A Review Study on Stabilization of Soil Sub grade by Adding Stone Dust

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***Abstract*—The weakest soil is very problematic base for any infrastructure development. It is not suitable for subgrade material for highways and railways. This is also not suitable for high-rise buildings. For avoide this problem the stability of this soil is required. There are so many options available in nature to stabilize this soil like lime, cement, flyash etc. Stone dust is one of the best options which is type of solid waste. Sub grade is the lower most layer known as sub base for any consltruction work which is most useful for any development over that type of soil. Such type of soil sub grade should be capable strong to carry load coming from the upper layer. The best way to eliminate these problems is to make use like stone quarry dust waste. Keep in mind regarding this study is to be conducted on locally available soil sample by mixing with stone dust in certain proportion. There are so many methods used for the stabilization of soil to improve quality of the weak soil. To enhance the bearing capacity and shear strength of that soil by using stone dust. Keeping this in view an experimental study was conducted on locally available soil by mixing it with Stone Dust. Many stabilization techniques are adopted to improve the stability and bearing capacity of soil. To enhance the properties of weak soil by conducting experiments required for this soil mix with stone dust upto 30%.**

***Index Terms*—Stone dust, SPT, UCS etc.**

I. INTRODUCTION

The leading industrial and fast-growing infrastructure developmentd required construction of highways and railways with their embankments. Also, so many other civil engineering infrastructures works increase day by day. Therefore problematic soil and construction activities, waterlogging areas , landfill problem are to be facing such problems.These soils having stability problem such soils as soft clays like black cotton soil and other weak soils which is required treatment to remove these problems by improving their bearing capacity and settlement behavior.The construction of different types of railways and roads, runways over these soils , stabilization of soil is required the pollfoundation or base is affecting the stability of the proposed structure. Any infrastructure development project required the strong sub base for stable structure. The construction of any civil structures required stability of the soil to enhance bearing capacity and shear strength of sub base material. This study properly based on stability of weak soil by usling stone dust. The mix of stone dust with soil upto 30 %. The construction of roads, highways, runways over these soils affect its stability. The development with growth of urbanization and industrialization leads to more structural development and roads infrastructure and ultimately they demand for good soil conditions to be used as the strong foundations, but expansive soils are more problematic for construction purposes and are generally available to a large extent in various regions of the world, including Argentina, Zimbabwe, China, Mexico Cuba, Ethiopia, India, Iran, Japan, Morocco, Spain, United States of America, Ghana, Myanmar, Australia, Oman, Saudi Arabia, South Africa, Sudan, Turkey, Canada, Venezuela, Israel and Brazil.[2] Traditional ways to deal with such type of soil were to replace the available problematic soil, that appeared to be more complicated because of high costs as well as due to the environmental reasons. Due to shrinkage and swelling nature of sub soil the pavement gets damaged it will cost heavy expenditure for repair. In recent year's lot of experimental studies have been carried out on improvement of sub-grade soil,

increasing the strength of the pavements and embankments to take heavier loads as well as widening and renewal of roads. The present work is aimed to assess the improvement in gradation. Atterberg's limits compaction characteristics, specific gravity, and CBR values on different samples with varying percentage of stone dust to original soil. The stone dust is added by percentage of weight to the dry soil sample for these properties of soils and properties of stone dust available from nearby stone crushing plant are found out. Due to their inability to be affected by vertical displacement, highway embankments and highways are largely unaffected by expansive soils. (Mowafy and colleagues, 1985) A structure or pavement reduces the amount of surface evapotranspiration, which in turn reduces the amount of rain, floods, leaky water or sewage lines, or other sources of moisture. These soils' mineral makeup is the root cause of this issue. Many soils, particularly those rich in the clay mineral montmorillonite (a smectite), show signs of this kind of behaviour. Expansive soils and unsaturated soil mechanics must be studied in depth in order to understand and solve these issues. For finding potentially expanding soils, there are numerous relevant relationships. They may also be identified visually. It's possible that visual cues are (Wayne et al., 1984); 1. Dry-season wide and extensive shrinkage fractures; 2. 2. When dry, soil is brittle, but when wet, it becomes stiff and sticky. 3. Expansion of soil causes damage to nearby buildings. The present study carries to assess the best utilisation of stone dust in highway or foundation or railway subbase with enhanced properties of weak soil. This study properly conducted to evaluate the properties of parent soil and stone dust. After that the proper mix of stone dust with soil upto 30 % to check the properties of mix soil is how much improved over parent soil. This sample used for experimental works as of stone dust is 0% to 50% in multiple of 10 to modification in the mix samples. The present paper deals with the study to be carried out to assess utilization of stone dust in road, highway construction the experimental program consisting of evaluating firstly the properties of original expansive soils collected from different location and the stone dust collected from same locations for modifications of soils. The modification is required for particular soil to improve the performance of weak soils in terms of Shear strength and bearing capacity of soil.

II. REVIEW OF LITERATURE

The improvement of soil by addition of different admixtures has been carried out by different researchers. But fewer statistics have been published on the geotechnical properties of soil that is reinforced by Waste Stone Dust (WSP). [4] Conducted the standard compaction test, Atterberg's limit tests and California bearing ratio test by adding with the blend of stone dust and lime in percentage of 6% and 1%, respectively in the soil sample and study revealed the fact that CBR value of soil was improved up to 26%. Moreover, Stone dust addition to week soil increases the shrinkage limit, angle of internal friction, maximum dry density and decreases the Atterberg's limits, soil cohesion and optimum moisture content.[5] Performed various tests including compaction test, plasticity test and strength tests by adding different percentages of stone powder on the soil that was basically gravelly in nature and he came to know that by mixing soil with stone dust, CBR value was increased and plasticity was decreased and soil was able to meet the specifications of morth as sub base material only by addition of stone dust up to 25-35%. [6] Carried out the tests like liquid limit, plastic limit, unconfined compressive test, California bearing ratio, and standard compaction test on soil by blending lime and waste stone powder mix as an admixture and found remarkable results. For CBR test 1% lime plus 6% stone powder and for UCS 7% lime and 6% stone powder have shown distinctive effect on strength properties. [7] Introduced the experimental test results of the examination of impact of fly ash and stone dust blending in various percentages and by the addition of 20%-30% of admixture, controlled the swell index of expansive soil and marked improvements in various properties of soil, and inferred that blend of stone dust and fly ash is more efficient than fly ash and stone dust alone in soil reinforcement.

Soil stabilization methods are as

A. Mechanical method of Stabilization

In this procedure, soils of different gradations are mixed together to obtain the desired property in the soil. This may be done at the site or at some other place from where it can be transported easily. The final mixture is then compacted by the usual methods to get the required density.

B. Additive Method of Stabilization

It refers to the addition of manufactured products into the soil, which in proper quantities enhances the quality of the soil. Materials such as cement, lime, bitumen, fly ash etc. are used as chemical additives. Sometimes different fibers are also used as reinforcements in the soil. The addition of these fibers takes place by two methods;

Many studies are carried out for the soil stabilization. Chandra et al 2015- In this study rice husk is added in soil for increase the stabilization of the soil. By this bearing capacity and CBR value of the soil are increased. Deepiya et al 2016- in this study used the marble dust for increasing the soil bearing capacity. Marble dust makes soil more stabiles. Kumar et al 2017 – Black cotton soil is more swelling and shrinkage property by adding water and load carrying capacity are low of black soil. So, it makes more loads carry capacity added dust practical.

III. DESIGN METHODOLOGY

SPT Test Standard protector test are carried out for the soil. Size of the Test Specimens Standard size of mould taken and soil fill in 3 layers in the mould by tamping 25 blows of each layer by tamping rod. Then soil sample is taken from the mould water content is determined for this soil. Then with the help of formula maximum dry density is calculated p_d = p//(1+w) Here p_d = Maximum dry density w= water content in the soil UCS Test Unconfined compassion test is carried out for the clayed soil by adding different portion of kota stone that is in Initially add 2% of Kota stone check the unconfined compressive strength of clayed soil. Now further percentage of kota stone will be increase that is added 4% and next sample increase 6%, 8%, 10% and 12 % added. And each mix unconfined compression strength is calculated

IV. OBJECTIVES OF THE STUDY

The study on use of Kota stone in clayey soil conducting laboratory test are carried out. The main objectives of study are:

1. To increase the bearing capacity of sub grade soil by adding Kota stone dust 2. To determine the maximum dry density of clayey soil by adding different percentage of Kota stone slurry.
3. To determine the unconfined compression strength of soil by adding varying percentage of Kota stone dust
4. To determine the optimum moisture content of soil sub grade.

The purpose of this research was to study that Kota stone how much effective to increase the load carrying capacity of soil sub grade when it added in clayey soil because large percentage of lime are available in stone dust.

V. CONCLUSION

Based on the studies carried out following are the conclusions drawn:

1) Liquid limit can be decreased by adding stone dust since stone dust have less liquid limit. Similarly plastic limit may also be decreased for the same reasons.
2) Plasticity index also reduces thereby plasticity characteristics of soil is decreased. This intern's increases the usefulness of soil as highway sub-grade material since soils representing higher ranges of plasticity is not considered suitable good for bearing moving loads.
3) Stone dust a product from crusher unit consists of mainly sand size particles and is having good C.B.R. value.
4) Thus, the stone dust itself can be considered as a good sub base material. Hence it can be used for construction of road embankment
5) From the compaction studies out on stone dust, it is found that the maximum dry density and optimum moisture content relationship is fairly flat at peak values.

Hence the variation in water content as compared to optimum moisture content leads to marginal change in maximum dry density.

6) In soil by addition of stone dust showed considerable increase in maximum dry density and considerable reduction in optimum moisture content.
7) The information based on the studies carried out will be useful for the design and construction of sub grade, embankment and structural fills for utilization of stone dust as a stabilizing agent.
8) Stone dust has high specific gravity and the CBR value for standard compaction is more.

9) This indicates that stone dust can be used as an embankment material, backfill material for the lower layer of sub base. Also reuse of this waste material is economically advantages and does not bring any environmental hazards.
10) As the CBR value of stone dust is more, the crust thickness of flexible pavement is less and it is economical in construction of road, highways

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