An Experimental Study on Geotechnical Behavior of Pond Ash mixed with Marble Dust

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Abstract *There are numerous substances that cause air, water and soil pollution, disrupt ecological cycles and set off environmental hazards and one of them is fly ash. Fly ash is the ash produced by burning of pulverized coal in thermal power plants that gets collected at the bottom of furnace as well as in electrostatic precipitators. The high temperature of burning coal turns the clay minerals present in the coal powder into fused fine particles mainly comprising aluminium silicate. Fly ash produced thus possesses both ceramic and pozzolanic properties. It exhibits engineering behavior similar to fine grained soils. It is possible to use fly ash as an alternative to geo materials. This paper deals with geotechnical characteristics of the pond ashes collected from Adoni city Power Plant located in the National Capital Region, Delhi. Since the proposed study is based on the characteristics of pond ashes mixed with another waste - marble dust, another waste, which is generated as a by-product during cutting of marble, hence its properties has also been investigated. The purpose of mixing this admixture with pond ash is to check the liquid limit, plastic limit, compaction, compressive strength of soil.*

Keywords *Pond Ash, Marble Dust, Geotechnical Characterization, Physical Properties, geo technical Tests*

1. INTRODUCTION

In India, thermal power is the chief source of energy and produces nearly 70 percent for total energy production. The coal ash generated from all the existing thermal power plants is over 100 million tonnes per year (Gulhati & Datta, 2005). Since the production of high ash content and low percentage utilization, most of the fly ash has to be suitably disposed off on land by creating an engineered ash pond to take care of environmental concerns. The fly ash as well as bottom ash produced by the plant is generally disposed of in an ash pond in a form of slurry in a ratio varying from 1 part ash and 6 to 10 parts of water which are located within few kilometers distance from the power plant. This ash is called pond ash.

This study deals with geotechnical characteristics of the pond ashes obtained from Thermal Power Corporation. The characteristics of pond ashes when mixed with another waste Marble Dust in the percentage of 2.5, 5, 7.5 and 10 by weight are also checked in the current study. The purpose of mixing marble dust with pond ash is to check the strength, deformability, volume stability (shrinking and swelling), permeability, erodibility, durability etc. Improving the engineering properties of pond ash by admixture is often simply compared with soil stabilization, particularly in road construction.

Soils with low-bearing capacity can be strengthened economically for building purposes through the process of "soil stabilization" using different types of stabilizers. Soil bed should bear all generated stresses transmitted by shallows or piles. The soil often is weak and has no enough stability in heavy loading. In this regard, it is necessary to reinforce and or stabilize the soil. With the increased global demand for energy and increasing local demand for aggregates, it has become expensive from a material cost and energy use standpoint to remove inferior soils and replace them with choice, well-graded aggregates. One way to reduce the amount of select material needed for base construction is to improve the existing soil enough to provide strength and conform to engineering standards. This is where soil stabilization

has become a cost-effective alternative. In India, thermal power is the chief source of energy and produces nearly 70 percent for total energy production.

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The main objectives of this study are to study the atterberg limits for soil by using pond ash and marble dust in soil, to study the OMC and Maximum dry density for different proportions of pond ash and marble dust as 2.5%, 5%, 7.5%, 10%, to study the maximum strength of soil for different proportions of pond ash and marble dust material and to calculate the UCS values for different proportions of pond ash and marble dust material.

2. LITERATURE REVIEWS

Akshaya K. Sabat and Radhikesh P. Nanda (2011) has done work to investigate the effect of Marble dusts on strength and durability of an expansive soil stabilized with optimum percentage of Rice Husk ash (RHA). The MDD keeps decreasing and OMC keeps on increasing by whatever the percentage of addition of Marble dust to RHA stabilized expansive soil. The UCS of the RHA stabilized expansive soil increased up to 20% addition of Marble dust. Further addition of Marble dust decreased the UCS of the expansive soil.And the UCS of the virgin soil has 228% increase.

B. Diouf et al.(1990): To stabilize sand dunes is temporary stabilization is done by any material that stops surface sand movement. The second step is biological stabilization,which consists of establishing a permanent vegetative cover To develop inexpensive technology to stabilize highly erodible soils and arrest migrating sand dunes,B. Diouf et al.(1990), has carried out a research work to evaluate the effectiveness of adding clay to very sandy soil to reduce wind erosion susceptibility.

V. Aggrawal and Mohit Gupta (2000) has used marble dust as stabilizing additive to expansive soil is evaluated. Different test are done on soil mixture with varying proportion of marble dust (from 0 to 30%).They had concluded that:The addition of the marble dust to the expansive soil reduces the LL, raises the SL and decrease in the plasticity index of soil and thus swelling potential.

3. MATERIALS USED IN THIS STUDY

Expansive soil

As a piece of this examination, the sweeping dark cotton soil was obtained from the site. The dark cotton soil subsequently got was conveyed to the research center in sacks. A limited quantity of soil was taken, sieved through 4.75 mm strainer, gauged, and air-dried before gauging again to decide the common dampness substance of the equivalent.

Pond ash

The pond ash samples used in the present research work was obtained from thermal Power plant . The collected pond ash from power plant near to kurnool were characterized in the geotechnical laboratory. Tests were conducted to determine the physical properties, and geotechnical properties of all pond ashes. In India, thermal power is the chief source of energy and produces nearly 70 per cent for total energy production. The coal ash generated from all the existing thermal power plants is over 100 million tonnes per year.

Pond ash

Marble dust

Marble is a non – foliated metamorphic rock composed of re-crystallized carbonate minerals, most commonly calcite or dolomite. Marble is a metamorphic rock resulting from the transformation of a pure limestone.

Marble dust

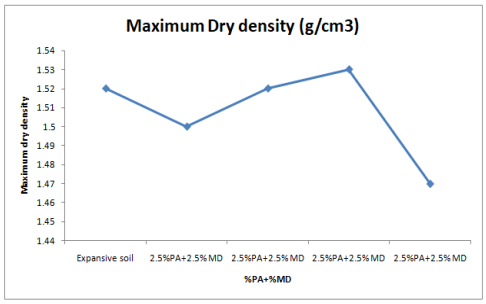
4. METHODOLOGY ADOPTED

To assess the impact of pond ash and marble dust as a balancing out added substance in far reaching soils, arrangement of tests, where the substance of fly powder in the sweeping soil was differed in estimations of 2.5% to 10% (products of 2.5) and 2.5% to10% marble dust by weight of the all out amount taken. The Indian Standard codes were pursued during the conduction of the accompanying analyses:

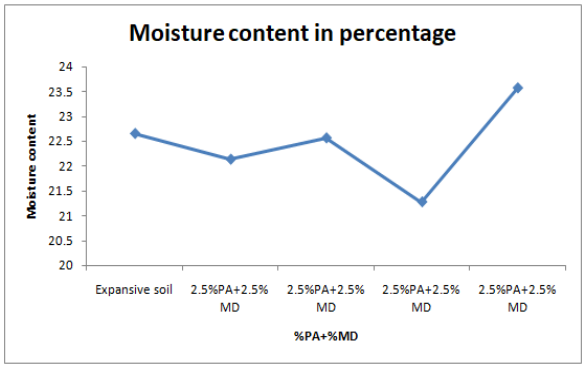
- Standard proctor test – IS : 2720 (Part 7) - 1980
- Unconfined compressive strength (UCS) test – IS : 2720 (Part 10) - 1991
- California bearing ratio (CBR) test – IS : 2720 (Part 16) - 1987
- Liquid & Plastic limit test – IS 2720 (Part 5) - 1985

5. RESULTS AND ANALYSIS

Standard compaction test

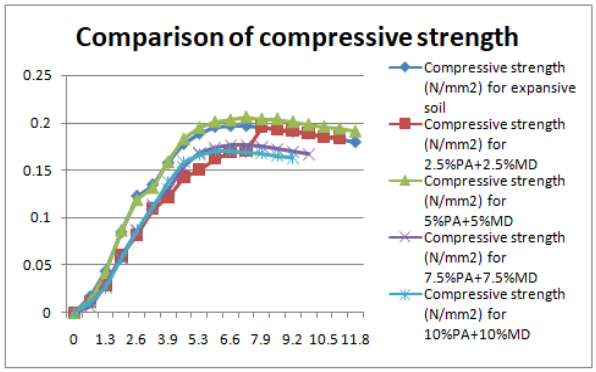


Comparison of maximum dry density

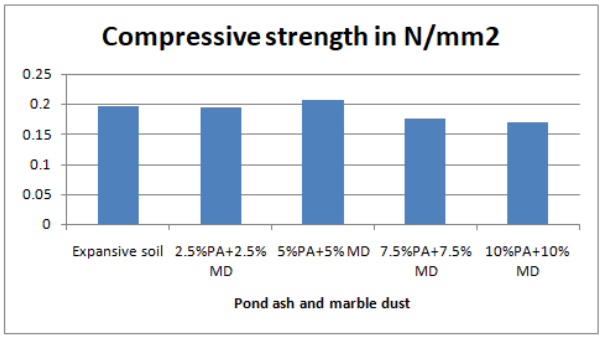


Comparison of moisture content in percentage

Unconfined compressive strength

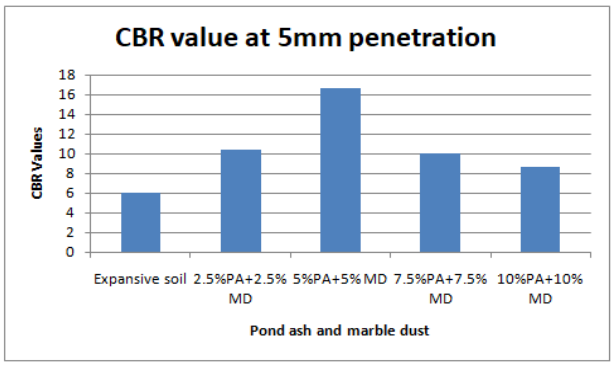


Variation of compressive strength of soil

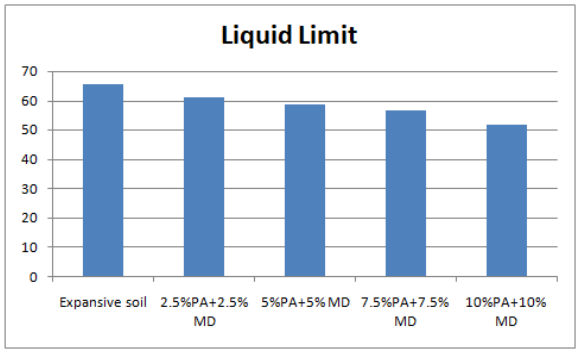


Comparison of maximum compressive strength values

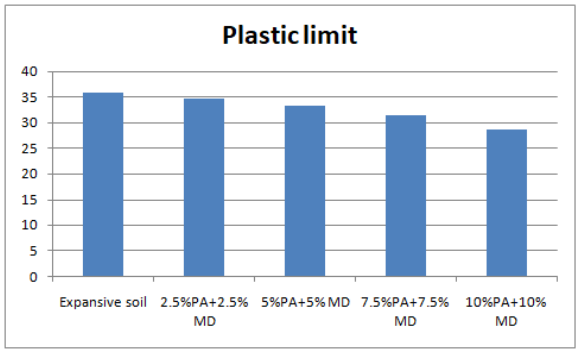
CBR Test results



CBR values at 5mm penetration



Variation of liquid limit values



Variation of plastic limit values

6. CONCLUSIONS

This project is focused on the review of performance of pond ash and marble dust stabilization material. The study suggests that if pond ash and marble dust if properly mixed and applied, can be used as a great soil stabilization technique .On the basis of this project the following results were obtained.

1. pond used as an excellent soil stabilizing materials for highly active soils which undergo through frequent expansion and shrinkage.
2. The pond ash as an additive decreases the swelling, and increases the strength of the expansive soils.
3. The higher value of maximum dry density was observed at 5% pond ash and 5% marble dust and the maximum value of Optimum moisture content was observed at 5% pond ash and 5% marble.
4. The optimal value of unconfined compressive strength was observed at 5% pond ash and 5% marble.
5. The optimal value of CBR value was observed at 5% pond ash and 5% marble.
6. The values of liquid limit and plastic limits decreases with increasing the percentages of 5% pond ash and 5% marble.

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