

# Effect of Multilayer Natural Fiber Reinforcement on CBR Value of Black Cotton Soil

Apeksha Pandey, Vishal Chandrakar

Post graduate student, Civil Engineering Department, Shri Shankaracharya Technical Campus, Bhilai

Assistant Professor, Civil Engineering Department, Shri Shankaracharya Technical Campus, Bhilai

## ABSTRACT

Soil is the foundation of the structure, it actually supports the structure from below and distributes the load evenly. If the soil is not stable enough, the structure will collapse in the form of settlement, cracks, etc. Possible reduction. In order to overcome this problem, the soil needs to be improved with artificial materials. Soil stabilization technology is one of the tools used to improve soil quality. Road development has always been an important topic in highway and geotechnical engineering. The use of jute fibers for reinforcing the subgrade soil is good because they are cheap, locally available and biodegradable. In this paper, soil samples were compacted to their maximum dry density (according to their moisture content) in California Laboratory Bearing Ratio (CBR) molds with and without jute fibers. To study its effect on the CBR value, natural jute fiber pieces equal to the diameter of the CBR mould were placed in layers.

**Keywords:** Jute Geotextile Sheet, Geotextile Reinforcement, Expansive soil, Stabilization, CBR, Strength of soil.

## 1- Introduction

Due to rapid growth and urbanization, land development has become an important part of construction. The term land development refers to the process of improving the properties and other electrical properties of weak soil. Construction of roads, bridges, etc. on expansive soil is a difficult task for civil engineers due to the expansion and contraction properties of expansive soil in wet and dry conditions. 25% of the land in India is covered with black cotton. Due to changes in moisture content, these types of soils show significant changes in swelling, compressibility and structural damage. Therefore, there is a need to improve the soil by using jute geotextile and we can use the existing weak soil in the area. The main purpose of soil support is to increase its stability by increasing its bearing capacity, reducing settlement and external deformation. Fiber reinforced soil acts as a composite material. When loaded, the fibers exert tensile strength, giving more strength to the soil. The use of natural or synthetic fibers in geotechnical engineering has been used to create pavement layers, roads and railway embankments..

## 2- Materials used

Soil  
Jute fibres

**Soil**

The soil used in the study was natural soil collected from Smriti Nagar area of Bhilai. After removing the topsoil from the tunnel, soil samples were collected from a depth of 60 cm

**Jute Fibres**

The jute bag is purchased from shop and then cut in circular shape.

**3-Methodology**

Following test has been conducted

- Sieve Analysis
- Modified Proctor Test
- CBR test

**A. Proctor Compaction Test:**

This test is conducted to calculate OMC and MDD.

The soil samples were dried at 105°C for 24 hours. The soil passed through a 4.75 mm sieve was removed and stored in a 2250cc volume mold. Measure the MDD and provide the water content corresponding to the MDD as OMC. Repeat the analysis of the 2-layer and 4-

layer support structure and observe the changes in the corresponding values

**B. California Bearing Ratio Test:**

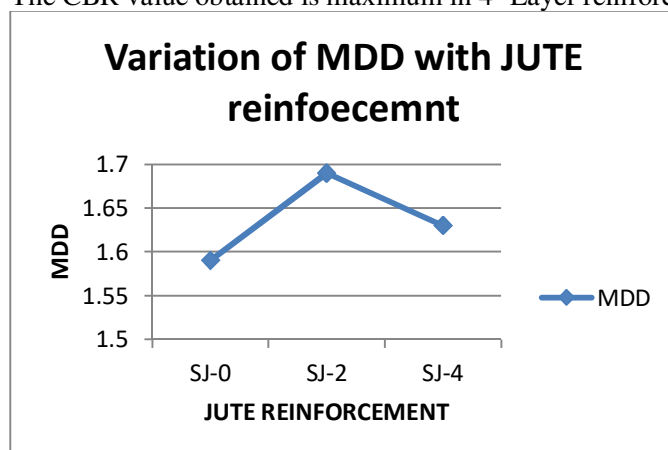
As a result, as a monitoring model, California Bearing Ratio (CBR) analysis was performed on soils with out jute fiber and with different proportions of jute fiber added.

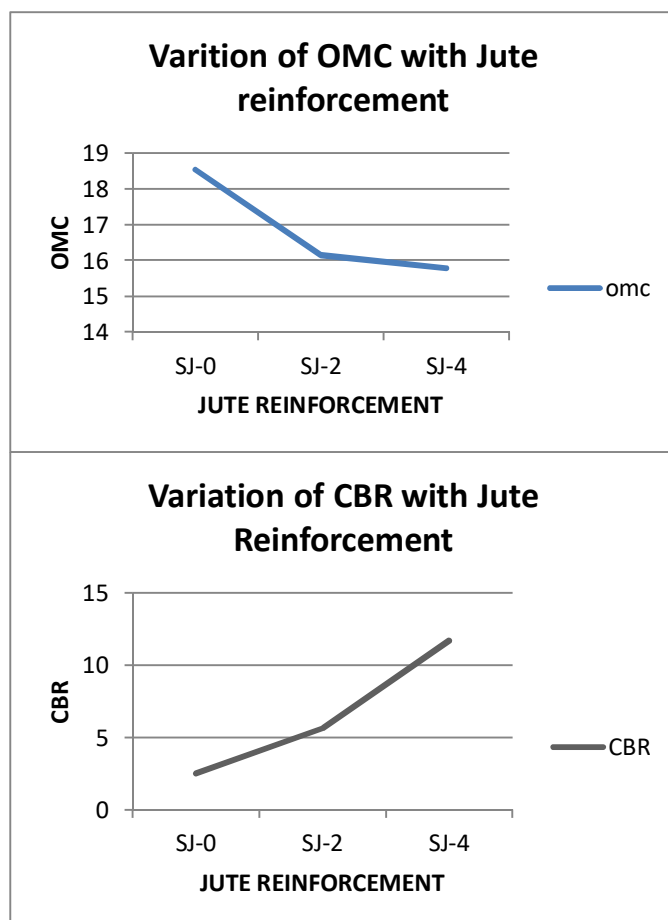
**4-Results and Discussion**

The density and CBR of the soil are improved. The biggest improvement comes from 4-layer splicing. The results are tabulated below:

Sno.	Experiment	SJ-0	SJ-2	SJ-4
1	MDD (g/cc)	1.58	1.69	1.63
2	OMC (%)	18.34	16.14	15.58
3	CBR (%)	2.4	5.55	11.75

The above results show that the MDD (maximum dry point) of the soil is largest when 2-layer is used and slightly decreases when 4-layer is used.. The OMC (Optimum Moisture Content) is reduced from 18.34% to 15.58%. The CBR (California Bearing Ratio) is improved from 2.4% to 11.75%. The CBR value obtained is maximum in 4- Layer reinforcement in soil sample.





## 5-Conclusions

In the study, it was found that jute reinforcement is effective in stabilizing the expansive soil as the CBR value of the soil increases. After significant development, soil changes are observed. Land OMC decreased from 18.34% to 15.58%. With 2 layers, MDD increased from 1.58 g/cc to 1.69 g/cc, while with 4 layers of jute support, MDD decreased to 1.63 g/cc. CBR value increase CBR value of the natural structure is 2.4%. 11.75%. Therefore, it can be concluded that the reinforcement of 4 layers of jute layer on the ground is the highest.

## References

1. Ali.M.S,andKoranne.S.S.:(2011)“Performance Analysis of Expansive Soil Treated With Jute fibres andFlyash”.EJGEVol.16Bund.I,PP.973-982.
2. Arora K.R.; (2002): Soil mechanics and foundation Engineering , second addition , StandardPublication New Delhi.
3. Bairagi Harshita, Yadav R.K and Jain R; (2014) “Effect of Jute Fibres on Engineering characteristics of Black Cotton Soil”. International Journal of Engineering Sciences & Research Technology, PP. 705-707.

4. Choudhary A, Gill K, Jha J; (2012) "Improvement in CBR of Expansive Soil Subgrade with a single Reinforcement layer". ECUPublications, Proceedings of Indian Geotechnical Conference, Paper No. B-214, Delhi.
5. Aggarwal, P. and Sharma, B. (2010), "Application of Jute Fibre in the Improvement of Subgrade Characteristics".
6. Chandra S., Viladkar, M.N. and Nagrrale P.P. (2008), "Mechanistic Approach for fibre reinforced flexible pavements" Journals of Transportation Engineering, Vol. 134, 15-23.
7. Mathew, A., Raneesh, K.: Effect of random inclusion of sisal fibre on strength behaviour of soil. Int. J. Sci. Res. **5**(9), 1702–1707 (2016).
8. Neeraja, D.: Influence of lime and plastic jute on strength and CBR characteristics of soft clayey (expansive) soil. Glob. J. Res. Eng. **10**(1), 16–24 (2010).
9. Singh, H., Bagra, M.: Improvement in CBR value of soil reinforced with jute fiber. Int. J. Innov. Res. Sci. Eng. Technol. **2**(8), 3447–3452 (2013)
10. Tapas, D., Baleshwar, S.: Deformation and strength characteristics of jute geotextile reinforced soils. J. Environ. Res. Develop. **8**(4), 987–995 (2014).
11. Anzar Hamid (2017), "Subgrade Soil Stabilization Using Jute Fibre as a Reinforcing Material", IJEDR.
12. Yagya sharma (2017), " Improvement of Soil Properties by Using Jute Fibre as Soil Stabilizer", American Journal of Engineering Research (AJER).