CHAPTER 1

INTRODUCTION

1.1 GENERAL

Through years of practice and experience, concrete has proven to be a suitable and crucial material in construction and it also has been successfully implemented in numerous projects. Demand for concrete for construction is on the increase and at the same time there is a shortage of natural aggregates in many areas. Today it has become really difficult to obtain natural aggregates for concrete locally. Bringing aggregate from far away places increases the cost of concrete. Hence a real and urgent need to consider using satisfactory alternative aggregate materials.

The demand for construction materials such as crushed stone, river sand and gravel continues to rise while economic sources are often becoming limited. To insure that the best use is made of available materials, an overall materials utilization strategy must be developed that will be coupled with environmental and energy considerations. While recognizing the need for a unified strategy, a detailed study focuses on the utilization of recycled aggregates (waste concrete and ceramic wastes) and industrial byproducts (fly ash) in construction is necessary. Increased usage of recycled aggregates and byproducts of thermal power plant will both decrease the demand for available materials and solve the disposal problems.
1.2 ALTERNATIVE MATERIALS

Aggregates have many different applications in the construction industry, such as in concrete production, foundation and pavement construction and general earthworks filling. They are also used for ground improvement purposes such as vibrated columns and slope stabilization. Large quantities of freshly quarried stones are used in these applications. Recycling of alternative/waste materials would clearly provide substantial benefits to the industry in terms of reduced material supply and waste disposal cost, increased sustainability and reduced environmental impact. Annette et al. (2001) states that the use of alternative aggregate materials as a substitute for primary materials results in multiple environmental benefits including:

- a reduction in primary quarrying activity (reduced noise, dust and land consumption)
- a reduction in development of new waste stockpiles and reuse of material in existing piles
- clearance and reduction of abandoned land generated through waste disposal
- economical disposal or recycling of waste materials and
- a reduction in the utilization of finite natural resources

1.3 RECYCLED AGGREGATES

1.3.1 Recycled Concrete Aggregate

Recycled concrete aggregate (RCA) comes from the demolition of cement concrete elements of buildings, roads and other concrete infrastructures. Due to the reservation of natural resource, prevention of environmental pollution and cost saving consideration of construction project, the recycled concrete aggregate has been widely used again for
making different construction materials (Yong Haung Lin 2004). Finding a use for recycled concrete aggregate has generally focused on various construction areas, because recycled concrete aggregate is not only desirable as a construction material but also its reuse is environmentally friendly. Several beneficial uses of recycled concrete aggregate in concrete production have been proposed in the past.

1.3.2 Ceramic Waste Aggregate

In the factory producing ceramic materials such as electrical insulators (porcelain), glazed ceramic tiles and sanitary items, a large amount becomes wastes due to handling and manufacturing defects. Ceramic wastes thus form one of the waste materials worldwide. The reuse and recycling of these materials is still not a common practice, especially in India, where more than 95% of the total ceramic wastes is deposited in dumping grounds.

1.4 FLY ASH

Thermal power stations using pulverized coal as fuel produce enormous quantities of ash as waste products of combustion. India produces about 100 million tonnes of fly ash annually at present. Assuming a current utilisation rate of about 20 percent in various applications including cement and concrete, this means that more than 80 million tonnes of fly ash is being ponded or disposed of in landfills. Hence the problem of ash disposal is expected to become acute due to the limited space available for ash disposal near most of the power plants.

During the last few years, many cement companies have started using fly ash in manufacturing cement, known as ‘Portland Pozzolana Cement,’ but the overall percentage utilization of fly ash remains very low and most of the fly ash is dumped at landfills. This calls for strategies to
encourage and establish technological concepts for bulk utilization of fly ash which should not only be cost-effective but also environment friendly.

1.5 ENVIRONMENTAL PROTECTION

The protection of the environment is a basic factor, which is directly connected with the survival of the human race. Parameters like environmental consciousness, protection of natural resources, sustainable development play an important role in modern requirements for construction works. The creation of non-decaying waste materials, combined with a growing consumer population, has resulted in a world waste disposal crisis. A solution to this crisis lies in recycling waste into useful products. Therefore, research on new and innovative uses of waste materials is continuously advancing. Many construction agencies, private organizations and individuals are in the process of completing a wide variety of research projects concerning the feasibility, environmental suitability and performance of recycled products in construction.

1.6 SUMMARY

Although the use of lean concrete in construction is not a new idea, developing a lean concrete for various applications in construction (such as base course for low volume roads, flooring etc.,) with primarily waste materials (recycled aggregate and fly ash) is certainly timely and innovative. This study try to match society’s needs for safe and economic disposal of waste materials with construction industry’s needs for better and cheaper construction.