INTRODUCTION TO, APPEARANCE AND DURABILITY OF GLASS REINFORCED PLASTIC (GRP)

What is GRP?

First developed in the 1940's for military and aerospace uses, glass reinforced plastic (GRP) is a polymer based resin which when consolidated with a woven matt made from strands of glass becomes extremely strong.

GRP materials are used routinely in many varied applications in both the marine and civil engineering sectors. They gained early acceptance in the boatbuilding industry during the 1950s and 1960s which led to a reputation for long term durability. This has been confirmed through experience with the Royal Navy's minehunter fleet where the whole ship is made out of GRP [1]. Investigations into the degradation of hull and superstructure GRP have allowed the minehunters' original design life to be doubled, conservatively, to 40 years, though it is believed that the actual life of the material could be up to 100 years or more.

GRP does not corrode and the effects of moisture can be mitigated or planned for. Other applications include pipes, valves, tanks, slabs, walkways, bridge decks, gratings, column reinforcing wraps, patch repairs to cracked steel structure and reinforcing bars for concrete. In many of these examples, GRP is exposed to one or more environmental influences. All GRP materials are durable in that they are water resistant, thermally stable and do not corrode. DTI funding for a Building Research Establishment programme has enabled substantial research to be carried out on the long term performance of GRP in service, in order to increase confidence in its use [2].

Other common uses are the civil and structural world for load bearing and decorative panels, roofs, bridges, replicated architectural detail on film sets and in other real building situations, including over the last 15 years or so, telecommunications, in particular due to its 'radio-transparency' ie GRP allows signals to pass through it whereas steel and other standard building materials do not.

GRP has application in the new build market but, more importantly in the rehabilitation of structures, particularly historic buildings. It is often deemed an environmental benefit based on aesthetics and weight, as GRP offers a weight saving of up to 60% compared to stainless steel, whilst proving comparably strong. Examples include granite effect cladding as well as numerous applications of wrought iron effect railings, brick and tile effect cladding, chimneys, replica flagpoles and timber louvres. GRP structures for telecommunications uses have been successfully replicated following the grant of planning permission on Grade I, Grade II* and Grade II listed churches throughout Britain, demonstrating that in fact the material is acceptable for use in conservation areas such as Parkhill where Troyes House is located. We can provide examples if required.

How is it moulded to match existing materials?

Due to the material having a liquid composition prior to the addition of a catalyst, GRP can be formed into simple or complex shapes with the use of a mould produced from any existing form. This means a wide variety of textures and profiles can be replicated, as can material no longer available or in production.

The item/s to be replaced with GRP are usually taken from site to the factory where the profile, size, shape and texture are carefully recreated by specialist carpenters or as they are commonly known, 'pattern makers'. In the case of Chester Court, an existing structure is not being replicated, so this step is not necessary; a pattern will be constructed using the detailed

design drawings and a visit to see the bricks used in the building façade that the proposed GRP structures will match.

From the timber pattern the GRP mould is produced and from that ultimately the GRP product is produced by the impregnation of glass fibre mat with a liquid polyester mix. Hand lay-up is the method used for producing composite structures by hand applying composite materials in successive layers on a tool or mould that defines the part geometry.

Due to the range of colours available, it is possible to create a finish identical to the original material, be it granite, wood, slate, concrete, tile, brick or metal. See Figure 1 for samples and Figure 2 for real life examples.

Figure 1a: Examples of GRP reproductions – brick, stone, timber, slate

Figure 1b: Examples of GRP reproductions – stone, slate, brick

Figure 1c: Example of GRP reproduction - timber

Thus it can be seen the desired colour, shape, size and texture of the proposed item can be accurately created or copied, depending on the circumstances. See Figure 2 for real life examples.

Figure 2a: GRP chimney close up

Figure 2b: GRP chimney from Figure 2a, from street level

Figure 2c: GRP chimney very close up, with GRP chimney pots

Figure 2d: GRP enclosures (two different sites)

It can also be seen how authentic the materials look up close, and thus how they will appear even more so from a distance.

Due to the robust nature and high quality of GRP, the surface finish of GRP for telecommunications uses has a lifespan in excess of 25 years with the exception of some minor discolouration from environmental conditions. It is of note the only threat to the surface finish will come from damage as a result of chemical or mechanical intervention.

Some of the most frequent causes of mechanical damage happen on site before installation, therefore the operators will ensure careful handling of the products pre-installation. The apparatus will then be craned on to site. Given the locations of the apparatus and the restricted nature of their access, this will ensure that only specialised operatives will maintain the site. This will prevent damage to the structures which could potentially lead to water ingress causing damage to the surface finish over a period of time.

Due to the resilient nature of GRP products, minimal maintenance will be required once the equipment is in situ, although regular cleaning is recommended in order to maintain the finish. When cleaning the GRP products, care shall be taken as to avoid scratching the finished surface. If a foreign material i.e. paints, mortar or plaster comes into contact with the GRP, this will be removed with a specialist chemical providing the manufacturer's instructions for use are followed. For general cleaning purposes, an ammonia free detergent solution shall be used.

Typically, chemical damage occurs when a solvent or acidic based cleaner comes into contact with the GRP product. Similarly due to the nature of telecommunications installations and their position at height, any cleaning of the external surfaces will be undertaken by specialised operatives appointed by the operators who will use non-abrasive cleaning products that will maintain the finish of the GRP as outlined above.

Due to the nature of the intended product environment, the product will experience a great deal of exposure to UV rays (direct sunlight). Although GRP suppliers use materials which are UV stable, over a period of time some discolouration will take place. The sun will have a bleaching effect on the original colour which cannot be prevented. This process will take a relatively long period of time and discolouration levels will vary depending on the surrounding environment. In this regard, the operators would be willing to accept a suitably worded condition that requires the regular inspection of the shrouds and their replacement should it be considered appropriate.

References

1 R H Dixon, B W Ramsey and P J Usher *'Design and build of HMS WILTON.'* RINA Symposium on GRP ship construction, October 1972.

2 S Halliwell and T Reynolds *'Fibre reinforced polymers in construction: long term performance in service'* ISBN 1 86081 6371. Pub. Building Research Establishment (BRE) Press, August 2003.