Chapter 2 Contents of the Project

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2-1 Basic Concept of the Project

2-1-1 Objectives of the Project

The Project aims at the improvement in the distribution system of fishery product in Grenville, the largest city next to St. George's, the capital, in population, having the largest volume of fish landings in Grenada, in order to promote the improvement in the national distribution system of fishery product, the system which is one of the most urgent problems for the Government, and the Project is to be implemented on the basis of the results of past fisheries development projects and their reform measures. The contents of the Project are to construct newly a modern fish market complex in Grenville in place of the existing superannuated public fish market plus to improve the Grand Etang Road and four bridges over it connecting Grenville with St. George's west to east. The Government of Grenada requested Japan to extend a Grant Aid for the implementation of this Project, and its contents are summarized as follows.

(A) Fish market complex component: construction of landing/berthing wharf and fish market, exterior works, and provision of equipment and materials.

(B) Road component: improvement of Grand Etang Road (21.7 km long) including 4 bridges.

2-1-2 Basic Concept of the Project

The Government intends to execute an well-balanced fishery development policy to increase fish products substantially to meet domestic/tourism demand by decreasing post-harvest loss through the improvement in the national fishery distribution infrastructure, along with promotion of fishery export.

For this development policy, it is essential to develop the fisheries in the Atlantic side, which is generally less developed than the western coast on which St. George's is located. The fishing industry on the eastern coast centering around Grenville which contributes 25-30% of total fishery production of the country is flourishing due to plenty of fishermen including young generation. But, in spite of such favorable condition, lots of fish catches are not utilized effectively because of lack of suitable outlet during high fishing season February to April. Also, though the circumferential road of the island is well-developed, the Grand Etang Road crossing the 600 to 700 m high mountains traversing the island is very risky for vehicles due to numerous defiles, steep slopes and sharp turns. An improvement in safety of the Road is essential for the development of the economy of the Atlantic side through promotion of distribution of fishery/agricultural products.

Successive assistance by the Japanese Government in the fishery sector of Grenada has contributed

greatly to the development of it, and private investment for mainly species for export is increasing rapidly. As a result fishing activities on the western coast are developing greatly, but such rapid development is apt to lead over operation off the western coast and thus diversity of fishing activities and target species is needed. As for unexploited offshore resources, the development of the Atlantic waters centering around Grenville is important and is given top priority in the future fisheries development. For this, promotion as well as stabilization of distribution of fish product between the eastern and western sides of the island through an improvement of road network is necessary.

Besides increasing contribution to the state economy and promotion of employment opportunities, the fisheries development objectives of the Government of Grenada are (1) sustainable utilization of fishery resources, (2) stabilization of fishery production, (3) improved fishery distribution, and (4) safety of fishermen at sea. The basic design of each item of 2 components of the Project is determined on the basis of how to achieve these objectives effectively and its content, specifications and scale essential for the future development, in accordance with the current condition of coastal fisheries, after the position occupied by the requested component is clarified as the table below.

Table 2-1 Basic Concept of the Project

<table>
<tr><th>Development Target / Project Component</th><th>Sustainable Utilization of Fisheries Resources</th><th>Promotion of Stable Fish Production</th><th>Improvement of Fish Marketing System</th><th>Safety of Fishermen at Sea</th></tr>
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(A)Grenville Fishery Facility
(B)Grand Etang Road</td><td colspan="4">＜(A)Promotion of Fish Marketing around Grenville：Improvement of Fish Marketing Facility ＞</td></tr>
<tr><td>Improvement of Fishing Technique of Fisheries Division and Facility for Promoting Fisheries Resources Management</td><td>Improvement of Fisheries Base on East Coast of Grenada island</td><td>Improvement of Fish Marketing around Grenville</td><td>Improvement of Safety Observation System on Fishing Operation of East Coast of Grenada island</td></tr>
<tr><td colspan="4">＜(B)Promotion of Marketing Between East and West：Fisheries Products、Fisheries Equipments, etc＞</td></tr>
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2-1-2-1 Contents of the Request

The table below shows the "Results of discussion at Preparatory Study (March 2000)" and the "Mutually agreed contents at Basic Design Study (July 2001)."

(1) Mutually agreed contents at basic design study

Classification	Preparatory Study（March 2000）	Basic Design Study（July 2001）	Note
(A) Fish Market			
i) Facilities	①Berthing Warf（It's confirmed to request Fish Landing Jetty instead of berthing Warf.）	①Fish Landing Jetty	Processing Equipment
	②Fish Market Complex －1. Retailing area －2. Ice making storage plant －3. Cold Storage －4. Fishermen's lockers －5. Fish handling area －6. Sanitary room －7. Workshop －8. Water tank －9. Fuel / Oil tank －10. Fishery development center	②Fish Market Complex －1. Retailing area －2. Ice making storage plant －3. Cold Storage －4. Storage －5. Fish processing room －6. Fish handling space －7. Sanitary room －8. Work shop and Slipway －9. Water tank －10. Sewage facility －11. Administration offices －12. Fishermen's locker	
	③External Facilities －1. Parking area －2. Lighting －3. Sewage and Drainage －4. Pavement	③External Facilities －1. Parking area (Including pavement in the area) －2. Lighting	
ⅱ） Equipment	①Seawater pump ②Pushcarts ③Insulated boxes and fish boxes ④Weighing scales ⑤Radio sets	①Seawater pump ②Pushcarts ③Insulated boxes and fish boxes ④Weighing scales ⑤Radio sets ⑥Maintenance tool for Engine ⑦Radio antenna post	
(B) Road			
i) Road	①Section Ⅰ Section Ⅰ-1* (D) Section Ⅰ-2* (A)	①Section Ⅰ Section Ⅰ-1* (B～C) Section Ⅰ-2* (A～B)	
	②Section Ⅱ Section Ⅱ-1* (D) Section Ⅱ-2* (B)	②Section Ⅱ Section Ⅱ-1* (B～C) Section Ⅱ-2* (A～A)	
	③Section Ⅲ Section Ⅲ-1* (C) Section Ⅲ-2* (C)	③Section Ⅲ Section Ⅲ-1* (B～C) Section Ⅲ-2* (B～C)	
ⅱ) Bridges	①Section Ⅱ (Bridges) Section Ⅱ-2 St. Margaret* (B) Section Ⅱ-2 Birch Grove* (B)	①Section Ⅱ (Bridges) Section Ⅱ-2 St. Margaret* (B～) Section Ⅱ-2 Birch Grove* (A~)	

	②SectionIII (Bridges) Section III-1 Balthazarr* (A) Section III-2 St. Cyr Great River* (B)	②SectionIII (Bridges) Section III-1 Balthazar* (A～) Section III-2 St. Cyr Great River* (B～C)	
Note: *A,B,C,D indicate the difference of the priority by contents of the improvement.			

(2) Implementation arrangement

1. The Ministry of Agriculture, Forestry, Lands & Fisheries (A.F.L.&F.) is responsible for the Project as a whole.
2. The following two governmental agencies are responsible for each component of the Project.

The executing agency of the road component of the Project, Road Division of Ministry of Works, Communications and Public Utilities, was reorganized and renamed to the Project Implementation Management Unit (PIMU). Since all of civil engineers of Road Division were transferred to PIMU, there exist no technical problems.

(A) Fish Market Complex component --- Fisheries Division, Ministry of A.F.L. & F.

(B) Road component --- PIMU, Ministry of Works, Communications and Public Utilities.

(3) Proposed Project site

Grenville and Grand Etang Road

(A) Fish market complex: Grenville

Area: approximately 30,000 m^2 (land and sea)

Address: Grenville, St. Andrews, Grenada, W.I.

(Note) The proposed Project site on land is situated at a sand beach east of the premises of an Anglican church and covers an area of about 6,000 m^2. The location of the site is the same as the one of 1989 Request but the area is different.

(B) Road: Grand Etang Road (St. George's to Grenville)

Improvement of whole 6 blocks of 3 sections (total 21.7 km) and 4 bridges is requested.

(4) Management of the Project

a) Staffing plan

(A) Fish market complex

At present there exist two fishery-related facilities in Grenville. One is the fishery center (fish market) managed by the Fisheries Division and the other is the fishermen center operated by a local fishermen's association entrusted by the Grenada Commercial Fisheries Ltd. (GCFL). The original request described that GCFL will operate the proposed fish market complex, but it is now agreed that the Fisheries Division is responsible for the operation of it. Also the previous staffing plan consisting of 16 persons was changed to 10 personnel system, 2 seculities, 3 persons for fish market, and 5 persons responsible for whole facilities.

(B) Road component

The implementing Ministry of the Project is the Ministry of A. F. L. & F as mentioned above, and the executing agency of the road component is the PIMU as mentioned above. The number of staff was drastically decreased from 130 in 1998 to 68 at present due to outsourcing. However, it was confirmed that the PIMU would have responsibility for the maintenance of road sections and bridges under this project after completion of the construction.

b) Budget

The fish market complex is to be operated by the Fisheries Division with a governmental budget. The road is managed and maintained by PIMU. Both of them have experience in such kind of project.

(5) Position of the Project

The basic policy in executing the fishery and road components is as follows.

- Fishery sector related component: Enhancement of contribution to the economy, sufficient supply of fishery product to domestic demand, increase of income and employment of the sector, and promotion of participation of fishermen to commercial fisheries.
- Road sector component: Promotion of effective improvement of road network (development of key industries, and development of rural economy)

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

Main requested items include (A) construction of landing/berthing wharf, fish market, and fishermen's locker, exterior works, and provision of seawater pump, pushcart, insulated box and fish box, weighing scale and radio set, and, as for Grand Etang Road, (B) widening and pavement of the Road, construction of side drain, renovation of steep slope, installation of safety sign, and repair and renovation of 4 bridges.

A landing/berthing wharf was changed to a fish landing jetty. Also a supervisor office and an administration office are to be installed in the fish market facility. The priority order of requested road-related items was technically examined, and it was partly changed due to the current situation of fishing activity on the eastern coast, natural condition of the Project site, the present condition of the Road, and road condition in the reserved forest.

Besides, it is of urgent necessity to improve in supply-demand relation of fish product in Grenada because of increasing export of fish as much as one fourth of total fish production, and a hygienic fish processing room was requested to develop fish marketing and secure a stable outlet of fish. The results of examination of each item are as follows.

(1) Examination of Grenville fishery facilities

In Grenada, the fishery is one of important industries supporting the state economy, along with agriculture and tourism. For the growth of the economy it is essential to establish food security, to earn foreign money by export, and to save foreign currency with import substitution through the sustainable development of its marine resources. Grenville, the Project site, on the Atlantic side of the island yields 25-30% of national fish production and occupies an important position in the national fishery development. But the previous fishery development projects have put emphasis on the western coast, and so the fishermen in Grenville are backward in fishing technique comparing with the ones in Gouyave and Grand Mal on the western side. In order to improve the nationwide distribution it is of urgent necessity to improve the fishery distribution infrastructure on the Atlantic side.

1) Fish Landing Jetty

Almost all of fishing boats in St. Andrew Parish, covering eastern half of the whole island, are landing their catches at Grenville. The number of operating fishing boats are 87 (74 in service and 13 unknown, but 181 registered) and 152 fishermen are now working (one missing due to distress and 268 registered). At present they are landing their catches on natural sand beach. There are no landing jetty and mooring facility except some 30 small mooring buoys (plastic/styrene foam balls for fishing) on the sea.

The fishing boats are mostly of wooden made, many became superannuated, and some 10 of them have to be always beached on the foreshore just after landing to prevent leak of seawater.

There is a commercial jetty south of the Project site, but the jetty is not available for fishermen for the reason that Grenville is an international commercial port next to St. George's. Fishermen are therefore obliged to work in water whenever they sail out for fishing, return to port, and land their catches. Heavy rolling of boats in high wind and seas endangers the working fishermen. Landing work in water consumes greatly time and energy, and restricts hours for fishing. These situation must be urgently improved.

2) Fish market facilities

At present there are two fishery-related facilities in Grenville. One is the fishery center (fish market) managed by Fisheries Division and the other is the GCFL-owned fishermen center operated a local fishermen's association. The former was constructed with CIDA assistance in 1972 and the latter was provided by Japan's Grant Aid in 1992.

The existing fishery center (fish market) is the only public fish market in this district and is handling about 400 tons of fish a year in weighing, purchasing, retailing, treatment, storing, and salt/dry processing. Though the environmental hygiene condition of the market is in need of improvement due to discharging wastes including gills and guts, it is difficult to improve it on this location because the facility stands on the corner of the bus terminal/commercial quarter in the center of Grenville city, getting between the

commercial jetty and the Port Authority's building and Victoria Street. The fish market site must be removed.

Since the cold storage unit breaks down frequently, large insulated containers (ice storage) are being used for preservation of freshness. Also this cold storage unit is lent to specified retailers, which monopoly situation is impeding the original purpose of the unit, and the revenue from fixed small rental fee is not enough for maintenance of the facility.

Since one-day fishing trip is the standard operation pattern, fish are generally distributed in fresh state without ice. Even during the high fishing season surplus catches are marketed in the same manner, and thus deterioration of fish after days is heavy, which unfavorable condition deprives often the confidence in marketed fish from consumers. The Fisheries Division is earnestly encouraging the usage of ice. Production and security of ice are very important for the improvement of the distribution of fish product in Grenville.

a) Retailing room and fish counter

The existing U-type fish counter, 3 m wide and 4 m deep, consists of 6 booths. Each counter is covered with tile, and there installs a wash basin behind it respectively. Surplus fish not enable to display on the counter are piled on the floor, which piles are cutting the traffic line in the small retailing room. The retailing right is given to only 6 retailers due to only 6 retailing booths, which monopoly situation is excluding many applicants to fish business and impeding free competition in improving freshness and reasonable price for consumers. The retailing room is an important place in that fish producers (Fishermen) contact with consumers. It is necessary to improve the situation so that both producers and consumers can secure their merits.

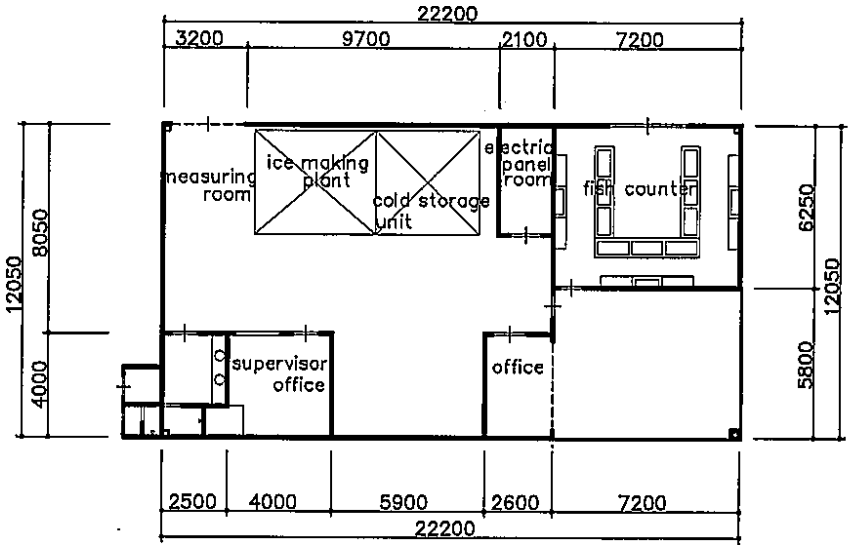

Figure 2-1 Existing fish market

b) Ice making plant

As mentioned above, Grenville has a fishery center (since 1972) and a fishermen center (since 1992). Both facilities have been equipped with the following ice making plants, but at present only the one (plate ice, 2 ton/day capacity) of the fishermen center is in service, and its capacity dropped to less than 10% of the original one due to superannuation for more than 10 years since installation.

Name	Capacity	Present condition
Fishery center	3 ton/day, flake ice	Unserviceable due to superannuation
Fishermen center	2 ton/day, plate ice	Capacity less than 10%, 48-60 ton/year
	1 ton/day, block ice	Breakdown beyond repair, no production.

Under these conditions the procurement of ice is strictly restricted, and the clients of GCFL are marketing ice procured from the ice plant of GCFL in Grand Mal (about 60 tons a year). Ice is indispensable for preservation of freshness of fish, and all-out dependence on the western side for ice means an abandonment of independent fishing activity on the eastern coast. It is of urgent necessity for the Atlantic side fishery to secure an independent and systematic procurement of ice.

Assuming that fish to ice relation is 1:1 for preservation purpose base on the guideline of the Fisheries Division, the demand of ice in Grenville is estimated at some 1,000 tons a year as below, and, of which about 610 tons associated with the operations regarding the Project must be independently secured. Flake ice is generally required due to retailing and distributing purpose. In the past 3 years, the maximum landing of 4,569 kg (10,154 pounds) in the high fishing season were recorded on February 11, 1999. When the capacity is established at 1-2 ton/day, an ice storage facility must be prepared to cover the shortage.

Purpose	Fish (ton)	Ice (ton)
Fishery	400	400
Fish market (retailing)	400	550
Distribution	60	60
General demand	0	0
Total		1,010

c) Cold storage facility

The existing fishery center has a cold storage facility (17.5 m^3 capacity), and the fishermen center has two cold stores (10 m^3 each). At the fishery center fish boxes are also used by retailers, keeping a half or one third of sales for the next day. This volume is varying, and, according to the interview survey, it is equal to the landing not able to sell in the day due to late return in the afternoon, about 400 kg--30% of average daily landing (average yearly catch: 400 tons, fishing day: 300 days, average daily

catch: 1.33 tons, 30% of 1.33 tons are about 400 kg)—and 60 tons for 3 months (72 days in 12 weeks), February to April, in the highest fishing season. These fish must be kept in a cold store. Since the efficiency of taking in and out fish was not worth due consideration due to small frequency of distribution, the capacity of a cold storage facility has been hitherto determined on the condition of bulk storage. But the primary purpose of a cold storage facility is to keep the freshness of fish, and, from the viewpoint of cost-effectiveness, strict temperature control is required. Besides, the fish boxes are used to keep larger fish (common dolphin, wahoo, etc.) constantly requested so as to stabilize sales income. Taking into consideration these situations, the scale and specifications of the cold storage facility is to be decided on the storage condition using fish boxes.

d) Store

The minimum store space necessary for operations and management of the fishery center of the Project is required.

e) Fish processing room

At present, at the existing fishery center (fish market), Fisheries Division staffs are working to make a value-added product, salting and drying the surplus fish of the day. The product is a substitute for traditional import of salted cod, and its intention is to contribute to saving foreign currency and import substitution. But the work is conducted at a space outside at weekend or in spare time, which situation poses a hygiene problem. In order to continue this work a hygiene fish processing room is necessary.

f) Fish handling space

At the existing fishery center, sales, filleting, scaling, etc. after weighing are at present conducting outdoor due to narrow space. On the beach, wastes including blood, gills, and guts are dumped out without treatment after landing. On the premises, customers, visitors, and even grazing animals are freely going in and out. It is necessary to arrange the traffic lines as well as to provide a hygiene fish handling space to maintain the primary function as a fish market.

g) Sanitary facility

There exist two shower/toilet facilities in the existing fishery center (fish market). The inside one is for registered retailers, their employees, and fish market staff (manager and other 3 persons), and the outdoors one is for fishermen and various market workers. In the new facility of the Project the minimum number of sanitary facilities are to be provided to service for (a) fishermen, (b) retailers and market workers including scalers, and (c) office staff, considering a ratio of male to female.

(Note: The existing fishermen center (Japan’s Aid) has a toilet for its staff only. A public toilet is on the south of the Port Authority’s premises. The Project has no consideration for any public toilet.)

h) Workshop and slipway

There exist no workshop for fishery equipment and engine in Grenville.

Maintenance of boat is given on the foreshore where the boat was beached. Outboard motors are also repaired by contracted mechanics or fishermen themselves on the foreshore. The work must be conducted carefully to prevent accident of passersby, and stopped whenever the weather becomes bad. Missing parts is not uncommon. A workshop for engine/outboard motor, fishing equipment and other devices plus a storing space for tools and spare parts are necessary.

A repair shop for the hull of small fishing boat was requested. The fishing boats in Grenville are almost 6-7 m wooden boats. It will be necessary to provide a repairing space without a permanent roof. A ramp way for boat in hurricane (apron of embankment) can be utilized as this space.

A slipway is essential to operate effectively the workshop facility. As one of options, taking into consideration the sedimentation effect, it is considered to utilize part of the foreshore as a natural slipway, leaving its natural condition as much as possible.

i) Water tank

The precipitation in Grenville is about 1,500 mm at average for the past 10 years. But the difference between wet and dry seasons is great; 309 mm in November and only 37 mm in February. The rainfall in the wet season is more than 8 times the dry season. It is important to utilize abundant rainfall. For this a water tank is to be provided. Water of the tank will be used as a rule for general service such as floor washing.

j) Sewage facility

Despite the second largest city, Grenville has no public sewage system. The Project requires the following measures.

Drainage from toilet	: Installation of septic tank
Drainage from Fish handling area and processing room	: Installation of sewage tank
Drainage from fish market	: Installation of sewage tank

k) Office area

At present 3 persons from the Fisheries Division are stationed at the existing fishery center (fish market). The Fisheries Division staff are sent to 6 fishery centers located at Melville Street of St. George's, Grenville, Gouyave, Victoria, Duquesne and Sauteurs respectively, and covers such various fields as guidance in fish dealing, surveillance, data gathering, training, extension service, and resources management. But, the existing Grenville fishery center has only one small room as office, and hence it is difficult for the staff to cope with these duties. In the Project it is necessary to provide two offices, one for administration of the whole facilities, and one for supervision over wholesale trading.

l) Fishermen's locker

At present there exist 16 fishermen's lockers. The fishermen in Grenville are 151 in number, and fishing boats are 74 (the number is derived from the site survey because the registry is not up-to-date). The rate of operation is 65-70%, and hence about 50 boats on a fishing boat basis and about 100 persons on a fisherman base will be in service. Consequently, the shortage of locker is 32-35 on a boat base and 62-70 on a fisherman base. The locker is 1.5 m × 1.15 m × 2.0 m height (1.7 m^2) in size and used effectively. But its number was originally in short (for only 20% of boats in service) and several groups are jointly using, the space is not sufficient, and hence fishermen cannot take out necessary articles at once due to a stack of them. The new locker will require a space 1.5 to 2.0 times the existing one so that fishermen can arrange stored articles properly. Main articles to be stored are as follows.

Outboard motor (about 40 PS) × one or two sets, 40 liter oil tank × 2

Long-line gears box (70cm^3, 350 liters) × one or two boxes

Hand line × 10 sets

Other materials, raincoat, spare clothes, etc.

3) Exterior works

No parking lot is provided at the existing fish market. Customers park their cars on Victoria Street and its surroundings, which situation is obstructing traffic in the city. The Project requires a parking lot for customers and business trucks, considering an arrangement of traffic lines of men, vehicles, and goods so that the Project site can be effectively used. Also lighting facilities are necessary for safety at night in the premises of the Project.

A radio antenna post shall be erected to secure communications with fishing boats. The Project site is situated at a flat area on the east coast of Grenada, but the 600-700 m high mountains rise on the middle of the island. An antenna tower system is needed for translation. The Grenville Police Station has the antenna post system, but erection of an antenna on this post is dangerous due to superannuation and sharing would pose some problems on management and maintenance. The Project shall construct independently an antenna post.

4) Requested equipment and materials

a) Seawater pump

Seawater pump is to be used for washing the bottom of fishing boats and the landing jetty. At present buckets are being used for this purpose. The water source of the Project will be public water, rainwater, and seawater. Each source shall be used according to its purpose.

b) Pushcarts

At present landings are carried manually from the foreshore to the fish market. After construction of a fish landing jetty and a fish market facility in the Project, fish, ice, materials, etc. will be efficiently carried by pushcart.

c) Insulated boxes and fish boxes

At present fish not displayed on the counter are stocked on the floor due to narrow space. Deterioration of these fish is hastened because temperature is as high as more than 27℃ all the year around. This situation must be improved. The Project requires, from the standpoint of temperature control and quality control, insulated box for temporary storage (ice storage) of large fish and fish box for storage of fish in cold store and for carriage of fish.

d) Weighing scales

Weighing must be correctly conducted for gathering of fishery data and fair dealings. Two kinds of weighing equipment, desktop type balance and platform type scale, are needed.

e) Radio sets

VHF radio set is necessary for safety of boat and communications, and SSB radio set is also necessary for long-distance communications with foreign vessels on the Caribbean waters at emergency.

f) Repairing tools for outboard motor/inboard engine

At present there is no repair shop for fishing boat in Grenville. The Project shall provide repairing tools for outboard motor and inboard motor at a minimum scale for its repair shop.

(2) Study on the Improvement of Grand Etang Road

In Grenada, improvement of the coastal roads has been carried out. On the other hand, Grand Etang Road, which connects St. Georges' and Grenville, passing through the mountainous area of the central peaks of the island (about 600m above the sea level) is very narrow, and there are many steep gradients and sharp curves. Therefore, this road is considered a very dangerous road.

The Mid-term Economic Strategic Plan in Granada is in its fourth stage (2000-2002) at present. Since the first Mid-term Economic Strategic Plan, the Government has prepared a basic policy, "for the acceleration of the development of fishery, agriculture, tourism and local economy sectors, it is important to implement effective improvements of the road network," and priority has been put on the improvement of road network. As a result, road conditions in the whole area of Grenada Island have greatly improved.

Following the improvement of the road network, conditions of physical distribution and movement of people have also been eased, and the local economy has also been promoted. However, for the promotion of the rural economy along the east coast of the island around Grenville, improvement of the physical distribution of fishery and agricultural products is essential. As a result, improvement of Grand Etang Road is one of the most important issues to be resolved at an early stage.

1) Improvement of Road Sections

The contents of the Requests for the improvement of road sections other than bridges covered a broad range, such as 1) widening, 2) rehabilitation of pavement, 3) improvement of roadside drainage, 4) improvement of steep gradient sections, and 5) installation of traffic safety devices. Hence, it is necessary to identify priorities for improvement according to the following criteria, and to select sections which require urgent improvement within the whole stretch of the study road.

- Traffic bottlenecks
- Continuous narrow carriageway sections where it is difficult to pass by vehicles coming from the other direction
- Hazardous locations with many traffic accidents
- Sections where high level technology is required for improvement work, and where it is difficult for the Government of Grenada to conduct improvement work without assistance
- Sections judged to have higher effectiveness vis-à-vis project cost
- Road sections outside of the Grand Etang Forest Reserve, where road improvement work may not be accepted from the environment preservation point of view
- Sections judged to have no problems for land acquisition

2) Improvement of Bridges

On the other hand, Requests were made for the improvement of four bridges on the Grenville side, i.e., Birch Grove Bridge, Balthazar Bridge, St. Cyr Great River Bridge, and St. Margaret Bridge on Grand Etang Road. In addition, two other bridges on the St. George's side, i.e., Vendome Bridge and Beaulieu Bridge, have also been identified as in need of improvement. Therefore, in the same manner as for road sections, it is necessary to identify priorities for improvement according to the following criteria, and to select bridges which require urgent improvement within the whole stretch of the study road:

- Old bridges with possibility of collapse due to structural damage
- Narrow bridges where it is difficult to pass by vehicles coming from the other direction
- Bridges located in areas with many pedestrians and where it is considered dangerous for pedestrians to cross the bridge
- Bridges where high level technology is required for the improvement work, and where it is difficult for the Government of Grenada to conduct improvement work by itself

- Bridges judged to have higher effectiveness vis-à-vis project cost
- Bridges judged to have no problems for land acquisition and leasing land for the construction yard during the construction period

Since conditions of each bridge are different, it is necessary to study the type of improvement and level of emergency from the perspectives of both replacement of a bridge and rehabilitation of a bridge. Content of improvements can be classified as follows in consideration of the present condition of bridges:

a) Replacement of an existing bridge

For an old bridge containing structural problems and narrow carriageway width, which causes obstruction for vehicle traffic and pedestrians, it is necessary to consider replacement by a new bridge.

b) Widening of an existing bridge

For a bridge with narrow carriageway width, which causes a traffic bottleneck, it is necessary to consider the widening of the bridge as far as possible to suit the carriageway width of approach roads. Also, in the case of Vendome Bridge, where a new structure has already been built but has not been opened for traffic due to an incomplete access road, it is necessary to consider the construction of approach roads from the point of view of effective usage of the existing facility.

2-1-2-3 Basic policy of the Project

The Grenada fishery has developed from the traditional artisanal coastal fishery, exploiting their fishery resources for themselves. It is an important industry in Grenada, greatly contributing to food security, employment, foreign money earning, and import substitution. The Government intends to implement a balanced fishery development policy to increase fish products substantially to meet domestic/tourism demand of fish by decreasing post-harvest loss through the improvement in the national distribution infrastructure, along with enhancement of fish export. Also the Government recognizes the importance of road network for activation of rural economy through improvement of the standard of living and creation of employment opportunities, and declared clearly the continuation of road network improvement project in the 4th Medium Term Economic Strategy Paper (2000-2002). The Project was formulated in line with this high level national plan, aiming to execute 2 components consisting of improvement of Grenville fishery facility and Grand Etang Road.

As a result of examination of importance of the Project components based on the contents of the Request and results of discussions, it is proposed that the following facilities, equipment and materials, road sections, bridges, and associated equipment materials should be included in corporation plan. The basic policy of cooperation for requested items is as follows.

(1) Basic policy toward Grenville fisheries facility

The development of the eastern coast fishery is a pressing issue for the Grenada Government. The eastern coast fishery is producing one fourth to one third of the national fishery production, and flourishing due to plenty of fishermen including young generation. But, in spite of such favorable condition, lots of fish catches during the high fishing season are not utilized effectively due to lack of proper outlet, and fishermen are not able to operate stably all the year around due to less development than the western coast fishery. It is judged that the following policies should be applied in order to improve these situations.

1) Fish Landing Jetty

The original plan of the Grenada side was a platform type landing warf to be constructed in the water and on a wide natural sand beach deposited for long year. But this plan was requested to change to a jetty construction at the preparatory study, and the modified jetty plan was confirmed on the Basic Design study. Since almost all of Grenville fishing boats are as small as 6-7 m long, the jetty is to be constructed more than 75 m away from the existing commercial jetty in accordance with the request of the Port Authority. At the first request in 1990 a jetty and a fishermen center were requested at the same

Project site, and the fishermen center was constructed at other site, but the jetty plan was cancelled because the site was not owned by the Government. This is the jetty that fishermen have eagerly waited for more than 10 years. The construction of the jetty will contribute to development of the Grenada fishing industry.

2) Fish market facility

The market facility consists of two buildings of a market building and fishermen's locker house. The original plan of a market on man-made platform was changed to a shore building at the Preparatory Study (March 2000), and the natural condition survey necessary for construction was executed on the Basic Design Study.

The survey revealed that the site ground is formed with deposited sand and its N value is over 30 at the surface but less than 5 at middle stratum. Ground preparation and building foundation construction must be executed with suitable countermeasures.

The Grenada side hoped to construct it near the existing fishery center (fish market), but there was no proper Government-owned land. Also ground preparation by piling or reclamation was discussed. Fortunately, a wide plot of land, where fishermen used to land their fish catches, was transferred from an Anglican church, and this plot was selected as the Project site. Since the coast around Grenville is fringed by reef of Grenville Bay and St. Andrew's Bay, the selection of site based on the presence of shore land only is not proper due to limited access of fishing boat from the sea. Other two fishing villages of Soubise and Marquis exist near Grenville, and these 3 sites were appraised. From the viewpoint of convenience of fishermen, local residents, and customers, the selected site is considered to be the best.

a) Retailing room and fish counter

The fish counter for retailing in the Grenville fishery center (fish market) is playing an important role to supply fish to people in St. Andrew's Parish and St. David's Parish. The Project will reform the system of retailing in two points. First, the number of fish counters will be increased according to the actual circumstances so as to stimulate free competition of retailers, and secondly a forwarding system to the Metropolitan area will be established through separation of wholesale space and retailing corner. Increasing fish counters will accept new applicants of fish trade as well as give new business chance to already-registered 6 retailers, which situation will activate fishing activity on the Atlantic side and thus contribute to growth of rural economy.

Scalers, alike retailers, are very important at fish markets in Grenada. At present 31 persons are engaging in fish trade and more than 20 persons are working as scalers in the market. Scaler's technique is fast and precise, securing customer's reliance and reputation. There may be a chance to apply their skill to processing work. Their working space shall be widely secured.

b) Ice making/storage facility

The original request was an ice plant with 5 tons/day production capacity. It was pointed out that this plan was overcapacity on the following reasons at the Preparatory Study.

-6 retailers monopolize retailing.
-Use of ice for fishery is limited.
-Use of ice is limited for distribution.
-Ice for fishery is limited for fish for export.
-Consideration of the possibility of ice supply from GCFL.

As a result of examination of the results of preparatory study, a production capacity in a minimum scale is to be established on the following policies.

-Ice for fishery is not included in the plan.
-Ice for general demand is not included in the plan.
-Quantity to be produced must be in line with the operation of the plan.
-Flake ice suitable for distribution is to be produced.

The existing fishermen center (Japan's Aid) is now owned by GCFL and operated by a local fishermen's association. Consequently, GCFL is responsible for the management and maintenance of the ice plant of this fishermen center, and the local association is operating the ice plant under the contract with GCFL. Considering this situation, it is wise for the development of the Grenville fishery to separate clearly the ice plant in charge of the Fisheries Division from the one belonging to the fishermen center. Since flake ice is produced, the quantity of ice to be preserved is established based on the quantity of 2 to 3 days production.

c) Cold storage facility

The scale of the cold storage facility is, alike the ice plant, established at a minimum. The calculation of size follows the facility plan of Melville Street Fish Market, but the local conditions different from the Metropolitan area (seasonal difference is great) is to be fully considered. A cold storage facility is essential for preservation of freshness of fish and shellfish. But since the freshness of fish varies significantly depending on fishing method and handling after catching, a consistent quality control system must be maintained throughout the all steps from production to distribution and consumption. For this, it is important to spread knowledge of quality control through extension service. Hence, the establishment of efficiency utilization of the cold storage facility through promotion of use of fish box and easy taking in and out the facility is the basic policy to be followed.

The cold storage facility is also useful for processing. The facility is mainly used for retailing and storage of fresh fish, but also it can be used for keeping of fillets or salted/dried fish products. By doing so the facility shall earn storage charges as much as possible to cover running cost.

d) Store

Various spaces corresponding to various functions are arranged in all fish markets. Unsuitable configuration of a store obstructs the function of the market, with equipment and materials being left on passages. Taking into consideration traffic lines of fish, goods, articles, and men, a store space necessary for the plan shall be provided.

e) Fish processing room

The plan aims to develop the eastern coast fishery through the improvement in distribution of fish. The content of the requested cooperation plan is the construction of a landing jetty and a fish market. In order to maintain the appropriateness, effectiveness, efficiency, impact, and independent viability, it is necessary to appraise the present condition, and then to devise countermoves. The sanitary circumstance of the existing facility can be improved in the plan.

However, the impact and viability of the Project are carefully considered. For example, the ongoing salted/dried fish production using surplus is as small as supplying only the local demand, and it is important to establish a system enabling to supply constantly the product as well as other value-added product to the Metropolitan area all the year round. But the current tendency of HACCP (Hazard Analysis Critical Control Point) requirement applying to export to Europe and America will pose a financial burden on processing factories when it is applied to domestic distribution. Considering these situations, a processing room suitable for local conditions shall be provided.

f) Fish handling space

A fish handling space is an important space at which selection, gutting, washing, weighing, display, trade, retailing, and forwarding are conducted. In Grenville, at present, gutting is conducted before weighing out of doors, and scaling a fish is mixed with these works, resulting in confusion.

According to observation at the spot, gutting is done at the rate of 120 kg/hour/person, and average amount of work done for 10 days on the maximum landing record for the successive 2 months (for the past 3 years) was 3.02 tons. This amount is twice the annual average, and at least 3 workers are needed if it must be processed in a day (8 working hours). A space necessary for this work shall be provided.

g) Sanitary facility

The sanitary facility for the facility-related persons and employees shall be provided. Its specifications are to be determined in a minimum scale with reference to the existing facility. A public toilet is not included in the plan. (The fish market is a public place at which many and unspecified persons do their shopping, and its security and convenience as a public facility must be maintained. But the Project is part of the rural city development program of the Grenada Government, and this policy is in line with the program).

h) Workshop and slipway

A workshop is essential in planning a fishery facility. Even when fishermen mastered skills concerning fishing boat, outboard motor, and fishing gear necessary for their fishing operation, support of workshop and related mechanics is required in repairing or maintenance. At present no workshop exists in Grenville. A workshop shall be planned.

i) Water tank

Utilization of rainwater is very important in a region having the dry season. The fishery facility will consume a large quantity of water, resulting in heavy water charges. In order to lighten this burden, on condition that rainwater should not be used for edible fish, a water tank shall be included in the plan.

j) Sewage facility

The handling volume of the proposed fish market will not significantly differ from the one of the existing fishery center, but the capacity of sewage facility shall be decided according to change of handling species or increase of processed fish. In Japan, the processing factory discharging waste water more than 50 m^3/day is regulated by law. It is less than 10 m^3 a day in the facility. But waste water will be produced through washing fishing gear and fish or defrosting bait fish for long-line fishing, and however small quantity it may be, proper treatment is necessary because Grenville is an enclosed area whose coast is fringed by reef.

k) Office

There is a fishermen's center financed by Japan's Aid in Grenville. It is owned by GCFL and managed by an entrusted local fishermen's association. In the training room (about 60 m^2) of this center plate ice is sold to the fishermen. Also the fishermen's cooperative is selling fuel oil in the premised of this center. It is important for the staff sent from the Fisheries Division to encourage and guide these fishermen's spontaneous activity. The office for the staff has an important role as a hub station of fishery activity on the eastern coast.

Besides this office, a market supervisor office shall be independently provided. The market supervisor carries out important duties regarding fair transaction, control of unfairness, prevention of troubles on trade, market information, safety of operation and so on.

l) Fishermen's locker

The fishermen's lockers are very important for fishermen, and lent to them virtually free of charge. The existing lockers house is so damaged as to bore holes on the roof, but it is left as it is without repair due to budget. A system that beneficiaries should pay for part of maintenance cost shall be established.

3) Exterior works

The number of registered cars is increasing at a rate of about 900 a year. At present the total is estimated at some 17,000 to 20,000, that is, one car per 4 to 5 persons or one car per one family, for a population of 80,000. As the circumferential road is improved, a parking lot is required at every public facility.

As for the type of lighting, the street lamp type and the exterior lamp type are considered. Though the former is in favor of saving of electricity as a public facility, the latter will be better due to security of the facility.

There is no place of relaxation for the citizens on the seashore around Grenville city. Open of the facility at night may have an impact , and hence the lighting facility shall be included in the plan.

Almost all fishing boats are equipped with VHF set. The eastern offshore of the island is open to the Atlantic Ocean, and hurricane restricts frequently fishing activity. The radio communication during operation is essential for fishing boats. A radio antenna post is necessary due to the rely antenna on the middle mountainous district.

4) Requested equipment and materials

a) Seawater pump

Some say that the public water is sufficient for the plan. But water source should be used according to its purpose in Grenville where the difference of rainfall between wet and dry seasons is great. As a rule, seawater is not used for washing and processing fish. The seawater pump of the plan is an important equipment used for washing bottoms of boats, and it is considered that the equipment was requested based on the fishermen's needs.

b) Pushcart

A pushcart will be used for transport of ice, fish, and materials in the premises (landing jetty, retailing space, and handling space). The Grenada side requested a forklift, but its necessity and urgency is not great because at present no forklift is used at the existing fish market and the handling volume will not differ significantly after the completion of the plan. It is judged that the pushcart with good performance is appropriate due to no need of maintenance.

c) Insulated box and fish box

As for these boxes, firstly, easy of local availability of them must be considered. Fish boxes are used for improvement of handling and preservation of fish. Consequently these are so damaged badly and swiftly (service life is 2 to 3 years) that a certain quantity must be periodically supplemented. The insulated box is as large as some 750 liters in capacity and is used for temporary storage of fish. Both are essential materials for the proposed facility and shall be included in the component. (Deterioration of fish starts onboard just after it was caught. Promotion of usage of small insulated boxes is required. FAO has been stressing for several decades that encouragement of utilization of ice

links directly to the development of fishery, but the Grenville fishery is not still using ice. The Grenville fishery has an ideal one day cycle of production, distribution, and consumption, but actually when it was fished is unclear, which situation means that the quality control system in distribution is not established. To overcome this big problem will be the starting point for extension of distribution of fish to the Metropolitan area).

d) Weighing scale

A weighing scale is the most important instrument for retailers. It must be periodically inspected and adjusted. The weighing scale used for the proposed facility shall be included in the component and taken custody properly. From the viewpoint of the benefit principle, sharing of the maintenance cost shall be clarified when the retailing space is contracted.

e) Radio sets

That radio sets are installed in which of the office of Fisheries Division, the administration office, or the market supervisor office must be carefully examined because it is related to safe operation of fishing boat. Basically it is judged that to install in the market supervisor office is the most appropriate decision.

f) Repairing tools for outboard motor/inboard engine

Trial manufacture, experiment, and repair of fishing gear and repairing of fishing boat and outboard motor/inboard engine are conducted under the auspice of the Fisheries Division. Training of repair of motor/engine will be given to trainees at the workshop of the proposed facility. It is considered to be appropriate to provide repairing tools necessary for these purpose at a minimum.

(2) Basic Policy for Improvement of Grand Etang Road

Based on the identification criteria stipulated in the previous section and the results of site investigations, priorities for improvement by location requiring improvement on Grand Etang Road are determined. Then, coverage of projects under the Grant Aid scheme and the content of projects are summarized as the basic concept for the improvement.

1) Selection of Locations Containing Problems

Based on the request from the Government of Grenada, and results of discussions with authorities concerned and site investigations, locations containing problems on Grand Etang Road were selected. For the selection of locations with problems, sections containing problems according to sectional divisions determined during the Preparatory Study stage were selected at first, and then particular locations

containing problems were specified. In this stage, it should be noted that II-1 Section in the Grand Etang Forest Reserve was excluded from consideration under the Basic Design study, even though some locations with problems of horizontal and vertical alignment were identified, because the Forestry Department had very strong concerns about road improvement from the environmental preservation point of view.

a) Road Section

i) Hair-pin Curve at Section II-2

The stretch of Grand Etang Road, II-2 Section between the border of the Grand Etang Forest Reserve and Birch Grove in the Grenville side contains many problems. Within II-2 Section, most serious traffic and traffic safety problems were identified at the 360m long section between km 10+840 and km 11+200. At this section, the average carriageway is as narrow as an average width of 4.4m, and it is impossible to pass by a vehicle coming from the other direction; hence this section becomes a traffic bottleneck due to the waiting vehicles. In addition, many accidents have been recorded at this section due to the very difficult horizontal alignment, with two sharp curves including one hair-pin curve, a gradient as steep as 12%, and inadequate installation of traffic safety devices.

At this section, however, it is difficult to secure the necessary width by cutting into the mountain side, because this section is located in a very steep mountainous area and there are many boulders in the soil. Therefore, it is necessary to adopt a highly skilled construction method for the improvement of this section.

i) Intersection beside the church at Constantine (km 3+750 – 3+850)

Following Section II-2, many problems were identified in Section I-2 between Sans Souci intersection and Vendome on the St. George's side. Within this section, three locations were identified as in need of improvement.

The first location is an intersection beside a church at Constantine. At this intersection, the carriageway width of the approach road from Grenville is only 4.0m, and many vehicles are forced to wait for vehicles from the other direction to pass, because it is impossible to pass by at this approach. In addition, due to the shape of intersections, many vehicles to/from Annandale have to make quick turns several times in intersections when they are going to/coming from Grenville.

From the engineering point of view, improvement of these intersections is judged to be very effective vis-à-vis construction cost. However, land acquisition including a house (abandoned house) is necessary for the improvement of this intersection, and the landowner is living in the U.S.A. Hence, problems with land acquisition are pointed out. Therefore, this location is excluded from the improvement projects

under this Grant Aid Program.

iii) Approach road of the Vendome Bridge (km 5+855 – km 5+965)

The existing Vendome Bridge, located at the eastern edge of Section I-2, is a box culvert type bridge with 4.0m carriageway width, and it is impossible to pass by a vehicle coming from the other direction. In parallel with this existing bridge, major parts of the structure of a new bridge (box culvert) with 8.0m width were constructed about 10 years ago; however, this new bridge has not been used because railings and approach roads were not constructed due to financial constraints. Since it is possible to improve the horizontal alignment of Grand Etang Road by constructing approach roads and utilizing the new bridge, improvement of this location is very effective in terms of utilization of an existing facility. Therefore, improvement of this location, together with rehabilitation of the new bridge, is included in the improvement projects under the Grant Aid Program.

iv) Widening of Grand Etang Road at Beaulieu residential area (km 1+400 – km 2+450)

Many houses are located on both sides of Grand Etang Road at the Beaulieu residential area in the centre of Section I-2. At this location, the carriageway is as narrow as 4.8m width and it is only possible to pass by vehicles coming from the other direction very carefully. Since traffic volume at this location is as heavy as 4,519 vehicles/12 hours and there are many pedestrians, this location is judged to be very dangerous from the traffic safety point of view.

On the other hand, many water supply pipes are installed just under the pavement in a cross sectional direction, and it is supposed that re-installation of those pipes requires a large amount of the budget of the Government of Grenada and a long period of time. Also, the vertical grade of existing access roads to many housing lots are almost at the limit of the climbing ability of vehicles. Hence, it might be difficult to provide new access roads to housing lots, if the carriageway were to be widened. Therefore, this location is excluded from the improvement projects under the Grant Aid Program.

v) Installation of traffic safety devices

Even though Grand Etang Road is a mountainous road with hazardous conditions from the traffic safety point of view, traffic safety devices, such as curve mirrors, guard fences, pavement markings, traffic signs, etc., are very limited. For hazardous locations on Grand Etang Road included for improvement, it is considered to be necessary to install at least these types of traffic safety devices in order to secure sufficient sight distance and prevent accidents such as running off the road. Therefore, traffic safety devices are planned to be installed at locations with improvement.

b) Improvement of Bridges

i) Beaulieu Bridge

- The Beaulieu Bridge is located near the start point of Section I-2 and it is a two spans RC bridge with 22.0m of length and 9.5m of width. The carriageway width of this bridge is sufficient for two lanes, and the structure is almost healthy except for the following damage.
  Guardrails are utilized as railings of this bridge. However, some parts of the guardrails have been damaged, and the safety of road users, particularly pedestrians, is not secured.
- This bridge was designed to drain rain water using precast concrete slabs. As a result, the protective covering on the flanges of the outside girders has been exfoliated due to erosion and the swelling of the iron bars in the concrete. At present, this type of damage is concentrated only at the centre of the structure, however, it may expand to the entire girders in the near future.

Since this damage is not at serious levels and repair work can be done by the Government of Grenada, improvement of this bridge is excluded from the improvement projects under the Grant Aid Program.

ii) Vendome Bridge

As mentioned in “Improvement of Road Sections,” the Vendome Bridge is a box culvert type bridge with 8.8m of length and 4.0m of width, and it is impossible for vehicles to pass by each other on the bridge. In parallel with the existing bridge, a new box culvert bridge with 8.7m of length and 8.0m of width was constructed 10 years ago, however this new bridge has not been used due to the lack of construction of approach roads for the new bridge.

According to the results of detailed investigations of this new bridge, the structural condition of both superstructure and sub-structure have been judged to be sound; however, no railing has been installed, and it is necessary to install railings when this new bridge starts to be utilized. In addition, scoring and damage on the bottom part of the concrete river-bed was observed at the edge of the sub-structure, because there was a level gap at the lower end of the concrete river-bed, and water flow generated scoring. If scoring continues, the concrete river-bed might be totally destroyed, and the front side of the abutments might also be scored. Therefore, it is necessary to fill concrete at the lower edge of the concrete river-bed in order to prevent scoring by water flow. Together with the approach road, rehabilitation of this bridge is included in the Grant Aid Program.

iii) St. Margaret Bridge

St. Margaret Bridge is a box culvert type bridge located at the start point of Section II-2 with 4.8m of length and 4.5m of width. Since this bridge is located at the middle of a curve section with limited sight distance and vehicles cannot pass-by each other on the bridge, it is very dangerous from a traffic safety point of view. However, this bridge is a very small structure, and construction volume is very limited, if widening work is required; hence improvement works can be carried out by the Government of Grenada. Therefore, improvement of this bridge is excluded from the improvement projects under

the Grant Aid Program.

iv) Birch Grove Bridge

The existing Birch Grove Bridge was built in 1895, and the structure has become superannuated after more than 100 years of usage. The centre span of this bridge is a through-girder type metal bridge, while the side spans are concrete arch type, and the total length is 32.6m and width is 3.7m. On the main girder of this bridge, the metal structures have been heavily corroded and several holes have opened on the pavement level; hence it is considered that the main girder has already lost its function. In order to supplement the function of the main girder and to facilitate loading as a temporary measure, three stringers were installed under the slab. The slab of the existing bridge was replaced later by wave-shaped metal plates, with forms and iron bars; however, much rust was observed during the site investigation. In addition, it was observed that the concrete arch type side spans occupied a large portion of the river cross section, and the river flow obstruction ratio is very high. Considering the superannuation, insufficient bridge width, and high river flow obstruction ratio, it is judged that constructing a new bridge to replace the existing bridge would be best, from the structural engineering point of view.

On the other hand, the carriageway width of the existing bridge is 3.7m, and pedestrians have been facing difficulty in crossing the bridge when vehicles are crossing, because it is a very dangerous situation. Since one elementary school is located very close to this bridge and it is used as a part of the way to/from the school, it is essential to secure the safety of pupils. Hence, also in order to secure the safety of vehicles and pedestrians, construction of a new bridge to replace the existing bridge is judged to be necessary. As a result, construction of a new bridge to replace the existing Birch Grove Bridge is included in the improvement projects under the Grant Aid Program.

Even though there is a small shed on the upper stream side, it is possible to use the land for a detour road and construction yard during construction.

v) Balthazar Bridge

The Balthazar Bridge is a two span through-girder type metal bridge 33.2m in length and 3.75m in width. Based on the type of the bridge, connection of girders by rivets, and its condition, it is considered that this bridge was built at almost the same time as the Birch Grove Bridge. Hence, superannuation of structure is almost the same as the Birch Grove Bridge. Particularly, the upper-stream side girder of the right side span has been heavily damaged by flood waters, and the centre part of this girder has largely bent. In addition, the lower-stream side girder has also been deformed on the outside; hence, this span is in very critical condition, and it may totally collapse at anytime. In order to prevent destruction and to maintain the function of the bridge at a minimum

level, various types of repairs and support works have been conducted. In addition, the location and shape of the centre pier causes obstruction of the river water flow.

Even though the carriageway width of the Balthazar Bridge is 3.7m and vehicles cannot pass by each other on the bridge, the velocity of many passing vehicles is relatively high, because the horizontal alignment of both sides of approach is in a straight alignment. As a result, this bridge is dangerous for the possibility of head-on collision. In addition, pedestrians on the bridge must avoid a vehicle by stepping aside the railing of the bridge. Since there are several houses near the bridge and local residents are crossing this bridge, it is necessary to construct a new bridge to replace the existing bridge in order to secure the safety of vehicles as well as pedestrians.As a result, construction of new bridge to replace the existing Balthazar Bridge is included in the improvement projects under the Grant Aid Program.

vi) St. Cyr Great River Bridge

This bridge is an over-flow type bridge. This bridge consists of a concrete arch structure and three short span concrete slab structures on the Grenville side, with 33.2m of length and 4.8m of width.

Over-flow on the existing bridge occurs during very heavy rainfall because of the structural characteristics of this bridge, whose structure obstructs about 50% of the cross-section of the river. Even though no critical damage was found on the structure of the arch section, sedimentation had occurred on the upstream side of the bridge, while scoring had occurred at the river-bed and downstream side of the bridge, and about 1m of gap had been generated. If this scoring expands, there is a possibility that the bridge will collapse. In order to prevent the worst situation for the time being, it is necessary to repair the scorings on the downstream side of the bridge by filling them using boulders available near the bridge.

On the other hand, concrete on the lower part of the slabs was exfoliated at many spots and iron bars were exposed and greatly rusted; hence, it is risky not to repair damages. For this damages, it is necessary to undertake repair from the lower side of the slabs in order to protect the iron bars.

In addition, no traffic safety devices, including railings, are installed on this bridge due to the structural characteristics of the over-flow type of bridge, and the possibility of running off the road is considered present on this bridge. Therefore, in order to secure visual guidance on the bridge, particularly at night, it is desirable to install delineators on the curbs as well as to install traffic signs to control the velocity of vehicles. Furthermore, it is also desirable to install a traffic information board and/or traffic signs prior to the detour roads, in order to provide appropriate information to drivers when water is overflowing the bridge.

As a result, rehabilitation of the existing St. Cyr Great River Bridge is included in the improvement projects under the Grant Aid Program.

Based on the above mentioned studies, improvement priorities on Grand Etang Road is summarized in Table 2-2 Based on the priority of improvement, only projects judged to be in the priority A category are included in the improvement projects under the Grant Aid Program.

Table 2-2 Priority of Improvement of the Grand Etang Road

Locations with Problems		Causes of Problem/Improvement Measures	Priority
Road Sections	i) Hair-pin Curve at Section II-2 (km 10+840 – km 11+200)	○Traffic bottleneck due to narrow carriageway ○Requiring high level construction technology ○Hazardous location with many accidents	A
	ii) Intersection beside a church at Constantine (km 3+750 – 3+850)	○Traffic bottleneck due to narrow approach ○Several quick turn is required in the intersection △Effective improvement with limited amount of construction cost Land acquisition, including a house, is required	B
	iii) Approach road of the Vendome Bridge (km 5+855 – km 5+965)	○Possible to secure sufficient carriageway width by using a new bridge ○Better horizontal alignment ○Effective improvement with limited amount of construction cost	A
	iv) Widening of Grand Etang Road at Beaulieu residential area (km 1+400 – km 2+450)	○Continuous narrow carriageway section ○Heavy traffic volume (4,500 veh./hr) ○Many pedestrians facing danger of traffic Many water supply pipes under the pavement result complicated construction work Many access roads to housing lots may cause trouble with local residences	C
	v) Installation of traffic safety devices	○Curve mirrors, guard fences, pavement markings, etc.	A
Bridges	i) Beaulieu Bridge	△Repair of Rails (Possible by local government) △Repair of the main girder (Possible by local government)	B
	ii) Vendome Bridge	○New bridge with sufficient width was already constructed in parallel with the existing bridge ○Horizontal alignment can be improved by using new bridge ○Installation of railing ○Filling score	A
	iii) St. Margaret Bridge	△Widening is necessary, but structure type is simple box culvert with small scale	B
	iv) Birch Grove Bridge	○More than 100 years after the construction and metal structures are heavily corroded, hence replacement of bridge is necessary ○Traffic bottleneck due to only one-lane width ○Many pedestrians, including pupils, cross the bridge and they are facing danger of accident	A
	v) Balthazar Bridge	○More than 100 years after the construction and metal structures were heavily damage by flooded water, hence replacement of bridge is necessary ○Traffic bottleneck due to only one-lane width	A
	vi) St. Cyr Great River Bridge	○Impassable during water overflow due to the overflow type of bridge ○A part of slabs were damaged, even though there in no serious structural problem ○Traffic bottleneck due to only one-lane width ○Scoring at the lower stream side of the bridge ○Proper traffic safety measures are required to improve visibility of the bridge during water overflow and at night	A (Rehabili-tation)

Legend - ○:Serious problems, △:Not so serious problem, :Obstruction for improvement

2-2 Basic Design of the Requested Japanese Assistance

The Project aims to improve the fish marketing for Grenville, the second largest city in Grenada. The contents of the Project requested by the Government of Grenada consist of two components, that is (A) Grenville fisheries facility (a fish landing jetty, a fish market building, exterior facility, and equipment and materials) and (B) Grand Etang Road component (improvement of road and bridges).

(A) Grenville Fisheries Facility

2-2-1 Design Policy

The basic design concept of the proposed facilities consists of 5 parts; that is (1) Management plan, (2) Layout plan, (3) Facility plan, (4) Implementation plan, and (5) Local conditions.

(1) Management Plan

The management plan of the Project shall be formulated through the utilization of long experience which the Fisheries Division has gotten in management of fishery centers (fish markets) in various districts, its positive achievements, and its existing system, and furthermore, considering the promotion of fishing and marketing activities of coastal fishermen all over the country.

The task conducted by the Project aims to fill up the distribution and marketing functions of the proposed fishery facility as the central fish market in Grenville as well as to activate the distribution of fish in the whole country, along with the improvement in Grand Etang Road, and then, promotes the improvement in the fishery infrastructure for the fishing activity offshore the Atlantic side of the island. And, through this task, the Project intends to establish the “sustainable utilization of fisheries resources” “stabilization of fish production” “ improvement of fish marketing” and “safety of fishermen at sea.”

The Project facility belongs to the Fishery Division and is operated and managed by a national budget as like other five fishery centers (Melville Street, Gouyave, Victoria, Duquesne, and Sauteurs fish markets), and hence the management system of the task enabling to earn revenue such as rental fee of facilities, proceeds of ice, and storage charges shall follow the current management system.

(2) Layout Plan

The proposed site is located on the coast near the center of Grenville city. The existing Grenville fishery center (fish market) stands on the corner of the bus terminal/commercial quarter in the center of the city, getting between the commercial jetty and the Port Authority’s building and Victoria Street, consequently it is impossible to extend the market function at this location. The market site is moved to the foreshore where fishermen used to land their catches. As mentioned in the description of the selection of the

project site, there are other two fishing villages of Soubise and Marquis around Grenville. But the coast of both villages is fringed by reef and thereby the access from the sea is limited. A beach plot facing an Anglican church is sheltered from waves, and a commercial jetty has already been constructed near. This site is the best for the Project. But the proposed fish landing jetty is to be constructed more than 250 ft away from this commercial jetty in accordance with the request of the Port Authority.

The basic concept of the layout plan is to arrange rationally each facility so that the fisheries facility can demonstrate fully its function as the hub of fishing activities and fish distribution. To be concrete, first the location of the jetty is set, and then the fishermen's locker house/workshop is placed on the north of it, the market building on the south of it, and the access road of service truck for transport is constructed between the fishermen's locker/workshop and the market building, separating from the traffic line of customers around the retailing space.

On the east side of the Anglican church and its school, a five (5) m wide road is constructed on the premise along the boundary so as to put the facility building to the east side.

Since the coast side of the Project site tends to deposit sand, the natural beach line and the foreshore are intended to leave as possible.

On part of the foreshore on which small fishing boats can be beached as before, a multi-purpose esplanade is prepared, at least 10 m apart from the facility building, and the northern corner of the esplanade is used as a space for repairing fishing boats and engines.

The parking lot for customers is arranged and constructed on the south side of the market building, and the one for service trucks and employees' vehicles on the north side. In addition to the existing access road to the premise on the south side, an access road for business purpose is constructed on the north-west side corner.

(3) Facility Plan

The major facilities of the Project are a fish market building, a fishermen's locker house, a workshop (attached to the fishermen's locker house), a fish landing jetty, and a parking lot for customers and employees respectively. Since selling activity of ice and fuel oil by local fishermen's cooperative and association is now conducting in the premises, no duplicated commercial space is provided. The jointly-used space which is used as a passage for pedestrians is made of comfortable and maintenance-easy materials, and the parking lot and premises are paved with asphalt or concrete, and as for the apron of shore protection, an interlocking block system will be used in view of maintenance.

(4) Implementation Plan

In preparation of the Implementation Plan, all-out co-operation of the Grenada side is required. In particular, issues concerning clearing of the site ground (including lumbering of part of trees in the site), stock yard, alternative drainage canal, alternative landing place, traffic during construction works, and countermeasures for customers shall be thoroughly discussed and settled.

The work is a large scale civil/building construction work conducted in the center of the city, and the historical church and school buildings are near the site. Physical influence (noise, vibration, etc.) shall be minimized. Security and cleaning around the site must be maintained. As a rule, the civil work regarding jetty construction, revetment, and foundation preparation will go ahead of the building work of fish market building, fishermen's locker house, and others. Both civil work and construction work shall be carefully done to avoid damages to these superannuated historical buildings. Homogeneous earth for banking of good quality from a selected quarry shall be used. The progress of the work shall be always grasped in its totality and the details of preparation work shall be discussed with the Grenada side in order to avoid a drastic delay due to the rainy season.

(5) Local Condition (Natural condition, social circumstances, and construction condition)

1) Natural condition

a) Special care shall be taken in ventilation and lighting from the weather standpoint of high temperature and humidity.

b) The annual rainfall in the mountainous district is as much as 4,000 mm, while it is only 550 mm in the coastal area during the dry season. (The rainfall in the wet season is 1,150 mm, twice the dry season). Rainwater shall be caught and used for various services. Also seawater is effectively used for washing bottoms of boats, landing jetty, in-corrodible places and parts and so on.

c) Since the site facing the sea is in subject to salt damage, salt-resistant building materials and equipment shall be applied.

d) In planning the height of ground, consideration shall be given to easy-draining, flooding by hurricane, and the maximum wave height. Since the jetty is the first landing jetty on the eastern coast, special care shall be exercised in the tide level (different from the western coast).

e) The sea in front of the site is Grenville Bay, sheltered from the open sea by reef, and comparatively calm. The sewage facility for exclusive use of the fisheries facility shall be provided to avoid pollution caused by waste water. A drainage ditch shall be constructed to connect with the existing drainage ones through the Project site.

2) Social circumstances

a) The Project site is situated at the center of the city of Grenville, and surrounded by buildings on three sides; an Anglican church and its attached school buildings on the west side, the Port Authority's facilities including the commercial jetty on the south side, and a private car workshop (Kevin's Garage) on the north side. The present situation of neighboring buildings seems to

continue in the future, but there may be a plan to change the site of the existing fishery center (fish market) to a bus terminal. Hence, consideration shall be given to the traffic line of customers to the fish market of the Project.

b) Special care shall be taken in materials, color, and shape of the buildings of the Project so that their external appearance may match the surrounding environment. Despite of the second largest city in Grenada, Grenville has no waterside on which the citizens can relax except the existing commercial jetty. But the general people are prohibited from entering the jetty without permission for the reason that it is the facility of the Grenville International Port. The facilities of the Project are intended to have a function of a relaxation place on the seashore. The primary technical requirement of a building to be constructed on the seaside must be easy-maintenance, but consideration shall be given to the surrounding circumstances because the building of the Project is a public facility.

3) Construction condition

a) The regulations and standards concerning construction and design of civil structure are in conformity with UK or US rules. Besides, CARIB CODE is applied. With reference to these rules and standards, the Project shall be designed based on the Japan's construction standards and civil engineering standards. The environmental standards of waste water shall be in conformity with the local standard according to discussion with the Grenada side.

b) At present Fron gas is not prohibited in Grenada. From a technical viewpoint, non-Fron refrigerant or ammonia is problematic. The Project will use R 22 Fron usable until 2020.

c) Both construction firms and marine civil engineering companies in Grenada have a few experts. In the past, necessary engineers have often be invited from abroad. This is a common construction situation in the West Indies.

d) Sand, aggregate, and earth for banking are available locally, but steel materials (for civil engineering work) and piping materials depending on import are scanty in stock. Although locally available materials shall be used as much as possible, materials which are difficult to obtain within the country will be brought from Japan or the third countries with comparison of procurement cost.

e) Some local construction firms have experience in public work and so are useable as subcontractor. Utilization of local labor shall be maximized.

2-2-2 Basic Plan

2-2-2-1 Examination of Design Condition

The scale and quantity of the equipment and materials of the Project shall be calculated according to Fisheries Division statistics and interview survey. The main component consists of the construction of a fisheries complex in Grenville and the improvement of Grand Etang Road. Hence, first the impact which each component will give to the whole Project and the investment effect of each component shall be relatively appraised, and then, based on its result, a plan that the content and scale of each component are well-balanced shall be proposed. The scale and specification of both components shall be determined to enhance the extent achievable with self-reliance effort, the viability of the Project, and the effectiveness of its management, operation, and maintenance, according to the system, manpower, and technical level in Grenada. (Maintenance-free or easy-maintenance shall be considered.)

Results	Index
Improvement in freshness	Utilization rate of ice
	Frequency of occurrence of food poisoning
Activation of fishing activity	Fishing income
Improvement of transportation	Traffic volume
Increase of west-east exchange	Goods and man

(1) Coastal fishery of Grenada

The sea area around Grenada is on the migration route of tuna in the South Tropical Current, and hence a good fishing ground for large pelagic fish is formed. Its 200 miles EEZ covers an area of about 12,000 km^2, some 35 times the land area. Pelagic fish resources are broadly distributed offshore east and west of the island. Demersal species have a good fishing ground offshore southeast of the ground, and is broadly distributed around Carriacou Island and Petite Martinique Island.

The Grenada fishery is divided into three categories; “coastal fishery of Grenada Island,” “commercial fishery including tuna fishery,” and “coastal fishery of outer islands including Carriacou Island.” The coastal fishing fleet of Grenada island and Carriacou Island consists of 3 to 10 m wooden or FRP boats with outboard motor. They are mainly catching small pelagic or demersal fish in one-day trip pattern. Their fishing activities are greatly affected by the weather, and the annual catch varies, ranging from 1,400 tons to 2,200 tons, depending on the weather and season.

The tuna long-line fishery (commercial fishing industry), starting in the middle of 1980s, was favored by

good export of yellowfin tuna, and now more than 100 long-liners are operating from Gouyave and Grand Mal. In 1992, eight 36 feet type long-line fishing boats granted by Japan commenced fishing, contributing to diffusion of new fishing method and increase of tuna production. Also in April 1997, a base facility of the commercial fishery was constructed at Grand Mal, 5 km north from St. George's, playing an important role in export of fisheries products and development of commercial fishery.
Main fishing methods of the western coast fishery are trolling, bottom lining (hand-lining), and beach seining, and also tuna long-line fishing is flourishing.

The beach seining, important source of fish supply, is operating at 50 spots in the whole island.
On the other hand, the eastern coast on which the Project site is situated is open to the Atlantic Ocean, and tuna long-line fishing is not flourishing as compared with the western coast due to rough sea. Major fishing methods are trolling, bottom hand-line fishing, and diving fishing for conch and lobster.

In Carriacou Island and Petite Martinique Island, demersal fishing is flourishing on the wide continental shelf (almost 80% of the catch are demersal fish), and so bottom long-line fishing, bottom gill-net fishing, and cage (trap) fishing for demersal species are mainly being operated. Also a distinctive feature of the Carriacou and Petite Martinique fisheries is that 90% of catch are high-quality demersal fish such as grouper and bream plus expensive shellfish such as conch and lobster, and these are exported abroad including French Martinique. But, in the outer island waters, a sign of decline of demersal fish resources is distinguished, and prompt countermeasures are required. The table below shows the fish production by area.

Table 2-3 Fish production in quantity by area(1994-2000) （Unit : ton）

Area	1994	1995	1996	1997	1998	1999	2000
St. George's – Carenage	0.0	0.0	0.0	0.0	0.0	0.0	0.0
St. George's – Melville Street	274.3	182.0	203.1	83.7	101.6	45.0	98.5
St. John's – Guoyave	622.5	519.5	332.6	351.1	302.2	128.1	306.3
St. Mark's – Victoria	48.4	97.9	68.2	53.1	55.4	23.0	61.5
St. Mark's – Duquesne	57.2	126.2	106.0	80.5	112.6	27.2	81.2
St. Patrick's – Sauteurs	55.6	62.4	61.2	40.8	62.6	21.3	47.9
St. Andrew's - Grenville	384.4	343.4	373.4	351.1	479.9	376.6	404.8
Carriacou & Petite Martinique	139.5	116.1	193.4	111.7	149.3	79.1	100.6
Landing at tertiary sites	42.3	31.9	227.0	197.3	435.5	919.5	586.6
Total	1,624.2	1,479.4	1,564.9	1,269.3	1,699.3	1,619.6	1,687.4

Source: Fisheries Division in Grenada

High fishing season of the traditional coastal fishery is from January to June with a little regional difference. The period is in the dry season without hurricane, and fishing is operated almost every day.
In Grenville, the fishing operation is conducted 6 days a week except Sunday, resulting in 25 fishing days

a month. On the other hand, the commercial tuna long-line fishing boats from Gouyave and Grand Mal on the western coast is operating only 15 days a month due to a lack of bait fish.

Meanwhile, in latter half on the year, July to October, it is difficult for a small boat with an outboard motor to fish in the open sea due to hurricanes. Thus the fishing day a month drops to some 10 days due to lay-by, resulting decrease of production. Though the period from June to July is a transition period from the high fishing season to the poor season, fishermen is fishing every day until having no catch because they have no industry other than fishery and agriculture. Also repairing of boat and fishing gear is made during this period. The period from November to December is another transition period from the poor fishing season to the high season. The figure below shows the fish production by month.

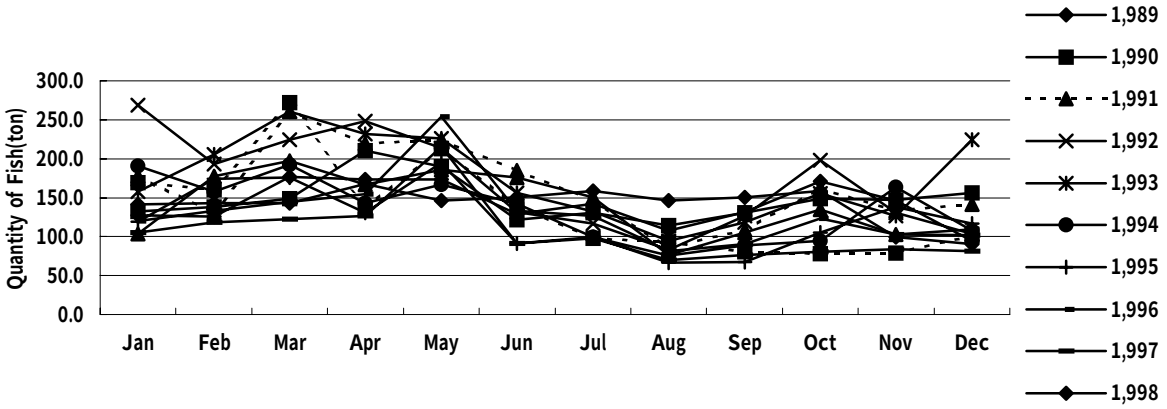

Figure 2-2 Fish production by month

The total number of fishing boats in Grenada is 498, and almost all are 3 to 10 m long wooden or FRP boats. Their outboard motor is 15 to 60 HP. Recently the FRP long-line fishing boat increased to more than 100 in number. Their outboard motor is large as 40 to 85 HP, and some are equipped with 2 sets for the safety's sake. Also, with the diffusion of tuna long-line fishing, at present 17 over 10 m tuna long-line fishing boats are operating (inboard engine-equipped boat is 24 in total), and larger boats with an inboard engine-sizing are increasing. However, Grenville have only one fishing boat with an inboard engine due to lack of fishery infrastructure. For the development of offshore fishery here, it is necessary to introduce the fishing boat of suitable type and size for the safety's sake.

The following shows the number of fishing boats and fishermen by area.

Table 2-4 Number of Fishermen and Fishing Boats by area

Area	Fishery Center (Fish market)	Population (Persons)	Fish catches (ton)	No. of Boats	No. of Fishermen		
					Full-time	Part-time	Total
St. George's	Melville Street	31,994	81.7	97	348	100	448
St. John's	Guoyave	8,752	245.5	109	291	78	369
St. Mark's	Victoria	3,861	46.6	37	57	16	73
	Duquesne		73.7				
St. Patrick's	Sauteurs	10,118	43.9	44	180	37	217
St. Andrew's	Grenville	24,135	420.4	74	151		151
St. David		11,011	138.4	30	64	17	81
Sub total in Grenada Island		89,871	1,050.2	391	1,091	248	1,339
Carriacou & Petite Martinique	Hillsborough	5,726	109.7	107	198	43	241
Others (Export, etc)			(508.9)				
Total in Grenada		95,597	1,668.8	498	1,289	291	1580

Source: OECS Regional Fisheries Management/Development Grenada Profile, Fisheries Division

Number of boats and fishermen in St. Andrew's is adjusted depend on result of field survey.

(2) Fish handling volume at the Grenville fishery center (fish market)

The handling volume of fish in Grenville is considered to be equal to the whole fishery production in St. Andrew's Parish occupying two third of the Grenada Island. Because there exists other 3 landing sites on the eastern coast but they have only a few fishing boats, and all of these boats are landing their catches at Grenville. The annual fish landing at Grenville is 480 tons in 1998, about 377 tons in 1999, and 404 tons in 2000, averaging 420 tons for these 3 years. The maximum was 74.1 tons in March 1999, while the minimum was only 7.9 tons in October the same year, varying drastically. Consequently, the scale of the ice plant of the Project is, as mentioned later, established on the basis of figures of the handling volume of 400 tons and the maximum monthly landing of 70 tons.

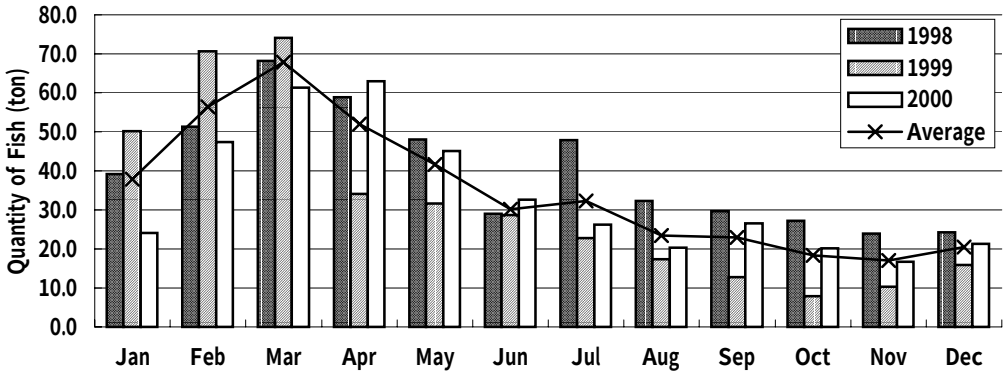

Figure 2-3 Fish catches in existing Grenville Fishery Center(Fish Market)

(3) Demand-supply relation of fisheries products

The fish and fisheries products in Grenada are distributed in 2 forms, for domestic consumption and for

export, and also divided into 2 categories of domestic products (fresh or frozen fish) and imported marine products (processed fish and fisheries products) as the below table shows.

Table 2-5 Summary of fish marketing in Grenada

Object / Purpose of Marketing	Domestic fish product		Exported fish product	
	Chilled fish	Frozen Fish	Processed fish	Others
For Domestic consumption (General consumer) (Industrial Consumer) (Tourism Industry)	Local Fishery Center (Fish market)	GCFL	Private super market, canteen	Ditto
For export (USA, EU) (Martinique, etc)	GCFL + Private exporter (Tuna) Remote island (ex. Carriacou) (Chilled fish)	GCFL	—	—

Among them, the fresh fish distribution for domestic consumption covered by the Project is conducted at the fishery center (fish market) at various places, playing an important role to supply good quality animal protein to the nation of Grenada. Despite its importance, the fishery centers are almost superannuated, and at long last the Melville Street Fish Market in St. George's, the Capital, was recently improved by Japan's Aid. Since the fishery infrastructure necessary for domestic distribution of fish is less developed, on the one hand Grenada is exporting 400 to 500 tons tuna a year, on the other they must import about 700 tons of fisheries products every year. The table below shows the demand-supply relation for 3 years from 1998 to 2000.

Table 2-6 Balance of supply and demand on fish product Unit: ton

Item / Year	1998	1999	2000	Average
Domestic fish catch (A)	1699.30	1619.60	1687.40	1668.76
Total amount of export (B)	477.11	530.54	465.47	491.04
Total amount of import (C)	705.20	825.40	646.90	725.83
Total domestic supply (D)=(A)-(B)+(C)	1927.39	1914.46	1868.83	1903.56

Source: Fisheries Division, Central Statistic Office

The Table below shows a shortage or surplus allowable to supply to other areas at various fishery centers, calculated on the production and consumption at each area. As the result shows, Grenville on the eastern coast covered by the Project and Gouyave, Victoria, and Duquesne on the western coast have a surplus allowable to supply to other consumption areas. Sauteurs in St. Patrick Parish in the northern part of the island is short of fresh fish like the Metropolitan area in the Table, but this situation was caused by poor condition of the circumferential road, and Sauteurs is not a consuming city like the capital, consumption matching production has been maintained within the area. Recently, catches of the beach seining fishery around Sauteurs began to distribute to various areas. Improved distribution of fisheries products from

these northern and eastern parts of the island to the Metropolitan area and realization of systematic marketing will make it possible to increase the export of tuna from Gouyave and Grand Mal as well as to decrease the import of fisheries products, contributing greatly to earning and saving foreign currency.

Table 2-7 Fresh fish consumption and fish production by area in Grenada

Area	Fishery Center	Population	Fish catches (ton)*	Estimated Consumption of fresh fish (ton)**	Amount of lack (-) or possible supply (+)(ton)
St. George's	Melville Street	31,994	81.7	396.7	-315.0
St. John's	Guoyave	8,752	245.5	108.5	137.0
St. Mark's	Victoria	3,861	46.6	47.9	69.7
	Duquesne		73.7		
St. Patrick's	Sauteurs	10,118	43.9	(125.5)	(-81.6)
St. Andrew's	Grenville	24,135	420.4	299.3	121.1
St. David		11,011	138.4	136.5	1.9
Sub total in Grenada Island		89,871	1,050.2	1,114.4	-66.9
Carriacou & Petite Martinique	Hillsborough	5,726	109.7	71.0	38.7
Others (Export, etc)			(508.9)		(508.9)
Total in Grenada		95,597	1,668.8	1,185.4	-28.2

Note:

* Production of fish is average catch between 1998 and 2000.

** Estimated Consumption of fresh fish by area=population 95597×Average annual fish consumption 20 kg***×Percentage of fresh fish 0.62****

*** Average annual fish consumption =(Domestic fish production - total amount of exported fish + total amount of imported fish)÷Population

**** Percentage of fresh fish=(Domestic fish production - total amount of exported fish)÷Domestic supply of fish

(4) Weather condition

Grenada island is situated at the most southerly of the Windward Islands, and Barbados is on the northeast of the island and Trinidad and Tobago 145 km southeast. Grenville, the Project site, is at around 12° 07'N and 61° 37'W, almost middle of the eastern side of the island, and the second largest city in Grenada. The Project site is on the head of Grenville Bay surrounded thick and fast by developed reef, and its shape of beach was formed with sand which have been naturally deposited since long before. Easterly trade wind is prevailing, but the front of the Project site is calm due to enclosing reef.

1) Temperature, humidity, and rainfall

Grenada belongs to the tropical marine climate. Table 2-8 shows the temperature at Grenville. The highest temperature is about 30℃ at average, while the lowest is 25℃ at average, and average temperature throughout the year is about 27℃. Table 2-9 shows the humidity observed in St. George's. Monthly average humidity is as high as 80%.

It is wet from June through November and dry from December through May. Table 2-10 shows the annual rainfall. The rainfall was about 3,200 mm in 1998, about 2,500 mm in 1999, and 1,400 mm in 2000.

Table 2-8 Monthly Maximum and Minimum temperature in Grenville (1978-1984) Unit:℃

Year / Month	1978		1981		1983		1984	
	Max	Min	Max	Min	Max	Min	Max	Min
Jan	28.4	23.3	28.4	23.4	28.3	24.1	28.5	22.8
Feb	29.1	23.7	29.2	23.6	28.8	24.1	28.4	23.8
Mar	29.5	24.3	29.3	24.4	29.9	25.1	28.5	23.9
Apr	30.3	25.2	30.0	25.0	30.2	25.1	29.5	24.7
May	30.9	25.9	30.0	25.3	29.8	25.5	29.4	24.5
Jun	29.8	25.0	29.9	25.3	29.9	25.5	29.9	25.3
Jul	29.6	24.6	29.7	24.9	30.1	25.3	29.4	24.9
Aug	30.1	24.3	30.1	24.8	30.5	25.2	29.7	24.8
Sep	30.4	25.1	30.3	24.9	30.3	24.9	30.2	24.7
Oct	30.4	22.9	30.8	24.7	30.6	23.8	30.6	23.8
Nov	30.1	21.9	30.9	24.5	30.5	23.2	30.5	23.2
Dec	29.4	24.1	29.9	24.4	29.7	24.3	29.7	24.3
Average	29.8	24.2	29.9	24.6	29.9	24.7	29.5	24.2

Source: Pearls Airport in Grenville

Table 2-9 Monthly humidity in Grenada (1992-1996) Unit: %

Year / Month	1992	1993	1994	1995	1996	1997
Jan	80	78	79	77	77	81
Feb	81	77	75	81	75	80
Mar	77	76	75	75	76	76
Apr	78	77	74	75	81	76
May	79	80	76	73	79	81
Jun	83	79	77	79	82	85
Jul	82	82	78	82	82	85
Aug	81	82	80	82	82	86
Sep	82	83	78	81	81	—
Oct	80	81	87	83	83	—
Nov	82	83	86	82	82	—
Dec	80	82	86	78	78	—
Average	80	80	79	79	81	—

Source: Point Salines Airport in St. George's

Table 2-10 Monthly rainfall in Grenville (1994-2001) Unit: mm

Year / Month	1994	1997	1998	1999	2000	2001
Jan	98	98	68	33	151	40
Feb	29	37	13	33	43	46
Mar	39	36	24	153	91	14
Apr	50	63	23	73	33	—
May	32	18	186	13	74	22
Jun	119	256	218	139	0	—
Jul	181	229	153	119	85	—
Aug	163	273	108	61	107	—
Sep	253	155	78	183	181	—
Oct	297	97	490	176	113	—
Nov	373	205	193	93	333	—
Dec	75	19	413	129	76	—
Total	3,195	3,453	3,172	2,492	1,409	—

Source: Paradise Estate in Grenville

2) Wind

Grenada belongs to tropical breeze zone. Easterly wind prevails throughout the year, falling from night to morning. Table 2-11 shows the wind speed observed at St. George's. The average wind speed is 3 m/sec according to the Table.

Data in Grenville is not available, and the Basic Design Study team observed a strong trade wind blowing from offshore to the site (east to west) in the day time during survey.

Table 2-11 Monthly mean wind velocities in St. George's Unit: m/sec

	1988	1989	1990	1991	1992
Jan	2.6	2.7	3.7	3.5	2.5
Feb	2.8	2.5	2.7	3.2	2.9
Mar	2.9	2.9	3.3	3.2	3.2
Apr	3.9	3.6	3.3	3.4	3.8
May	4.0	4.0	3.5	3.8	3.6
Jun	3.7	3.6	3.5	3.9	3.4
Jul	2.3	2.8	3.1	2.9	3.0
Aug	2.2	2.5	2.4	2.7	2.4
Sep	2.7	2.6	2.3	3.0	2.9
Oct	2.1	2.3	3.1	2.1	2.7
Nov	2.3	3.1	3.1	2.3	2.6
Dec	2.6	3.1	2.1	2.0	2.3
Average	2.8	3.0	3.0	3.0	2.9

Source: Point Salines Airport in St. George's

3) Hurricane

Grenada is the most southerly of the Caribbean islands on the 12° N parallel. A hurricane is formed on

the Atlantic Ocean far east from Grenada, and goes up north to the Caribbean Sea and the Gulf of Mexico via the Caribbean Islands. Since around the 12° N parallel is an area in which a hurricane is born, Grenada has less hurricanes than the northern part of the Caribbean Islands. Recently storm surge caused by hurricane "Lenny" attacked the island in 1999, causing considerable damage to Gouyave, Carenage, Grand Anse, and Victoria on the western coast. Though detailed damages are unknown, Hurricane Janet attacked Grenada in 1955, Hurricane Flora in 1963, and Hurricane Benett in 1994. Grenville has no damage report for the past 50 years including Hurricane Lenny in 1999.

4) Earthquake

The Caribbean countries including Grenada are on the Caribbean tectonics earthquake belt, and few earthquake was observed but a structural damage was reported in St. George's in 1888. According to an earthquake-recording station in Trinidad and Tobago, only a few earthquakes of 6 -6.9 magnitude have occurred between 1898 and 1976 (Earthquake Parameters for Engineering Design in the Caribbean). Recently two earthquakes, 4.9 and 3.7 magnitude respectively, were observed in the sea area between Trinidad & Tobago and Grenada. In St. George's it was "a light shaking which a person sitting on a chair can be felt."

(5) Sea condition

1) Tide

The tidal harmonic constant at Grenville Port is not available. The Basic Design Study team consequently made an observation on the spot for 15 days during the site survey, conducted a harmonic analysis and calculated the harmony constant and designed tide level. The below is the results of harmony analysis.

MHHWL：+0.75 m
HWL ：+0.72 m
MSL ：+0.44 m
LWL ：+0.16 m
MLLWL ：+0.09 m
CDL ：±0.00 m

2) Wave

Wave data in Grenville Port is one of the most important parameters in planning and designing the jetty constructions. In spite of a prevailing strong easterly trade wind, the inside of the harbor is calm due to reef developed in front of it. According to the interview survey, they have never experienced such a high tidal wave as to reach the fishermen's center over the backshore, reaching the fore end of the sand beach at the very most. No damage by hurricane is reported in the past. Considering these situations, based on the weather data for the past 50 years, an computer simulation concerning a

hurricane considered to exert the worst influence upon Grenville Port was performed, and calculated a designed wave.

Result of the estimation of computer simulation on designing wave in this Grenville Bay corresponds to the result of interview survey. The result proofs that Grenville Port is natural good harbor.

Table 2-12 Wave direction and wave height around planed jetty tip

Characters of offshore Wave			**Wave direction and wave height around planned jetty tip**	
Offshore Wave Direction	Wave Height (m)	Period (s)	Wave Direction(degree)	Wave Height(m)
NE	4.9	15.3	128-131	0.33-0.38
ENE	4.1	13.5	127-131	0.33-0.37
E	4.2	8.0	127-131	0.30-0.34
ESE	4.2	8.0	128-134	0.31-0.35

Note: Characters of offshore wave are fixed from NE, ENE, E, and ESE. Typical wave direction and wave height are calculated by distribution of average wave direction and wave height in wave transforming calculation.

3) Current

Survey on the current was conducted 3 days, twice, total 6 days during basic design study period. And current in the Grenville port is not observed.

Survey period: 12th-15th July, 18th-21st July, 3 days each, total 6 days

Survey position: Tip of existing commercial jetty, 5m depth

Survey method: "CM-1 current direction and speed meter" was fixed at 2m depth. It was observed by 1 hour each, 24 hours/day.

Result of survey: Current was not observed.

4) Transformation of beach

The Project site is a sand beach formed by sedimentation for more than 100 years. According to a previous photograph, the sea has reached the revetment in front of the church. In order to clarify the coastal deformation, an investigation of the shore line and the inside edge of reef was made, and also interview survey was conducted.

On the north of the site, the sand beach stretches as far as to the open of the old drainage ditch, but, further north, sea erosion is developing, fallen coconut trees are scattered about, and the remains of their roots are seen in the water. The reef in the front of the site is covered with fine sand on its whole surface, and, at low tide shallows were exposed here and there, wild birds searching about for food on them were observed. On the submerged part of the inside edge of reef marine algae such as eelgrass grow thick. During the site survey, a considerable strong east wind was blowing through the daytime and white caps were seen offshore, but the front sea area of the site was calm. The shore line west from Telescope Point is always washed with heavy waves due to the trade wind, and sea erosion is

developing.

According to observation of the whole Grenville Bay, it seems that sand around the Project site is conveyed by waves from the offing, and sedimentation of the shore line is observed on the north of the debris of pits for the commercial jetty but not observed on the south.

5) Seawater quality

a) Sampling position: W_1, W_2, W_3 (3 points; Refer to the Figure 2-4 for the detail.)

b) Sampling numbers: 2 times in low and high tides

High tide: 15:00 3rd July 2001

Low tide: 09:00 4th July 2001

c) Item researching: PH, Temperature, BOD, COD (Analyzed in a laboratory after sampling)

d) Result of the analysis

Table 2-13 Result of Seawater Analysis

Sampling position and time		Sampling position (3 points)	PH	Water Temperature (℃)	BOD (mgO_2/L)	COD (mgO_2/L)
3rd July 2001	14:45	W_1	7.96	30.3	4.08	5,998
	14:50	W_2	8.04	30.4	2.74	7,798
	14:55	W_3	8.04	30.1	<DL	5,236
4th July 2001	09:07	W_1	7.94	28.0	<DL	7,656
	09:10	W_2	7.96	28.0	<DL	6,610
	09:05	W_3	7.88	28.2	2.00	3,165

e) A diving survey was made in the front sea area of the Project site. The visibility is rather bad due to suspending silt and waste water. In an area ranging from the shore line to 100 m seaward, the visibility was 30 to 50 cm.

6) Sediment

Sediment on the sea bottom has been sampled and analyzed as well as seawater.

a) Sampling position: Sampled at 3 points on the bottom (S1, S2, S3). Refer to the Figure 2-4 for the sampling position.

b) Item of the analysis: Specific gravity and particle size analysis

c) Result of the analysis: Result of the analysis is indicated on the attached Appendices.

Table 2-14 Result of Sediment analysis

Sampling position	Item of analysis	
	Specific gravity	Particle analysis
S1	2.53	Mesh #200 (Particle size 0.075 mm) 98%
S2	1.89	Mesh #200 (Particle size 0.075 mm) 74% Mesh #100 (Particle size 0.150 mm) 92%
S3	2.74	Mesh #200 (Particle size 0.075 mm) 2% Mesh #100 (Particle size 0.150 mm) 14% Mesh # 50 (Particle size 0.300 mm) 20% Mesh # 36 (Particle size 0.425 mm) 28% Mesh # 8 (Particle size 0.200 mm) 98%

7) Soil condition survey

To confirm the condition of soil on the project site, boring survey has been conducted at 2 points of land and 3 points of sea.

a) Survey position: Please refer Figure 2-4 on the survey points of boring.

b) Item of survey: Standard Penetration Test and the other physical character

c) Result of the survey: Summary is indicated as follow. Please refer “Other relevant data” in the end of this report on the detail.

Table 2-15 Result of Soil Condition Survey

Survey position		Summary on the result of survey
Sea	HSA1	There is continuous soft silt layer (N value less than 5) from surface. Tight sand layer is observed from 11m layer.
	HSA2	N value more than 50 is observed at 9m layer.
	HSA3	N value more than 50 is observed at 13m layer.
Land	HSA4	There is approximately 6m of soft silt layer from surface and N value is less than 10. The under layer is 1m of clay layer. There is silt layer again by 11m layer again and clay layer by 14m layer. There is N value layer more than 50 from approximately 15m.
	HSA5	This survey position is closer than HSA2 to the shorefront. There is continuous soft sand layer by 10m, (N value less than 10) from surface. There is tight layer from the under layer. But there is soft layer which N value is around 4. N value becomes 50 from 16m layer.

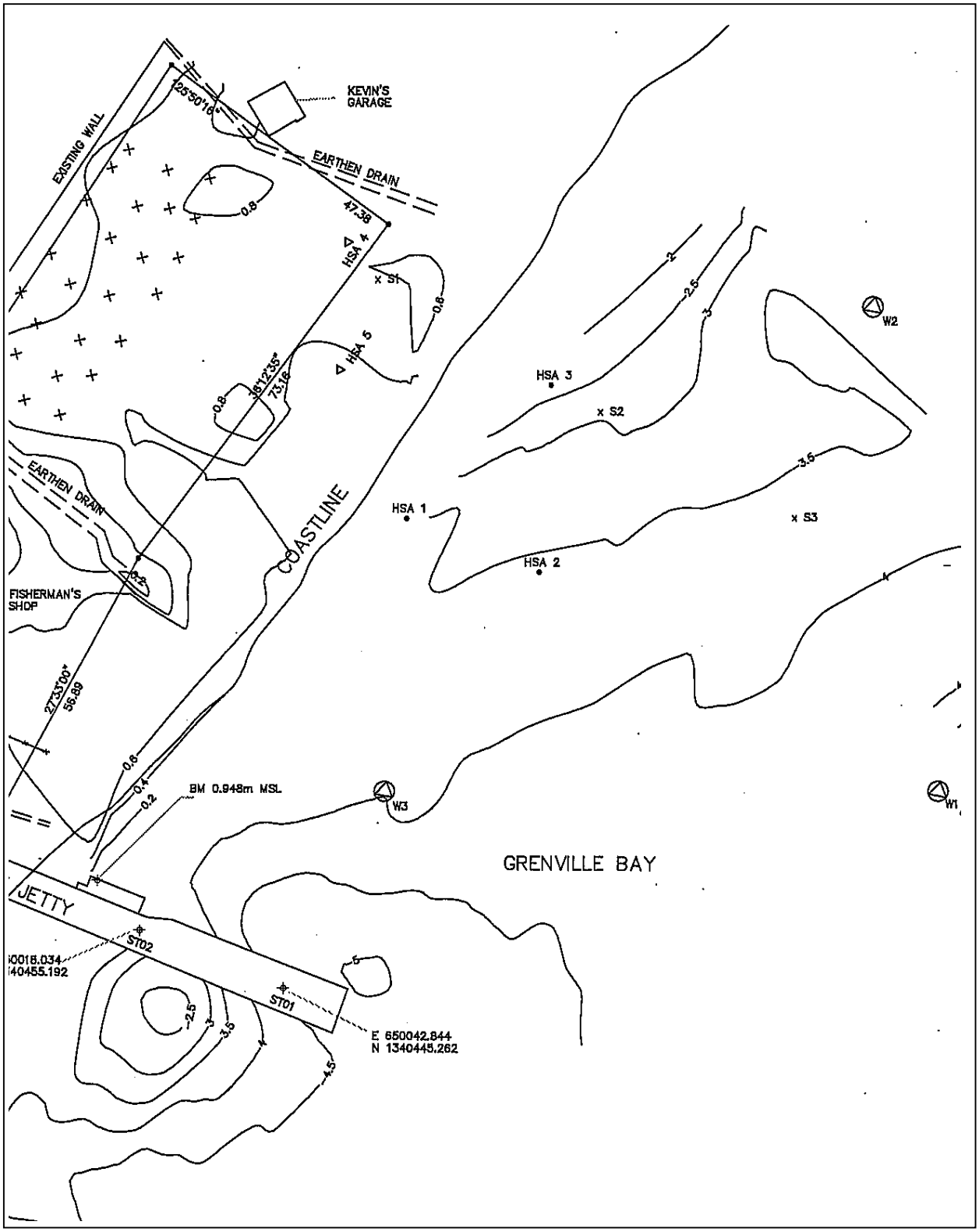

Figure 2-4 Site of Natural condition survey

HSA1-HSA3: Borehole points on sea HSA4-HSA5: Borehole points on land

S1-S3 : Sampling points of Sediment W1-W3 : Sampling points of seawater