Fly Ash Stabilization In Subgrade

Sham salve[1], Rushikesh shirsathe[2], Rushikesh makasare[3], Vaibhav bhalchim[4], Pravin valvi[5], Mr. Mayur P.Chounde[6]
[6]Lecturer
[1, 2, 3, 4, 5, 6] Dr. D. Y. Patil Pratishthan's, Y.B Patil Polytechnic, Akurdi, Pune

Abstract- *Soil stabilization is a method of improving soil properties by blending and mixing bituminous materials. Soil is used sub base and base material, if strength of soil is poor, then stabilization is usually required. Subgrade is sometimes stabilized or changed with solider soil. If good earth is not available at the construction site, it becomes imperative to opt for soil stabilization. Soil stabilization is a process to treat a soil to maintain or improve the performance of the soil as a construction material. The stabilizing agent improves the strength parameters of sub grade of road pavement and leads to strengthening of embankment. The objective of this paper is to review the applications of stabilizing agents such as fly ash, cement for different type of soil.*

Keywords- fly ash stabilization, Black Cotton soil, ground improvement techniques, road construction, surface, CBR Value.

I. INTRODUCTION

In India about 51.8 million hectares of the land area are covered with Expansive soils (black cotton soil).The Black cotton Soils are very hard when dry, but lose its strength completely when in wet condition. Expansive soils are a worldwide problem that poses several challenges for civil Engineers. Various methods are adapted to improve the engineering characteristics of expansive soils. The problematic soils are either removed and replaced by good and better quality material or treated using additive. The stabilization of the problematic soils is very important for many of the geotechnical engineering applications such as pavement structures, roadways, building foundations, channel and reservoir linings, irrigation systems, water lines, and sewer lines to avoid damage due to settle of soft soil or to the swelling action of expansive soil.

Soil stabilization is a general term for any physical, chemical, biological, or combined method of changing a natural soil to meet an engineering purpose. Improvements include increasing the weight bearing capabilities and performance of in-situ sub soils, sands, and other waste materials in order to strengthen road surfaces. Stabilization in a broad sense incorporates the various methods employed for modifying the properties of a soil to improve its engineering performance. Stabilization is being used for a variety of engineering works, the most common application being in the construction of road and airfield pavements, where the main objective is to increase the strength or stability of soil and to reduce the construction cost by making best use of locally available materials. Soil stabilization in road construction is a common practice in the construction of roads, whether they are highways, major or local roads, is conditioned by structured layers capable of carrying certain traffic loads.

II. FLY ASH

A waste material extracted from the gases emanating from coal fired furnaces, generally of a thermal power plant, is called fly ash. One of the chief usages of volcanic ashes in the ancient ages were the use of it as hydraulic cements, and fly ash bears close resemblance to these 5 volcanic ashes. These ashes were believed to be one of the best pozzolana (binding agent) used in and around the globe.

The demand of power supply has exponentially heightened these days due to increasing urbanization and industrialization phenomena. Subsequently, this growth has resulted in the increase in number of power supplying thermal power plants that use coal as a burning fuel to produce electricity. The mineral residue that is left behind after the burning of coal is the fly ash. The Electro Static Precipitator (ESP) of the power plants collects these fly ashes.

III. OBJECTIVES

- To study the California Bearing Ratio
- To improve on-site materials to create a solid and strong sub-base and base courses.
- To study the various soil stabilization IS codes related to CBR value
- To study MDD and OMC

IV. IS CODES

- Water content – IS 2720-1980 (part 3/sec1)
- Specific gravity – IS 2720-1980 (part 2/sec2)
- Standard proctor test – IS 2720-1980 (part 7)
- Modified proctor test - IS 2720-1980 (part 8)
- Atterbergs limits- IS 2720-1980 (part 5 and 6)

- Grain size analysis - IS 2720-1980 (part 4)
- California bearing ratio - IS 2720-1980 (part 16)
- Unconfined compressive strength- IS 2720-1980 (part 16)
- Direct shear strength - IS 2720-1980 (part 13)
- Triaxial shear test - IS 2720-1980 (part 11)
- Consolidation - IS 2720-1980 (part 15)

V. CALIFORNIA BEARING RATIO TEST

The California bearing ratio test is penetration test meant for the evaluation of subgrade strength of roads and pavements. The results obtained by these tests are used with the empirical curves to determine the thickness of pavement and its component layers. This is the most widely used method for the design of flexible pavement.

- Normally 3 specimens each of about 7 kg must be compacted so that their compacted densities range from 95% to 100% generally with 10, 30 and 65 blows.
- Weigh of empty mould
- Add water to the first specimen (compact it in five layer by giving 10 blows per layer)
- After compaction, remove the collar and level the surface.
- Take sample for determination of moisture content.
- Weight of mould + compacted specimen.
- Place the mould in the soaking tank for four days (ignore this step in case of un soaked CBR.
- Take other samples and apply different blows and repeat the whole process.
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- Add water to the first specimen (compact it in five layer by giving 10 blows per layer)
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- Take other samples and apply different blows and repeat the whole process.

VI. RESULTS

Maximum dry density – 1.62 g/cc
Optimum Moisture content – 13.6 %

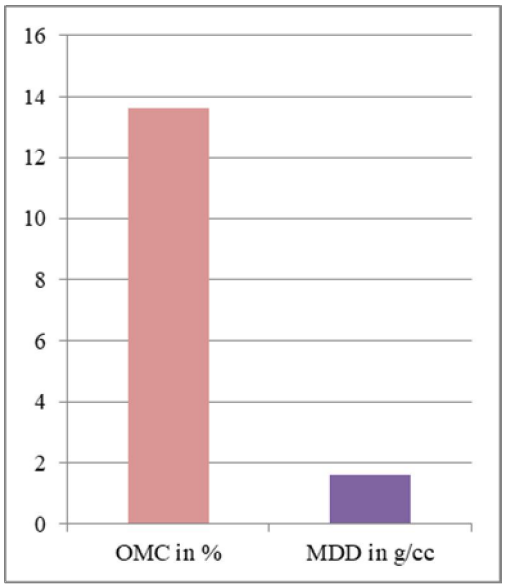

Chart 01- MDD and OMC

The chart plotted by considering fly ash percentage replacement in black cotton soil

Table 01- CBR value

Sr.no	Replacement in %	CBR Value
1	10	12.4
2	20	13
3	30	16.3
4	40	17.3

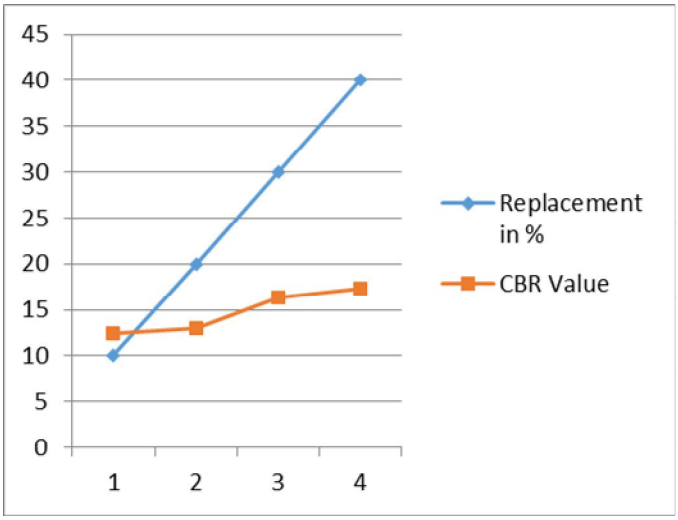

Chart 02- CBR value

VII. CONCLUSION

With results it is observed that, the unsoaked CBR value is higher with 20% Fly ash compared to other mixes. Comparatively the dry density with 20% fly ash is higher than the other percentages of fly ash. So it may be reported that fly ash has good potential for use in geotechnical applications. The relatively low unit weight of fly ash makes it well suited for placement over soft or low bearing strength soils. Its low specific gravity, freely draining nature, ease of compaction, insensitiveness to changes in moisture content, good frictional properties, etc. can be gainfully exploited in the construction of embankments, roads, reclamation of low-lying areas, fill behind retaining structures, etc.

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