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PREVIEW PAPER ON DESIGN OF FLEXIBLE PAVEMENT BY STABLIZATION OF SOIL USING LIME AND FLY ASH.

[1]Omkar Dhamke, [2]Sambhaji Megha, [3]Sonam Jadhav, [4]Mansi Warghade, [5]Samriddhi Shelavale

[1]Student of Civil Dept, [2]Student of Civil Dept, [3]Student of Civil Dept, [4]Student of Civil Dept, Assit.Prof Civil Dept.

[1]Civil Engineering Department,

[1]Atma Malik Institute of Research and Technology, Shahapur, India

Abstract : Today, poor soil properties are a big issue in engineering projects. Changing the qualities of the bad soil may be the initial step in the construction process. Low soil subgrade pavement structures show early distress, which causes the pavement to break quickly. It is common for clayey soil to have the potential to have unfavorable engineering features like limited bearing capacity, substantial shrinkage and swell characteristics, and high moisture susceptibility. Stabilizing these soils is a typical practice to improve their tensile strength. A method called soil stabilization is adding a binder to the soil in order to improve the engineering performance of the soil. This study describes the local strengthening of the cohesive soil due to the addition of both lime and fly ash.

Keywords -: Lime, Fly ash, Pavement, Clayey Soil, Bearing Capacity, Soil Stabilization.

1.INTRODUCTION

The process of modifying a soil to maintain, change, or enhance its performance as a material used in building is soil Stabilization. Soil stabilization is a method used in civil engineering to hone and enhance the engineering qualities of soils. Compressibility, mechanical strength, permeability, plasticity, and durability are some of these qualities. It involves modifying soils to improve their physical characteristics. Stabilization, which can increase a soil & shear strength and or manage its shrink-swell characteristics, enhances a subgrade & capacity to support foundations and pavements. When the subsoils are inappropriate for building, soil stabilization can be used on highways, parking lots, site development projects, airports, and many other places.

NEED OF THE STUDY.

1. Lime and fly-ash stabilization increase engineering qualities of soil in place of poor soils.
2. The strengthening of the soil results in an increase in its bearing capacity.
3. Dust control for a safe environment.

2. LITRATURE SURVEY

PAPER NO 1. "Soil stabilization using fly ash and iron dust" by Vikas B.Manchare, Prafullakumar R. Mahale, Rohan P. Warugase, and Vaibhav P. Shinde

Conclusion: Increased soil strength can be achieved with the use of fly ash soil stabilization. Fly ash is an inexpensive material that accumulates substantial strength, giving the construction its sturdiness and durability.

PAPER NO 2. "Geotechnical properties of fly ash and its application on soft soil stabilization" by Emilliani Anak Geliga and Dygku Salma Awg Ismail.

Conclusion: Axial tension was being applied with its greatest possible force. When clay is blended with fly ash (60 percent by Weight). Clay and fly ash mixtures should contain 50% to 60% fly ash as an addition. Fly ash not only improves shear strength but also combination soil & dry density and the optimal moisture content.

PAPER NO 3. "Stabilization of Red soil using lime and fly ash" by Aravind.V.Boobesh A., Gnanamanikandan. K, Jawahar Sundhar. A, Raman.P, Conclusion: Nonetheless, a minor (3%) rise in fly ash content is possible. Ash content increases decrease plasticity. For silty Soil, fly ash is not a particularly effective stabilizer. PAPER NO 4. "Stabilization of Soil using fly ash, lime & cement" by Santosh Dhaka, S. K. Jain Conclusion: The soil & liquid limit and plastic limit are raised when lime, fly ash, lime + fly ash, and Cement + lime are combined.

PAPER NO 5. "Comparative study of soil stabilization using lime and cement" by Kaiser Saleem, Amit Kumar, Sukhdeep Singh.

Conclusion: The ideal moisture content decreases from 15.35% to 14.35%. When soil is combined with lime in varied proportions. 1.477 becomes the dry density, down from 1.578.

3. METHODS OF SOIL STABILIZATION

3.1. Mechanical stabilization:-

By changing the gradation of the soil, mechanical stabilization improves the characteristics of the soil.

In order to achieve the appropriate grading, locally occurring materials are strategically blended to ensure mechanical stability.

This strategy, which is more conventional, involves either compaction or adding fibrous and other non-biodegradable reinforcements to the soil. This practice doesn't include altering the soil's chemistry.

To accomplish mechanical stabilization, a variety of techniques are employed.

3.2. Compaction :-

By applying pressure from above, compaction normally uses a large weight to enhance the soil's density.

For this reason, equipment like massive soil compactors with vibrating steel drums is frequently utilized. Over compaction of the soil in this situation should be avoided and given careful consideration because it results in crushed aggregates and the soil losing its engineering features.

3.3. Soil reinforcement :-

Sometimes mechanical repairs, whether engineered or not, are used to address soil issues. Geotextiles and engineered plastic mesh are made to capture soils and assist in regulating soil permeability, moisture levels, and erosion. Larger aggregates like gravel, stones, and boulders are frequently used in construction projects where the extra mass and stiffness can stop soil migration or enhance load-bearing capabilities

3.4. Addition of Graded Aggregate Materials :-

A popular technique for enhancing a soil's designed properties is to incorporate certain aggregates that provide the soil desirable properties, like enhanced strength or decreased flexibility. This technique offers material economy, enhances the Subgrade's ability to support structures, and gives a working surface for the remaining structure.

3.5. Chemical stabilization:-

Chemical soil stabilization is the process of combining and adding chemical additives to improve the engineering properties of he soil. The effectiveness of stabilization depends on how the chemical or stabilizer used interacts with the characteristics of the soil particle.

To strengthen the strength, workability, and durability of the soil as well as to prevent any potential shrinkage and swelling, chemical additions are employed for soil stabilization. The higher performance significantly reduces the lifecycle costs of the pavement, implying decreased maintenance expenditures. Less need for dusting, controlled voume adjustments to the soil, and increased workability are further advantages. Selecting the stabilizer that is most suited for a particular type of soil is considered most strongly.

3.6. Bitumen Emulsion ;-

In cohesive and non-cohesive soils, bitumen emulsion is used as a binding agent. In soils, though, this method may no longer be economical as the soil particles need a large dosage at smaller grain sizes in order provide the same or higher degree of bonding of bitumen emulsion. In addition to being harmful to the environment, bitumen emulsion hardens into a brittle substance that compromises soil stability.

3.7. Lime :-

In the United States, Africa, Australia, and India, the application of soil-lime stabilization has grown in popularity during the past 25 years. As base courses or subbases, soil lime mixes are used. Due to India's pleasant climate and the widespread prevalence of clayey soils, this technology has a wide range of applications.

3.8. Mechanism of lime-soil interaction:-

Several reactions happen when lime (CaO) is added to a fine-grained soil. Some of them happen right away, while others take time to happen. Base Exchange (also known as ion exchange) is one of the early reactions. With exchangeable ions of sodium, magnesium, potassium, or hydrogen adsorbed on the surface, clay particles are often negatively charged. A majority of positively charged calcium ions are present on the surface of the clay particles as a result of the strongly positively charged calcium ions contained in the lime being stronger than the lesser ions of sodium, magnesium, potassium, or hydrogen. This in turn reduces the soil's flexibility. The clay particles' propensity to aggregate into big particles (flocculation) gives the combination a friable quality. Any extra lime will chemically react with the clay minerals after the previous first-stage reactions are finished. In the presence of water, the aluminous and siliceous components in the clayey soils will react with lime to generate cementitious gels, which boost the mixture's strength and durability. These Pozzolanic reactions take a long time to complete up to many years in certain cases and are slow. The production of calcium carbonate as a result of carbon absorption is another potential source of strength.

3.9. Quantity of Lime: -

The quantity of lime in a soil lime mixture has a significant impact on its strength. Lime mixtures with less than a 2 percent concentration are typically difficult to mix well and are not advised for usage. The majority of soils can typically be stabilized with 3-10% by weight of dry soil. Because handling quicklime can result in burns for personnel who are not wearing protective gear, Ca (OH2), or hydrated lime, is more desirable than CaO (quick lime).

3.10. Lime-Pozzolanic (fly ash) Stabilization:

Pozzolanic is a siliceous substance that, although it doesn't have cementitious qualities by itself, reacts with calcium hydroxide in the presence of water to create cementitious compounds.

Pozzolanic may be created by calcining clay, naturally occurring volcanic ash, or industrial waste like fly ash. When fly ash is employed, the mixture is referred to as a lime-fly ash stabilized mixture, or LFA-stabilized mixture in an abbreviated version. ot all soils contain a sufficient amount of clay minerals to allow lime to react with them to create cementitious products.

Therefore, stability of such soils is easily possible by the addition of a Pozzolanic substance. Lime Pozzolanic is used in slags, gravels, crushed stone, sandy soils, and silts, among other types of materials. Stabilization may be effective. These soils, which can be stabilized using lime pozzolana, include the alluvial silts of northern India. The proportion of lime to pozzolana varies greatly and might range from 1:1 to 1:9. The Between 10 and 25 percent of a mixture can be made up of pozzolana and lime. Mixtures of lime, pozzolana, and aggregate can be utilized to create superior-strength road bases. This substance has excellent structural strength and functions more like a semi-rigid pavement. Although the usage of lime-pozzolana in our nation is still in its infancy, given the issue of how to dispose of enormous amounts of fly ash from thermal plants, this material may come into greater use in the future.

4. Flexible Pavement

Flexible pavements have surfaces made of bituminous (or asphaltic) material. These can include pavement surface treatments like bituminous surface treatments (BST), which are often seen on lesser volume highways, or HMA surface courses, which are typically used on bigger volume roads like the Interstate highway system. Because the entire pavement structure "bends" or "deflects" in reaction to traffic loads, these pavements are known as "flexible" pavements. A flexible pavement construction is made up of several layers of materials that can withstand this "flexing". Generally speaking, flexible pavements have little to no flexural strength and respond structurally in a flexible way to loads.

Therefore, flexible pavements are designed to transmit load as soon as an incident occurs.

The composition and structure of flexible pavement consists of

1. Surface course
2. Binder course
3. Base course
4. Subbase course
5. Frost protection course
6. Subgrade.

5. CONCLUSION

1. From an economic and environmental perspective, reducing aggregate thickness can benefit from the advantages of lime/fly ash-reinforced subgrade courses. A longer lifespan can also lengthen the pavement & useful life and reduce the cost of constructing a pavement as a whole.
2. The study focused into the use of lime or fly ash as a form of road construction reinforcement when applied to subgrade material. A mixture of lime/fly ash significantly improves the strength of poor soils, as seen by increased CBR values. The study demonstrates that the position of the lime and fly ash at various depths greatly improves the subgrade & strength.
3. Adding lime or fly ash to weak soils makes them stronger.
4. As a result, promoting the use of lime/fly ash as a feasible and cutting-edge technique to improve road construction on Subpar subgrade materials is necessary. Analysis of more research should be conducted.

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