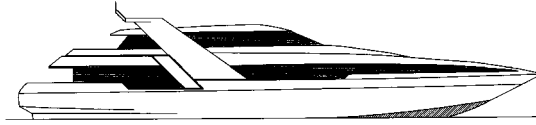


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NOTES

ON

FERRO-CEMENT CONSTRUCTION

1. INTRODUCTION

Stewart Marine Design Pty Ltd is the only ship design firm in Australia that is government licensed to design commercial vessels in ferro-cement. We are also one of the few government licensed marine surveyors in ferro-cement. As such, we are often asked to provide general comments to people on building vessels in ferro-cement. These notes have been prepared to try and give some general information to the public on ferro-cement construction.

2. HISTORY

Vessels constructed of ferro-cement have had a chequered history. During the 1960's and 70's, ferro-cement became the construction material of choice for many armature builders. These armature (and some "professional") builders did not have a full and proper understanding of the requirements for sound ferro-cement construction. As a consequence, many ferro-cement vessels experienced structural problems later in their life. This is what led to the chequered history.

3. CHOOSING TO BUILD IN FERRO-CEMENT

The choice of a vessel's construction material is always a compromise. No construction material is perfect for the job. There are advantages and disadvantages with all types of materials. Before the design process begins, the vessel owner, in consultation with the designer, must first decide on the construction material(s) for the vessel.

We will not go into the advantages and disadvantages of all main vessel construction materials. The more common vessel construction materials are-

- Steel
- Aluminium alloy
- Fibre reinforced plastic
- Timber
- Ferro-cement
- Copper-nickel (rare)

4. **ADVANTAGES OF FERRO-CEMENT**

The advantages of building a vessel in ferro-cement are-

- (a) Low construction material cost.
Ferro-cement construction normally has the lowest material cost of any of the common vessel construction materials. Typically, the material cost in ferro-cement is about 30% to 50% of that for steel.
- (b) Low labour skill required in setting up steel meshwork.
The setting up and fixing of the steel mesh in ferro-cement construction does not require a high level of skill. Labourers can perform the work after they have been given some basic instructions and practice.
- (c) Ease of fairing during construction.
The fairing of the hull form is done during the plastering stage of construction. This means that the hull framing does not have to be as accurate as may be required with other common construction materials.
- (d) Low ongoing maintenance.
With proper design and construction, ferro-cement vessels require only minimal ongoing maintenance. If not being moved through the water, it does not even require antifouling.
- (e) Intrinsically safer in the event of grounding.
When subjected to severe impact (e.g., grounding), ferro-cement does not tear like some other materials. The concrete cracks but remains mostly secured to the steel mesh substrata. This can restrict the amount of water that ingresses into the hull.
- (f) Long operational life.
Well designed and built ferro-cement vessel have demonstrated that they have an extremely long economic life. Fifty years or more is not uncommon.

5. **DISADVANTAGES OF FERRO-CEMENT**

The disadvantages of building a vessel in ferro-cement are-

- (a) Specialist design expertise is required.
Because of the many variables that can influence the finally built vessel, it is necessary for an experienced designer to prepare detailed and accurate design plans and documentation.
- (b) Heavier displacement.
Ferro-cement vessels tend to have a heavier displacement than a similar size vessel built in steel. Typically the ferro-cement vessel has a mass that is 20% to 40% heavier than steel. With good design, the mass of the ferro-cement vessel can be kept relatively close to that of a steel vessel.
- (c) Detailed supervision is required during construction.
This is particularly so just before the start of and during plastering.
- (d) Difficulty in attaching fittings, etc.
Ferro-cement when cured is extremely hard and very tough to drill into. A lot of this disadvantage can be overcome with detailed planning during the design process.
- (e) High labour content
The labour content of construction is high, particularly in setting up and securing the steel mesh.

- (f) Specialist skilled labour required for plastering.
The plastering of the vessel (i.e. the application of the concrete) is a job requiring some skill and expertise. Normally qualified tradesmen are suitable for the work, provided they have first had some experience in applying concrete to a ferro-cement vessel structure.
- (g) Atmospheric environment during curing is critical.
Great care must be exercised in ensuring that the atmospheric environment is acceptable during the curing phase of the concrete.
- (h) Difficulty in performing repairs.
Unless the repairer is experienced, the repair of a ferro-cement structure can be difficult to properly effect.

6. **CONCLUSION**

Taking into account the advantages and disadvantages of building in ferro-cement, this construction material lends itself readily to slower moving (or stationary) displacement type vessels built in areas that have a relatively low cost for semi-skilled labour. It is normally not economically viable to commercially build ferro-cement vessels in first-world countries. However, this construction material is very well suited to construction in third-world and developing countries.

Typical applications are-

- Non-self-propelled barges
- Smooth-water self-propelled barges
- Cruising yachts (sailing and/or motor)
- Pontoons