A REVIEW STUDY ON THE USE OF BITUMEN EMULSION IN THE SOIL SAMPLE

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***Abstract*: The foundation is very important and has to be strong enough to support the entire structure. In order for the foundation to be strong, the soil around it plays a very critical role. So we need to have proper knowledge about their properties and factors which affect their behaviour to work with soil. The process of soil stabilisation helps to achieve the required properties in a soil needed for the type of construction work. Pavements are a conglomeration of materials. These materials, their associated properties, and their interactions determine the properties of the resultant pavement. Thus, a good understanding of these materials, how they are characterized, and how they perform is fundamental to understanding pavement. The materials which are used in the construction of highway are of intense interest to the highway engineer. This requires not only a thorough understanding of the soil and aggregate properties which affect pavement stability and durability, but also the binding materials which may be added to improve these pavement features.**

***Keywords*: Soil Stabilization, Bitumen Emulsion, Pavement.**

1.0 INTRODUCTION

Soil is a major component of the Earth's ecosystem. It is one of nature's most superabundant construction materials. Any kind of construction founded is based upon the soil. The subgrade is the lowest layer of the pavement layer system which ultimately support all other layers and traffic loads. so, failure of subgrade will results in failure of the pavement because it will get reflected in the top surface. Generally sub grade consists of variously available soil materials that sometimes might be wet and / or soft which cannot have enough strength to support pavement loading .A good knowledge on properties of subgrade soil under in-situ condition is necessary prior to the construction of the pavement. With increasing environmental needs In-situ sub grades do not provide the support required to attain acceptable performance under increasing traffic loads. Inspite of the fact that stabilization is a widely known alternative for improving properties of soil yet the properties determined from stabilization shift broadly because of heterogeneity in soil creation, dissimilarities in micro and macro structure among soils, heterogeneity of geologic quantities, and because of chemical differences in mixture of interactions between utilized stabilizers and the soil. These properties require the thought of site-specific treatment alternatives which must be accepted through testing of soil-stabilizer mixtures.

Modifying the properties of a soil to improve its engineering performance is referred to as soil stabilization. Methods of stabilization may be grouped under two main types : (a) modification or improvement of a soil property of the existing soil without any admixtures. Examples for this kind of stabilization are compaction and drainage which improve the inherent shear strength of soil (b)modification of the properties with the help of admixtures Examples for second type stabilization are Mechanical stabilization, stabilization with cement, lime and chemicals etc… .Soil is the un aggregated or un cemented deposits of mineral and/or organic particles or fragments covering large portions of the earth's crust. Sub grade is a native material underneath a constructed road. Soil underneath the pavement without interruption is called regular soil sub grade. Sub grade which is commonly compacted by inhibited development of distinctive sorts of substantial compactors is defined as compacted sub grade.

2.0 LITERATURE REVIEW ON BITUMEN EMULSION

Kota prudhvi teja et al directed the improvement of silty soil as subgrade material by stabilizing with bituminous emulsion. The first part of investigation was to identify the soil classification of the selected soil according to USCS (Unified soil classification system) by conducting Atterberg's limit test, after soil is classified sieve analysis was done to know the Coarse fraction and Fine fraction of the soil to determine whether the soil is well graded. The second part of the investigation was to identify the specific gravity of the soil which helps to determine the dry density of the soil, by using modified proctor test the maximum dry density (MDD) of the soil is concluded with different concentrations of water and optimum moisture content is observed by plotting a graph between dry density and moisture content. The final part of the investigation was to discriminate the changes in General, physical and mechanical properties of soil. The second part and third part of investigation found that soil physical and mechanical properties of stabilized soil are improved with reference to, CBR and Maximum dry density. In final investigation the correlation with different emulsion concentrations with cohesion, internal shear angle and three parameters of Atterberg's limits are increased.

Habiba Afrin stated the Different Types Soil Stabilization Techniques. The main objective of this study is to review the physical and chemical properties of soil in different types of stabilization methods. Stabilization and its effect on soil indicate the reaction mechanism with additives, effect on its strength, improves and maintains soil moisture content and suggestion for construction systems. Soil stabilization can be accomplished by several methods. All these methods fall into two broad categories namely mechanical stabilization and chemical stabilization. As technology advances and economic conditions change, many more chemical agents will be introduced into subgrades to improve their compactability, durability, and strength. At the same time,

more performance-based testing will be necessary to prove the effectiveness of these stabilization agents. In addition, there are chemicals being used today in the petrochemical industry whose use in soils is as yet unexplored. Another area for research is such processes as injection and spray-on techniques for more economical treatment. Global climate change may affect the durability and application of stabilizers.

N. Vijay Kumar et al studied the strength of Laterite soil using bitumen emulsion and ESP, CSA. In this research study, the admixture bitumen emulsion is added at 5%, 10%, & 15% proportions. Similarly egg shell powder and coconut shell ash are also added at the same proportions. The initial strength of the Laterite soil is determined through various tests like Sieve Analysis, Plastic Limit, Liquid Limit, Specific Gravity, Compaction, Unconfined Compression, California Bearing Ratio and Direct Shear tests. The same tests have been conducted with Laterite soil added with bitumen emulsion and Laterite soil added with egg shell powder and coconut shell ash. The results obtained are then compared with initial Laterite soil and Laterite soil added with admixtures. This study made a comprehensive examination of the effectiveness of soils on the performance of bitumen emulsion. The characteristics of soil sample were known from the tests conducted and the similar tests are conducted for the soil sample mixed with three different proportions of bitumen emulsion.

Maheshwari G.Bisanal et al stated the Stabilization of Soil Using Sea Shell and Bitumen Emulsion. In this study an attempt has been made to stabilize the black cotton soil with sea shell and bitumen emulsion. Soil stabilization is a technique aimed at increasing or maintaining the stability of soil mass and chemical alteration of soils to enhance their Engineering Properties. These curiosity factors influenced us to determine the significant results for proposed combination of work and are described in this paper. Stabilization can be used to treat a wide range of subgrade materials from expansive clay to granular materials. This allows for the establishment of design criteria as well as the determination of the proper chemical additive and admixture rate to be used in order to achieve the desired engineering properties. Benefits of the stabilization process can include higher resistance values, reduction in plasticity, lower permeability, reduction of pavement thickness, elimination of excavation material hauling or handling. Stabilization of expansive soils with admixtures controls the potential of soils for a change in volume, and improves the strength of soils.

M.Udaya Sri et al studied the Laterite Soil Stabilization Using Bitumen Emulsion. The main intent of this experimental study is to improve the properties of the Laterite soil by adding bitumen emulsion. An attempt has been made to use bitumen emulsion for improving the strength of Laterite soil expressed in terms of California Bearing Ratio (CBR) values which may prove to be economical. In this research, the whole laboratory work revolves around the basic properties of soil and its strength in terms of CBR. A little Fly ash is added to improve soil strength. It is observed that excellent soil strength results by using cationic bitumen emulsion (CMS) with little quantity of fly ash used as filler. The appropriate mixing conditions for Laterite soil with CMS Bitumen emulsion have been first attempted. This is followed by deciding four specific material conditions to show the variation in dry density and CBR value to achieve the best feasible strength properties of Laterite soil.

Vishal Kumar Pal directed the use of bitumen emulsion in the construction of gravel road. In this study, the properties of stabilized soil are discussed by adding bitumen emulsion. In this study, the whole laboratory work revolves around the basic properties of soil and its strength in terms of CBR. A little cement added to provide better soil strength. It is observed that excellent soil strength results have been achieved by using cationic bitumen emulsion (CMS) with little quantity of cement used as filler. The appropriate mixing conditions for gravelly soil with CMS bitumen emulsion are being first attempted. This is followed by deciding four particular material conditions to show the variation in dry density and CBR value to achieve the best possible strength properties of gravel soil. According to this investigational learning, the California Bearing Ratio rate has improved to 40 % to 50 % with respect to the standard soil CBR. It is helpful in reducing the economic cost and to make the improvements in the soil stabilization quality.

Olugbenga Oludolapo Amu et al studied the Suitability and Lime Stabilization Requirement of Some Lateritic Soil Samples as Pavement. In this work, Soil samples A, B, and C collected from a dam site and stabilized with 0, 2, 4, 6, 8, and 10% of lime were subjected to preliminary tests (natural moisture content, specific gravity, particle size analysis and Atterberg's limits) and strength tests (compaction, California bearing ratio (CBR), unconfined compression and undrained triaxial). Results of the preliminary tests classified the samples as fair to poor pavement construction materials. The suitability of samples A, B and C was improved by optimum lime stabilization at 8, 6, and 6% respectively.

Simarpreet Singh Batra et al studied the effect of cationic bitumen emulsion on shear strength parameters of soil. Many attempts have been made by numerous scholars in the history to increase the strength of soil by different methods including addition of lime, cement etc. Recent research is being carried to use non-traditional materials like Bitumen Emulsions etc. for improving the properties of soil. Bitumen Emulsions are usually dispersions of minute droplets of bitumen in water i.e. oil in water emulsions and are used to improve the cohesive strength of granular, low cohesion, low plasticity materials. They can also improve the integrity of road base, sub-base or sub-grade materials by resisting the damage caused by water. In this paper, the Direct Shear Test was conducted on soil with varying amount of Cationic Bitumen Emulsion (0%, 2%, 5%, 6% and 7%) to study the effect on Shear Strength parameters of the soil. The maximum shear strength of the soil was observed at 6% Bitumen Emulsion from the laboratory tests performed on the soil i.e. approximately 65% more shear strength by increasing Angle of Internal Friction but reduced Cohesion than the soil without any Emulsion.

CONCLUSION

Following are the various conclusions drawn from this study:

1. The unconfined compressive strength of soil increased by the addition of admixtures such as bitumen emulsion.

2. Addition of bitumen emulsion with soil reduces their plastic indices significantly
3. The use of bitumen emulsion to stabilize uniform grained soil can create improved ground layer but also a surface base.
4. Observing its economic cost and quality of stabilization improvement, it is clear that this type of stabilization may be applicable in gravel soil road or in shoulder portion of highways.
5. Specific gravity of the soil is increased when the bitumen emulsion is mixed with gravel soil.

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