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LABORATORY INVESTIGATIONS AND FIELD EVALUATIONS OF SOFT HIGHWAY SUBGRADE SOIL IMPROVISED WITH CALCIUM CARBIDE RESIDUE- A REVIEW

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ABSTRACT

Tourism cannot operate without infrastructure development. It should ensure continuous work in the development of the tourism sector (Bazagani and Hasan 2021). The availability of infrastructure is a major concern, and the nature of tourism largely determines its performance. Next, the features that determine its performance must be made to solve and to identify its performances and evaluations. After going through various researches, it was found that research on various tourist destinations is of good scope. Various samples will be collected randomly for the survey purposes at the certain locations like Pahlgam, Dal Lake, Shalimar Garden, Gulmarg. Different survey groups will be conducted and the perceptions so achieved will be recorded and will be plotted in the tabulated and graphical form in the form of Questionnaire.

I. INTRODUCTION

Highway construction and maintenance are essential for the development of transportation infrastructure. One critical aspect of highway construction is ensuring the stability and load-bearing capacity of the road subgrade, which serves as the foundation for the entire roadway structure. Soft subgrade soils pose a significant challenge as they often lack the required strength and stability for supporting heavy traffic loads. To address this issue, various soil improvement techniques are employed, and one promising approach is the use of calcium carbide residue. Calcium carbide residue, a byproduct of acetylene gas production, has gained attention as a potential soil stabilizer for soft highway subgrades. This residue contains a high concentration of calcium hydroxide (Ca (OH)2), which exhibits excellent pozzolanic properties, making it a suitable candidate for enhancing the engineering properties of weak subgrade soils. Laboratory investigations and field evaluations are crucial steps in assessing the feasibility and effectiveness of using calcium carbide residue for subgrade soil improvement.

Laboratory Investigations:

Soil Testing: In the laboratory, samples of soft highway subgrade soil are collected and analyzed to determine their physical and geotechnical properties, including particle size distribution, moisture content, compaction characteristics, and shear strength.

Calcium Carbide Residue Analysis: The chemical composition of calcium carbide residue is examined to understand its pozzolanic and binding properties. This includes assessing the concentration of calcium hydroxide and other chemical constituents.

Mixing and Testing: Laboratory experiments involve mixing various proportions of calcium carbide residue with subgrade soil samples to create different soil-calcium carbide blends. These blends are then subjected to a battery of tests, such as Proctor compaction tests and unconfined compression tests, to evaluate the improvement in soil properties.

Microstructural Analysis: Techniques like X-ray diffraction and scanning electron microscopy can be employed to examine the microstructural changes within the soil-calcium carbide mixtures, providing insights into the mechanisms of soil improvement.

II. LITERATURE REVIEW

Misra 1993 found that the essential components in sawdust cannot be calcium, potassium, and magnesium, even though Sulphur, phosphorus, and manganese are found in about 1% and iron, aluminium, copper, zinc, sodium, silicon. , and boron is opened by common sense numbers.

Elinwooden ash 2006 and those of solid objects. The study has also solved the general scope of molecular dispersion in addition, physical, compound, design, and mechanical properties of sawmill.

Elinwooden ash 2008 Reported as, wood ash (WA) by 10% instead the level of the binding fabric in fixing the mud mixture works on it the self-assembly method also results in gaining higher power than normal traditional blend without adding fabric instead of regular Portland cement (OPC). Because of the wood ash (WA) as a material and does not take part of any pleasant reaction to the hydration system delays energy gain length compared to a mixture made of standard Portland cement (OPC). Previously a for a long time very low energy properties are found in wood ash (WA) compounds such as additional fabric, but with long-lasting blends made of wood (WA) as an additive the best-known shows comparable characters because the compounds are prepared without any to add additional minerals. In the long run combos are made in different high classes up to 20% of the same popular electricity prices

Chowdhury and Maniar (2014): Contains information that the soil saw was purchased from wood finishing machines. Accommodation arrangements are important, integrated and mineralogical Wood ash (WA) is supplied and broken. Power limits i.e... Its stressful quality, elasticity and flexibility of flexible cement mortar (WA) concrete is tested. As a result, it was noted that wood waste was wood ash (WA) should be mixed with concrete without compromising solid quality properties. In addition, the use of another measurable concept of help vector Gadget Vigilator (SVM) machine, standard power parameters with wood ash (WA) develops a suitable model.

Raheem Examined the impact of releasing years on the oppressive forces of the earth access to information (SDA) concrete. From the results, it is shown that it is stressful the increase in quality is largely due to the release of age and decreased progressively ground access information (SDA). The effects also showed that solid ground information (SDA) strength gains little by little in the beginning to restore years. This is in line with early detection of solid content pozzolanic objects gradually gained strength at the beginning of the release period (74 and 102] in recent years, pozzolanic work had begun and improved ground compression strength access to information (SDA) concrete.

Okeyinka and Oladejo Announced the dynamic force of solid 3D shape decreases with the development of the content of wood waste. Calcium carbonates (CACO3) as an admixture compound basically increases the compressive strength wood waste cement and concrete for all levels of options. The pressure force of wood cement debris concrete made (CACO3) admixture will grow with years of release and the greatest strength occurs in 10% of the wood waste content, followed by 20% content of wood waste.

Tastan E. et al. (2011) have reported that blending flies a shin to soft organic soils increases their unconfined compressive strength and resilient modulus. It is possible to increase the unconfined compressive strength of organic soils with an addition of fly ash, but the amount of advancement depends on soil type and fly ash characteristics. Stabilization is adversely affected by soil organic content. Soil with more organic matter will have less strength, indicating that soil with more fly ash will have less strength.

Sabat A. et al. (2013) have analyzed the mutual effects of two industrial wastes namely, fly ash and quarry dust on several properties such as compaction characteristics, shear strength parameters, UCS, California bearing ratio (CBR), and swelling pressure of expansive soil. The highest value for UCS is achieved concerning 45% fly ash-quarry dust mixture. The UCS value further decreases with an increment in its percentage. As the percentage of fly ash-quarry dust mixes increases, the MDD increases and the OMC decreases.

Horpibulsuk S. et al. (2013) have analyzed the improvement in the strength of stabilized CCR and FA clay. A very high $Ca(OH)_2$ content of 76.7% is found in CCR. A soil that contains a high percentage of natural pozzolanic material can be improved by using it alone. They also mentioned that if the natural pozzolanic material is completely absorbed by the input CCR, CCR and FA can be used together for higher strength requirements.

Kampala A. et al. (2013) have focused their study to have a basic idea about the engineering properties of stabilized CCR soil in its recycled form. Scanning electron microscopic (SEM) images manifest that the recycled form of stabilized CCR soil grains is bigger than the CCR and clay particles. The reason for this is the attached pozzolanic products with their cycled stabilized CCR soil. The large grains of the recycled CCR stabilized clay reduces linear shrinkage and free swell ratio. Since the hard pozzolanic products resist compaction, the recycled CCR stabilized clay has a lower unit weight compared to the CCR stabilized clay for the same amount of compaction energy and CCR content.

Vichan S. et al. (2013) have conducted experimental work to investigate the effects of blending CCR and biomass ash (BA) which acts as a stabilizing chemical additive, and leads to a pozzolanic reaction. Their research work suggests that calcium hydroxide Ca (OH)2 was formed when CCR dissolves in water. Pozzolanic products were obtained by dissolving the amorphous Si from BA in a higher pH solution (pH=12.6). It has also been observed that the combined effects of CCR and BA on clay strength development were observed when the binder content reached 30% of the dry soil weight.

Raut J. et al. (2014) have tried to examine the property enhancement of expansive soil by varying the percentage of fly ash and marram. With an increase in the percentage of fly ash and murrum, the MDD and unconfined compressive strength is found to be increasing till a certain limit and thereafter their value decreases. They have reported that the optimal combination for property enhancement of clay is attained by mixing 5% of fly ash and 7.5 % of murrum with it.

Jiang N. et al. (2015) have compared the stabilized quicklime soil by conducting a multi-scale laboratory investigation focusing on the several properties viz., mechanical, physical and also microstructural of stabilized CCR clayey soils. It was observed that within the initial 28d, stabilized CCR soil has significantly lower pore volume as compared to stabilized quicklime soil. However, this difference in pore volume is almost negligible at 120d. A converse correlation was noticed between the stabilized soil and a larger volume of pore in the soil. At the initial stage, the vital contributor to the rapid and complete development of flocculation and agglomeration of soil particles are high pH value, significant specific area and fine size particle of CCR soil when compared to quicklime.

Du Y. et al. (2016) worked on finding the mechanical properties of CCR stabilized soft clayey soil which is utilized as a subgrade course material for the highways. In an adjacent field section, Quicklime was used as a control binder to compare its performance with CCR.

Latifi N. et al. (2018) have focused their study to examine CCR practicability to stabilize clay. Natural pozzolanic materials in clay can react with CCR following pozzolanic reactions. Tests indicated that a significant improvement in compressibility and strength has been observed utilizing CCR. The highest strength improvements in UCS tests were obtained with CCR dosages of 9% and 12% for bentonite and kaolin, respectively.

III. CONCLUSION

Soft subgrade soils in highway construction often pose challenges, including low bearing capacity, poor load-bearing ability, and susceptibility to settlement, which can lead to increased maintenance costs and safety risks. Researchers and engineers have been exploring various soil stabilization methods to address these issues. The quality of subgrade soils is crucial for the durability and performance of highway networks. Many regions require cost-effective methods to enhance soft subgrade soils to extend the service life of road infrastructure.

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