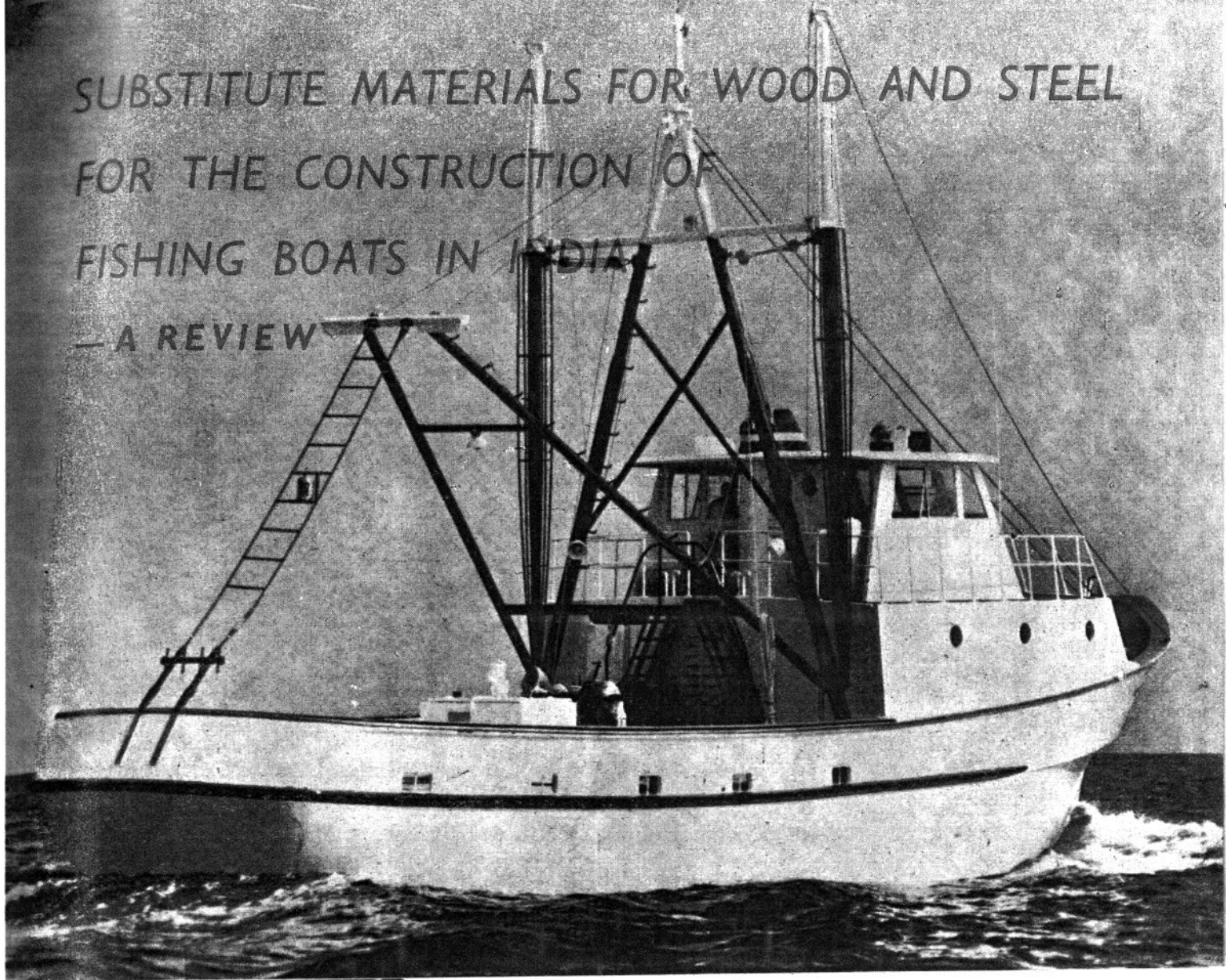


SUBSTITUTE MATERIALS FOR WOOD AND STEEL FOR THE CONSTRUCTION OF FISHING BOATS IN INDIA — A REVIEW



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*A 74' Fibreglass Trawler with 365 HP engine at 1800 rpm with a 6:1 reduction gear — made in U.S.A. Price F. O. B. American Port
Rs. 13 Lakhs (Approximate)*

Fishing Industry in India is fast developing so also the expansion of her fishing fleet. To-day there are about 7500 mechanised wooden fishing boats and 50 steel trawlers operating both in the Public and private sectors. During the Fourth Five Year Plan period a further expansion of the mechanised fishing fleet is expected with the addition of 8000 wooden trawlers and 200 steel vessels. It is now quite apparent that the

progress of construction of these vessels within India has considerably slowed down of late either due to shortage of constructional materials or to their high costs in the open market. Position of supply for special grade ship-building steel has become much restricted and only a limited quantity is made available at a cost of nearly Rs. 1800/- per ton. The fear of heavy corrosion of steel and the expensive methods

of protection always presents a gloomy picture. The conventional and popular material, wood, has also become scarce since suitable boat-building timbers are not now easily available either in the required sizes or in adequate quantity. Naturally time has now come for a serious consideration as regards the introduction of newer construction materials like Fibreglass reinforced plastics, Ferrocement and aluminium as suitable substitutes. Though not actually based on research investigations, tests and trials carried out in India, the newer materials, some how, have got the public attention to such an extent that the introduction of such vessels are being eagerly looked for either by indigenous manufacture or by imports from countries much advanced in this field.

Technically speaking fibreglass reinforced plastics, ferrocement and marine quality aluminium have all now been acclaimed to be ideal materials in the light of their individual characteristics for use in marine environment, especially for fishing boats and their accessories. As regards service life and performance under critical conditions, they are believed to be far superior to wood and steel. However, under normal working conditions, wood and steel permit a greater amount of versatility due to their well known characteristics and working qualities. Though opinions have been unanimous as regards the need for the introduction of such fishing vessels in all developing countries, statistics as regards their economics seem to vary from country to country. Undoubtedly, these three types of boats would require materials that would cost more than the conventional materials like wood and steel. May be, the initial high investment on

these types of vessels is likely to be offset by their low maintenance cost, prolonged service life and better pay load. It must be borne in mind that all these basic constructional materials are limited to fishing vessels of certain lengths. (see illustration). Each material has its advantages and disadvantages over the others and no single material can be said to offer dis-

Canada which is worth a perusal in the present context.

Boat size 100' OAL

24' Breadth moulded

13' Depth moulded

The general arrangement is for a typical one and half partial shelter deck combination vessel with bridge and engine room forward and fish hold aft.

Materials	Material content for a 100' vessel	To percentage of steel weight.	Price compared in percentage		
			One Hull %	5 Hulls %	25 Hulls %
1	2	3	4	5	6
Steel	106.20 Tons	100 %	100	100	100
Wood	111.51 ,,	105 %	106	106	106
Aluminium	47.65 ,,	45 %	135	135	135
FRP	64.20 ,,	60.5%	143	100	90
Ferrocement	110.32 ,,	104 %	88	88	88

distinct advantages. The newer materials require careful selection, handling and maintenance in as much as we lack the much needed experience with them, compared with the traditional materials which have been used for generations in ship building. If one accepts the fact that the aim is to produce economical boats and that different constructional materials and construction methods are the means to achieve this, a true and authentic picture of the influence of materials and methods can be obtained only if planned and concentrated attempts are made with complete cost prototype models. In the following pages a few important background data on these newer materials has been brought out. Based on prototype studies, the following estimation of hull work and material content for 100 ft. combination vessel of a basic design but in different materials constructed as per Lloyd's rules, has been made by D. J. Fraser of Montreal,

It is clearly evident from the above tabular statement, that FRP boats though initially would cost very much higher than all other materials, would be cheaper ultimately if mass production is attempted. Fortunately this newer material and the method of construction yields to mass production taken off from a single mould. This unique feature is not possible with the rest of the materials where the conventional construction is by the one off method and thereby no saving is possible.

Fibreglass Reinforced Plastic Boats

Reinforced plastics with the use of ideal materials like fibreglass and thermosetting resins, offer a construction medium which can, within reasonable limits, be moulded to any required shape or form. This material and method of construction is ideally suited wherever mass production is envisaged. Moulding of boat hulls is possible by the 'contact' or 'hand lay-up' method and

the laminates are produced in moulds of the form and shape required, by laying plies of glass reinforcement impregnated by resin and consolidating before application of the succeeding layers of reinforcement.

The advantages of FRP applied to ship-building are (a) a light weight and high strength material (Tensile strength 14000 psi; sp. gr 1.6); (b) a material completely impervious to marine corrosion (c) free from marine borer attack in tropical waters (d) increased payload capacity and (e) much reduced hull maintenance besides being associated with reduced heat leakage and skin friction losses. Although superior to most woods, the resistance of FRP to abrasion is poor considering its use in conjunction with wire ropes, otter doors and other heavy fishing

gear but this can be solved by incorporating additional weather plates wherever necessary. The concept of FRP shipyard is necessarily a function of many variables, geographical position, climate, proximity to raw material suppliers, size, type and number of boats to be built, in addition to many other influencing factors. Careful programming appears to be essential considering rate of production under mass scale moulding - 20 hulls a day. Bonding, riveting, bolting and screwing in F. R. P. work requires great care and vigilance. The effect of elevated temperatures on plastic laminates should be given careful consideration.

Fibreglass construction methods have been used for many years in the field of small pleasure crafts and life boats. With the

collection of more and more of valuable data on this new material combined with the increase in production of Fibreglass, resin and other components, a size of 40 to 80 ft. fishing trawlers was reached. Considerable progress has since been made and a notable event was the publication by Lloyd's Register of shipping of provisional rules for the application of reinforced plastic to the construction of fishing craft from 20 ft. to 100 ft. long. Today no other material is taken advantage of as much as FRP for larger sizes of trawlers and sophisticated vessels including hover-crafts and rockets. It is now believed that vessels upto 200' can also be built out of FRP to satisfaction. South Africa has the best experience where more and more FRP vessels are being constantly added.

The first "ferro-cement" trawler designed and constructed in India in a private boat-building yard in Cochin. 32' OAL - 6.75 Tons displacement with 57 HP indigenous marine engine.

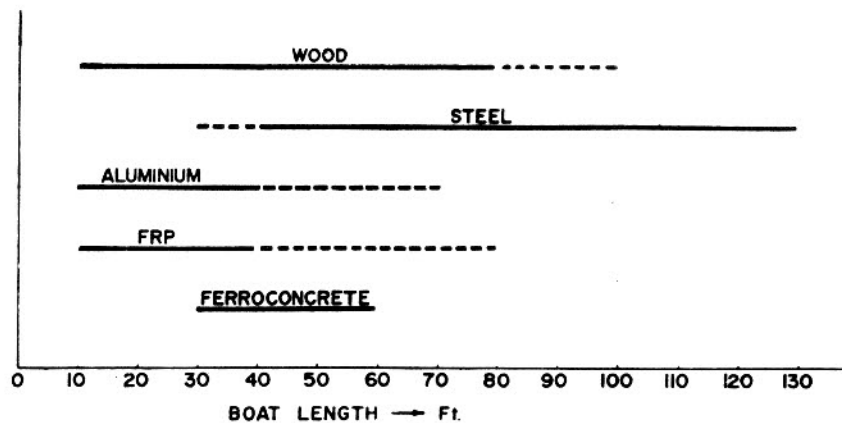


They are popular in U. S. A. Canada, Japan and U. K. With the Production of fibreglass and resin within Japan, more of FRP boats are being built now as per their traditional requirements. A 54 feet FRP fishing boat has already arrived in India (Cochin) from Norway for carrying out fishing investigations under a UNDP programme.

One variety of 'A' glass fibres in the form of chopped strand mat, woven roving, surface mat are now being produced in India. 4 or 5 firms are producing the much needed polyester resin and a few boat-builders of repute have advertised for their competency for building FRP trawlers in India. Central Institute of Fisheries Technology, besides studying the characteristics of the indigenous glass fibre products and the useful resins has standardised FRP as a perfect sheathing material for wooden boat hulls, and Fish hold lining. Suitable painting schedule on FRP structures has also been standardised.

As regards to cost, it appears, that FRP boat hulls are at least 1.5 to 2 times costlier than their wooden counterparts but this high cost is likely to be much reduced under mass production, reduced overheads and mould cost. High cost is also off-set by the added advantage of easy maintenance. However, in India as it is today, the cost of raw materials for FRP jobs is considerably high and the technical know how and design knowledge are much limited. The better variety of 'E' glass and resins like epoxies are still not freely available at competitive rates. Above all, experiences elsewhere, have revealed that FRP,

APPROXIMATE SIZES WHEN SOME TYPICAL BOAT BUILDING MATERIALS ARE USED TO ADVANTAGE (after Traung F.A.O. 1968)



just like any other material, has its own technological limits.

“Ferrocement” Fishing Boats

‘Ferrocement’ or ‘Ferro concrete’ is the name given to a material consisting essentially of a number of layers of galvanised iron wire mesh and steel rods impregnated with a mortar made of fine sand and good quality cement. The resulting material exhibits all the mechanical properties of a new material so well suited for fishing boat construction with very many advantages. The material is easy to fabricate into complex shapes without the use of forms and moulds. It has good strength to weight and stiffness to weight ratios; it is water proof; it is corrosion resistant.

The specific gravity of ‘Ferrocement’ at 2.4 - 2.6 seems high when compared to 1.6 for FRP and 0.9 for wooden boats including fastenings. However, the absence of heavy internal frames reduces the weight of a ferrocement hull sufficiently that for boats over 45 feet long, the weight is 5 to 15% less (?) than an equi-

valent wooden hull. Ferrocement boats having lengths between 35 and 45 feet, will have weights comparable to boats made of wood, steel and Fibreglass, but above 45 ft., it is always lighter. This merit has to be taken to maximum advantage. In addition a gain of 11% in internal volume is realised. The ability to build hulls, decks, bulk-heads, floors, engine bearers, fish holds and bulwarks in one piece is possible and easy with ferrocement construction. This material still requires a further period of development being a comparatively recent innovation as a boat construction material for fishing vessel hulls and the thresh hold size ranges are still being debated upon. However, Italian Naval Register and the Department of Marine Engineering of the Italian Navy accepted ferrocement as a hull construction material as early as 1943. Not only Lloyd’s approved ferrocement but in January 1967, they have produced their own rules for ferrocement craft, thus giving the material the international recognition. F. A. O. of the United Nations have already

designed and completed prototype constructions out of ferroconcrete.

In spite of advocates and adversaries for ferrocement fishing boats, the U. S. A., Canada, New Zealand and U. K. are fast progressing in popularising and specialising in this novel method of boat construction. There are, however, marine engineers in many countries who feel that more research and development is needed. At the same time University of Queensland, University of Michigan and British Columbia Research Council have done the necessary research investigations on 'ferrocement' with special reference to civil engineering aspects and mechanical properties. From the performances of 'ferrocement' vessels so far constructed, it appears, a size range of 40' to 60' boats will give satisfactory service if constructed on standard sound lines. However, price calculations are still fluctuating. In India (Cochin), a 32' ferrocement boat, first of its kind, has been constructed in a private yard. At present such a boat is reported to cost a little more than a wooden counter part. It is also reported that the Tamil Nadu Fisheries Department is shortly introducing ferro-cement boats for the benefit of the fishermen. The first of the eight 38 feet long boats proposed for the purpose is now being built at Madras. Designs for larger sizes of fishing boats are also ready. The Department is also contemplating construction of house boats out of ferro-cement in connection with the promotion of

tourism. If steel and cement that are required for 'Ferrocement' boats are freely available at competitive price, this new material has a bright future in India.

Aluminium for Fishing Vessels

The use of aluminium in the construction of boats and ships is not new and in fact it dates back as far as the 1890's. The earlier attempts did not meet with great success because the right type of material and the method of construction were not well known. During the 1930's the marine-type aluminium-magnesium alloy was developed. The advancement in metallurgy, together with advancements in welding techniques made possible the free use of aluminium alloy to fishing vessel construction.

These special alloys are very light (specific gravity 2.7 as against 7.9 for mild steel) and have a high strength to weight ratio. The marine aluminium alloy containing 2 to 5% of magnesium are extremely durable, they resist sea-water corrosion, they will not rot, rust, wrpp, or absorb moisture. This material gives the vessel a light weight with high strength per weight, low centre of gravity for proper stability, greater speed per horse power and a minimum cost of maintenance. Aluminium is mostly not compatible with other conventional metals, more so in sea-water due to electrolysis. Correct welding procedures and techniques in dealing with aluminium are of great importance. One of the main disadvantages of using aluminium for the main hull

structures is its low melting point and the adverse effect of heat on its strength characteristics and as such suitable fire insulations are insisted. Frequent inspections are essential during construction.

Unlike steel, cement etc., the required aluminium is easily available in India and at least more than one firm is producing marine quality aluminium in the form of plates and extrusions. The leading ship-building yards in India may also be fully equipped with the latest welding techniques. Some aluminium crafts are at present operating in inland waters of India. The recently introduced 57' class of indigenous steel trawlers in India have their entire super-structure built out of marine grade aluminium. This will improve the stability of the vessel by lessening the top heaviness. India can make the best use of this indigenous raw material by utilising them as much as possible wherever other conventional materials have failed for one reason or other.

Considering both the merits and demerits of these new constructional materials - Fibreglass reinforced plastics, Ferrocement and Aluminium alloys are bound to play a vital role in the development of fishing crafts in India as suitable substitutes or alternate materials for the conventional wood and steel, both of which are becoming scarce at present. A wider choice of constructional materials is now available for the future builders of fishing boats. ●