

Chapter 2 Contents of the Project

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2-1 Basic Concept of the Project

(1) National Plan Target and Project Target

1) National Target

This project contributes to the development target shown in “the third midterm economic development strategy (1998 to 2000)” which is the state level fisheries development plan of Grenada.

- ① Contribution to national economy
- ② Sufficiency to the demand of domestic fisheries products
- ③ Income increase of people related with fisheries industry
- ④ Expansion of job opportunities in countryside
- ⑤ Promotion of commercial fisheries for Grenada fishermen and the following targets shall be achieved.

The National Target of this project is to promote the contribution of Fishery sector in the primary industry of Grenada Economy and the concrete targets are shown below.

- ① Contribution to the promotion of self sufficiency ratio of food in Grenada
- ② Contribution to the increase of acquisition of foreign currency and cash earning by the fish export
- ③ Contribution to the increase of employment opportunity

2) Project Target

The facilities in the existing fisheries center which has been damaged by hurricane “TVAN” shall be restored in Gouyave district and as well as the function enhancement of facilities responding to the change of fisheries pattern and the consolidation of the existing fish market, the safety management system of operating fishing boats shall be intensified.

3) Outline of project

This project will consolidate the existing fisheries center and the existing fish market and improve jetty at Gouyave district in St. John county where is located at north west of Grenada Island in order to achieve the above mentioned target and as well as the New Fisheries Center will be constructed, radio tower and repeater shed for the observation of activities of fishing boats of Gouyave operated in offshore, west coast of Grenada, receiving the transmitted signals at an emergency and so forth will be constructed.

(2) Outcome of the Project

1) Expected achievement

The expected achievement by this project will be as follows.

- ① Fisheries basic infrastructure, facilities of fisheries production and distribution base facilities and equipment will be provided by the consolidation of the existing fish market function into the New Fisheries Center and the rehabilitation of the existing fisheries center and its improvement of the function.
- ② Radio tower and repeater shed being possible to receive the transmitted signals at an emergency and observation of activities of fishing boats operated in offshore, west coast of Grenada will be constructed.
- ③ The operation and management framework of the New Fisheries Center will be established.

2) Scope of the Cooperation

Figure 2-1 (1) shows layout plan of the project. And Table 2-1(1) shows the drafts of the request of the Government of Grenada, and the Basic Design. The scopes of the cooperation in the Project by the Government of Japan are Basic Fisheries Facility, Fishery Production • Distribution Infrastructure, Communication Facility for Fishery and equipment.

In addition, concerning the breakwater including in the request of Grenada Government, the tranquility and the topography change in port mouth involving the construction of breakwater were studied. As the result of the study, neighboring topographical change was anticipated therefore, a jetty type which the influence on the neighboring topographic change is lesser has been considered. The study result is shown on the tranquility study (7-4) and topographic change study of port mouth (7-5) involving the construction of breakwater.

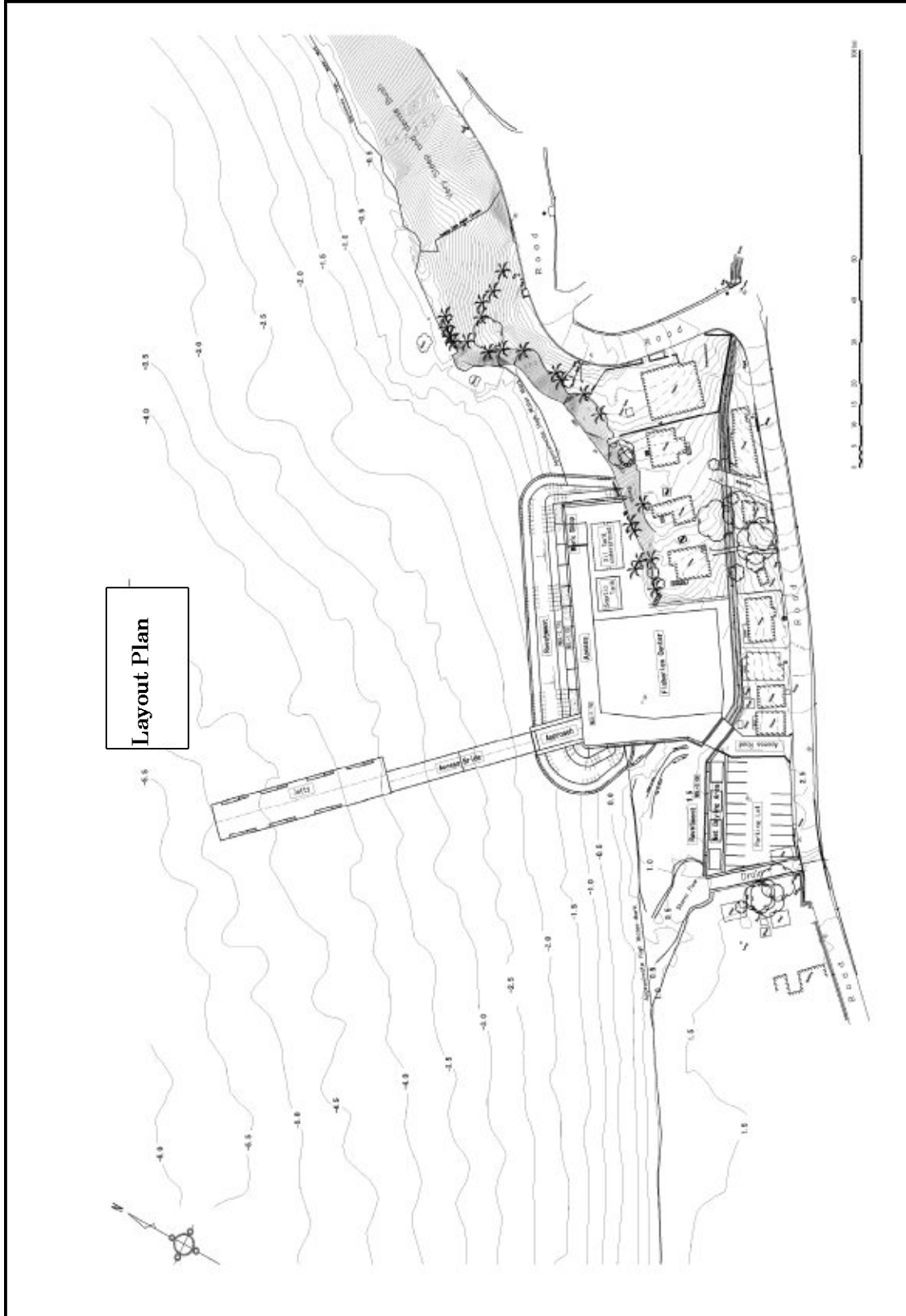


Figure 2-1(1) Project Layout Plan

Table 2-1(1) Components Comparison between Request and Basic Design Stage
Components requested by the Government of Grenada

Item	Usage	Specification	Spec/Quantity	Remarks
(1) Basic Facility for Fishing Port				
1 Breakwater	Improvement of wave condition around existing Jetty	170m Rubble mound (with wave absorbing function)		
2 Partial improvement of existing Jetty	Improvement of landing & preparation for fishing (for long line fishing boat & trawler targeted large size offshore pelagic fish)		Jetty length: 88m Steel Pipe Pile with anticorrosion 145m for berth section and 38m for access section)	• Width of berth section: 9m. Width of access section: 4.88m • Included removal of existing jetty
3 Jetty lighting facility	Lighting facility for night work around jetty	2 sets	4 sets	
4 Installation of gasoline & diesel supply pipe lines	To supply fuels to out & in board engines from the jetty	2 sets	Installation of pipe trench (250mm x 250mm x 94m)	(Supply piping for oil and water: is installed by Grenada)
5 Slipway facility	A slope for lifting boat to maintain and repair	60 m ²		
6 Slipway	For loading a boat on this	Corresponding to 28 ft to 45 ft		
7 Lorry	For haul up a lorry	Power driven (12 t)		
8 Driving winch	Yard for maintain and repair boats lifted up	160m ²		
9 Boat yard	Room to maintain & repair for out & in board engines	25 m ²	Work shop (27.04m ²), RC structure	
10 Engine repair room				
(2) Fisheries Production & Distribution Facilities				
1. Landed fish treatment, storage and process facilities				
1 Chest freezer	Storage mainly for domestic sales of large size pelagic fish and its processed products	120 m ³ x 2 rooms	Blast freezing room with 17 m ³ ice storage room with 87 m ³ slow freezing storage room with 117 m ³ in -20°C -25°C	Blast freezing room: 250 kg/day, -25°C - 30°C. Freezing storage room with 20 hours one time fish volume: 3.5 t at -20°C for about 2 weeks. Slow freezing room: 4.3 t/day, -20°C -25°C for about 3.5 days. Ice storage at -5°C for 1.5 days storage. Ice storage: fish volume: 1.1 ton/day
2 Cold storage room	2 to 4 days storage mainly for exporting tunas	20 m ³ x 2 rooms		Fish storage volume: 540 kg/day at -20°C for one month
3 Bait room	Storage flying fishes etc. used for long-line fishing	20 m ³ x 2 rooms		
4 Ice machine & Ice storage room	Ice to be used for preparation of fishing, quick freezing of landed fish and its storage, domestic transportation and sales in fishing market of fresh fishes	Ice making capacity with 4 t/24 hours flake ice. Ice storage room (volume with 10 t)		Concrete made with Terrazo finishing
5 Vending booth	Fresh fish sales for consumers in Gouyave district	10 booths		Weighing tools and storage cases are born by the Government of Grenada
6 Fish receiving & Cleaning room	Sorting, cleaning and weighing of landed fishes	Floor area with 80 m ² x 1 room		
7 Fish primary treatment room	Cleaning, gutting and removing scales of small size fishes to be sold in fish market	Floor area with 20 m ² x 1 room		
8 Fish cleaners sink	Cleaning, gutting and removing scales of small size fishes to be sold in fish market	10 sinks		
9 Fish processing room	Process for fillet, round slice & etc of large size pelagic fish for domestic caught in high season (processing products are stored as frozen and supply stably o meet	Floor area with 100 m ² x 1 room		Insulated storage box and processing equipment are born by the Government of Grenada
2. Facility management and Sanitary facilities				
Fisheries Center				
1 Manager's office	Business execution and receiving center; guest	1 room		RC structure (total floor space with 1,110m ²) Fisheries Division: 1 room, Market management: 1 room
2 Administrative office	Management of the center	1 room (Fisheries Development Office cum Data Processing Room)		Fish Market Management Office x 1 room
3 Training & conference room	Fisheries supervising and training to fishermen, FR activities, & fishermen's conference	1 room		1 room
4 Warehouse for material	Storage for stationeries, documents, tools and etc.	1 room		1F Warehouse for management (storage for cleaning tools)
5 Staff toilet, & shower room	Sanitary & welfare facilities for staff	For men x 1, women x 1, with washing & shower (1 room)		
6 Staff changing room	For staff	1 room		
7 Toilet & shower for fishermen & vendors	Sanitary & welfare facilities for fishermen & vendors	Toilet for fishermen x 2, shower x 3 (cum vendors)		
8 Changing room for fishermen & vendors	For fishermen & vendors	1 room		Included in the above
3. Revetment and outlaying facilities				
1 Land reclamation and backfilling	Securing land for the New Fisheries Center	800 m ²		
2 Revetment & Parapet wall	Protection of the New Fisheries Center from waves	100m. Parapet: 25m		
3 Grating covers	Grating cover for rain water in site and making use of project site	80 m ²		Settlement bridge (Concrete made)
4 In port access road	Securing smooth and safe working environment in project site	L 95 m		
5 Concrete pavement	Securing smooth and safe working environment in project site	850 m ²		
6 Exterior Lighting, Illuminations	Securing night work in project site and its guard duty	4 sets		
7 Sewage treatment plant	Treatment for sewage water generated in project site and domestic waste water and environment			Septic tank, Removal of oil pollution from boat yard
8 Car parking	Securing convenience for visitors and fishermen			Concrete pavement
4 Facilities concerning fisheries				
1 Dry storage room	Mending of fish nets			
2 Beacon light	For calling port by fishing boats			3 m x 5 m 4 sets with temporary roof 1 Beacon light with solar generation) Distance: 5 n miles (same as existing facility)
(3) Remote communication facility				
1 Antenna	Expansion of communication coverage of VHF radio loaded on fishing boats (Presently fixed type with boat with about 25 n miles change and expand to portable type with about 50 to 90 n miles)	Self standing communication antenna tower (U-type steel structure with the height of 180 ft)		
2 Repeater installation shed	Installation of VHF repeater, storage (just beneath antenna or the side)	3 m x 3m		Necessary separation between repeater installation and office due to protection of radio disturbance
3 Marine VHF Repeaters	Communication rely between VHF radio loaded on fishing boat and Gouyave land station (1 for primary reception and 1 for mutual communication)	Power (50 w x 2)		
(4) Equipments				
1 Forklift	For landing, loading and transportation of landing fish and ice loading			1 vehicle (LPG specification) Loading capacity: 1 ton
2 Truck with crane	Fishing landing and transportation			1 truck (2 tons) Lifting capacity: 1 ton

(3) Policy for the establishment of the Project frame work

1) Project size (Frame)

a) Setting of planned standard date

It is necessary to set project standard date in order to provide project size at Gouyave district. In order to set the project standard date firstly, selecting the sequence of large volume of fish landing per day from the first to the tenth from the maximum landing volume of two months in row out of monthly landing volume of a year is general method.

However, as Figure 2-1(4) to (6) show, it is difficult to apply this since the fluctuation of daily landing volume is too big at Gouyave district. And so, as shown in Figure 2-1(2), with the use of the standard date and daily fishing port distribution of annual landed volume of Japan(the record of landing volume in Grenada can be considered as the landed volume in landing place), the landing volume of project standard date is to be set.

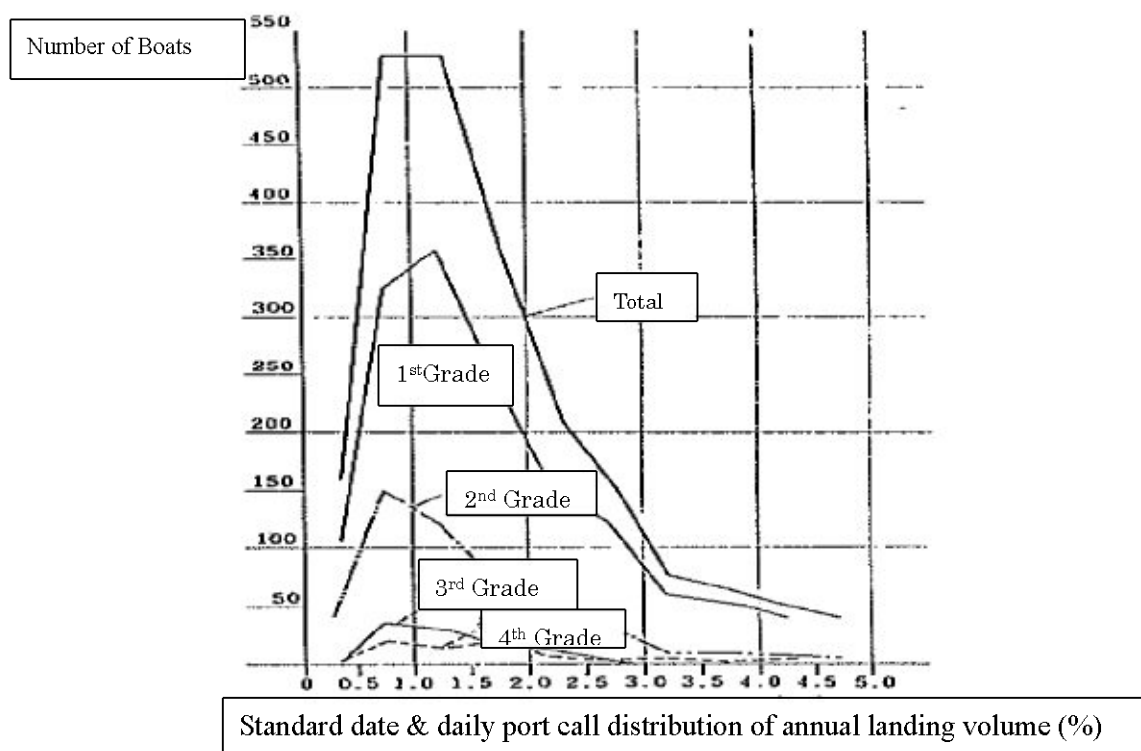


Figure 2- 1 (2) Standard date & daily port call distribution of annual landing volume
(Quote: Guidance of Fishing Port Plan, 1980 issued by All Japan Fishing Port Association)

According to the Figure 2-1(2), it is understood that there are many fishing ports to show 0.5 to 1.5% of annual fish landing volume as landing volume in the standard date. It is 0.8 to 1.8% in the fourth-Grade fishing port which is similar with the project fishing port size. And so, in this project, annual ranking analysis is executed based on the obtained record of landing

volume in three years from 2005 to 2007 as the standard date, the tenth volume with 5,500 lbs/day (2.5 tons/day) which is the minimum value to be able to cope with peak day in high fishing season and effective operation of preservation facilities under the percentage of 0.8 to 1.8% is properly decided as project standard date in Gouyave district. As the information, this value is 0.87% of annual fish landing volume.

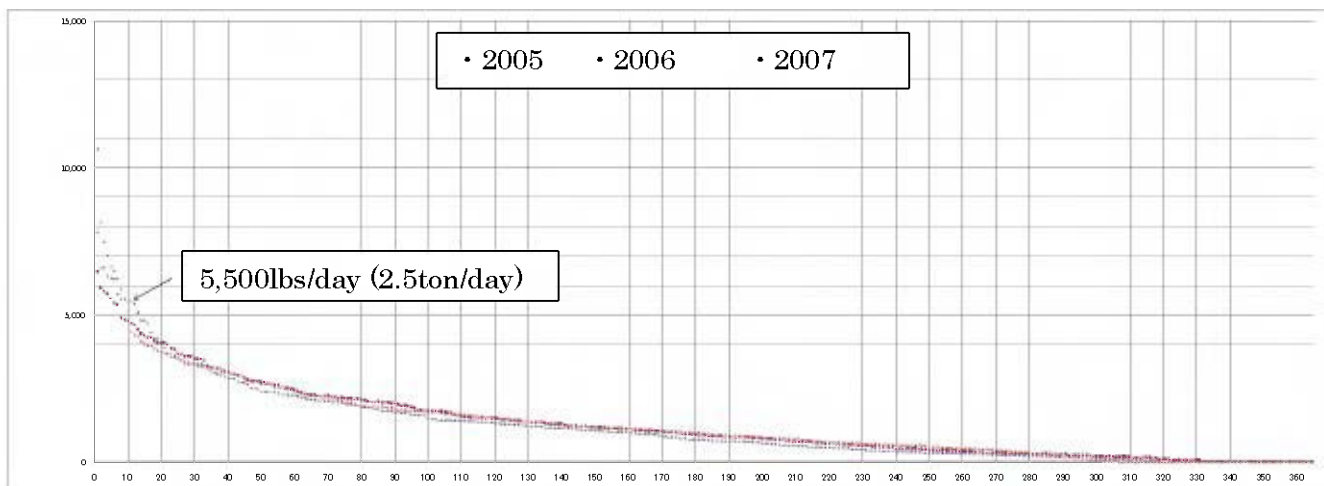


Figure 2-1(3) Fish landing volume at standard date

The relevance of fish landing volume in project standard date is judged by the volume to be able to cope with the peak time volume and not to be excessive investment. Figure 2-1(4) to Figure 2-1(5) show the relations of annual landing volume from 2005 to 2007 and the volume of project standard date. According to these, the volume of project standard date (5,500 lbs/day: 2.5 tons/day) is below in a few days than the peak volume however, as the volume in peak time is not continued more than three days, it is considered to be able to cope with the effective operation of preservation facilities and the ice storage capacity (10 tons). Thus, it is understood that setting of landing volume in project standard date is appropriate.

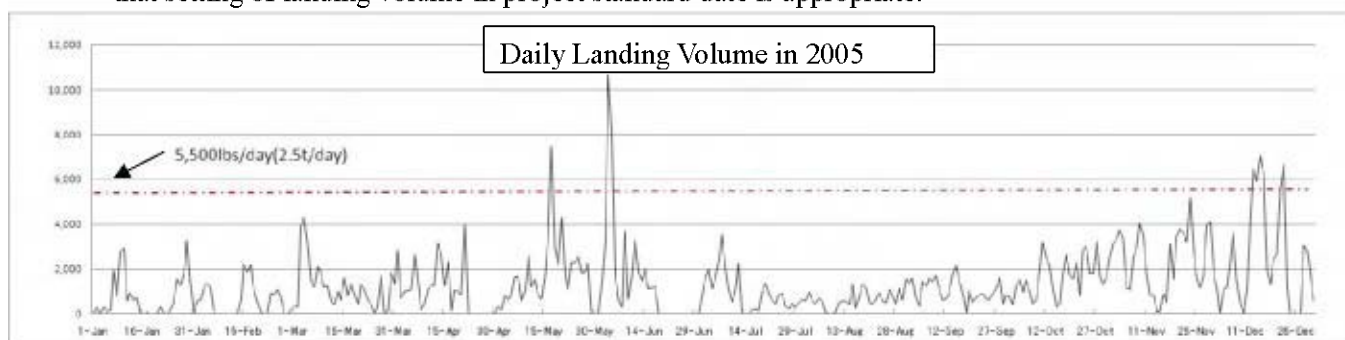


Figure 2-1(4) Relation between daily landed volume and its standard date in 2005

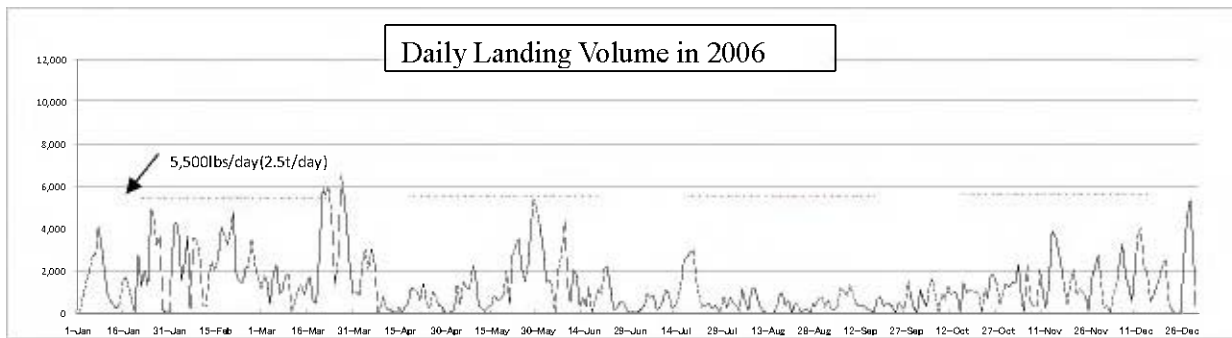


Figure 2-1(5) Relation between daily landed volume and its standard date in 2006

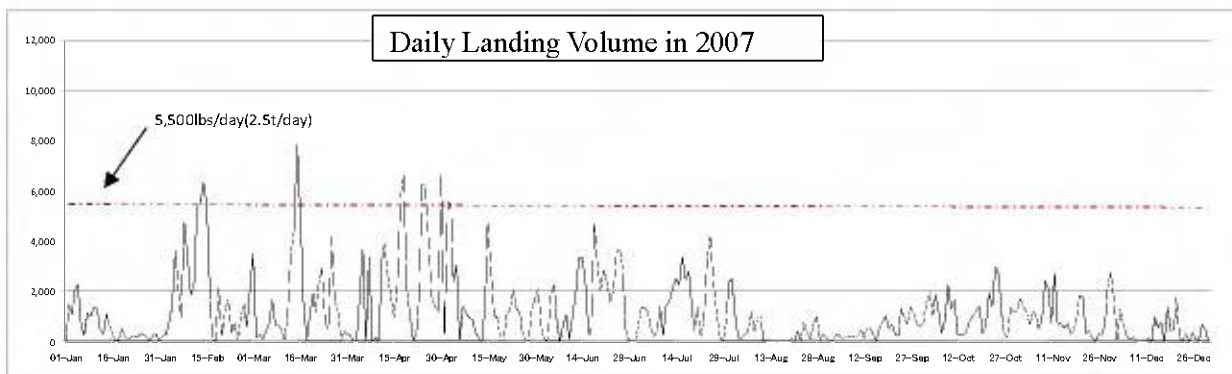


Figure 2-1(6) Relation between daily landed volume and its standard date in 2007

b) Consideration on number of fishing boats in concurrent operation

Based on the daily landing record in fishing boat at Gouyave in 2005, 2006 and 2007, tenth 31 boats in the project standard date is defined as the number of fishing boat in concurrent operation by the annual ranking analysis. Now, according to the fishing boat ledger of Fisheries Office, the number of fishing boats of Gouyave in 2007 is 151 and 88 boats are registered and the number of fishing boats in operation is 148. According to the questionnaire survey shown in 4) asking the days in operation, the result was about 6 days in a month. That is, the operating ratio of fishing boats in Gouyave is considered to be 20% ($6 \text{ days} \div 30 \text{ days} = 0.2$). Therefore, 31 boats which is the number of fishing boats in concurrent operation is 20.5% of 151 fishing boats of Gouyave and it is considered to be appropriate number of boats in concurrent operation.

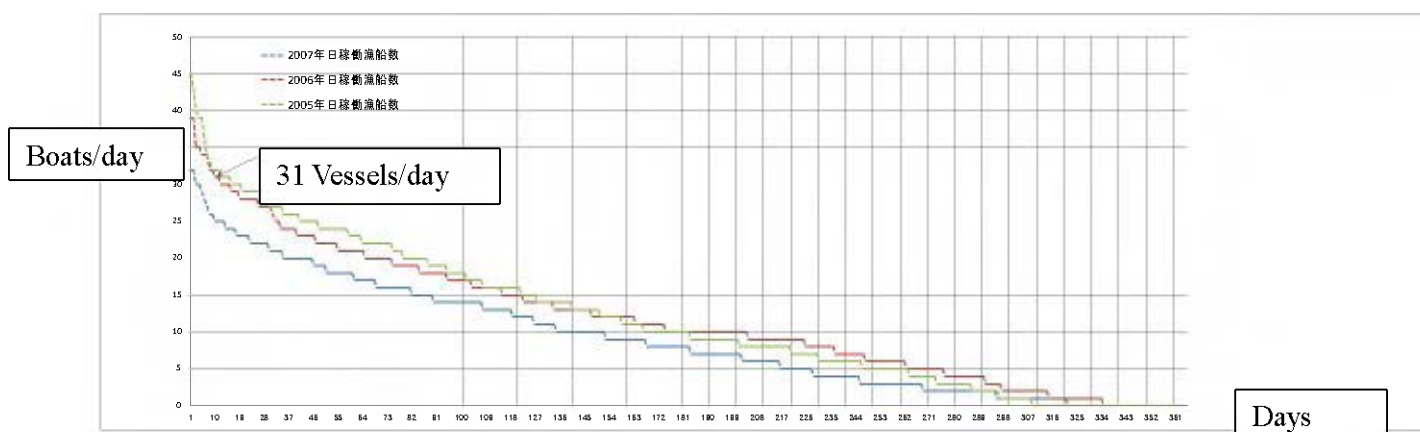


Figure 2-1(7) Number of boats in concurrent operation in planned standard date

Table 2-1(2) Breakdown of Number of Fishing Boat in Fishing Method

Fishing Method	Number of Fishing Boat
Longline	42
Light longline	34
Small longline	12
Hand line	23
Small line	8
Bank fishing	3
Gill net	1
Beach seine	18
Others	10
Total	151

(Remark) Others including Shellfish, Shrimp, Turtle and others

c) Handling of landed fish in planned standard date

From the result of Interview Survey and Questionnaire Survey (picked up 58 fishing boats (38%) out of 153 boats: 151 boats registered plus 2 boats registered in other port and picked up 24 persons (65%) out of 37 persons of Vender · Retailer), as Figure 2-1(8) shows landed fish in Gouyave are considered as ① Fresh fish is 10% ② Temporary storage is 30% ③ Cold Storage is 60% (50% + 10%) based on Handling · Storage Method. Figure 2-1(9) shows the status of fishery product distribution in Gouyave. The issues are the 9.8 % of post harvest loss and 10% which need Blast freezing & Cold storage out of Stored fish (a kind of offshore pelagic fishes) as shown in Figure 2-1(8) have no other choice to sell as domestic consumption since they cannot be exported since the freshness cannot be maintained due to the lack of cold storage capacity in Gouyave. These Blast freezing &

Cold storage are equal to 10% of stored fish shown in Figure 2-1(8). In order to resolve the issues, upgrading and expanding of cold storage and chilled storage capacity are necessary. The specific method for preservation of freshness as Figure 2-1(10) are required to have three systems with ①Blast freezing →Cold storage, ②Cold storage and ③ Chilled storage. The storage capacity shown here requires storage area(refer to Page 2-43~P2-51 for the calculation grounds). Figure 2-1(10) shows the recommended method for adopting mixed storage of large fish with Wire mesh Pallet and Ledge and Floor Grates on the premise of effective operation of storage space. The breakdown of cold storage including a bait storage shows in Table 2-1(3). As hospitals, hotels and restaurants which are consumers of frozen fish are lacking of storage capacity of frozen food and depended on the storage by the supply side and purchased frozen fishes with small pack delivery. Judging from the hearing survey from hospitals, hotels and restaurants, the number of days for frozen fish storage is considered to be 2 weeks since the delivery interval of frozen fish is about two weeks. The cold storage period is considered to be 3.5 days since about 4 days was necessitated judging from the refrigeration record of existing fish market. And as cold storage is the over-night storage, it sets as 1.5 days.

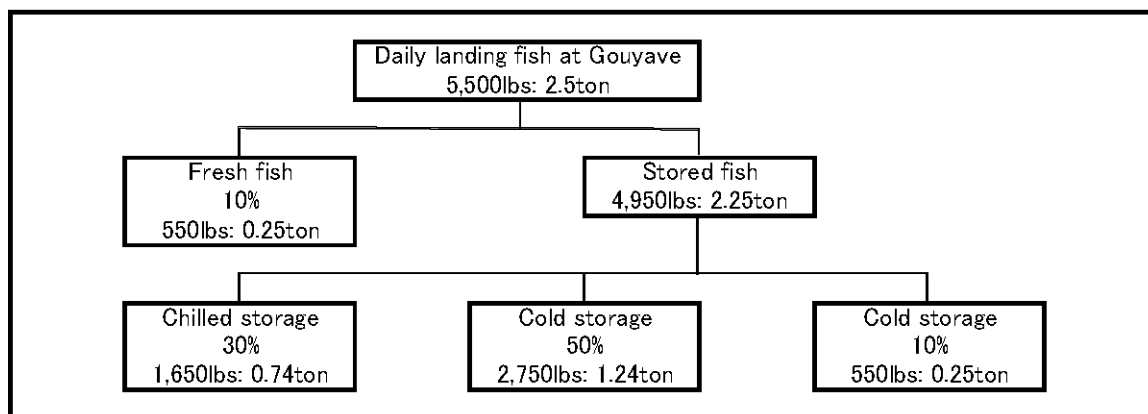


Figure 2-1(8) Fish landing volume per type of storage in planned standard day

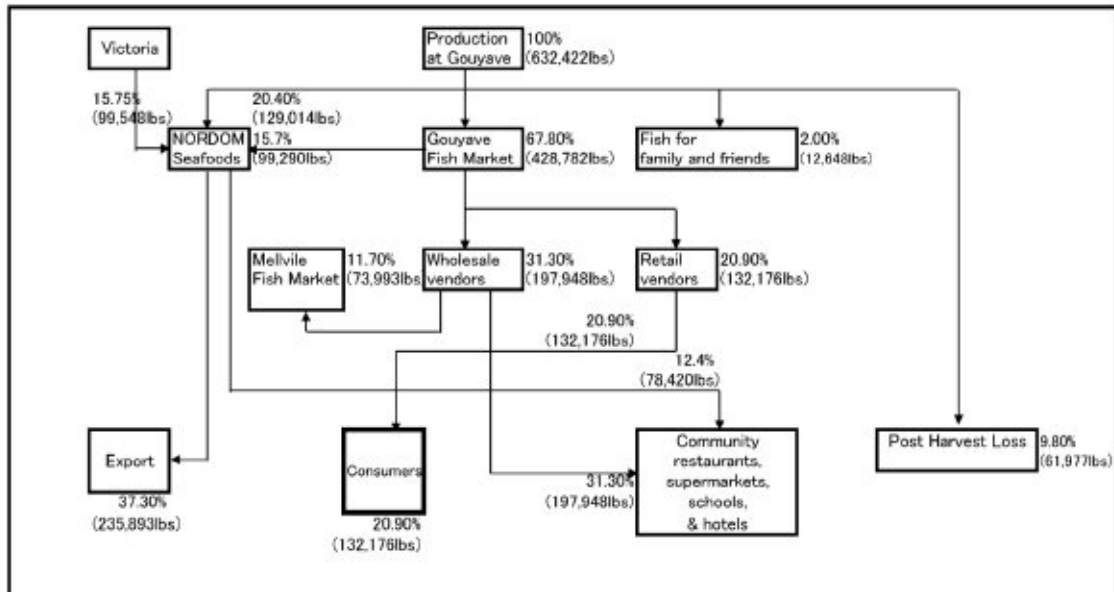


Figure 2-1(9) Fishery products distribution status in Gouyave

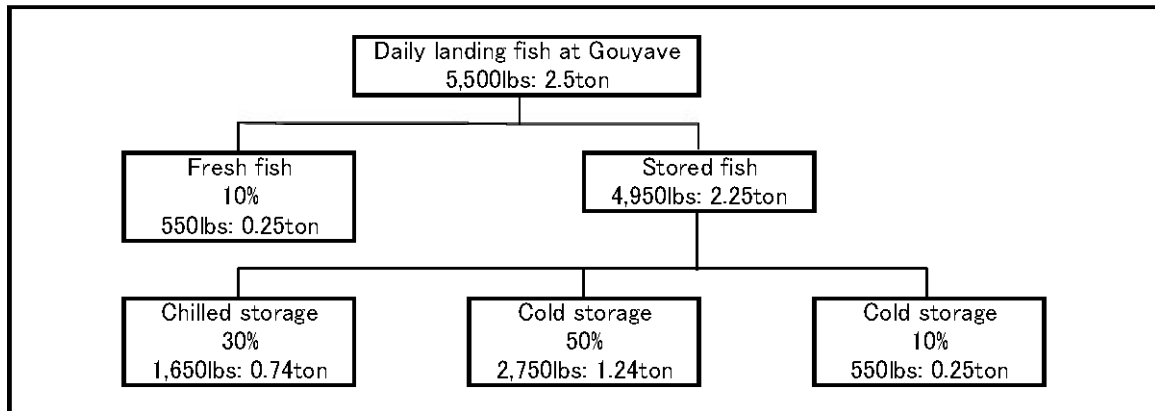


Figure 2-1(10) Landing volume per storage pattern in planned standard date

Table 2-1(3) Breakdown of cold room specifications

	Purpose	Fish Volume	Fish species	Temp.	Storage term	Cubic capacity	Remarks
Blast freezer	- Freeze at -25°C and secure freshness	250 kg	Big catch large size fishes Yellow fin tuna, Atlantic sailfish, Black fin tuna, Common dolphin fish	-25°C~ -30°C	24 hours	3 x 2.2 x 2.5m = 17 m ³ . In order to prevent temp. loss and promote working efficiency, it is installed in chilled room	- Not only fresh fish but also frozen one are shown demand in hotel and restaurant. Fresh fish which is not consumed in a day is frozen after seasoning and stored for re-consumption.
Chest freezer	- Products storage after rapid freezing	3,500 kg		-20°C	About 2 weeks	4.98 x 4.7 x 2.5m = 59 m ³	- The demand of frozen fish is about 4,000 lbs/month in school (75 primary and mid schools) and about 3,600 lbs hospitals (3 main hospitals with impatient facility) and the demand is getting increased. - In order to make sure the storage control with first in first out system, rack and movable pallet are surely used. (cold storage room and bait room are also applied)
Slow freezer & Cold storage room	- Freeze at -25°C for short term	4,300 kg	Offshore pelagic fish	-20°C~ -25°C	About 1 week	4.98 x 9.4 x 2.5m = 117 m ³	- Pre-cooling room is allocated inside in order to improve freezing effectiveness.
Cold storage room	Chill at -5°C and secure freshness for shipping	1,100 kg	Coastal pelagic fish, coastal bottom fish	-5°C	1-2 days	4.98 x 3.0 x 2.5 m = 38 m ³	- Effective utilization is conspired by utilizing racks and existing fish boxes.
Bait room	Freeze & store bait fish for long line	2,700 kg	Jack, flying fish	-20 °C	About 1 month	4.98 x 4.5 x 2.5m = 56 m ³ Working space (2 x 2.2 m = 6 m ²) is installed due to the frequent coming & going of fishermen	- Dead space shall not be created by organized storing with own bucket on racks in order not to confuse.

d) Consideration on ice making capacity

Necessary ice making capacity was calculated based on the result of questionnaire survey to fishermen previously described since there are no accurate shipment ledgers in the existing fisheries center for the ice and the dimension of fishing boat holds. Totaling 58 boats were picked out for questionnaire surveys from 153 fishing boats, 151 boats registered and 2 boats registered at other fishing port, and the result is shown in Table 2-1(4). The response rate in fishing boat type is as per Table 2-1(4) and the total response rate is 38% and the response rate of main ice users except other Pirogue is 44 to 90% therefore, this questionnaire survey is considered to be effective.

Table 2-1(4) Response Rate to Hearing Survey (Unit: No. of boat)

	Launch	Pirogue with cabin	Pirogue for Long line	Pirogue for Light long line	Other Pirogue	Total
Registered in Gouyave	8	16	18	34	75	151
Other ports registered	2	0	0	0	0	2
Number of hearing survey	9	7	13	21	8	58
Response rate	90%	44%	72%	62%	11%	38%

The following is the fishing pattern, fishing ground, one-time landing volume and ice demand in high season of 58 boats in 5 boat types.

a) Launch (LOA exceeding 32 ft equipped with 165 hp or more inboard engine)

It carries on longline targeting offshore pelagic fish in the voyage with 2 nights and 3 days by 3 crews. The questionnaire survey was conducted to 9 boats which are mooring at Gouyave. The hearing has been made from 7 launches (6 owners and 1 captain) although there are 8 launches registered in Gouyave but one was engaged in repairs and 2 launch owners registered in other fishing port.

① **Fishing pattern and grounds in high season**

The pattern repeats 6 voyages during 22 days in high fishing season and 3 voyages during 12 days in low fishing season. 7 launches out of 9 depart at 02:00 to 03:00 in mid night and return to port 02:00 to dawn day after next and fish landing work is done at early morning. Another 2 launches depart at 23:00 to 24:00 and return at night to dawn in 3 days after. The fishing ground is 40 to 70 miles offshore.

② **One time landing volume and ice demand**

Fish landing volume in one time is 1,500 to 6,500 lbs (about 0.7 to 3 tons) in high fishing

season and these launches depart for fishing loading ice which is 1.0 to 2.2 times of fish catch volume (about 0.7 to 5 tons) in one time. The owners strongly requested the early establishment of system so as to be supplied two times of ice for fish catch volume on a steady basis since the yellow fin tuna for export is required freshness. That is, 1 owner replied that the ice can be received without any problem, the other owner replied that the ice is always lacked and difficult to get and other 7 owners replied that the ice was not prepared enough and some time obliged to depart with insufficient condition.

b) Pirogue with cabin (equipped with cabin and outboard engine of more than 80 hp)

It carries on long line targeting offshore pelagic fish by 3 crews. There are 16 pirogues with cabin registered in Gouyave of which 2 are not operated and the questionnaire survey was conducted to 7 pirogues (3 owners and 4 captains) which equal to 50% of remaining 14 pirogues.

① Fishing pattern and grounds in high season

6 pirogues depart at 02:00 to 04:00 early in the morning and one departs at 20:00 at night. 2 pirogues departing in the early in the morning return to port in 7 or 8 hours later. Remaining 5 return in 11 to 24 hours (average 18 hours) later. Fishing ground is 10 to 50 miles offshore.

② One time landing volume and ice demand

One time fish landing volume is 600 to 5,000 lbs (about 0.3 to 2.3 tons) in high fishing season. The request for ice supply system is the same as the owners of launches and there is no owner and captain replied that the ice can be obtained without any problem. One replied that the ice is always lacked and other 6 replied that the ice was not prepared enough and some time obliged to depart with insufficient condition.

c) Pirogue for Long Line (LOA between 16 to 28 ft equipped with 40 hp or more out board engine)

It carries on long line targeting offshore pelagic fish by 2 or 3 crews. There are 18 pirogues for long line registered in Gouyave and the questionnaire survey was conducted to 13 pirogues (8 owners and 5 captains) which is equal to 72%.

① Fishing pattern and grounds in high season

5 pirogues depart at 02:00 to 07:00 in the morning and work for 3 to 9 hours at 6 to 22 miles offshore. 8 depart at early morning or night and work for 12 to 22 hours (average 17 hours) and return to port. Fishing ground is 14 to 30 miles offshore.

② One time landing volume and ice demand

One time fish catch volume is 150 to 1,500 lbs (about 67 to 700 kg) in high fishing season. The early establishment of ice supply system on a steady basis is required. And the surveys were replied that 12 fishermen some time could not get necessary volume and had no other choice but went fishing with lack of ice. The only one replied to receive necessary volume.

d) Pirogue for Light long line (LOA between 15 to 20 ft equipped with 25 to 40 hp outboard engine)

It carries on long line targeting offshore pelagic fish by 2 crews. There are 34 pirogues for light long line registered in Gouyave and the questionnaire survey was conducted to 21 pirogues (12 owners and 9 captains) which are equal to 62%.

① Fishing pattern and grounds in high season

Only 1 pirogue departs at early-evening and returns to port at the night. 20 pirogues depart at 02:00 to 06:00 early in the morning and 2 of them return to port after 5 to 6 hours later, 18 return after 10 to 19 hours (average 13 hours) late. Fishing ground is 3 to 28 miles offshore.

② One time landing volume and ice demand

One time fish catch volume is 150 to 1,300 lbs (about 70 to 600 kg) in high fishing season. The early establishment of ice supply system on a steady basis is required. The surveys were replied that all fishing boats except one departing at early evening and two returning after 5 to 6 hours later, some time could not secure the necessary volume and had no other choice but went fishing with lack of ice.

e) Other Pirogue

The questionnaire surveys were also conducted to 8 (11%) out of 75 fishing boats such as Small long line, Small line, Hand line, Bank fishing, Gill net, Beach seine.

① Fishing pattern and grounds in high season

6 pirogues fish for 9 to 17 hours at 4 to 18 miles coastal with 2 crews. No replies were made from two boats.

② One time landing volume and ice demand

One time fish catch volume is 55 to 300 lbs (about 25 to 135 kg) in high fishing season targeting coastal pelagic fish and coastal bottom fish. The early establishment of ice supply system on a steady basis is required. The surveys were replied that 6 would like to load about 0.2 to 0.8 times of ice for fish catch volume however, all fishing boats some time could not get necessary volume and some time could not secure the necessary volume and had no other choice but went fishing with lack of ice. No replies were made from two boats.

In addition, although Small long line and Small line mount 15 to 40 hp outboard engine, Hand line, Bank fishing, Gill net and Beach seine have no engines. And both power driven boat and no engine boat are also made of wood. 55 boats out of all surveyed 58 boats have mounted VHF radio and remaining 3 boats were to say to use mobile phones.

As fishing activities of 58 boats by the type of fishing boats and the ice demand status were described the above, it will become apparent each type feature when focusing fish catch species as Table 2-1(6) shown. Namely, not only large Launch equipped with inner engine and Pirogue with cabin equipped with hold but also, small pirogues also positively catch offshore pelagic fish and it can be defined that the fishing style is totally different from other area where mainly operate in coastal area back on the same day.

Table 2-1(5) sorts out together with ice loading volume in fishing boat type. According to this, it is 3,667 lbs/boat in Launch, 792 lbs/boat in Pirogue with cabin, 608 lbs/boat in Pirogue for long line and 150 lbs/boat in Pirogue for light long line. There is a big difference of the ice loading volume for other Pirogues between the boat targeted offshore pelagic fish and the boat targeted coastal pelagic fish and bottom fish. However, as shown in the result of questionnaire survey. The average landing volume in high season is 150 lbs/boat in average and it is expected to have ice loading volume with about 0.5 times of fish catch volume. Therefore, it is appropriate to consider as 75 lbs/boat (=150 lbs x 0.5) in other Pirogue.

Table 2-1(5)-1 Ice loading volume and the ratio of fish landing volume in fish species based on hearing survey (Unit: lbs)

No. of boat	Launch	Pirogue with cabin	Pirogue for long line	Pirogue for light long line	Other Pirogue	Other Pirogue
	Ice loading volume lbs/boat	Ice loading volume lbs/boat	Ice loading volume lbs/boat	Ice loading volume lbs/boat	Ice loading volume lbs/boat	Ice loading volume lbs/boat
1	3,000	1,000	500	100	100	10
2	3,000	1,000	500	200	100	20
3	3,000	1,000	500	150	100	
4	3,000	1,000	450		150	
5	3,000	0	550		200	
6	3,000	1,000	550		300	
7	3,000	1,000	550			
8	7,000	-	600			
9	5,000	1,000	600			
10		0	800			
11		1,500	800			
12		0	900			
13		-	-			
14		1,000				
Ave	3,667	792	608	150	158	15

Table 2-1(5)-2 Ice loading volume and the ratio of fish landing volume in fish species based on hearing survey

	Launch (9 boats)	Pirogue with cabin (7 boats)	Pirogue for long line (13 boats)	Pirogue for light long line (21 boats)	Other Pirogue (6 boats)	Other Pirogue (2 boats)	
Landing ratio per fish species (average)							
Offshore Pelagic Fish	Yellow fin tuna	78.3%	68.0%	48.8%	49.2%	—	—
	Atlantic sailfish	13.3%	11.0%	33.3%	24.5%	25.5%	—
	Blackfin tuna	—	—	2.1%	9.1%	41.8%	—
	Common dolphinfish	5.8%	13.0%	5.4%	5.9%	11.0%	—
	Blue marlin	—	—	—	—	—	—
	Albacore	1.7%	—	1.7%	2.1%	—	—
	Wahoo	—	—	0.8%	1.3%	—	—
	White marlin	—	—	—	—	—	—
	Great barracuda	0.8%	8.0%	—	3.9%	7.2%	—
	Sword fish	—	—	6.7%	0.3%	—	—
	Flying fish	—	—	0.8%	—	—	—
	subtotal	—	—	0.4%	* 4.5%	* 14.5%	—
		100%	100%	100%	100%	100%	—
	Coastal Pelagic						
Ballyhoo	—	—	—	—	—	43.8%	
halfbeak, Cavalli/Jack							
Coastal bottom							
Snapper	—	—	—	—	—	56.2%	
Total	100%	100%	100%	100%	100%	100%	

Table 2-1(6) shows the result of the estimated ice demand volume of fishing boat at planned standard day based on the ice loading volume per one fishing boat. According to this, the ice demand volume of fishing boat is calculated as 8,375 lbs/day (3,769 kg/day) at planned standard day in Gouyave district.

Table 2-1(6) Ice demand of fishing boat in planned standard day

Fishing Method	Launch (3,667lbs/boat)	Pirogue with cabin (792lbs/boat)	Pirogue for Longline (608lbs/boat)	Pirogue for Light longline (150lbs/boat)	Other Pirogue (75lbs/boat)	Total (No. of boat) (lbs)
Long line	1 (3,667lbs)	1 (792lbs)	1 (608lbs)	2 (300lbs)		5 (5,367lbs)
Light long line			1 (608lbs)	4 (600lbs)		5 (1,208lbs)
Small long line				3 (450lbs)		3 (450lbs)
Hand line					5 (375lbs)	5 (375lbs)
Small line					4 (300lbs)	4 (300lbs)
Bank fishing					2 (150lbs)	2 (150lbs)
Gill net					1 (75lbs)	1 (75lbs)
Beach seine					4 (300lbs)	4 (300lbs)
Others					2 (150lbs)	2 (150lbs)
Total (No. of boat)	1 (3,667lbs)	1 (792lbs)	2 (1,216lbs)	9 (1,350lbs)	18 (1,350lbs)	31 (8,375lbs)

Note: Others mean shellfish, Lobster, Turtle and others

And, based on the ledger of existing fish market and the hearing survey, the ice demand is found 1.0 times for the fish handling in the existing fish market, 1.0 times for Nordom and 0.2 times for family and friends. Table 2-1(7) shows the ice demand volume in the existing fish market.

Table 2-1(7) Ice demand in existing fish market

Ice demanded	Ratio in annual landing volume (%)	Annual fish handling volume (lbs/year)	Annual ice demand volume (lbs/year)	Remarks
Existing fish market	67.80%	428,782	428,782	Ice demand : 1 time of annual fish handling volume
NORDOM	20.40%	129,014	129,014	Ice demand : 1 time of annual fish handling volume
For family and friends	2.00%	12,648	2,530	Ice demand : 0.2 times of annual fish handling volume
Total			560,326	

As the number of annual operating days in the existing fish market is 256 days, the ice demand volume of the existing fish market in the project standard date is 2,188 lbs/day (=560,326 lbs÷256 days: 984 kg/day). In addition, there are 328 lbs /day Community demand in Gouyave (restaurant, assembly, funeral and so forth) with 15% (2,188 lbs x 0.15=328 lbs/day: 147 kg/day) of the ice demand in the existing fish market. Therefore, the total ice demand of Gouyave district in the

project standard date is 10,891 lbs/day (= fishing boat 8,375 lbs/day + existing fish market 2,188 lbs/day + community 328 lbs: 4,901 kg/day). In order to cover this ice demand volume, the combination of 10 tons ice storage and 4 tons ice making machine can be corresponded as the ice making supply balance in Table 2-1(8) shows.

Table 2-1(8) Ice making and supply balance

Ice supply balance under ice making capacity 4t/day, ice storage with 10t and ice demand with 4.90t/day (market etc. 1.13 t and fishing boat 3.77 t)					
Day	Hours	Stock	Production	Supply	Stock
Mon	06	10.00	1.00	1.13	9.87
	12	9.87	1.00	3.77	7.10
	18	7.10	1.00		8.10
	24	8.10	1.00		9.10
Tue	06	9.10	1.00	1.13	8.97
	12	8.97	1.00	3.77	6.20
	18	6.20	1.00		7.20
	24	7.20	1.00		8.20
Wed	06	8.20	1.00	1.13	8.07
	12	8.07	1.00	3.77	5.30
	18	5.30	1.00		6.30
	24	6.30	1.00		7.30
Thu	06	7.30	1.00	1.13	7.17
	12	7.17	1.00	3.77	4.40
	18	4.40	1.00		5.40
	24	5.40	1.00		6.40
Fri	06	6.40	1.00	1.13	6.27
	12	6.27	1.00	3.77	3.50
	18	3.50	1.00		4.50
	24	4.50	1.00		5.50
Sat	06	5.50	1.00	1.13	5.37
	12	5.37	1.00		6.37
	18	6.37	1.00		7.37
	24	7.37	1.00		8.37
Sun	06	8.37	1.00		9.37
	12	9.37	0.63		10.00
	18	10.00			10.00
	24	10.00			10.00

e) Necessity of renewal of existing jetty

As the concrete floor slab of existing jetty is in weak condition which shows like crack and partly lost, fishing boats are occasionally damaged by hitting to jetty since there are no buffer facilities like fender. And, the existing pipe piles show the decrease of pile thickness exceeding the corrosion rate of original design although concentrated corrosion is not appeared and it is considered to be difficult to response to the stress before 30 years expected lifetime.

In addition, judging from the changing present situation like growing size of landing fishes, the change of fish landing that uses 2 ton truck to transport fishes after landing and weak condition of the existing jetty, it is necessary to renew the existing jetty.

When renewing, the utilization of existing pipe piles is difficult against the required size of jetty to be described and loading conditions corresponding to the growing sizes of landing fishes and the change of transportation method. And, as the existing pipe piles is possible to cut off at the seafloor surface, it is difficult to pull out the piles below sea bottom therefore the renewal cannot be done on the normal line of the existing jetty.

f) New location of jetty

The new jetty of which function is improved so as to attain smooth transportation of ice, landed fish and peoples move is necessary to make met with the traffic line of land facilities. The New Fishing Center has access road at south side of New Fishing Center so as to make easier to access from national road. It is reasonable that the traffic line with the new fisheries center which is land facility also becomes smooth by according the traffic line of this access road and the jetty. Therefore, the location of new jetty is planned to install at the west end of land facilities. Furthermore, the new jetty is directed to NNW that is the most frequent wave direction being favorable for berthing of fishing boats.

Table 2-1(9) Frequent distribution by wave direction and by wave height rank (full year and fishing season)

Season	Direction	WSW	W	WNW	NW	NNW	Total
	Height(m)						
All year	0.00-0.25	1.8	0.0	0.1	0.4	1.0	3.3
	0.25-0.50	7.5	0.0	0.4	1.7	21.0	30.7
	0.50-0.75	0.1	0.0	0.3	0.8	53.6	54.8
	0.75-1.00	0.0	0.0	0.0	0.1	9.4	9.5
	1.00-1.25	0.0	0.0	0.0	0.0	1.2	1.2
	1.25-1.50	0.0	0.0	0.0	0.0	0.4	0.4
	1.50-1.75	0.0	0.0	0.0	0.0	0.1	0.1
	1.75-2.00	0.0	0.0	0.0	0.0	0.0	0.0
	Total	9.4	0.0	0.8	3.1	86.7	100.0
High Season (Oct-Jun)	0.00-0.25	1.3	0	0.1	0.4	0.6	2.5
	0.25-0.50	6.4	0	0.5	1.9	17.3	26.2
	0.50-0.75	0	0	0.4	1	56.5	58
	0.75-1.00	0	0	0	0.1	11	11.1
	1.00-1.25	0	0	0	0	1.5	1.6
	1.25-1.50	0	0	0	0.1	0.5	0.6
	1.50-1.75	0	0	0	0	0.1	0.1
	1.75-2.00	0	0	0	0	0	0
	Total	7.8	0	1	3.6	87.6	100
Low Season (Jul-Sep.)	0.00-0.25	3.1	0	0	0.5	2.4	6
	0.25-0.50	10.8	0	0	1.1	32	43.9
	0.50-0.75	0.2	0	0	0.2	44.9	45.3
	0.75-1.00	0	0	0	0	4.8	4.8
	1.00-1.25	0	0	0	0	0	0
	1.25-1.50	0	0	0	0	0	0
	1.50-1.75	0	0	0	0	0	0
	1.75-2.00	0	0	0	0	0	0
	Total	14.1	0	0.1	1.7	84.1	100

g) Length of jetty

Breakdown of fishing boat type in Gouyave is shown in Table 2-1(10).

Table 2-1(10) Breakdown of fishing boat type in Gouyave

Type of fishing boat	No. of fishing boat	LOA: ft	Beam: ft	Draft: ft	Blue work line: ft
Launch	8	34	12	6	5.5
Pirogue with cabin	16	32	8	5	5.0
Pirogue	127	32	6	5	2.5
Total	151				

(Note) The figures of LOA, Beam, Draft, Blue work line are for largest fishing boat.

The operation days, landing hours, preparation hours and lay-byhours per one voyage of fishing method type of each fishing boat can be set by reviewing daily record of landing fishing boat

in Gouyave. The reviewed result is shown in Table 2-1(11).

Table 2-1(11) Breakdown of fishing boat activity by fishing method

Fishing method	No. of fishing boat	Operation days (per a voyage)	No. of operating fishing boat per day	Landing hours	Preparation hours	Lay-by hours	Hours in fishing port
Longline	42	2	4.2	1.5	2.0	5	8.5
Light longline	34	1.5	4.5	1.0	1.5	5	7.5
Small longline	12	1	2.4	1.0	1.5	5	7.5
Hand line	23	1	4.6	0.5	0.5	5	6.0
Small line	8	0.5	3.2	0.5	0.5	3	4.0
Bank fishing	3	0.5	1.2	0.5	0.5	3	4.0
Gill net	1	1	0.2	0.5	0.5	5	6.0
Beach seine	18	1	3.6	1.0	0.5	5	6.5
Others	10	1	2.0	0.5	0.5	5	6.0
Total	151	-	25.9	7.0	8	41.0	56.0

Three functions of the landing and preparation function, the pier for lay-by and the supply of fuel etc. as required jetty function are necessary. The length of landing and preparation jetty is shown in Table 2-1 (12) and the jetty length for rest is shown in Table 2-1(13).

Table 2-1 (12) Jetty length for landing and preparation

Fishing method	Turn over	No. of the fishing boat	Necessary no. of pier	LOA	Necessary length of jetty (ft)	Necessary number of berth/length (ft)
Longline	1	5.0	1.0	34	34	3/98
Light longline	1	5.0	1.0	32	32	
Small longline	1	3.0	1.0	32	32	
Hand line	10	5.0	1.0	25	25	2/50
Small line	10	4.0	1.0	25	25	
Bank fishing	10	2.0	0.0	25	0	
Gill net	10	1.0	0.0	25	0	
Beach seine	10	4.0	0.0	25	0	
Others	10	2.0	0.0	25	0	
Total		31.0	5.0		148.0	5/148.0

Table 2-1(13) Jetty length for lay-by

Fishing method	No. of operating fishing boat	Place for lay-by	Beam	Jetty length(ft)
Longline	5.0	Jetty	12.0	60
Light longline	5.0	Jetty	8.0	40
Small longline	3.0	Jetty	8.0	24
Hand line	5.0	Beach		
Small line	4.0	Beach		
Bank fishing	2.0	Beach		
Gill net	1.0	Beach		
Beach seine	4.0	Beach		
Others	2.0	Beach		
Total	31.0			124

As the lay-by jetty can be used together with landing and preparation jetty, the length of 124 ft for lay-by jetty is good if the length is within the length of landing and preparation jetty. Therefore, the required jetty length for the New Fishing Center shall be set as per Table 2-1(14).

And, these lengths of jetty were calculated based on the parallel mooring method of fishing boats. The allocation of ancillary facilities like bollard has been planned with the basis of the parallel mooring.

This time however, the mooring ring is planning to install and fishing boats can be also moored perpendicular to the jetty. However, there will be possible inefficiency of fish landing, ice loading and others and the problem of boat stability.

Table 2-1(14) Required jetty length

Jetty function	No. of jetty	Length of jetty (ft)	Length of jetty (m)
For landing and Preparation (Lunch, Pirogue with cabin)	3	98	44.1 (45.0)
For landing and preparation (Pirogue)	2	50	22.5(23.0)
For fuel supply	1	32	14.4 (15.0)
Total	6	180	81.0 (83.0)

Now, the length of jetty is decided by fixing section so as to be able to secure the required water depth and layout of above jetty functions. Although the details are shown at (1) Policy for the design of civil facilities in 2-2 Design Policy, 38m for fixing section, 45m for jetty length totaling 83 m is required as jetty length. And, 12.9m as the approach section to connect filled ground and fixing section is necessary.

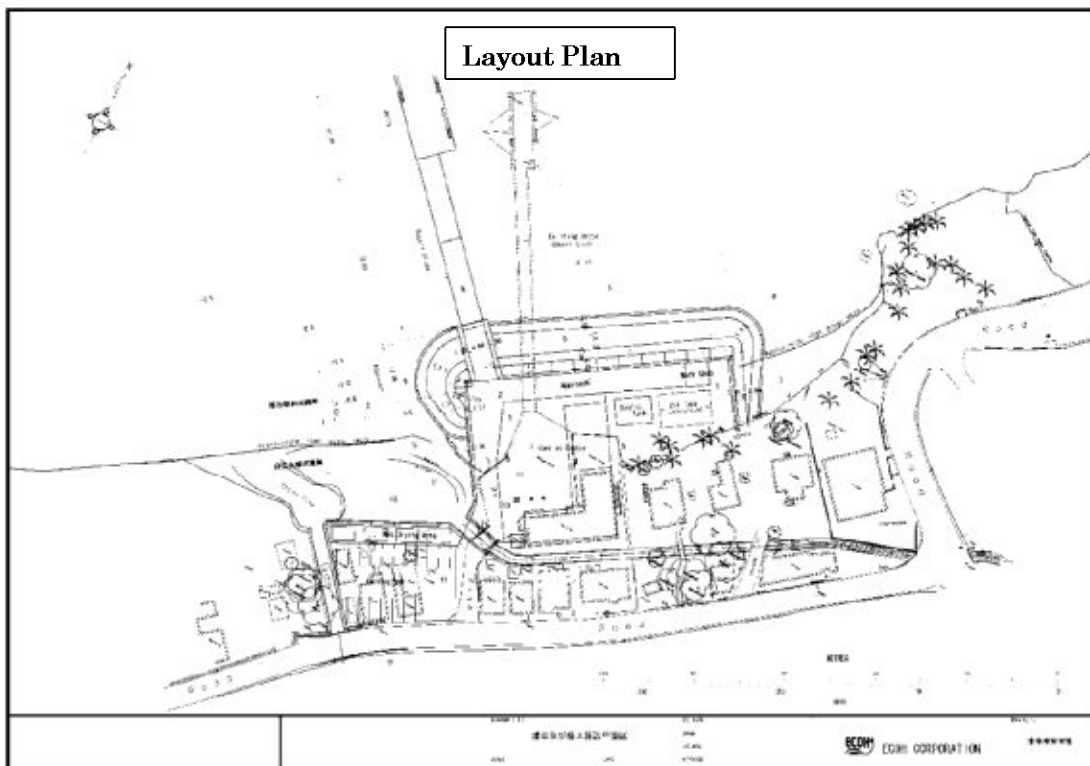


Figure 2-1(11) Installation Normal Line of New Jetty

h) Work Shop

The number of fishing boats in Gouyave is 151 as previously described. According to the interview survey to fishermen, the daily maintenance work of outboard engine of Pirogue is executed

by fisherman himself but the periodical maintenance about one time per year is executed by repair expert in work shop. And although the hull maintenance is executed about one time annually, the daily maintenance is executed by fishermen as with the outboard engine.

The number of fishing boats concerned is 151 boats as shown in Table 2-1(2). It takes around 3 days/boat for periodical maintenance of Pirogue (127 boats) and 14 days/boat for Launch (8 boats) and Pirogue with cabin (16 boats). Therefore, it needs 717 boat · day=127 boats x 3 days+ (8 boats+ 16 boats) x 14 days as total maintenance days. The number of concurrent boat maintenance becomes 4 boats when the maintenance operating day is assumed to be 256 days (70%).

Table 2-1(15) Concerned fishing boat and maintenance day

Type	Number of boat	Average maintenance day	Required maintenance day	Concurrence boat maintenance number
Launch	8	14	112	0.43(1 boat)
Pirogue with cabin	16	14	224	0.88(1 boat)
Pirogue	127	3	381	1.49(2 boats)
Total	151	-	717	4 boats

(Note) The operating days are set as 256 days (70%).

As the existing work shop (25m²) is in existing Fisheries Center where has been damaged by hurricane “TVAN”, it is necessary to re-build separately but at adjoining place to the new Fisheries Center in view of sanitary aspect of the New Fisheries Center including fish market functions.

i) Location and function of New Fisheries Center

The Government of Grenada is planning to secure adjacent to existing Fisheries Center and unify the function of Fish Market since the existing Fisheries Center and Fish market are located at separated places and the convenience for artisanal fishermen and consumers is not economically good like the requirement of double investments by cold room and etc. And as the New Fisheries Center will be regarded as the base of fisheries production and distribution, it is economical to plan New Fisheries Center to have the function of Fish Market on the existing Fisheries Center. Table 2-1(16) show the function comparison of the existing Fisheries Center and Fish Market and New Fisheries Center (on-shore facility). The required functions as New Fisheries Center are the existing Fisheries Center and Fish Market although the functions and facilities renewal are necessary.

Table 2-1(16) Comparison of function between existing fisheries center& fish market and New Fisheries Center (Onshore facilities)

Function	Existing fisheries center	Existing fish market	New Fisheries Center
1. Management			
1) Operation (market, center)		○	○ (update)
2) Management & Promotion (Fisheries Div.)	○		○ (update)
3) Training room	○		○ (update)
2. Fish Market			
1) Sales booth		○	○ (update · expansion)
2) Cleaner		○	○ (update · expansion)
3. Ice making & storage			
1) Ice machine	○ (need to be updated)		○ (update · renewal)
2) Storage room	○ (need to be updated)		○ (update · renewal)
4. Bait Storage			
1) Bait room	○ (malfunction)	○ (malfunction)	○ (update · renewal)
5. Pretreatment & Processing			
1) Receiving		○ (small plot)	○ (update · expansion)
2) Pretreatment facility		○ (small plot)	○ (update · expansion)
3) Processing facility	○ (need to be updated · small plot)		○ (update · expansion)
4) Forklift	○ (need to be updated)		○ (update · renewal)
6. Weighing & Recording			
1) Weighing facility		○	○ (update ·

			expansion)
7. Storing			
1) Cold storage room	<input type="radio"/> (need to be updated)	<input type="radio"/> (need to be updated)	<input type="radio"/> (update • renewal)
2)Chest freezer & Cold storage room			<input type="radio"/> (update • renewal)
3)Slow freezer & Cold storage room			<input type="radio"/> (update • renewal)
8. Repair			
1)Work shop	<input type="radio"/> (need to be updated)		<input type="radio"/> (update)
2)Boat yard	<input type="radio"/> (need to be updated)		
9. Supply			
1)Fuel tank & supply line	<input type="radio"/> (small & capacity shortage)		<input type="radio"/> (Grenada side)
2)Water tank & supply line			<input type="radio"/> (Grenada side)
3)Power supply line			<input type="radio"/> (Grenada)
10. Car parking			
1) Car parking lot	<input type="radio"/> (need to be updated)		<input type="radio"/> (New construction)
2)Fish net drying space	<input type="radio"/> (need to be updated)		<input type="radio"/> (New construction)

j) Application of existing Fisheries Center Building

The frame made of RC of existing Fisheries Center is still sound condition and it will be economically favorable to compose New Fisheries Center in a unified manner with extension part of the existing building than removal of existing building and the new construction. As well as making separation between the existing building and the extension part structurally and keeping the structural stability, it makes unified by expansion joint for leakage prevention.

However, judging from the inducing flow lines of each function, required area and so forth, it is necessary to build an extension in front demolishing the protruding part to north-west from the existing L-shape building and leave east side I-shape two stories planar building in view of the security of functional flow line and the structural stability. The partial demolition of constructed facility under Japanese Grant Aid has been agreed by the Government of Grenada however it is necessary to apply the demolition and the approval by the Government of Japan at the future stage of this plan.

k) Radio Communication Facility

In Grenada, the operating area for Launch is up to 40 to 70 sea miles offshore and its for Pirogue with cabin is up to 10- 50 sea miles offshore. And its for Pirogue is up to 14 to 30 sea miles offshore. Fishing boats operated beyond 5 sea miles have a requirement to equip a radio shack in Grenada. In fishing boats of main landing places, 507 boats have the obligation to equip radio shack. In Gouyave, 119 boats which operate from Longline to Small line are targeted and 89 boats (75%) out of that have equipped radio shacks. Fishing boats in Gouyave operated in offshore area of west coast of Grenada are vital to load a safety facility (radio shack or others) of fishing boat. In fact, the existing antenna to receive outgoing signals for the observation of fishing activities and emergency purpose does exist in north east (Kublal) of Grenada Island however, the radio wave does not reach to west coat marine area blocked by Mt. St. Catherine (height: 2,757 ft). Due to these, radio communication facility which radio wave can be reached 90 miles for the purpose of contact to fishing boats and communication at the time of emergency shall be constructed where is middle point of the road to connect Melville Street and Grenville, 400 m inside of mountain side from main road and the place where the antenna of Cable and Wireless and one for FM broad casting are installed.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Design policy for civil work

1) Land Preparation (Reclamation)

With the premise of utilization of existing Fisheries Center, as the planned land for the New Fisheries Center and the work shop is small and little, it is necessary to secure the land by executing necessary minimum reclamation of seashore in front of the project site.

2) Revetment

The revetment is installed for the protection of the New Fisheries Center being constructed on the above filling land from storm surge and strong waves at the time of anomalous weather condition. The facility development in coastal area is required to consider the sea level rise by climate change in Grenada. The revetment structure and the crown height considered the storm surge, strong wave at the time of anomalous weather condition and the sea level rise are set in the design of revetment.

3) Jetty

As the crown height of existing jetty is too high for fishing boats, the fish landing and preparation are conducted utilizing the stage being made of steel grating lowering it to water level. There are many cases that fishing boats are damaged since there is no facility with this steel made grating to protect fishing boats when they berth like fenders. And also, as the width of this grating is narrow, fishermen are often injured during fish landing.

Since this new jetty will face to outer sea, the crown height shall be higher than the existing jetty and there will be high possibility to be hit by wave at the time of anomalous weather condition. As most of the landing fishes in Gouyave are large size fish, the landing work by crane or etc. is necessary in order to secure the convenience and safety of fish landing work. However, fixed type jib crane on the jetty where the wave will be over topped at the time of big wave has difficulty on maintenance works and 4 of them are necessary to install at the landing jetty therefore, it is reasonable to land fishes by providing mobile truck with crane from the economical point of view as well. Here, considering fish landing volume and etc. 2 ton truck with crane shall be provided having 1 ton of lifting capacity. The truck with crane shall be stored at driveway apron located outside of the primary treatment room of the new fisheries center.

Table 2-2(1) Comparison of landing work method in jetty

	Truck with crane	Fixed jib crane
Easy landing work	<ul style="list-style-type: none"> • easy response to berthing location of fishing boat • reducing berth-waiting time since fishing boats can berth at vacant spots. 	The possibility for berth-waiting is high since fishing boats have to berth at the fixed location of crane.
Easy maintenance	<ul style="list-style-type: none"> • it can be evacuated by itself at the time of storm • able to correspond with simple daily and periodical maintenance • able to correspond with a driver and a assistant (popular method in Grenada) • present technical level is enough to correspond due to easy operation 	<ul style="list-style-type: none"> • easy to jam by sea water at the time of storm • 4 operators are necessary in high season • present technical level is enough to correspond due to easy operation
Construction cost	Low	High
Evaluation	○	×

4) Design Standard

There is no design standard of fishing port and port and harbor facilities in Grenada. In the designing of structures, BS and ASTM which is equivalent to Japanese JIS has applied for designing of each facility wise. In this project, “DESIGN STANDARDS FOR FISHING PORT AND FISHING GROUND FACILITIES” (hereinafter is called as” HDBK “) that is the design standard to regulate design approach of Japan’s fishing port facilities is applied and as the supplementary, “TECHNICAL STANDARDS AND COMMENTARIES FOR PORT AND HARBOR FACILITIES IN JAPAN” (hereinafter is called as “Port and Harbor Design Criteria”) that is the design standard to regulate is applied correspondingly.

5) Natural Conditions

In view of the natural conditions having an impact on structural design, the design is conducted with the care of the followings.

① Wave condition

The offshore wave in Gouyave is studied by the wave forecasting and hind casting based on

the past records of hurricane. And, the wave deformation calculation is conducted based on the sounding chart obtained by nautical chart and the bottom topographic survey and estimate surrounding waves of the planning structures (breakwater and etc.) In the forecasting and hind casting works of Gouyave offshore wave, the offshore waves used for the design of jetty for cruise ship in capital city, St. Johns shall be referred. And, in the run-up height of design wave on the seashore shall consider the influence of run-up wave to revetment and car parking area.

② **Storm Serge**

As the storm surge by low pressure is to be occurred at the time of hurricane, the storm surge is considered as design tide level condition. The value is calculated considering the absorption by a drop in atmospheric pressure and wind setup by numerical simulation which solves an energy balance equation.

③ **Seismic Force**

Although there is no standard of seismic force affecting to civil structures of Port & Harbor and Fishing Port in Grenada, in the aforementioned construction experience of the jetty construction for cruise ship, the seismic factor $K_h=0.18$ was used in accordance with BS Standards. Referring to this case, the civil facilities are designed with the seismic factor 0.18 in this project. And, this factor is the same as with Japanese Standards.

(2) Design policy for architectural facility

1) Design Standard

Building standard in Grenada is used “Grenada Building Code” which is based on “OECS (Organization of Eastern Caribbean States). This is the uniform criteria of Caribbean countries and it mainly covers architectural design (i/o structural design). The reference as structural criteria becomes CUBiC (Caribbean Uniform Building Code)

2) Structural design condition

① **Seismic force**

The horizon force caused by the seismic force is provided for referring to CUBiC from Grenada Building Code Section 12 LOADS is calculated as follows.

$$V=ZCIKSW$$

Where,

Z: Numerical coefficient related to the seismicity of a region (0.50)

C: Basic elasticity time of structure coefficient (0.12)

I: Occupancy importance coefficient of building (1.5)

K: Coefficient of structural system (0.8)

S: Coefficient of site-structures resonance (1.5)

W: Perpendicular load in building (fixed load + lived load)

From the numerical value that corresponds by using the above-mentioned

$$V=0.5 \times 0.12 \times 1.5 \times 0.8 \times 1.5 \times W = 0.108W$$

On the other hand, seismic shear force coefficient C_i : in regulations of Building Standard Law of Japan.

$$C_i = Z R_t A_i C_o$$

Where,

Z: Coefficient that the Minister of Land, Infrastructure and Transport provides, the level of the earthquake damage based on the record of an earthquake past in the province (1.0-0.7),

R_t : Numerical value calculated with showing vibrational property of building by method established by the Minister of Land, Infrastructure and Transport according to proper period of building and kind of the ground (1.0)

A_i : Numerical value calculated by method established by the Minister of Land, Infrastructure and Transport who shows distribution of direction of height of building of seismic shear force coefficient (1.0)

C_o : Standard shearing power coefficient (0.2 or more)

From the above-mentioned

$C_i = 0.7 \times 1.0 \times 1.0 \times 0.2 = 0.140$ is obtained. The seismic force is obtained by multiplying a perpendicular load (fixed load + live load) to this seismic shear force coefficient for the standard of Japan and the seismic force is:

$$C_i \times W = 0.140W$$

Numerical value $C_i W$ and V calculated according to regulations of the two countries have the same meaning because the concept of numerical value W in a perpendicular load in Building Standard Law of Japan and CUBiC. It is understood that it makes use of the past experiences of big earthquakes in Grenada, whilst the standards in Japan have been modified through the large number of earthquakes for many years. Comparing the two values from different standards, the former in Grenada is smaller than the latter in Japan. In this project, as the structure is composed by different structural schemes of existing structure and new structure, the impact to the joint part is considered to be decreased by reducing the pendulum to a maximum extent in the new structure and therefore, the criteria of Japan which becomes more stable by big story shear force is adopted.

② Wind load

The calculation standard of the horizontal force in Grenada caused by the wind pressure is provided for referring to CUBiC as well as the seismic force as follows by "OECS Grenada Building Code".

$$W = (q_{ref})(C_{exp})(C_{shp})(C_{dyn})$$

Q_{ref} : Reference velocity per unit area ($q_{ref} = 0.60$ kPa in Grenada).

C exp: Exposure factor against height of building (highest height 5m -10m is C exp=1.00).

C shp: Aerodynamic shape coefficient (C shp=±0.7)

C dyn: Dynamic response factor (It is C dyn=2.0 for the principal structural part).

The above is calculated.

$$W = 600 \times 1.0 \times 0.7 \times 2.0 = 840.0 \text{ Pa (N/m}^2\text{)}$$

The wind pressure at the side between girders uses velocity pressure q by setting 4.5m in highest height in the case of the building of the gable shape when the wind pressure power is calculated from the definitive method of Japan.

$$q = 60v^2 = 181.00 \text{ (kgf/m}^2\text{)}$$

Wind loading coefficient shall be 0.9 according to the Table of Building Code

$$W = 0.9 \times q = 162.90 \text{ (kgf/m}^2\text{)} = 1,597.48 \text{ Pa (N/m}^2\text{)}.$$

Comparing both results the numerical value of Japan is about two times of the Grenada. Under ordinary circumstance, the numerical value of CUBiC should be adopted since this is the code of the project country however judging from the condition of structure in coastal area where the wind load is directly hit, the structural calculation shall be conducted in accordance with the criteria of Japan.

③ Structural Stability of the existing Fisheries Center

The existing Fisheries Center is re-used and in view of floor layout plan and leakage protection, I-shape structure is constructed from part demolition of L-shape structure. Two independent structures shall be existed consisting that the existing part is not connected to the extension part structurally and the structural stability is considered not only on the extension part but also the existing part.

④ Antenna Tower

Antenna tower has no shielding around and stands hitting direct wind load. As there is no design criteria of steel structure in Grenada, it is designed in accordance with Japanese design criteria for Steel Structures and the above ① and ②.

3) Policy to natural conditions

The shoreline at Gouyave is located at geographical condition where is often hit by hurricanes. Considering past experiences of damage of buildings by wave influence, the floor elevation of the New Fisheries Center should be above from the ground elevation of the existing buildings so as not to receive flood damages. And, as the buoyant force is occurred due to the affection of under-ground water level when the foundation level becomes deep, planning buildings as well as the existing buildings shall minimized the impact by continuous footing not by mat foundation in this

project.

4) Measures for Salt Damage and Termite

The facilities which face to the coast in saline air and occasionally as they receive waves directly, the materials to be rusted should possibly be avoided. However, the roofing finish is generally steel sheet in Grenada and the steel sheet is used in this project. The building requires steel structures considering own weight of building. Hence, the anti-salt paint is necessary for the protection of steel structure surface as an anticorrosive measure when the exposure is necessary or covers the main part or other parts under eaves. And also, wooden material to be used in warm and wet climate in Gouyave necessitates anti-ants treatment beforehand.

5) Wastewater Standard by Septic Tank

There is no specific numerical regulation like wastewater standard for the water from septic tank in Grenada. Generally in Grenada the discharging water is mainly percolated method however, as the ground-water level is high and there is not enough land area and it is difficult to make discharged water penetrate to underground in project site area, the discharging water from septic tank shall be released to sea water area. Currently, this coast is utilized as the place of people's living and recreation and the coast and sea area are necessary to keep clean. Therefore, the effluent control value is set as 20 mg/l for the treated water by Japanese Standard.

(3) Policy for Construction method/Procurement and Construction schedule

1) Temporary Yard

The Government of Grenada shall secure necessary land with the area of Width 15m x Extension around 100m near project site (about 3.5 km from project site). Temporary rubble mound jetty is going to be constructed for handling marine construction materials. The Government of Grenada shall permit approval on the construction of this jetty.

2) Revetment etc

As the reclamation distance is about 25m and the revetment is constructed at shallow water where the depth is about 1.5m, the work from land side shall be the base.

3) Jetty

As the removal of the existing jetty and the construction of revetment are implemented together and the new jetty and the building are simultaneously constructed, the work from marine side shall be the base.

4) Construction sequence

The reclamation work is executed first and the building work shall be premised to commence upon confirming the ground due to the narrow and small site.

5) Main equipment procurement plan

a) Rubble stone and armor stone

Two stone mountains in Grenada were confirmed at the time of Basic Design Study stage (Mt. Hartman and Telescope). Hotel construction (now under construction) is scheduled near Mt. Hartman and it is said that the mountain is going to be closed shortly. Therefore, this is not used for the project. Telescope (Stone Mountain shown in figure at page after next) is located about 20km from the site. There is only a road which is narrow with big difference of elevation and continuous sharp curve therefore, the big stone material like basic mound and armor stone is necessary to consider to be transported in maximum two times a day even using 10 ton dump truck. The cheaper one shall be selected upon the cost comparison of local material and import material.

b) Ready-mixed concrete

The supplier which is closest to the site is located at Queens Park, about 20 km from the site. As it is possible to supply within one hour to the project site, the utilization of this plant shall be assumed.

c) Steel bars

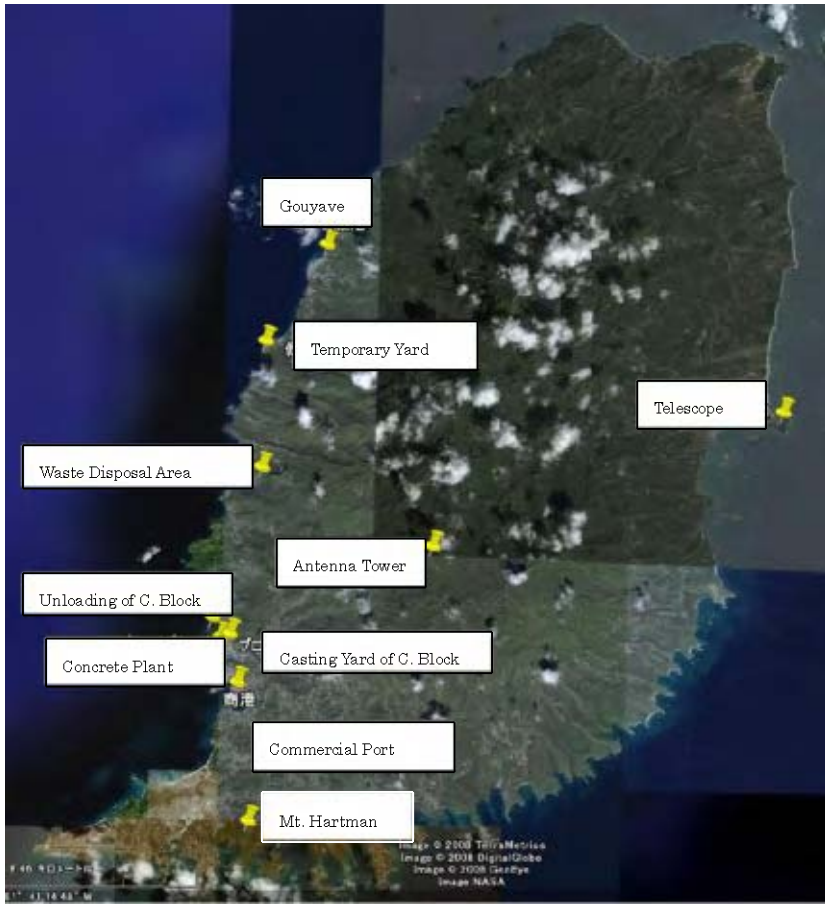
The procurement shall be from Japan as the result of cost comparison among local supplier, the supplier in Trinidad Tobago and the price in Japan (Consumer Price Index).

d) Related equipment with Ice machine and Ice storage room

The equipment which was used in the past projects of Grenada is the products of Japan and maintenance engineer has accustomed to handle Japanese products. However, there was the opinion that the procurement of maintenance parts has not been smooth. The Consultant studies the procurement with cost comparison based on the design specification not limiting to Japanese products.

e) Related with procurement of construction machineries

There is close to no construction machinery to be rented in Grenada. The construction machineries which cannot be rented locally are assumed to be supplied by neighboring countries like Trinidad Tobago, Barbados and others. The machineries related with ships and boats which are impossible to be locally procured shall be procured from neighboring countries as many as possible and the procurement from Japan shall be minimized.



2-2-2 Basic Plan

2-2-2-1 Basic Plan of Civil Facilities

(1) Revetment

In order to smoothly handle the vehicle transportation like the vehicles to carry fishes to and from New Fisheries Center and fork lift, the road in the front is necessary and the width of 5m is secured considering the rotating movement of small truck (2 ton capacity). In addition, a work-shed as the repair facility of fishing boats is planned to be set near coast line of north-east side of Fisheries Center. In order to secure land considered such facility, the minimum necessary land filling (about 900 m²) is necessary due to the narrow existing land. A revetment is necessary as the protective facility of the land fill with length of 99.8m and the revetment shall be sloping method mainly made of stone materials and the reducing effect of reflected wave to the existing jetty is expected. And, the car parking on revetment (including fish nets drying place) is also planned in order to reduce the impact of run-up wave at the time of anomalous weather condition like hurricane etc.

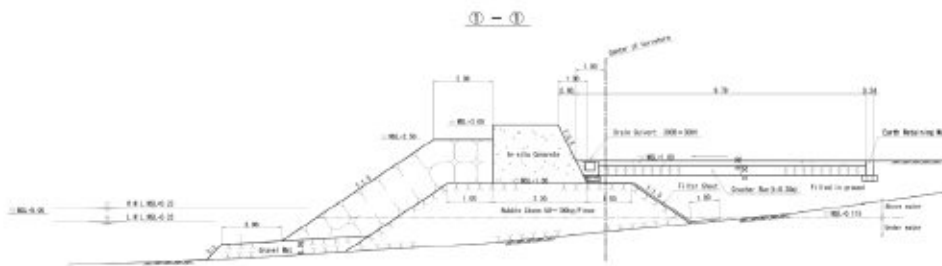


Figure 2-2(1) Revetment structure (in front of the New Fisheries Center)

(2) Jetty

Jetty is necessary to be stable against uplift pressure by design wave (30 years life time) and at the same time has the structure which jetty slab is not flooded by 0.75 m wave height being the occurrence is more than 90% in a year so that it can attain the safe and relieved landing functions. And, as well as securing convenience and safety of landing and preparation work with the good combination of described truck with crane and the landing works, steel grating height (MSL+0.60m) that is installed to existing jetty shall be installed at platform.

Berthing function section of the New Jetty as Figure 2-2(2) shows, 9m will be secured for the space considering the minimum turning radius of the truck with crane. In general, as the width of apron is required as 10m however, as the minimum turning radius of the truck with crane is 7.0m, 9.0m of minimum width so as to be able to turn around by K-turn shall be the jetty width. And, as the width of access section is good for passing of truck with crane therefore, 4.3 m is planned to be able to secure necessary traffic. As the traffic frequency is not heavy, the separation of automobile and foot walk shall not be made. Ancillary facilities such as lighting facility, beacon light, bollard, berthing ring and fender are necessary to secure the convenience and safety of landing and fishing preparation and are properly allocated in the berth function section of the jetty. Under ground supply duct is designed

in order to install fuel and water pipes being necessary at preparation berth.

i) Design depth

*** Landing and preparation berth (Launch & Pirogue with cabin)**

Full draft of the design fishing boat is 6 ft (1.83m) and the necessary water depth is to add 0.5m as margin to maximum draft according to “companion” and when following the “companion”, the design water depth of berth is calculated as follows.

$$\text{Necessary design water depth} = 1.83\text{m} + 0.5\text{m} = 2.33\text{m}$$

As LWL is -0.23m from MSL, this design water depth shall be -2.60m from MSL. However, this standard is the provision of at calm water and it is rather difficult to apply in case of the construction facing to outer sea like this project. There, the water depth that can be moored even at the time of normal wave height at the project site (10% occurrence ratio) with 0.75m shall be designed. Therefore, the water depth of project berth is calculated as follows.

$$\text{Necessary design water depth} = 1.83\text{m} + 0.75\text{m} + 0.5\text{m} = 3.08\text{m}$$

i.e. Design water depth = 3.08m + 0.23m = MSL-3.31m or more.

*** Berth for the supply of fuel & etc.**

Design fishing boat is the same as the above and the design water depth shall be more than MSL-3.31m.

*** Berth for landing and preparation (Pirogue)**

The full draft of this design fishing boat is 5 ft (1.52m) and the required design water depth shall be

$$\text{Necessary design water depth} = 1.52\text{ m} + 0.75\text{m} + 0.5\text{m} = 2.77\text{m}$$

As LWL is MSL-0.23m, this design water dept shall be more than MSL-3.00 m

ii) Crown height

The crown height of existing jetty is MSL+1.35m (previously designed as +1.10m). However, as NHHWL is MSL +0.84m, this height goes under the water at the time of normal rough sea (90%:0.75m). While on the premise that the jetty must not go under the water even at the time of design wave of 30 years probability, the crown height will be more than 5.5 m that is not realistic. And so, in order that the floor slab will not go under water at the time of normal rough sea and make resistance against the uplift pressure of design wave of 30 years probability by the thickness of floor slab, the following calculation can be worked out with the assumption that the thickness of floor slab is 0.4 m.

$$\text{Crown height of jetty} = +0.84\text{ m} + 0.75\text{ m} + 0.4\text{m} = 2.08\text{ m}$$

Therefore, the crown height of jetty shall set as MSL + 2.10 m.

iii) Width

As previously described that a truck with crane will be adopted, the berth function section of

jetty will have 7.0 m of minimum necessary width where the truck with crane can turn and 0.30m of car stop and will install platform with the width of 0.7 m for foot board to/from fishing boats and landing works. Therefore, the berth function section needs its width of $7.0 \text{ m} + (0.3\text{m} \times 2) + (0.7\text{m} \times 2) = 9.0\text{m}$.

And, the access section needs its width of 3.0 m of truck with crane passage, 0.6 m = 0.3 m x 2 for car stops and 0.7 m of pedestrian passage totaling the width of 4.3m. In addition, plus 0.58 m for pipe trench duct of fuel and water, the total width shall be 4.88 m. Figure 2-2(4) shows the detail of pipe trench.

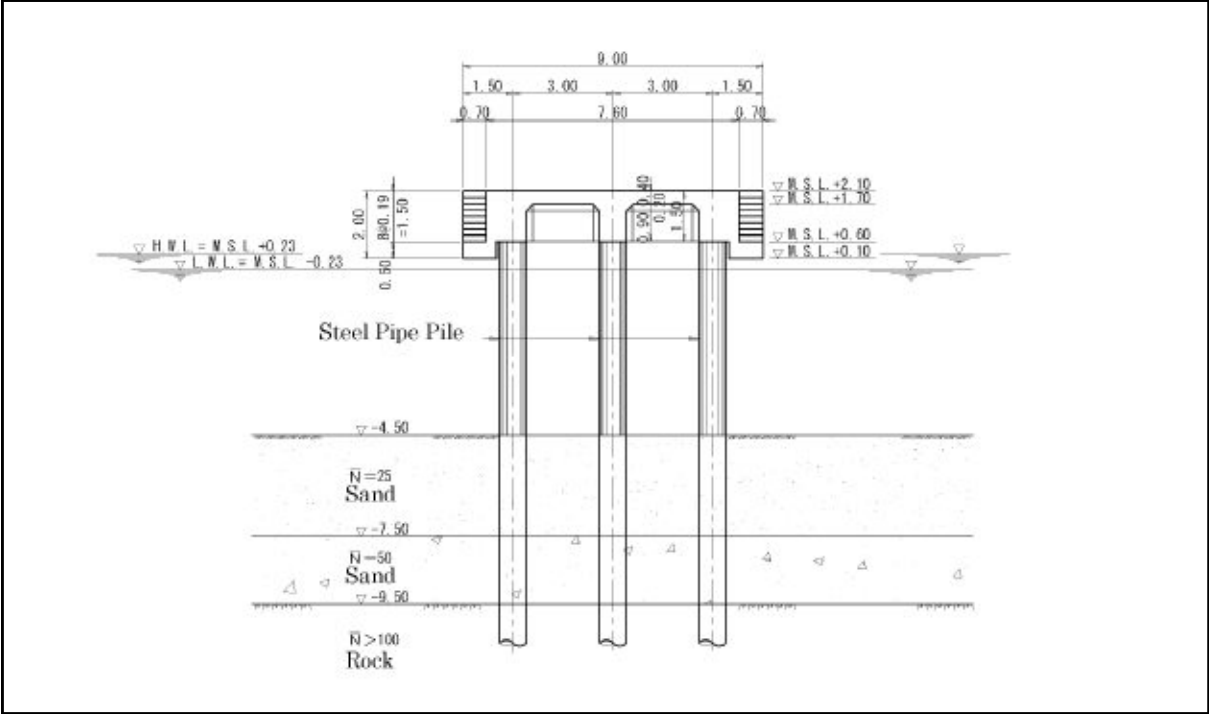


Figure 2-2(2) Berth function section of new jetty

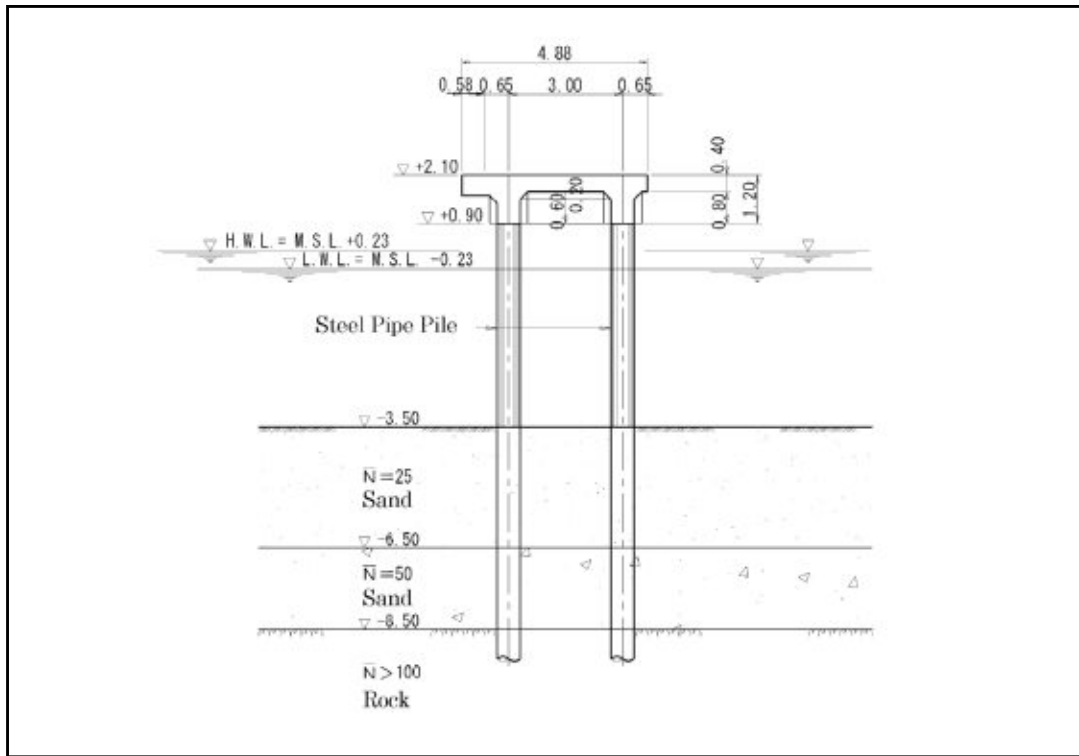


Figure 2-2 (3) Access section of new jetty

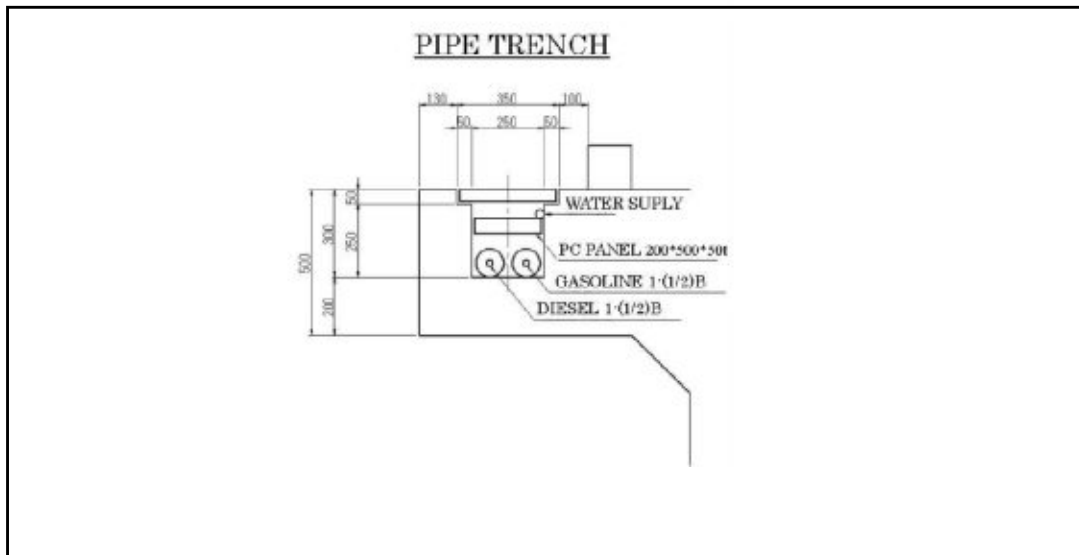


Figure 2-2(4) Detailed pipe trench

(3) Access Road

1) Access Bridge

There is the situation to divide the existing concrete drainage where is located from the backside of New Fisheries Center to the west side and the land for car-parking in western side of the Center. Considering the function and the moving line, this drainage should lay underground pipe lines and the above area should be well utilized. However, this flow line is for the domestic waste water from the houses of hinterlands and there are steep slopes around 1:1 to 1:3 by

location. Therefore, as it is anticipated to flow down with big water at the time of concentrated heavy rain, the planning bridge shall become similar structural method with existing bridge for the drainage and is planned to make the floor slab go under water at the time of concentrated heavy rain.

2) Access Road

It shall be improved by expanding the width of existing access road from national road to New Fisheries Center. This access road shall be functioned to the New Fisheries Center and Work Shop. In addition, this road shall be functioned as the access to the existing jetty. The road extension shall be 95m.

3) Car Parking (including fishing net mending and drying space)

The existing fish market is in urban area without car parking. And also, the existing Fisheries Center has equipped the space to be able to park one transportation vehicle and its rotation movement. The installation of car parking is inevitable since related people shall be gathered to new Fisheries Center and Fish Market. The land for car parking is allotted to adjoining land located at south side of existing Fisheries Center which accommodated as project site by the Government of Grenada. It is possible to park 16 vehicles judging from the land area. And, fish nets mending and drying shed is set at the part of this car parking since there is no mending space for fishing net. The length of revetment on the car parking is 31.2m.

2-2-2-2 Basic Plan of Building Facility

(1) Layout Plan of New Fisheries Center

Landed fish catch is transported to New Fisheries Center by Forklift or handcart from jetty and allocate and preserve to/at, ①Gutting/Cleaning and separation are carried out in Receiving area, ②weighing and recorded in Weighing Area, ③freezing or cold storage room ④primary processing room (Processing Area). Although some fresh fish is stored at cold storage room, fresh fish is distributed by retailer etc. at ⑤Vending Area. The basic flow is as per Figure 2-2(5). And, in Gouyave where large size fish is the main, the effective transportation system using Forklift is necessary. The forklift is used not only for handling landed fishes but also used to load ice and bait onto fishing boats.

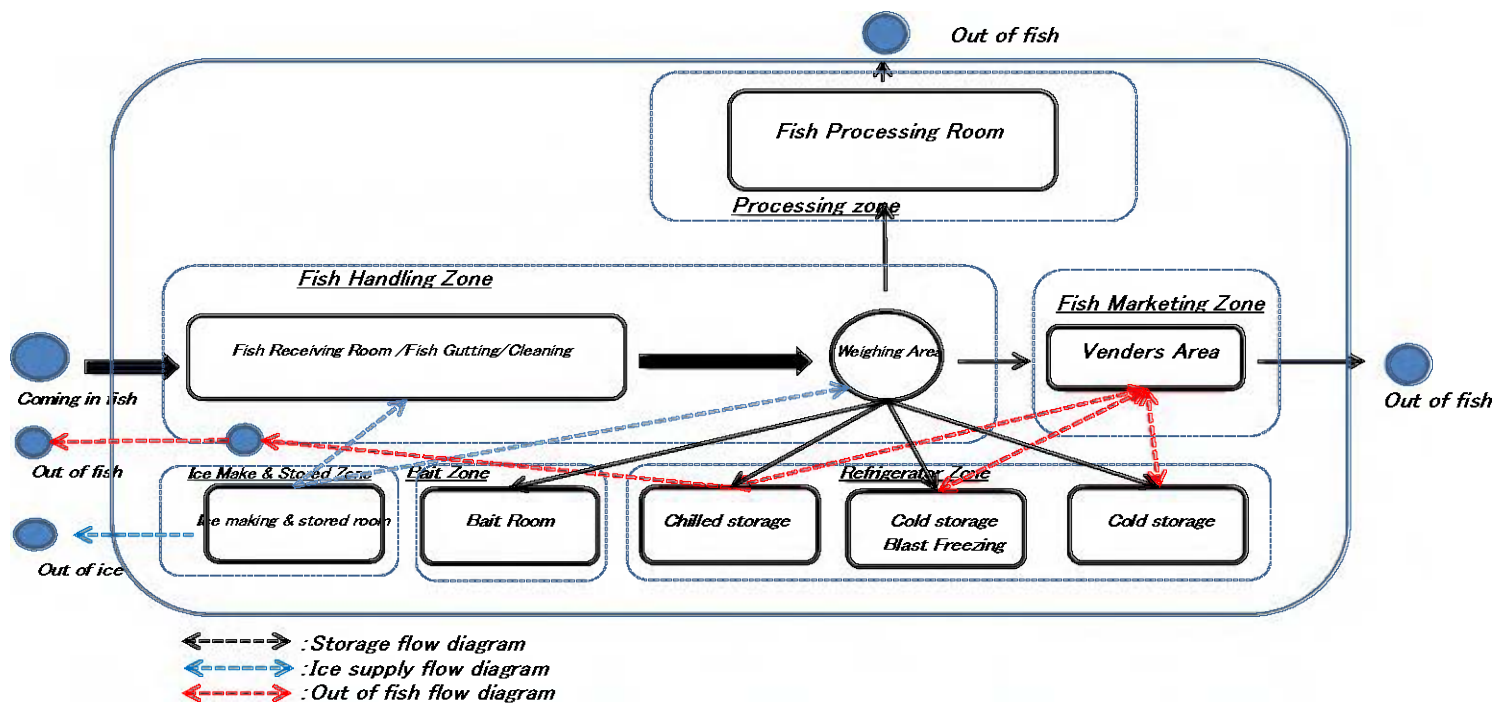


Figure 2-2(5) Flow diagram in the New Fisheries Center

The comparison of room area of existing Fisheries Center and Planned Facility are shown at Table 2-2(1).

Table 2-2(1) Comparison of room area of existing Fisheries Center and Planned Facility

Fl	Room	Design area	No. of Staff	Existing room area
First Floor	Fish receiving room	77 m ²	3	50 m ²
	Fish weighing area	39 m ²	3	35 m ²
	Fish processing room	91 m ²	5	50 m ²
	Vending area	132 m ²	15	45 m ²
	Administration room	27 m ²	3	
	Manager room	12 m ²	1	14 m ²
Second Fl.	Dry storage	12 m ²		
	Training & Meeting	80 m ²	(70)	65 m ²
	Ext. Officer (with Library)	26 m ²	1	
	Storage	45 m ²		27 m ²
	Ice Making Machine	68 m ²		25 m ²

Note: No. of staff is set by hearing surveys to the existing Fisheries Center, Fish Market and Fisheries Division.

As the supporting facility of these necessary spaces, laying storage room, bait room etc. out

in a line from the entrance side and all these facilities make one unit instead of installing separately with subjective basis and makes separation by dividing walls. The area of administration room is designed in accordance with $5.0\text{m}^2 - 15.0\text{m}^2/\text{person}$ (Basic Design Data Corpus compiled by Architectural Institute of Japan).

Movable space by forklift is secured in front of ice storage room, bait room and cold storage etc.

1) Workshop

Machine shop for repairing fishing boats and work shop for engine repair are planned. The frame structure is RC and the wall is concrete block and the roof shall be v-shaped steel sheet.

2) Net mending shed

Net mending and drying shed is installed beside the car parking. Stainless steel rack is installed and RC pillar and girder are attached to slab cum foundation and the roof shall be v-shaped steel sheet.

3) Ice machine and ice storage room, Freezing room and Cold room

Flake ice has been written in the request letter of Grenada, however, plate ice which was using at the existing fisheries center was confirmed as the request of Grenada at local study stage of Basic Design Study. In accordance with feature of plate ice making machine, ice machine in 2nd floor and ice storage room in ground floor just beneath are necessary to be installed. As the production capacity is increased in comparison with the existing ice making machine, the machine and ice weight will be increased therefore, to install new ice making machine with the same position of the existing building is structurally problem considering the slab load force. So, new ice making machine is installed in new building. The water supply to the ice making machine is continuous and the water tank should be provided at the nearest possible location however, condenser and others are necessary to install at the same 2nd floor level and the live load will be heavy therefore, such method should be avoided from the structural view. And, considering water pressure to machines, the water tank is desirable to install with the slab just above and the water supply by natural drop. About 8 tons is considered to be appropriate as the capacity of water tank with the calculation of daily necessary water volume + α . Since main girder with principal rafter shape is remained therefore, the roof shape is forced to be gable shape and the water tank is installed at the space born in the top part of building and it could be possible to protect from strong wind. A freezing room and freezing machine of cold storage other than ice machine in 2nd floor ice making room are installed and the condenser is installed just above the slab of the roof top. It is necessary to adjust each device distance considering the air distribution of air cooling for the condenser and shall install above the girder to the utmost extent for supporting the device weight. Front floor of freezing room, cold storage room and ice storage room shall be non-metallic floor hardener finish which is sustainable for the forklift transportation and a drain is installed in front of door in order to collect ice melted water.

a) Fish Receiving and Cleaning Room

The floor finish shall be clay tile and installed a cabinet for cleaning. The wall finish shall be tile finish for breast wall considering the cleaning by water and drain is installed.

b) Weighing Room

The floor finish shall be clay tile.

c) Primary Treatment Room (Fish Gutting and Cleaning Room)

As well as Fish Receiving and Cleaning Room, the finish for the floor and breast wall shall be clay tile and an air conditioner is installed inside.

d) Retail Shop

Considering the hearing surveys to the existing Fish Market and Fisheries Division, 10 booths shall be installed for the fish retail. The booth shall have the depth for the purpose of putting ice to preserve fish freshness. The size of each booth shall be about 1,200 mm x 1,200 mm. The water is used a lot and therefore, drains shall be installed at several places in the floor and the floor finish shall be clay tile.

e) Administrative Office

The lighting intensity of desk for the rooms related with the administration is set as 500 lx in accordance with Building Design Data Corpus compiled by Architectural Institute of Japan. The floor finish shall be Vinyl Composition Tile and the ceiling is installed with acoustical board finish.

f) Toilet and Bathroom

Staff toilet, Venders toilet and bath room are equipped. The floor and wall shall be tile finish and the ceiling shall be VE finish on Calcium Silicate board. The bathroom floor is planned to lower about 100 mm for leakage prevention.

The Table 2-2(3) shows the area of each designed facility in this project.

Table 2-2(3) Designed area of each facility

Facility	Floor Space (m ²)	Floor Area (m ²)			Total Floor Area (m ²)	Execution Floor Area (m ²)
		B1F	1F	2F		
A) Fisheries Center	714.63	82.50	679.28	348.74	1,110.52	1,573.20
B) Work Shop	32.02		27.04		27.04	62.44
C) Dry Storage Room	34.44		34.44		34.44	60.00
D) Repeater Shed	28.00		24.00		24.00	66.00

(2) Section Plan

As the frame of existing Fisheries Center is re-used, 1st floor height and 2nd floor height and the girders coming along with these heights have no choice but to meet with the existing one. The effective height from the existing 1st floor level to the bottom of girder is 2,975 mm and the height is enough to install ice storage room, freezing room and etc. which necessary height is about 2,750 mm. The facilities planned in 2nd floor of re-using existing building limit to the space for administration in order to diminish load force as smaller as possible and the installation of water related facilities, ice making machine and cold room etc. are planned in newly extending portion and the structural stability is secured by this.

1st floor level shall be the ground surface +300 mm as the average. And concerning the height of ceiling, the administration space shall be 2,500 mm with ceiling but the work room shall be slab exposed finish without ceiling.

(3) Water Proofing Plan

The expansion joint to connect with existing frame and new frame is necessary to equip water proofing capacity as well as buffer material to swing movement of different frames. The expansion joint equipment shall be made of stainless and select rubber sheet as the joint material. As it is difficult to secure water proofing capacity in case that installing portion is concrete block, exterior walls and joint portions of buildings in this project shall be all RC structures.

(4) Structural Plan

Structural plan of planned facilities in this project is shown below.

Table 2-2(4) Structural Plan of each building

Building	Foundation	Floor Slab	Column	Girder	Wall	Frame	Roof
A) Fisheries Center	RC	RC	RC	RC	RC* *	S	Bent plate
B) Work Shop	RC	RC	RC	RC	CB		RC
C) Dry Storage Room	RC	RC		RC			Bent plate
D) Septic Tank	FRP (main body)	RC					
E) Antenna Tower	RC	RC	S	S			
F) Repeater Shed	RC	RC	RC	RC	CB		RC

* RC: Reinforce Concrete, CB: Concrete Block, S: Steel Structure

** Walls which structurally need bearing wall in the existing and extension portion shall be RC

(5) Facility Plan

Table 2-2(5) shows necessary facilities in each room of New Fisheries Center.

Table 2-2(5) Facility in each room of New Fisheries Center

Floor	Room	Room Area(m ²)	Number of Staff	Consent	Telephone	LAN	Water	A-CON	Illuminance
First Floor	Fish receiving room	77	3				○		300
	Fish weighing area	39	3	○					300
	Fish processing room	91	5	○	○		○	○	300
	Vending area	132	15					○	300
	Administration room	27	3	○	○	○	○	○	500
	Manager room	12	1	○	○	○			500
	Dry storage	12							150
Second Floor	Training & Meeting	80	(70)	○				○	350
	Ext. Officer(with Library)	26	1	○	○	○		○	500
	Storage	45							150
	Ice Making Machine	68		○			○		250

(Note) Luminance of each room is planned to allocate lighting fixtures and the wiring to keep necessary illuminance considering natural illumination.

The following is the ground of facilities size setting in New Fisheries Center.

● shows the present situation and ○ shows the plan. Blast freezing facility corresponding to -60 degree C in private company (SFS) of Grand Male in Grenada has been operated therefore, Grenada is regarded to have enough technical capability to handle when it is donated.

	Existing Place	Current improved points in new facilities and the reason to set the magnitude
① Fish Receiving Room	Fish Market	<ul style="list-style-type: none"> ● The entrance space of existing Fish receiving room is narrow about 2m and there is a space inside with $7 \times 7 = 49 \text{ m}^2$ however, as there are 3 fish cleaning tables ($3\text{m} \times 0.85\text{m} + 4.4\text{m} \times 0.85\text{m} + 3.8\text{m} \times 0.85\text{m} = 9.5 \text{ m}^2$) and 2 sinks ($2 \text{ m} \times 0.65\text{m} \times 2 \text{ sinks} = 2.6 \text{ m}^2$), the actual working space is only 37 m^2. In addition, the corner of sink and wall side space of cleaning table become the dead space therefore, the effective working space is only 22 m^2 and congested. It is impossible to enter pull cart with fish. ○ The necessary working space of new facility is calculated as 77 m^2 based on the Guidance for Fishing Port Plan (issued by National Association of Fisheries Infrastructure) so as to cope with fish landing of 5,500 lbs(2.5 tons)/day with the following calculation. <ul style="list-style-type: none"> <Calculation Condition> Daily handling volume planned: 2.5 tons of Bonito and Tuna (N) Line-up method: Loose in bulk Handling Volume in unit area: 27 kg (P) Turnover: 2 times (R) Occupancy Ratio: 0.60 (α) <Calculation> $\text{Necessary area} = \frac{N}{R \cdot \alpha \cdot P}$ $= \frac{25,000}{2 \times 0.60 \times 27} = 77 \text{ m}^2$ <p>And also the entrance size is secured about 3.6 m so as to make carrying- in of large size fish easy.</p> <ul style="list-style-type: none"> ○ And the cleaning table shall be the layout to avoid the dead space and arrange attaching to south side wall with the length of 11m and the width of 0.65m. A drain of 0.1m is installed at wall side and the water on the table shall not be flowed over the floor. The water for cleaning is supplied through rubber horse of about 50 cm attaching to several taps from wall side. ○ A wall is not installed at south side and keep good ventilation and wide environment. ○ One water tap being exclusive use for floor cleaning is installed.

② Weighing room	<ul style="list-style-type: none"> ● Currently, there is the space of 5m x 7m=35 m² however, as there is unused table, the effective area shall be 18 m² which is narrow. ○ In new facility, considering the space for fish waiting of weighing after cleaning and the space for fish waiting after weighing before the storage into cold room in addition, so as to be able to deliver with push cart, there secures 39 m² which is double of existing effective space. ○ In order to avoid exposure to water, the space for scale installation with 2m x 2m shall be provided raising 0.1 m from the floor. ○ One water tap being exclusive use for floor cleaning is installed at sea side wall since water mixed with fish blood flows over the floor. ○ The passage way to north from weighing area shall not have steps but make it as flat due to the frequent traffic of push cart.
③ Retail shop & sales	<ul style="list-style-type: none"> ● Retailers are selling fishes storing fish in small insulated boxes due to no display rack. 4 retailers are using 2 gutting and cleaning tables with 2.8 m x 0.65 m = 1.82 m² as sales table also. ○ In new facility, display racks are installed so as to be able to actively work using ice. ○ Total 10 booths including for retailers who newly wish to sell fish in the facility. ○ A space for removing scales from fish is installed at east side of the retail space. ○ One water tap being exclusive use for floor cleaning is installed.

④ Cold storage room	<ul style="list-style-type: none"> ● The thermometer in the existing cold storage room (External size 3.6x3m=11 m²) does not work and the room is extremely old with heavy dewdrop. ○ Corrosion of freezing machine is going on and abnormal noise and blot of air cooler condenser are significant. ○ 1,650 lbs (0.74t)/day which correspond to 30% of fish catch with 5,500lbs (2.5t)/day shall be secured with 1.5 days turn over. ○ In order to secure necessary space for storing 0.74t x 1.5 days=1.1t, the volume shall be 4.98m x 3.015 m x 2.5m =38m³ ○ Concerning storage patten, 0.75 t (45 kg/ m²) is stored at each rack (3 tiers) of 4.0m x 0.8m x 1.6m and 3.0 m x 0.8 m x 1.3 m and also stored piling flat on the floor grates (1.2 m x 1.0 m x 4 grates) (94 kg/m²). Small volume of mid and small size of fishes are stored in fish boxes (0.77 m x 0.35 m x 0.30m, 30 kg pack). The room temperature of cold storage room shall be -5 degree C.
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⑤ Freezing room	<ul style="list-style-type: none"> ● The existing freezing room (external size 3.6m x 3m=11 m²) is heavily deteriorated with age. As the thermometer does not functioned, only -15 degree C against the -20 degree C capability is secured and the dew drop is apparent as the photo shows. ○ • Corrosion of freezing machine is going on and abnormal noise and blot of air cooler condenser are significant. ○ New facility shall install child room, bait room and freezing room as new cold storage rooms. Freezing room is used to meet with the following three purposes. ○ • Blast-freezer : Long term storage for Large size fishes and promotion of quality frozen fish ○ • Freezing storage room : storage for above quick-frozen fish <ul style="list-style-type: none"> • Slow-freezer/Storage room : For short-term storage. As the capacity shall be required to increase when stores fishes already frozen and fishes to be frozen at the same room, it will not be economical due to the hike of power charge. Therefore, this storage room shall install inner partition and secure pre-cooling room. ○ Blast-Freezing Room <ul style="list-style-type: none"> • This is to store 550 lbs (0.25t) which correspond to 10% of fish catch of 5,500lbs (2.5t) /day after quick freezing for the purpose of long-term storage and promotion of high quality. • As 0.25t is frozen at one time in 20 hours, a movable cart equipped with freezing rack which can handle 0.25 tons fishes is used and it is vent on a mandatory basis with the temperature from -25 degree C to -30 degree C. • The volume of freezing room is 3.05m x 2.2 m x2.5 m =17 m³ and allocate working space of 1.5m x 2.2m=3.3 m² ≐ 3 m² in front of entrance. • In order to obtain economic efficiency before the freezing, the above mentioned pre-cooling room is utilized. ○ Ice storage room <ul style="list-style-type: none"> • It stores frozen fishes by the above quick-freezing room for around two weeks keeping the room temperature of -20 degree C. • The space to be able to store 0.25t x 14 days=3.5t shall be secured and its volume becomes 4.98m x 4.7m x 2.5 m =59 m³. • The storing method is to put 2.75t (124 kg/m²) with 2 racks of 2.4m x 0.8m x 1.6 m (3 tiers) and 1 rack of 4.5m x 0.8 m x 1.3m (3 tiers) and put 0.75 t (71 kg/ m²) on 3 movable freezing racks. <p>The frozen fishes placed in installing racks are handled by movable freezing rack.</p>
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o Slow Freezer & Cold storage room

- It freezes 2,750 lbs(1.24t)/day which correspond to 50% of fish catch, 5,500lbs (2.5t) /day under the room temperature from -20 degree C to -25 degree C for 30 hours and store with 3.5 days turn over. Therefore, the storing capacity of 1.24t x 3.5 day=4.3t is required.
- The necessary volume is 4.98m x 9.4m x 2.5 m =117 m³ and the break down of pre-cooling room and freezing storing room are as follows.
In addition, this pre-cooling is also utilized before processing for quick-freezing and freezing of bait.
Pre-Cooling Room: 4.98m x 4.7m x 2.5m = 58.5 m³
Freezing Storing room: 4.98m x 4.7 m x 2.5 =58.5 m³
- Storing method after frozen is to use installed racks and metal mesh pallet cart. 2.8t (137 kg/ m²) is placed in 2 installed racks (4.0m x 0.8m x 1.6m, 4.5m x 0.8m x 1.3 m) and 0.3t x 5=1.5t (300 kg/ m²) is placed in bulk on 5 metal mesh pallet carts.
- What is used these racks and carts for storing frozen fishes is to resolve the present inefficiency and danger as shown in the following photos.



Present bulk storing (frozen fish first in is never out unless the room becomes empty)



Present bulk storing (inefficient storing) Present bait storing (unstable and dangerous storage)

⑥ Bait room	<ul style="list-style-type: none"> ● The freezing machine of existing bait room (Inner size 2m x 3.5m x 2m = 14m³) has been heavily corroded and not worked. ○ The long line fishing boat is usually use live fish bait (30 lbs/ voyage/boat) however, the same volume of frozen bait is used at the time of shortage of live fish bait. Bait fishes which locally catch is frozen and store in preparation for the shortage. Fishermen carry in live bait with plastic bucket (diameter 35 cm, depth 40 cm) which is able to put 35 lbs (16 kg) and freeze and store. Judging from the empirical value of two persons in charge of the management for frozen fish and frozen bait, The daily demand is about 1,200 lbs (540 kg) and the bait for 5 days is frozen and secured. ○ As inside of room cannot be well utilized with the method to set out buckets scattered over floor, the rack with 3 tiers is provided and store as 2 row placements on each tier. ○ In order to attain safe and effective storing the volume shall be 4.98m x 4.5m x 2.5m = 56 m³. The working space (2.0m x 2.8m = 5.6 m² ≐ 6 m²) is secured in the room since many fishermen come in and out. The room temperature is -20 degree C. ○ The small bait fishes catch at front beach by beach seine is once cooled at pre-cooling room and then freeze.
⑦ Manager room	<ul style="list-style-type: none"> ● As existing child room and chest freezer are heavily deteriorated and the temperature is unstable, the freezing machine has been always worked and as the machine is generated big noise, the administration works such as weigh-in and recording works are disturbed. ○ Although the administration office and manager room shall be located where the noise from freezing machine does not affect in new facility, the administration office shall locate the position to be able to always watch sales department and weigh-in department.
⑧ Toilet	<ul style="list-style-type: none"> ● One toilet and shower for administration staff and venders is installed. ○ Toilet for administration staff (1 for male and 1 for female) and toilet and shower for venders (1 for male and 1 for female) and shower (2 for male and 1 for female) are installed in new facility.

⑨Ice Machine ⑩Ice storage room ⑪Freezing room 1 ⑫Freezing room 2	Fisheries Center	<p>●It is necessary to be replaced since 4 facilities have been passed over 15 years since Japan has procured and each component has been apparently deteriorated except the part of component which were replaced by JICA follow-up cooperation in 2007.</p> <p>○Ice Machine</p> <ul style="list-style-type: none"> • As the result of 3 times of ice volume tests against existing ice machine which daily production capacity used to be 2t of plate ice, it was found that the capacity has decreased to 1.1t/day (56%) due to the aging. According to the interview survey to fishermen, existing market and processors, the new facility is required to supply ice of 4t /day and 2 plate ice machines with 2t/day capacity are supplied. The interview were made to 58 fishermen (58/153 boats= 38%) and 24 retailers and venders (24/37 persons=65%). <p>○Ice Storage Room</p> <ul style="list-style-type: none"> • Wooden panel rack has been heavily deteriorated and the joint with wall panel has been broken away. A lot of water from bottom of the panel has been leaking and the replacement is inevitable. • Assuming the operating ratio of ice machine as 70% (256 days) per year and the ice storing volume coping with peak time in high fishing season, the ice storing capacity is required as 10t which is 2.5 times of ice making capacity. <p>●Freezing room 1</p> <ul style="list-style-type: none"> • Due to the deterioration of wooden rack, floor face in floor area has been subsided and break away of panel joint is heavy. • Freezing machine has been heavily deteriorated such as the oil leakage from shaft seal and motor insulation failure. <p>Therefore, the freezing room with the capacity as mentioned in the above ⑤ shall be newly provided.</p> <p>●Freezing room 2</p> <ul style="list-style-type: none"> • Due to the deterioration of wooden rack, floor face in floor area has been subsided and break away of panel joint is heavy. And, the insulated door has been damaged. • Freezing machine has been heavily deteriorated such as the oil leakage from shaft seal and motor insulation failure. <p>Therefore, the freezing room with the capacity as mentioned in the above ⑤ shall be newly provided. And out of renewal facilities, the removal is necessary to carry out carefully under the supervisor from Japan since the parts are possible to divert to Glenville, Mellville Street and other places.</p>
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⑬ Fish Processing Room

New Facility Equipment

- Slice in rounds product of frozen fish for food services to school and hospital etc. has been generalized and the demand has been increased. The better quality products are required to supply upon the needs of hotels and restaurants.
- As there is no fish processing room in existing fish market, only simple fish processing like slice in rounds is done at fish retail booth. Quality and quantity of processed fishes are not enough for increased demand.
- A space for fish processing is installed to resolve above problem. Here high quality fish processing is performed, including handling of fresh yellow fin tuna and in addition, the development of new processing product such as salted and dried fish processing shall be studied.
- The following equipment is necessary in new facilities and the necessary space for processing work and the space for placing these equipment are calculated as follows. These equipment shall be planned and prepared by the own effort of Grenada.

Equipment	No	Length (m)	Width (m)	Equipment Area (m ²)	Workable Width (m)	Workable Area (m ²)	Total Area (m ²)
Work table	2	1.80	0.75	2.70	0.6	6.12	9
Frozen fish cutter	1	1.00	0.75	0.75	0.6	2.10	3
Vacuum Packaging Machine	1	1.30	0.60	0.78	0.6	2.28	3
Heat sealer	1	0.50	0.50	0.25	0.6	1.20	1
Weigh-in table & scale	1	1.80	0.75	1.35	0.6	3.06	4
Packaging table	2	1.80	0.75	2.70	0.6	6.12	9
Sink	2	1.20	0.75	1.80	0.6	4.68	6
Small freezer	1	1.20	0.75	0.90	0.6	2.34	3
Appliance storage	2	1.80	0.75	2.70	0.6	3.96	7
Fresh fish treatment table	2	1.80	0.75	2.70	0.6	3.96	7
Fresh fish freezing box	5	1.00	1.00	5.00	0.6	9.00	14
Fresh fish shipping table	2	1.80	0.75	2.70	0.6	3.96	7
Walk space & doors							18
GTotal							91

*The workable width means 0.6m in which one person can work standing up around each equipment and calculated as (around equipment) x 0.6 m= (workable space).

- Installation of air-conditioner
- 2 sinks are installed in north side of wall.

		<ul style="list-style-type: none"> ○ As the floor will be dirty by fish cutting and etc., one water tap being exclusive use for floor cleaning is installed and install some blocking tool of blood and grease called “Grease Trap” to drain. ○Cropper, Sealer, Power source for ice box (water proof) are installed.
⑭ Forklift		<ul style="list-style-type: none"> ● Processing company which owns truck carries ice by truck however, general fishermen load to fishing boat carrying with the unit of 80 lbs(36kg)/bag by cart. And, landed fishes are handled by the same way therefore, the labor burden to fishermen for handling ice and fish is severe. ○ Improving jetty and fish receiving space, a forklift is going to be provided for the purpose of labor reduction and promotion of functional efficiency as fish landing base. The loading capacity is to carry an usual fish box ice (ice about 400 kg/1 m³) in one time and considering safety of cargo loading and unloading the forklift with 1t capacity shall be selected. It mainly works outdoors however, it shall be operated by propane gas provided that it moves up to front side of cold storage room indoor.

① Electrical Facility

The electrical energy being necessary for the facilities planned in Gouyave area such as New Fisheries Center and others in this project is about 150kVA and feed from three-phase three-wire 400v after transformed from high-voltage electrical power lines (11kV) located at front face of project site. Underground cables connect to buildings from electrical pole standing road side and receive it at ice machine room and distribute to each room and each facility.

The illumination of each room shall be planned based on 500lx for administration and 300lx for work room as the standard. Natural illumination is also considered and as well as arranging lighting fixtures, it will be some help for the saving energy policy by conducting the wiring from switch board according to the plan.

Concerning light electrical equipment, telephone facilities are installed in the administration rooms and primary process room. And, in order to secure data exchange among administration rooms and internet communication with outside (Fisheries Division, clients and etc.), Wired LAN cable is installed to administration rooms. (Even if radio LAN is installed in one room it is easy to be influenced by RC wall and RC slab so the wired LAN is also installed.)

② Water Supply Facility

The possibility of water outage in Gouyave area is small however, considering the water supply capacity of water pipe; a septic tank should be installed at Fisheries Center. The installation of the septic tank is appropriate to install underground due to the narrow land. The water is supplied by alternate operation of 2 pressure pumps from the septic tank to each room in 1st floor of the facility. The septic tank will install in the trench and discharge water to outside in order to cope with the

overflow and etc. And, the ventilating facility is installed due to the necessity of lowering the temperature. The water to the facility in 2nd floor by installing effective 8 t tank just above the ice machine room is supplied by natural drop method. Currently, although there is the water pipe with 50φ laying in both sides of road in front of project site, it also supply water to neighboring houses therefore, it is considered that necessary water will be supplied to the project site. It plans to take water from the main water pipe (about 150φ) which is located at the bridge in south side of project site. Main feeding facilities and water volume are shown in Table 2-2(6).

Table 2-2(6) Necessary water volume in Fisheries Center

Usual feeding facility	Necessary water volume
Ice machine related	5.6 t /day
Freezing and ice storage related	3.6 t /day
Fish cleaning	2.0 t /day
Floor cleaning	1.3 t /day
Toilet	4.0 t /day
Total	16.5 t /day

A space for installing overflow pipe in the septic tank is necessary and its volume is about 20% of total volume of the septic tank. With this, in order to secure effective water volume 16.5m³ in the above, the volume of septic tank of 20 m³ with the calculation as $16.5 \text{ m}^3 / (1-0.2) = 16.5 \text{ m}^3 / 0.8 = 20.6\text{m}^3$ shall be installed.

③ Drainage Facility

There are 3 drainage systems from New Fisheries Center and the surrounding area. The first one is rain water drainage system which discharges water from the rain to roof and ground to ocean. The second one is contaminated water drainage system which the water from toilet is induced directly to purifier tank. The third one is mixed discharging waters drainage system which the water are from sinks in vender's room, fish receiving room and primary processing room and showers. It will consider to be induced only discharged water to purifier tank by installing some blocking tool called "Grease Trap" against fish blood coming from the removal treatment of fish guts and scale in Grenada.

Number of sanitary apparatus planned for the New Fisheries Center is shown in Table 2-2(6).

Table 2-2(7) Number of sanitary apparatus in the New Fisheries Center

Floor	Room	Water basin	Urinary	Closet bowl	Shower
1	Toilet for vender(M)	2	2	1	
	Toilet for vender(F)	1		1	
	Shower room Toilet for staff(M)	2	2	1	2
	Shower room Toilet for staff(F)	1		1	1
2	Toilet(M)	2	2	2	
	Toilet(F)	1		1	

Here, in order to calculate treatment capacity of septic tank, the calculation of discharging water and waste water volume to the septic tank are as follows.

Discharging water from New Fisheries Center

- ① Water from fish processing $2.0\text{m}^3/\text{day} \times 800\text{mg}/\ell = 1.60 \text{ kg}$
- ② Cleaning water for floor $1.3\text{m}^3/\text{day} \times 100\text{mg}/\ell = 0.13 \text{ kg}$
- ③ Water from 1st floor toilet $30 \text{ persons} \times 5 \text{ 0L} \times 260 \text{ mg}/\ell = 0.390 \text{ kg}$
- ④ Water from 2nd floor toilet $1 \text{ resident and assuming to use toilet one time by half number of users of training room (1 person} \times 50\ell + 35 \text{ persons} \times 10\ell) \times 260 \text{ mg}/\ell = 0.104 \text{ kg}$
- ⑤ Water from shower $15 \text{ persons} \times 50\ell \times 50\text{mg}/\ell = 0.0375 \text{ kg}$

The above total volume is calculated as below and the septic tank is designed based on this value.

Inflow sewage volume to septic tank	5.95 m ³
Inflow BOD density	$2.26 \text{ kg} / 5.95 \text{ m}^3 \times 1,000 = 380 \text{ mg}/\ell$
Discharge BOD density	20 mg/ℓ

2-2-2-3 Radio Communication Facility

The land for installing antenna for radio communication is located at middle on the road to connect from Melville Street to Grenville. It locates at about 400m inside of mountain side from main road and currently the antenna (height: 150ft) of Cable and Wireless and one for FM broad casting are already constructed. It is necessary to send radio wave to 90 miles for the contact with fishing boats and emergency purpose. Steel tower with the height of 180 ft (about 55m) as the antenna in order to clear the problem of wave distance and avoid interference with existing antennas is planned. Presently, wireless application used in fishing boats in Grenada has 8 channels with the frequency from 156 to 164MHz.

Although one antenna (height: 210 ft) is installed at north side of island, Kublal, Mt. St. Catherine (height: 2,757ft) partly disturb to send wave to outer sea and new antenna is necessary to improve such status. A stage for safety maintenance work shall be installed at top of antenna tower.

It is possible to use one co-axial cable (diameter about 30 mm) from to antenna and repeater since this system is to receive wave from base station and send it with different frequency through repeater. However, in order to avoid the wave attenuation it is desirable to construct shed for the installation of repeater at the place closest possible to the antenna

Repeater shed is constructed by RC frame and CB wall and one door facing to south, one window with bars for antitheft each and one air conditioner to make equipment operate smoothly and stably is accommodated. The site area is good view without blockers therefore, a standby generator (10 KVA) is installed due to the fear of electrical line severance at the time of strong wind. And, office is planned to make clear separation from the generator room and storage room in order to prevent radio disturbance by generated radio wave from the generator against repeater and etc.

As the result of soil bearing capacity survey, N-value at ground surface area was 7 to 8 and increase smoothly up to around GL-1 4 m and N-value at GL-14 is 20 and became 50 at around GL-16. The stress against pull-out force by wind pressure is secured by concrete foundation.

2-2-3 Basic Design Drawings

(1) Lay out plan

Layout plan is shown in Figure 2-3(1).

(2) Basic Design drawings for civil facilities

Figure 2-3(2) ~Figure 2-3(11) show sectional drawings for civil facilities.

Figure 2-3(2) Overall View of Jetty and Access Sections

Figure 2-3(3) Overall View of Jetty Section

Figure 2-3(4) Structural Drawing for Jetty Super Structure

Figure 2-3(5) Overall View of Access Bridge

Figure 2-3(6) Structural Drawing for Access Bridge Super Structure

Figure 2-3(7) Standard Section for Revetment 1

Figure 2-3(8) Standard Section for Revetment 2

Figure 2-3(9) Standard Section for Revetment 3

Figure 2-3(10) Standard Section for Revetment 4

Figure 2-3(11) Standard Section for Revetment 5

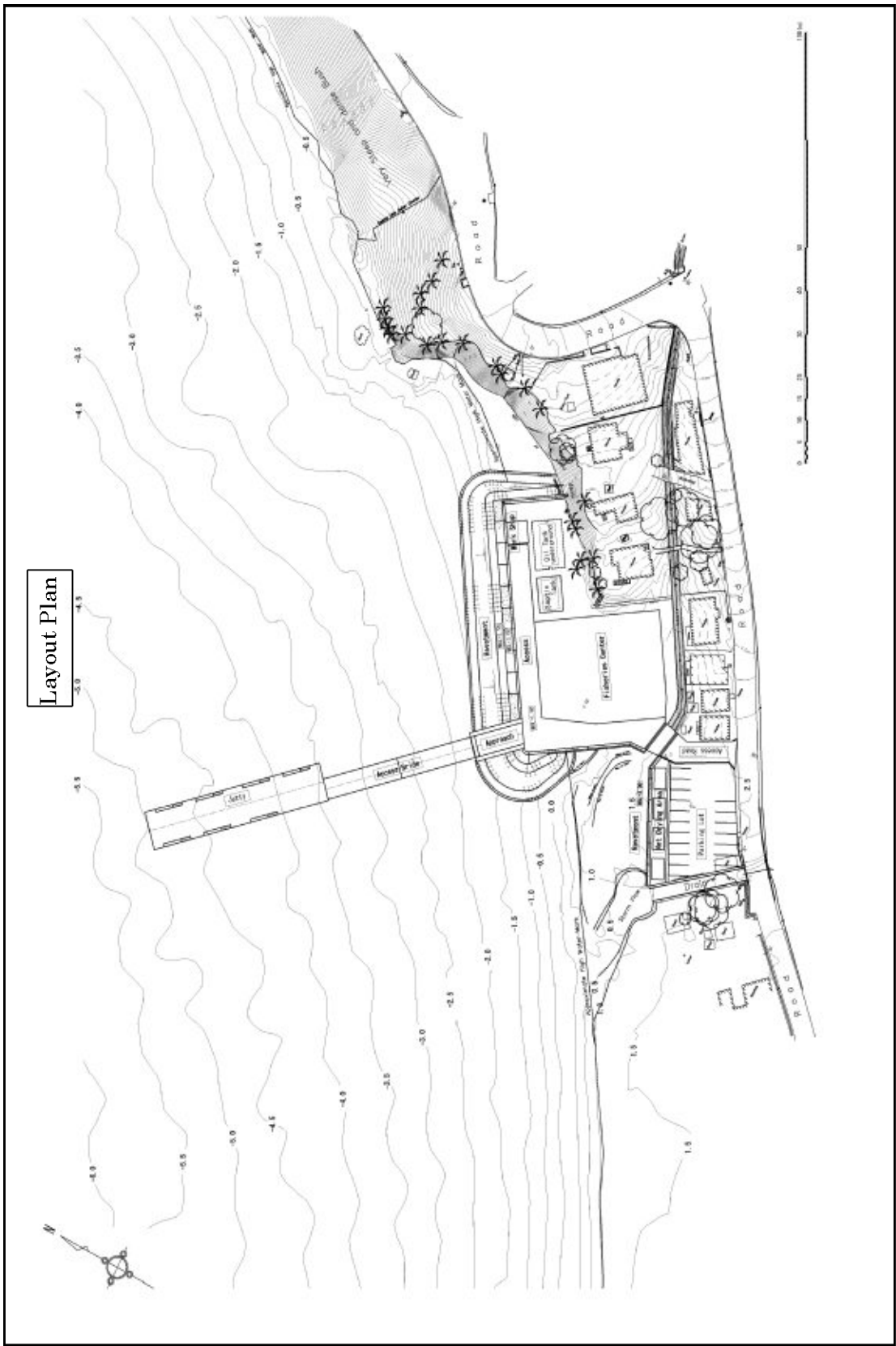


Figure 2-3(1) Layout Plan

Structural Drawing for Jetty Super Structure

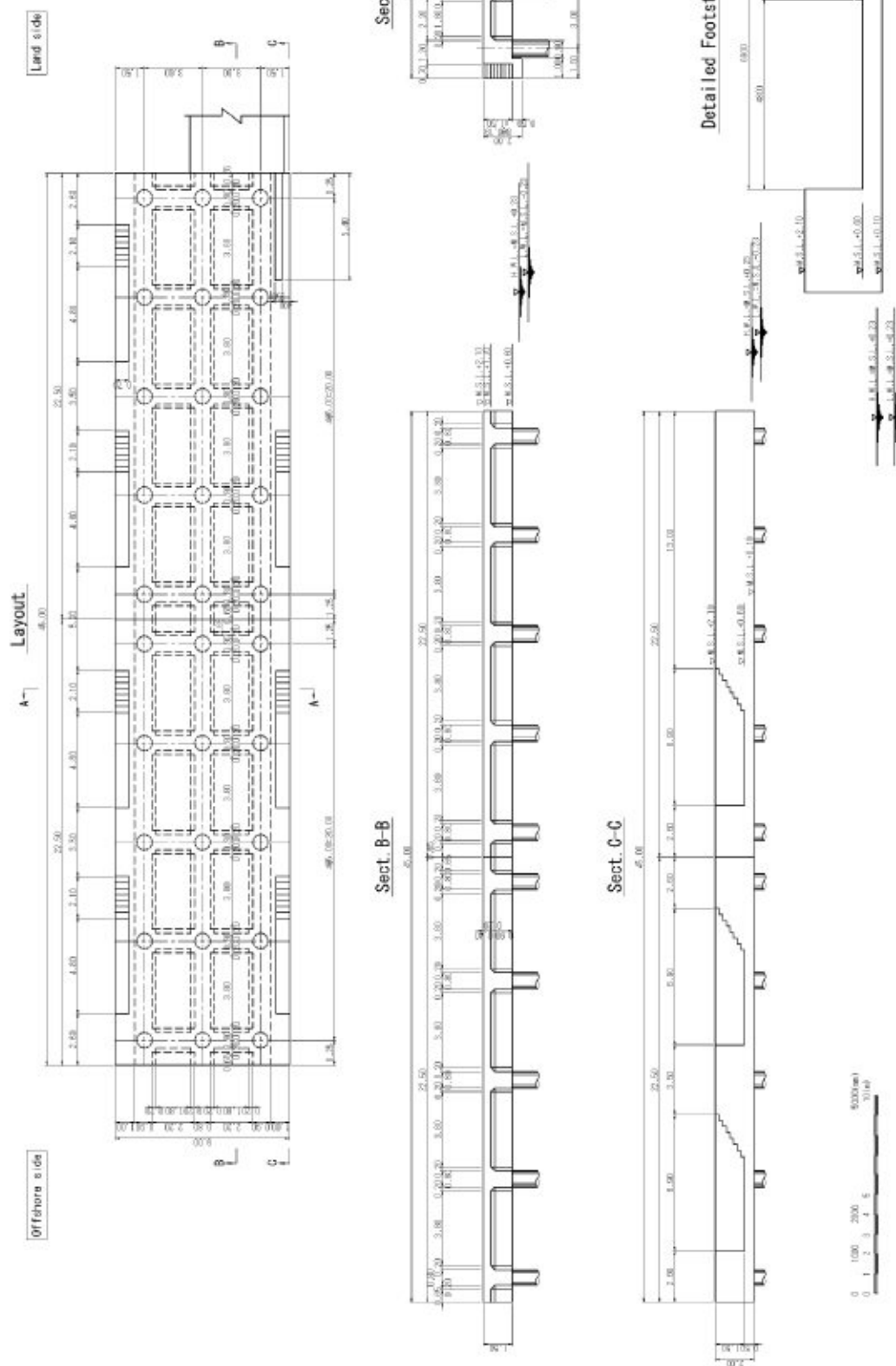


Figure 2-3(4) Structural Drawing for Jetty Super Structure

Overall View of Access Bridge

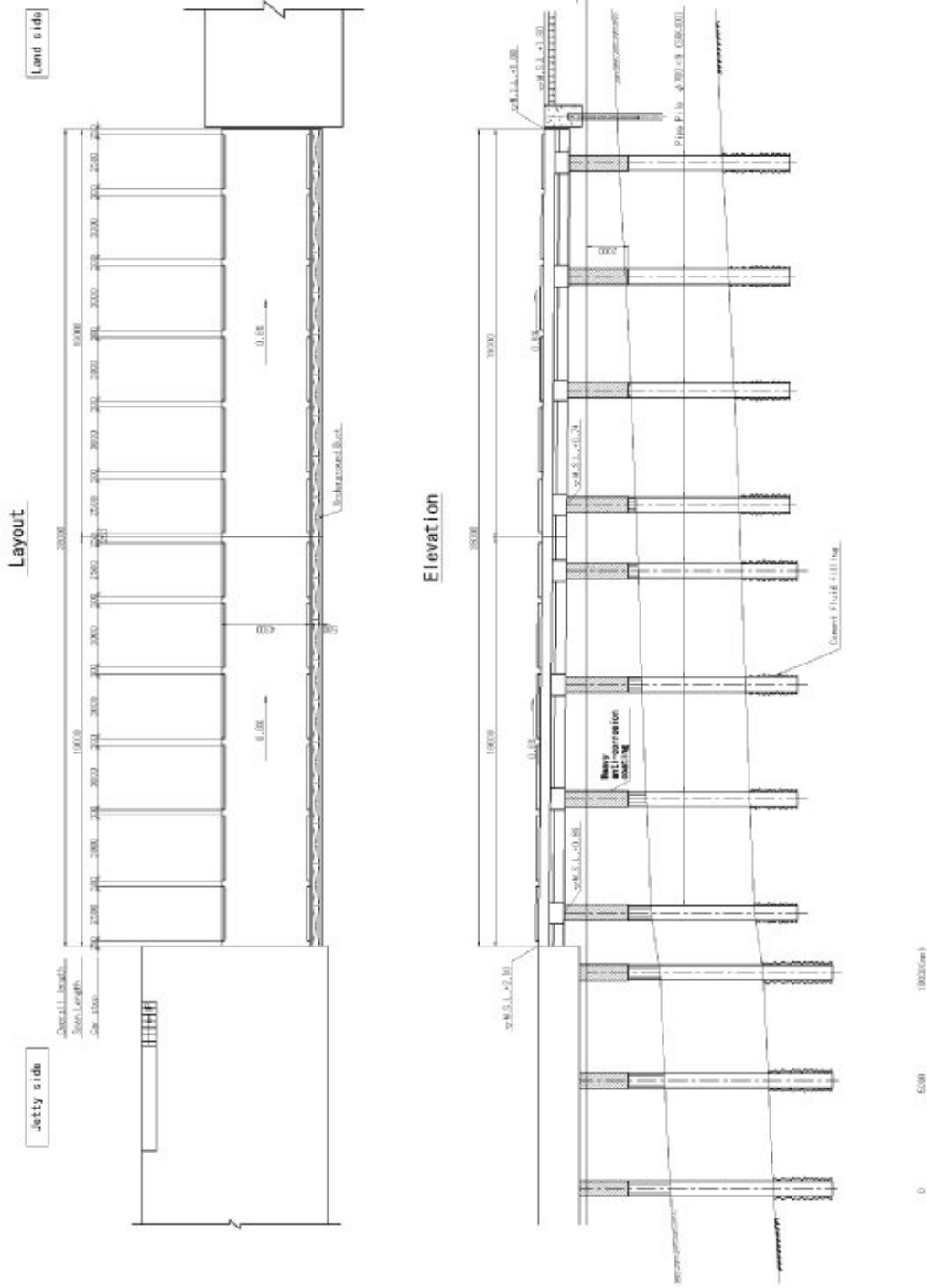
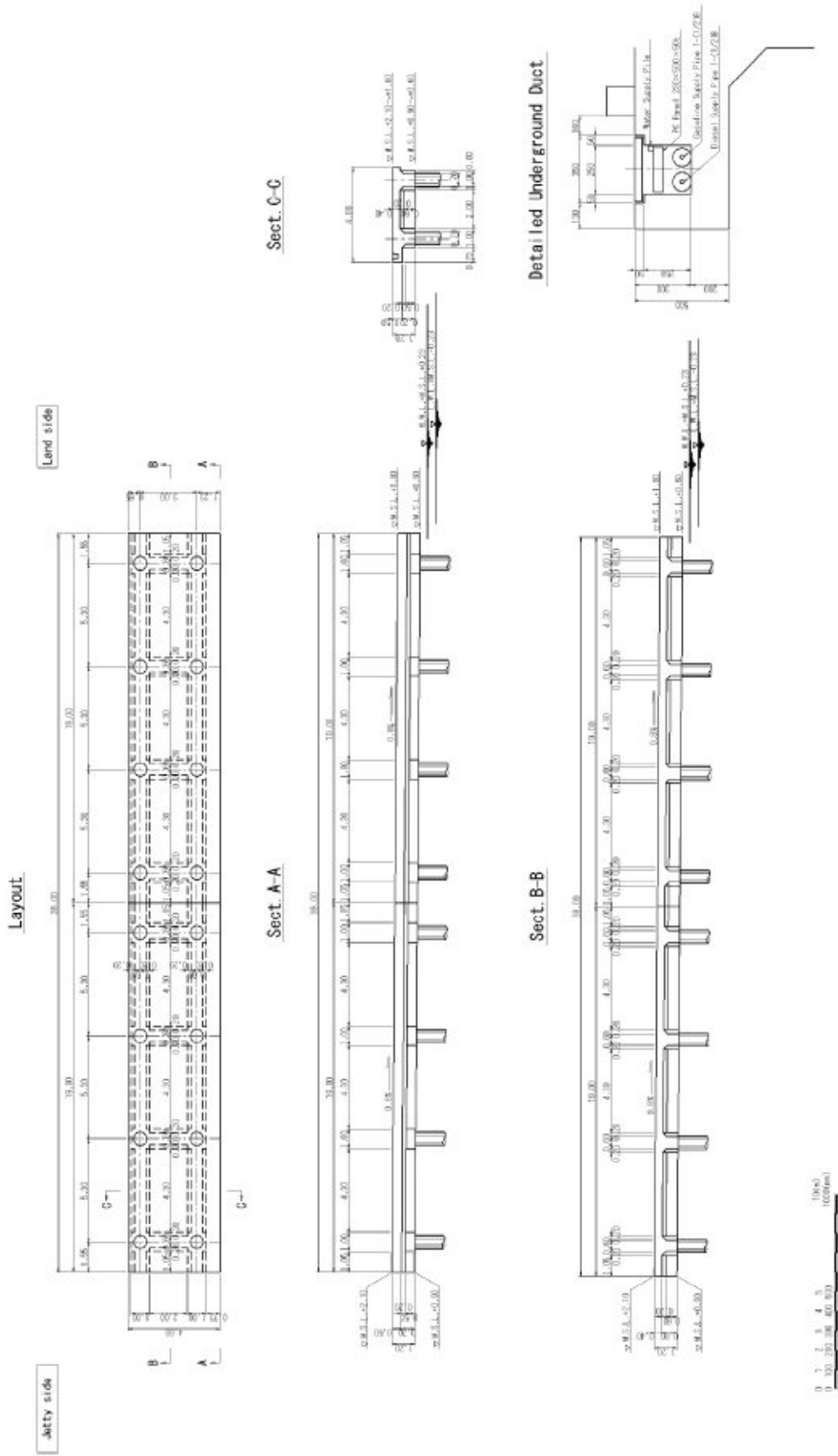


Figure 2-3(5) Overall View of Access Bridge

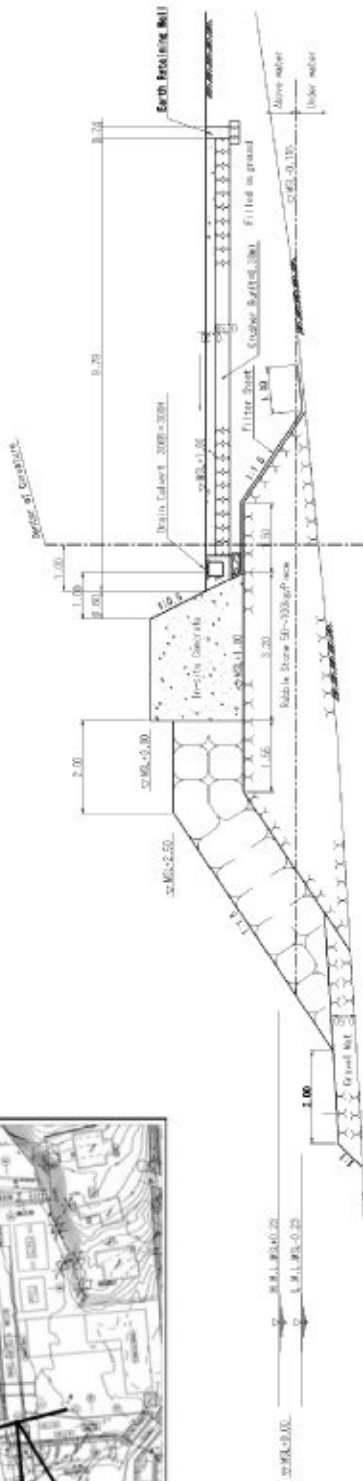
Structural Drawing for Access bridge Super Structure



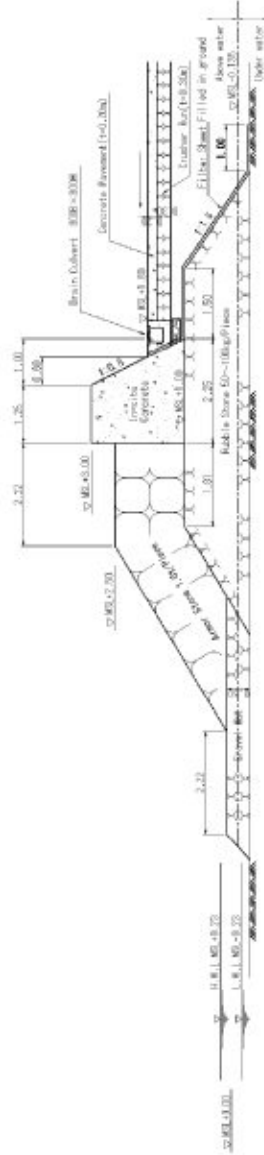
Standard Section for Retement 1



① - ①



② - ②

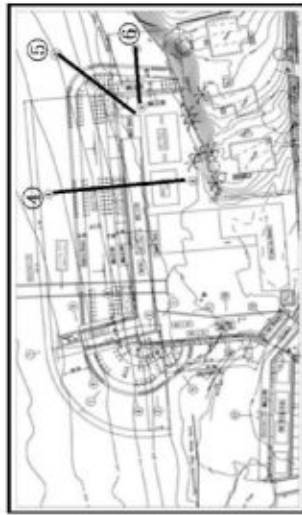


③ - ③

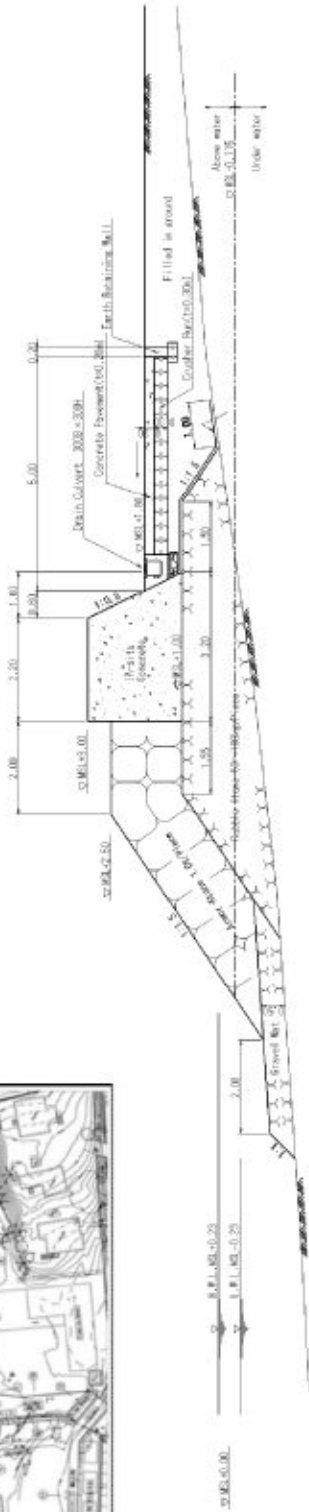


Figure 2-3(7) Standard Section for Retement 1

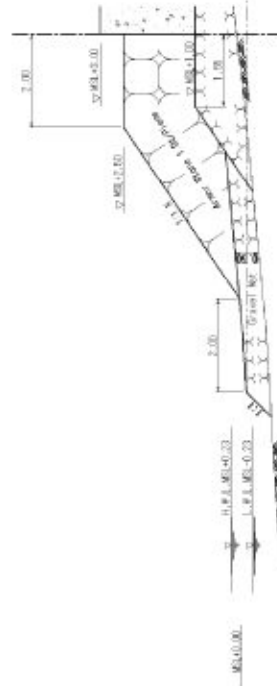
Standard Section for Revement 2



④ - ④



⑤ - ⑤



⑥ - ⑥

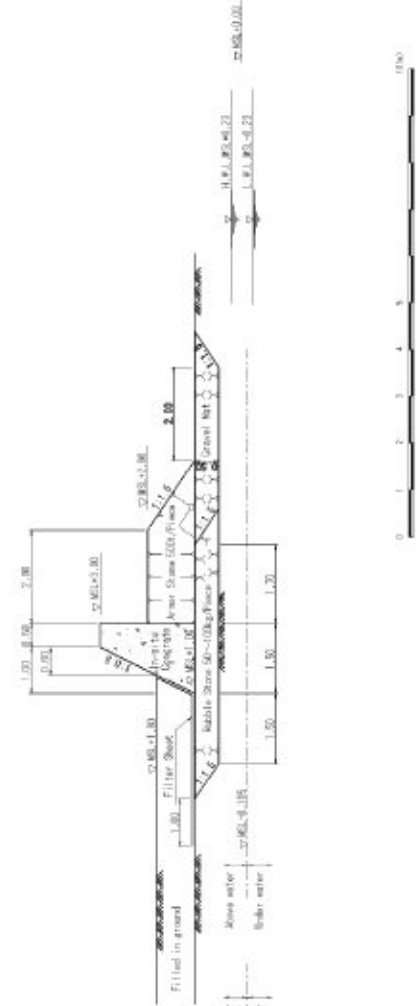
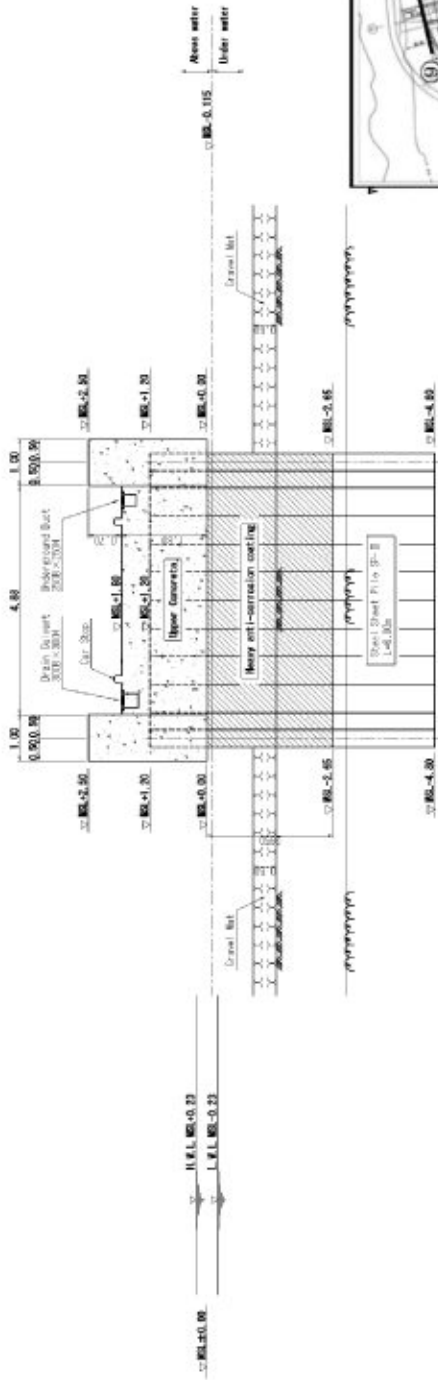


Figure 2-3(8) Standard Section for Revement 2

Standard Section for Revement 4

9 - 9



10 - 10

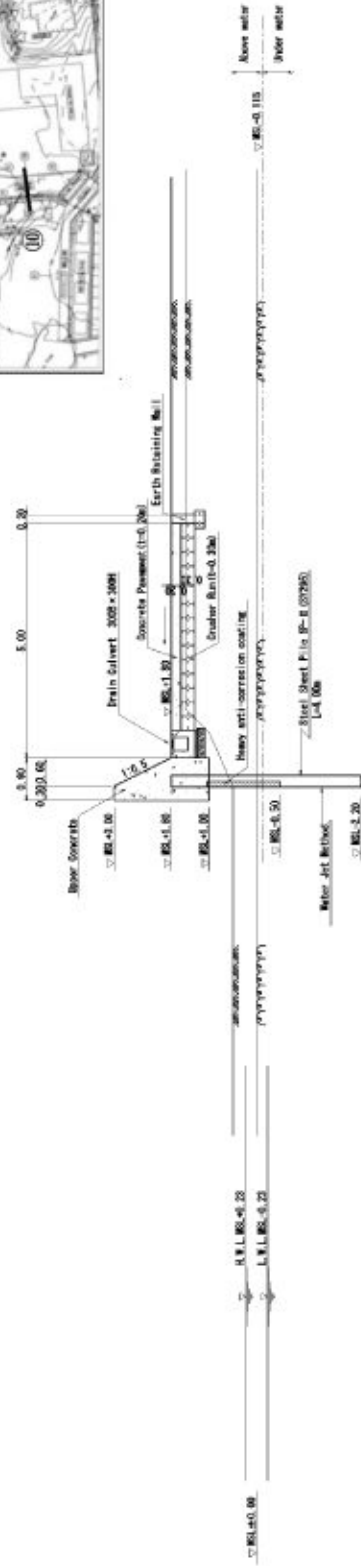
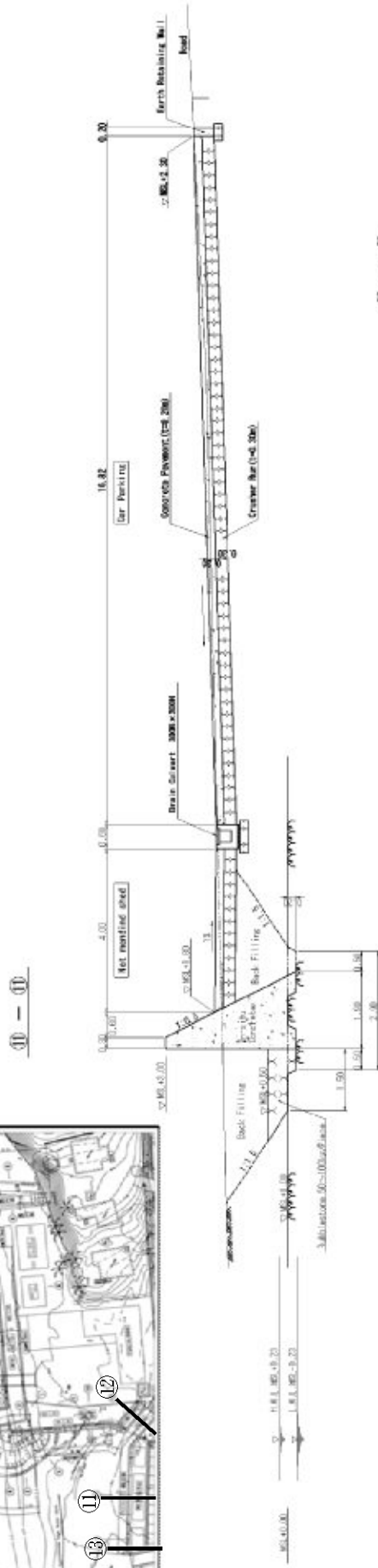
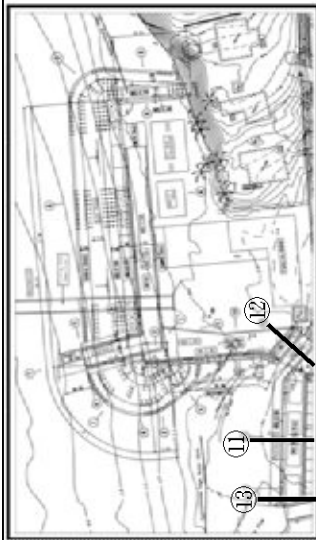


Figure 2-3(10) Standard Section for Revement 4

Standard Section for Revement 5



13 - 13

12 - 12

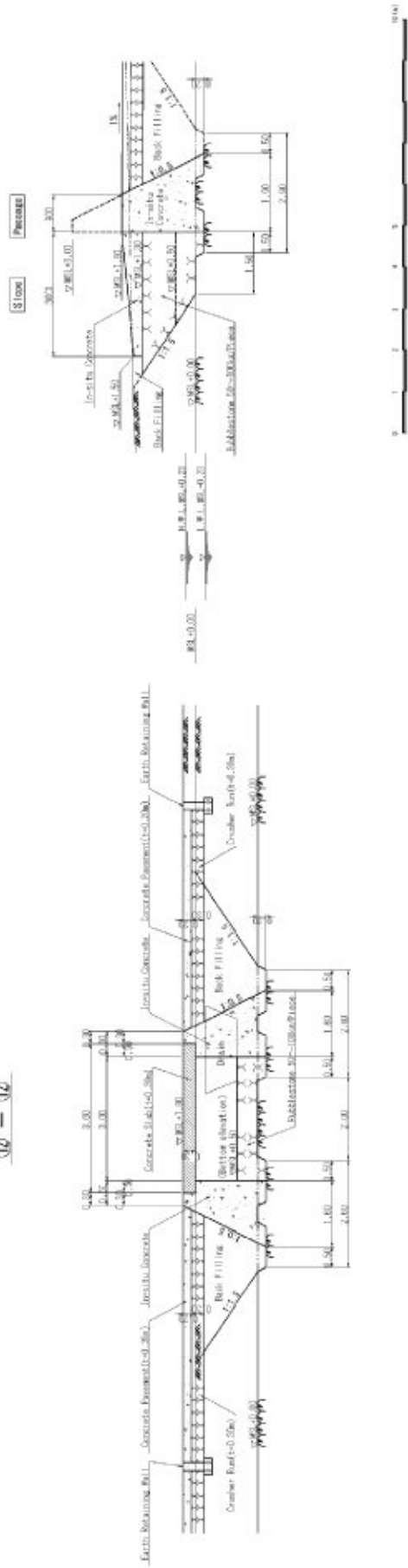


Figure 2-3(11) Standard Section for Revement 5

(3) Basic drawings for Buildings

Figure 2-3(12) ~ Figure 2-3 (23) show Basic Design Drawings for Building Facilities.

Figure 2-3(12)	Layout of New Fisheries Center (1F)
Figure 2-3(13)	Layout of New Fisheries Center (2F)
Figure 2-3(14)	Layout of New Fisheries Center (RF)
Figure 2-3(15)	Roof Framing Plan of New Fisheries Center
Figure 2-3(16)	Layout of New Fisheries Center (Basement)
Figure 2-3(17)	Elevation Plan of New Fisheries Center (North, South)
Figure 2-3(18)	Elevation Plan of New Fisheries Center (East, West)
Figure 2-3(19)	Cross Section of New Fisheries Center
Figure 2-3(20)	Layout • Cross-Section • Elevation for Workshop
Figure 2-3(21)	Layout • Cross-Section • Elevation for Net Mending Shed
Figure 2-3(22)	Steel Tower for Antenna, Repeater Shed
Figure 2-3(23)	Steel Tower for Antenna, Repeater Shed (Detail)

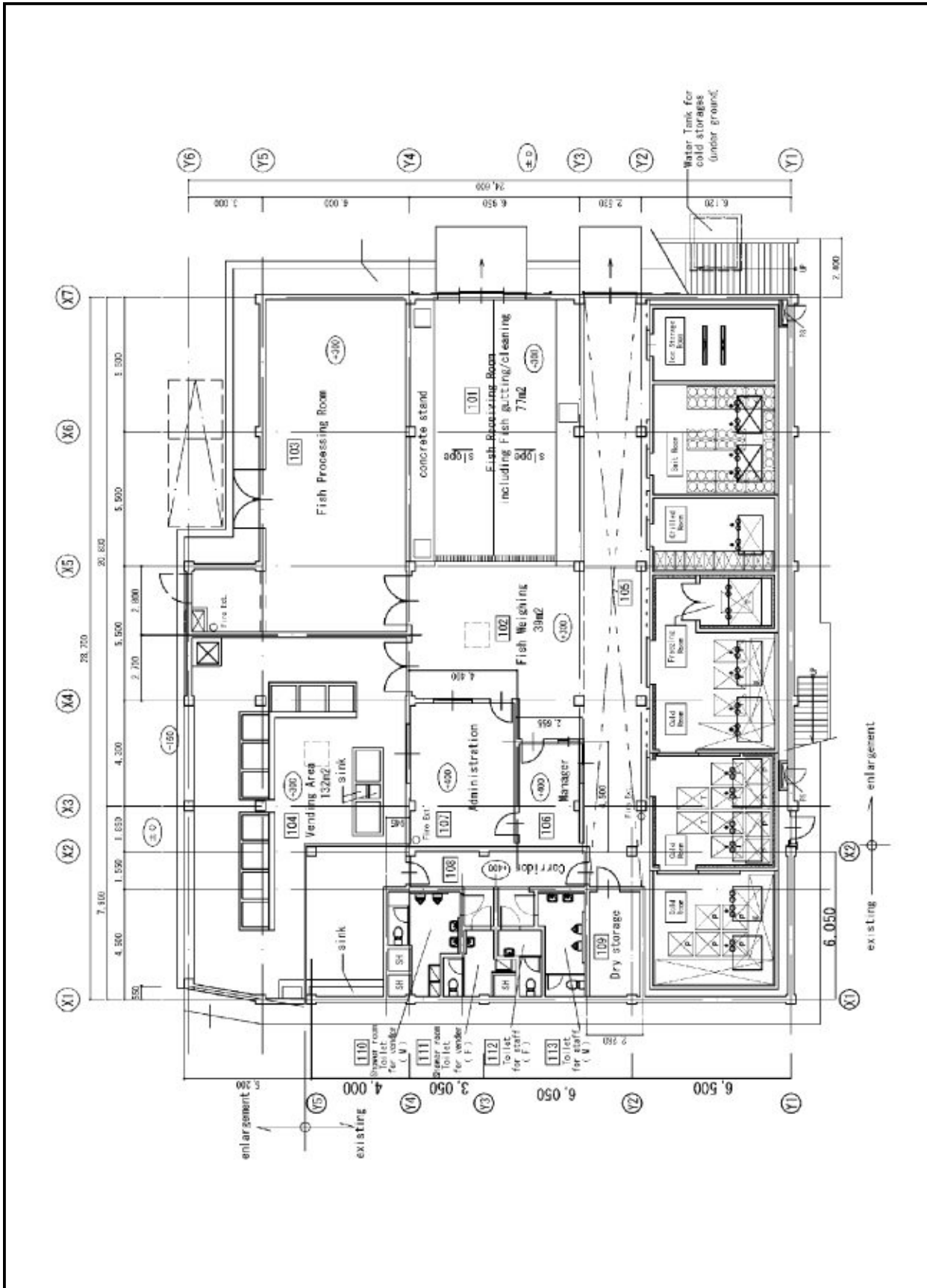


Figure 2-3(12) Layout of New Fisheries Center (1F)

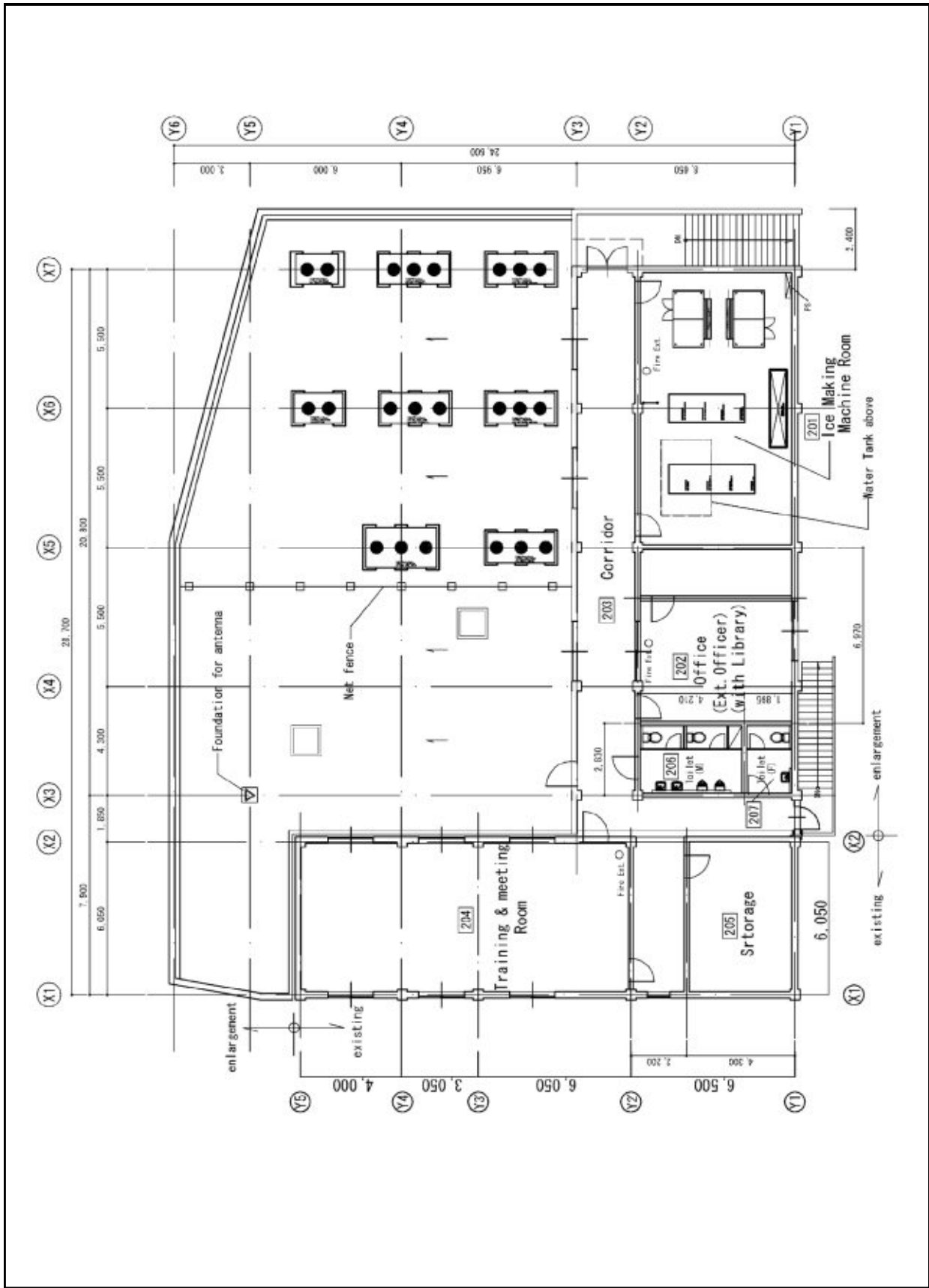


Figure 2-3(13) Layout of New Fisheries Center (2F)

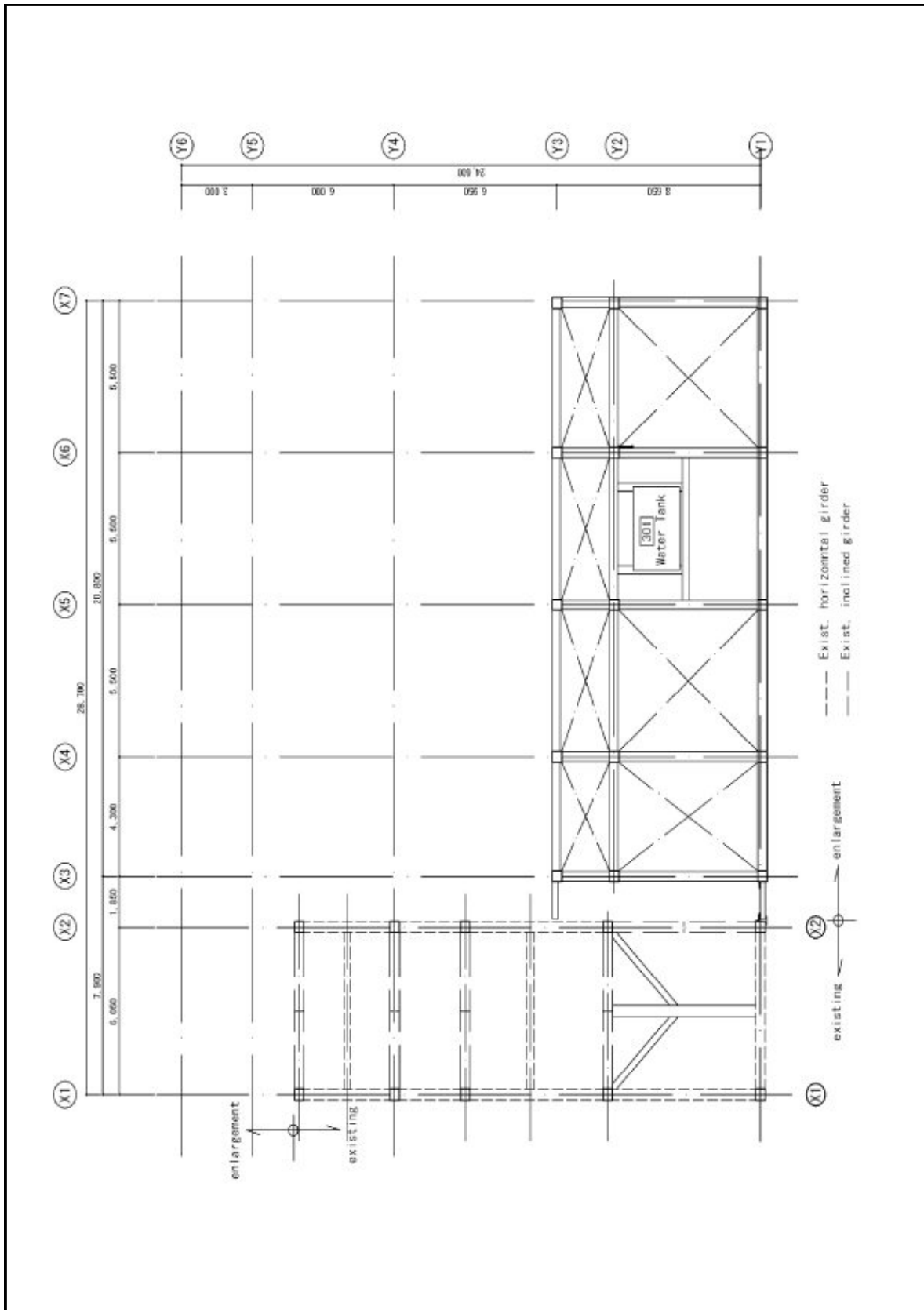


Figure 2-3(14) Layout of New Fisheries Center (RF)

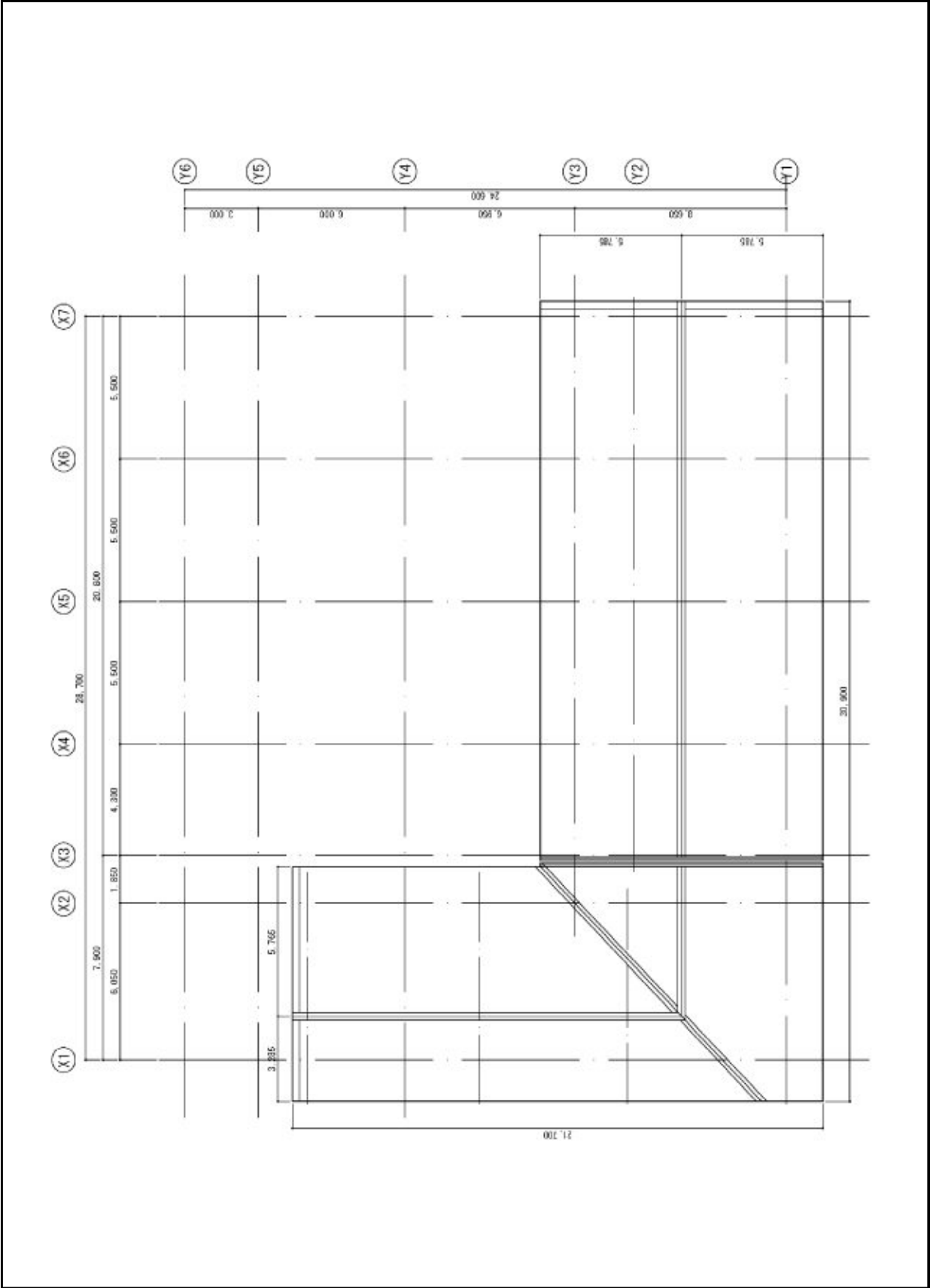


Figure 2-3(15) Roof Framing Plan of New Fisheries Center

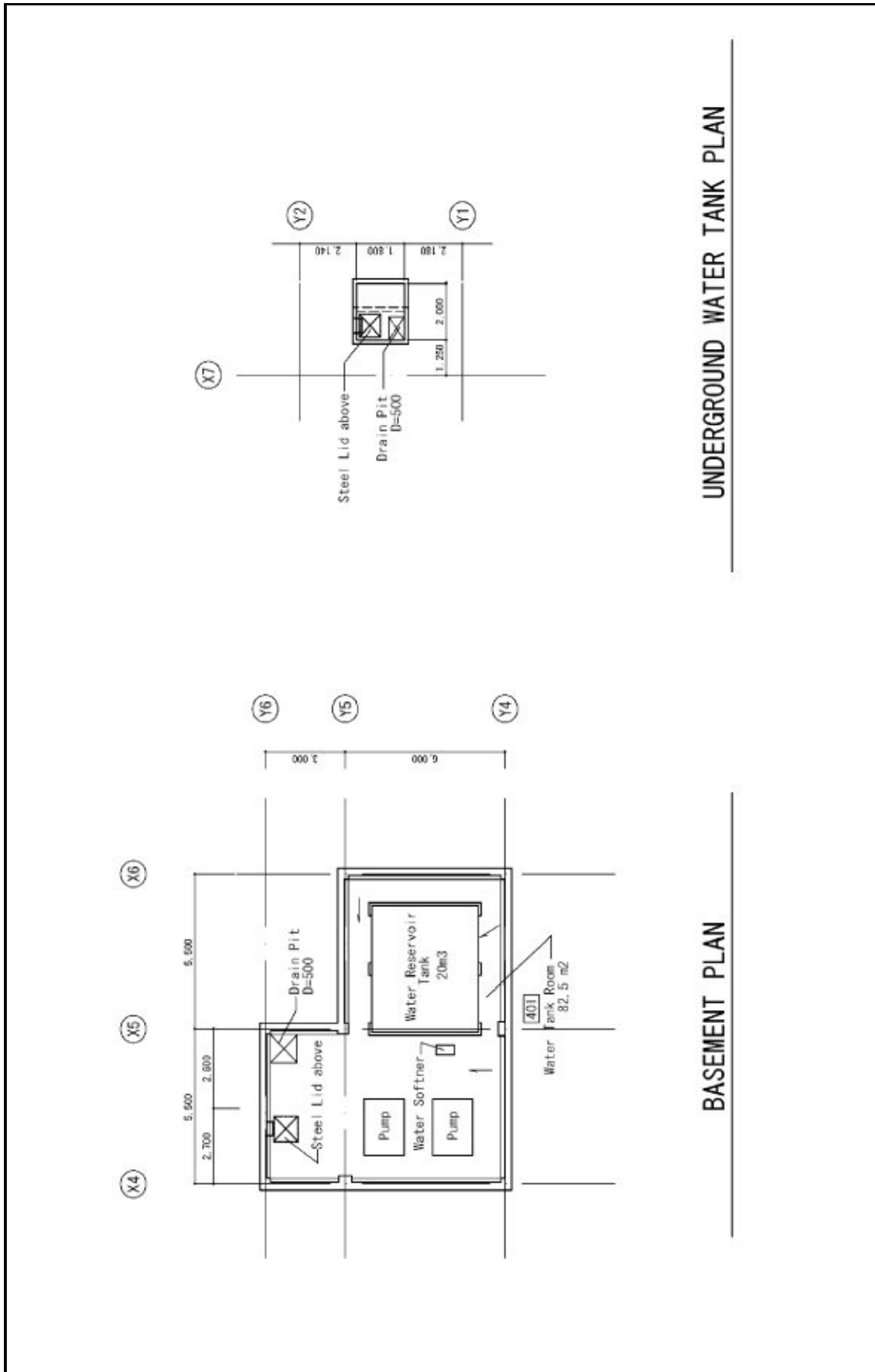


Figure 2-3(16) Layout of New Fisheries Center (Basement)

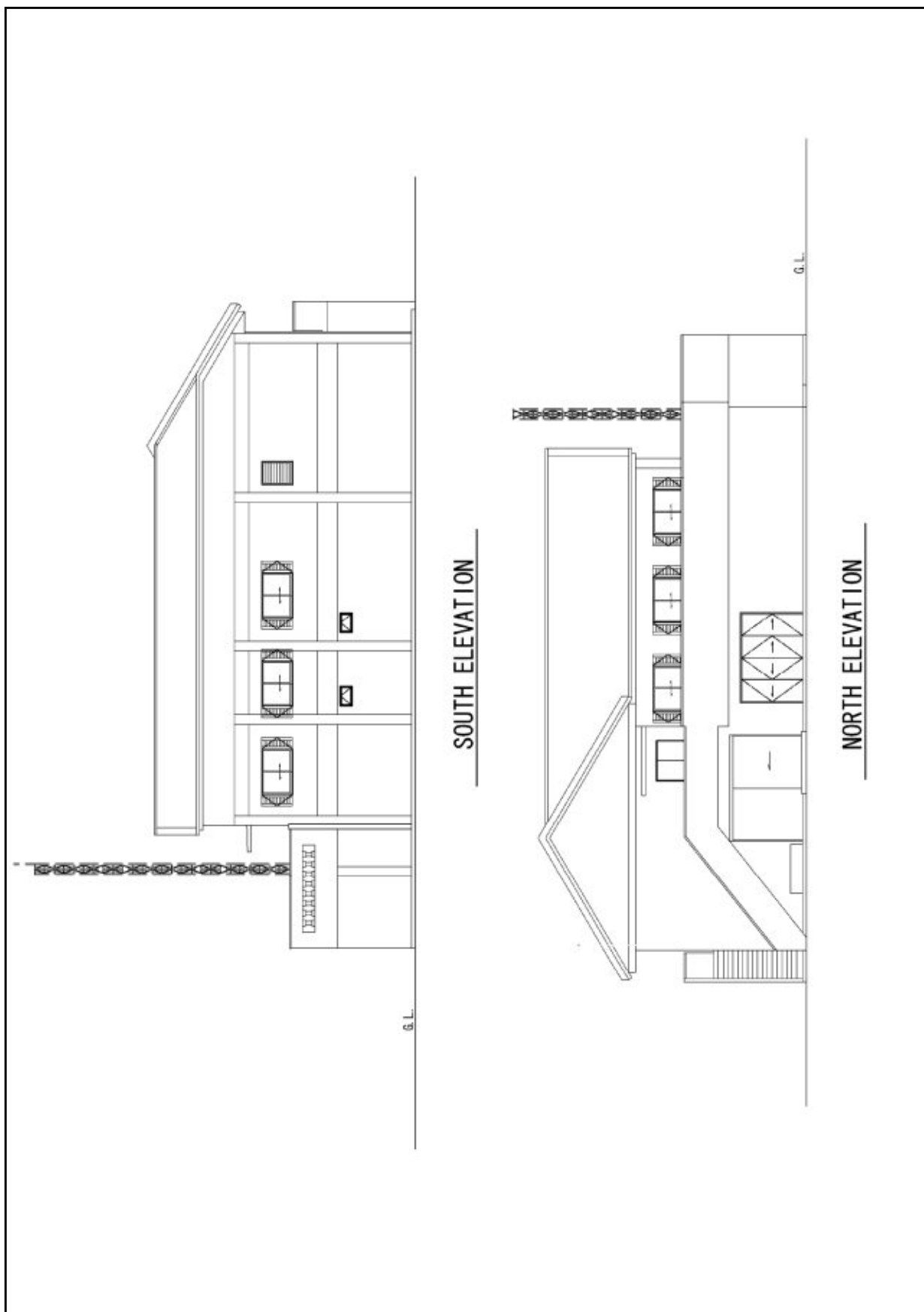


Figure 2-3(17) Elevation Plan of New Fisheries Center (North, South)

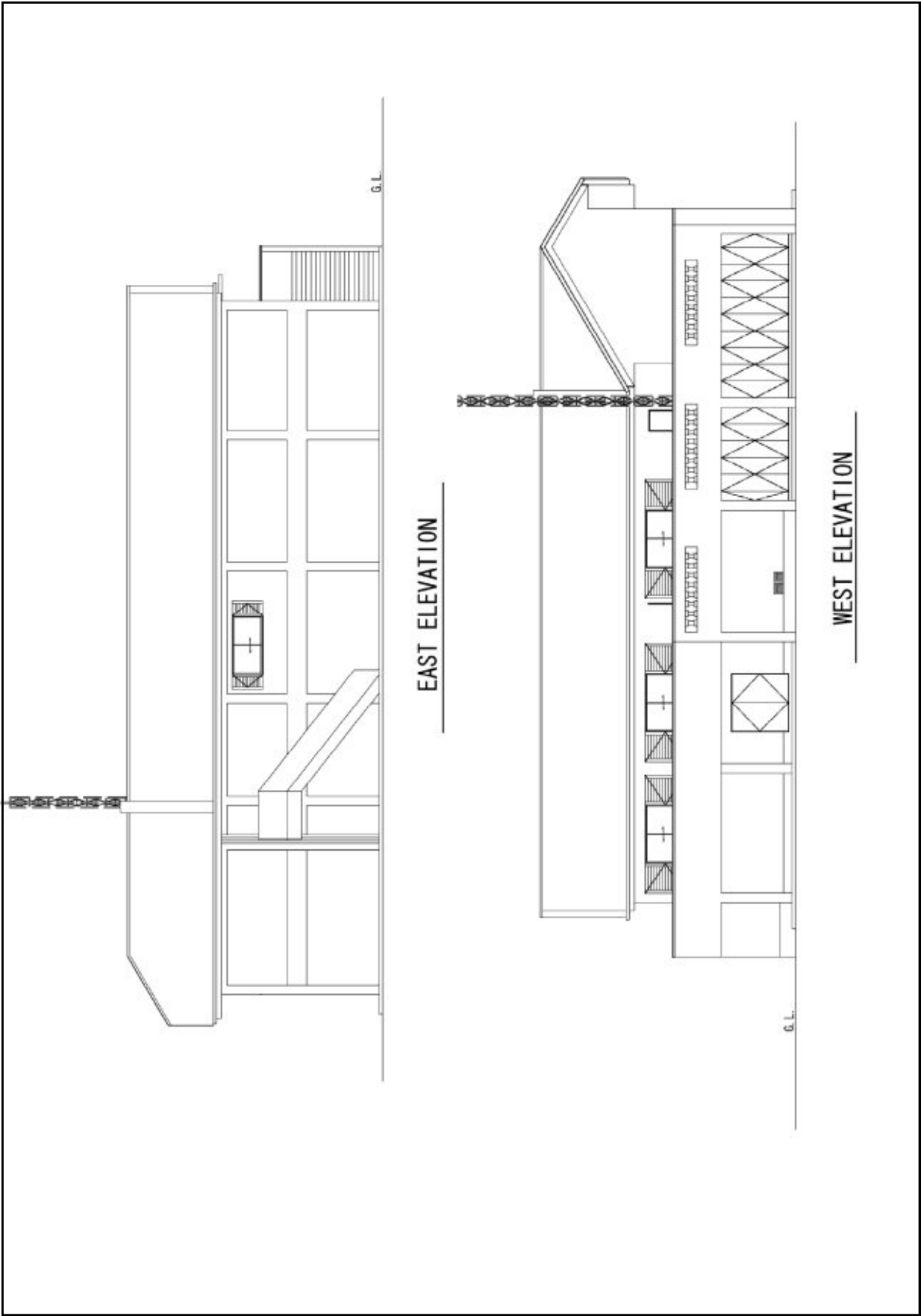


Figure 2-3(18) Elevation Plan of New Fisheries Center (East, West)

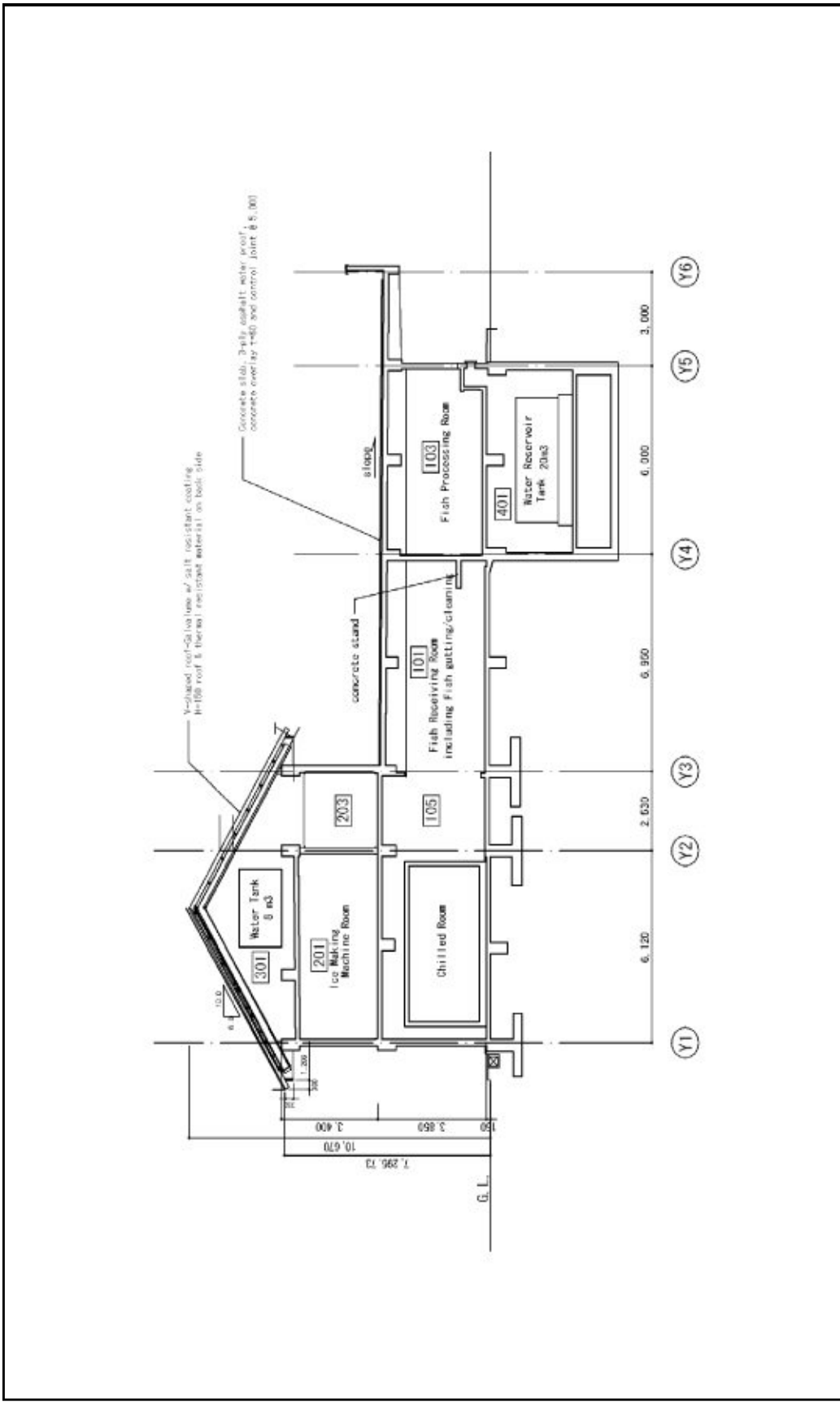


Figure 2-3(19) Cross Section of New Fisheries Center

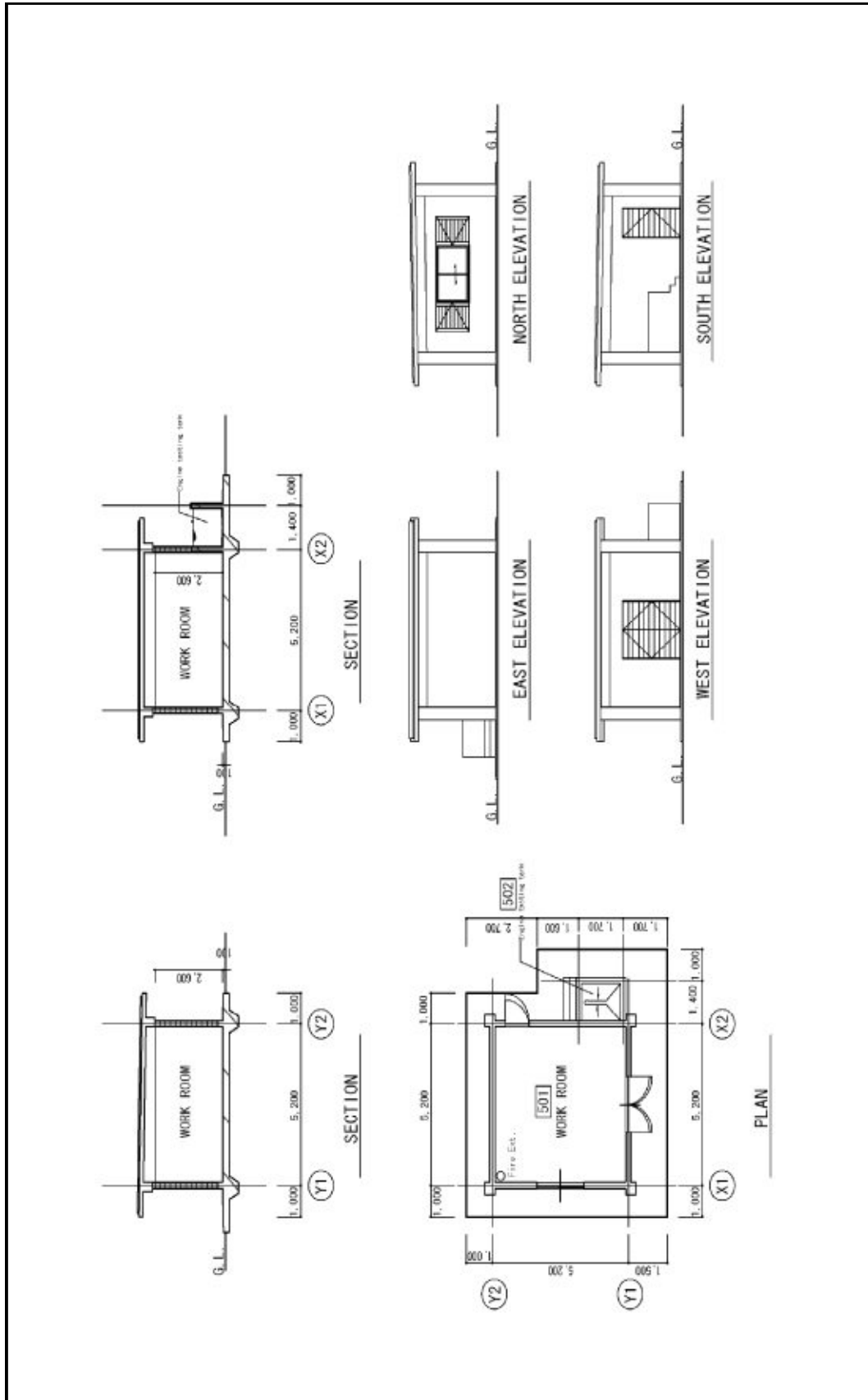
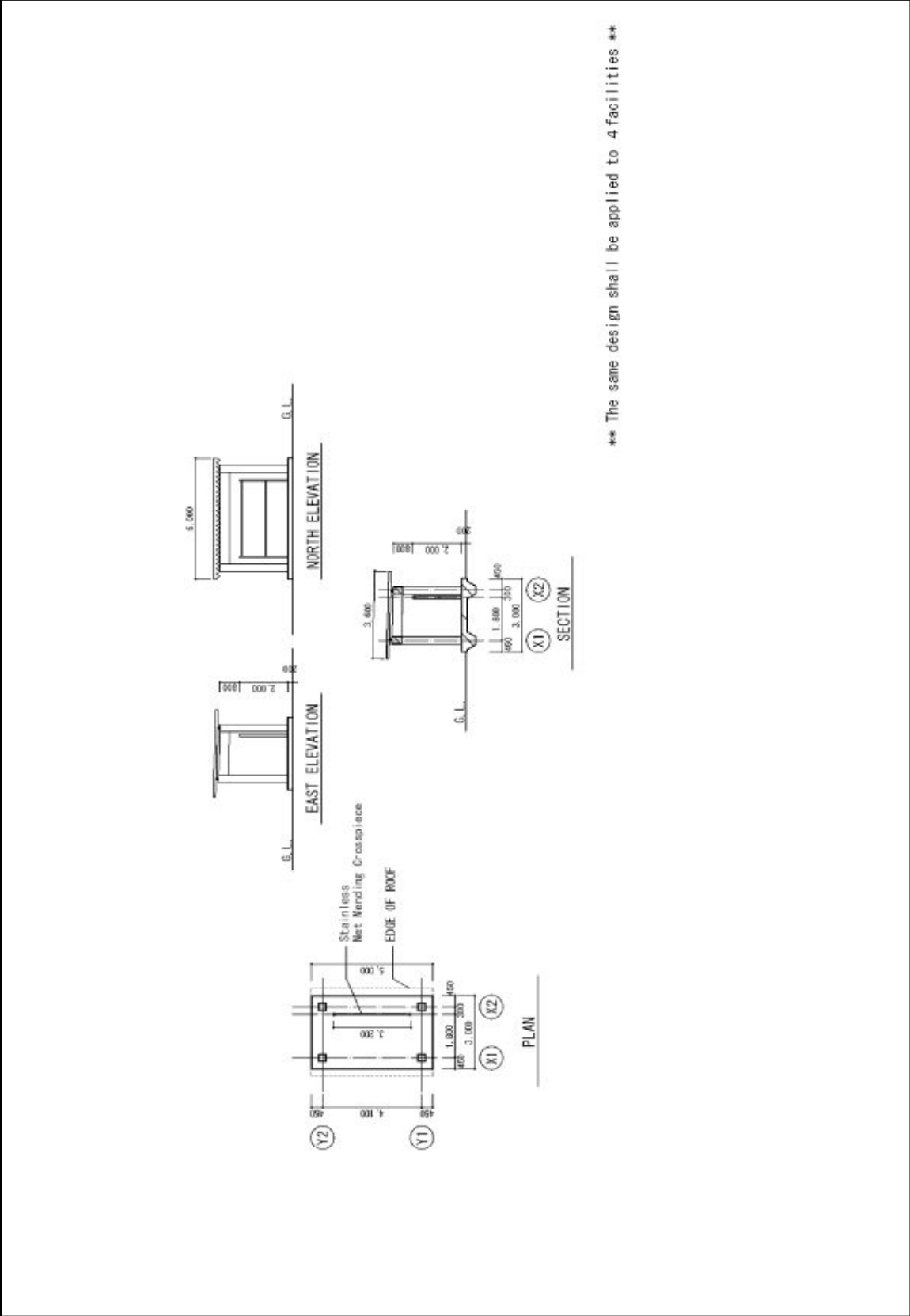


Figure 2-3(20) Layout • Cross-Section • Elevation for Workshop



** The same design shall be applied to 4 facilities **

Figure 2-3(21) Layout • Cross-Section • Elevation for Net Mending Shed

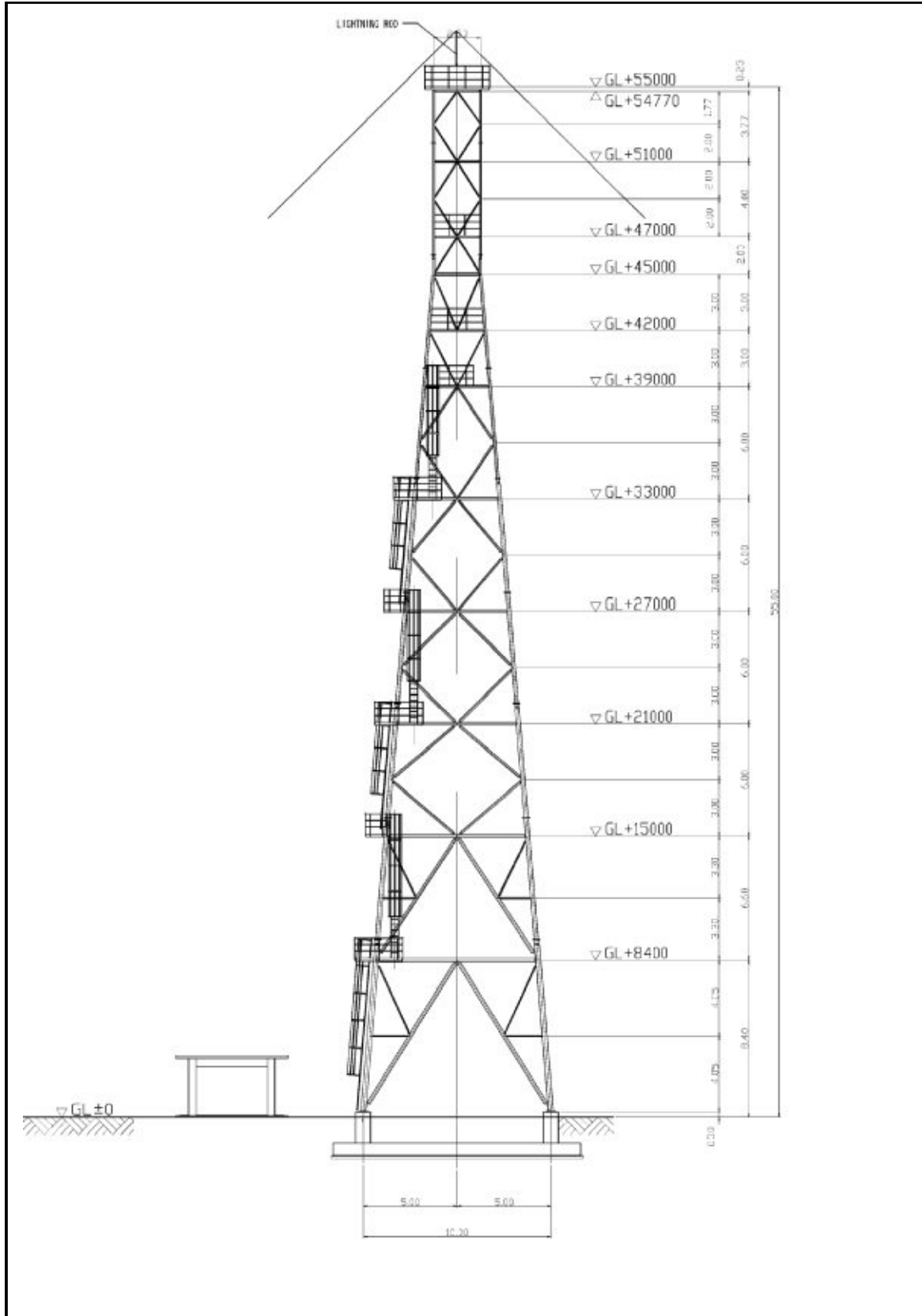


Figure 2-3(22) Steel Tower for Antenna, Repeater Shed

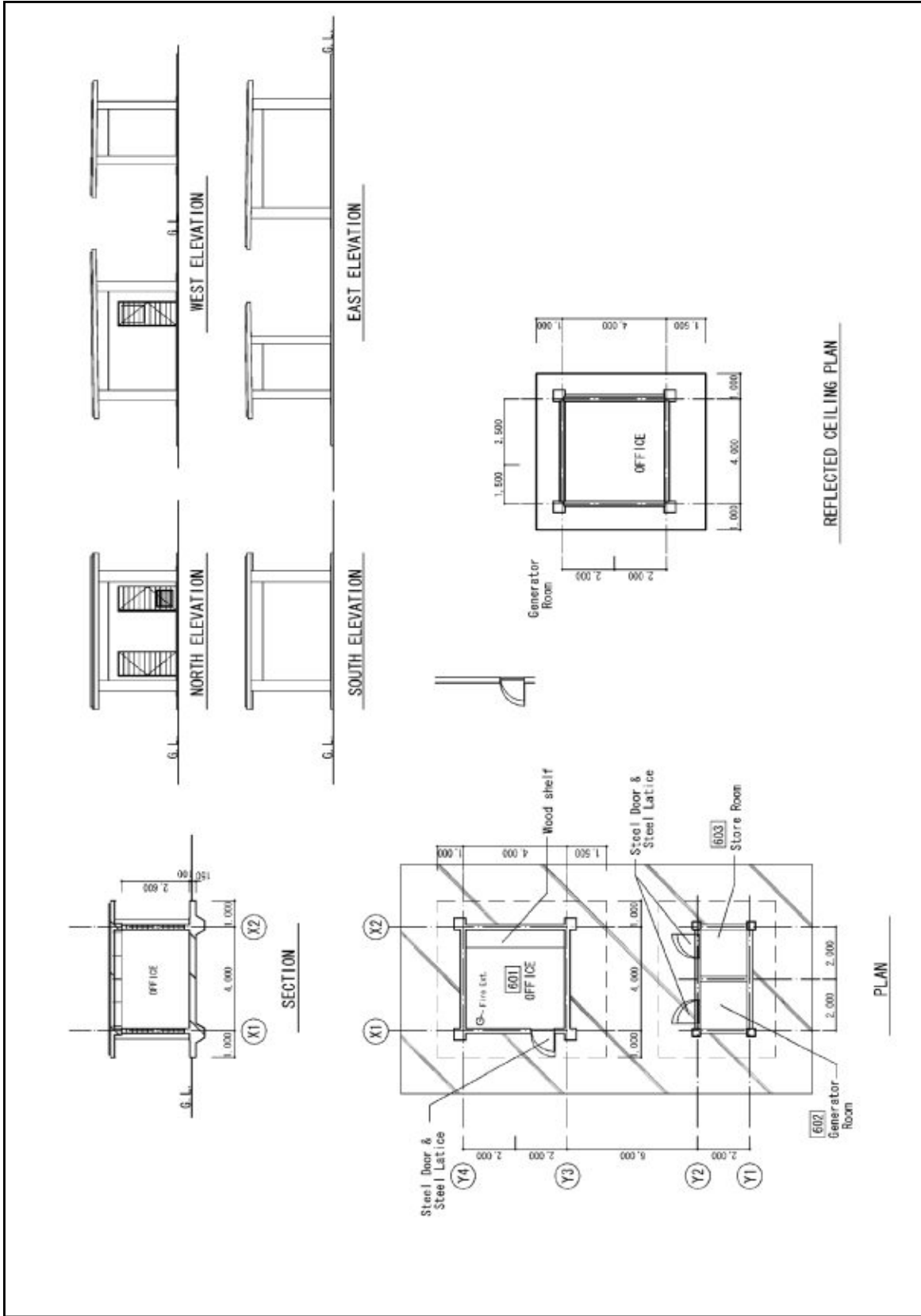


Figure 2-3(23) Steel Tower for Antenna, Repeater Shed (Detail)

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) General description of project implementation

- ① For implementation of the Project, the Exchange of Notes (E/N) between the Government of Japan and the Government of Grenada is concluded and after concluding the Grant Agreement between Japan International Cooperation Agency (JICA), and Ministry of Agriculture, Forestry and Fisheries of the Government of Grenada, a contract for undertaking consulting services by a Consultant who has Japanese nationality will be concluded.
- ② The consulting firm will prepare all documents required for the tender and conclusion of the contract such as the drawings of the project facilities, technical specifications, cost estimates and so forth. After the approval of these documents by the Government of Grenada, the contractor will be selected from Japanese construction firms by means of tender through examining the pre-qualifications and tender procedures.
- ③ The construction work will be performed by the selected construction firm, in accordance with the construction contract concluded by the Government of Grenada.
- ④ Regarding the total construction period for this project, 5.5 months will be required for detailed designs and 17 months for construction works.

(2) Plans for implementation and procurement

- ① The project components are comprised of a revetment, outdoor facility (removal of part of existing jetty and existing outdoor facilities, access road, car parking, lighting) as civil facility and Fisheries Center, work shop, net drying space, steel tower for antenna, repeater shed as building facility.
- ② Backfilling work shall be commenced first and building work will follow upon securing soil bearing capacity due to the narrow project site.
- ③ Shore-based work shall be the base of civil works. Building work shall be commenced after completion of reclamation and backfill work and confirming substantial soil bearing capacity since the facilities are to be constructed on reclaimed ground and the land after removal of oil tank by the Government of Grenada.
- ④ The Government of Grenada is to secure land as temporary yard with about W 15m x L 100m in neighboring area of project site (about 3.5 km from project site).
- ⑤ The equipment which were used in the past project of Grenada are the products of Japan. Maintenance engineer is accustomed with handle such Japanese products. However, there were opinions that the procurement of maintenance parts is not smooth. The Consultant

will study the procurement comparing costs based on the specifications.

- ⑥ Material and machinery being locally available will be preferentially procured for the project studying the quality and supply capacity.
- ⑦ Material and machineries which are not locally available are decided considering easy maintenance and cost comprehensively from other neighboring countries and Japan.

2-2-4-2 Implementation Condition

(1) Construction Circumstance

1) Construction Firm

A construction firm in Grenada has experienced the projects of “Construction of Fish Market in Melville Street” and “Glenville Fisheries Distribution Improvement Plan” as sub-contractor of construction of land facilities and his implementation capability is believed to be good. There is another firm that has experienced the project of “Glenville Fisheries Distribution Improvement Plan” as sub-contractor for civil works such as road construction and revetment construction and this firm also has no problem in the implementation capability. Judging from these, the construction firms in Grenada can be technically utilized as sub-contractor of Japanese Construction Firm.

2) Construction Machinery

Local construction firms own general construction machineries in Grenada but their models and number of machineries are limited. And, they have not owned marine working ships which can use in this project. Therefore, there are almost no construction machineries to be able to utilize with rental basis. As the implementation plan in this project separating the marine work and the land work, a working ship like a barge with crane and others are necessary. Marine machineries being locally unavailable will be purchased from neighboring countries in order to limit its procurement from Japan as minimum.

3) Labor

As there is no local expert experiencing marine work, it is necessary to dispatch divers from neighboring countries or Japan. Concerning piling of pipe pile, since the piling method is special one grouting cement fluid in order to attain circumjacent friction force in addition to piling used by vibration-hammer with water jet against solid ground, it is necessary to be supervised by Japanese rigger expert who has the experience of this method. And, it needs Japanese expert of crane operator since there are no local experts for marine work operators to be able to work for marine pipe piling works and super structure of jetty under rough and strong swelled sea. It is also necessary to dispatch fully experienced engineers to supervise the

installation work of special equipment like an ice making machine and freezing facilities.

4) Construction Material and Equipment

Concrete aggregates, ready-mixed concretes and blocks for building are produced locally.

Nearest supplier of ready-mixed concrete is located at Queens Park where is about 20 km away from the project site. This plant is considered to be the base supplier since it takes about one hour to the site.

Local materials for rubble foundation and armor stone are selected due to the cheaper price as the result of cost comparison between local materials and imported materials. Cement, steel material including re-bar is mainly imported from Trinidad and Tobago. Steel material is selected by cost comparison among procurements from local, neighboring countries and Japan. But, steel sheet pile is procured from Japan considering its quality and easy procurement.

Concerning other general construction material, the imported products from Trinidad and Tobago, Brazil, USA and other countries are handled as stock sale and they can use as local material. In this project, the materials which are difficult to secure its quality and quantity in Grenada and neighboring countries shall procure from Japan.

5) Safety Control

This project site is located at north urban side of Gouyave and all materials and equipment to be transported have to pass through urban area of Gouyave. As the urban area is narrow under many people passage and on-street parking, it is inevitable to hook up with local police. In this project, safety control security (traffic control person) are always watching in several points in addition, in order to avoid an invasion of the third person this construction area is enclosed by the fence and show that this is dangerous area by installing sign board in this project.

(2) Consideration on Implementation

- ① Proper temporary plan, construction method plan and construction schedule are made considering local natural condition enough.
- ② Staff and experts from Japan are planned its proper number, timing and duration according to progress of construction work.
- ③ Local materials are adopted as many as possible and minimize overseas procurement.
- ④ Temporary yard as processing of molds and re-bar and storing material and equipment is required. The temporary yard as described in Minutes at the time of Basic Design Study is accommodated at closest place from the project site by the Government of Grenada.

(3) Consideration on Procurement

- ① Although liner container ship is available from Japan for marine transportation, it takes about 120 days including transshipment. It is hard to use bulk carrier which has no regular service in view of construction schedule control. Therefore, the procurement from Japan shall be based on the shipment by container ship.
- ② Also as no regular service of bulk carrier is available for the marine transportation from neighboring countries, it is necessary to control construction schedule.

2-2-4-3 Scope of Works

The obligation of Japan side and Grenada side are as follows.

(1) Obligation of Japan Side

- ① Consulting services such as Detailed Design, Support to Tender and Supervision of Construction work
- ② Provision of all necessary construction materials and labors for the construction work of Japan side.
- ③ Execution of marine and inland transportation of importing materials and equipment being necessary for construction work of Japan side and equipment procurement in this project.
- ④ Necessary quality inspection for construction work of Japan side and equipment procurement in this project.
- ⑤ Concerning related infrastructures in building work, the following area shall be basic area.

Electricity: All works after leading-in work from electric pole closest to the project site as the responsive boundary point.

Water supply: All works after laying water supply pipes inside of the responsive boundary line

Drainage: All works for drainage

Telephone: Up to installation of empty pipe laying in buildings.

(2) Obligation of Grenada Side

- ① Securing of land for project site (demolition work of existing buildings and removal of obstacles located in the project site)
- ② Leading-in work to project site boundary line from main water pipe closest to the project site.
- ③ Power inlet work to the electric pole closest to this project site boundary line.
- ④ Procurement and installation of office equipment, telephones, furniture in Fisheries Center and other facilities included in this project.

- ⑤ Fuel and water Supply Facility (including fuel tank)

2-2-4-4 Consultant Supervision

The Consultant who fully understood Basic Design concept in accordance with Grant Aid Cooperation of the Government of Japan executes consistent and smooth detailed design work and supervising work on construction work for the project. In the supervising stage, the Consultant dispatches resident engineer who has enough experiences in construction site and execute supervision on construction work and communication in addition, dispatches expert engineer according to work progress and inspect and supervise construction works.

(1) Policy on Supervision

- ① It aims to complete facilities based on the implementation schedule without delay having good communication with related organization of both countries and persons in charge and make reports.
- ② In order to construct facilities in accordance with design drawings, it executes timely and proper instruction and advise for construction related parties.
- ③ The adoption of local construction method by local construction materials shall be preferable whenever possible.
- ④ It approaches to transfer the construction method and technology and brings out the effect as the project of grant aid cooperation.
- ⑤ It suggests smooth operation of maintenance work after handing over the facilities by appropriate suggestion and instruction.

(2) Management on Construction Work

1) Cooperation on Construction Contract

Selection of contractor, decision of construction contract method, drafting of construction contract, content check of breakdown of construction works, witness of construction contract and etc. are executed.

2) Checking and confirmation of shop drawing and others

It checks shop drawings, materials, finish samples and equipment etc. which are submitted by the Contractor.

3) Instruction on Construction Works

It executes the study of construction plan, construction schedule and the report of work progress to the Client.

4) Cooperation on Payment Procedure

It cooperates to check the contents and procedures of invoices and etc. related with the payment during construction and after completion of construction.

5) Witness to Inspection

It inspects and leads the Contractor for each progress during construction period upon need. The Consultant shall complete the work by witness to handing over of contracted object upon confirming the completion of construction work and the implementation of contract contents and receipt by the Client. And, it reports progress status during construction, payment procedure and necessary matters related with handing over to the concerned persons of the Government of Japan.

2-2-4-5 Procurement Plan

The following is the consideration on procurement of necessary materials and equipment in this project implementation.

(1) Procurement Policy

The procurement from Japan limits as minimum in view of the cost and delivery upon adequate studies on the quality (and inspection status), supply capacity (delivery and quantity), maintenance and cost comparison.

1) Procurement from Japan

The materials needed order production or domestic processing when purchasing from Japan must be precisely studied its procurement and transportation plan since it takes rather long time for order→ production→ packing→ delivery.

2) Local Procurement

Material locally procured is decided considering its locality, quality, delivery condition and others.

3) Cost

The cost comparison of material and equipment locally and from Japan is executed. Paying attention to additional cost of packing, transportation, insurance and port charge for the procurement from Japan and to be duty free for the procurement locally, the cheaper one is adopted upon comparison with the prices.

For the above, main materials and equipment used in this project are planned as follows.

(2) Procurement Items

1) Construction Material

The result to study procurement source based on the study previously described shows at Table 2-4(1).

Table 2-4(1) Source of procurement for main construction materials

Construction Materials	Country			remarks	
	Local	Japan	Neighbor		
Civil	Ready Mixed Concrete	○			
	Re-bar		○	Cost comparison	
	Steel Sheet Pile		○	Quality, Easy Purchase	
	Stone Materials	○		Cost comparison	
	Reclamation Soil	○			
Building	Molds	○			
	Sand, Aggregate	○			
	Re-bar		○	Cost comparison	
	Steel Structure		○	Quality, Cost comparison	
	Cement	○			
	Ready Mix Concrete	○			
	Molds	○			
	Concrete Block	○			
	Wood	○			
	Metal Fixtures	○		Aluminum	
	Metal Fixtures		○	Steel & Door	
	Wooden Fixtures	○			
	Roofing Materials		○	Quality, Specification	
	Electrical	Cable	○		
		Distribution & Switch Board		○	Quality
Lighting Fixture & Bulb		○			
Fixture	Piping & Valve	○			
	Sanitary Fixture	○			
	Septic Tank& Purifier		○	Quality, Specification	
Others	A/C, Fan, Exhaust Fan	○			
	Ice making & Freezing Facilities		○	Spec., Cost comparison	
Equipment	Forklift		○	Specification	
	Truck with crane		○	Specification	

2) Construction Machinery

It is impossible to locally procured marine machinery, large size crane and etc. since local sub-contractors own only general construction machinery. Table 2-3(2) shows construction machinery to be used in the project.

Table 2-4(2) Source of procurement for main construction machineries

Construction Machinery		Source of Procurement			Remark
		Local	Japan	Neighboring Countries	
Barge with crane	100 tons crane			○	
Anchor Boat	5 tons lifting capacity			○	
Tug Boat	D550PS			○	
Barge	300t loading capacity.			○	
Crawler Crane	50t lifting capacity			○	
Bulldozer	15t	○			
Backhoe	0.6m ³	○			
Backhoe	1.0m ³	○			
Dump truck	10 t	○			
Truck with crane	25 t lifting	○			
Vibration Hammer	90 kW		○		
Vibration Hammer	120 kW		○		For pipe piling
Water Jet	100 kW		○		For sheet piling
Water jet	243 kW		○		For pipe piling
Clamp for pipe pile			○		

2-2-4-6 Quality Control Plan

(1) Quality Control of Material

The materials to be used in this project are managed and controlled in accordance with “Criteria of Quality Control for Port Construction Work”, “Common Specifications for Fishing Ports and Fishing Grounds Construction Work in Japan”, “Common Specification for Port Construction Work in Japan”, “Architectural Construction Standards and Specifications the JASS 5 commentary therein (Architectural Institute of Japan)”, “Common Specifications for Building Work (Ministry of Land, Infrastructure and Transport)” “Guidelines for Management of Building Work (Ministry of Land, Infrastructure and Transport)” , “Japan industrial Standards” and the approval in advance shall be taken.

(2) Mixture Design of Concrete

Based on the mixture design of concrete, strength, mixing time and methods of placing of concrete will be confirmed with trial mix prior to commencement of the work. Quality control of concrete will be made with examining statistically analyzed data of concrete strength

for each concrete mixture for the work.

And, the quality maintenance and control are conducted by producing Test Report per each composition, Concrete Strength Control Table, Control Chart (X-R chart and etc.) Especially, since the transportation time is expected to be about one hour with the temperature exceeding 25°C, it is necessary to draw up the precise construction schedule.

2-2-4-7 Implementation Schedule

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

(1) Detailed Design Work

After the consultant contract has been concluded between the Japanese consulting firm and the Government of Grenada, the consulting firm will start detailed design with verification of the contract from the Japanese Government. During the detailed design stage, a full set of design documents should be prepared for tendering, based on the basic design study report. Through discussions with the Government of Grenada on details of facilities and machinery, approval of all the tender documents should be obtained from the Government of Grenada. The detailed design stage will take about 3 months.

(2) Tendering

The Contractor, which is a Japanese construction company, is selected determined by tender. The tender is performed in the following order, and require 2.5 months: letters of interest, pre-qualifications, distribution of tender documents, tender, evaluation of tenders, determination of a company, and contracting.

(3) Construction Work

After the construction contract is verified by the Government of Japan, construction work can start. Considering facility size and content and local construction circumstances and as the result of estimation of construction period with premise that no unexpected matter occurred, the Contractor will need about 17 months for the completion of the project.

The implementation schedule of the project is described in Table 2-5 (3) after concluding the Exchange of Notes (E/N) and the Grant Agreement to the completion of construction.

Table 2-4(3) Implementation Schedule

Calendar year	2009												2010												2011													
Calendar month	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct				
Running month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10				
[Detailed Design]																																						
E/N G/A	△																																					
Detailed Design		■	■	■	■																																	
Producing and distribution of tender documents					■	■	■																															
Tender							△																															
[Procurement/Construction]																																						
Transportation from Japan								■	■	■	■	■																										
Gouyave																																						
(Civil Works)																																						
Production and shipment for pipe & sheet pile								■	■	■	■	■	■																									
Temporary and removal works								■	■			■	■																									
Temporary rubble mound groin										■	■	■	■	■																								
Reclamation & revetment								■	■	■	■	■	■	■																								
Access section and car parking																																						
Jetty construction																																						
(Building Works)																																						
Fabrication of steel structure & shipment								■	■	■	■	■	■																									
Removal of existing buildings								■	■																													
Fisheries center																																						
Work shop																																						
Septic tank																																						
Net drying space																																						
Grand Etang																																						
Antenna tower																																						
Repeater shed																																						

2-3 Obligations of recipient country

(1) Obligations of recipient country

The obligations of the Government of Grenada have been confirmed by the government and the study team as described in the Minutes of Discussions and others are as follows:

- ① To secure necessary land for the project and clearly articulate of land ownership and secure land for temporary yard,
- ② To secure space for landing during construction,
- ③ To provide electricity, water and telephone to project site,
- ④ To exempt taxes on imported equipment to Grenada,
- ⑤ To exempt Japanese nationals from customs duties, internal taxes and fiscal levies for the execution of the works related with the Contract verified by the Government of Japan ,
- ⑥ To accord facilities to Japanese nationals who enter and stay at Grenada for the execution of the works related with the Contract verified by the Government of Japan,
- ⑦ To bear commissions for banking services such as advising commission of A/P and payment commission,
- ⑧ To take necessary approvals and permissions in Grenada,
- ⑨ To maintain and use properly and effectively the facilities under the scheme of Japanese Grant Aid,
- ⑩ To bear all the necessary expenses, other than those to be borne by the Grant.
- ⑪ To secure necessary budget and personnel for the project,
- ⑫ To take a prompt measure when the approval and permission is required on the facilities construction,
- ⑬ To carry out Environmental Impact Assessment (EIA) when needed,
- ⑭ To execute training for facilities operation and maintenance of facilities equipment to the staff of The New Fisheries Center.

2-4 Project Operation Plan

Fisheries Division of Grenada has adjusted fish price fixed the fish price fluctuation per fish species in order to secure the stable fish price. It is expected to purchase all fresh fishes and accommodate the sales function under self operation by cooperative under the support of tax benefit or a like in the New Fisheries Center however; actually the operations by cooperative were not done in Grenville and Melville Street. According to the hearing survey, there were opinions of fishermen to expect self operation by the cooperative (deregulation of price control) however, because of non functional actual situation of existing cooperative and the policy of the Government of Grenada to secure fish price stability, direct undertaking by Fisheries Division is the premise of operation and maintenance system.

The exporting fish handled by Nordom is dealt under overseas market price. The more dealing volume of Nordom, the more income of fishermen will increase. While, the income of fishermen in fisheries products handled by venders or retailers will not be increased as long as the handling volume is increased. Fisheries Division has run a campaign that the more freshness (quality) is improved, the more purchasing volume is increased and fishermen's income is increased. Although adopting all fish purchasing system (Buying and selling) in the New Fisheries Center and operation by cooperative which is liable to return a part of sales profit is recommended, judging from the fact that the establishment of Fisheries Cooperative in existing fisheries organizations and communitywide fisheries cooperatives has been delayed, it is understood that the operation and maintenance plan under the direct management of Fisheries Division is appropriate at this moment.

2-4-1 Organization

The Government of Grenada is planning the organization as operation and maintenance organization for The New Fisheries Center as per Figure 2-4-1(1). This organization is the same as other main fisheries Centers in Melville Street and Glenville and know-how of operation and maintenance has built up in Fisheries Center, Therefore, this organization planned by the Government of Grenada can be understood workable in this project.

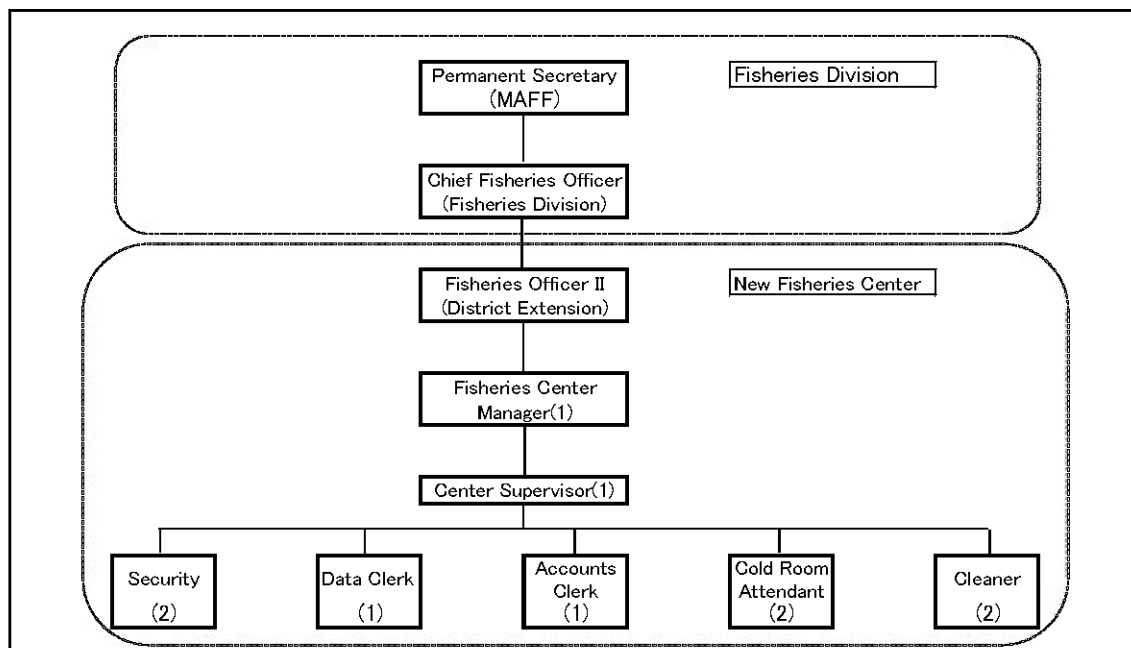


Figure 2-4-1(1) Organization of the New Fisheries Center

Fisheries Division of Grenada is planned to allocate a District Fisheries Promoter (Fisheries Officer II) as General Manager to cover the New Fisheries Center. Under him, there allocate 1 Center Manager, 1 Center Supervisor and ①2 Securities, ②1 Data Clerk, ③1 Accounts Clerk, ④2 Cold Room Attendants, ⑤2 Cleaners, total 11 staff will operate and maintain this The New Fisheries Center. Fisheries Center of Grenada will bear personnel cost for General Manager and The New Fisheries Center will bear the personnel cost for remaining 10 staff. In addition, water charge to be used in The New Fisheries Center is paid out from the central consolidated fund of the Government annual budget and The New Fisheries Center will not bear. And, the staff personnel cost of The New Fisheries Center will be paid out from the central consolidated fund as well as water charge and the profit of The New Fisheries Center will be deposited into the consolidated fund in accordance with public statute. While, if The New Fisheries Center suffers a loss in its operation, the loss is compensated by the budget of Ministry of Agriculture, Forestry and Fisheries or Fisheries Division.

2-4-2 Management and Operation Plan

(1) Roles of the New Fisheries Center

The New Fisheries Center has the following roles:

- ① Maintain appropriate sanitary standards of caught fishes.
- ② Improve quality of fish and fisheries products at post harvest stage to the final consumer.
- ③ Foster an operating environment that is conducive to the smooth functioning of all stakeholders.

- ④ Maintain the physical facilities and its contents in adequate working condition.
- ⑤ Provide the requisite data and information to the Fisheries Division to facilitate management and planning within the fishing industry.
- ⑥ Promote primary processing for the purpose of adding value and contributing to food security.

(2) Business Activities of the New Fisheries Center

Activities to be conducted at the New Fisheries Center are as follows:

- ① Receiving of fish (Fish dues)
- ② Selling ice
- ③ Selling fuel (Commission fee)
- ④ Bait room management
- ⑤ Cold storage management
- ⑥ Chill storage management
- ⑦ Vendors management
- ⑧ Cleaners management
- ⑨ Fish processing management
- ⑩ Workshop management
- ⑪ Office management

(3) Operation and Maintenance Cost of the New Fisheries Center

The Fisheries Division of the Government of Grenada is liable for facilities operation and this project is the same size with the example of two districts of Melville Street and Grenville therefore, the operation and maintenance of Center can be well conducted.

① Revenue

As described the above, the New Fisheries Center executes 11 business activities. Table 2-4-2(1) shows the breakdown of revenue and total revenue is expected to be EC\$1,050,668 (about 42 million Japanese yen)/year.

Table 2-4-2(1) Revenue of the New Fisheries Center

Items	Revenue/year (EC\$)	Estimation Grounds
①Receiving of fish (fish dues)	31,621	Commission EC\$0.05/lbs x 632,422 lbs
②Selling ice	307,969	Unit price EC\$0.15/lbs x 2,053,126 lbs
③Selling fuel (commission fee)	606,528	Commission fee of fuel EC\$1.20gal x 505,440 gal
④Bait room management	4,380	Unit price EC\$0.05/lbs x 1,200 lbs x (365/5 days)
⑤Cold storage management	15,056	Unit price EC\$0.05/lbs x (5,500 x 0.3 x (365/2 days))
⑥Chill storage management	13,264	Unit price EC\$0.05/lbs x (5,500 x 0.5 x (365/4 days)) Unit price EC\$0.05/lbs x (5,500 x 0.1 x (365/14 days))
⑦Vendors management	27,000	Unit price EC\$10.00/day x 10 booth x 270 days
⑧Cleaners management	6,750	Unit price EC\$5.00/day x 5 stand x 270 days
⑨Fish processing management	24,000	Unit price EC\$2,000.00/month x 12 months
⑩Workshop management	6,000	Unit price EC\$500.00/month x 12 months
⑪Office management	8,100	Unit price EC\$2.00/a person x 15 persons x 270 days
Total	1,050,668	(42,026,720 Japanese Yen)

- (Remark) 1) Unit price of ice, bait, fuel, commission, management fee and so forth have been referred to existing fisheries Center and Fish Market.
- 2) Landed value, bait and fuel sales in Gouyave have been set based on the sales record and etc. of the existing fish market.
- 3) Ice sales volume has been set adding the community demand on the demands of fishing boats and fish market.
- 4) The scale of cooling facility and freezing facility have been calculated corresponding to the planned standard landing volume (5,500 lbs/day).

② Expenditure

The annual operational expense of the New Fisheries Center are a) Staff salary, b) Electricity bill, c) Office expense, d) Water service, e) Maintenance & repair fee for buildings, f) Maintenance & repair fee for ice and cold facilities, g) Reserve fund for ice and cold facilities.

Breakdown of expenditure are as follows.

a) Personnel expenses

Table 2-4-2(2) Breakdown of personnel expenses

Post	Monthly salary (EC\$)	Annual Total (EC\$)
Fishery Officer II (1)	0.00	0.00
Manager (1)	2,500	30,000
Supervisor (1)	1,225	14,700
Security (2)	1,900	22,800
Data clerk (1)	950	11,400
Account clerk (1)	950	11,400
Cold room attendant (2)	1,600	19,200
Cleaner (2)	1,600	19,200
Total	10,725	128,700

(Note) Unit price of the existing Fisheries Center and Fish Market (at the time of Basic Design Stage) were adopted. () show s the number of persons.

b) Electricity charges

Table 2-4-2(3) Breakdown of electric utility rate in the New Fisheries Center

	Power Consumption(kwh)	Operating time (h/d)	Operating days (270 days)	Electric rate (EC\$0.9/kwh)
1. Ice making machine & cold facilities				
①Plate ice machine (making machine, ice storage room)	28.568	24	270	166609
② Chest freezer for bait storage: -20°C	13.748	18	270	60134
③ Chilled room : -5°C	6.428	20	270	31,240
④ Freezer : -20~-30°C	11.512	20	270	55,948
⑤Chest freezer : -20°C	17.748	18	270	77,630
⑥ Chest freezer for pre-cooling : -25°C	21.628	18	270	94,601
⑦Chest freezer for slow freezing: -25°C	15.348	18	270	67,132
Sub. total	114.98			553,294
2. New Fisheries Center				
① Lighting equipment	11.76	10	270	28,577
②Out door light, projector	1.2	10	270	2,916
③ General outlet	6.2	10	270	15,066
④Air conditioner	12.29	18	270	53,756
⑤Ventilation	1.75	10	270	4,253
Sub Total	33.20			104,568
G. Total	148.18			657,861

(Note) Unit rate at the time of Basic Design Study

Sample of calculation: Power consumption volume (kwh) x operating time (h/d) x operating day (270 days) x Electric rate (EC\$0.9/kwh) = Annual electricity charge

c) Office maintenance expenses

Annual expenses (EC\$ 81,000/year) of office maintenance of Fisheries Division in 2008(as communication expenses, office supplies, office equipment, expendable supplies, copy expenses, etc.) has been posted with the expenses of Fisheries Division and each landing place combined. Of which office expenses of 7 main landing places occupies its 35% and it is

necessary about 5 % as the expenses of the New Fisheries Center. The New Fisheries Center needs the annual expenses with the sum of EC\$81,000/year x 0.05 = EC\$4,050 (144,140 Japanese yen) is necessary.

d) Water charge

As described the above, water charge is paid directly from the consolidated fund of Ministry of Finance therefore, it will not be posted.

e) Expenses for maintenance /repair for the building

The budget of Fisheries Division in 2008 for the expenses of maintenance and repair for the building (EC\$226,530) is that of expenses of each landing place. The budget covering 3 places, Melville Street, Gouyave and Grenville occupies 30% of it. And, as the cost of construction of building in this project will be about 450 million Japanese yen, about 0.2% of it (900 thousand Japanese yen) is necessary as the maintenance and repair expenses. Therefore, as annual maintenance and repair expenses for the building, about 10% of the budget for maintenance and repair expenses in 2008 of Fisheries Division, EC\$226,530 x 0.1=EC\$22,653 (about 900 thousand Japanese yen) is estimated.

f) Maintenance cost of an ice machine and cold storage etc.

The facility maintenance fee of ice machine, cold storage facility and others are the costs of consumables like a refrigerant and the costs of inspection and repair on main parts which is conducted every 5th year and 9th year. Table 8.4 shows facility maintenance costs of ice machine and cold storage facility.

Table 2-4-2(4) Cost of Maintenance of ice making and cold storage facilities (Unit : EC\$)

Years for maintenance	Cost for consumables and inspection & repair	Remarks
First year to Fourth year	10,000	Consumables cost
Fifth year	11,000	Consumables + Inspection & Repair
Sixth year to eighth year	10,000	Consumables cost
Ninth year	15,000	Consumables + Inspection & Repair
Tenth year to thirteenth year	10,000	Consumables cost
Total (average of 13 years)	56,000(4,308/year)	

g) Parts replacement cost for ice making and cold storage facilities

Ice making and cold storage facilities are necessitated to replace parts periodically and replace main parts in every 3 years with the 13 years of the legal durable years (“Notebook of refrigerating and air conditioning” issued by Japan Society of Refrigerating and Air Conditioning Engineers) in addition to the above facility maintenance costs. The costs of parts replacement are as per Table2-4-2(5).

Table 2-4-2(5) Parts replacement costs of ice making and cold storage facilities (Unit: ECS)

Period of replacement	Annual replacement cost	Remarks
Third Year	17,120	Periodic Replacement
Sixth Year	106,610	Periodic Replacement + Main parts update
Ninth Year	17,120	Periodic Replacement
Twelfth Year	106,610	Periodic Replacement + Main parts update
Total	247,460	

h) Reserve fund of an ice machine, cold storage and etc.

Ice making and cold storage facility are desired to renew facilities after 13 years of the end of its life. It is necessary to reserve the fund for renewal fee and periodic replacement and the replacement of main parts taking from the profit of the New Fisheries Center. The reserve fund is shown in Table 2-4-2(6).

Table 2-4-2(6) Renewal cost of ice machine and cold storage and etc. (unit: ECS)

Renewal & parts	Renewal Cost (ECS)	Remarks
Main facilities (incl. installation fee)	2,153,055	Reserve in 12 years (about \$180,000/year)
Periodical & Main parts	247,460	Reserve in 11 years and use (about \$22,000/year)
Total	2,400,515	Annual reserved amount : \$ 202,000

Table 2-4-2(7) Profitability of New Fisheries Center

Item	Breakdown	Annual sum (ECS)
Income	①Receiving of fish (fish dues)	31,621
	②Selling ice	307,969
	③Selling fuel (Commission fee)	606,528
	④Bait room management	4,380
	⑤Cold storage management	15,056
	⑥Chill storage management	13,264
	⑦Venders management	27,000
	⑧Cleaners management	6,750
	⑨Fish processing management	24,000
	⑩Workshop management	6,000
	⑪Office management	8,100
	Annual revenue subtotal	1,050,668
Expenses	①Staff salary	128,700
	②Electricity bill	657,861
	③Water service charge	0
	④Maintenance cost of building	22,653
	⑤Office expenditure	4,050
	⑥Maintenance cost of ice and cold storage facilities	4,308
		Annual expenses subtotal
Annual Profit		233,096
Reserve fund for renewal	①Saving for machine(incl. installation fee)	179,422
	②Saving for main parts	22,496
	Saving subtotal	201,918
Gross profit	Total	31,178

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

Necessary project cost when this project is implemented by the Government of Grenada is about EC\$ 301,500.

Item	Qty	Sum (EC\$)	Remarks
Dismantle & Removal of existing cold room, ice making & storage room etc.	1 set	34,000	Obligation of Fisheries Division
Leading-in of electricity	50m	25,000	Obligation of Fisheries Division
Leading-in of water	20m	4,000	Obligation of Fisheries Division
Office appliance, furniture and facility	1 set	81,000	Obligation of Fisheries Division
Installation of oil pipeline for Gasoline and Diesel	1 set	125,000	Obligation of Fuel Supplier
Commission for banking arrangement	1 set	32,500	Obligation of Fisheries Division
Total		301,500	

2-5-2 Cost estimation condition

- ① Time of estimation : April, 2009
- ② Exchange rate: US\$=96.16, 1EC\$=35.61
- ③ Construction period: Detailed design and construction schedule are as per Implementation Schedule
- ④ Others: This project is to execute with the Grant Aid Cooperation of the Government of Japan

2-5-3 Considerations on project implementation

For the smooth implementation of this project, the following considerations are required to be conducted promptly by Grenada after concluding the Exchange of Notes are expected

- ① To conduct the procedures of approval and permission promptly without delay related with Environment Impact Assessment (EIA) being necessary for the application of building permission by the Government of Grenada and other marine civil engineering works.
- ② The district to implement construction work is difficult area to secure temporary yard for construction work. For the implementation of construction, it is necessary to secure

temporary yard at nearest point of the project site.

- ③ Resident who lives in newly expropriated land has to be moved and complete removal work of houses. The delay of this problem makes severe impact for the project implementation.
- ④ There will be the moment to restrict usage by part of fishing boats due to the marine work implementation during construction. It is required to lead the publicity and cooperation concerning off limit district and time to fishermen. And, it has to consider providing other landing place during restricted period not so as to stop fisheries activities of artisanal fishermen.
- ⑤ In case that the marine disposal of bottom soil generated by the excavation work, it is required to work for permission, coordination and conciliation of marine disposal place.

Chapter 3 Project Evaluation and Recommendations

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effect

As described in Chapter 1 Project Background, the Government of Grenada has paid attention to the extensive fishery resources and established “Fisheries Management and Development Plan: 2002” aiming to the contribution to economic development with the sustainable and effective utilization from the latter part of 19080’s to now, the nutrition improvement and food supply for the people(sufficiency of domestic demand by imported food/substitute of imported goods), the acquisition of foreign currency by the promotion of export, the generation of employment opportunity, the increase of cash income for artisanal fishermen and has been executed the projects by the support of Grant Aid Cooperation of Japan or others. Gouyave district, St. John county where is the project site is the largest traditional fishing community in Grenada being survived by fisheries industry for more than 300 years. There are 45 fish landing places in Grenada, of which 7 major places are managed by Fisheries Division, of which 3 Victoria, Gouyave and Melville Street are located in the west coast. Gouyave is the #1 fish landing place in west coast occupying 15% of all fishing landing volume. 95% of the landing volume is occupied by offshore pelagic fishes and contribute to the acquisition of foreign currency in the fisheries industry of Grenada but presently the following issues are existed.

- ① The sustainable and maximum effective utilization, of the coastal fisheries resources, are executed as ensuring job security for local artisanal fishermen and food security for the area people and, of the offshore fisheries resources as the resources for the consumers mainly in urban area , tourism industry and export market in the recent development guideline of fisheries sector. The fisheries base facilities in Goyave are still stayed ways they were responding to the coastal fisheries in spite of the change of fisheries pattern that the dependence degree is more than 95 % on offshore pelagic fish (migrant) from the coastal fisheries.
- ② Although the fish landing function of existing jetty is only just maintained by repeated disasters like hurricanes and repairs, a secured and safe berthing of artisanal fishing boat is in difficult condition due to the aging of steps for landing, no installation of fenders and etc. Steel pipe piles which support the jetty are corroded with the damages of coating for anti-corrosion and etc. exceeding the assumed corrosion speed.
- ③ Fisheries distribution function has been a scheme to support with the existing fisheries center and fish market that were constructed by Japanese Grant Aid for Fishery Sector in 1989/1990 however the existing fisheries center is not functioned due to the damage by hurricane “IVAN” and the functions like ice making machine have been

deteriorated (actually 1.1 tons/day). The cold storage capability has also been seriously deteriorated with the corrosion of freezer and aging of wall, floor and door of refrigerator.

- ④ The situation to put off fishing has been happened stopping the fish landing and shipping at high season due to the lack of fisheries distribution facilities. And, according to the growing in fish size, frozen storage has been required but there is no capability of frozen storage therefore 9.8% of landed fish becomes post harvest loss (fish is thrown out).
- ⑤ These influence is appeared on the annual landing volume and the landing volume in Gouyave district shows downward trend (the landing volume in 2007 was 0.81 times of its 2002) while the landing volume of total Grenada shows no apparent change. (The landing volume in 2007 is 1.01 times of its 2002)
- ⑥ Fishing boats in Gouyave operating offshore of west coast of Grenada are inevitable to load safety tools (wireless application and etc.) while, the existing tower which works for observation of fishing boats activities, transmittal of signal at the time of emergency is existed at north east of Grenada Island but the radio wave is not reached up to the west coast due to the terrain condition. Therefore, fishermen's safety such as observation of fishing boats activities which operate offshore or transmittal of emergency signal is not secured.

This project implementing under the above background and issues will bring following effects.

(DIRECT EFFECT)

- ① Increase of income with related people of fish market

The supply of fresh fish always becomes possible in the New Fisheries Center. And, the income of related people with fish market can be expected in accordance with the increase of the handling volume.

- ② Supply protein source to people of Grenada and increase of work opportunity

Since fresh fisheries products are supplied through out the country, the benefit that can be supplied protein source to 110 thousand people of Grenada and increase of work opportunities by the development of fisheries center along with the improvement of export of fisheries products can be expected.

Annual handling volume in the existing fish market is 428,782 lbs however, the handling volume in the New Fisheries Center shall be increased with the construction of the new fisheries center and conduction of effective distribution in the market. And, it is estimated that the current post harvest loss of fisheries products is 9.8% (61,977 lbs/year) of annual handling volume of the existing fish market, as the effective distribution of fisheries products is executed with the provision of freezing rooms in the new fisheries center, these post harvest losses shall be resolved.

- ③ Promotion of efficiency and safety of landing with construction of jetty
Fish landing is difficult in the existing jetty since the crown height is elevated against present fishing boats. And, since the gratings which were installed at lower part of jetty by Grenada are too narrow without installing fenders, there are troubles at landing works and problems of safety. Safe and effective landing works will become possible solving these problems by the construction of jetty.
- ④ Improvement of convenience and sanitary condition and increase of users by improving function of fish market
The existing fish market has no car parking space and the available sales booths are only 4 due to the narrowness. As the sales booths will be increased and about 16 vehicles can be used simultaneously in the consolidated new fisheries center, it will be more convenient. 10 sales booths for the vendors which are 2.5 times of the present will be made. The area of sales table per booth will be wider and the booth will be possible to put fish on ice which leads to the sanitary sales with preserving freshness and the consumers can purchase fresh fisheries products. Consequently, the increase of the number of users to purchase fisheries products and the vendors to utilize the market can be expected.
- ⑤ Increase of processing volume and variety in fish market
As expanding the function of freezing storage in the New Fisheries Center, the variety of handling fishes from fresh fish to frozen fishes shall be increased. As well as tuna processing for export can be possible, cutting process in rounds of frozen fish (Tuna, Atlantic sailfish and Common dolphin fish) for domestic market is promoted. And, the expanding process room makes handling of processed fish possible.
- ⑥ Increase of ice sales volume and income
As the ice supplying capacity corresponding to the present ice demand in the New Fisheries Center shall be improved, the ice sales volume will be increased and its income of the Fisheries Center which is operating organization will be increased. As the ice making capacity will be 4 tons/day from the present 1.1 tons/day and the storage capacity will be 10 tons, the annual ice sales amount will be increased.
- ⑦ Decrease of number of marine peril
Most of fishing boats in Gouyave have operated at the offshore of 40 to 70 sea miles. Although the antenna was installed at Kublal located north side of Grenada Island St. Catherine hampers the radio wave and it does not transmitted to open sea. About 30 marine perils at Gouyave district have occurred in the past 5 years. Half of these (16 perils) were caused by having trouble contacting in an emergency.
The antenna which will be constructed with this project is set 90 miles as longitudinal coverage and basically most of fishing boats can be operated within the range of the radio. Therefore, the improvement of receipt of rescue signal from fishing boats, finding of operation area, provision of information and etc. become easy and decrease the marine perils can be expected.

(INDIRECT EFFECT)

- ① Income increase of related business with fish market

Fresh fishes will be always possible to be supplied in the New Fisheries Center and the handling volume will be increased and the income increase of related business with fish market can be expected.

- ② Supply of protein sources to the people of Grenada and increase of employment opportunities

As fresh fisheries products are supplied throughout Grenada, 110 thousand of peoples national shall receive the effect such as getting supply of protein and the benefit the increase of employment opportunity by the development of fisheries industries through the export of fisheries product.

Fisheries office that is an implementation organization of the New Fisheries Center is proposed to make efficient use of the New fisheries Center and operate and maintain it after completion of construction of this project with well taking care of the following points.

Table 3-1(1) is the list for the effect of project implementation and the extent of improvement from the present conditions. It is possible to improve from present situation.

Table 3-1(1) The effect of project implementation and the extent of improvement from the present conditions

Current issues	Mitigations in the Project	Extent of effect
1. Response to the change of fishery configuration	<p>① Construction of the New Fisheries Center (Partial removal, expansion and relocation of fish market function of the existing fisheries center)</p> <p>a) Freezer: Chest freezer with 17 m³ and storage room with 87 m³.</p> <p>b) Cold storage room: Slow freezing storage with 117 m³ and cold storage room with 38 m³.</p> <p>c) Bait room: 42 m³</p> <p>d) Ice machine and ice storage room: Ice making capacity with 4 tons/24 hours (plate ice) and ice storage room for 10 tons capacity.</p> <p>e) Vending booth: 10 booths (vending area with 132 m²)</p> <p>f) Primary fish treatment room: Fish receiving and cleaning room with 80 m² and weighing and recording room with 39 m².</p> <p>g) Fish cleaners sink: 10 sinks</p> <p>h) Fish processing room: 91 m²</p>	<p>①Improvement for infrastructures of fishery production and distribution function</p> <p>a) Securing blast freezing capacity with 250 kg/day and its storing capacity with 3.5 tons</p> <p>b) Securing freezing capacity with 4.3 tons and cold storage capacity with 1.1 tons.</p> <p>c) Securing freezing and storing capacity of bait fish for long line fishing</p> <p>d)Responding to the demand of 924 tons/year</p> <p>e) Increase to 10 against 4 now and vending booth will expand to 132 m² from 45 m² now and vending function will be increased.</p> <p>f) Enlarging receiving and cleaning room to 80 m² from 50 m² and weighing and recording room to 39 m² from 35 m² and the working efficiency will be improved.</p> <p>g)Increasing to 10 sinks from 2 (corresponding to the number of vending booths)</p> <p>h) Enlarging to 91m² from 50 m² and handling capacity will be increased.</p>
2. Safe and untroubled landing function	<p>①Construction of new jetty</p> <p>a) Jetty length with 83m (wharf jetty length is 45m and access part is 38m)</p>	<p>① Construction of new jetty</p> <p>a) Fish landing and preparation for fishing always become possible.</p> <p>b) Safe and untroubled landing work</p>

	<p>b) Jetty width is 9m and the width of access part is 4.83m)</p> <p>c) Installation of beacon light and lighting facility</p> <p>② Removal of existing jetty</p> <p>a) Removal of aging existing jetty</p>	<p>can be carried out using a truck with crane.</p> <p>c) Fish landing and preparation for fishing at night or early morning can be possible.</p>
3. Damage recovery and renewal of facilities	<p>① Recovery of existing fisheries center (1 . Response to the change of fishery configuration as described)</p> <p>② Renewal of old facilities (1 . Response to the change of fishery configuration as described)</p>	<p>1 . Response to the change of fishery configuration as described</p>
4.. Facilities renewal corresponding to landing volume	<p>① Upgrading and expanding existing fisheries center (1 . Response to the change of fishery configuration as described)</p> <p>② Relocation and upgrading and expanding existing fish market (1 . Response to the change of fishery configuration as described)</p>	<p>①The fish landing volume in Gouyave district will be 632,422 lbs/year against 428,782 lbs/year in the existing fish market. (improving 1.47 times of handling volume)</p>
5 Settlement of post harvest loss	<p>① Addition of cold storage function (1 . Response to the change of fishery configuration as described)</p> <p>②Upgrading and expanding of child storage function (1 . Response to the change of fishery configuration as described)</p>	<p>① Settlement of 9.8% of post harvest loss at Gouyave</p> <p>② 3.5 tons freezing storage capacity for about 2 weeks and 4.3 tons slow freezing capacity for 3.5 days.</p> <p>③1.1 cold storage capacity now in existing fish market can be improved to 1.1 tons.</p>
6. Security of fishermen's safety and asset maintenance	<p>①Tower construction</p> <p>a) Self supporting radio antenna (steel structure with the height of 180 ft)</p> <p>b) Repeater shed (generator and air</p>	<p>① Safe management for the operation area within 70 sea miles can be possible.</p> <p>② Safe management for operation area in west coast of Grenada Island</p>

	conditioner c)VHF Repeater (50 w x 2) ② Enhancement of safety management system on fishing boat operation a) Establishment of management system for combined operation with the existing tower in north (the Government of Grenada)	can be possible. ③ Currently, 75% of fishing boats equip with radio facilities. The safe of these boats are secured ④ Fishermen's assets such as their lives and fishing boats cab be secured.
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3-2 Recommendations

Fisheries Division that is implementing agency of the New Fisheries Center should effectively utilize and operate the New Fisheries Center paying special attention to the following after completion of this project.

(1) Framework to execute the daily management and periodical maintenance of facilities, machines and so forth.

Daily management is important in order to maintain and retain the functions of facilities, machines and equipment which will be adopted with this project. Although the existing fish market has been kept clean by daily sweeping, the daily cleaning is also required in the New Fisheries Center as well and establish a framework to record the daily operation and usage situations of facilities, machines and equipment and execute the periodical maintenance is important.

(2) Establishment of monitoring system

It is necessary to find the freshness of fish and user's need with the execution of weighing and recording of landed fishes, recording the quantity of fuel and water to fishing boats, surveying berth occupancy time of fish landing boats, surveying fish freshness, surveying users by periodical questionnaire survey and etc.

(3) Operation Manual

The operation manual of facility cleaning, fish handling, fish processing method, freshness evaluation method and etc. for vender's booth, process room, ice making and storage room and make vendors and users like staff of the New Fisheries Center thoroughly master.

(4) Market exploration

It is necessary to respond properly to export promotion of fresh fishes and frozen fishes for restaurants, hotels, hospitals and others in addition to the fresh fishes for venders. It is necessary to promote the quality monitoring the comments and requests of newly explored clients as well as keeping freshness in order that the New Fisheries Center will progress in a sustainable way.

(5) Reserve fund to renew machines

As described in previous chapter, costs for periodical maintenances, replacements of main parts and renewal of machines after 13 years of the end of its life shall be generated in the machines of the New Fisheries Center such as ice making, cold storage and other machines. It is necessary to properly reserve fund for this renewal of the machines.

3-3 Project Evaluation

As described in Chapter 1 Project Back ground, in spite that the fishing industry in Gouyave has been changed its type of operation to catch offshore pelagic fishes with the technical cooperation of Japan and so forth and its handling volume and quality have been greatly changed, the existing fisheries center can not be corresponded and has been malfunctioned due to the damage of hurricane "IVAN". The existing fisheries center is also become too old to correspond to the landing volume in Gouyave. This project will contribute to the rehabilitation of from the disasters of hurricane "IVAN" and also correspond to the change of fisheries pattern and the increase of landing volume and construction of the New Fisheries Center which consolidates the existing fish market function and , the fish landing base which will become available with 24 hours service.

The beneficiary of this project is not only the people of Guyave but also all the about 106 thousand people of Grenada and this project is expected to be a mean of the acquisition of precious foreign currency as well as providing the effect of supply of quality fish to the people. At the same time, this project is met with "the contribution of the fisheries industry in the primary industries of Grenada economy is promoted " which is one of the target of national development plan and contribute to ① Improvement of food self-sufficiency in Grenada, ② Acquisition of foreign currency with export of fishery products and the increase of cash income ③ Increase of employment opportunity.

Fisheries Division has committed their all necessary participations to play a leading role from the construction stage and a staff of Fisheries Division as the overall manager in the New Fisheries Center will be allocated at the stage of management for operation and maintenance and a proper operation plan, management, recording of landed fishes and etc. will be executed there.

With the above, the construction of the New Fisheries Center implementing by this project

through the Grant Aid Cooperation is greatly desired and this project is considered to be relevant and significant judging from the implementation effect and the essence of plan.

3-4 Conclusions

This project is, as well as expected to bring numerous benefits as previously described as this project will widely contribute to the improvement of BHN (Basic Human Needs), the relevancy for the implementation of Japanese Grant Aid Cooperation against a part of total project is confirmed. Furthermore, concerning the operation and maintenance management of this project, the recipient country side is considered to have enough personnel and fund.