

The scale of Fishermen's Center satisfying the above conditions is as shown in the table below. It must be remembered, however, that even though the same functions will be offered at the facilities, there will be some differences in the required areas in view of land availability factors at Gouyave and Grenville.

Area of the Fishermen's Centers (m³)

		Gouyave	Grenville
Ground floor	Block ice making machine and cold storage room	95.40	94.25
	Plate ice making machine	24.00	19.60
	Small-scale repair shop	14.00	10.00
	Emergency generator room	12.00	10.00
	Sales shop	5.60	5.40
	Others	18.00	30.00
	Sub-total	169.00	164.25
First floor	Training & meeting room and storeroom	74.75	78.00
	Fishermen's center administration office	13.20	17.50
	Plate ice making machine room	24.00	25.00
	Lavatory	10.80	12.00
	Others	58.25	58.72
	Sub-total	181.00	191.72
	Total	365.00	355.97

3-2-2 Small-sized Inboard Engine Fishing Boats

Small-sized inboard engine fishing boats for developing offshore fishing grounds that cannot be exploited by the existing fishing boats of coastal fishermen will be supplied under the project. Longline fishing boats are being operated on an economic basis in Grenada by private fishing companies. Fishing boats to be supplied under the project will be longliners of the smallest scale that can be operated with the current level of technical skill of the local fishermen. They are expected to become model boats for extending the coastal fisheries of Grenada. These fishing boats are designed to allow longline fishing during the peak fishing season and demersal fishing during the off season. Moreover, the boats must have large fishing capacity and economical efficiency because

they will belong to the fishermen's cooperatives (Fishermen's Centers) and will function as model boats. Such being the case, they will be designed as the smallest boats satisfying the following conditions.

- 1) The fishing boats must have inboard engines from the standpoint of economical operation.
- 2) Longlines are the main fishing gear for this kind of boat and under 1 mile in length on existing fishing boats. The maximum longline size which can be handled by human power is of the order of 3 miles and extremely hard work is required in this case. Such being the case longline fishing by human power has low economical efficiency and fishing is practiced in boats with plural numbers of crew. A small winch (capable of handling longlines of approximately 10 miles) will be introduced for their manpower saving advantages in the throwing and hauling of the longline.
- 3) Accommodations for the crew will be required to allow longer fishing voyages. A four-person crew will be required to cope with the increased length of the longline.
- 4) Ice and fish holds will be required concurrently with the extension of the operating time of the fishing boats to assure the freshness of the catch. The fish hold must be at least 2 meters along the major axis because the catch consists mainly of large-sized pelagic fish and moreover it is necessary to take into account the enlarged fishing capacity resulting from the extended longline fishing gear (existing fishing boats have a fishing capacity of the order of 100 pounds per mile of longline). Such being the case, the fish hold will be designed with the following capacity:

$$100 \text{ pounds} \times 10 \text{ miles} \times 2 \text{ days} = 2,000 \text{ pounds} = 900\text{kg}$$

A fish hold of approximately 2m^3 capacity will be required to cope with expected catches.

- 5) The fishing boats should be capable of bottom fishing. Fish finder equipment is regarded as indispensable in this connection.

- 6) Lighting equipment will be required for night time operations and safety equipment will be required for safe navigation.

The smallest boat satisfying these conditions will be approximately 11 meters in overall length. There are 291 and 216 fishermen in Gouyave and in Grenville, respectively. The original goal of the project is to extend the use of inboard engine fishing boats to approximately 1/3 of the fishermen, i.e., to approximately 80 members of the fishermen's cooperatives of Gouyave and Grenville. The duration of operations and extension training for crews is assumed to be one year taking into consideration the peak fishing season and the off season period. The training programs to be implemented by the Fisheries Division making use of the inboard engine fishing boats are assumed to have 5-years' duration (this is the period in which the inboard engine fishing boats supplied under the project will be able to maintain initial capacity, and also the depreciation period set for this project).

$80 \text{ fishermen} \times 2 \text{ places} \div 4 \text{ fishermen (crew)} \div 5 \text{ years} = 8 \text{ fishing boats}$
(Gouyave, Grenville)

It is appropriate to supply 8 inboard engine fishing boats under the project, with 4 boats at the Fishermen's Centers of Gouyave and 4 at Grenville.

3-2-3 Small-sized Jetties

Small-sized jetties for mooring, supplying the inboard engine fishing boats, landing the catch, etc., will be required at Gouyave and at Grenville concurrently with introduction of the boats required for developing offshore fishing grounds in Grenada. The four small-sized inboard engine fishing boats (approximately 11 meters overall length) to be supplied under the project will use these jetties. Approximately 1.0 meter draught, approximately 0.3 meter height from the surface of the sea to the deck and approximately 0.8 meter height from the surface of the sea to the bullwork top of the boats are the conditions required for fishing boats to use the jetties.

1. Gouyave

There are already 14 inboard engine fishing boats (these boats are sized 9 to 10 meters in overall length and are equivalent to outboard engine fishing boats in terms of fishing capacity, operating range and other relevant peculiarities because they are not equipped with insulated fish holds and accommodations for the crew but have slightly better economical efficiency in terms of maintenance, control and fuel consumption because they are powered by inboard engines). As a general rule these fishing boats are moored offshore. The mooring method consists of merely dropping an anchor. The boats ride parallel to the shoreline. Such being the case, it is presumed that the tidal flow is also parallel to the shoreline. On the other hand, the waves are from offshore in a direction perpendicular to the isobath. The jetty to be constructed under the project will be arranged perpendicular to the tidal flow for the small-sized inboard engine fishing boats. It is more convenient to moor these boats with the bow facing the waves in order to facilitate the landing of the fish and other activities. In other words, the jetty will be an I-shape design. Moreover, since the breakwater zone is located approximately 40 meters offshore, the projecting length of the jetty must extend beyond this distance.

2. Grenville

Grenville is better than Gouyave in terms of conditions for designing the jetty because it has an anchorage surrounded by coral reefs, as mentioned previously in this report. The breakwater zone is located approximately 40 meters offshore and the jetty will be located outside that zone.

The jetties to be built under the project will be an I-shape design provided with an access bridge in conformity with local sea conditions. In principle, the access bridge will not function as a jetty but may be used secondarily by existing outboard engine boats. The berth at the extremity of the I-shaped jetty will be approximately 17 meters in length, with a 3-meter space for mooring ropes secured at the bow and stern of the fishing boat using it. Since the boats

using the berth will be exposed to the wind and waves while moored, the jetties should be used in such a way as to shorten as much as possible the mooring time. In principle, boats should be anchored offshore when not at sea. The jetties will be designed to allow simultaneous mooring of two fishing boats supplied by this project. The jetties will be used as dedicated berths for only eight inboard engine fishing boats during the period of implementation and operation of this project and their scale is not regarded as advantageous from an economical standpoint. It must be remembered, however, that reinforcing the fleet of inboard engine fishing boats is regarded as indispensable for future development of the offshore fishing resources of Grenada and therefore the scale of these jetties is regarded as appropriate when future increases in the number of boats is taken into consideration.

3-2-4 Slipway for Hauling the Small-sized Fishing Boats

As mentioned previously in this report, the shoreline conditions at Victoria are inadequate for hauling up fishing boats. There are 37 fishing boats registered in Victoria but only 7 or 8 of them are suited for using the slipways. The other boats are operating under poor conditions. The slipway to be constructed under the project will be designed in such a way to make it possible to haul up half (i.e., approximately 15) of the small-sized fishing boats.

It may safely be said that hauling the fishing boat ashore is the hardest part of setting out navigating to the fishing grounds - fishing - navigating back - and coming a shore. On the other hand it must be remembered that when the distribution system is taken into consideration, it is difficult to modify the existing system however hard hauling a fishing boat ashore may be. Even when this socio-economic practice is taken into consideration, hauling a fishing boat ashore is undeniably hard work for fishermen. Therefore, a slipway sufficient to haul ashore 15 fishing boats operating under the worst conditions will be designed as the first step. If these 15 fishing boats play a leading role in the fisheries of the area using this slipway, it is only natural that other

fishermen facing the same difficulty in hauling their vessels ashore will gather at this slipway. The shoreline at the site is being used only for quarrying, with no exploitation of fisheries, and there is sufficient space (government-owned land) in the vicinity of the slipway. Such being the case, it may safely be said that there is sufficient space to accommodate all fishing boats even when boats of in adjacent areas are gathered around the slipway.

3-2-5 Fishing Gear

Fishing gear to be used on the 8 inboard fishing boats will be included in this project. Apart from this, anxious about the risk of sea disasters that could occur concurrently with the recent expansion of the operating areas of fishing boats, the Ministry of Education, Culture and Fisheries is taking steps to establish legislation making it obligatory for fishermen to carry safety apparatus for emergency situations. It must be borne in mind that however strict the established legislation may be, its observance will be quite unrealistic for fishermen, being hard pressed in their daily lives, to observe if the government does not offer financial aid to purchase the required safety equipment. Such being the case, it is regarded as particularly important to pay attention to measures aimed at securing the safety of fishermen and therefore the supply of safety equipment of low cost and convenient use for fishermen is included in this project as a first step. Furthermore, it is also necessary to supply electric reels and other equipment to promote development of demersal fishing. Moreover, two FADs (Fish Aggregating Devices) to be installed at Gouyave and Grenville, respectively, are also included in the project. Since it is possible to build more FADs using materials available on the local market, only model two units are included. More FADs can be built and installed using local materials and manpower if they are regarded as effective.

3-2-6 Fishermen's Lockers

This project includes the installation of fishermen's lockers for use by fishermen aboard boats now sailing. There are currently no lockers at either Gouyave and Grenville. Such being the case, it is necessary to install at least as many lockers as there are members of the fishermen's cooperatives. From the standpoint of administration of these lockers by the Fishermen's Centers, they must be installed nearby. It is regarded as appropriate to install lockers serving fishermen sailing from the area close to the Fishermen's Centers and, under the circumstances, 20 units will be installed at each site. Another 15 lockers are being required adjacent to the Victoria slipway and the installation of 25 lockers at Sauterurs is regarded as appropriate in order to serve the 25 fishermen playing a leading role in promoting the activities of the existing St. Patrick Fishermen's Cooperative. The lockers, provided with doors and locks, will be used by individual fishermen for storing outboard engines (40 horsepower on the average), two fuel tanks, longlines (about 1 mile length, sized approximately 70 x 70 x 70cm when stored in a wooden box), fishing gear and the like. Lockers to be installed at the various sites are as follows.

Gouyave Fishermen's Center	: 20 units
Grenville Fishermen's Center	: 20 units
Victoria slipway; St. Mark's Fishermen's cooperative	: 15 units
St. Patrick fishermen's cooperative	: 25 units
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Total	: 80 units

3-2-7 Materials for Laying Water Supply System for Fisheries

This project includes the provision of materials for a water supply system aimed at assuring an adequate supply of water to the fishermen of Calliste. The nearest water source (student dormitory of the Medical College) is located at approximately 400 meters from the place being used as an operational base by fishermen. This project will provide the materials required to supply water from this source.

3-2-8 Maintenance Equipment

Some tools and means of transportation are required for repair of fishing equipment. Basic tools will be supplied to the Fishermen's Centers consisting mainly of hand tools. Apparatuses included in the AFDP repair shop are tools needed for routine duties of the repair shop as well as portable tools to be carried to the Fishermen's Centers and the various fishing bases of Grenada. Moreover, a truck equipped with a small crane for transporting fishing equipment that cannot be repaired at the various fishing bases and a mobile repair car for transporting engineers and mechanics and repair tools will be required as well.

3-2-9 Insulated Fish Box Manufacturing Machine

Machines for manufacturing polystyrene fish boxes will be included in this project. These boxes will improve the freshness of the catch, improve distribution of fresh fish, promote the export of fresh fish, etc. Fish boxes sized at least 100 x 50 x 50cm in will be required because the catch consists mainly of such pelagic fishes as Marlin and the like. There are about 1,400 fishermen in Grenada and the service life of a polystyrene fish box is no more than six months even when reinforced with an internal wooden box. The demand for fish boxes amounts to $1,400 \times 2$ units (quantity required annual by per fisherman) = 2,800 units/year from the fishermen's side alone. Additional fish boxes, according to the quantity of the catch, are required for distribution use. Moreover, approximately 1,000 units per year (Quantity of fresh fish: 50 tons. 5% of current exports of fresh fish of 900 tons/year produced, mainly at Carriacou Island) are required for promoting exports. Although machines for fabrication of insulated fish boxes are characterized as scale merit machines (production costs are most economical in accordance with the scale of production), the adoption of equipment of the smallest scale, with a capacity of the order of 6,500 units/year is regarded as appropriate for this project because the boxes will be used exclusively for fish. Moreover, it must be clearly stated that disposal of used polystyrene by incineration at each village is compulsory in order to prevent the occurrence of future problems of industrial waste (disposed or broken boxes).

3-2-10 Retail Stockers

Stockers (small-scale freezers) for retail sales use will be included in this project to improve distribution of catches by AFDP. The AFDP has signed contracts with approximately 110 stores for distribution of fresh fish. The additional catch expected through operation of the Fishermen's Centers within the context of this project will be approximately 240 tons (66,000 pounds per year of operation x 8 fishing boats x 0.45) attributable to the small sized inboard engine fishing boats. Assuming that the distribution system will work 240 days/year and that 200kg of fish will be sold every 2 days, 10 small-sized freezing storages ($240 \text{ tons} \div [240 \text{ days} \div 2 \text{ days}] \div 200\text{kg} = 10 \text{ units}$) will be sufficient for the additional production resulting from operation of this project.

3-2-11 Insulated Truck

Like the stockers mentioned in the previous section, insulated trucks will be required to transport the additional catch resulting from operation of this project from the Fishermen's Centers to St. George's, the consumption market. Effective operation of this project is expected to bring about a direct increase of approximately 240 tons in total, which corresponds to approximately 120 tons for each Fishermen's Center. Assuming that an insulated truck can operate 240 days/year, the required fish transportation capacity will be 500kg. It is regarded as appropriate to adopt insulated trucks of 1 ton capacity because it will be necessary to transport a quantity of ice with the fish. One insulated truck with 1 ton capacity will be provided for each Fishermen's Center to improving the distribution system. A few daily trips with these insulated trucks should be sufficient to transport the catch of existing fishing boats because the distance from Gouyave to St. George's and from Grenville to St. George's is approximately 30km. As can be seen, the provision of insulated trucks of 1 ton capacity is expected to make a substantial contribution to transportation of fresh fish.

3-3 Architectural Design

3-3-1 Basic Policy

- a. The Fishermen's Centers are designed with priority attached to functional aspects and with special measures taken to facilitate maintenance and control. The frames of the Fishermen's Centers will be of reinforced concrete in view of its superior durability. Walls will be of concrete blocks because the project sites are in a rainy tropical area and face the sea. The rooves of Fishermen's Centers will be covered with roofing tiles of a material commonly used in Grenada. Both manpower and materials required for erecting reinforced concrete structures are available at Grenada. As a general rule, a natural ventilation system will be adopted at the Fishermen's Centers. Moreover, screen blocks and the like will be used as much as possible to assure good ventilation for the installed equipment. Special attention will also be paid to the layout of the equipment, corrosion prevention treatment and other measures because the Fishermen's Centers will be build at sites adjacent to sea.
- b. The Fishermen's Centers will be designed with special attention to the weather and environmental conditions and proper measures will be taken to make the most of these peculiarities so as to facilitate maintenance and control. Such aspects as the form of work to be carried out at the Fishermen's Centers and traffic during the work hours will be examined from the standpoint of the various functions to be included therein with the object of designing facilities convenient to use by fishermen.
- c. Construction materials available in Grenada and adjacent countries will be used as much as possible and the Fishermen's Centers will be designed to facilitate as much as possible maintenance and control during operation. For example, roofing materials available in Grenada and characterized by easy maintenance will be used in this project taking into consideration the fact that Spanish style roofing is adopted for ordinary houses of the country.

3-3-2 Design Conditions

- a. Grenada does not have its own architectural design standards. Architectural design is carried out in conformity with British standards (American standards are adopted in some cases) however, in view of the historical background of the country. Such being the case, facilities for this project will be designed in conformity with the British standards applicable (structure, disaster prevention, electricity, water, drainage, etc.). At the Land Development Planning Department of the Ministry of Health, there are architectural design regulations based on British standards that cover for such matters as procedures for obtaining construction permits, scale, structure and usage of buildings and other relevant aspects. Points to be taken into consideration in connection with this project are conservation of the shoreline, the number of storeys of the buildings and drainage. It takes approximately 2 months to obtain a construction permit.

The Land Development Control Authority, consisting of representatives of the various government offices, legal and private organizations, is responsible for authorization of land use and construction. The Physical Planning Unit of the Ministry of Works is in charge of examination of applications and other related matters. Authorization and permits, covering planning, construction and equipment are issued by the Land Development Control Authority and in particular matters related to equipment, are under the control of the following organizations.

Power : The supply, transmission and distribution of power is controlled by Grenada Electricity Services. There is some voltage fluctuation and occasional power stoppage but the fluctuation itself is not so sharp. There is a seasonal fluctuation of the order of a few percent but it may be safely said that the supply of electricity is relatively stable. Electricity is supplied in the form of 3-phase, 400 Volt, single-phase, 230 Volt, 50Hz alternating current. All power lines are overhead type

and practically all of the country is served with electricity.

Running : The water system is controlled by the Ministry of Works.
water Since there are mountainous districts with relatively high altitudes, water is abundantly available at the sources and 1.3/4" piping is laid throughout the country.

Sewerage: Sewerage is under the control of the Ministry of Health. There are no clearly defined regulations applicable to sewerage but as a general rule drainage of ordinary households is treated by means of a single chamber septic tank.

Telephone: The telephone system is operated and controlled by the Grenada Telegraph Corporation. Installation of telephones is handled by telegraph companies.

b. Fishermen's Centers will be constructed at two places. Gouyave (St. John's parish) and Grenville (St. Andrews parish). The required functions are the same.

c. The following factors are taken into consideration as design conditions related to natural disasters and the like.

I. Since Grenada is located to the south of the latitude where hurricanes occur, practically no damage is caused by this phenomenon. According to a technical committee consisting of representatives of the private sector and government offices in charge of natural disaster, the reference wind velocity for design is 50 m/second.

II. No earthquakes or damage from this phenomenon have been recorded so far. The committee adopts standards of the ANSI (American National Standards Institute) applicable to Class 2

seismic areas. According to these standards, the seismic intensity for design is under 0.10.

III. Damage due to landslids and the like occur near the circumference road but the slope at Gouyave, one of the Fishermen's Center construction sites, is not so steep as to cause collapses, and it is presumed that there will be no problem.

IV. No data is available on damage caused by lightning and there are no standards for the installation of arresters.

3-3-3 Basic Design Policy

- a. Since space available for construction is small both at Gouyave and at Grenville and moreover there are many restrictions regarding the shape of the construction sites, access roads and other relevant aspects, the layout of the various rooms will be planned in the most efficient way and traffic lines will be arranged in the most functional way. Space for ice-making, cold storage and ice storage, including heavy machinery, will be arranged on the ground floor of the Fishermen's Centers because these facilities will be used frequently. The training & meeting room and the Fishermen's Center administration office will be located on the first floor, taking into consideration such factors as view, ventilation and acoustic isolation.
- b. Both the ground and first floors of the Fishermen's Centers will be provided with as much open space as possible and effective use will be made of natural light and ventilation. The ice-making and cold storage rooms will be arranged at most interior area of the building to minimize the noxious effect of seawaves on the equipment. The eaves will be extended as far possible and eave troughs will be installed to protect the first storey from direct sunlight and rain. No drainspouts will be installed in view of the frequent occurrence of tropical rain showers but drain ports will be provided instead at various points on the eave troughs.

- c. The frame of the Fishermen's Centers will be of reinforced concrete in view of its superior durability and the roof beams will be of wood in view of its easy maintenance character. The walls will be of reinforced concrete blocks and screen blocks in view of the easy execution of installation work and availability of materials. It will be possible to realize low-cost construction making use of local materials and manpower, thereby contributing to the local industry, through the adoption of this line of reasoning.
- d. No mechanical ventilation equipment will be required and apparatuses for lighting and other purposes to be installed in the living spaces, machine room and the like will be minimized thanks to adoption of natural lighting, natural ventilation and natural shading.
- e. A simplified septic tank system is being used in Grenada to treat sewage and waste water is directed into the sea. Two or more septic tanks will be used in this project and drainage will be discharged via infiltration pipes into sandy soil.

3-3-4 Design Outline

A. Fishermen's Center

In principle, the Fishermen's Centers of Gouyave and Grenville will be provided with the same functions but each Center will be designed separately taking into consideration the different peculiarities of each site. The Centers will be two-storey reinforced concrete structures.

- a. Specifications of buildings (common to the two Centers)

Finish of various parts

Roofing	:	Spanish type or slate
External Wainscot	:	Trowel-finished mortar, paint coating
Wainscot	:	Ditto
Berm	:	Trowel-finished concrete
Eave gutters	:	Trowel-finished waterproofed mortar

Interior finish

Ceilings	:	Exposed concrete slab
Inner walls	:	Trowel-finished mortar, paint coating
Wainscot	:	Ditto
Plinth	:	Trowel-finished mortar
Fittings	:	Steel doors, aluminum or wooden sash
Shutters	:	Steel or wooden
Floors	:	Trowel finished concrete with dust-proof finish
Lighting apparatus	:	Fluorescent lamp

Structural materials

Concrete	:	FC210 (fc = 3,000 Psi) or equivalent
Reinforcing bar	:	SD30 (fy = 40 Ksi) or equivalent
Foundation	:	Spread foundation (bearing power; 3.5 t/m ² Sandy soil)

Drainage

Septic tank	:	Concrete structure
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b. Specifications of equipment (common to both Centers)

1) Block ice making machine: 1 unit

Capacity	:	1 ton/24 hours, 25kg cans x 20 cans x 2 times per 24 hours
Type	:	Brine tank system
Brine tank	:	Approximately 3 meter length, approximately 1.5 meter width, steel structure, internal insulation, hair pin coil system, provided with agitator.
Peripheral facilities	:	Work stages at three sides of the periphery, melting tank, dewatering chute
Refrigerator	:	Single stage, air-cooled, low-speed, open type
Required power	:	7.5kw
Capacity	:	Approximately 5,800Kcal, -25°C
Refrigerant	:	R-22

Condenser : Air-cooled
Required power : 0.1kw
Cooling area : Approximately 94m²
Capacity : Approximately 15,400Kcal
Ice crusher : 1.5kw

2) Plate ice making machine: 1 unit

Capacity : 2 tons/24 hours
Type : Plate ice making machine, automatic operation system
Size : Approximately 2.1 meter length x 1.1 meter width x 1.1 meter height
Refrigerator : Single stage, air-cooled, low-speed, open type
Required power : 11kw
Capacity : Approximately 11,900Kcal, -25°C
Refrigerant : R-22
Condenser : Air-cooled
Required power : 0.6kw
Capacity : Approximately 35,000Kcal
Ice storage room : Prefabricated type
Heat insulation thickness : 100mm
Size : Approximately 2.7 meter length x 2.7 meter width x 2.6 meter height
Capacity : 15m³
Ice storage quantity : Approximately 3.75 tons

3) Cold Storage: 2 units

Capacity : 24m³ x 2 units = Total approximately 48m³
Size : Approximately 6.3 meter width x 3.6 meter length x 2.6 meter height
Type : Prefabricated type
Heat insulation : 100mm
Cooler : Air-cooled finned tube type, 2 units
Required power : 15.6kw
Refrigerator : Single stage, air-cooled, low-speed, open type, 2 units

Required power : 15.0kw
 Capacity : Approximately 11,600Kcal, -25°C
 Coolant : R-22
 Condenser : Air-cooled, 2 units
 Required power : 0.1kw
 Capacity : Approximately 15,000Kcal

- 4) Stand-by generator: 31kw equipped with water-cooled radiator
- 5) Electric panel: Switchboard, control pavel, etc., 1 set
- 6) Carts, Plastic baskets, Carriers, Balance and other apparatus
- 7) Service tools: Including hand tool set (hammer, screwdrivers, wrenches, spanners and other basic tools), vise, battery charger and other asic apparatus. Details provided later.
- 8) Educational equipment: TV, video player, video camera, slide projector, screen (one each), plus educational video software and texts.

B. Fishermen's lockers

Lockers, totaling 80 units, will be installed at various places with the object of housing fishing materials and equipment of the fishermen. The number of lockers mentioned in the section on definition of scale of the project will be installed adjoining each other at various sites on Grenada.

a. Specifications of shed (common to all sites)

External finish

Roofing : Corrugated galvanized sheet iron
 External wall : Tooled joint concrete block masonry, painted finish
 Floor : Trowel-finished concrete
 Structural material: Concrete-reinforced block structure
 Foundation : Spread foundation

3-4 Civil Works Design

3-4-1 Design Conditions

Small-sized jetties will be built at two places, Gouyave and Grenville, for mooring and supplying the inboard engine boats included in this project and one slipway for hauling fishing boats will be installed at Victoria.

- a. Since there are no regulations applicable to marine civil engineering and civil works (harbor, fishing port construction) in Grenada. The case, the Standard Design Method of Fishing Harbor Construction (Japan Fishing Harbor Association) will be adopted in this project. The Land Planning Department of the Ministry of Health has jurisdiction over marine civil construction from the standpoint of method of utilization of coastal land. As a general rule the Land Planning Department does not authorize the construction of structures (particularly embankment structures) that have the risk of bringing about changes in the coastal topography due to the influence of sand drift and the like resulting from changes in natural hydraulic conditions. Special attention will be paid to prevention of any influence on the environment during execution of the construction work and after its completion.

- b. The structures will be made as simple as possible to facilitate maintenance after completion. Construction materials available on the local market will be used to facilitate maintenance and control during operation of the project. Four alternatives - piling system, block system, gravity system (block type) and pontoon system - were taken into consideration for the small-sized jetties. As for compromises consisting of a combination of two or more of the alternatives, such as a pile type structure adopted for the jetty itself and a block system or the gravity system (block type) for the access bridge, it is obvious that they would require construction equipment such as pile driving barges and crane barges for installation of the blocks, thereby resulting in expensive construction

cost. The four structural types mentioned above were submitted to comparative examination individually, without taking into consideration any combination of types. The four items mentioned below are examined in this connection.

1. Functional characteristics, including maintenance and control.
2. Characteristics of structure
3. Workability
4. Characteristics of materials

It has been concluded as a result of comparative examination of the merits and demerits of each alternative that the pile system is most appropriate. The contents of the comparative study are summarized in the table on the next page.

- c. Such factors as topography, geology, tidal currents, waves, tidal level and the like prevailing at the project site are examined with care and are taken into consideration in the design. Moreover, the peculiarities of each site are taken into consideration as well.
- d. The same conditions as for the architectural facilities are taken into consideration in connection with earthquakes and other external forces.

3-4-2 Outline of the Design

A. Gouyave jetty

As can be seen from the comparative table of the four types of jetty structures, the pile system (steel pipe piling) method will be adopted for this project. Since the jetty extends out from the Fishermen's Center, it is necessary to align the level of the jetty access bridge with the site of the Fishermen's Center. Design of the apron area, reclamation and revetment of the Fishermen's Center site, raising and retaining wall of the Fishermen's Center site ground level, and access road are included in the scope of the civil engineering design.

Comparative Table of Jetty Structure Alternatives

	Pile system	Block system	Gravity system (Block type)	Pontoon system
Ground plan and standard cross section				
Functional characteristics (including maintenance and control)	<ol style="list-style-type: none"> 1. The jetty brings about no changes in the configuration of the shoreline. ○ 2. The jetty experiences no displacement and/or movement when it is being used. ○ 3. Maintenance/control is required in the case of steel piling. △ 	<ol style="list-style-type: none"> 1. There is risk of change in the configuration of the shoreline. △ 2. The jetty experiences no displacement and/or movement when it is being used. ○ 3. No maintenance/control is required. ○ 	<ol style="list-style-type: none"> 1. There is a serious risk of change in the configuration of the shoreline. × 2. The jetty experiences no displacement and/or movement when it is being used. ○ 3. No maintenance/control is required. ○ 	<ol style="list-style-type: none"> 1. The jetty brings about no change in the configuration of the shoreline. ○ 2. The jetty experiences displacement and/or movement when it is being used. × 3. Maintenance/control is required in the case of steel jetty. △
Structural characteristics	<ol style="list-style-type: none"> 1. Superior structural stability. ○ 2. Technical compatibility with local resources (system already in use in Grenada). ○ 3. Precasting of superstructure is practicable. ○ 	<ol style="list-style-type: none"> 1. Few cases of practical use (structural insecurity). × 2. Precasting is practicable. ○ 3. Measures are required to prevent scouring. △ 	<ol style="list-style-type: none"> 1. Structural insecurity. ○ 2. Precasting is practicable. ○ 3. Measures are required to prevent scouring. △ 	<ol style="list-style-type: none"> 1. Adoption of this system is practicable only in calm water. × 2. Movable access bridge is required. △
Workability	<ol style="list-style-type: none"> 1. Execution of work on the land is also practicable. ○ 2. Depending on the subsoil there is insecurity with pile driving. △ 	<ol style="list-style-type: none"> 1. Only a few types of simple works are required. ○ 2. Accurate levelling of the foundation mound is required. △ 3. Hoisting machinery of large capacity is required. △ 	<ol style="list-style-type: none"> 1. Only a few types of simple works are required. ○ 2. Accurate levelling of the foundation mound is required. △ 3. Hoisting machinery of large capacity is required. △ 	<ol style="list-style-type: none"> 1. Only on-the-spot installation is required. ○ 2. Pile driving equipment is required, however, when adopting pile type mooring system. △
Characteristics of the materials	<ol style="list-style-type: none"> 1. Imported materials are required when using steel piling (steel pipes, H shape steel) △ 	<ol style="list-style-type: none"> 1. Local procurement of materials only. ○ 	<ol style="list-style-type: none"> 1. Local procurement of materials only. ○ 	<ol style="list-style-type: none"> 1. Local procurement of materials only. △
Comprehensive evaluation	○	△	△	×

As for the location of the jetties, they should be properly arranged so as to secure the calmness required for boats to moor with sufficient safety. At on the Gouyave coast it will be selected at the northern end because the influence of the wind and waves is minimal. Currently operating inboard engine boats are being moored offshore in the coastal area of Gouyave. By way of note, the signification wave height during the winter season is presumed to be of the order of 80cm in the vicinity of Gouyave.

The water depth at the back of the jetty should be at least 1.5m (standard value: loaded draught + 0.5m or more) to cope with the fishing boats of the largest scale expected to use the jetty, but in reality it must be a little deeper (-2.5m) for the significant wave height not to break. Such being the case, the jetty will be designed with a projecting length of approximately 57 meters based on the bathymetric chart (attached to the end of this report.)

The crest elevation of the jetty must be sufficiently low taking into consideration the scale of the fishing boats using it (the deck is 30cm above the surface of the sea when boat is loaded). On the other hand, it must be sufficiently high to prevent waves from washing over the jetty superstructure. The crest elevation for waves to pass under the jetty is $0.6m$ (M.H.H.W.) + $0.8m$ (significant wave height) + 0.25 (slab thickness) = 1.7 meter. The jetty will be provided with a platform at the mooring position to facilitate landing work thereby, improving operability. Assuming that two fishing boats are moored at one time, the jetty is designed with $17m$ [overall length of the inboard engine fishing boat + $3m \times 2$ (mooring rope length)] $\times 6m$ size (minimum dimensions required for two boats of the said size to moor carry out other relevant work at the same time). The substructure of the jetty is designed assuming a life of 30 years. Steel pipe piles ($\phi 500mm$) to be used in the jetty structure will have $9mm$ wall thickness to secure a corrosion margin of 3 millimeters. The accurate value of the depth of embedment of the piles cannot be determined at present because no boring data are available but penetration of the order of 10 - 11 meters is regarded as sufficient from the design standpoint. Moreover it is thought possible to realize this penetration depth in view of information provided by

local consultants. The superstructure will be made of RC beams and floor slabs.

The access bridge will stretch 30 meters from the tip of the causeway and it will be designed with 3m width so that two persons transporting materials and catch by handcarts and the like can pass each other. Moreover, the access bridge height is designed with L.W.L. + 1.7m height for the waves to pass under its structure so as to avoid any obstruction of access due to waves. In principle the access bridge will have the same structure as the jetty.

The causeway will be a rubble mound embankment stretching out of the shoreline but the scale will be as small as possible to prevent it becoming an impermeable structure, which could bring about changes in the coastal topography.

The elevation of the ground surface of the Fishermen's Center site adjacent to the jetty will be properly leveled to be compatible with the jetty. Fuel supply facilities of 2-ton capacity will be provided at the base of the causeway for refueling the inboard engine fishing boats. Although there are no fire regulations applicable to this kind of facility in Grenada, special attention will be paid to fire prevention and fire fighting when erecting the facilities. Moreover, no fuel supply piping will be laid up to the end of the jetty in order to simplify the structure and facilitate as much as possible its maintenance and control. A small-sized beacon activated by solar energy will be installed at the tip of the jetty as fishing boats using it as a base may return from their fishing voyages during hours of darkness.

B. Grenville jetty

The structure will be the same as that of the Gouyave jetty. The distance from the base of the jetty to the Fishermen's Center site is greater compared with Gouyave but from the operational standpoint the jetty facilities must be functionally connected with the Fishermen's Center to realize systematic operations.

The jetty construction site at Grenville has more calm water than Gouyave. The jetty will be designed to cope with a significant wave height of the order of 50 centimeters.

The water depth at the back of the jetty will be -1.5m. Conditions for fishing boats using the jetty are the same as those for Gouyave but the jetty will stretch 52m offshore based on data contained in the bathymetric chart because the construction site is shallow compared with Gouyave.

The crest elevation, area and construction of the jetty will be the same as those for Gouyave. From the theoretical standpoint it is possible to build the jetty with a crest height lower than that of Gouyave in view of the smaller wave heights, but the same crest elevation is adopted for structural and workability reasons.

The access bridge will be 3 meters wide and will stretch approximately 24 meters out from the causeway tip. The elevation of the ground level of the Fishermen's Center is approximately 1.0 meter above the crest of the access bridge and the jetty, but the causeway is designed with a grade of the order of 5% to avoid a steep slope which might hinder the transportation of goods.

Fuel oil replenishing facilities of 2 ton capacity will be provided at the base of the jetty in the same way as for Gouyave, with the object of supplying the inboard engine fishing boats. Moreover, a small-sized beacon activated by solar energy will be installed at the tip of the jetty.

C. Slipway for hauling fishing boats

The slipway to be constructed at Victoria will be used for hauling out fishing boats currently in use. Underwater work will be required for construction of the slipway because the shoreline at the Victoria site is covered with many large boulders as mentioned earlier in this report. The slipway will have a 1:10 grade. Underwater work will be required up

to approximately 8 meters in the offshore direction. The size of the slipway (6m width, -50cm depth at the tip) is determined taking into consideration the dimensions of the fishing boats to be hauled up (approximately 6m overall length, 1.7m beam, 30cm draught). Space to place the fishing boats is required adjacent to the slipway and this is designed as 30 meters in length x 10 meters in width to accommodate 15 boats. The slipway will be an RC structure (cast-in-place and precast concrete floor slabs). Fifteen fishermen's lockers and two manual winches (towing load: 750kg) will be installed at the slipway.

3-4-3 Scale and Specifications

1) Small-sized jetties at Gouyave and Grenville

a. Jetty: 1 unit each

Size : (17m length x 6m width)
Substructure : Steel pipe piling, ϕ 500mm x t 9mm (SKK41)
Superstructure: Cast-in-place and precast concrete
Protection : Wooden structure
structure
Beacon : Solar cell system

b. Access bridge: 1 unit each

Size
Gouyave : Length 30m (5 span x 6m) x width 3m
Grenville : Length 24m (4 span x 6m) x width 3m
Substructure : Steel pipe piling, ϕ 400 x t 900mm (SKK41)
Superstructure: Cast-in-place and precast concrete

c. Causeway

Rubble-mound : 1 unit each
embankment

Size

Gouyave : 10m (Distance measured from shoreline to the sea side at high tide)
Grenville : 11m (Distance measured from shoreline to the sea side at high tide).

2) Slipway for hauling fishing boats - Victoria

a. Slipway

Size : Length 22m x width 6m
Cast-in-place and precast concrete

b. Yard for fishing boat

Size : Length 30m x width 10m
Cast-in-place concrete

c. Manual winch: 750kg load capacity x 2 units

3-5 Design of Equipment

3-5-1 Inboard Engine Fishing Boats

The small-sized inboard engine fishing boats of minimum scale satisfying the conditions mentioned in the section on determination of the scale of the Project have the following specifications.

Type : FRP fishing boat
Size : Approximately 11m (overall length) x 2.8m (overall beam) x 1.4m (overall depth)
Engine : Inboard engine, approximately 70 HP
Accommodation: 4 persons (inside the vessel), canvas awning (entire stern deck area)
Fuel tanks : Fuel (250L), hydraulic system (200L)
Fish hold : 2m³ (Securing 2.0m lid length, insulation 100mm)
Equipment : Hydraulic winch for longline main line 1 unit
Manual winch for longline branch line 1 unit
Reel for manual deep sea fishing 1 unit
Fish finder 1 unit
VHF radio telephone 1 unit
Lighting, lifesaving equipment, etc. 1 set

Eight inboard engine fishing boats of the above specifications are included in the Project.

3-5-2 Insulated Fish Box Manufacturing Machine

The supply of an insulated fish box manufacturing machine is included in this project for improving fish handling and distribution of the catch. The insulated fish box manufacturing machine will be installed and operated at the former fish processing factory provided by the Government of Grenada. There is no problem regarding electrical wiring and water piping systems because the building was once used as a factory. Moreover, there is sufficient space to house the equipment.

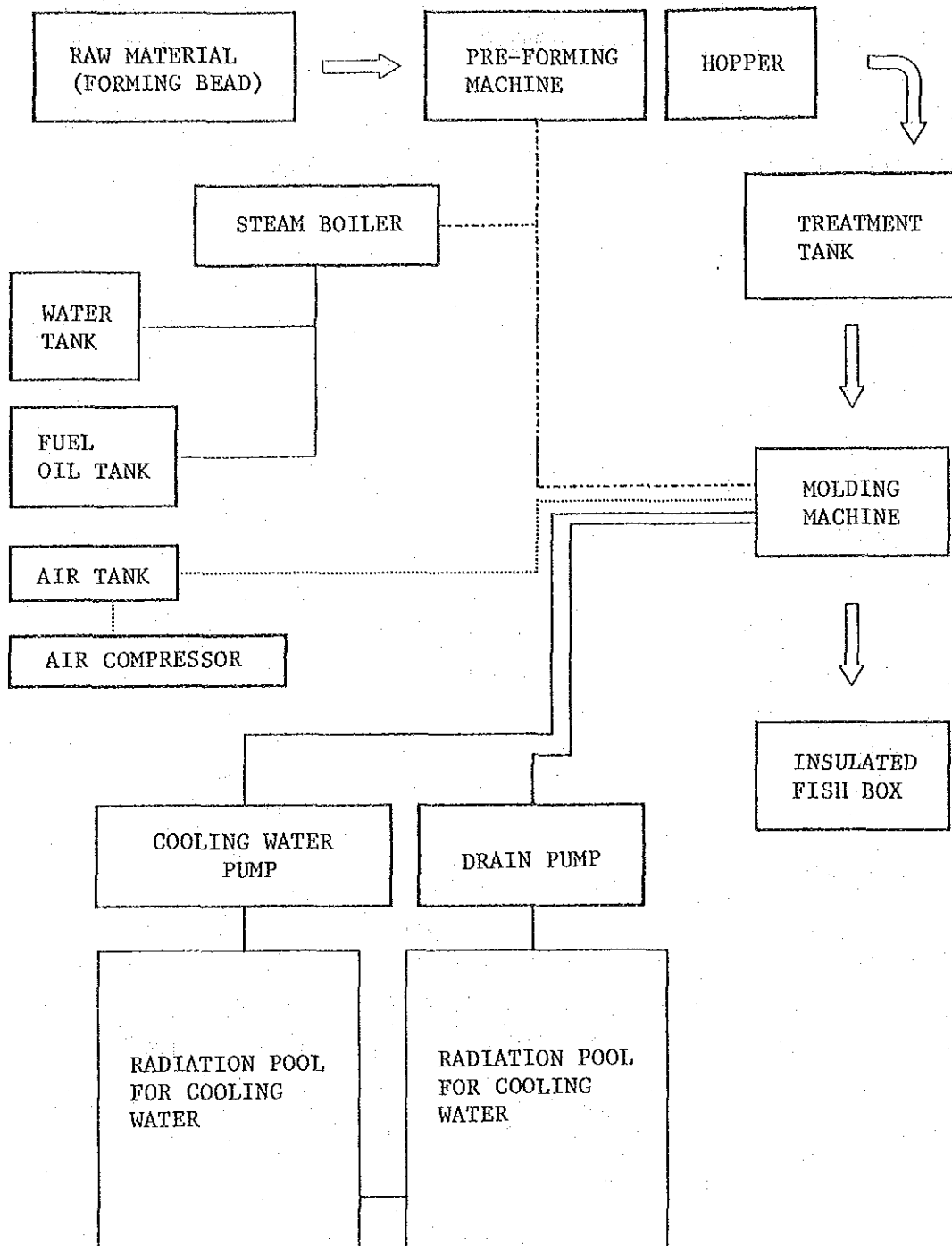
Specifications of Machinery

The machine for manufacturing insulated fish boxes consists of the equipment mentioned below. It operates by foaming polystyrene beads with steam and cooling the foam in a mold.

Box molding machine	:	2 units (For bottom and lid of box sized 0.5 x 0.5 x 1.0m)
Air compressor	:	3.7kw
Air tank	:	230L
Boiler	:	Smoke tube type, 350kg
Pre-foaming machine	:	1 unit
Pre-foaming hopper	:	1 unit
Treatment tank	:	1 unit
Water tank	:	3 ton
Oil tank	:	1 unit

The equipment is interconnected by steam piping, water piping, electric wiring, etc., to compose the insulated fish box manufacturing machine. The wiring and piping will be built into a turret made of angles with the object of simplifying the piping and wiring work during installation. The various steps in the insulated fish box manufacturing process and the equipment are shown in the accompanying chart.

Flow Chart of Molding Plant for Insulated Fish Boxes



3-5-3 Fishing Gear

Fishing gear included in this project consists of: 1) Fishing gear to be used on inboard engine fishing boats, 2) Safety equipment, 3) Fishing equipment for promoting demersal fishery and 4) Fish Aggregating Devices. Details are as follows.

1) Fishing gear to be used on inboard engine fishing boats

1. Main line for longline	Monofilament	10 miles
2. Line for floats	Monofilament	850 fathoms
3. Branch line for longline	Monofilament	6,500 fathoms
4. Snaps		850 fathoms
5. Wire leaders		1 roll
6. Fish hooks		510 units
7. Swivels		510 units
8. Kanseki springs		510 units
9. Floats		170 units
10. Sleeves		4,000 units

2) Safety equipment

1. Life saving equipment (signal light, etc.)	each type	60 units
2. Magnetic compass		20 units

3) Equipment for promoting demersal fishing

1. Electric reels for deep sea fishing	4 units
2. Manual reels for deep sea fishing	8 units

4) Fish Aggregating Devices (FADs)

1. FADs for shallow sea	Finished product	2 units
Drum floats: 5 units, Weights: 5 units, Wires of various kinds: 340m, Chains: 1m, Swivels, Shackles: 14 units, Artificial seaweed		

3-5-4 Tools

Tools to be used at the small-scale repair shops of the two Fishermen's Centers and the repair shop accessory to the Artisanal Fisheries Development Project office of St. George's will be supplied under the project. The list of tools to be supplied to the repair shop of St. George's was formulated by investigating the tools possessed by that shop so as to make up for those items lacking.

Tools of the St. George's Repair Shop

1. Electric compressor : 1 set
2. Fuel injection valve tester : 1 set
3. Hydraulic press : 1 set
4. Flaring tool : 1 set
5. Micrometer : 1 set
6. Special tools for outboard engines: 1 set
7. Notched offset wrench set : 1 set
8. Special tools for inboard engines : 1 set
9. Iron mallet : 1 set
10. Screwdriver set : 1 set
11. Hexagonal wrench : 1 set
12. Vise : 1 set
13. Tap & die set : 1 set
14. Box wrench set : 1 set
15. Offset wrench set : 1 set
16. Fork end spanner : 1 set
17. Adjustable wrench : 1 set
18. Pipe wrench : 1 set
19. Water pipe pliers : 1 set
20. Calipers : 1 set
21. Packing punch set : 1 set
22. Punch set : 1 set
23. Grease gun : 1 set
24. Oil syringe : 1 set
25. Electric grinder : 1 set
26. Electric drill : 1 set
27. Welding machine : 1 set
28. Battery Charger : 1 set

Tools for Fishermen's Centers (common to both Centers)

1. Iron mallet	:	1 set
2. Screwdriver set	:	1 set
3. Hexagonal wrench	:	1 set
4. Vise	:	1 set
5. Tap & die set	:	1 set
6. Box wrench set	:	1 set
7. Offset wrench set	:	1 set
8. Fork end spanner	:	1 set
9. Adjustable wrench	:	1 set
10. Pipe wrench	:	1 set
11. Water pipe pliers	:	1 set
12. Calipers	:	1 set
13. Packing punch	:	1 set
14. Punch set	:	1 set
15. Grease gun	:	1 set
16. Oil syringe	:	1 set
17. Electric grinder	:	1 set
18. Electric drill	:	1 set
19. Battery Charger	:	1 set

3-5-5 Other Equipment and Materials

Other equipment and materials included in this project have the following specifications.

1) Vehicles

a. Small-sized crane truck: 1 unit

Overall length: 3.2m, Number of seats: 2, Lightweight truck,
Hoisting capacity of crane: 490kg, Radius of working area: 0.25
to 2.34 meters

b. Small-sized mobile repair car: 1 unit

Overall length: 4.7m, Number of seats: 6, Loading capacity: 1.3
tons, Double cab type

c. Small-size insulated truck: 2 units

Overall length: 4.8m, Number of seats: 2, Cold storage box capacity: 3.7m³

2) Retail stocker (370L capacity): 10 units

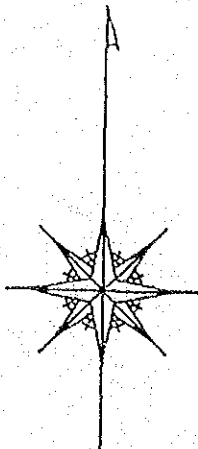
3) Materials for water supply system

The cost and arrangements for obtaining the permit, laying the water system and securing the supply of water will be borne by the Government of Grenada.

Steel pipe (1") 400m, Joints, Valves: 1 set

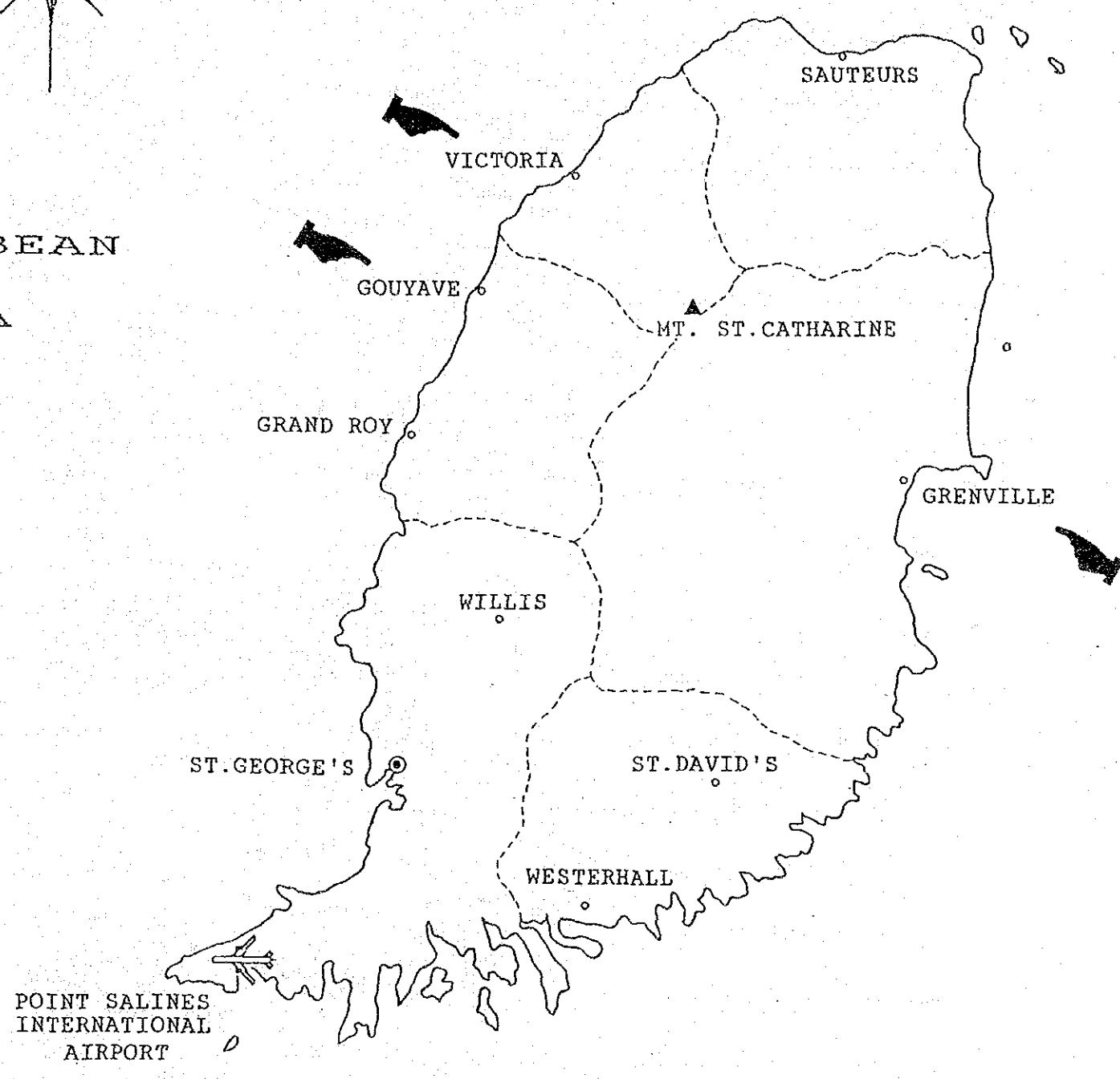
3-6 Basic Design Drawings

1. Map of project site
2. Gouyave site layout drawing (Fishermen's Center and small-sized jetty)
3. Ground plan of Gouyave Fishermen's Center
4. Elevation of Gouyave Fishermen's Center
5. Access road and causeway of Gouyave Fishermen's Center site
6. Ground plan, side view and cross section of jetty
7. Ground plan, side view and cross section of access bridge
8. Grenville site layout drawing (Fishermen's Center and small-sized jetty)
9. Grenville Fishermen's Center ground plan
10. Grenville Fishermen's Center elevation
11. Victoria site layout drawing (slipway)
12. Ground plan of Victoria site slipway
13. Side view and cross section of Victoria slipway
14. Ground plan, side view and cross section of Fishermen's lockers
15. Inboard engine fishing boat

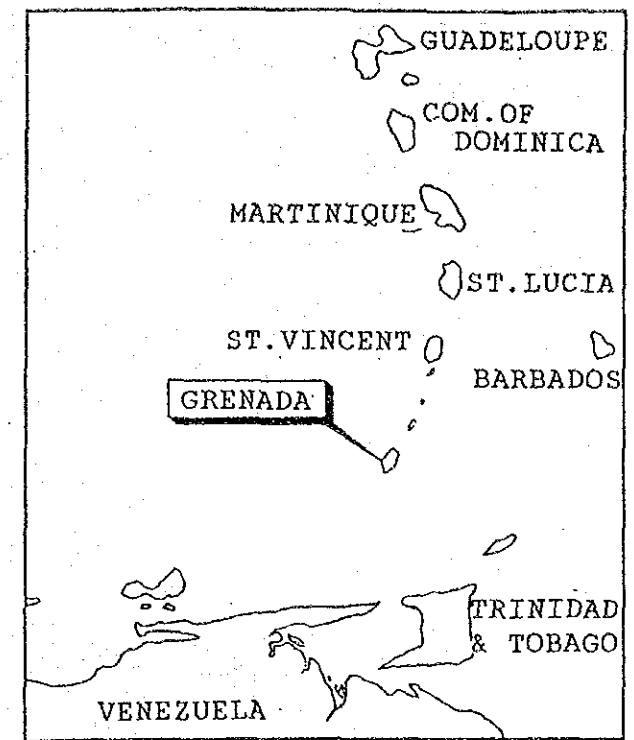


1. Map of project site

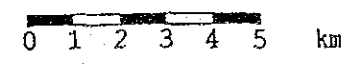
CARIBBEAN
SEA



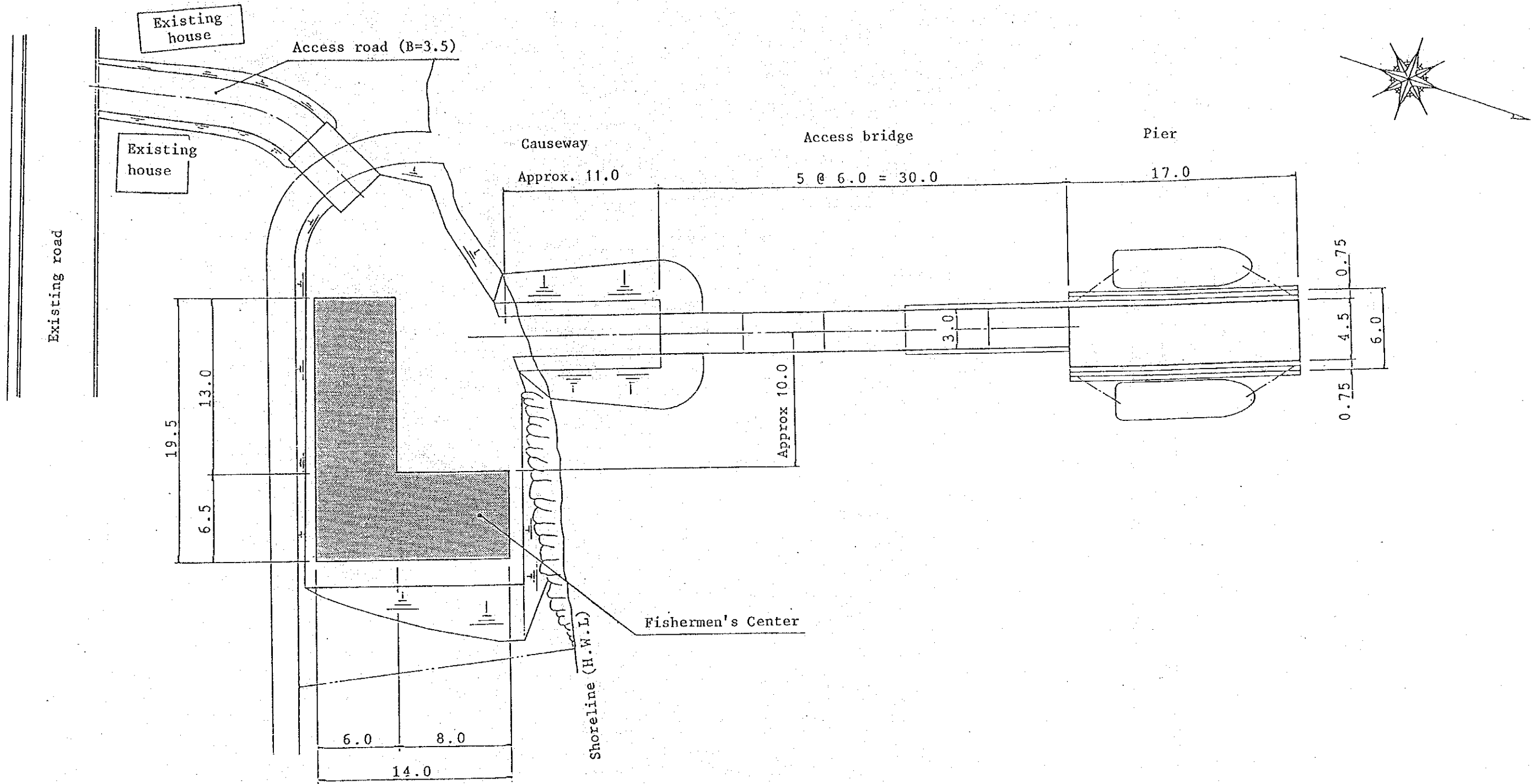
GRENADA



LOCATION MAP

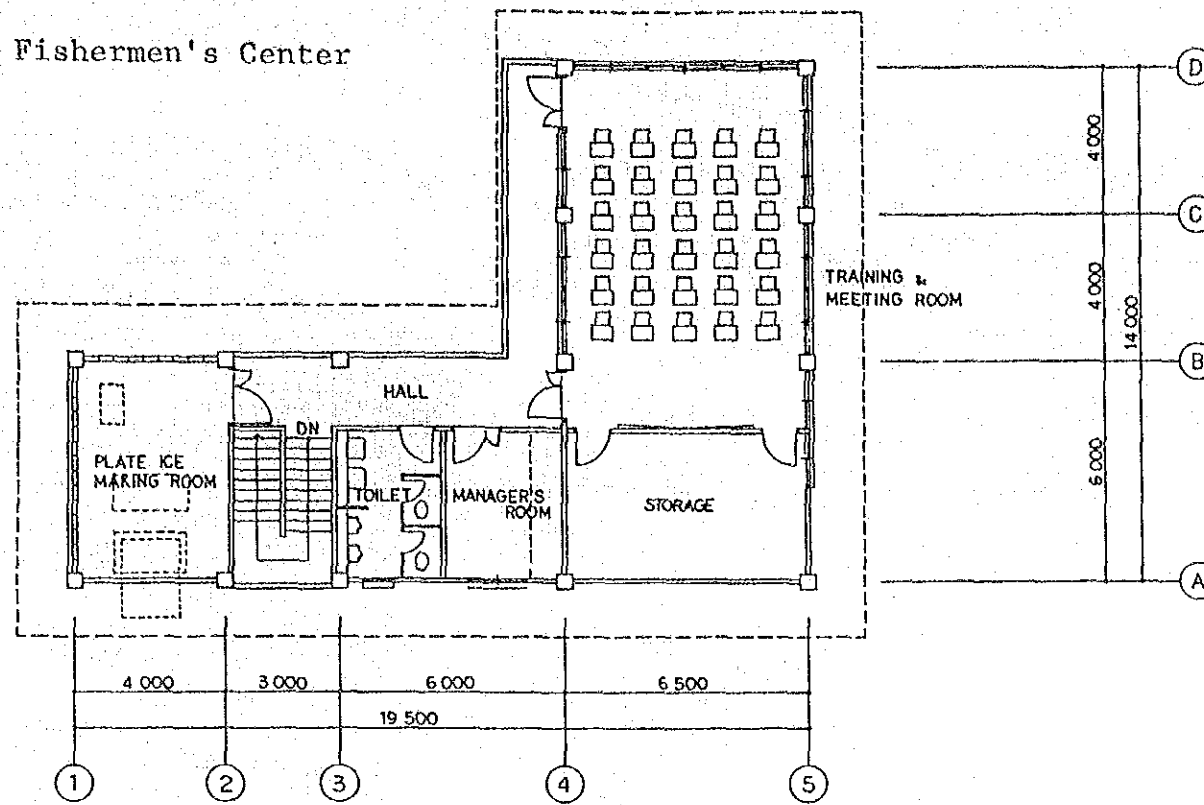


2. Gouyave site layout drawing (Fishermen's Center and small-sized jetty)

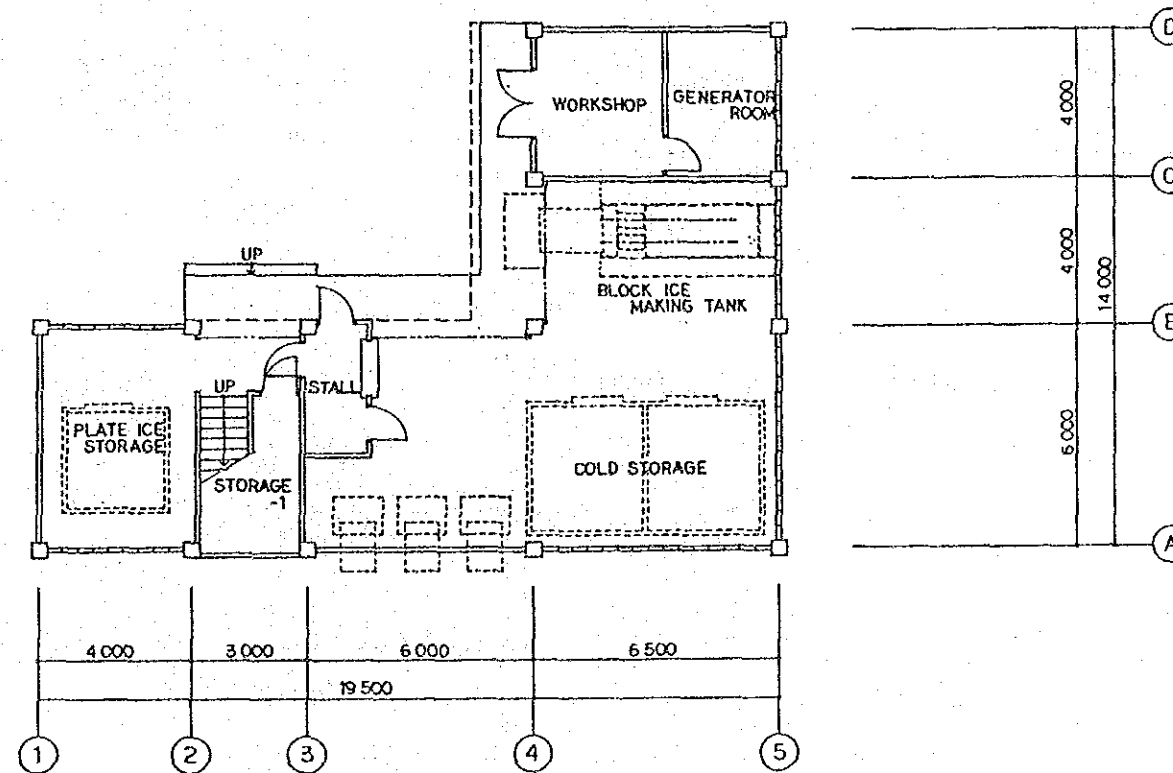


Site ground plan (Gouyave)
Unit: m S=1:300

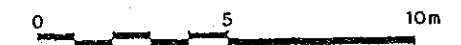
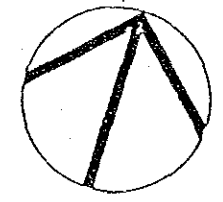
3. Ground plan of Gouyave Fishermen's Center



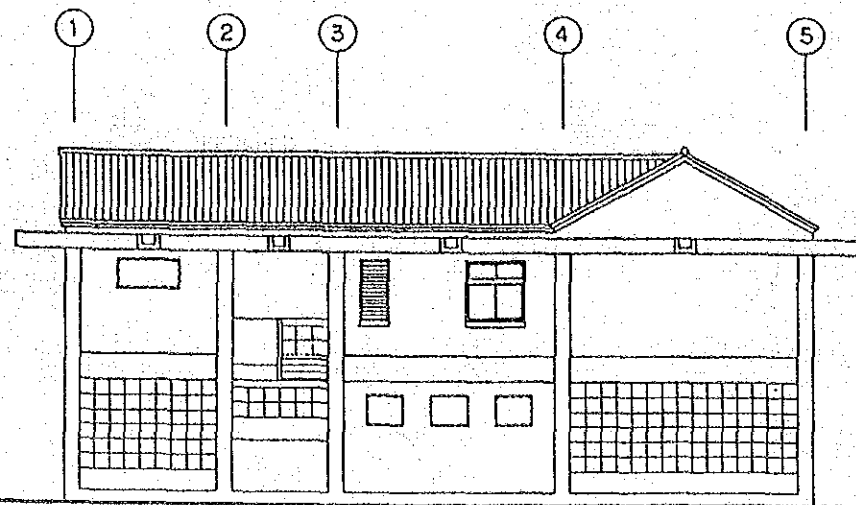
1st FLOOR PLAN



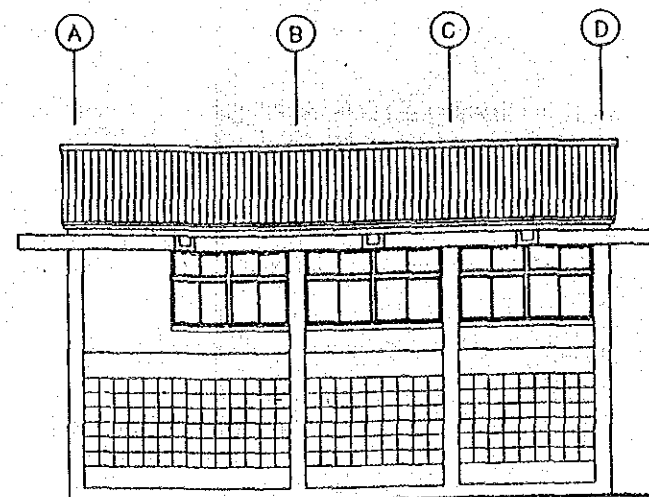
GROUND FLOOR PLAN



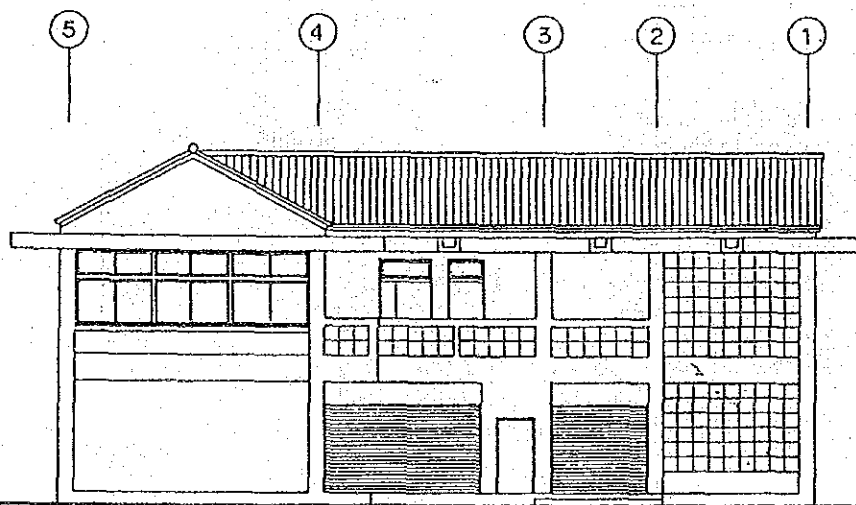
FISHERIES CENTER AT GOUYAVE



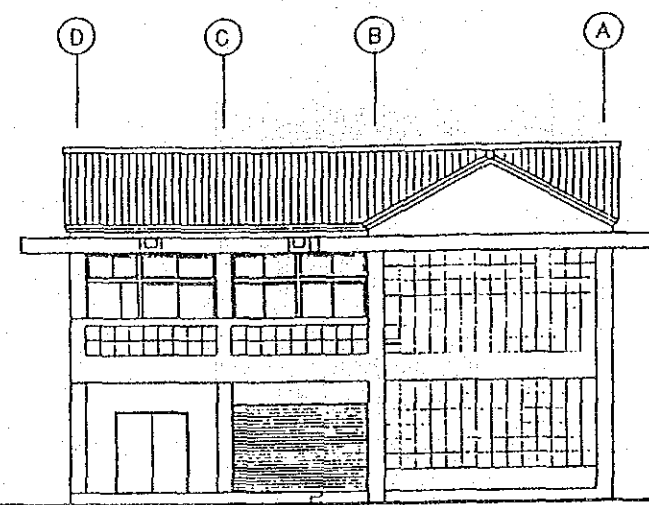
SOUTH ELEVATION



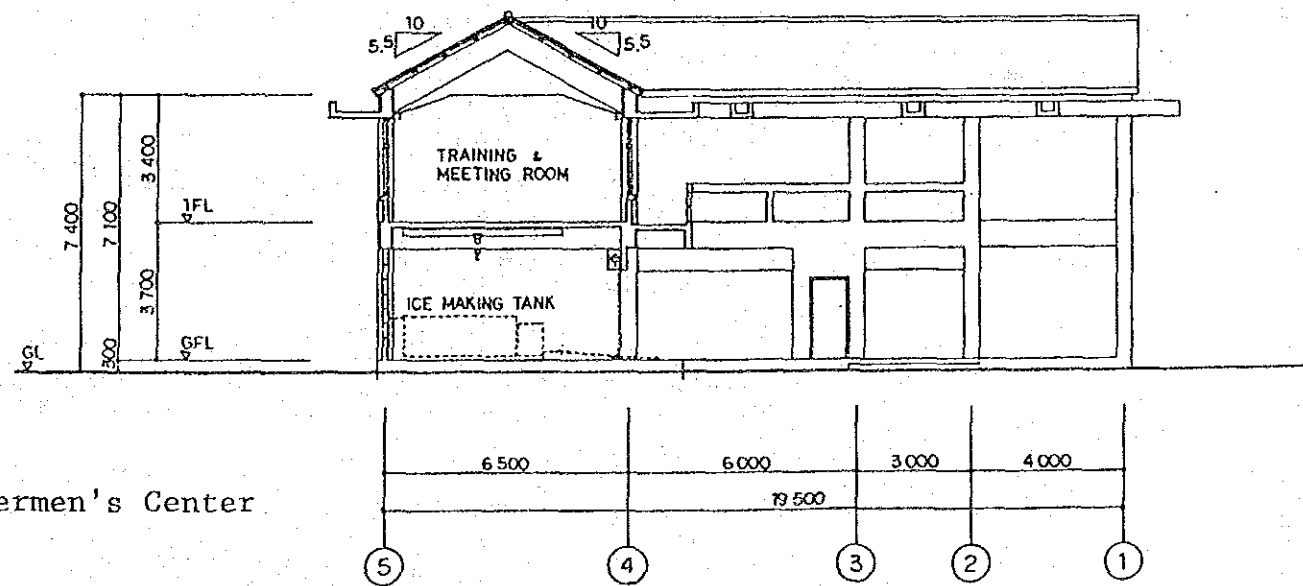
EAST ELEVATION



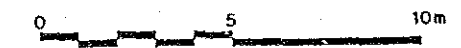
NORTH ELEVATION



WEST ELEVATION

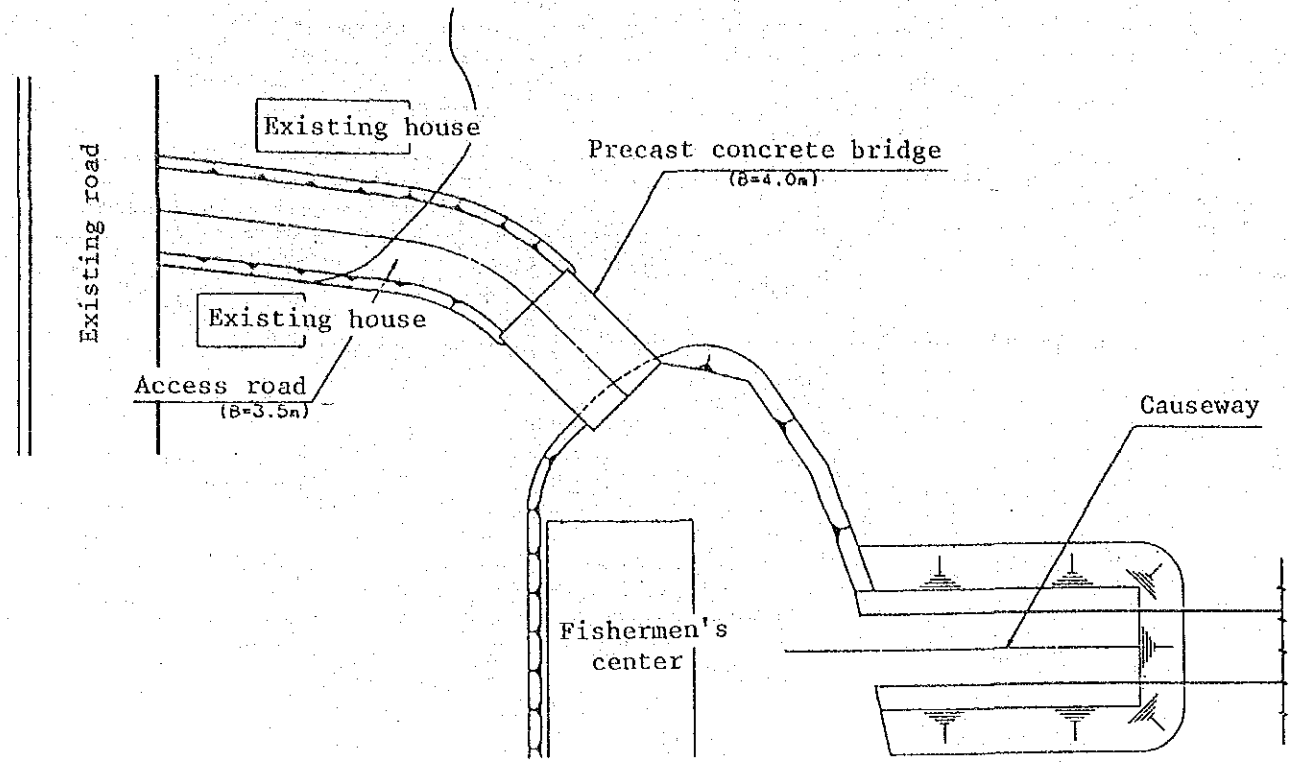


SECTION

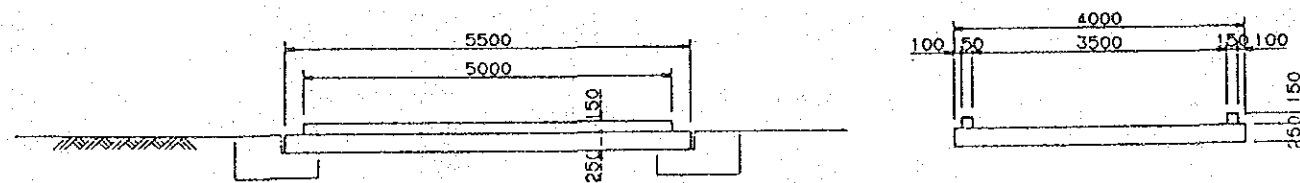
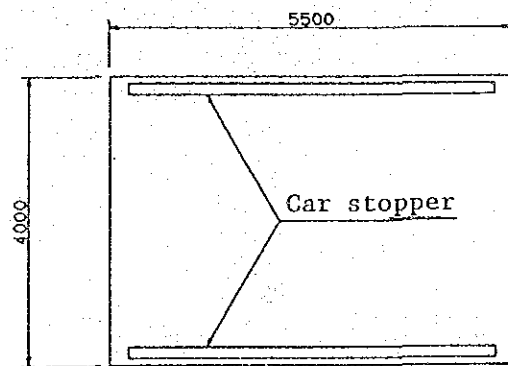


4. Elevation of Gouyave Fishermen's Center

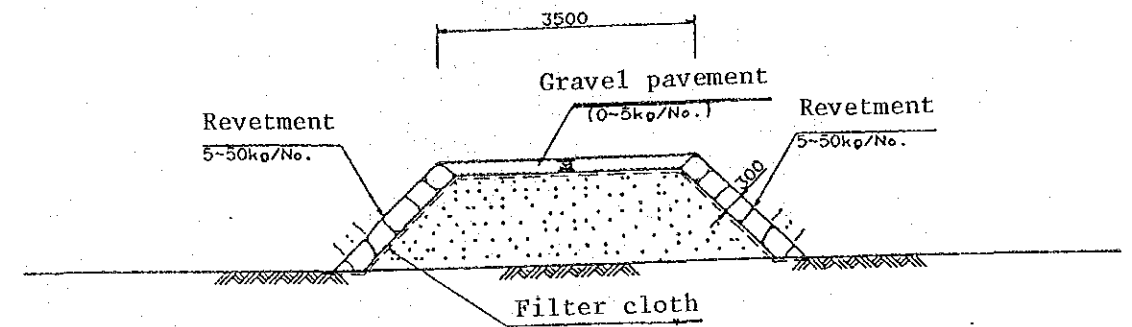
5. Access road and causeway of Gouyave Fishermen's Center site



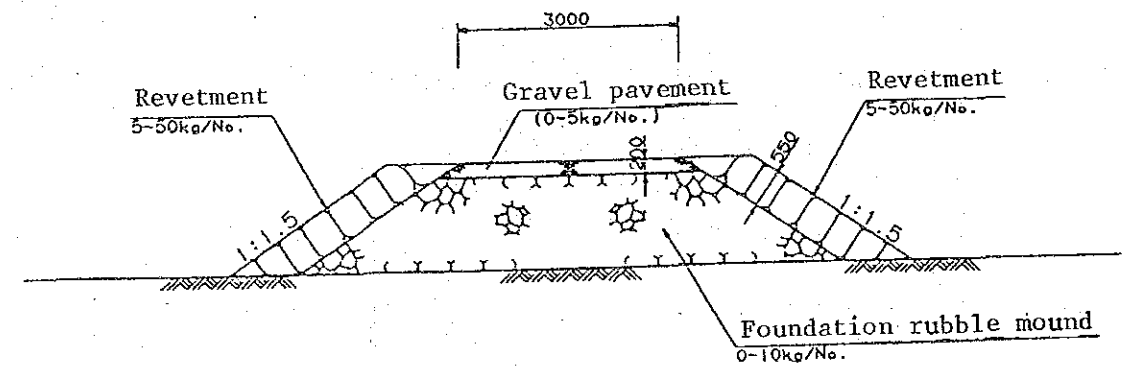
Site ground plan (Gouyave)
S=1:300



Precast concrete bridge
S=1:100

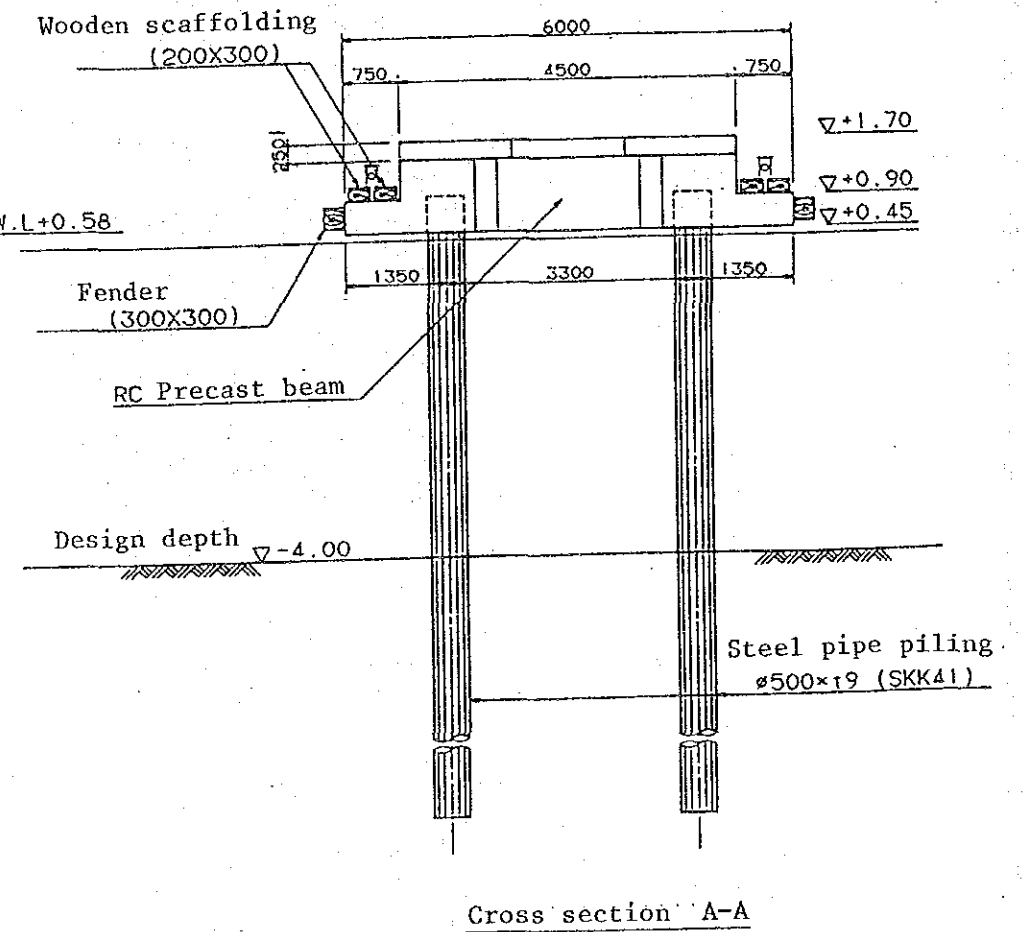
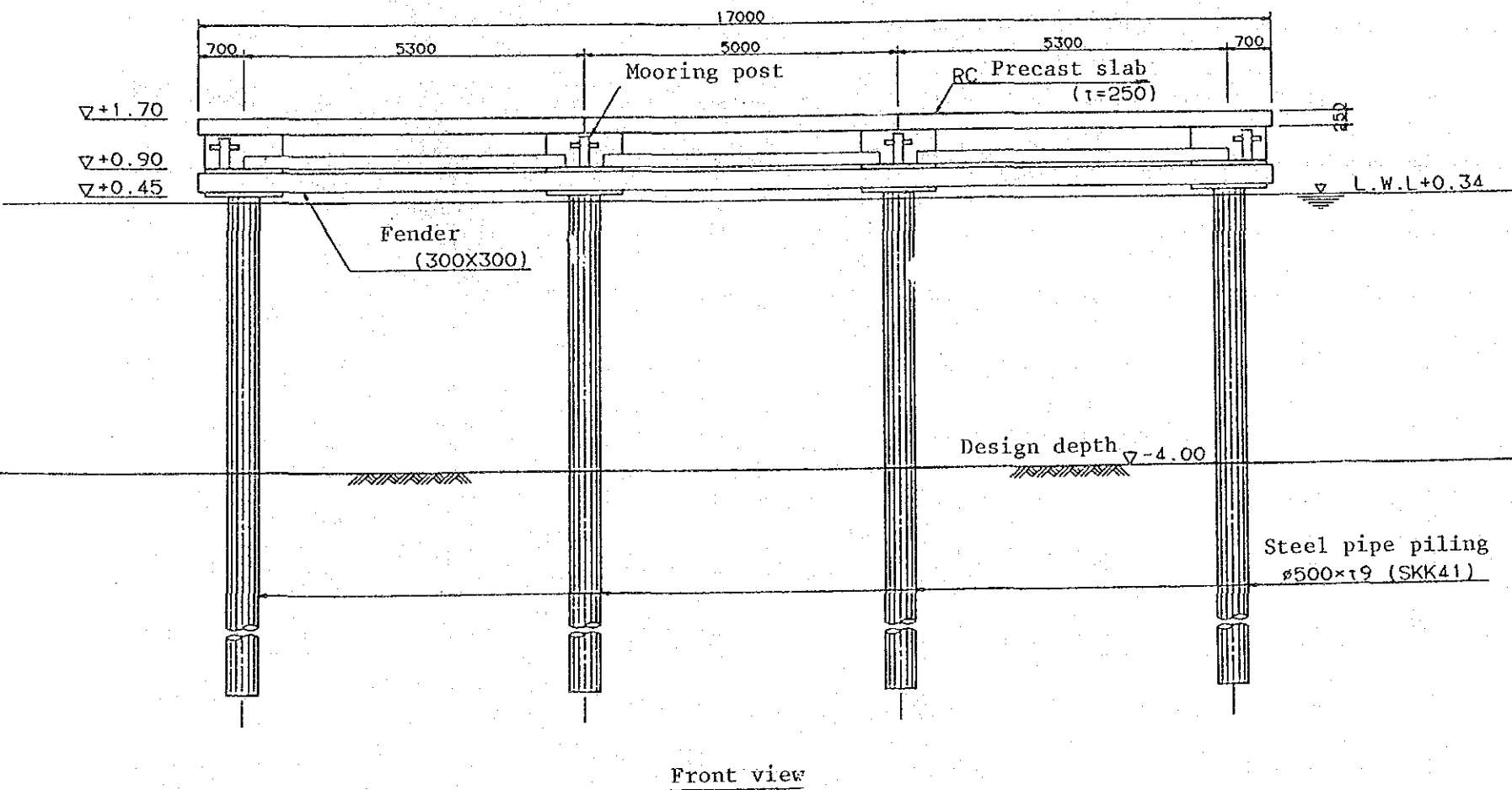
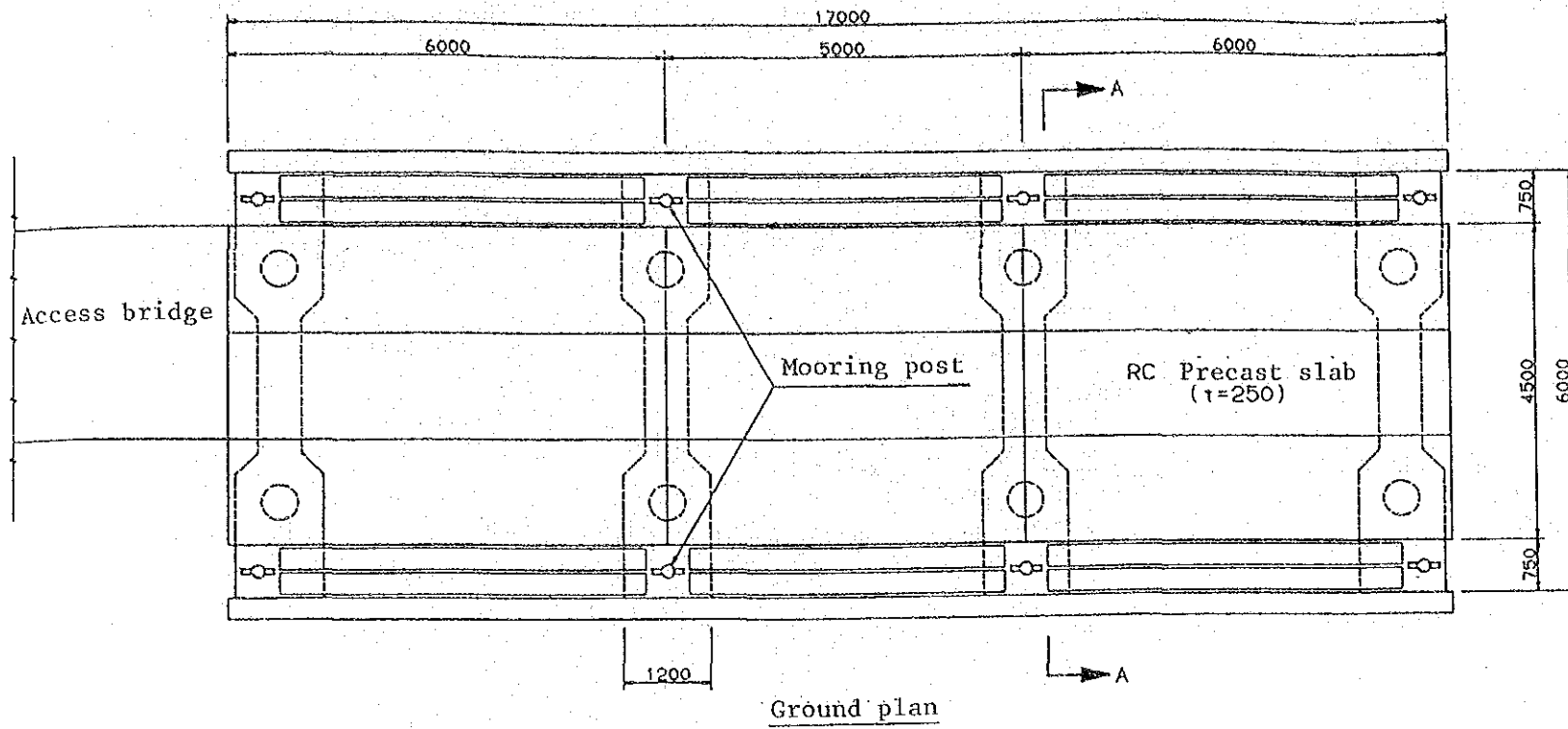


Standard cross section
(Access road) S=1:100



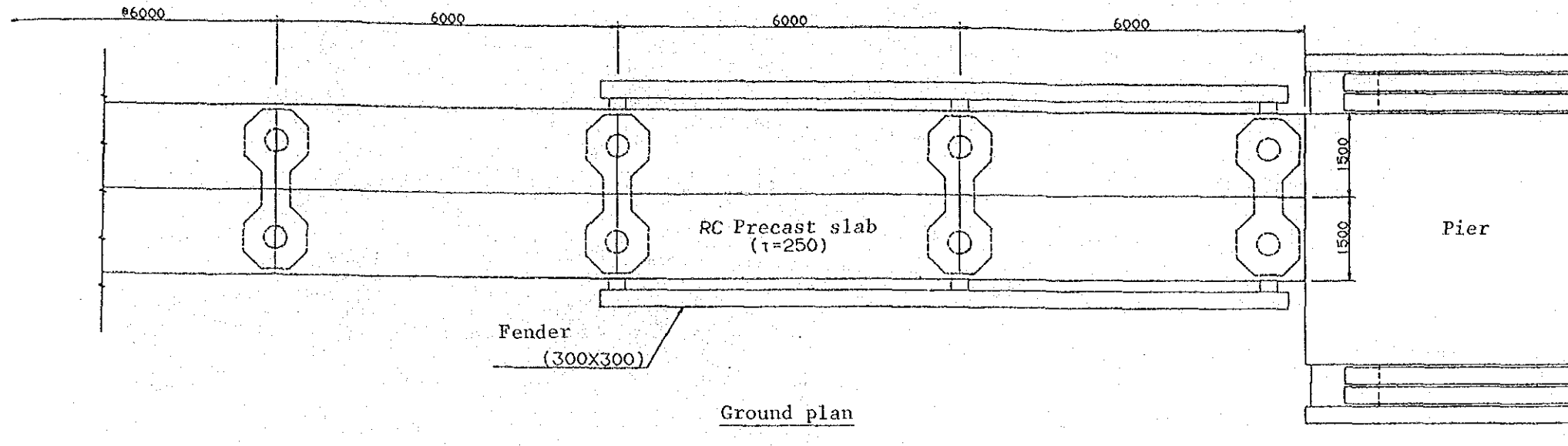
Standard cross section
(Causeway) S=1:100

6. Ground plan, side view and cross section of jetty

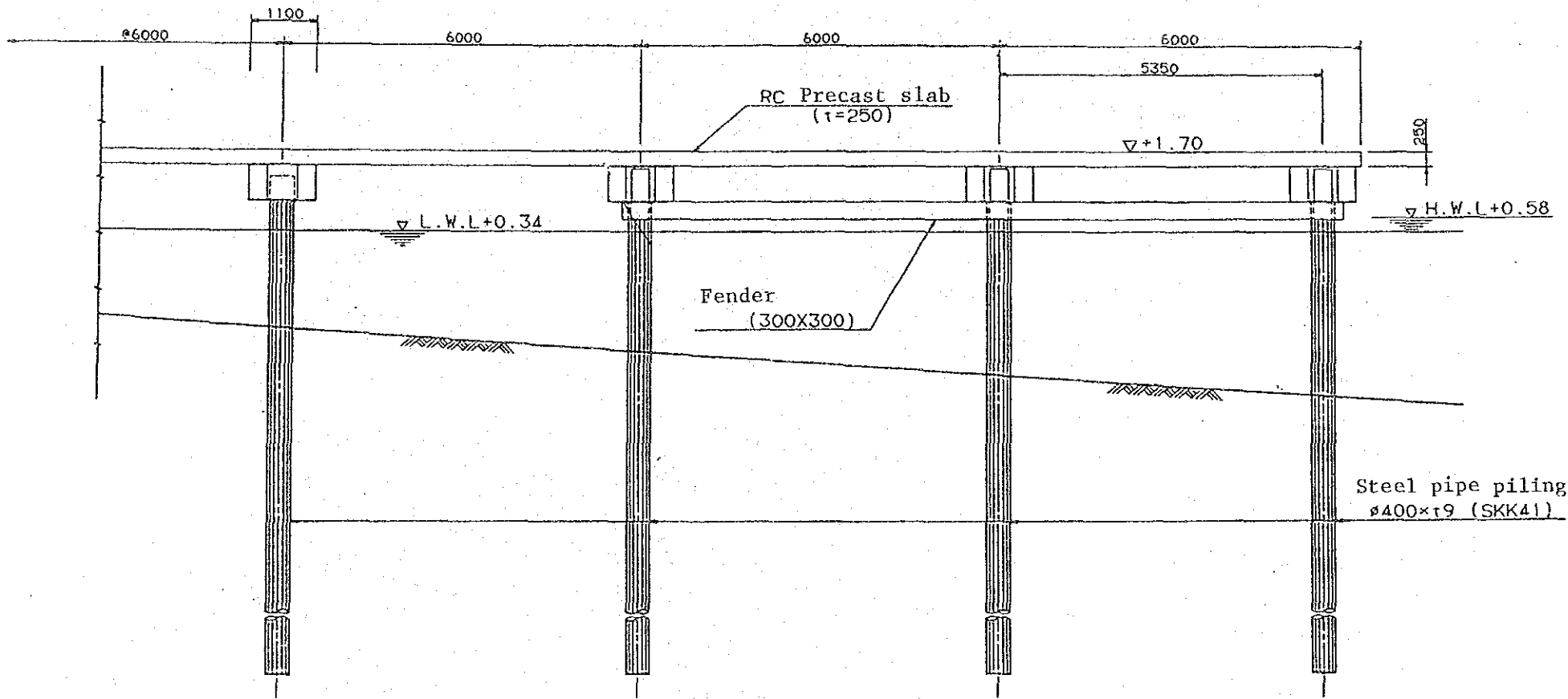


Pier
S=1:100

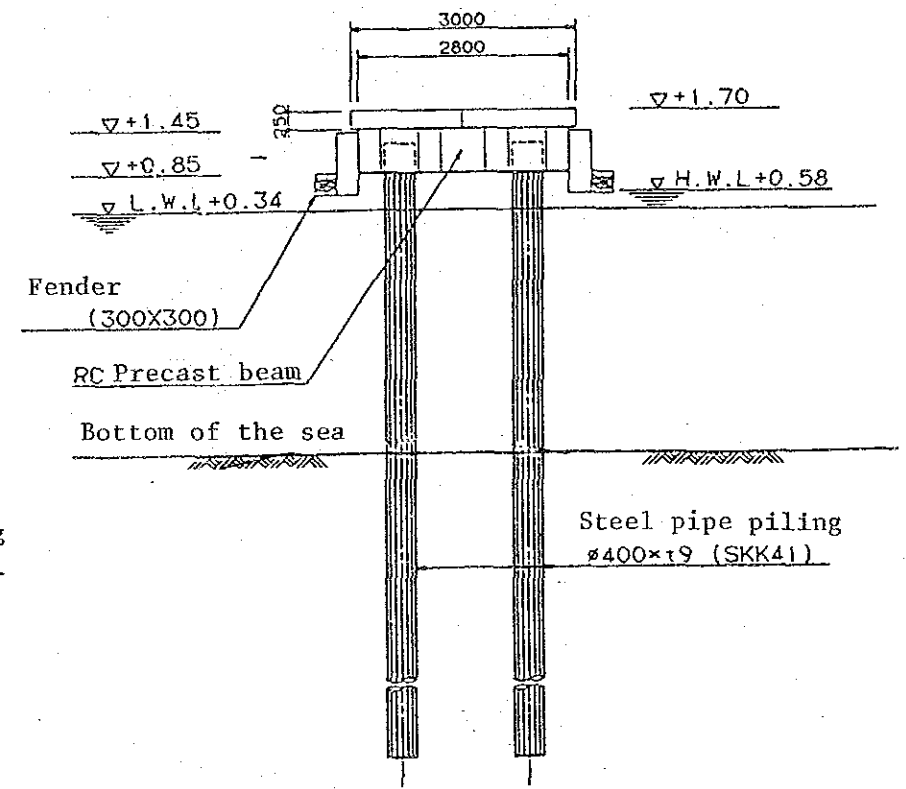
7. Ground plan, side view and cross section of access bridge



Ground plan



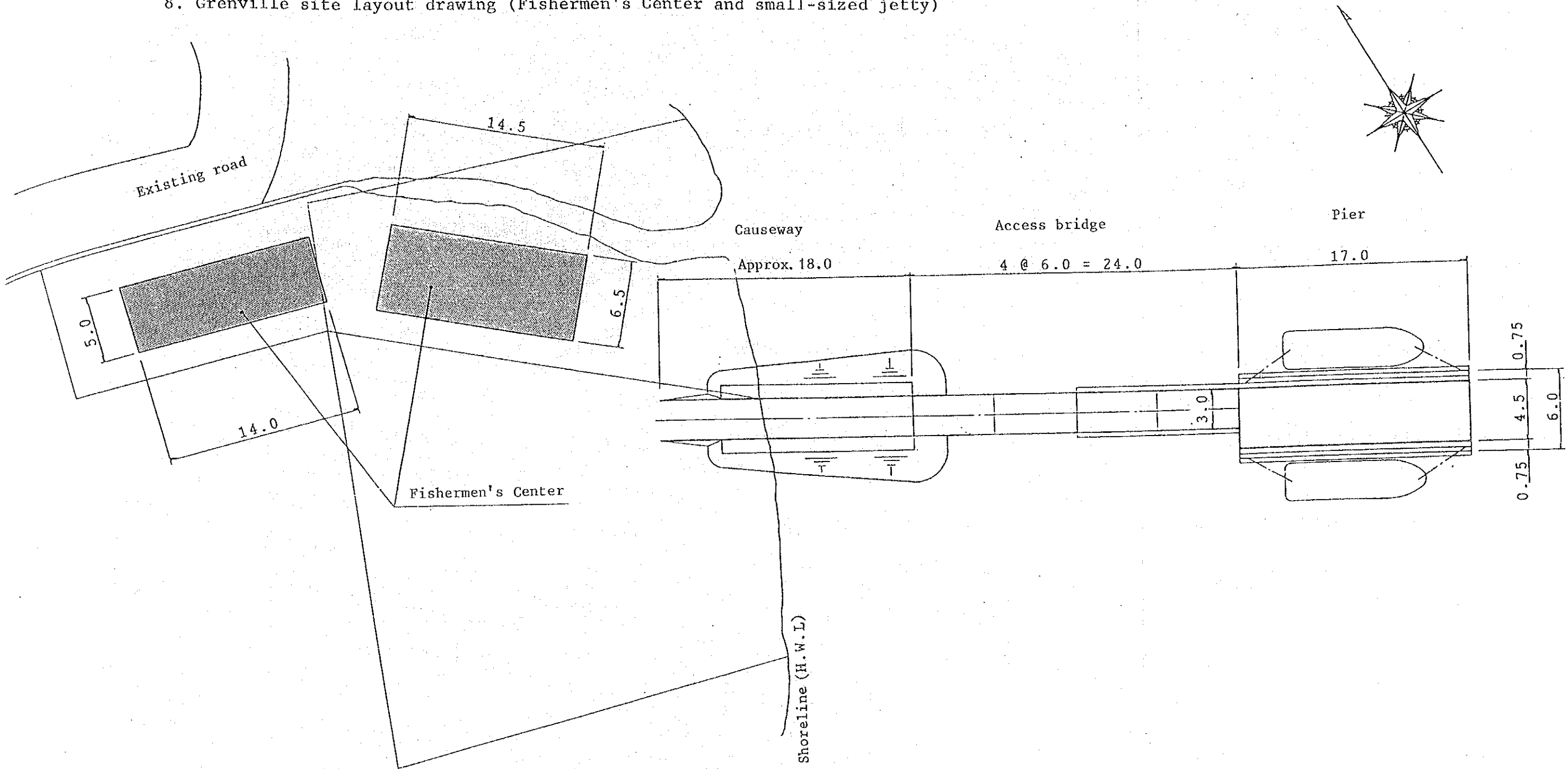
Side view



Standard cross section

Access bridge
S=1:100

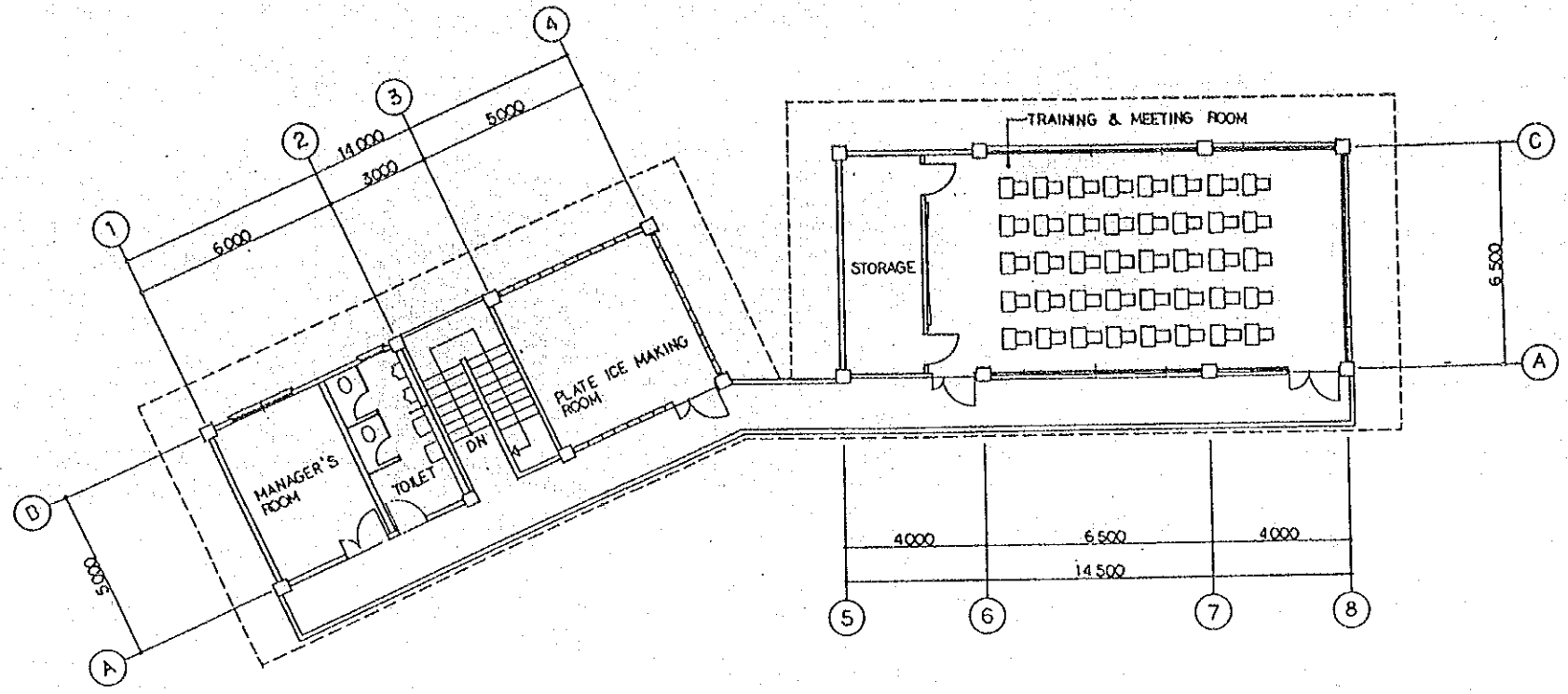
8. Grenville site layout drawing (Fishermen's Center and small-sized jetty)



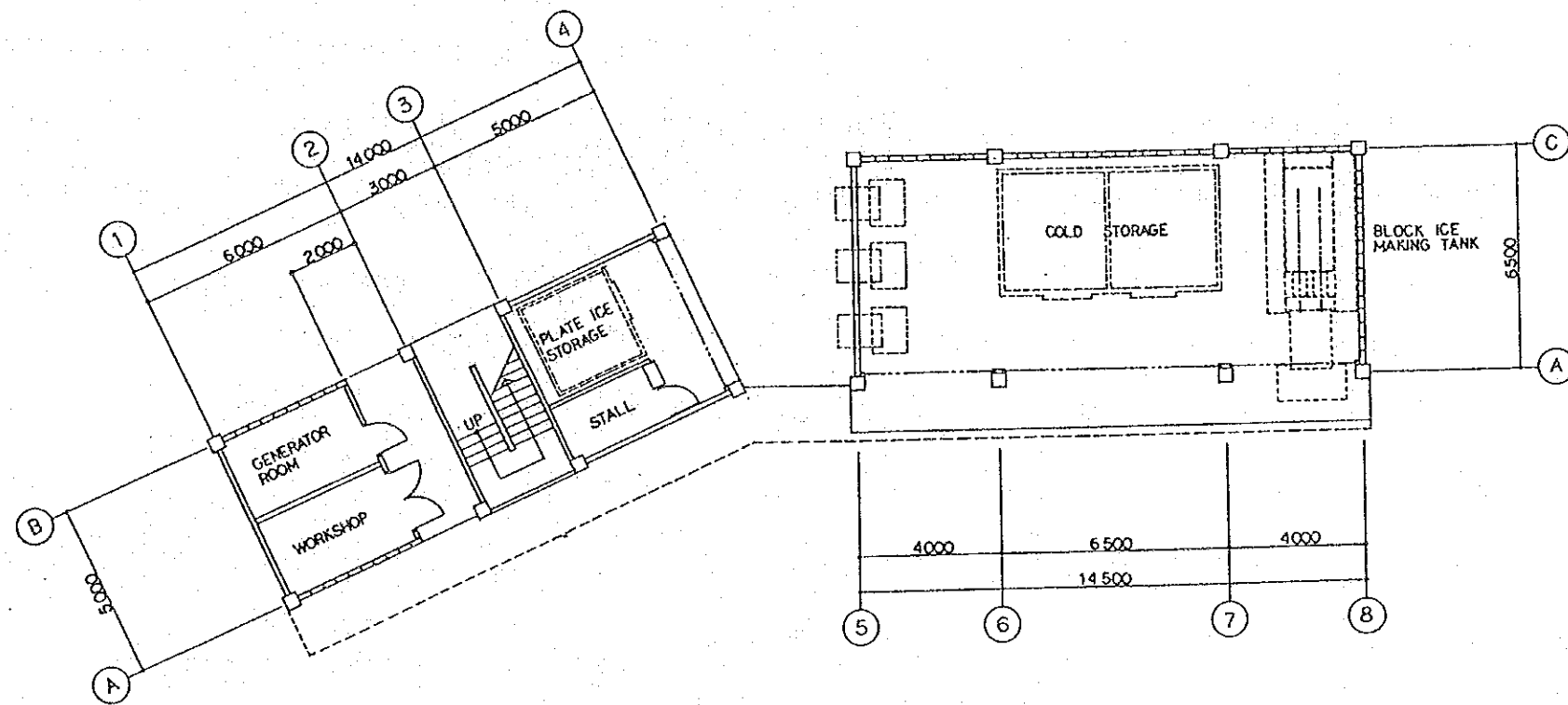
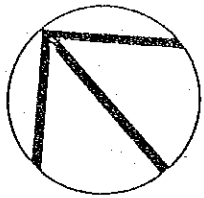
Site ground plan (Grenville)

Unit:m S=1:300

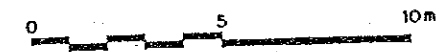
9. Grenville Fishermen's Center ground plan



1st FLOOR PLAN

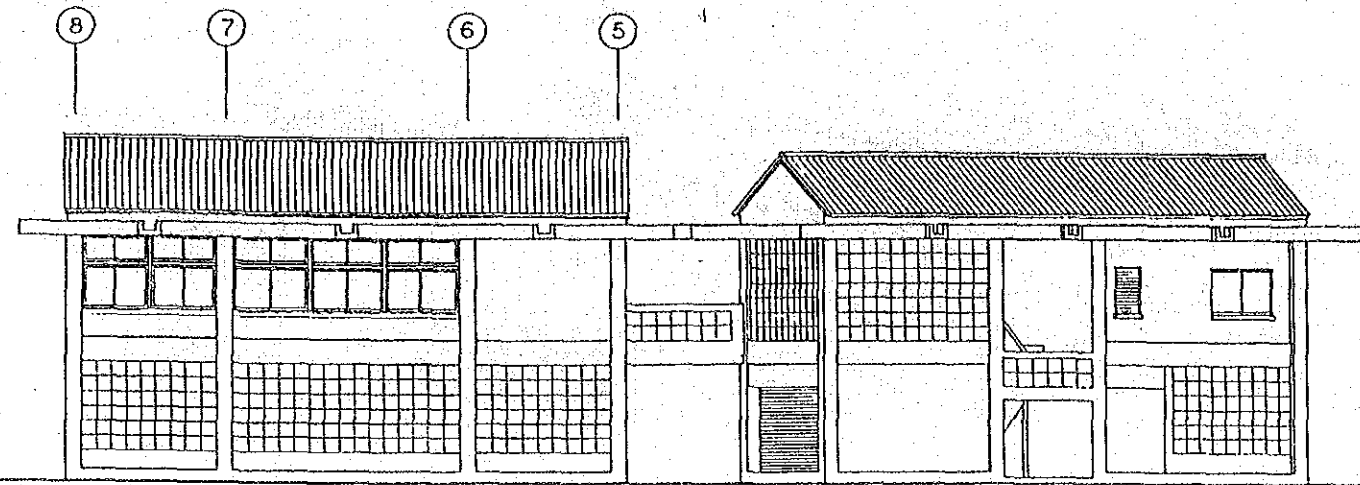


GROUND FLOOR PLAN

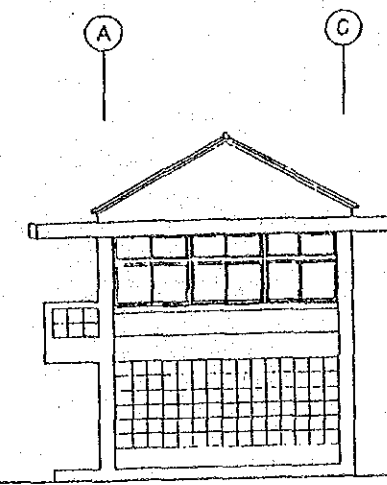


FISHERIES CENTER AT GRENVILLE

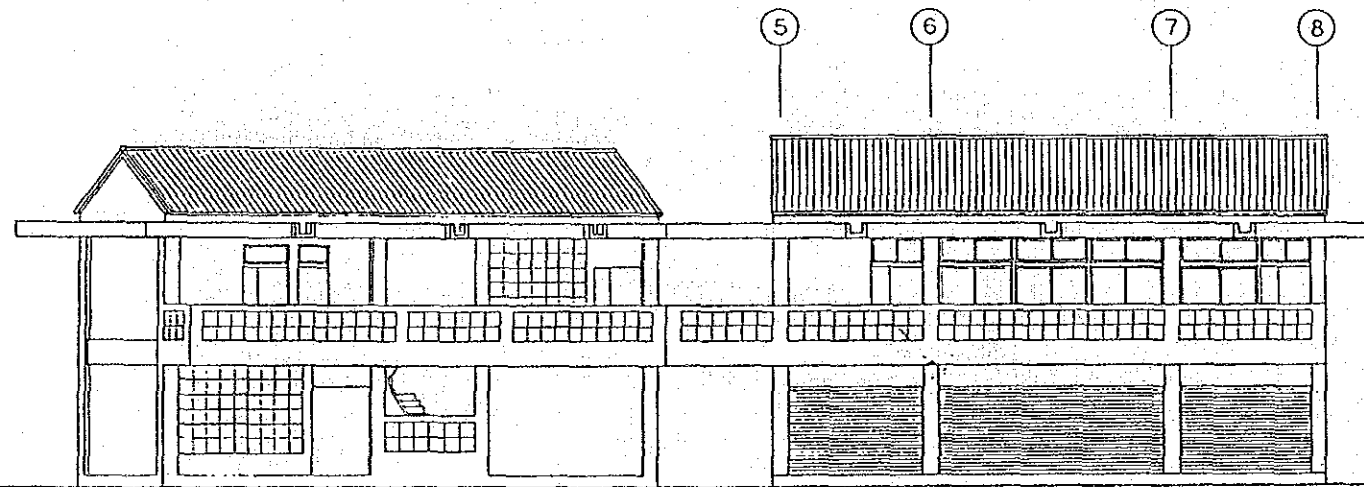
10. Grenville Fishermen's Center elevation



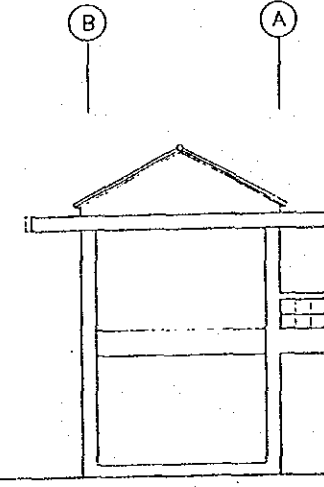
NORTH ELEVATION



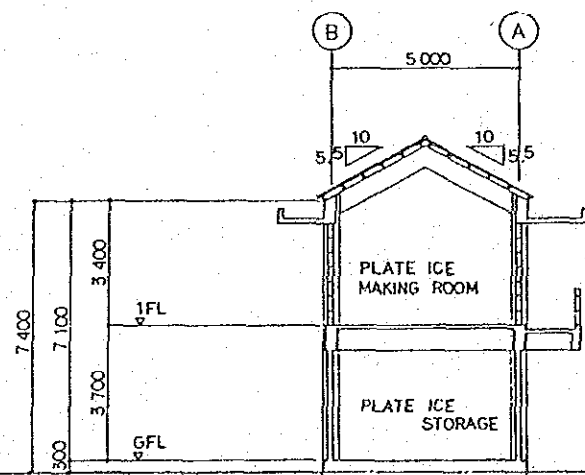
EAST ELEVATION



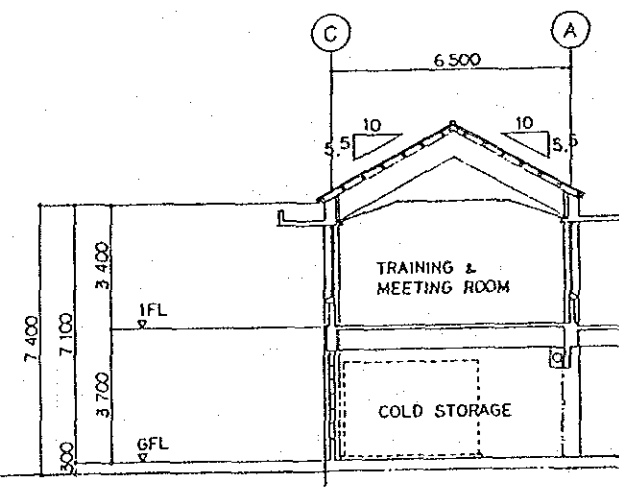
SOUTH ELEVATION



WEST ELEVATION



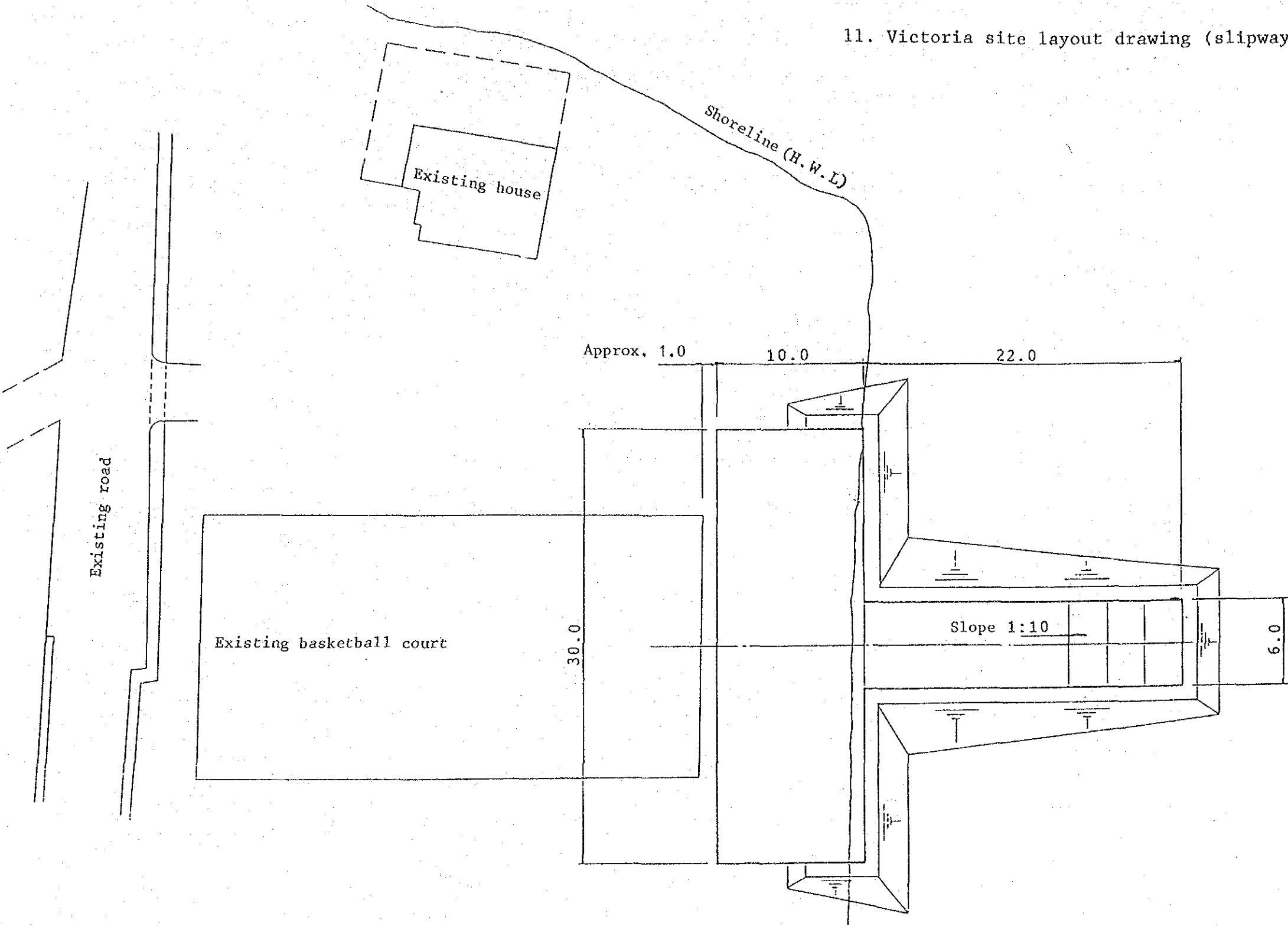
SECTION



SECTION



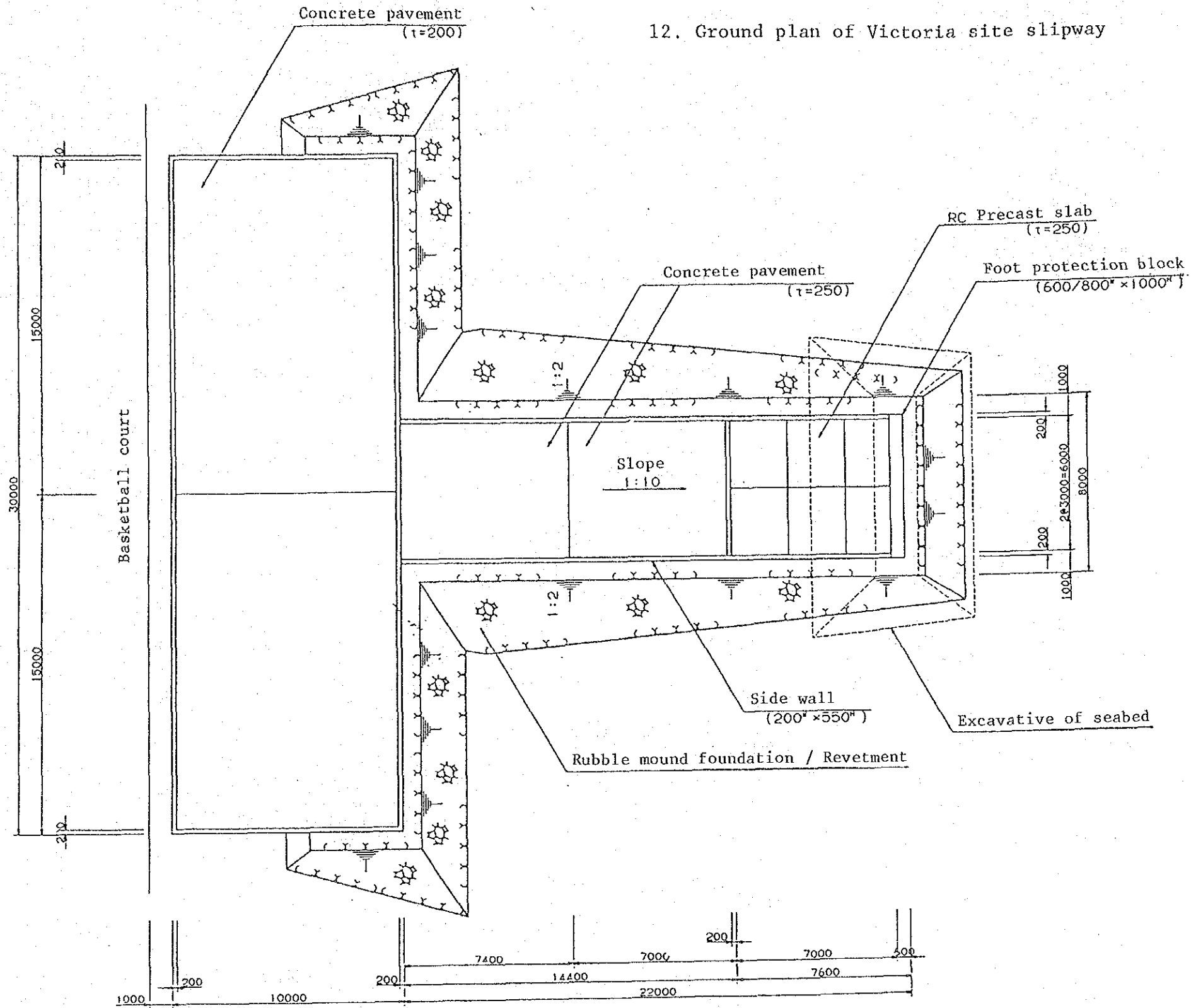
11. Victoria site layout drawing (slipway)



Site ground plan (Victoria)

Unit: m S=1:300

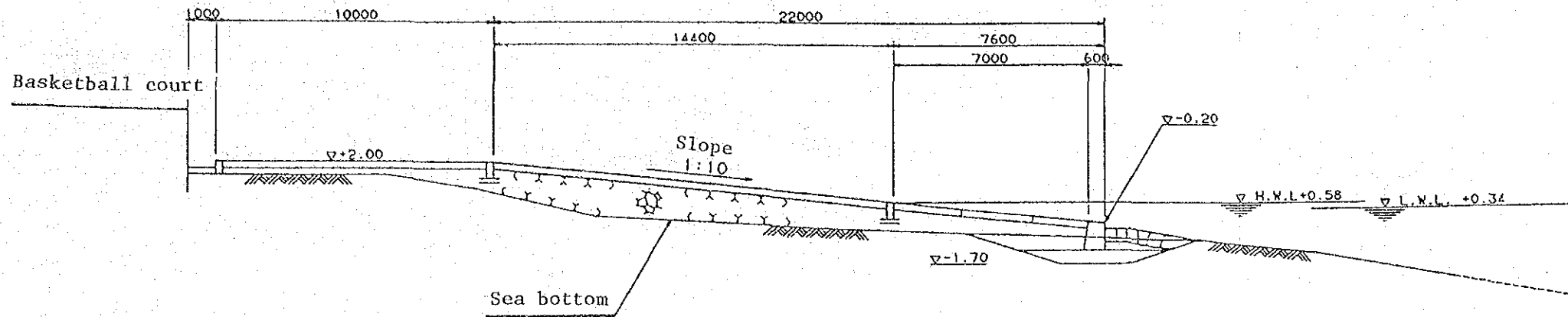
12. Ground plan of Victoria site slipway



Slipway (1) ground plan

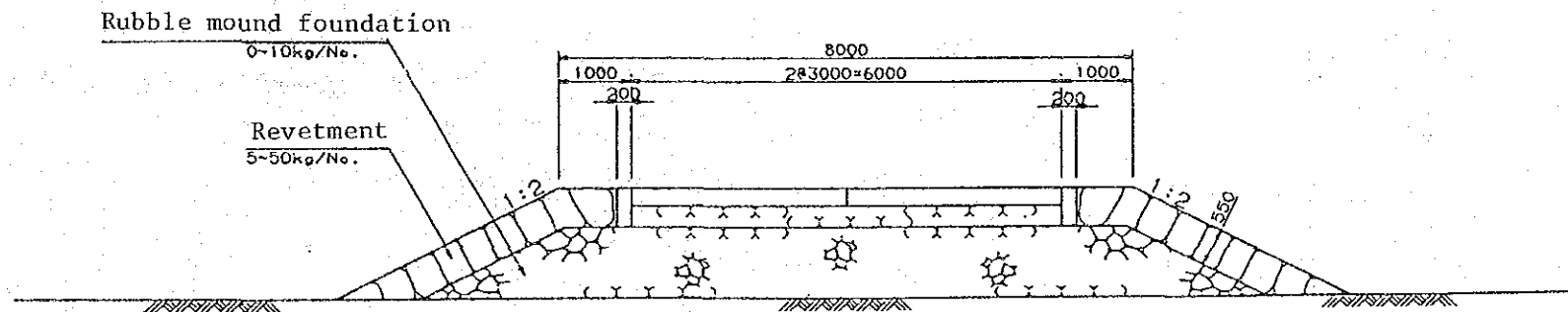
S=1:200

13. Side view and cross section of Victoria slipway



Side view

S=1:200

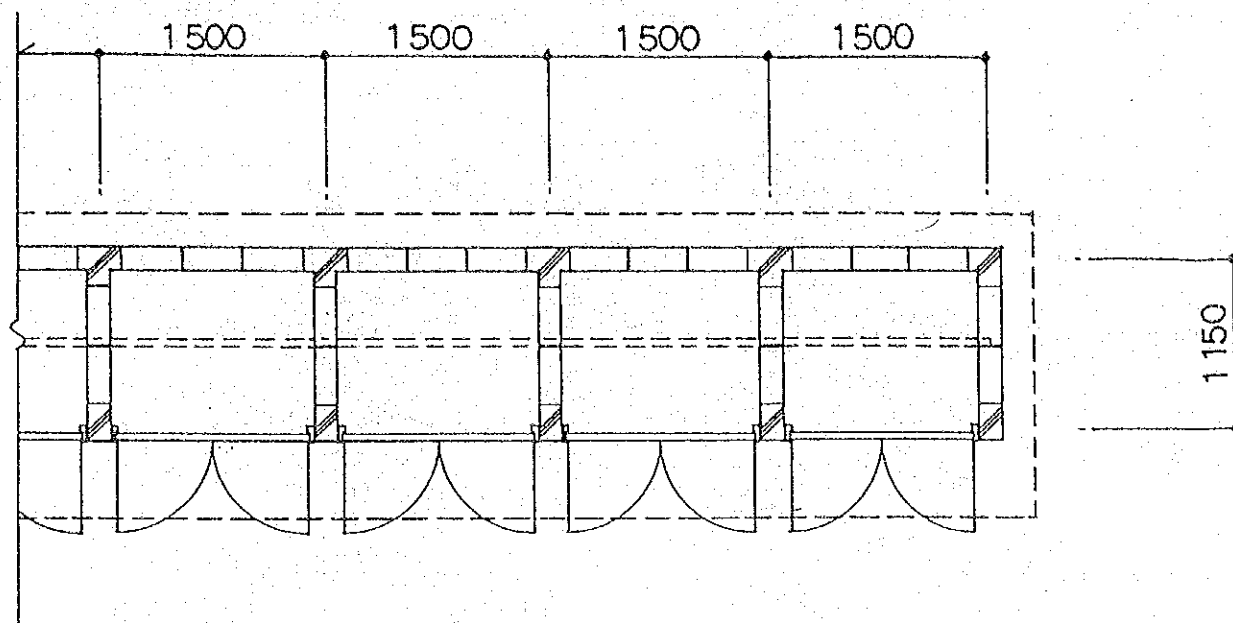


Standard cross section

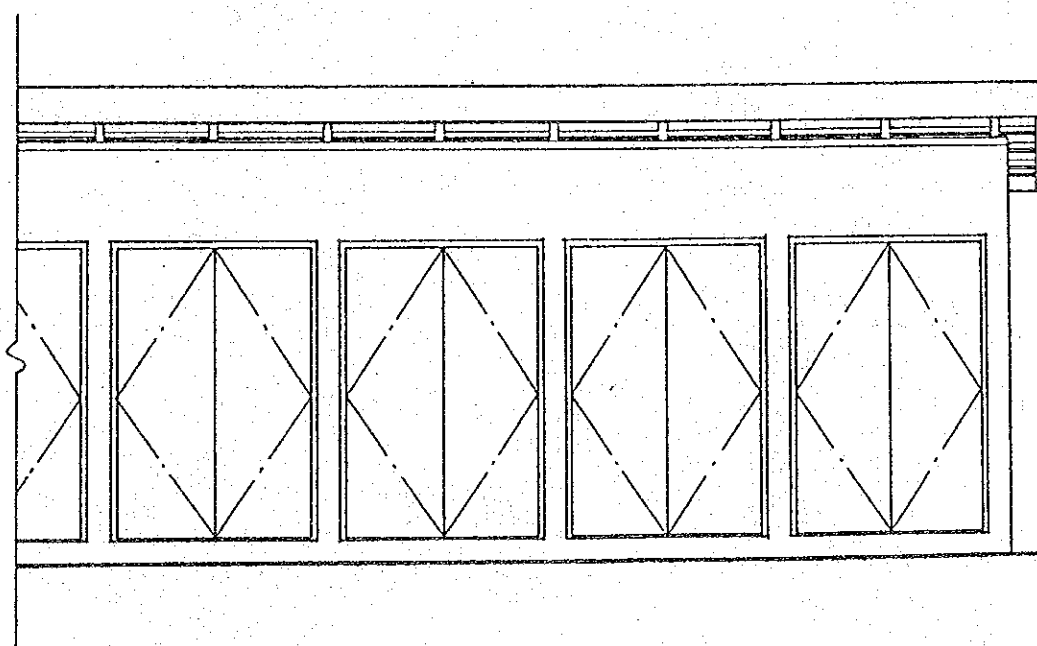
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Slipway (2)

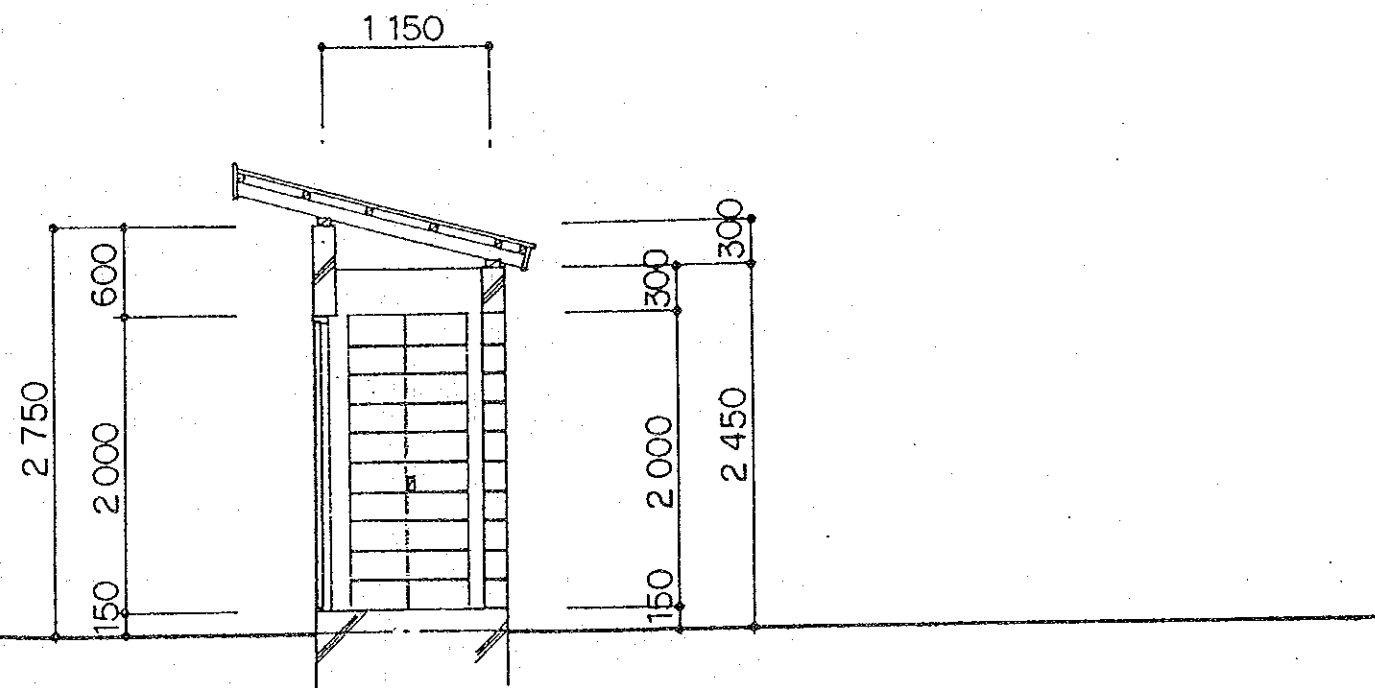
14. Ground plan, side view and cross section of Fishermen's lockers



TYPICAL PLAN



TYPICAL ELEVATION

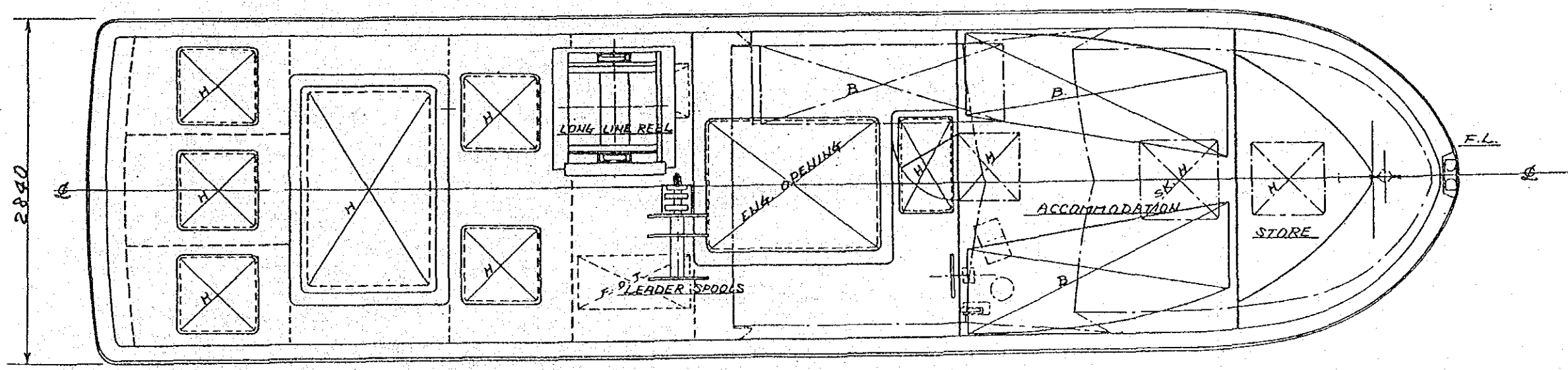
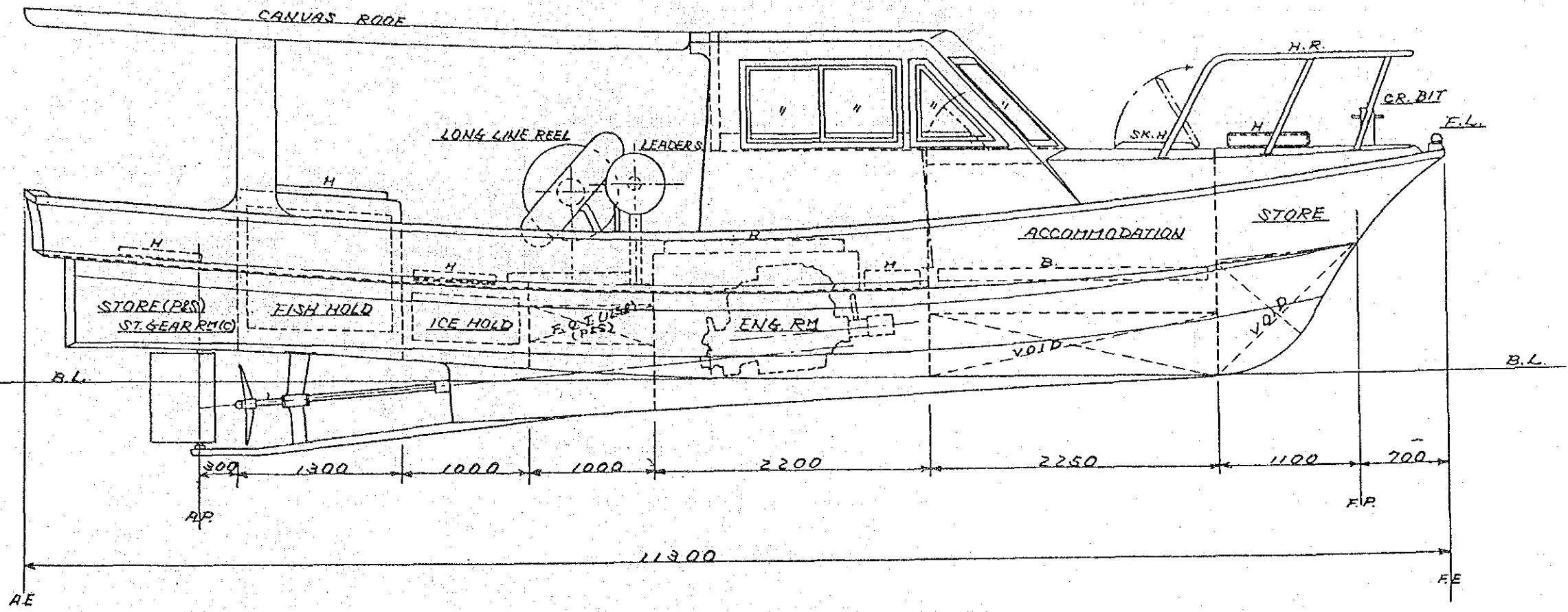


SECTION



LOCKERS

15. Inboard engine fishing boat



SCALE = 1/40

CHAPTER 4
PROJECT IMPLEMENTATION PLAN

CHAPTER 4 PROJECT IMPLEMENTATION PLAN

4-1 Executing and Supervisory Agency for Implementation of The Project

In Grenada the Land Planning Department of the Ministry of Health is in charge of authorization of works related to the land and the Ministry of Works is in charge of authorization of civil engineering and construction. Most of the public works carried out so far in Grenada involve the infrastructure sector and consist mainly of road construction with U.S. aid since 1984. It must be borne in mind, however, that the various infrastructure works were being carried out without much coordination and are under the control of different government offices so it is difficult to realize systematic implementation, control and operation. In 1988, the Government of Grenada decided to unify public works and the like carried out with financial resources provided mainly through aid programs under the control of the Ministry of Finance. The Ministry of Finance of Grenada will exert general control over this project. From the technical standpoint, the Land Planning Department of the Ministry of Health has authorization authority for land use and the Ministry of Works authorization authority for executing construction and civil engineering works. On the other hand, the Ministry of Education, Culture and Fisheries, which is the office in charge of the planning, implementation and operation of fisheries development projects, will serve as executive agency in charge of implementation of this project under the control of the Ministry of Finance.

4-2 Situation in the Construction and Civil Works Industry

As mentioned above, public works of various kinds have been carried out with financial aid from the U.S. over the past 5 years (a program for consolidation of the infrastructure with financial aid from the U.S. was completed in 1988), and the construction industry of Grenada grew dramatically during this period (the GNP of the construction industry grew by 15% in 1988). It must be borne in mind, however, that the availability of construction materials on the local market is very

limited. On the other hand, it must be noted that although the availability of hard currency in Grenada is limited there is no restriction on the import of construction materials and these can be procured from such places as the United States, Barbados, Trinidad Tobago, Venezuela, etc. Local contractors and laborers have no experience with large-scale construction works such as buildings and the like, but they have sufficient skill to cope with such construction and civil works as those ones to be executed under the project.

a. Construction materials:

At present, the following construction materials are being produced in Grenada.

Aggregates, sand and lumber (for temporary works).

It must be borne in mind, however, that thanks to the promotion of the construction industry such items as ready-mixed concrete, cement blocks, tiles and other roofing materials, asphalt and the like are being procured and fabricated by suppliers importing the required raw materials. Other materials can also be imported and supplied as needed.

b. Construction Equipment:

The Central Garage is in charge of the control and operation of construction equipment in Grenada. As a matter of fact, construction and civil works contractors on Grenada must borrow construction machinery from the Central Garage for their projects. It must be remembered, however, that the equipment of the Central Garage consists mainly of machinery for road for construction. Such equipment as barges, cranes and the like for harbor work are not available in Grenada, and they must be brought from Trinidad Tobago or from Barbados.

c. Transportation situation

As mentioned before, maintenance of roads on Grenada is reasonably good. However, for individual roads, there are restrictions regarding transportation of large-sized containers and lengthy commodities due to insufficient load bearing capacity of roads and bridges, steep slopes of mountain roads, etc.

4-3 Project Implementation Policies

Implementation of this project is planned in conformity with the following policies.

1. Overall plan

Careful explanation on implementation of the project must be carried out to assure maximum understanding of its mechanisms because Grenada has no experience regarding grant-in-aid cooperation from Japan.

2. Construction plan

Local labor and materials available in Grenada or in neighboring countries will be used as much as possible in this project. Moreover, careful attention will be paid to conservation of the environment at the project sites when executing the construction work. Furthermore, the winter season must be avoided when carrying out pile driving work and the underwater work required for construction of the jetties and slipways because Grenada is markedly influenced by the trade winds during this period.

3. Equipment & material plan

This project will be planned in such a way as to realize smooth operation of equipment and material supply, taking into consideration such factors as the technical skills of users of the facilities, equipment and materials to be supplied under the project, etc.

4-4 Implementation Plan

As for the materials required for construction and civil works under this project, such items as aggregates and sand and lumber for temporary works will be procured on the local market. Materials not available on the local market will be procured from neighboring countries. Basic construction machinery is available in Grenada but the barges and cranes required for constructing the jetties must be procured from neighboring countries. Such parts of the project as the construction of fishing boats, supply of machines for manufacturing insulated fish boxes, etc., will be handled by Japanese companies in view of production control advantages, but such items as winches for longlines, electric reels, etc., will be procured from third countries if appropriate equipment is not available in Japan.

Space of the order of 1,600m², for stocking materials, parking construction machinery, repair yard, manufacturing precast products, etc., will be required for the construction and civil works.

It was not possible to execute surveys to verify subsoil characteristics, particularly boring surveys, for this study. Boring surveys must be carried out as soon as possible within the context of detailed design work when the project is commenced in order to determine the proper construction method for the jetties.

4-5 Supervision Plan

Immediately after signing a contract on execution of detailed design work of the project with the Government of Grenada, the consultant will execute boring surveys with the object of evaluating geological conditions at the project sites. Field surveys and final discussions with executing and related agencies in Grenada will follow, and such work as preparation of detailed design drawings, preparation of structural calculations, preparation of bills of quantities, as well as formulation of tender specifications and other documents required for the bid will be carried out based on the results obtained. Such procedural steps as

approval of the project, pre-qualification, tender and tender evaluation will be arranged after completion of the tender documents, and suppliers and contractors in charge of the supply and work of implementing the project will be selected through an appropriate process.

After the signing of the relevant contracts by suppliers and contractors and the Government of Grenada, the consultant will check, from the technical standpoint, the construction drawings submitted by the contractors and the documentation for selection of equipment and materials submitted by the suppliers, will supervise the manufacture of equipment to be procured in Japan, will witness the quality tests to be carried out before shipment and will inspect quantities. Supervising engineers will be sent to Grenada to take charge of such duties as supervision of the work and quality control tests, witnessing of completion inspections and technical checks of all facilities and equipment handed over to the Government of Grenada under the project. The duties of the consultant will be regarded as finished with the approval of the Government of the Grenada.

4-6 Demarcation of Work under the Project

Demarcation of various parts of the work related to implementation of this project to be taken charge of by Japan and by Grenada is shown in the following table.

	Site	Japan	Grenada
Fishermen's Center	Gouyave	Construction, site ground level adjustment, revetment, exterior work, construction work	Removal of existing construction, felling of existing trees, supply of electric power, supply of water, ground levelling
	Grenville	Exterior work, construction work	Removal of existing construction, felling of trees, supply of electric power, supply of water
Small-sized jetty	Gouyave	Construction work of jetty and periphery	Felling of trees
	Grenville	Construction work of jetty and periphery	
Slipway	Victoria	Slipway construction work	Felling of trees
Fishermen's lockers	Gouyave	Construction work	Felling of trees, ground levelling
	Grenville	Construction work	Felling of trees, ground levelling
	Victoria	Construction work	Felling of trees, ground levelling
	Sauteurs	Construction work	Felling of trees, ground levelling
Materials for water system	Calliste	Supply of materials	Pipe laying work
Insulated fish box manufacturing machine	Calliste	Supply and installation of equipment	Provision of building, power and water
Stockers for retail	Various sites	Supply of equipment and materials	Transportation, installation

4-7 Implementation Schedule

Since land reclamation (embankment: the project site is inclined at Gouyave and load bearing of the existing ground is insufficient at Grenville) is required at the construction sites for the Fishermen's Centers included in this project, it is necessary to wait for the ground to stabilize before starting construction works. It is desirable to implement this project by dividing it into two stages. It must be kept in mind that although the machinery for manufacturing insulated fish boxes consists of relatively simple equipment, it will be introduced for the first time in Grenada. Under the circumstances, it is desirable to include this in the first stage of the project so as to allow the consultant to supervise and to provide guidance regarding operation during the second stage. Such being the case, implementation of this project will be divided into the following stages.

First stage : Construction work on jetties and slipways, reclamation of sites for Fishermen's Centers to be used concurrently as yards for jetty construction works, machinery for manufacturing insulated fish boxes, materials for water system.

Second stage: Construction of Fishermen's Centers, other facilities and equipment including small-sized inboard engine fishing boats.

From the standpoint of cost efficiency, it is not desirable to divide the civil works because the machinery for marine civil works will be procured from other countries. The project implementation schedule, including the supervision work, is shown in the following chart.

Implementation Schedule

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Type of work														
★ First stage: Exchange of notes of intent Consulting services														
Signature of contract, boring survey														
Execution design														
Tender														
Evaluation of proposals, witnessing of signature of contract														
Approval of drawings														
Inspection														
Work supervision														
Construction of facilities, procurement of materials														
Tender														
Signature of contract														
Approval of drawings														
Preparation work in Japan														
Transportation														
Execution of works														
Installation of equipment														
Completion of works and handing over														
★														
Second stage: Exchange of notes of intent Consulting services														
Signature of contract														
Execution design														
Tender														
Evaluation of proposals, witnessing of signature of contract														
Approval of drawings														
Inspection														
Work supervision														
Construction of facilities, procurement of materials														
Tender														
Signature of contract														
Approval of drawings														
Preparation work in Japan														
Transportation														
Execution of works														
Installation of equipment														
Completion of works and handing over														
★														

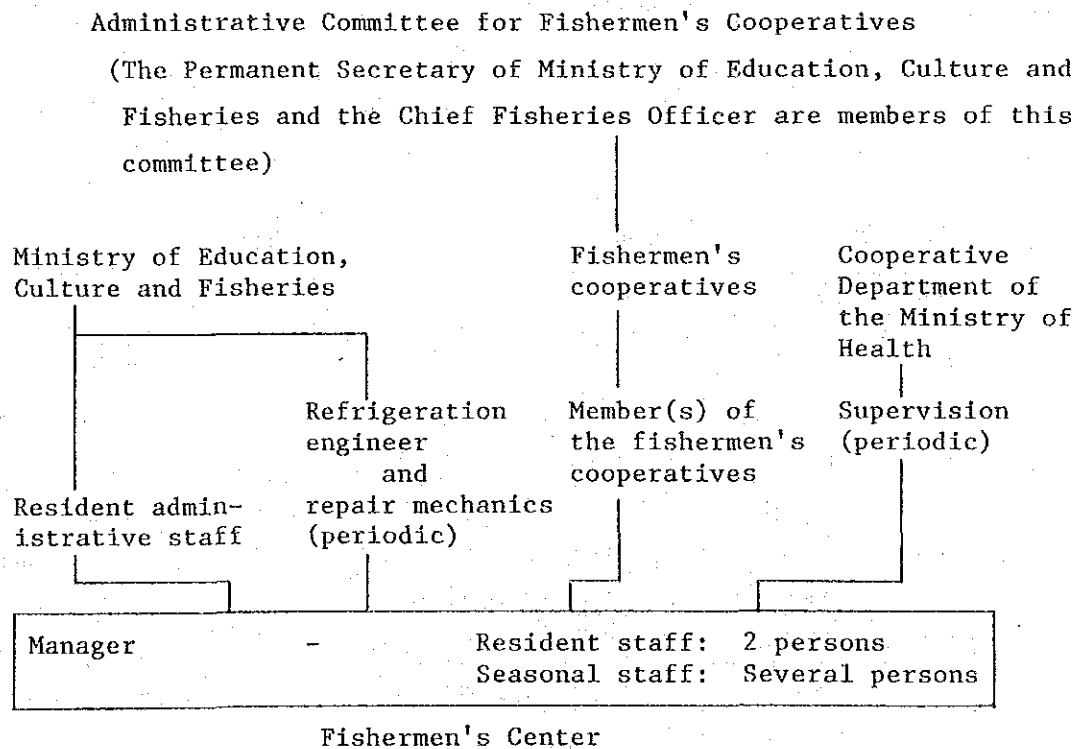
4-8 Maintenance and Control Plan

The system for operation of the various items in this project is described in the following.

1. Promotion of coastal fisheries

a. Fishermen's Centers

The allotment of sites for construction of the Fishermen's Centers is the responsibility of the Land Planning Department of the Ministry of Health. The Ministry of Education Culture and Fisheries is in charge of maintenance and control of the facilities. The concept of the Fishermen's Centers comprises a plan for promotion of fishermen's cooperatives so there are plans to transfer the facilities to the fishermen's cooperatives concurrently with smooth progress in the activities of these cooperatives. The schematics of the system of operation for Fishermen's Centers is shown in the following.



The Fishermen's Centers will be operated as a self-supporting system. The resident administrative staff (in charge of accounting and administrative affairs in general) will be dispatched from the Ministry of Education, Culture and Fisheries. Mechanics and supervisors of the cooperatives will be dispatched from their home workplaces as needed. The wages (EC\$500/month) of the staff, excluding the resident manager and other costs such as those for electricity, fuel oil, etc., will be covered from operating profits of the Fishermen's Centers. Duties to be performed at the Fishermen's Centers consist of implementing training and extension programs for fishermen periodically (50 persons x 2 times/month) by the Ministry of Education, Culture and Fisheries as well as routine fishing and distribution activities. The following profits are expected as a result of operation of the Fishermen's Centers.

Operational profit of small-sized inboard engine fishing boats

Ice sales	:	For fishermen	¢10/lb
		For ordinary use	¢25/lb
Cold storage rental	:	¢3/lb/day (for vendors)	
Weighing charges	:	¢3/lb.	
Fishermen's locker charges	:	EC\$5/month	
Insulated truck freight charges:		EC\$50/St. George's round trip	

b. Small-sized jetties

The small-sized jetties will be registered with the Port Authority. It must be remembered, however, that actual maintenance and control will be handled by the Ministry of Education, Culture and Fisheries, which is the user entity. The jetties will be used for landing of catches and replenishment of fuel/water, etc., for the boats included in this project. As a general rule the boats will be anchored in adjacent waters after landing and supply work. For existing small-sized outboard engine fishing boats, these new jetties will be used only as a secondary means of access. Handcarts will be used for transporting goods on the jetty, with the object of minimizing load conditions.

c. Inboard engine fishing boats

From the standpoint of the current level of technical skill of the local fishermen there should be no problem regarding operation of the fishing boats. It must be remembered, however, that the local fishermen do not have the financial resources to purchase these boats. According to the Commercial Bank of Grenada, which is responsible for fishermen's loans of the Artisanal Fisheries Development Project, the sum of loans regarded as appropriate is under US\$10,000. Even so, only 60 fishermen are able to cope with loans of this amount. Under the circumstances, the inboard engine fishing boats included in this project will be leased to the fishermen's cooperatives of Gouyave and Grenville. Operating expenses of the fishing boats will be borne by the fishermen's cooperatives and lease charges will be covered from the operating profits of the fishing boats. Financial resources for building substitute boats and for increasing the fleet of fishing boats will be raised from operating profits of the Fishermen's Centers as a whole. Crews of the fishing boats will be paid monthly wages proportional to the catch. Since there are many fishermen interested in operating fishing boats larger than the existing ones, the criteria mentioned below for selecting properly qualified fishermen, have been established under the supervision of the Ministry of Education, Culture and Fisheries. Crews consisting of fishermen meeting these criteria will be changed every year because the fishing boats supplied under the project are to be used to popularize the use of modern fishing boats. Fishermen satisfying the following criteria should be selected to crew the boats.

- 1) Good reputation as a fisherman,
- 2) Positive attitude toward the activities of the fishermen's cooperatives and participation in its training programs,
- 3) The fishing boats should be operated for periods longer than the minimum number of days directed by the Ministry of Education, Culture and Fisheries. A crew should be replaced by another if the fishing boat is found to be working uneconomically based on periodic evaluation of operations every 6 months.

The Ministry of Education, Culture and Fisheries will deposit the leasing charge for the inboard engine fishing boats collected from the fishermen's cooperatives in a revolving account opened for the this project and utilize it to promote the development of fisheries by purchasing new boats and fishing gear when sufficient funds are available.

2. Consolidation of fishing environment

a. Slipway for hauling out small-sized fishing boats

The slipway (including winches and fishermen's lockers) for hauling out small-sized fishing boats to be constructed at Victoria will be controlled and operated by the St. Mark's fishermen's cooperative. Fishermen's lockers will be required adjacent to the new slipway because it will be located 500 meters from the existing area for hauling out boats.

b. Fishermen's lockers

The fishermen's lockers will belong to the fishermen's cooperatives, which will be in charge of their maintenance and control. The St. John's and the Soubise fishermen's cooperatives will take charge of the maintenance and control of fishermen's lockers installed at the Fishermen's Centers of Gouyave and Grenville, and the St. Mark's and the St. Patrick fishermen's cooperatives will take charge of those at Victoria and Sauteurs, respectively.

c. Equipment for maintenance and repair

The Carenage shop of the Artisanal Fisheries Development Project, which is operating the existing repair shop, will be in charge of control and operation of tools and vehicles included in this Project. The repair service system of that shop for fisheries will be improved to cover areas that are not being served by maintenance and repair supplied so far. In particular, priority will be attached to upgrading the functions of repair and maintenance services at St. George's, Gouyave and Grenville so as to realize a nationwide network and to establish an effective service system.

3. Improvement of the distribution facilities

a. Insulated fish box manufacturing machine

Polystyrene beads must be imported for manufacturing insulated fish boxes in Grenada. The import of raw materials must be arranged with special care because beads have a short life of the order of six months. The insulated fish box manufacturing machine will be controlled and operated by the Artisanal Fisheries Development Project Office, which is in charge of the distribution and processing of fisheries products. This office is planning to install the machine in 2 building owned by the government in the vicinity of Calliste which was once used as a fish processing factory. Authorization to use the factory has already been obtained on condition of implementation of the project. Equipment at the factory has already been removed and as things now stand it is vacant. The building is a prefabricated $36 \times 9.5\text{m} = 342\text{m}^2$ steel frame structure accessed by a 6m-wide road. Since the space for installing the fish box manufacturing machine is of the order of 100m^2 , this building meets the basic requirements for installing the machine. The Artisanal Fisheries Development Project Office is planning to allocate two resident operators to handle production of the insulated fish boxes.

b. Retail stockers

A network for selling fresh fish is being developed concurrently with progress of the Artisanal Fisheries Development Project and 110 shops, located mainly in St. Andrew's, St. David's and St. George's parishes, have been contracted to handle fish. The distribution capacity is limited, however, because these shops are not properly equipped with facilities to maintain freshness. The distribution cost is as a result rather high because fresh fish must be delivered three times a week. Such being the case, small-sized stockers (small sized freezers) will be installed at shops in areas where the consumption of fish is expected to increase with the object of increasing supply and sales. The Artisanal Fisheries

Development Project Office will be responsible for distribution, maintenance and control of the equipment.

c. Insulated trucks

It is very difficult to secure means to transport fresh fish from the countryside to St. George's. Therefore, insulated trucks will be allocated at the two Fishermen's Centers and these will be used to transport and supply fresh fish to the Artisanal Fisheries Development Project Office of St. George's (Burns Point). The inclusion of two more vehicles in the existing fleet of trucks for transporting fish is expected to make a substantial contribution to improvement of fresh fish transport from the production sites to consumption markets because there are currently only four insulated trucks in use. These insulated trucks will be operated and controlled by the Fishermen's Centers and will be used mainly to support the trade of vendors responsible for the distribution of fresh fish.

CHAPTER 5 PROJECT EVALUATION

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5-1. Project Evaluation

When the contents of this Project are analyzed, it may be broadly divided into that portion which provides direct benefits to the fishermen by promoting coastal fisheries through the extension of modern technologies and the portion which reinforces the Government's support systems for coastal fisheries through improvements in the training of fishermen and the distribution system. The portion which extends direct benefits to the fishermen was planned so that smooth implementation of this Project, which aims for modernization of fisheries, will trigger technological innovation and improve the living standards of many and unspecified fishermen. The following is a list of where the facilities and equipment contained in this Project belong and where they will be transferred to.

Facilities & equipment	To whom they belong	To whom transferred
Fishermen's Centers	Ministry of Education, Culture & Fisheries	Will become the assets of the Ministry of Education, Culture and Fisheries although the Fishermen's Cooperatives, who will be the users, will be responsible for their management and maintenance. They will be transferred to the Fishermen's Cooperatives when the activities of the cooperatives have been fully developed.
Small jetties	Port Authority	Will become the statutory assets of the Port Authority although the Fishermen's Cooperatives, who will be the users, will be responsible for management and maintenance.

Slipway	Port Authority	Will become the statutory asset of the Port Authority although the Fishermen's Cooperative, who will be the user, will be responsible for management and maintenance.
Small inboard engine fishing boats	Fishermen's Cooperatives	The Fishermen's Cooperatives will pay the Ministry of Education, Culture and Fisheries the cost of the boats on installment and the Ministry will pool the account set up for this Project and use same for future fisheries promotion programs.
Fishermen's lockers	Fishermen's Centers (Fishermen's Cooperatives)	Where they belong and other matters same as the Fishermen's Centers.
Tools	Fishermen's Centers Ministry of Education, Culture and Fisheries	To be operated, managed and maintained by the Fishermen's Centers and AFDP Office of the Ministry of Education, Culture and Fisheries.
Materials for laying waterworks system for fisheries	Ministry of Education, Culture and Fisheries	The users, who are fishermen where the waterworks are installed, will be responsible for management and maintenance.
Mobile repair cars	Ministry of Education, Culture and Fisheries	AFDP Office will be responsible for management and maintenance.
Small trucks	Ministry of Education, Culture and Fisheries	AFDP Office will be responsible for management and maintenance.
Insulated fish box manufacturing machine	Ministry of Education, Culture and Fisheries	AFDP Office will be responsible for management and maintenance.
Retail stockers	Ministry of Education, Culture and Fisheries	AFDP Office will be responsible for management and maintenance.

The materials and equipment to be provided under this Project (among the equipment and materials listed above, the inboard engine fishing boats and safety equipment are the objects) will be leased to the fishermen's cooperatives and elsewhere and proceeds of sales will be pooled in a separate account set up for the Project by the Ministry of Education, Culture and Fisheries. Accumulated funds will be used for future fisheries development. If the leasing prices of all directly leased equipment and materials were to be recovered, the total would amount to roughly EC\$2,500,000 after subtracting leased commissions and collection charges (the fishing boats, etc. to be leased under the Project will be made in Japan and their depreciation charges and selling prices in this report are calculated on the basis of their ex-godown prices. However, considering that Japanese products are comparatively high priced in the international market, their actual leasing prices and depreciation charges, etc. will be based on import prices of equivalent products from the United States and elsewhere if those prices are lower). The recovered fund will be used as a revolving fund for importing and distributing fishing boats, fishing gear and other fishing materials, the costs of which would then be recovered by selling or leasing them to fishermen. The benefits that the revolving fund would bring, therefore, would be extremely large.

Of the facilities and equipment mentioned above, those the direct purpose of which lies in their being diffused will be successfully developed only when they are operated economically. A financial evaluation of the Fishermen's Centers and their various equipment, inboard engine fishing boats, insulated trucks, insulated fish box manufacturing machine and other equipment and materials which must be operated economically is given in the next paragraph. Particularly important is smooth operation of the Fishermen's Centers with primary emphasis on the promotion of activities of the fishermen's cooperatives. Grenada, which adopted socialist-oriented policies at one time, has a long history of cooperative activities (the Cooperative Societies Ordinance was enacted in the 1950s). However, it was only quite recently that it launched any promotion measures for fishermen's cooperatives so the activities of these cooperatives can hardly be claimed to be well rooted. The establishment of the Fishermen's Centers is therefore

included in this Project promote the activities of the fishermen's cooperatives at Gouyave and Grenville, the two largest fishing areas on Grenada. Promotion of the activities of the fishermen's cooperatives is the ubiquitous theme for fisheries development of many developing countries but implementation of effective promotion measures is always difficult due to the complex socio-economic factors of each country. Generally, the following factors and promotion measures are necessary for the development of fishermen's cooperatives.

- 1) A competent leader or manager who can personally manage the activities of the cooperatives is necessary.
- 2) The benefits of the members must be protected by fishing right or other means.
- 3) Cooperatives must have financial capabilities. Particularly in developing countries, cumbersome and time-consuming redtape often has to be cleared before official financial assistance reaches the members.
- 4) Cooperatives themselves must have the power to distribute their fish catches.
- 5) Many advantages other than the above must accrue to members.

It is necessary to analyze each of the above conditions for this Project, too, and unless all of them are satisfied, the objective of this Project, which is to promote the activities of the cooperatives, will be in vain.

- 1) The personnel assignment plan of this Project is to permanently station a staff member of the Fisheries Division of the Ministry of Education, Culture and Fisheries as the person responsible for the operation and management of each Fishermen's Center and to have the staff of the Cooperative Department periodically visit the Fishermen's Centers to offer guidance. As it is the judgement of the Ministry of Education, Culture and Fisheries that the Fishermen's

Centers at Gouyave and Grenville should be established as the pioneering nuclei for fisheries development in Grenada, it is likely that this will be reflected in its personnel assignment plan and that competent personnel will be selected to assume responsibility for operation and management of each Fishermen's Center.

- 2) The Fisheries Act of Grenada makes provisions for fishing rights but this is enforced only when granting permission to commercial fish interests and does not restrict anyone from freely participating in artisanal fishery. If fishery is to be promoted and established as an attractive occupation, however, it will be necessary to provide the fishermen with protection of their rights.
- 3) As later shown in the financial evaluation of the Fishermen's Centers, their position will be assured of considerable profit by smooth operation of the Project. Also, as stipulated in the Cooperative Societies Ordinance, no tax will be levied on the profits of the fishermen's cooperatives as they are juridical persons established for the welfare of the public, and their earnings can be internally reserved and effectively utilized as funds for the welfare of the fishermen and for fisheries promotion under an appropriate system of control.
- 4) Effective utilization of cold storages, ice making machines, insulated trucks and other transportation equipment and materials which are to be provided for the Fishermen's Centers will improve distribution of catches from the producing areas to the consuming areas. The equipment and materials will remedy the problem of accumulation of stock at the producing areas, especially during the peak fishing season, and afford incentives for the fishermen who, being freed of worries about distribution, will be able to concentrate on their fishing activities.
- 5) Through implementation of the Project, members of the cooperatives will be allowed the use of equipment and materials made available through operation of the Fishermen's Centers and will be eligible for various services on a priority basis. For instance, they will

be allowed to participate in operating the inboard engine fishing boats introduced for diffusion (during the participation period, attractive pay will be ensured), and be able to purchase fishing gear, receive training, access repair services, and obtain ice through Fishermen's Centers. In these ways, the fishermen who find no advantage in becoming cooperative members at present will be encouraged to recognize the benefits of membership and participation in the activities of the cooperatives.

Also, government support, which hitherto had failed to reach some areas of fisheries development, will be reinforced by implementation of the Project. Firstly, training of fishermen, which has been conducted sporadically at various places in the past, will be integrated and offered at the Fishermen's Centers at two places. With this integration, the training programs can be implemented more efficiently and be higher in density. Furthermore, implementation of the Project will allow facilities and materials to be supplied to Victoria, Sauteurs and Calliste, places the support of the Ministry of Education, Culture and Fisheries has not reached as readily as in Gouyave and Grenville and thus deepen the ties between the Ministry and the fishermen in those places, which is important for future fisheries development.

The insulated fish box manufacturing machine is expected to have a major impact on the fisheries industry. Firstly, the provision of insulated fish boxes for the many and unspecified fishermen (although they will be limited to those in the vicinity of existing fishing centers and those planned under this Project which are able to acquire supplies of ice) will allow the uneconomical fishing mode that prevails today (fishermen are compelled to allocate only a short time for fishing relative to the long time that they spend going to and from fishing grounds in order to retain the freshness of their catches) to be replaced by a more effective and economical one. Secondly, it will improve the current mode of distribution and transportation which uses no ice and allow fresh fish to be supplied in larger quantities to the consuming areas. Furthermore, when demersal fisheries, which are to be promoted mainly in Grenville through inducement of small inboard engine fishing boats, is developed so as to be able to promote exports to neighboring

countries where the demand for demersal fish is large, insulated fish boxes will become important components of the system.

The inclusion of the inboard engine fishing boats in the Project will allow Grenada's coastal fisheries to target development of fisheries resources in distant waters and thus increase fish catches and develop the industry. The contribution of the fisheries industry in animating the stagnating economy of Grenada centered on agricultural production will have a significant impact on the economic development of Grenada.

The effects expected from implementation of the Project are summarized as follows.

- 1) Promotion of the activities of fishermen's cooperatives,
- 2) Integration and improved efficiency of training for fishermen,
- 3) Smoother repairs to fishing equipment and apparatus,
- 4) Brighter prospects for future programs through the effective, utilization of the revolving fund (by the Ministry of Education, Culture and Fisheries and also the fishermen's cooperatives),
- 5) Development of offshore fisheries resources by modern fishing methods. The major objective of the Project is diffusion of technologies for modern fisheries, and with their diffusion, a substantial increase in fish catch is anticipated.

Catch/year by small inboard : 66,000 lbs. x 8 boats = 528,000 lbs.
engine fishing boats

Increased production/year by : 4,400 lbs x 200 boats = 880,000 lbs.
use of insulated fish boxes

1,408,000 lbs.

In other words, an increase in production of approx. 630 tons per year (an increase of about 30% over and above 1987 production) can be expected.

- 6) Consolidation and improvement of the fishing environment,
- 7) Improvement in catch distribution,
- 8) Promotion of fish exports.