PREFACE

World-wide, various programs have been conducted to develop rural societies and to improve the living conditions of the poorest social groups on our planet. The keyword in all activities at present is sustainability. After the end of a certain program, the targeted group must be able to continue the introduced activities by itself, and an often used strategy is to improve the existing processes rather than implementing new ones. The basic idea is to maximize the effect by applying the least possible changes. The concepts of the composite materials go back to antiquity; but the technology has been developed and most of the progress has occurred in the last few decades, and this development has been accompanied by a proliferation of literature in the form of reports, proceedings and journals.

Over the last three decades, composite materials, plastics and ceramics have been the dominant emerging materials. The volume and number of applications of composite materials have grown steadily, penetrating and conquering new markets relentlessly. Modern composite materials constitute a significant proportion of the engineering materials market ranging from everyday products to sophisticated applications. While composite materials have already proven their worth as lightweight materials, the current challenge is to make them cost-effective. The efforts to produce economically attractive composite components have resulted in several innovative manufacturing techniques currently being
used in the composites industry. It is obvious, especially for composites, that the improvement in manufacturing technology alone is not enough to overcome the cost hurdle. It is essential that there must be an integrated effort in the design, material, process, tooling, quality assurance, manufacturing and even program management, for composites to become competitive materials with metals.

The composite industry has begun to recognize that the commercial applications of composites promise to offer much larger business opportunities than the aerospace sector due to the sheer size of the transportation industry. Thus, the shift of composite applications from aircraft to other commercial uses has become prominent in recent years. Increasingly enabled by the introduction of newer polymer resin matrix materials and high performance reinforcement fibers of glass, carbon and aramid, the penetration of these advanced materials has witnessed a steady expansion in uses and volume. The increased volume has resulted in an expected reduction in costs. High performance fiber reinforced polymers (FRPs) can now be found in such diverse applications as composite armouring designed to resist explosive impacts, fuel cylinders for natural gas vehicles, windmill blades, industrial drive shafts, support beams of highway bridges, and even papermaking rollers. For certain applications, the use of composites rather than metals has, in fact, resulted in savings of both cost and weight. Some examples are, cascades for engines, curved fillets, replacements for welded metallic
parts, cylinders, tubes, ducts, blade containment bands etc. Further, the need of composites for lighter construction materials and more seismic resistant structures has placed high emphasis on the use of new and advanced materials that not only decrease dead weight but also absorb shocks and vibrations through tailored microstructures.

Composites are now extensively being used for rehabilitation/strengthening of pre-existing structures that have to be retrofitted to make them seismic resistant, or to repair damage caused by seismic activity. Unlike conventional materials like steel and aluminium, the properties of the composite material can be designed considering the structural aspects. The design of a structural component using composites involves both material and structural design. The properties of composites such as stiffness, thermal expansion etc., can be varied continuously over a broad range of values under the control of the designer. The careful selection of the reinforcement type enables the finished product characteristics to be tailored to almost any specific engineering requirement.

While the use of composites will be a clear choice in many instances, material selection in others will depend on factors such as working lifetime requirements, the number of items to be produced in terms of running length, complexity of product shape, possible savings in assembly costs, and on the experience and skills of the designer in tapping the optimum potential of the composites. In some instances, the
best results may be achieved through the use of composites in conjunction with traditional materials.

In this study, glass and natural fiber reinforced composites are fabricated by using the hand lay-up technique, and applied pressure using the compression moulding machine. The mechanical properties and machining characteristics of these hybrid composite materials have been evaluated and analyzed in detail.