iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** V **Month of publication:** May 2022

DOI: https://doi.org/10.22214/ijraset.2022.42862

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue V May 2022- Available at www.ijraset.com

Study of the Various Properties of the Gravely Soil by Adding Bitumen Emulsion as Stabilizing Agent

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***Abstract:** In this research the excessive elastic deflections that would result in fatigue cracking within the layer or in overlying layers and to Preventive measure for excessive permanent deformation through densification is studied. The main objectives of the Research Work is to study the properties of the gravely soil by adding bitumen emulsion as stabilizing agent and to find the California Bearing Ratio value of soil subgrade. to optimize the strength of soil and its dry density properties.*

I. INTRODUCTION

Soil is a major part of the global ecosystem. It is one of the most common natural building materials. Any type of construction based on the ground. The subgrade is the lowest layer of the pavement layer system that ultimately supports all other layers and loads of traffic. therefore, failure of the subgrade will lead to failure of the pedestrian path because it will be visible at the top. Typically, sub-grade contains a variety of ground materials that can sometimes be wet and / or soft which may not be strong enough to support road loading. Good knowledge of the in-situ soil structures is required prior to the construction of the paved road. With growing environmental demand the small In-situ distances do not provide the support needed to achieve acceptable performance under increasing vehicle loads.

Despite the fact that stabilization is one of the most widely known ways to improve soil structures yet the structures determined in stabilization are changing dramatically due to variations in soil formation, variability of small and medium-sized structures between soils, geologic density variations, and due to chemicals. the difference between the combination of interactions between the applied solvents and the ground.

These structures require consideration of alternative site-specific treatments that should be adopted by testing soil compaction mixtures.

Altering soil structures to improve their engineering performance is called soil consolidation. Stabilization methods can be organized under two main types:

1) Alteration or improvement of the existing soil surface area without any admixtures. Examples of this type of density stabilization and drainage that promote natural soil compaction
2) Alterations with the help of mixtures Examples of the second type of stabilization of mechanical stability, cement reinforcement, lime and chemicals etc.

Soil is an unbroken or uncut deposit for minerals and / or organic particles or fragments that cover large parts of the earth's crust. Sub grade is a traditional thing under a built road. The ground beneath the paved road without disturbance is called standard sub grade. A small distance is usually covered by a restriction the development of different types of large computers is defined as a small integrated space.

II. LITERATURE REVIEW

Any earth-based structure depends on the elements of its foundation. For that reason, soil is the most critical factor influencing the success of construction work. Soil is the first component of a foundation or one of the immature materials used in the entire construction process. So the main thing related to us is soil stability is not an object but a process of increasing the CBR capacity of the soil for a given construction purpose. So much work has been done on cement, lime or fly ash ash. But very little work has been done to strengthen the soil tar. The bitumen emulsion is used as a chemical stabilizer. Cement is used here as a bond to improve road strength. Previously a lot of work was done to strengthen the asphalt in the sand and to strengthen the asphalt in the sandy soil in various places. This research is inspired by that research. Dust red clay is used here, as it is found in many provinces of India. Other similar functions, performed earlier, are discussed below.

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Kota prudhvi teja et al (2015) directed the development of muddy soils as a substrate by stabilizing with bituminous emulsion. The first part of the investigation was to determine the subdivision of the selected soil according to the USCS (Unified soil classification system) by conducting the Atterberg boundary survey, after the soil was sorted by screen filtering was done to determine the Coarse and Fine part of the soil to determine whether the soil was properly prepared. The second part of the study was to identify the specific gravity of the earth to help determine the dryness of the soil, using a modified proctor test of maximum density dry density (MDD) of soil completed with a different concentration of water and a larger amount. humidity is determined by setting a graph between the amount of dryness and the humidity. The last part of the investigation was to disclose General changes, body structures and ground machinery. The second and third trimesters found that the visible and mechanical properties of stable soils were improved according to CBR and Maximum dry density. In the final investigation associated with different emulsion concentrations and combinations, the internal shear angle and three Atterberg boundary boundaries increase.

Habiba Afrin (2017) stated Different Types of Land Reform. The main purpose of this study is to review the physical and chemical properties of different soils types of stabilization methods. Stability and its impact on the soil reflects the reaction of the ingredients, the effect on their strength, enhances and retains soil moisture and the proposal of construction systems. Soil consolidation can be done in many ways. All of these methods fall into two broad categories namely mechanical stability and chemical stabilization. As technology advances and economic conditions change, more and more chemical agents will be introduced at lower levels to improve their combined efficiency, durability, and strength. At the same time, further performance-based testing will be required to confirm the effectiveness of these stabilization agents. In addition, there are chemicals used today in the petrochemical industry whose use in the soil has not been tested. Another area of study is procedures such as injections and spraying techniques to find a cost-effective treatment. Global climate change may affect the resilience and the use of stabilizers.

N. Vijay Kumar et al (2017) studied the strength of Laterite soils using bitumen emulsion and ESP, CSA. In this research study, an admixture bitumen emulsion was added to 5%, 10%, & 15%. Similarly egg shell powder and coconut shell ash are also added in equal proportions. The initial strength of the Laterite soil is determined by various tests such as Sieve Analysis, Plastic Limit, Liquid Limit, Specific Gravity, Compaction, Unconfined Compression, California Bearing Ratio and Direct Shear testing. Similar tests have been performed with Laterite soil mixed with bitumen emulsion and Laterite soil mixed with egg shell powder and coconut shell ash. The results obtained were then compared with the original Latite soil and the Laterite soil mixed with compounds. This study conducted a complete soil performance test on the performance of the bitumen emulsion. The characteristics of the soil sample are known by the experiments performed and the same tests are performed for the soil sample mixed with three different concentrations of bitumen emulsion.

Maheshwari G. Bisanal et al (2015) stated The Stabilization of the Earth by Using Marine Shell and Bitumen Emulsion. In this study an attempt was made to stabilize the soil of black cotton with sea shell and bitumen emulsion. Soil consolidation is a method intended to increase or maintain the stability of the soil weight and the chemical modification of the soil to improve their Engineering Buildings. These curiosity led to our decision the key effects of the proposed combination of work are described in this paper. Stabilization can be used to treat a variety of low-level conditions from expanded to granular. This allows for the establishment of a design process and the determination of the appropriate level of chemical additives and compounds that will be used to achieve the required engineering properties. The benefits of the stabilization process can include high resistance rates, plastic reduction, low accessibility, reduced road stiffness, eliminating the transport of excavation material or handling. Extensive compaction of compacted soil controls the ability of the soil to change volume, and improves soil strength.

III.MATERIAL USED

Soil: In this study, clayey sub-grade soil is used. Locally available clayey soil was collected from the fields nearby the my research centre (Shri Shankaracharya Technical Campus, SSGI) Junwani, Durg at a depth of 0.7 m below the ground surface by using technique of disturbed sampling the sample is collected and further the sample is thoroughly hand sorted to eliminate the vegetative matters and pebbles before taken in to laboratories. The sample is then stored in a dry place in wooden box. The soil Sample used for further work is then carried out. the different soil indicators are determined by different tests as per IS code provisions.

A. Bitumen Emulsion

Emulsified bitumen usually contains drops of tar hanging in water. Many emulsions are used for local treatment. Due to the low viscosity of the Emulsion compared to the hot bitumen used, the Emulsion has good penetration capacity and distribution. The type of emulsifying agent used in the bituminous emulsion determines whether the emulsion will be anionic or cationic. In the case of cationic emulsions there are bituminous drops with good value and Anionic emulsions have a negative charge of bituminous drops.

Based on their set rate or set time, which indicates how quickly water evaporates or settles, anionic and cationic emulsions are further divided into three distinct types. That is quick set (RS), intermediate set (MS), and slow set (SS). Among them a quick-release emulsion is very dangerous to work with as it is very little time left before setting. The set time for MS emulsion is approximately 6 hours. Therefore, working with a medium setting emulsion is very easy and there is enough time to put things in the right place before setting. The setting level is basically controlled by the type and amount of emulsifying agent. The main difference between anionic and cationic amulsion is that the cationic emulsion delivers water faster than the anionic emulsion.

IV.METHODOLOGY

Emulsified bitumen usually contains drops of tar hanging in water. Many emulsions are used for local treatment. Due to the low viscosity of the emulsion compared to the hot bitumen used, the emulsion has good penetration and distribution capacity.

In this case mixing the soil with bitumen emulsion for installation does not work well and quick setup is not easy to work with soil. So here we use the cationic medium setting emulsion as the main stabilizing agent. In cationic emulsion the emulsifier used is a long chain amine. Bitumen bulbs are well charged due to the cover of the NH3 + group which is built near the bitumen droplets and provides emulsion stability through electrostatic repulsion. and that is why the emulsion is called cationic. The bitumen emulsion is used in gravel soil in different percentages 0%, 2%, 4%, 6% & 8%. and various tests were performed to find the effect of bitumen emulsion.

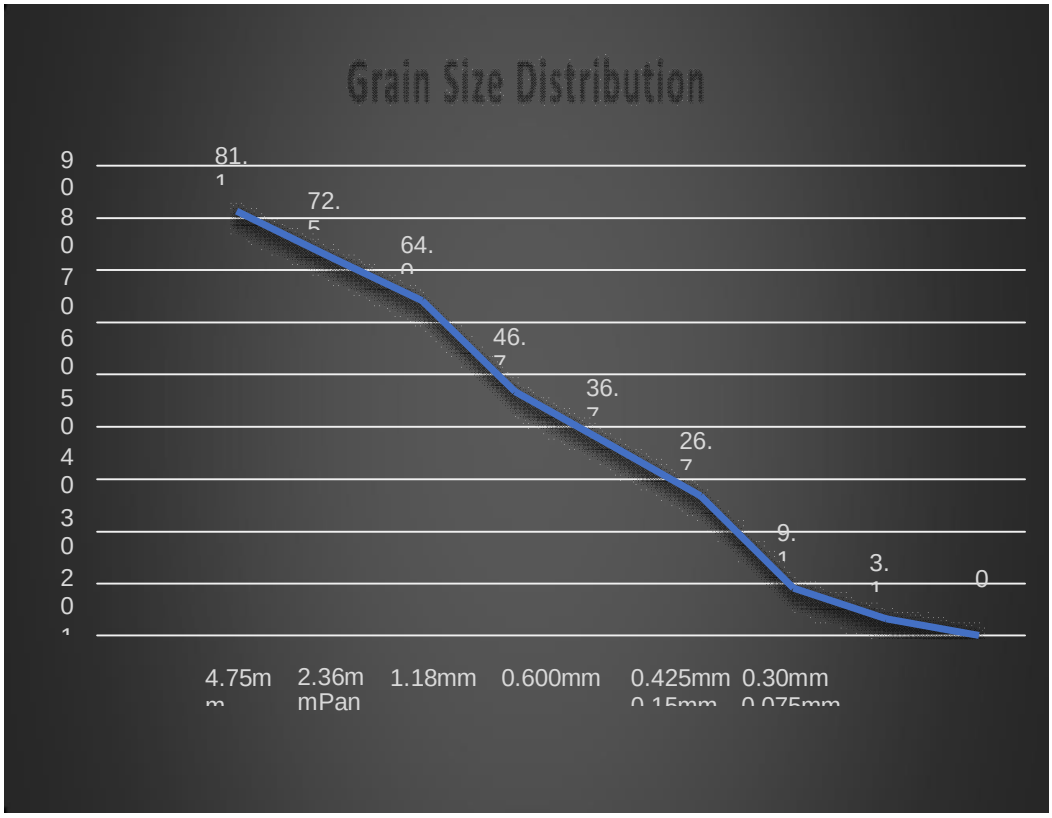
The following tests were conducted:-

1) Grain Size
2) Liquid Limit and Plastic Limit Test
3) Proctor Test (Light weight and Heavy weight test)
4) California bearing ratio test (CBR Test)
5) Specific gravity test

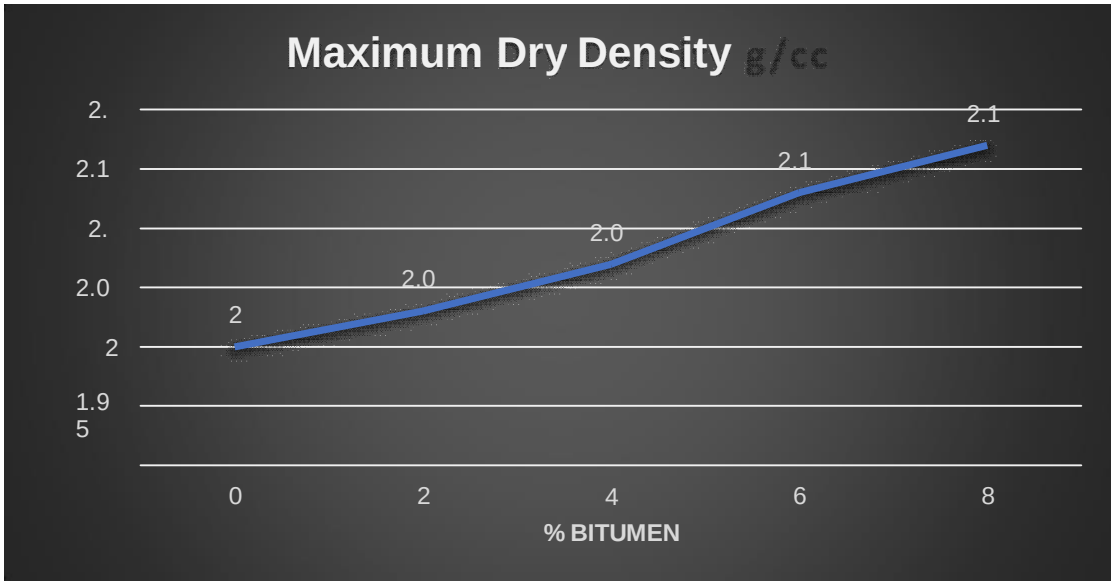
V. RESULTS

In this chapter, the experimental results are presented and discussed.

1) The Specific Gravity of soil sample taken (G) = 2.5.
2) Grain Size Distribution



3) Maximum Dry Density



4) California bearing Ratio (CBR) Test results

Penetration in (mm)	Load (kN)			
	2% Bitumen Emulsion	4% Bitumen Emulsion	6% Bitumen Emulsion	8% Bitumen Emulsion
2.5 mm	2.34%	4.75%	6.40 %	9.14 %
5 mm	2.33%	4.54%	5.40%	9.0%

VI. CONCLUSIONS

1) The To study the effect of addition of bitumen emulsion in soil on MDD and OMC relationship different percentages of bitumen emulsion is added and adjusted.
2) The addition of 2% bitumen emulsion gives CBR values as 2.35% and 2.33% for soaked tests at 2.5mm and 5.0mm penetration respectively.
3) The addition of 4% bitumen emulsion gives CBR values as 4.75%and 4.54% for soaked tests at 2.5mm and 5.0mm penetration respectively.
4) The addition of 6% bitumen emulsion gives CBR values as 6.4% and 5.4% for soaked tests at 2.5mm and 5.0mm penetration respectively.
5) The addition of 8% bitumen emulsion gives CBR values as 9.14% and 9% for soaked tests at 2.5mm and 5.0mm penetration respectively.
6) The best results are obtained when the soil is left for soaking after mixing with bitumen.
7) The soaked CBR values of soil samples increases considerably with addition of bitumen emulsion as compared to the normal soil.
8) The stabilization of gravel soil with bitumen emulsion gives better strength to subgrade soil in pavement design.

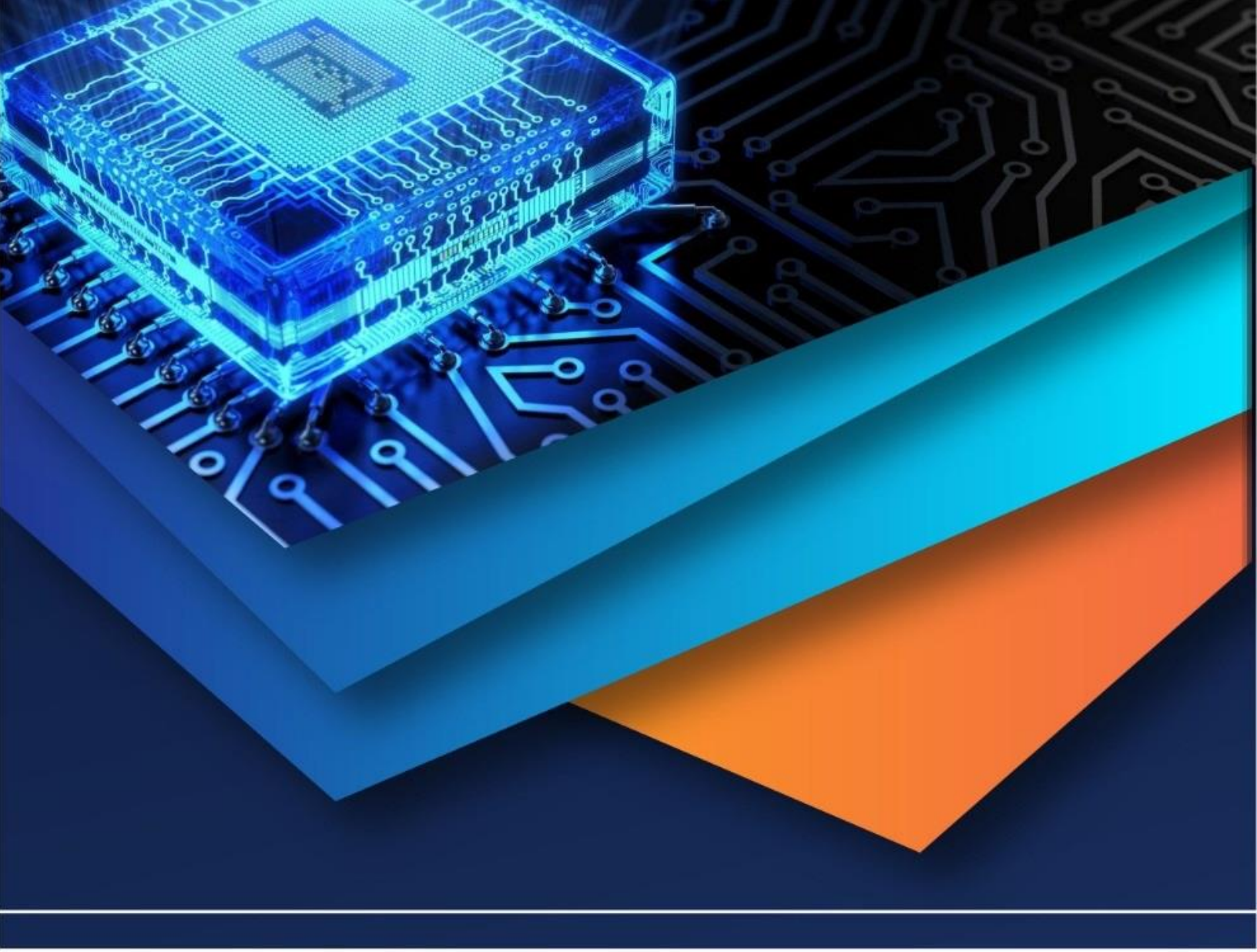
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