IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

SOIL STABILIZATION TECHNIQUES

For Dhori-Ghat Ganga River bank

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Abstract: The main objective of this study is to investigate the use of materials in geotechnical applications and increase the strength of soil .The soil stabilization can be explained as the alteration of the soil properties by chemical or physical means in order to enhance the engineering quality of soil. The main objective s of the soil stabilization is to increase the bearing of the soil, its resistance to weathering process and soil permeability . The long-term performance of any construction project depends on the soundness of underlying soils. Unstable soils can create significant problems for pavements or structure, therefore soil stabilization techniques are necessary to ensure the good stability of soil so that it can successfully sustain the load of the superstructure e specially in case of soil which are highly active, also it saves a lot of time and millions of money when compared to the method of cutting out and replacing the unstable soil .This paper deals with the complete analysis of the improvement of soil properties and its stabilization

Index Terms **- Stablization, soil, strength, fly ash, compaction, water content etc.**

I. INTRODUCTION

Stablization in a broad sense, incorporates the various methods employed for modifying the properties of soil to improve its engineering performance. Stablization is being used for variety of engineering works, the most common application being in the construction of road and air-field pavements, where the main objective is to increase the strength or stability of soil and reduce the construction cost by making best use of locally available materials. Methods of stablization may be grouped under two main types :(a) modification or improvements of soil property of existing soil without any admixture, and (b) modification of properties with the help of admixtures . Comapaction and drainage are the examples of the first type, which improve the inherent shear strength of soil. Examples of second type are: Mechanical stablization, Stablization with cement, lime, bitumen and chemicals etc. Some of the more commonly used methods will discussed in this chapter.For any land-based structure, the foundation is very important and has to be strong to support the entire structure. In order for the foundation to be strong, the soil around it plays a very critical role. So, to work with soils, we need to have proper knowledge about their properties and factors which affect their behavior. The process of soil stabilization helps to achieve the required properties in a soil needed for the construction work. From the beginning of construction work, the necessity of enhancing soil properties has come to the light. Ancient civilizations of the Chinese, Romans and Incas utilized various methods to improve soil strength etc., some of these methods were so effective that their buildings and roads still exist. In India, the modern era of soil stabilization began in early 1970's, with a general shortage of petroleum and aggregates, it became necessary for the engineers to look at means to improve soil other than replacing the poor soil at the building site. Soil stabilization was used but due to the use of obsolete methods and also due to the absence of proper technique, soil stabilization lost favor. In recent times, with the increase in the demand for infrastructure, raw materials and fuel, soil stabilization has started to take a new shape. With the availability of better research, materials and equipment, it is emerging as a popular and cost-effective method for soil improvement

1.1 Principles of Soil Stabilization:

Evaluating the soil properties of the area under consideration. Deciding the property of soil which needs to be altered to get the design value and choose the effective and economical method for stabilization.Designing the Stabilized soil mix sample and testing it in the lab for intended stability and durability values

1.2Need and Advantage

Soil properties vary a great deal and construction of structures depends a lot on the bearing capacity of the soil, hence, we need to stabilize the soil which makes it easier to predict the load bearing capacity of the soil and even improve the load bearing capacity. The gradation of the soil is also a very important property to keep in mind while working with soils. The soils may be well-graded which is

desirable as it has less number of voids or uniformly graded which though sounds stable but has more voids. Thus, it is better to mix different types of soils together to improve the soil strength properties. It is very expensive to replace the inferior soil entirely soil and hence, soil stabilization is the thing to look for in
these cases

1.3 Specific gravity

of a substance denotes the number of times that substance is heavier than water. In simpler words we can define it as the ratio between the mass of any substance of a definite volume divided by mass of equal volume of water. In case of soils, specific gravity is the number of times the soil solids are heavier than equal volume of water. Different types of soil have different specific gravities, general range for specific gravity of soils:

Table 1.1 Specific Gravity

Sand	2.63-2.67
Silt	2.65-2.7
Clay and Silty clay	2.67-2.9
Organic soil	<2.0

II . RESEARCH METHODOLOGY

The methodology of soil stabilization we prefer mixing of (Fly ash & Rice husk) and second method soil stabilization we consider the (Fly ash & Lime) both method adopted for our major project. The soil stabilization done by some others materials such as cement, polymers, etc.

2.1 Fly ash stabilization:

Fly ash has been found in multiple studies to be a suitable stabilizer for soils. Fly ash is a byproduct of coal burning power plants and its usage in stabilization reduces disposal of material in landfills. Fly ash is regarded as non-plastic fines which are often hollow spheres of aluminium, silicon, and iron oxides. The standard specification for coal fly ash and raw or calcined natural pozzolana for use in concrete (ASTM C618-12a) classifies fly ash within two, categories, Class C and Class F fly ash
. Class F fly ash typically produced from the combustion of anthracite or bituminous coal, while Class C fly ash is produced from the combustion of lignite or subbituminous coal and typically has a higher calcium content (ASTM C618-12a). Within Oklahoma there are multiple sources of fly ash making it readily available pending the project location for soil stabilization?

2.2 Lime stabilization:

Hydrated lime and quicklime have been used extensively in Oklahoma as a chemical stabilizer for road subgrade and is readily available for use as a soil stabilizer. Stabilization with lime has been found to be effective in stabilizing clayey soil; however, lime has little effect on highly organic soils and soils with low clay content (Ingles and Metcalf). The benefits of the lime stabilizers on soil are caused primarily by decreasing the water sensitivity of the soil and flocculation of the soil particle structure. **M**ethodology section outline the plan and method that how the study is conducted. This includes Universe of the study, sample of the study, Data and Sources of Data, study's variables and analytical framework. The details are as follows;

Collection of sample: Normal soil

Soil +Fly ash

Soil+Fly ash+ Lime (5%)

Soil + Lime (5%)

Weight of sample: Normal soil: w1=0.094Kg ;w2=0.064Kg;w3=0.049kg

Soil+Fly ash(5%):w1=0.046kg;w2=0.051kg;w3=0.041kg

Soil+Lime(5%):w1=0.064kg;w2=0.091kg;W3=0.092kg
Soil+Fly ash(5%)+Lime(5%):w1=0.037kg;w2=0.040kg;w3=0.050Kg

2.3 Proctoer Compaction Test This experiment gives a clear relationship between the dry density of the soil and the moisture content of the soil. The experimental setup consists of (i) cylindrical metal mould (internal diameter- 10.15 cm and internal height-11.7 cm), (ii) detachable base plate, (iii) collar (5 cm effective height), (iv) rammer (2.5 kg). Compaction process helps in increasing the bulk density by driving out the air from the voids. The theory used in the experiment is that for any compactive effort, the dry density depends upon the moisture content in the soil. The maximum dry density (MDD) is achieved when the soil is compacted at relatively high moisture content and almost all the air is driven out, this moisture content is called optimum moisture content (OMC). After plotting the data from the experiment with water content as the abscissa and dry density as the ordinate, we can obtain the OMC and MDD. The equations used in this experiment are as follows:

$$\text{Wet density} = \frac{\text{weight of wet soil in mould gms}}{\text{volume of mould cc}}$$

$$\text{Moisture content \%} = \frac{\text{weight of water gms}}{\text{weight of dry soil gms}} \text{ X } 100$$

$$\text{Dry density } \gamma_d \text{ (gm/cc)} = \frac{\text{wet density}}{1+\frac{\text{moisture content}}{100}}$$

III . RESULTS AND DISCUSSION

3.1 Results of Soil Sample-1 (Normal Soil)

Table 3.1 Dry Density for Normal soil

Sample number	1	2	3
Weight (w) kg	0.094	0.064	0.049
Dry Density (D1) gm/m^3	2.01	2.04	2.014

3.2 Soil sample-2 (Normal soil+ Fly Ash)

Table 3.2 Dry Density for Normal soil + Fly Ash

Sample number	1	2	3
Weight (w) kg	0.037	0.040	0.045
Dry density (D_2) gm/m^3	1.926	2.052	1.95

3.3 Soil Sample-3 (Soil+Lime)

Table 3.3 Dry Density for Normal soil + Lime

Sample Number	1	2	3
Weight (w) Kg	0.069	0.091	0.092
Dry Density (D_3) gm/m^3	2.074	2.069	2.037

3.4 Soil Sample-4 (soil+Fly ash+ Lime)

Table 3.4 Dry Density for Normal soil + Fly Ash+ Lime

Sample Number	1	2	3
Weight (w) kg	0.037	0.040	0.045
Dry Density (D_4) gm/m^3	1.926	2.052	1.95

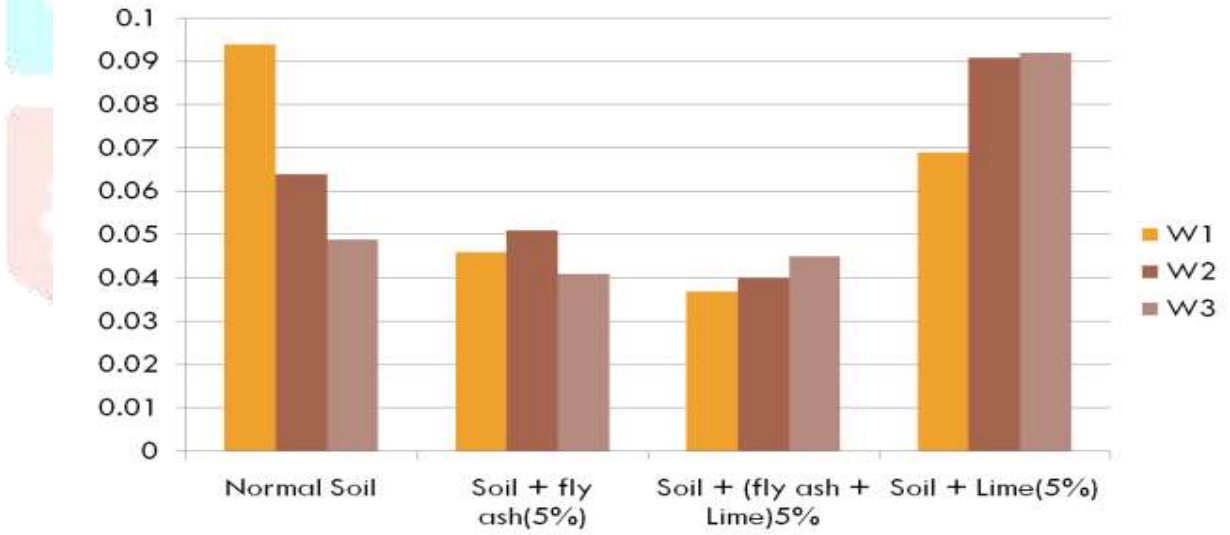

Fig. 1. Graph Of Water content for Different sample

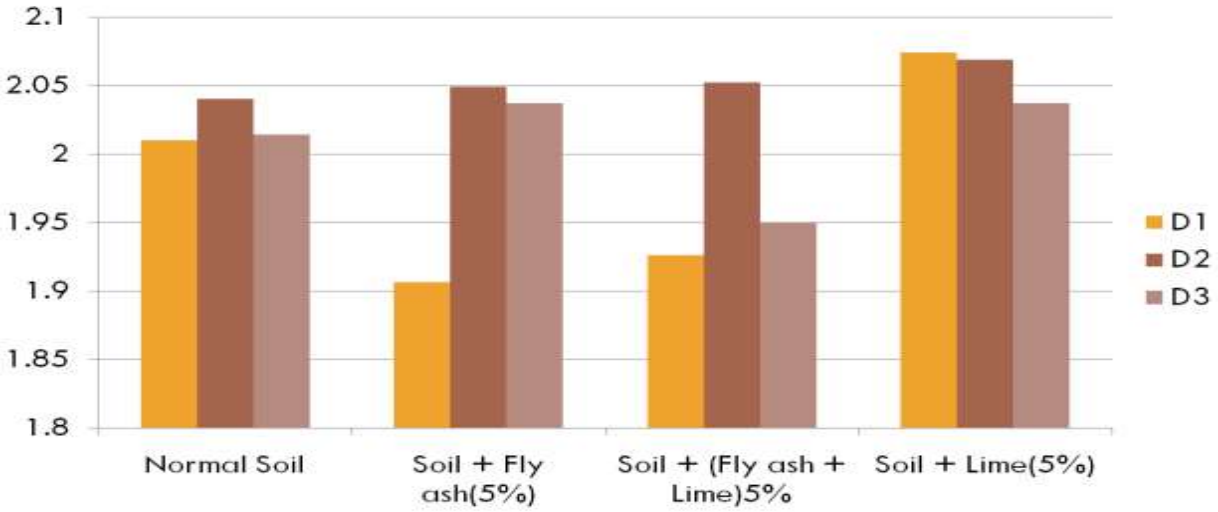

Fig. 1. Graph Of Dry Density for Different sample

By the abobe result best result are soil or lime and fly ash for 2nd sample give the most sutable result .

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