CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter presents the sequences of laboratory experimental work procedure to evaluate the load-carrying capacity of short and slender columns manufactured using low calcium fly ash based Geopolymer concrete. In addition, various parameters affecting strength of Geopolymer concrete are also focused. The aim of this investigation is to experimentally examine the development and application of “Geopolymer Technology” with fly ash and materials of Indian origin. It examines various strength aspects such as compressive strength, tensile strength, bond strength and thermal strength of dry heat cured Geopolymer concrete. In addition, cost effectiveness of Geopolymer concrete over OPC concrete is also investigated.

This thesis is categorized into four stages of work and is listed below.

In the first stage, the study begins with the investigation of material properties, concrete mix design and a preliminary study on the strength property of mortar prepared with silicates and hydroxides of sodium and potassium. This is primarily studied to select the optimum mix to meet the performance criteria and economy. All the ingredients for manufacturing concrete were collected from local market except the major constituent, fly ash. The mix design methods are determined for both high and normal strength Geopolymer concrete mixes based on BV Rangan’s literature. For
high strength concrete, slight adjustment in proportioning of ingredients is done to achieve the target strength.

In the second stage, some Geopolymer concrete mixtures are tried and tested to assess their strength properties such as compressive strength, split tensile strength, flexural strength and bond strength. They are also tested to examine their behavior when exposed to fire and water. Basic elastic constant Young’s Modulus is also found out for the mixes.

The third stage consisted of testing the applicability of the optimized mixture into the main structural reinforced elements, columns. The investigation of load bearing capacity of short and slender column is done with circular and square shapes, different sectional properties, molarity and concrete compressive strengths as test parameters. Columns of same cross sectional area and percentage steel as that of BV Rangan’s GCI columns were tried and been compared with the results published in GC 3 research report.

In the last stage, the feasibility and adaptability of this concrete as a commercial product to make it more viable in the construction industry are studied by evaluating the cost of manufacturing one cubic meter of concrete and been compared with the cost of OPC concrete. This might lead to the elimination of usage of Portland cement in a phased way to ultimately have a sustainable environment for generations to come.