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Use of Non-Conventional Technique for Subgrade Improvement

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***Abstract*- The subgrade soil and its properties are important in the design of pavement structure. The main function of the subgrade is to provide sufficient stability under adverse climatic and loading conditions. The soil subgrade is a layer of natural soil prepared to receive the load of the layers of pavement materials placed over it. The loads on the pavement are ultimately received by the soil subgrade for dispersion to the earth mass. It means the pressure transmitted on to the top of the subgrade is within the allowable limit. It is essential that at no time, the soil subgrade is over stressed. The weak subgrade whether in cut or fill should be well compacted to utilize its full strength to economize the overall thickness of the pavement required. But in case this supporting layer does not come up to the expectations, the same is treated or stabilized to suit the requirements.**

Due to weak nature of soil, significant distress in the soil occurs, causing severe damage to the overlying structure. This type of soils are considered as a potential natural hazard, which if not treated well can cause damages to not only to the structures built upon them but also can cause loss of human life. Hence stabilization of black cotton soil is required to improve the strength of sub grade sub base and base layers of the pavement structure

I. INTRODUCTION

Satisfactory performance of road depends on the sub grade condition. If the sub grade soil consists of expansive soil or the soil, which swells after increase in water content and loses its strength, there by stability of the road pavement reduces. Soil reinforcement is an effective and reliable technique for improving strength and stability of soils. Also irrespective of the season, roads in India have invariably been observed to have puddles of water standing on the surface, regardless of whether or not they have been provided with a side trench. They are usually in a deplorable state, caused not only by rainfall, poor drainage but also by sewage accumulating on the surface. Reinforcing black cotton soil by a plastic gunny bags is of great importance in the field of road construction. The well-built and maintained roads play major role in the development of nation, if the weak subgrade of black cotton soil is stabilized or reinforced, the crust thickness will be less. The rutting is also restricted resulting in less repairs and overall economy. Use of plastic gunny bags in the subgrade assumes a great promise and comparatively easier for construction.

Expansive soils contain minerals such as smectite clays that are capable of absorbing water. When they absorb water they increase in volume. The more water they absorb the more their volume increase. Expansions of ten percent or more are not uncommon. This change in volume can exert enough force on a building or other structure to cause damage. Expansive soils will also shrink when they dry out. This shrinkage can remove support from buildings or other structure and result in damaging subsidence. Fissures in the soil can also develop. These fissures can facilitate the deep penetration of water when moist conditions or runoff occurs. This produces a cycle of shrinkage and swelling that places repetitive stress on structure The term soil stabilization means the improvement of the stability or bearing power of the soil by the use of controlled compaction, proportioning and or the addition of suitable admixture or stabilizer. The basic principles in soil stabilization may be stated as follows: 1. Evaluating the properties of the given soil. 2. Deciding the method of supplementing the lacking property by the effective and economical method of stabilization. 3. Designing the stabilized soil mix for intended stability and durability values. 4. Considering the construction procedure by adequately compacting the stabilized layers.

Reinforced soil is a composite construction material formed by combining soil and reinforcement. This material possesses high compressive and tensile strength similar, in principle, to the reinforced cement concrete. It can be obtained by either incorporating continuous reinforcement inclusions (for example, strip, bar, sheet, mat or net) within a soil mass in a definite pattern or mixing discrete fibers randomly with a soil fill before placement.

2. LITERATURE REVIEW

P. B. Ullagaddi, T.K.Nagaraj[1] says that investigation has been carried out with different thickness configuration of the two soils and three types of woven and non-woven geotextiles, having different physical and mechanical properties. Based on experimental work it infers that there is improvement in CBR Value and therefore increases bearing capacity.

Sarika B. Dhule and S.S.Valunjkar [2](2011) says that Geogrid +murrum –increase CBR value and factors affecting the compaction characteristics are shear strength and low permeability. CBR value depends upon degree of compaction. **A.K.Choudhary, K.S.Gill and J.N.Jha[3]** (2011) says that expansion ratio decreases when number of reinforcing layer is increased.CBR value increases by increasing number of reinforcing layer.

K. Rajagopal, S. Chandramouli, Anusha Parayil & K. Iniyan[4] says that by using geosynthetic material there is improvement in strength and stiffness and shows better performance under repeated loads(fatigue condition).Under monotonic loading, modulus improvement factor is higher. **Vaishali S. Gor L. S. Thakur Dr. K.R. Biyani[5]** concludes that by Addition of metakaolin, swelling pressure of black cotton soil reduces 17 | P a g e but further increment in the amount of metakaolin results in increase in swell pressure.

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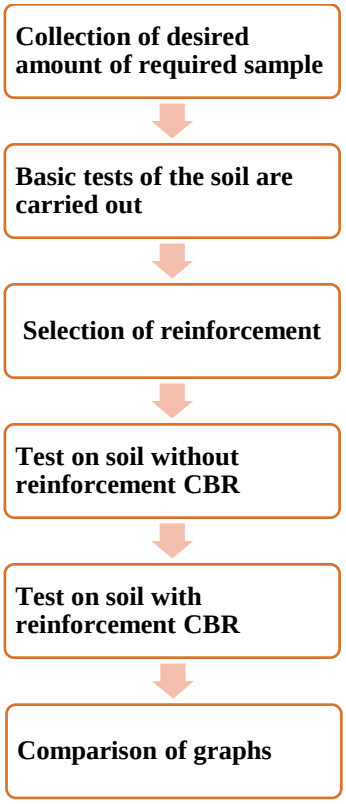
Increase in unconfined compressive strength has been noticed. Stabilised metakaolin expansive soil CBR value is higher compared to expansive soil without metakaolin.

3.METHODOLOGY

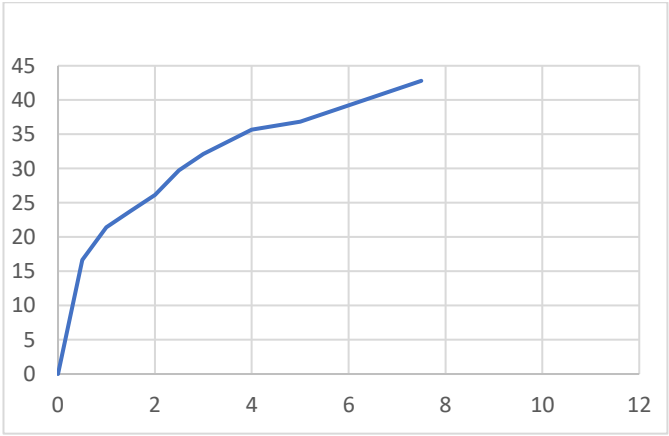
A methodology for the laboratory will be presented long with the properties of materials used during the laboratory experimentation. The C.B.R test will be conducted on both nonreinforcement and reinforced soil samples presented. The properties of the soil are presented in all tests carried on the soil.



Properties of clayey soil

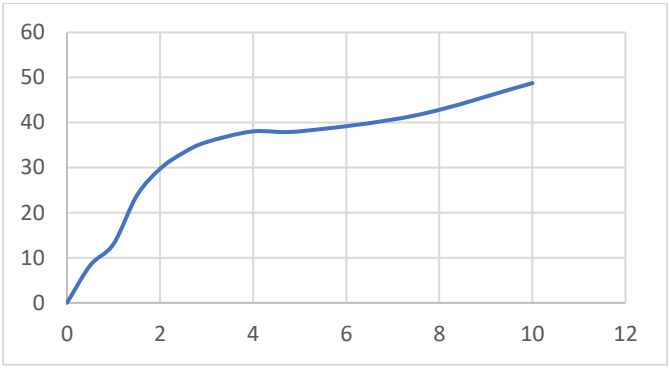
TYPE OF MATERIAL USED

- **CEMENT BAG**
- **RICE BAG**



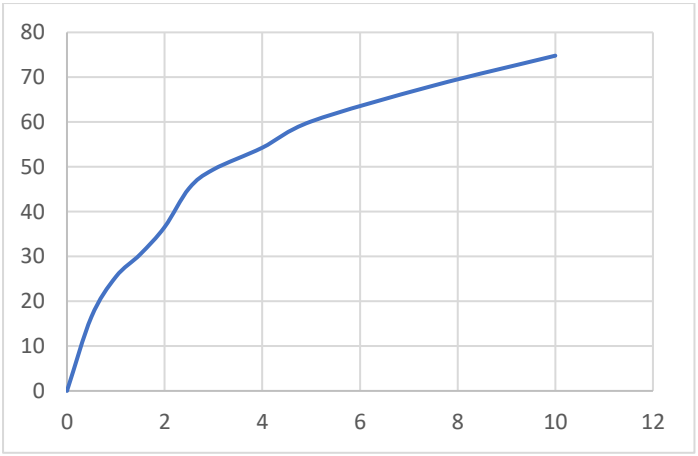
CBR GRAPH FOR NON-REINFORCED SOIL (UNSOAKED)

CBR VALUE AT 2.5MM PENETRATION IS 2.1%
CBR VALUE AT 5.OMM PENETRATION IS 1.79%



CBR GRAPH FOR NON-REINFORCED SOIL (SOAKED)

CBR VALUE AT 2.5MM PENETRATION IS 1.56%
CBR VALUE AT 5.OMM PENETRATION IS 1.11%



CBR GRAPH UNSOAKED FOR CLAYEY SOIL WITH REINFORCED (CEMENT BAG)

SL.NO	PROPERTIES	VALUES
1	SWELL INDEX	33.33 %
2	SPECIFIC GRAVITY	2.23
3	LIQUID LIMIT	81.33 %
4	PLASTIC LIMIT	41.960 %
5	SHRINKAGE LIMIT	12 %
6	COMPACTION TEST	OMC = 18 %
7	DRY DENSITY	1.129
8	SEIVE ANALYSIS	CC=1.47, CU=5.384

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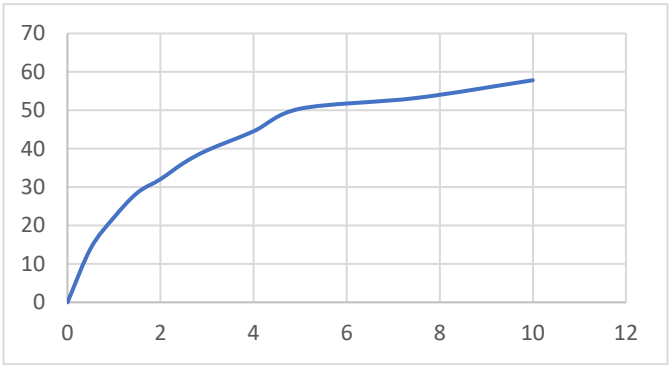
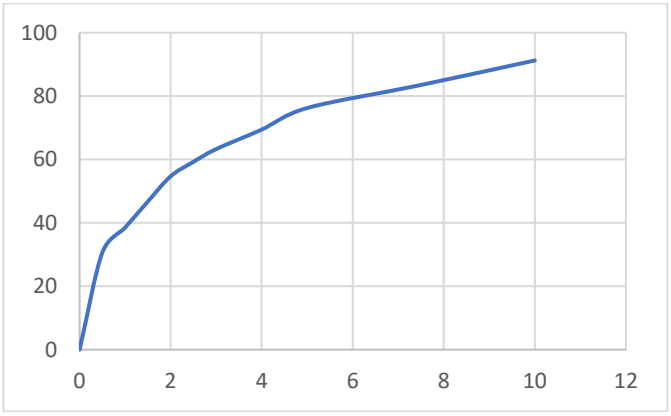
CBR VALUE AT 2.5MM PENETRATION IS 3.299 %
CBR VALUE AT 5.0MM PENETRATION IS 2.9%



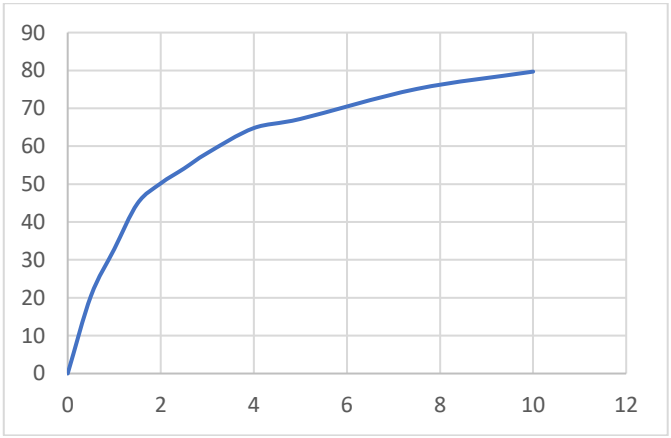
CBR GRAPH SOAKED FOR CLAYEY SOIL WITH REINFORCED (CEMENT BAG)

CBR VALUE AT 2.5MM PENETRATION IS 2.6%
CBR VALUE AT 5.0MM PENETRATION IS 1.85%



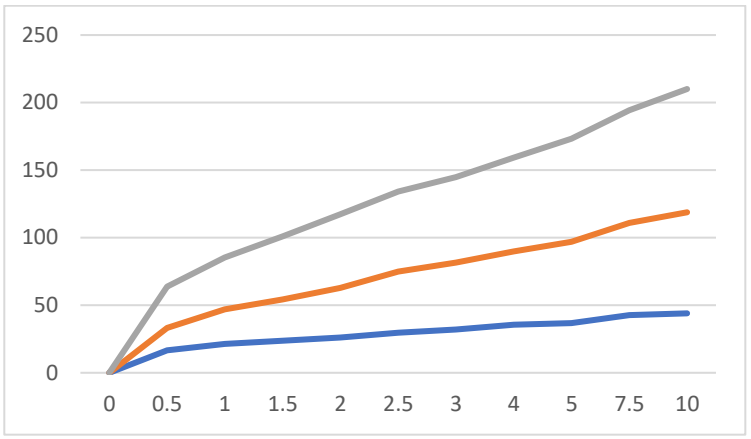
CBR GRAPH UNSOAKED FOR CLAYEY SOIL WITH REINFORCED (RICE BAG)

CBR VALUE AT 2.5MM PENETRATION IS 4.32%
CBR VALUE AT 5.0MM PENETRATION IS 3.71%

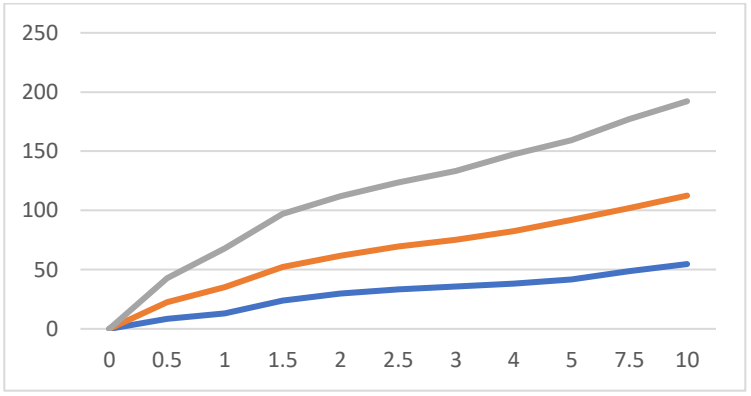


CBR GRAPH SOAKED FOR CLAYEY SOIL WITH REINFORCED (RICE BAG)

CBR VALUE AT 2.5MM PENETRATION IS 3.95%
CBR VALUE AT 5.0MM PENETRATION IS 3.27%



COMPARISON FOR UNSOAKED RICE BAG, CEMENT BAG AND BLACK COTTON SOIL.



COMPARISON FOR SOAKED RICE BAG, CEMENT BAG AND BLACK COTTON SOIL.

4. CONCLUSION

- The CBR results shows that, the different composition of stabilized soil gives higher CBR value
- Using high density cement and rice bags the strength of the subgrade can be increase
- The CBR of rice bag is 3.71 % and cement bag is 2.9 % this conclude the rice bag improves subgrade strength to larger extent
- Inclusion of rice bag and cement bag as non-conventional geotextile material increases the strength of subgrade
- With this method, CBR is increased to stabilize subgrade in a
  cost effective way compared to the conventional techniques.

5.REFERENCES

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