

Bakau fish landing spot, and to encourage them to get rid of the form of very artisanal operations.

- ⑤ To strengthen the artisanal fisheries promotion activities managed by Bakau Subcommittee and Project Management Committee and to induce synergic effect (combined effect by simultaneous promotion of many activities) of the support activities.
- ⑥ To improve the hygienic environment suited to siting conditions of the Bakau fish landing spot
- ⑦ To promote supply of fish as source of animal protein supply for Gambian nationals, through management of the artisanal fisheries support facilities including implementation of the project and operation of the fisheries equipment at the Bakau fish landing spot

4-2 Study and examination on the request

(1) Adequacy and necessity of the project

In The Gambia, fishes are ranked as an important source of animal protein supply for Gambian nationals. Especially bonga as mass school type fish are traded in a great variety of ways in addition to being handled as fresh fish and smoked products; for example they are roasted on the roadside with a small burner and traded as roast fish, or are minced and sold at the retail market. They are extensively used as a low-priced daily household dish among Gambian nationals. In The Gambia where tourism industry is ranked as a key to economic development, supply of high-priced fresh fishes is drawing the attention of the people concerned as providing a promising commercial market against the background of the tourist demands for fishery products. By performing operations oriented toward such a market, it is considered to be possible to promote improvement of added value in management of artisanal fisheries; hence independent development of the artisanal fisheries.

Against this background, triggered by the improvement of the land facilities, ranking of the Bakau fish landing spot as an urban & tourist resort type fish landing place for artisanal fisheries is going to be clearly defined. By contrast, looking at the situation of fish landing operations, wooden canoes must be pulled down and up the beach at the time of departure and landing due to lack of proper fish landing facilities. This required improvement in the efficiency of fish landing operations, and daily works of pulling up

and down the canoe on the beach will cause earlier deterioration of the canoe. The severe work of pulling them up is one of the major factors hindering adoption of increased size of the canoe.

The purpose of the project is to construct the proper fish landing facilities and to improve fishing equipment such as fishing canoes and fishing gears in order to provide further promotion to the artisanal fisheries operations placed under such situation at the Bakau fish landing spot. The project is considered to be much needed and is appropriate from the viewpoint of maintaining and promoting the artisanal fisheries operations at the Bakau fish landing spot, and improving the fishing people's household management, as well as from the viewpoint of maintaining and promoting supply of animal protein for Gambian nationals.

(2) Implementation and management plan

This project is implemented by the Fisheries Department of the Ministry of Natural Resources and the Environment, and is managed by the Bakau Subcommittee and Project Management Committee which are currently managing the land facilities under the guidance of the Fisheries Department. For the management system, the current organization is reinforced; in this case, the current organization is taken over without expanding it, with its personnel requirements filled by increasing the staff. Operation of the land facilities by the Bakau Subcommittee and Project Management Committee started in June 1993. Effective operation has been performed so far, registering some operation earnings. The operation earnings are controlled as artisanal fisheries promotion fund, and financial control conditions are satisfactory.

(3) Relationship with similar projects

Banjul fishing port repair project is similar to this project. However, it is a repair project to cover a large scale industrial fisheries port for large steel-made trawl vessels, while the present project covering the canoe type vessels for artisanal fisheries; so there is no overlap in the coverage between these two projects. Landing for the artisanal fishing is also operated at part of the Banjul fishing port. It is intended for the stow net fishing at the River Gambia which is not covered by the present project. In this respect there is no overlap with the present project. In the field of artisanal fisheries promotion, aid activities by international organizations and foreign countries are sluggish in recent years, and there is no project which overlaps with the present project.

(4) Study of the project and component factors

The functions of the fishing facilities and equipment according to the project can be classified into three factors which are related to the artisanal fisheries activities carried out on the basis of the Bakau fish landing spot; (1) fisheries production capacity improvement support, (2) operation improvement support for departure for fishing and fish landing and (3) fishermen's household management support by promoting the multi-operations between surrounding gill net fishing and bottom gill net fishing for improvement of added value for operations. When these three factors perform simultaneous working in the process from fisheries to marketing, the maximum effect is ensured in artisanal fisheries promotion. In this sense, the component factors of the present project have no excess or deficiency.

(5) Study of the contents of required facilities and equipment

1) Fish landing facilities (fish landing jetty oriented facilities)

In the artisanal fisheries of The Gambia centering on the one-day operation, the limited fishing operation time is further limited by the time required to pull down and up the canoe on the beach at the time of departure of shore early in the morning, at the time of return to the spot and at the time of fish landing. This trend is conspicuous for the fishermen who own larger canoes having a great fishing production capacity such as surrounding gill net fishing and large hand line fishing canoes. It has given rise to a vicious circle that poor efficiency of the fish landing becomes a greater bottleneck for the entire operation, as operating efficiency is increased according to the learning curve effect (operation skill is improved and productivity is increased with operating experience). In The Gambia where fresh fish marketing support facilities such as cold storage and fish preservation facilities are insufficient, the major current of the fresh fish distribution system for the moment is that fish landing is completed before 4 o'clock in the afternoon and fish catches are brought to the evening retail market. This can be said to be the optimum way of reflecting the value of the fisheries products to the benefits of Gambian nationals at a low cost.

Under these circumstances, improvement of the fish landing operation by installing the suitable fish landing facilities will bring about improvement of the fishing productivity by increase of the operable time, and improvement of the added value by minimizing the post-harvest loss in the fish landing process. When large canoes can be moored, deterioration of the canoes will be greatly minimized. It will have a great significance in the improvement and development of entire artisanal fisheries. To ensure effective use of the fish landing facilities,

introduction of hand carts used to assist the fish landing work will improve the form of sorting the fish products in the country where fish catches are carried on the shoulder, and will lead to an effective use of fish landing facilities.

2) FRP fishing canoes

In the adverse environment where construction of houses is progressing in the movement for improvement of the living standards and urbanization, and wood resource growing area is reducing by development of the housing lot, the environmental factor of shortage of wood resources in The Gambia is given pressure to the national economy through increased wood imports, and is becoming a bottleneck for economic development of the country.

Under these circumstances, how to support the construction for fishing canoes which are the core of the fisheries production and how to ensure the fishing canoe for the new enthusiastic successors as a result of the fishermen training is the biggest problem for the promotion measures of the Fisheries Department. In the growing motivation of fishermen for operation management as a result of the fishermen training project, on the other hand, excellent rigidity of and safety of the FRP fishing canoes against the offshore, rough weather conditions is highly evaluated among the fishermen.

Against this background, introduction of the FRP fishing canoes is considered to be very significant in stabilizing the fishing household management by prolonging the service life of the ship hull and in promoting the modernization of artisanal fisheries. However, appropriate FRP fishing canoes to be introduced are the canoe type vessels which are used in the artisanal fisheries of The Gambia, and the boat type 4-ton purse seiner listed as part of the requested vessels is not proper to be covered by the present project because of its scale, operation system and applicability to the fishing ground. Therefore, only the FRP fishing canoes are covered by this project. Since the spread of the FRP fishing canoes is still in the transitional phase, on the other hand, it is necessary to establish the FRP fishing canoe hull maintenance and repair system by introduction of related tools and materials.

3) Outboard engines

In the artisanal fisheries in western Africa using the fishing canoes, efforts are made to achieve improvement of operability by motorization of the canoes with outboard engines, expansion of the fishing ground, and increase of the fishing

production, taking advantage of the simplicity, convenience and adequate traveling speed. In The Gambia which is also following the similar pattern, motorization of the fishing canoes is proceeding. It can be said that motorization in the major fisheries production area is carried out, with the major target set to large fishing canoes. On the other hand, in the recent fisheries promotion, it is becoming a major task to push forward the improvement of operation form in the small hand line fishing canoes placed under the artisanal management in artisanal fisheries, and to promote modernization in small hand line fishing method aiming at conversion into medium scale management in future.

Under these circumstances, the motorization rate of the fishing canoes is low at the Bakau fish landing spot. Motorization is going on mainly with the large fishing canoes, but at present only 14 out of 42 canoes have been motorized. Since the outboard engines are imported products, motorization for artisanal fishermen amounts to a great temporary investment. This situation makes it necessary to provide some adequate means of procuring such equipment. To solve this problem, the Fisheries Department selects competent fishermen and writes letters of recommendation to get a bank loan, thereby promoting motorization. Against this background, it is considered to be significant in the promotion of artisanal fisheries to introduce the outboard engines in order to maintain motorization of the already motorized fishing canoes and to promote motorization, so that excellent small fishing canoes will reach the national level of motorization. Furthermore, motorization by outboard engines requires establishment of a system to ensure constant supply of spare parts, as well as a repair and maintenance system. In The Gambia which is a smaller country, the import lot is small, so the import price is higher. Thus, introduction of the outboard engines requires consideration of the supply of spare parts.

4) Fishing gears

For fisheries management, fishing gears have characteristics not as capital goods but as consumption goods for fisheries operation. In The Gambia where the economic scale is smaller, possibility of domestic production of fishing net is slim, and the country has to depend on imports. On the other hand, since fishing gears are consumption goods, the amount of consumption inevitably increases with the activated operation. At present, those engaged in artisanal fisheries purchase the fishing gears imported on the private basis, or get the gears which the Fisheries Department sells to the excellent fishermen at a low price for promotion purposes. The fishing gears which are supplied by the Fisheries

Department and which can be got so long as they work hard and are enthusiastically engaged in fisheries activities are attractive to the fishermen in the artisanal fisheries yet to break from the artisanal fisheries management. Fishing gear sales profits, together with the outboard engine sales profit, are used as a basis for the artisanal fisheries promotion fund of the Fisheries Department. This fund is used to provide financial support to the artisanal fisheries promotion activities in The Gambia.

From this viewpoint, it is significant to prepare the fishing gears within the range of supporting the promotion of artisanal fisheries at the Bakau fish landing spot in this project. However, it is not proper in this project to introduce all the fish gears which should be basically purchased at the market. It is considered to be proper to introduce the fishing gears required for the multi-operation to be performed with FRP fishing canoes which are to be introduced in this project.

5) 4WD vehicles

The requested four-wheel drive vehicles are to be used for fisheries promotion support activities to be implemented by the Bakau Subcommittee and Project Management Committee. This project is intended not only to just open the facilities to the artisanal fisheries fishermen but also to render the artisanal fisheries activities support service. At present there is no vehicle which can take part in these support services. It is considered necessary to introduce the scale and number of vehicles in conformity to appropriateness of the contents and objectives of the support activities.

6) VHF radio telephone

The requested VHF radio telephone sets are used for communication between two insulated vans funded by 1991 Japan's grant aid and their control office. Insulated vans are used to transport the fresh fish in the local area. Since there is no telephone network in local districts of The Gambia, it is considered essential to introduce the radio telephone in order to strengthen the insulated vans transportation system.

7) Materials for hygienic environment improvement for fish landing spot

This is a new item added during the basic design study. It consists of worm preventive vinyl sheets for the drying shelves and small basckets as beach bins to store the fish waste which are disposed of at the Bakau fish landing spot. A great interest is taken of the environmental hygiene at the Bakau fish landing spot

surrounded by commercial districts and tourist resorts. Improvement of hygienic environment at the fish landing spot is one of the major tasks for implementation of this project. Even though it is a fish landing spot for artisanal fisheries, its functions can be fully used only if it is adapted to the surrounding and is accepted by the inhabitants of the surrounding area and visitors. From this viewpoint, the above mentioned equipment are considered to be required.

4-3 Project description

(1) Executing agency and operational structure

This project is implemented by the Fisheries Department of the Ministry of Natural Resources and the Environment, and is managed by the Bakau Subcommittee and Project Management Committee which are currently managing the land facilities under the guidance of the Fisheries Department. The activities to be implemented by the managing organization include extension of such current activities as artisanal fisheries marketing support activity, fishing equipment sales activity and industrial artisanal fisheries operation support activity; they further include new additional activities such as artisanal fish landing support activity, FRP fishing canoes maintenance support activity and hygienic environment improvement activity for the fish landing beach related to the facilities and equipment of this project. The staff of the current organization will be increased to meet the requirements of the management system required for implementation of these activities to be expanded and reinforced.

Fig. 3 illustrates the current organization. The staff in the Facilities Maintenance unit will be increased to meet the requirements of the fish landing support activity and environment improvement activity as new additional activities, and the staff in the Outboard Engine Maintenance and Repairs unit will be increased to meet the requirement of the FRP fishing canoes maintenance support activity. The requirements of the expansion of current activities can be met by the current members. Table 7 illustrates the members after implementation of this project.

Table 7 Project Management Committee Member

		Personnel expenses (Dalasis/month)
1. Management members		
1)	One project manager (Rep. of fishermen)	500
2)	One sub-manager (Rep. of fishermen)	500
3)	One accountant manager (Rep. of the district)	500
4)	One technical advisor (dispatched from the Fisheries Dept.)	—
2. Staff members		
1)	Two refrigeration engineers (project staff)	1,500
2)	Three guards (project staff)	1,300
3)	Three trainers (dispatched from the Fisheries Dept.)	—
4)	Two in charge of fisheries processing and statistics (dispatched from the Fisheries Dept.)	—
5)	Three in charge of money collection, fishing and marketing (project staff)	900
6)	One in charge of miscellaneous works (project staff)	200
7)	Two in charge of cleaning (project staff)	600
8)	Two insulated van drivers (project staff)	800
9)	One clerk (project staff)	300
10)	Two fish landing facilities managers (project staff)	800
11)	One FRP maintenance engineer (dispatched from the Fisheries Dept.)	—
12)	Two support vehicle drivers (project staff)	800
13)	One environment improvement instructor (project staff)	300
Total		9,000 Dalasis/month
	28 persons	

A total of 28 persons are required for implementation of this project. Six of 28 persons will be dispatched from the Fisheries Department in the early stage, and personnel expenses will be borne by the Fisheries Department. Personnel expenses for the dispatched staff are funded from the fisheries extension activity budget of the Fisheries Department. The Fisheries Department has been placing emphasis on the field of fisheries extension. While the total budget of the Fisheries Department is growing at the rate of about 12%, the fisheries extension budget shows an growth of 20% or more. The Fisheries Department has started preparation for the budget required for this project (See Table 1).

The personnel expenses for managing personnel and project staff except for those dispatched from the Fisheries Department are paid from the earnings from operations of the facilities. Table 2-12 shows the balance of earnings and expenses at the Bakau fish landing spot. Judging from this balance, it is capable of paying personnel expenses.

(2) Project activities plan

The Bakau Subcommittee and Project Management Committee, managing organizations of this project, have already started the artisanal fisheries promotion activity. They will be implementing the following activities when this project is implemented:

1) Activities already under way

- ① Ice making and sales:
production and sales of plate ice under a daily production capacity of 3 tons
- ② Outboard engine maintenance and repairs:
spare parts sales, simple repair service, and diesel outboard engine maintenance instruction
- ③ Artisanal fisheries support:
artisanal fishermen support such as rent of fishermen lockers
- ④ Artisanal fish handling and processing improvement:
smoking oven, fish drying shelf, related processing technique instruction service
- ⑤ Artisanal fish marketing support:
fish handling procedure improvement instruction by renting the fish boxes and releasing the preservation facilities, and fresh fish marketing support service to the inland area by renting the insulated vans.
- ⑥ Fishing equipment sales:
sales of the outboard engines and fishing gears to the excellent fishermen, and recommendation service for getting bank loans
- ⑦ Commercial artisanal fisheries activities support:
artisanal fisheries form improvement instruction such as promotion of multi-operation by joint operation of the FRP canoes with excellent fishermen
- ⑧ Fishermen training:
new fishermen training and instruction tied up with the fishermen training program of the Fisheries Department

2) New activities

- ① Artisanal fish landing support
 - i. Instruction and control of berthing and mooring of artisanal fishing canoes at landing facilities
 - ii. Berthing and mooring control for other vessels
 - iii. Maintenance of fish landing facilities
- ② FRP fishing canoe maintenance support
 - i. Instruction of FRP fishing canoe hull maintenance technique
 - ii. Instruction of FRP fishing canoe maintenance technique
- ③ Hygienic environment improvement at fish landing beach
 - i. Fish waste collection service
 - ii. Fish waste disposal and transport service

(3) Overview of the facilities and equipment

The following describes the overview of the facilities and equipment required for this project:

- ① Fish landing facilities
- ② FRP fishing canoes
- ③ Maintenance tools and materials for FRP fishing canoes
- ④ Outboard engines and spare parts
- ⑤ Fishing gears
- ⑥ Artisanal fisheries support vehicles
- ⑦ Communication equipment for insulated vans
- ⑧ Materials for hygienic environment improvement at fish landing beach

(4) Maintenance control plan

The facilities and equipment are maintained and controlled by the Bakau Subcommittee and Project Management Committee. Fig. 7 illustrates the organization and staff members.

For the use of the fish landing facilities introduced under the project, the artisanal fishermen should preferably pay the cost from the standpoint of the beneficiary paying the expenses. However, this may cause excessive burden on the shoulder of the artisanal fishermen yet to break from the artisanal fisheries, and may hinder their effort for management improvement. With consideration given to this possibility, the facilities are used free of charge by the artisanal fishermen, and the cost will be borne by them as they have succeeded more in their efforts for fisheries management improvement.

With consideration given to depreciations, FRP fishing canoes are rented out to the local fishermen of Bakau fish landing spot at the annual rent of 30,000 Dalasis. Appendix V shows the estimate of the earnings and expenses for the operation when FRP fishing canoes are used. Expenses of 146,450 Dalasis are calculated for the annual earnings of 162,500 Dalasis; it is possible to get the annual profit of 16,050 Dalasis. This shows appropriate operational profitability of this activity. Therefore, renting out of FRP fishing canoes is considered to make a contribution for promotion of artisanal fisheries and improvement of the artisanal fisheries household management.

Appendix IV shows the balance of earnings and expenses for the operations related to this project. As shown below, the annual profit of 261,630 Dalasis can be obtained according to the operation management:

Annual earnings	1,008,600 Dalasis
Annual expenses	746,970 Dalasis
Annual profit	261,630 Dalasis

The above profit is estimated at a comparatively great amount. This is because the depreciation for the facilities and equipment are not included.

To ensure continuous implementation of artisanal fisheries promotion activity, it is essential to renew such equipment as the ice plant, diesel generator and insulated van introduced under the fiscal 1991 Japan's grant aid, and the support vehicles and other equipment to be introduced under this project. Therefore, the annual profit resulting from the activity must be reserved as allowance for facilities and equipment renewal.

4-4 Technical cooperation

The facilities supplied under this project can be operated by the staff of the Bakau Subcommittee and Project Management Committee as the project implementation bodies both in quality and quantity. They have basic techniques regarding the operation and maintenance control of the fishing equipment included in this project.

However, to ensure more effective use of the fishing equipment, the Japanese Government is requested to extend technical cooperation in the following areas:

1) Acceptance of trainees

Trainees for maintenance technique for

FRP fishing canoes and outboard engines

several persons

CHAPTER 5 BASIC DESIGN

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5-1 Design policy

The basic design of this project should be worked out according to the following basic policy, based on the current conditions and actual situations of the artisanal fisheries in The Gambia and the project site:

- (1) Setting up the appropriate project scale
 - ① The scale of facilities and equipment shall be set up according to appropriate demand prediction.
 - ② The facilities and equipment to be provided shall be within the scope of Japan's grant aid system.
 - ③ Efforts shall be made to minimize the maintenance expenses after completion.
- (2) Sufficient consideration given to natural conditions and environmental conservation measures at the project site
 - ① Topographical, geological, meteorological and oceanographic conditions at the project site shall be sufficiently studied to work out the basic design.
 - ② The project site faces the Atlantic Ocean, and the marine structures are directly subjected to swelling waves in winter. So these structures will be designed with sufficient durability.
 - ③ Precipitation is very severe in the rainy season. Water drainage groove and reclamation surface will be provided with measures to prevent flooding or erosion from occurring due to heavy rainfall.
 - ④ Transformation of the current topographical configuration by dredging and similar works shall be minimized.
 - ⑤ Consideration must be given to maintain landscape.

(3) Adoption of facilities structures, equipment materials and construction method suited to The Gambia and the project site

- ① Structure should be maximally simple and durable to permit easy maintenance.
- ② The equipment and materials shall be selected to facilitate maintenance.
- ③ It should be noted that sand for concrete can be available in The Gambia, but most construction materials must be imported.
- ④ Since the related regulations and standards of The Gambia are not sufficiently prepared, the Japanese regulations and standards shall be used for the purpose of the design of the related facilities.

5-2 Study and examination on design criteria

Based on the information on the natural conditions obtained from the basic design study, technical requirements for working out the design shall be set up as follows:

(1) Meteorological conditions

Temperature	Max. 35°C	Min. 15°C
Relative humidity	Max. 160%	Min. 0%
Wind direction and velocity	Max. velocity 30 m/sec. Prevailing wind: western to west northwestern (velocity 5 - 8 m/sec.)	

(2) Oceanographic conditions

① Tide level

H.W.L	+1.87m
M.S.L.	+1.15m
L.W.L.	±0.43m
L.L.W.L	±0.00m
E.L.	±0.00m
C.D.L	±0.00m

② Waves

Designed offing waves have been estimated according to the data on oceanographic conditions obtained at the site and the existing data. At the project site, western wind is prevailing except in winter, and produces waves, affecting the number of days for operation of the fish landing facilities (fish landing jetty). In winter, swelling waves coming from the outer ocean send huge waves which affect the structure design. The following shows the result of calculation (See Appendix VIII).

Wave used for stability calculation

Wave height : $H = 3.5\text{m}$
Wave direction : facing westward
Period : $T = 10.0\text{ sec.}$

Maximum wave height permitting use of fish landing jetty: $H = 0.5\text{m}$

③ Tidal current

On calm days, waves are produced by prevailing western wind on sea surface. Basically, the tidal current runs from west to east at the time of high water, and from east to west at the time of low water. The speed of the tidal current is 0.6 knots on calm days. For the purpose of design, 1.3 knots at the estuary of the River Gambia close to the project site should be used.

(4) Seismic force

In The Gambia, occurrence of earthquake is not confirmed according to the past statistical data. Therefore, seismic force shall not be taken in account. Earthquake at the abnormal times is not handled for stability calculation of the structures.

(5) Soil quality conditions

Boring survey was conducted extensively at the project site during the basic design study under the fiscal 1991 Japan's grant aid project. Since it includes the range of the facilities covered by this project, the result of that survey will be used in basic design. Appendix VII shows the result of the survey.

(6) Requirements for the use of fish landing facilities

① Specifications for fishing vessels covered

The following describes the fishing vessels capable of using the fish landing facilities (jetty):

	Total length (m)	Average width (m)	Average draft (m)	Freeboard height (m)	Type
Small hand line fishing canoe	5.0	0.8	0.4	0.2	Canoe type
Gill net fishing canoe	9.3	1.0	0.7	0.3	Canoe type
Large hand line fishing canoe	13.0	2.0	1.0	0.8	Canoe type
Surrounding gill net canoe	13.0	2.0	1.0	0.8	Canoe type
Multi-operation canoe	13.0	2.0	1.0	0.8	Canoe type

The multi-operation canoe denotes the canoe which is intended for multiple operations including surrounding gill net fishing, bottom gill net fishing and large hand line fishing operations.

- ② Berthing speed $V = 50\text{cm/sec.}$
③ Attraction force of vessel $T = 5\text{ tons for each bollard}$
④ Surcharge 2t/m^2 , Live load 0.5t/m^2

(7) Materials

Friction

- Back filing : angle of internal friction $\phi = 40^\circ$, $\delta = 15^\circ$
Rubble mound : angle of internal friction $\phi = 40^\circ$

Unit sedimentary weight

- Reinforced concrete : 2.45t/m^3 (hollow), 1.42t/m^3 (underwater)
Reinforced concrete : 2.30t/m^3 (hollow), 1.27t/m^3 (underwater)
Steel : 7.85t/m^3 (hollow)
Backfilling : 1.80t/m^3 (hollow), 1.00t/m^3 (underwater)
Reclamation : 1.80t/m^3 (hollow), 1.00t/m^3 (underwater)

(8) Static friction coefficient

For precast concrete and rubble mound: 0.6

For cast-in-place concrete and rubble mound: 0.8

(9) Safety factor

Sliding: 1.2 (at normal condition)

Overturning: 1.2 (at normal condition)

Ground bearing capacity: 2.5

Circular rupture: 1.3

(10) Allowable strength

Structure steel : 1,400 kg/cm² (SS41)

Deformed bar steel : 1,400 kg/cm² (SD30)

Reinforced concrete : 240 kg/cm² (standard design strength)
90 kg/cm² (allowable bending strength)
9 kg/cm² (allowable shearing strength)

Plain concrete : 180 kg/cm² (standard design strength)

(11) Corrosion speed of steel

For H.W.L. or more : 0.3mm/year

For H.W.L. to M.L.W.L. - 1m : 0.1 to 0.3mm/year

For M.L.W.L. - 1m to sea bottom : 0.1mm/year

Corrosion-proof painting : no repair for 7 years

(12) Standards for reference

Standard Concrete Specifications (Japan Association of Civil Engineering)

Standard Design for Fishing Port Structures, 1992 (Japan Fishing Association)

Japanese Industrial Standards (JIS)

5-3 Setting the facilities and equipment scale

5-3-1 FRP fishing canoes

(1) Basic policy

- ① FRP Fishing canoes will be introduced to meet the substituting canoe construction demands in 1995 resulting from deterioration of large wooden fishing canoes of the Bakau fish landing spot engaged in surrounding gill net fishing, bottom gill net fishing and large hand line fishing.
- ② Canoes will be introduced for use by new fishermen who have completed the fishermen training course implemented at the Bakau fish landing spot.
- ③ Canoes to be introduced should be designed to allow multi-operations of surrounding gill net fishing, bottom gill net fishing, and large hand line fishing.

(2) Calculating the required number of canoes

1) Demands of FRP fishing canoes for substitute of existing large fishing canoe

Large wooden fishing canoes of the Bakau fish landing spot consist of a total of 12 canoes as of 1993; five surrounding gill net fishing canoes, four bottom gill net fishing canoes and three large hand line fishing canoes. The service life of the locally made wooden fishing canoes is about three years due to deterioration and damages by shipworms. So one third of the total numbers requires building of substitutes every year. In 1995 (two years later), two thirds of the current canoes will require building of substitutes. Since it becomes more and more difficult to build wooden canoes in The Gambia, eight canoes corresponding to the demands of substitutes will be introduced in this project.

$$12 \text{ canoes} \times \frac{2}{3} = 8 \text{ canoes}$$

2) Canoes for use by new fishermen having completed the fishermen training course

By 1995, nine fishermen will complete the fishermen training course by NO.8 training canoe implemented by the Fisheries Department at the Bakau fish landing spot. Since there is no prospect of finding out the canoes to be distributed after the course in future, the training period of one year has been extended to 1.5 to 2 years. This is said to be intended to give sufficient training to the trainees. The NO.8 training canoe is a 13-meter FRP canoe provided

with diesel outboard engine. It is also used to instruct the way of operating similar fishing canoes. According to the training course by the Fisheries Department, every two or three fishermen having completed course are formed into a new operation group. Fishing canoes are rented out to the fishermen of such a group, or assistance for canoe building fund is extended to them on the priority basis. Therefore, four FRP fishing canoes are required for four fishing groups consisting of nine new fisherman having completed the course.

For the reasons given above, 12 FRP fishing canoes in total will be introduced in the project. The canoes to be introduced will be 13-meter FRP canoes provided with diesel outboard engine; this type has already been introduced, and is considered to suit the requirements of the artisanal fisheries.

5-3-2 Fish landing facilities

(1) Basic policy

- ① The facilities shall be intended for artisanal fish landing at the project site in 1995.
- ② The scale shall be determined with consideration given to reduction of the fish landing time resulting from the use of new facilities.
- ③ Since there is no applicable standards to calculate the berthing length in The Gambia, the related calculation formula of Japan will be used.
- ④ The scope of the fish landing facilities shall include the revetment of the jetty connection section as outer facilities, parking area as transport facilities, and navigation marks, in addition to the fish landing jetty as the mooring facilities, with consideration given to the effective fish landing operation and efficient use of the facilities.

(2) Number of canoes using the facilities

The canoes of the following three fields will use the facilities:

- ① A total of 48 canoes belonging to the Bakau fish landing spot, in 1995, including the canoes brought about by natural increase and eight substitute canoes under this project

② A total of seven new canoes (FRP fishing canoes) for multi-operations; three funded by the fiscal 1991 Japan's grant aid and four funded by this project

③ Bottom gill net fishing canoes coming from Brufut, a nearby fish landing spot, to land the demersal fish. Only a small number of canoes from Brufut come on an irregular basis under the current conditions without fish landing facilities. According to a survey by hearing from the Fisheries Department and fishermen, 7 (about 20%) of 34 bottom gill net fishing canoes of Brufut are estimated to come when the fish landing facilities are improved.

④ Number of vessels using the facilities as of 1995

	Number	Average length (m)	Average draft (m)	Operation mode	Remarks
i) Small hand line fishing canoe	34	5.0	0.4	One-day operation, 200 days/year	
ii) Gill net fishing canoe	5	9.3	0.7	One-day operation, 275 days/year	
iii) Large hand line fishing canoe	4	13.0	1.0	Three-day operation, 275 days/year	Substitute for FRP fishing canoes
iv) Surrounding gill net fishing canoe	5	13.0	1.0	One-day operation, 275 days/year	Substitute for FRP fishing canoes
v) Multi-operation fishing canoe	7	13.0	1.0	One-day operation, 275 days/year	Multi-operation of surrounding gill net fishing and bottom gill net fishing
vi) Brufut canoe	7	9.3	0.7	One-day operation, 275 days/year	Bottom gill net fishing
	62				

⑤ Average number of canoes using facilities per day

	Number	Rate of departure	Average number of canoes using facilities per day
i) Small hand line fishing canoe	34	0.55 (200/365)	18.70
ii) Gill net fishing canoe	5	0.75 (275/365)	3.75
iii) Large hand line fishing canoe	4	0.25 (275/365 + 3)	1.00
v) Surrounding gill net fishing canoe	5	0.75 (275/365)	3.75
v) Multi-operation fishing canoe	7	0.75 (275/365)	5.25
vi) Brufut canoe	7	0.75 (275/365)	5.25
	62		37.7

(3) Study of jetty use time during fish landing

The following planned fish landing time is set to ensure improvement of the fish handling efficiency by the use of the facilities funded by this project. Fish landing time will be reduced by 20% ~ 40% in comparison with current time.

(unit: min.)

	Current situation				Planned				reduce ration (%)
	Canoe landing	Fish landing	Equipment loading and unloading	Total	Berthing and un- docking	Fish landing	Equipment loading and unloading	Total	
i) Small hand line fishing canoe	5	10	10	25	5	10	5	20	20
ii) Gill net fishing canoe	10	12	15	37	5	10	10	25	32
iii) Large hand line fishing canoe	15	40	30	85	5	30	15	50	41
iv) Surrounding gill net fishing canoe	15	60	20	95	5	45	10	60	37
v) Multi-operation fishing canoe	-	-	-	-	5	45	10	60	-
vi) Brufut canoe	10	12	15	37	5	10	10	25	32

(4) Calculating the required berth length

- ① The canoe is moored alongside the jetty, and the standard conversion method of "average berthing length by 1.15" is used.
- ② The berth water depth is determined by "average draft plus 0.5 to 1.0 m".
- ③ When calculating berth length, the canoes having a draft of 0.4 to 0.7 m are assigned to the area with water depth of 1.0 to 1.5 m, while those having a draft of 1.0 are assigned to the area with water depth of over 1.0 m; this is because the draft of each canoe is divided within the range of 0.4 to 1.0 m.
- ④ The fish landing time is three hours (180 minutes) from the current 13:00 to 16:00.

- ⑥ The berth length required for the area having a water depth of 1.0 to 1.5 m is 25.32 m, as follows.

Type of canoe covered	<a> Average number of canoes using facilities per day	 Average bottom length (m)	<c> Berth length for alongside mooring (m) x 1.15	<d> Mooring time during fish landing (min.)	<e> Number of berth rotations	<f> Required berth length (m) <a>x<c>+<e>
Small hand line fishing canoe	18.70	5.0	5.75	20	9.0	11.95
Gill net fishing canoe	3.75	9.3	10.70	25	7.2	5.57
Brufut canoe	5.25	9.3	10.70	25	7.2	7.80

Total 25.32 m

- ⑥ The berth length required for the area having a water depth of over 1.5 m is 49.00 m, as follows.

Type of vessels covered	<a> Average number of canoes using facilities per day	 Average bottom length (m)	<c> Berth length for alongside mooring (m) x 1.15	<d> Mooring time during fish landing (min.)	<e> Number of berth rotations	<f> Required berth length (m) <a>x<c>+<e>
Large hand line fishing canoe	1.00	13.0	14.95	50	3.6	4.15
Surrounding gill net fishing canoe	3.75	13.0	14.95	60	3.0	18.69
Multi-operation fishing canoe	5.25	13.0	14.95	60	3.0	26.16

Total 49.00 m

5-3-3 Outboard engines

(1) Basic policy

- ① Diesel outboard engines shall be assigned to the FRP fishing canoes supplied under this project. Since the introduction of the diesel outboard engines, the effect of low fuel cost operation has been highly evaluated in The Gambia. Introduction of diesel outboard engines is considered to be appropriate in order to set up a future model operation system.

- ② The gasoline outboard engines corresponding to substitute demands for gasoline outboard engines of the existing motorized wooden fishing canoes at the Bakau fish landing spot and those corresponding to the number of large fishing canoes as new comers by 1995 shall be introduced.
- ③ The gasoline outboard engines required for non-motorized small hand line fishing canoes of the Bakau fish landing spot shall be introduced.

(2) Number required

- ① Diesel outboard engines 12 units
One engine for each FRP fishing canoe introduced under this project

- ② Gasoline outboard engines totally 20 units
 - i) As substitutes to existing motorized fishing canoes 8 units

Twelve fishing canoes are motorized by outboard engines of 15 to 40 hp at the Bakau fish landing spot as of 1993; five gill net fishing canoes, three large hand line fishing canoes and four surrounding gill net canoes. The average service life of the gasoline outboard engine is about three years, so two thirds of the existing outboard engines will have to be replaced by 1995. Therefore, eight engines of 15 to 40 hp must be supplied; they are broken down as four engines of 15 hp for gill net fishing canoes and large hand line fishing canoes and four engines of 40 hp for large hand line fishing canoe and surrounding gill net fishing canoes.

$$12 \text{ engines} \times 2/3 = 8 \text{ engines}$$

- ii) For new fishing canoes 2 units

In addition to the canoes supplied under this project two wooden canoes (each one large hand line fishing canoe and surrounding gill net fishing canoe) shall be introduced at the Bakau fish landing spot by 1995.

A total of two engines -- one outboard engine of 15 hp and one outboard engine of 40 hp -- will be required to motorize these fishing canoes.

- iii) For promoting the motorization of small hand line fishing canoes 10 units
- The number of small hand line fishing canoes will reach 34 at the Bakau fish landing spot in 1995. These small hand line fishing canoes are planned to be modernized to the modernization rate of about 30%, which is half that of the national average of 62% . For this purpose, about ten 8-hp outboard engines shall be introduced.

$$34 \text{ engines} \times 30\% = 10.2 \text{ (10 engines)}$$

5-3-4 Fishing gears

- ① The fishing gears for the surrounding gill net fishing, bottom gill net fishing, drift gill net fishing, shark gill net fishing, bottom long line fishing, hand line fishing shall be introduced. These gears are required for the multi-operation of twelve FRP fishing canoes.
- ② The form of multi-operation shall be the surrounding gill net fishing method as a major operation, plus two of the bottom gill net fishing, drift gill net fishing, bottom long line fishing and hand line fishing methods aimed at high-priced fish. The surrounding gill net fishing method as major operation provides higher productivity in terms of quantity and is targeted at catching bonga which provide a source of animal protein supply for Gambian nationals.
- ③ For the surrounding gill net fishing gear, the net is specified in two types; monofilament and multifilament; this is intended for comparison and improvement of fishing methods. One set shall be provided for one canoe, and each 6 sets of monofilament and multifilament types shall be introduced.
- ④ Bottom gill net fishing method is considered to be most appropriate combination method for used with multi-operations. The fishing gear specifications differ from fish species. Under this project, introduction of three types such as bottom gill net fishing for general purpose, bottom gill net fishing for croaker and bottom gill net fishing for shark is recommendable. Each 4 sets shall be introduced.
- ⑤ As a second combination fishing method, an operation method different from bottom gill net fishing shall be introduced, to promote use of the school of fish different from that for bottom gill net fishing. For this purpose, three type such as the drift gill net, bottom long line and hand line fishing gear shall be supplied in the project. Each 4 sets shall be introduced.

5-3-5 FRP fishing canoe maintenance tools and materials

① Tool and materials required for maintenance of the hulls of four FRP fishing canoes introduced under fiscal 1991 Japan's grant aid and twelve FRP fishing canoes to be introduced under this project shall be introduced.

② Details of the tools and materials

The tools and materials shall include the FRP lamination tool required to repair the FRP fishing canoe hulls, chopped strand mats, rubber gloves, laminated resins, etc. Some of repair materials are not suited for a long-term storage, so they shall be introduced only in an appropriate amount.

5-3-6 Artisanal fisheries support vehicles

① The following two vehicles shall be introduced as operation vehicles for artisanal fisheries support activities of the Project Management Committee.

② Though an operation vehicle is necessary for various artisanal fisheries support activities such as communication with the Fisheries Department in Banjur, transport of outboard engines to the workshop in Banjur for major repair, transport of fishing gears and marine chandlery from the storage in Banjur, fresh fish delivery to nearby hotels based on their purchase orders, etc., the Project Management Committee does not hold a vehicle for those purposes. Then, one pickup type vehicle shall be introduced for common usage.

③ As the Project Management Committee engages in fish waste transport services to the disposal site from the Bakau fish landing spot, another pickup type vehicle shall be introduced for this purpose because it is not preferable to use the above mentioned vehicle for this purpose in aspects of operation objectives and hygiene.

5-3-7 Radio telephone for insulated vans

① Two insulated vans of the Bakau fish landing spot will transport fresh fish to the local and inland district. Since the telephone network in local areas is not sufficient in The Gambia, one small VHF radio telephone set shall be installed for each of the insulated vans, and one VHF radio telephone set to be installed at the insulated van control office to assist middle range communication, thereby ensuring improved distribution service.

5-3-8 Materials for hygienic environment improvement at the fish landing beach

- ① Fish treatment such as removing of gills and guts of the fish are currently performed at the Bakau fish landing spot as preparatory works for smoking and drying processes. Collection and transport boxes for the fish waste collection service shall be introduced.
- ② Thirty employees are engaged in fish processing business in the Bakau fish landing spot. So thirty small baskets (10-liter capacity) and four waste transport boxes (100-liter capacity) shall be supplied.
- ③ Vinyl sheets shall be introduced to ensure improved hygienic conditions for drying work on the fish drying shelf.

5-4 Basic plan

5-4-1 Layout plan

This project requires the layout of the facilities as illustrated in Fig. 8; this is the result of studying the flow of the preparatory work for fish distribution, including the flow of catches landed on the facilities under the project, fuel supply and ice transport, and vehicle movement, including the relationship with the existing facilities:

Basic facilities	Outer facilities	:	Site revetment
	Mooring facilities	:	Fish landing jetty
Functional facilities	Transport facilities	:	Parking area
	Navigation support facilities	:	Navigation marks

The utility supply facilities, fish handling and preservation facilities were constructed under the fiscal 1991 Japan's grant aid, and will be used integrally in combination with the facilities constructed under this project. Fig. 8 illustrates the layout plan.

Fig.8 Layout plan

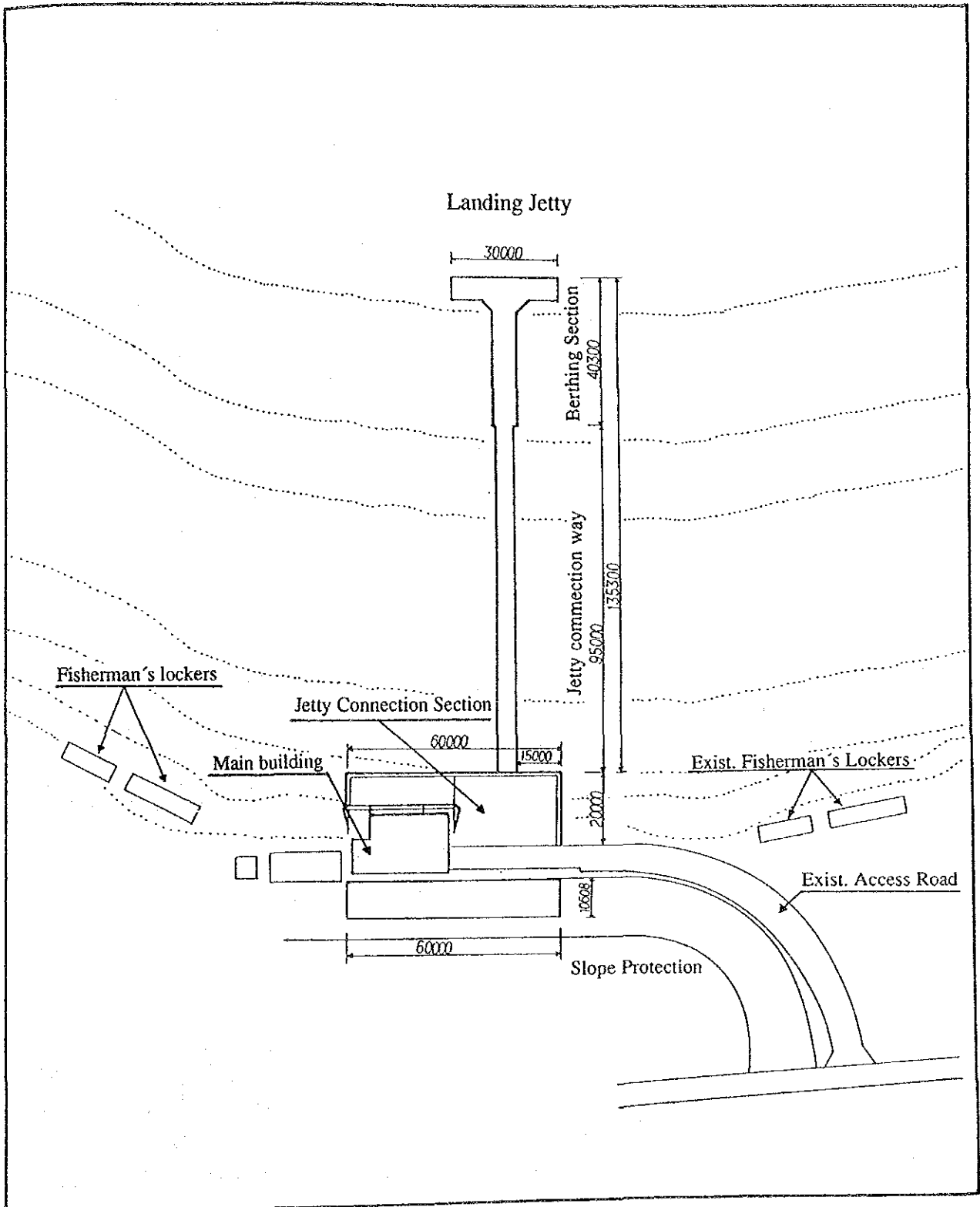
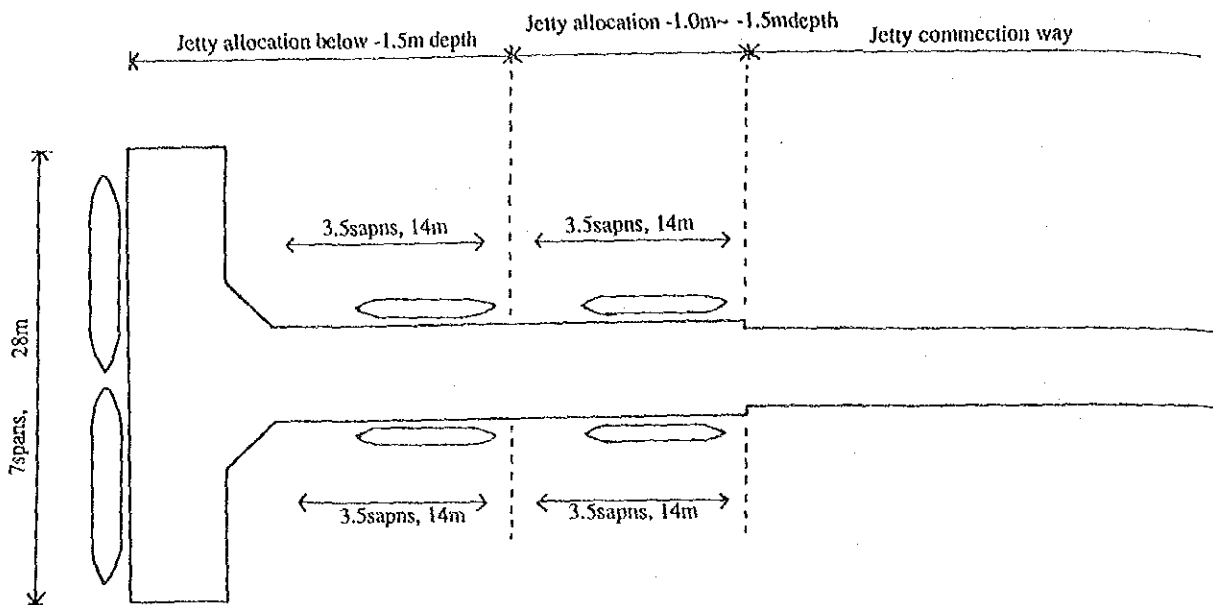


Fig.9 Berthing Allocation plan



5-4-2 Facilities plan

(1) Basic plan

1) Basic plan for fish landing jetty

The following shows the berth lengths according to water depths as calculated in 5-3:

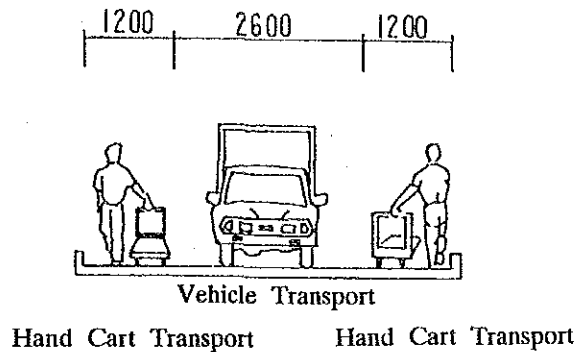
Water depth	Required berth length
-1.0 to -1.5 m	25.32 m
- over 1.5 m	49.00 m

Because of the jetty structure, pile distance is designed as 4 m for the standard section, jetty allocation is determined to meet the berth length requirements given in Fig. 9, with consideration given to pile distance and sea bottom slope . The pickup type vehicle passed on the top end of the fish landing jetty; since it must turn the direction there, the jetty is T-shaped. To provide fish landing support, furthermore, the stepped staircase for elevation will be installed inside the fender rather than outside, as required.

2) Basic plan for jetty access way

The jetty access way to connect land and sea shall have a width of 5 m as shown in Fig. 10, to facilities transport of the fish catches by the vehicle and man power.

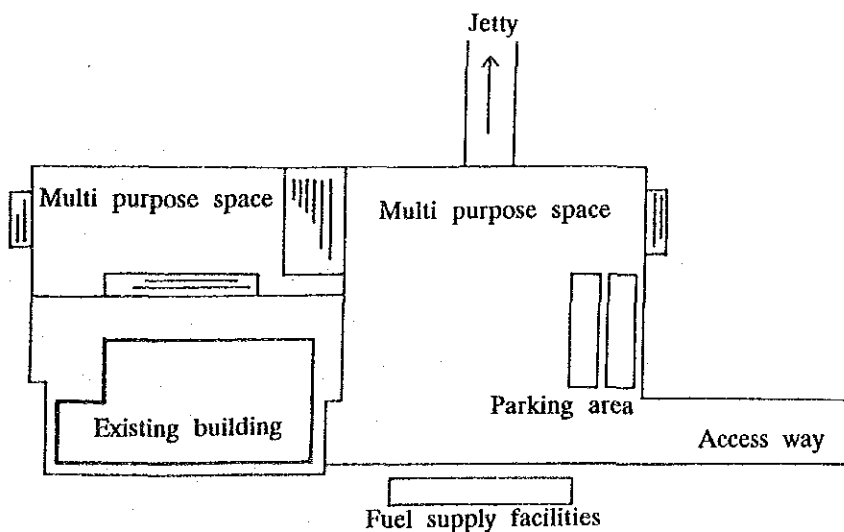
Fig. 10 Jetty access way width plan



3) Basic plan for fish landing jetty connection section

Fish handling, ice packing and packaging works are performed on the jetty connection section, so the jetty connection section must be planned to meet the related work requirements. Two artisanal fisheries support vehicles and two insulated vans are used for the facilities under this project. This requires a parking space for these vehicles. Fig. 11 shows the layout plan to provide a multi-purpose space for fish handling and parking areas, with consideration given to the layout condition of the existing land facilities. It should be noted, however, that the parking area are used by both the insulated vans and artisanal fisheries support vehicles. Staircases shall also be installed to improve accessibility from the sandy beach.

Fig. 11 Jetty connection section layout plan



(2) Basic design

1) Determination of type of landing facilities

The sea bottom of the project area consists of sandy ground, and the shoaling beach extends to a great distance from the shore. Therefore, the structure must be designed so that it is not to be affected by beach deformation due to movement of the sand drift. It is preferable not to adopt a combination of facilities with dredging of the route and berth which are likely to subside. So the jetty structure projecting up to the specified water depth must be used. The projecting moorage can be considered in the following types:

- ① Jetty type
- ② Gravity type (sheet piling type, concrete block type)
- ③ Pontoon type

The gravity type does not suit the present purpose because it is likely to be affected by the above mentioned beach deformation. The Gambia has not much experience in using the pontoon type. Under wave conditions of facing the open sea, it is highly probably that loss accidents are caused by breakage of the mooring chain. It will require much maintenance cost such as coating, and is not recommended for the present purpose. Thus, the jetty type will be used for the present project.

Table 8 shows the comparison of types of landing facilities.

2) Determining the structure type of the fish landing jetty

The following describes the structure type of the fish landing jetty determined on the basis of survey results on similar facilities at the site and experience of use:

① Pile

The pile type jetty using the concrete piles at the Banjul fishing port is deteriorated by sea water in about ten years after construction, and fails to provide the specified strength. It is difficult to procure the high-quality sands or stone around the country. Production of the durable concrete piles is considered to be difficult. Under the present project, steel pipe piles featuring uniform quality will be used, and the surface will be provided with corrosion preventive coating, so that there is no need for

maintenance for about seven years after construction. Regarding the use after seven years, thickness allowance against corrosion will be considered in the design to ensure safety for a total of 20 years. Furthermore, it can be used still longer by repair and maintenance and by removing rust from the part from which the coating is peeled off.

② **Beam:**

When consideration is given to connection with piles and restriction of the construction period under grant aid assistance, use of the concrete beam is not recommendable for quality and process. So steel-made beams shall be used in the present project. To solve rust problems, thickness allowance against corrosion is taken into account as in the case of piles.

③ **Superstructure:**

The steel-made slit type slabs shall be used because of the difficulties in obtaining high quality concrete, and problems involved in interface or connections with beams and uplift pressure in the face of heavy waves. Galvanized hot dipping shall be used as corrosion-proof coating.

④ **Steps:**

To ensure easy use of the jetty by the canoes, the floor level of the jetty should be as close as possible to the sea level. However, waves are high especially in winters at the project site, and the slabs at the jetty may be subjected to damages. So the floor level should be set at a specified height from the sea level. The difference of tide levels at the project site is about 2 meters, and it is necessary to provide the facilities to solve problems raised by the difference of tide levels. For this purpose, appropriate steps shall be installed under the present project. The steel material provided with corrosion-proof coating shall be used; it is required to have sufficient strength against waves. To ensure safety, on the flights of the steps shall be provided with stoppers against slipping, and the steps shall be provided with handrails on the side.

Table 8 Comparison of type of landing facilities

	Jetty type	Steel sheet pile type	Pontoon type
Functional characteristics (including maintenance control)	<ol style="list-style-type: none"> 1. Beach deformation does not occur. ○ 2. No deformation or shift during use ⊙ 3. Maintenance required in the case of steel piles and steel materials △ 4. Restricted by difference of tide levels during use △ 	<ol style="list-style-type: none"> 1. Beach deformation may occur. × 2. No deformation or shift during use ⊙ 3. Maintenance required for steel piles sheet piles △ 4. Restricted by difference of tide levels during use △ 	<ol style="list-style-type: none"> 1. Beach deformation does not occur. ⊙ 2. Deformation or shift occurs during use × 3. Maintenance required, including measures against chain breakage × 4. Not restricted by difference of tide levels during use ⊙
Structural characteristics	<ol style="list-style-type: none"> 1. Stable structure ○ 2. Pre-casting is possible on the superstructure ○ 3. Not affected by erosion ⊙ 4. Not much affected by current and wave ○ 	<ol style="list-style-type: none"> 1. Stable structure ○ 2. A great amount of concrete to be placed at site △ 3. Not much affected by erosion ○ 4. Not affected by current and wave ⊙ 	<ol style="list-style-type: none"> 1. Requires combined with other methods △ 2. Small amount of work to be done at site ○ 3. Not much affected by erosion ⊙ 4. Affected by current and wave ×
Constructability	<ol style="list-style-type: none"> 1. Can be constructed on land ○ 2. Pile placement work affected, depending on the ground △ 	<ol style="list-style-type: none"> 1. Can be constructed only in sea △ 2. Pile placement work affected, depending on the ground △ 	<ol style="list-style-type: none"> 1. Complicated mooring work × 2. Requires a crane with greater capacity. △
Material	Entirely depends on imports. △	Allows use of locally procured sands. ○	Entirely depends on imports. △
Construction term	Long construction term at site △	Long construction term at site △	Short construction term at site ○
Total evaluation	○	×	×

⑤ Accessories

Fenders shall be installed to protect the fish landing jetty against impact by canoes. They shall be made of wood for maintenance aspects. Wooden stoppers shall also be provided to prevent the vehicles from slipping. A navigation light shall be provided for signals to navigating vessels nearby, and mooring rings and posts shall be installed for easier use by the fishing canoes.

3) Setting the revetment structure type

Revetments shall be constructed to protect against the waves the multi-purpose space for fish handling and parking areas of the fish landing facilities under the present project. According to the site study, the coast at the project site tends to be eroded. The structure type should be selected to ensure that stability is maintained and the reflection wave is minimized, even if sands in front of the revetment are eroded to some extent. In the case of the upright type structure, sands tend to be reduced by sudden waves breaking in the front, so the armor stone is provided in the front to form a gradually sloping revetment.

5-4-3 Equipment plan

① FRP fishing canoes 12 canoes

Type: Beaching type canoe, round bottom, bow and stern formed in a big curve for easy landing on the beach, tiller steering

Material and structure: Glassfiber reinforced plastic (FRP), FRP laminated single sheet structure

Hull dimensions: about 13 m in total length, 2 m in total width and about 1 m in total depth

Engine: diesel outboard engine with 27 hp capacity

Supplies: magnetic compass, life vest, rain coat, etc.

② Outboard engines and spare parts

a) Diesel outboard engines for the above mentioned
FRP fishing canoes 12 units

Output : 27 hp

Starting method: by electric motor

- b) Gasoline outboard engines in total 20 units
 - Type: Long shaft model
 - Starting method: manual
 - Demarcation: 10 engines for 8 Hp
 - 5 engines for 15 Hp
 - 5 engines for 40 Hp

c) 1 lot of spare parts for the above mentioned outboard engines (a) and (b)

③ Fishing gears

Materials for the fishing gears shall be supplied, and shall be set up by the user.

- a) Surrounding gill nets A 6 sets

One surrounding gill net set shall include the following:

Net fabric: nylon multifilament (210d/ 12 x 90 mm x 140 MD x 100 m x 16 sheets)

Others: polyvinyl chloride-made float, lead sinker, polypropylene rope, buoy rope, set-up twine, mending twine and net needle

- b) Surrounding gill nets B 6 sets

One surrounding gill net set shall include the following:

Net fabric: nylon monofilament (# 10 x 90 mm x 140 MD x 100 m x 16 sheets)

Others: polyvinyl chloride-made float, lead sinker, polypropylene rope, buoy, buoy rope, set-up twine, mending twine and net needle

- c) Bottom gill nets for general purpose 4 sets

One bottom gill net set for general purpose shall include the following:

Net fabric: nylon monofilament (# 16 x 120 mm x 30 MD x 100 m x 16 sheets)

Others: polyvinyl chloride-made float, lead sinker, polypropylene rope, buoy, buoy rope, set-up twine, mending twine and net needle

- d) Bottom gill nets for croaker 4 sets

One bottom gill net set for croaker shall include the following:

Net fabric: nylon multifilament (210d/ 27 x 120 mm x 30 MD x 100 m x 16 sheets)

Others: polyvinyl chloride-made float, lead sinker, polypropylene rope, buoy, buoy rope, anchor, anchor rope, set-up twine, mending twine and net needle

- e) Bottom gill nets for shark 4 sets

One bottom gill net set for shark shall include the following:

Net fabric: 210d/ 36 x 300 mm x 40 MD x 100 m x 14 sheets

Others: polyvinyl chloride-made float, lead sinker, polypropylene rope, Others: buoy, buoy rope, anchor, anchor rope, set-up twine, mending twine and net needle

- f) Drift gill nets for barracuda 4 sets

One drift gill net set for barracuda shall include the following:

Net fabric: 210d/ 36 x 140 mm x 50 MD x 100 m x 20 sheets

Others: polyvinyl chloride-made float, lead sinker, polypropylene rope, buoy, buoy rope, set-up twine, mending twine and net needle

- g) Bottom long lines 4 sets

One bottom long line set shall include the following:

"Mutsu" type hook: NO. 2, 3 and 4, 1500 each

Main line made of polyethylene, 6 mm in diameter by 200 m: 15 winds

Branch line made of nylon monofilament NO.36 by 200 m: 5 winds

Others: buoy, buoy rope, anchor, anchor rope, sinker, set-up twine

- h) Hand line fishing gears 4 sets

One hand line fishing gear set shall include the following:

Kerby Sea Hook NO.7, 10, 11: each 500

Nylon monofilament: NO.16, 28 by 500 g: each 5 winds

④ FRP fishing canoe maintenance tools and materials

- a) Lamination tool 10 set
- b) Rubber gloves 10 set
- c) Chopped strand net 1 wind
Material: Glass fiber
Type: 600 g/m², 50 m/wind
- d) Roving cloth 1 wind
Material: Glass fiber
Type: 580 g/m², 50 m/wind
- e) Lamination resin 2 cans
Material: unsaturated polyester resin
Capacity: 20 kg/can
- f) Gel coat 1 can
Color: white
Capacity: 20 kg/can
- g) Hardening agent 1 can
Capacity: 1 kg/can
- h) Promoter 1 can
Capacity: 250 cc/can

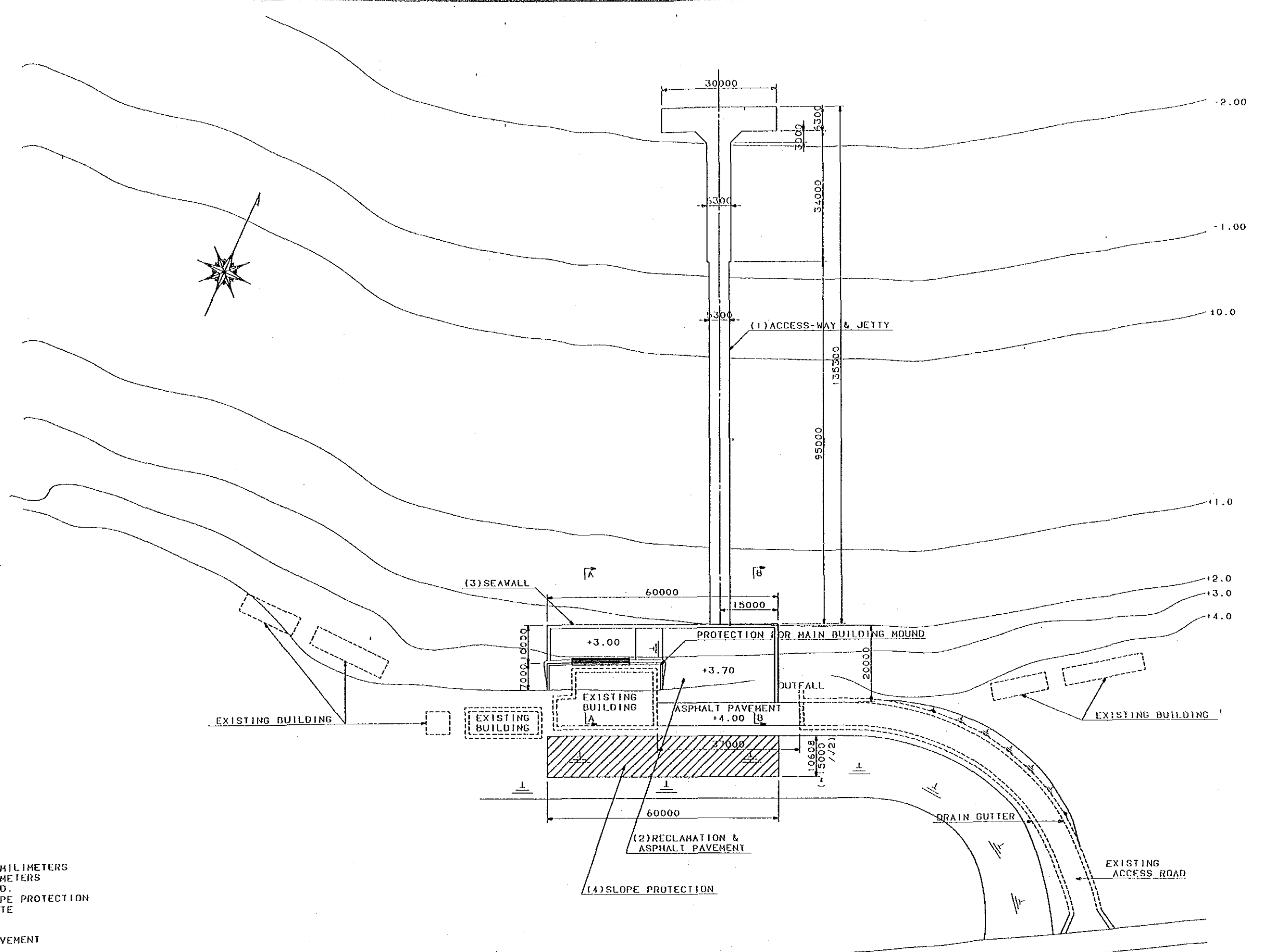
⑥ Artisanal fisheries support vehicles 2 units

- Model: 4-wheel drive pickup truck with long wheel base and double cabine
- Seating capacity: 5 seats
- Engine: diesel engine of about 85 hp
- Dimensions: about 4.7 m in total length, about 1.7 m in total width, about 2.8 m in wheel base distance

- ⑥ Radio telephone for insulated vans
 - a) For insulator van control office 1 unit
 - Model: VHF/FM radio telephone
 - Frequency: 153.475 MHz
 - Output: 60W
 - Others: antenna cable, etc.
 - b) For insulator van
 - Model: VHF/FM radio telephone 2 units
 - Frequency: 153.475 MHz
 - Output: 25W
 - Others: antenna cable, etc.
- ⑦ Materials for hygienic environment improvement at the fish landing beach
 - a) Small beach bins 30 units
 - Model: Polyvinyl chloride-made bin provided with cover and grip
 - Capacity: about 10 liters
 - b) Collection beach bins 4 units
 - Model: Polyvinyl chloride-made bin provided with cover and grip
 - Capacity: about 100 liters
 - c) Vinyl sheet for fish drying shelves 1 roll
 - Material: Polyvinyl chloride
 - Dimension: 0.15mm thick, 2m width and 100m length per one roll
- ⑧ Hand carts 3 units
 - Model: Manually driven two-wheel cart
 - Max. load: 500 kg

5-5 Basic design drawings

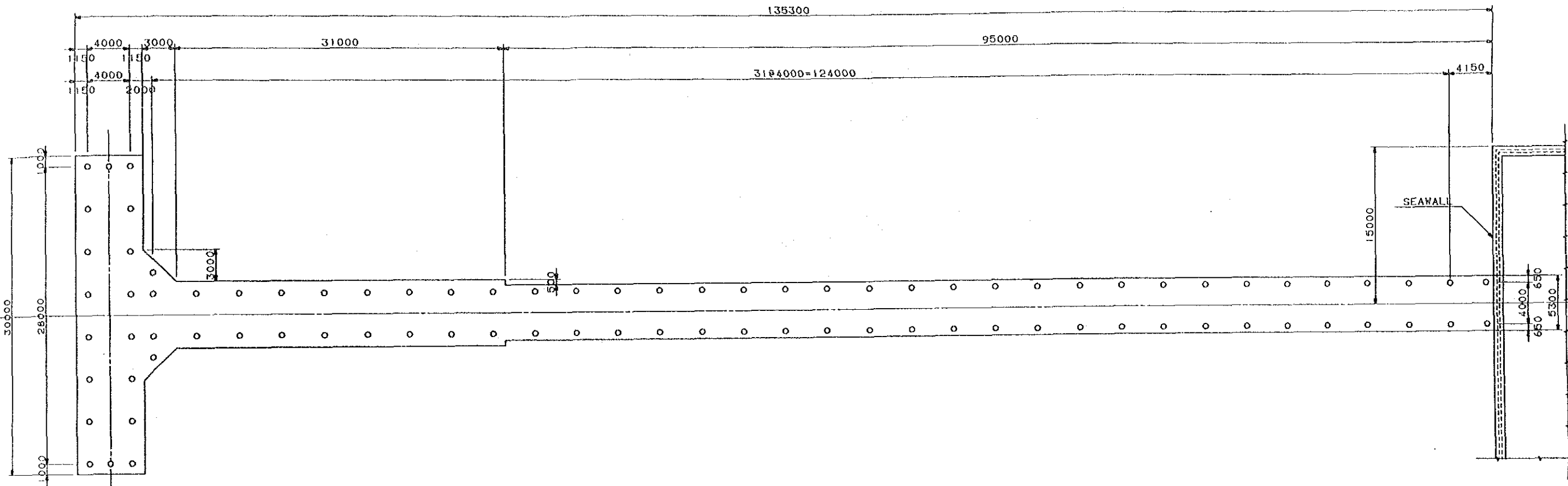
1. Layout plan
2. General plan of jetty
3. Piling layout & side view of jetty
4. Part plan & front view of jetty
5. Typical section of jetty
6. Typical section of seawall
7. Typical section of slope protection
8. Plan of FRP fishing canoe



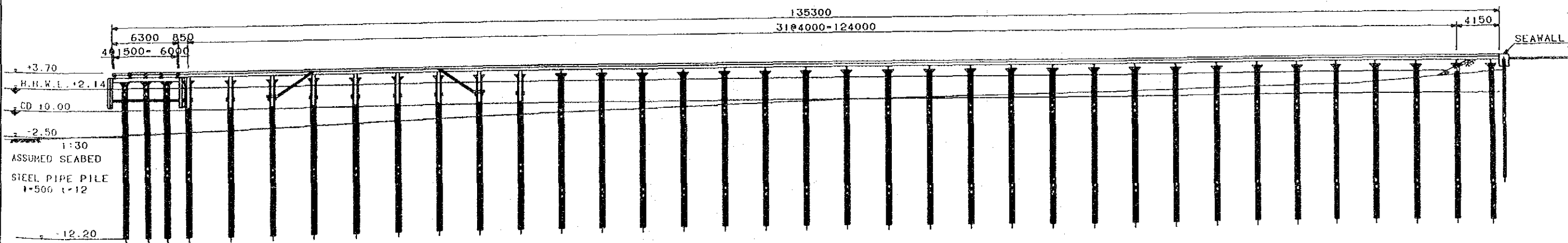
NOTES:
 1. ALL DIMENSIONS ARE IN MILLIMETERS
 AND ALL LEVELS ARE IN METERS
 UNLESS OTHERWISE STATED.
 2. DETAIL LOCATION OF SLOPE PROTECTION
 TO BE DETERMINED AT SITE
 SCOPE OF WORKS:
 (1) ACCESS-WAY & JETTY
 (2) RECLAMATION & ASPHALT PAVEMENT
 (3) SEAWALL
 (4) SLOPE PROTECTION

KEY PLAN
 S=1:1000

1. Layout plan

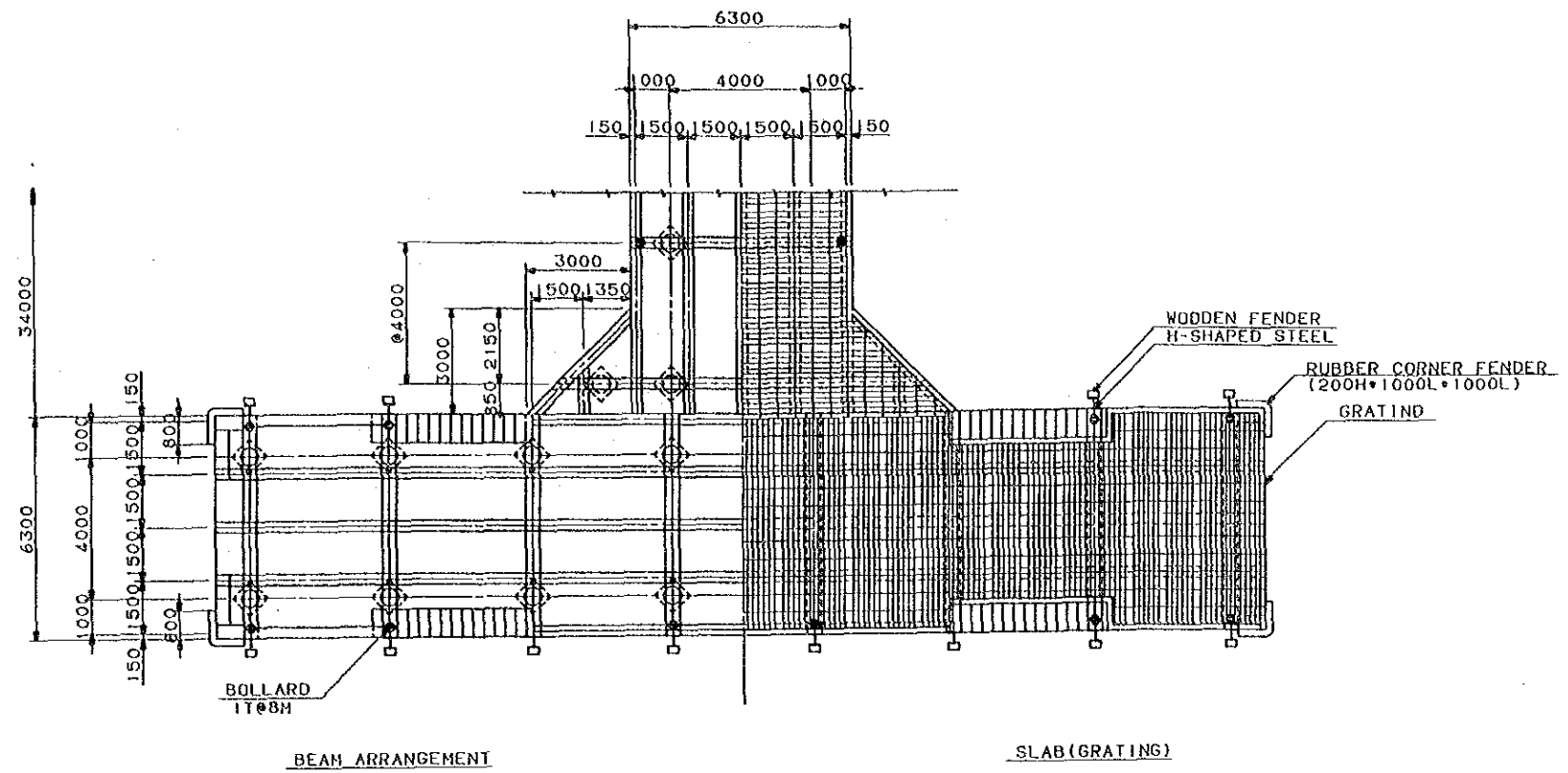


PILING LAYOUT
S=1:400

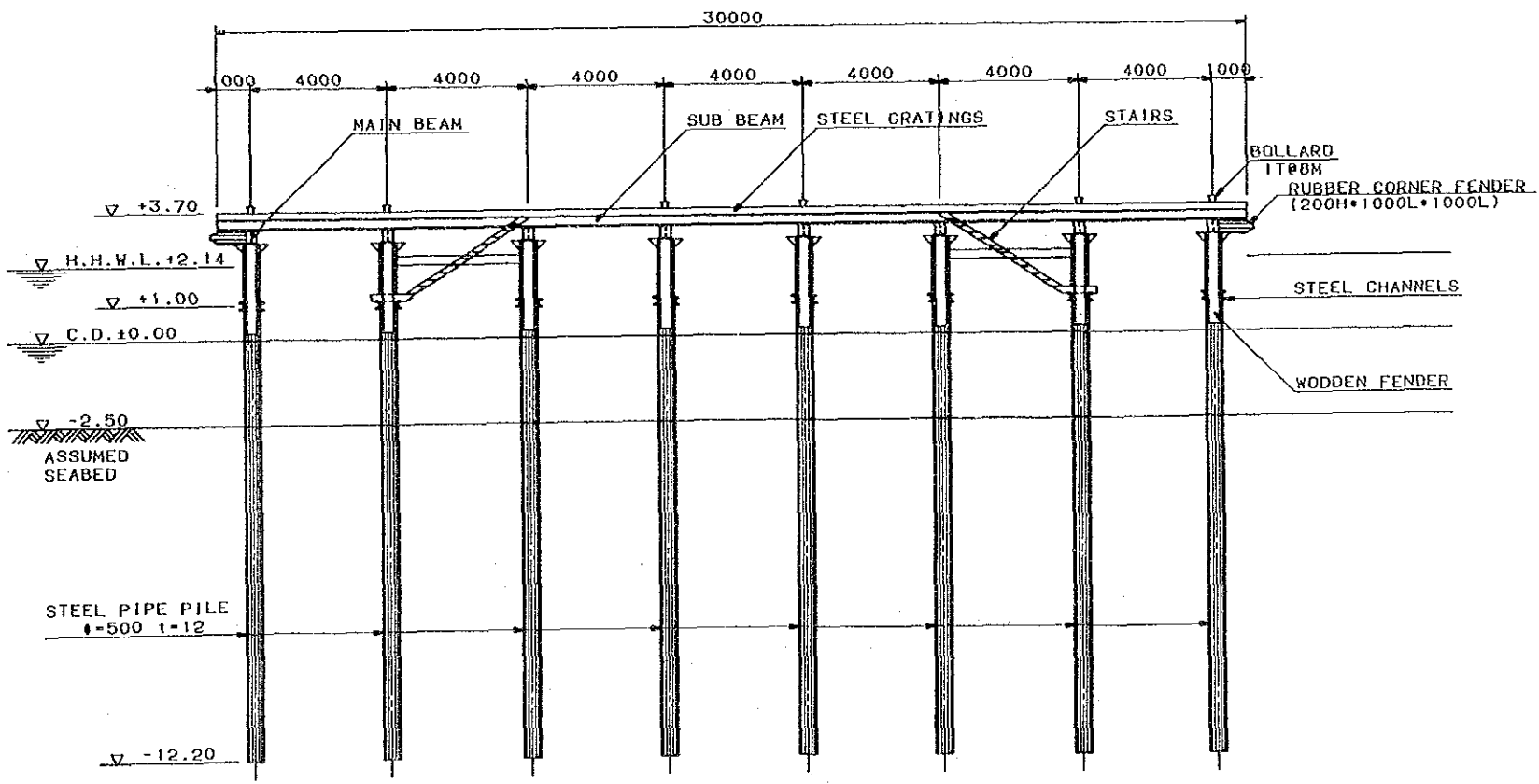


SIDE VIEW
S=1:400

3. Piling layout & side view of jetty

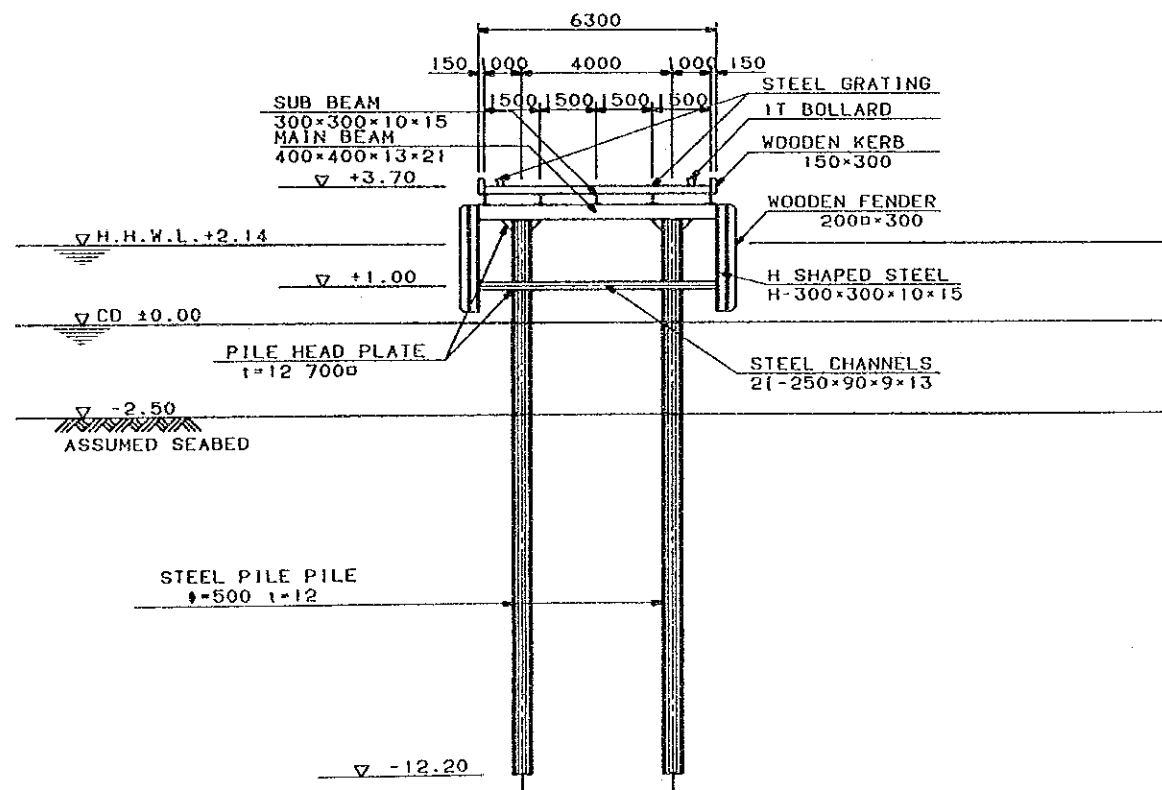


PART PLAN
S-1:200

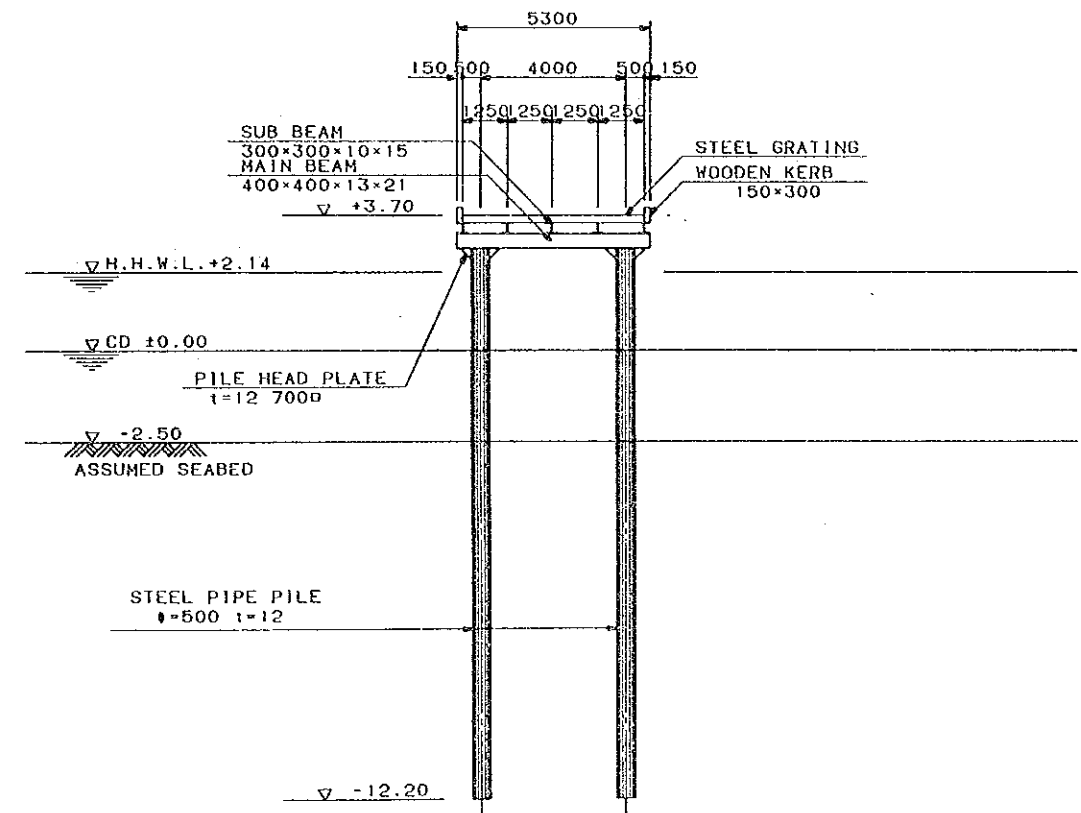


FRONT VIEW
S-1:200

4. Part plan & front view of jetty

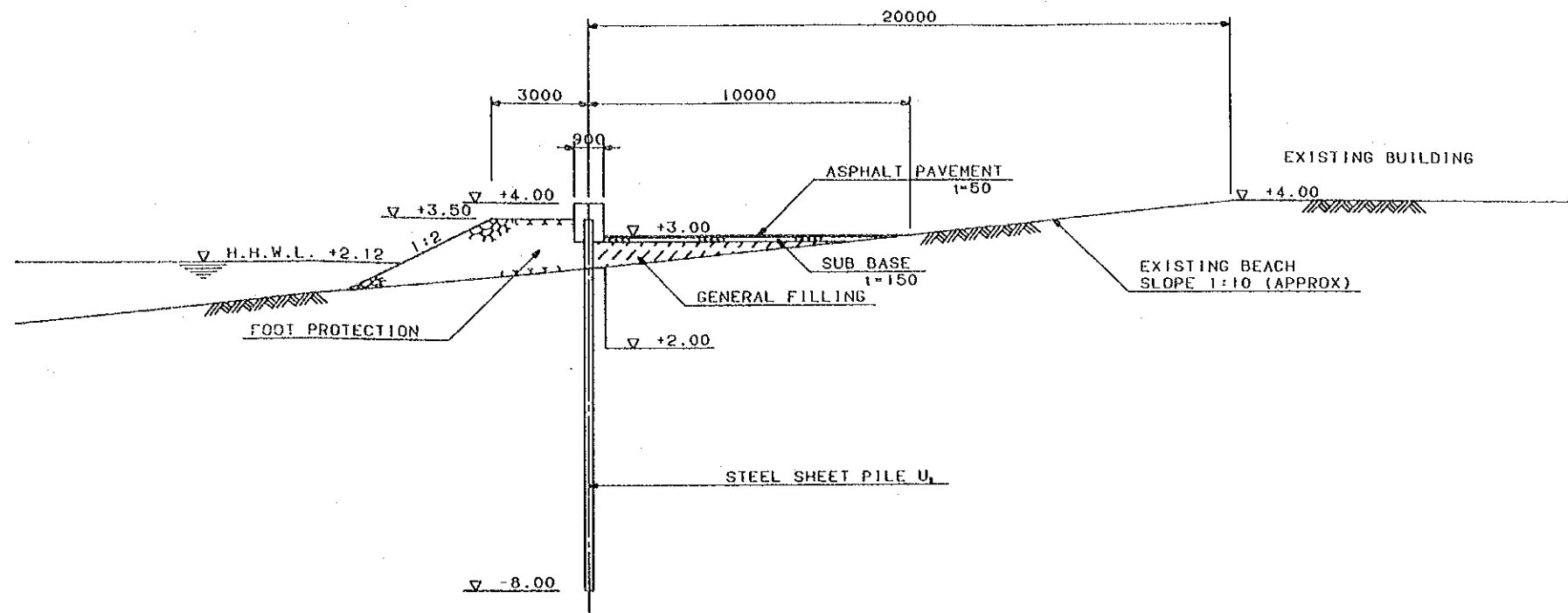


TYPICAL SECTION (BERTH)
S=1:200

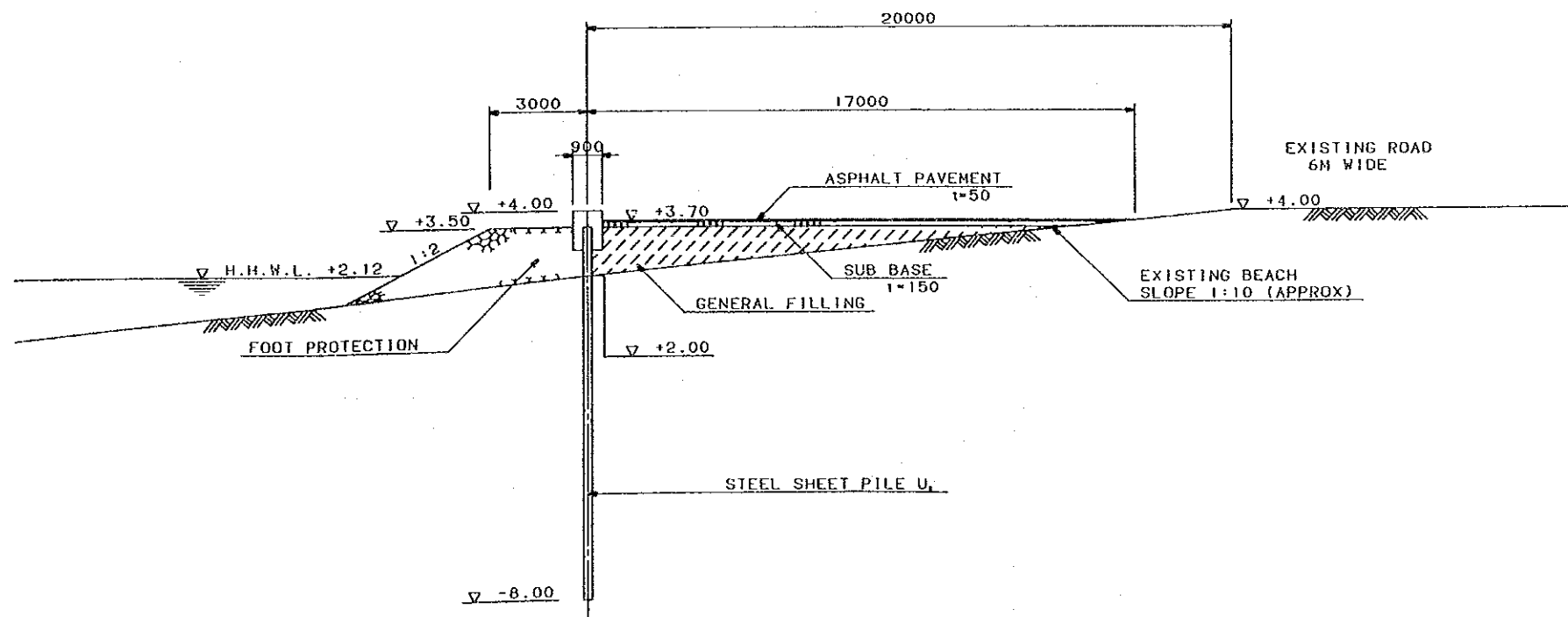


TYPICAL SECTION (ACCESS-WAY)
S=1:200

5. Typical section of jetty

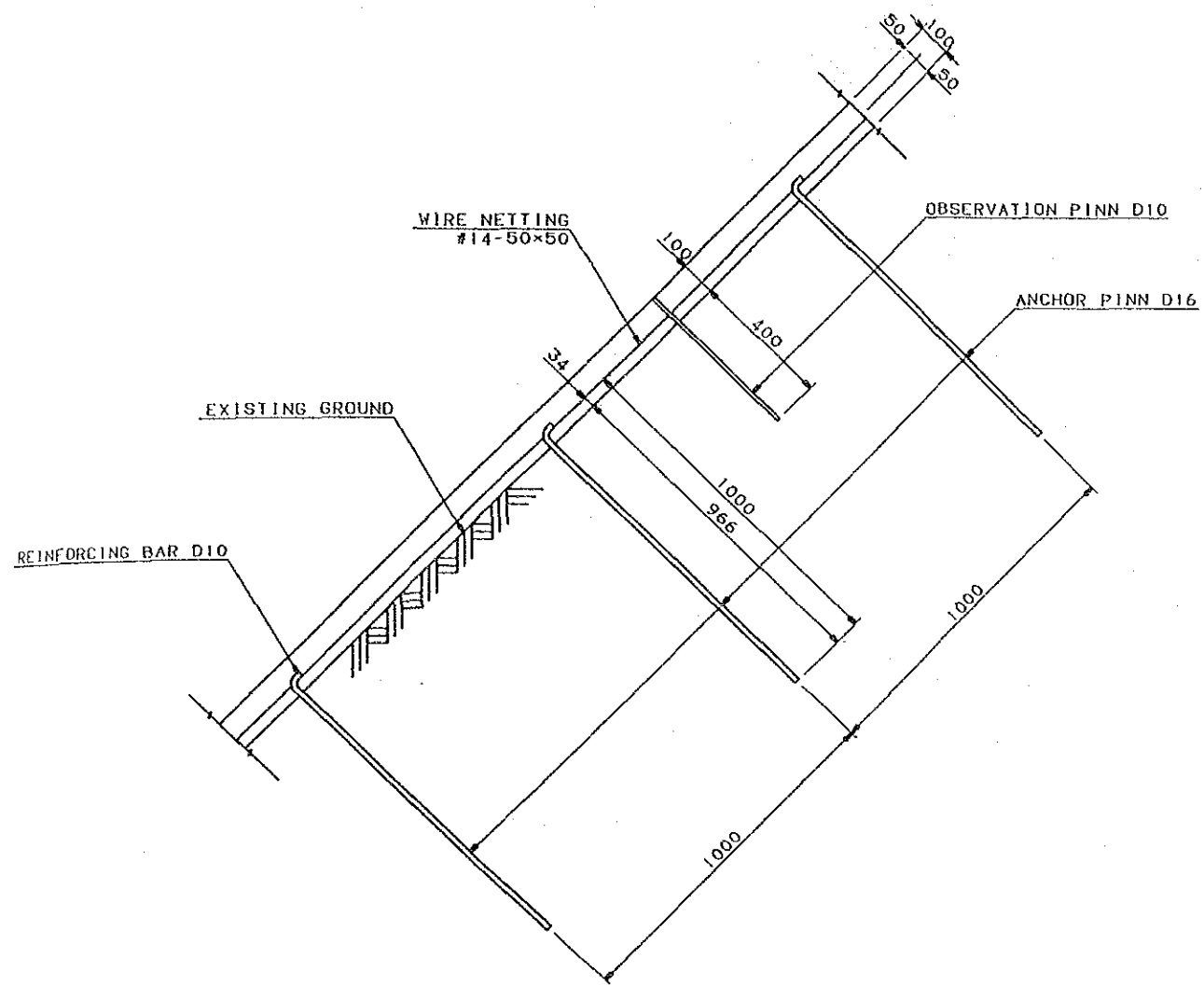


TYPICAL SECTION(A) OF SEAWALL
S=1:200

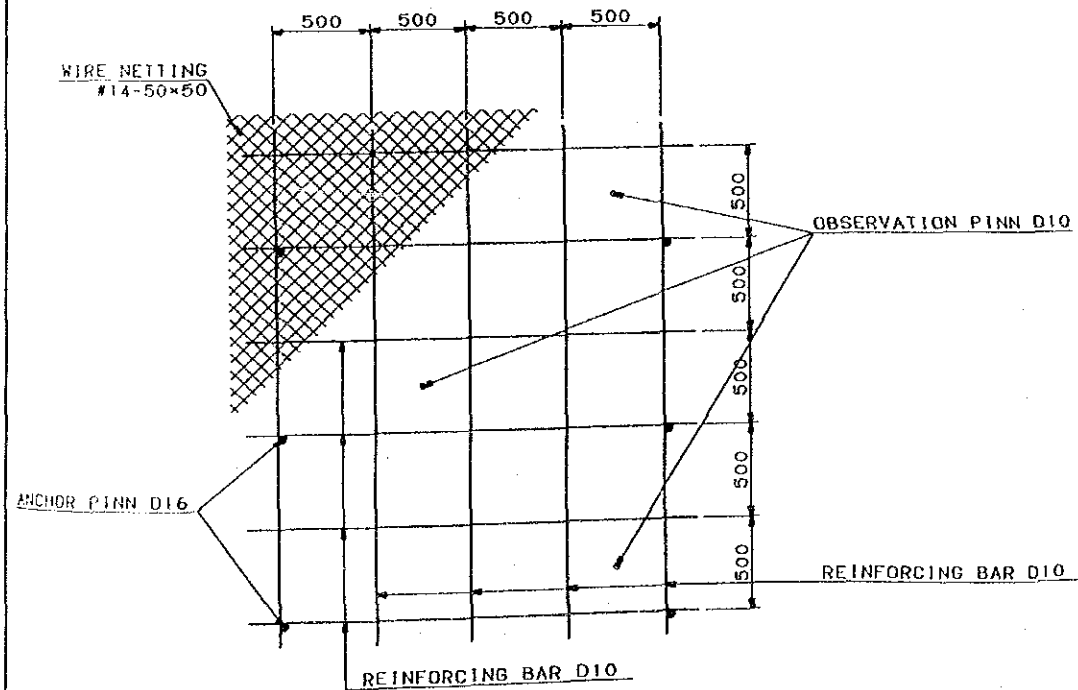


TYPICAL SECTION(B) OF SEAWALL
S=1:200

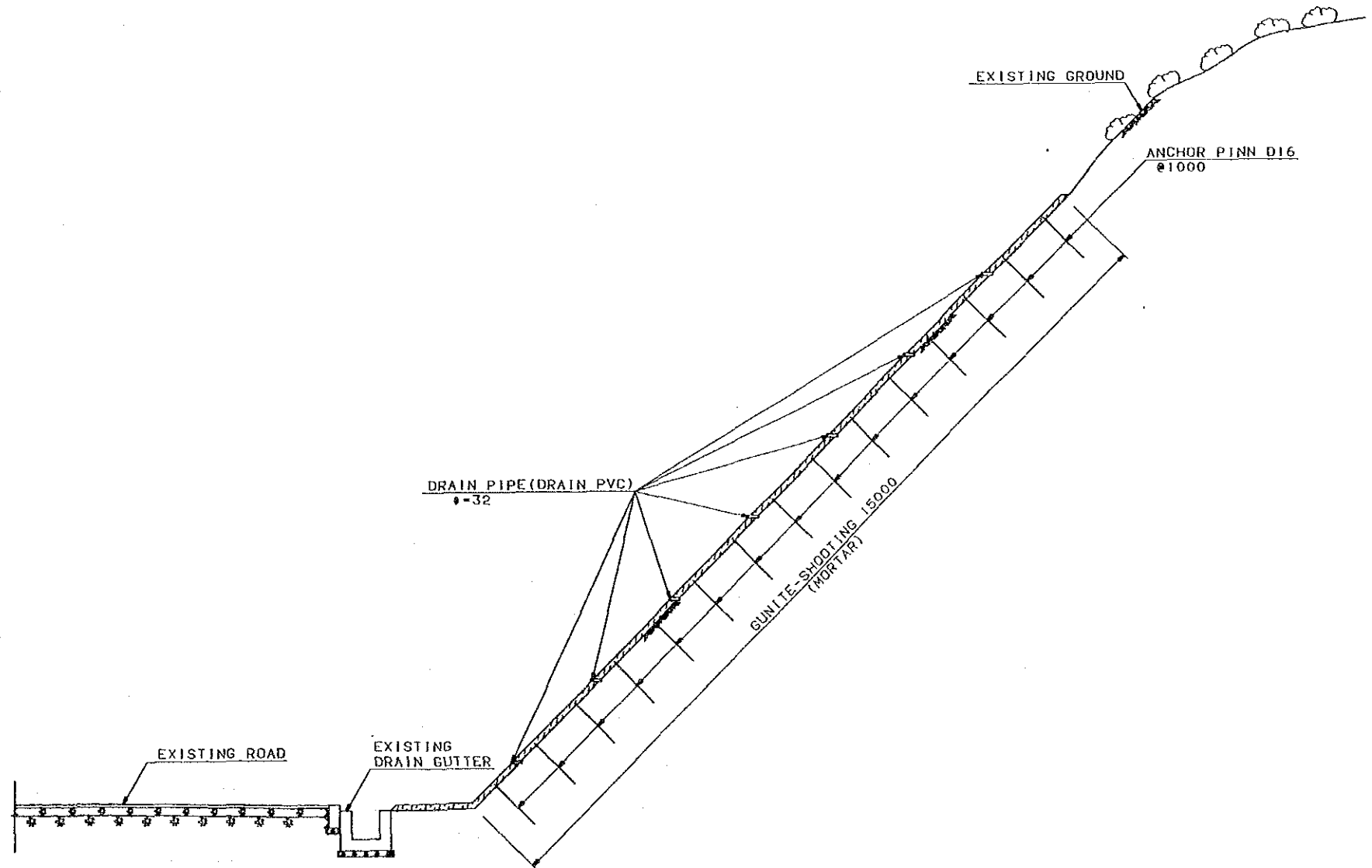
6. Typical section of seawall



DETAIL OF SLOPE PROTECTION
S=1:20

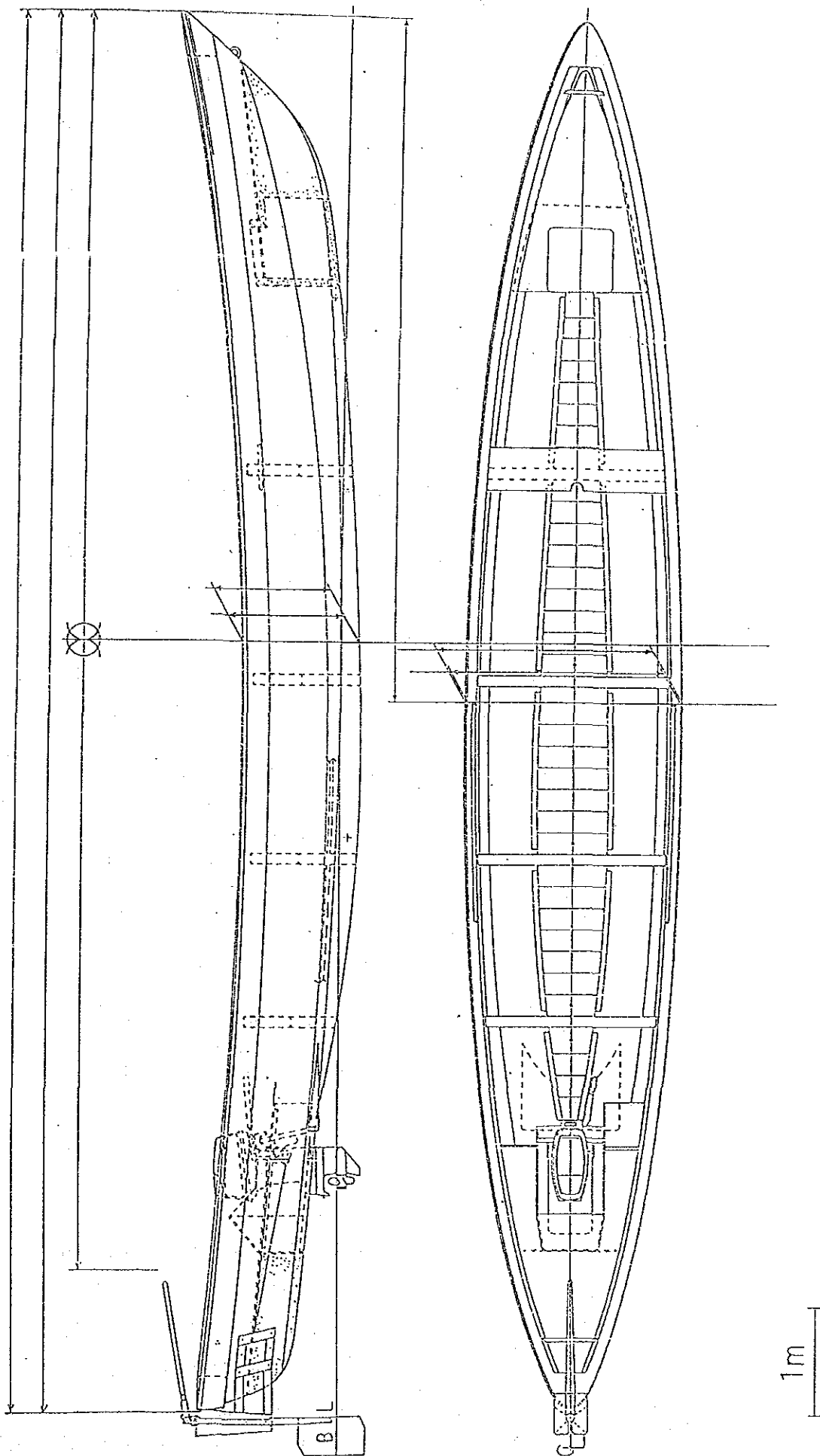


PLAN
S=1:40



TYPICAL SECTION OF SLOPE PROTECTION
S=1:100

7. Typical section of slope protection



8. Plan of FRP fishing canoe

5-6 Implementation plan

(1) Construction policy

1) Basic policy

The construction plan for the project is worked out according to the following policy:

- ① To make the maximum use of the locally available man power and materials
- ② To make efforts for ambient environment protection
- ③ To have a close contact with the local authorities to avoid troubles
- ④ To respect culture and tradition of the country

2) Scope of the construction work

The following describes the scope of the construction work:

- ① Construction of the fish landing facilities for artisanal fisheries
- ② Procurement of the fisheries equipment
- ③ Execution of the above mentioned work and work supervision
- ④ Going through the necessary procedure for execution of the above mentioned work and acquisition of licenses

3) Expenditures shared by Japan and the Republic of The Gambia

The following describes the expenditures shared by both countries for implementation of the project

[Responsibility shared by the Republic of The Gambia]

- ① To secure the construction site and remove the obstacles within the project site including the water area
- ② To clear the customs for the equipment to be used for this project and to go through the procedures for import duties exemption
- ③ To go through the procedures for exemption from all taxes and other surcharges to be imposed on the Japanese working to supply the equipment and services required for this project in the Republic of The Gambia

- ④ Exemption from approval for implementation of the project required by the Japanese involved in this project, and acquisition and granting of other rights
- ⑤ Effective maintenance and operation of the facilities constructed under the grant aid

[Responsibilities shared by Japan]

- ① To supply all materials and labor required for construction
- ② To execute overseas and inland transport of imported equipment required for construction, and to bear the export insurance premium
- ③ To render consultant services including assistance to preparing implementation plan, tender assistance and construction work supervision

(2) Construction situation and precautions for construction

1) Construction situation

At the time of the basic design study, a survey was conducted of the construction situations in The Gambia especially with regard to construction machinery and labor force on a priority basis. Since the basic industries are not much developed in The Gambia, the country depends on imports for the supply of construction materials. Rubble mounds, large stone and concrete aggregates must also be imported. It is also difficult to procure sands having uniform grain size. As to the construction machinery, in order to implement construction from the land as planned under the project, required machines must be imported from overseas country. Since the project site faces the Atlantic Ocean, the marine construction work must be minimized. For the reasons of both process and safety, it is necessary to reconsider the overall schedule, on condition that construction is executed from the land.

In the country, there is no civil engineering company provided with large construction machinery even though there are several small-sized construction companies. During the site survey, road repair work was carried out at Banjul by CSE (Sene-The Gambia Engineering), a constructor based in Senegal. For the harbor and airport, the country has to depend on foreign construction contractors.

As for water supply for construction work, public water supply is available in the project site to ensure stable water supply. This can be used for this project. Power suspension often occurs to the electric power system due to overcapacity. This is

not suited for the construction work. A large three-phase generator must be installed at the project site to supply electric power to the pile driver.

2) Construction material

Sands will be the only material that can be supplied in The Gambia. Since high quality river sands have been reduced, shore sands tend to be used. When they are used for the reinforced structures, concrete will be oxidized and may erode the reinforcing bar, causing problems to durability of the concrete. In recent years, desertification is proceeding in The Gambia, making it difficult to procure timbers.

The following shows suppliers of the major materials:

Steel pipes and sheet piles -----	Japan
H-section steel and slabs -----	Japan
Rubble mound and coarse aggregates -----	Senegal
Sand -----	Senegal and The Gambia
Cement -----	The Gambia (imports)
Timber -----	Guinea Bissau
Reinforced bar -----	The Gambia

3) Precautions for construction work

Since construction on sea soil is difficult because of the shoaling beach, it is the most effective way for jetty construction to place temporary slabs on the piles driven from the land area, and to shift the jetty. In this case, it is necessary to check if the piles used for the final installation provide the required bearing force or not. According to the soil quality requirements at the projected site shown in Appendix VII, N-value 40 is recorded at the point about 13 m deep. The bearing pile shall be provided with pile head treatment, with consideration given to such soil quality requirements.

(3) Construction and supervisory plan

After signing the consulting services agreement with The Gambia, the consultants shall have a site study and final discussion with The Gambia, and prepare documents required for the tender, such as detail design drawing, structure calculation statement, quantity calculation table and construction specifications. After the tender documents

have been worked out, the contractors are selected through, tender qualification review, tender and tender evaluation according appropriate procedures under Japan's grant aid system. After signing the construction contracts, the consultant shall check construction drawings submitted by contractors in Japan, supervise the production of the materials manufactured in the factory, and conduct witnessed inspection of the export products and equipment quality, as well as shipping inspection. Upon start of the construction at the site, superintendent engineers will be dispatched to conduct acceptance adjustment for the contractor, to supervise the works, to attend the witnessed inspection of the quality control and construction volume, and to prepare the supervision report.

(4) **Equipment procurement plan**

A plan will be worked out to supply from Japan the fisheries equipment such as FRP fishing canoes, fishing gears, artisanal fisheries support vehicles, and outboard engines to be supplied under the project. For overseas transport from Japan to The Gambia, goods are normally transferred via Rotterdam, Netherland. This overseas transport will required about two months.

(5) **Implementation schedule**

This project is based on the detail design period of 3.5 months and construction period of 11 months, as shown in Table 9.

Table 9 Implementation schedule

Month order	1	2	3	4	5	6	7	8	9	10	11
Implementation process	Detail survey										
		Detail design									
			Tender and contracting								
Construction	Preparatory works										
			Jetty connection section								
				Jetty							
								Revetment			
									Slope protection		
											Delivery
Equipment procurement	Equipment procurement										
						Transport					
								Installation			
									Delivery		

CHAPTER 6 PROJECT EVALUATION AND CONCLUSION

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6-1 Effect of the project

- (1) The direct benefit brought about by the construction of the fish landing facilities is an increase in the fisheries production because of extension of the actual fishing operation time which results from reduced fish landing time. For example, when the current surrounding gill net fishing canoes are used, the fishermen leave the spot at 9:30, arrive at the fishing ground at 10:00, leave the fishing ground at 14:00, and start fish landing at 14:00 to 15:00; actual operation time is about 4 hours (240 minutes). In the case of surrounding gill net fishing canoes, the current 95-minute fish landing time can be reduced to about 60 minutes, so the actual fishing operation time can be extended from the current 240 minutes to 275 minutes, an increase of about 15%. Since the current annual fish production at the Bakau fish landing spot is 500 to 700 tons, an annual increase of about 75 to 100 tons in fish production can be expected.

Indirect benefit resulting from the construction of the fish landing facilities is reduction of loads in preparation for departure for fishing, and fish and equipment landing. Especially, a small hand line fishing canoe is handled by one or two persons. Fatigue by the work at the time of entering and leaving the shore not only reduces the operation efficiency, but also prevents participation of the younger successors in the fishing industry. Reduction of the loads by the use of the new facilities is considered to make a significant contribution to improve such a situation.

- (2) The direct benefit brought about by the use of FRP fishing canoes is the increase in fish production, resulting from an increase in the number of operating canoes. Since eight of the FRP fishing canoes to be introduced are substitutes for the existing wooden canoes, there is no effect of increasing the fish production. The other four canoes are intended for the new comers; there is an average fish catch of 500 kg per day. When operation is performed for 275 days a year, there will be an increase of about 460 tons in the fish production every year in the case of four canoes.

Indirect benefit resulting from the use of FRP fishing canoes is technique spread and its effect resulting from the FRP fishing canoes which use the diesel outboard engines. Introduction of the diesel outboard engine which reduces fuel cost by about 50% compared with that of the gasoline outboard engine is considered to trigger establishment of a high value added operation system which aims at reduction of operation cost. The fisheries management in the developing countries tends to pursue

comparatively short-term profitability. Fishing with FRP fishing canoes having much longer service life than that of the wooden canoes is considered to make a significant contribution to convert such management into a planned fisheries management based on a long-term entrepreneur spirit.

- (3) The increased fish production at the Bakau fish landing spot resulting from implementation of the project will contribute to ensure supply of the fish to meet the domestic demands in the metropolitan area of Banjul. The annual fish catch per capita in The Gambia was estimated at 11.5 kg. This figure was raised to about 20 kg in 1992. If there is fish supply the demands are expected to increase further. In the part of Africa where fish are consumed in comparatively greater amount, fish consumption tends to increase naturally to the level of annual 25 kg per capita even if there is not much improvement in the marketing sector. Therefore, annual supply of fish amounting to 5,000 tons is essential to fill the demands for the population of about 200,000 living in the metropolitan area of Banjul. The demands have so far been filled by smoked products coming from the southern fishing districts. Demands for fresh fish are increasing in the metropolitan area where demands for fresh fish tend to grow according to the upgrading standard of living. In this country where ice plants and fish preservation facilities are insufficient, fresh fish distribution from the south is accompanied by disadvantages.

In the Old Jeshwan fish landing spot which is the source of supply for the traditional fresh bonga fish at the metropolitan area of Banjul, the landing beach is small and is affected by tide. The number of the canoes cannot be increased over the current 11, canoes and this spot can supply the fresh fish of only 3,000 tons per year. Therefore, at least half of the remaining 2,000 tons --- 1,000 tons --- must be provided by the Bakau fish landing spot. To achieve this purpose, it is necessary to increase the fish production by a minimum of 300 to 500 tons from the current level of 500 to 700 tons. Increased operation and fish landing resulting from implementation of the present project is expected to make a great contribution to solve this problem.

- (4) Promotion and guidance toward multi-operation of surrounding gill net fishing, bottom gill net fishing, and large hand line fishing by using the FRP fishing canoes supplied under this project will improve the added value of the artisanal fisheries and stabilize the fisheries management. Though bonga fishing mainly by surrounding gill net fishing method is characterized by high quantitative productivity, bonga fish value is low, so economic productivity is not always high. In the fish producing spots of the southern area where marketing conditions are poor, mass production of the low-priced fish based on supply of the processed product to the inland district can be said to be suited to the