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Soil Stabilization using Waste Materials

Krutika K Shirke[1], Prachi S Mathe[2], Vishwadh Rane[3], Shubham Patil[4], Sneha Hirkane[5]
[1, 2, 3, 4] *Student, Civil Department, [5]Professor, Civil Department First-Fifth Vishwaniketan Institute of Management Entrepreneurship and Engineering Technology, Mumbai,India*

Abstract: Soil stabilization can be defined as the alteration of the soil properties or change in soil properties by chemical or physical means in order to enhance the engineering properties of the soil. The main objectives of soil stabilization is to increase the different properties like bearing capacity of soil ,resistance to weathering process, wear & tear, to reduce plasticity of soil, to reduce the permeability of soil. The long term performance of any construction project depends on the capacity of underlying soil. Unstable soils can create different types of problems for pavement or structures, therefore by using proper soil stabilization techniques we can ensure the good stability of soil so that it can successfully sustain under different conditions. By achieving high stability we can saves a lot of time and money when compared to the method of cutting out and replacing the unstable soil. Stabilization of different problematic soil by using chemicals or additives becomes costly. However, by using industrial waste we can stabilize soil at minimum cost and also achieving environmental safety and minimizing waste material.
Keywords: Soil stabilization, bearing capacity, plasticity, unstable soil, environmental safety

I. INTRODUCTION

Soil is basic material for any type of construction. It is necessary to have soil which fulfils all the requirement of engineering properties (bearing capacity, shear strength, compaction, consolidation, cohesion etc.). Stabilization of different types of problematic soil by using chemicals or additive becomes costly.

However, by using industrial waste we can stabilize soil at minimum (negligible) cost and also achieving environmental safety and minimizing waste materials.

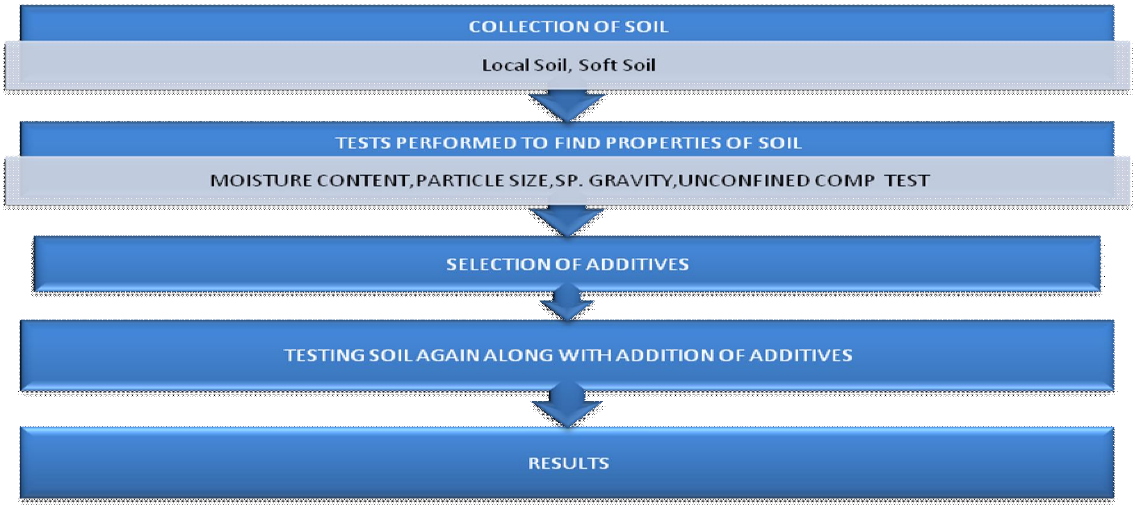
Stabilization is the permanent physical and chemical alteration of soils and aggregates to enhance their engineering properties thus improving the load bearing capacity of a sub-grade or sub-base to support pavements and foundations. Nowadays, industries are growing to a greater extent, which is beneficial for the economic development of the country but in return it creates a lot of hazard by letting the waste generated into the nature which is not only increases the pollution but also effects the waste generation. Some industrial wastes can be reused for soil stabilization like waste plastic, fly ash, ggbs (ground granulated blast furnace slag), rice husk.

II. LITERATURE REVIEW

1) *Neva Elias:* Neva Elias did this study to investigate the use of waste materials in geotechnical applications and to evaluate the e ffects of waste paper sludge on strength development of soft soil. This review discussed the effect of waste paper sludge on stab ilized soils. In this paper, attempts were made to utilize the same for the soil improvement. The application of Waste Paper Slud ge (WPS) was investigated in this study by conducting laboratory tests, compaction and unconfined compressive strength. Soil with 2% and 5% WPS had an optimum moisture content more closed to OMC of clay soil alone. The addition of WPS had incre ased the strength at 5%and it was found to be a constant and optimum value of strength to soil. In general it was found that WP S is a suitable waste material for strengthening soft soil, the beneficial reuse of the paper sludge also saved landfill space.
2) *Nilo Cesar Consoli:Ju´ Lio Portella Montardo Pedro Domingos Marques Prietto; And Giovana Savitri Pasa:* Unconfined compression tests, splitting tensile tests, and saturated drained triaxial compression tests with local strain measurementwere carried out by them to evaluate the benefit of utilizing randomly distributed polyethylene terephthalate fiber, obtained fromrecycling waste plastic bottles, alone or combined with rapid hardening Portland cement to improve the engineering behavior of a uniform fine sand. The separate and the joint effects of fiber content (up to 0.9 wt%) , fiber length (up to 36 mm), cement content (from 0 to 7 wt%), and initial mean effective stress (20, 60, and 100 kN/m^2) on the deformation and strength characteristics of the soil were investigated using design of experiments and multiple regression analysis. The results has shown that the polyethylene terephthalate fiber reinforcement improved the peak and ultimate strength of both cemented and uncemented soil and somewhat reduced the brittleness of the cemented sand. In addition, the initial stiffness was not significantly changed by the inclusion of fibers.

3) *E.A. Basha, R. Hashim, H.B. Mahmud, A.S. Muntohar:* According to them stabilization of residual soils was studied chemically by using cement and rice husk ash. Investigation included the evaluation of such properties of the soil as compaction, strength, and X-ray diffraction. Test results showthat both cement and rice husk ash reduce the plasticity of soils. In term of compactability, addition of rice husk ash and cement decreased the maximum dry density and increased the optimum moisture content. From the viewpoint of plasticity, compaction and strength characteristics, and economy, addition of 6–8% cement and 10–15% rice husk ash was recommended as an optimum amount.

III.METHODOLOGY



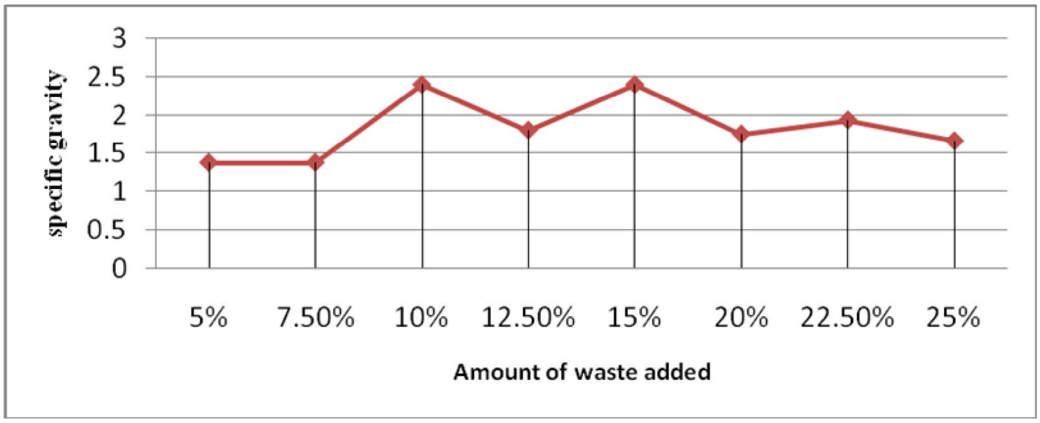
IV.RESULTS

M1 M2 M3 M4

A. *Specific Gravity*

M1=mass of empty pycnometer
M2=mass of pycnometer + dry soil
M3=mass of pycnometer + dry soil +water
M4=mass of pycnometer + water
SOFT SOIL + 5% FLYASH + 5% RICE HUSK
M1 =630gm
M2= 740gm
M3= 1430gm
M4 = 1400gm
G= M2-M1/(M4-M1) - (M3-M2)
G=1.375

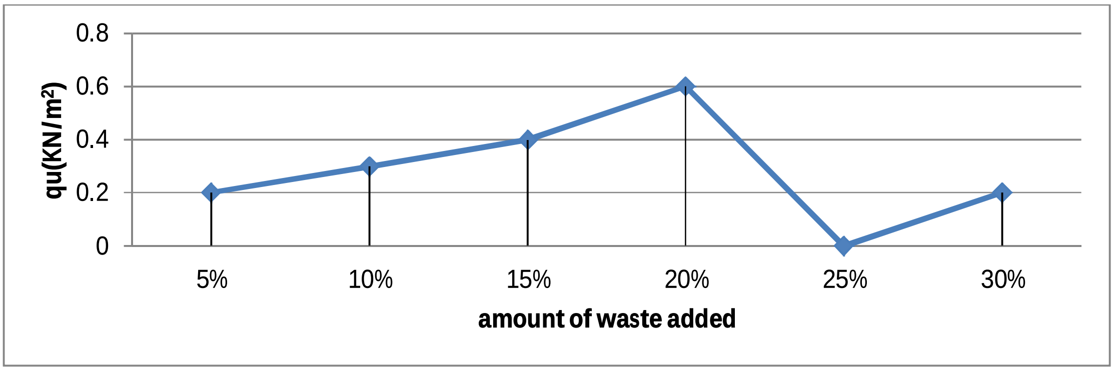
Amount of flyash & rice husk (%)	Specific gravity
5%	1.375
7.50%	1.385
10%	2.4
12.50%	1.8
15%	2.4
20%	1.75
22.50%	1.933
25%	1.66



Graph1- sp.gravity

Unconfined Compression Test

Amount of flyash & rice husk (%)	Qu (KN/m^2)
5%	0.2
10%	0.3
15%	0.4
20%	0.6
25%	0
30%	0.2



Graph no-2 Unconfined compression test

V. CONCLUSIONS

When admixtures were added to local soil, the sp. Gravity was reduced comparatively from its original sp. gravity. When admixture s were added to soft soil, the results were positive as expected as the sp. gravity decreased with addition of Rice husk, Flyash& plast ic but increased on addition of a combination of Flyash and Rice husk. In unconfined comp test on local soil, the strength was decre ased with all the admixtures. In unconfined comp test on soft soil, the strength was zero in soft soil which was considerably increase d with addition of admixtures. The combination on soft soil + Rice husk& soft soil + Rice husk + Flyash showed the same results w hich were maximum. When variable % of flyash& Rice husk were added during pycnometer test the addition of 10% flyash + 10% Rice husk & 15% flyash + 15% Rice husk has shown the maximum results.In unconfined compression test 15% addition has shown the max results, which concluded that 15% addition of Flyash and Rice husk is the optimum combination to increase the strength of our acquired soft soil.

VI.FUTURE SCOPE

The above work has been carried out in laboratory conditions. Practical feasibility at site has to be studied. Other than the aboveadm ixture used, we can further use different types of admixture from different industries to study their effect on stabilisation of soil. We have added the flyash 15 % &Rice husk 15% and we got maximum strength of sample. By using this proportion w can stabilize the soil up to required strength.

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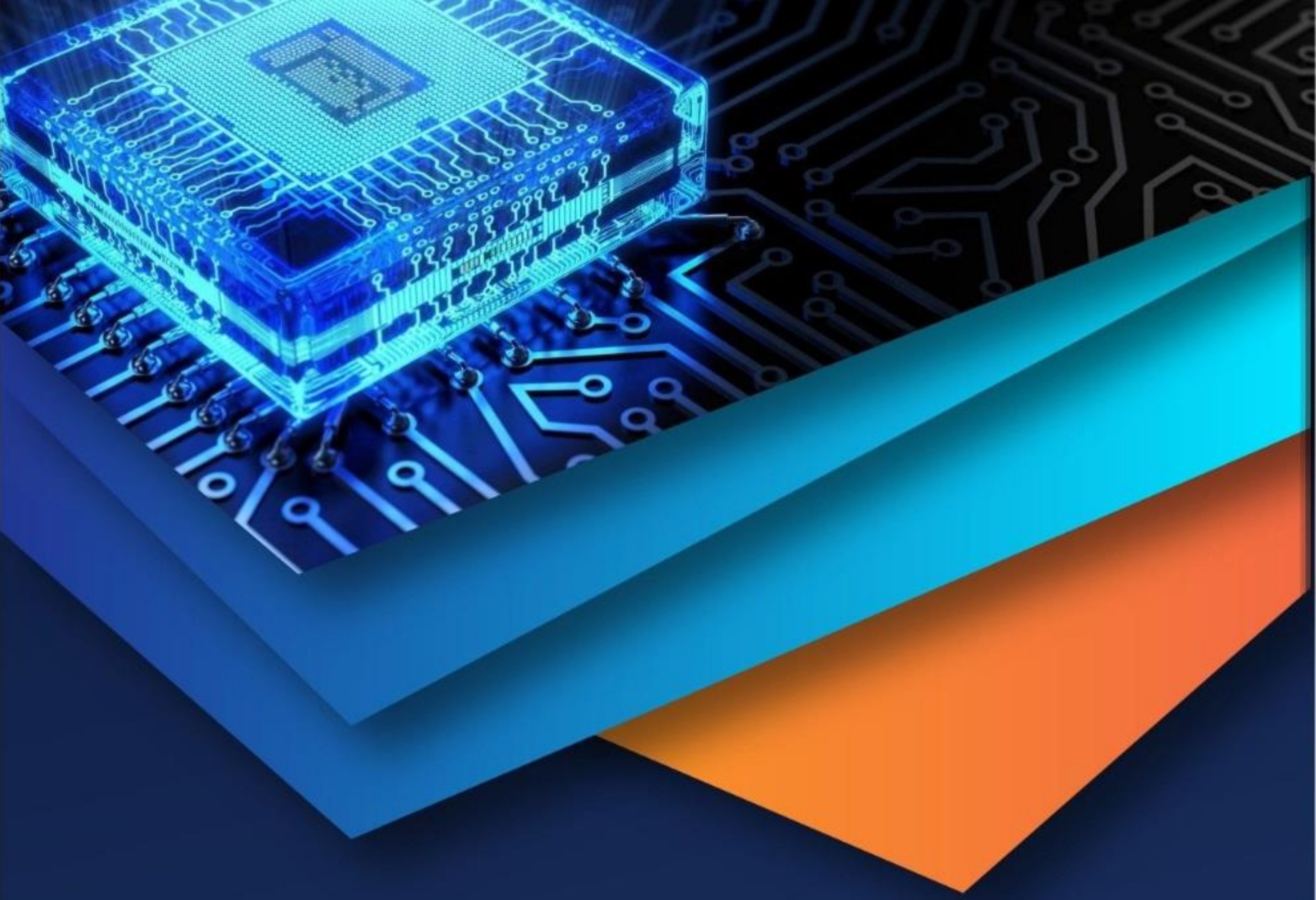

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