6 Bus service routes in Antigua Islands

	Service area	Bus terminal
# 1	St. John's~Nelson Dockyard	West
# 2	St. John's~Oldroad	West
# 3	St. John's~Freetown	(East)
# 4	St. John's~Coolridge	(East)
# 5	St. John's~Hodges Bay	(East)
# 6	St. John's~Five Islands	West

- Number of trips : Average 10times/day
- Number of daily passengers : about 7,700
- Number of monthly passengers : about 200,000
- Number of yearly passengers : about 2,400,000

① Current situation and constraints

The WBS is crowded with passengers of office workers and people who go to work and return home in every morning and evening, market shoppers and the vehicles of bus, taxi, trucks, etc.

Especially, morning time and evening time congestion is a problem because of severe traffic jam on the road (Valley Rd.) passing the market area along the project site. An effective countermeasures is urgently required to relieve the current congestion in the market area.

Table 2-3-7 Current situation of WBS

Items	Current situation & problem	Cause of congestion
• Opening hours a day	• 6AM—6PM or more (Opening hours are long and fluctuated : Setting of opening hours for management)	• Causes within bus terminal *No separation between people and vehicle *Entrance/exit only for buses and taxis
• Peak time	• 6~8AM, 4~6PM (Peak hours are long : abt.1hour seems to be appropriate)	*No separation between bus/taxis and other vehicles
• Average stopover time (Boarding and getting off time)	• abt.15minutes/stop (Stopover time is long : 5~6minutes seems to be appropriate)	• External causes *Many cars parked along the street
• Peak ratio	• abt. 1.5 times (The peak ratio is small.)	

② Bus terminal and number of berths

How to relieve a traffic jam in Valley Rd. and congestion in the market area is one of the biggest problems for the Antigua government in the market area development program.

Antigua government plans to totally rearrange the area moving taxi stand, market parking lot into existing fish market place, etc. and traffic control of one-way, etc. in the market roads and streets.

This project includes a rehabilitation of bus terminal facility, because it is inevitable to secure an effective and efficient use of the fisheries facilities to be constructed by this project. Number of berths for the bus terminal is calculated as follows;

$$B = (N \times R \times r \times t) / (H \times 60)$$

B : Number of berths required

- N** :Number of buses in operation
R :Average number of trips per day bus
t :Average stopover time (minutes)
r :Peak ratio
H :Opening hours

There are entrances and exists but only for buses and taxies, and early coming buses and taxies position better places close to the exists, hence late comers cannot enter into deeper terminal area even if there are some spaces inside; this situation produces a worse effect for efficient utilization of spaces.

Required number of berths is 24 berths according to the result of analysis on the current situation at site. Forecast of traffic volume in target year can be the same number of berths because of stable population in Antigua (annual increase is 0.8%), and improved traffic control countermeasures, increase of efficiency can easily overcome those natural demand increase.

Table 2-3-8 Number of berths required

Items	Current situation	Target year (2005)		Remarks
		Plan-1 (Without traffic control)	Plan-2 (With traffic control)	
Number of berths required: B	24	48	24	<ul style="list-style-type: none"> • Traffic control of market area including and others is inevitable for efficient use of bus terminal • Improvement of longer stopover time • Increase of rotation at peak time
Number of buses: N	77	77	77	
Number of trips: R	10	10	10	
Av. Stopover time t (minutes)	15	15 (*)	7.5	

Peak ratio r	1.5	2.5	2.5	- Improvement of heavy congestion
Opening hours: H (hrs)	12 over	10	10	
Peak hours (hrs)	more tha 2 hours morning and evening	abt. 1 hour morning and evening	abt. 1 hour morning and evening	
Average trip per hour	64	77	77	

note : *Stopover time (t) in the above table, completely depends on the traffic control in the market roads including Valley Rd.

3) Facility function and space

Function and space necessary for fish landing and marketing activities can be summarized as follows;

Table 2-3-9 Necessary facility function and space

Function	Space	Facility, equipment, etc.
• Landing of fish catches	<ul style="list-style-type: none"> • Space for landing(catches) • Space for fishing preparation (boat) • Space for mooring (boat) • Space for emergency (boat) • Space for washing (catches) • Space for trading (catches) • Space for resting (fishermen) • Space for storage (catches) 	<ul style="list-style-type: none"> Fishery wharf and epron Anchoring, operation area Access road, handling space Trading space Gear storage space Rest space (fishermen)
• Marketing of fish catches	<ul style="list-style-type: none"> • Space for receiving and delivery (fish) • Space for storage (fish) • Space for processing (fish) • Space for storage (fish products) • Space for selling (fish products) • Space for shoppers 	<ul style="list-style-type: none"> Access road Handling space Ice making and storage space Cold room Fish shop Storage Sewage facility Fish retail market

<ul style="list-style-type: none"> • Administration and management of facilities 	<ul style="list-style-type: none"> • Administration space • Guest space • Space of maintenance of facilities • Security space • Meeting/discussion space • Sanitary space • Space for public retailers 	<ul style="list-style-type: none"> Office, Storage Storage for maintenance material Emergency generator room Security space Police box Meeting room Office toilet Pantry Display space for extension services
<ul style="list-style-type: none"> • Public services at site 	<ul style="list-style-type: none"> • Space of path for customers • Space for parking • Sanitary space • Kiosk space for food and drinks • Space for rest 	<ul style="list-style-type: none"> Entrance and exit for visitors paths Pedestrian path (common use) Trees Parking Bus terminal facility Public toilet and rest room Kiosks

4) Topographic condition

① Sea bed survey

Sea bed just in front of existing market wharf has a muddy layer of about 1.2m thick and almost no water depth (tidal change is very small with only about 20cm). At the end of existing jetty is about 2.75m water depth and the muddy soil layer is about 0.7m. In accordance with the result of this survey, three plans are examined in order to secure a required water depth for fishing boats;

- (a) Rehabilitation of existing wharf and jetty
- (b) Construction of new wharf with reclamation beyond existing wharf
- (c) Construction of new jetty with dredging

Further details are shown on next paragraph "5) Facility structure".

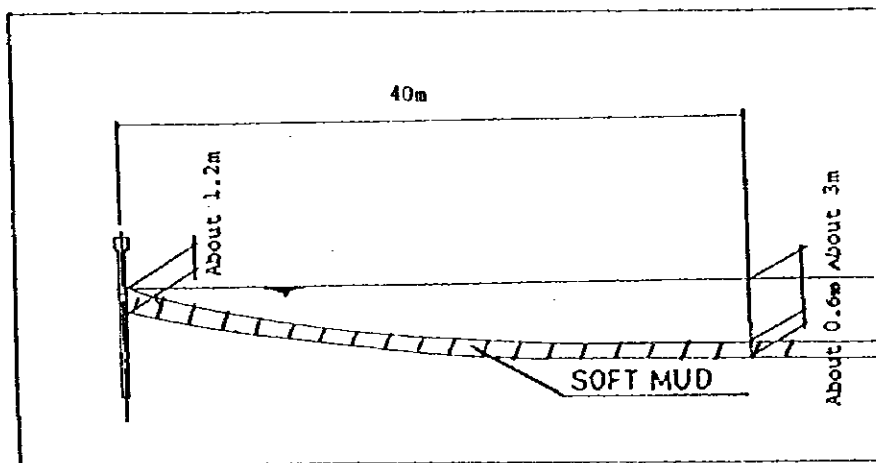


Fig. 2-3-4 Typical section of sea bed

② Land survey

West bus station (WBS) site is composed of gentle slopes as shown on Fig. 2-3-5. Facility layout plan and each building facility plan must be designed taking fully into consideration of the land survey result. On the leveling, necessary banking is to be provided in order to make suitable adjustment between each boundary with road and wharf. Rainwater drainage is suitably arranged as necessary.

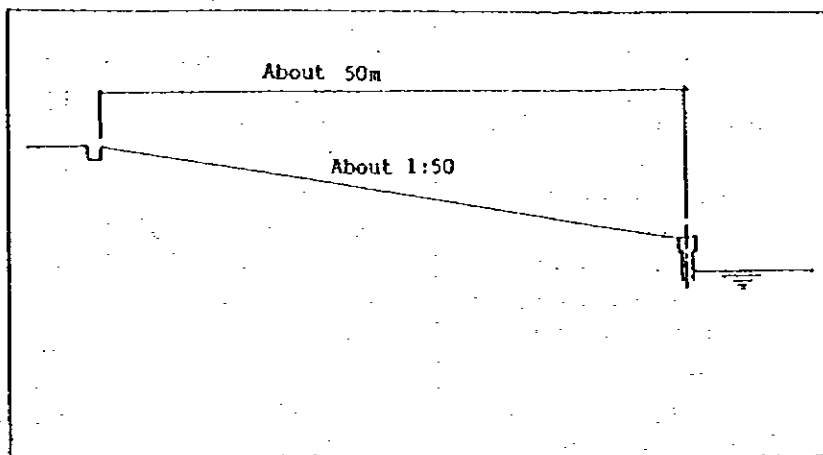


Fig. 2-3-5 Typical section of land

5) Facility structure

① Mooring wharf

Following three plans are carefully examined from the functional, designing and constructing points of views and also the economical comparison is made.

As a result, the Plan(b) is considered the most appropriate in case of this project.

- (a) Rehabilitation of existing wharf and jetty
- (b) Construction of new wharf with reclamation beyond existing wharf
- (c) Construction of new jetty with dredging

Table 2-3-10 Comparison of three Plans

Item	Plan(a):Jetty	Plan(b):Wharf	Plan(c): Jetty & dredging
Scope of works	<ul style="list-style-type: none"> • Basically existing facility is maintained. Scope of work is rehabilitation of wharf and new jetties construction. 	<ul style="list-style-type: none"> • Construction of new wharf with reclamation. Wharf is extended to the distance abt. 25m to provide necessary water depth. 	<ul style="list-style-type: none"> • Dredging is added to Plan(a) because front waetr area is not used efficiently in case of Plan(a).
Func-tions and Designing	<ul style="list-style-type: none"> • Steel sheet pile of self supporting style is installed at 2 ~ 3 m beyond the existing wharf. Self supporting sheet pile requires carefull examinaion on its deflection when the purpose is mooring wharf. • Exisiting wharf can not be used as mooring wharf because of severe deterioration and self supporting style. 	<ul style="list-style-type: none"> • No clear distinction among the three functions of landing, preparation and resting because of no markable construction. • For emergency an apron can be effectively used as a shelter space of boats on land. 	<ul style="list-style-type: none"> • Total length of steel piling is longer than Plan(a). • Bigger amount of deflection needs carefull examination same as Plan(a). • Dredging ceates an effective water area with required depth. Land shelter space for fishing boats is not enough when emergency.

Const- ruction	Longer construction period because building construction cannot be proceeded in parallel due to lack of space between wharf and building.	• It will be necessary to remove the mud from sea bottom. And have to prepare the place to to dump the mud.	• Itwill be necessary to remove the mud from sea bottom. And have to prepare the place to dump the mud.
Cost	<ul style="list-style-type: none"> • Comparison of cost is made among the 3 plans. • Plan(a) is set a base ; 1.00. • Plan(b) and Plan(c) are as shown right. 	1.23 (23%up)	1.50 (50%up)

② Building facility

According to soil investigation, the site consists of stiff clay and its supporting layer is 4.5~5.0m deep (N>50). Then the foundation of the building is decided as bearing power of soil.

6) Layout plan of facilities (Zoning)

Layout of the facilities must be planned in accordance with the following basic concept considering effective land use and site conditions.

① Effective utilization of site area

The project site, west bus station (WBS), is positioned, at southern part in St. John's where is the capital city of Antigua and Barbuda. The site is called market wharf as well as WBS because there are vegetable, fish and meat markets along the Valley Rd., and the total area is creating biggest market zone. Existing AFL building is next to the north boundary of the WBS site, south side neighbor is private owned land. Antigua government plans redevelopment of total market area in accordance with the St. John's city development plan. Basic concept of market redevelopment is placed on revitalization and more effective use of land

area through rearrangement of each facility function.

Outline of the plan is to unify, at first, the fisheries functions into a new building facility of this project. Then vegetable market will be reconstructed, meat market will move to existing AFL building. The land of existing fish/meat market may be used as a taxi stand and also parking lot, and the total market zone may be improved its efficiency for the people in Antigua and Barbuda.

Therefore, fishing facilities development of this project is given top priority by the government under the St. John's development plan and may contribute to the further fisheries development and to market area development providing effective utilization of market area land.

② Dissolution of congestion

The road in the market area is the most congested one in Antigua even though the distance is only 200~300m along the market area. Streets in St. John's city are crowded with a lot of parked cars at lunch time, but traffic flow is rather smooth, which traffic is controlled by the police department. Main causes of traffic jam in the market area are analyzed as follows;

- (a) Many cars are parked along the road when shopping.
- (b) Since WBS is a terminal covering southern districts in Antigua, entering is less problem but going out requires crossing to the other side lane (no traffic signal). Taxi and other vehicles going to southern direction have the same problem.
- (c) Fishermen's trucks and private vehicles use the same entrance and exit as the buses/taxies.
- (d) Both sides of the road are occupied by small shops and retailers except entrances and exits of buses/taxies.

Taking the above situation into consideration, the layout plan is to be designed as follows;

Flow paths of vehicle and people must be separated and fishermen's trucks be separated from bus terminal entrance and exit. Antigua side is required to review traffic control plans in the area which is inevitable to dissolve the traffic jam and relieve excessive congestion.

(2) Examination of the Outline of the Project

1) Fish Landing Facility (Mooring Wharf)

Problem at the market wharf is extreme shortage of mooring length against the required capacity. Water depth is not available for many fishing boats.

To improve the situation, following three plans were compared and examined.

As a result, the plan "(b) Reclaimed wharf" formed conclusions from the experiences;

- (a) Jetty construction,
- (b) Reclaimed wharf construction,
- (c) Jetty & Dredge work.

Sufficiency-percentage is abt. 6% at present as shown on the following table 2-3-11. It is managed by the method of mooring to the other boats due to extreme shortage of the wharf length. In this plan, the above percentage will be improved to 63%.

Table 2-3-11 Outline of facility

Facility section		Length(m)		Required length (m)	Shortage length(m)		Sufficiency (%)	
		Current	Plan		Current	Plan	Cur'nt	plan
Mooring wharf	Depth 1.70m over	9(23)*	45	114	105	69	8	39
	depth 2.70m over	2(5)*	70	68	66	-2	3	103
	total	11(28)*	115	182	171	67	6	63
Space for refuge		0 (No space)	115 (Use apron)	110	110	-5	0	104

note : * () shows for reference at present extension length at high tide . As to moorage, it is responsible to secure the same capacity at present including maneuvering area.

Table 2-3-12 Necessary wharf extension

Water Depth	Wharf length (m)				Apron(m)
	a.For landing	b. Preparation	c.Rest	Total	d.Refuge
Below 1.70m (small boat)	8.68 (7 boats)	39.16 (7 boats)	66.15 (21 boats)	113.93 (28boats)	91.35 (29 boats)
Over 2.70m (large boat)	6.40 (2 boats)	21.32 (2 boats)	40.56 (8 boats)	68.28 (10 boats)	18.60 (4 boats) *
Total	15.08 (9 boats)	60.48 (9 boats)	106.71 (29 boats)	182.27 (38 boats)	109.95 (33 boats)

Note : * Five(5) large boats are not included, Bigger ones will take refuge in other ports.

① Particulars of Fishing Boats

Principal particulars of 38 fishing boats which use the wharf at presently are as follows; "Small fishing boat" means below 2 GT (with out board engine) and "Large fishing boat" over 2 GT (with inboard engine) herein.

Table 2-3-13 Particulars of Fishing Boats

Boat type (G.T.)	Number of Boat	Boat Length (m)	Boat Breadth (m)	Boat Draft (m)
below 2 G.T. (Length less than 8m)	29 boats	Max. : 7.90	Max. : 2.55	Max. : 0.90
		Mean : 6.47	Mean : 2.10	Mean : 0.49
		Std.Des : 8.00	Std.Des : 2.20	Std.Des : 1.20
2~4 G.T. (Length 8~10m)	4 boats	Max. : 9.20	Max. : 3.30	Max. : 1.00
		Mean : 8.68	Mean : 3.10	Mean : 0.90
		Std.Des : 10.00	Std.Des : 2.60	Std.Des : 1.60
4~10 G.T. (length 10~13m)	3 boats	Max. : 12.20	Max. : 3.50	Max. : 1.20
		Mean : 11.60	Mean : 3.50	Mean : 1.07
		Std.Des : 13.00	Std.Des : 3.50	Std.Des : 2.00
10~20 G.T. (length 13~17m)	2 boats	Max. : 16.80	Max. : 4.00	Max. : 1.40
		Mean : 15.30	Mean : 3.75	Mean : 1.30
		Std.Des : 17.00	Std.Des : 3.50	Std.Des : 2.20
Total	38 boats			

Remark: "Std. Des" means design standards in accordance with "Design Standards of Fishing Port Construction"(1990 Edition).

② Total Wharf Length planned : $L = 130\text{m}$

Total wharf length is 130m, however, effective wharf length is 115m, because the southern part corner of abt. 15m (stone protection) cannot be used.

③ Depth & the wharf length

Depth of water shall be over the maximum draft of fishing boats with at least 0.5 m allowance. Existing small and large fishing boats require the water depth as follows:-

For small boats: Depth of water = 0.90m + 0.50m = More than 1.40m

For large boats: Depth of water = 1.40m + 0.50m = More than 1.90m

In the same way, the designed water depths are obtained as follows in accordance with the standard drafts (Std. Des = designed standard in Table 2-3-13) for small and large boats;

For small boats (below 2.0 GT) : 1.20m + 0.50m = over 1.70m

For large boats (more than 2.0 GT) : 2.20m + 0.50m = over 2.70m

The depth at the designed wharf front is between 1.40m and 3.00m except southern (abt. 5 m length) and northern (abt. 30 m length) corners of 35m length in total where the depth is less than 1.40m. Shallow waters shall be dredged to comply with the design conditions.

Effective wharf length (Total 115 m)	Designed water depth (Dredging depth)	Remarks
45 m	1.7 m (2.0m)	For small boats
70 m	2.7 m (3.0m)	For small and large boats

As for the dredging works, the depth shall be 3.0 m and 2.0 m respectively taking silting up into consideration.

④ Wharf length by functions

The wharf shall be designed to include following four(4) major functions such as "unloading" "preparation" "resting" and "for refuge". Particulars of fishing boats are used from the existing ones as shown on Table 2-3-13.

(a) Unloading

The wharf length required for unloading (when mooring alongside) is obtained as follows;

$$\text{Necessary length} = (\Sigma N/r) \times L$$

L: Berth length = boat length + allowance

N: Number of boats which use the wharf a day

r: Berth rotation = (Unloading hours a day)/(Unloading time per boat)

Small fishing boat:

$$\text{Necessary length} = (\Sigma N/r) \times L = (7/6) \times 7.44 = 8.68 \text{ (m)}$$

$$L = 6.47\text{m} + 0.15 \times 6.47\text{m} = 7.44\text{m}$$

N = 7 boats/day

Unloading time a day : 3.0hours (5:00am~8:00am)

Unloading time per boat : 0.5hours/boat

$$r = 3.0 \text{ h} / 0.5\text{h} = 6$$

$$r = 3.0 \text{ h} / 0.5 \text{ h} = 6$$

Large fishing boat:

$$\text{Necessary length} = (\Sigma N / r) \times L = (2 / 4) \times 12.79 = 6.40 \text{ (m)}$$

$$L = 11.12 \text{ m} + 0.15 \times 11.12 \text{ m} = 12.79 \text{ m}$$

$$N = 2 \text{ boats/day}$$

Unloading time a day : 3.0 hours (5:00am~8:00am)

Unloading time per boat : 0.75 hours/boat

$$r = 3.0 \text{ h} / 0.75 \text{ h} = 4$$

(b) Preparation

The wharf length required for preparation (when mooring alongside) is obtained as follows;

$$\text{Necessary length} = (\Sigma N' / r') \times L$$

L: Berth length = boat length + allowance

N': Number of boats which use the wharf a day

r': Berth rotation = (Possible mooring hours a day) / (Preparation time per boat)

Small fishing boat:

$$\text{Necessary length} = (\Sigma N' / r') \times L = (7 / 1.33) \times 7.44 = 39.16 \text{ (m)}$$

$$L = 6.47 \text{ m} + 0.15 \times 6.47 \text{ m} = 7.44 \text{ m}$$

$$N' = 7 \text{ boats/day}$$

Possible mooring time a day : 2.0 hours

Preparation time per boat : 1.5 hours/boat

$$r = 2.0 \text{ h} / 1.5 \text{ h} = 1.33$$

Large fishing boat:

$$\text{Necessary length} = (\Sigma N' / r') \times L = (2 / 1.2) \times 12.79 = 21.32 \text{ (m)}$$

$$L = 11.12 \text{ m} + 0.15 \times 11.12 \text{ m} = 12.79 \text{ m}$$

$$N = 2 \text{ boats/day}$$

Possible mooring time a day : 3.0 hours

Preparation time Unloading time per boat : 0.75 hours/boat

$$r = 3.0 \text{ h} / 2.5 \text{ h} = 1.2$$

(c) Resting

The wharf length required for resting (when mooring longitudinal side) is obtained as follows;

$$\text{Necessary length} = \Sigma n \times B$$

n : Number of boats mooring the wharf a day

B: Berth length per boat = Boat's breadth + allowance

Small fishing boat:

$$\text{Necessary length} = \Sigma n \times B = 21 \times 3.15 = 66.15 \text{ (m)}$$

n = 21 boats/day

$$B = 2.1 \text{ m} + 0.5 \times 2.1 \text{ m} = 3.15 \text{ m}$$

Large fishing boat:

$$\text{Necessary length} = \Sigma n \times B = 8 \times 5.07 = 40.56 \text{ (m)}$$

n = 8 boats/day

$$B = 3.38 \text{ m} + 0.5 \times 3.38 \text{ m} = 5.07 \text{ m}$$

(d) For refuge

Fishing boats shall be landed on the apron for refuge. The dimension of apron is 130m length and 10m width. In total 33 boats are possible to be sheltered as shown below;

$$\text{Necessary length} = (\text{boat breadth} + 0.5 \times \text{boat breadth}) \times \text{number of boats}$$

$$L = (2.1 \text{ m} + 2.1 \text{ m} \times 0.5) \times 29 \text{ boats} + (3.1 \text{ m} + 3.1 \text{ m} \times 0.5) \times 4 \text{ boats}$$

$$= 91.35 \text{ m} + 18.60 \text{ m} = 109.95 \text{ m} \approx 110 \text{ m} < 130 \text{ m}$$

⑤ Sufficiency ratio of the Mooring Wharf

Sufficiency ratio of the mooring wharf is calculated as shown below;

$$\text{Sufficiency ratio (\%)} = \frac{(\text{necessary length} - \text{shortage of length}^*) \times 100}{\text{necessary length}}$$

* shortage length (m) = necessary length - designed length

Necessary length in total is abt. 182 meters.

for unloading :	small fishing boat	8.68 m
	large fishing boat	6.49 m
for preparation :	small fishing boat	39.16 m
	large fishing boat	21.32 m
for resting :	small fishing boat	66.15 m
	large fishing boat	40.56 m
<hr/>		
total		182.27m

shortage length (m) = necessary length - designed length

$$= 182.27\text{m} - 115.0\text{m} = 67.27\text{m}$$

$$\text{Sufficiency ratio(\%)} = \{(182.27\text{m} - 67.27\text{m}) / 182.27\} \times 100 = 63.1\%$$

⑥ Maneuvering water area

Maneuvering water area when mooring boats alongside the wharf is obtained by following formula;

Necessary maneuvering area (distance from the wharf)

$$L = 3 \times \text{boat length} + 1.5 \times \text{boat breadth}$$

$$\text{Small fishing boat : } 3 \times 8\text{m} + 1.5 \times 2.2\text{m} = 27.3\text{m}$$

$$\text{Large fishing boat : } 3 \times 17\text{m} + 1.5 \times 3.5\text{m} = 56.0\text{m}$$

Maneuvering area of 56m distance (and water depth 1.9m or more) from the wharf is required according to the above formula. This project can comply with the requirement.

2) Fish Distributing Facilities (Building)

Design conditions for fish distributing facilities of this project have been examined based on the result of site survey, the estimation of fish volume (by AFL, fish market and fishermen, etc.) in a target year (2005).

In the study, all the existing fisheries functions at the project site have been reviewed and summarized again, and the layouts, specifications, sizes have been carefully examined. Concerning the facility scale, it is the importance of harmonizing the St. John's city development plan as well as taking the site conditions into account. Then the facility size shall be properly decided so that current situation can be improved at first.

The facilities shall be designed in accordance with a policy based on the fresh fish distribution, as the road networks are well maintained, and the Antigua Island has proper driving distance of 24km(east-west) and 20km(north-south).

① Administration Office

216m²

An administration office shall be arranged in the fish distributing facilities in accordance with the St. John's market area development plan. Currently there is no space for fishermen to have a meeting and discussions on fishing development, etc. Other office spaces for AFL's plant supervisor, engineers and clerks are quite limited and occupied with maintenance records, sales records and other documents of instruction manuals, etc. So some clerks are working with desk in the corridor space. To improve current situation, administration office space shall be provided. AFL manager is also an accountant. In manager's room, there are file cabinets for accounting documents, etc. and a desktop computer. Accounting works are executed with staffs but no space to deal with the task. Therefore it is necessary to provide some spaces for accounting task and/or meeting with any visitor. The existing toilet is commonly used by office staffs and fish processors. But it is necessary for food processing area to be separated from the other office and public spaces, etc. The guests in the conference room also use the toilet, so a new toilet on the second floor shall be provided. Office spaces and areas are shown below with a comparison between existing and this project plan.

<u>Office spaces</u>	<u>Existing</u>	<u>Plan</u>
• Manager room	18.0 m ²	24 m ²
• Secretary room	12.0 m ²	21 m ²

• Offices (Plant supervisor, Engineer, Clerk)	12.0 m ²	24 m ²
• Pantry	16.0 m ²	} 14 m ²
• Toilet		
• Meeting room	-	36 m ²
• Corridor, stairway spaces, etc.	19.7 m ²	73 m ²
Total	77.7 m²	216 m²

② Fishing Gears Storage

144 m²

Existing fishing gear storage space is 300 m³ in volume with 196 m² floor area. The contents of fishing gears are as follows;

<u>Kinds of fishing gear</u>	<u>Quantity</u>	<u>Volume</u>
Wire net for fish trap	120 pc.	28m ³
Fish boxes Large size	5 pc.	13m ³
Medium size	13 pc.	133m ³
Small size	16 pc.	16m ³
Float	800 pc.	27m ³
Rope	abt. 1000 coil	156m ³
Total		300m³

At present fishing gears are not stored in a best way, which are dispersed here and there at site; the stowage performance is very low. Therefore, it is necessary to review the stowage rate in accordance with the reasonable figure of standards:

<u>Item</u>	<u>Quantity</u>	<u>Stowage method</u>	<u>Floor area</u>
Wire nets	150pcs	2 tiers, 8pcs/m ²	9m ²
Fish box	10pcs	3 tiers, 3pcs/m ²	4m ²
Float	1000pcs	2 tiers, 12pcs/m ²	83m ²
Rope	1000coils	3 tiers, 15pcs/m ²	66m ²
Others			5m ²
Total			167m²

For better use of spaces, two(2) tiers of shelves shall be provided in the fishing gear storage space. Shelves produce abt. 56m², then abt. 144m² are required for fishing gear storage room including corridor spaces, etc.

③ Spaces for Ice Making Plant 144 m²

The Ice making machine shall be installed on the ice storage bin. The ice storage bin and ice handling spaces require abt. 144m² in the building.

④ Spaces for Cold Storage 36 m²

Spaces for installation of a chilled room (3.6m×4.5m) shall be arranged in the building facility; necessary area is one compartment of 6m spans (36m²).

⑤ Fish Processing Facility 144m²

Fish processing facility shall be designed in accordance with the existing facility specifications, the past records and data of fish processing for consideration. Two persons are working for fish processing (fish processing means here removing scales, gills and gutting) of 100 to 200kg fish a day at the existing fish processing facility. There are 2 processing tables with four booths for four persons and usually only two booths are used. When fishermen bring a lot of fish to AFL, the all four booths are used by two full time processors and two part time staffs in addition. Four person can make fish processing of maximum 600kg per day. The facility shall be designed in accordance with the Japan's Fishing Harbor Design Standard.

The project facility shall comply with the design conditions of abt. 50 tons fish to be handled by AFL in the year 2005, which is equivalent to average 0.18 tons/day, i.e. 0.13 tons/day in low season and 0.28 tons/day in high fishing season when 260 business days are count a year.

Fish processing facility shall include the following areas/spaces;

- (a) Fish handling area (weighing, sorting of fish by species)
- (b) Fish processing area
- (c) Passage and carrying spaces
- (d) Spare space for freezer

(e) Toilet and shower

(a) Fish handling area (25m²)

Fish handling area of abt. 25m² shall be provided in accordance with the Japan's Fishing Harbor Design Standards.

$$S = N / (R \cdot \alpha \cdot P)$$

$$S = 0.28 / (0.012 \text{ ton/kg} \times 0.6 \times 1.5) = 25\text{m}^2$$

S: Area necessary for fish handling

N: Max fish handling quantity 0.28 tons/day (high season)

R: Handling quantity per unit area; 0.012 t /m²

Standard size of reef fish; length 18cm, body height 7cm, weight 200g

Number of fishes in one square meters is 63 fishes

$$1.0 \text{ m}^2 \div (0.18\text{m} \times 0.07\text{m}) \times 80\% = 63 \text{ fishes}$$

$$63 \text{ fishes/m}^2 \times 200\text{g/fish} = 12.6\text{kg/m}^2 = 0.012\text{tons/m}^2$$

Ref.: Coastal fish handling rate = 0.010tons/m² at Shizuoka Pref. in Japan

α : Occupancy factor 0.6

P: Rotation factor 1.5 times (frequency of fish handling per day)

(b) Fish processing area (15 m²)

Fish processing area of abt. 15 m² shall be arranged.

$$A = M_i / N_i \times L_i = 50 / 260 \times 83 = 15 \text{ m}^2$$

A: Area necessary for fish processing (m²)

M_i: Fish quantity per annum, 50 tons

N_i: Working days per annum, 260 days (5 days per week)

L_i: Area per unit weight (L_i=1/R=1/0.012= 83 m²/ton)

(c) Passage and carrying spaces (33 m²)

Passage and fish carrying spaces shall be adequately arranged in the facility; so that push cart with fish boxes can be efficiently used in the area. The layout shall be carefully examined not to cross the traffic lines of movement among the ice storage bin, fish shop and etc.

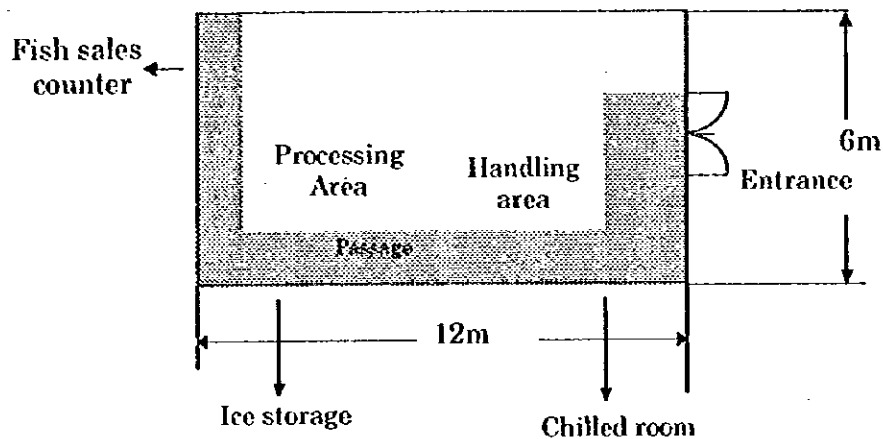


Fig. 2-3-6 Passages in Processing area

Design standards of fish processing facility is being studied in Antigua. The processing area of this project shall be separated from the other office spaces as much as possible in order to maintain hygienic standards in accordance with the Antigua's draft regulations. An air conditioner (which is independent from the other spaces) shall be provided too.

(d) Spare space for the freezer (36m²)

To supplement domestic demand, AFL is importing annually abt. 3 tons fish. One shipment is between abt. 500kg and 1800kg and usually three shipments per annum. Even for temporal stowage of imported fish a freezing storage is necessary, an installation space shall be provided in the facility building. As the quantity of imported fish is very small and Antigua government has a fish production program to comply with the strong domestic fish demand, fresh or frozen fish imports will be expected to decrease from now on. Past maximum import record was 1800kg and the average abt. 1000kg. Abt. 36 m² space which is appropriate for 1 ton freezer, will be secured for the purpose mentioned above.

(e) Toilet & Shower (36m²)

Each one set of shower and toilet shall be provided for men and women in the fish processing area. Toilets and showers require abt. 36 m².

⑥ Fish sales counter

36m²

A fish sales counter shall be arranged in the facility building, with a space for each one set of showcase (chilled) and cash register machine, in order to sell the fish processed by AFL. The area is abt. 36 m² which is almost the same as the existing fish shop.

⑦ Fish market

94 m²

Number of booths in the existing market is shown below. In the fish market, sea water should not be used because city drain is flowing into the sea beside the market wharf. City water shall be provided to the fish market.

Table 2-3-14 User of existing fish market

Item	Full time (person)	Part time (person)	Fisher-men (W.B.S)	Fisher-men (Others)	Q'ty (ton)	Remarks
Ordinary weekdays	3	--	2~3	1~2	0.5~0.7	High Season; AM6~PM6
Saturday Sunday	3	1	3~4	3~4	1.0~0.7	High Season; AM6~PM6

note; W.B.S means West Bus Station.

Number of booths of fish market shall be decided according to the current situations of fish marketing as shown below.

Fish retailers : 4 booths (Full and part times, all days)

Fishermen cum-retailer : 8 booths (West Bus Station 4, Other landing places 4)

Total 12 booths

Each one weighing scale for every two booths shall be provided. Selling table in each booth shall be of 1.5m and 0.8m size which is identical to existing ones and made of washable material and construction. Fish market space is abt. 72 m² including 12 booths and passage spaces around.

⑧ Fishermen's workshop

158m²

Fishermen's workshop shall be used for fish sorting, weighing, trading, etc. and also used for miscellaneous preparatory works and temporal gear storage before going

fishing. When fishing, fisherman marks his catches in a special manner of cutting fin before storing in the ice box, because every piece of catches belong to the fisherman who angled and/or caught it. In case of large boat, each fisherman has his own ice box, while fishermen share one ice box in case of small boat. Therefore all the catches must be sorted and weighed at first before selling to the middlemen or fish retailers.

Fish handling space (122 m²)

287 tons of fish will be handled in the West Bus Station annually. Then the space area is calculated as follows;

$$S=N/(P \times R \times \alpha)= 1.1/(0.012 \times 1.5 \times 0.5) = 122m^2$$

N: Maximum handling capacity high seasons 1.1 tons

P: Fish quantity handled, 0.012tons/m² (same as AFI)

R: Number of rotation 1.5 (same as number of landings a day)

A: Occupancy rate 0.5 (Ref.: Japanese fish box handling data)

Washable multipurpose fish processing table (abt. 80cm wide) shall be provided between fish market and fishermen's space. All the spaces shall be suitably arranged so that push cart can be used efficiently.

Other spaces (36m²)

Fish handling space is to be used for fishermen's miscellaneous works such as standby and resting before fishing. Then toilet and fishing gear store shall be provided for fishermen.

3) Public Infrastructure Facilities

① Bus Terminal

(a) Present condition of west bus terminal

There is no big bus company nor public corporation. Buses are being operated only by private people. As for the bus service business ATB is responsible for an issue of business license and a traffic control/operational plan such as number of trips for each route. Number of buses at WBS has been checked from 14th to 20th July 1997

as shown below.

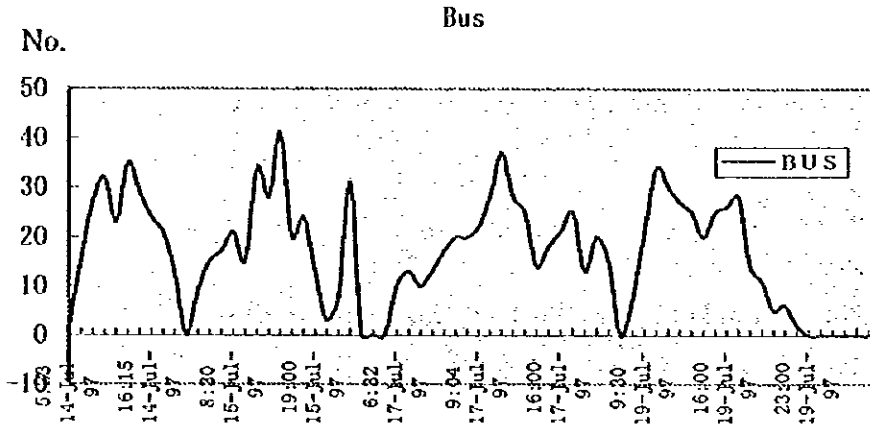


Fig.2-3-7 Number of bus waiting by time at West Bus Station

Operation hour for the bus is not regulated but usual business hour is from 7:00a.m. to 5:00p.m.

Table 2-3-15 Number of Buses waiting in West Bus Station

Month/day	Time	No	Month/day	Time	No.
July/17	7:20	10	July/19	7:03	7
	8:04	20		8:03	14
	9:04	22		9:00	21
	10:02	28		10:00	34
	11:05	37		11:02	30
	12:05	28		12:00	27
	13:02	25		13:00	25
	14:03	14		14:00	20
	15:30	18		15:00	25
	16:00	21		16:00	26
	17:12	25		17:00	28

Daily patterns of bus operation are almost same. There is a peak at around 11 o'clock in the morning and number of buses are over 30. Average number of buses

are 23 (7:00a.m. to 5:00p.m.). More than 25 buses are waiting from 9:00a.m. to 2:00 p.m. when there are small number of passengers. Number of buses at rush time is between 20 and 25.

(b) Capacity of bus terminal by parking system

Following two systems of "[a] parallel parking" and "[b]zigzag parking" were studied. Parallel parking system has some advantages as shown below. Then the design shall be executed in accordance with the parallel parking system.

Table 2-3-16 Parking Style

Check items	[a] Parallel parking	Result	[b] Zigzag parking	Result
1.Driving	Easy	◎	Require switch back	○
2.Safety	Driver only	◎	Require assistant for switch back	○
3.Area efficiency				
Total area required	1,710 m ²	◎	2,142 m ²	○
Unit area per bus	71 m ²		89 m ²	
4.Area dimensions				
Berth area length	60 m		51 m	
Berth area width	28 m		42 m	

Note : ◎ ; Very good ○ ; good

② Small shops

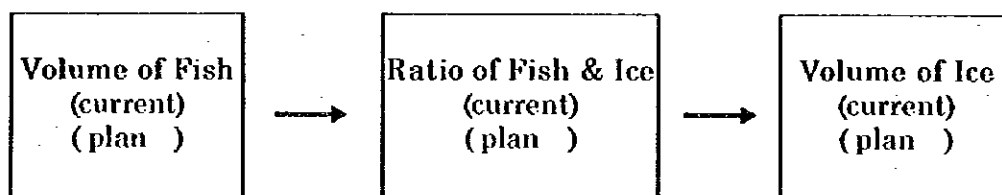
About 25 to 30 small shops and retailers are located at the west bus terminal in the WBS and they are extending convenience for fishermen, market people and bus passengers, etc. From the Market Street to the Valley Road, there are a lot of shops and retailers lined up through to the market area. This project includes a development of bus terminal facility which will greatly improve the efficiency of traffics at the site, and a 21 small shop facility which will promise continuous services to the people from now on as well as so far. As the small shops have wide

range of business from drinks and foods, miscellaneous goods to barbers, etc. each shops interior works shall be performed by the tenants after completion of the project in accordance with the agreements with the government (ATB will represent).

4) Size of Equipment

① Ice-making and Ice-storage

Development of a fish distribution system is one of the major objectives of the Project. Especially, installation of an ice-making facility plays quite an important role to boost reduction of post-harvest loss. Ice-making facility shall be examined in line with the following conceptual flow and the most adequate size must be concluded.



As shown in the table, the results of the analysis on current state of ice usage which was concluded with the above concept was that fish and ice are in the ratio 1 : 1.1 on the annual average. In the target year necessary volume of ice is expected to be abt. 2400 tons a year including ice to be used for distribution which will reduce post harvest loss. The volume will be abt. 6.6 tons a day ($2400/365=6.6t/day$). Let the capacity of ice-making machine 7t/day ($3.5t/day \times 2$ sets) and the capacity of ice storage shall be equivalent to the two days volume of ice production.

Table 2-3-17 Ratio of Fish and Ice

Purpose	Quantity of fish (ton)		Ratio of Fish & Ice		Quantity of Ice (ton)	
	Current	Plan	Current	Plan	Current	Plan
1. Ice for fishing						
• Fish production	1,773	1,890				
• Barbuda portion	-127	-135	1 : 1.1	1 : 1.1	1,777	1,895
• Private section	-30	-32	(*1)			
• Ice need fish Q'ty	1,616	1,723				
2. Ice for distribution						
• From other zone	250	266				
• In St. John's	466	762				
(Q'ty in St. John's)	(579)	(617)	1 : 0.0	1 : 0.5	0	381
(AFL Q'ty)	(-27)	(-29)				
(Fish Market Q'ty)	(-86)	(-92)				
• Q'ty of target fish	716	762				
3. Ice for Processing						
• AFL raw fish	47	50				
• AFL processing fish (sale)	(*2) 19	20	1 : 0.5	1 : 0.5	9.5	10
• AFL processing fish (delivery)	(*2) 19	20	1 : 1.0	1 : 1.0	19	20
4. Ice for Fish Market	126	134	1 : 0.0	1 : 0.5	0	67
Sub Total					1,805.5	2,373
5. Ice for public					26	28
Grand Total					1,831.5 (5t/day)	2,401 (6.6t/day)

Note: *1 Current ratio of fish and ice = 1616 : 1777 = 1 : 1.1

*2 Weight ratio between products and raw material is 80%.

AFL's current supply of ice stands at the level that fish and ice are in the ratio 1:1.1 in the low fishing season. In intermediate season the ratio is managed to keep, relying on surplus ice of WFM (White's Fish Market) from private sector. On the peak season ice should be in short and the ratio is estimated at 1:0.7. Fishing people are positive in using ice. According to a hearing survey they get ice 1.5~2.0 times as much as the catches. When ice is not available some fishing boats call off fishing. Necessary volume of ice for each fishing season is summarized as shown below. The size of ice making plant in this project shall be determined with the major purpose of improving a current ice shortage, so that AFL can supply ice on a more steady basis and increase an ice supply which is currently dependent on surplus ice from a private fishing company.

Table 2-3-18 Variation of Ice Demand by Fishing Season

Fishing Seasons	Fish Q'ty	Ice Q'ty	Ice Ratio (Ice/Fish)	Fish Q'ty	Ice Q'ty	Ice Ratio (Ice/Fish)
1. High Season (Nov.-Jan., 3 months)	582 (0.36)	444 (336+108)	76% (58+18)	620	472	76%
2. Normal Season (Feb.Mar.Sep.Oct.4 mt)	646 (0.40)	752 (570+182)	116% (88+28)	689	801	116%
3. Low Season (Apr.Aug.,5months)	388 (0.24)	581 (440+141)	150% (113+36)	414	623	150%
Total	1,616 (1.00)	1,777 (1346+431)	110% (83+27)	1,723	1,895	110%

It is ideal that the capacity of ice-making shall be decided based on the demand of ice in the peak season which lasts three months, however, it is advisable that current state should be improved at first to cover nine months of intermediate and low seasons. The government of Antigua is planing to construct fishing complex (fuel stand, repair works, etc.) which will form a fish production base at Point Wharf in St. John's, and also plans for introducing adequate fishing boats for effective exploitation of offshore pelagic fish resources. Considering the circumstances, it is advisable to improve the ice supply conditions according to a progress of each fishery development stage on a step by step basis toward the target 1.5~2.0 times ice (ratio of ice and fish) which will meet the demand of fishermen.

Table 2-3-19 Ice Sales Records (Sep.'95~Aug.'96)

Month	Number of Pots	Q'ty (Kg/month)	Q'ty (Kg/day)
September	3,192	79,800	2,660
October	3,773	94,325	3,042
November	6,409	160,225	5,340
December	3,961	99,025	3,194
January	3,603	90,075	2,905
February	2,258	56,450	2,016
March	2,341	58,525	1,887
April	3,028	75,700	2,523
May	3,553	88,825	2,865
June	3,006	75,150	2,505
July	4,439	110,975	3,579
August	15,326	383,150	12,359
Total		1,372,225	

(Source : AFL)

② Chilled Storage

(a) Volume of fish handled by AFL

Average volume of fish which AFL handled in the past five years is abt. 30~50tons a year. Catches which AFL bought from August 1996 to June 1997 is estimated at abt. 30tons showing an yearly tendency to fall.

Table 2-3-20 Fish Purchasing Records (Oct.'96~Jun.'97)

Species	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Total	%
Big	61	39	577	215	28	106	130	127	194	1,480	6.56
Conch	59	98	0	0	0	19	0	0	0	176	0.78
Pelagic	97	0	0	0	0	0	8	529	0	634	2.81
Lobster	22	0	0	0	0	0	9	0	0	31	0.14
Mix	2,256	1,609	931	1,972	1,180	1,220	2,010	1,978	1,401	14,558	64.57
Red	498	0	384	226	266	553	1,070	1,303	96	4,396	19.50
Shell	1	0	0	20	0	71	44	5	28	169	0.74
Grouper	0	0	0	133	0	0	0	84	0	217	0.96
Snapper	0	405	0	158	0	0	0	249	0	812	3.60
Other	0	0	0	0	0	0	0	65	10	75	0.34
Sub-total	2,997	2,151	1,892	2,724	1,474	1,969	3,271	4,340	1,729	22,518	87.63
Import	0	0	0	473	886	0	1,824	0	0	3,183	14.12
Total	2,997	2,151	1,892	3,197	2,360	1,969	5,095	4,340	1,729	25,731	100.00

(Source : AFL)

Monthly average 2,573kg 30 tons per annum

The volume of fish processing by AFL is abt. 100~200kg a day. AFL purchases fish brought in by fishermen and also AFL collects fish from the local landings. Frequency of fish collection from local landings is once every 2-3 days or 2-3 times a week. 65% of the collected fish are small reef-fish priced at EC\$4.0 per pound. Big reef fish is at EC\$5.0, red fish is EC\$5.0, snapper is at EC\$5.5, etc. per pound. Purchased fish are put in cooler boxes and stored with an ice for processing. In off season 100~200kg are collected every 2-3 days, and in the peak season they arrive almost every day. AFL removes scale, gill, guts, etc. of fish and put them on sale at the shop. Big fish are slowly frozen in the refrigerator (-20°C, abt.14 m³) taking one day, and sold at the shop cut with handsaw in round slices. They make efforts for stable supply of fish and import fresh fish or frozen fish from Trinidad Tobago, Grenada, etc. in case of shortage of materials due to bad weather, etc.

(b) Capacity of chilled room

The volume of fish which AFL received was abt. 40tons on the annual average in the

past five years and not more than 50tons. Most fish are reef fish. AFL is a public enterprise established for the fisheries development. Then it is a major policy for AFL to purchases all the fish when fishermen brought their catches, regardless of stock of fish in AFL. Annual volume of fish handled by AFL will be set at 50 tons in this project. This is abt. 190kg purchasing for one day (260days a year, 5days a week). In the peak season (abt. 3months), abt. 300kg is expected which is 1.5 times of the above average (the past record is 700kg a day; November 27, 1996). Then abt. 1 ton capacity will comply with the demand even in the peak season provided that the chilled room will be used for temporal storage of both raw and processed fish. And the past data analysis shows that 927kg is the maximum requirement to the chilled room as shown below. The capacity must be abt. 1 ton as a result.

Table 2-3-21 Fish purchasing record in May 1997 (Unit: kg)

Date	Quantity	Date	Quantity
1997/5/01	48	1997/5/16	469
5/02	285	5/19	78
5/05	122	5/22	442
5/06	604	5/24	405
5/07	53	5/25	269
5/09	643	5/28	205
5/11	176	5/29	255
5/12	54	5/30	187
5/14	55		

(Source: AFL)

Monthly average	4000kg
Business days a month	20days
Daily average	200kg (=4000/20)
Q'ty to be processed (for the day)	200kg
Q'ty at the beginning of the day	400kg (=for the day + for another day)
Maximum quantity in the past	927kg (obtained as shown below)
One day maximum	643kg

Weekly maximum	1422kg
Daily average	284kg/day(=1422kg/5days)
Q'ty at the beginning of the day	
	927kg (=284kg + 643kg)

(c) Storage plan

Fish are currently kept in bags of poly-texture (same as rice bags). It is recommended fish are kept in piles of boxes in the chilled room to keep better quality and less space. Fish boxes are likely to need at AFL but they have their own procurement plan for boxes. The dimension of chilled room shall be determined by calculating necessary capacity for storing the fish boxes.

The size of fish box is 77cm(L)x45cm(W)x30cm(D) which can accommodate 25kg fish with ice. Then 36 fish boxes will be required in the peak season. Fish boxes storage spaces will be abt. 5 m² when three tiers of shelves are provided in the chilled room. For the carrying fish boxes, push cart shall be used. The working spaces will be abt. 11.5 m².

Then the total floor area will be abt. 16.5 m² and the chilled room dimension shall be abt. 4.5m and 3.6m (internal dimension) because of 6m span building in general.

③ Emergency Generator

Existing emergency generator is as old as 16 years, running for 8,500 hours. Annual average runnings are 530 hours (equal to 1.4 hours/day), showing extremely frequent usage. The hearing survey also proved that power failures of 2-3 times a month are usual. Backup power supply is essential for chilled room, ice-storage, fish sale showcase, etc. The capacity of ice-storage shall be designed to keep ice for two day's consumption. The generator shall be abt. 35KVA as details shown below :

<u>Items</u>	<u>Rated capacity</u>	<u>Plan</u>
Chilled Refrigeration		
Refrigerator	7.5kw	Stop

Fun motor(s)	0.6kw	Stop
Door packing heater	0.1kw	0.1kw
Defrost heater	10.5kw	10.5kw
Ice Storage		
Refrigerator	2.2kw	Stop
Fun motor(s)	0.4kw	Stop
Defrost heater	7.5kw	7.5kw
Door packing heater	0.1kw	0.1kw
Chilled show case (0 °C)	6.0kw	6.0kw
Security Light(Outside) 400W x10	4.0kw	4.0kw
Light (AFL, Market) 40W x 10	0.4kw	0.4kw
Night guards	0.1kw	0.1kw
Computer	0.2kw	0.2kw
Total		28.9kw

④ Processing Table

Abt. 1 ton of fish (raw material) will be processed a week (abt. 50 tons of annual processing). The size shall be of 3.0m x 1.6m which are calculated from the average volume of 200kg a day to maximum 300~400kg.

⑤ Fish Sales Showcase

Weighing ratio between products and raw material is abt. 80%, i.e. 40tons processed fish from 50tons of raw fish material. Of which 20t of fish are sold at the shop and the rest are delivered to large consumers. Abt. 80~120kg must be sold a day, 400kg a week estimated from annual handling volume of 20tons, with seasonal fluctuations taken into account. The showcase shall be a flat-open type, which is convenient for inspection and shopping of fish. The size of the display shelf shall be of abt. 3.5m x 0.7m.

⑥ VHF Radio Telephone

Most large fishing boats are equipped with VHF radio telephone, while some small fishing boats have handy radio telephone. Fisheries Division used to maintain a radio station for the safety of life at sea and statistical purposes, but not working

now. AFL will start the radio communication services instead of Fisheries Division in order to promote assistance to fishermen and improve a management of AFL's public services.

⑦ Insulated Pickup Truck

AFL's fish collection and delivery services;

Major location of fish collection, customers of fish products and the frequency are shown below. Any occupational driver is not employed. AFL officials collect and sell the processed fish when occasion demands. Abt. 70kg to 400kg of fish is collected each time. Delivery services are requested by telephone and AFL is regularly delivering to public organizations including the police office and the schools, etc. AFL's delivery service business in 1996 achieved abt. 46% of total handling. A system for delivery of processed fish shall be developed, which is expected to reach 20t a year while 50t of material is expected.

An insulated van truck shall be provided and effectively used for fish collection and delivery services of processed fish. Payload shall be an appropriate capacity of abt. 0.5tons, not so big, economical and convenient even a very short distance or long distance, so that better services may be provided.

Table 2-3-22 Fish collection sites and customers of AFL

Collection sites and Customers	Frequency (times / weeks)	Distance	Remarks
Weekly driving distance : about 200km			
Jolly Harbour	2	11.0km	
Crab hill bay (Johnson's point)	3	14.7km	Scattered between AFL and Old road
Falmouth Harbour	2	15.5km	
Old road	3	21.7km	
Brysons Wharf	2	17.0km	
Point Wharf	3	0.8km	St.John's
High Street Wharf	3	0.5km	

(Source : AFL)

⑧ Push Cart

Push cart will be used to carry ice and catches, both in and out of AFL building. The table size shall be abt. 0.75m x 1.2m, calculated from the capacity needed for ice transportation (125kg in 5 bags/each time). Number of carts are four; one for AFL, one for fish market and two for fishermen.

⑨ Weighing Scale

A scale for AFL's use (200-pound), and six for fish market (60-pound) (1 for every 2 booths) shall be provided. As the scale for AFL is used for weighing of raw fish, it shall be of salt resistant. Currently scales are used in the fish market which are of private possession, and accuracy is suspected inadequate with many weighing errors. This should be urgently improved.

⑩ Spare Parts

Spare parts for ice storage, ice-making machine, emergency generator, insulated pickup truck, push cart shall be provided. They shall be stored as initial stock and a system that will make one order after one consumption will be adopted. Usually it took about four months from order to procurement so the following spare parts which are expected to be replaced frequently, shall be stored for four months' consumption. As for vehicles and refrigerator, necessary spare parts for inspection after a running test shall be prepared. The other spare parts which are essential for operation and not easily procured shall also be added to the inventory.

Ice storage bin:

Refrigerant, Tools, Dryer, Fuse, Relay, Heater, Door packing

Ice plant :

Electric parts, Relay, Fuse, Refrigerant, Dryer, Wirings

Generator :

Packing for engine assembly, Starter plug, Oil filter, Fuel filter

Truck : Door packing, Valves, Fuse

Push cart : Wheel

2-3-3 Basic Design

Basic plan of this Project can be summarized as follows;

Table 2-3-1 Summary of Basic Design

Name	Description	Qty	Remarks
1. Facility			
1-1 Landing Facility (Wharf)	Steel sheet pile wharf, wharf length 130m, apron width 10m	1 lot	With anchor tension pile
1-2 Distributing Facility (Building)	RC building 2 floors (partly with steel frame roof structure), Floor area 1080m ²	1 lot	Foundation: Bearing of soil power
① Administration office ② Storage (f. gear) ③ Ice plant space ④ Cold storage space ⑤ Processing facility ⑥ Fish sale counter ⑦ Fish market ⑧ Fishermen's workshop ⑨ Common spaces, etc.	2F 216 m ² Total of ②~⑥ 576 m ² (1F) (*) Total of ⑦⑧ 288 m ² 180 m ²		*Including 36 m ² expansion space
1-3 Public Infrastructure Facility			
① Bus Terminal	8 berths x 3 lanes, platform with roof, total 24 berths	1 lot	
② Small shops	Concrete block building, 21 units, Dimension (3m x 4m=12m ²)	1 lot	
2. Equipment			
① Ice making/Storage	3.5tons/day x 2 units, plate ice, 15 tons ice storage	1 lot	
② Chilled room	Approx. 1.0 ton, -5°C	1 set	
③ Emergency generator	35KVA, Diesel engine drive	1 unit	
④ Processing Table	Stainless Steel 3.0m x 0.8m x 0.77m	2 sets	
⑤ Fish sale showcase	Chilld, 3.5m x 7.0m	1 set	
⑥ VHF radio telephone	Marine band VHF radio, 25W	1 set	with antenna set
⑦ Insulated truck	Payload 500kg, Pickup type insulated van	1 unit	
⑧ Push cart	Stainless Steel 0.7m x 1.2m	4 units	
⑨ Weighing scale	60lbs x 6 (for Fish Market), 200lbs x 1 (for AFL.)	7 units	
⑩ Spare parts	For Ice making machine, Cold storage, Generator, Push cart and Insulated van truck	1 lot	

(1) Site and Facilities Layout Plan

The site is rectangular in shape with 160m long in north-south and 50m width in east-west. Its north side faces existing AFL building, east side is along to Valley Rd.(9m width) and west side faces to the landing wharf.

Basic concept of site usage shall be focused on the following two points;

- ① Effective utilization of the restricted site area, and
- ② Dissolution of congested traffic by peoples, buses, cars and goods (landings from the fishing boats) at the site.

An access road shall be arranged at the northern end of the project site between the newly constructed wharf and the Valley Rd. The distributing facility building will be constructed along this access road.

The bus terminal layout shall be designed in accordance with the result of analysis on the current conditions of the west bus terminal, i.e. the traffic lines of people such as pedestrians, passengers and shoppers, etc. shall be separated from the buses and other vehicles, etc. in order to secure the safety at the bus terminal.

And as for the small shops, which are now scattered with the west bus terminal site, the southern boundary area near the existing bus-waiting shed shall be decided as a building site of small shops, because it is convenient for the shoppers, and an integrated small shops corner may create new traffic line of the people at the area.

A newly created land (abt.25m width) because of mooring wharf construction, may be efficiently utilized as a water front esplanade being provided with greenbelt, etc. by the citizens and visiting tourists.

(2) Landing Facility Plan (Mooring wharf)

1) Layout Plan

Several plans of landing facility have been studied and examined from the various point of views such as "function and design" "construction works" and "cost performance". As a result a reclaimed wharf plan has been decided as the most appropriate plan, then landing facility shall be designed in accordance with the reclaimed wharf plan.

The outline of landing facility is to reclaim abt. 25m distance from the existing wharf and to construct a mooring wharf for the fishing boat at the reclaimed front end. The total wharf length is 130m and an effective berthing is 115m which can be used by the fishing boats.

The shape of new wharf is just the same as the existing but extending abt. 25m offshore side. Major scope of works are as the followings;

- ① Reclamation
- ② Construction of mooring wharf
- ③ Construction of apron

2) Section Plan

The wharf construction is to be of steel sheet pile with back tension anchor pile. The life time of wharf is to be 50 years. The most easy corrosive part between low water and -1.0m of the steel sheet piles shall be protected with concrete covering (underwater concrete). The apron is made of concrete pavement with joints every 5m; the dimension is 130m long and 10m wide.

3) Terms of Design

① Design standards

In Antigua and Barbuda, ASTM and BS are generally used as a standard for materials of steel, concrete, etc. This project will use the following Japanese regulations/standards which are equivalent or more to the abovementioned ASTM and BS.

- a. Standad Fish Port Design Method :Association of Japan Fish Port
- b. Concrete Standard Specification :Association of Japan Civil engineering

- c. Japan Industrial Standard :Japan Standard Association
- d. Method of Soil Investigation :Japan Soil Investigation Society
- e. Method of Road Pavement :Japan Road Association
- f. Guideline of Sewage Design :Japan Sewage Design Association

② Tide

M.H.H.W.L.	+0.400m
M.L.L.W.L.	+0.200m
D.L.	±0.000m

Due to the little difference of tide level in St. John's, the design of wharf uses following formulas;

$$M.H.H.W.L. \div H.W.L.$$

$$M.L.L.W.L. \div L.W.L.$$

③ Mooring area and depth

(a) Mooring area

- Shore protection at northern end of wharf L=25m
- Mooring wharf (fishing boats) L=130m
- (Combine the following functions ; unloading, preparation and resting)
- Apron (To be used for refuge of small fishing boats.)

(b) Wharf facilities

Usage	Levee crown	Apron		Depth	Structure system
		Width	Pitch (slope)	Plan	
Mooring wharf for fishing boats	+1.30m	10m	2.5%	3m	Steel sheet pile construction

c. Depth

Scheduled depth is as follows;

- Small scale fishing boat (Below 10 tons) : Deeper than 2.0m
- Large scale fishing boat (Over 10 tons) : Deeper than 3.0m

4) Facility particulars and design conditions

① Boat speed limit

- Less than 10GT (Gross tonnage) : 0.5m/sec

② Bollard pull of fishing boat

- Less than 10GT : 1.0 ton per bollard
- Over 10GT and less than 50GT : 3.0 tons per bollard

Bollard of 3.0tons load are to be provided and arranged in accordance with the layout plan.

③ Loading capacity

- Ordinary : 1.0 ton/m²
- Seismic tremor : 0.5 ton/m²

④ Seismic force

Seismic load may be calculated based on the "CUBIC", but the "CUBIC" standard is for building construction, therefore, the facility of this project must be designed in accordance with the Japanese Standard. Then, it shall be examined whether "CUBIC" is fit for the civil engineering construction or not. Horizontal seismic load (V) against the self weight (W) of the structure is given by the following formula;

$$V = K'(W)$$

Seismic factor (K) of rigid structures (those with fundamental period of the structure less than 0.06 second) is given by the following formula;

$$K' = 0.5 \times Z \times I$$

Z : Seismic zone factor

(Z = 0.3 ; Because Antigua belongs to the Leeward Islands in the Caribbean sea)

I : Importance factor of structure

(I = 1.0 ; Because mooring facility is not perilous to life like hospital nor public assembly hall)

Then, the seismic factor (K) shall be as follows;

$$K' = 0.5 \times 0.3 \times 1.0 = 0.15$$

This figure (K'=0.15 as Seismic factor) is equivalent to the figure of "Landing wharf" or "Preparation wharf" in the Japanese Standards. And this figure shall be used for the designing of civil works in this project.

5) Corrosion

① Corrosion life time

50 years

② Corrosion speed

Average corrosion speed of steel is to be as follows;

Corrosion circumstance		Corrosion speed (mm/ year)
At sea	above H.W.L.	0.3
	H.W.L.~M.L.W.L. - 0.1m	0.1 ~ 0.3
	M.L.W.L. - 0.1m~ Sea bed	0.1
	Mud layer above the sea bed	0.03
On land	Atomosphere	0.1
	Underground (above residual water level)	0.03
	Underground (below residual water level)	0.02

③ Design conditions (Cathodic protection and thickness)

Exposed side surface of the steel sheet pile shall be protected with cathodic protection. Lasting time of cathodic protection shall be 30 years and remaining 20 years shall be covered with steel thickness. In addition, the most rapidly rusting layer of steel sheet piles (H.W.L.~M.L.W.L.-1.0m zone) shall be protected with an concrete covering made of under water concrete-cement.

6) Accessories

- ① Fenders :every 5m intervals along the wharf
- ② Bollards :every 5m intervals on the apron
- ③ Car stopper :every 1.5 m intervals on the wharf
- ④ Tie ring :at the endline of shoreside on the apron
(for lashing boats at emergency, etc.)
- ⑤ Palisade :boundary fencing at northern end on the apron
(for traffic restriction)

7) Unit weight and Internal friction angle (Civil works materials)

Materials	Unit weight (ton/m ³)	Internal friction angle (Degree)	Remarks
Steel	7.85	-	
Reinforced concrete	2.45	-	
Concrete	2.30	-	
Cement-mortar	2.20	-	
Wood	0.80	-	
Sand / Gravel	1.8 (above residual water level)	35	Back filling materials
	1.0 (below residual water level)	35	
Unscreened Gravel	1.8 (above residual water level)	30	
	1.0 (below residual water level)	30	

8) Design coefficient, etc.

The followings will be used for designing of steel structures.

- Young's modulus 2.1 x 10⁵ kg/cm²
- Elastic modulus (shearing) 8.1 x 10⁵ kg/cm²
- Poisson's ratio 0.30
- Coefficient of linear expansion 12 x 10⁻⁶ /°C

9) Allowable stress

① Allowable stress of steel material

Kinds of steel materials	Ordinary δs (kg/cm ²)	Seismic tremor $1.5 \times \delta s$ (kg/cm ²)
Steel sheet pile (SY295)	1800	2700
Structural steel (SS400)	1400	2100
Tie rod (SS400)	(40mm Φ and less) 960	1440
	(40mm Φ and less) 880	1320

② Allowable stress of reinforcing bar

Kind of reinforcing bar	SD30A · B
Allowable tensile stress	1800 (kg/cm ²)

10) Strength of design standard

Reinforced concrete : 210kg/cm²

11) Covering

Concrete covering of reinforcing bar shall be 7 cm or more : where confronts to sea or strong briny air.

(3) Design of Building Facilities

1) Plot plan and section plan

① Office

Offices are to be arranged at the first floor while the processing room and store rooms are at the ground floor. The first floor is to be provided with one(1) manager's office, three(3) office rooms, one(1) meeting room, one(1) set of pantry/toilet and corridors, stairway, etc. A balcony of one meter width is to be constructed at outside of the first floor which to form another escape route at emergency.

② Fishing gear storage

Fishing gear storage for retailing shall be arranged at the ground floor and is to have 144 m² floor area. Two tiers of shelves are to be provided with along the internal walls for an efficient stowage of fishing gears.

③ Ice making facilities

Ice making facility is used by the fishermen; those who belong to WBS come on foot to AFL for purchasing an ice, and by car in case of other local fishermen. For the convenience of both fishermen from WBS and other fishing villages, an ice making facility shall be located at the northern part of the building along the access road to the new mooring wharf. Internal approach is suitably arranged between ice storage and processing space. As the ice making machine is installed on the ice storage housing, the spaces ceiling height shall be abt. 8 m.

④ Cold storage

Cold storage space shall be arranged and designed adjacent to the processing space, with an area of 36 m².

⑤ Handling and Processing space

Processing space shall be arranged at the northwest corner on the ground floor facing to the landing wharf. Entrance door is to be arranged on the seaside wall

and fish handling space adjacent to the door in order not to make "in-out of fish" complicated. Assorted fish is to be treated with ice and stored in the cold storage room. These handling spaces are to be provided too. Processing space is to be arranged along the assorting place, and spaces for processing tables, fish scaling tool, band-saw, vacuum sealer are to be provided. And also space for additional cold storage shall be provided.

⑥ Fish shop (for retail)

AFL's fish shop is to be arranged on the ground floor, next to the fish marketing space. One(1) set of chilled showcase and cashier's space shall be provided in the shop.

⑦ Fish market (for fish retailers)

Marketing space is abt. 72 m² with 12 booths inside. The fish market is to be arranged at the southwestern part of the building in parallel and next to the fishermen's workshop considering smooth fish flow after landing. There shall be an open space with steel structured roof but with no wall. Each booth shall be provided with a set of selling table of 0.8m(D) and 1.5m(L); the table is to have water drain so that display can be used with enough ice and washing water.

⑧ Fishermen's Work Shop

Fishermen's workshop of 120 m² is to be used for washing, assorting spaces of catches after landing. Partition table which can be multipurposely used for fish scaling, temporal stowage of fish boxes, etc. shall be provided between the fish market and the workshop. Fish unloading is mostly in the morning time, then fishermen may use this space efficiently for resting, preparation of fishing and other purposes in the afternoon. Other facilities of water faucets, fishermen's toilet (15 m²) and fishing gear storage (21 m²) are inevitable. Fishing gear storage may be used for fishermen's locker room when they are fishing at sea.

2) Structure plan

① Standard for structure design

British Standards and USA Regulations are mainly used in Antigua and Barbuda. There is also CARIB CODE for the caribbean countries. Building facilities of this project shall be designed in accordance with the Japanese Construction Standard while the BS, CARIB Code, etc. will be referred to, but sewage system shall be designed in accordance with local standard in Antigua and Barbuda.

② Outline of structures

Building	Super-structure	Sub-structure
Fish distributing facility	Reinforced concrete structure partly with steel frame roof	Concrete floor with foundation of bearing power of soil

③ Design load

(a) Fixed load

Weight of structural materials, finishing materials and equipment will be calculated respectively. Unit weight of each major construction material will be used as follows;

Concrete	2.30 ton/m ³
Reinforced concrete	2.40 ton/m ³
Concrete-mortar	2.00 ton/ m ³
Concrete block	300kg/m ³ (19cm x 19cm x 39cm)

(Including filling concrete, joint mortar and reinforcing bar, etc.)

(b) Live load

(Unit : kg/m²)

Portion	Slab and small beam	Column, large beam	Seismic force
Roof	30	10	0
Office, etc.	300	180	80

Designed live load to the roof shall be of "No walking" "No suspension" except for

the occasion of construction and inspection.

(c) Wind load

With reference to the hurricane records on the wind data, wind load of 60m/sec is obtained and the pressure is calculated in accordance with the Japanese Standards.

$$V_s = 60 \text{ m/sec}$$

$$p = 0.125 \text{ kg sec}^2/\text{m}^4$$

$$q = 1/2 \times 0.125 \times 60^2 = 225 \text{ kg/m}^2$$

Design velocity pressure will be 225kg/m² with uniform distribution in height and direction.

(d) Seismic force

As the Antigua Island stands on the west indie's older (or outer) volcanic arc in the caribbean volcanic zone, every building shall be designed for full quake resisting. Base shearing of Co=0.2 shall be considered as in Japan.

(e). Major materials and allowable stress

Material	Standard	Long term allowable stress (kg/cm ²)			Short term allowable stress (kg/cm ²)		
		Comp- ressin	Tension	Shearing	Comp- ression	Tension	Shearing
Concrete	Fc= 180kg/cm ²	60	-	6	120	-	9
Reinforc- ing bar	SD295 (JIS)	2000	2000	2000	2000	3000	3000
Structural steel	SS100 (JIS)	1600	1600	900	900	2400	1350

Salt damage on steel bars is anticipated due to usage of local product for aggregates of concrete. The aggregates shall be washed by fresh water and shall be satisfied with the allowable salt content (equivalent to JASS 5.11 class). Concrete structure members shall be carefully designed as well as mixing of concrete. As the natural conditions against the steel structures are very severe, surfaces of steel frames shall be fully treated and galvanized to prevent rusting and quick deterioration of the structural members which are exposed to the weather.

3) Facility plan

① Water supply facility

City water shall be supplied to the site. Branch piping of 30mm ϕ is to be installed from the existing city water main line along the Valley Rd. Rain water tank is to be provided. Rain water shall be collected from roof of the building, and used for cleaning the fish market and fishermen's workshop. For the city water supply, a headwater tank shall be installed because city water pressure is not sufficient and existing building is also equipped with it.

② Sewage facility

Public sewer system is not available. Sewage facility shall be planned as follows.

- (a) U-type ditches and water pits discharging into the sea shall be installed.
- (b) Toilet sewage shall be collected into the septic tank at first, then discharged into the sea.
- (c) Waste water from the fish market and processing space, etc. shall be guided and collected into the treatment tank, and discharged into the sea.
- (d) Fish market shall be equipped with strainers at drainage ditches of each booth in order to protect fish scales and other fish segments flowing directly to the treatment tank.
- (e) Water pits shall be installed at processing space and put on washable strainers to avoid fish scales and other foreign elements flowing to the treatment tank.
- (f) Sewage system shall be designed in accordance with local standards in Antigua and Barbuda.

③ Electric facility

(a) Transformer

There is power-line of 380V/220V, 50Hz at existing AFL site. Electricity shall be supplied from the power line through the distribution panel installed at the ground floor of the fish distribution building, then delivered to the bus terminal, main building and Fish market, etc.

(b) Lights and outlet-plug

Lighting shall be planned in accordance with the policy that natural lighting be used as much as possible. Electric lamps are of fluorescent type and mercury vapour lamp in view of durability and efficiency. Outlet-plug shall be arranged as suitable for electric appliances and equipment used in the building.

(c) Telephones

Telephones are to be provided at the fish distributing building as follows;

Manager's office, office rooms, fish shop and processing space (Total 6 places)

(d) Calling up bell to the fish landing-in door

The processing area door from landing wharf is to be closed usually for the reason of sanitation. Door bell shall be provided for convenience both fishermen and AFL.

④ External arrangement plan

Exterior design of the site such as pavement is very important as well as fish landing and distributing facilities in view of the functions.

(a) Pavement plan

Access road at the northern side of AFL and fish market between Valley Rd. and the wharf, bus terminal road and parking area shall be paved with concrete. Pedestrian path other than the abovementioned shall be paved with asphalt. Rubbish collection spots are to be finished with mortar cement and provided with an appropriate slope for easy floor washing and cleaning-up.

(b) Sewage plan in the site

The site has a slope of 1/50 down to the seaside from Valley Rd. Each one sewage pit at the both ends of wharf apron shall be installed, and the sewage network shall have two routes. Sewage ditches and pits are to be suitably arranged to prevent flooding due to the squalls and rainfalls.

⑤ Construction material plan

Procurement of the construction materials shall be planned in full consideration of both imports from abroad and local products, and in accordance with the following conditions.

- Construction site is facing seaside and salt damage is anticipated.
- High temperature by tropical sunshine and high humidity over 72% all the year round.
- Sanitary materials shall be selected which are easy to clean and not easily get dirty because handles perishable fish food.

Major finishing materials shall be as the followings;

(a) Exterior finishing

- Roof : Weather proof material integrated with insulation
- Wall : Reinforced concrete with paint finishing

(b) Interior finishing

- Floor : Office rooms : Vinyl tile covering
Fish processing area, Fish market, Fishermen's workshop : Epoxy paint finish on concrete
- Wall : Office rooms : Plasterboard with paint finish
Other spaces : Paint finish on mortar with concrete block
- Ceiling : Office rooms : Plasterboard with paint finish

(Roof truss portion of the fish market is to be finished with painting.)

- Door, shash, etc.:

Outer doors shall be of painted bonded-steel of anti-corrosion. Lattice net for crime prevention shall be provided to the windows on the ground floor external walls.

⑥ Air conditioning

Offices and processing area shall be provided with an air-conditioning equipment, respectively.

(4) Public infrastructure facilities

① Bus terminal

Three (3) lanes of bus terminals with eight (8) berths on each lane shall be provided (24 berths in total, with roof).

② Small shops

Twenty one (21) small shops building shall be arranged at the southern end of the project site. Each shop has a frontage of 3m and 4m deep in dimension. Interior works shall be done by each tenant after handing over to the Antigua government because of too many variations of service-shops.

③ Structure

<u>Building</u>	<u>Super-structure</u>	<u>Sub-structure</u>
Bus terminal	Steel frame roof	Concrete floor, Independent footing
Small shops	Reinforced concrete block construction	Concrete floor and continuous footing

(The other structures are to be equivalent to the fish distributing building.)

(6) Equipment

① Ice making machine

(a) Frame structure

Structure :	Steel frame
Dimension :	Approx. 1000mm(L) x 4300mm(W) x 3750 (H)

(b) Machine

Quantity :	2 units
Outside design temperature :	35°C
Kind of raw water :	Fresh water
Raw water design temperature :	28°C
Power requirement :	3 phase 380V, 50Hz

Ice making capacity	: 3.5 tons per day
Type of ice	: Plate ice
Location	: Over the ice storage bin
Compressor	: Approx.30kw
Refrigerant	: Fron R-22
Condenser	: Air cooling type, anti-corrosive type (fin and tube)
Accessaries	: Exhaust duct of condensor (stainless steel)

(c) Ice storage bin

Quantity	: 1 unit
Capacity	: 15 tons
Outside design temperature	: 35°C
Storage temperature	: 0~-5°C
Power supply	: 3 phase 380V, 50Hz or single phase 220V, 50Hz
Dimensions	: Approx. 8100mm(L) x 2700mm(W) x 2900mm(H)
Compressor	: Approx. 2.2kw
Refrigerant	: Fron R-22
Condenser	: Air cooling type, anti-corrosive type (fin and tube)
Insulated panel	: Colored steel plate with 100mm insulation
Accessories	: Exhaust duct of condnsor (stainless steel), Thermometer, Relief valve, Door heater, Drain trap and tube

② Cold storage

Quantity	: 1 unit
Outside design temperature	: 35°C
Storage temperature	: -5°C
Power supply	: 3 phase 380V, 50Hz

	or single phase 220V, 50Hz
Inside Dimensions	: Approx. 4500mm(L) x 3600mm(W) x 2750mm(H)
Compressor	: Approx. 7.5kw
Refrigerant	: Fron R-22
Condenser	: Air cooling type, anti-corrosive type (fin and tube)
Door	: Approx. 900mm(W) x 1750mm(H)
Insulated panel	: Colored steel plate with 100mm insulation
Accessories	: Sus-shelves, Exhaust duct of condensor (sus), Grating (wooden), Door heater, Relief valve, Thermometer, Drain trap and tube

③ Generator

Quantity	: 1 unit
Output	: 35KVA
Output voltage	: 380V, 3 phase
Engine	: Diesel engine
Control system	: Automatic start and stop when power failure
Fuel oil tank	: 400 liters

④ Processing table

Quantity	: 2 units
Dimensions	: 3050mm(L) x 830mm(W) x 770mm(H)
Material	: Stainless steel plate (top plate :3mm thick or more)

⑤ Fish sale showcase

Quantity	: 1 unit
----------	----------

Outside design temperature : 35°C
Temperature : 0~-4°C
Compressor : 6kw
Power supply : Single phase, 220V, 50Hz
Dimensions : Approx. 3500mm(L) x 800mm(W) x 750(H)

⑥ VHF Radio telephone

Quantity : 1 unit
Band : Marine VHF band
Power supply : 220V
Attachment : Microphone, whip antenna, antenna mast (2m), antenna setting attachment, antenna cable (30m), metal fitting and wire (for antenna setting), power supply cable(10m), spare fuses

⑦ Insulated van truck

Quantity : 1 unit
Type : Pickup type
Engine : Gasoline engine 2200 cc
Loading Cap. : 500kg
Insulation : 50~100mm urethane insulation, aluminium panel with insulation

⑧ Push cart

Quantity : 4 units
Type : Fixed handle type
Dimension : Approx. 1200mm x 750mm
Loading cap. : 500kg
Materials : Stainless steel

⑨ Weighing scale

• For AFL

Quantity : 1 unit
Type : Platform type
Capacity : 200 lbs
Material : Stainless steel (Outside covering)

• For fish market

Quantity : 6 units
Type : Balance type
Capacity : 60 lbs
Material : Stainless steel (scale-bowl)

⑩ Spare parts

(a) For Ice making machine and refrigerating facilities

:Refrigerant, Ref-oil, Tool set, Spare parts of compressors, Spare parts of controllers

(b) For generator

:Engine overhauling packing, Ignition plug, Oil filter, Fuel filter, etc.

(c) For insulated van

:Door packing, Electric bulb, etc.

(d) For push cart

:Wheels

2-3-4 Basic Design Plan

Figure - 1 Location Map

Figure - 2 Site Plan

Figure - 3 Fish Landing Facility (Wharf) Plan

Figure - 4 Fish Landing Facility (Wharf) Section

Figure - 5 Distribution Facility Plan

Figure - 6 Distribution Facility Plan and Section

Figure - 7 Distribution Facility Elevation

Figure - 8 Public Infrastructure (Bus Terminal and Kiosk) Plan

Figure - 9 Public Infrastructure (Bus Terminal and Kiosk) Section

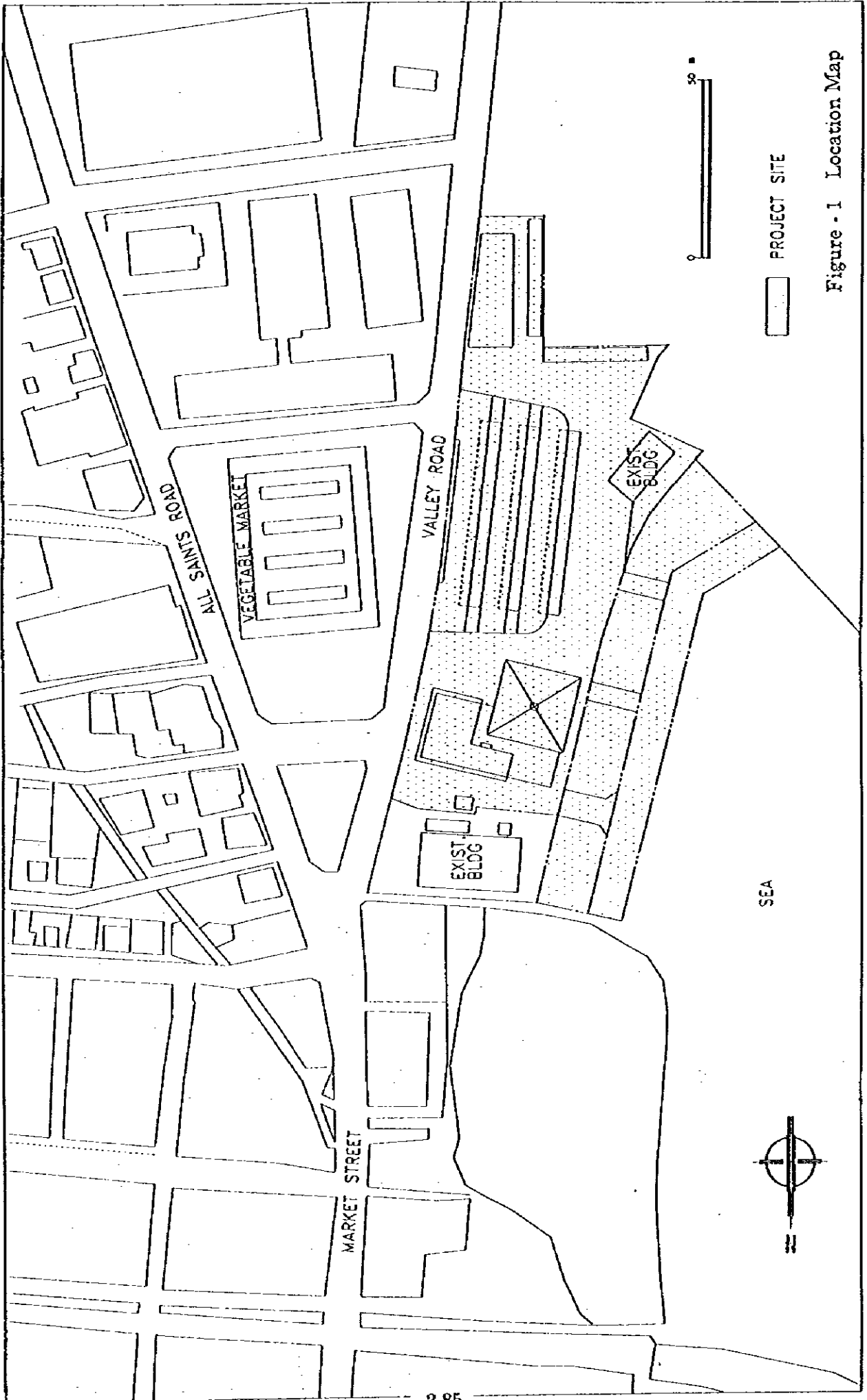


Figure - 1 Location Map

LOCATION MAP

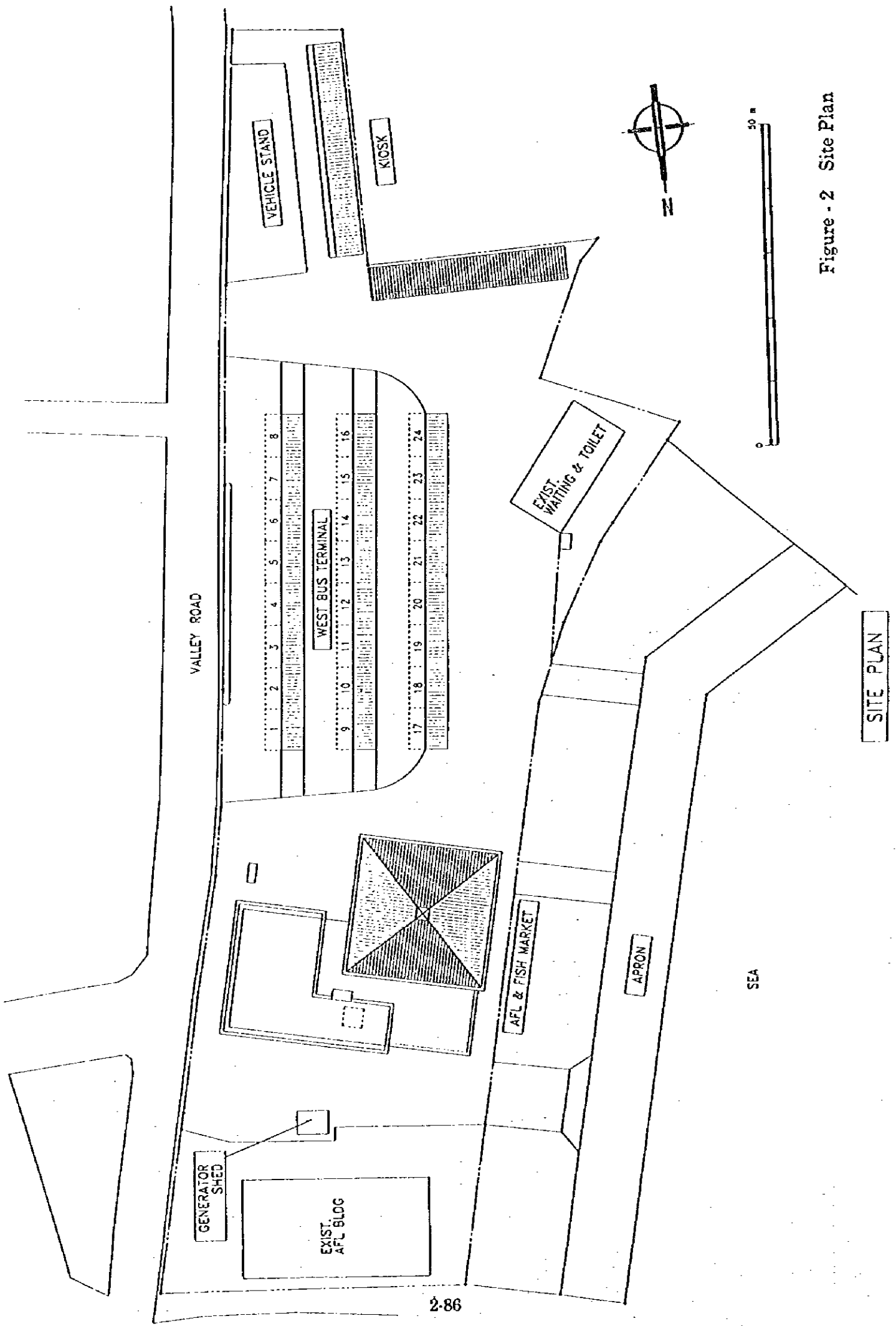


Figure - 2 Site Plan

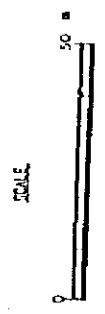
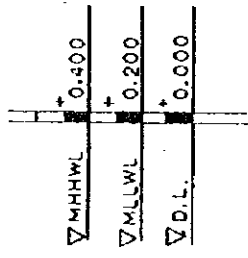
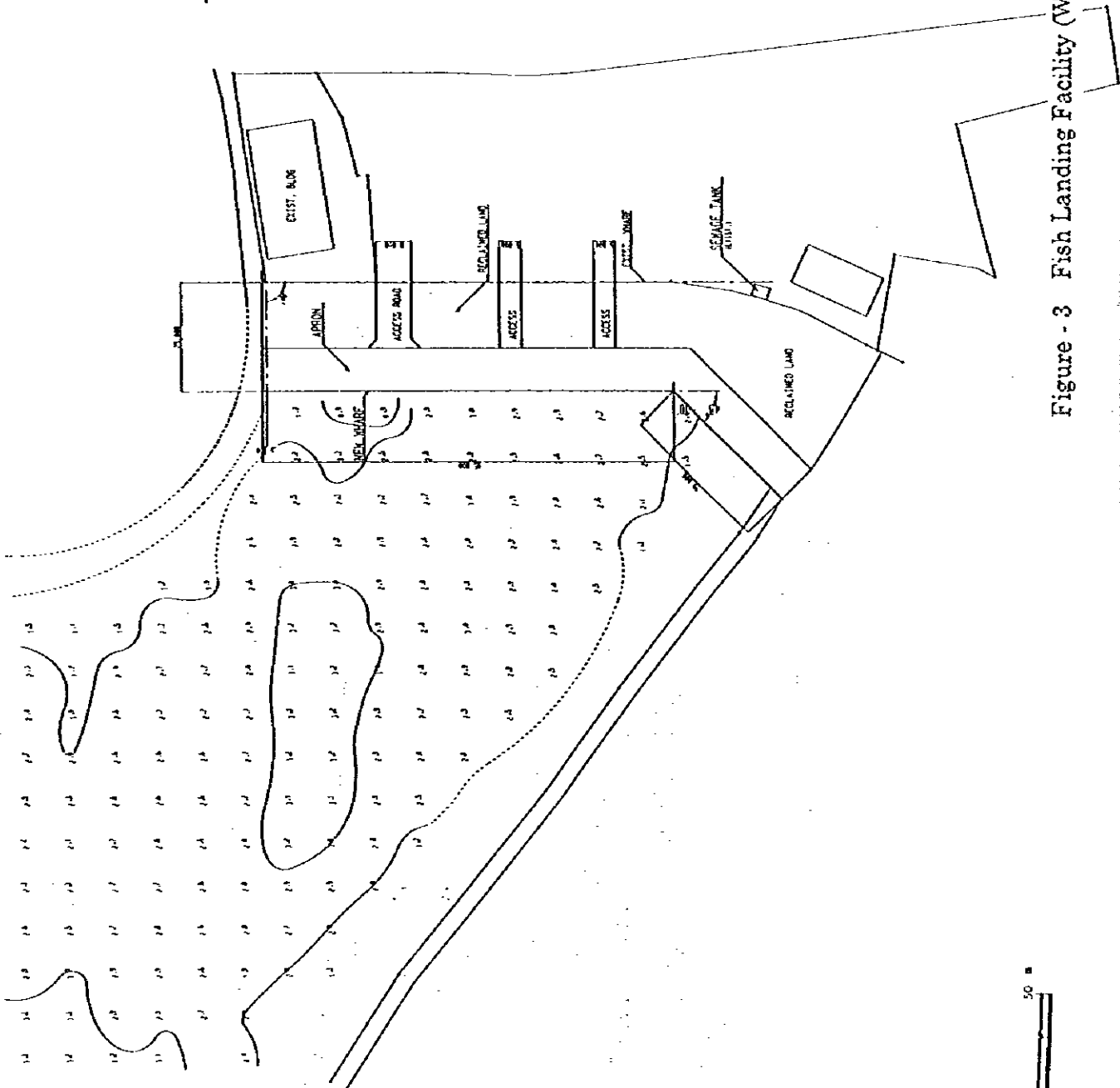


Figure - 3 Fish Landing Facility (Wharf) Plan

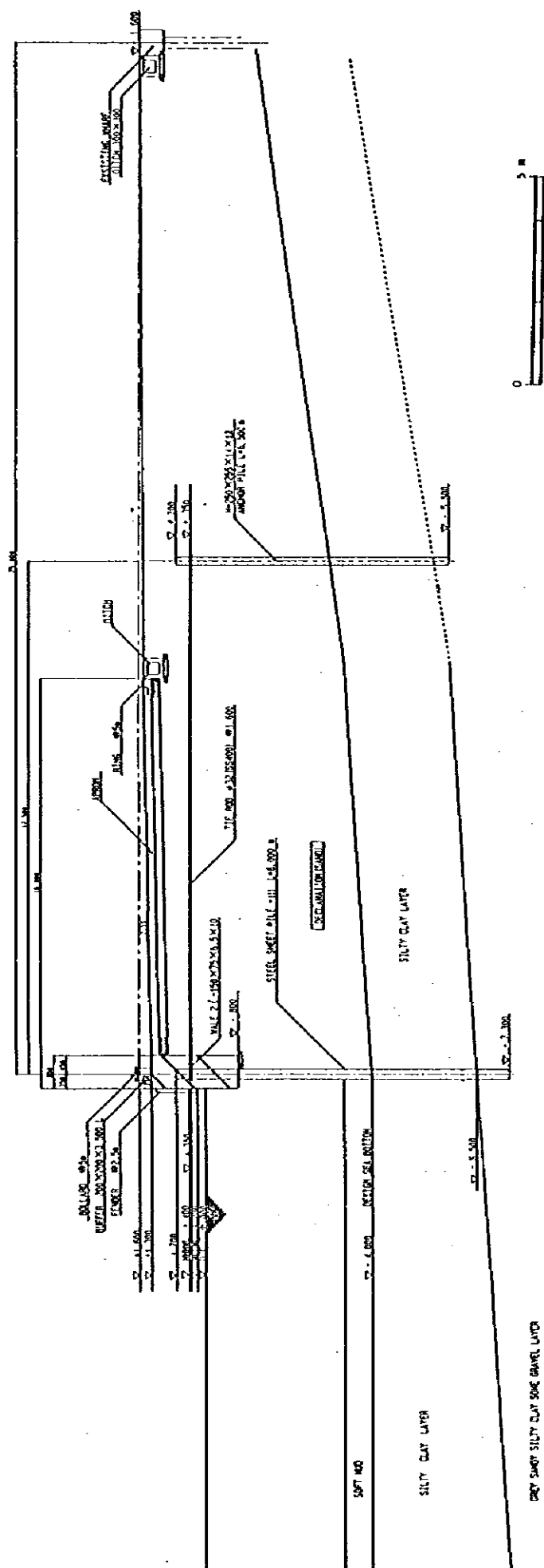
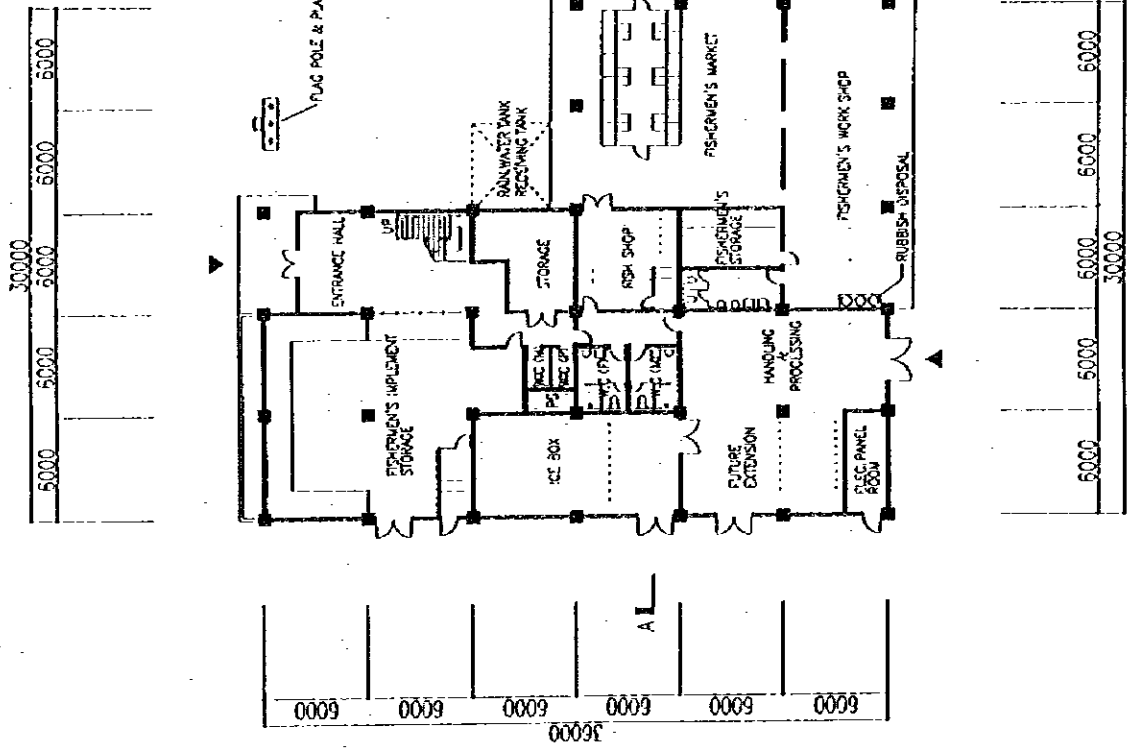
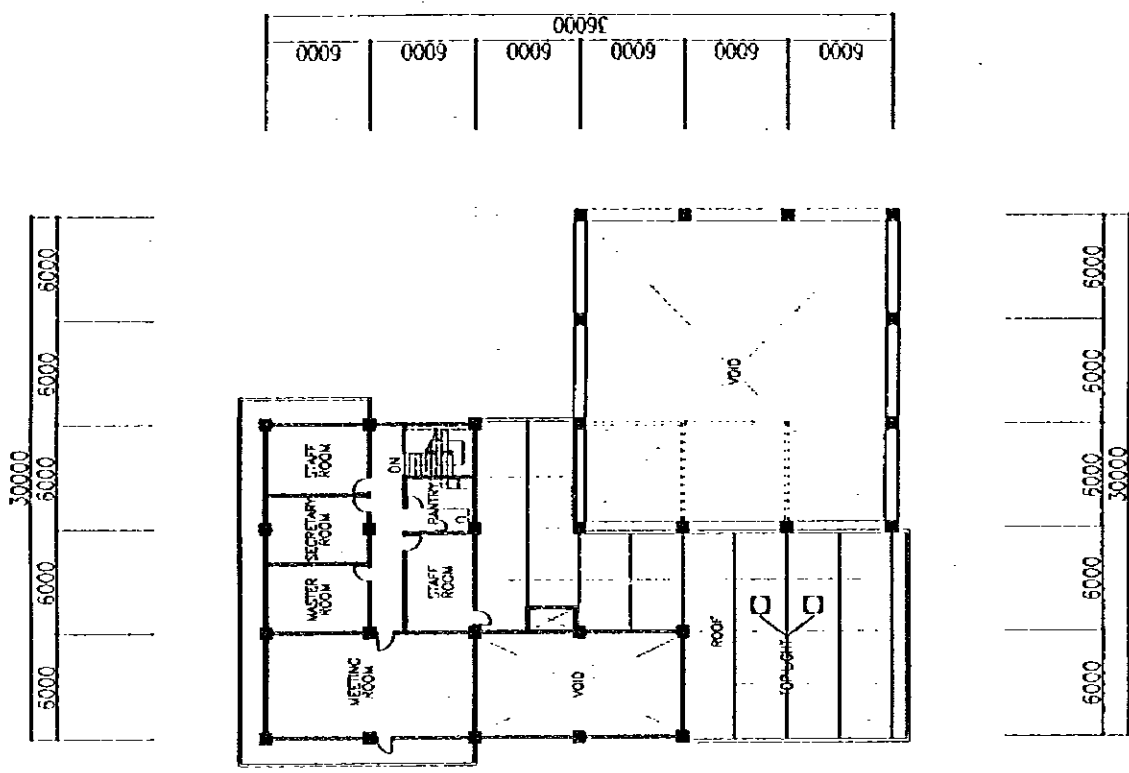


Figure - 4 Fish Landing Facility (Wharf) Section



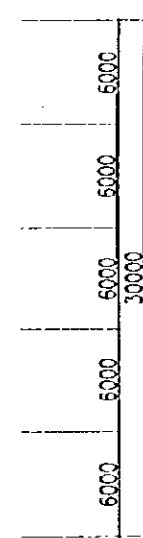
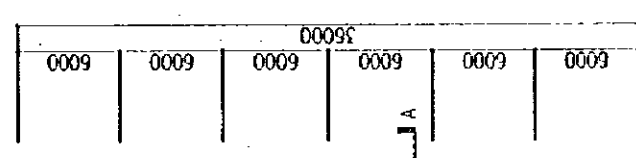
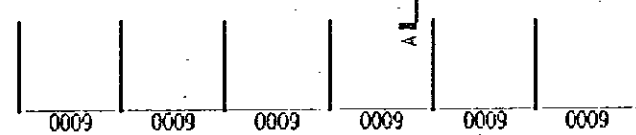
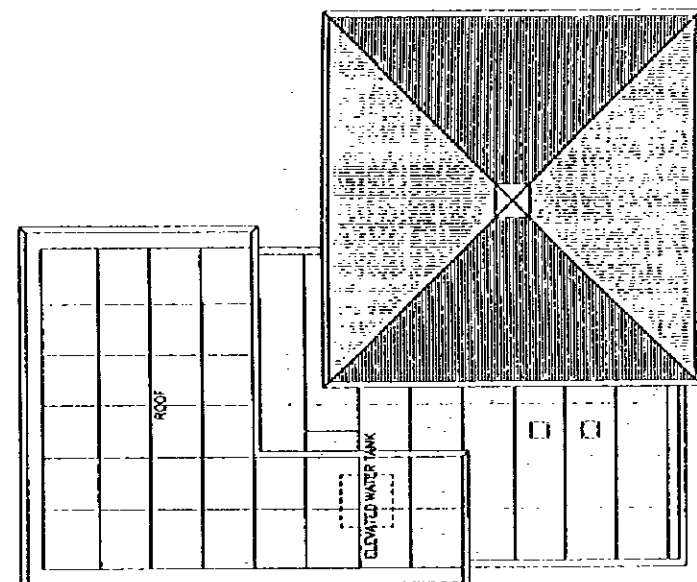
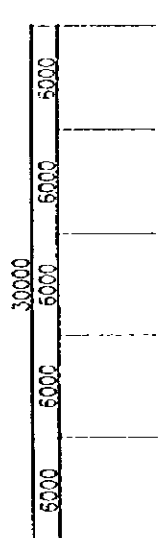
GROUND FLOOR PLAN



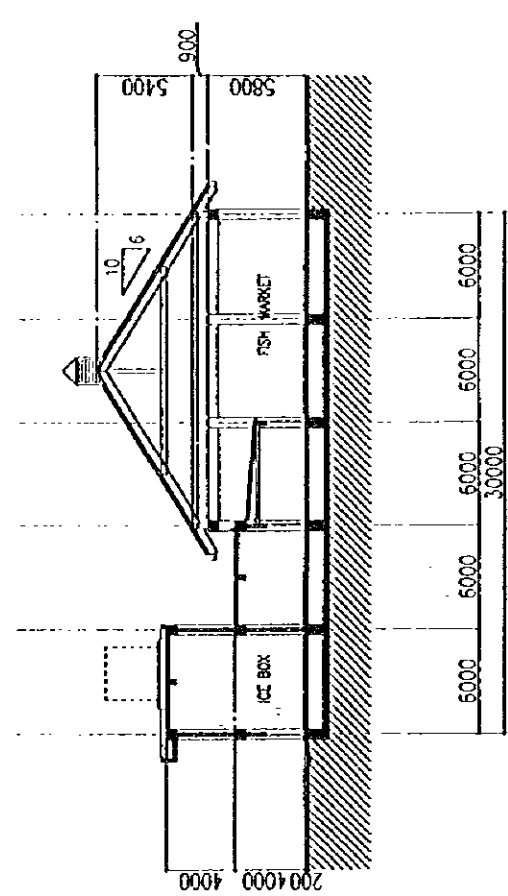
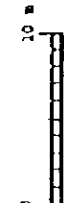
FIRST FLOOR PLAN



Figure - 5
Distribution Facility Plan
AFL & FISH MARKET



ROOF PLAN

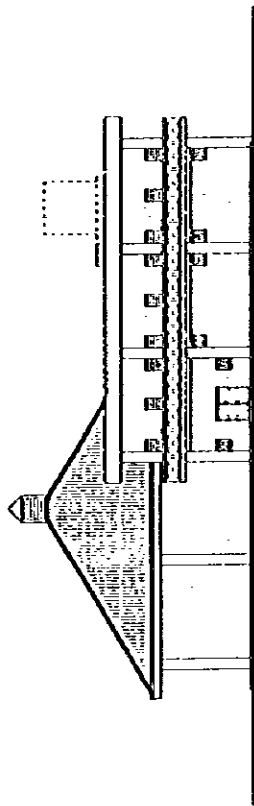


SECTION A - A

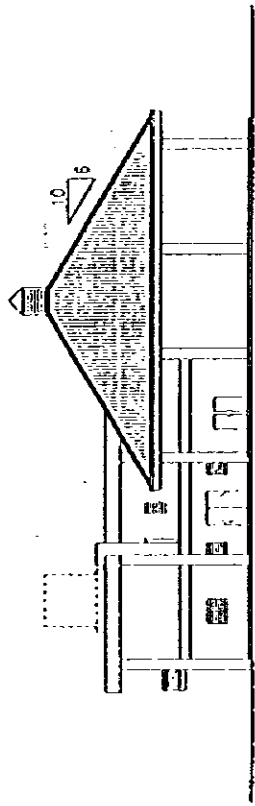


Figure - 6 Distribution Facility Plan and Section

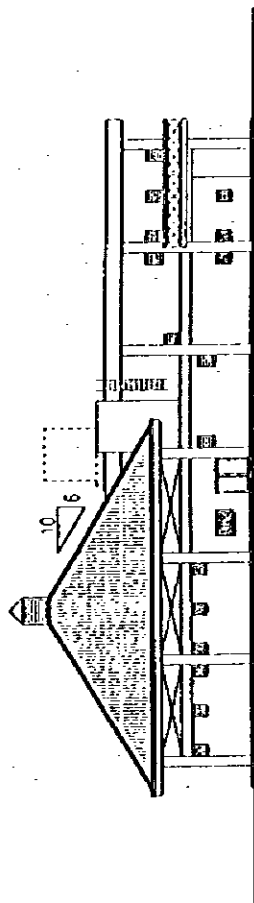
AFL & FISH MARKET



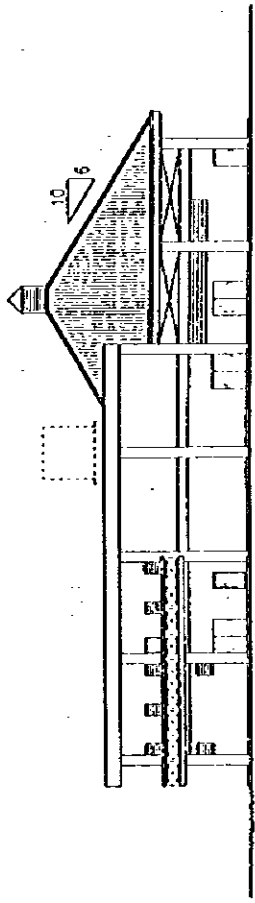
EAST ELEVATION



WEST ELEVATION



SOUTH ELEVATION



NORTH ELEVATION

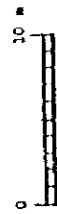


Figure - 7 Distribution Facility Elevation

AFL & FISH MARKET

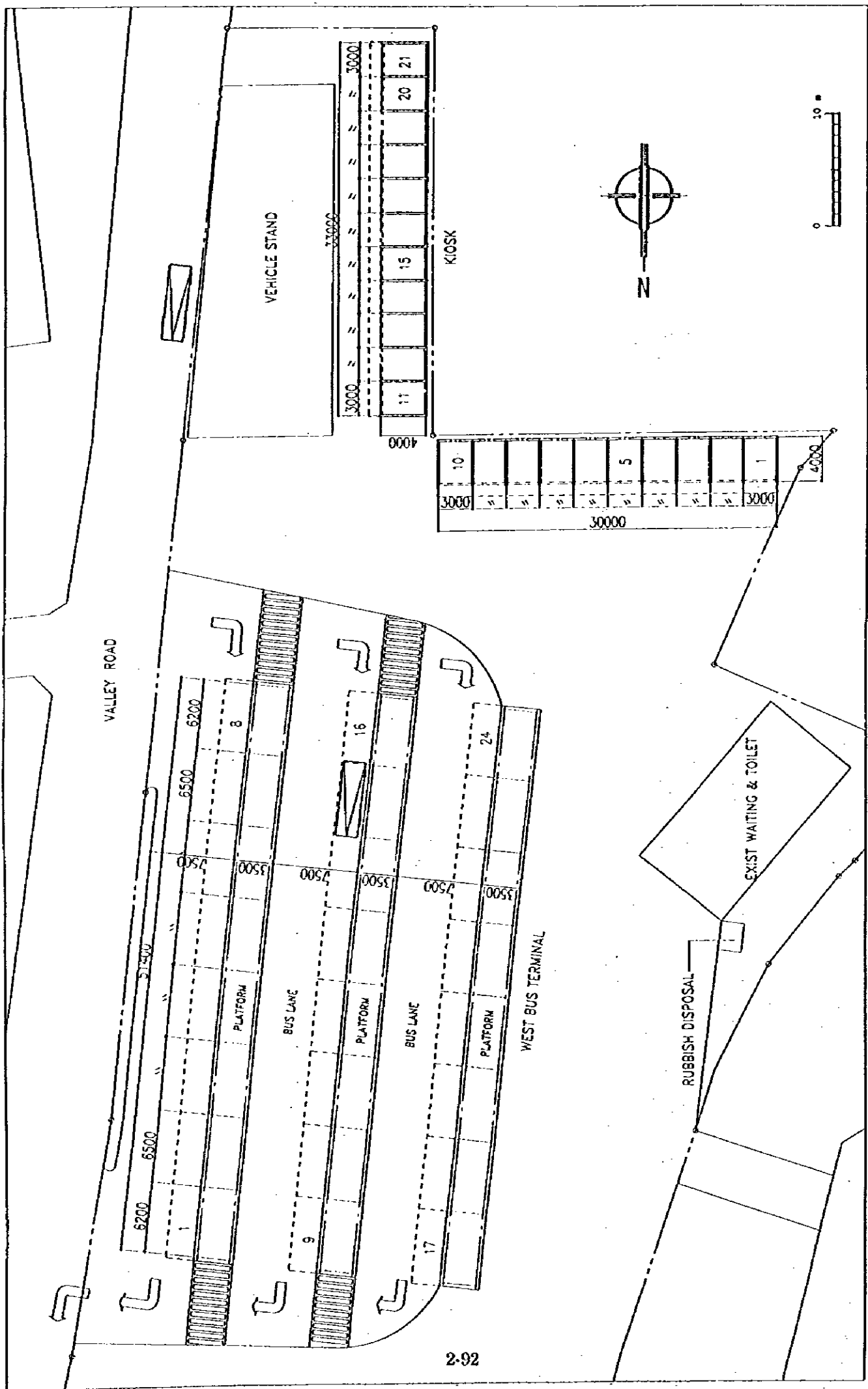


Figure - 8 Public Infrastructure (Bus Terminal and Kiosk) Plan

WEST BUS TERMINAL & KIOSK

PLAN

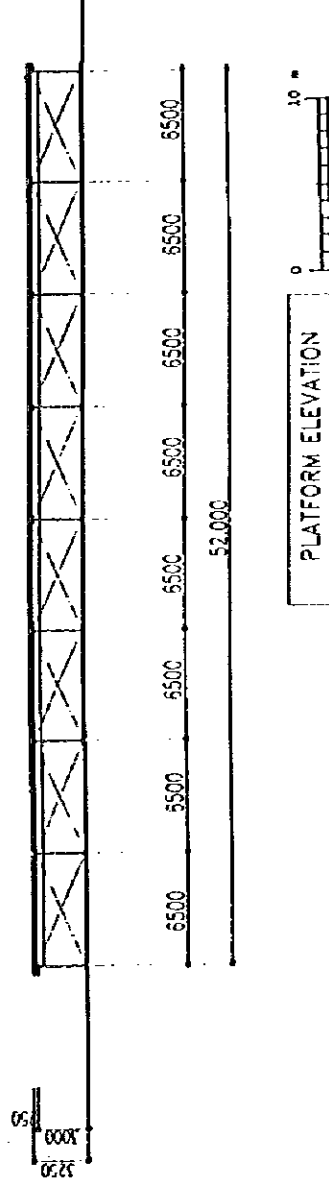
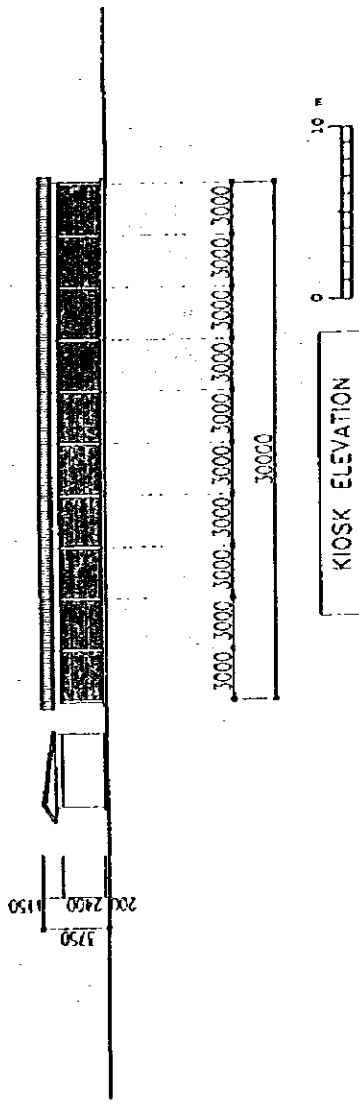
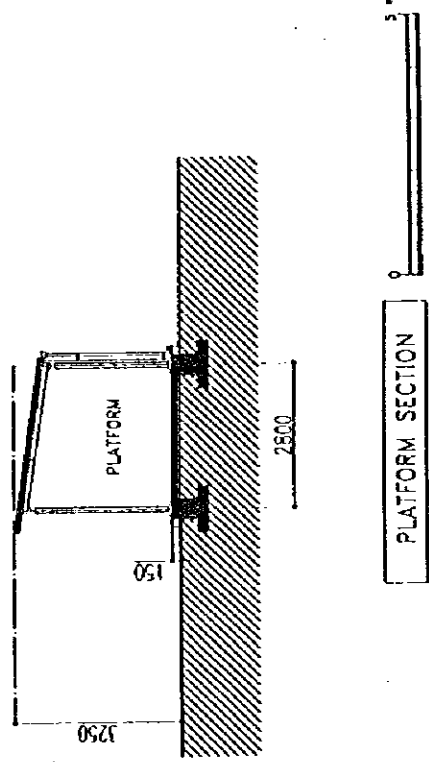
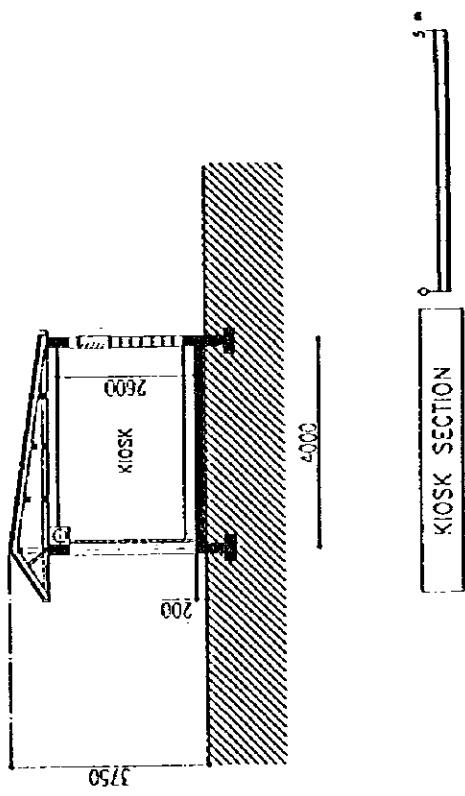


Figure - 9 Public Infrastructure (Bus Terminal and Kiosk) Section

WEST BUS TERMINAL & KIOSK