CHAPTER 1

PROBLEM STATEMENT AND SCOPE OF STUDY

1.1 Introduction

The nature of the problem undertaken and the rationale behind is presented. After reviewing the current critical gaps in the study area, the objectives for the present study are pinpointed. Brief description of the materials used for the investigation is provided.

1.1.1 Significance of the Study

The rapid pace of industrialization has necessitated setting up of large number of coal based thermal power plants in the country. The coal-fired power plants contribute nearly 75% of India’s power generation. Fly ash in the form of fine dust is a waste product from these power plants. India’s coal based power plants produce 100 million ton of fly ash per annum. Considering the pivotal place to thermal power generation in our national policy and with a known coal reserve of about 200 billion ton, India’s dependence on coal as a source of energy will continue in the foreseeable future. Keeping in view the energy projection, the production of ash is expected to touch the mark of 125 million ton per year by the end of this year. The ash produced in Germany, U.K., U.S.A. and Canada is around 10% of the coal burnt whereas in India it is about 40% to 50% [46]. The high ash content of Indian coal has made the problem more serious and complex. Ash ponds have already occupied nearly 65,000 acres of land. With the growing environmental concern and less availability of land, the power plants are actively seeking economically viable and environmentally friendly disposal methods, with
preference to the development of beneficial utilization alternatives. Among the various alternatives within civil engineering, a geotechnical application such as structural fill possesses a potential of bulk consumption of ash. Therefore, the pressing need of clearing the accumulated quantity of fly ash at various thermal plants of the country can be competitively met by a strategic plan for high volume utilization of fly ash as geo-material. It is estimated that currently only 15% of the ash generated in the country is being utilized for gainful applications against the European average of 70 percent. However, such bulk utilization of fly ash can be made only when characterisation and standardization of fly ash as geo-material for various end applications are preceded. Thus research for an enhanced utilization and development of strategies for sustainable management of the fly ash likely to be produced in coming years is of immense significance.

1.1.2 Current Critical Gaps and Objectives of the Study

A national database on the properties of fly ash of the power plants across the country needs to be developed. Such a database would be a beneficial tool for promoting and screening the appropriateness of this abundantly available solid waste for various civil engineering applications.

In India, IRC has made several publications providing tentative guidelines for use of fly ash as a component of stabilized base and sub-base mixtures for road construction. CRRI in collaboration with CBRI has published an exhaustive report on lime-fly ash stabilized soil for roads and buildings. In early sixties, Singh [90] studied use of fly ash and lime as stabilizer of marginal quality subgrade soils. However, in contrast to usage of fly ash as a soil stabilizer, its use as an artificial soil or geo-material by itself or in conjunction with a stabilizing agent like lime is relatively new in this country. To this end the factors controlling the
process of compaction of fly ash alone and in conjunction of lime have yet not been studied in detail. No comprehensive study has been made to study the compaction characteristics of lime-stabilized fly ash together with their relationship on strength development as well as durability performance of the final product. Similarly no literature is available for assessing durability of lime-stabilized fly ash taking the relevant local environmental factors into account. Only very limited study for quantification of minimum amount of lime addition for optimum strength development of a fly ash is available.

After determining the physio-chemical properties of fly ash of Salakati Thermal Power Plant in general, this study attempts to address some of these current critical gaps with a focus to examine the following:

i. Factors controlling the compaction characteristics of lime-stabilized fly ash

ii. Influence of compaction-controlled factors on strength and durability of lime-stabilized fly ash.

iii. A test protocol for durability assessment for lime-stabilized fly ash.

iv. Determination of optimum lime content for fly ash and rational estimation of strength of lime-stabilized fly ash with different curing period in terms of sediment volume test.

1.1.3 Source of Fly Ash Used

The fly ash for this study was obtained from coal-based thermal power plant of Salakati, in the district of Bongaigaon, Assam, India. The power plant consumes 720 ton of coal per day for its installed capacity of 240 MW. The power plant uses a blend of coal from Raniganj and Assam in the ratio of 70:30. From the power plant, about 80000 ton of coal ash is produced per annum, 80% of which is fly ash and the rest is bottom ash. The fly ash is disposed in slurry form to a pond by...
pumping through a network of pipes about 8 km in length. Plate 1 depicts the
typical sample of fly ash, bottom ash and pond ash of the power plant.

1.1.4 Preparation of Sample for Test Series

In order to eliminate or minimize the possible variation of grain size, specific
gravity or chemical composition of fly ash with coal type or their burning
condition, planning was made to collect the fly ash in a single lot so as to cover the
entire test series. As such, the fly ash coming from hopper was put in about 1000
plastic bags and then carried by truck to laboratory. From the above lot, bags of fly
ash were randomly selected. The randomly selected fly ash were then mixed and
air-dried. Plate 2 depicts the typical air-drying of fly ash. The air-dried fly ash was
stored in airtight drums and used as sample fly ash for the test series.

1.1.5 Type of Lime Used

Hydrated lime having a 90% purity mark was used. Chemical analysis of the
hydrated lime was not conducted. The average specific gravity of the lime as
obtained by Le Chatelier’s flask was 2.22.