Infrastructure Facilities for Deep-Sea and Off-Shore Fishing

By

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1. Scope

This paper is an attempt to give a brief account of the infrastructure facilities required for the fishing industry. An account of the facilities presently available in Sri Lanka and those that are under construction, a few suggestions indicating the nature of infra structure facilities that are vital to the local situation at its present stage of development are also included.

2. Facilities

Infrastructure facilities required for the fishing industry could be broadly classified into (I) Fish landing places ; (II) Unloading and handling facilities ; (III) Vessel servicing facilities ; (IV) Navigation aids.

(I) Fish Landing Places

The fish landing places can be sub-divided into — (*a*) The fishery harbours providing fish landing facilities for deep-sea fishing vessels, and (*b*) Minor landing places providing facilities for small coastal vessels.

Among factors that have to be evaluated in the location of fishery harbours are the following :

(1) Distance from the fishing grounds ;

(2) Proximity and communications with the potential fish market or consuming areas ;

(3) Availability of adequate sea and land area for development of auxiliary industries, such as boat repair facilities, fish processing areas, fish meal plants ;

(4) Suitability of the location for navigation during all seasons ;

(5) Availability of electrical power and water in adequate quantities ;

(6) Reasonable initial cost and maintenance costs ; and

(7) Suitable soil and coastal conditions to permit necessary construction work.

To determine the scale of the harbour, it will be necessary to have a reasonably accurate forecast of the fleet which will use the port. The number and the size of the vessels are important factors that have to be ascertained. The basin area of the harbour, i.e., the area enclosed by the breakwaters, depths and other repair facilities, market building, freezing and cold storage facilities etc. are determined by the fleet forecast. The fleet forecast will in turn depend on the available fish resources and fishing methods to be used, which, I believe, would be a subject area that would be dealt with by some other participant.

TheFish landing facilities required for coastal fishermen need not necessarily consist of protected basin areas if the type of fishing craft utilised is so designed to be capable of being hauled up on the beach. However in the local situation, the 3½-ton mechanised fishing craft commonly used does not bend itself to such handling and therefore need protected basins for refuge during monsoon periods.

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For the purpose of producing a protected basin area it is necessary to construct breakwaters, capable of withstanding the heavy seas. Such constructions are a major component in the cost of a fish landing facility. Since the depth required by the small coastal fishing vessel is limited, feasibility of utilizing lagoons and river estuaries as fish landing places is being explored. The problem encountered is the sand bank formations at the lagoon mouths and river outfalls which block the approaches during certain periods of the year. The hydraulic engineering studies of such outfalls are of a very complicated nature, often necessitating model studies. Either type of these constructions require considerable capital expenditure. Another aspect which may be considered is the social and ethnic background which prevent fishermen from one area accommodating those from another at a facility identified as located in this area. Under these circumstances the gradual introduction of a flat bottom coastal craft capable of being hauled on the beach should receive consideration.

At this point we may pause to consider the technical problems that have to be overcome in the construction of harbours, economic considerations being specifically excluded from this paper.

The construction of breakwaters cause disturbances in the existing natural coastal conditions of the region. Let us briefly consider the problems encountered by the engineer in the undertaking of such construction works.

The types of beaches mostly encountered are sandy beaches where littoral sand drift occurs due to the action of waves and currents. The magnitude and direction of such sand drifts will depend on the location and the season. If the construction works were to obstruct this movement of sand, siltation and erosion problems are encountered requiring expensive remedies. It is therefore necessary to have preliminary site studies extending for over a minimum period of one year before any design work could be undertaken. A longer period of study is more desirable. History of the behaviour of the coastline, if available, would be of immense benefit. Meteorological data, particularly information regarding winds, is important.

The scope of such studies cover wave heights, surface and sub-surface currents and sand drift. Hence the inability and the undesirability of commencing construction work as immediately as desired.

The breakwater construction adopted in Sri Lanka is the rubble mound type breakwater. This type being decided upon due to the availability of large quantities of granite and the limited foundation studies required for this type of construction. However it is necessary to point out that granite, though available cheap, require heavy expenditure for its transport and handling. A major portion of such costs being, indirectly, in foreign exchange.

(II) Unloading and Handling — Quays and Jetties

Quays and Jetties where the fishing vessels can be berthed alongside provide the basic unloading facility.

The factors that determine the required quay length are—

(1) Average number of vessels unloading at a particular time with a knowledge of the variations during slack and peak periods ;

(2) Average quay length required per vessel ;

(3) Unloading rate.

It is best to provide separate quay areas for refuelling and repairs. This would be referred to under vessel servicing facilities to be discussed later. The unloading itself could be done by mechanical aids such as conveyor-systems or by manual handling. In the case of deep-sea fishing vessels, where the catch is normally frozen on board, handling with mechanical aids is desirable to achieve speed with a view to preventing the deterioration in quality. Fish in the wet form is mostly handled in baskets and would require only quay-side lifting winches for handling. However if the fish could be packed in boxes while at sea and iced, the quality of the product would be enhanced and discharging made easier.

Market Halls

In the planning of market halls basic information necessary are —

(1) Anticipated annual fish landings with the quantities expected during peak period ;

(2) System of disposal envisaged.

The market halls have to provide for the processes such as sorting, washing, weighing, selling, packaging, icing, etc.

The market halls should be located in close proximity to the landing facility so that the fish could be handled quickly, reducing exposure to high temperature, dry winds and direct sunlight. They should permit a smooth flow pattern to achieve operational efficiency and reduce damage to the fish. The floor of the market buildings require special attention to ensure that they are of a smooth and dense finish which can be readily washed, thus preventing the growth of bacteria. Smooth concrete floors are adequate for this purpose. More expensive flooring may be used if finances permit. Walls could be finished smooth with washable paint or in the alternative the more expensive glazed tiling could be adopted, such finishes being limited to a height of about 5 feet.

Ice Plants

The transport and distribution of fresh fish cannot be done properly without cooling the fish. Ice is the cooling agent most commonly used. However to obtain satisfactory results it is necessary to use sufficient quantities of ice and replenish ice as and when necessary to ensure that the fish is kept properly cooled during the entire chain.

Ice is produced in two basic forms : block ice, which consist of blocks of weight $\frac{1}{2}$, 1 or 2 cwt. or ice in small particles such as flake, cubes, plate and slice ice. The local fishermen are mostly acquainted and show a preference for block ice. This preference for block ice may be due to their ignorance of the advantages of the other types. In the recent past flake ice plants too have been installed at certain locations (Please see annexes). The gradual increase in the demand for flake ice indicates its acceptance by the local fishermen.

Block ice plants use a batch-type process requiring about 24 hours to complete a production cycle. Also their capacities are relatively large and the initial installation costs high compared to the flake ice plants. Flake ice plants are available in small capacities. Their output begins in a short time thus avoiding the need to wait for hours to obtain the ice. The other advantages of flake ice plants are that they occupy less space, can be fully automatic and need less maintenance and supervision However in the local employment situation these may not be considered as advantages or could only. receive marginal consideration.

It may, however, be mentioned that flake ice is more suitable for the icing of fish for it causes less damage to the fish than crushed block ice.

The capacity of the plant to be installed should receive due consideration to ensure that the capacity is not too small to meet the requirements and not too large for installation costs to become an unnecessary burden.

An ice store has to be provided to ensure regular supplies of ice to customers. It is an insulated and refrigerated room maintained at a temperature of around – 5°C for block ice and around – 20°C for flake ice. The capacity of the ice store is related to the production capacity of the plant. The store being usually constructed in such a way that the ice produced could be transferred to the store by gravity.

Freezers and Cold Storages

For storage of fish for long periods it is necessary to freeze and store the fish at sub-zero temperatures. If the period of storage is to be over 6 months the storage temperature would be around – 30° C and if the storage period is less than 6 months a storage temperature of about – 20° C is adequate. The freezing is done at a temperature of around – 40° C.

The trend in recent years has been for the deep-sea fishing vessels to undertake trips of longer duration. This has necessitated the freezing of fish on board the vessels.

The construction of the cold storages are similar to the construction of the fish on ice storages the difference being in the thickness of insulation utilized and the capacity of the refrigeration unit.

Fish Meal, Fish Oil and Canning Plants

Mention must also be made of other fish processing facilities such as fish meal, fish oil and canning plants.

Transport facilities are a necessity to ensure an efficient marketing system.

(III) Vessel Servicing Facilities

The quick preparation of the vessel for the next fishing trip is of primary importance to make the fishing operations economically viable. To achieve this objective efficient vessel servicing facilities have to be provided.

Such facilities include repair and maintenance quays, slipways, docks, the supply of fuel, fresh-water, ice, bait, food, space for gear maintenance and storage, and stocks of spare-parts.

At major fishing ports it is necessary to provide separate quays and slipways for vessel maintenance work Such quays being equipped with necessary cranes and other lifting devices. Mechanical and carpentary workshop should be located in close proximity to these quays and slipways. Even at small fish landing places facilities should be available for engine and hull maintenance.

Fuel and lubricating oil supplies should be at a separate nearby location to avoid contamination and for safety reasons.

(IV) Navigation Aids

Navigation aids are necessary to enable the vessels to reach their destination safely. The type of aid required will vary with the function expected of it. They are aids to warn the crew, of the hidden dangers such as submerged rocks, limits of approach channels and sand bars, etc.

Floating buoys, Navigation lights on breakwaters, piers, dolphins and other objects projecting into the channel and Lighthouses are some of the common navigation aids.

3. Infrastructure Facilities already provided in Sri Lanka

Above is an account of the facilities that are considered desirable at fishery harbours and fish landing places.

The facilities already installed and are being installed in Sri Lanka are given in the Annexures.

These facilities had been planned on the basis of an ambitious programme of introduction of boats. However due to the introduction of boats not keeping pace with the construction of the infra-structure facilities most of the constructed facilities remain under-utilized. Although such a situation exists in relation to major facilities already provided, at certain other locations urgently needed facilities have not been provided. These are briefly indicated in the next section.

4. Conclusion

As will be seen from the Annexes, we have, at present, three fishery harbours capable of accommodating deep-sea fishing vessels. These are located at Mutwal, Galle and Trincomalee.

The facilities provided at these harbours and the installed capacities could accommodate a much larger fishing fleet than available at present and envisaged in the recent future. These harbours have not included fish meal, fish oil and fish canning plants,* which may become necessary depending on the future programme of introduction of fishing crafts and the type of fish landings anticipated. However in my opinion no further capital investment is desirable at these major fishery harbours for the present.

The small fishery harbours constructed, and which are under construction are mostly located in the southern and south-western coasts of the Island except for the harbour at Myliddy. It is necessary to provide safe anchorage facilities at several locations along the east coast.

Considering the heavy expenditure incurred in the construction of break waters and their maintenance, the time consumed in arriving at a suitable design to reduce adverse effects on the sea coast, it is opportune to consider a change in the type of coastal fishing vessel to be utilised in the future. The type of boat that could be hauled up on the beach should be adopted as an alternative to the construction of small harbours or anchorages. However, even with this type of boat, it may be necessary to widen and improve the beach front of fishing villages at such locations so that they could be easily hauled up. This would have the additional advantage of providing a recreation area for the local population. From a coastal engineering point of view such improvement schemes are a possibility, and also, much cheaper to realise than harbours or anchorages.

The provision of ice, freshwater, fuel, gear and spares at all fish landing points is an immediate necessity.

The availability of ice can be ensured by either installing an ice plant and an ice storage at the location or by the storage of ice supplied from a nearby plant, in an insulated storage room. This storage room could be refrigerated, if electrical power is available at the location, if not, it could be a room with thicker insulation to enable storage of ice for a reasonable period without refrigeration. Since ice plants and refrigeration plants consume considerable quantities of electricity, it would be not

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*Fish meal and fish oil plants have been installed at Mutwal Fishery Harbour, but their operational efficiencies have been imparied by age.

economical to install such plants in areas where electrical power is not available. The operation of such equipment utilising electrical energy generated at the site would be an unnecessary burden. In such instances it is suggested that the ice plants be located at a suitable point on the distribution net-work so that ice could be carried to the landing point by transport returning to collect fish.

A fish canning factory is being operated by the Ceylon Fisheries Corporation at Pesalai.

Before the development of facilities at any location is undertaken it is necessary to ensure that adequate supplies of fresh water is available in the area. In the past this aspect had not been given sufficient consideration resulting in heavy expenditure being incurred to obtain the necessary water In this connection advice from the experts should be sought.

At present fuel supplies are available only at a few of the fish landing points. Fishermen carry their requirements of fuel for long distances from the available distribution points which have been located to serve land vehicles. It is therefore very essential to provide fuel supplies at the fish landing points. This facility could be provided at little cost in collaboration with the Ceylon Petroleum Corporation.

The other related services such as supply of fishing gear and spare-parts should be improved ; making them available in close proximity to the fish landing points without their being scattered a various points requiring the fishermen to shuttle from place to place to collect the essential requirements The storage and distribution network for such items should therefore be suitably located to be of assistance to the fishermen.

In my opinion, it is not necessary to install any additional freezing and cold storage facilities in the near future. The facilities installed at fishery harbours remain under-utilized. The fish intended for the local market need not be frozen for it can reach the consumer in prime condition if iced in time and adequate transport facilities are provided. Only fish for the export market need be frozen. The facilities installed and are being installed at the fishery harbours would be adequate to meet these requirements, unless a large expansion in the fishing fleet is envisaged.

Finally, it has to be pointed out that the skilled man-power required for the erection, operation and maintenance of the infra-structure facilities mentioned above is in short supply and there is an urgent need to have adequate numbers trained to ensure continuous operation of the facilities.

REFERENCES

F.A.O. Fisheries Technical Paper 123–1973

F.A.O. Fisheries Technical Paper 131–1974

F.A.O. Fisheries Technical Paper 157–1976

F.A.O. Publication on Fishing Ports and Markets 1970

Design and Construction of Ports and Maritime Structures—Alonzo de F Quinm

Dock and Harbour Engineering—W.P. Shephard—Barron.

ANNEXURE I

Infrastructure Facilities provided and planned to be provided at Fishery Harbours

	Mutwal	*Galle*	*Trincomalee*	*Beruwala*	*Tangalle*	*Mirissa*	*Myliddy*
Harbour Facilities							
1. Basin Area (Acres)	2½ C	12 C	Over 50 C	25 C	4½C	17 C	7½ (Dec. 77)
2. Dredged Depth (ft. below Lowest)	20 C	20 C	20 (Feb. 78)	8 (Dec. 78)	8 C	8 C	8 (Sep. 78)
3. Quay Wall Length (ft.)	300	630 C	500 C	—	335 C	512 C	—
4. Jetty Length (ft.)	—	300 C	100 C	180 C	—	—	—
5. Slipways	—	500 and 65 TC	20T C	30T (Dec. 78)	20T C	20T	—
Shore Facilities							
6. Holding Room Fish on Ice (tons)	—	400 C	—	25 (Dec. 77)	50 C	5 C	—
7. Holding Room Wet Fish on Ice (tons)	25 under construction	200 C	50 C	25 (Dec. 77)	—	—	—
8. Frozen Fish Storage (tons)	500 C	2,400 C	200 C	200 (Dec. 77)	—	—	—
9. Freezing Capacity (tons/day)	18 C	20 C	10 C	10 (Dec. 77)	—	—	—
10. Block Ice (tons/day)	10 C	—	10 C	—	10 C	—	—
11. Flake Ice (tons/day)	18 C	50 C	—	10 (Feb. 78)	—	—	—
12. Ice Storage (tons)	—	150 C	—	50 (Dec. 77)	20 C	10 C	—
13. Market Area (sq. ft.)	2,500	17,000 C	1,670 C	2,800 C	—	—	—

C—Items completed.
( ) — Programmed date of Completion.

ANNEXURE II

Facilities planned to be Provided at pocations other than at Fishery Harbours by the C. F. H. C.

	Negombo	*Chilaw*	*Kalpitiya*	*Kokilai*	*Ulla*	*Thoduwawa*
1. Frozen Fish Storage (tons)	50 (Jul. 78)	—	—	—	—	—
2. Holding Room Wet Fish on Ice (tons)	5 (Jul. 78)	10 (Feb. 78)	5 (Dec. 77)	5 (Oct. 78)	5 (Sep.78)	5 (Sep. 78)
3. Ice Production (tons/day)	5 (Jul. 78)	5 (Feb. 78)	—	—	—	—
4. Ice Storage (tons)	30 (Jul. 78)	30 (Feb. 78)	5 (Dec. 77)	5 (Oct. 78)	5 (Sep. 78)	5 (Sep. 78)
5. Freezing Capacity	2 (Jul. 78)	—	—	—	—	—

Facilities provided at Locations other than at Fishery Harbours by the C. F. C.

	Batticaloa	*Anuradha-pura*	*Kariyoor*	*Pesalai*	*Silavaturai*	*Battulu-oya*	*Bandara-wela*
1. Frozen Fish Storage (Tons)	125	15	—	—	—	—	—
2. Holding Room Wet Fish on Ice (tons)	25	25	—	—	—	—	—
3. Ice Production (tons/day) (Block)	8½	10	5	5	2	5	2½
4. Ice Storage (tons)	25	30	35	25	10	25	—
5. Freezing Capacity (tons/day)	8½	—	—	—	—	—	—
6. Workshop (sq. ft.)	—	—	—	—	—	—	—

ANNEXURE III

Private Sector — Ice Production

District	*Production/Capacity (tons/day) Block Ice*	*Storage Capacity (tons)*
Colombo	161½	187
Galle	5	8
Matara	6	13
Batticaloa	11	68
Trincomalee	28½	144
Jaffna	25¾	107
Mannar	9½	45
Puttalam	22	—

DISCUSSION

Mr. Livera — Certain harbours constructed are not utilized and some others under utilized. A harbour for Mannar is very important for the safety of fishing boats operating in this area.

Mr. Senanayake — The possibility of a fishing harbour at Mannar is being investigated. Two locations near Mannar town are being studied.

Mr. Lucas Fernando — Due to shortage of fuel during the recent past, people in places like Mannar and Pesalai faced a difficult situation. Storage and distribution of fuel to fishermen should be considered by the authorities.

Mr. Senanayake — Solutions to these problems are under consideration. Before installing a fuel distribution centre Petroleum Corporation always considers its economic liability.

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