Comparative Studies of Soil Stabilization Approach

Aditya Kumar Anshu[1], Yamem Tamut[2]
[1]*PG Scholar, Department of Civil Engineering, NERIST, Arunachal Pradesh*
[2]*Assistant Professor, Department of Civil Engineering, NERIST, Arunachal Pradesh*

***Abstract* - This study shows that in a well-organized system, trash disposal offers a significant concern in terms of where and how to adequately dispose of garbage without causing harm to society. In recent years, the use of solid waste materials in soil stabilisation has gained traction as a cost-effective way to manage trash generated from construction projects and different industries. This article provides an overview of the various solid waste resources that can be used in this paper. Soft soils have been stabilised using this technique. There are a variety of approaches and strategies that can be used to stabilise them. This research shows how waste products can be used to help soft soils stay stable.**

***Index Terms* - Soil, Stabilization, OMC, MDD, CBR, UCS.**

I.INTRODUCTION

As the soil is in direct contact with the item, it functions as a load transmission intermediary, therefore soft soil stability is critical throughout construction. Soft soils have low shear strength and a low CBR, and they have alternating wetting and drying cycles. Soil strengthening enhances bearing capacity, lowers settlement, and aids in soil liquefaction reduction. Since then, significant progress has been achieved in the design and construction of geotechnical structures such as foundations, embankments, pavements, and retaining walls, among other things. The need for soil stabilisation comes as a result of a number of issues, including low bearing capacity, a high rate of post-construction settlement, excavation instability, and expensive construction costs; enhance the strength of the sub-grade on clayey soil. Soil stabilisation is the process of improving the engineering properties of soil by combining stabilisers to enhance load carrying capacity and weathering resistance. To improve the engineering characteristics of soft soil, several stabilising agents are employed. These are main binders (hydraulic) and secondary binders (non-hydraulic) additives that react with pozzolanic minerals and water to produce a composite with cementitious properties when they come into contact with them. The goal of this research is to see how waste from diverse sources, such as agriculture and industry, may be used to stabilise soil.

Civil Engineers are sometimes obliged to build a project on a site chosen for reasons other than soil characteristics. As a result, it is becoming increasingly necessary for the engineer to understand the extent to which the soil's technical qualities may improve or other options for the building of the intended project at the given location. If inappropriate soil conditions are discovered at the proposed structure's location, the unsatisfactory soil can be bypassed by extending a deep foundation to a suitable bearing material, the poor material can be removed and replaced with a suitable material, or the soil in-place can be treated with any suitable ground improvement methods (soil stabilisation) to improve its engineering properties. As a result, in order to puzzle out at the chosen location, we need to be well-versed on their characteristics and elements that influence their behaviour. As a result, the requirement of elevating soil characteristics has become apparent since the start of construction work, and the procedure of soil stabilisation aids us in achieving the essential attributes in a soil for building work. With a worldwide shortage of petroleum and aggregates, the contemporary period of soil stabilisation in India began in the early 1970s. It became important for technicians to search for ways to enhance soil other than replacing the bad soil at the building site. Soil stabilisation was employed, but it fell out of favour owing to the use of out-of-date technologies and the lack of correct methodology. With the rise in demand for infrastructure, sensitive materials, and fuel in recent years, soil stabilisation has begun to require a new approach. It is becoming a popular and cost-effective way of land development as more research, resources, and equipment become available. Before a work can be completed, site feasibility assessments for geotechnical projects are quite useful. Before the design process begins, a site survey is generally conducted to determine the features of the subsoil on which the project's location may be based. During the site selection process, the following geotechnical design factors must be addressed such that design load and function of the structure, type of foundation to be utilized and also the load carrying capacity of the subsoil.

II.LITERATURE REVIEW

VaishaliSahu (Dec-2013), “Sustainable reuse of stabilized and fibre reinforced flv ash-lime sludge (FALS) as pavement sub-base material.” The globe is experiencing a significant scarcity of traditional building materials in the road construction industry. However, there are many twist offs from various fabricates laying around as trash in that appreciate. A composite material made up of fly fiery remnants and lime slime (FALS) was used as a sub-base material in the clearing in this investigation. FALS was adjusted with industrially available lime and gypsum, and the influence of introducing polypropylene strands to balance out FALS was investigated.To assess the influence of fibre consideration on the sturdiness and flexibility characteristics of the composite, a series of unconfined pressure tests were performed on samples of fibre-strengthened fly fiery debris lime muck composite (FRFALS). The result of fibresupport on the shear strength parameters and California Bearing Ratio (CBR attachment (c) and inside rubbing point (ϕ) is additionally discussed. Based on the findings, it has been concluded that the addition of small amounts of polypropylene fibre (0.1 percent) increases the solidity and malleability of the FRFALS for the specific curing time period. With fibre extension and the shear parameters c and corresponding increases, the CBR estimation of FALS increased by 54 percent. In the future, the FALS composite can be used in adaptable asphalt sub-base layers if it is reinforced with polypropylene fibre.

G. S. Hambirao et al.(Feb-2014), “Soil stabilisation using waste Shredded rubber `tyre chips.” The development of structures on fragile or sensitive soil is seen as risky. A variety of ground enhancement measures can reduce the change in load bearing capacity of the ground. The support material in this investigation was destroyed elastic from waste, and the limiting operator was concrete, which was arbitrarily mixed into the soil at three distinct segments of fibre substance, i.e. 5%, 10%, and 15% by weight of soil. The research looked at the quality of soil that has been reinforced with arbitrarily destroyed elastic bands. California bearing ratio and unconfined compressive strength tests were performed on the specimens. The shear strength and bearing capacity characteristics of the concentrating on soil have clearly improved as a result of the experiments.

Kharade et al. (2014) studied bagasse ash with partial replacement in black cotton soil in various proportions like 3%, 6%, 9%, 12%. They establish that optimum proportion of bagasse ash was 6%. The findings at this percentage indicated that MDD rose by 5.8%, CBR increased by 41.52 percent, and UCS increased by 43.58 percent, indicating that adding bagasse ash enhanced CBR and compressive strength by nearly 40%, although density barely changed little.

Kawade et al. [2013] examined utilization of industrial and agricultural waste, sugarcane bagasse ash. Sugarcane ash had been chemically and physically separated, and had been partially substituted in proportions of 10%, 15%, 20%, 25%, and 30% of cement by weight. At the ages of 7, 28, 56, and 90 days, fresh concrete characteristics such as slump and hardened concrete properties were evaluated. The results showed that when 15% SCBA was replaced in cement, the properties of the concrete improved. In contrast to concrete without sugarcane ash, the results indicated that sugarcane ash mix concrete had much higher strength. As a result, it is possible to deduce that up to 15% of cement can be replaced with sugarcane ash.

Rathan et al.(2016) analysed expansive soil using rice husk ash known as RHA by using different percentages 5%, 10%, 20%, 30%, 40%, 50% of it. Various tests were performed, including liquid limit and plastic limit, free swell index, specific gravity, MDD and OMC, CBR, and direct shear test. By raising the proportion of RHA, the values of LL and FSI were reduced drastically. For 80 percent rice husk ash for clay, the OMC fell gradually from 17.89 percent to 13.25 percent, while the MDD rose from 16.39kN/m3 to 19.5kN/m3. The undrained consistency of the soil-RHA mix was reduced from 60 KN/m2 to 30 KN/m2, while the angle of friction (Φ) was raised from 17°5' to 38°. The wet CBR value was increased from 2.4 percent to 4.4 percent and the unsoaked CBR value was increased from 3.2 percent to 9.3 percent, respectively.

Abhijit and Aruna (2015) analysed black cotton soil with ground granulated blast furnace slag (GGBS) and sisal fibres. By adding GGBS to natural soil, they discovered that the optimal moisture content dropped and the maximum dry density rose. Adding sisal fibre to GGBS improved the undrained shear strength and CBR. The best outcome came from a high dose of GGBS combined with 0.75 percent sisal fibres.

Teresa and Joy (2016) investigated banana fibre as soil stabilizer which is a waste material. The results of several tests such as UCS, CBR, consistency limitations, and compaction were analysed. Banana fibre content ranges from 0.25 percent to 0.75 percent, 1 percent to 2 percent. The banana fibres improve the soil's properties. For marine clay, the optimum dosage of banana fibre was found to be 0.75 percent. With the addition of banana fibre, dry density dropped and OMC increased. With 0.75 percent banana fibre, the shear strength increased to 32.91kN/m2, and the CBR increased from 2.79 to 13.2, making it suitable for sub-grade.

Sodhi et al. (2017) studied utilization of fines obtained from structural concrete debris and polypropylene fibres waste in enhancement of the different properties of intermediate clayey soil. They discovered that when fines were added at 10% by weight of soil, the MDD of virgin soil increased by 5.03 percent and the moisture content increased by 10.37 percent, with a negligible drop in the MDD of soil-mix with an increase in waste polypropylene fibres. The reinforced mix with 20 mm polypropylene fibres and 0.35 percent dry soil sample by weight exhibited a 23.77 percent increase in cohesion and a 53.12 percent increase in cohesion. For direct shear strength testing, the optimal number of waste polypropylene fibres for reinforcing the soil to increase the properties of a particular soil (CI) was determined to be 20mm in length at 0.35 percent polypropylene by weight of dried soil sample.

Ayyappan et al.(2010) analysed polypropylene fibres with fibre lengths of sizes 6mm, 12mm and 24 mm for reinforcing the soil. For MDD, samples of soil-fly ash mix were prepared with fibre concentrations ranging from 0 to 1.5 percent by weight. The optimal proportion of reinforcement for all soil-fly ash mix samples was set at 1% by weight of soil-fly ash mix. For soil-fly ash mix reinforcement, the maximum value was achieved with a 12mm length of fibre. The CBR value was enhanced by 1% by dry weight for all mixtures owing to fibre lengths of 12mm. The results revealed that using a reinforced soil-fly ash combination with 12 mm fibres at 1% yielded superior outcomes.

Brooks (2009) The use of waste material RHA and fly ash improved the characteristics of soft soil. He looked at the possibility of using a RHA-fly ash mixture as a swell reduction layer between the sub-grade and the foundation footing. When the fly ash concentration was increased from 0 to 25%, the percentage of failures in strain and stress increased by 50% and 106 percent, respectively, according to UCS. UCS was enhanced by 97 percent and CBR was increased by 47 percent by adding rice husk ash from 0 to 12 percent. As a result, 25 percent fly ash and 12 percent RHA were used to strengthen the fly ash. He chose a fly ash concentration of 15% for blending into RHA to produce a well reduction layer since its performance in lab testing was good.

III.CONCLUSION

The soil type has a low bearing capacity, making it unsuitable for construction. The materials for soil stabilisation recommended in this study are low-cost and effective. In comparison to other types of stabilising agents, this study found that using waste as a stabiliser helps to tackle the waste disposal dilemma while also improving the engineering qualities of soft soil and lowering building costs.

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