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Guide to simple repairs of FRP boats in a tropical climate

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Guide to simple repairs of FRP boats in a tropical climate

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Foreword

This booklet was prepared under the FAO Project on **Safety at sea for small-scale fisheries in developing countries** (GCP/GLO/200/MUL) implemented in South Asia and West Africa during 2007 – 2009. It results from FAO's experience in FRP work in many developing countries, particularly in Asia. This booklet would be useful for fishers and small workshops in the fishing villages to undertake minor repairs on the FRP boats. It may also serve as a guide for officials of the department of fisheries and other concerned agencies with training in matters of simple repairs of FRP boats. It is recommended to translate and adapt the contents of this booklet for each target audience, in order to be consistent with the local weather conditions, topography, types of vessels, etc.

Acknowledgements

This guide to simple repairs of FRP boats in a tropical climate has been prepared with the support of a number of people working with FRP boatbuilding. It was developed under the FAO project **Safety at sea for small-scale fisheries in developing countries**, GCP/GLO/200/MUL, funded by the Swedish International Development Cooperation Agency (Sida) and the International Maritime Organization (IMO).

Most of the pictures and illustrations in the guide were provided by Thomas Anmarkrud during his previous work in India, Sri Lanka and the Maldives. Other pictures have been provided by Per Danielsson, Global Project Coordinator for the Safety at sea for small-scale fisheries project and R Ravikumar, Regional Coordinator of the South Asia component of the project and the BOBP-IGO.

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Introduction

This guide to simple repairs of FRP boats was developed to address simple repairs that can be carried out by fishing boat owners or others who do not have the necessary expertise. A great deal of repair work is done by boat owners, including work that should have been carried out by FRP experts, because the owners might have difficulties in finding a skilled FRP boatbuilder or taking the boat to a boatyard for proper repair work. This booklet gives simple guidance to owners or laminators on how to carry out good simple FRP repair on the beach, the pitfalls and the do's and don'ts. It also advises when a skilled FRP expert should be contacted because of the complexity of the repair work.

Common bad practices in relation to FRP repairs

- Substandard workshop conditions.
- Incorrect FRP handling.
- Inadequate lamination methods.
- Lack of personal safety and protection.
- Careless handling of dangerous and highly inflammable materials.
- Insufficient waste disposal.

What can be repaired on the beach?

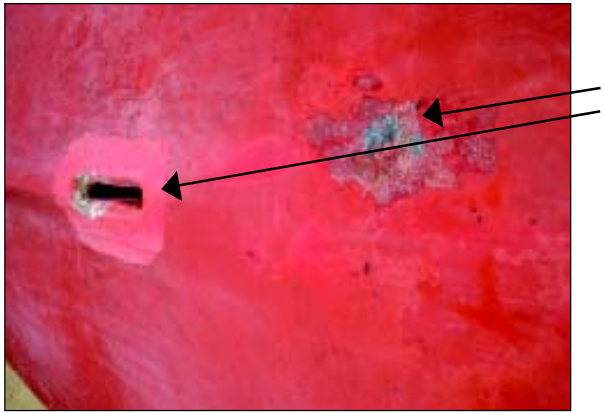


Figure 1

Abrasion of gelcoat and shallow damage to the fibreglass.

This is an example of damage that could be repaired on the beach by the boat owner.

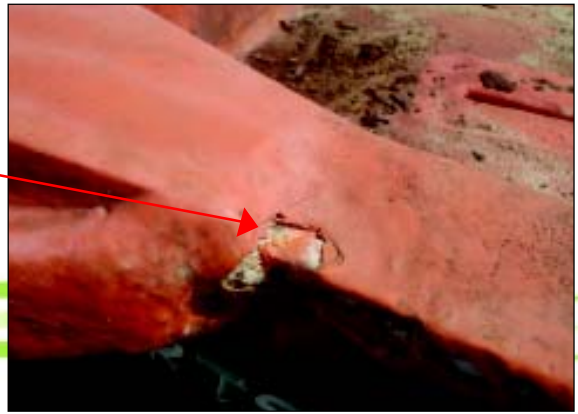


Figure 2

Small damages on the gunwale.

Another example of damage that could be repaired on the beach by the boat owner.

Figure 3

This is a typical example of major damage that needs professional FRP repair work.

Damages that penetrate the laminate should only be repaired by a trained FRP boatbuilder.

What is FRP?

Fiberglass reinforced plastic, or FRP, is a composite of several materials (mainly fibreglass fibres and resin) laid down in alternating layers and hardened to form a solid laminate.

If put together correctly, the laminate can be both strong and stiff with good resistance to fatigue and the influence of water.
If constructed badly, the laminate might still look good on the surface but, because of its poor quality, may degrade and collapse in half the expected lifetime or even less.

Figure 4

Handling of FRP materials

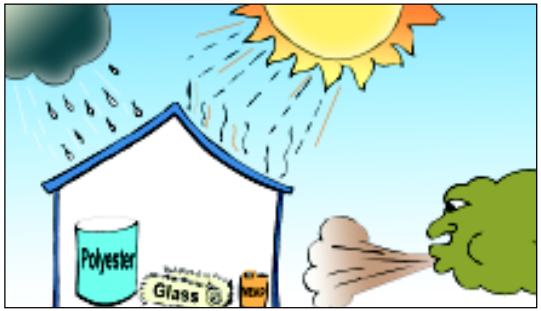


Figure 5

FRP materials should be protected from sun, wind and rain.

Figure 6

Here are some guidelines to follow when carrying out simple FRP repair work.

- Always check that you actually get what you have ordered from the supplier.
- Keep the fibreglass dry and clean.
- All polyester-related materials should be stored in as dark and cool places as possible, and the hardener should be stored separately.
- Ensure that gelcoat and resins have been properly mixed in the drum or container before use, to avoid additives settling at the bottom.
- Ideally, when undertaking repair work, all raw materials, the boat itself and the environment should be at the same temperature.

Dry storage

Figure 7

In a tropical climate, FRP materials must be stored in conditions as dark and cold as possible in order to ensure maximum shelf-life.

Work area

Figure 8

It is very important to protect the work area from sun, wind and rain.

If a shelter like the one shown in the picture is not possible, a temporary shelter should be constructed, using canvas, for example.

Tools

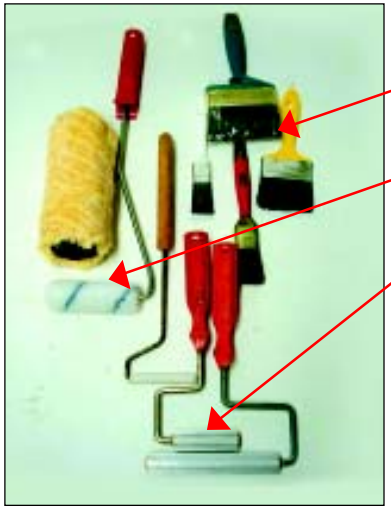


Figure 9

Brushes are best for applying gelcoat but can also be used for getting polyester resin into tight corners and on to small details.

Resin rollers of different sizes can be used. They should be made of materials that will not be damaged by solvents.

A variety of *compacting rollers* are used for different applications. They should be applied firmly but not too hard. Compacting must stop as soon as the resin starts to gel, otherwise the continued used of rollers will only create air bubbles rather than remove them.

Figure 10

Electric disc grinders are mainly used for sanding away damaged FRP. They can be fitted with rubber backing discs for use with 40 grit paper or coarser.

Carborundum cutting and grinding discs can be attached and used for cutting or grinding cured laminate and cutting off stainless steel bolts.

Repairing of damage to the laminate

Marking of the damaged area to be grinded

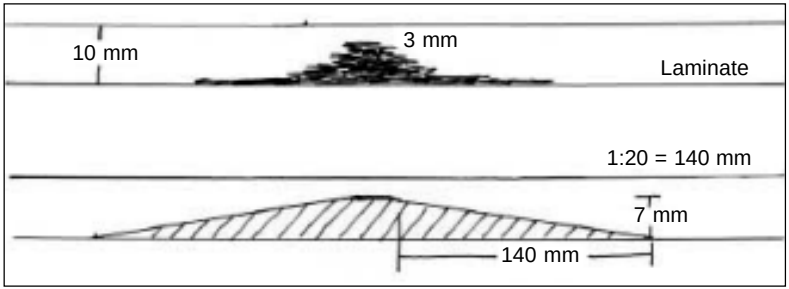


Figure 11

This damage does not penetrate the laminate.

The scarf should be at least 1:20.

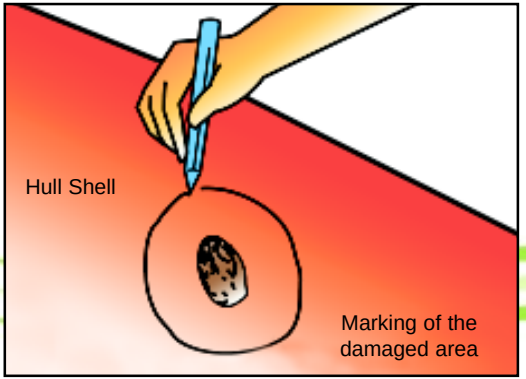


Figure 12

Mark the area on the surface of the laminate to be grinded.

Prepairing for the repair work

Figure 13

Prior to grinding, all surface contamination, such as oil and silicone, should be washed off and removed with an appropriate solvent.

Choosing the right paper

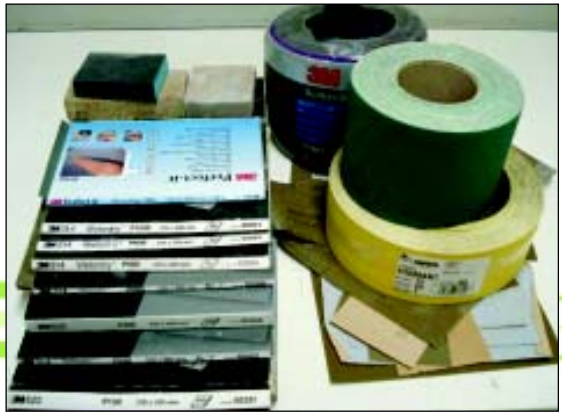


Figure 14

For grinding, 40 grit paper, or coarser, is a good choice.

Grinding

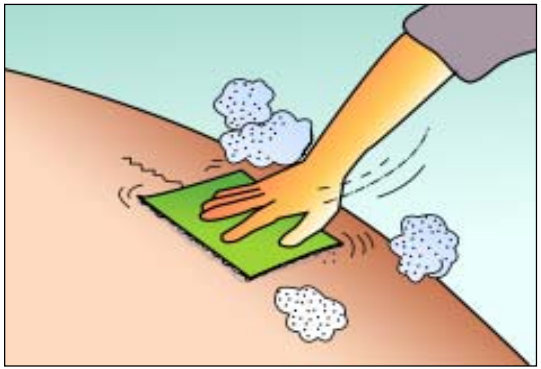


Figure 15

The area should be grinded with grit paper, either manually or by power tools, such as disc grinders.

All damaged fibreglass must be removed.

Remember that the scarf should be at least 1:20.

Fibreglass

Figure 16

For simple repair work, choose chopped strand mat (CSM), which should be tailored for the repair.

The first piece should fit in the deepest point of the hole. Other pieces should increase gradually in size to fill the hole along the bevel as the repair progresses.

When tailoring the patches it is best to tear the CSM to size, leaving a tapered edge to the patches, otherwise excess thickness may build around the edges of the patch.

Figure 17

A handy tool for measuring hardener can be made by attaching a piece of steel wire to a bottle cap.

A typical cap from a soda bottle will hold 5 ml (0.18 oz) of hardener, which is sufficient for 500 ml (17.6 oz) of resin.

The resin and the hardener should be mixed thoroughly.

Figure 18

Mixing the resin and hardener

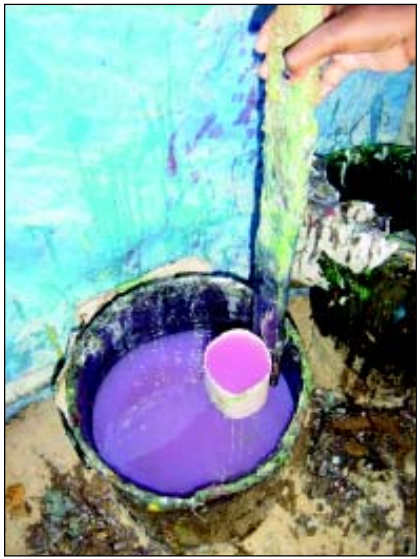


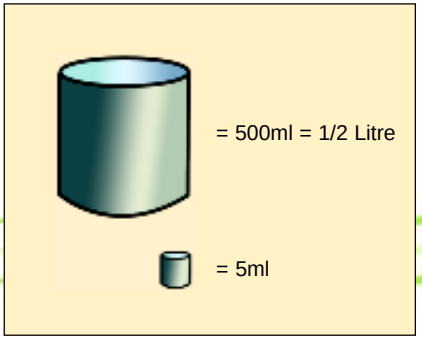
Figure 19

A cut-off plastic bottle may be used to measure the resin. It should contain exactly 500 ml (17.6 oz).

The resin is poured into a bucket.

Figure 20

The correct amount of hardener to resin is 1 percent, however 0.8 percent will normally also work in the tropics.



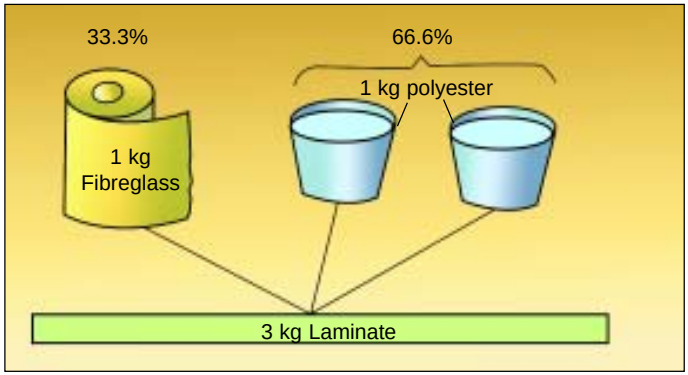


Figure 21

This is the correct amount of polyester resin to fibreglass.

For example, the amount of resin for 1.0 m^2 of 450g/m^2 CSM is 1000 g (or 1 kg).

Applying the resin

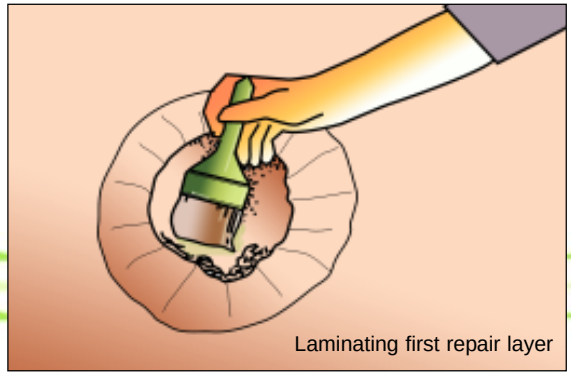


Figure 22

A coat of resin should always be applied *before* applying the fibreglass mat.

Figure 23

Another coat of resin should be applied *after* applying the fibreglass mat.

Compacting the resin and fibreglass layers together

Figure 24

The metal roller should be used to eliminate any air bubbles and to compact the resin and fibreglass layers together.

Preparation of the topcoat

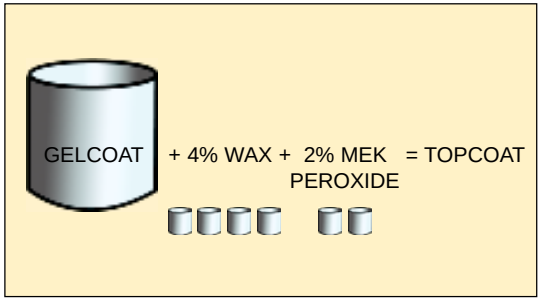


Figure 25

The topcoat can be prepared by mixing gelcoat, wax and hardener in the percentages shown in the figure.

A colour pigment can be added to the topcoat. It should be noted, however, that it is virtually impossible to obtain a perfect colour match with the surrounding area.

Topcoating

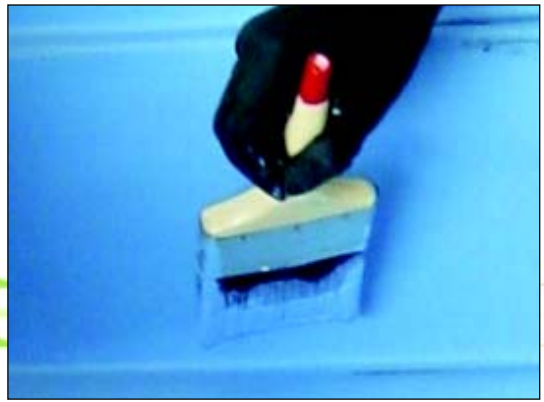


Figure 26

The topcoat is applied on the top of the repaired laminate.

The purpose of the wax is to ensure proper hardening of the topcoat.

If the topcoat does not have wax included, it should be covered with a layer of thin plastic or a coat of polyvinyl alcohol (PVA), which serves the same purpose.

Gelcoat or topcoat repair work

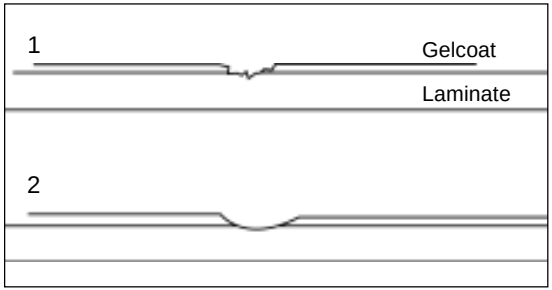


Figure 27

When there are small cracks or abrations in the gelcoat or topcoat, but no damages in the fibreglass, the damage can be fixed by repairing only the gelcoat or topcoat.

Preparing for the repair work

Figure 28

All surface contamination, such as oil and silicone, should be washed off and removed with an appropriate solvent.

Figure 29

The damaged area should then be grinded by hand with 40 grit paper or coarser.

Topcoating

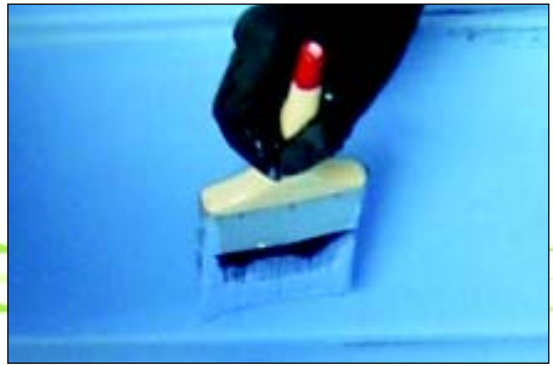


Figure 30

Finally, the fibreglass should be sealed with a topcoat.

Examples

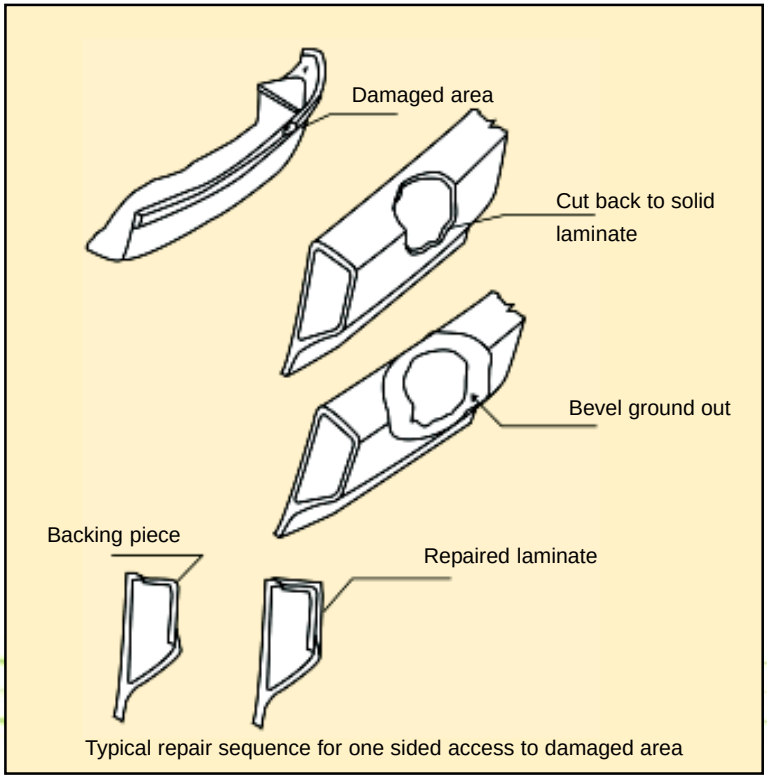


Figure 31

A typical repair to a damaged hollow gunwale.

Occupational safety and health

- Always use **eye protection** when working with FRP, there are hazards both from chemicals, which can be anything from an eye irritant to a severely corrosive liquid, to airborne particulate matter.
- Always use **respirator** and/or **dust mask** when working with FRP to protect from hazardous fumes and FRP grinding dust.
- Always use proper **gloves** when working with FRP repair work to protect skin from hazardous liquids and solvents.
- Always use **ear protection** when working with noisy machinery during FRP repair work.

Environment

Always get rid of waste in a **safe** and **environmentally** friendly way.

Check with your local authorities on how to handle **hazardous waste**.

Always reuse as much as possible to save money and the environment.

Further reading

Anmarkrud, T. 2009. Fishing Boat Construction: 4. Building an undecked fibreglass reinforced plastic boat. FAO Fisheries and Aquaculture Technical Paper. No.507. Rome. FAO.

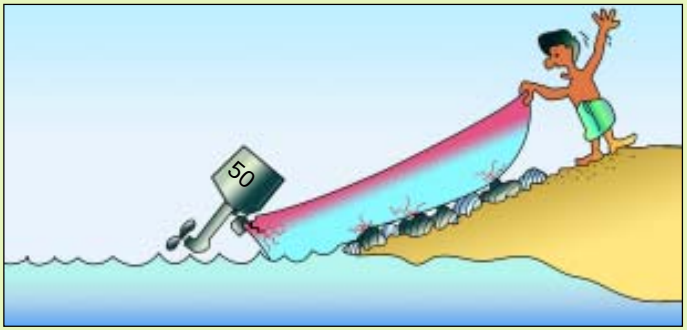
Coackley, N. 1991. Fishing Boat Construction: 2. Building a fibreglass fishing boat. FAO Fisheries Technical Paper. No.321. Rome. FAO. 84p.

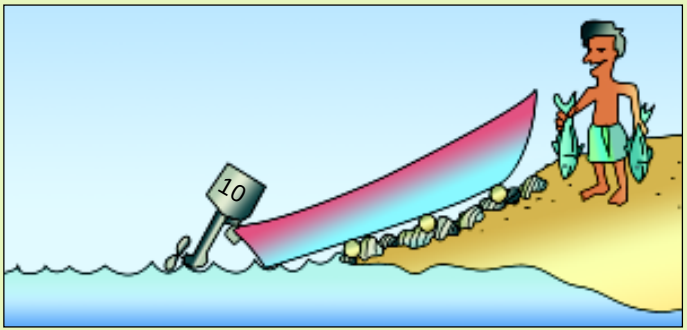
McVeagh, J. et al. 2010. Training manual on the construction of FRP beach landing boats. Chennai. FAO.

Note:

These publications can be downloaded from the Safety for Fishermen Web site at: www.safety-for-fishermen.org

Do not pull your boat up on to a rocky shore
without protection!





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