Chapter 3

AIM AND SCOPE OF PRESENT RESEARCH

Concrete is a widely used construction material in spite of its low tensile strength, ductility and energy absorption capacities. Engineers developed reinforced concrete to overcome some of these deficiencies. Advances in technology have allowed this material to be used over longer spans/heavily loaded structures. Ductility and energy absorption capacity can be enhanced by incorporating fibres in concrete. It is well established that one of the important properties of fibre reinforced concrete is its superior resistance to cracking and crack propagation. As a result of this ability to arrest cracks, fibre composites possess increased extensibility and tensile strength, both at first crack and at ultimate, and the fibres are able to hold the matrix together even after extensive cracking. The transformation from a brittle to a ductile type of material would substantially increase the energy absorption characteristics of the fibre composite and its ability to withstand repeatedly applied, shock or impact loading.

Most of the fibre reinforced concrete used in practice contains only one type of fibre. It is known that failure in concrete is a gradual, multi-scale process. Gradual and multi-scale nature of fracture in concrete implies that a given fibre can provide reinforcement only at one level and within a limited range of strains. For an optimal response, different types of fibres may be combined. In hybrid fibre technology, two or more types of fibres can be rationally combined to produce a composite that derives the benefits from each individual fibre and exhibit synergistic response.

Thus, addition of fibres or hybrid fibres can significantly improve the characteristic properties of concrete. In a similar way, use of fibre reinforced plastics can also bring substantial changes in the behavioural pattern of concrete. Corrosion of steel reinforcement
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is one of the major problems of the construction industry. Fibre reinforced plastics (FRP) have been considered as a substitute for conventional steel reinforcement owing primarily to their high corrosion resistance. In addition, high strength, lightweight and non-conductivity of FRP composites have attracted the attention of researchers, as well as the industry. Use of fibre reinforced plastic composites can be classified into two broad fields. Firstly, in the construction of infrastructure in corrosion prone areas and next is in rehabilitation or retrofitting of distressed structures.

Study of literature has shown that, efforts are being continuously made to improve the characteristic behaviour of concrete. Enhancing ductility and improving other characteristics of concrete is a challenging task for researchers and earlier work reported in literature shows that sustained efforts have been made to enhance the properties of concrete. This is to meet the increasing demands of construction industry to produce concrete for specific situations. The field of concrete technology still has wide scope for research to understand this complex material and enhance its characteristic properties.

Further, there is an increasing demand to devise suitable methods of rehabilitation and retrofitting of existing structures for various requirements such as increasing strength, functional changes in structures, higher ductility requirement, possible degradation of the structure etc. Use of fibre reinforced plastics (FRP) is one of the ways of improving the structural behaviour of concrete structures. Glass fibre reinforced plastic (GFRP) is one such material used widely. It has been reported in the literature that, GFRP wrapping of structural elements like beams and columns, although improves the characteristic properties, brittle rupture or debonding of wrapping is a shortcoming, and has become extremely difficult to quantify the enhancement of properties. Intense research is underway to modify the behaviour of GFRP to include the property of ductility. Research is also under progress to
impert ductility to the members designed for special purposes using fibre reinforced composites.

The present work is carried out towards improving some of the shortcomings, mentioned above and an effort has been made to find ways of improving the characteristic properties of concrete. The effect of incorporation of micro and macro fibres, hybrid fibres, GFRP plate reinforcements on the characteristic properties of concrete are studied. The effect of plain GFRP wrapping and sandwich GFRP wrapping on flexural and shear behaviour of beams; axial compression behaviour of short columns are also investigated. Following studies have been carried out in the present work,

- Flexural behaviour of concrete beams reinforced with GFRP plate reinforcements.
- Flexural behaviour of concrete beams containing GFRP plate reinforcements along with micro and macro fibres.
- Flexural behaviour of hybrid fibre reinforced concrete beams with sandwich GFRP wrapping.
- Effect of GFRP wrapping and sandwich GFRP wrapping on shear strength of RCC beams.
- Behaviour of short columns reinforced with GFRP sections of different shapes along with micro and macro fibres.
- Behaviour of fibre reinforced short columns confined with GFRP wrapping and sandwich GFRP wrapping.
- Impact strength of concrete panels reinforced with GFRP plates.

Entire study is experiment oriented and the conclusions are drawn based on experimental results.