AN EXPERIMENTAL STUDY OF EXPENSIVE SOIL STABILIZED WITH CEMENT AND FLY ASH

M Balukumar[1], Adapa Shravani[2], Boda Hymavathi[2*], Kalavala Kumara Swamy[2], Ponnam Akhil[2***], Mohammad Abdul Mohsin[2****]**

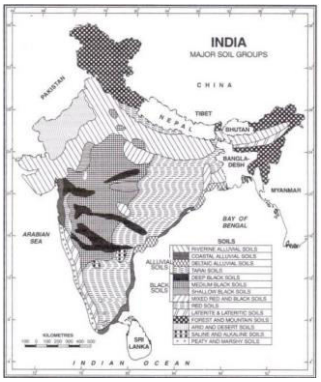
[1] ASSISTANT PROFESSOR DEPARTMENT OF CIVIL ENGINEERING IN JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCENCES NARSAMPET, WARANGAL DIST, TELANGANA, INDIA

[2, 2*, 2**, 2***, 2****]SCHOLAR, DEPARTMENT OF CIVIL ENGINEERING IN JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCENCES NARSAMPET, WARANGAL DIST, TELANGANA, INDIA

ABSTRACT- *Over the past few decades several factors have led to an increase in the number of people migrating to large cities. Consequently these large cities are getting over populated and quite expectedly necessity of business, residential construction has increased the civil engineering projects located in areas with unsuitable soil is one of the most common problems in many parts of the world. The unsuitable soil (Black cotton Soil) can be stabilized by performing soil stabilization. In India black soil is the most problematic soil when it comes to construction. In rainy season black cotton soil swells and become sticky. Whereas in summers the moisture present in the soil evaporates and soil shrinks resulting in the crack of approximate 10 to 15 cm wide and up to 1 meter deep. The percentage covered by black cotton soil in geotechnical areas of India is 16.6%, which says huge amount of soil in India needs stabilization. Mechanical, chemical, electrical, thermal and other methods are in practice to improve the engineering properties of soil. Chemical stabilization is the best method used for highways and air-field. The black cotton soil is known as expansive type of soil which expands suddenly and start swelling when it comes in contact with moisture. Due to this property of soil the strength and other properties of soil are very poor. To improve its properties it is necessary to stabilize the soil by different stabilizers. Expansive type of soil shows unpredictable behavior with different kind of stabilizers. Soil stabilization is a process to treat a soil to maintain, alter or improve the performance of soil. in this project fly ash and cement are used as stabilized materials to improving engineering properties of expansive soil. The evaluation involves the determination of the swelling potential, atterberg's limits, & compaction test of expansive soil in its natural state as well as when mixed with varying proportion of fly ash and cement.*

1. INTRODUCTION

Soil stabilization can be clarified as the change of the dirt properties by substance or physical methods so as to upgrade the building nature of the dirt. The principle goal of the dirt adjustment is to expand the bearing limit of the dirt, its protection from enduring procedure and soil penetrability. The long haul execution of any development undertaking relies upon the adequacy of the basic soils. Flimsy soils can make huge issues for asphalts or structures, Therefore soil adjustment strategies are important to guarantee the great steadiness of soil with the goal that it can effectively continue the heap of the superstructure particularly if there should be an occurrence of soil which are profoundly dynamic, likewise it spares a ton of time and a great many cash when contrasted with the technique for removing and supplanting the insecure soil. This examination manages the total investigation of the improvement of soil properties and its adjustment utilizing ferrochrome slag.



Major Soil Types in India

Fly ash

A waste material extricated from the gases radiating from coal terminated heaters, by and large of a warm power plant, is called fly cinder. One of the central uses of volcanic fiery remains in the old ages was the utilization of it as pressure driven bonds, and fly slag looks to some extent like these volcanic cinders. These fiery debris were accepted to be extraordinary compared to other pozzolans (restricting operator) utilized in and around the world.

The interest of intensity supply has exponentially elevated nowadays because of expanding urbanization and industrialization wonders. Consequently, this development has brought about the expansion in number of intensity providing warm power plants that utilization coal as a consuming fuel to create power. The mineral buildup that is abandoned after the consuming of coal is the fly fiery debris. The Electro Static Precipitator (ESP) of the power plants gathers these fly cinders.

Cement in soil stabilization

Soil cement stabilization is soil particles bonding caused by hydration of the cement particles which grow into crystals that can interlock with one another giving a high compressive strength. In order to achieve a successful bond the cement particles need to coat most of the material particles. To provide good contact between soil particles and cement, and thus efficient soil cement stabilization, mixing the cement and soil with certain particle size distribution is necessary.

Objectives of the study

From this study the following objectives were made

1. To study the atterberg limits for soil by using fly ash and cement materials in soil.
2. To study the OMC and Maximum dry density for different proportions of fly ash like 0%, 2.5%, 5%, 7.5%, and 10% with 0%, 2.5%, 5%, 7.5%, and 10% cement as additive material .
3. To study the maximum strength of soil for different proportions of fly ash and cement material.
4. To calculate the UCS values for different proportions of fly ash and cement material.

2. LITERATURE REVIEW

Tripti Goyal, Er. Rubel Sharma, et al.,(2018)

The point of this examination is to think about the qualities of soil when prepared with fly fiery debris and recron-3s. The technique utilized in the examination is arbitrarily circulated fiber support soil likewise named as RDFS. In this examination number of delegate test, unconfined compressive quality test were performed. From Proctor test, it was resolved that O.M.C increments and M.D.D diminishes with increment in fly fiery remains and recron-3s.

Ankita Sonkar, S. Srividhya, et al.,(2017)

This paper explored the resultant quality and swelling conduct when haphazardly circulated palm filaments are utilized to fortify far reaching soil and balanced out utilizing bagasse fiery debris. The dirt was inspected for compaction test and unconfined pressure test at four diverse fiber substance (0.25%, 0.5%, 1% and 1.25%). The impact of angle proportion and distinctive level of fiber on the conduct of the composite soil example with restoring were contemplated.

From this examination it was presumed that the Maximum Dry Density (MDD) of fiber balanced out soils continues diminishing and Optimum Moisture Content (OMC) continues expanding with increment in the level of fiber in soil. The outcome demonstrated that consideration of palm fiber expands the pliability and quality of soil.

Amit Tiwari[1], H. K. Mahiyar[2], et al.,(2014)

As the Black Cotton Soil have unwanted designing properties like Excessive Variation in volume with change in water content, There is impressive

shrinkage on drying bring about development of broad breaks, Black Cotton soil encounters high swelling on being drenched, Low compressive quality at higher water content and so on. To accomplish this objective test study on 48 preliminary examples test were conveyed in two stage, for example, in first stage, the physical properties of soil, for example, hygroscopic dampness substance grain size dispersion, explicit gravity, Atterberg's breaking points, Direct shear test, Swelling weight, MDD-OMC, CBR, Permeability test esteems are resolved.

3. MATERIALS AND METHODS

Black cotton 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.

Fly ash

A waste material extricated from the gases exuding from coal terminated heaters, by and large of a warm power plant, is called fly fiery debris. The mineral buildup that is abandoned after the consuming of coal is the fly cinder. The Electro Static Precipitator (ESP) of the power plants gather these fly cinders. Basically comprising of alumina, silica and iron, fly fiery remains are small scale measured particles. Fly powder particles are commonly circular in size, and this property makes it simple for them to mix and stream, to make an appropriate mixture.

Cement

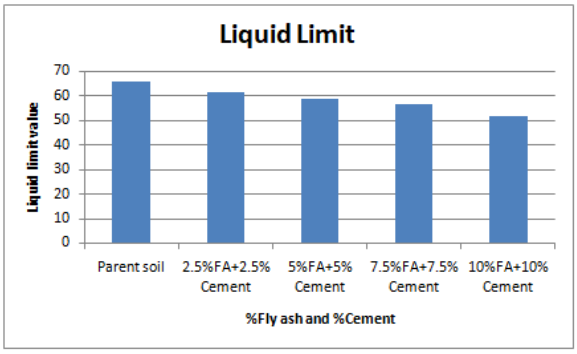
Cement is a binder, a substance utilized in production that units and hardens and can bind other materials together. The maximum vital forms of cement are used as a issue inside the production of mortar in masonry, and of concrete- that is a aggregate of cement and an mixture to form a sturdy building material.

Experimental Investigation

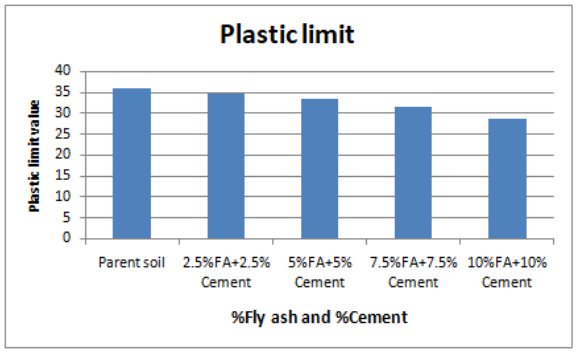
- Liquid limit test
- Plastic limit test
- Compaction test
- Unconfined compressive strength

4. RESULTS AND ANALYSIS

Liquid limit

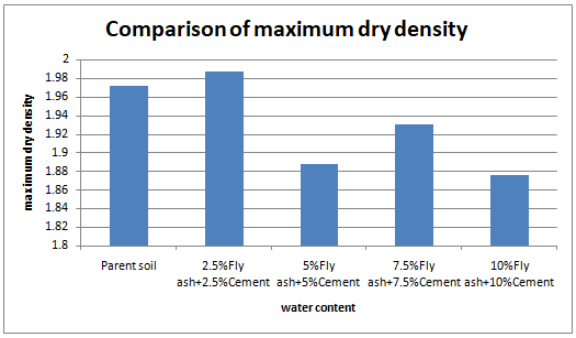


Plastic limit

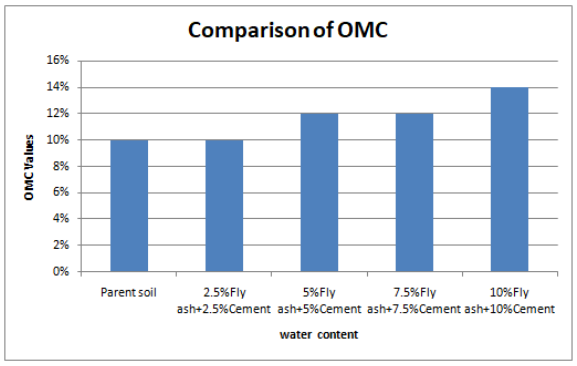


Compaction test

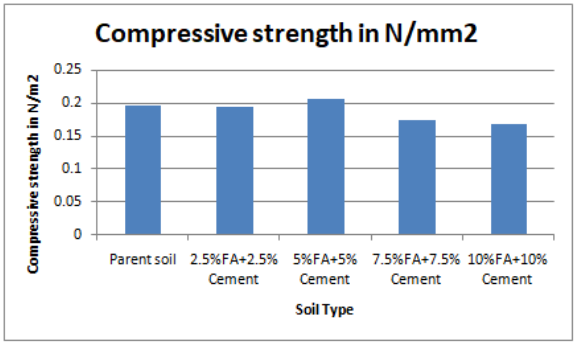
Comparison of maximum dry densities



Comparison of OMC



Compressive strength



5. CONCLUSIONS

This project is focused on the review of performance of fly ash and cement as a soil stabilization material. The study suggests that if fly ash and cement 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. Fly ash is used as an excellent soil stabilizing materials for highly active soils which undergo through frequent expansion and shrinkage.
2. The Fly 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 2.5% fly ash and 2.5% cement and the maximum value of Optimum moisture content was observed at 2.5% fly ash and 2.5% cement.
4. The optimal value of unconfined compressive strength was observed at 5 % fly ash and 5% cement.
5. The values of liquid limit and plastic limits decreases with increasing the percentages of fly ash from 0% to 20% with 1% cement.

REFERENCES

[1]. Tripti Goyal, Er. Rubel Sharma, et al.,(2018), "Experimental study of clayey soil stablised with fly Ash and recron-3s", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 10 | Oct 2018 www.irjet.net p-ISSN: 2395-0072.

[2]. Ankita Sonkar, S. Srividhya, et al.,(2017), "experimental study on strength Characteristics of palm fiber Reinforced soil stabilize using Bagasse ash", International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 4, April 2017, pp. 2027–2035, Article ID: IJCIET_08_04_231.

[3]. Amit Tiwari[1], H. K. Mahiyar[2], et al.,(2014), "Experimental study on stabilization of black cotton soil by fly ash, coconut coir and crushed glass", International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 11, November 2014).

[4]. Mahevi Malik Affan Masood Javeed[1], Gavit Deepak Bhagwat[2], et al.,(2018), "Stabilization of Black Cotton Soil using Fly Ash and Coconut Coir", IJSRD - International Journal for Scientific Research & Development| Vol. 6, Issue 01, 2018 | ISSN (online): 2321-0613.

[5]. K.Padmavathamma[1], S.Jyothirmayee[2], L.Vimala[3], et al.,(2017), "Experimental Study on Stabilization of Black Cotton Soil by Using Fly Ash and Coconut Coir Fiber", International Journal of Innovative Research in Science, Engineering and Technology

[6]. Sharan Veer Singh, Mahabir Dixit, et al.,(2017), "Stabilization of Soil by Using Waste Plastic Material: A Review", International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified

Organization) Website: www.ijirset.com Vol. 6, Issue 2, February 2017

[7]. Jasmin Varghese Kalliyath, Jithin Thomas Joy, et al.,(2016), "Soil Stabilization using Plastic Fibers", IJSTE - International Journal of Science Technology & Engineering | Volume 2 | Issue 12 | June 2016 ISSN (online): 2349-784X.

[8]. Deekonda Gowthami, R. Sumathi, et al.,(2017), " Expansive Soil Stabilization using Plastic Fiber Waste Polypropylene", International Journal of Latest Research in Engineering and Technology (IJLRET) ISSN: 2454-5031

[9]. Sagar E. Shinde, Azim A. Shaikh ,Shubham D. Kulkarni, et al.,(2017), " EFFECT ON PROPERTIES OF SOIL USING WASTE PLASTIC FIBRES", International journal of advanced technology in engineering and science, vol no 5, issue no 2 Feb 2017.