International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 09 | Sep 2022 www.irjet.net p-ISSN: 2395-0072

Stabilization of Lithomargic Soil by Using Different Additives

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Abstract – *Nowadays engineers are coming up with the important question of building on soils, to explain or describing about the loads withstanding with support the loads mislead administration during execution of projects or explanation with useful life of a product of the structure. In many parts of India, soil contain different and delicate portions particularly sediment element of the object. In this experimental investigation, the stabilization of soil starts with the selection of type of soil and collection of data about the particular soil which are required to stabilize the soil. Experiments were conducted to dictate the geotechnical features of the lithomargic soil and the tests are performed as per relevant codes. Changes in their properties have studied by blending the soil sample with silica fume, glass powder and quick lime powder and ends with the comparison on selected soil and the conventional soil.*

Key Words: Stabilization, Lithomargic soil.

1. INTRODUCTION

Soil is the important factor or part of a building structure which ultimate necessary for the infrastructure. The major task for the civil engineers is the design and explanation of embankments and basis on faint and unfavorable soil especially for organization engineer. The performance of the characteristics of the progressive soil mainly depends on the nature of the fines existed in the substance.

Lithomargic soil available at an insight of few meters below from the ground level and it is locally known as shedi soil. This shedi soil is very un-useful for structure use endeavor. The balance of slope stability on ground depends on this shedi soil.

The term stabilization is defined as the synthesizing and joining materials accompanying a soil to upgrade sure characteristics of the soil. The mechanism contains the integrating of soils to gain a sought step or joining of commercially free supplements may change the step, pattern or pliancy, or act as a cover for agreement of the soil.

1.1 OBJECTIVES

The main objectives of this study are as follows

- To study the change of geotechnical properties (such as CBR, Atterberg limits, permeability, bearing capacity, OMC and MDD, particle size distribution) of the Lithomargic clay before and after adding additives.
- To discuss the strength characteristics of soil after stabilization.

1.2 LITERATURE REVIEW

Many researches are under process for development of different type of soil to make uncapable soil to capable one with good bearing and withstand capacity for construction purpose.

Kalantari et al.[1] Examined the influence of utilizing waste stone powder and produce in sustaining earth soil in laboratory. The workshop tests that include Atterberg limits, grain size analysis, standard supervisor compaction tests, loose confining test and California bearing ratio tests. After the test the results shows that plasticity decreases with changing optimum liquid essence and also highest dry density of clay soil.

B. Michael et al. [2] Expressed his ideas about the preserving impact of grated glass on clay soil. Damaged glass powder used for adding to stabilized soil in variable dimensions like 1%, 2%, 5%, 10% and 15% in addition to 15% cement by pressure of the soil sample. The miscellaneous tests were completed. According to obtained results, the soil sample captured consented to group-6 soils acknowledged as fair to feeble soil type in agreements advantageous as leakage and substitute grade material.

2. RESEARCH METHODOLOGY

The stabilization of soil starts with the selection of type of soil and collection of data about the particular soil which are required to stabilize the soil with correct percentage of different additives and followed by different types of tests on particular soil and ends with the comparison on selected soil and the conventional soil the complete procedure is explained in the following flow chart.

Materials used: Lithomargic soil, Silica fume,

Basic Tests: Specific gravity, Grain size analysis test, Liquid test, Plastic limit, Standard Proctor test, Unconfined compression test, California bearing ratio test.

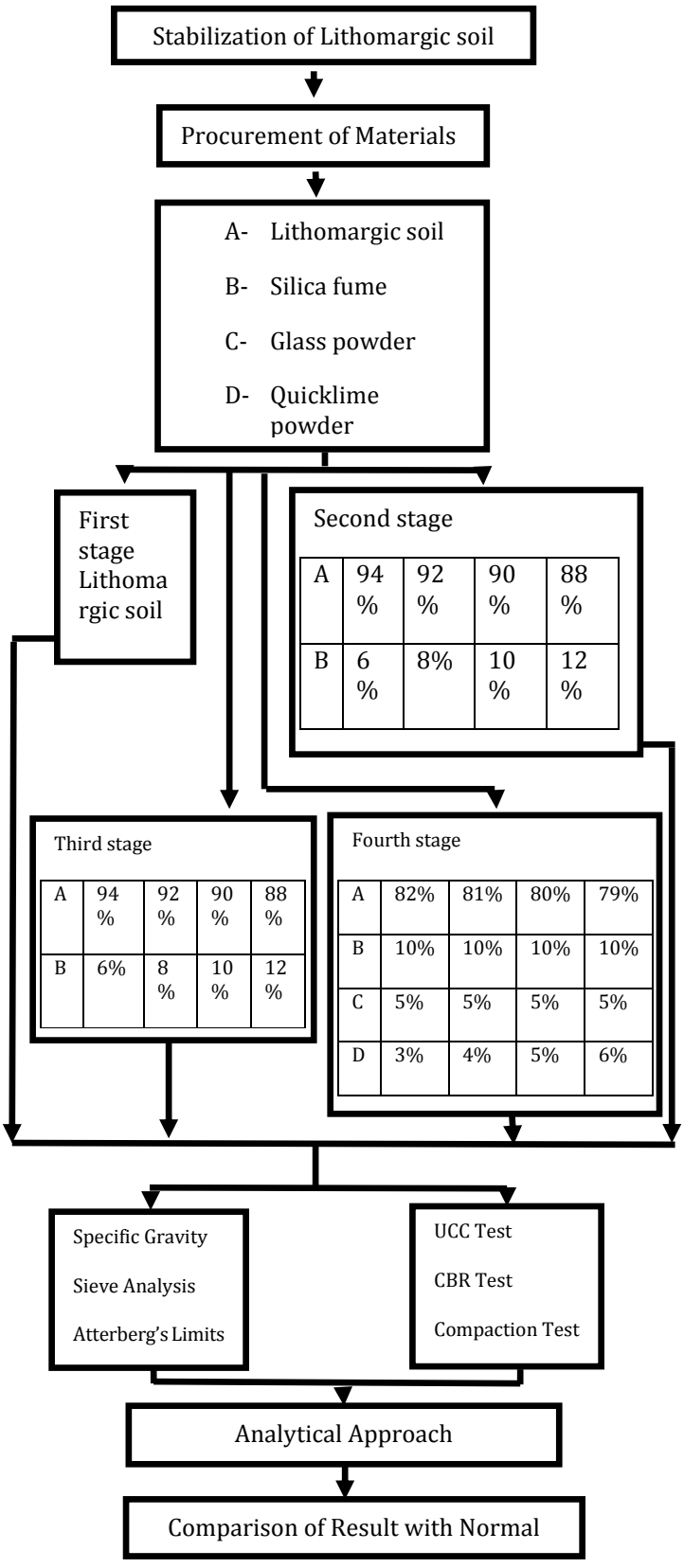

Fig-1: Stabilization of Lithomargic Soil

2.3. RESULTS AND DISCUSSION

2.3.1 Observation of Lithomargic soil: The clay accessed from the location proven to achieve different geotechnical features. The result is produced in the table 1. Different geotechnical features like grain magnitude distribution, specific gravity, consistency limit, compaction traits, shear substance components etc. are tabulated

Table -1: Basic geotechnical properties of Lithomargic soil

PARAMETERS	RESULT
GRAVEL%	25
SAND%	68
SILT AND CLAY %	18 & 14
COEFFICIENT OF UNIFORMITY (Cu)	16.207
COEFFICIENT OF CURVATURE (Cc)	0.69
TYPE OF SOIL	SANDY SOIL (Cu>6 and Cc<1)
GRADE	POORLY GRADED
SPECIFIC GRAVITY	2.76
OMC %	16
DRY DENSITY (g/cc)	1.64
CBR %	5.79
UCC (kg/cm2	0.1582
LIQUID LIMIT %	45
PLASTIC LIMIT %	16

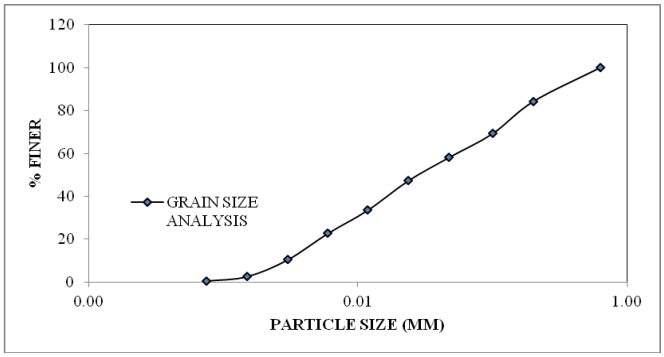

Chart -1: Grain Size Analysis for Lithomargic soil

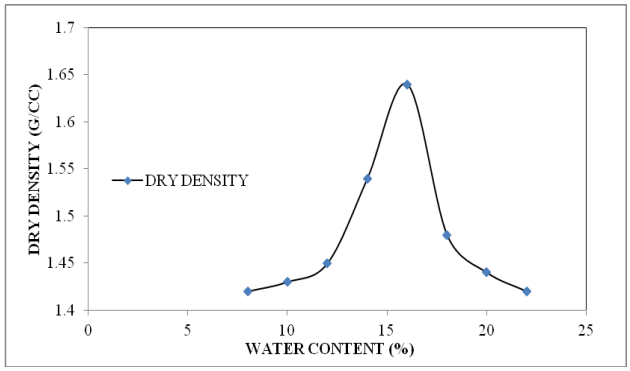

Chart -2: Compaction Curve showing OMC and MDD

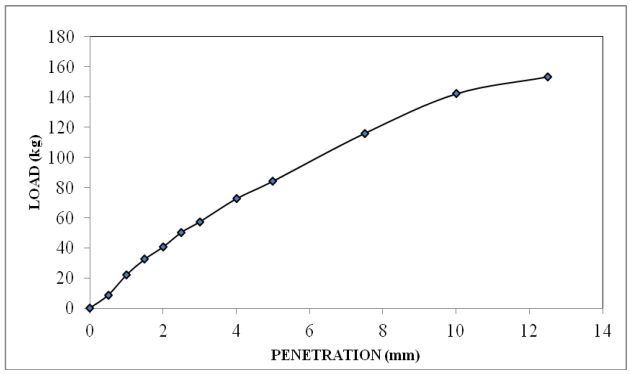

Chart -3: California Bearing Ratio (Unsoaked)

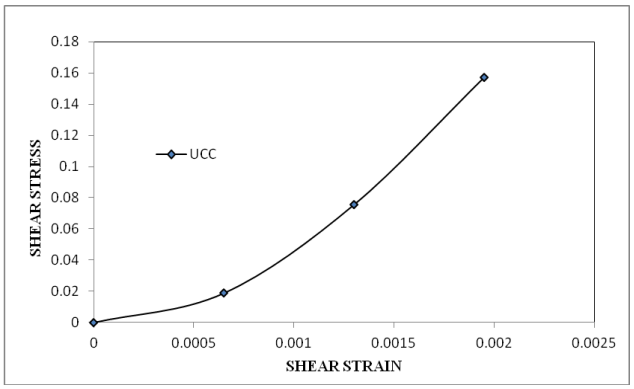

Chart -4: Unconfined Compression Curve

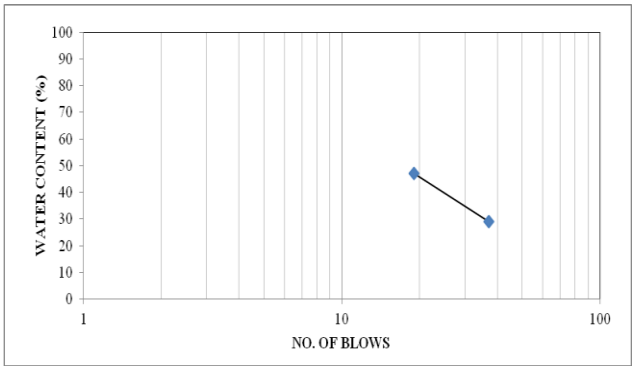

Chart -5: Liquid Limit

2.3.2 Observation of silica fume

a) Effect of Silica fume on Compaction Characteristics of Shedi soil: The accurate preliminary Programme has existed anticipate the determination compaction characteristics with an immediate effect for shedi soil with a various amount of silica fumes are given in the below table 2

The compaction test was conducted on Shedi soil alone and Shedisoil treated with various percentage of SF. The ultimate dry mass of Shedi soil separate found expected 1.64 g/cc and best moisture content 16%. On addition of different % SF to Shedisoil, the ultimate dry mass maximizes with the increases in SF percentage and decreases in optimum moisture content as SF percentage increases as shown in table 3 and figure 6,7,8,9 & 10

Table -2: Experimental Programme for Compaction characteristics shedi soil

Mixture	Test conducted
Shedi soil	Compaction
Shedi soil + 6% to 12 % SF	compaction

Table -3: Compaction Characteristics of Shedi soil with a different percentage of Silica Fume.

MIXTURE	OMC (%)	MDD(g/cc)
Shedi soil+6%SF	21	1.71
Shedi soil+8% SF	19.5	1.73
Shedi soil+10% SF	18.5	1.75
Shedi soil+12% SF	18.3	1.72

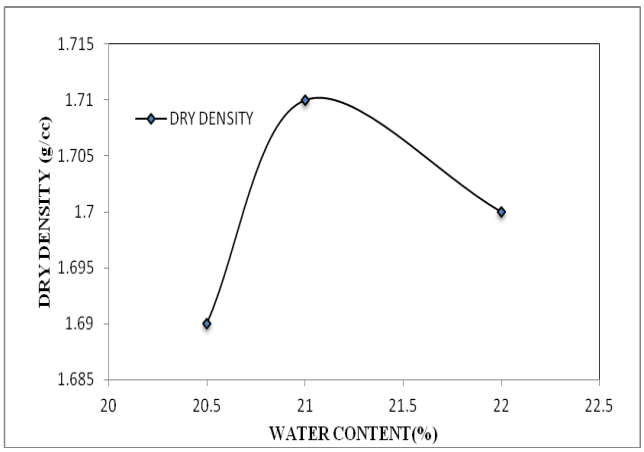

Chart -6: Compaction curve for shedi soil with 4%SF

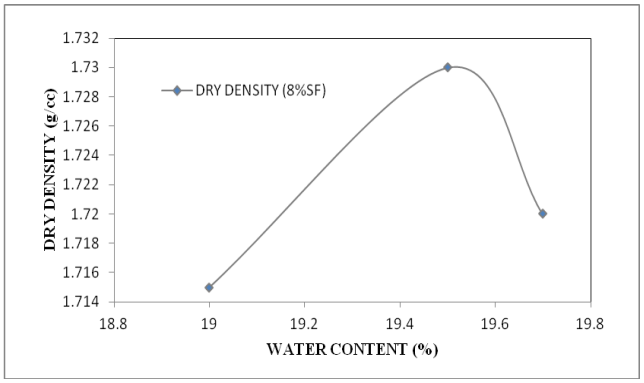

Chart -7: Compaction curve for shedi soil with 8% SF

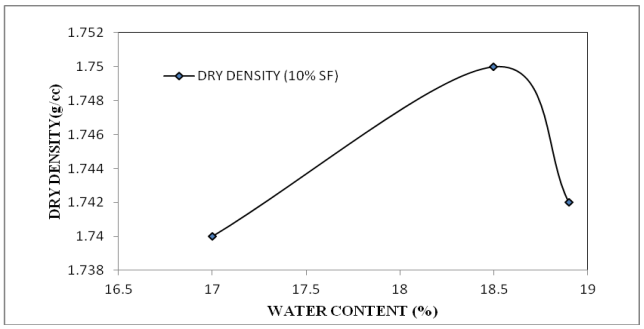

Chart -8: Compaction curve for shedi soil with 10% SF

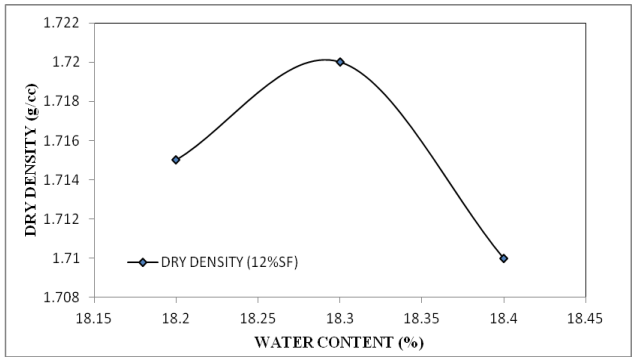

Chart -9: Compaction curve for shedi soil with 12% SF

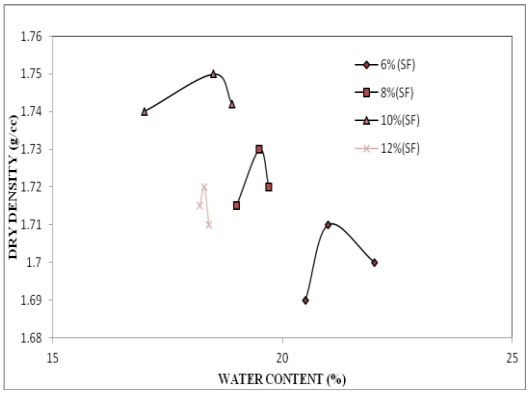

Chart -10: Comparison of Compaction Curve for different % of SF effects of Silica fume on strength

As seen from Table **1,** the loose compressive strength of Shedi soil unique on instantons experiment was 0.1582 kg/cm2 respectively. On addition of 6 % to 12 % of Silica fume to Shedi soil, the energy maximized up to 10 % of Silica fume additions on immediate testing.

Reducing in the power of Shedi soil acted with Silica fume further 10% addition is may be due to the form of the Shedi soil is agitated to a greater extent accompanying the increase of Silica fume. Hence, 10 % adding of Silica fume the Shedi soil has existed preferred as the optimum portion. The alternative of loose compressive strength of Shedi soil doctored with different quantity of Silica fume for next, are shown in Table 5& Figure 11,12,13 &14.

Table -4: Experimental Programme for strength characteristics Shedisoil.

Mixture	Test	Curing periods in days
Shedisoil + 6% to 12 % SF	UCS	Immediate

Table -5: Unconfined compressive strength of Shedisoil treated with various percentages of Silica fume

MIXTURE	UCS (kg/cm2)
SHEDI SOIL	0.1582
SHEDI SOIL+6%SF	0.178
SHEDI SOIL+8%SF	0.1924
SHEDI SOIL+10%SF	0.2505
SHEDI SOIL+12%SF	0.2325

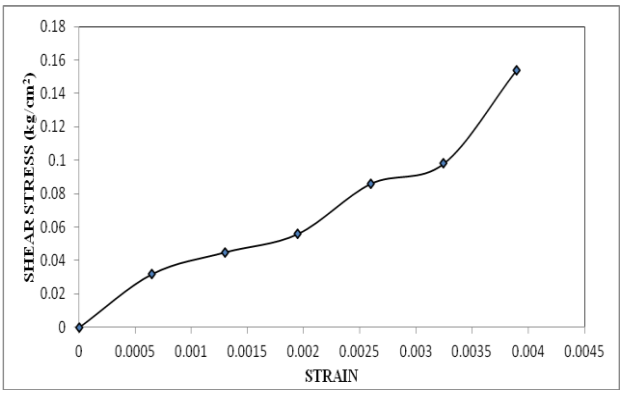

Chart -11: Stress Strain behavior shedi soil with 6% SF

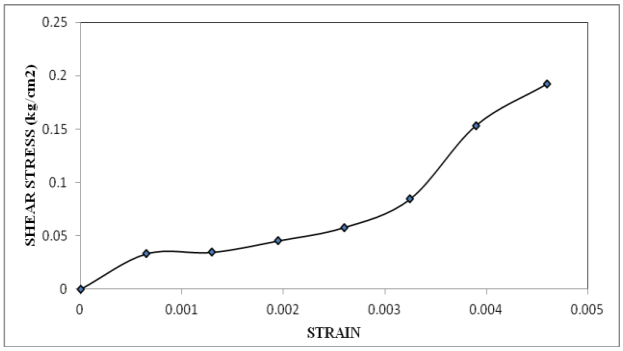

Chart -12: Stress Strain behavior shedi soil with 8% SF

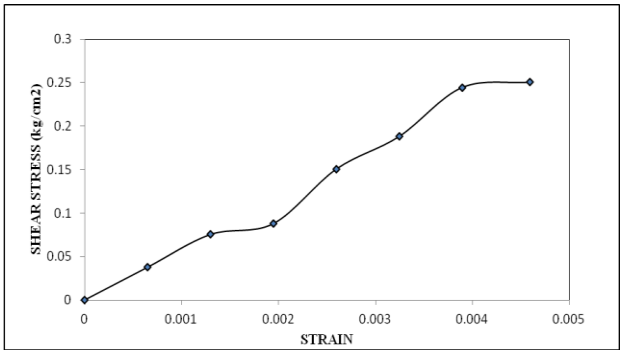

Chart -13: Stress Strain behavior shedi soil with 10% SF

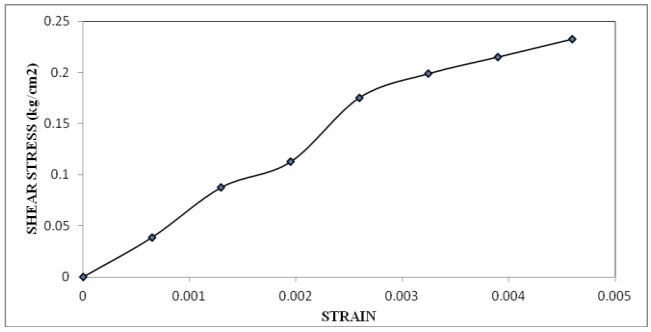

Chart -14: Stress Strain behavior shedi soil with 12% SF

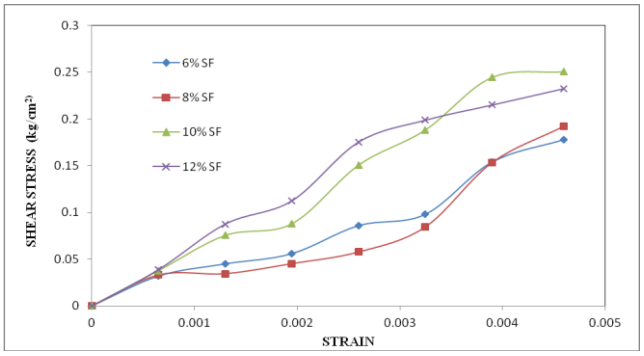

Chart -15: Unconfined Compressive Strength of Shedi soil acted with different % of SF impacts of Silica seethe on California bearing ratio:

Table -6: Experimental Programme for strength characteristics Shedi soil

MIXTURE	TEST	CURING PERIOD IN DAYS
Shedisoil + 6% to 12 % SF	**CBR**	Immediate

As seen from Table 5the CBR of Shedi soil alone on testing, it was 5.79%. On addition of 6 % to 12 % of Silica fume to Shedi clay, the CBR value increases up to 10% of Silica fume on recent testing.

The reduce in the CBR Value of Shedi soil considered with Silica fume beyond 10% addition of Silica seethe. Hence, 10 % addition of Silica fume to the Shedi soil has existed preferred as the best portion. The variation of CBR values in Shedi soil treated with various percentages of Silica fume for immediate, are shown in Table 7 and Figure 16,17,18&19.

Table -7:CBR Values with different % of Silica fume

COMBINATONS /PENETRATION (mm)	CBR VALUES	
	2.5	**5**
SHEDI SOIL	**5.79**	**4.98**
SHEDI SOIL + 6 % SF	**6.023**	**5.820**
SHEDI SOIL + 8 % SF	**6.34**	**6.258**
SHEDI SOIL + 10 % SF	**7.28**	**7.10**
SHEDI SOIL + 12 % SF	**6.9**	**6.864**

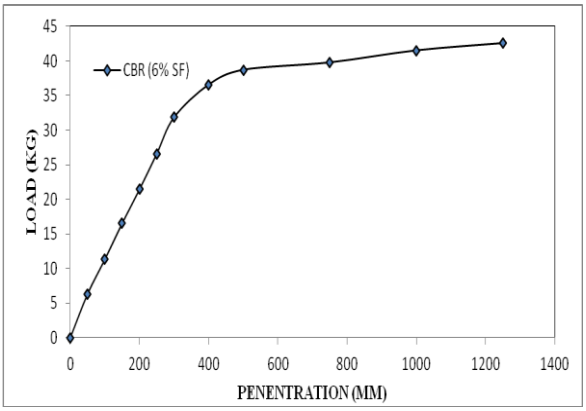

Chart -16: California Bearing Ratio (Unsoaked)

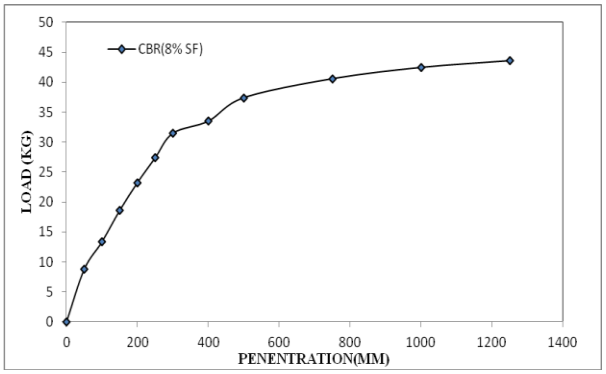

Chart -17: California Bearing Ratio (Unsoaked)

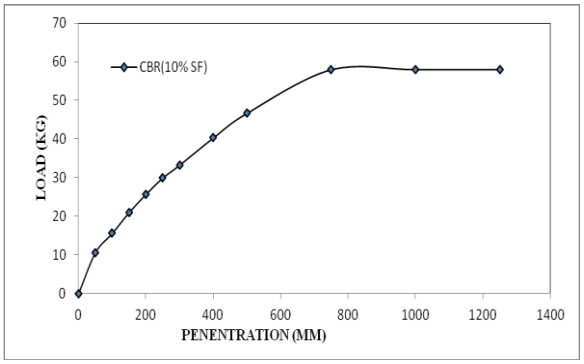

Chart -18: California Bearing Ratio (Unsoaked)

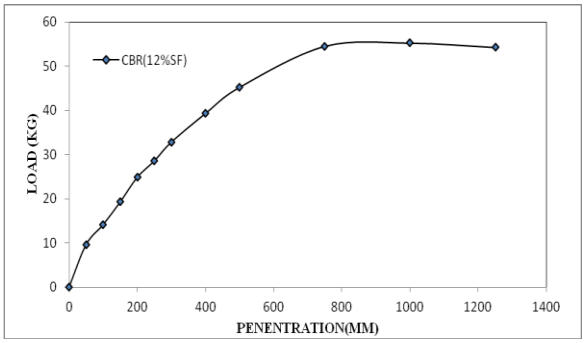

Chart -19: California Bearing Ratio (Unsoaked)

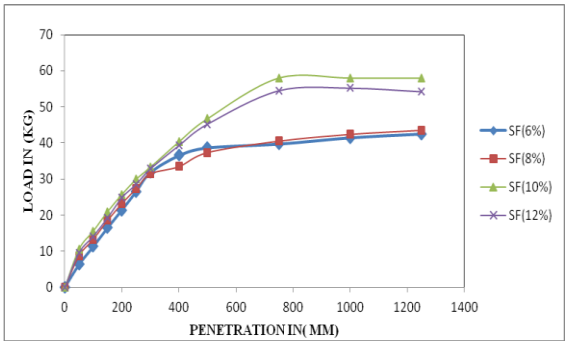

Chart -20: California Bearing Ratio (Unsoaked)

3. CONCLUSIONS

Depend up on the results, discussions and detailed analysis of the data obtained from the exploratory outcomes the subsequent decisions have been drawn,

- The increase in SF percentages to the shedi soil, which in turn improves the strength, increases dry density and also improves the shear strength. Thus, use of silica fume will be beneficial to lithomargic soil in improving their soil properties.

- Inclusion of various percentage of Silica seethe, to Shedi Soil, strength (0.2505kg/cm2) and CBR value (7.28%) increases up to 10% due to pseudo-cohesion or friction of Silica Fume thereafter strength decreases. Hence, 10% Silica seethe was deliberate as best.

- The stress-strain curve become to a greater extent confined and shows materialistic behavior with higher stress carrying capacity at lower strain rate. When it reaches to peak stress the failure of the samples compacted at dry of optimum are brittle in nature.

3.1 FUTURE SCOPE

- The Shedi soil preserved with Silica fume can be used as a sub grade material for construction of flexible pavements in country roads with depressed traffic capacity.

- For laying economical local pavements, lightly intoxicated buildings like residential constructions which are not in addition to 2 floors the substitute of clay soil with admixtures may be decided apiece builder.

- The consolidation characteristics of soils can be found by replacing Silica fume.

- The Silica fume can be replaced with a different aspect ratio for different types of soils.

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