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Stabilization of Clayey Sand (SC) Type of soil using Cement

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Abstract — ***For enhancement of the material characteristics we have to use some stabilizing agent with various doses. The main objectives of the soil stabilization is to increase the compressive strength of soil and bearing capacity also. Due to stabilizing agent mixing with soil, there is an improvement in soil charecterstics such as Liquid limit, Plastic limit, Maximum Dry Density, Permeability, etc.***

This Sc type of soil stabilized with 2% Cement, 4% Cement, 6% Cement, 8% Cement. The compressive strength of cube made out of soil-cement Mixture at 6% cement in 2.5N/mm^2.Further increase in cement content to 8% does not yield any improvement in the compressive strength of the cube. So 6% cement is optimum percentage of cement which give good compressive strength.

Keywords- Stabilization of soil; Cement; Liquid Limit; Plastic Limit; Standard proctor test; Cube Compressive Strength.

I. INTRODUCTION

In Geotechnical engineering there are problematic soil such as soft soil and expansive soil, so we have to improve it. The problematic soil is improved with replacing the soft soil with good quality material or using chemical stabilization for enhanced the material characteristics.

Stabilization is the process of stabilizing agent mixing with soil to improve the problematic soil characteristics such as strength, Durability, Volume change, swelling, shrinkage, Characteristic strength etc.

Mostly soft soil has a major volume change due to change in moisture content. This problem is also solving using chemical stabilization. Stabilizing agent is also used for sub grade layer in road or pavement construction.

The various chemicals are used as stabilizing agent.

- Lime stabilization
- Fly ash stabilization
- Lime/ Fly ash stabilization
- Cement stabilization
- Fly ash stabilization
- Cement/Fly ash stabilization

II. LITERATURE REVIEW

At present literature study, using stabilizing agent like Rice husk ash, Non pozzolanic Fly ash, pozzolanic Fly ash, Lime, Cement mixed with non-expansive soil, and expansive soil – Black cotton soil to understand Geotechnical properties of soil.

Mihirvora, Ankit patel, Mohammad SoyabSaikh :

In this research author has used Rice husk ash as a stabilizing agent to understand geotechnical properties of soil. In this study various test are conducted, i.e. standard proctor test, Cube compressive strength, Weathering effect – Spray test. After study they concluded that when proportion of RHA (Rice husk ash) was increased by 5%,10%,15% there was decrease in MDD while OMC was increased. The specific gravity of RHA was low as compared to Natural soil so there was reduction in UCS value. In research also conducted Spray test on 100% Natural soil and Soil + RHA with different percentage. It was observed that Natural soil sample disintegrated in 45 minutes while in increasing varying percentage of RHA, the sample was disintegrated in 20 to 30 minutes. There was reduction of cube compressive strength also. So addition of cement or lime is must require for stabilization of rammed earth.

LaxmikantYadu, Rajesh Kumar Tripathi, DhramveerSingh :

In this research author has used Rice husk ash and Fly ash as a stabilizing agent to understand geotechnical properties of Black cotton (BC) soil. The soil was stabilized with different percentage of FA (5%,

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8%,10%,12%,15%) and RHA (3%,6%,9%,11%,13%,15%). The author performed various test i.e. standard Proctor test, CBR test, Unconfined compressive strength. After study they are concluded that when RHA increase there was decrease in MDD while OMC increases, while these value decreases with addition of FA (Fly ash). The optimum amount of FA was determined as 12% while Optimum value of RHA was determine as 9%. The optimum amount of FA gives higher value of UCS (Unconfined compressive strength) and CBR value as compared to RHA. The study shows that FA is better additive as compared to RHA.

Dr. S. M. Prasannakumar:
In this research author has used Pozzolanic fly ash and non pozzolanic fly ash mixed with different percentage in Expansive soil – Black cotton soil, and Non expansive soil - Red soil to understand geotechnical properties soil. Due to silica component present in non pozzolanic fly ash, it reacts with cement. Similarly, lime is reacting with pozzolanic fly ash for stabilization of soil. The Geotechnical engineering properties like stabilization, Compressive strength, Compaction character for both soils have been studied in this work. Author concludes that Optimum percentage 40% of any ash gives high density of mixture. Also Cement as Secondary Additive added with Non pozzolanic fly ash gives Good stabilizing agent, while Lime as Secondary Additive added with pozzolanic fly ash gives Good stabilizing agent.

III. LABORATORY TEST LIST

Particle Size Distribution (IS: 2720, Part 4)

- Wet Sieve Analysis

Atterberg's Limit (IS: 2720, Part 5)

- Liquid Limit
- Plastic Limit
- Plasticity Index

Standard Compaction Test (IS: 2720 Part 7)

- Maximum Dry Density
- Optimum Moisture Content

Cube Compression test

- Strength after 7 day Curing
- Strength after 28 day Curing

IV. MATERIAL USED

In this Experimental Study, using SC type of soil and used stabilizing agent as Cement. SC type soil made by mixing with some percentage of Soil + Sand + Gravel.

Soil :-

Soil of Rozam Village of District Dahod in Gujarat is used for this Study.

Sand :-

As per IS classification size of particle range between 4.75mm to 0.75 micron.

Gravel :-

As per IS classification size of particle range between 10mm to 4.75 mm.

Cement :-

Portland Pozzolanic Cement (PCC) of Ultratech Brand.

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V. RESULT AND DISCUSSION

1 Grain Size Distribution:-

Soil Particle	Percentage
Gravel	**4%**
Sand	**42%**
Silt + Clay	**54%**

2 Atterberg's Limit :-

2.1 Liquid Limit :-

The Liquid limit of the soil using Varying percentage of Cement is given in Table 1 and Fig. 1.

Table 1: liquid limit values for soil with cement

% of Cement	Liquid Limit (%)
0	33.85
2	32.15
4	32.05
6	31.18
8	29.66

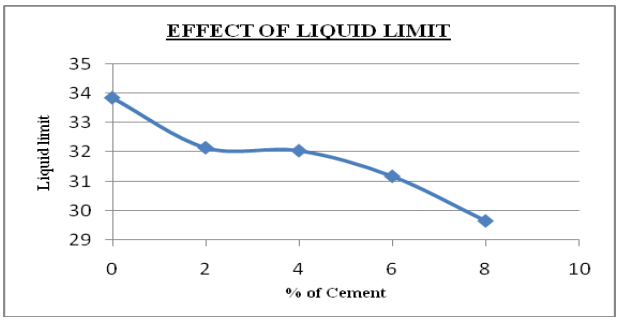

Fig. 1: liquid limit distribution curve for cement

2.2 Plastic Limit :-

The Plastic limit of the soil using Varying percentage of Cement is given in Table 2 and Fig. 2.

Table 2: plastic limit values for soil with cement

% of Cement	Plastic Limit (%)
0	24.00
2	23.56
4	23.50
6	23.23

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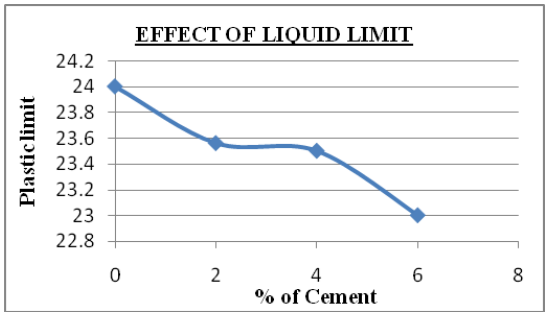

Fig. 2: plastic limit distribution curve for cement

2.3 Plasticity Index:-

The Plasticity index of the soil using Varying percentage of Cement is given in Table 3 and Fig. 3.

Table 3: plasticity index values for soil with cement

% of Cement	Liquid Limit (%)
0	9.85
2	8.59
4	8.55
6	8.18

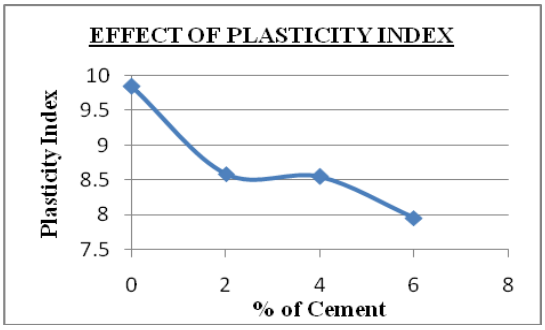

Fig. 3: plasticity index distribution curve for cement

3. Standard Proctor Test:-

The OMC and MDD of the soil using Varying percentage of Cement is given in Table 4 and Fig. 4.1 and 4.2.

Table 4: omd and mcc values for soil with cement

% of Cement	Maximum Dry Density (MDD) (g/cc)	Optimum Moisture Content (OMC) (%)
0	1.96	12.5
2	1.94	12.0
4	2.00	14.0
6	2.3	12.1
8	2.1	11.5

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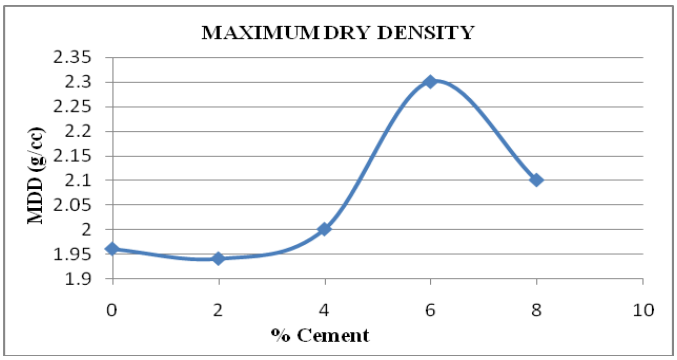

Fig 4.1: MDD distribution curve for cement

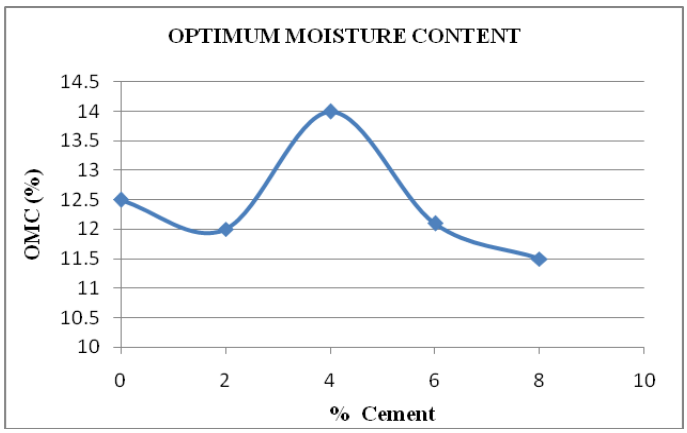

Fig 4.1: OMC distribution curve for cement

4. Cube Compressive Strength :-

The Cube Compressive Strength of the soil using Varying percentage of Cement is given in Table 5 and Fig. 5.

Table 5: compressive strength values for soil with cement

% of Cement	Cube Compressive Strength (N/mm^2)	
	After 7 day Curing	After 28 day Curing
0	0.50	0.85
2	0.56	0.95
4	0.70	1.2
6	1.65	2.50
8	1.65	2.50

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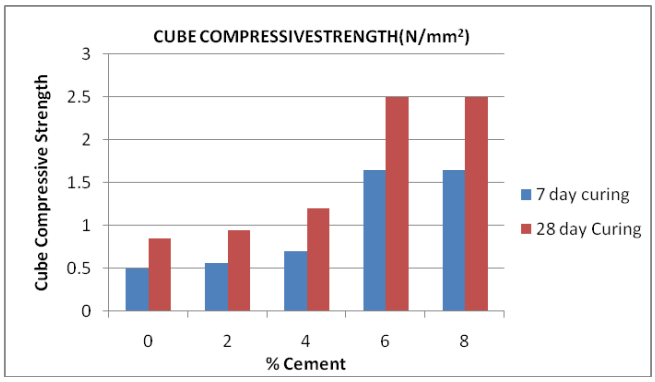

Fig. 5: compressive strength distribution curve for cement

VI. SUMMERY AND CONCLUSION

- From the Wet sieve analysis particle range is decided. Sand content 54% (<50%) So it's coarse grained soil. And Maximum dry density is of Unstabilized soil is also very high because of this.
- The graph 1, 2, 3 shows that when cement percentage is increased there is a Reduction in liquid limit, Plastic limit.
- Also the table 2 shows that at 8% cement mix with soil, the soil become a Non plastic soil.
- Table no.4 shows that after adding the cement content there is reduce in Maximum dry density.
- From table no. 5 we can says that 6% Cement mixed with soil gives Good compressive strength, and the MDD of 6% cement with soil is also high.
- From Fig.5 shows that, there is increase in compressive strength with increasing cement percent with soil.
- Further increase in cement content to 8% does not yield any improvement in the compressive strength of the cube. So 6% cement is optimum percentage of cement which give good compressive strength.
- After all the result performing test we conclude that Cement is good Stabilizing agent for Sc type of soil and 6% cement is optimum percentage for soil and also it give better compressive strength.

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