CHAPTER-1

INTRODUCTION

1.0 INTRODUCTION

Geopolymer concrete (GPC) has been described as one of the most revolutionary development in concrete construction. Geopolymer was developed to replace conventional cement and utilization of industrial waste like flyash, rice husk, ground granulated blast furnace slag (GGBS) and metakaolin. Production of one tonne of cement generates an equal amount of carbon dioxide polluting the atmosphere which becomes a major threat to the environment. In addition, large quantity of energy is also required for the production of cement. This leads to the development of an alternative binder and usage of industrial wastes.

The thermal power plants using coal produces flyash and steel plants produces GGBS which has to be dumped requiring large areas. GPC addresses the above issues in making concrete as a sustainable material. GPC doesn’t require any cement, thereby while producing cement avoiding pollution of the environment.

Geopolymer used as a binding material in GPC have better resistance against acids, elevated temperature, high strength, also they have better durability, cold setting, quick setting, stable bonding of heavy metals and harmful substances and simple manufacturing techniques. There is large potential for geopolymer concrete applications for bridges,
precast structural elements etc. Internationally better carbon credits can be obtained by using GPC.

The literature review indicates that most of the work on geopolymer concrete was focused on normal strength geopolymer concrete. Therefore a need based studies on high strength geopolymer concrete was carried out in the laboratory for better usage of geopolymer concrete in prestressed and precast industries. At present the application of precast elements used in construction industries.

The novelty of the thesis is that an attempt has been made to produce high strength geopolymer concrete, which will have applications in prestressed and precast industries.

1.1 OBJECTIVES OF THE PRESENT STUDY

Utilization of GPC in structural elements requires justification with respect to mix design and strength properties, durability, flexure and shear behavior of beams and slabs. It is required to conduct laboratory investigation with respect to the above behavior.

The objectives of the present research work are

- Mix design and strength properties
- Durability studies
- Flexural behavior of high strength GPC beams
- Shear behavior of high strength GPC beams
- Flexural behavior of high strength one way GPC slabs with fully and partially restrained supports
1.1.1 Mix design and strength properties of GPC

- To develop M60 grade of GPC, Rangan’s method has been used and for TVC Perumal’s method has been used. The same mix has been used for achieving the required objectives.
- To study the mechanical properties of GPC by conducting different strength tests.

1.1.2 Durability studies on GPC

- To conduct the durability studies on GPC and TVC with respect to acid, sulphate, salt water and corrosion attacks and study their effects on the compressive strength of GPC and TVC.
- To evaluate the residual compressive strength at elevated temperature of GPC and TVC of grade M60.

1.1.3 Flexural behavior of high strength GPC beams

- Casting and testing of six GPC and six TVC reinforced beams of size 125 × 250 × 2000 mm.
- Measuring cracking load, ultimate load, mid-span deflections and width of crack for the specimens.
- Studying the available code provisions for their validation with respect to ultimate strength, deflection, cracking, and ductility.
1.1.4 Shear behavior of high strength GPC beams

- Casting and testing of six GPC and six TVC reinforced beams of size 125×250 ×2000 mm.
- Measuring cracking load, ultimate load, mid-span deflections and width of crack of the specimens.
- Studying the available code provisions for their validation with respect to ultimate shear strength, deflection and cracking.

1.1.5 Flexural behavior of high strength one way GPC slabs with fully and partially restrained supports

- Casting and testing of four GPC and four TVC reinforced slabs of size 1080×500 mm and with 50/65 mm thickness for fully and partially restrained supports.
- Measuring cracking load, ultimate load, mid-span deflections and width of crack for the specimens.
- Studying the available code provisions for their validation with respect to ultimate strength, deflection and cracking.
- To propose an analytical method for the prediction of load deflection behavior of such slabs.