3.2.3 Examination of Facilities and Machinery Requested

(1) Scope of landing wharf

1) Planning conditions

i) Catch

As shown in Table 2-10, catch by tuna fishing vessels has little fluctuated since 1985. The use conditions were therefore set based on the catch in 1991, the most recent data available, in estimating the scope of the wharf. According to Table 2-13, the number of fishing trips made by fishing vessels depends on their maintenance conditions of engines and other machinery equipment. As discussed in the Section on Tuna Fishery, vessels make fishing trips throughout the year and there is no specific season when fishing trips are made more often than at other times.

For the total of 195 fishing trips a year, the total catch is 37,585 tones, the average catch per vessel per trip being about 193 tones.

ii) Number of fishing vessels

The number of fishing vessels engaged in tuna fishery is shown below.

Those in operation (as of 1991)	27
Those not in operation (ditto)	9
Total	36

The required number of berths is studied based on the above mentioned number of operating vessels that use Tema Fishing Harbour.

iii) Landing operation

Fish unloading from the hold of a vessel plays a critical role in

landing the catch from the vessel. Currently, either a derrick crane is solely used on the vessel or both the crane and a mobile crane on land. The former can land 40 tones a day, and the latter 70 tones a day. The number of days required for landing an average catch is discussed below.

Derrick crane	: 193 mt 40 mt/day = 4.8 days
Mobile and derrick crane	: 193 mt 70 mt/day = 2.7 days

iv) Fishing Trips per Year

Most of the tuna fishing vessels are second-hand, requiring extensive time for repairs and limiting the number of fishing trips made in a year. Currently, a vessel makes 7 to 9 trips a year on an average. As shown in Table 2.3.3-1, only 27 vessels operated in 1991 while 9 were laying. The table shows that the average number of fishing trips for an operating vessel is 7.2 or 8 fishing trips a year.

Based on the interview survey with fishing companies, the average pre-landing delay is three days, and the total days of such delays for 8 fishing trips is 24 days. If the Project could dissolve the congestion in the harbour, there will be at least 24 extra days.

As mentioned in the section on landing, if cranes can be used at any time, the landing operation could be shortened by about 2 days. For 8 landings, the work can be shortened by a total of 16 days. It is therefore believed that the current operation days could be shortened by a total of 40 days by implementing this Project. Judging from the current 40-day fishing trip (500 GRT class), the project could increase at least one fishing trip. The annual number of operations can be summarized as below.

Current number of operation	8 times
Future number of operation	9 times

v) Number of landing operations at the landing wharf

It is assumed that landing is carried out on 25 days a month exclud-

ing Sundays.

2) Required number of berths

The required length of landing wharf is generally calculated by the following formula.

$$\text{Required length} = \Sigma \frac{N}{r} L$$

wherein L : berth length = ship length + turning area

N : standard number of ships using the berth per day

r : number of times a berth is used = hours when landing is possible/hours spent in landing per ship

Since the tuna vessels studied for this Project make regular fishing trips throughout the year, the number of berths required is calculated based on the total number of days per month that is used by them.

The project conditions are described below.

*Number of fishing vessels: 27 (operating)

*Annual number of fishing trips: 8/vessel(current)
9/vessel(future)

*Number of landing days: 4 days/vessel(current) 3 days/vessel(future)

*Number of operating days for the landing wharf: 25 days/month

The required numbers of berths can be obtained by the following formula.

$$\text{(Required number of berths)} = \frac{\text{(total number of days used per month)}}{\text{(number of days operated per month)}}$$

i) Number of required berths under the present conditions

*Total number of days used per month:

27 (vessels) x 8 (times/year) / 12 (months/year) x 5 (days/vessel)

= 90 days/month

*Number of berths required:

90 (days/month) / 25 (days/month) = 3.6 (berths)

ii) Number of required berths in future

Necessary berths are calculated as below for 27 fishing vessels in operation.

* Total number of days used per month:

27 (vessels) x 9 (times/year) / 12 (months/year) x 3 (days/vessel)

= 60.8 (days/month)

* Number of berths required:

60.8 (days/month) / 25 (days/month) = 2.4 (berths)

iii) Seeking the number of berths required

Based on the above result, the number of required berths for 27 fishing vessels that are currently operating is 4. After the completion of the Project, 2.4 berths or 3 berths will be required with improving handling efficiency.

3) Required length of berth

Based on Table 3-1 showing the dimensions of the existing tuna fleet, the vessels are classified according to the overall length.

Table 3-1 Dimensions of Tuna Fishing Vessels

	LOA(m)	Width(m)	Draft(m)	GRT	Non-operation (1991) (*)
1	80.47	14.0	6.40	992.00	
2	65.10	12.2	5.87	971.20	
3	62.10	9.3	4.50	499.71	
4	57.85	8.4	3.56	402.96	
5	57.45	9.0	3.76	431.23	
6	57.08	8.3	3.75	344.98	
7	56.00	8.4	3.60	426.20	
8	55.45	8.5	3.70	416.90	*
9	55.45	8.5	3.70	416.90	
10	55.45	8.5	3.70	416.90	
11	55.45	8.5	3.70	416.90	
12	55.45	8.5	3.55	371.97	*
13	55.00	11.00	5.80	898.06	
14	55.00	11.00	5.50	898.06	
15	55.00	11.00	5.50	898.06	*
16	55.00	11.00	5.50	898.06	
17	49.40	8.6	3.90	440.50	
18	49.40	8.6	3.90	440.41	*
19	49.40	8.6	3.90	439.89	*
20	49.25	9.0	4.10	454.26	
21	49.25	9.0	4.10	454.26	*
22	48.80	8.8	4.00	284.28	
23	47.40	8.9	3.30	284.86	
24	47.34	8.5	3.95	374.38	
25	47.25	8.5	2.95	372.11	
26	46.10	8.6	3.30	284.76	
27	46.10	8.6	3.30	284.78	
28	45.70	8.4	3.30	282.94	
29	45.70	8.4	3.30	126.56	
30	44.78	8.0	3.69	194.35	
31	43.00	7.6	3.60	294.66	
32	43.00	8.0	3.70	399.78	
33	41.96	7.4	3.55	284.28	*
34	31.00	8.2	5.00	299.28	
35	31.00	8.2	5.00	299.28	*
36	31.00	8.2	5.00	299.28	*

Dimensions of Fishing Vessels

Category	Ship length	Ave.length	No.vessel
(1)	80.47 m	80.47 m	1
(2)	55.0 - 65.1 m	56.86 m	15
(3)	41.96 - 49.4 m	46.7 m	17
(4)	- 31.0 m	31.0 m	3
Total			36

The required berth length is usually calculated based on the average length of fishing ships that normally use the berth. As shown in the table, there is about 50 meter difference between the shortest and the longest vessels. It is considered appropriate to plan the berth length based on the average ship length indicated as each category.

The new wharf should be able to accommodate any fishing vessel when it enters the Harbour. Based on this premises, at least one berth should have the length that can accommodate a ship of the maximum length.

Remaining two berths will be designed to accommodate vessels of the category 2. This is based on the fact that the difference in the

average length between the category (2) vessels and the category (3) vessels is about 9 meters, and if a berth was designed for those of the category (3), two of the category (2) would not be able to berth simultaneously.

In planning a fishing harbour in Japan, the length (L) of lateral berth is calculated by adding to the length of a subject vessel 15%

of the said length as an allowance.

The required berth length in this project is calculated based on the categories (1) and (2).

L = (80.47m x 1 berth x 1.15) + (56.86m x 2 berths x 1.15) = 223.3 m

The berth length for the present Project is thus planned to be 225 meters.

4) Depth of Wharf

According to Design Standards for Fishing Port Structures in Japan" (Pub: Japan Fishing Port Association), the depth of quaywall is obtained by adding 0.5 meter to the maximum draught of the largest fishing vessel if the sea bottom is soft.

The maximum draught of fishing vessels that will use the planned harbour is 6.4 meters, followed by 5.87 meters and 5.80 meters as is shown in Table 4-1.

It is appropriate to build a linear quaywall with three berths in view of the intended use and the construction costs. To calculate the required berth length, one berth is intended for the maximum size vessels and two berths for others. If the depth of quaywall is varied for three berths, a vessel might not be able to berth at the position with appropriate depth when draft of vessels does not meet depth of an open berth. In that case, the ships already landing the catch may have to suspend their operation and move elsewhere to give the space to a larger vessel in order that the larger ship would not have to wait for its turn of berthing. This is not in keeping with the aim of the project.

To enable all the fishing vessels to freely use the quay, its depth will be obtained as a total of maximum where in draught of fishing vessels and its allowance of 0.5 meter.

6.4 m + 0.5 m = 6.9 m

The design quaywall depth is thus determined to be 7.0 meters.

This is almost equal to the depth of the adjacent quaywall, and trawlers that are using the existing quay of the Outer Fishing Harbour can use the new quay whenever a berth is available, thus facilitating landing operation of trawlers.

5) Crown Height of Quaywall

According to Design Standards for Fishing Port Structures in Japan", the required crown height (H) is obtained by adding the value of Table 3-2 to the mean monthly highest water level.

Table 3-2 Crown Height of Quaywall

Mean range (H.W.L.~ L.W.L.)	Fishing vessels (G.T.) 0~20t	20~150t	150~500t	500t or larger
0 m - 1.0 m	0.7 m	1.0 m	1.3 m	1.5 m
1.0 - 1.5	0.7	1.0	1.2	1.4
1.5 - 2.0	0.6	0.9	1.1	1.3
2.0 - 2.4	0.6	0.8	1.0	1.2
2.4 - 2.8	0.5	0.7	0.9	1.1
2.8 - 3.0	0.4	0.6	0.8	1.0
3.0 - 3.2	0.3	0.5	0.7	0.9
3.2 - 3.4	0.2	0.4	0.6	0.8
3.4 - 3.6	0.2	0.3	0.5	0.7
3.0 - 3.2	0.3	0.5	0.7	0.9
3.6 or over	0.2	0.2	0.4	0.6

(NB) Crown height of landing wharf = H.W.L.+ (values of Table 4.2.3-2)

As shown in Chapter 4.2 of the section of natural conditions, H.W.L. is 1.8 m. The crown heights for the ships smaller than 500 GT and larger than 500 GT are obtained from the following formulas.

150 - 500 GT : 1.8 + 1.1 = (+) 2.9 m

larger than 500 GT : 1.8 + 1.3 = (+) 3.1 m

On the other hand, the height of the existing quay adjacent to the planned site in the Outer Fishing Harbour is +3.05 m. This does not hinder the landing operation of tuna vessels that occasionally use the wharf. The appropriate crown height of the new quaywall under the present project is to be +3.05 m.

6) Apron width

According to "Design Standards for Fishing Port Structures in Japan", values shown in Table 3-3 are recommended for the apron width.

Table 3-3 Apron Width

Classification	Apron Width (m) Landing wharf
Deliver all catches to building	3.0
Deliver directly by car from apron	10.0
Wharf for preparing for fishing trip	10.0
Lay-by wharf	6.0

According to the plan, landing is by mobile cranes and delivery by trailers and trucks. The apron width is 10 meters.

(2) Transitional part of Seawall and Quaywall

1) Transitional part of the existing quaywall

The end of the existing quaywall on the side of the planned site is made of concrete blocks piled in steps. The length of this portion is 9.6 m. The cross section of the existing quaywall was designed by a British consultant firm. No applications of such type of structure

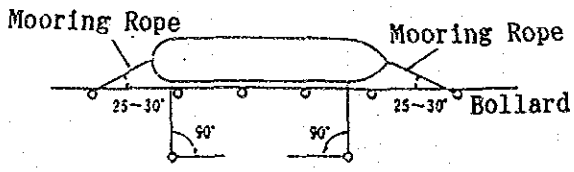
are available in Japan, and "Design Standards for Fishing Port Structures" does not instruct such design methods. Since the structure under this plan is to be designed according to the "Design Standards", this portion will have a different structure.

The face line for the new quaywall will have an angle of 10 degrees toward the offshore from the face line of the existing quay. If the new quay is to start from the end of the existing quay, the overhanging of capping will become larger. This is not preferable for the quay structure. This portion shall therefore be considered as the transitional part of the existing quay, have the same face line as the existing. The end of the blocks piled in steps will be the beginning of the planned new quaywall and give 9.6 m long for the part.

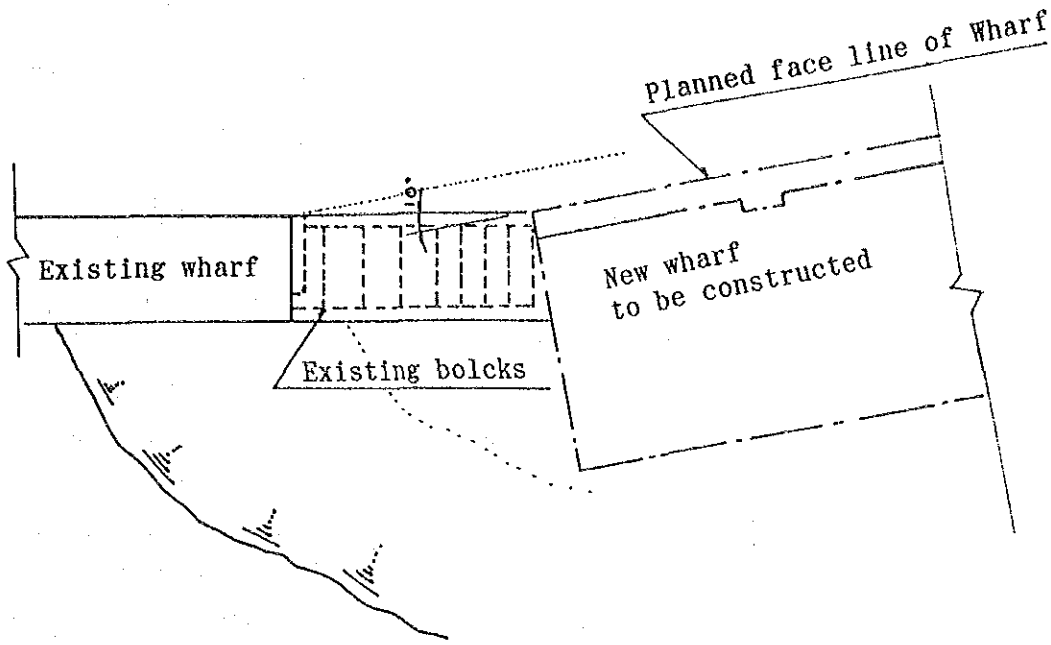
2) Transitional part of the existing breakwater

The portion to be used as the wharf will naturally have bollards for mooring. According to "Technical Standards for Port Facilities", both the bow and the stern should be attached to the mooring posts with mooring rope at an angle of 25 - 30 degrees from the face line of the quaywall. The maximum degree of 30 degrees is used here in calculating the position of the bollard when the bow of the largest fishing vessel with 14 m width was at the end of the quaywall. The distance between the bitt and the quaywall end is:

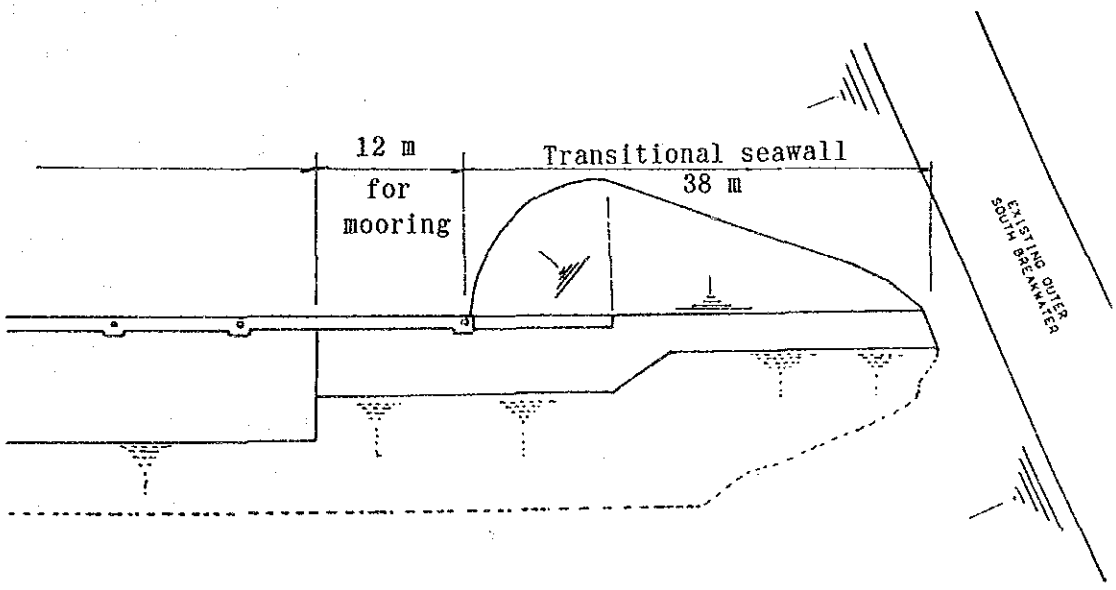
$14/2 \times \cot 30^{\circ} = 12$ m.



Based on the result, the 12 meter section from the end of quay to the mooring post is given the same structure as the quaywall considering oscillation of a vessel. The water depth of 7 meters is secured similarly.



Transitional part of existing wharf



Trasnsitional part of seawall

Fig. 3-1 Transitional Part of Planned Structures

The 38 meter section from the mooring post to the existing breakwater is used as a seawall for reclamation.

(3) Administration Office

Tuna catch is currently being landed at three places, i.e. Inner Harbour, Outer Fishing Harbour and Tema Port. Due to the shortage of staff, fishing harbour management can not adequately control fishery activities in the harbour area. After the Outer Harbour Rehabilitation Project is completed, all the tuna fishing vessels will be controlled in the Outer Fishing Harbour under GPHA. GPHA proposes to re-organize their system, assign the administrative staff to the Outer Fishing Harbour, and place both the Inner and the Outer Harbours under the control of Fishing Harbour Administration Office. Table 3-4 shows the organization of the Office after the completion of the Project. The Office is currently located adjacent to the fish market on the north of the Inner Harbour, but it does not have enough space to accommodate the increased number of personnel after re-organization. Catch in temporary storage under bond for transshipment/export is placed under a strict control going through the customs inspection and the port health services within the Fishing Harbour. A fishing harbour administration office to house the increased number of GPHA staff, customs officials and port health service officers is essential under the situation described above.

Table 3-4 Staff Organization of Fishing Port Office

Title	Supervisor	Clerk(administrator)	Staff	Total
Fishing harbour manager	1			1
Secretary		1		1
Auditing	1	1	2	4
Account	1	1	5	7
Operation control	1	1	16	18
Administration			2	2
Customs		1	1	2
Port health service		1	1	2
Total	4	6	27	37

(Source: GPHA)

Staff organization consists of 4 supervisors, 6 administrators, and 27 staff, totaling 37. The Administration Office will require the area as shown in Table 3-5.

Table 3-5 Required Area of New Fishing Port Office

Title	No.of persons	No.of rooms	Standard floor area m^2/person	Actual floor area m^2/person	Required floor area m^2
Supervisor	4	4	13-18	16.4	65.6
Administrator	5	5	13-17	15.58	77.9
Secretary	1	1	13-17	16.4	16.4
Clerk	27	7	4.5-7.5	5.9	159.9
Reception	-	1		(incl.passage)	24.6
Conference	-	1	40 m^2 min.		32.8
Kitchen	-	2	21 m^2	10.25x2=20.5	20.5
Toilet(M)	-	2	15 m^2 min.	12.30x2=24.6	24.6
Toilet(W)	-	2	15 m^2 min.	10.25x2=20.5	20.5
Staircase	-	4		12.3 x4=49.2	49.2
Corridor	-	2		54.00x2=108	108.0
Total	37	34			600 m^2

(4) Toilet Facilities

Sanitary condition in the Outer Fishing Harbour is not good because toilet facilities are not available for stevedors and vessel crews working for handling, maintenance, etc.

A toilet facilities is recommended for sanitary reasons in the Outer Fishing Harbour since gravitation of people working for fishery activities there is expected after the provision of a new wharf.

Desks, chairs, filing cabinets, bookcases, sofas and tables will be placed with suitable intervals, and the area required for them will be included in the floor area of the office.

(5) Security-check House and Security Fencing

In order to prevent frequent pilferage of landed catch in the Inner and Outer Harbours, security-check is essential and the entry should be restricted to authorized personnel.

As the transshipment of tuna for export is planned in the Outer Harbour, this area should be controlled as the bonded area.

Security fencing and security-check houses will be planned to separate the Outer Harbour District from the other area of the port. A total of 430 meter fence will be built along the boundary of the Inner and the Outer Harbours and the access road in the rear. One each security-check house will be built at the quay and the road in the rear.

(6) Road in the Harbor

Roads to transport landed catch to cold stores outside the Harbour are essential. The harbour area is very much congested as discussed in the section of the Present Use of Harbour, and smooth transportation by trucks and trawlers is impossible. After the rehabilitation of the Outer Harbour, the traffic congestion is expected to become worse. The road over the Lee Breakwater which is currently used to

access the oil berth will therefore be used for access to the Outer Harbour. Vehicles authorized to use this access road are currently limited to those having business at the oil berth, and therefore the traffic is very light. Transportation of landed catch from trawlers using the existing wharf will be facilitated if this road is used. As shown in Fig.4.2.3-3, the road will be planned to go behind the apron of the new quay from the existing quay and to join the road on the breakwater. The road falls subject to "Type 3, Class 5 of the local roads" as defined in "Design Standards for Roads". A lane will have 3.0 meter width, and the road will have two lanes or the total width of 6.0 meters.

(7) Tuna Unloading Service Equipments

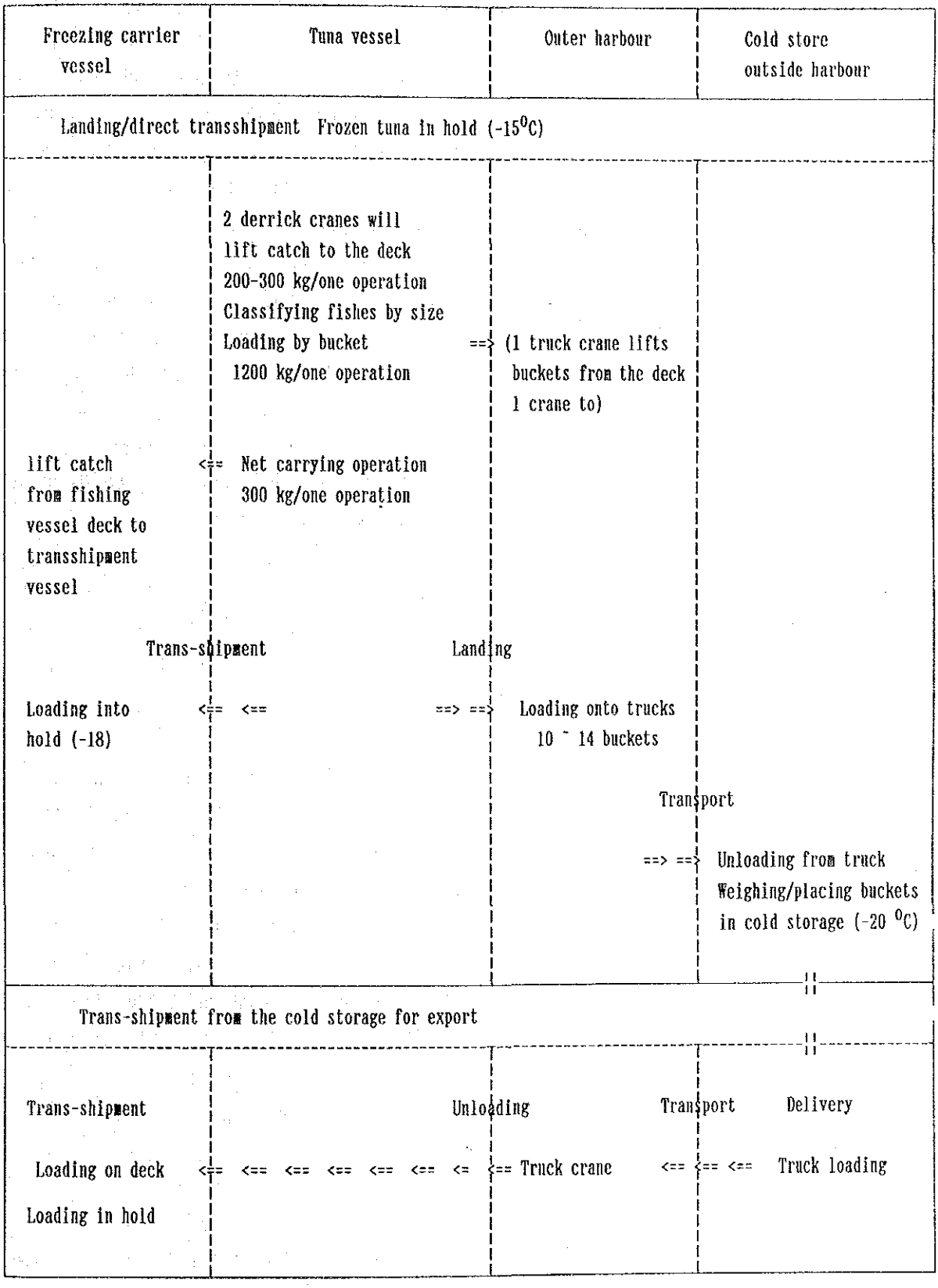
As discussed in Section 3.2: Details of the Request, the Government of Ghana requested following equipments for unloading tuna catches.

*Belt conveyor, trailer
*2.5 tonne fork lift
*Tuna container

These equipments are requested based on the premises that the fish catch will be transferred to a large cold storage facility annexed to the quay. In view of the fact that the present plan does not include an cold store, that the private sector will construct the facility, and that the facility will not be ready with the completion of the Outer Harbor quaywall and reclamation, these equipments are considered to lack the urgency or the necessity under this Plan.

It is therefore considered reasonable to exclude these equipments from the Plan.

The following chart shows the present procedure of landing and transshipment of frozen fish for export.



As is clear from the chart, work in the hold cargo decisidedly affects the efficiency in cargo handling. This is because the hatch

opening is not large enough to take out a large volume of frozen fish at one time, the operability of the derrick crane is inadequate and the work efficiency is poor because workmen have to work in the cold atmosphere. The work efficiency in the hold must be improved by assigning an optimum number of workers, and the cargo handling efficiency by using a mobile crane. As discussed in the section of "Present Conditions of Landing Operation" in fishing harbours, mobile cranes on lease from private companies is currently operating. This crane cannot be used exclusively for landing because it is used also for construction work, thereby causing delays in cargo handling and demurrage, and difficulties in management of fishery companies.

In order to correct such a situation and improve the landing efficiency, one mobile crane per berth is recommended.

Such a mobile crane must be capable of landing catch of all the fishing vessels. As about 300 kg of fish is placed in a net and suspended from the hold, at least 13 meter is required as the work radius from the center of turning of the crane.

Fish is classified by sizes on board and placed in buckets. The buckets weighing about 1.5 tonnes in total are then transferred from the boat deck to the truck on the quay. The work radius is about 10 meters.

There are rarely small mobile cranes that are suitable for such operation, but a 20-ton truck crane is recommended for the present project by judging the work efficiency, capacity and price as a whole.

(8) Reclaimed land for Fishing Harbour Infrastructure

Private fishery companies are very much interested in the plan to build an cold storage facility with the private capital as discussed by the Government of Ghana in the request. The area required for the administration facility, road in the harbour ground, parking area,

apron, etc. in addition to the area for a cold store was estimated.

As the pipelines for oil and water are laid in the back of the reclaimed area, there should be left at least 5 meter strip between the area and the buildings.

1) Site for cold storage

The area required for a cold store and related facilities is estimated based on "Guideline for Fishing Harbour Planning". The basic values discussed below are obtained from the Guideline. Assuming the capacity of a cold storage facility is 3,000 tonnes as mentioned in the Request and the effective height of the store is set as 5 meters,

Area for storage (m2)= 4.5 x Storage capacity(t)/Effective height(m)
= 4.5 x 3,000/5 = 2,700 m2

Adding to the above area 300 m2 for external facilities and administration office, 3,000 m2 is required as the area for cold storage facility.

2) Site for trailer truck turn-around

Landing fish at the wharf requires a work site for cranes and trailers to transport boxes of fish to cold storage facilities in the city. The site area is planned to accommodate the largest size of trailers, whose length is 16 m. The present formation shows the maximum width of the site requires not less than the trailer's length or 16 m.
The site width for landing work is planned to be 20 m, considering additional width for safe work and the width includes 10 m of the quay apron.

The entrance for the cold storage facility will face the wharf, and there will be provided a space for trailers to turn around. Currently, the trailers being used require the minimum turn-around radius of about 14 meters. Another meter will be allowed, making the width of the space 15 meters.

3) Roads and parking strip

In order to ease the traffic congestion in the Fishing Harbour, the road on the breakwater along the boundary of the Outer Harbour and the Commercial Harbour is to be used as the access road to the Fishing Harbour. As this road has no turning space for trailer trucks, the junction of the road and the access will be curved in order to secure smooth movement of vehicles into the site for Outer Fishing Harbour. According to "Geometric Standards of Roads", the design speed of 20 km/h will require the minimum radius of 30 meters. Therefore, the radius of the center of the inner lane will be set at 30 meters and that of the outer lane 30 meters. These curves will allow smooth joining to the road behind the quaywall apron.

4) Site for Administration Office

The two-story office is planned with its total floor area of 600 m2. The ratio of building to the lot is usually 70%, and the area for the office will be:

(600 / 2) x 1/0.7 = 430 m2.

To accommodate cars of 12 administrators and 12 concurrent visitors, a parking space for the maximum of 24 cars will be provided. The space for parking a car is 5.0 m x 2.5 m = 12.5 m2 according to the Guideline. For forward parking, the width required is 19.5 meters. Since the Guideline also suggests to add 0.25 m allowance to the width of 2.5 meters, the total length of the parking lot will be

(2.5 + 0.25) m x 12 cars = 33.01.

The parking lot should therefore have the space of

33.0 m x (19.5 + 0.5) = 660 m2.

(8) Support facilities

1) Oil and water supplies

Oil and water supplied to the offshore trawlers and tuna fleet are serviced at the existing wharf in the Outer Fishing Harbour and the lay-by wharf in the Inner Fishing Harbour while landing their catch. There is no facility for exclusive servicing of oil and water supplies for fishing trips.

After the completion of the Project, tuna vessels will concentrate in the Outer Harbour, increasing the need for oil and water supply facilities. Under the present Project, oil and water pipes will be buried alongside the quay of the new fishing harbour with three faucets each to allow the fishing preparation during the landing operation at three berths.

2) Lighting facility

In order to allow night time landing and maintain security within the harbour ground, lights will be provided near the quaywall, apron, roads and the administrative office.

3) Sewerage and drainage

For draining rain water from the reclaimed land within the Fishing Harbour, the land will have a gradient of 1/100. Drainage system will be built to drain the rain water from the Administration Office and connected to the existing sewage for draining at the front of the quaywall.

Sewerage system for the office will be provided with connecting with the existing sewerage and an ejection pump.

4) Fire fighting facility

Since there is no facility in the fishing harbour to extinguish fire occurring on fishing vessels, fire fighting system with pumping

seawater will be planned on the new quay. An emergency generator will be provided in case of failure of the external power source.

3.2.4 Strategy of Project Planning

The project has been justified to be appropriate of its urgency and effectiveness through the above examination. Ghana Ports and Harbour Authority has sufficient experience, work force and financial backup in administering and operating the facilities planned in this project. High publicity of fishing port facilities as basic infrastructure well meet the principles of the Japanese grant aid scheme. Thus, the project will be further examined and planned for the basic design toward realization under a Japanese grant aid programme.

The contents of the Project have been changed following the results of examination in the preceding section.

3.3 Outline of the Project

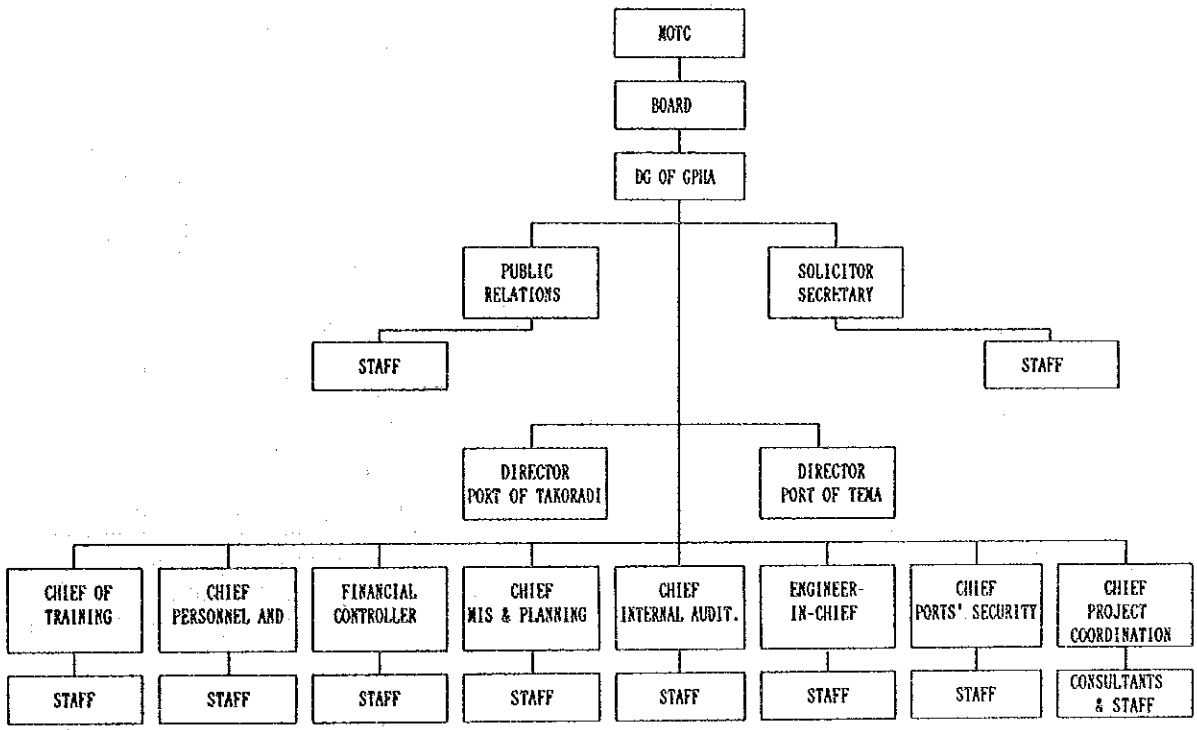
3.3.1 Executing Agency and Management System

(1) GPHA Headquarters and Tema Harbour Organization

GPHA is responsible for the overall management of the Tema Port with the Fishing Harbours. GPHA consists of three organizations of Tema Harbour, Takoradi Harbour and the Headquarters. These organizations have the nominal independent accounting systems as shown in Appendix A-3.3-1. Fig. 3-2 shows the organization chart of GPHA Headquarters and Fig. 3-3 that of Tema Harbour.

ORGANIZATIONAL FRAMEWORK OF GPHA

(I) HEAD OFFICE



MOTC = MINISTRY OF TRANSPORT & COMMUNICATIONS
DG = DIRECTOR GENERAL
WAPT1,MARCH 1986

Fig. 3-2 Organization Chart of GPHA Headquarters

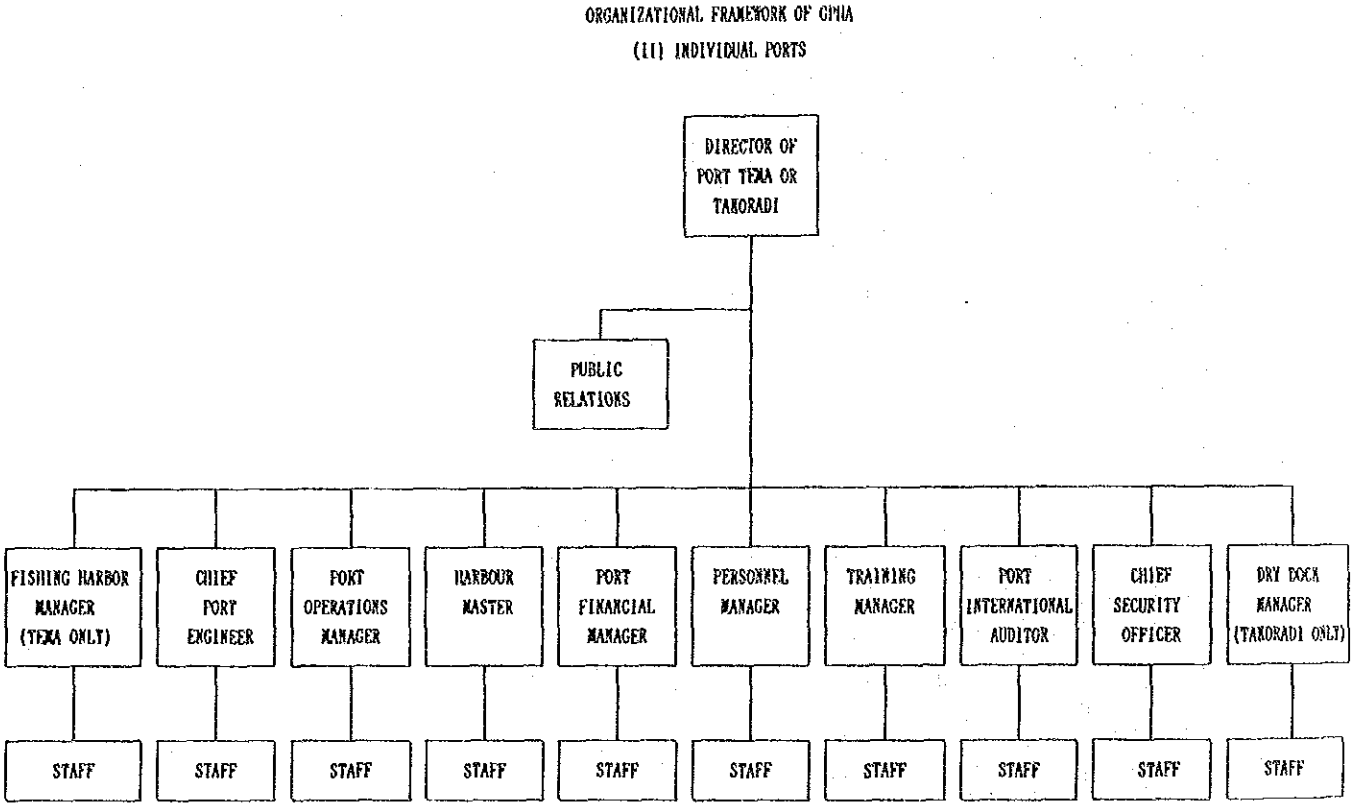


Fig. 3-3 Organization Chart of Takoradi/Tema Harbours

(2) Tema Fishing Harbour Administration Office

GPHA maintains the Administration Office in Tema Fishing Harbour and the Fishing Port Manager is responsible for overall administration. The Office is mainly responsible for collecting the quay charges and landing charges and for selling fresh water to fishing vessels.

The current Fishing Harbour Administration Office is managed by 25 staff members as shown in Fig. 3-4.

Since 1992, GPHA is converting the Office to an independent organization as one bureau of GPHA, and is planning an organization consisting of an administration department headed by the Fishing Port Manager and the staff of the Inner and the Outer Harbours. The organization is not going to recruit new staff but is going address the change to reshuffle the present staff members. The present staff of 25 currently engaged in the administration of the Fishing Harbour will be reassigned and there will be 37 staff excluding the security guards, etc. as shown in Fig. 3-5. Security-checks will be the responsibility of Tema Harbour Security Section.

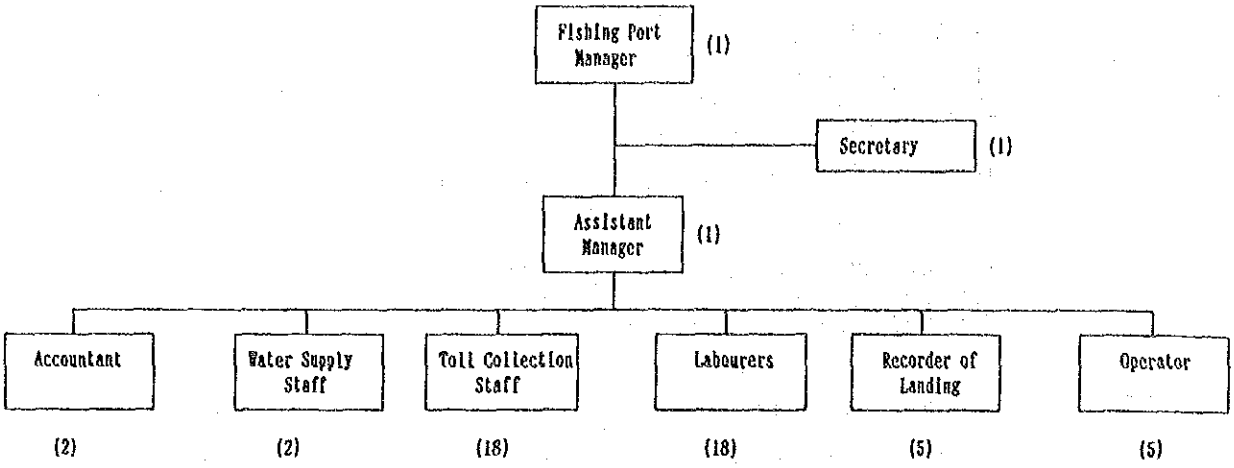


Fig. 3-4 Present Organization Chart of Fishing Harbour Administration Office

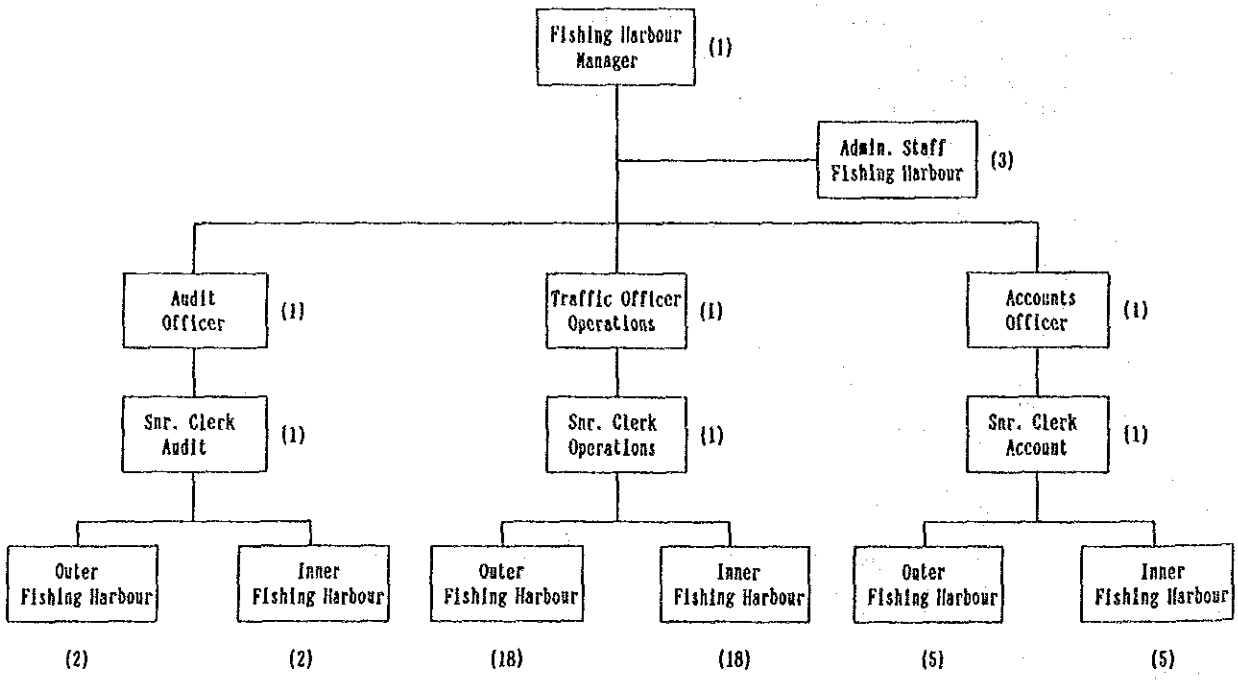


Fig. 3-5 Organization Chart of Fishing Harbour Administration Office after Rehabilitation

3.3.2 Location and Conditions of Plan Site

The site is within the Outer Fishing Harbour adjacent to Tema Port. Fig. 3-6 shows the plan. The Fishing Harbour is very well protected by the existing breakwaters. There is N-S quay wall (210 m) extending in north-south directions in the Outer Fishing Harbour as shown in Fig. 3-6. The quay is a gravity type concrete block construction which was completed about 30 years ago.

This quay is mainly used for offshore trawlers for lay-by, but it is also used occasionally for landing as there are not enough berths for fishing vessels. There are 6 to 7 non-operating fishing ships moored laterally to the berth closest to the Inner Harbour. These ships hardly move from where they are. There are also 3 to 4 vessels laterally moored to other fishing vessels which are berthed to the remaining 2 berths. Most of these vessels are large trawlers, making already crowded basin more crowded.

Fig. 3-6 shows the project site by the present Plan. Behind the land to be reclaimed is an extensive slope of the breakwater covered by armour stones each weighing 2 to 3 tonnes. As will be discussed in detail in Chapter 5, all the quaywalls are built with concrete blocks in Tema Harbour because there is a firm foundation layer beneath the soft layer of 2 to 3 meters of the sea bottom.

As for fishery harbour infrastructures on land, the water and oil pipelines are laid along the existing quaywall can be extended easily to the planned site. Power lines can be introduced most easily from the power station No. 3 in the Inner Harbour.

There is a manhole near the SFC cold storage in the Inner Harbour and sewage from the Outer Harbour should be connected to the man hole.

3.3.3. Outline of Facilities and Equipments

Based on the result of the review, the facilities and equipments judged to be offered under the grant aid programme are outlined below. Their details

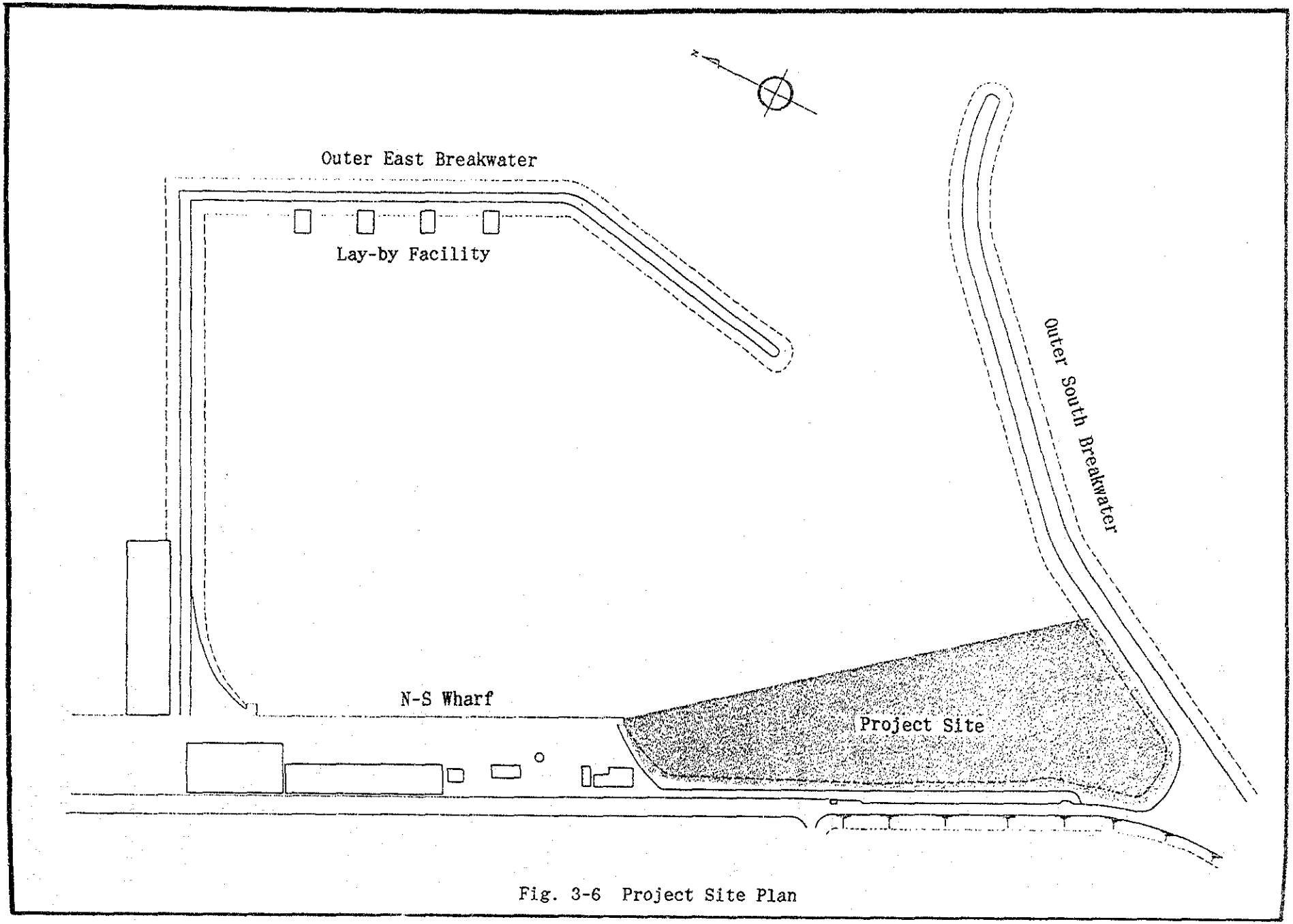


Fig. 3-6 Project Site Plan

will be discussed in Chapter 5: BASIC DESIGN.

(1) Land reclamation	19,950 m2
(2) Landing wharf	
1) Mooring wharf	
* Wharf length	225.0 m
* Depth	7.0 m
2) Apron	
* Width	10.0 m
* Length	225.0 m
(3) Transitional part of seawall	
* Existing-wharf part	9.6 m
* Existing-breakwater part	50.0 m
(4) Administration office	
* Total floor area	600.0 m2
(5) Security facilities	
* Security-check house	2.0 units
* Security fencing	430.0 m
(6) Road	335.0 m
(7) Cargo handling facility in fishing harbour	
* Mobile crane (20 t)	3.0 units
(8) Support facilities	
1) Faucets for water and oil pipes	3.0 each
2) Lighting	8.0 units
3) Drainage	25.0 m
4) Fire extinguishing facilities	
Water pump	1.0 unit
Hydrants	3.0 units

3.3.4 Administration and Operation Plan

The organization and budget of GPHA, the execution Agency, are described in the sections 3.2.2 Implementation and Management Plan and 3.3.1 Execution Agency. It was highlighted that the system of GPHA and its branch, Fishing Harbour Administration Office, was fully capable of its job. This section examines the administration expenses and fishing harbour management after the Project is completed.

(1) Administration expenses

As revenue and expenditure in the Inner Fishing Harbour for the first half of 1992 is well balanced, administration expenses for the Outer Harbour after the completion of Plan are examined.

Table 3-6 shows the revenue which basically comprises the harbour rent dues, tuna landing charges and the fishing vessel handling charges when all the tuna landing operation is transferred to the Outer Fishing Harbour from the Main Port. Charges for stevedoring will not be considered here since the actual expenses are charged to fishery companies.

Water supply fees with a bit of include the service charge are accounted and amount of the charges is comparatively small. They are not included in the discussion here.

Table 3-7 shows the expenditures which mainly comprise personnel expenses for administration of the Harbour and buildings and expense maintenance and repair for facilities. Although rental fee of US$66/hour is paid for cargo handling crane currently, it is assumed that it will be offered at cost by GPHA and therefore eliminated the intermediate cost. The actual costs of fuel and operation for 3 mobile cranes are included in accounting.

Comparing the revenues and expenditures, increased cargo handling of tuna will enable the Outer Fishing Harbour to manage independently. The balance will be in black when the landing volume is assumed as 35,000 tonnes.

Table 3-6 Revenue after Completion of Outer Fishery Harbour

Revenue

1. Wharfage (fishing boat over 30 m)	230,000
2. Anchorage	450,000
3. Mooring charge	826,000
4. Landing charge	91,420,000
5. Towage	9,700,000
Total	102,626,000

NB 1. Oil and water supply will be at cost, as a rule, and will not be listed.
2. Stevedoring cost will be at cost, and will not be listed.
3. Port charges will be assumed as paid

Table 3-7 Expenditure after Completion of Outer Fishery Harbour

Expenditure

1. Personnel expenses	9,722,000
2. Operation costs, miscellaneous	1,940,000
3. Administration/maintenance	11,244,000
Crane maintenance/repair, purchase 3%/yr	5,953,000
Building maintenance/repair, purchase x 0.5%/year	1,984,000
Infrastructure maintenance/administration, construction x 0.1%	3,307,000
4. Electricity	8,130,000
5. Water	6,773,000
For buildings	1,656,000
For vessels	5,117,000
6. Telephone, etc.	5,000,000
7. Misc. consumables	5,000,000
Total	47,809,000

(2) Management of Fishing Harbour

When the wharf at Tema Outer Fishing Harbour is provided for exclusive use for tuna vessels, efficient landing operation can be expected. However, the current situation at the Outer Fishing Harbour does not necessarily provide enough space or berth. For promoting still more efficient management of the Outer Fishing Harbour. The restricted uses and improvements described below are indispensable.

1) Matters related to use of wharf

i) The new wharf will be used exclusively for landing. Its use for laying or preparation will be restricted

ii) Tuna fleet will be given priority in using the new wharf. Cost reduction in management is a requisite for the fishing industry to be internationally competitive. GPHA is expected to pay the maximum consideration to the fleet.

iii) For efficient use of the wharf, fishery companies will be required to submit the entrance plan in advance.

iv) The Project aims at improving the landing efficiency with construction of the wharf. In actual use, all the fishing vessels will need time to lay-by inside the harbour and such needs should be met. In view of insufficient number of berths in both Inner and Outer Fishing Harbours, it is recommended to secure a lay-by area near the East Breakwater of the Outer Fishing Harbour.

v) Non-operational vessels or vessels that are moored indefinitely in the basin in the Outer Harbour should preferably be removed from the fishing harbour.

2) Improving efficiency of oil and water supply operations

No special wharf will be provided for oil and water supply. The operations will be performed efficiently during the cargo handling operation.

3) Improving efficiency of fish landing operation

i) GPHA is expected to efficiently control the entrance and departure of fishing vessels, berthing and cargo handling operations, and other services with the minimum number of persons. Fish landing equipment such as mobile cranes will be provided at reasonable costs.

ii) In view of hovering prices in the international fish market, intermediate costs should be curtailed as much as possible by consigning to the private sector such works of selection of fish species and sizes that directly affect the costs and delivery to/from the cold storage.

4) Restricted entry to Outer Harbour Area

Entries to the Outer Harbour Area should be restricted as the bonded area. GPHA will issue permits for entry only to fishing vessel crews and fishery company personnel concerned.

3.4. Technical Assistance

No big project comprising various kinds of port works has not been carried out since implementation of Tema Fishing Harbour Rehabilitation Project in 1990. The Project for Tema Outer Fishing Harbour Rehabilitation is expected to serve a good training opportunity for engineers from GPHA. GPHA conveys to the Japanese side the intention to join training courses in terms of the fishing port engineering at the site and in Japan .

Regarding fishing vessels' maintenance, foreigners are mainly involved in such work as engine maintenance and only few Ghanaian experts are available for such work. Present situation shows most non-operational fishing vessels are suffering from lacking necessary spare parts and delaying their purchase. For establishment of independent fishery industry with increase of fish catch, training system for the engineers is indispensable. It is considered that technical cooperation on fishing vessel engines will be required.

CHAPTER 4

BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 Design Policies

Preceding chapters discusses the concept and scope of the Project. Aiming to promote tuna fishing industry, the project facilities discussed are designed in accordance with the basic policies mentioned below:

(1) Convenience is considered for fishing vessels in their maneuvering in the projected fishing harbour.

(2) Coordination of new facilities with the inner fishing harbour is made for activating functions of both of the fishing harbours.

(3) As the project site is close to the existing wharf, the project facilities should be planned not so as to disturb the normal harbour operation.

(4) The project facilities will be planned by considering natural conditions and construction conditions at the site, and the utilization of local materials and manpower should be maximized.

(5) As the construction period is short, the construction methods which afford the swiftest possible progress of works should be adopted.

(6) With regard to the design standards, Japanese Standards will be applied to all civil works, building, machinery and utilities referring to the existing facilities constructed at the adjacent.

4.2 Project Site Conditions

4.2.1 Natural Conditions at Project Site

(1) Meteorological Conditions

1) Temperature

The monthly average of maximum and minimum temperature for the past 20 years and the latest 2 years at Tema are shown in Table 4-1. As shown in the Table, the monthly average of maximum temperature on the highest temperature season from February to May is about 31 ^{o}C and that of minimum temperature is about 24 ^{o}C, and the diurnal range is about 7 ^{o}C. While, the monthly average of maximum temperature in the lowest temperature season from July to September is about 27 ^{o}C and that of minimum temperature is about 22 ^{o}C, and the diurnal range is about 5 ^{o}C.

The annual range of maximum and minimum temperature is about 4 ^{o}C and 5 ^{o}C, respectively. The seasonal change of temperature is small.

Table 4-1 The monthly average of maximum and minimum temperature at Tema

	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Max.	'56 -'75	30.4	30.8	31.0	31.0	30.5	28.7	27.3	26.7	27.4	29.2	30.5	30.6	29.5
	'90 -'91	30.7	30.9	31.6	30.6	30.4	29.4	27.4	26.7	28.0	29.1	30.6	30.6	29.7
Min.	'56 -'75	23.8	24.5	24.7	24.5	24.3	23.3	22.6	21.9	22.4	23.2	23.9	23.9	23.6
	'90 -'91	24.3	24.8	25.9	24.8	24.8	24.5	23.3	22.1	22.1	23.5	24.5	24.0	24.1

The monthly average of maximum and minimum temperature for the past 30 years at Accra, the capital of Ghana about 25 km west away from Tema is shown in Table 4-2. Comparing the data at Accra and Tema, the average of maximum temperature at Tema is slightly lower, but the general tendency and the average of minimum temperature is almost same each other.

Table 4-2 The monthly average of maximum and minimum temperature at Accra

	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Max.	'61 -'90	32.1	32.7	32.5	32.2	31.2	29.3	28.0	28.0	29.1	30.5	31.6	31.7	30.7
Min.	'61 -'90	23.4	24.1	24.1	24.2	23.9	23.1	22.5	22.2	22.4	22.9	23.5	23.4	23.3

2) Rainfall

The monthly average of rainfall for the past 25 years and the latest 2 years at Tema are shown in Table 4-3. As shown in the Table, the annual mean rainfall is about 700 mm and is relatively small comparing with 1,440 mm at Tokyo. The monthly rainfall fluctuates by year, and it can be seen that the season on which the rainfall is a lot is constantly likely from March to July and September and October. Especially the rainfall for two months from May to June amounts nearly to a half of annual rainfall.

Table 4-3 The monthly average of rainfall at Tema

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
'61 -'85	8.2	25.5	48.9	88.4	129.1	203.3	63.9	25.7	45.9	56.5	25.3	12.8	733.5
1990	1.4	16.0	5.5	79.1	114.8	112.3	13.1	0.1	39.2	31.5	18.9	111.0	542.9
1991	5.7	17.3	4.7	175.1	189.6	81.0	189.3	12.9	22.7	59.1	0.1	0.0	757.5

3) Relative humidity

The monthly average of relative humidity at 6:00 hours and 15:00 hours for the past 15 years and the latest 2 years at Tema is shown in Table 4-4. As shown in the Table, the monthly change of average relative humidity at 6:00 hours is small and about 92 %. The aver-

age of relative humidity at 15:00 hours is 10 to 20 % lower than that at 6:00 hours and is about 76 % in average. The highest relative humid season is around August after rainy season and the lowest season is around December.

Table 4-4 The monthly average of relative humidity at Tema

	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
6:00	'66 -'80	90	90	90	90	91	93	93	93	93	92	91	91	91
	'90 -'91	89	88	91	92	93	93	94	94	92	92	93	90	92
15:00	'66 -'80	73	74	74	74	74	79	81	82	80	76	73	72	76
	'90 -'91	74	77	75	78	77	79	82	81	81	76	75	70	77

4) Wind direction and velocity

The monthly average of wind direction and velocity for the latest a year and that of wind velocity for the past 13 years are shown in Table 4-5. As shown in the Table, the predominant wind direction is SW throughout the year. The monthly average of wind velocity is almost constant and 4 to 6 knots.

Table 4-5 The monthly average of wind direction and velocity at Tema

	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Direction	1991	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW
Velocity	'66 -'78	5.0	6.1	6.0	5.5	5.1	5.1	5.5	5.9	6.5	6.3	5.2	4.7	5.6
	1991	3.9	4.8	4.5	3.7	3.7	3.4	5.1	4.8	5.4	5.5	4.7	3.5	4.4

(2)Sea Conditions

1) Waves

(a) Design wave

To evaluate wave conditions over the Ganaian region, Offshore waves coming over the Nigerian region are applied. This is because (1) the predominant wind direction at Tema is SW, corresponding to the direction of deep water waves at Lagos, (2) source of most waves can be considered to be Atlantic Ocean, and (3) the contour lines in the sea region of Gulf of Guinea along from Ghana to Lagos are nearly parallel to his coastal line. Therefore, the deep water wave characteristics at Lagos are adopted to examine the waves around the Tema region, which are valued as follows referring to the report of "Feasibility Study on the New Port Construction Project (East District) in Nigeria, January, 1982" by JICA.

* 50-year wave
  - Height of Significant Deep Water Wave (Ho): 6.0 m
  - Period of Significant Deep Water Wave (To): 12.0 sec.
  - Direction of Significant Deep Water Wave: SW

Refraction diagrams for establishing the design wave are shown in the Appendices. As the results of the computation of wave refraction, the dimensions of the design wave, that is incident wave to the harbour mouth are obtained as follows:

  - Wave Height (H): 2.97 m
  - Wave Direction: S (South)

(b) Calmness in the inner harbour

By using the above dimensions, the calmness at present in Tema Outer Fishing Harbour is computed and the results are shown in Fig. 4-1. Numerals in the Figure indicate the rate of wave height (%) to the incident wave height. From the Figure, it can be seen that the wave height at present in the inner harbour is less than 0.30 m (= 0.10 H) and extremely calm, and this is nearly corresponding to the present condition.

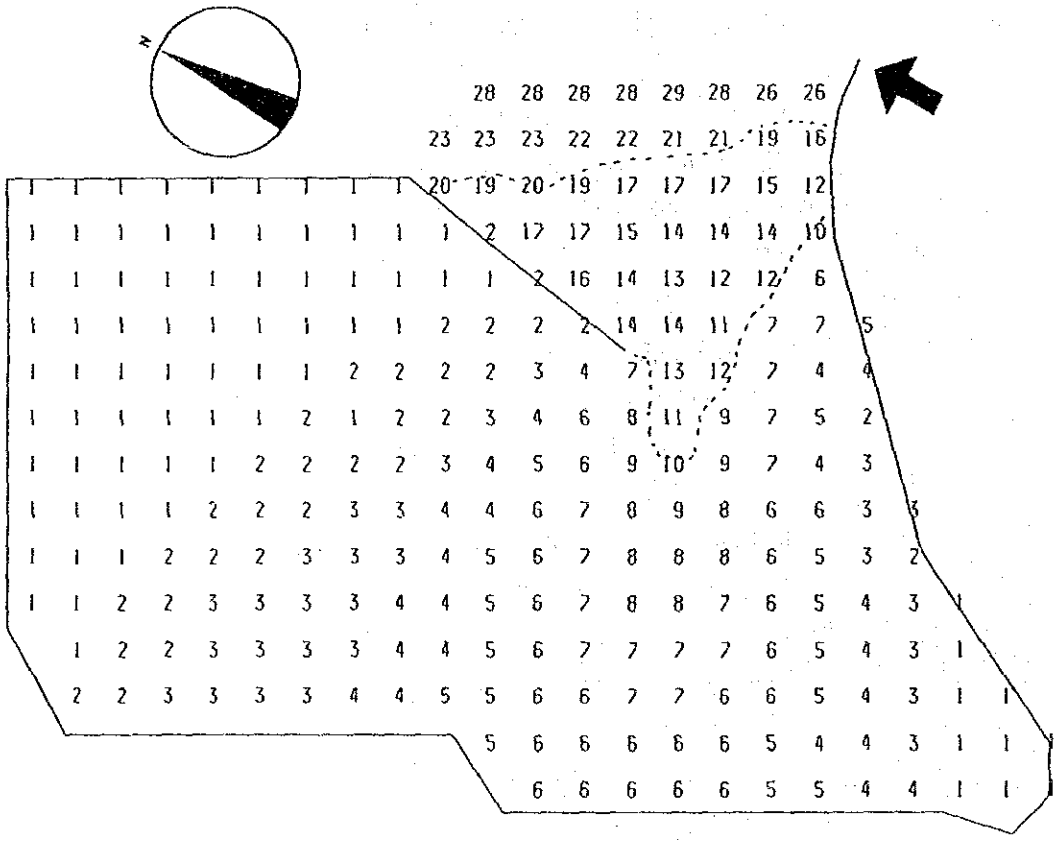


Fig. 4-1 Wave Distribution in Tema Outer Fishing Harbour

2) Tide level

From the harmonic analysis of tidal records obtained by means of 15 days' continuous observation, the following major four tidal components such as Principal Lunar Semidiurnal Component (M2), Principal Solar Semidiurnal Component (S2), Principal Lunar Diurnal Component (O1) and Luni-solar Diurnal Component (K1) are obtained:

- M2: 0.512 m (0.505 m)
- S2: 0.114 m (0.106 m)
- O1: 0.024 m (0.021 m)
- K1: 0.163 m (0.177 m)

Numerals in the above ( ) indicate the values reported by the previous project of "Basic Design Study on the Project for the Tema Fishing Harbour Rehabilitation, September, 1988" conducted under the Japan's Grant Aid Program. Since there are no efficient differences between the both values, the following tidal conditions reported by the said project are still applied for this project.

H.W.L.: + 1.80 m
M.W.L.: + 0.85 m
L.W.L.: ± 0.00 m (Datum Line)

3) Current

The bottom current observation was made for continuous 25 hours at spring tide using an electro-magnetic current meter set near the construction site in the Outer Fishing Harbour and the observed data show that bottom current was recognized to be toward offshore and was weak and less than 0.05 m/sec. Therefore, it can be considered that this much current has no interferences in maneuvering of fishing vessels.

(3) Topographical Conditions

Fig. 4-2 shows the results of topographical and sounding surveys.

The Outer Fishing Harbour facilities consist of the existing wharf of some 200 m, armour stone slope type revetment and rubble mound breakwaters surrounding them. The existing wharf has 25 to 30 m width of apron, about + 3.0 m height of crest elevation and 6.0 to 7.0 m depth. The existing rubble mound breakwater is constructed with individually several tons of rubble piled up in a slope of 1 : 1 to 1.5, and its crown is about 5 m in width and about +6.0 m in height. The existing armour stone slope type revetment next to the wharf is constructed with the same rubble as mentioned above, and its crown height is about + 3.5 m, the front slope being 1 : 2.

The seabed in the inner harbour tilts north to south toward the sea and almost flat with about - 5 to - 7 m of water depth. The area for a new wharf is - 7 to -8 m in depth of water. And the area of harbour mouth has extra space to secure a new wider approach channel of about 50 m in width and of - 7 m in depth of water.

Fig. 4-2 Water Depth in the Tema Outer Fishing Harbour

(4) Soil Conditions

Generally, bearing strength of soil layer at site is a key factor to determine a structural type of wharf. In order to obtain the soil data at the project site, a local consultant carried out the soil investigation including boring under the supervision of the study team.

1) Boring method

A floating pontoon with winches for adjusting the position was used, on which a boring machine was installed, and Jet Boring and Sounding by means of Dynamic Penetrometer Test were executed.

2) Boring location

Boring was carried out at four points shown in Figure 4-3 in order to obtain the effective soil data covering the whole area for a new wharf.

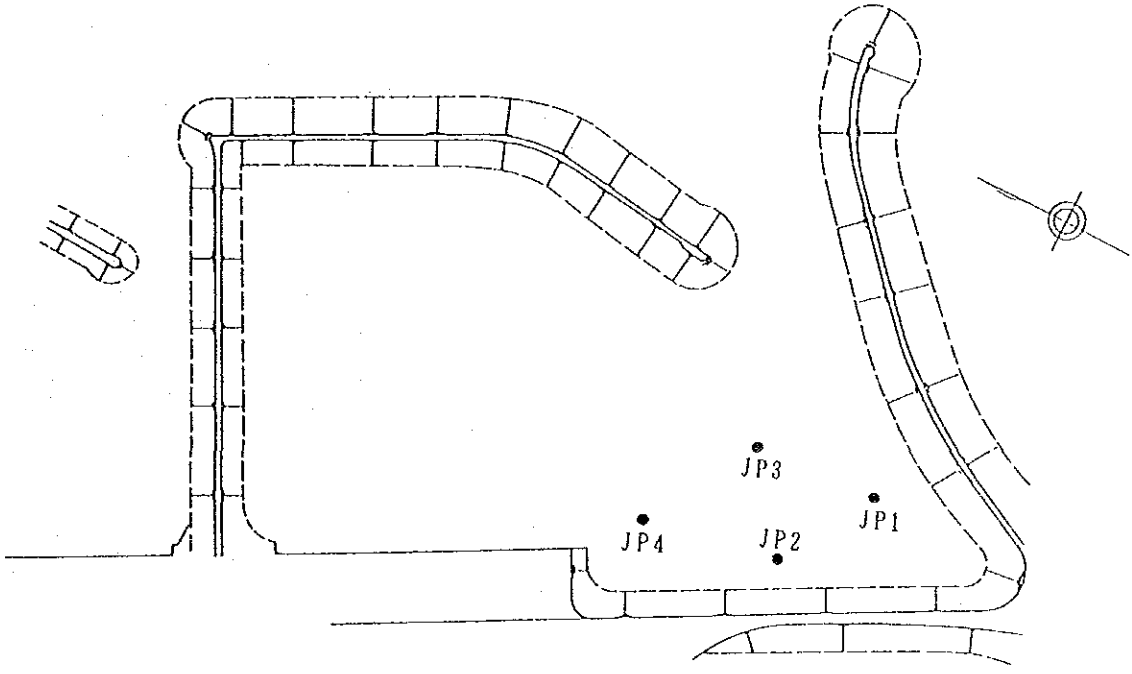


Fig. 4-3 Jet-boring Locations

3) Results

The soil profiles of each boring point are shown in Figure 4-4. N values shown in the figure are obtained through conversion from dynamic-cone-penetration values. From these soil profiles, the soil property at the project site can be characterized as follows:

* 1st layer: Silty clay with N-value less than 10, underlying widely up to - 7.5 m to - 9.0 m in depth with the thickness 0.3 to 2.0 m.

* 2nd layer: Gravel including sand with N-value more than 20.

And the thickness of the 1st layer at the point JP2 and JP4 near the existing revetment tend to be more thick than the other points and the depths also tend to be deeper.

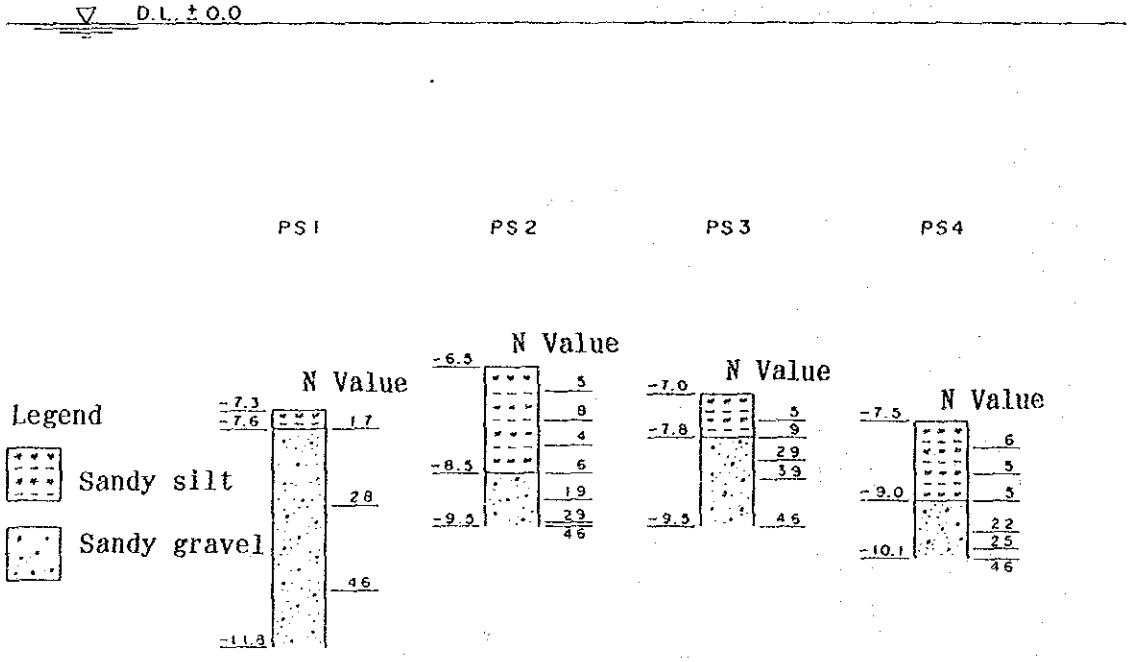


Fig. 4-4 Profiles of Boreholes

On the other hand, the results of sieve analysis of sampled soil are shown in Fig. 4-5. Comparing the both results of the 1st and the 2nd layer, it is obvious from the values of D 50 that the 2nd layer mainly comprises sandy gravels with a D50 value of 2.5 mm and the 1st layer mainly comprises sandy silt with a D50 value of 0.015 mm.

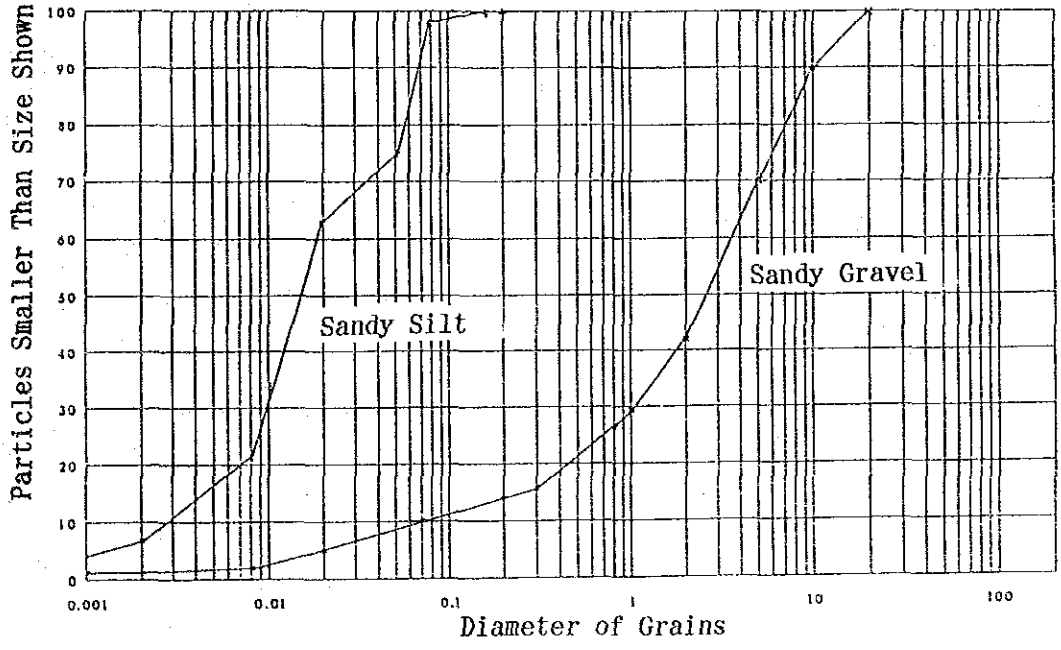


Fig. 4-5 Typical Grading Curves

(5) Investigation of soil materials for reclamation

The area to be reclaimed behind a new wharf needs a large amount of soil materials and a good quality of soil materials for reclamation including sand, stones, etc. are indispensable from the view point of limitation of construction period.

Judging from the interviews to the G.P.H.A and the local construction and consultant firms and the field examination, laterite is applicable as soil materials for reclamation in preference of the previous experiences of construction in the ports and harbours in Tema. The laterite can be procured at Mobole and Kpone which are located within about 30 km away from the Tema Fishing Harbour as shown in Figure 4-6.

Since dredged spoils include a large amount of silty clay in the 1st layer, they are unsuitable for reclamation to prevent the consolidation settlement due to the short term construction.

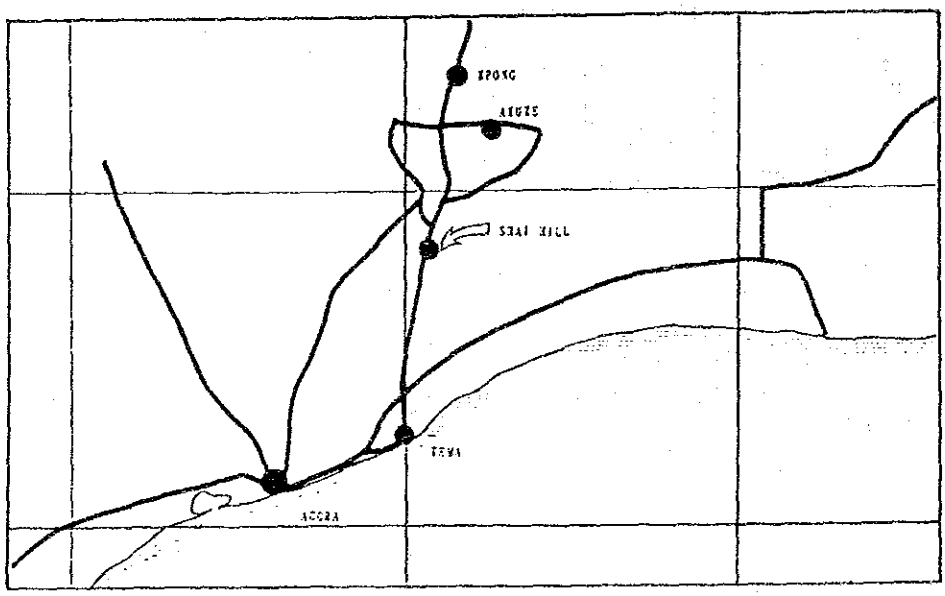


Fig. 4-6 Location of Quarry Site

(6) Earthquake

From the Ghanaian Architectural Standards, the seismic force applied to the structural design is given by the following formula:

$$Kh = A * S * K * I * F$$

where,
- Kh: Horizontal seismic coefficient
- A: Regional seismic acceleration value, 0.04g
- S: Seismic response coefficient by the natural period determined by the building size, 1.0
- K: Coefficient by the antiseismic structure, 2.0
- I: Critical coefficient by the antiseismic structure, 1.0
- F: Coefficient by the structure of foundation, 1.0

From the above formula, horizontal seismic force is obtained as follows:

$$Kh = 0.04 * 1.0 * 2.0 * 1.0 * 1.0$$
$$= 0.1$$

Therefore,
Horizontal seismic forces are 0.1 in air and 0.2 in water.

4.2.2 Infrastructure at the Project Site

The project site is located at the southern side of the outer fishing harbour, being next to the existing wharf running from north to south. Since the water and oil supply facilities are already extended to this existing wharf, the project site is of high convenience for a new fishing harbour site.

The outline of infrastructure conditions of the project site is summarized as follows:

(1) Water Supply

Outlet of water supply is provided on the pedestal with a 6 inches of water pipe being extended to the existing wharf. Extension of the pipeline to the project site is possible.

(2) Oil Supply

As the same as water supply, outlet of oil supply is provided on the existing wharf with the pipe being buried. Extension of the pipeline to the project site is possible.

(3) Sewerage

All the treatment of sewage in the commercial ports and the fishing harbours in Tema is not of a septic tank system but of a terminal treatment plant system. Sewage from an administration office at the project site will also be treated by the said terminal treatment plant system.

The manhole nearest to the project site is located adjacent to the cold storage owned by the State Fishing Corporation in the inner fishing harbour. Judging from the elevation of the said manhole, the sufficient hydraulic-grade can not be taken, so the installation of a ejection pump will be needed at the project site for transference of sewage to the said manhole.

(4) Electric Power

A power cable from the No. 3 transforming plant at the inner fishing harbour to the project site can be easily extended. The existing power dimensions are 3-phase, 415 V through the 500 kva of transformer at the said plant.

(5) Access Road

A new access road to the project site is possible to be allocated to

the route running to the existing wharf in the outer fishing harbour from the behind of the inner fishing harbour, but it is partially narrow and one-way, and moreover heavily crowded with passengers. So the existing paths will not accommodate future traffic after completion of project. While, there is another route on the embankment between the outer fishing harbour and the main port which runs to the oil berth with a scarce traffic volume. Therefore, this route will be able to be a good access with a minor construction work to fit a two meters of gap to a new wharf site.

4.3 Design of Basic Facilities of the Outer Fishing Harbour

4.3.1 Planned Facilities

The followings are facilities newly planned for the promotion of a tuna fishery in Ghana.

(1) Tuna Landing Wharf

(2) Seawall

(3) Land Reclamation for Functional Facilities

(4) Road System

4.3.2 Layout Plan

The preceding chapters discusses the scope and size of the project facilities to enable the maximum efficient contribution to a tuna fishery in Ghana. All the project components will be discussed in the next sub-sections to embody the outline of the facilities based on the following polices:

(1) The new fishing harbour facilities shall function as a main terminal of tuna fishery, which shall be established in systematic connection with the existing fishing harbour separating it from the terminal for a small scale of fishery in the inner fishing harbour.

(2) Various services for fishing vessels shall be available at a new wharf.

(3) Access ways to and from the fishing harbour district shall provide a smooth traffic flow for fish transport smoothly connecting to a new motorway.

(4) A layout plan of a new inner basin and land reclamation shall be made considering that it will efficiently function for fishing vessels' maneuvering and land equipment's operating.

Layout plan made based on the above is as shown in Fig. 4-7.

Furthermore, a face line of a new wharf is determined by computing the calmness of an inner harbour after the completion in the same way as examined in the sub-section 4.2.1. The results of computation of calmness are shown in Fig. 4-8.

Judging from the results, wave heights in the inner harbour will become a little higher than that before the construction described in the sub-section 5.2.1 but will be still less than the wave height (0.3 m) under the condition of which cargo handling is possible, thus still being an extremely calm basin.

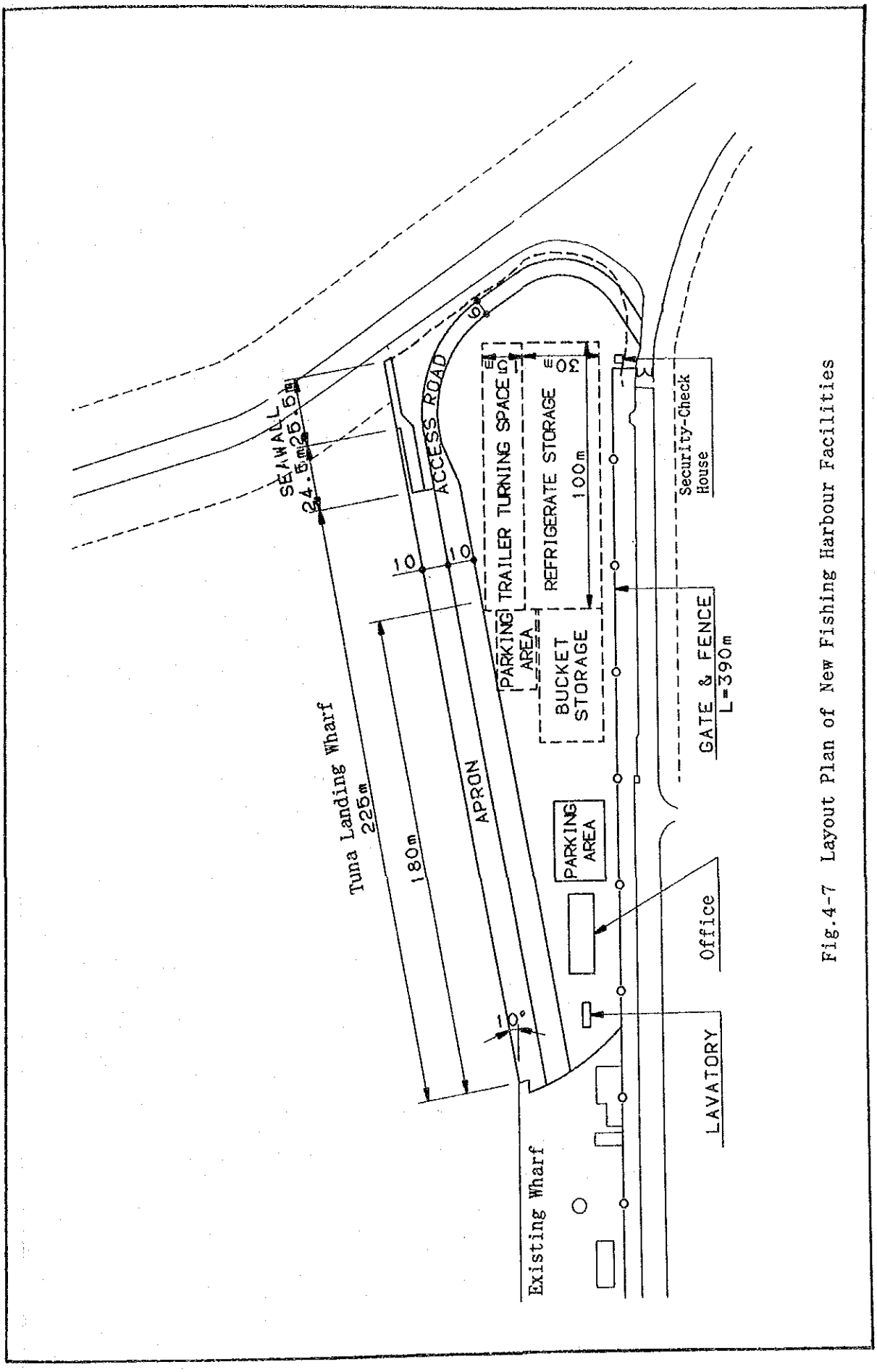


Fig.4-7 Layout Plan of New Fishing Harbour Facilities

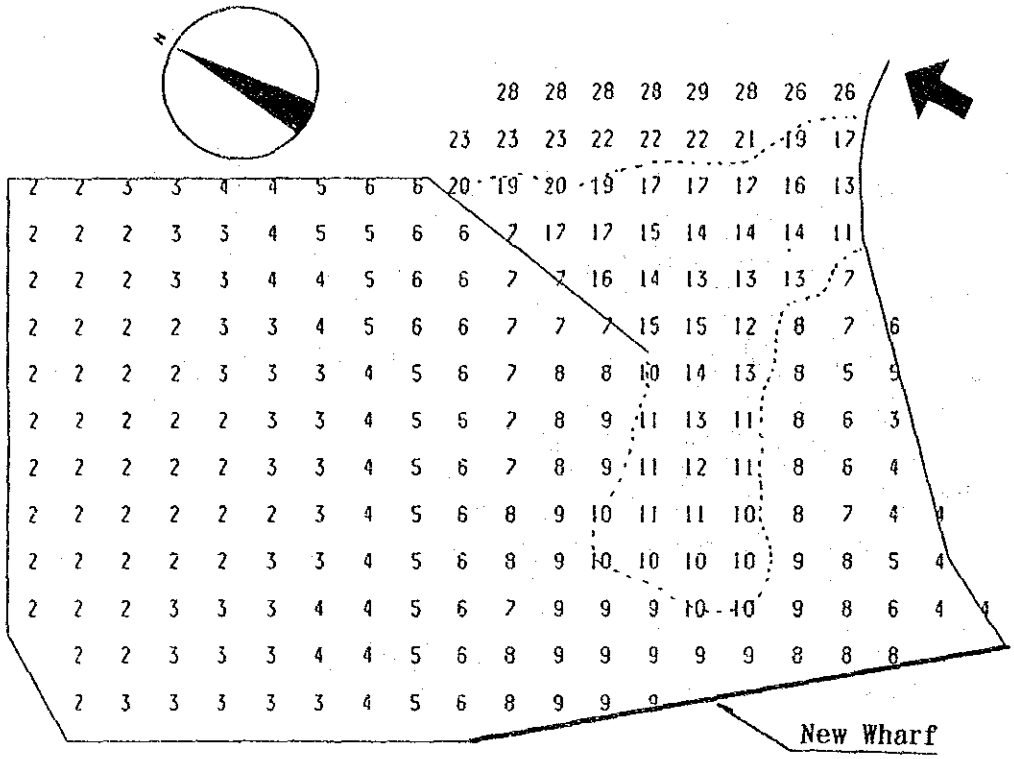


Fig. 4-8 Wave Distribution in Tema Outer Fishing Harbour after Completion

4.3.3 Basic Design of Facilities

(1) Design Conditions

Design conditions of basic design are as follows:

1) Basic Premises

(a) Size of facilities

* Landing wharf
  - Number of berth: 3
  - Overall length of berth: 225 m
  - Width of apron: 10.0 m
  - Depth of wharf: - 7.00 m below L.W.L (±0.00 m)
  - Height of wharf: + 3.05 m above L.W.L
* Seawall: 50 m long
* Land reclamation: 19,950 m^2

(b) Structural conditions

* Surcharge

1.0 t/m^2 is adopted for the surcharge at ordinary of a landing wharf, according to the value in the following table established in the "Design Standards of Fishing Port Structure in Japan".

(ton/m^2)

Facilities	Surcharge	Facilities	Surcharge
Landing Wharf Fitting Wharf Idling Wharf	1.0 1.0 0.5	Revetment	0.5

Note: Surcharge at earthquake is a half at ordinary

* Approaching velocity of fishing vessels

0.15 m/sec of approaching velocity is adopted based on the conditions defined in the "Technical Standards for Port and Harbour Facilities in Japan" that a tugboat will assist fishing vessels in approaching the landing wharf.

2) Natural conditions

(a) Tide level

- H.W.L: + 1.80 m
- L.W.L: ± 0.00 m (Datum Line)

(b) Design seismic force

- Kh = 0.1 (in air)
- Kh' = 0.2 (in water)

(c) Conditions of foundation soil

A bearing stratum underlies - 2 m below the existing seabed. A bearing stratum is filled with sandy silt stratum having an N-value of 5 to 9.

3) Materials

(a) Specific weight

- Steel:	7.85 t/m^3 (in air)
- Reinforced concrete:	2.45 t/m^3 (in air)
- Plain concrete:	2.3 t/m^3 (in air)
- Sea water:	1.03 t/m^3

(b) Allowable stress of concrete

* Coping concrete for wharf	
- Standard design strength:	240 kg/cm^2
- Allowable compressive stress for bending:	90 kg/m^2
* Coping concrete for seawall	
- Standard design strength:	180 kg/cm^2
* Apron	
- Design bending stress:	45 kg/cm^2

(2) Design of Landing Wharf

A gravity type structure with concrete blocks is already applied for the wharves of the commercial port, the VALCO Quay and the existing fishing harbour. Figure A-4.3.3-1 of Appendix shows a typical structure of the existing fishing harbour.

From the results of boring at the project site, it is known that a hard soil layer including sandy gravel underlies some 2 meters below the existing seabed. When driving a pile or sheet pile into such layer, a water jet or earth auger machine is needed for loosening the soil layer, and it results in large expenditure of time and costs, thus this construction method being not usually applied.

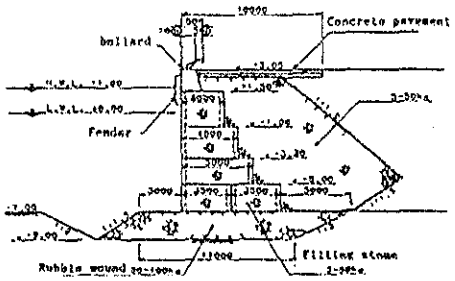
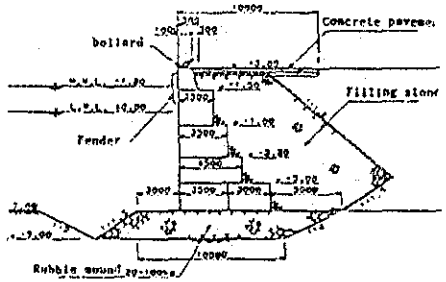
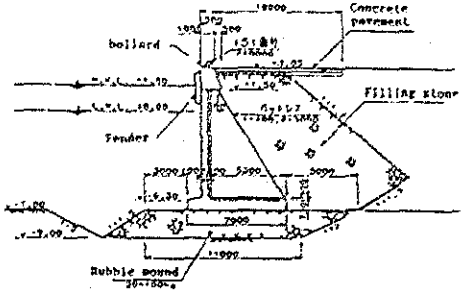
Therefore, a gravity type structure which has been applied before in Tema Fishing Harbour will be applied this time also as well as the same applied to such layer in Japan. However, since a soft layer above the bearing stratum is not of an enough bearing stratum for such a heavy structure as a gravity type, it must be removed and replaced with rubble stone to form a rubble mound on which the structures will be installed. To meet the site conditions, types of cellular blocks, concrete blocks, L-shaped retaining wall and caission are proposed. For selection of suitable structure for the wharf, the three types as shown in Table 4-6 are copmpared, considering availability of heavy construction equipment and marine craft in the local market and considering construction costs for the types. It means caisson type structure is excepted from the alternatives from the above view point.

Table 4-6 shows results of comparision of the proposed alternatives. From a view point of lifting capacity owned by a suitable foating crane for the works, four layers for cellular and rectangular concrete blocks are proposed. From the above results, a cellular concrete block type having an advantage in the construction and costs is proposed for the landing wharf.
The situation allows additional dredging upto -8 m in the basin, unless the dredging directly harms any part of the structure.

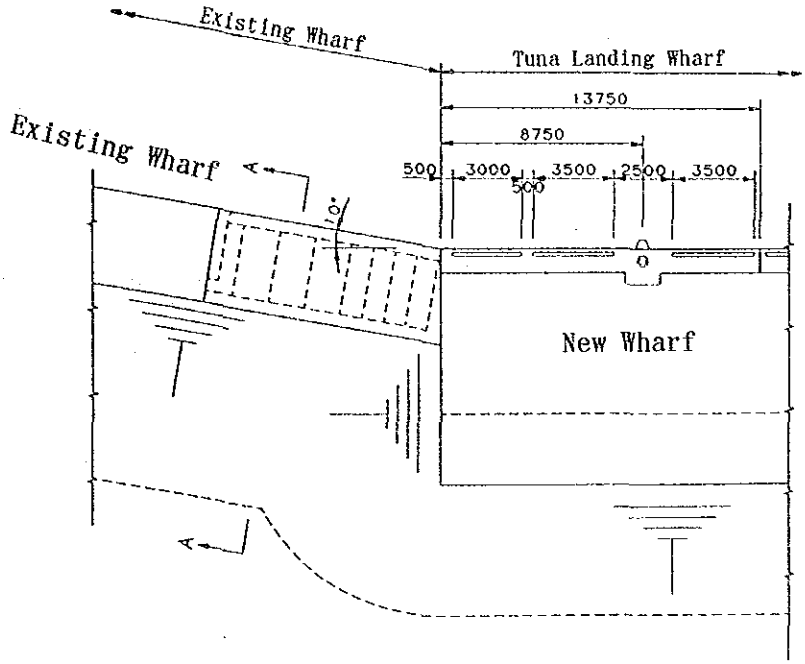
(3) Seawall

The seawalls comprise three different types of structure. One is a cellular concrete block type that will be adopted in a 12 m of section having a -7 m of wharf depth between a new landing wharf and a mooring bitt as mentioned before in Chapter 4. Another is an armour stone slope type with 50 to 200 kg/piece of stones that will

Table 4-6 Comparison of Alternatives for Wharf Structure

Item \ Structure Type			Cellular Block Type	Concrete Block Type	L-shaped Retaining Wall Type
Typical Cross Section					
Summary Quantity (for Whole Length)	Concrete (m3)	Main Structure: Precast	3,070	6,370	1,910
		Capping: Cast-in-place	450	450	450
		Total :	3,520	6,820	2,360
	Stone (m3)	Mound	12,500	12,100	12,500
		Backfill	18,800	19,200	22,700
		Filling	4,900	0	0
		Total :	36,200	31,300	35,200
	Excavation (m3)		17,300	17,000	17,300
	Reclamation (m3)		79,500	80,500	81,600
Construction Efficiency and Main Machinery			Number of Blocks : 460 pcs Accurate levelling of surfaces of filling store be required Many Work items be required Crane's lifting capacity : 100 tons	Work items are not many Many blocks be installed Crane's lifting capacity: 100 tons	Blocks are not so many as others Floating crane with lifting capacity of 200 tons be required
Cost (Ratio)			1.0	1.1	1.3
Period (Month)			13 - 15	13 - 15	13 - 15

be adopted in the section fitting the existing breakwater. While, the other one is the same concrete block type with cast-in-place concrete under the water as the existing wharf that will be adopted in a 9.6 m of section between the existing and new wharves.



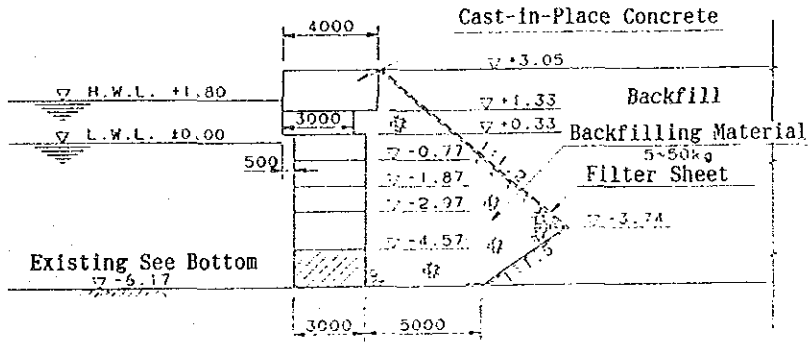
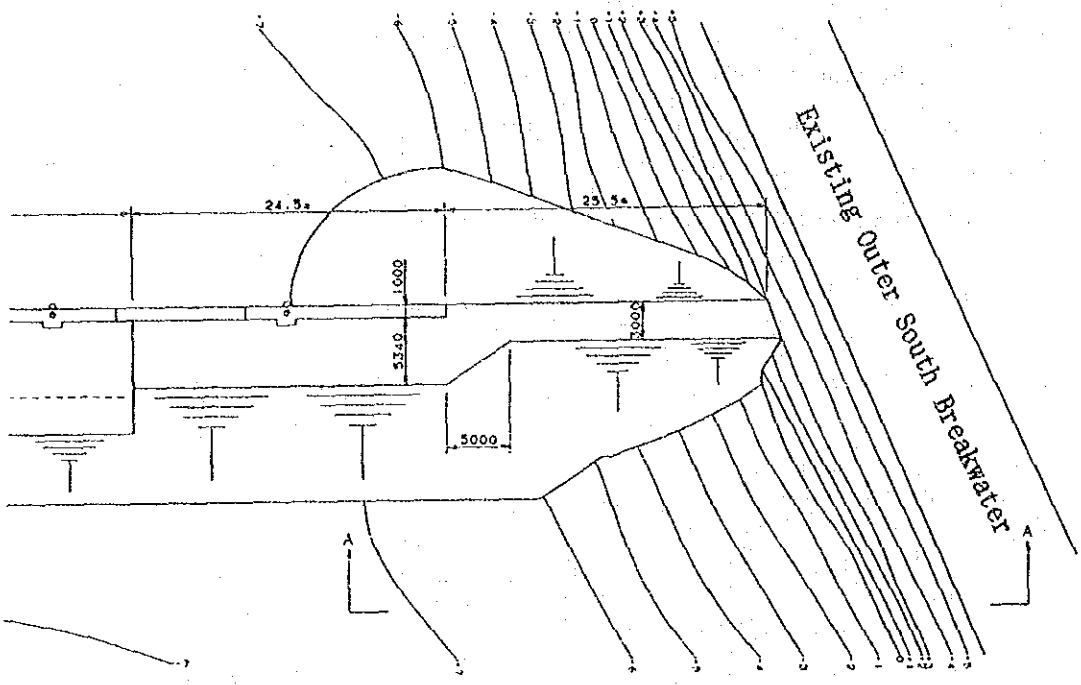


Fig. 4-9 Structure of Transitional Part with the Existing Wharf(1)



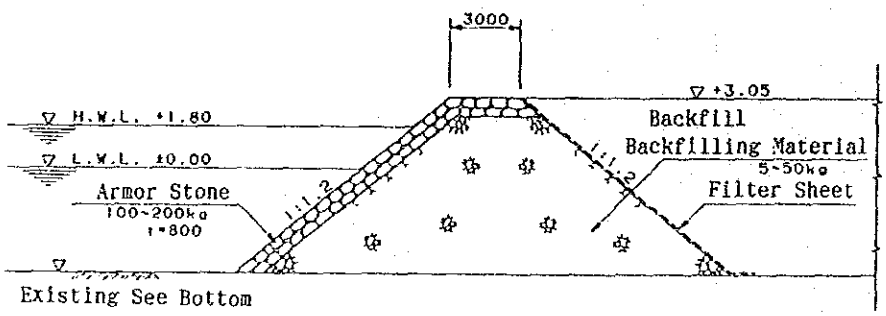


Fig. 4-10 Seawall Structure of Transitional Part (2)

(4) Land Reclamation

Since the waves usually coming over the project site are swells having long periods, it is easily considered that water particles move in and out between the inner basin and the outer harbour and this causes some erosion. Therefore, canvas will be laid over the inside slope of breakwater to prevent erosion of soil materials in the reclamation. The embankment between the commercial port and the outer fishing harbour, where waves are small, does not require canvas and its armour stone slope only has to be filled with key stones.

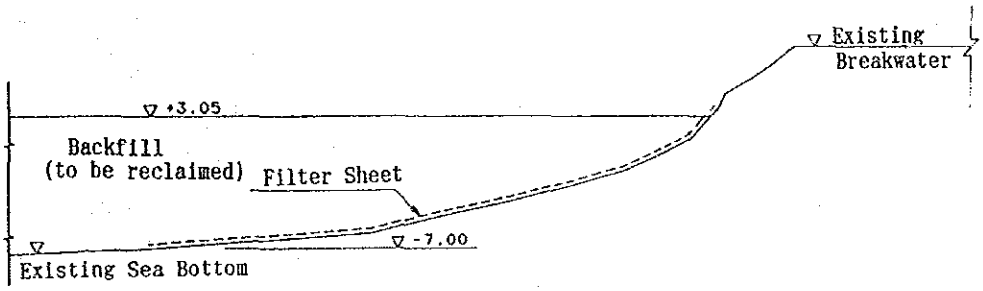


Fig. 4-11 Chemical Fablic Filter for Anti-erosion

(5) Road System

In considering with the construction period and costs, complete removal of all the soft layer underlying the entire area of reclamation is impossible and only the part influenced by heavy structures is to be removed and replaced. The area reclaimed for the road is anticipated to settle down in a long term. For easy maintenance after completion, the road in a new fishing harbour will be constructed in an asphalt pavement type with mixed-asphalt with crushed stones as shown in Fig. 4-12.

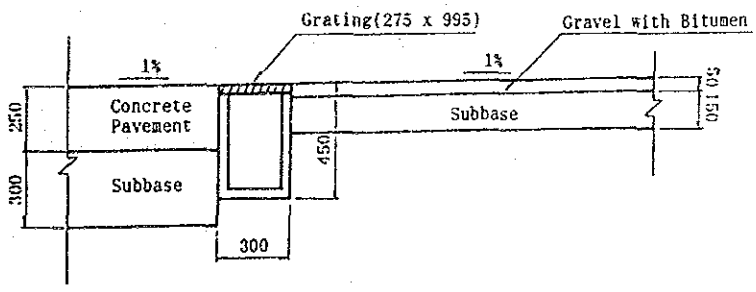


Fig. 4-12 Tyipical Cross Section of Pavement

4.4 Design of Functional Facilities and Equipment of Fishing Harbour

4.4.1 Planned Facilities and Equipment

The following facilities are included in the Project:

(1) Administration Office
Building area: 600 m^2

(2) Security Guarding Facilities
Building: 2
Fence: 430 m

(3) Lavatory
Building area: 24 m^2

(4) Cargo Handling Equipment
Mobile crane (20 t): 3

4.4.2 Basic Design of Facilities and Equipment

(1) Examination of Design Conditions

Design Conditions are established as follows based on the results of the site survey:

1) Atmospheric temperature: 24 to 33 ^{o}C

2) Relative humidity: more than 95 %

3) Wind direction and velocity: Predominant wind direction is SE.
Mean wind velocity is 10 to 14 knots.
Maximum wind velocity is 50 knots.

4) Rainfall: 851 mm/year

5) Electric power: 415 V, 3-phase, 50 Hz
240 V, single-phase, 50 Hz

6) Applicable design standards:
The design standards for wind velocity and seismic force follow the Ghanaian Standards, but the design standards for the structural design will basically follow the Japanese Standards.

(2) Administration Office

1) Design of plane

An administration office building for 37 officers will be built in the outer fishing harbour. The required building area is calculated as shown in Table 3-5 based on the necessary areas per each occupant defined in the "Architectural Standards in Japan".

The above area contains necessary area for office equipment.

Based on the above calculated result, a plane view of the administration office is shown in Fig. 4-13.

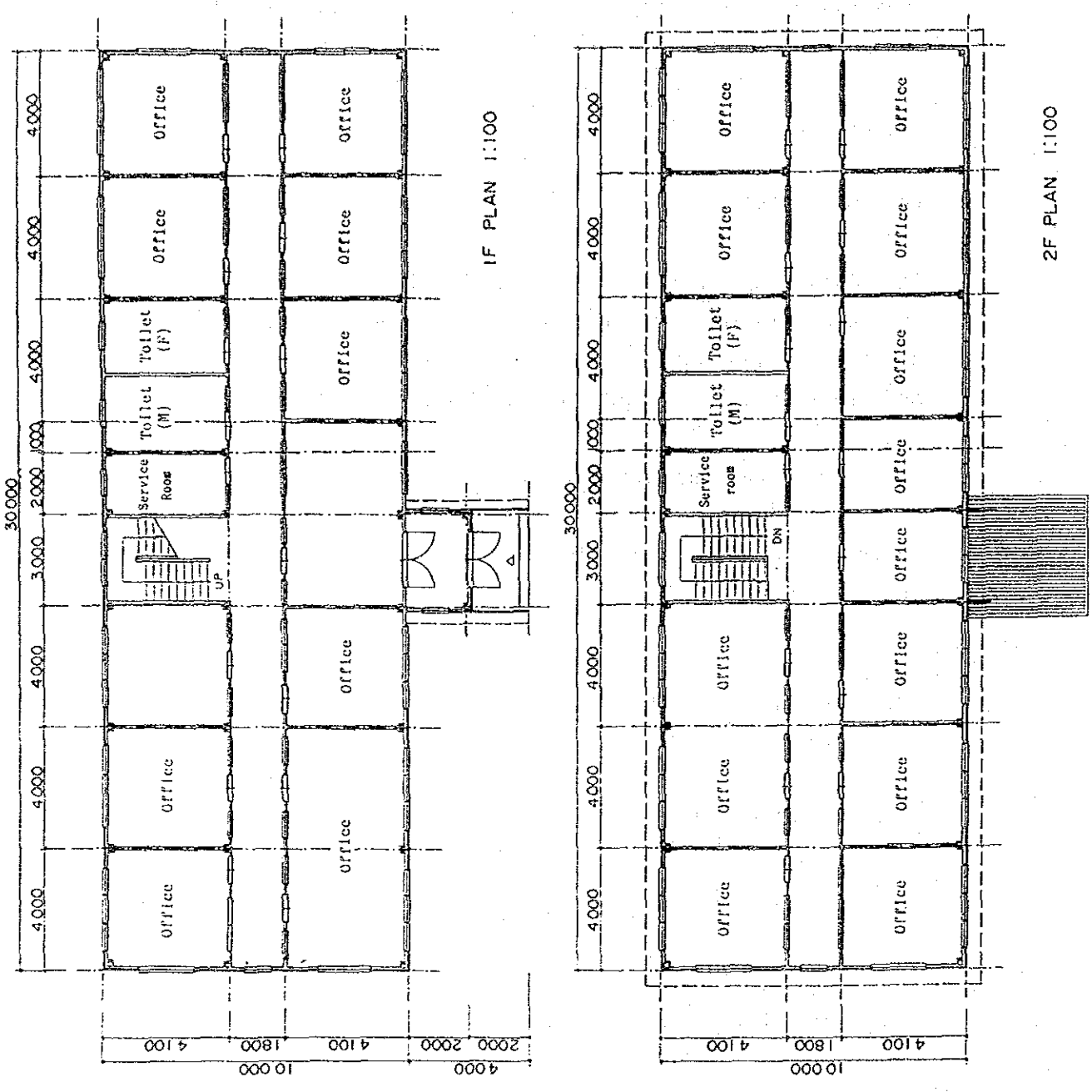


Fig. 4-13 Plane View of Administration Office

2) Structural design

(a) Structural type

Two stories with steel frame construction.

(b) Applicable design standards

Japanese Design Standards to be applied with the reference of BS.

(c) Foundation:

Mat foundation is adopted to prevent the differential settlement of the building site that will be made by reclaiming a new wharf area.

(d) Seismic force

As discussed in the sub-section 5.2.1, Project Site Conditions,

Kh = 0.1 (in air)

(e) Design wind velocity

From the Ghanaian Architectural Standards, the wind velocity applied to the structural design is given by the following formula:

$$Vs = V * S1 * S2 * S3$$

where Vs: Design wind velocity (m/s)
V: Regional standard wind velocity (= 29 m/s)
S1: Coefficient by topographical conditions, 1.0 is adopted considering the condition of the location near the sea.
S2: Coefficient by conditions of ground surface or building (wall type, building size, etc.), 0.83

is adopted.

S3: Coefficient by service life, 1.0 is adopted as a 50-year of service life.

From the above formula, design wind velocity is obtained as follows:

$$Vs = 29 * 1.0 * 0.83 * 1.0$$
$$= 25 \text{ m/s}$$

3) Design of each part of building

(a) Roof:

Will be of a steel truss roofing with 0.8 mm thickness of colored steel sheet galvanized with zinc and aluminum, 4 mm thickness of heat insulating materials being put under the roof and with gutters.

(b) Exterior Wall:

Will be of a semi-non-inflammable panel with surface materials of colored steel sheet galvanized with zinc and aluminum, and be more than 40 mm in thickness.

(c) Opening:

Doors, windows' frames, etc. will be of anticorrosive materials considering the site conditions near the sea. Jalousie windows that have most opening rate will be adopted considering ventilation in summer season. All the windows outside will be equipped with curtain pipes and thick cloth of curtains for sun blind. All the windows outside at the first floor will be equipped with wire mesh and insect screen outside for burglar-proof.

(d) Interior Finish:

Ceiling and wall will be of a wallboard with paint finish. Louver type ventilator will be provided at the aisle of the partition wall. Wall in the kitchenette and toilet room will be of a ceramic floor tile finish.

(e) Floor:

Will be of a resin paint finish after a mortar steel trowel finish. Wall in the kitchenette and toilet room will be of a ceramic floor tile finish.

4) Utilities Plan

(a) Water supply facilities:

Water supplying pipe to a building will be laid being extended from the existing city water pipe in the outer harbour.

(b) Drainage facilities:

Sanitary sewage will be gathered in the sewage tank and be pumped away 800 m to the sewer pipe at the existing inner fishing harbour. Scope of sewer piping work included in this project will be within the project site.

Storm sewage and miscellaneous waste water will be discharged into the sea through outside ditches.

(c) Air-conditioning facilities:

A window type cooler for each office room will be installed and two coolers will be installed for each conference room and

waiting area.

(d) Sanitary ware:

The wares will be arranged as follows based on the Japanese Codes.

- Toilet room for men:
  2 water closet, 2 urinal, 2 wash fountain, 1 sink and 1 ventilator will be installed in both the 1st and 2nd floors.

- Toilet room for ladies:

  2 water closet, 2 wash fountain, 1 sink, 1 room for sweeping tools and 1 ventilator will be installed in both the 1st and 2nd floors.

(e) Kitchenette:
1 sink, 1 faucet, 1 water heater, and 1 sideboard will be installed in both the 1st and 2nd floors.

(f) Electrical wiring work

a) Scope of wiring work

In order to supply necessary electric power, an installation of power line up to the project site will be executed by the Government of Ghana, and all the wiring works within the project site will be included in this project.

b) Distribution system and receiving and distributing facilities

* A distribution system of electric power is planned as follows:

- Main cable: 415 V, 3-phase, 50 Hz
- Power circuits: 415 V, 3-phase, 50 Hz
- Lighting circuits: 240 V, single-phase, 50 Hz

*Electric power will be distributed to each circuit through a service-entrance panel, switchboards and panelboards. A special consideration is necessary to protect all the electrical facilities from high temperature, high humidity, brine damage and corrosion.

c) Power pumps

*Wiring work required for pumps for fire hydrant and drainage will be executed.

d) Lighting and outlet

*Fluorescent lamps will be used, and intensity of illumination at various places are as follows:

- Office room, conference room, waiting area: 400 Lux
- Kitchenette, toilet room, stair, corridor: 60 Lux

*As for the outlets, one more outlet will be provided for each office room and 2 more outlets will be for each conference room and waiting area in addition to the outlets for air-conditioners and water heaters.

e) Telephone facilities

An empty conduit piping work for leading a telephone wire into a office room, conference room and waiting area will be included in this project, while a telephone cable laying work to the site shall be executed by the Government of Ghana.

(3) Security Check House

1) Design of plane

For the safety control of the outer fishing harbour, security check houses will be planned at two places, the inner fishing harbour and the boundary of project site. As two persons occupy each house, a building size of 3.1 m X 3.1 m X 2.9 m will be planned based on the Japanese Codes.

2) Structural design

Footing foundation is adopted to prevent the differential settlement of the building site that will be made by reclaiming a new wharf area.

3) Design of each part of building

(a) Roof:

Will be of a steel truss roofing with 0.8 mm thickness of color galvanized plates , 4 mm thickness of heat insulating materials and gutters.

(b) Exterior Wall:

Will be of a reinforced concrete block bond with cement plastering and paint finish.

(c) Opening:

Wooden doors will be provided and jalousie wind with curtain for sun blind will be provided.

(d) Interior Finish:

Ceiling will be of a board with paint finish and wall will be of a cement plastering and paint finish.

(e) Floor:

Will be of a mortar steel trowel finish.

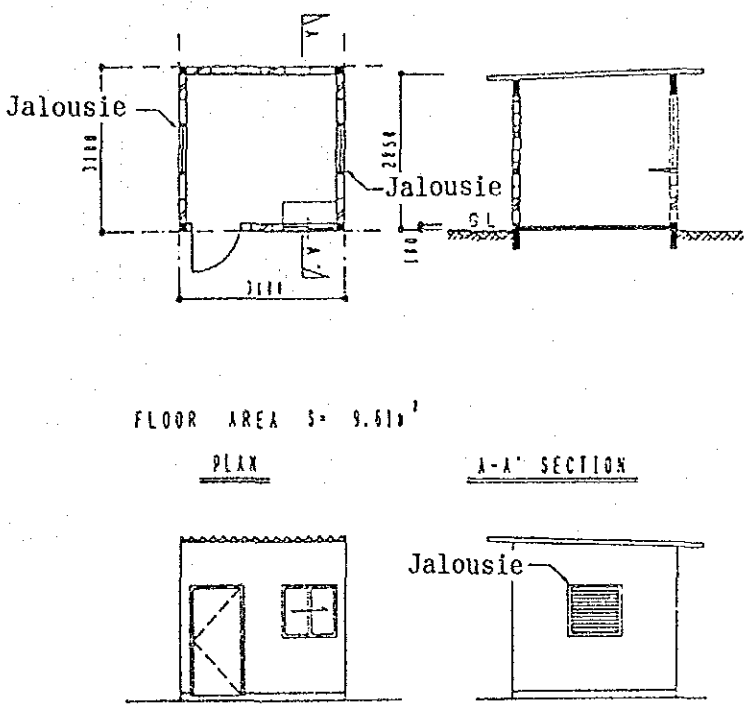


Fig. 4-14 Outline of Security Guard House

(4) Fence

Fence will be planned at the boundary line of the project site as shown in the general layout plan of the following section.

General specifications are as follows:

- Net: Of a vinyl coating net, and 1.8 m height with barbed wire
- Post: Of a 60mm diameter of steel pipe hot-dipped galvanized, 5 mm thickness, and post to post 2 meters

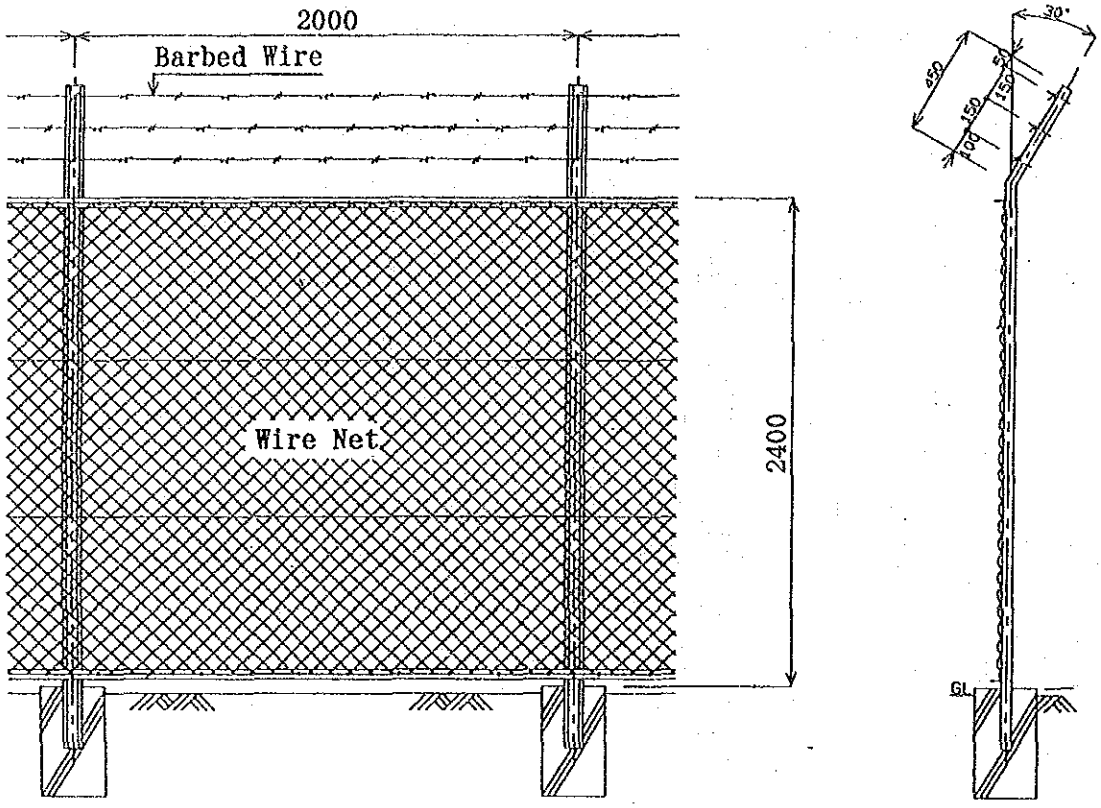


Fig. 4-15 Outline of Fence

(5) Lavatory

1) Layout

A lavatory with a building area of 24 m^2 (7.5 m X 3.2 m) will be planned.

2) Structural design

A single floor with reinforced concrete block bond.

Footing foundation is adopted to prevent the differential settlement of the building site that will be made by reclaiming a new wharf area.

3) Design of each part of building

(a) Roof:

It will be of a steel truss roofing with 0.8 mm thickness of color galvanized plates , 4 mm thickness of heat insulating materials and gutters.

(b) Exterior Wall:

It will be of a reinforced concrete block bond with cement plastering and paint finish.

(c) Opening:

Wooden doors will be provided in the three toilet room and a room for sweeping tools. The entrance and the upper opening will be casement window.

(d) Interior Finish:

Wall will be of a cement plastering and paint finish.

(e) Floor:

It will be of a mortar steel trowel finish.

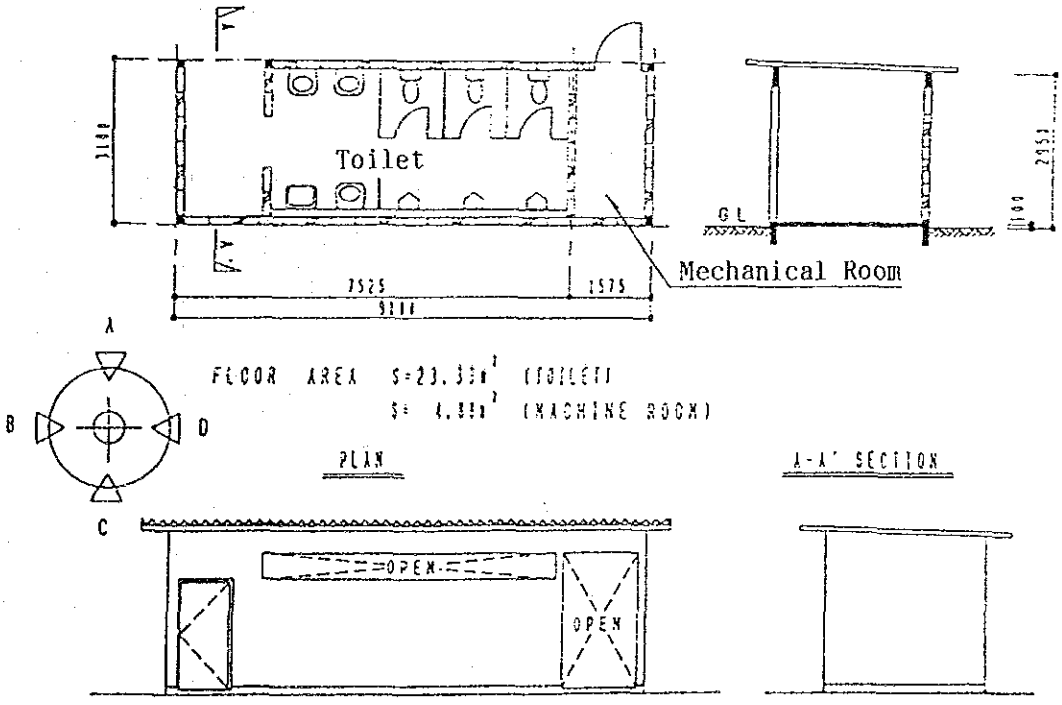


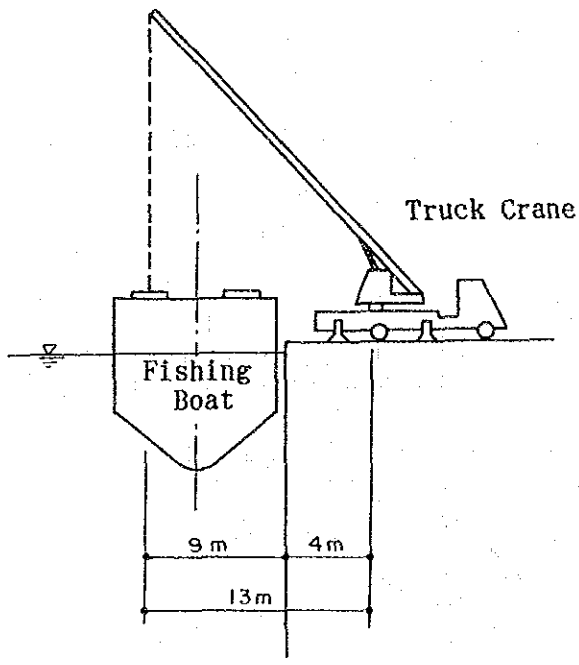
Fig. 4-16 Plan and Side View of Toilet

(f) Mobile Crane;

Lifting capacity of a mobile crane is determined for fish to be lifted from the hold of the maximum size of the fishing vessel.

The figure shows working radius needs 13 m from lifting netted fish of 0.3 tonnes and 10 m for a bucket filled with fish at the deck center.

Lifting capacity of a mobile crane to meet the above is 20 tons, examining all crane products in Japan. A truck crane with lifting capacity of 20 tons is to be provided for improvement of landing fish.
For selection of a mobile crane, its easy maintenance is an indispensable condition.



5.5 Drawings

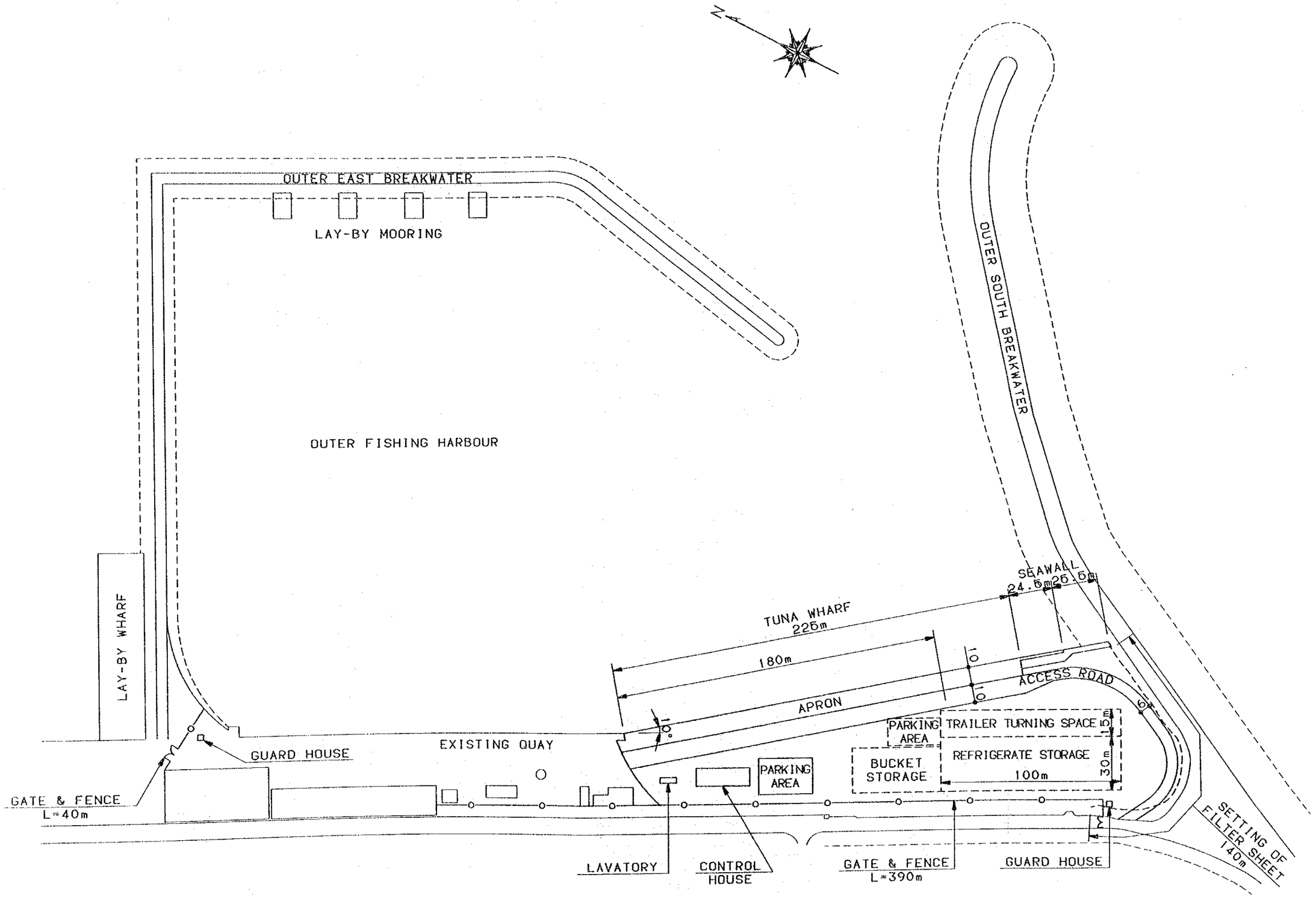


Fig. 4-17 General Plan of Project Facilities

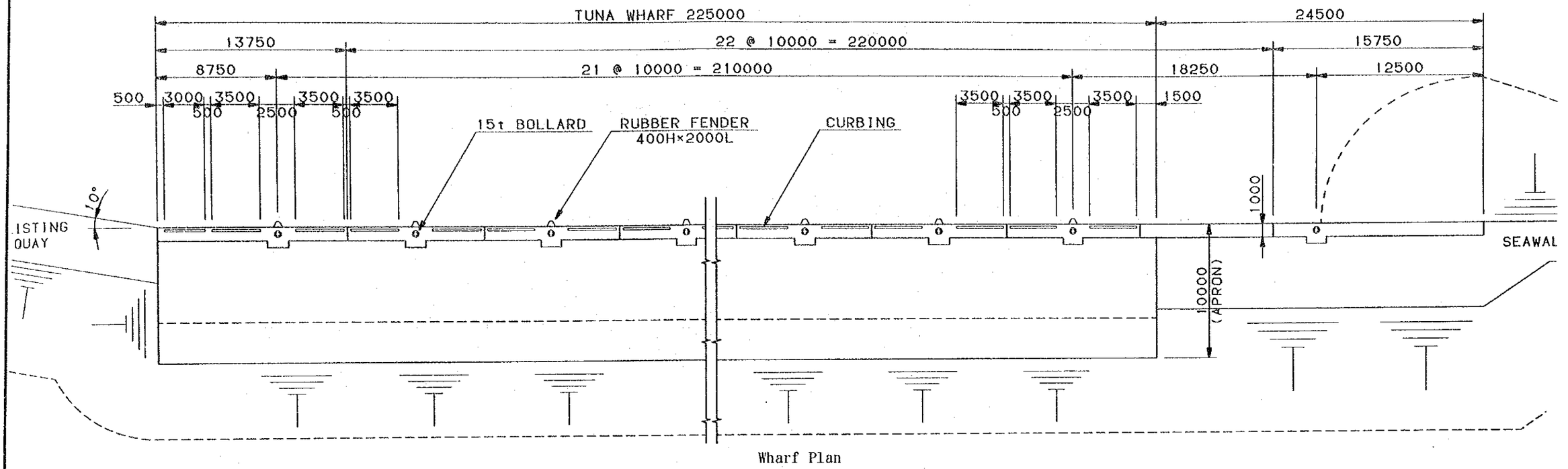


Fig. 4-18 Plan and Typical Cross section of New Wharf

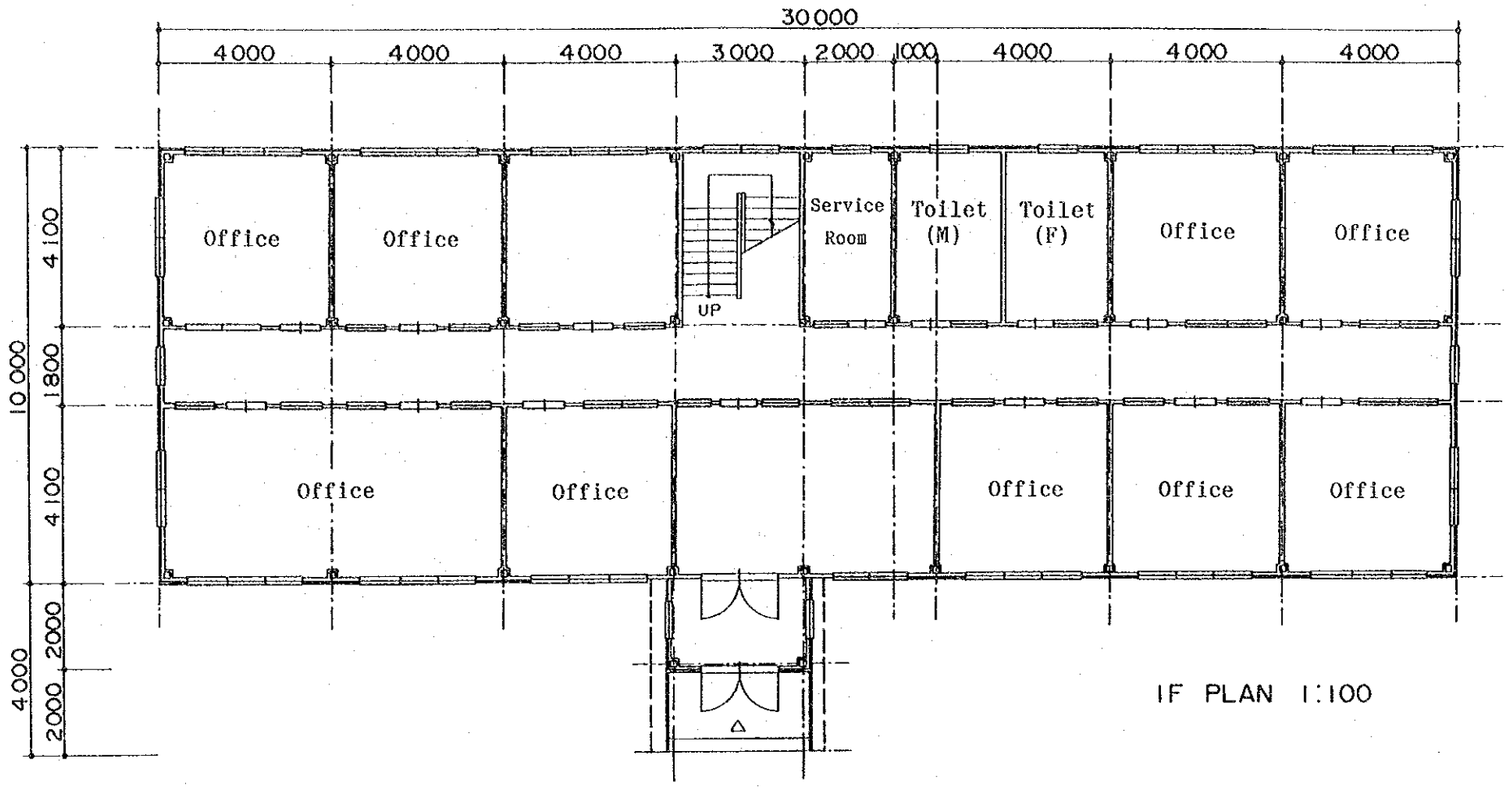
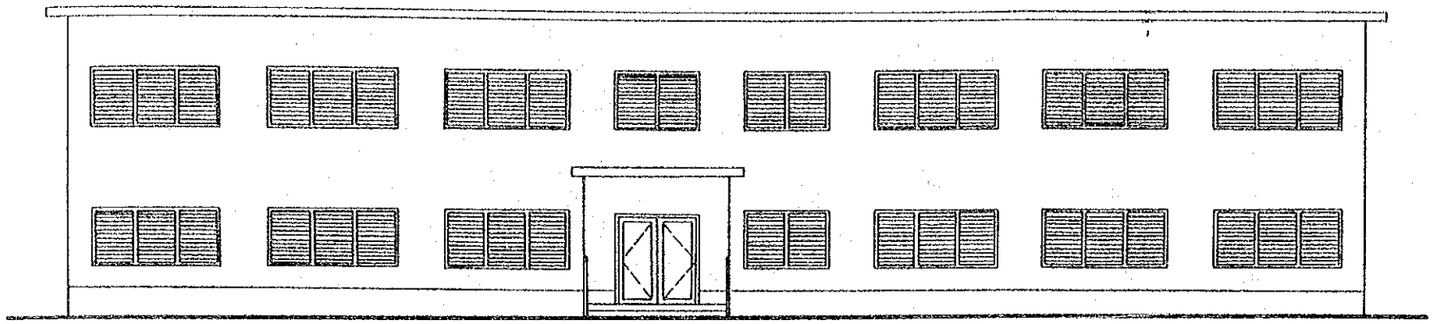
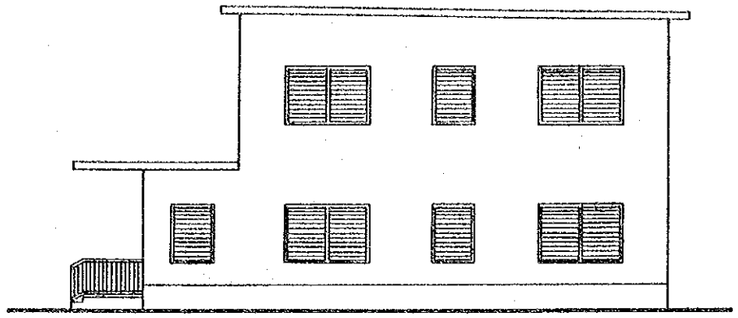


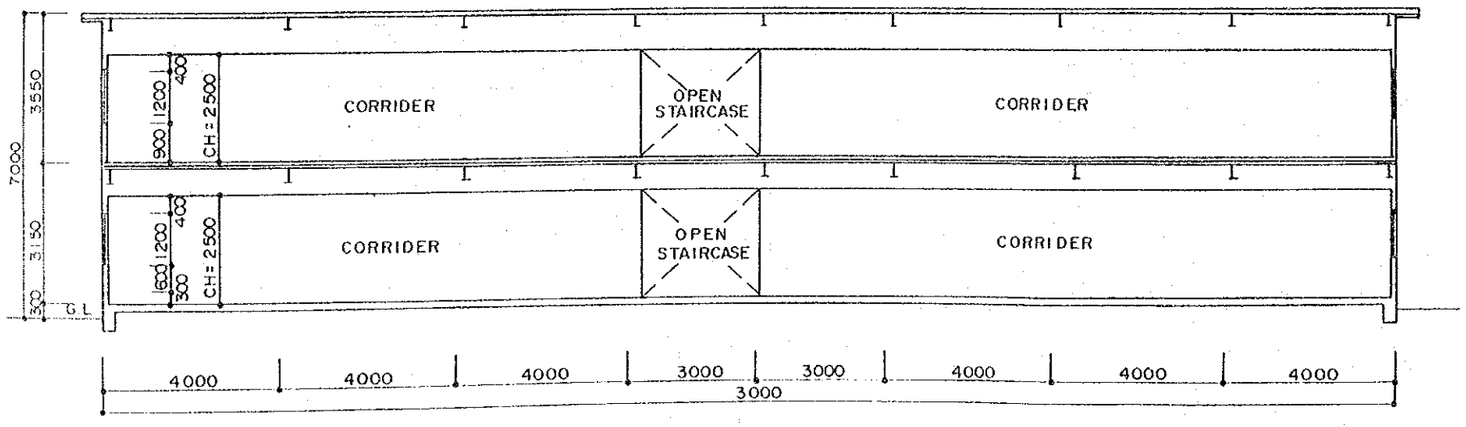
Fig. 4-19 Plan of New Administration Office Building



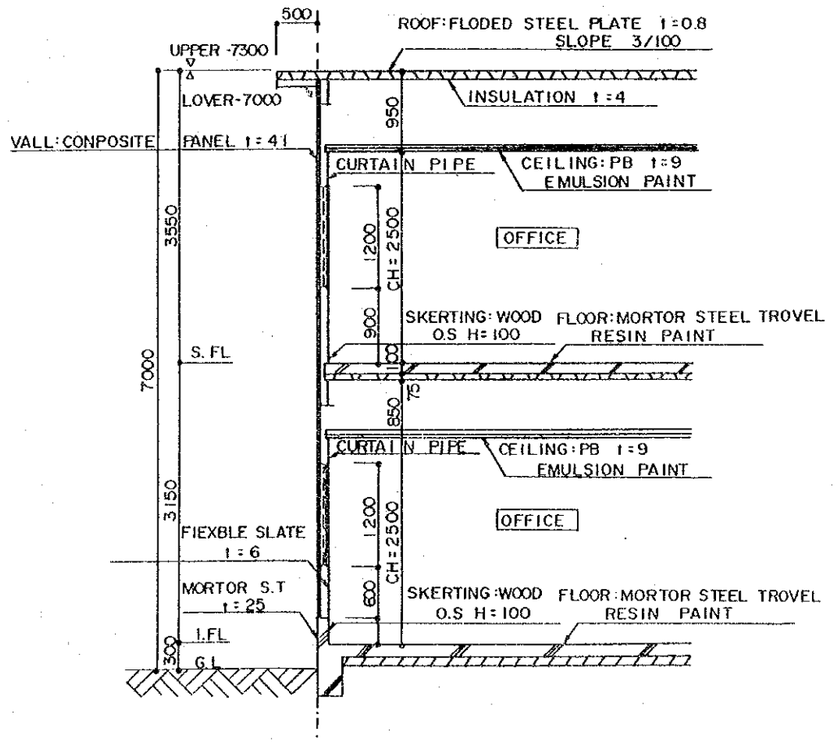
EAST ELEVATION



SOUTH ELEVATION



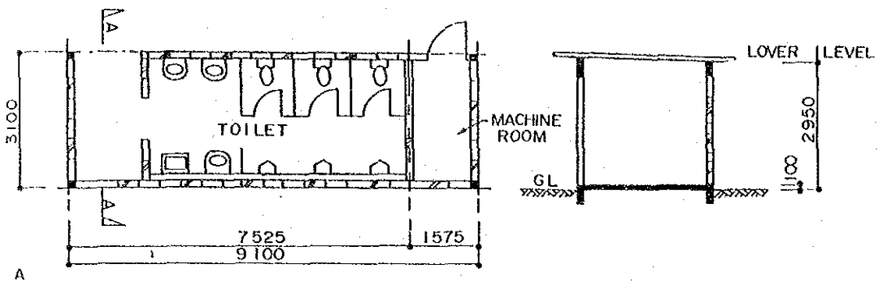
A-A SECTION



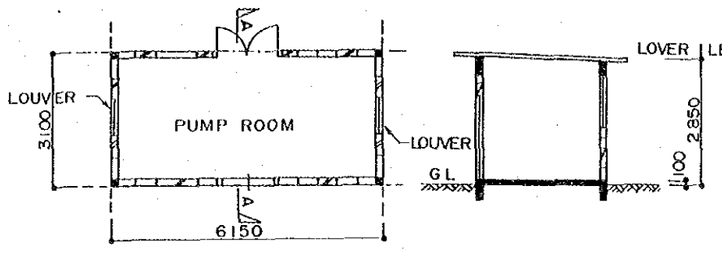
TYPICAL DETEILED SECTION

Fig. 4-20 Elevations and Sections of New Administration Building

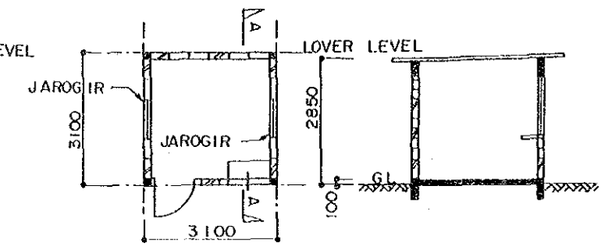
TOTLET BUILDING

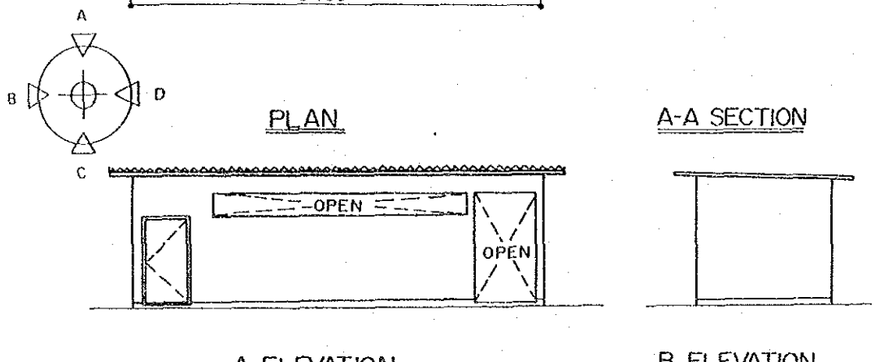


PUMP BUILDING

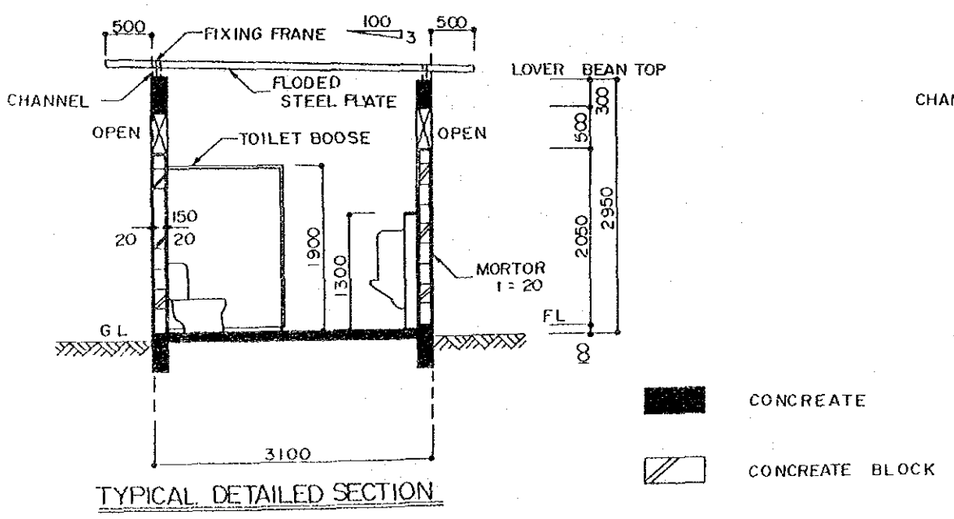


DARDE HOUSE

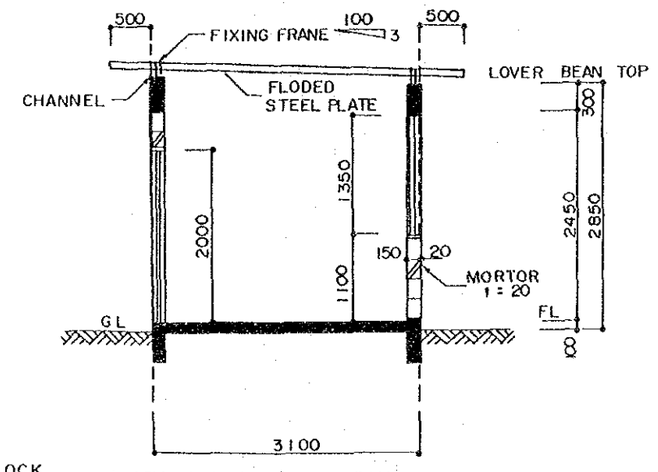




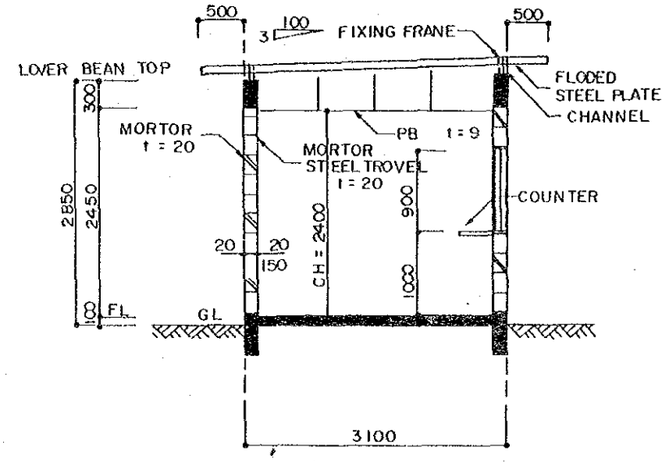
A ELEVATION B ELEVATION A ELEVATION A ELEVATION C ELEVATION D ELEVATION



TYPICAL DETAILED SECTION



TYPICAL DETAILED SECTION



TYPICAL DETAILED SECTION

Fig. 4-21 Elevations and Sections of Small Facilities

4.6 Implementation Plan

4.6.1 Implementation Policies

(1) Implementation Policies

This project will be carried out under the scope of the Japan's Grant Aid Program. After approval of the project by the Government of Japan and the Government of the Republic of Ghana, Exchange of Notes (E/N) will be taken place between both governments and the project plan will be officially put into effect. Then, a Japanese consultant, which shall be appointed by the Government of Ghana, will be start the detailed design work of facilities and equipment. After preparation of tender documents by the consultant, Japanese contractor shall be selected by tender and then the construction work will commence.

The construction period is expected to be 26 months taking into consideration the scope of the project and site conditions.

Ghana Ports and Harbours Authority is the executing organization of the project. For the execution of this project, close cooperation and arrangement between Japanese project group and GPHA are required. Fig. 4-22 shows organization of construction management.

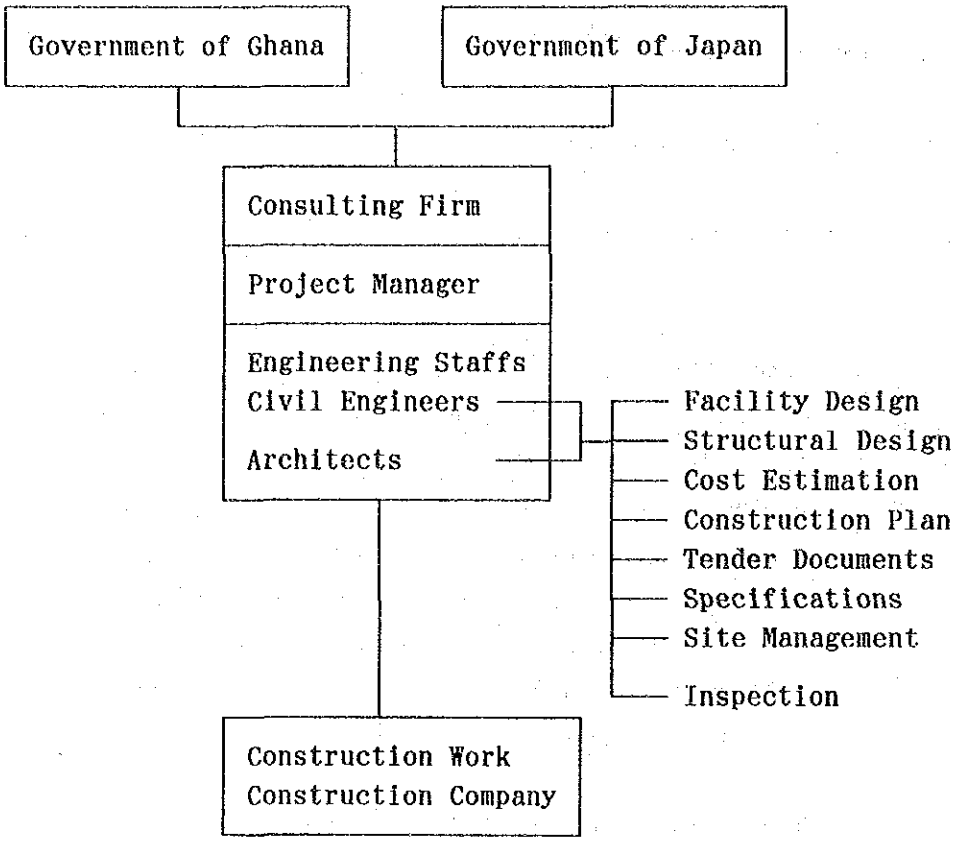


Fig. 4-22 Organization Chart of Project Implementation

(2) Scope of the Grant Aid Project

1) Scope of the grant aid project

The scope of work of the project by the grant aid project covers the following items:

(a) 1st Phase

a) Tuna landing wharf
b) Land reclamation

(b) 2nd Phase

a) Tuna landing wharf
b) Land reclamation

(c) 3rd Phase

a) Tuna Landing wharf
b) Seawall
c) Land reclamation
d) Road
e) Administration office
f) Security guarding house
g) Lavatory
h) Mobile crane

2) Undertakings by the Government of Ghana

The followings are the items to be undertaken by the government of Ghana under its responsibility.

a) Improvement work of access road
b) Piping work of water and oil supply
c) Piping work of sewerage
d) Wiring work of power supply and telephones

4.6.2 Construction Conditions and Implementation Plan

(1) Construction Conditions in Ghana

1) Construction equipment

Construction equipment for any projects in Ghana such as road construction is usually imported solely for the each project unit. This is an alternative to obtain machinery because of a few necessary number of the units and of a very few well-maintained equipment in Ghana.

Several road projects are now going on in Ghana, but their construction equipment are not possible to be rented. Therefore, construction equipment for the road construction of this project such as vehicles for carrying stones and soil materials for land reclamation will be procured from the foreign countries. Also floating cranes,

heavy equipment for marine construction, which are indispensable for main works of the project, will be procured from the foreign countries as well because these equipment are not available in Ghana.

2) Labour for marine construction

Although local labourers have some experiences engaged in marine construction works under the rehabilitation project in Tema Fishing Harbour, there are no labourers being skillful in operating a large sized floating crane or a tugboat towing a large sized barge. Introduction of Japanese skilled labourers are necessary for this project.

3) Imported goods and materials

It takes time to procure imported goods and materials through the agents or stores in Tema. And a storing volume of the imported goods and materials are not sufficient and sometimes sold out. In order to obtain a constant supply, a procurement schedule should be carefully made in advance, and a close communication with the agents is necessary to control their inventory.

4) Annual working days

The major marine construction works except the work to convey and dump excavated soils in the specified waters will be executed in the calm water inside the harbour the works will not be influenced by the waves. A small rainfall will not affect the work. Therefore, annual working days, which should be calculated excluding holidays, can be assumed 301 days.

5) Escalation of labour cost

At the time of the field examination of this project, it was concerned that a full scale of price escalation would occur in the fields of materials and labour after the general election and the presidential election to be held in between November and December. The ordinary rate of inflation is kept about 15 %, but it is consid-

ered that the scope of project facilities might be modified, if the full scale of price escalation would occur at such occasion.

(2) Implementation Plan

In panning the implementation schedule, the followings shall be given a special attention:

1) Construction schedule should be planned considering the natural conditions at the site.

2) Work schedule of the other projects should be coordinated with this project.

3) Number of Japanese supervisors and their working period should be minimized.

4) Use of local materials should be maximized.

5) Utmost attention should be paid to the fishing fleet activity during marine construction works.

4.6.3 Supervision by the Consultant

The policy of the Japanese Government for the grant aid project requires that the project proceeds consistently throughout the period from the detailed design stage to the construction stage under the assistance of the Japanese consultant which shall be employed by the local government at the time of initiation of detailed design works of the Project.

The consultant is requested to supervise the construction work by stationing resident engineers at the site for guidance and instruction in work and testing, inspecting and reporting, as well as a short term dispatching of specialized engineers for each specific technique.

(1) Object of supervisory control

1) Control of the work progress in accordance with the construction schedule, maintaining close contact and reporting to the personnel in both countries responsible.

2) Provision of adequate guidance and advice to the work execution staff so that they can complete construction of the facilities to conform with the design plans.

3) Provision of guidance for adoption of local materials and subcontractors as much as possible.

4) Promotion of technology transfer in construction and engineering to make the most of the grant project.

5) Provision of adequate advice and guidance on maintenance of the delivered facilities to help smooth operations thereof.

(2) Main supervisory work on construction

1) Assistance on contracting

Providing assistance on selection of contractors, determining type of contract, preparing draft of contract agreements, reviewing details in work plans and witnessing contract awarding.

2) Checking and approval of work drawings, etc.

Checking and approving work drawings, as well as materials and equipment proposed or submitted by the contractors.

3) Guidance in construction work

Reviewing work plans, processes, etc., providing guidance for contractors, and reporting progress of the work to the owner.

4) Assistance in payment to the contractor

Collaborating in checking and processing bills on payment to the contractor for the work in progress and for the completed work.

5) Inspecting

Inspecting periodically each of the works in progress and completed and guiding the contractor.

The consultant shall, upon confirmation of completion of the works and fulfillment of requirements of the contract, witness the delivery of the objects of the contract and confirm the owners' acceptance thereof to complete obligations.

The consultant shall also provide reports to the Government of Japan in relation with work progress, payment procedures and delivery of completed facilities.

4.6.4 Procurement and Logistic Policy

Special attention should be paid to the items below in procuring necessary materials/equipment for this project.

(1) Policy on procuring materials/equipment

For procurement of materials and equipment, local availability will have to be examined thoroughly. The procurement policy is to minimize supply from Japan.

1) Supply from Japan

For certain materials/equipment to be procured from Japan, a procurement schedule will have to be studied carefully since such materials require a long period from production to delivery. In ordering fabricated materials, production, processing, packing and shipping will require a much longer time.

Though some small sized construction equipment are locally available, an equipment procurement plan from Japan should be established considering the local services conditions and possibility of long term lease.

Close communication with related authorities have to be kept for unloading and customs clearance at the local port to effect mobilization without delay.

2) Local supply

Stones are a major material to be supplied locally. For procurement of stones, careful studies on sources, capacity, quantity and transportation have to be made. On the quality of imported materials such as cement, asphalt, etc.,. a thorough check on price, quality and quantity are necessary.

3) Cost

Low price has priority in selecting a supply source either locally or from Japan. It should be noted that the supply price from Japan must include fees for packing, transport and insurance but is exempt from tax.

(2) Material and Equipment Supply

On supply and logistics of materials and equipment, some details on this particular project are given as below.

1) Material

Local: Rubble, Crusher-run, Sand, Cement, Reinforcement Bars, Materials for Building, etc.

Japan: Steel Form, Fender, Bollard/Mooring Bitt, Buffer Stop, Scaffolding, H-shaped Steel, etc.

2) Equipment

Local: Tired Roller (10t), Vibrating Roller (6t), Bulldozer (11t), Motorgrader

Japan: Crawler Crane (50t), Dump Truck, Barge (500t), Floating Crane (100t crane, 1,000t barge)

4.6.5 Implementation Schedule

Implementation of the project by the grant aid of the Japanese Government will proceed in the following manner.

After an exchange of notes between the Government of Japan and the Government of Ghana, the latter is requested to conclude a consulting contract with a pertinent Japanese consulting company as soon as possible.

The consulting company will cover detailed design, tender management and supervision of the construction. Before awarding the construction contract, the consultant shall have finished detailed design work and cost estimation and tender management. As shown in Table 4-8, 3 months are required for detailed design and 11 months for construction works in the first phase, 3 months for detailed design and 12 months for construction works in second phase and 3 months for detailed design and 10.5 months for construction works in third phase.

Since the overall project term exceeds 24 months, the project will have to be divided into three phases in accordance with the Japanese governmental budget system. Therefore, before the start of the second and third phase projects, all procedures such as the exchange of notes, the consulting contract and the construction contract will have to be repeated between the related parties.

Table 4-8 Project Implementation Schedule

		1	2	3	4	5	6	7	8	9	10	11	12	Remarks
PHASE (1)	D	*** (Field)												Site Survey
		**********		****	(Home)									Design, Tender Documents
				** (Field)										Approval of Tender Documents
	C	***** (Preparation)												
			**********		(Mobilization)									
					**********									Tuna Landing Wharf
PHASE (2)	D	*** (Field)												Site Survey
		**********		****	(Home)									Design, Tender Documents
				** (Field)										Approval of Tender Documents
	C	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	Tuna Landing Wharf
PHASE (3)	D	*** (Field)												Site Survey
		**********		****	(Home)									Design, Tender Documents
				** (Field)										Approval of Tender Documents
	C	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********		Seawall, Office Bldg., etc.

Note: D = Detailed Design, C = Construction

CHAPTER 5

PROJECT EVALUATION AND CONCLUSION

CHAPTER 5 PROJECT EVALUATION AND CONCLUSION

5.1 Project Evaluation

Tuna fishery plays a significant role not only as a supply source of animal protein but also as an earner of foreign currency by transshipment. As discussed in the previous Chapter, Tema Outer Fishing Harbour as the fishery base has a plethora of problems, posing bottlenecks for promotion of tuna fishery. The present Project aims to remove the bottleneck and is expected to manifest various effects and improvements. The expected effects are summarized below.

1) Current situation and problems

Due to lack of exclusive wharves for tuna vessels in Outer and Inner Harbours at Tema, demurrage is unavoidable, with imposing burdens for mooring and personnel expenses on fishery companies. The vessels use the wharves in the Main Port, hindering efficient management of the Main Port.

Measures proposed under the Project

Three berths (225 m) will be provided for exclusive use by tuna fleet.

Improvement expected under the Project

* When the exclusive wharf is completed, congestion will be obviated and at least 24 days will be available additionally. With the improved landing operation efficiency, the number of fishing trips can be increased once.

* When the plan is completed, all the tuna fishing vessels be using the Outer Fishing Harbour, thereby improving the management efficiency of the wharf in the Commercial Harbour.

2) Current situation and problems

Unloading operation from the hold on fishing vessels can be shortened by 2 days by using both the derrick crane and the mobile crane. Since there is no crane provided for exclusive use at the Fishery Harbour, they may not be available when needed.

Measures proposed under the Project

One mobile crane for each berth (total of 3) will be provided.

Improvements expected under the Project

* By making available three mobile cranes, there will be 16 additional days a year. With the shortened demurrage days, there will be a total of 40 additional days, increasing one fishing trip.

3) Current situation and problems

Tuna is stored in the cold rooms in Tema City awaiting for transshipment and local consumption. If the transport is conducted for day operations, the fish quality may become deterioated.

Measures proposed under the Project

Construction of an cold storage facility near the wharf is being planned by private capital, and the land is to be secured behind the wharf.

Improvements expected under the Project

The quality of frozen fish will be maintained and the transportation costs will be decreased, to thereby improve the management of fishery companies.

4) Current situation and problems

Access to the Fishery Harbour is relatively free and pilferage of landed fish occur frequently. Fishery companies are suffering great losses.

Measures proposed under the Project

Tema Outer Fishing Harbour area shall be made the bonded area, which enclosure by fences. Security check houses will be built at two entrances to restrict entry by unauthorized persons.

Improvements expected under the Project

* Since pilferage of landed fish can be prevented, the loss suffered by fishery companies can be lessened.

* Setting the bonded area will enable precise control of trans-shipment and amounts of fish.

5) Current situation and problems

Because of traffic congestions within the Fishing Harbour, smooth traffic flow is not secured. After the completion of the Outer Fishing Harbour rehabilitation, further congestion is expected.

Measures proposed under the Project

Roads will be constructed inside the Outer Fishing Harbour to detour the congested areas.

Improvements expected under the Project

The travelling time to and from the outside cold stores will be shortened to maintain the landing operation efficiency without affecting the landing operation hours.

6) Current situation and problems

After the Outer Fishing Harbour rehabilitation is completed, additional staff will be required at the Administration Office to control tuna landing.

There is no space to accommodate the increased staff of 37 since the present Office is only for 25 persons.

Measures proposed under the Project

A new office of 600 m2 will be built to house GPHA, the customs and the port health services staff.

Improvements expected under the Project

Control of entire tuna fleet is possible at the Outer Fishing Harbour. GPHA can aim at smooth management of wharves and promote smooth landing operation in cooperation with the customs and the port health services.

5.2 Conclusion

As discussed above, the Project aims to contribute to promotion of tuna fishery and efficient management of the Main Port, to secure stable supply of animal proteins, to earn foreign currency and to offer private industry an incentive for building a cold storage, thereby contributing to the life of Ghanaian people and their national economy. To implement the Project under a grant aid programme at an early instance is adequate and quite meaningful.

Since the Republic of Ghana has sufficient capacities in respect of organization, bearing the management costs and maintenance of the system after completion, there are no problems envisaged for management and administration of the Project.

In order to manage the fishery port more efficiently, the administrators are recommended to take following improvement measures including following restrictions on use.

(1) Use of wharf

1) The new wharf is to be used exclusively for landing;

2) Tuna fleet is to be given priority in use of the new wharf

3) The Fishing Harbour Office will require fishery companies to submit advance reports regarding the entry/departure of fishing vessels

4) Basins using the waters inside the Outer Fishing Harbour should be secured for lay-by

5) Fishing vessels moored idly in the Fishing Harbour should preferably be removed

(2) Basin for ship maneuvering

Considering larger vessels such as reefer carriers will call the Outer Fishing Harbour, it is recommended that a part of the eastern breakwater in the Outer Fishing Harbour be removed to secure the space for maneuvering in the basin.

(3) Preparation for fishing trips

As there is no wharf for exclusive use by vessels preparing for fishing trips, efficient supply of oil and water during landing is recommended.

(4) Fish handling

1) Fish handling efficiency should be improved by use of mobile cranes

2) As selection of landed catch directly affects the fish prices, it is recommended to consign the work to private companies.

(5) Restricted access to the Outer Fishing Harbour Area

The access to the area should be restricted to authorized personnel only.

APPENDICES

APPENDICES

1. Basic Design Study Team Members and Field Study Schedule
2. Minutes of Discussion
3. List of Interviewees
4. Statistics and Others

Appendix 1 Basic Design Study Team Members and Study Schedule

(1) Basic Design Field Study

* Study Team Members

Name	Assignment	Position
Mr. Osamu HASHIMOTO	Team Leader	Deputy Director, Fishing Port Construction Division, Fishing Port Department, Fisheries Agency
Mr. Shuji ONO	Project Coordinator	Second Basic Design Study Division, Grant Aid Study and Design Dept., JICA
Mr. Taiji ENDO	Fishing Port Development Planner	Nippon Tetrapod Co., Ltd.
Mr. Masafumi ITO	Port Civil Engineer	-ditto-
Mr. Hisashi HIRATSUKA	Fishing Port Facilities Planner	-ditto-
Mr. Keishiro MORIO	Fishery Development Planner	-ditto-
Mr. Norichika HAMAGUCHI	Natural Conditions Surveyor	-ditto-
Mr. Masayoshi NODA	Fishing Port Management Planner	-ditto-
Mr. Minoru HANZAWA	Cost Estimator	-ditto-

* Field Study Schedule

FIELD SURVEY SCHEDULE

No	M	D	D	I T I N E R A R Y
1	8	22	S	Departure : Narita 11:00
2		23	S	Arrival : Accra 19:25
3		24	M	Visit JICA Office, Japanese Embassy, Arranging Schedule Visit MFEP, MTC, FD, GPHA
4		25	T	General Meeting with Government Officials, MTC, FD Discussion with World Bank Ghana Office
5		26	W	General Meeting, Explanation & Discussions on ICR & QTN with GPHA, and Site Examination
6		27	T	Discussion with GPHA
7		28	F	General Meeting, Discussions on ICR for Minutes with GPHA
8		29	S	Site Examination Preparation for Site Survey
9		30	S	Team Meeting
10		31	M	Discussions on ICR and Minutes, Signing of Minutes
11	9	1	T	Site Examination and Preparation for Site Survey Mr. HASHIMOTO and Mr. ONO leave Accra at 20:15
12		2	W	Discussion on Port Management with GPHA
13		3	T	Discussion with GPHA & FD, Site Survey
14		4	F	Discussion with GPHA & FD, Site Survey
15		5	S	Site Survey, Mr. HANZAWA arrives at Accra
16		6	S	Team Meeting
17		7	M	Site Survey, Interview with Fishing Firms
18		8	T	Messrs. Mori, Hiratsuka, Node depart Accra at 20:15 Discussion with MPW
19		9	W	Data Collection, Site Survey, Visits Quarry Plants Discussion with GPHA

FIELD SURVEY SCHEDULE

No	M	D	D	I T I N E R A R Y
20	9	10	T	Data Collection, Site Survey
21		11	F	Discussion with GPHA
22		12	S	Data Collection, Site Survey
23		13	S	Team Meeting
24		14	M	Site Survey, Data Collection, Discussion with GPHA
25		15	T	Messrs. Endo, Ito, Hanzawa leave Accra at 20:15 Site Survey
26		16	W	Site Survey
27		17	T	Site Survey
28		18	F	Site Survey
29		19	S	Site Survey
30		20	S	Data Analysis
31		21	M	Site Survey
32		22	T	Site Survey
33		23	W	Site Survey
34		24	T	Site Survey
35		25	F	Site Survey
36		26	S	Site Survey
37		27	S	Mr. Hamaguchi leaves Accra at 21:10
38		28	M	arrives at London at 6:40
39		29	T	leaves London at 18:00
40		30	W	arrives at Narita at 13:50

Note : MFEP : Ministry of Finance and Economic Planning
MTC : Ministry of Transportation and Communications
MPW : Ministry of Public Works
FD : Fisheries Department
GPHA : Ghana Ports and Harbours Authority
SFC : State Fishing Corporation
ICR : Inception Report
QTN : Questionnaire

(2) Draft Final Report Explasnation

* Study Team Members

Name	Assignment	Position
Mr. Osamu HASHIMOTO	Team Leader	Deputy Director, Fishing Port Construction Division, Fishing Port Department, Fisheries Agency
Mr. Shuji ONO	Project Coordinator	Second Basic Design Study Division, Grant Aid Study and Design Dept., JICA
Mr. Taiji ENDO	Fishing Port Development Planner	Nippon Tetrapod Co., Ltd.
Mr. Masafumi ITO	Port Civil Engineer	-ditto-

* Draft Final Report Explanation Schedule

No	M	D	D	I T I N E R A R Y
1	11	17	T	Departure : Narita
2		18	W	Arrival : Accra
3		19	T	Visit JICA Office, Japanese Emabassy Visit MFEP, MTC to Explain the Draft Final Report
4		20	F	Explanation & Discussions on the Draft Final Report with GPHA
5		21	S	Data Collection & Site Survey
6		22	S	Team Meeting
7		23	M	Discussions with GPHA on the Report
8		24	T	Discussions on the Report with MFEP, MTC, FD & GPHA
9		25	W	Signing of the Minutes of Discussions
10		26	T	Data Collection
11		27	F	Departure : Accra 22:00
12		28	S	Arrival : London 6:45
13		29	S	Departure : London 16:55
14		30	M	Arrival : Narita 13:45

Appendix 2 Minutes of Discussion

MINUTES OF DISCUSSION

BASIC DESIGN STUDY

ON

THE TEMA OUTER FISHING HARBOUR REHABILITATION PROJECT

IN THE REPUBLIC OF GHANA

In response to a request of the Government of the Republic of Ghana , the Government of Japan decided to conduct a Basic Design Study on The Tema Outer Fishing Harbour Rehabilitation Project (hereinafter refered to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Ghana a study team headed by Mr. Osamu Hashimoto, Deputy Director,Fishing Port Construction Division,Fishing Port Department,Fisheries Agency , and is scheduled to stay in the country from August 23rd to September 27th 1992.

The Team held discussions with the officials concerned of the Government of Ghana and conducted field surveys at the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Accra, August 31st ,1992

橋本牧

Osamu Hashimoto
Leader,
Basic Design Study Team,
(JICA)

Charles Abakah
Director,
International Economic
Relations Division(IERD)
Ministry of Finance and
Economic Planning

ATTACHMENT

1. Objectives of the Project

The objective of the Project is to rehabilitate the Tema Outer Fishing Harbour.

2. Project site

The Project site is located in the town of Tema.

(Project area and site map are attached as ANNEX - 1.)

3. Executing Agency

Ghana Ports and Harbours Authority(GPHA) is responsible for the administration and execution of project.

4. Items requested by the Government of Ghana.

After discussions with the Basic Design Study team,the following items were finally requested by the Ghanaian side.

Provision of the tuna base area;

(1) Tuna Landing Wharf

(2) Land Reclamation for necessary functional facilities

(3) Administration Building

(4) Security Fencing with a security-guard house

(5) Unloading-tuna service equipment

(6) Support Facilities

The final items of the project will be decided after the detailed studies in Japan.

5. Japan's Grant Aid Program

(1)The Government of Ghana has understood the system of Japanese Grant Aid explained by the team.

(2)The Government of Ghana will take necessary measures,described in ANNEX II, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

6. Schedule of the study

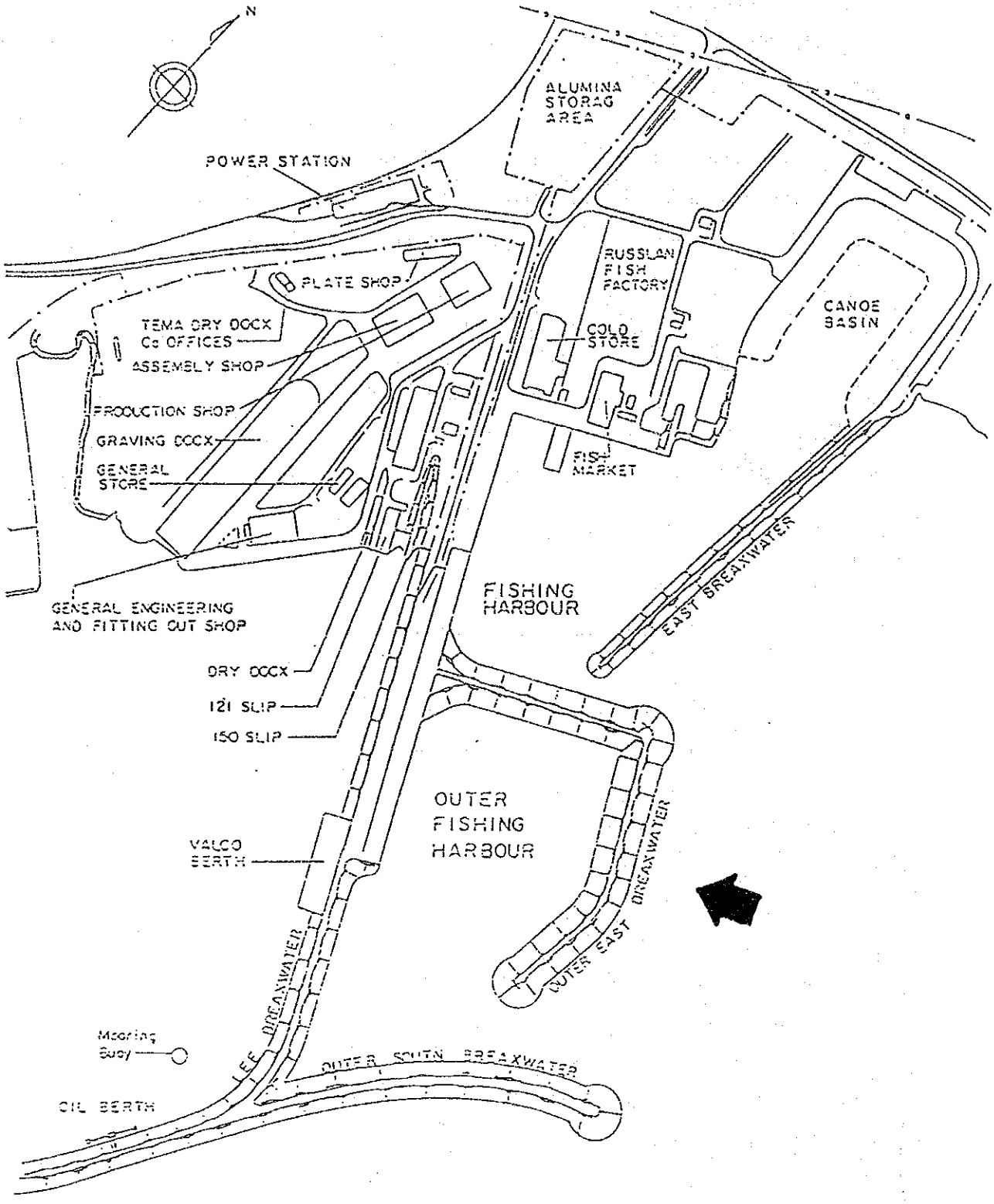
(1)The consultants will proceed to further studies in Ghana until September 27th, 1992.

(2)JICA will prepare the draft report in English and dispatch a mission in order to explain its contents at the end of November.

(3)In case that the contents of the report is accepted in principle by the Government of the Republic of Ghana 、JICA will complete the final report and send it to the Government of Ghana by the end of January, 1993.

ANNEX-I

Project Area and Site Location Map



ANNEX-II

Necessary measures to be taken by the Government of Ghana in case Japan's Grant Aid executed.

1. To secure the site of the Project.
2. To clear, level and reclaim the site prior to commencement of the construction.
3. To construct wall and fences around the Project site.
4. To improve the access road to the Project site.
5. To provide facilities for distribution of the electricity, watersupply, drainage, sewage and other incidental facilities to the Project site.
6. To bear commissions to the Japanese foreign exchange bank for banking services based upon the Banking Arrangement (B/A).
7. To exempt taxes and take necessary measures for customs clearance of the materials and equipment bought for the Project at port of disembarkation.
8. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Ghana and stay therein for the performance of their work.
9. To maintain and use properly and effectively the facilities constructed and equipment under the verified contracts.
10. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.
11. To coordinate and solve any matters related which may arise with third party and inhabitants living in the Project area during implementation of the Project.

MINUTES OF DISCUSSION

BASIC DESIGN STUDY

ON

THE TEMA OUTER FISHING HARBOUR REHABILITATION PROJECT
IN THE REPUBLIC OF GHANA
(CONSULTATION ON DRAFT REPORT)

In August 1992, the Japan International Cooperation Agency (JICA) dispatched the Basic Design Study team on the TEMA OUTER FISHING HARBOUR REHABILITATION PROJECT (hereinafter referred to as the "the Project") to the Republic of Ghana, and, through discussions field survey and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult the Ghanaian side on the components of the draft report, JICA sent to the Republic of Ghana a study team, which is headed by Mr. Osamu Hashimoto, Deputy Director, Fishing Port Construction Division, Fishing Port Department, Fisheries Agency, and is scheduled to stay in the country from November 18th to 27th, 1992.

As a result of discussions, both parties have confirmed the main items described on the attached sheets.

Accra, November 25, 1992.

橋本 牧	
.....	.....
Osamu Hashimoto	**Charles Abakah**
Leader	Director
Draft Report Explanation Team	International Economic
JICA	Relations Division (IERD)
	Ministry of Finance and
	Economic Planning

ATTACHMENT

1. *Components of Draft Report*

The Government of Ghana has agreed and accepted in principle the component of the Draft Report proposed by the team.

2. Japan's Grant Aid Programme

(1) The Government of Ghana has understood the system of Japanese Grant Aid explained by the team

(2) The Government of Ghana will take necessary measures, described in ANNEX 1, for the smooth implementation of the Project on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

3. Further Schedule

(1) The team will make the final report in accordance with the confirmed items, and send it to the Government of Ghana by the end of January, 1993.

Annex 1: Necessary measures to be taken by the Government of Ghana in case Japan's Grant Aid is extended.

1. To secure the site for the project.
2. To clear the site, prior to the commencement of the project.
3. To undertake the incidental outdoor works such as gardening, fencing, gates and exterior lighting in and around the site.
4. To construct the access road to the site, prior to the commencement of the Project.
5. To provide facilities for the distribution of electricity, water supply, drainage, telephone lines and other incidental facilities to the Project site.
6. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.
7. To exempt taxes and take necessary measures for customs clearance of the materials and equipment brought for the project at the port of disembarkation.
8. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Ghana and stay therein for the performance of their work.
9. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant.
10. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.
11. To coordinate and solve any matters related which may arise with third party and inhabitants living in the Project area during implementation of the project.

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Appendix 3 List of Interviewees

1. The Government of the Republic of Ghana

1.1 Ministry of Finance and Economic Planning

Name	Position
Mr. Charles Abakah	Director, International Economic Relations Division
Mrs. Agnes Batsa	Chief of Bilateral Assistance, IERD
Mr. Michael Baddo	Officer-in-charge of Japanese Desk, IERD
Mr. Kwesi Opoku	Officer, IERD

1.2 Ministry of Transport and Communications

Name	Position
Mr. G. P. Ansah	Ag.Chief Director(Administion)
Mr. E. A. Kwakye	Ag.Chief Director(Planning)
Mr. T. Selby	Director

1.3 Fisheries Department, Ministry of Agriculture

Name	Position
Mr. M. Armah	Ag. Director
Mr. A. Mensah	Deputy Director
Mr. C. K. Asafo	Deputy Director

2. Ghana Ports and Harbours Authority

Name	Position
Capt. E. T. Owsu-Ansah	Director-General
Mr. T. T. Addy	Director of Port-Tema
Mr. B. B. Okutu	Chief Port Engineer, Tema Port
Mr. K. Frimpong	Chief Port Engineer, Takoradi Port

3. Private Sector

3.1 Consultant

Name	Company Name
Mr. M. I. Musah	Architectural & Engineering Services Corp. (AESC)
Mr. A. Issah	AESC

3.2 Construction Firms

Name	Company Name
Mr. A. Kani	State Construction Corp.
Mr. J. Aggrey	Marine Construction Co., Ltd
Mr. I. Scott	Construction Pioneers

3.3 Quarry Plant

Name	Company Name
Mr. C. Egman	Ghana Stone Quarry Ltd.
Mr. K. Mireku-Odei	Twin Rock Quarry
Mr. S. Frinmpong	Eastern Quarry