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Effect of Lime and Glass Powder on Properties of Regur Soil

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***Abstract*— Nowadays, considerable attention has been paid to the utilization of alternative materials, which bear higher engineering quality than traditional materials and are financially affordable. Soil is the most important material used in variety of construction material like earth dam and earth canal. The fact that the soil may provide all the resistance characteristics necessary for a project. Hence the importance of various methods used to improve soil quality. Soil stabilization is the process for altering the engineering properties of a soil. The main purpose of stabilization is to increase the strength of soil and also to make the project economical by making the best use of the locally available materials. Regur soils have less compressive strength, high swelling, high shrinkage characteristics and low in CBR value. So we can used glass powder and lime powder to improve properties of regur soil.**

Keywords: Regur Soil, Glass Powder, Lime Powder, Soil Stabilization

I. INTRODUCTION

Regur soils with high content of clay particles are found very weak and they cannot be used as foundation layers or as a construction material. Different methods are adopted to stabilize these types of soils to suit the specifications of construction industry. Glass powder and Lime powder were used to study the effect on the properties of Regur soil. Glass powder primarily contains silicon dioxide (SiO_2), calcium oxide (CaO), & Sodium oxide (Na_2O) which increase the bearing capacity of soil. When lime powder is inorganic mineral. It contains calcium oxide (CaO) & calcium hydroxide ($Ca(OH)_2$). Which gives bond between soil & glass powder. The main objective of this paper is to determine the improvement in engineering properties of Regur soil under varying percentage of glass powder and lime powder. An improvement in the strength properties of Regur soil by use of glass powder and lime powder will help to find application for waste material to improve the properties of Regur soil and can be used as a better stabilizing agent.

A. REGUR SOIL:

Regur soils are found in lava-covered areas of Maharashtra, Saurashtra, Northern Karnataka, etc. The word "**regur**" originates from the Latin "**regurgitare**" which means "**to overflow**" .It is black in colour and ideal for growing cotton. It is commonly known as "black cotton soil" as they are perfect for growing cotton. This type of soil is typical of the Deccan trap (Basalt) region spread over North-West Deccan plateau and is made up of lava flows. Five characteristics of this soil are as follow: 1) it is black in colour. 2) It is used for growing cotton. 3) It is made up of fine clayey material with a high moisture retention capacity. 4) It is rich in soil nutrients like calcium carbonate, magnesium, potash and lime, but poor in phosphoric content. 5) It develops deep crack during hot weather, helping in proper aeration of the soil.

B. NATURE OF REGUR SOIL:

Expansive clay is a clay soil that is prone to large volume changes (swelling and shrinking) that are directly related to changes in water content. Soils with a high content of expansive minerals can form deep cracks in drier seasons or years; such soils are called vertisols. Soils with smectite clay minerals, including montmorillonite and bentonite, have the most dramatic shrink-swell capacity.

Mitigation of the effects of expansive clay on structures built in areas with expansive clays is a major challenge in geotechnical engineering. Some areas mitigate foundation cracking by watering around the foundation with a soaker hose during dry conditions. This process can be automated by

International Journal of Engineering Research & Technology (IJERT)
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Vol. 8 Issue 07, July-2019

a timer, or using a soil moisture sensor controller. Even though irrigation is expensive, the cost is small compared to repairing a cracked foundation. Admixtures can be added to expansive clays to reduce the shrink-swell properties, as well.

C. REGUR SOIL IN INDIA:

The Regur or Black Cotton soils of India seem to be members of the same great soil group as the Houston Black and Houston series of Texas, on the basis of field studies by the author in the Deccan plateau in 1951. Similarities between the soils on the separate continents are evident in morphology, contents of organic matter, clay minerals, carbonate content and distribution, and the high coefficients of expansion and contraction upon wetting and drying. Like Houston Black clay, the Regur soils are widely used for cotton, although much greater acreages of the soils, with a total area equal to that of the Corn Belt, are devoted to sorghum, pearl millet, pulses, and other food crops. Agricultural production is largely dependent upon animal power and human labour, with little benefit from products of heavy industry such as tractors, fertilizers, insecticides, and the like. Yield levels for most crops are low as compared to those in the United States, although yields have been stable at these low levels for centuries. Higher levels of production will require substantial changes in the agricultural arts and in the technological and industrial resources available to and used by the cultivators of the Regur soils.

D. SOIL STABILIZATION:

Soil stabilization a general term for any physical, chemical, biological or combined method of changing a natural soil to meet an engineering purpose. Improvements include increasing the weight bearing capabilities, tensile strength, and overall performance of in-situ subsoil, sands, and other waste materials in order to strengthen road surfaces. However, recent technology has increased the number of traditional additives used for soil stabilization purposes. Such non-traditional stabilizers include: Polymer based products (e.g. cross-linking water-based styrene acrylic polymers that significantly improves the load-bearing capacity and tensile strength of treated soils), Copolymer Based Products, fiber reinforcement, calcium chloride, and Sodium Chloride. Soil can also be stabilized mechanically, for example, using geogrids or geocells, which are a 3D mechanical soil stabilization technique.

Principles of the soil stabilization:

- Evaluating the soil properties of the area under the consideration.
- Deciding the property of soil which needs to altered to get the design value and choose the effective and the economical method for the stabilization.
- Design the stabilized soil mix sample and testing it in the lab for intended stability and durability of the values.
- Soil stabilization may also result in following changes like, increase in strength, reducing the sensitivity of the strength to environmental changes, reduce frost susceptibility.

E. GLASS POWDER:

Glass is used in many forms in day-to-day life. It has limited life span and after use it is either stock piled or sent to landfills. Since glass is non-biodegradable, landfills do not provide an environment friendly solution. Hence, there is strong need to utilize waste glasses.

Table 1 “Chemical Composition of Glass Powder”

Chemical Composition	(Glass) Powder % by Mass	(Cement) Powder % by Mass
SiO_2	67.330	29.30
AL_2O_3	2.620	3.95
Fe_2O_3	1.420	2.75
CaO	12.450	30.12
MgO	2.738	2.078
Na_2O	12.050	10.02
K_2O	0.638	0.562
ZrO_2	0.019	0.009
ZnO	0.008	0.010
SrO	0.016	0.022
P_2O_5	0.051	0.065

Glass Powder includes the expansion of broken glass powder to soil in order to enhance its engineering performance. Glass is absolutely idle and in this manner non-biodegradable. It degrades in a manner similar to natural rock. As a dormant development material, it can expand the quality of different street building components. Glass has been investigated as a substitute total in asphalt concrete. Squashed glass has additionally been utilized as a stabilizer for sub-base. Glass is a formless non crystalline material, which is ordinarily fragile and optically straightforward. The commonplace sort of waste glass materials are drinking vessels and windows, in any case, the majority of the promptly accessible waste glass material is pop lime glass made out of around 75% silica ($Si0_2$), Na_2O, CaO and a few added substances.

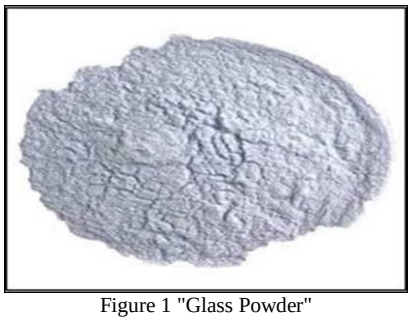

Figure 1 "Glass Powder"

F. LIME POWDER:

Lime powder is a calcium containing inorganic mineral in which oxides, and hydroxides prevail. In the strict sense of the term, lime is calcium oxide or calcium hydroxide. It is likewise the name of the characteristic mineral CaO which happens as a result of coal crease fires and in modified limestone xenoliths in volcanic eject. These materials are as yet utilized as a part of expansive amounts as building and designing materials (counting limestone items, bond, cement, and mortar), as synthetic feedstock’s, and for sugar refining, among different employments. Lime businesses and the utilization of a significant number of the subsequent items date from ancient circumstances in both the Old World and the New World. Lime is utilized widely for wastewater treatment with ferrous sulphate.

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Figure 2 "Lime Powder"

The stones and minerals from which these materials are inferred, normally limestone or chalk, are made basically out of calcium carbonate. They might be cut, squashed, or pounded and artificially changed. Consuming (calcination) changes over them into the exceptionally acidic material quicklime (calcium oxide, CaO) and, through ensuing expansion of water, into the less scathing (yet unequivocally basic) slaked lime or hydrated lime (calcium hydroxide, Ca(OH)2), the procedure of which is called slaking of lime. Lime furnaces are the ovens utilized for lime consuming and slaking. At the point when the term is experienced in a horticultural setting, it ordinarily alludes to agrarian lime, which is smashed limestone, not a result of a lime oven. It is most commonly slaked lime, as the quick setting of lime is usually described specifically as quicklime.

II. LITRATURE REVIEW

Soil stabilization means alternation of soil properties to meet the specified engineering requirements. With the same intention literature review is undertaken on utilization of solid waste materials for stabilization of soil and their performance.

1. **Ankit Jain et al (2016),** "**Effect of Lime on Index Properties of Black Cotton Soil".**
   They concluded that an addition of 4% lime decreases the liquid limit. They have added various percentage of lime into soil by its weight. After that they have found that liquid limit of soil decreases from 67.49% to 52.01% with increase in lime content up to 8% after that there is no significant change with increase in lime content. Differential free swell decreases from 60% to 14% with increase in lime content. (Jain, 2016)

2. **Mahendra Mapariet al (2014),** "**Stabilisation of Black Cotton Soil with Lime and Geo-grid".**
   They made rectangular Block of Black Cotton soil (200mm×100mm×100mm), reinforced and unreinforced with geo-grid for performing various tests like liquid limit, plastic limit, compressive strength etc. They content to compressive strength of Black Cotton soil blocks increases. It is observed that, for 15% addition of lime with geo-grid reinforcement the percentage increased in compressive strength was highest.

3. **Parth D. Daxini et al (2014), "Analysis of Engineering Properties of Black Cotton Soil and Stabilization Using Lime".**
   They used hydrated lime and quicklime for soil stabilization. If quicklime is used, the design lime contents determined here in for hydrated lime should be reduced by 25%. Specifications for quicklime and hydrated lime may be found in ASTM c 977. They concluded as per the atterberg's limit determined the liquid limit, plastic limit, plastic index, activity of soil.

4. **Hemalatha A. et al (2017), "A Study on Behaviour of Black Cotton Soil with Glass Power and Saw Dust".**
   They used glass power and saw dust in black cotton soil. Soil with different ratio of glass powder and saw dust mixed. And Geotechnical properties like plastic limit, liquid limit, specific gravity, optimum moisture content, maximum dry density, cohesion and California bearing ratio of black cotton soil with 5% saw-dust and 12.5% of glass powder as contaminant is represented.

5. **A.Mohammed et al (2015), "Effect of Waste Glass on the Strength Characteristic of Cement Stabilized Expansive Soil".**
   The study investigates the suitability of using waste glass as admixture to cement stabilized black cotton for roads fills and embankment. The soil is stabilized with 0, 2, 6, and 8% cement and 0,5,10 and 20% waste glass by weight of dry soil. Laboratory tests were carried out using the standard proctor, compactive efforts, California bearing ratio, unconfined compressive strength (UCS), and compaction characteristics tests to evaluate the effectiveness of waste glass on ordinary Portland cement (OPC) stabilized black cotton soil. The peck 7 day UCS values of 1152 KN/m^2 was obtained of 8% OPC and 20% waste glass. The results indicate that there is a potential in the use of waste glass as admixture to strengthen black cotton soil.

6. **S. Srikanth Reddy et al (2018), "Lime Stabilized Black Cotton Soil and Brick Powder Mixture as Sub base Material".**
   They used lime as a stabilizer material in black cotton soil Stabilized black cotton soil and brick powder mixture as sub base material in flexible pavement. The mixture of 20% brick powder and 80% lime stabilized black cotton soil under study resulted in increase in the CBR value by about 135% in comparison with lime stabilized black cotton soil.

7. **Ankit Singh Negi et al (2013), "Soil Stabilization Using Lime".**
   They represent the soil stabilization using lime with 3 to 10 % of the weight of the soil. The main objectives of the soil stabilization is to increase the bearing capacity of the soil. Lime acts immediately and improves various property of soil such as carrying capacity of soil resistance to shrinkage during moist conditions, reduction in plasticity index, and increase in CBR value and subsequent increase in the compression resistance with the increase in time.

III. METHODOLOGY

There are several most popular mechanical, physical and chemical alterations for remedial measures or stabilization of expansive soils. This involves excavation of the expansive soil and replacement with non-expansive material, where the depth of active zone (depth from ground surface wherein seasonal

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

moisture fluctuations occur) is small and where a suitable replacement material is available.

A. Mechanical methods of soil stabilization

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

B. Physical methods of soil stabilization

In physical alteration, granular material is mixed with the expansive clay to minimize heave. However, permeability of the resulting blend would be more than that of the expansive soil resulting in a faster ingress of the water into the soil.

C. Chemical alteration of soil stabilization

Chemical alteration, involves addition of chemicals to expansive clay to reduce heave by altering the nature of the expansive clay minerals (Chen, 1988). Lime treatment of expansive soils is the well-known to all engineers over the world as also most widely used technique and the most effective technique of chemical alteration to minimize volume changes and to increase the shear strength of foundation expansive soils.

Addition of calcium chloride ($CaCl_2$) to expansive soil has also proved the efficacious in altering the swelling properties of the soil. Calcium chloride is a hygroscopic material and hence, is pre-eminently suited for stabilization of the expansive soils, because it absorbs water from the atmosphere and prevents shrinkage cracks occurring in the expansive soils during summer. Addition of calcium chloride to expansive soils reduced Plasticity Index (PI), free Swell Index (FSI %), swell potential and swelling pressure, significantly.

Addition of Gypsum, to prevention and correction of the sodality, include greater stability of soil organic matter, more stable soil aggregates, improved water penetration into soil, and more rapid seed emergence. Gypsum improves the ability of the soil to drain and not become waterlogged due to a combination of high sodium, swelling clay, and excess water.

Crude Oil should be sprayed on top surface of the roads as it helps in the lubrication of surface layer with the aggregates. It should be preferred over water as its density is much higher than that water.

D. Additive methods of soil stabilization

It refers to the addition of the 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 the different fibers are also used as reinforcement in the soil.

E. DIRECT EXPERIMENTS METHODS

In this project, the project has conducted various experiments to find the stabilization of the black cotton soil.

1. FREE SWELL INDEX TEST:

Free Swell Index is the increase in volume of a soil, without any external constraints, on submergence in water.

Table 2 “Classification of Soil”

Degree of expansiveness	**DFS, %**
Low	< 20
Moderate	20 to 35
High	35 to 50
Very high	>50

2. SPECIFIC GRAVITY TEST:

Table 3 “Specific Gravity Range”

Sand	2.63 - 2.67
Silt	2.65 - 2.7
Clay and silt-clay	2.67 - 2.9
Organic soil	< 2.0

Specific gravity of a substance denotes the number of times that substance is heavier than water. In simpler words we can define it as the ratio between the mass of any substance of a definite volume divided by mass of equal volume of water. Different types of soil have different specific gravities, general range for specific gravity of soils are given in Table 3.

The specific gravity of soil is the ratio between the weight of the soil solids and weight of equal volume of water. It is measured by the help of a volumetric flask in a very simple experimental setup where the volume of the soil is found out and its weight is divided by the weight of equal volume of water.

3. LIQUID LIMIT:

Liquid limit is defined as the moisture content at which soil begins to behave as a liquid material and begins to the flow. The importance of liquid limit test is to classify the soils. Different soils have varying the liquid limits. Also, once must use the plastic limit to determine its plasticity index.

From the results of liquid limit the compression index may be estimated. The compression index value will help us in settlement analysis. If the natural moisture content of soil is closer to liquid limit, the soil can be considered as soft if the moisture content is lesser than liquids limit, the soil can be considered as soft if the moisture content is lesser than liquid limit. The soil is brittle and stiffer.

4. PLASTIC LIMIT:

Plastic limit is defined as the moisture content and expressed as a percentage of the oven dried soil at which the soil can be rolled into the threads one eighth inch in the diameter without the soil breaking into pieces.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

Table 4 "Different Soil Classification System"

First Or Second Latter	Definition
G	Gravel
S	Sand
M	Silt
C	Clay
O	Organic
P	Poorly Graded (uniform particle sizes)
W	Well Graded (diversified particle sizes)
H	High plasticity
L	Low plasticity

5. SHRINKAGE LIMIT:

As the soil loses moisture, either in its natural environment, or by artificial means in laboratory it changes from liquid state to plastic state to semi-solid state and then to solid state. The volume is also reduced by the decrease in water content. But, at a particular limit the moisture reduction causes no further volume change. A shrinkage limit test gives a quantitative indication of how much moisture can change before any significant volume change and to also indication of change in volume. The shrinkage limit is useful in areas where soils undergo large volume changes when going through wet and dry cycles (e.g. earth dams)

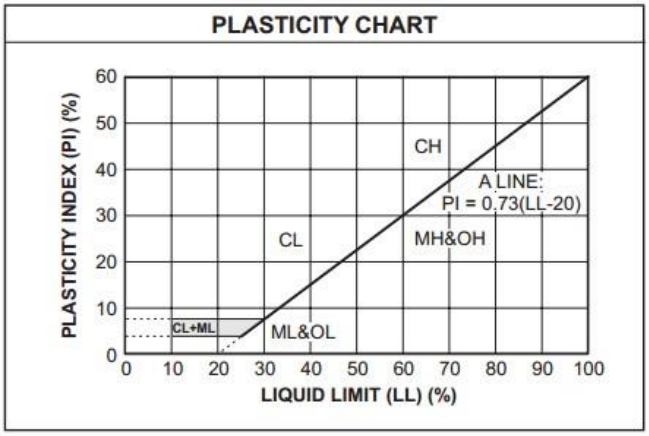

Figure 3 "IS Soil Classification"

6. UNCONFINED COMPRESSION TEST:

It is define as the ratio of failure to the c/s area of the soil sample, if it is not subjected to any lateral pressure.

It is not always possible to conduct the bearing capacity test in the field. Sometimes it is cheaper to take the undisturbed soil sample and test its strength in the laboratory. Also to choose the best material for the embankment, one has to conduct strength tests on the samples selected. Under these conditions it is easy to perform the unconfined compression test on undisturbed and remoulded soil sample.

$$Qu = \frac{load}{Corrected\ Area\ (A)}$$

7. PROCTOR COMPACTION TEST:

Compaction test of soil is carried out using Proctor's test to understand compaction characteristics of different soils with change in moisture content. Compaction of soil is the optimal moisture content at which a given soil type becomes most dense and achieve its maximum dry density by removal of air voids. Determination of the relationship between the moisture content and density of soils compacted in a mould of a given size with a 2.5 kg rammer dropped from a height of 30 cm. the results obtained from this test will be helpful in increasing the bearing capacity of foundations, decreasing the undesirable settlement of structures, Control undesirable volume changes, Reduction in hydraulic conductivity, Increasing the stability of slopes and so on.

8. CALIFORNIA BEARING RATIO (CBR) TEST:

The California bearing ratio (CBR) is a penetration test for evaluation of the mechanical strength of natural ground, subgrades and base courses beneath new carriageway construction. It is the ratio of force per unit area required to penetrate a soil mass with standard circular piston at the rate of 1.25 mm/min. to that required for the corresponding penetration of a standard material.

$$CBR\ Value = \frac{Penetration\ load * 100}{Standard\ load}$$

IV. RESULT ANALYSIS

A. *PRESENTATION OF RESULT:*

The expansive soil used in the investigation has been collected from Astan near Bardoli, Gujarat. Laboratory investigation has been carried out to determine the engineering properties of Regur soil with GP and LP. It is not preferable to compact expansive soil under heavy compaction conditions as it results in higher swelling. So, compaction characteristics of the soil have been evaluated from the light compaction test preferred by IS: 2720 (Part-7) – 1983. Unconfined compressive test (UCS) is determined on soil samples passing through 425 micron IS sieve as to know the potential effect of differential percentage of Glass powder and Lime powder on strength and shrinkage characteristics of soil. Free swell index has been determined as the ratio of difference of the volume of pure soil in distilled water and in kerosene, expressed as percentage. The specific gravity of the fresh soil has been determined. In this work, the different percentage of GP and LP filler material to evaluated as potential stabilizer in enhancing strength and volume change properties of soft, organic, highly plastic and expansive soil applications.

Physical and engineering properties of Regur soil were determined conducting various laboratory experiments. A laboratory program was conducted to investigate the effects on physical and engineering properties of the Regur soil with the addition of various percentage of GP and LP are used.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

B. ANALYSIS OF ENGINEERING PROPERTIES OF SOIL:

Table 5 "Geotechnical Properties of Regur Soil"

Index and Engineering Properties	Result
Free Swell Index (%)	70
Specific Gravity	2.56
Liquid Limit (%)	59.15
Plastic Limit (%)	29.78
Shrinkage Limit (%)	15.74
IS Soil Classification	CH
Unconfined Compressive Strength (kn/m^2)	90.780
Proctor Test	
• Maximum Dry Density (gm/cc)	1.589
• Optimum Moisture Content (%)	22.1
California Bearing Ratio	
• Unsoaked (%)	8.84
• Soaked (%)	2.26

C. EVALUATION OF GlASS POWDER AND LIME POWDER ON ENGINEERING PROPERTIES OF REGUR SOIL:

*Notation for the Graph *

A	12%GP + 8%LP
B	10%GP + 8%LP
C	8%GP + 8%LP

1. DIFFERENTIAL FREE SWELL INDEX:
The purpose of free swell is to determine the swell potential of the soil. As see in Graph, at addition of 10% Glass powder and 8% Lime powder into Regur soil, a Minimum swelling is noted, which equal to 35%.

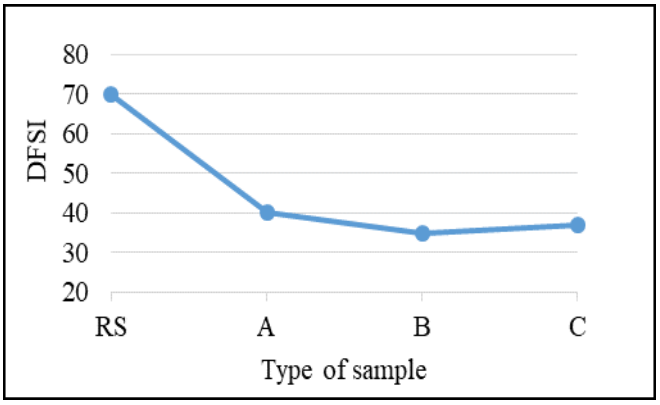

Figure 4 "Differential Free Swell Index"

2. LIQUID LIMIT:
Liquid Limit of Regur soil is decrease, when addition of Glass Powder and Lime Powder in soil. As see in graph, at addition 10% of GP and 8% of LP into Regur soil, a minimum liquid limit is noted, which is equal to 49.231%.

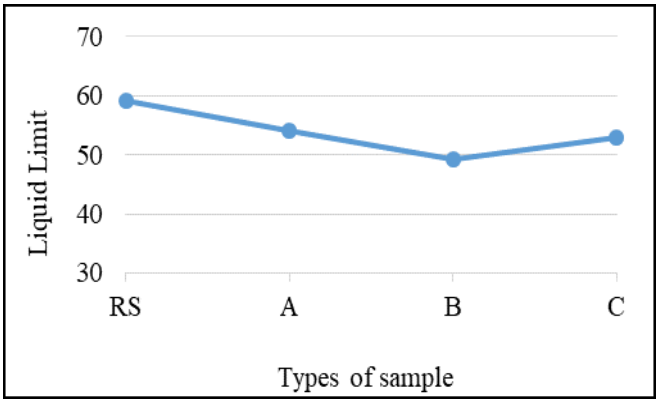

Figure 5 "Liquid Limit"

3. PLASTIC LIMIT:
Plastic Limit of Regur soil is increase, when addition of Glass Powder and Lime Powder in soil. As see in graph, at addition 10% of GP and 8% of LP into Regur soil, a minimum Plastic limit is noted, which is equal to 33.095%.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

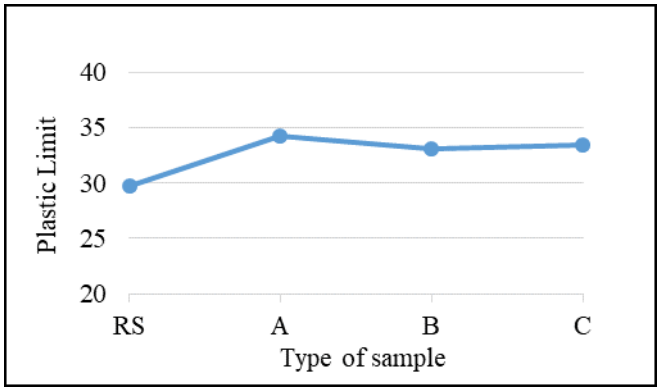

Figure 6 "Plastic Limit"

4. IS SOIL CLASSIFICATION:
After Addition of GP and LP Soil converted into CL from CH type.

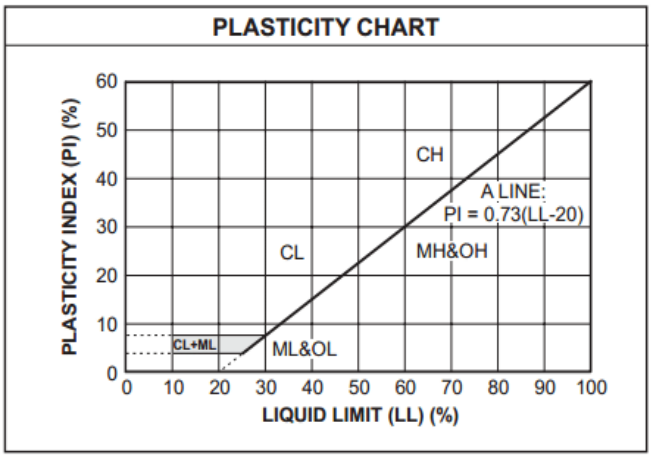

Figure 7 "Plasticity Chart"

5. COMPACTION (PROCTOR) TEST:

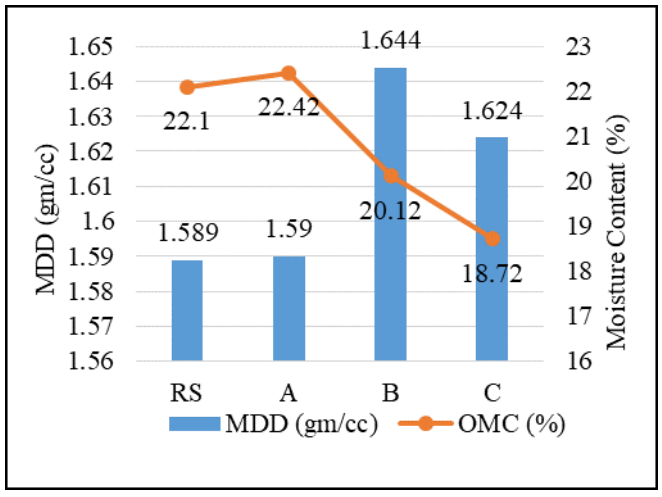

Figure 8 "OMC & MDD Graph for Addition of Various % of GP & LP"

Soil with 10% of glass powder and 8% of Lime powder was chosen for the treated soil compaction tests. Below Figure 16 shows the moisture-unit weight compaction curve for the untreated and treated soils respectively. The maximum dry density (MDD) and optimum moisture content (OMC) of pure soil was 1.589 gm/cc and 22.10% respectively. Maximum dry density can achieve at addition of 10% glass powder and 8% lime powder values 1.644 gm/cc. Values of maximum dry density and optimum moisture content found to be opposite in nature. Mean due to decrease in moisture content, value of dry density becomes maximum.

6. Unconfined Compressive Strength Test:
Unconfined Compressive strength of Regur soil is increase, when addition of Glass Powder and Lime Powder in soil. As see in graph, at addition 10% of GP and 8% of LP into Regur soil, a Maximum strength is noted, which is equal to 110.231 KN/sq. m.

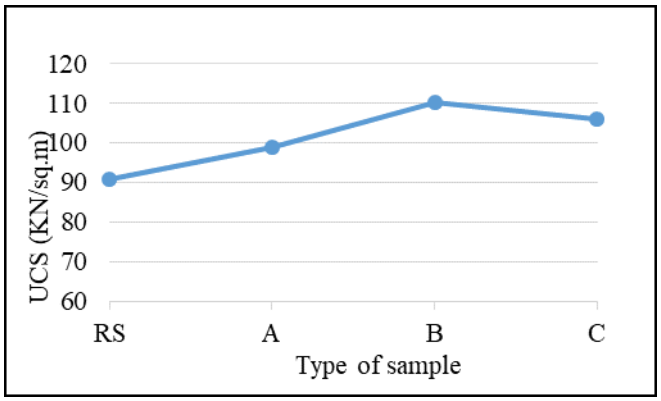

Figure 9 "Unconfined Compressive Strength"

7. California Bearing Ratio Test (Soaked):
C.B.R of Regur soil is increase, when addition of Glass Powder and Lime Powder in soil. As see in graph, at addition 10% of GP and 8% of LP into Regur soil, a Maximum C.B.R. value is noted, which is equal to 5.74%.

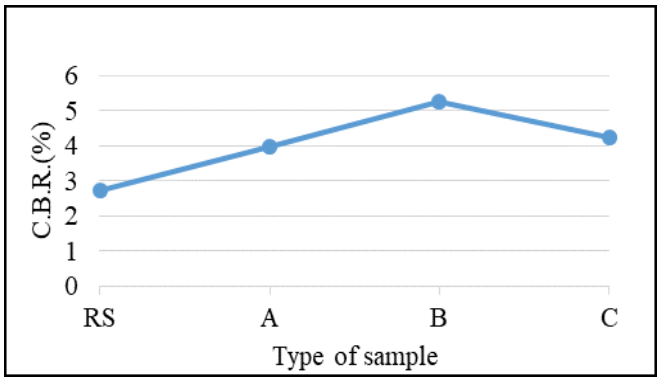

Figure 10 "C.B.R. (Soaked)"

8. California Bearing Ratio Test (Unsoaked):
C.B.R of Regur soil is increase, when addition of Glass Powder and Lime Powder in soil. As see in graph, at addition 10% of GP and 8% of LP into Regur soil, a

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

Maximum C.B.R. value is noted, which is equal to 13.57%.

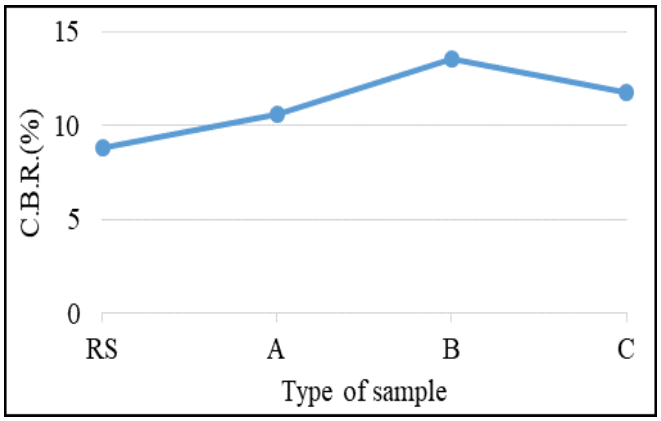

Figure 11 "C.B.R. (Unsoaked)"

V. SUMMARY

A. *EVALUATION CHARACTERISTICS OF REGUR SOIL WITH ADDITION OF GLASS POWDER AND LIME POWDER:*

Table 6 "Comparison of Properties of soil"

Index and Engineering Properties	RS	RS+ 10%GP+ 8%LP
Free Swell Index (%)	70	35
Specific Gravity	2.56	2.462
Liquid Limit (%)	59.15	49.231
Plastic Limit (%)	29.78	33.095
Shrinkage Limit (%)	15.74	11.841
IS Soil Classification	CH	ML
Unconfined Compressive Strength (KN/m^2)	90.780	110.231
Proctor Test		
• Maximum Dry Density (gm/cc)	1.589	1.644
• Optimum Moisture Content (%)	22.1	20.12
California Bearing Ratio		
• Unsoaked (%)	8.84	13.57
• Soaked (%)	2.26	5.74

Here in this paper, we adopt different percentage of Glass powder and Lime powder in Regur soil as 8%, 10% and 12%. It is concluded from the results of Regur soil properties with addition of 10% GP and 8% LP is best suitable to minimize swelling characteristics and plasticity index of soil. After addition of this material soil classification changes CH to CL type. Result of Differential free swell index of Regur soil with 10% Glass powder and 8% Lime powder is observed lowest as 35%. Maximum dry density and Optimum moisture content of pure expansive soil is observed 1.589 gm/cc and 22.1% respectively. However due to addition of 10% Glass powder and 8% Lime powder optimum result of compaction, MDD 1.644 gm/cc and OMC 20.12% concluded.

Unconfined Compressive strength of Regur soil is increase, when addition of Glass Powder and Lime Powder in soil. At addition 10% of GP and 8% of LP into Regur soil, a Maximum strength is noted, which is equal to 110.231 KN/sq. m.

C.B.R of Regur soil is increase, when addition of Glass Powder and Lime Powder in soil. At addition 10% of GP and 8% of LP into Regur soil, a Maximum C.B.R. value is noted, which is equal to 13.57%.Hence this soil used in subgrade material for highway designing purpose.

VI. CONCLUSION

From the above experiment, following conclusions can be drawn:

- Based on our research work, we may concluded that addition of Glass Powder and Lime Powder are suitable for increasing property of Regur Soil.
- Soil Stabilization using Glass Powder is better way to disposal of Glass instead of dumping glass in land.
- By performing experiment at varying percentage of Glass Powder and Lime Powder, we may concluded that Maximum property of regur soil for soil stabilization is achieved at 10% of Glass Powder and 8% of Lime Powder in Regur soil.

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